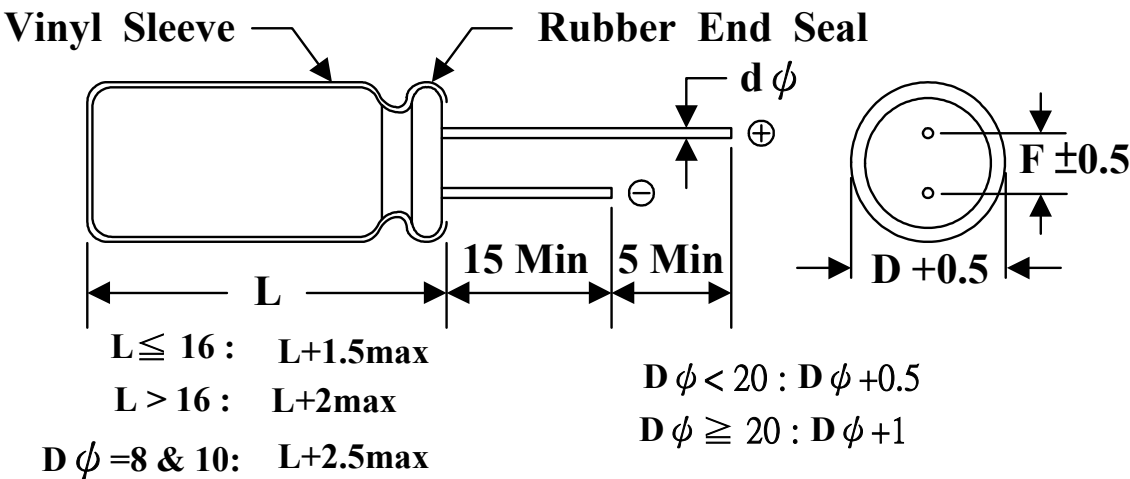


SZ Type

-40 to +105° C ultra low impedance and ESR, miniature aluminum electrolytic capacitors.

SZ type capacitors have been developed for use in output of mother board and other high frequency applications, which feature low equivalent series resistance, impedance and inductance over wide temperature range.

Diagram of Dimensions (Unit = mm)



| D φ | 5.0 | 6.0 | 8.0 | 10.0 | 12.0 | 13.0 | 16.0 | 18.0 | 22.0 |
|-----|-----|-----|-----|------|------|------|------|------|------|
| F   | 2.0 | 2.5 | 3.5 | 5.0  |      |      | 7.5  |      | 10.0 |
| d φ | 0.5 |     |     | 0.6  |      |      | 0.8  |      | 0.8  |

PERFORMANCE CHARACTERISTICS

Feature

- . Working voltage range : 6.3 to 16V
- . Operating temp. range : -40 to 105 °C
- . Rate capacitance range : 470 to 3300uF
- . Capacitance tolerance : -20 to +20%
- . DC leakage current (uA) : 0.03CV  
( Measurements shall be made after a 2 minute charge at rated working voltage)
- Dissipation factor : at 120 Hz, 20 °C

|       |     |    |    |
|-------|-----|----|----|
| WV(V) | 6.3 | 10 | 16 |
| ----- |     |    |    |
| DF(%) | 22  | 19 | 16 |

For capacitor whose capacitance exceeds 1000 uF, the value of DF(%) is increased by 2% for every addition of 1000 uF.

- . Load Life (2000 hrs, at rated temperature)
  - Capacitance change ..... : within ±25% of initial value
  - Dissipation factor ..... : not exceed 200% of specified value
  - Leakage current ..... : not exceed the specified value

Catalog Numbering

SZ    010   M    1000   B    5    S                    -    1012

      --    ---       -       ----    -    -       -    -       ----

      :       :       :       :       :       :       :       :       : ...Case size

      :       :       :       :       :       :       :       :       : ...Lead cut

      :       :       :       :       :       :       :       :       : ...Rubber

      :       :       :       :       :       :       :       :       : ...Pitch

      :       :       :       :       :       :       :       :       : ...Package Code

      :       :       :       :       :       :       :       :       : ...Capacitance. This expressed in microfarads

      :       :       :       :       :       :       :       :       : ...Capacitance tolerance

      :       :       :       :       :       :       :       :       : ...DC voltage rating. This is expressed in volt.

      :       :       :       :       :       :       :       :       : ...YAGEO type number. This identifies the basic capacitor design

*PERFORMANCE CHARACTERISTICS (continued)*

## 1. General Characteristics

1.1 Marking

Capacitors shall be marked with YAGEO mark ; rated capacitance ; rated DC working voltage range. and the date code of manufacture.

The cathode lead will be identified with minus signs (-) on the side of the case.

1.2 Operating Temperature Range

These capacitors are designed to operate over a temperature range of -40°C to +105°C .

1.2.1 At -40°C , capacitors shall retain at least 70% of their original 20°C measured capacitance. At +105°C. capacitance shall increase to no more than 120% of their original 20°C measured capacitance.

1.2.2 At -40°C , impedance shall increase to no more than the following table.

## TEMPERATURE CHARACTERISTIC (at 120Hz)

| Working Voltage (WV) | 6.3 | 10 | 16 |
|----------------------|-----|----|----|
|----------------------|-----|----|----|

|                           |   |   |   |
|---------------------------|---|---|---|
| Impedance Z-40°C / Z+20°C | 3 | 3 | 3 |
|---------------------------|---|---|---|

1.3 Vent Test (applies only to those capacitors with vents)

During and after the applicable test below (1.3.1 or 1.3.2.) there shall be no explosion, flash, flame or expulsion of particles of the core or container. In addition, the case shall not be expelled from the core.

If the capacitor under test is a multisection unit, this test shall apply to the input section only.

## 1.3.1 AC Test. Capacitors with DC Rating Over 16 Volts

The capacitor under test shall be connected to a 120 volt RMS 60Hz, 100 ampere service through a 30 ampere thermal breaker and a 0.5 ohm, low inductance, series resistor. The capacitor shall be connected to this circuit for 5 minutes after the initial setting of the breaker or until the breaker has opened 3 times. If the breaker opens, it shall be reset not sooner than 30 seconds nor longer than 60 seconds from the time it opened.

## 1.3.2 DC Test. Capacitors with DC Rating 16 Volts or Less

Both of the following tests shall be performed, but on separate test units.

## 1.3.2.1 Forward Bias Test.

The capacitor under test shall be connected to a DC power supply that has sufficient voltage to supply a constant direct current of 500 milliamperes with the positive terminal of the capacitor connected to the positive supply terminal and the negative capacitor terminal connected to the negative supply terminal. The constant current shall be maintained until (1) the capacitor vents, (2) 300 seconds have elapsed, or (3) the capacitor under test open circuits.

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*PERFORMANCE CHARACTERISTICS (continued)***1.3.2.2 Reverse Bias Test.**

The capacitor under test shall be connected to a power supply with sufficient voltage to provide a constant direct current of 500 milliamperes when the positive capacitor terminal is connected to the negative supply terminal and the negative capacitor terminal to the positive supply terminal. The constant current shall be maintained until (1) the capacitor vents, (2) 300 seconds have elapsed, or (3) The capacitor open circuits.

**2. Mechanical Characteristics****2.1 Lead Pull test**

Capacitor leads shall withstand a steady pull of 1 Kg applied axially to the leads for 5 seconds.

**3. Electrical Characteristics****3.1 Standard Test Conditions**

Unless otherwise specified all tests shall be performed at, or referred to, an ambient temperature of 20°C and a relative humidity not greater than 50%.

**3.2 Capacitance and Dissipation Factor**

Measurements shall be made on a capacitance bridge capable of  $\pm 2\%$  accuracy on capacitance and dissipation factor measurements. Measurements shall be made at 120 Hz The RMS value of the AC measuring voltage shall not exceed 1.0 volt.

**3.3 Leakage Current****3.3.1 Pre-conditioning.** Rated working voltage shall be applied to

capacitors for a minimum period of 15 minutes duration at least 24 hours and not more than 48 hours before test.

**3.3.2 Test.** Measurements shall be made after a 2 minute charge at rated

working voltage at 20°C with an application of a steady source of power. Such as a regular power supply, with a 1000 ohm resistance to limit the charging current, connected in series with each capacitor under test.

**3.4 Surge Voltage**

The surge DC rating is the maximum voltage to which the capacitor should be subjected under any conditions. This includes transients and peak ripple at the highest line voltage.

**3.4.1 Capacitors, connected in series with 1000 ohm resistors, shall withstand the surge test voltage applied at the rated of 1/2 minute on, 5 1/2 minutes off, for 1000 successive test cycles at 25°C.**

(see the following table)

|               |     |    |    |
|---------------|-----|----|----|
| Rated Voltage | 6.3 | 10 | 16 |
| -----         |     |    |    |
| Surge Voltage | 8   | 13 | 20 |

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*PERFORMANCE CHARACTERISTICS(continued)*

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3.4.2 After the test, the capacitors shall meet the requirement specified in the following table.

| Test               | Value after test                                  |
|--------------------|---------------------------------------------------|
| Leakage Current    | Not more than the initial value specified         |
| Capacitance Change | More than 85% of the value before test            |
| Dissipation Factor | Not more than 175% of the initial value specified |

### 3.5 Humidity Test

Capacitors shall be subjected to a temperature of  $40 \pm 2^{\circ}\text{C}$  at a relative humidity of 90-95% for a period of 500 hours, then air dried for 1 hour. Following this conditioning, capacitors shall meet the specified requirements for dissipation factor and DC leakage current, and the capacitance value shall not change more than 10%.

## 4. Life And Reliability Test

### 4.1 Life Test

4.1.1 Rated voltage shall be applied to the capacitors for a period of 2000 hours at  $105^{\circ}\text{C}$ .

4.1.2 Capacitors shall then be removed from the test chamber and return to room temperature.

4.1.3 The capacitance shall then be measured in accordance with section 3.2 It shall not decrease to less than 75% of the capacitance at  $20^{\circ}\text{C}$ , measured prior to the test, nor shall it increase to more than 125% of the original  $20^{\circ}\text{C}$  value.

4.1.4 The dissipation factor shall be measured in accordance with section 3.2 The dissipation factor shall not exceed 200% of the specified value.

4.1.5 At the conclusion of the test, the leakage current shall not exceed the initial DC leakage current requirement. Measurements shall be made in accordance with section 3.3

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*GUIDE TO APPLICATION*

## 1. Maximum Ripple Current

1.1 Maximum rms. ripple current at 105°C, 100K Hz is given in the table 1.

1.2 When capacitors are operated at temperatures other than 105°C, and frequency other than 100K Hz, the maximum rms. ripple currents must be multiplied by the factors shown in below table.

**COMPENSATION FACTOR OF RIPPLE CURRENT VERSUS FREQUENCY**

| $\mu F \setminus$ Frequency | 120  | 1K   | 10K  | 100K (Hz) |
|-----------------------------|------|------|------|-----------|
| 3300                        | 0.40 | 0.70 | 0.90 | 1         |

## 2. Ripple voltage

Ripple voltage must not exceed the following:

The sum of the DC voltage plus the AC ripple voltage must not exceed the rated DC voltage. The DC voltage plus the peak AC voltage must not cause a voltage reversal more than 1.5 volts.

## 3. Insulating

General types of aluminum electrolytic capacitors are covered with a vinyl sleeve or the like. And this sleeve is used for marking. When the internal element or the container is needed to be insulated, capacitors specially designed for insulation requirement are recommended to be used.

## 4. Soldering

4-1 When soldering a printed circuit board with various components too high soldering temperature or too long dipping times may cause secondary shrinking of the sleeve which unnecessarily exposes the container. Soldering is allowed to performed at less than 260°C for less than 10 seconds.

4-2 Soldering may melt or break the sleeve, if the sleeve is contacted with circuit patterns. To avoid this trouble, the capacitors are recommended to be slightly apart from the circuit boards.

## 5. Vent

The capacitors are provided with a pressure resistive controlled safety vent formed on the bottom of the container. The vent is designed to rupture in the event that higher internal pressure is developed by circuit malfunction or capacitor miss-use.

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*GUIDE TO APPLICATION (continued)*

## 6. High Altitude

These capacitors are capable of withstanding in transit conditions where storage temperature may range from -40°C to +105°C and the altitude may reach 200,000 feet.

## 7. Cleaning agents

Halogenated hydrocarbon cleaning solvents are not recommended for use in cleaning capacitors supplied with exposed end seals. Where cleaning with a halogenated solvent is desired, capacitors should be ordered with a Epoxy-coated end seal.

## 8. Others

- (1) All Yageo capacitors comply to RoHS(Restriction of Hazardous Substances) requirements where Chromium (Cr+6), Cadmium(Cd), Mercury(Hg), Lead (pb), Polybrominated biphenyls(PBBs) and Polybrominated biphenyl/diphenyl ethers (PBBEs/PBDEs) have not been detected [lower than MDL (Method Detection Limit)] per SGS certification test report.
- (2) Satisfied characteristic JIS C 5101
- (3) Aluminum Electrolytic Capacitors may be damaged by corrosion which is caused by any halogenated hydrocarbon solvents. Please let us know in advance the solvent name and conditions for your PCB cleaning.

**Table 1-1 SZ Type, Standard Ratings and Catalog Number**

| Catalog Number     | Capacitance<br>( $\mu$ F) | Rated<br>Voltage<br>(V.DC) | Size<br>D X L<br>(mm) | Leakage<br>Current<br>( $\mu$ A) | Dissipation<br>Factor<br>(Tan $\delta$ ) | Ripple<br>100KHz<br>(mA) | ESR<br>20 °C 100KHz<br>(ohm) |
|--------------------|---------------------------|----------------------------|-----------------------|----------------------------------|------------------------------------------|--------------------------|------------------------------|
| SZ006M0820B3F-0811 | 820                       | 6.3                        | 8X11                  | 155                              | 0.22                                     | 1140                     | 0.036                        |
| SZ006M0820A3F-0811 | 820                       | 6.3                        | 8X11                  | 155                              | 0.22                                     | 1140                     | 0.036                        |
| SZ006M0820A5F-0811 | 820                       | 6.3                        | 8X11                  | 155                              | 0.22                                     | 1140                     | 0.036                        |
| SZ006M1200B3F-0815 | 1200                      | 6.3                        | 8X15                  | 226.8                            | 0.22                                     | 1490                     | 0.028                        |
| SZ006M1200A3F-0815 | 1200                      | 6.3                        | 8X15                  | 226.8                            | 0.22                                     | 1490                     | 0.028                        |
| SZ006M1200A5F-0815 | 1200                      | 6.3                        | 8X15                  | 226.8                            | 0.22                                     | 1490                     | 0.028                        |
| SZ006M1500B5S-1012 | 1500                      | 6.3                        | 10X12                 | 283.5                            | 0.22                                     | 1540                     | 0.026                        |
| SZ006M1500A5S-1012 | 1500                      | 6.3                        | 10X12                 | 283.5                            | 0.22                                     | 1540                     | 0.026                        |
| SZ006M1800B3F-0820 | 1800                      | 6.3                        | 8X20                  | 340.2                            | 0.22                                     | 1870                     | 0.021                        |
| SZ006M1800A3F-0820 | 1800                      | 6.3                        | 8X20                  | 340.2                            | 0.22                                     | 1870                     | 0.021                        |
| SZ006M1800A5F-0820 | 1800                      | 6.3                        | 8X20                  | 340.2                            | 0.22                                     | 1870                     | 0.021                        |
| SZ006M1800B5S-1015 | 1800                      | 6.3                        | 10X15                 | 340.2                            | 0.22                                     | 2000                     | 0.019                        |
| SZ006M1800A5S-1015 | 1800                      | 6.3                        | 10X15                 | 340.2                            | 0.22                                     | 2000                     | 0.019                        |
| SZ006M2200B5S-1019 | 2200                      | 6.3                        | 10X19.5               | 415.8                            | 0.24                                     | 2550                     | 0.016                        |
| SZ006M2200A5S-1019 | 2200                      | 6.3                        | 10X19.5               | 415.8                            | 0.24                                     | 2550                     | 0.016                        |
| SZ006M3300B5S-1022 | 3300                      | 6.3                        | 10X22                 | 623.7                            | 0.26                                     | 2800                     | 0.012                        |
| SZ006M3300A5S-1022 | 3300                      | 6.3                        | 10X22                 | 623.7                            | 0.26                                     | 2800                     | 0.012                        |
| SZ010M0680B3F-0811 | 680                       | 10                         | 8X11                  | 204                              | 0.19                                     | 1140                     | 0.036                        |
| SZ010M0680A3F-0811 | 680                       | 10                         | 8X11                  | 204                              | 0.19                                     | 1140                     | 0.036                        |
| SZ010M0680A5F-0811 | 680                       | 10                         | 8X11                  | 204                              | 0.19                                     | 1140                     | 0.036                        |
| SZ010M1000B3F-0815 | 1000                      | 10                         | 8X15                  | 300                              | 0.19                                     | 1490                     | 0.028                        |
| SZ010M1000A3F-0815 | 1000                      | 10                         | 8X15                  | 300                              | 0.19                                     | 1490                     | 0.028                        |
| SZ010M1000A5F-0815 | 1000                      | 10                         | 8X15                  | 300                              | 0.19                                     | 1490                     | 0.028                        |
| SZ010M1000B5S-1012 | 1000                      | 10                         | 10X12                 | 300                              | 0.19                                     | 1540                     | 0.026                        |
| SZ010M1000A5S-1012 | 1000                      | 10                         | 10X12                 | 300                              | 0.19                                     | 1540                     | 0.026                        |
| SZ010M1500B3F-0820 | 1500                      | 10                         | 8X20                  | 450                              | 0.19                                     | 1870                     | 0.021                        |
| SZ010M1500A3F-0820 | 1500                      | 10                         | 8X20                  | 450                              | 0.19                                     | 1870                     | 0.021                        |
| SZ010M1500A5F-0820 | 1500                      | 10                         | 8X20                  | 450                              | 0.19                                     | 1870                     | 0.021                        |
| SZ010M1500B5S-1015 | 1500                      | 10                         | 10X15                 | 450                              | 0.19                                     | 2000                     | 0.019                        |
| SZ010M1500A5S-1015 | 1500                      | 10                         | 10X15                 | 450                              | 0.19                                     | 2000                     | 0.019                        |
| SZ010M1800B5S-1019 | 1800                      | 10                         | 10X19.5               | 540                              | 0.19                                     | 2550                     | 0.016                        |
| SZ010M1800A5S-1019 | 1800                      | 10                         | 10X19.5               | 540                              | 0.19                                     | 2550                     | 0.016                        |
| SZ010M2200B5S-1022 | 2200                      | 10                         | 10X22                 | 660                              | 0.21                                     | 2800                     | 0.012                        |
| SZ010M2200A5S-1022 | 2200                      | 10                         | 10X22                 | 660                              | 0.21                                     | 2800                     | 0.012                        |
| SZ016M0220BZF-0611 | 220                       | 16                         | 6.3X11                | 105.6                            | 0.16                                     | 700                      | 0.07                         |
| SZ016M0470B3F-0811 | 470                       | 16                         | 8X11                  | 225.6                            | 0.16                                     | 1140                     | 0.036                        |
| SZ016M0470A3F-0811 | 470                       | 16                         | 8X11                  | 225.6                            | 0.16                                     | 1140                     | 0.036                        |
| SZ016M0470A5F-0811 | 470                       | 16                         | 8X11                  | 225.6                            | 0.16                                     | 1140                     | 0.036                        |

**Table 1-2 SZ Type, Standard Ratings and Catalog Number**

| Catalog Number     | Capacitance<br>( $\mu$ F) | Rated<br>Voltage<br>(V.DC) | Size<br>D X L<br>(mm) | Leakage<br>Current<br>( $\mu$ A) | Dissipation<br>Factor<br>(Tan $\delta$ ) | Ripple<br>100KHz<br>(mA) | ESR<br>20 °C 100KHz<br>(ohm) |
|--------------------|---------------------------|----------------------------|-----------------------|----------------------------------|------------------------------------------|--------------------------|------------------------------|
| SZ016M0680B3F-0815 | 680                       | 16                         | 8X15                  | 326.4                            | 0.16                                     | 1490                     | 0.028                        |
| SZ016M0680A3F-0815 | 680                       | 16                         | 8X15                  | 326.4                            | 0.16                                     | 1490                     | 0.028                        |
| SZ016M0680A5F-0815 | 680                       | 16                         | 8X15                  | 326.4                            | 0.16                                     | 1490                     | 0.028                        |
| SZ016M0680B5S-1012 | 680                       | 16                         | 10X12                 | 326.4                            | 0.16                                     | 1540                     | 0.026                        |
| SZ016M0680A5S-1012 | 680                       | 16                         | 10X12                 | 326.4                            | 0.16                                     | 1540                     | 0.026                        |
| SZ016M1000B3F-0820 | 1000                      | 16                         | 8X20                  | 480                              | 0.16                                     | 1870                     | 0.021                        |
| SZ016M1000A3F-0820 | 1000                      | 16                         | 8X20                  | 480                              | 0.16                                     | 1870                     | 0.021                        |
| SZ016M1000A5F-0820 | 1000                      | 16                         | 8X20                  | 480                              | 0.16                                     | 1870                     | 0.021                        |
| SZ016M1000B5S-1015 | 1000                      | 16                         | 10X15                 | 480                              | 0.16                                     | 2000                     | 0.019                        |
| SZ016M1000A5S-1015 | 1000                      | 16                         | 10X15                 | 480                              | 0.16                                     | 2000                     | 0.019                        |
| SZ016M1500B5S-1019 | 1500                      | 16                         | 10X19.5               | 720                              | 0.16                                     | 2550                     | 0.016                        |
| SZ016M1500A5S-1019 | 1500                      | 16                         | 10X19.5               | 720                              | 0.16                                     | 2550                     | 0.016                        |
| SZ016M1800B5S-1022 | 1800                      | 16                         | 10X22                 | 864                              | 0.16                                     | 2800                     | 0.012                        |
| SZ016M1800A5S-1022 | 1800                      | 16                         | 10X22                 | 864                              | 0.16                                     | 2800                     | 0.012                        |

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