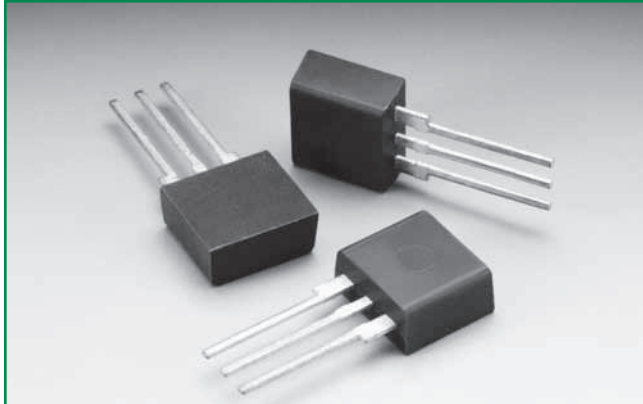


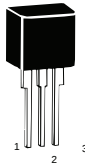
**RoHS Balanced MC Series - Modified TO-220**



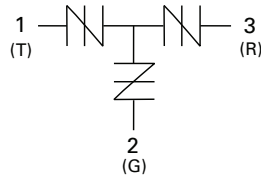
**Agency Approvals**

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

**Pinout Designation**



**Schematic Symbol**



**Description**

Balanced MC Series Modified TO-220 are low capacitance SIDACtor® devices designed to protect broadband equipment from damaging overvoltage transients. The patented "Y" configuration also ensures balanced overvoltage protection.

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 with use
- Fails short circuit when surged in excess of ratings
- Balanced overvoltage protection
- 40% lower capacitance than our Baseband Protectors, for applications that demand greater signal integrity
- Robust Modified TO-220 Package
- Custom lead forms available

**Applicable Global Standards**

- TIA-968-A
- TIA-968-B
- ITU K.20/21 Enhanced Level
- ITU K.20/21 Basic
- GR 1089 Inter-building
- 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>@ $I_T=2.2$<br>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).

- Devices 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.)

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Specifications are subject to change without notice.

Please refer to [www.littelfuse.com](http://www.littelfuse.com) for current information.

## 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

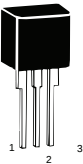
| Series | $I_{PP}$                                     |                                        |                                          |                                            |                                            |                                          |                                            |                                              |                                           | $I_{TSM}$<br>50/60 Hz | di/dt |
|--------|----------------------------------------------|----------------------------------------|------------------------------------------|--------------------------------------------|--------------------------------------------|------------------------------------------|--------------------------------------------|----------------------------------------------|-------------------------------------------|-----------------------|-------|
|        | 0.2x310 <sup>1</sup><br>0.5x700 <sup>2</sup> | 2x10 <sup>1</sup><br>2x10 <sup>2</sup> | 8x20 <sup>1</sup><br>1.2x50 <sup>2</sup> | 10x160 <sup>1</sup><br>10x160 <sup>2</sup> | 10x560 <sup>1</sup><br>10x560 <sup>2</sup> | 5x320 <sup>1</sup><br>9x720 <sup>2</sup> | 10x360 <sup>1</sup><br>10x360 <sup>2</sup> | 10x1000 <sup>1</sup><br>10x1000 <sup>2</sup> | 5x310 <sup>1</sup><br>10x700 <sup>2</sup> |                       |       |
|        | A min                                        | A min                                  | A min                                    | A min                                      | A min                                      | A min                                    | A min                                      | A min                                        | A min                                     |                       |       |
| C      | 50                                           | 500                                    | 400                                      | 200                                        | 150                                        | 200                                      | 175                                        | 100                                          | 200                                       | 30                    | 500   |

Notes:

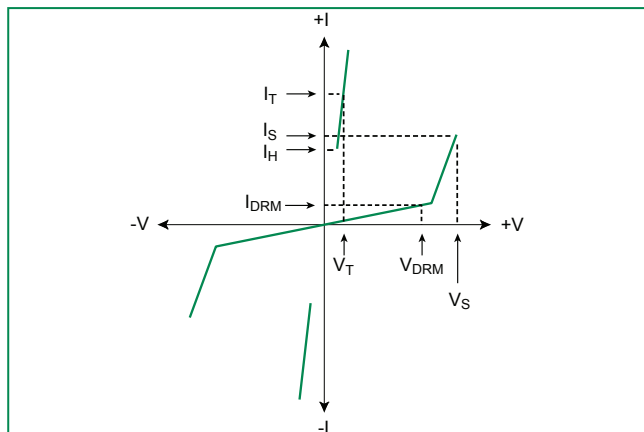
- 1 Current waveform in  $\mu s$
- 2 Voltage waveform in  $\mu s$

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

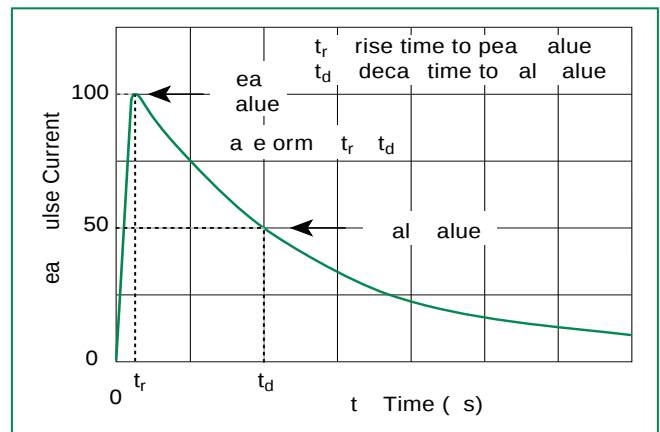
## Thermal Considerations

| Package                                                                                                   | Symbol          | Parameter                               | Value       | Unit |
|-----------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------|-------------|------|
| Modified<br>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 |

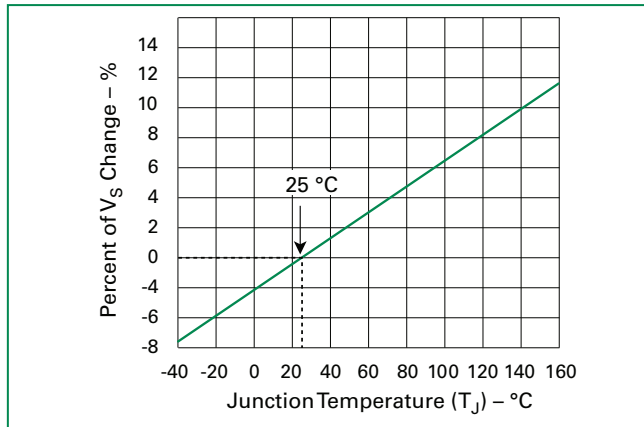
## V-I Characteristics



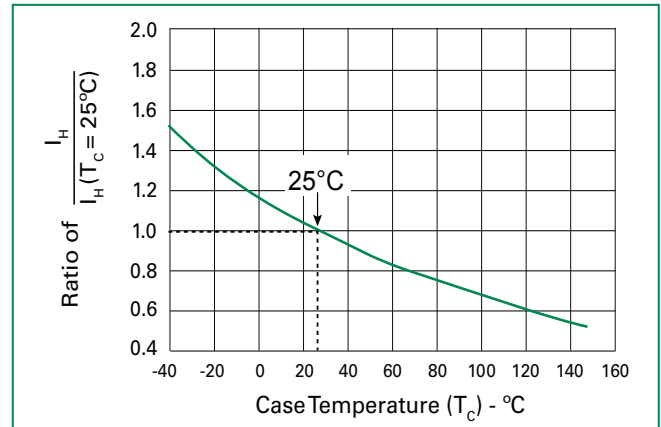
## $t_r \times t_d$ Pulse Waveform



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

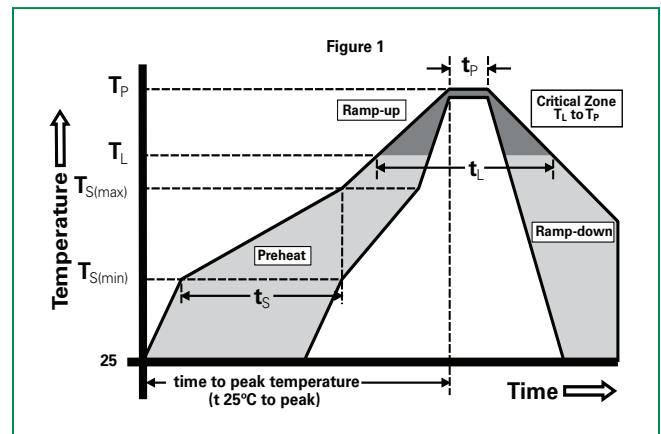


### Normalized DC Holding Current vs. Case Temperature



### 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                        |



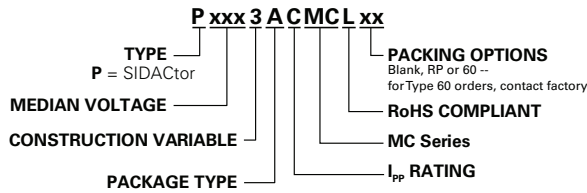
### Physical Specifications

|                 |                                                               |
|-----------------|---------------------------------------------------------------|
| Lead Material   | Copper Alloy                                                  |
| Terminal Finish | 100% Matte-Tin Plated                                         |
| Body Material   | UL recognized epoxy meeting flammability classification 94V-0 |

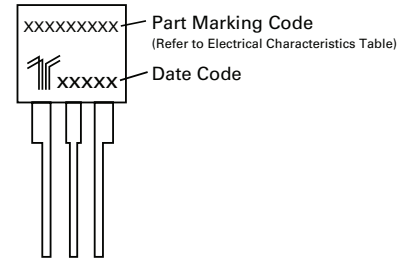
### Environmental Specifications

|                                  |                                                                                                                        |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------|
| High Temp Voltage Blocking       | 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 |
| Temp Cycling                     | -65°C to +150°C, 15 min. dwell, 10 up to 100 cycles. MIL-STD-750 (Method 1051) EIA/JEDEC, JESD22-A-104                 |
| Biased Temp & Humidity           | 52 $V_{DC}$ (+85°C) 85%RH, 504 up to 1008 hrs. EIA/JEDEC, JESD22-A-101                                                 |
| High Temp Storage                | +150°C 1008 hrs. MIL-STD-750 (Method 1031) JEDEC, JESD22-A-101                                                         |
| Low Temp Storage                 | -65°C, 1008 hrs.                                                                                                       |
| Thermal Shock                    | 0°C to +100°C, 5 min. dwell, 10 sec. transfer, 10 cycles. MIL-STD-750 (Method 1056) JEDEC, JESD22-A-106                |
| Autoclave (Pressure Cooker Test) | +121°C, 100%RH, 2atm, 24 up to 168 hrs. EIA/JEDEC, JESD22-A-102                                                        |
| Resistance to Solder Heat        | +260°C, 30 secs. MIL-STD-750 (Method 2031)                                                                             |
| Moisture Sensitivity Level       | 85%RH, +85°C, 168 hrs., 3 reflow cycles (+260°C Peak). JEDEC-J-STD-020, Level 1                                        |

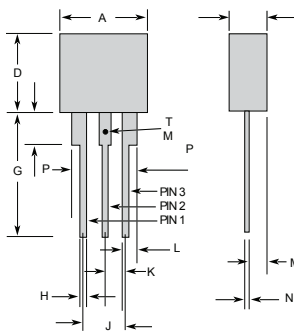
## Part Numbering



## Part Marking



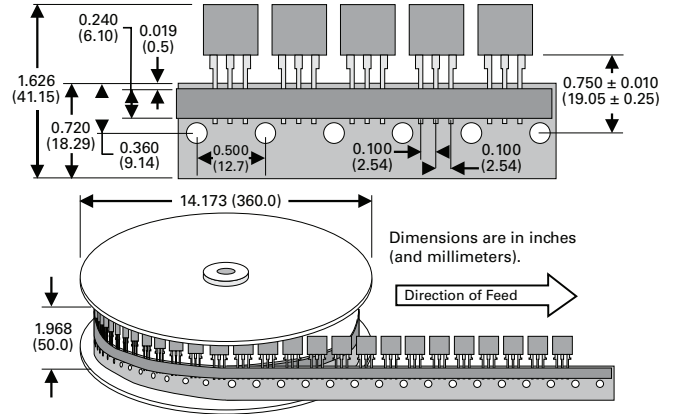
## Dimensions - Modified TO-220



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