

Issue No. : **EA-04-11-05-03S**  
 Date of Issue : **05<sup>th</sup>, November, 2004**  
 Classification : ☒New ☐Changed ☐Revised

## PRODUCT SPECIFICATION

Product Description : Aluminium Electrolytic Capacitor  
 Product Part Number : **A TYPE M SERIES**  
 Country of Origin : Malaysia / Japan  
 Marking of the Origin : Printed on the packaging label  
 Classification of Spec. : Product specification  
 Applications : **Set Top Box**  
 For other application, contact our person signed below.  
 Term of Validity : **04<sup>th</sup>, November, 2009 from the date of issue**

| CUSTOMER USE ONLY                                                                                                                                                        | Receipt Record # : |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| This was certainly received by us.<br>One copy is being returned to the manufacturer within 2 months from the date of issue. If not, it shall be considered as accepted. | Date of Receipt    |
|                                                                                                                                                                          | Received by :      |

- This capacitor is designed to be used for electronics circuits of, such as, audio/visual equipment, home appliances, computers and other office equipment, optical equipment, measuring equipment and industrial robots.
- No Ozone Depleting Chemicals (ODC's), controlled under the Montreal Protocol Agreement, are used in producing this product.
- This product does not contain PBBs or PBBs.
- All the materials that are used for this product are registered as "Known Chemicals" in the Japanese act "Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substances".
- This product is not subject to the control under Foreign Exchange and Foreign Trade Control Law of Japan as one of the strategic products.

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                |                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------|
| Miniature Aluminium Electrolytic Capacitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                | EM-O-TE-B-F17-01 |
| A Type M Series                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                | Contents         |
| <p><u>Contents</u></p> <ul style="list-style-type: none"> <li>● Scope Page 1</li> <li>● Part number Page 1</li> <li>● Can size Page 2 ~ 3</li> <li>● Standard rating Page 4</li> <li>● Dimensions and appearance Page 4</li> <li>● Constructions Page 5</li> <li>● Performance characteristics Page 6 ~ 9</li> <li>● Marking Page 10</li> <li>● Other specifications Page 10</li> <li>● Part number list Page 11 ~ 15</li> <li>● Dimensions (Snap-in lead formed type) Page 16</li> <li>● Taping shape and dimensions Page 17 ~ 20</li> <li>● Taping specification Page 21 ~ 24</li> <li>● Application guidelines Page 25 ~ 28</li> </ul> |                                                                                |                  |
| Remark                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                |                  |
| Established Date<br>10.06.2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |                  |

|                                                                                                                                         |  |                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                   |     |                 |                  |                                        |     |                              |     |
|-----------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------|-----|-----------------|------------------|----------------------------------------|-----|------------------------------|-----|
| Miniature Aluminium Electrolytic Capacitor                                                                                              |  |                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                   |     |                 | EM-O-TE-B-F17-01 |                                        |     |                              |     |
| A Type M Series                                                                                                                         |  |                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                   |     |                 | Page 1           |                                        |     |                              |     |
| 1.0 Scope                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                   |     |                 |                  |                                        |     |                              |     |
| This specification applies to Aluminium Electrolyte Capacitors for electronic equipment use which conform to JIS C 5141.                |  |                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                   |     |                 |                  |                                        |     |                              |     |
| 2.0 Part number                                                                                                                         |  |                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                   |     |                 |                  |                                        |     |                              |     |
| $\frac{EC}{2-1}$                                                                                                                        |  | $\frac{A}{2-2}$                                                                                                                                                                                                                                                                                                                                                                                               |  | $\frac{\bigcirc\bigcirc}{2-3}$    |     | $\frac{M}{2-4}$ |                  | $\frac{\bigcirc\bigcirc\bigcirc}{2-5}$ |     | $\frac{\square\square}{2-6}$ |     |
| 2-1                                                                                                                                     |  | Aluminium Electrolytic Capacitor                                                                                                                                                                                                                                                                                                                                                                              |  |                                   |     |                 |                  |                                        |     |                              |     |
| 2-2                                                                                                                                     |  | Type : Radial lead type (JIS:04 type)                                                                                                                                                                                                                                                                                                                                                                         |  |                                   |     |                 |                  |                                        |     |                              |     |
| 2-3                                                                                                                                     |  | Rated voltage code                                                                                                                                                                                                                                                                                                                                                                                            |  |                                   |     |                 |                  |                                        |     |                              |     |
|                                                                                                                                         |  | Voltage code                                                                                                                                                                                                                                                                                                                                                                                                  |  | 0J                                | 1A  | 1C              | 1E               | 1V                                     | 1H  | 1J                           | 2A  |
|                                                                                                                                         |  | Rated voltage                                                                                                                                                                                                                                                                                                                                                                                                 |  | 6.3                               | 10  | 16              | 25               | 35                                     | 50  | 63                           | 100 |
|                                                                                                                                         |  | Voltage code                                                                                                                                                                                                                                                                                                                                                                                                  |  | 2C                                | 2D  | 2E              | 2V               | 2G                                     | 2W  |                              |     |
|                                                                                                                                         |  | Rated voltage                                                                                                                                                                                                                                                                                                                                                                                                 |  | 160                               | 200 | 250             | 350              | 400                                    | 450 |                              |     |
| 2-4                                                                                                                                     |  | M series                                                                                                                                                                                                                                                                                                                                                                                                      |  |                                   |     |                 |                  |                                        |     |                              |     |
| 2-5                                                                                                                                     |  | Capacitance code : Capacitance value in $\mu\text{F}$ is indicated by 3 figures.<br>The first two figures denote the first two figures of the capacitance value.<br>The third figure denotes the number of subsequent zeros of the capacitance value.<br>“R” denotes the decimal point.<br>Ex : $0.1\mu\text{F} \rightarrow 0\text{R}1$ , $10\mu\text{F} \rightarrow 100$ , $1000\mu\text{F} \rightarrow 102$ |  |                                   |     |                 |                  |                                        |     |                              |     |
| 2-6                                                                                                                                     |  | Suffix code for appearance                                                                                                                                                                                                                                                                                                                                                                                    |  |                                   |     |                 |                  |                                        |     |                              |     |
|                                                                                                                                         |  | Blank                                                                                                                                                                                                                                                                                                                                                                                                         |  | Standard long lead                |     |                 |                  |                                        |     |                              |     |
|                                                                                                                                         |  | E                                                                                                                                                                                                                                                                                                                                                                                                             |  | Snap-in lead                      |     |                 |                  |                                        |     |                              |     |
|                                                                                                                                         |  | I                                                                                                                                                                                                                                                                                                                                                                                                             |  | Lead taping (2.5mm pitch)         |     |                 |                  |                                        |     |                              |     |
|                                                                                                                                         |  | B                                                                                                                                                                                                                                                                                                                                                                                                             |  | Lead taping (5.0mm / 7.5mm pitch) |     |                 |                  |                                        |     |                              |     |
| Refer to page 16 for snap-in lead dimensions, page 17 ~ 20 for lead taping dimensions, and page 21 ~ 24 for lead taping specifications. |  |                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                   |     |                 |                  |                                        |     |                              |     |
| Remark                                                                                                                                  |  |                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                   |     |                 |                  |                                        |     |                              |     |
| Established Date<br>10.06.2004                                                                                                          |  | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division                                                                                                                                                                                                                                                                                                                                |  |                                   |     |                 |                  |                                        |     |                              |     |

|                                            |                                                                                |                      |                            |                    |                    |          |                     |          |
|--------------------------------------------|--------------------------------------------------------------------------------|----------------------|----------------------------|--------------------|--------------------|----------|---------------------|----------|
| Miniature Aluminium Electrolytic Capacitor |                                                                                |                      |                            |                    |                    |          | EM-O-TE-B-F17-01    |          |
| A Type M Series                            |                                                                                |                      |                            |                    |                    |          | Page 2              |          |
| Can size                                   |                                                                                |                      |                            |                    |                    |          |                     |          |
|                                            |                                                                                |                      |                            |                    |                    |          | ΦD x L [mm]         |          |
| W.V. (V. DC)<br>Cap (μF)                   | 6.3                                                                            | 10                   | 16                         | 25                 | 35                 | 50       | 63                  | 100      |
| 0.1                                        |                                                                                |                      |                            |                    |                    | 5x11     |                     |          |
| 0.22                                       |                                                                                |                      |                            |                    |                    | 5x11     |                     |          |
| 0.33                                       |                                                                                |                      |                            |                    |                    | 5x11     |                     |          |
| 0.47                                       |                                                                                |                      |                            |                    |                    | 5x11     |                     | 5x11     |
| 0.68                                       |                                                                                |                      |                            |                    |                    | 5x11     |                     |          |
| 1                                          |                                                                                |                      |                            |                    |                    | 5x11     | 5x11                | 5x11     |
| 2.2                                        |                                                                                |                      |                            |                    |                    | 5x11     | 5x11                | 5x11     |
| 3.3                                        |                                                                                |                      |                            |                    |                    | 5x11     |                     | 5x11     |
| 4.7                                        |                                                                                |                      |                            |                    |                    | 5x11     | 5x11                | 5x11     |
| 6.8                                        |                                                                                |                      |                            |                    |                    | 5x11     |                     |          |
| 10                                         |                                                                                |                      | 5x11                       | 5x11               | 5x11               | 5x11     | 5x11                | 5x11     |
| 22                                         |                                                                                |                      | 5x11                       | 5x11               | 5x11               | 5x11     | 5x11                | 6.3x11.2 |
| 33                                         | 5x11                                                                           |                      | 5x11                       | 5x11               | 5x11               | 5x11     | 6.3x11.2            | 8x11.5   |
| 47                                         | 5x11                                                                           |                      | 5x11                       | 5x11               | 5x11               | 6.3x11.2 | 6.3x11.2            | 8x11.5   |
| 68                                         |                                                                                |                      | 5x11                       |                    |                    |          |                     |          |
| 100                                        | 5x11                                                                           | 5x11                 | 5x11                       | 6.3x11.2           | 6.3x11.2           | 8x11.5   | 8x11.5<br>10x12.5 S | 10x16    |
| 220                                        | 5x11                                                                           | 6.3x11.2<br>5x11 U   | 6.3x11.2                   | 8x11.5             | 8x11.5             | 10x12.5  | 10x16               | 12.5x20  |
| 330                                        | 6.3x11.2                                                                       | 6.3x11.2             | 8x11.5                     | 8x11.5             | 10x12.5            | 10x16    | 10x20               | 12.5x25  |
| 470                                        | 6.3x11.2                                                                       | 8x11.5<br>6.3x11.2 U | 8x11.5                     | 10x12.5            | 10x16              | 10x20    | 12.5x20             | 16x25    |
| 1000                                       | 8x11.5                                                                         | 10x12.5              | 10x16<br>8x20 L<br>10x12 U | 10x20<br>10x16 U   | 12.5x20<br>10x20 U | 12.5x25  | 16x25               | 18x35.5  |
| 2200                                       | 10x16                                                                          | 10x20<br>10x16 U     | 12.5x20                    | 12.5x25            | 16x25              | 16x31.5  | 18x35.5             |          |
| 3300                                       | 10x20                                                                          | 12.5x20              | 12.5x25                    | 16x25              | 16x31.5            | 18x35.5  |                     |          |
| 3900                                       |                                                                                |                      | 16x20 U                    | 16x25              |                    |          |                     |          |
| 4700                                       | 12.5x20                                                                        | 12.5x25              | 16x25                      | 16x31.5<br>18x25 S | 18x35.5            |          |                     |          |
| 5600                                       |                                                                                |                      |                            |                    | 18x35.5            |          |                     |          |
| 6800                                       | 12.5x25                                                                        | 16x25                | 16x31.5                    | 18x35.5            |                    |          |                     |          |
| 8200                                       |                                                                                |                      |                            | 18x35.5            |                    |          |                     |          |
| 10000                                      | 16x25                                                                          | 16x31.5              | 18x35.5                    |                    |                    |          |                     |          |
| 15000                                      | 16x31.5                                                                        | 18x35.5              |                            |                    |                    |          |                     |          |
| 22000                                      | 18x35.5                                                                        |                      |                            |                    |                    |          |                     |          |
| Remark                                     |                                                                                |                      |                            |                    |                    |          |                     |          |
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|                                            |                                                                                |                      |          |          |           |                        |
|--------------------------------------------|--------------------------------------------------------------------------------|----------------------|----------|----------|-----------|------------------------|
| Miniature Aluminium Electrolytic Capacitor |                                                                                |                      |          |          |           | EM-O-TE-B-F17-01       |
| A Type M Series                            |                                                                                |                      |          |          |           | Page 3                 |
| 160V ~ 450V                                |                                                                                |                      |          |          |           | $\Phi D \times L$ [mm] |
| W.V. (V. DC)<br>Cap ( $\mu F$ )            | 160                                                                            | 200                  | 250      | 350      | 400       | 450                    |
| 0.47                                       | 5x11                                                                           |                      | 5x11     |          |           |                        |
| 1                                          | 6.3x11.2                                                                       | 6.3x11.2             | 6.3x11.2 | 6.3x11.2 | 6.3x11.2  | 8x11.5                 |
| 2.2                                        | 6.3x11.2                                                                       | 6.3x11.2             | 6.3x11.2 | 8x11.5   | 8x11.5    | 10x12.5                |
| 3.3                                        | 6.3x11.2                                                                       | 6.3x11.2             | 8x11.5   | 8x11.5   | 10x12.5   | 10x16                  |
| 4.7                                        | 6.3x11.2                                                                       | 8x11.5               | 8x11.5   | 10x12.5  | 10x16     | 10x20                  |
| 6.8                                        | 8x11.5                                                                         |                      |          |          | 10x16     |                        |
| 10                                         | 10x12.5                                                                        | 10x12.5              | 10x16    | 10x20    | 10x20     | 12.5x20                |
| 22                                         | 10x16                                                                          | 10x20<br>10x16 U     | 10x20    | 12.5x20  | 12.5x25   | 16x25                  |
| 33                                         | 10x20                                                                          | 10x20                | 12.5x20  | 16x25    | 16x25     | 16x31.5                |
| 47                                         | 12.5x20                                                                        | 12.5x20              | 12.5x25  | 16x25    | 16x31.5   |                        |
| 68                                         |                                                                                |                      |          |          | 16x31.5 U |                        |
| 82                                         |                                                                                | 16x25                |          |          | 18x35.5   |                        |
| 100                                        | 12.5x25                                                                        | 16x25<br>18x20 S     | 16x31.5  |          | 18x40     |                        |
| 150                                        |                                                                                | 16x31.5              |          |          |           |                        |
| 220                                        | 16x31.5                                                                        | 16x31.5 U            | 18x40    |          |           |                        |
| 330                                        |                                                                                | 18x40<br>18 x 35.5 U |          |          |           |                        |
| 470                                        | 18x40                                                                          |                      |          |          |           |                        |
| Remark                                     |                                                                                |                      |          |          |           |                        |
| Established Date<br>10.06.2004             | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |                      |          |          |           |                        |



|                                            |  |  |                  |  |  |
|--------------------------------------------|--|--|------------------|--|--|
| Miniature Aluminium Electrolytic Capacitor |  |  | EM-O-TE-B-F17-01 |  |  |
| A Type M Series                            |  |  | Page 5           |  |  |

5.0 Constructions

5-1 Inside construction :-

3 Aluminium can

2 Sleeve

4 Sealing rubber

1 Lead wire

9 Aluminium lead

Inside unit  
(5 Separator, 6, 7 Anode and cathode foil, 8 Electrolyte)

5-2 Construction parts :-

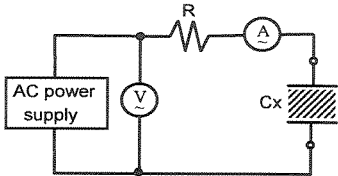
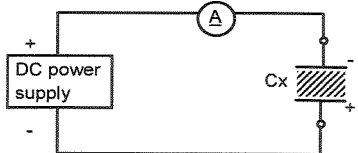
| No. | Parts          | Materials                             |   | Parts               | Materials                  |
|-----|----------------|---------------------------------------|---|---------------------|----------------------------|
| 1   | Lead wire      | Solid tinned copper welded steel wire | 5 | Separator           | Manila hemp / Kraft paper  |
| 2   | Sleeve         | Polyethylene terephthalate            | 6 | Anode foil          | High purity aluminium foil |
| 3   | Aluminium can  | Aluminium                             | 7 | Cathode foil        | Aluminium foil             |
| 4   | Rubber packing | Synthetic rubber                      | 8 | Electrolyte         | Ethylene Glycol            |
|     |                |                                       | 9 | Aluminium lead wire | Aluminium                  |

Remark

|                                |                                                                                |
|--------------------------------|--------------------------------------------------------------------------------|
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|--------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Miniature Aluminium Electrolytic Capacitor |                             |                                                                                                                                                                                                             |                                                                                                                                                |                                                                                                                                                                                                                                                                                            | EM-O-TE-B-F17-01                                                                                                                              |                  |
| A Type M Series                            |                             |                                                                                                                                                                                                             |                                                                                                                                                |                                                                                                                                                                                                                                                                                            | Page 6                                                                                                                                        |                  |
| 6.0 Performance Characteristics            |                             |                                                                                                                                                                                                             |                                                                                                                                                |                                                                                                                                                                                                                                                                                            |                                                                                                                                               |                  |
| No                                         | Item                        |                                                                                                                                                                                                             | Performance Characteristics                                                                                                                    |                                                                                                                                                                                                                                                                                            | Test                                                                                                                                          |                  |
| 1                                          | Leakage current             |                                                                                                                                                                                                             | 6.3V~100V : I ≤ 0.01CV or 3μA whichever is greater.<br>160V~450V : I ≤ 0.06CV+10μA<br>I : Leakage current C : Capacitance<br>V : Rated voltage |                                                                                                                                                                                                                                                                                            | Series resistor : 1000 ± 10 Ω<br>Applied voltage : Rated working voltage<br>Measuring : After 2 minutes                                       |                  |
| 2                                          | Capacitance                 |                                                                                                                                                                                                             | Within the specified capacitance tolerance                                                                                                     |                                                                                                                                                                                                                                                                                            | Measuring frequency : 120 Hz ± 20%<br>Measuring circuit : Equivalent series circuit<br>Measuring voltage : +1.5~2 V D.C.<br>(≤ 0.5V for A.C.) |                  |
| 3                                          | tan δ                       |                                                                                                                                                                                                             | Less than the values in Table 1 of Page 10<br><br>Add 0.02 per 1000μF for products which capacitance value is above 1000μF.                    |                                                                                                                                                                                                                                                                                            | Measuring frequency : 120 Hz ± 20%<br>Measuring circuit : Equivalent series circuit<br>Measuring voltage : +1.5~2 V D.C.<br>(≤ 0.5V for A.C.) |                  |
| 4                                          | Temperature characteristics | Step                                                                                                                                                                                                        | Impedance ratio :                                                                                                                              |                                                                                                                                                                                                                                                                                            | Step                                                                                                                                          | Test temperature |
|                                            |                             | 2                                                                                                                                                                                                           | Less than values in Table 2 of Page 10.                                                                                                        |                                                                                                                                                                                                                                                                                            | 1                                                                                                                                             | 20 ± 2°C         |
|                                            |                             | Step 4                                                                                                                                                                                                      | Leakage current :<br>≤ 500% of value of Item 6.1<br>Capacitance change :<br>Within ±25% of value in Step 1<br>tan δ<br>≤ the value of Item 6.3 | 2                                                                                                                                                                                                                                                                                          | ■                                                                                                                                             | -*               |
|                                            |                             |                                                                                                                                                                                                             |                                                                                                                                                | 3                                                                                                                                                                                                                                                                                          | 20 ± 2°C                                                                                                                                      | 15 minutes       |
|                                            |                             |                                                                                                                                                                                                             |                                                                                                                                                | 4                                                                                                                                                                                                                                                                                          | 85 ± 2°C                                                                                                                                      | 2 hours          |
|                                            |                             |                                                                                                                                                                                                             |                                                                                                                                                | 5                                                                                                                                                                                                                                                                                          | 20 ± 2°C                                                                                                                                      | -*               |
|                                            |                             |                                                                                                                                                                                                             |                                                                                                                                                | Impedance shall be measured at frequency of 120 Hz ± 10%<br>■ 6.3V ~ 100V : -25 ± 3 °C, -40 ± 3 °C<br>160V ~ 450V : -25 ± 3 °C<br>* The capacitor should be stored at the impedance or capacitance are stabilized.                                                                         |                                                                                                                                               |                  |
| 5                                          | Surge voltage               | Leakage current :<br>≤ the value of Item 6.1<br>Capacitance change :<br>Within ±15% of initial measured value<br>tan δ<br>≤ the value of Item 6.3<br>Appearance :<br>No significant change can be observed. |                                                                                                                                                | Test temperature : 15 ~ 35°C<br>Series resistor : R = $\frac{100 \pm 50}{C}$<br>R : protective resistor (kΩ)<br>C : nominal capacitance (μF)<br>Test voltage : Item 3.5<br>No. of cycles : 1000 cycles<br>Each cycle lasts for 6 ± 0.5 min.<br>"ON" for 30 ± 5 s<br>"OFF" for 5 ± 0.5 min. |                                                                                                                                               |                  |
| Remark                                     |                             |                                                                                                                                                                                                             |                                                                                                                                                |                                                                                                                                                                                                                                                                                            |                                                                                                                                               |                  |
| Established Date<br>10.06.2004             |                             | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division                                                                                                                              |                                                                                                                                                |                                                                                                                                                                                                                                                                                            |                                                                                                                                               |                  |

| Miniature Aluminium Electrolytic Capacitor |                         |                                                                                                                                                                                                                                                                                                                                         | EM-O-TE-B-F17-01                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |
|--------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| A Type M Series                            |                         |                                                                                                                                                                                                                                                                                                                                         | Page 7                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |
| No                                         | Item                    | Performance Characteristics                                                                                                                                                                                                                                                                                                             | Test                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |
| 6                                          | Lead terminal           | There is no damage or breakage after test                                                                                                                                                                                                                                                                                               | <u>Lead pull strength</u>                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Diameter [mm]                                                                                                                                                                                                                                                                                                                                                                                                                                   | Pull strength [N] |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Φ 0.50                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5                 |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Φ 0.60 ~ Φ 0.80                                                                                                                                                                                                                                                                                                                                                                                                                                 | 10                |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Pull strength is applied axially for 10 ± 1 seconds.                                                                                                                                                                                                                                                                                                                                                                                            |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | <u>Lead bending strength</u>                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Diameter [mm]                                                                                                                                                                                                                                                                                                                                                                                                                                   | Static load [N]   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Φ 0.50                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2.5               |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Φ 0.60 ~ Φ 0.80                                                                                                                                                                                                                                                                                                                                                                                                                                 | 5.0               |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | The capacitor is placed in a vertical position. The weight specified in the above table is applied to one lead. The capacitor is slowly rotated 90° to horizontal position and then return to vertical position. The bendings shall last for 2~3 seconds. Additional bends shall be made in the opposite direction.                                                                                                                             |                   |
| 7                                          | Resistance to vibration | Capacitance :<br>During the test, measured value shall be stabilized.<br>(Measure several times within 30 mins before completion of test. The value shall be monitored from and to both ends of the frequency values.<br>Appearance :<br>No significant change can be observed.<br>Capacitance change :<br>Within ±5% of initial value. | Frequency : 10~55 Hz<br>(1 minute per cycle)<br>Vibration distance : 1.5 mm<br>Direction and duration of vibration :<br>It is done in the X,Y,Z axis direction for 2 hours each, with a total of 6 hours.<br>Mounting methods :<br>The capacitor shall be fixed with its lead wires at the point of 4mm from the bottom of capacitor body.<br>Capacitor greater than 12.5mm diameter or longer than 25mm must be fixed in place with a bracket. |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Solder : H60A, H60S, or H63A<br>Solder temperature : 235 ± 5°C<br>Immersing time : 2 ± 0.5 s<br>Immersing depth : 1.5 ~ 2.0 mm<br>Flux : Approx. 25% resin (JIS K5902) in ETHANOL (JIS K1501)                                                                                                                                                                                                                                                   |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Solder : H60A, H60S, or H63A<br>Solder temperature : 260 ± 5°C<br>Immersing time : 10 ± 1 s<br>Immersing depth : 1.5~2.0 mm                                                                                                                                                                                                                                                                                                                     |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Leakage current :<br>≤ the value of Item 6.1<br>Capacitance change :<br>Within ± 10% of initial measured value<br>tan δ :<br>≤ the value of Item 6.3<br>Appearance :<br>No significant change can be observed.                                                                                                                                                                                                                                  |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Leakage current :<br>≤ the value of Item 6.1<br>Capacitance change :<br>Within ± 10% of initial measured value<br>tan δ :<br>≤ the value of Item 6.3<br>Appearance :<br>No significant change can be observed.                                                                                                                                                                                                                                  |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Leakage current :<br>≤ the value of Item 6.1<br>Capacitance change :<br>Within ± 10% of initial measured value<br>tan δ :<br>≤ the value of Item 6.3<br>Appearance :<br>No significant change can be observed.                                                                                                                                                                                                                                  |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Leakage current :<br>≤ the value of Item 6.1<br>Capacitance change :<br>Within ± 10% of initial measured value<br>tan δ :<br>≤ the value of Item 6.3<br>Appearance :<br>No significant change can be observed.                                                                                                                                                                                                                                  |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Leakage current :<br>≤ the value of Item 6.1<br>Capacitance change :<br>Within ± 10% of initial measured value<br>tan δ :<br>≤ the value of Item 6.3<br>Appearance :<br>No significant change can be observed.                                                                                                                                                                                                                                  |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Leakage current :<br>≤ the value of Item 6.1<br>Capacitance change :<br>Within ± 10% of initial measured value<br>tan δ :<br>≤ the value of Item 6.3<br>Appearance :<br>No significant change can be observed.                                                                                                                                                                                                                                  |                   |
|                                            |                         |                                                                                                                                                                                                                                                                                                                                         | Leakage current :<br>≤ the value of Item 6.1<br>Capacitance change :<br>Within ± 10% of initial measured value<br>tan δ :<br>≤ the value of Item 6.3<br>Appearance :<br>No significant change can be observed.                                                                                                                                                                                                                                  |                   |
| Remark                                     |                         |                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |
| Established Date<br>10.06.2004             |                         | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |

|                                            |                                                |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
|--------------------------------------------|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|-----|------------|-------------|----------|---------------|--------|-----------------|---------|-------------------|------------|---------|---|---------------|--------|--------|--------------|--------|---------------|
| Miniature Aluminium Electrolytic Capacitor |                                                |                                                                                                                                         | EM-O-TE-B-F17-01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| A Type M Series                            |                                                |                                                                                                                                         | Page 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
|                                            |                                                |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| No                                         | Item                                           | Performance Characteristics                                                                                                             | Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| 10                                         | Permanency of marking                          | There shall be no damage and legible marked. Marking shall be deciphered easily.                                                        | Class of reagent : ISOPROPYL ALCOHOL (JIS K8034) or superior<br>Test temperature : 20 ~ 25°C<br>Immersing time : 30 ± 5 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| 11                                         | Vent<br>( for products with diameter ≥ Φ 6.3 ) | Vent shall operate without any hazardous expulsion or emission of flame.<br>No emission of gas after 30 minutes application of voltage. | <div>• AC current method :</div> <div></div> <div>50Hz or 60Hz<br/>(A) : AC ammeter      R : Series resistor<br/>(V) : AC voltmeter      Cx : Tested capacitor</div> <div>Applied voltage :<br/>AC voltage equals to rated W.V. x 0.7 or 250V (rms) whichever is smaller.</div> <table><tr><td>Nominal cap. (μF)</td><td>DC resistance (Ω)</td></tr><tr><td>≤ 1</td><td>1000 ± 100</td></tr><tr><td>&gt; 1    ≤ 10</td><td>100 ± 10</td></tr><tr><td>&gt; 10    ≤ 100</td><td>10 ± 1</td></tr><tr><td>&gt; 100    ≤ 1000</td><td>1 ± 0.1</td></tr><tr><td>&gt; 1000    ≤ 10000</td><td>0.1 ± 0.01</td></tr><tr><td>&gt; 10000</td><td>*</td></tr></table> <div>* When nominal capacitance is over 1000μF, the value of series resistor is half impedance of tested capacitor.</div> <div>• Reverse voltage method :</div> <div></div> <div>(A) : DC ammeter      Cx : Tested capacitor</div> <table><tr><td>Diameter (mm)</td><td>DC (A)</td></tr><tr><td>≤ 22.4</td><td>1 (constant)</td></tr><tr><td>&gt; 22.4</td><td>10 (constant)</td></tr></table> | Nominal cap. (μF) | DC resistance (Ω) | ≤ 1 | 1000 ± 100 | > 1    ≤ 10 | 100 ± 10 | > 10    ≤ 100 | 10 ± 1 | > 100    ≤ 1000 | 1 ± 0.1 | > 1000    ≤ 10000 | 0.1 ± 0.01 | > 10000 | * | Diameter (mm) | DC (A) | ≤ 22.4 | 1 (constant) | > 22.4 | 10 (constant) |
| Nominal cap. (μF)                          | DC resistance (Ω)                              |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| ≤ 1                                        | 1000 ± 100                                     |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| > 1    ≤ 10                                | 100 ± 10                                       |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| > 10    ≤ 100                              | 10 ± 1                                         |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| > 100    ≤ 1000                            | 1 ± 0.1                                        |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| > 1000    ≤ 10000                          | 0.1 ± 0.01                                     |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| > 10000                                    | *                                              |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| Diameter (mm)                              | DC (A)                                         |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| ≤ 22.4                                     | 1 (constant)                                   |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| > 22.4                                     | 10 (constant)                                  |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| Remark                                     |                                                |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |
| Established Date<br>10.06.2004             |                                                | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |                   |     |            |             |          |               |        |                 |         |                   |            |         |   |               |        |        |              |        |               |

| Miniature Aluminium Electrolytic Capacitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                |                                                                                                                                                                                                                                           | EM-O-TE-B-F17-01                                                                                                                                                                                                                                                                                                                                                                         |    |      |                             |      |    |                                    |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                           |    |           |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          |    |            |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|-----------------------------|------|----|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A Type M Series                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                |                                                                                                                                                                                                                                           | Page 9                                                                                                                                                                                                                                                                                                                                                                                   |    |      |                             |      |    |                                    |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                           |    |           |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          |    |            |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                       |
| <table border="1"> <thead> <tr> <th>No</th><th>Item</th><th>Performance Characteristics</th><th>Test</th></tr> </thead> <tbody> <tr> <td>12</td><td>Moisture Resistance (Steady State)</td><td> Leakage current :<br/> <math>\leq</math> the value of Item 6.1<br/> Capacitance change :<br/> Within <math>\pm 20\%</math> of initial measured value<br/> <math>\tan \delta</math><br/> <math>\leq 120\%</math> the value of Item 6.3<br/> Appearance :<br/> No significant change can be observed. </td><td> Test temperature : <math>40 \pm 2^\circ\text{C}</math><br/> Relative humidity : <math>90 \sim 95\%</math><br/> Test duration : <math>240 \pm 8</math> hours<br/> <br/> After subjected to the test, the capacitor shall be left for 2 hours at room temperature and room humidity before measurement is performed. </td></tr> <tr> <td>13</td><td>Endurance</td><td> Leakage current :<br/> <math>\leq</math> the value of Item 6.1<br/> Capacitance change :<br/> Within <math>\pm 20\%</math> of initial measured value<br/> <math>\tan \delta</math><br/> <math>\leq 150\%</math> the value of Item 6.3<br/> Appearance :<br/> No significant change can be observed. </td><td> Test temperature : <math>85 \pm 2^\circ\text{C}</math><br/> Test duration : <math>2000_{-0}^{+72}</math> hours<br/> Applied voltage : D.C. voltage with specified ripple current.<br/> The sum of DC and ripple peak current shall not exceed the rated working voltage. After subjected to the test, the capacitor shall be left at room temperature and room humidity for 2 hours before measurement is performed. </td></tr> <tr> <td>14</td><td>Shelf life</td><td> Leakage current :<br/> <math>\leq</math> the value of Item 6.1<br/> Capacitance change :<br/> Within <math>\pm 20\%</math> of initial measured value<br/> <math>\tan \delta</math><br/> <math>\leq 150\%</math> the value of Item 6.3<br/> Appearance :<br/> No significant change can be observed. </td><td> Test temperature : <math>85 \pm 2^\circ\text{C}</math><br/> Test duration : <math>1000_{-0}^{+48}</math> hours<br/> <br/> After subjected to the test, DC working voltage shall be applied to the capacitor for 30 minutes as post-test treatment. The capacitor shall be left at room temperature and room humidity for 2 hours before measurement is performed. </td></tr> </tbody> </table> |                                                                                |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          | No | Item | Performance Characteristics | Test | 12 | Moisture Resistance (Steady State) | Leakage current :<br>$\leq$ the value of Item 6.1<br>Capacitance change :<br>Within $\pm 20\%$ of initial measured value<br>$\tan \delta$<br>$\leq 120\%$ the value of Item 6.3<br>Appearance :<br>No significant change can be observed. | Test temperature : $40 \pm 2^\circ\text{C}$<br>Relative humidity : $90 \sim 95\%$<br>Test duration : $240 \pm 8$ hours<br><br>After subjected to the test, the capacitor shall be left for 2 hours at room temperature and room humidity before measurement is performed. | 13 | Endurance | Leakage current :<br>$\leq$ the value of Item 6.1<br>Capacitance change :<br>Within $\pm 20\%$ of initial measured value<br>$\tan \delta$<br>$\leq 150\%$ the value of Item 6.3<br>Appearance :<br>No significant change can be observed. | Test temperature : $85 \pm 2^\circ\text{C}$<br>Test duration : $2000_{-0}^{+72}$ hours<br>Applied voltage : D.C. voltage with specified ripple current.<br>The sum of DC and ripple peak current shall not exceed the rated working voltage. After subjected to the test, the capacitor shall be left at room temperature and room humidity for 2 hours before measurement is performed. | 14 | Shelf life | Leakage current :<br>$\leq$ the value of Item 6.1<br>Capacitance change :<br>Within $\pm 20\%$ of initial measured value<br>$\tan \delta$<br>$\leq 150\%$ the value of Item 6.3<br>Appearance :<br>No significant change can be observed. | Test temperature : $85 \pm 2^\circ\text{C}$<br>Test duration : $1000_{-0}^{+48}$ hours<br><br>After subjected to the test, DC working voltage shall be applied to the capacitor for 30 minutes as post-test treatment. The capacitor shall be left at room temperature and room humidity for 2 hours before measurement is performed. |
| No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Item                                                                           | Performance Characteristics                                                                                                                                                                                                               | Test                                                                                                                                                                                                                                                                                                                                                                                     |    |      |                             |      |    |                                    |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                           |    |           |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          |    |            |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                       |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Moisture Resistance (Steady State)                                             | Leakage current :<br>$\leq$ the value of Item 6.1<br>Capacitance change :<br>Within $\pm 20\%$ of initial measured value<br>$\tan \delta$<br>$\leq 120\%$ the value of Item 6.3<br>Appearance :<br>No significant change can be observed. | Test temperature : $40 \pm 2^\circ\text{C}$<br>Relative humidity : $90 \sim 95\%$<br>Test duration : $240 \pm 8$ hours<br><br>After subjected to the test, the capacitor shall be left for 2 hours at room temperature and room humidity before measurement is performed.                                                                                                                |    |      |                             |      |    |                                    |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                           |    |           |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          |    |            |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                       |
| 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Endurance                                                                      | Leakage current :<br>$\leq$ the value of Item 6.1<br>Capacitance change :<br>Within $\pm 20\%$ of initial measured value<br>$\tan \delta$<br>$\leq 150\%$ the value of Item 6.3<br>Appearance :<br>No significant change can be observed. | Test temperature : $85 \pm 2^\circ\text{C}$<br>Test duration : $2000_{-0}^{+72}$ hours<br>Applied voltage : D.C. voltage with specified ripple current.<br>The sum of DC and ripple peak current shall not exceed the rated working voltage. After subjected to the test, the capacitor shall be left at room temperature and room humidity for 2 hours before measurement is performed. |    |      |                             |      |    |                                    |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                           |    |           |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          |    |            |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                       |
| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Shelf life                                                                     | Leakage current :<br>$\leq$ the value of Item 6.1<br>Capacitance change :<br>Within $\pm 20\%$ of initial measured value<br>$\tan \delta$<br>$\leq 150\%$ the value of Item 6.3<br>Appearance :<br>No significant change can be observed. | Test temperature : $85 \pm 2^\circ\text{C}$<br>Test duration : $1000_{-0}^{+48}$ hours<br><br>After subjected to the test, DC working voltage shall be applied to the capacitor for 30 minutes as post-test treatment. The capacitor shall be left at room temperature and room humidity for 2 hours before measurement is performed.                                                    |    |      |                             |      |    |                                    |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                           |    |           |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          |    |            |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                       |
| Remark                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          |    |      |                             |      |    |                                    |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                           |    |           |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          |    |            |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                       |
| Established Date<br>10.06.2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          |    |      |                             |      |    |                                    |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                           |    |           |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          |    |            |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                       |

## 7.0 Marking

Marking indicated on the products :

- a) Rated working voltage
- b) Nominal capacitance
- c) Negative polarity
- d) Manufacturer's identification
- e) Maximum operating temperature
- f) Series Code
- g) Lot no. (or date code)

## 8.0 Others

Unless specified otherwise, the product shall conform to JIS C 5141.

Table 1  $\tan \delta$ 

|               |      |      |      |      |      |      |      |      |
|---------------|------|------|------|------|------|------|------|------|
| W.V. (V D.C.) | 6.3  | 10   | 16   | 25   | 35   | 50   | 63   | 100  |
| $\tan \delta$ | 0.28 | 0.24 | 0.20 | 0.16 | 0.14 | 0.12 | 0.11 | 0.10 |

|               |      |      |      |      |      |      |
|---------------|------|------|------|------|------|------|
| W.V. (V D.C.) | 160  | 200  | 250  | 350  | 400  | 450  |
| $\tan \delta$ | 0.16 | 0.18 | 0.18 | 0.20 | 0.20 | 0.20 |

Add 0.02 per 1000 $\mu$ F for product with capacitance value greater than 1000 $\mu$ F

■ Table 2      Temperature characteristics (Impedance ratio at 120Hz)

|                  |     |    |    |    |    |    |    |     |
|------------------|-----|----|----|----|----|----|----|-----|
| W.V. (V D.C.)    | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 |
| Z(-25°C)/Z(20°C) | 5   | 4  | 3  | 2  | 2  | 2  | 2  | 2   |
| Z(-40°C)/Z(20°C) | 12  | 10 | 8  | 5  | 4  | 3  | 3  | 3   |

1. Add 0.5 per 1000 $\mu$ F for products more than 1000 $\mu$ F at -25°C
2. Add 1.0 per 1000 $\mu$ F for products more than 1000 $\mu$ F at -40°C

|                  |     |     |     |     |     |     |
|------------------|-----|-----|-----|-----|-----|-----|
| W.V. (V.D.C.)    | 160 | 200 | 250 | 350 | 400 | 450 |
| Z(-25°C)/Z(20°C) | 2   | 2   | 3   | 5   | 6   | 6   |

■ Table 3      Frequency correction factor for ripple current

|                |        |     |     |      |
|----------------|--------|-----|-----|------|
| Frequency (Hz) | 50, 60 | 120 | 1k  | 10k~ |
| Coefficient    | 0.7    | 1   | 1.3 | 1.7  |

### Remark

| Customer<br>Part No | Matsushita<br>Part No | W.V.<br>(V D.C.) | Cap<br>(μF) | tan δ | D.C.L.<br>(μA) | Ripple<br>current<br>(mA rms.)<br>*1 | Dim. (mm) |      |     |      |
|---------------------|-----------------------|------------------|-------------|-------|----------------|--------------------------------------|-----------|------|-----|------|
|                     |                       |                  |             |       |                |                                      | φD        | L    | F   | φd   |
|                     | ECA0JM330             | 6.3              | 33          | 0.28  | 3.0            | 60                                   | 5         | 11   | 2.0 | 0.50 |
|                     | ECA0JM470             | 6.3              | 47          | 0.28  | 3.0            | 60                                   | 5         | 11   | 2.0 | 0.50 |
|                     | ECA0JM101             | 6.3              | 100         | 0.28  | 6.3            | 130                                  | 5         | 11   | 2.0 | 0.50 |
|                     | ECA0JM221             | 6.3              | 220         | 0.28  | 13.8           | 240                                  | 5         | 11   | 2.0 | 0.50 |
|                     | ECA0JM331             | 6.3              | 330         | 0.28  | 20.7           | 300                                  | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA0JM471             | 6.3              | 470         | 0.28  | 29.6           | 380                                  | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA0JM102             | 6.3              | 1000        | 0.28  | 63.0           | 580                                  | 8         | 11.5 | 3.5 | 0.60 |
|                     | ECA0JM222             | 6.3              | 2200        | 0.30  | 138.6          | 890                                  | 10        | 16   | 5.0 | 0.60 |
|                     | ECA0JM332             | 6.3              | 3300        | 0.32  | 207.9          | 1020                                 | 10        | 20   | 5.0 | 0.60 |
|                     | ECA0JM472             | 6.3              | 4700        | 0.34  | 296.1          | 1170                                 | 12.5      | 20   | 5.0 | 0.60 |
|                     | ECA0JM682             | 6.3              | 6800        | 0.38  | 428.4          | 1270                                 | 12.5      | 25   | 5.0 | 0.60 |
|                     | ECA0JM103             | 6.3              | 10000       | 0.46  | 630.0          | 1450                                 | 16        | 25   | 7.5 | 0.80 |
|                     | ECA0JM153             | 6.3              | 15000       | 0.56  | 945.0          | 1700                                 | 16        | 31.5 | 7.5 | 0.80 |
|                     | ECA0JM223             | 6.3              | 22000       | 0.70  | 1386.0         | 1900                                 | 18        | 35.5 | 7.5 | 0.80 |
|                     |                       |                  |             |       |                |                                      |           |      |     |      |
|                     | ECA1AM101             | 10               | 100         | 0.24  | 10.0           | 150                                  | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1AM221             | 10               | 220         | 0.24  | 22.0           | 250                                  | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA1AM221U            | 10               | 220         | 0.24  | 22.0           | 240                                  | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1AM331             | 10               | 330         | 0.24  | 33.0           | 330                                  | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA1AM471             | 10               | 470         | 0.24  | 47.0           | 400                                  | 8         | 11.5 | 3.5 | 0.60 |
|                     | ECA1AM471U            | 10               | 470         | 0.24  | 47.0           | 350                                  | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA1AM102             | 10               | 1000        | 0.24  | 100.0          | 630                                  | 10        | 12.5 | 5.0 | 0.60 |
|                     | ECA1AM222             | 10               | 2200        | 0.26  | 220.0          | 920                                  | 10        | 20   | 5.0 | 0.60 |
|                     | ECA1AM222U            | 10               | 2200        | 0.26  | 220.0          | 920                                  | 10        | 16   | 5.0 | 0.60 |
|                     | ECA1AM332             | 10               | 3300        | 0.28  | 330.0          | 1090                                 | 12.5      | 20   | 5.0 | 0.60 |
|                     | ECA1AM472             | 10               | 4700        | 0.30  | 470.0          | 1200                                 | 12.5      | 25   | 5.0 | 0.60 |
|                     | ECA1AM682             | 10               | 6800        | 0.34  | 680.0          | 1400                                 | 16        | 25   | 7.5 | 0.80 |
|                     | ECA1AM103             | 10               | 10000       | 0.42  | 1000.0         | 1600                                 | 16        | 31.5 | 7.5 | 0.80 |
|                     | ECA1AM153             | 10               | 15000       | 0.52  | 1500.0         | 1850                                 | 18        | 35.5 | 7.5 | 0.80 |
|                     |                       |                  |             |       |                |                                      |           |      |     |      |
|                     | ECA1CM100             | 16               | 10          | 0.20  | 3.0            | 30                                   | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1CM220             | 16               | 22          | 0.20  | 3.5            | 75                                   | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1CM330             | 16               | 33          | 0.20  | 5.2            | 110                                  | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1CM470             | 16               | 47          | 0.20  | 7.5            | 130                                  | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1CM680             | 16               | 68          | 0.20  | 10.9           | 140                                  | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1CM101             | 16               | 100         | 0.20  | 16.0           | 180                                  | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1CM221             | 16               | 220         | 0.20  | 35.2           | 280                                  | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA1CM331             | 16               | 330         | 0.20  | 52.8           | 350                                  | 8         | 11.5 | 3.5 | 0.60 |
|                     | ECA1CM471             | 16               | 470         | 0.20  | 75.2           | 440                                  | 8         | 11.5 | 3.5 | 0.60 |
|                     | ECA1CM102             | 16               | 1000        | 0.20  | 160.0          | 680                                  | 10        | 16   | 5.0 | 0.60 |
|                     | ECA1CM102L            | 16               | 1000        | 0.20  | 160.0          | 680                                  | 8         | 20   | 3.5 | 0.60 |
|                     | ECA1CM102U            | 16               | 1000        | 0.20  | 160.0          | 680                                  | 10        | 12.5 | 5.0 | 0.60 |
|                     | ECA1CM222             | 16               | 2200        | 0.22  | 352.0          | 10                                   |           |      |     |      |

\*1 120Hz 85°C

Matsushita Electronic Devices (M) Sdn. Bhd.  
Electrolytic Capacitor Division

Standard long lead type

[illegible]

Remark <sup>\*</sup><sub>1</sub>

120Hz 85°C

|                  |            |
|------------------|------------|
| Established Date | 10.06.2004 |
|------------------|------------|

Matsushita Electronic Devices (M) Sdn. Bhd.  
Electrolytic Capacitor Division

Standard long lead type

| Customer<br>Part No | Matsushita<br>Part No | W.V.<br>(V D.C.) | Cap<br>(μF) | tan δ<br>max. | L.C.<br>(μA)<br>max. | Ripple<br>current<br>(mA rms.)<br>max. *1 | Dim. (mm) |      |     |      |
|---------------------|-----------------------|------------------|-------------|---------------|----------------------|-------------------------------------------|-----------|------|-----|------|
|                     |                       |                  |             |               |                      |                                           | φD        | L    | P   | φd   |
|                     | ECA1HM0R1             | 50               | 0.1         | 0.12          | 3.0                  | 1.3                                       | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HMR22             | 50               | 0.22        | 0.12          | 3.0                  | 2.9                                       | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HMR33             | 50               | 0.33        | 0.12          | 3.0                  | 4.4                                       | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HMR47             | 50               | 0.47        | 0.12          | 3.0                  | 5                                         | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HMR68             | 50               | 0.68        | 0.12          | 3.0                  | 7                                         | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HM010             | 50               | 1           | 0.12          | 3.0                  | 10                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HM2R2             | 50               | 2.2         | 0.12          | 3.0                  | 20                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HM3R3             | 50               | 3.3         | 0.12          | 3.0                  | 35                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HM4R7             | 50               | 4.7         | 0.12          | 3.0                  | 45                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HM6R8             | 50               | 6.8         | 0.12          | 3.0                  | 7                                         | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HM100             | 50               | 10          | 0.12          | 5.0                  | 65                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HM220             | 50               | 22          | 0.12          | 11.0                 | 100                                       | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HM330             | 50               | 33          | 0.12          | 16.5                 | 110                                       | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1HM470             | 50               | 47          | 0.12          | 23.5                 | 130                                       | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA1HM101             | 50               | 100         | 0.12          | 50.0                 | 250                                       | 8         | 11.5 | 3.5 | 0.60 |
|                     | ECA1HM221             | 50               | 220         | 0.12          | 110.0                | 400                                       | 10        | 12.5 | 5.0 | 0.60 |
|                     | ECA1HM331             | 50               | 330         | 0.12          | 165.0                | 500                                       | 10        | 16   | 5.0 | 0.60 |
|                     | ECA1HM471             | 50               | 470         | 0.12          | 235.0                | 650                                       | 10        | 20   | 5.0 | 0.60 |
|                     | ECA1HM102             | 50               | 1000        | 0.12          | 500.0                | 1050                                      | 12.5      | 25   | 5.0 | 0.60 |
|                     | ECA1HM222             | 50               | 2200        | 0.14          | 1100.0               | 1300                                      | 16        | 31.5 | 7.5 | 0.80 |
|                     | ECA1HM332             | 50               | 3300        | 0.16          | 1650.0               | 1500                                      | 18        | 35.5 | 7.5 | 0.80 |
|                     |                       |                  |             |               |                      |                                           |           |      |     |      |
|                     | ECA1JM010             | 63               | 1           | 0.11          | 3.0                  | 15                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1JM2R2             | 63               | 2.2         | 0.11          | 3.0                  | 25                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1JM4R7             | 63               | 4.7         | 0.11          | 3.0                  | 50                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1JM100             | 63               | 10          | 0.11          | 6.3                  | 70                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1JM220             | 63               | 22          | 0.11          | 13.8                 | 105                                       | 5         | 11   | 2.0 | 0.50 |
|                     | ECA1JM330             | 63               | 33          | 0.11          | 20.7                 | 130                                       | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA1JM470             | 63               | 47          | 0.11          | 29.6                 | 160                                       | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA1JM101             | 63               | 100         | 0.11          | 63.0                 | 270                                       | 8         | 11.5 | 3.5 | 0.60 |
|                     | ECA1JM101S            | 63               | 100         | 0.11          | 63.0                 | 270                                       | 10        | 12.5 | 5.0 | 0.60 |
|                     | ECA1JM221             | 63               | 220         | 0.11          | 138.6                | 450                                       | 10        | 16   | 5.0 | 0.60 |
|                     | ECA1JM331             | 63               | 330         | 0.11          | 207.9                | 550                                       | 10        | 20   | 5.0 | 0.60 |
|                     | ECA1JM471             | 63               | 470         | 0.11          | 296.1                | 750                                       | 12.5      | 20   | 5.0 | 0.60 |
|                     | ECA1JM102             | 63               | 1000        | 0.11          | 630.0                | 1100                                      | 16        | 25   | 7.5 | 0.80 |
|                     | ECA1JM222             | 63               | 2200        | 0.13          | 1386.0               | 1400                                      | 18        | 35.5 | 7.5 | 0.80 |

### Remark

\*1 120Hz 85°C

Established Date  
10.06.2004

Matsushita Electronic Devices (M) Sdn. Bhd.  
Electrolytic Capacitor Division

| Customer<br>Part No | Matsushita<br>Part No | W.V.<br>(V D.C.) | Cap<br>(μF) | tan δ<br>max. | L.C.<br>(μA)<br>max. | Ripple<br>current<br>(mA rms.)<br>max. *1 | Dim. (mm) |      |     |      |
|---------------------|-----------------------|------------------|-------------|---------------|----------------------|-------------------------------------------|-----------|------|-----|------|
|                     |                       |                  |             |               |                      |                                           | φD        | L    | P   | φd   |
|                     | ECA2AMR47             | 100              | 0.47        | 0.06          | 3.0                  | 10                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA2AM010             | 100              | 1           | 0.06          | 3.0                  | 20                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA2AM2R2             | 100              | 2.2         | 0.06          | 3.0                  | 30                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA2AM3R3             | 100              | 3.3         | 0.06          | 3.0                  | 40                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA2AM4R7             | 100              | 4.7         | 0.06          | 3.0                  | 50                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA2AM100             | 100              | 10          | 0.06          | 10.0                 | 70                                        | 5         | 11   | 2.0 | 0.50 |
|                     | ECA2AM220             | 100              | 22          | 0.06          | 22.0                 | 115                                       | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA2AM330             | 100              | 33          | 0.06          | 33.0                 | 145                                       | 8         | 11.5 | 3.5 | 0.60 |
|                     | ECA2AM470             | 100              | 47          | 0.06          | 47.0                 | 180                                       | 8         | 11.5 | 3.5 | 0.60 |
|                     | ECA2AM101             | 100              | 100         | 0.06          | 100.0                | 350                                       | 10        | 16   | 5.0 | 0.60 |
|                     | ECA2AM221             | 100              | 220         | 0.06          | 220.0                | 550                                       | 12.5      | 20   | 5.0 | 0.60 |
|                     | ECA2AM331             | 100              | 330         | 0.06          | 330.0                | 700                                       | 12.5      | 25   | 5.0 | 0.60 |
|                     | ECA2AM471             | 100              | 470         | 0.06          | 470.0                | 900                                       | 16        | 25   | 7.5 | 0.80 |
|                     | ECA2AM102             | 100              | 1000        | 0.06          | 1000.0               | 1300                                      | 18        | 35.5 | 7.5 | 0.80 |
|                     |                       |                  |             |               |                      |                                           |           |      |     |      |
|                     | ECA2CMR47             | 160              | 0.47        | 0.16          | 3.0                  | 9.5                                       | 5         | 11   | 2.0 | 0.50 |
|                     | ECA2CM010             | 160              | 1           | 0.16          | 3.0                  | 36                                        | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA2CM2R2             | 160              | 2.2         | 0.16          | 3.5                  | 53                                        | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA2CM3R3             | 160              | 3.3         | 0.16          | 5.3                  | 66                                        | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA2CM4R7             | 160              | 4.7         | 0.16          | 7.5                  | 78                                        | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA2CM6R8             | 160              | 6.8         | 0.16          | 10.9                 | 86                                        | 8         | 11.5 | 3.5 | 0.60 |
|                     | ECA2CM100             | 160              | 10          | 0.16          | 16.0                 | 105                                       | 10        | 12.5 | 5.0 | 0.60 |
|                     | ECA2CM220             | 160              | 22          | 0.16          | 35.2                 | 175                                       | 10        | 16   | 5.0 | 0.60 |
|                     | ECA2CM330             | 160              | 33          | 0.16          | 52.8                 | 235                                       | 10        | 20   | 5.0 | 0.60 |
|                     | ECA2CM470             | 160              | 47          | 0.16          | 75.2                 | 320                                       | 12.5      | 20   | 5.0 | 0.60 |
|                     | ECA2CM101             | 160              | 100         | 0.16          | 160.0                | 515                                       | 12.5      | 25   | 5.0 | 0.60 |
|                     | ECA2CM221             | 160              | 220         | 0.16          | 352.0                | 830                                       | 16        | 31.5 | 7.5 | 0.80 |
|                     | ECA2CM471             | 160              | 470         | 0.16          | 752.0                | 1440                                      | 18        | 40   | 7.5 | 0.80 |
|                     |                       |                  |             |               |                      |                                           |           |      |     |      |
|                     | ECA2DM010             | 200              | 1           | 0.18          | 3.0                  | 34                                        | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA2DM2R2             | 200              | 2.2         | 0.18          | 4.4                  | 50                                        | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA2DM3R3             | 200              | 3.3         | 0.18          | 6.6                  | 62                                        | 6.3       | 11.2 | 2.5 | 0.50 |
|                     | ECA2DM4R7             | 200              | 4.7         | 0.18          | 9.4                  | 86                                        | 8         | 11.5 | 3.5 | 0.60 |
|                     | ECA2DM100             | 200              | 10          | 0.18          | 20.0                 | 100                                       | 10        | 12.5 | 5.0 | 0.60 |
|                     | ECA2DM220             | 200              | 22          | 0.18          | 44.0                 | 180                                       | 10        | 20   | 5.0 | 0.60 |
|                     | ECA2DM330             | 200              | 33          | 0.18          | 66.0                 | 220                                       | 10        | 20   | 5.0 | 0.60 |
|                     | ECA2DM470             | 200              | 47          | 0.18          | 94.0                 | 300                                       | 12.5      | 20   | 5.0 | 0.60 |
|                     | ECA2DM820             | 200              | 82          | 0.18          | 164.0                | 390                                       | 16        | 25   | 7.5 | 0.80 |
|                     | ECA2DM101             | 200              | 100         | 0.18          | 200.0                | 475                                       | 16        | 25   | 7.5 | 0.80 |
|                     | ECA2DM151             | 200              | 150         | 0.18          | 300.0                | 530                                       | 16        | 31.5 | 7.5 | 0.80 |
|                     | ECA2DM221U            | 200              | 220         | 0.18          | 440.0                | 530                                       | 16        | 31.5 | 7.5 | 0.80 |
|                     | ECA2DM331U            | 200              | 330         | 0.18          | 660.0                | 1140                                      | 18        | 35.5 | 7.5 | 0.80 |
|                     | ECA2DM331             | 200              | 330         | 0.18          | 660.0                | 1140                                      | 18        | 40   |     |      |

\*1 120Hz 85°C

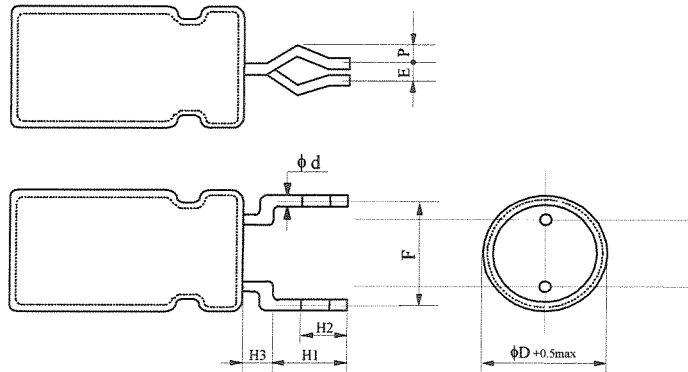
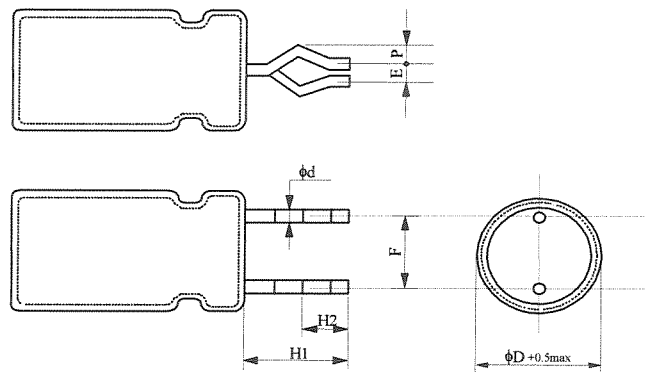
Matsushita Electronic Devices (M) Sdn. Bhd.  
Electrolytic Capacitor Division

| Customer<br>Part No | Matsushita<br>Part No | W.V.<br>(V D.C.) | Cap<br>( $\mu$ F) | tan $\delta$<br>max. | L.C.<br>( $\mu$ A)<br>max. | Ripple<br>current<br>(mA rms.)<br>max. *1 | Dim. (mm) |      |     |          |
|---------------------|-----------------------|------------------|-------------------|----------------------|----------------------------|-------------------------------------------|-----------|------|-----|----------|
|                     |                       |                  |                   |                      |                            |                                           | $\phi$ D  | L    | P   | $\phi$ d |
|                     | ECA2EMR47             | 250              | 0.47              | 0.18                 | 3.0                        | 34                                        | 5         | 11   | 2.0 | 0.50     |
|                     | ECA2EM010             | 250              | 1                 | 0.18                 | 3.0                        | 34                                        | 6.3       | 11.2 | 2.5 | 0.50     |
|                     | ECA1EM2R2             | 250              | 2.2               | 0.18                 | 5.5                        | 50                                        | 6.3       | 11.2 | 2.5 | 0.50     |
|                     | ECA2EM3R3             | 250              | 3.3               | 0.18                 | 8.3                        | 72                                        | 8         | 11.5 | 3.5 | 0.60     |
|                     | ECA2EM4R7             | 250              | 4.7               | 0.18                 | 11.8                       | 86                                        | 8         | 11.5 | 3.5 | 0.60     |
|                     | ECA2EM100             | 250              | 10                | 0.18                 | 25.0                       | 110                                       | 10        | 16   | 5.0 | 0.60     |
|                     | ECA2EM220             | 250              | 22                | 0.18                 | 55.0                       | 180                                       | 10        | 20   | 5.0 | 0.60     |
|                     | ECA2EM220U            | 250              | 22                | 0.18                 | 55.0                       | 180                                       | 10        | 16   | 5.0 | 0.60     |
|                     | ECA2EM330             | 250              | 33                | 0.18                 | 82.5                       | 250                                       | 12.5      | 20   | 5.0 | 0.60     |
|                     | ECA2EM470             | 250              | 47                | 0.18                 | 117.5                      | 330                                       | 12.5      | 25   | 5.0 | 0.60     |
|                     | ECA2EM101             | 250              | 100               | 0.18                 | 250.0                      | 530                                       | 16        | 31.5 | 7.5 | 0.80     |
|                     | ECA2EM101S            | 250              | 100               | 0.18                 | 250.0                      | 530                                       | 18        | 20   | 7.5 | 0.80     |
|                     | ECA2EM221             | 250              | 220               | 0.18                 | 550.0                      | 930                                       | 18        | 40   | 7.5 | 0.80     |
|                     |                       |                  |                   |                      |                            |                                           |           |      |     |          |
|                     | ECA2VM010             | 350              | 1                 | 0.20                 | 3.5                        | 32                                        | 6.3       | 11.2 | 2.5 | 0.50     |
|                     | ECA2VM2R2             | 350              | 2.2               | 0.20                 | 7.7                        | 55                                        | 8         | 11.5 | 3.5 | 0.60     |
|                     | ECA2VM3R3             | 350              | 3.3               | 0.20                 | 11.6                       | 60                                        | 8         | 11.5 | 3.5 | 0.60     |
|                     | ECA2VM4R7             | 350              | 4.7               | 0.20                 | 16.5                       | 65                                        | 10        | 12.5 | 5.0 | 0.50     |
|                     | ECA2VM100             | 350              | 10                | 0.20                 | 35.0                       | 115                                       | 10        | 20   | 5.0 | 0.60     |
|                     | ECA2VM220             | 350              | 22                | 0.20                 | 77.0                       | 195                                       | 12.5      | 20   | 5.0 | 0.60     |
|                     | ECA2VM330             | 350              | 33                | 0.20                 | 115.5                      | 300                                       | 16        | 25   | 7.5 | 0.80     |
|                     | ECA2VM470             | 350              | 47                | 0.20                 | 164.5                      | 325                                       | 16        | 25   | 7.5 | 0.80     |
|                     |                       |                  |                   |                      |                            |                                           |           |      |     |          |
|                     | ECA2GM010             | 400              | 1                 | 0.20                 | 4.0                        | 32                                        | 6.3       | 11.2 | 2.5 | 0.50     |
|                     | ECA2GM2R2             | 400              | 2.2               | 0.20                 | 8.8                        | 50                                        | 8         | 11.5 | 3.5 | 0.60     |
|                     | ECA2GM3R3             | 400              | 3.3               | 0.20                 | 13.2                       | 54                                        | 10        | 12.5 | 5.0 | 0.60     |
|                     | ECA2GM4R7             | 400              | 4.7               | 0.20                 | 18.8                       | 72                                        | 10        | 16   | 5.0 | 0.60     |
|                     | ECA2GM6R8             | 400              | 6.8               | 0.20                 | 27.2                       | 72                                        | 10        | 16   | 5.0 | 0.60     |
|                     | ECA2GM100             | 400              | 10                | 0.20                 | 40.0                       | 115                                       | 10        | 20   | 5.0 | 0.60     |
|                     | ECA2GM220             | 400              | 22                | 0.20                 | 88.0                       | 215                                       | 12.5      | 25   | 5.0 | 0.60     |
|                     | ECA2GM330             | 400              | 33                | 0.20                 | 132.0                      | 275                                       | 16        | 25   | 7.5 | 0.80     |
|                     | ECA2GM470             | 400              | 47                | 0.20                 | 188.0                      | 350                                       | 16        | 31.5 | 7.5 | 0.80     |
|                     | ECA2GM680U            | 400              | 68                | 0.20                 | 272.0                      | 350                                       | 16        | 31.5 | 7.5 | 0.80     |
|                     | ECA2GM820             | 400              | 82                | 0.20                 | 328.0                      | 300                                       | 18        | 35.5 | 7.5 | 0.80     |
|                     | ECA2GM101             | 400              | 100               | 0.20                 | 400.0                      | 600                                       | 18        | 40   | 7.5 | 0.80     |
|                     |                       |                  |                   |                      |                            |                                           |           |      |     |          |
|                     | ECA2WM010             | 450              | 1                 | 0.20                 | 4.5                        | 37                                        | 8         | 11.5 | 3.5 | 0.60     |
|                     | ECA2WM2R2             | 450              | 2.2               | 0.20                 | 9.9                        | 44                                        | 10        | 12.5 | 5.0 | 0.60     |
|                     | ECA2WM3R3             | 450              | 3.3               | 0.20                 | 14.9                       | 60                                        | 10        | 16   | 5.0 | 0.60     |
|                     | ECA2WM4R7             | 450              | 4.7               | 0.20                 | 21.2                       | 79                                        | 10        | 20   | 5.0 | 0.60     |
|                     | ECA2WM100             | 450              | 10                | 0.20                 | 45.0                       | 130                                       | 12.5      | 20   | 5.0 | 0.60     |
|                     | ECA2WM220             | 450              | 22                | 0.20                 | 99.0                       | 210                                       | 16        | 25   | 7.5 | 0.80     |
|                     | ECA2WM330             | 450              | 33                | 0.20                 | 148.5                      | 285                                       | 16        | 31.5 | 7.5 | 0.80     |

\*1 120Hz 85°C

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φ5 ~ φ8

 $\phi 10 \sim \phi 18$ 

\* Direction of bending shape is random

|      |          |     |         |         |     |        |           | [unit : mm] |     |
|------|----------|-----|---------|---------|-----|--------|-----------|-------------|-----|
| ΦD   | H1 ± 0.5 | H2  | H3 max. | F ± 0.5 | P   | E max. | Φd ± 0.05 | P.W.B.      |     |
|      |          |     |         |         |     |        |           | Φ           | t   |
| 5    | 4.5      | 2.7 | 2.5     | 5.0     | 1.0 | 1.0    | 0.5       | 0.9         | 1.6 |
| 6.3  | 4.5      | 2.7 | 2.5     | 5.0     | 1.0 | 1.0    | 0.5/0.6   | 1.0         | 1.6 |
| 8    | 4.5      | 2.7 | 2.5     | 5.0     | 1.0 | 1.0    | 0.6       | 1.0         | 1.6 |
| 10   | 4.5      | 2.7 | -       | 5.0     | 1.0 | 1.0    | 0.6       | 1.0         | 1.6 |
| 12.5 | 4.5      | 2.7 | -       | 5.0     | 1.0 | 1.0    | 0.6       | 1.0         | 1.6 |
| 16   | 4.5      | 2.7 | -       | 7.5     | 0.9 | 1.0    | 0.8       | 1.1         | 1.6 |
| 18   | 4.5      | 2.7 | -       | 7.5     | 0.9 | 1.0    | 0.8       | 1.1         | 1.6 |

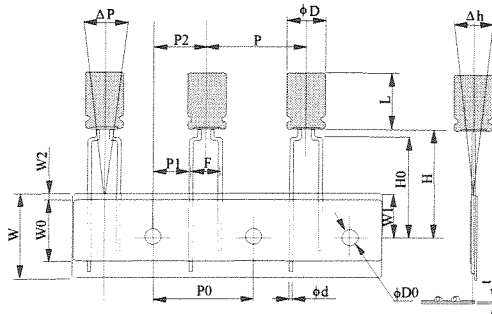
\* The above lead forming dimensions shall be subjected only to Electrolytic Capacitor outgoing inspection and not to customer's incoming inspection.  
Due to mechanical stress during transportation, actual dimensions may not meet to specification.

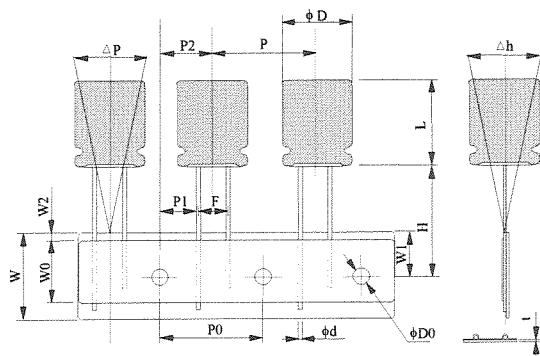
### Remark

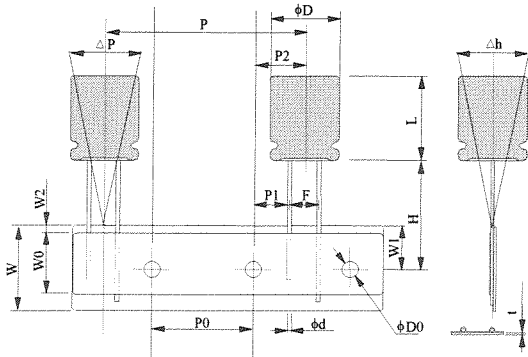
Established Date  
10.06.2004

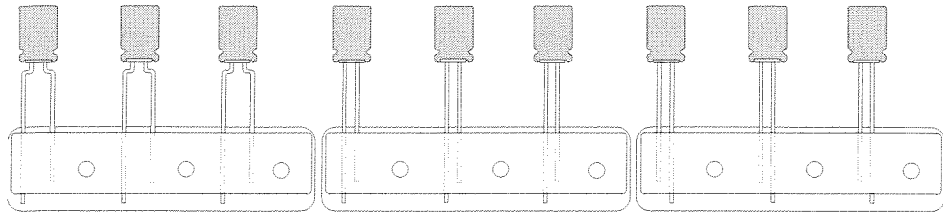
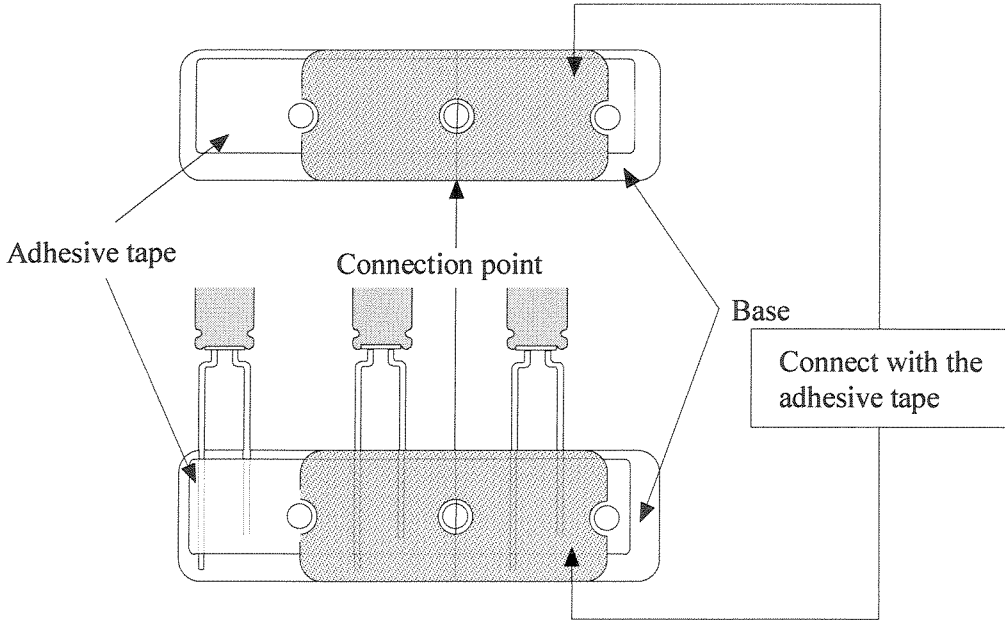
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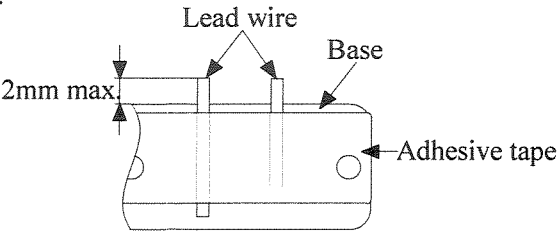
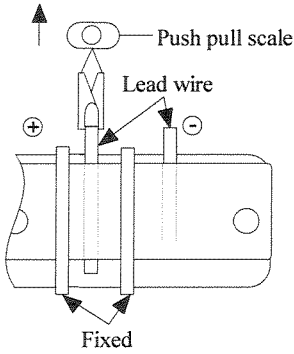
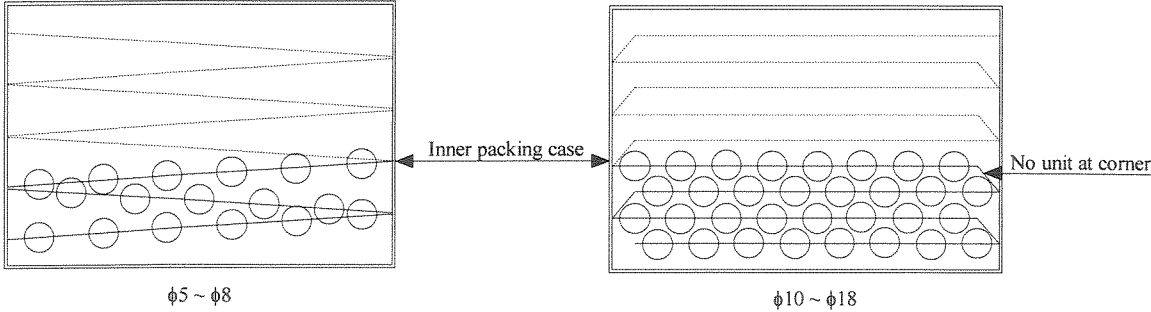
|                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                |             |               |                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------|---------------|----------------------------------------------------------|
| Miniature Aluminium Electrolytic Capacitor                                                                                                                                                                                                                                                                                                                                                                              |                                                                                |             |               | EM-O-TE-B-F17-01                                         |
| Lead taping ( I ) for $\phi 5 \sim \phi 6.3$                                                                                                                                                                                                                                                                                                                                                                            |                                                                                |             |               | Page 17                                                  |
| <p>1) Application range<br/>This specification is applied to aluminium electrolytic capacitor (JIS:04 type), taped with a single tape.</p> <p>2) Taping shape and dimension :</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p><math>\phi 5</math></p> </div> <div style="text-align: center;"> <p><math>\phi 6.3</math></p> </div> </div> |                                                                                |             |               |                                                          |
| [mm]                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                |             |               |                                                          |
| Item                                                                                                                                                                                                                                                                                                                                                                                                                    | Symbol                                                                         | Dimensions  | Tolerance     | Remarks                                                  |
| Product diameter                                                                                                                                                                                                                                                                                                                                                                                                        | $\phi D$                                                                       | 5    6.3    | + 0.50        |                                                          |
| Product length                                                                                                                                                                                                                                                                                                                                                                                                          | L                                                                              | 11.0 ~ 11.2 | + 1.00        |                                                          |
| Lead wire diameter                                                                                                                                                                                                                                                                                                                                                                                                      | $\phi d$                                                                       | 0.50        | $\pm 0.05$    |                                                          |
| Product pitch                                                                                                                                                                                                                                                                                                                                                                                                           | P                                                                              | 12.70       | $\pm 1.00$    |                                                          |
| Feed hole pitch                                                                                                                                                                                                                                                                                                                                                                                                         | P0                                                                             | 12.70       | $\pm 0.20$    |                                                          |
| Hole center to lead wire                                                                                                                                                                                                                                                                                                                                                                                                | P1                                                                             | 5.10        | $\pm 0.50$    | Specified by the contact face between tape and lead wire |
| Feed hole center to product center                                                                                                                                                                                                                                                                                                                                                                                      | P2                                                                             | 6.35        | $\pm 1.00$    |                                                          |
| Lead to lead distance                                                                                                                                                                                                                                                                                                                                                                                                   | F                                                                              | 2.50        | $\pm 0.50$    | Ditto                                                    |
| K liner width                                                                                                                                                                                                                                                                                                                                                                                                           | W                                                                              | 18.00       | $\pm 0.50$    |                                                          |
| Crepe tape width                                                                                                                                                                                                                                                                                                                                                                                                        | W0                                                                             | $6.0 \leq$  | -             |                                                          |
| Hole position                                                                                                                                                                                                                                                                                                                                                                                                           | W1                                                                             | 9.00        | $\pm 0.50$    |                                                          |
| Crepe tape slipping                                                                                                                                                                                                                                                                                                                                                                                                     | W2                                                                             | 1.50 max.   | -             |                                                          |
| Product from hole height                                                                                                                                                                                                                                                                                                                                                                                                | H                                                                              | 18.50       | +0.75 / -0.50 |                                                          |
| Feed hole diameter                                                                                                                                                                                                                                                                                                                                                                                                      | $\phi D0$                                                                      | 4.00        | $\pm 0.20$    |                                                          |
| Inclination of body                                                                                                                                                                                                                                                                                                                                                                                                     | $\Delta h$                                                                     | $1.00 \geq$ | -             | Specified by the edge of aluminium                       |
| Inclination of body                                                                                                                                                                                                                                                                                                                                                                                                     | $\Delta P$                                                                     | $1.00 \geq$ | -             |                                                          |
| Total tape thickness                                                                                                                                                                                                                                                                                                                                                                                                    | t                                                                              | 0.60        | $\pm 0.30$    | CP wire is not included                                  |
| Remark                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                |             |               |                                                          |
| Established Date<br>10.06.2004                                                                                                                                                                                                                                                                                                                                                                                          | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |             |               |                                                          |

|                                                                                                                                    |                                                                                |             |          |                  |                                                          |
|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------|----------|------------------|----------------------------------------------------------|
| Miniature Aluminium Electrolytic Capacitor                                                                                         |                                                                                |             |          | EM-O-TE-B-F17-01 |                                                          |
| Lead taping ( B ) for $\phi 5 \sim \phi 8$                                                                                         |                                                                                |             |          | Page 18          |                                                          |
| 1) Application range<br>This specification is applied to aluminium electrolytic capacitor (JIS:04 type), taped with a single tape. |                                                                                |             |          |                  |                                                          |
| 2) Taping shape and dimension :                                                                                                    |                                                                                |             |          |                  |                                                          |
|                                                  |                                                                                |             |          |                  |                                                          |
| [mm]                                                                                                                               |                                                                                |             |          |                  |                                                          |
| Item                                                                                                                               | Symbol                                                                         | Dimensions  |          | Tolerance        | Remarks                                                  |
| Product diameter                                                                                                                   | $\phi D$                                                                       | 5           | 6.3    8 | + 0.50           |                                                          |
| Product length                                                                                                                     | L                                                                              | 11.0 ~ 11.5 |          | + 1.00           |                                                          |
| Lead wire diameter                                                                                                                 | $\phi d$                                                                       | 0.50        | 0.60     | $\pm 0.05$       |                                                          |
| Product pitch                                                                                                                      | P                                                                              | 12.70       |          | $\pm 1.00$       |                                                          |
| Feed hole pitch                                                                                                                    | P0                                                                             | 12.70       |          | $\pm 0.20$       |                                                          |
| Hole center to lead wire                                                                                                           | P1                                                                             | 3.85        |          | $\pm 0.50$       | Specified by the contact face between tape and lead wire |
| Feed hole center to product center                                                                                                 | P2                                                                             | 6.35        |          | $\pm 1.00$       |                                                          |
| Lead to lead distance                                                                                                              | F                                                                              | 5.00        |          | +0.80 / -0.20    | Ditto                                                    |
| K liner width                                                                                                                      | W                                                                              | 18.00       |          | $\pm 0.50$       |                                                          |
| Crepe tape width                                                                                                                   | W0                                                                             | 6.0 ≤       |          | -                |                                                          |
| Hole position                                                                                                                      | W1                                                                             | 9.00        |          | $\pm 0.50$       |                                                          |
| Crepe tape slipping                                                                                                                | W2                                                                             | 1.50 max.   |          | -                |                                                          |
| Product from hole height                                                                                                           | H                                                                              | 18.5        | 20.0     | +0.75 / -0.50    |                                                          |
| Product from hole height                                                                                                           | H0                                                                             | 16.00       |          | $\pm 0.50$       |                                                          |
| Feed hole diameter                                                                                                                 | $\phi D0$                                                                      | 4.00        |          | $\pm 0.20$       |                                                          |
| Inclination of body                                                                                                                | $\Delta h$                                                                     | 1.00 ≥      |          | -                | Specified by the edge of aluminium                       |
| Inclination of body                                                                                                                | $\Delta P$                                                                     | 1.00 ≥      |          | -                |                                                          |
| Total tape thickness                                                                                                               | t                                                                              | 0.60        |          | $\pm 0.30$       | CP wire is not included                                  |
| Lead form angle, $\theta = 90^{\circ}$ min      |                                                                                |             |          |                  |                                                          |
| Remark                                                                                                                             |                                                                                |             |          |                  |                                                          |
| Established Date<br>10.06.2004                                                                                                     | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |             |          |                  |                                                          |

|                                                                                                                                    |                                                                                |             |       |                  |                                                          |
|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------|-------|------------------|----------------------------------------------------------|
| Miniature Aluminium Electrolytic Capacitor                                                                                         |                                                                                |             |       | EM-O-TE-B-F17-01 |                                                          |
| Lead taping ( B ) for $\phi 10 \sim \phi 12.5$                                                                                     |                                                                                |             |       | Page 19          |                                                          |
| 1) Application range<br>This specification is applied to aluminium electrolytic capacitor (JIS:04 type), taped with a single tape. |                                                                                |             |       |                  |                                                          |
| 2) Taping shape and dimension :                                                                                                    |                                                                                |             |       |                  |                                                          |
|                                                  |                                                                                |             |       |                  |                                                          |
| [mm]                                                                                                                               |                                                                                |             |       |                  |                                                          |
| Item                                                                                                                               | Symbol                                                                         | Dimensions  |       | Tolerance        | Remarks                                                  |
| Product diameter                                                                                                                   | $\phi D$                                                                       | 10          | 12.5  | + 0.50           |                                                          |
| Product length                                                                                                                     | L                                                                              | 12.5 ~ 25.0 |       | -                |                                                          |
| Lead wire diameter                                                                                                                 | $\phi d$                                                                       | 0.60        |       | $\pm 0.05$       |                                                          |
| Product pitch                                                                                                                      | P                                                                              | 12.70       | 15.00 | $\pm 1.00$       |                                                          |
| Feed hole pitch                                                                                                                    | P0                                                                             | 12.70       | 15.00 | $\pm 0.20$       |                                                          |
| Hole center to lead wire                                                                                                           | P1                                                                             | 3.85        | 5.00  | $\pm 0.50$       | Specified by the contact face between tape and lead wire |
| Feed hole center to product center                                                                                                 | P2                                                                             | 6.35        | 7.50  | $\pm 1.00$       |                                                          |
| Lead to lead distance                                                                                                              | F                                                                              | 5.00        |       | +0.80 / -0.20    | Ditto                                                    |
| K liner width                                                                                                                      | W                                                                              | 18.00       |       | $\pm 0.50$       |                                                          |
| Crepe tape width                                                                                                                   | W0                                                                             | 6.0 $\leq$  |       | -                |                                                          |
| Hole position                                                                                                                      | W1                                                                             | 9.00        |       | $\pm 0.50$       |                                                          |
| Crepe tape slipping                                                                                                                | W2                                                                             | 1.5 max.    |       | -                |                                                          |
| Product from hole height                                                                                                           | H                                                                              | 18.50       |       | +0.75 / -0.50    |                                                          |
| Feed hole diameter                                                                                                                 | $\phi D0$                                                                      | 4.00        |       | $\pm 0.20$       |                                                          |
| Inclination of body                                                                                                                | $\Delta h$                                                                     | 1.00 $\geq$ |       | -                | Specified by the edge of aluminium                       |
| Inclination of body                                                                                                                | $\Delta P$                                                                     | 1.00 $\geq$ |       | -                |                                                          |
| Total tape thickness                                                                                                               | t                                                                              | 0.60        |       | $\pm 0.30$       | CP wire is not included                                  |
| Remark                                                                                                                             |                                                                                |             |       |                  |                                                          |
| Established Date<br>10.06.2004                                                                                                     | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |             |       |                  |                                                          |

|                                                                                                                                    |            |                                                                                |       |                  |                                                          |
|------------------------------------------------------------------------------------------------------------------------------------|------------|--------------------------------------------------------------------------------|-------|------------------|----------------------------------------------------------|
| Miniature Aluminium Electrolytic Capacitor                                                                                         |            |                                                                                |       | EM-O-TE-B-F17-01 |                                                          |
| Lead taping ( B ) for $\phi 16$ and $\phi 18$                                                                                      |            |                                                                                |       | Page 20          |                                                          |
| 1) Application range<br>This specification is applied to aluminium electrolytic capacitor (JIS:04 type), taped with a single tape. |            |                                                                                |       |                  |                                                          |
| 2) Taping shape and dimension :                                                                                                    |            |                                                                                |       |                  |                                                          |
|                                                  |            |                                                                                |       |                  |                                                          |
| [mm]                                                                                                                               |            |                                                                                |       |                  |                                                          |
| Item                                                                                                                               | Symbol     | Dimensions                                                                     |       | Tolerance        | Remarks                                                  |
| Product diameter                                                                                                                   | $\phi D$   | 16                                                                             | 18    | + 0.50           |                                                          |
| Product length                                                                                                                     | L          | 20~31.5                                                                        | 20~40 | + 2.00           |                                                          |
| Lead wire diameter                                                                                                                 | $\phi d$   | 0.80                                                                           |       | $\pm 0.05$       |                                                          |
| Product pitch                                                                                                                      | P          | 30.00                                                                          |       | $\pm 1.00$       |                                                          |
| Feed hole pitch                                                                                                                    | P0         | 15.00                                                                          |       | $\pm 0.20$       |                                                          |
| Hole center to lead wire                                                                                                           | P1         | 3.75                                                                           |       | $\pm 0.50$       | Specified by the contact face between tape and lead wire |
| Feed hole center to product center                                                                                                 | P2         | 7.50                                                                           |       | $\pm 1.00$       |                                                          |
| Lead to lead distance                                                                                                              | F          | 7.50                                                                           |       | $\pm 0.50$       | Ditto                                                    |
| K liner width                                                                                                                      | W          | 18.00                                                                          |       | $\pm 0.50$       |                                                          |
| Crepe tape width                                                                                                                   | W0         | 6.0 ≤                                                                          |       | -                |                                                          |
| Hole position                                                                                                                      | W1         | 9.00                                                                           |       | $\pm 0.50$       |                                                          |
| Crepe tape slipping                                                                                                                | W2         | 1.5 max.                                                                       |       | -                |                                                          |
| Product from hole height                                                                                                           | H          | 18.50                                                                          |       | +0.75 / -0.50    |                                                          |
| Feed hole diameter                                                                                                                 | $\phi D0$  | 4.00                                                                           |       | $\pm 0.20$       |                                                          |
| Inclination of body                                                                                                                | $\Delta h$ | 2.00 ≥                                                                         |       | -                | Specified by the edge of aluminium                       |
| Inclination of body                                                                                                                | $\Delta P$ | 1.30 ≥                                                                         |       | -                |                                                          |
| Total tape thickness                                                                                                               | t          | 0.60                                                                           |       | $\pm 0.30$       | CP wire is not included                                  |
| Remark                                                                                                                             |            |                                                                                |       |                  |                                                          |
| Established Date<br>10.06.2004                                                                                                     |            | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |       |                  |                                                          |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                |                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------|
| Miniature Aluminium Electrolytic Capacitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                | EM-O-TE-B-F17-01 |
| Lead taping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                | Page 21          |
| <p>1. <u>Taping method</u></p> <p>1-1 The capacitors shall be placed vertically on the base tape, and be fixed with the adhesive tape, with polarity oriented.</p> <p>Example :</p>  <p>Polarity direction :</p> <p><math>\phi 5 \sim \phi 12.5</math> : Negative on the right</p> <p><math>\phi 16 \sim \phi 18</math> : Negative the left</p> <p>1-2 Blank spaces for connection shall be no more than 3 pieces. The number of blank spaces shall not be limited.</p> <p>1-3 The connection method is as follows. The portion shall meet the general taping specification. The position of connection shall not be limited.</p>  <p>Note :</p> <ol style="list-style-type: none"> <li>1) The base shall not be piled</li> <li>2) The connection shall not be done with staples</li> </ol> |                                                                                |                  |
| Remark                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                |                  |
| Established Date<br>10.06.2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |                  |

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Miniature Aluminium Electrolytic Capacitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | EM-O-TE-B-F17-01                                                               |
| Lead taping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Page 22                                                                        |
| <p>1-4 In the case of removing the products after taping, lead wires shall be cut, or the capacitor shall be pulled out. The length of remaining lead wire shall be less than 2.0mm from the upper edge of the base tape.</p>  <p>1-5 Tensile strength of lead wire after taping (applicable for the positive lead wire only) :<br/>         Fix the tape as below and pull the positive lead wire along the vertical direction by using the push pull scale.<br/>         The tensile strength shall be greater than 2.94N.</p>  <p>After storing for 250 hours in an atmosphere of <math>40 \pm 2^{\circ}\text{C}</math> and 90 ~ 98%RH, the taped products shall meet the above specification and there shall be no inclination of the capacitors or masking the holes with the adhesive.</p> <p>2. <u>Packing method</u></p> <p>2-1 Taped products shall be packed in a zigzag pattern into a cardboard box.<br/>         There shall be a single part number in an inner carton.<br/>         (Example)</p>  |                                                                                |
| Remark                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                |
| Established Date<br>10.06.2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |

| Miniature Aluminium Electrolytic Capacitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                | EM-O-TE-B-F17-01 |          |     |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
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| Lead taping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                | Page 23          |          |     |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
| <p>2-2 Polarity identification on a cardboard box shall match the polarity of products.</p> <p>2-3 Inner carton box shall be handled as follows :</p> <ul style="list-style-type: none"><li>* No more than 10 inner carton boxes shall be piled.</li><li>* In the case of putting the boxes lengthways, the indication of polarity shall face upwards.</li><li>* The product shall be handled with care.</li></ul> <div><div><div><div><div><div></div><div></div></div><div>&lt;Right&gt;</div></div><div><div><div></div><div></div></div><div></div></div></div><div><div><div></div><div></div></div><div></div></div><div><div><div></div><div></div></div><div></div></div></div></div> <div><div><div><div><div><div></div><div></div></div><div>&lt;Wrong&gt;</div></div><div>X</div></div><div><div><div></div><div></div></div><div></div></div><div><div><div></div><div></div></div><div></div></div></div></div> <p>2-4 The inner cartons shall be packed in a cardboard box for transportation.<br/>Various part numbers can be packed in an outer carton box.</p> <p>2-5 Shape and dimensions of the inner carton shall be as follows. The lids have perforation for easy removal.</p> <div><div><div><div><div></div><div></div></div><div>(b)</div></div><div><div><div></div><div></div></div><div>(c)</div></div><div><div><div></div><div></div></div><div>(a)</div></div></div><div><table><tr><th colspan="2">Can size</th><th colspan="3">[mm]</th></tr><tr><th>ΦD</th><th>L</th><th>(a)</th><th>(b)</th><th>(c)</th></tr><tr><td>5</td><td>11</td><td>328</td><td>52</td><td>208</td></tr><tr><td>6.3</td><td>11.2</td><td>328</td><td>44</td><td>270</td></tr><tr><td rowspan="2">8</td><td>11.5</td><td>328</td><td>53</td><td>223</td></tr><tr><td>20</td><td>328</td><td>59</td><td>223</td></tr><tr><td rowspan="3">10</td><td>12.5</td><td>337</td><td>50</td><td>169</td></tr><tr><td>16</td><td>337</td><td>54</td><td>169</td></tr><tr><td>20</td><td>337</td><td>57</td><td>169</td></tr><tr><td rowspan="2">12.5</td><td>20</td><td>324</td><td>57</td><td>264</td></tr><tr><td>25</td><td>324</td><td>61</td><td>264</td></tr><tr><td rowspan="2">16</td><td>25</td><td>306</td><td>62</td><td>216</td></tr><tr><td>31.5</td><td>217</td><td>68</td><td>312</td></tr><tr><td>18</td><td>35.5</td><td>275</td><td>73</td><td>343</td></tr></table></div></div> <p>Note : The dimensions listed above may change without prior notice.<br/>The carton shall be suitable for the auto-insert machines after change.</p> |                                                                                |                  | Can size |     | [mm] |  |  | ΦD | L | (a) | (b) | (c) | 5 | 11 | 328 | 52 | 208 | 6.3 | 11.2 | 328 | 44 | 270 | 8 | 11.5 | 328 | 53 | 223 | 20 | 328 | 59 | 223 | 10 | 12.5 | 337 | 50 | 169 | 16 | 337 | 54 | 169 | 20 | 337 | 57 | 169 | 12.5 | 20 | 324 | 57 | 264 | 25 | 324 | 61 | 264 | 16 | 25 | 306 | 62 | 216 | 31.5 | 217 | 68 | 312 | 18 | 35.5 | 275 | 73 | 343 |
| Can size                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                | [mm]             |          |     |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
| ΦD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | L                                                                              | (a)              | (b)      | (c) |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 11                                                                             | 328              | 52       | 208 |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
| 6.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 11.2                                                                           | 328              | 44       | 270 |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 11.5                                                                           | 328              | 53       | 223 |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
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| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 12.5                                                                           | 337              | 50       | 169 |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 16                                                                             | 337              | 54       | 169 |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
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| 12.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 20                                                                             | 324              | 57       | 264 |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
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| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 25                                                                             | 306              | 62       | 216 |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 31.5                                                                           | 217              | 68       | 312 |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
| 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 35.5                                                                           | 275              | 73       | 343 |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
| Remark                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                |                  |          |     |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |
| Established Date<br>10.06.2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |                  |          |     |      |  |  |    |   |     |     |     |   |    |     |    |     |     |      |     |    |     |   |      |     |    |     |    |     |    |     |    |      |     |    |     |    |     |    |     |    |     |    |     |      |    |     |    |     |    |     |    |     |    |    |     |    |     |      |     |    |     |    |      |     |    |     |

| Miniature Aluminium Electrolytic Capacitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                | EM-O-TE-B-F17-01               |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------|------------------------------|--------------------------------|--------------------------------|---|------|-------|-----|------|-------|---|------|------|----|-----|------|------|-----|------|----|-----|------|----|-----|-----|
| Lead taping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                | Page 24                        |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| <p>2-6 Packing Quantity</p> <table border="1"> <thead> <tr> <th>Product diameter (Φ)<br/>[mm]</th><th>Inner carton quantity<br/>[pcs]</th><th>Outer carton quantity<br/>[pcs]</th></tr> </thead> <tbody> <tr><td>5</td><td>2000</td><td>10000</td></tr> <tr><td>6.3</td><td>2000</td><td>10000</td></tr> <tr><td>8</td><td>1000</td><td>5000</td></tr> <tr><td>10</td><td>500</td><td>2000</td></tr> <tr><td>12.5</td><td>500</td><td>2000</td></tr> <tr><td>16</td><td>250</td><td>1000</td></tr> <tr><td>18</td><td>250</td><td>500</td></tr> </tbody> </table> |                                                                                |                                | Product diameter (Φ)<br>[mm] | Inner carton quantity<br>[pcs] | Outer carton quantity<br>[pcs] | 5 | 2000 | 10000 | 6.3 | 2000 | 10000 | 8 | 1000 | 5000 | 10 | 500 | 2000 | 12.5 | 500 | 2000 | 16 | 250 | 1000 | 18 | 250 | 500 |
| Product diameter (Φ)<br>[mm]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Inner carton quantity<br>[pcs]                                                 | Outer carton quantity<br>[pcs] |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2000                                                                           | 10000                          |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| 6.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2000                                                                           | 10000                          |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1000                                                                           | 5000                           |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 500                                                                            | 2000                           |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| 12.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 500                                                                            | 2000                           |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 250                                                                            | 1000                           |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 250                                                                            | 500                            |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| <p>3. <u>Storage</u></p> <p>3-1 The handling method shall follow Item 2-3 which is specified in this specification.</p> <p>3-2 The product shall not be in contact with direct sunlight and the temperature and humidity shall be normal.</p>                                                                                                                                                                                                                                                                                                                     |                                                                                |                                |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| <p>4. <u>Ordering unit</u></p> <p>The order placed shall be multiples of inner carton quantity.</p> <p>Example :</p> <p>φ5 ~ φ6.3 : minimum 2,000 pieces</p> <p>φ8 : minimum 1,000 pieces</p> <p>φ10 ~ φ12.5 : minimum 500 pieces</p> <p>φ16 ~ φ18 : minimum 250 pieces</p>                                                                                                                                                                                                                                                                                       |                                                                                |                                |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| Remark                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                |                                |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |
| Established Date<br>10.06.2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |                                |                              |                                |                                |   |      |       |     |      |       |   |      |      |    |     |      |      |     |      |    |     |      |    |     |     |

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| Miniature Aluminium Electrolytic Capacitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | EM-O-TE-B-F17-01                                                               |
| Application Guidelines                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Page 25                                                                        |
| <p><b>1. Circuit design</b></p> <p><b>1.1 Operating Temperature and Frequency</b><br/> Electrical parameters for electrolytic capacitors are normally specified at 20°C temperature and 120Hz frequency. These parameters vary with changes in temperature and frequency. Circuit designers should take these changes into consideration.</p> <p>(1) Effects of operating temperature on electrical parameters</p> <p>a) At higher temperatures, leakage current and capacitance increase while equivalent series resistance (ESR) decreases.</p> <p>b) At lower temperatures, leakage current and capacitance decrease while equivalent series resistance (ESR) increases.</p> <p>(2) Effects of frequency on electrical parameters</p> <p>a) At higher frequencies, capacitance and impedance decrease while <math>\tan \delta</math> increases.</p> <p>b) At lower frequencies, ripple current generated heat will rise due to an increase in equivalent series resistance (ESR).</p> <p><b>1.2 Operating Temperature and Life Expectancy</b></p> <p>(1) Expected life is affected by operating temperature. Generally, each 10°C reduction in temperature will double the expected life. Use capacitors at the lowest possible temperature below maximum guaranteed temperature.</p> <p>(2) If operating temperatures exceed the maximum guaranteed limit, rapid electrical parameter deterioration will occur, and irreversible damage will result.<br/> Check for maximum capacitor operating temperatures including ambient temperature, internal capacitor temperature rise caused by ripple current, and the effects of radiated heat from power transistors, IC's or resistors.</p> <p>(3) The formula for calculating expected life at lower operating temperatures is as follows :</p> $L2 = L1 \times 2^{\frac{T1-T2}{10}}$ <p>L1 : Guaranteed life (h) at temperature, T1 °C<br/> L2 : Expected life (h) at temperature, T2 °C<br/> T1 : Maximum operating temperature (°C)<br/> T2 : Actual operating temperature, ambient temperature + temperature rise due to ripple current heating (°C)</p> <p><b>1.3 Common Application Condition To Avoid</b><br/> The following misapplication load conditions will cause rapid deterioration to capacitor electrical parameters. In addition, rapid heating and gas generation within the capacitor may occur causing the pressure relief vent to operate and resulting leakage of electrolyte. Under extreme conditions, explosion and fire may result.<br/> Leaking electrolyte is combustible and electrically conductive.</p> <p>(1) Reverse voltage<br/> DC capacitors have polarity. Verify correct polarity before insertion. For circuits with changing or uncertain polarity, use DC bi-polar capacitors. DC bi-polar capacitors are not suitable for use in AC circuits.</p> <p>(2) Charge/Discharge Applications<br/> Standard capacitors are not suitable for use in repeating charge/discharge applications. For charge/discharge application, consult us and advise actual conditions.</p> <p>(3) Overvoltage<br/> Do not apply voltages exceeding the maximum specified rated voltage. Voltages within the surge voltage rating are acceptable for short periods of time. Ensure that the sum of the DC voltage and the superimposed AC ripple voltage does not exceed the maximum specified rated voltage.</p> <p>(4) Ripple Current<br/> Do not apply ripple currents exceeding the maximum specified value. For high ripple current applications, use a capacitor designed for high ripple currents or contact us with your requirements. Ensure that allowable ripple currents superimposed on low DC bias voltage do not cause reverse voltage conditions.</p> <p><b>1.4 Using Two or More Capacitor in Series or Parallel</b></p> <p>(1) Capacitors Connected in Parallel<br/> The circuit resistance can closely approximate the series resistance of the capacitor causing an imbalance of ripple current loads within the capacitors. Careful design of wiring methods can minimize the possibility of excessive ripple currents applied to a capacitor.</p> |                                                                                |
| Established Date<br>10.06.2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |

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| Application Guidelines                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Page 26                                                                        |
| <p>(2) Capacitor Connected in Series<br/>Normal DC leakage current differences among capacitors can cause voltage imbalances. The use of voltage divider shunt resistors with consideration to leakage currents, can prevent capacitor voltage imbalances.</p> <p><b>1.5 Capacitor Mounting Considerations</b></p> <p>(1) Double-sided Circuit Boards<br/>Avoid wiring pattern runs which pass between the mounted capacitor and the circuit board. When dipping into a solder bath, excess solder may collect under the capacitor by capillary action and short-circuit the anode and cathode terminals.</p> <p>(2) Circuit Board Hole Positioning<br/>The vinyl sleeve of the capacitor can be damaged if solder passes through a lead hole for subsequently processed parts. Special care when locating hole positions in proximity to capacitors is recommended.</p> <p>(3) Circuit Board Hole Spacing<br/>The circuit board hole spacing should match the capacitor lead wire spacing within the specified tolerances. Incorrect spacing can cause excessive lead wire stress during the insertion process. This may result the premature capacitor failure due to short or open circuit, increased leakage current, or electrolyte leakage.</p> <p>(4) Clearance for Case Mounted Pressure Relief Vents<br/>Capacitor with case mounted pressure relief vents requires sufficient clearance to allow for proper vent operation. The minimum clearances are dependent on capacitor diameters as follows :<br/> <math>\phi 6.3 \sim \phi 16\text{mm}</math> : 2mm minimum,      <math>\phi 18 \text{ mm}</math> : 3mm minimum</p> <p>(5) Clearance for Seal Mounted Pressure Relief Vents<br/>A hole in the circuit board directly under the seal vent location is required to allow proper release of pressure.</p> <p>(6) Wiring Near the Pressure Relief Vent<br/>Avoid locating high voltage or high current wiring or circuit board paths above the pressure relief vent. Flammable, high temperature gas exceeding 100°C may be released which could dissolve the wire insulation and ignite.</p> <p>(7) Circuit Board Patterns Under the Capacitor<br/>Avoid circuit board runs under the capacitor as electrolyte leakage could cause an electrical short.</p> <p>(8) Screw Terminal Capacitor Mounting<br/>Do not orient the capacitor with the screw terminal side of the capacitor facing downwards. Tighten the terminal and mounting bracket screws within the torque range specified in the specification.</p> <p><b>1.6 Electrical Isolation of the Capacitor</b><br/>Completely isolate the capacitor as follows :</p> <p>(1) Between the cathode and the case (except for axially leaded B types) and between the anode terminal and other circuit paths.</p> <p>(2) Between the extra mounting terminals (on T types) and the anode terminal, cathode terminal, and other circuit paths.</p> <p><b>1.7 Capacitor Sleeve</b><br/>The vinyl sleeve or laminate coating is intended for marking and identification purposes and is not meant to electrically insulate the capacitor.<br/>The sleeving may split or crack if immersed into solvents such as toluene or xylene, and then exposed to high temperature.</p> <p style="text-align: center;"><i>CAUTION!!!!</i></p> <p>Always consider safety when designing equipment and circuits. Plan for worst case failure modes such short circuits and open circuits which could occur during use.</p> <p>(1) Provide protection circuits and protection devices to allow safe failure modes.</p> <p>(2) Design redundant or secondary circuits where possible to assure continued operation in case of main circuit failure.</p> <p><b>2. Capacitor Handling Techniques</b></p> <p><b>2.1 Consideration Before Using</b></p> <p>(1) Capacitors have a finite life. Do not reuse or recycle capacitors from used equipment.</p> <p>(2) Transient recovery voltage may be generated in the capacitor due to dielectric absorption. If required, this voltage can be discharged with a resistor with a value of about 1 k<math>\Omega</math>.</p> <p>(3) Capacitors stored for long periods of time may exhibit an increase in leakage current. This can be connected by gradually applying rated voltage in series with a resistor of approximately 1 k<math>\Omega</math>.</p> |                                                                                |
| Established Date<br>10.06.2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |

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| Application Guidelines                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                | Page 27          |
| <p>(4) If capacitors are dropped, they can be damaged mechanically or electrically. Avoid using dropped capacitors.</p> <p>(5) Dented or crushed capacitors should not be used. The seal integrity can be compromised and loss of electrolyte/shortened life can result.</p> <p><b>2.2 Capacitor Insertion</b></p> <p>(1) Verify the correct capacitance and rated voltage of the capacitors.</p> <p>(2) Verify the correct polarity of the capacitor before inserting.</p> <p>(3) Verify the correct pole spacing before insertion (land pattern size in chip type) to avoid stress on the terminals.</p> <p>(4) Ensure that the auto insertion equipment lead clinching operation does not stress the capacitor leads where they enter the seal of the capacitors. For chip type capacitors, excessive mounting pressure can cause high leakage current, short circuit, or disconnection.</p> <p><b>2.3 Manual Soldering</b></p> <p>(1) Observe temperature and time soldering specifications and do not exceed temperatures of 350°C for 3 seconds or less.</p> <p>(2) If lead wires must be formed to meet terminal board hole spacing, avoid stress on the lead wire where it enters the capacitor seal.</p> <p>(3) If a soldered capacitor must be removed and reinserted, avoid excessive stress to the capacitor leads.</p> <p>(4) Avoid touching the tip of the soldering iron to the capacitor, to prevent melting of the vinyl sleeve.</p> <p><b>2.4 Flow Soldering</b></p> <p>(1) Do not immerse the capacitor body into the solder bath as excessive internal pressure could result.</p> <p>(2) Observe proper soldering conditions (temperature, time, etc.). Do not exceed the specified limits.</p> <p>(3) Do not allow other parts or components to touch the capacitor during soldering.</p> <p><b>2.5 Other Soldering Consideration</b></p> <p>Rapid temperature rises during the preheat operation and resin bonding operation can cause cracking of the capacitor vinyl sleeve.</p> <p>For heat curing, do not exceed 150°C for a maximum time of 2 minutes.</p> <p><b>2.6 Capacitor Handling after Soldering</b></p> <p>(1) Avoid movement of the capacitor after soldering to prevent excessive stress on the lead wires where they enter the seal.</p> <p>(2) Do not use the capacitor as a handle when moving the circuit board assembly.</p> <p>(3) Avoid striking the capacitor after assembly to prevent failure due to excessive shock.</p> <p><b>2.7 Circuit Board Cleaning</b></p> <p>(1) Circuit boards can be immersed or ultrasonically cleaned using suitable cleaning solvents for up to 5 minutes and up to 60°C maximum temperatures. The boards should be thoroughly rinsed and dried.</p> <p>The use of ozone depleting cleaning agents are not recommended in the interest of protecting the environment.</p> <p>(2) Avoid using following solvent groups unless specifically allowed for in the specification :</p> <p>Halogenated cleaning solvent except for solvent resistant capacitor types, halogenated solvents can permeate the seal and cause internal capacitor corrosion and failure. For solvent resistant capacitors, carefully follow the temperature and time requirements for the specification. 1-1-1 trichloroethane should never be used on any aluminium electrolytic capacitor.</p> <ul style="list-style-type: none"> <li>● Alkali solvent : could attack and dissolve aluminium case.</li> <li>● Petroleum based solvent : deterioration of the rubber seal could result.</li> <li>● Xylene : deterioration of the rubber seal could result.</li> <li>● Acetone : removal of the ink markings on the vinyl sleeve could result.</li> </ul> <p>(3) A thorough drying after cleaning is required to remove residual cleaning solvents which maybe trapped between the capacitor and the circuit board. Avoid drying temperatures which exceed the maximum rated temperature of the capacitor.</p> <p>(4) Monitor the contamination levels of the cleaning solvents during use by electrical conductivity, pH, specific gravity, or water content. Chlorine levels can rise with contamination and adversely affect the performance of the capacitor.</p> |                                                                                |                  |
| Established Date<br>10.06.2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |                  |

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| Application Guidelines                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Page 28                                                                        |
| <p><b>2.8 Mounting Adhesives and Coating Agents</b><br/> When using mounting adhesives or coating agents to control humidity, avoid using materials containing halogenated solvents. Also, avoid the use of chloroprene base polymers.<br/> After applying adhesives or coatings, dry thoroughly to prevent residual solvents from being trapped between the capacitor and the circuit board.</p> <p><b>2.9 Fumigation</b><br/> In exporting electronic appliances with aluminium electrolytic capacitors, in some cases fumigation treatment using such halogen compound as methyl bromide is conducted for wooden boxes. If such boxes are not dried well, the halogen left in the box is dispersed while transported and enters in the capacitors inside. This possibly causes electrical corrosion of the capacitors. Therefore, after performing fumigation and drying make sure that no halogen is left. Don't perform fumigation treatment to the whole electronic appliances packed in a box.</p> <p><b>3.0 Precaution for using Capacitors</b><br/> <b>3.1 Environmental Conditions</b><br/> Capacitors should not be stored or used in the following environments.<br/> (1) Temperature exposure above the maximum rated or below the minimum rated temperature of the capacitors.<br/> (2) Direct contact with water, salt water, or oil.<br/> (3) High humidity condition where water could condense on the capacitor.<br/> (4) Exposure to toxic gases such as hydrogen sulphide, sulphuric acid, nitric acid, chlorine, or ammonia.<br/> (5) Exposure to ozone, radiation, or ultraviolet rays.<br/> (6) Vibration and shock conditions exceeding specified requirements.</p> <p><b>3.2 Electrical Precaution</b><br/> (1) Avoid touching the terminals of the capacitor as possible electric shock could result. The exposed aluminium case is not insulated and could also cause electric shock if touched.<br/> (2) Avoid short circuiting the area between the capacitor terminals with conductive materials including liquids such as acids and alkaline solutions.</p> <p><b>4.0 Emergency Procedures</b><br/> (1) If the pressure relief vent of the capacitor operates, immediately turn off the equipment and disconnect from the power source. This will minimize additional damage caused by the vaporizing electrolyte.<br/> (2) Avoid contact with the escaping electrolyte gas which exceeds 100°C temperatures. If electrolyte or gas enters the eye, immediately flush the eye with large amount of water. If electrolyte or gas is ingested by mouth, gargle with water. If electrolyte contacts the skin, wash with soap and water.</p> <p><b>5.0 Long Term Storage</b><br/> Leakage current of a capacitor increases with long storage times. The aluminium oxide film deteriorates as a function of temperature and time. If used without reconditioning, an abnormally high current will be required to restore the oxide film. This current surge could cause the circuit or the capacitor to fail. In-order to keep the capacitor life, we recommend the capacitor store in-doors and temperature between 15°C ~ 35°C. Expiry date of capacitor shall be according to product model or type. Please consult us concerning the product life model by model. After storing exceeding the expiry date of the product, a capacitor should be reconditioned by applying rated voltage in series with a 1000Ω, current limiting resistor for a time period of 30 minutes.</p> <p><b>5.1 Environmental Conditions</b><br/> (1) Temperature exposure above the maximum rated or below the minimum rated temperature of the capacitor.<br/> (2) Direct contact with water, salt water, or oil.<br/> (3) High humidity conditions where water could condense on the capacitor.<br/> (4) Exposure to toxic gases such as hydrogen sulphide, sulphuric acid, nitric acid, chlorine, or ammonia.<br/> (5) Exposure to ozone, radiation, or ultraviolet rays.<br/> (6) Vibration and shock conditions exceeding specified requirements.</p> <p><b>6.0 Capacitor Disposal</b><br/> When disposing of capacitors, use on of the following methods :<br/> (1) Incinerate after crushing the capacitor or puncturing the can wall (to prevent explosion due to internal pressure rise). Capacitors should be incinerated at high temperature to prevent the release of toxic gases such as chlorine from the polyvinyl chloride sleeve, etc.<br/> (2) Disposal of solid waste.<br/> NOTE : Local laws may have specific disposal requirements which must be followed.</p> |                                                                                |
| Established Date<br>10.06.2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Matsushita Electronic Devices (M) Sdn. Bhd.<br>Electrolytic Capacitor Division |