

# P6002ABL Datasheet



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|                              |  |
|------------------------------|--|
| DiGi Electronics Part Number | P6002ABL-DG  |
| Manufacturer                 | <a href="#">Littelfuse</a>                         |
| Manufacturer Product Number  | P6002ABL   |
| Description                  | THYRISTOR 275V/550V 250A TO220-3                   |
| Detailed Description         | 275V, 550V Off-State 250 A Ipp TVS Thyristor 3-SIP |

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## Purchase and inquiry

Manufacturer Product Number:

P6002ABL

Series:

SIDACtor®

Voltage - Breakover:

350V, 700V

Voltage - On State:

4 V

Current - Peak Pulse (10/1000µs):

80 A

Number of Elements:

2

Mounting Type:

Through Hole

Supplier Device Package:

TO-220 Modified

Manufacturer:

Littelfuse

Product Status:

Active

Voltage - Off State:

275V, 550V

Current - Peak Pulse (8/20µs):

250 A

Current - Hold (Ih):

150 mA

Capacitance:

45pF, 80pF

Package / Case:

3-SIP

## Environmental & Export classification

RoHS Status:

ROHS3 Compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.30.0080

Moisture Sensitivity Level (MSL):

1 (Unlimited)

ECCN:

EAR99

# Pxxx2AxL Series

## Two-Chip SIDACtor® - Modified TO-220



### Description

The Pxxx2AxL Series Modified TO-220 Two-Chip SIDACtor® are designed to protect baseband equipment from damaging overvoltage transients.

The series provides a robust peak surge current capability that enables voice through DS-1 equipment to comply with various global regulatory standards.

### Features & Benefits

- Low voltage overshoot
- Low on-state voltage
- Does not degrade surge capability after multiple surge events within limit.
- Modified TO-220 Package
- Fails short circuit when surged in excess of ratings
- Single-port protection
- Lead forms available
- RoHS Compliant
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

### Additional Information



Resources

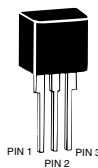


Accessories

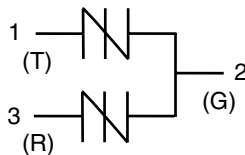


Samples

### Pinout Designation



### Schematic Symbol



### Applicable Global Standards

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

\*A/B-rated parts require series resistance

### Agency Approvals

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

### Electrical Characteristics

| Part Number | Marking | $V_{DRM}$          | $V_s$           | $V_{DRM}$          | $V_s$           | $V_T$         | $I_H$ | $I_s$  | $I_T$  | Capacitance                  |        |  |
|-------------|---------|--------------------|-----------------|--------------------|-----------------|---------------|-------|--------|--------|------------------------------|--------|--|
|             |         | @ $I_{DRM}=5\mu A$ | @ 100V/ $\mu s$ | @ $I_{DRM}=5\mu A$ | @ 100V/ $\mu s$ | @ $I_T=2.2 A$ |       |        |        | @ 1MHz, 2V bias              |        |  |
|             |         | V min              | V max           | V min              | V max           | V max         |       |        |        | pF min                       | pf max |  |
|             |         | Pins 1-2, 3-2      |                 | Pins 1-3           |                 | Pins 1-2, 3-2 |       | mA min | mA max | A max                        |        |  |
| P0602AALxx  | P0602AA | 25                 | 40              | 50                 | 80              | 4             | 50    | 800    | 2.2    | See Capacitance Values Table |        |  |
| P1402AALxx  | P1402AA | 58                 | 77              | 116                | 154             | 4             | 150   | 800    | 2.2    |                              |        |  |
| P1602AALxx  | P1602AA | 65                 | 95              | 130                | 190             | 4             | 150   | 800    | 2.2    |                              |        |  |
| P2202AALxx  | P2202AA | 90                 | 130             | 180                | 260             | 4             | 150   | 800    | 2.2    |                              |        |  |
| P2702AALxx  | P2702AA | 120                | 160             | 240                | 320             | 4             | 150   | 800    | 2.2    |                              |        |  |
| P3002AALxx  | P3002AA | 140                | 180             | 280                | 360             | 4             | 150   | 800    | 2.2    |                              |        |  |
| P3602AALxx  | P3602AA | 170                | 220             | 340                | 440             | 4             | 150   | 800    | 2.2    |                              |        |  |
| P4202AALxx  | P4202AA | 190                | 250             | 380                | 500             | 4             | 150   | 800    | 2.2    |                              |        |  |
| P4802AALxx  | P4802AA | 220                | 300             | 440                | 600             | 4             | 150   | 800    | 2.2    |                              |        |  |
| P6002AALxx  | P6002AA | 275                | 350             | 550                | 700             | 4             | 150   | 800    | 2.2    |                              |        |  |

Table continues on next page.

# Pxxx2AxL Series

## Two-Chip SIDACtor® - Modified TO-220

### Electrical Characteristics (continued)

| Part Number | Marking | $V_{DRM}$<br>@ $I_{DRM}=5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $V_{DRM}$<br>@ $I_{DRM}=5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $V_T$<br>@ $I_T=2.2 A$ | $I_H$  | $I_S$  | $I_T$ | Capacitance                        |
|-------------|---------|---------------------------------|--------------------------|---------------------------------|--------------------------|------------------------|--------|--------|-------|------------------------------------|
|             |         | V min                           | V max                    | V min                           | V max                    | V max                  | mA min | mA max | A max |                                    |
|             |         | Pins 1-2, 3-2                   |                          | Pins 1-3                        |                          | Pins 1-2, 3-2          |        |        |       |                                    |
| P0602ABLxx  | P0602AB | 25                              | 40                       | 50                              | 80                       | 4                      | 50     | 800    | 2.2   | See<br>Capacitance<br>Values Table |
| P1402ABLxx  | P1402AB | 58                              | 77                       | 116                             | 154                      | 4                      | 150    | 800    | 2.2   |                                    |
| P1602ABLxx  | P1602AB | 65                              | 95                       | 130                             | 190                      | 4                      | 150    | 800    | 2.2   |                                    |
| P2202ABLxx  | P2202AB | 90                              | 130                      | 180                             | 260                      | 4                      | 150    | 800    | 2.2   |                                    |
| P2702ABLxx  | P2702AB | 120                             | 160                      | 240                             | 320                      | 4                      | 150    | 800    | 2.2   |                                    |
| P3002ABLxx  | P3002AB | 140                             | 180                      | 280                             | 360                      | 4                      | 150    | 800    | 2.2   |                                    |
| P3602ABLxx  | P3602AB | 170                             | 220                      | 340                             | 440                      | 4                      | 150    | 800    | 2.2   |                                    |
| P4202ABLxx  | P4202AB | 190                             | 250                      | 380                             | 500                      | 4                      | 150    | 800    | 2.2   |                                    |
| P4802ABLxx  | P4802AB | 220                             | 300                      | 440                             | 600                      | 4                      | 150    | 800    | 2.2   |                                    |
| P6002ABLxx  | P6002AB | 275                             | 350                      | 550                             | 700                      | 4                      | 150    | 800    | 2.2   |                                    |
| P0602ACLxx  | P0602AC | 25                              | 40                       | 50                              | 80                       | 4                      | 50     | 800    | 2.2   |                                    |
| P1402ACLxx  | P1402AC | 58                              | 77                       | 116                             | 154                      | 4                      | 150    | 800    | 2.2   |                                    |
| P1602ACLxx  | P1602AC | 65                              | 95                       | 130                             | 190                      | 4                      | 150    | 800    | 2.2   |                                    |
| P2202ACLxx  | P2202AC | 90                              | 130                      | 180                             | 260                      | 4                      | 150    | 800    | 2.2   |                                    |
| P2702ACLxx  | P2702AC | 120                             | 160                      | 240                             | 320                      | 4                      | 150    | 800    | 2.2   |                                    |
| P3002ACLxx  | P3002AC | 140                             | 180                      | 280                             | 360                      | 4                      | 150    | 800    | 2.2   |                                    |
| P3602ACLxx  | P3602AC | 170                             | 220                      | 340                             | 440                      | 4                      | 150    | 800    | 2.2   |                                    |
| P4202ACLxx  | P4202AC | 190                             | 250                      | 380                             | 500                      | 4                      | 150    | 800    | 2.2   |                                    |
| P4802ACLxx  | P4802AC | 220                             | 300                      | 440                             | 600                      | 4                      | 150    | 800    | 2.2   |                                    |
| P6002ACLxx  | P6002AC | 275                             | 350                      | 550                             | 700                      | 4                      | 150    | 800    | 2.2   |                                    |

#### 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)

### 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 |
| P0602AALxx  | 15  | 145 | 10                        | 90  |
| P1402AALxx  | 40  | 60  | 20                        | 35  |
| P1602AALxx  | 35  | 60  | 20                        | 35  |
| P2202AALxx  | 30  | 50  | 15                        | 30  |
| P2702AALxx  | 25  | 45  | 15                        | 25  |
| P3002AALxx  | 25  | 40  | 15                        | 25  |
| P3602AALxx  | 25  | 35  | 10                        | 20  |
| P4202AALxx  | 25  | 35  | 10                        | 20  |
| P4802AALxx  | 20  | 35  | 10                        | 20  |
| P6002AALxx  | 20  | 35  | 10                        | 20  |
| P0602ABLxx  | 15  | 250 | 10                        | 145 |
| P1402ABLxx  | 40  | 155 | 20                        | 90  |
| P1602ABLxx  | 35  | 145 | 20                        | 85  |
| P2202ABLxx  | 30  | 115 | 15                        | 65  |
| P2702ABLxx  | 25  | 105 | 15                        | 60  |
| P3002ABLxx  | 25  | 95  | 15                        | 55  |
| P3602ABLxx  | 25  | 90  | 10                        | 50  |
| P4202ABLxx  | 25  | 85  | 10                        | 50  |
| P4802ABLxx  | 20  | 85  | 10                        | 50  |
| P6002ABLxx  | 20  | 80  | 10                        | 45  |

| 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 |
| P0602ACLxx  | 25  | 250 | 10                        | 145 |
| P1402ACLxx  | 55  | 155 | 30                        | 90  |
| P1602ACLxx  | 45  | 145 | 25                        | 85  |
| P2202ACLxx  | 45  | 115 | 25                        | 65  |
| P2702ACLxx  | 40  | 105 | 20                        | 60  |
| P3002ACLxx  | 35  | 95  | 20                        | 55  |
| P3602ACLxx  | 35  | 90  | 15                        | 50  |
| P4202ACLxx  | 30  | 85  | 15                        | 50  |
| P4802ACLxx  | 30  | 85  | 15                        | 50  |
| P6002ACLxx  | 30  | 80  | 15                        | 45  |

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

# Pxxx2AxL Series

## Two-Chip SIDACtor® - Modified TO-220

### Surge Ratings

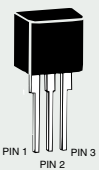
| Series | $I_{PP}$                                     |  |  |  |  |  |  |  |   | $I_{TSM}$<br>50/60 Hz | di/dt |
|--------|--|--|--|--|--|--|--|--|---|-----------------------|-------|
|        | 0.2x310 <sup>1</sup><br>0.5x700 <sup>2</sup> | 2x10 <sup>1</sup><br>2x10 <sup>2</sup> | 8x20 <sup>1</sup><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                                     |                       |       |
| A      | 20   | 150                                    | 150                                      | 90   | 50   | 75                                       | 75   | 45   | 75  | 20                    | 500   |
| B      | 25   | 250                                    | 250                                      | 150  | 100  | 100                                      | 125  | 80   | 100                                       | 25                    | 500   |
| C      | 50   | 500                                    | 400                                      | 200  | 150  | 200                                      | 175  | 100  | 200                                       | 50                    | 500   |

**Notes:**

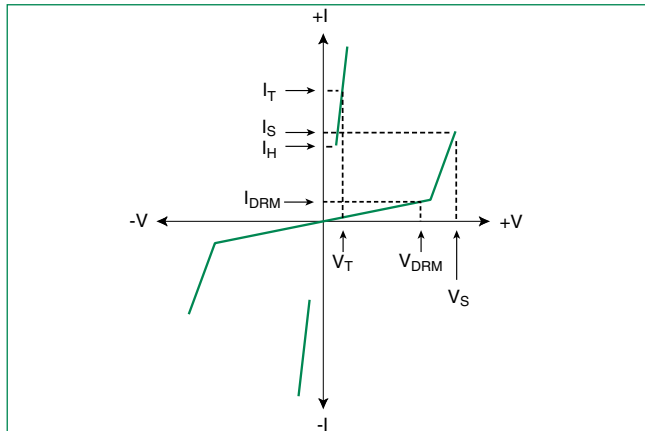
- Current waveform in  $\mu s$
- Voltage waveform in  $\mu s$

- 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

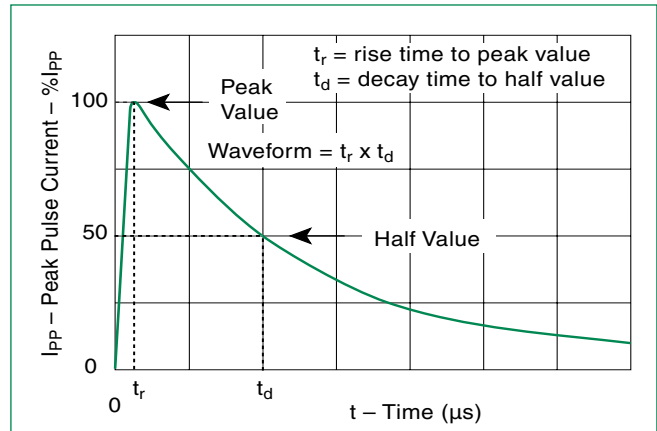
### Thermal Considerations

| Package  | Symbol          | Parameter                               | Value       | Unit |
|--|-----------------|---|-------------|------|
| Modified 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 | 60          | °C/W |

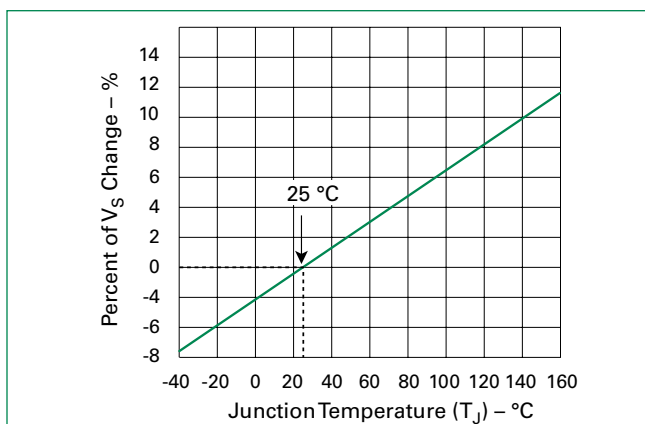
### V-I Characteristics



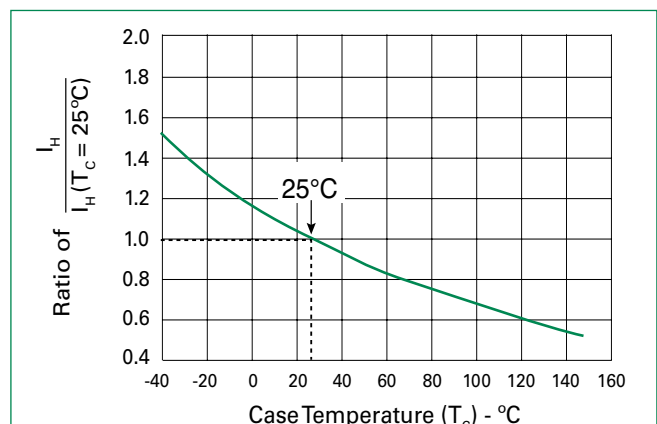
### tr x td Pulse Waveform



### Normalized VS Change vs. Junction Temperature



### Normalized DC Holding Current vs. Case Temperature

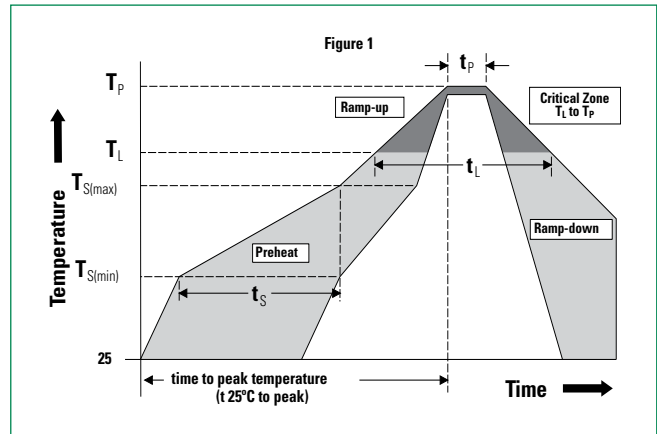


# Pxxx2AxL Series

## Two-Chip SIDACtor® - Modified TO-220

### Soldering Parameters

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



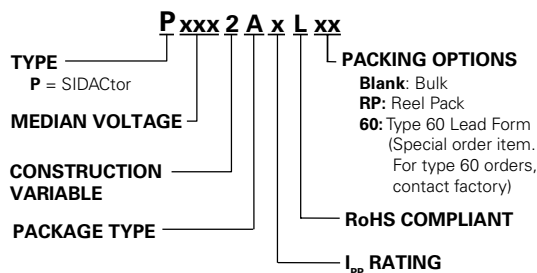
### Physical Specifications

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

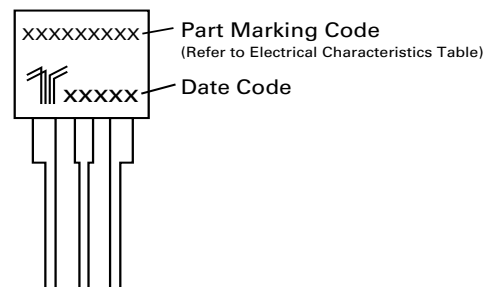
### Environmental Specifications

|  |   |
|--|---|
| <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>Unbiased Highly Accelerated Stress Test</b> | +130°C, 85%RH, 2atm, 168hrs. JESD22-A-118   |
| <b>Resistance to Solder Heat</b>               | +260°C, 30 secs. MIL-STD-750 (Method 2031)  |

### Part Numbering



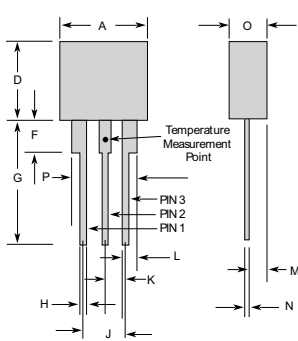
### Part Marking



# Pxxx2AxL Series

## Two-Chip SIDACtor® - Modified TO-220

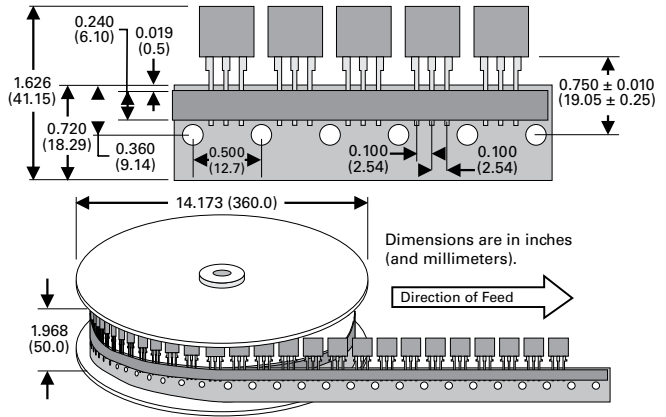
### Dimensions - Modified TO-220



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

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