

# MCR703A Series

Preferred Device

## Sensitive Gate Silicon Controlled Rectifiers

### Reverse Blocking Thyristors

PNPN devices designed for high volume, low cost consumer applications such as temperature, light and speed control; process and remote control; and warning systems where reliability of operation is critical.

#### Features

- Pb-Free Package is Available
- Small Size
- Passivated Die Surface for Reliability and Uniformity
- Low Level Triggering and Holding Characteristics
- Recommend Electrical Replacement for C106
- Surface Mount Package – Case 369C
- To Obtain “DPAK” in Straight Lead Version (Shipped in Sleeves):
  - Add '1' Suffix to Device Number, i.e., MCR706A1
- Epoxy Meets UL 94, V-0 @ 0.125 in
- ESD Ratings: Human Body Model, 3B > 8000 V  
Machine Model, C > 400 V



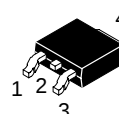
**ON Semiconductor®**

<http://onsemi.com>

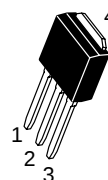
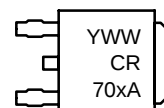
**SCRs**  
**4.0 AMPERES RMS**  
**100 – 600 VOLTS**



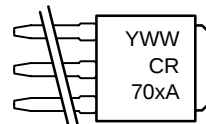
#### MARKING DIAGRAMS



**DPAK**  
**CASE 369C**  
**STYLE 2**



**DPAK-3**  
**CASE 369D**  
**STYLE 2**



Y = Year  
WW = Work Week  
x = 3, 6, or 8

#### PIN ASSIGNMENT

| PIN ASSIGNMENT |         |
|----------------|---------|
| 1              | Gate    |
| 2              | Anode   |
| 3              | Cathode |
| 4              | Anode   |

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

**Preferred** devices are recommended choices for future use and best overall value.

## MCR703A Series

**MAXIMUM RATINGS** (T<sub>J</sub> = 25°C unless otherwise noted)

| Rating                                                                                                                                    | Symbol                                              | Max               | Unit               |
|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-------------------|--------------------|
| Peak Repetitive Off-State Voltage (Note 1)<br>( $T_C = -40$ to $+110^\circ\text{C}$ , Sine Wave, 50 to 60 Hz, Gate Open)                  | MCR703A<br>MCR706A<br>MCR708A<br>$V_{DRM}, V_{RRM}$ | 100<br>400<br>600 | V                  |
| Peak Non-Repetitive Off-State Voltage<br>(Sine Wave, 50 to 60 Hz, Gate Open, $T_C = -40$ to $+110^\circ\text{C}$ )                        | MCR703A<br>MCR706A<br>MCR708A<br>$V_{RSM}$          | 150<br>450<br>650 | V                  |
| On-State RMS Current<br>( $180^\circ$ Conduction Angles; $T_C = 90^\circ\text{C}$ )                                                       | $I_T(RMS)$                                          | 4.0               | A                  |
| Average On-State Current<br>( $180^\circ$ Conduction Angles) $T_C = -40$ to $+90^\circ\text{C}$<br>$T_C = +100^\circ\text{C}$             | $I_T(AV)$                                           | 2.6<br>1.6        | A                  |
| Non-Repetitive Surge Current<br>(1/2 Sine Wave, 60 Hz, $T_J = 110^\circ\text{C}$ )<br>(1/2 Sine Wave, 1.5 ms, $T_J = 110^\circ\text{C}$ ) | $I_{TSM}$                                           | 25<br>35          | A                  |
| Circuit Fusing ( $t = 8.3$ msec)                                                                                                          | $I^2t$                                              | 2.6               | A <sup>2</sup> sec |
| Forward Peak Gate Power<br>(Pulse Width $\leq 1.0 \mu\text{sec}$ , $T_C = 90^\circ\text{C}$ )                                             | $P_{GM}$                                            | 0.5               | W                  |
| Forward Average Gate Power<br>( $t = 8.3$ msec, $T_C = 90^\circ\text{C}$ )                                                                | $P_{G(AV)}$                                         | 0.1               | W                  |
| Forward Peak Gate Current<br>(Pulse Width $\leq 1.0 \mu\text{sec}$ , $T_C = 90^\circ\text{C}$ )                                           | $I_{GM}$                                            | 0.2               | A                  |
| Operating Junction Temperature Range                                                                                                      | $T_J$                                               | -40 to +110       | $^\circ\text{C}$   |
| Storage Temperature Range                                                                                                                 | $T_{stg}$                                           | -40 to +150       | $^\circ\text{C}$   |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1.  $V_{DRM}$  and  $V_{RRM}$  for all types can be applied on a continuous basis. Ratings apply for zero or negative gate voltage; however, positive gate voltage shall not be applied concurrent with negative potential on the anode. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.

## THERMAL CHARACTERISTICS

| Characteristic                                                                | Symbol          | Max  | Unit |
|-------------------------------------------------------------------------------|-----------------|------|------|
| Thermal Resistance, Junction-to-Case                                          | $R_{\theta JC}$ | 8.33 | °C/W |
| Thermal Resistance, Junction-to-Ambient (Note 2)                              | $R_{\theta JA}$ | 80   | °C/W |
| Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds | $T_L$           | 260  | °C   |

2. Case 369C when surface mounted on minimum pad sizes recommended.

## MCR703A Series

### ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

#### OFF CHARACTERISTICS

|                                                                                                                                                                               |                                     |        |        |           |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------|--------|-----------|----|
| Peak Repetitive Forward or Reverse Blocking Current<br>(V <sub>AK</sub> = Rated V <sub>DRM</sub> ; R <sub>GK</sub> = 1 KΩ)<br>T <sub>C</sub> = 25°C<br>T <sub>C</sub> = 110°C | I <sub>DRM</sub> , I <sub>RRM</sub> | –<br>– | –<br>– | 10<br>200 | μA |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------|--------|-----------|----|

#### ON CHARACTERISTICS

|                                                                                                                                                                                                |                  |        |         |            |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------|---------|------------|----|
| Peak Forward "On" Voltage<br>(I <sub>TM</sub> = 8.2 A Peak, Pulse Width = 1 to 2 ms, 2% Duty Cycle)                                                                                            | V <sub>TM</sub>  | –      | –       | 2.2        | V  |
| Gate Trigger Current (Continuous dc) (Note 3)<br>(V <sub>AK</sub> = 12 Vdc, R <sub>L</sub> = 24 Ohms)<br>T <sub>C</sub> = 25°C<br>T <sub>C</sub> = –40°C                                       | I <sub>GT</sub>  | –<br>– | 25<br>– | 75<br>300  | μA |
| Gate Trigger Voltage (Continuous dc) (Note 3)<br>(V <sub>AK</sub> = 12 Vdc, R <sub>L</sub> = 24 Ohms)<br>T <sub>C</sub> = 25°C<br>T <sub>C</sub> = –40°C                                       | V <sub>GT</sub>  | –<br>– | –<br>–  | 0.8<br>1.0 | V  |
| Gate Non-Trigger Voltage (Note 3)<br>(V <sub>AK</sub> = 12 Vdc, R <sub>L</sub> = 100 Ohms, T <sub>C</sub> = 110°C)                                                                             | V <sub>GD</sub>  | 0.2    | —       | —          | V  |
| Holding Current<br>(V <sub>AK</sub> = 12 Vdc, Gate Open)<br>(Initiating Current = 200 mA)<br>T <sub>C</sub> = 25°C<br>T <sub>C</sub> = –40°C                                                   | I <sub>H</sub>   | –<br>– | –<br>–  | 5.0<br>10  | mA |
| Peak Reverse Gate Blocking Voltage<br>(I <sub>GR</sub> = 10 μA)                                                                                                                                | V <sub>RGM</sub> | 10     | 12.5    | 18         | V  |
| Peak Reverse Gate Blocking Current<br>(V <sub>GR</sub> = 10 V)                                                                                                                                 | I <sub>RGM</sub> | –      | –       | 1.2        | μA |
| Total Turn-On Time<br>(Source Voltage = 12 V, R <sub>S</sub> = 6 kΩ)<br>(I <sub>TM</sub> = 8.2 A, I <sub>GT</sub> = 2 mA, Rated V <sub>DRM</sub> )<br>(Rise Time = 20 ns, Pulse Width = 10 μs) | t <sub>gt</sub>  | –      | 2.0     | –          | μs |

#### DYNAMIC CHARACTERISTICS

|                                                                                                                                                                   |       |   |    |     |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---|----|-----|------|
| Critical Rate of Rise of Off-State Voltage<br>(V <sub>D</sub> = Rated V <sub>DRM</sub> , R <sub>GK</sub> = 1 kΩ, Exponential Waveform,<br>T <sub>C</sub> = 110°C) | dv/dt | – | 10 | –   | V/μs |
| Repetitive Critical Rate of Rise of On-State Current<br>(C <sub>f</sub> = 60 Hz, I <sub>PK</sub> = 30 A, PW = 100 μs, diG/dt = 1 A/μs)                            | di/dt | – | –  | 100 | A/μs |

3. R<sub>GK</sub> current not included in measurement.

#### ORDERING INFORMATION

| Device     | Package Type      | Package | Shipping <sup>†</sup> |
|------------|-------------------|---------|-----------------------|
| MCR703AT4  | DPAK              | 369C    | 2500 Tape & Reel      |
| MCR706AT4  | DPAK              | 369C    | 2500 Tape & Reel      |
| MCR706AT4G | DPAK<br>(Pb-Free) | 369C    | 2500 Tape & Reel      |
| MCR708A    | DPAK              | 369C    | 2500 Tape & Reel      |
| MCR708A1   | DPAK-3            | 369D    | 75 Units / Rail       |
| MCR708AT4  | DPAK              | 369C    | 2500 Tape & Reel      |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MCR703A Series

## Voltage Current Characteristic of SCR

| Symbol    | Parameter                                 |
|-----------|-------------------------------------------|
| $V_{DRM}$ | Peak Repetitive Off-State Forward Voltage |
| $I_{DRM}$ | Peak Forward Blocking Current             |
| $V_{RRM}$ | Peak Repetitive Off-State Reverse Voltage |
| $I_{RRM}$ | Peak Reverse Blocking Current             |
| $V_{TM}$  | Peak On-State Voltage                     |
| $I_H$     | Holding Current                           |

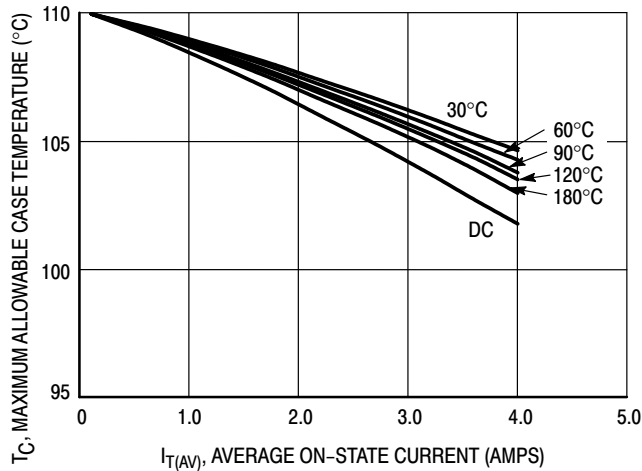
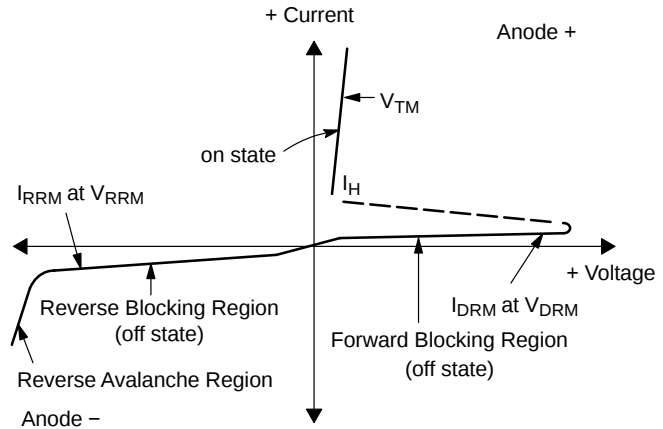


Figure 1. Average Current Derating

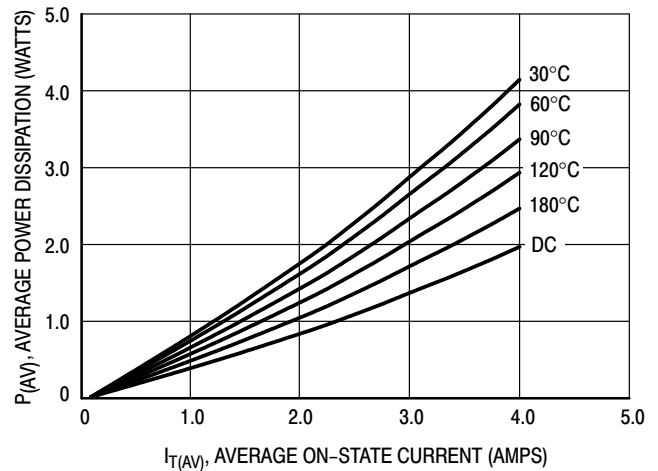


Figure 2. On-State Power Dissipation

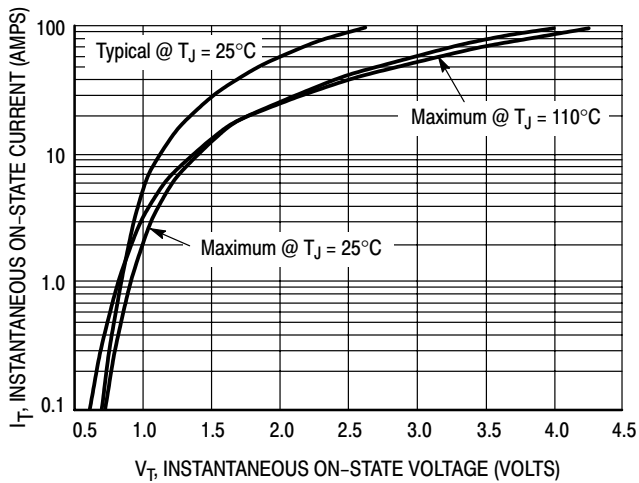


Figure 3. On-State Characteristics

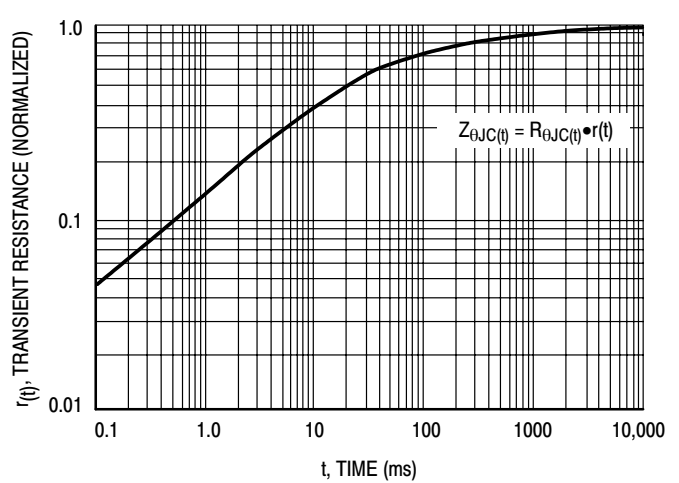


Figure 4. Transient Thermal Response

## MCR703A Series

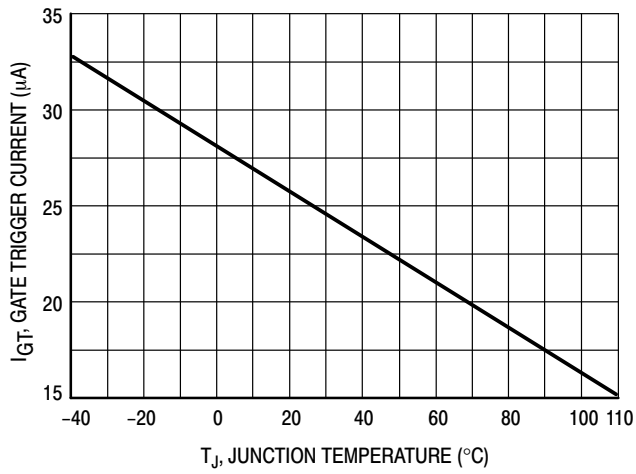


Figure 5. Typical Gate Trigger Current versus Junction Temperature

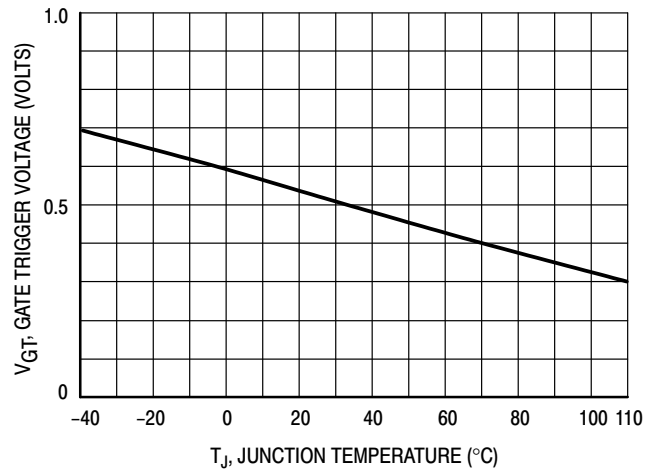


Figure 6. Typical Gate Trigger Voltage versus Junction Temperature

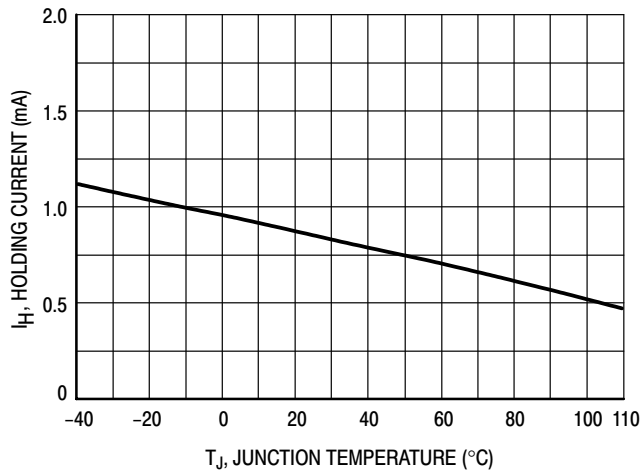


Figure 7. Typical Holding Current versus Junction Temperature

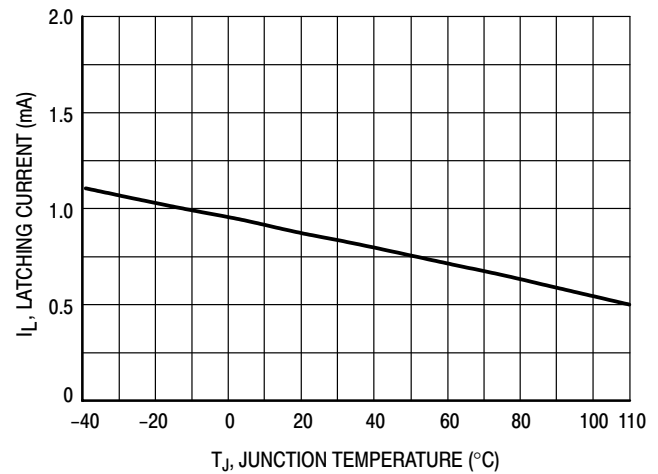
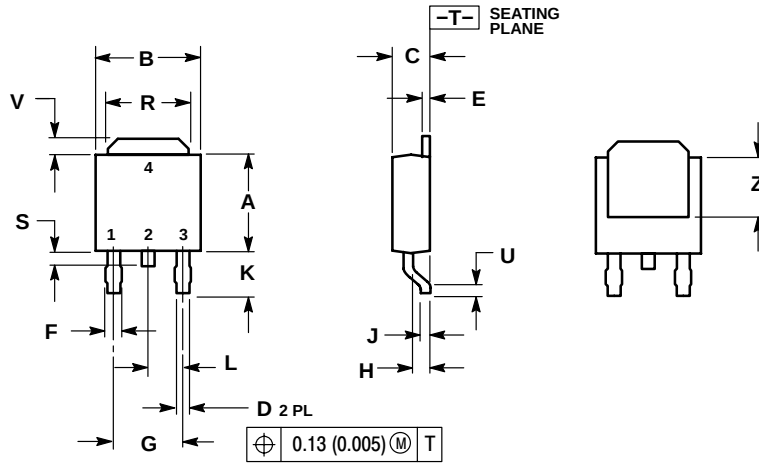


Figure 8. Typical Latching Current versus Junction Temperature

# MCR703A Series

## PACKAGE DIMENSIONS

### DPAK CASE 369C ISSUE O

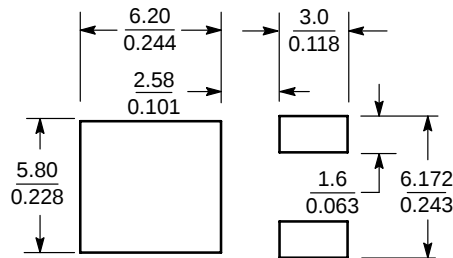


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.235     | 0.245 | 5.97        | 6.22 |
| B   | 0.250     | 0.265 | 6.35        | 6.73 |
| C   | 0.086     | 0.094 | 2.19        | 2.38 |
| D   | 0.027     | 0.035 | 0.69        | 0.88 |
| E   | 0.018     | 0.023 | 0.46        | 0.58 |
| F   | 0.037     | 0.045 | 0.94        | 1.14 |
| G   | 0.180 BSC |       | 4.58 BSC    |      |
| H   | 0.034     | 0.040 | 0.87        | 1.01 |
| J   | 0.018     | 0.023 | 0.46        | 0.58 |
| K   | 0.102     | 0.114 | 2.60        | 2.89 |
| L   | 0.090 BSC |       | 2.29 BSC    |      |
| R   | 0.180     | 0.215 | 4.57        | 5.45 |
| S   | 0.025     | 0.040 | 0.63        | 1.01 |
| U   | 0.020     | ---   | 0.51        | ---  |
| V   | 0.035     | 0.050 | 0.89        | 1.27 |
| Z   | 0.155     | ---   | 3.93        | ---  |

- STYLE 2:
- PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

### SOLDERING FOOTPRINT\*



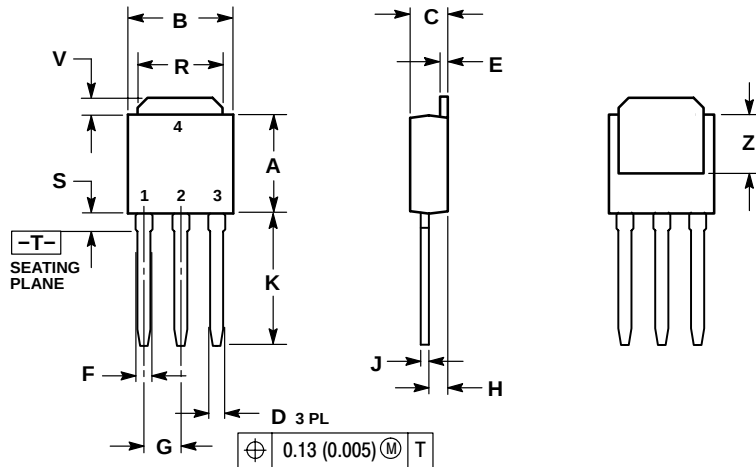
SCALE 3:1  $\left( \frac{\text{mm}}{\text{inches}} \right)$

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MCR703A Series

## PACKAGE DIMENSIONS

DPAK-3  
CASE 369D-01  
ISSUE B



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES |       | MILLIMETERS |      |
|-----|--------|-------|-------------|------|
|     | MIN    | MAX   | MIN         | MAX  |
| A   | 0.235  | 0.245 | 5.97        | 6.35 |
| B   | 0.250  | 0.265 | 6.35        | 6.73 |
| C   | 0.086  | 0.094 | 2.19        | 2.38 |
| D   | 0.027  | 0.035 | 0.69        | 0.88 |
| E   | 0.018  | 0.023 | 0.46        | 0.58 |
| F   | 0.037  | 0.045 | 0.94        | 1.14 |
| G   | 0.090  | BSC   | 2.29        | BSC  |
| H   | 0.034  | 0.040 | 0.87        | 1.01 |
| J   | 0.018  | 0.023 | 0.46        | 0.58 |
| K   | 0.350  | 0.380 | 8.89        | 9.65 |
| R   | 0.180  | 0.215 | 4.45        | 5.45 |
| S   | 0.025  | 0.040 | 0.63        | 1.01 |
| V   | 0.035  | 0.050 | 0.89        | 1.27 |
| Z   | 0.155  | ---   | 3.93        | ---  |

### STYLE 2:

- PIN 1. GATE
- DRAIN
- SOURCE
- DRAIN

# MCR703A Series

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