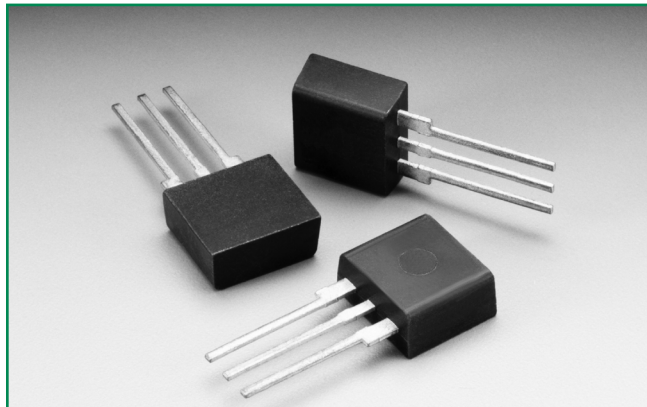


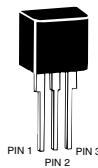
## Balanced MC Series - Modified TO-220



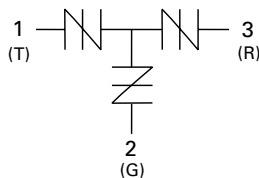
### Agency Approvals

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

### Pinout Designation



### Schematic Symbol



### Description

Balanced MC Series Modified TO-220 are low capacitance SIDACtor® components designed to protect broadband equipment from damaging overvoltage transients. The patented “Y” configuration also ensures balanced overvoltage protection that prevents a longitudinal to differential conversion.

The series provides a single port solution that enables equipment to comply with various 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
- Balanced overvoltage protection
- RoHS Compliant, Lead-Free, and Halogen-Free
- 40% lower capacitance than our Baseband Protectors, for applications that demand greater signal integrity
- Robust Modified TO-220 Package
- Custom lead forms available
- 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
- GR 1089 Intra-building
- IEC 61000-4-5
- YD/T 1082
- YD/T 993
- YD/T 950

### 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                  |
|--------------|-----------|-----------------------------------|--------------------------|--------------------|--------|-------|-----------------------------|------------------------------|
|              |           | V min                             | V max                    | mA max             | mA max | A max | V min                       |                              |
|              |           | Pins 1-2, 3-2, 1-3                |                          | Pins 1-2, 3-2, 1-3 |        |       |                             |                              |
| P1553ACMCLxx | P1553ACMC | 130                               | 180                      | 150                | 800    | 2.2   | 8                           | See Capacitance Values Table |
| P1803ACMCLxx | P1803ACMC | 150                               | 210                      | 150                | 800    | 2.2   | 8                           |                              |
| P2103ACMCLxx | P2103ACMC | 170                               | 250                      | 150                | 800    | 2.2   | 8                           |                              |
| P2353ACMCLxx | P2353ACMC | 200                               | 270                      | 150                | 800    | 2.2   | 8                           |                              |
| P2703ACMCLxx | P2703ACMC | 230                               | 300                      | 150                | 800    | 2.2   | 8                           |                              |
| P3203ACMCLxx | P3203ACMC | 270                               | 350                      | 150                | 800    | 2.2   | 8                           |                              |
| P3403ACMCLxx | P3403ACMC | 300                               | 400                      | 150                | 800    | 2.2   | 8                           |                              |
| P5103ACMCLxx | P5103ACMC | 420                               | 600                      | 150                | 800    | 2.2   | 8                           |                              |

**Notes:**

- Absolute maximum ratings measured at  $T_a = 25^\circ C$  (unless otherwise noted).
- Components are bi-directional (unless otherwise noted).
- **XX** Part Number Suffix: '**RP**' (Reel Pack), '**Blank**' (Bulk Pack), or '**60**' (Type 60 lead form, Bulk Pack. Special order item – contact factory.)

### Capacitance Values

| Part Number  | pF<br>Pin 1-2 / 3-2<br>Tip-Ground, Ring-Ground |     | pF<br>Pin 1-3<br>Tip-Ring |     |
|--------------|--|-----|---------------------------|-----|
|              | MIN  | MAX | MIN                       | MAX |
| P1553ACMCLxx | 30   | 55  | 20                        | 35  |
| P1803ACMCLxx | 30   | 60  | 15                        | 30  |
| P2103ACMCLxx | 30   | 45  | 15                        | 30  |
| P2353ACMCLxx | 25   | 45  | 15                        | 30  |
| P2703ACMCLxx | 25   | 40  | 15                        | 30  |
| P3203ACMCLxx | 25   | 40  | 15                        | 30  |
| P3403ACMCLxx | 20   | 35  | 15                        | 25  |
| P5103ACMCLxx | 20   | 30  | 10                        | 20  |

Note: Off-state capacitance ( $C_o$ ) is measured at 1 MHz with a 2 V bias.

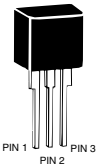
### Surge Ratings

| Series | $I_{PP}$                                     |  |  |  |  |  |  |  |   |       | $I_{TSM}$<br>50/60 Hz | di/dt |          |
|--------|--|--|--|--|--|--|--|--|---|-------|-----------------------|-------|----------|
|        | 0.2/310 <sup>1</sup><br>0.5/700 <sup>2</sup> | 2x/0 <sup>1</sup><br>2/10 <sup>2</sup> | 8/20 <sup>1</sup><br>1.2/50 <sup>2</sup> | 10/160 <sup>1</sup><br>10/160 <sup>2</sup> | 10/560 <sup>1</sup><br>10/560 <sup>2</sup> | 5/320 <sup>1</sup><br>9/720 <sup>2</sup> | 10/360 <sup>1</sup><br>10/360 <sup>2</sup> | 10/1000 <sup>1</sup><br>10/1000 <sup>2</sup> | 5/310 <sup>1</sup><br>10/700 <sup>2</sup> | A min |                       |       | A/μs max |
|        | 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                   |       |          |

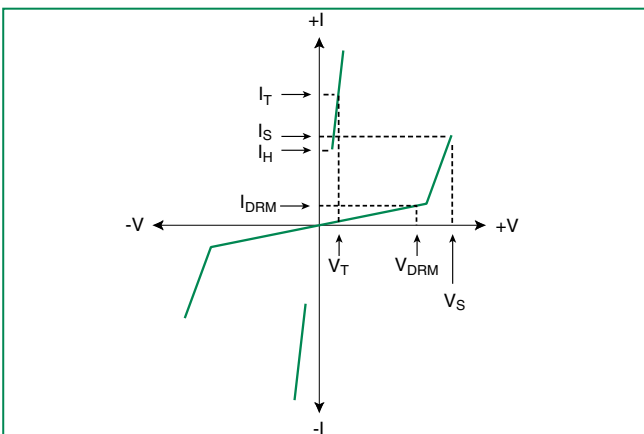
Notes:

- 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

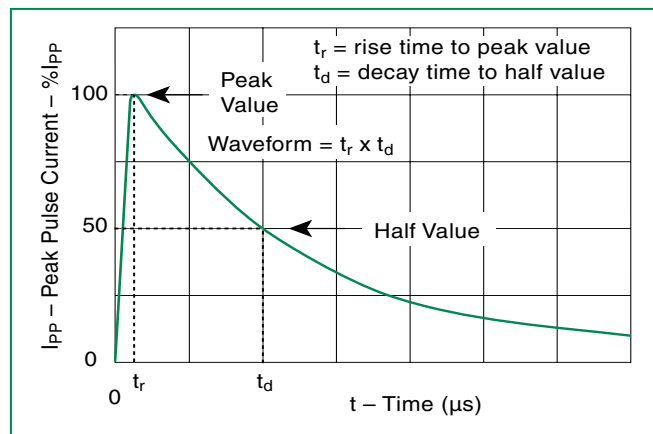
### Thermal Considerations

| Package  | Symbol          | Parameter                               | Value       | Unit |
|--|-----------------|---|-------------|------|
| Modified TO-220<br> | $T_J$           | 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 | 50          | °C/W |

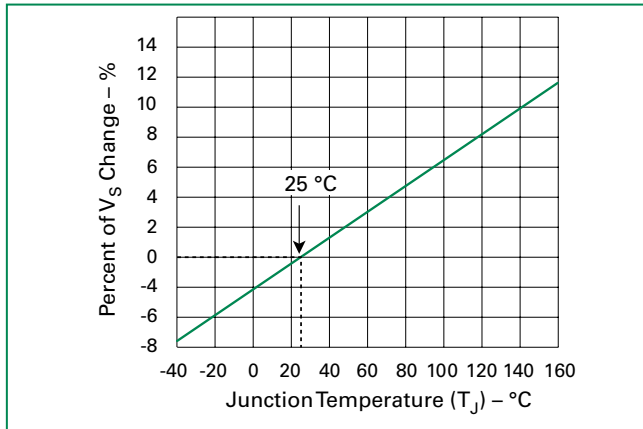
### V-I Characteristics



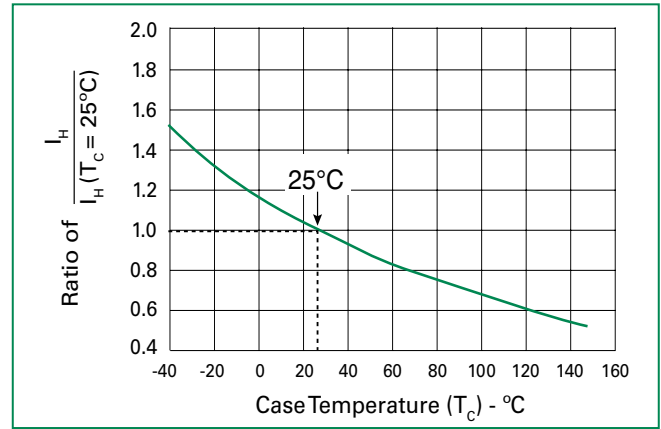
### $t_r \times t_d$ Pulse Waveform



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

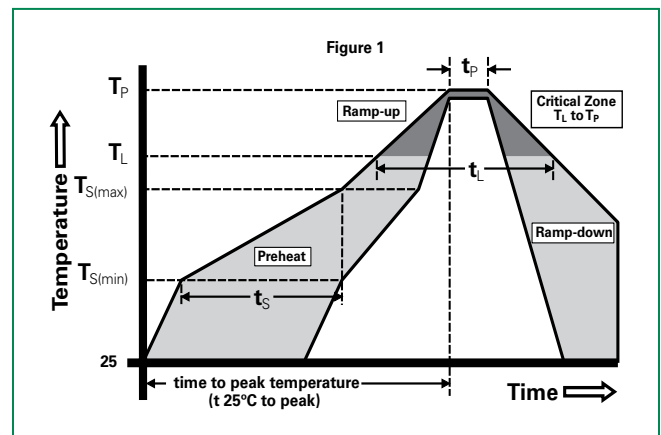


**Normalized DC Holding Current vs. Case Temperature**



**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 (Liquidus Temp ( $T_L$ ) 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 Peak Temp ( $t_p$ )          | 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                            |              |



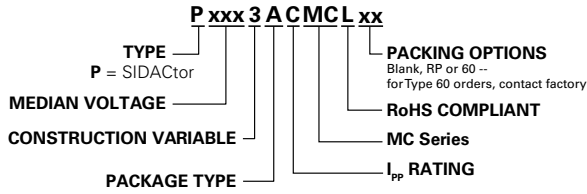
**Physical Specifications**

|                        |   |
|------------------------|---|
| <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 |

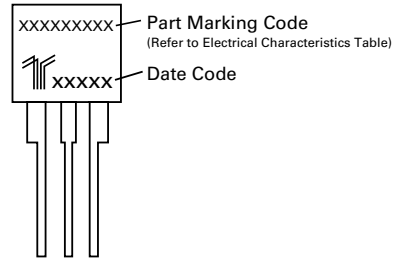
**Environmental Specifications**

|   |   |
|---|---|
| <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-A-104                |
| <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                                       |

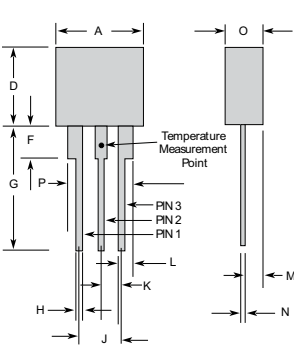
**Part Numbering**



**Part Marking**



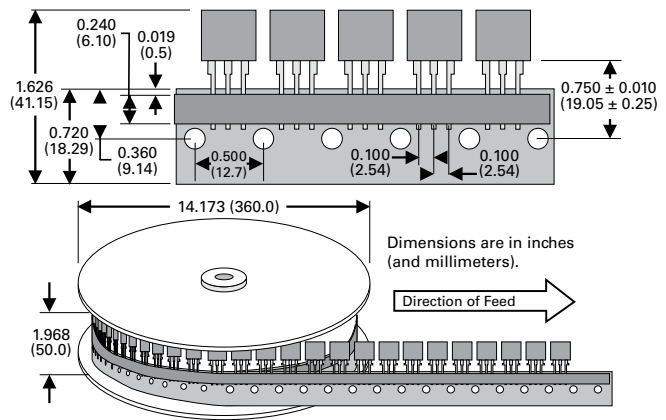
**Dimensions - Modified TO-220**



The modified TO-220 package is designed to meet mechanical standards as set forth in JEDEC publication number 95.

|          | Inches |       | Millimeters |       |
|----------|--------|-------|-------------|-------|
|          | Min    | Max   | Min         | Max   |
| <b>A</b> | 0.400  | 0.410 | 10.16       | 10.42 |
| <b>D</b> | 0.360  | 0.375 | 9.14        | 9.53  |
| <b>F</b> | 0.110  | 0.130 | 2.80        | 3.30  |
| <b>G</b> | 0.540  | 0.575 | 13.71       | 14.61 |
| <b>H</b> | 0.025  | 0.035 | 0.63        | 0.89  |
| <b>J</b> | 0.195  | 0.205 | 4.95        | 5.21  |
| <b>K</b> | 0.095  | 0.105 | 2.41        | 2.67  |
| <b>L</b> | 0.060  | 0.075 | 1.52        | 1.90  |
| <b>M</b> | 0.070  | 0.085 | 1.78        | 2.16  |
| <b>N</b> | 0.018  | 0.024 | 0.46        | 0.61  |
| <b>O</b> | 0.178  | 0.188 | 4.52        | 4.78  |
| <b>P</b> | 0.290  | 0.310 | 7.37        | 7.87  |

**Tape and Reel Specification — Modified TO-220**



**Packing Options**

| Package Type | Description                                  | Quantity | Added Suffix  | Industry Standard |
|--------------|--|----------|---|-------------------|
| A            | Modified TO-220 Tape and Reel Pack           | 700      | RP  | EIA-468-B         |
|              | Modified TO-220 Bulk Pack                    | 500      | N/A   | N/A               |
|              | Modified TO-220, Type 60 Lead Form Bulk Pack | 500      | 60<br>(special order item, contact factory for details) | N/A               |

**Additional Information**



Datasheet



Resources



Samples

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