

## MC Series - TO-92



### Agency Approvals

| Agency | Agency File Number |
|--------|--------------------|
|        | E133083            |

### Pinout Designation



### Schematic Symbol



### Description

The MC Series TO-92 are low capacitance SIDACtor® thyristors designed to protect broadband CPE equipment such as VoIP and DSL Modems from damaging overvoltage transients.

The series provides a through-hole solution that enables CPE equipment to comply with global regulatory standards while limiting the impact to broadband signals.

### Features and Benefits

- Low voltage overshoot
- Low on-state voltage
- Does not degrade surge capability after multiple surge events within limit
- Fails short circuit when surged in excess of ratings
- RoHS Compliant
- 40% lower capacitance than our Baseband Protectors, for applications that demand greater signal integrity
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

### Applicable Global Standards

- TIA-968-A
- TIA-968-B
- ITU K.20/21/45 Enhanced Level
- ITU K.20/21/45 Basic Level
- GR 1089 Intra-building
- IEC 61000-4-5 2nd edition
- YD/T 1082
- YD/T 993
- YD/T 950
- GR 1089 Inter-building

### Electrical Characteristics

| Part Number   | Marking   | $V_{DRM}$<br>@ $I_{DRM} = 5\mu A$ | $V_S$<br>@ $100V/\mu s$ | $I_H$  | $I_S$  | $I_T$ | $V_T$<br>@ $I_T = 2.2$ Amps | Capacitance<br>@ 1MHz, 2V bias |        |
|---------------|-----------|-----------------------------------|-------------------------|--------|--------|-------|-----------------------------|--------------------------------|--------|
|               |           | V min                             | V max                   | mA min | mA max | A max | V max                       | pF min                         | pF max |
| P0080ECMCLxxx | P0080ECMC | 6                                 | 25                      | 50     | 800    | 2.2   | 4                           | 35                             | 75     |
| P0300ECMCLxxx | P0300ECMC | 25                                | 40                      | 50     | 800    | 2.2   | 4                           | 25                             | 45     |
| P0640ECMCLxxx | P0640ECMC | 58                                | 77                      | 150    | 800    | 2.2   | 4                           | 55                             | 85     |
| P0720ECMCLxxx | P0720ECMC | 65                                | 88                      | 150    | 800    | 2.2   | 4                           | 50                             | 75     |
| P0900ECMCLxxx | P0900ECMC | 75                                | 98                      | 150    | 800    | 2.2   | 4                           | 45                             | 70     |
| P1100ECMCLxxx | P1100ECMC | 90                                | 130                     | 150    | 800    | 2.2   | 4                           | 45                             | 70     |
| P1300ECMCLxxx | P1300ECMC | 120                               | 160                     | 150    | 800    | 2.2   | 4                           | 40                             | 60     |
| P1500ECMCLxxx | P1500ECMC | 140                               | 180                     | 150    | 800    | 2.2   | 4                           | 35                             | 55     |
| P1800ECMCLxxx | P1800ECMC | 170                               | 220                     | 150    | 800    | 2.2   | 4                           | 35                             | 50     |
| P2300ECMCLxxx | P2300ECMC | 190                               | 260                     | 150    | 800    | 2.2   | 4                           | 30                             | 50     |
| P2600ECMCLxxx | P2600ECMC | 220                               | 300                     | 150    | 800    | 2.2   | 4                           | 30                             | 45     |
| P3100ECMCLxxx | P3100ECMC | 275                               | 350                     | 150    | 800    | 2.2   | 4                           | 30                             | 45     |
| P3500ECMCLxxx | P3500ECMC | 320                               | 400                     | 150    | 800    | 2.2   | 4                           | 25                             | 40     |

Notes:  
 - Absolute maximum ratings measured at  $T_A = 25^\circ C$  (unless otherwise noted).  
 - Components are bi-directional.  
 - **XXX** Part Number Suffix: **'AP'** (Ammo Pack), or **'RP1'** or **'RP2'** (Reel Pack).

**Surge Ratings**

| Series | $I_{PP}$             |                   |                     |                     |                     |                    |                     |                      |                     | $I_{TSM}$<br>50/60 Hz | di/dt    |
|--------|----------------------|-------------------|---------------------|---------------------|---------------------|--------------------|---------------------|----------------------|---------------------|-----------------------|----------|
|        | 0.2/310 <sup>1</sup> | 2/10 <sup>1</sup> | 8/20 <sup>1</sup>   | 10/160 <sup>1</sup> | 10/560 <sup>1</sup> | 5/320 <sup>1</sup> | 10/360 <sup>1</sup> | 10/1000 <sup>1</sup> | 5/310 <sup>1</sup>  |                       |          |
|        | 0.5/700 <sup>2</sup> | 2/10 <sup>2</sup> | 1.2/50 <sup>2</sup> | 10/160 <sup>2</sup> | 10/560 <sup>2</sup> | 9/720 <sup>2</sup> | 10/360 <sup>2</sup> | 10/1000 <sup>2</sup> | 10/700 <sup>2</sup> |                       |          |
|        | A min                | A min             | A min               | A min               | A min               | A min              | A min               | A min                | A min               | A min                 | A/μs Max |
| C      | 50                   | 500               | 400                 | 200                 | 150                 | 200                | 175                 | 100                  | 200                 | 30                    | 500      |

Notes:

- 1 Current waveform in μs
- 2 Voltage waveform in μs

- Peak pulse current rating ( $I_{pp}$ ) is repetitive and guaranteed for the life of the product that remains in thermal equilibrium.
- $I_{pp}$  ratings applicable over temperature range of -40°C to +85°C
- The component must initially be in thermal equilibrium with -40°C ≤  $T_J$  ≤ +150°C

**Thermal Considerations**

| Package   | Symbol          | Parameter                               | Value       | Unit |
|---|-----------------|---|-------------|------|
|  TO-92 | $T_J$           | Operating Junction Temperature Range    | -40 to +150 | °C   |
|   | $T_S$           | Storage Temperature Range               | -65 to +150 | °C   |
|   | $R_{\theta JA}$ | Thermal Resistance: Junction to Ambient | 90          | °C/W |

**V-I Characteristics**



**$t_r \times t_d$  Pulse Waveform**



**Normalized  $V_S$  Change vs. Junction Temperature**



**Normalized DC Holding Current vs. Case Temperature**



**Soldering Parameters**

|   |                                   |                               |
|---|-----------------------------------|-------------------------------|
| Reflow Condition                                      |                                   | Pb-Free assembly (see Fig. 1) |
| Pre Heat  | -Temperature Min ( $T_{s(min)}$ ) | +150°C                        |
|   | -Temperature Max ( $T_{s(max)}$ ) | +200°C                        |
|   | -Time (Min to Max) ( $t_s$ )      | 60-180 secs.                  |
| Average ramp up rate (LiquidusTemp ( $T_L$ ) to peak) |                                   | 3°C/sec. Max.                 |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                  |                                   | 3°C/sec. Max.                 |
| Reflow  | -Temperature ( $T_L$ ) (Liquidus) | +217°C                        |
|   | -Temperature ( $t_L$ )            | 60-150 secs.                  |
| Peak Temp ( $T_p$ )                                   |                                   | +260(+0/-5)°C                 |
| Time within 5°C of actual PeakTemp ( $t_p$ )          |                                   | 30 secs. Max.                 |
| Ramp-down Rate  |                                   | 6°C/sec. Max.                 |
| Time 25°C to Peak Temp ( $T_p$ )                      |                                   | 8 min. Max.                   |
| Do not exceed   |                                   | +260°C                        |



**Physical Specifications**

|                        |   |
|------------------------|---|
| <b>Lead Material</b>   | Copper Alloy  |
| <b>Terminal Finish</b> | 100% Matte-Tin Plated                                       |
| <b>Body Material</b>   | UL Recognized epoxy meeting flammability classification V-0 |

**Additional Information**



Datasheet



Resources



Samples

**Environmental Specifications**

|   |   |
|---|---|
| <b>High Temp Voltage Blocking</b>       | 80% Rated $V_{DRM}$ ( $V_{AC}$ Peak) +125°C or +150°C, 504 or 1008 hrs. MIL-STD-750 (Method 1040) JEDEC, JESD22-A-101 |
| <b>Temp Cycling</b>                     | -65°C to +150°C, 15 min. dwell, 10 up to 100 cycles. MIL-STD-750 (Method 1051) EIA/JEDEC, JESD22-A104                 |
| <b>Biased Temp &amp; Humidity</b>       | 52 $V_{DC}$ (+85°C) 85%RH, 504 up to 1008 hrs. EIA/JEDEC, JESD22-A-101  |
| <b>High Temp Storage</b>                | +150°C 1008 hrs. MIL-STD-750 (Method 1031) JEDEC, JESD22-A-101  |
| <b>Low Temp Storage</b>                 | -65°C, 1008 hrs.  |
| <b>Thermal Shock</b>                    | 0°C to +100°C, 5 min. dwell, 10 sec. transfer, 10 cycles. MIL-STD-750 (Method 1056) JEDEC, JESD22-A-106               |
| <b>Autoclave (Pressure Cooker Test)</b> | +121°C, 100%RH, 2atm, 24 up to 168 hrs. EIA/JEDEC, JESD22-A-102   |
| <b>Resistance to Solder Heat</b>        | +260°C, 30 secs. MIL-STD-750 (Method 2031)  |
| <b>Moisture Sensitivity Level</b>       | 85%RH, +85°C, 168 hrs., 3 reflow cycles (+260°C Peak). JEDEC-J-STD-020, Level 1                                       |

**Part Numbering**



**Part Marking**



**Packing Options**

| Package Type | Description              | Packing Options Quantity | Added Suffix | Lead Spacing      | Industry Standard |
|--------------|--------------------------|--------------------------|--------------|-------------------|-------------------|
| E            | TO-92 Tape and Reel Pack | 2000                     | RP1          | 0.1 inch (2.54mm) | EIA-481-D         |
|              | TO-92 Ammo Pack          |                          | RP2          | 0.2 inch (5.08mm) | EIA-481-D         |
|              | TO-92 Bulk Pack          |                          | AP           | (Not applicable)  | EIA-468-B         |
|              |                          |                          | N/A          | (Not applicable)  | N/A               |

**Dimensions – TO-92**



|   | Inches |       | Millimeters |      |
|---|--------|-------|-------------|------|
|   | Min    | Max   | Min         | Max  |
| A | 0.176  | 0.196 | 4.47        | 4.98 |
| B | 0.500  |       | 12.70       |      |
| D | 0.095  | 0.105 | 2.41        | 2.67 |
| E | 0.150  |       | 3.81        |      |
| G | 0.135  | 0.145 | 3.43        | 3.68 |
| H | 0.088  | 0.096 | 2.23        | 2.44 |
| J | 0.176  | 0.186 | 4.47        | 4.73 |
| K | 0.088  | 0.096 | 2.23        | 2.44 |
| L | 0.013  | 0.019 | 0.33        | 0.48 |
| M | 0.013  | 0.017 | 0.33        | 0.43 |
| N |        | 0.60  |             | 1.52 |

All leads are insulated from case. Case is electrically non-conductive. (Rated at 1600 V<sub>AC</sub> RMS for one minute from leads to case over the operating temperature range.)

Mold flash shall not exceed 0.13 mm per side.

The TO-92 is designed to meet mechanical standards as set forth in JEDEC publication number 95.

**Ammo Pack Specification – TO-92**



**Tape and Reel Specification – TO-92**



|            | Inches |        | Millimeters |       |
|------------|--------|--------|-------------|-------|
|            | Min    | Max    | Min         | Max   |
| A          | N/A    | 14.173 | N/A         | 360.0 |
| B          | 4.016  | N/A    | 102.0       | N/A   |
| C          | 3.386  | N/A    | 86.0        | N/A   |
| D          | 0.795  | N/A    | 20.2        | N/A   |
| W1         | 1.181  | 1.968  | 30.0        | 50.0  |
| P          | 0.496  | 0.504  | 12.60       | 12.80 |
| P0         | 0.498  | 0.502  | 12.65       | 12.75 |
| F(for RP1) | 0.090  | 0.110  | 2.29        | 2.80  |
| F(for RP2) | 0.182  | 0.244  | 4.63        | 6.19  |
| H          | N/A    | 1.673  | N/A         | 42.50 |
| H1         | N/A    | 1.270  | N/A         | 32.26 |
| W          | 0.674  | 0.763  | 17.12       | 19.38 |
| W2         | 0.354  | 0.370  | 8.25        | 9.75  |
| W3         | 0.236  | N/A    | 6.00        | N/A   |
| W4         | 0.020  | N/A    | 0.50        | N/A   |

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