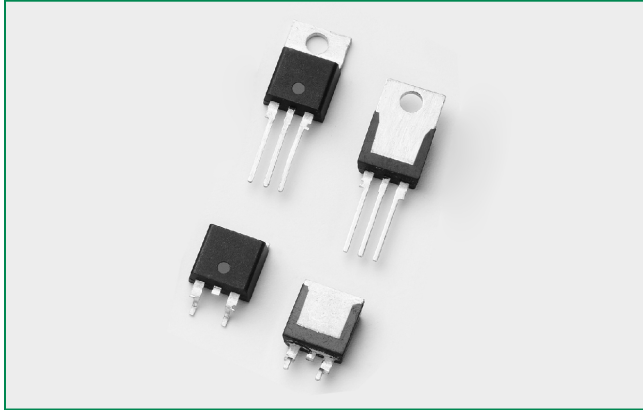


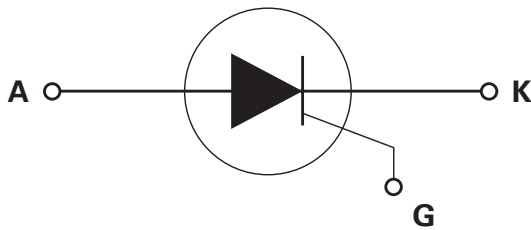
## S8016xA Series



### Main Features

| Symbol            | Value | Unit |
|-------------------|-------|------|
| $I_{T(RMS)}$      | 16    | A    |
| $V_{DRM}/V_{RRM}$ | 800   | V    |
| $I_{GT}$          | 50    | mA   |

### Schematic Symbol



### Description

The Littelfuse SCR S8016xA series are specifically designed for Electric Vehicle On-Board Charger (EVOBC) applications. This SCR AC line input rectifier can handle Level 1 charging up to 16Arms at 120V, and Level 2 charging up to 16A rms at 240V at 100°C and up to 25A rms for 80°C. Its excellent AC handling capability and surge robustness makes this series an ideal switch for these input rectifiers.

### Features & Benefits

- $V_{DRM}$  800V,  $I_T$  25rms to handle input from 100-250V line AC
- High  $di/dt$  of 375/ $\mu$ sec enables handling of 3kA 8/20 surge current operationally
- High  $V_{DSM}/V_{RSM}$  of 1300V, high  $dv/dt$  of 2000V/ $\mu$ sec prevents SCR mis-triggering during 6kV 1.2/50-8/20 surge event with minimal over voltage protection or snubber circuit
- Available in the compact TO-263 SMT package
- AEC-Q101 Fully Compliant
- Halogen free and RoHS compliant

### Applications

Input rectification of AC line input for EVOBC applications.

### Absolute Maximum Ratings

| Symbol            | Parameter                                 | Test Conditions                                                                                          | Value      | Unit             |
|-------------------|-------------------------------------------|----------------------------------------------------------------------------------------------------------|------------|------------------|
| $V_{DSM}/V_{RSM}$ | Peak non-repetitive blocking voltage      | $P_w=100\mu s$                                                                                           | 1300       | V                |
| $I_{T(RMS)}$      | RMS on-state current                      | $T_c=100^\circ C$                                                                                        | 16         | A                |
|                   |                                           | $T_c=80^\circ C$                                                                                         | 25         |                  |
| $I_{T(AV)}$       | Average on-state current                  | $T_c=100^\circ C$                                                                                        | 10         | A                |
|                   |                                           | $T_c=80^\circ C$                                                                                         | 16         |                  |
| $I_{TSM}$         | Peak non-repetitive surge current         | single half cycle; $f=50Hz$ ;<br>$T_J$ (initial)=25°C                                                    | 188        | A                |
|                   |                                           | single half cycle; $f=60Hz$ ;<br>$T_J$ (initial)=25°C                                                    | 225        |                  |
| $I^2t$            | $I^2t$ Value for fusing                   | $t_p=8.3 ms$                                                                                             | 210        | A <sup>2</sup> s |
| $I_{PP}$          | Non-repetitive peak surge current         | with Littelfuse MOV V20E420AUTO across line; $T_J=125^\circ C$ , 11.2/50-8/20 combination wave, $I_T=1A$ | 2400       | A                |
| $di/dt$           | Critical rate of rise of on-state current | $T_J=125^\circ C$                                                                                        | 375        | A/ $\mu s$       |
| $I_{GM}$          | Peak gate current                         | $T_J=125^\circ C$                                                                                        | 3.0        | A                |
| $P_{G(AV)}$       | Average gate power dissipation            | $T_J=125^\circ C$                                                                                        | 0.6        | W                |
| $T_{stg}$         | Storage temperature range                 |                                                                                                          | -40 to 150 | °C               |
| $T_J$             | Operating junction temperature range      |                                                                                                          | -40 to 125 | °C               |

**Electrical Characteristics** ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

| Symbol   | Test Conditions                                                                                                   |      | Value | Unit              |
|----------|-------------------------------------------------------------------------------------------------------------------|------|-------|-------------------|
| $I_{GT}$ | $V_D = 12\text{V}; R_L = 30\Omega$                                                                                | MIN. | 15    | mA                |
|          |                                                                                                                   | MAX. | 50    |                   |
| $V_{GT}$ |                                                                                                                   | MAX. | 1.5   | V                 |
| $dv/dt$  | $V_D = V_{DRM}$ ; gate open; $T_J = 125^\circ\text{C}$                                                            | MIN. | 2000  | V/ $\mu\text{s}$  |
|          | 1.2/50 pulse wave, with 250V AC with Littelfuse MOV V20E420AUTO across                                            | MIN. | 5     | KV/ $\mu\text{s}$ |
| $V_{GD}$ | $V_D = V_{DRM}$ ; $R_L = 3.3\text{ k}\Omega$ ; $T_J = 125^\circ\text{C}$                                          | MIN. | 0.2   | V                 |
| $I_H$    | $I_T = 400\text{mA}$ (initial)                                                                                    | MAX. | 150   | mA                |
| $t_q$    | $I_T = 0.5\text{A}$ ; $t_p = 50\mu\text{s}$ ; $dv/dt = 5\text{V}/\mu\text{s}$ ; $di/dt = -30\text{A}/\mu\text{s}$ | MAX. | 35    | $\mu\text{s}$     |
| $t_{gt}$ | $I_G = 2 \times I_{GT}$ ; $PW = 15\mu\text{s}$ ; $I_T = 40\text{A}$                                               | TYP. | 2     | $\mu\text{s}$     |

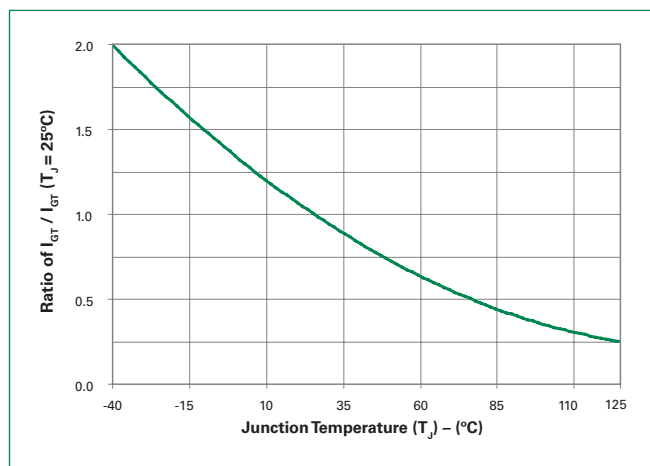
**Static Characteristics**

| Symbol              | Test Conditions                             |                           | Value | Unit          |
|---------------------|---------------------------------------------|---------------------------|-------|---------------|
| $V_{TM}$            | $I_T = 32\text{A}$ ; $t_p = 380\mu\text{s}$ | MAX.                      | 1.4   | V             |
| $I_{DRM} / I_{RRM}$ | @ $V_{DRM} / V_{RRM}$                       | $T_J = 25^\circ\text{C}$  | 20    | $\mu\text{A}$ |
|                     |                                             | $T_J = 100^\circ\text{C}$ | 1000  |               |
|                     |                                             | $T_J = 125^\circ\text{C}$ | 2000  |               |

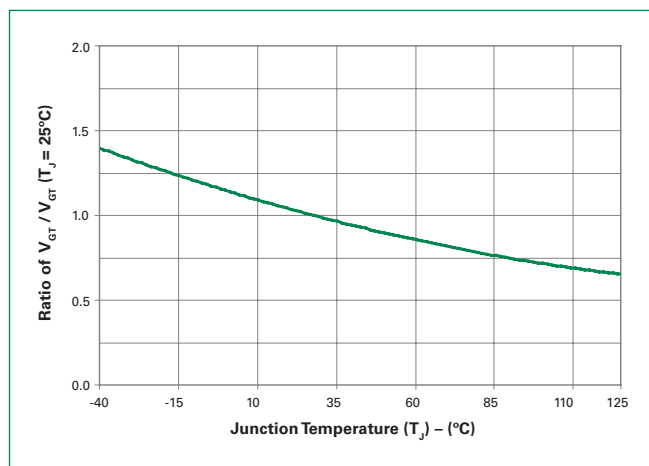
**Thermal Resistances**

| Symbol            | Parameter             | Value | Unit                      |
|-------------------|-----------------------|-------|---------------------------|
| $R_{\theta(J-C)}$ | Junction to case (AC) | 1.0   | $^\circ\text{C}/\text{W}$ |

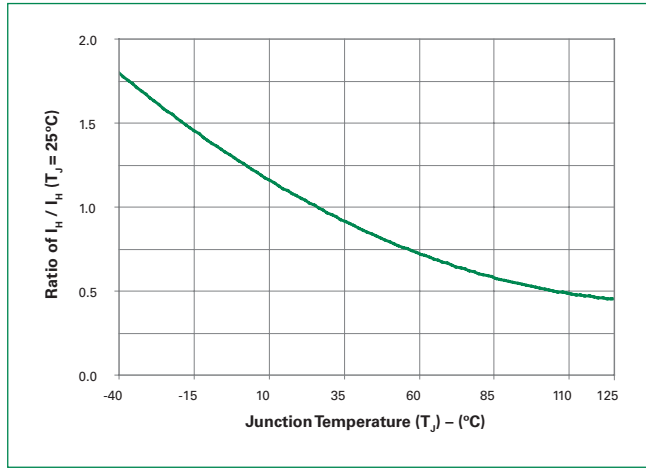
**Figure 1: Normalized DC Gate Trigger Current vs. Junction Temperature**



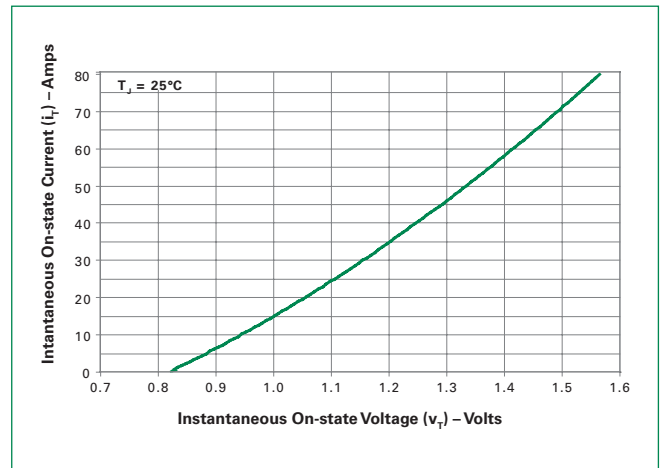
**Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature**



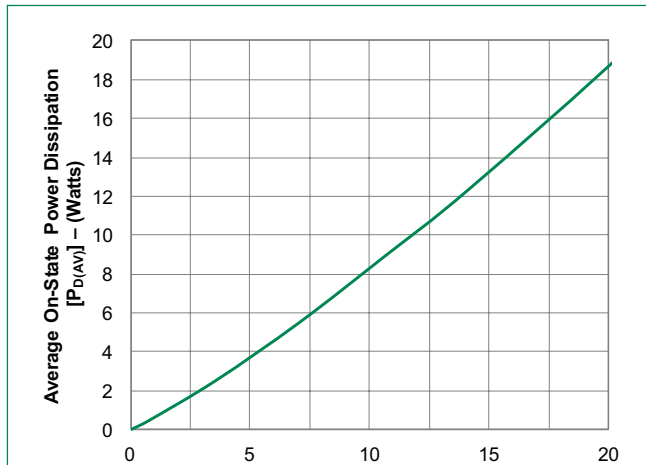
**Figure 3: Normalized DC Holding Current vs. Junction Temperature**



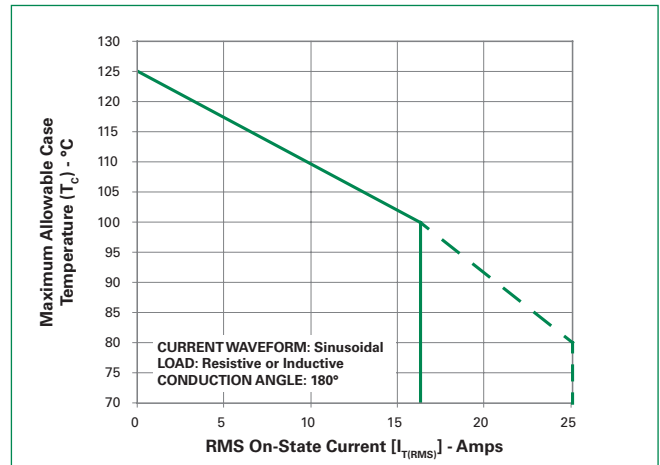
**Figure 4: On-State Current vs. On-State Voltage (Typical)**



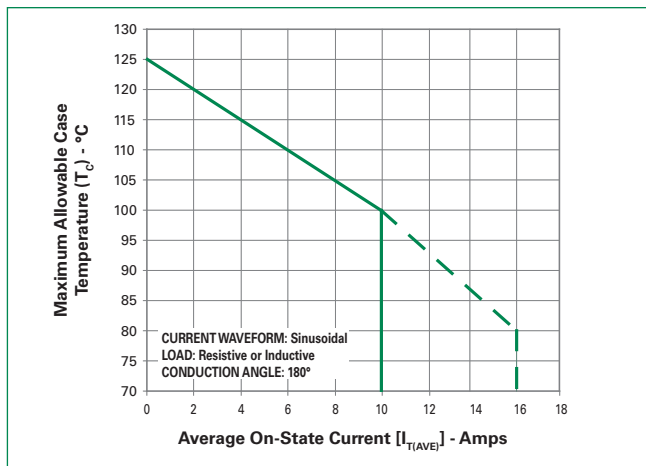
**Figure 5: Power Dissipation (Typical) vs. RMS On-State Current**



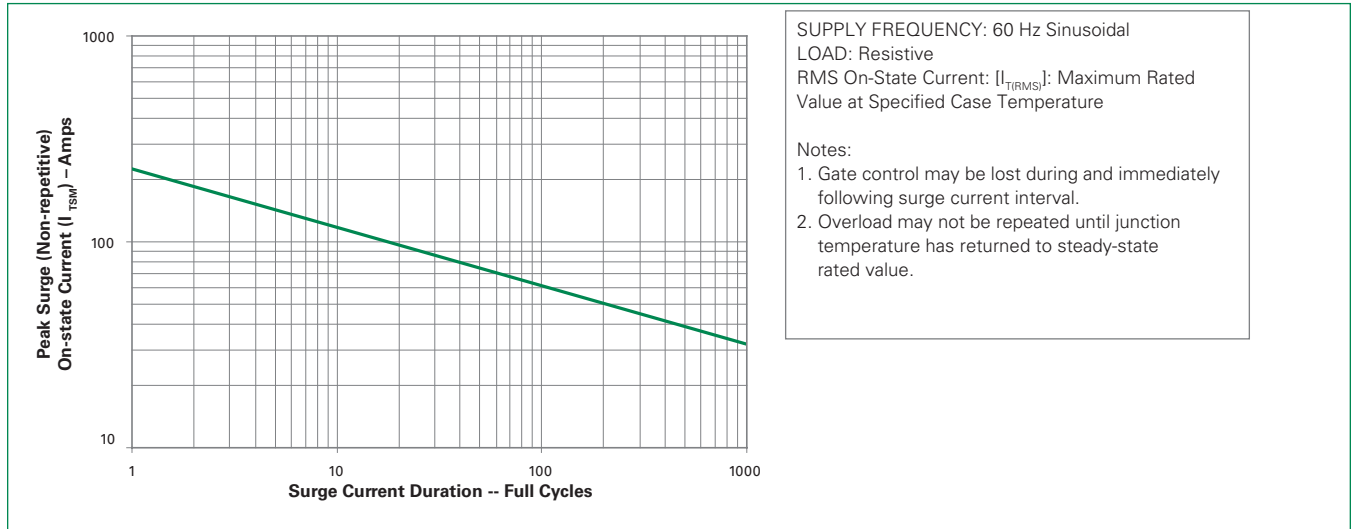
**Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current**



**Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current**

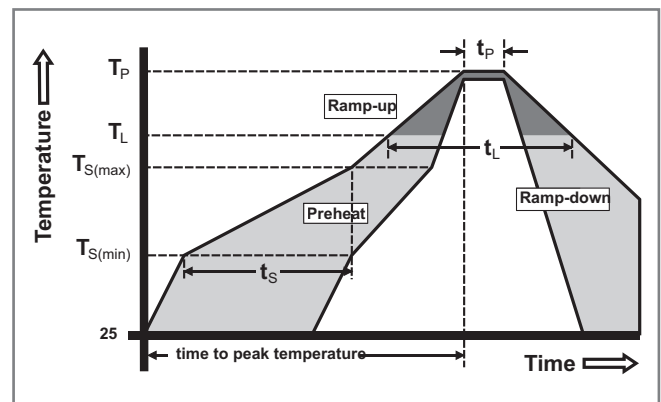


**Figure 8: Surge Peak On-State Current vs. Number of Cycles**



### Soldering Parameters

|                                                        |                                    |                         |
|--------------------------------------------------------|------------------------------------|-------------------------|
| Reflow Condition                                       |                                    | Pb – Free assembly      |
| 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 |                                    | 5°C/second max          |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                   |                                    | 5°C/second max          |
| Reflow                                                 | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|                                                        | - Time ( $t_L$ )                   | 60 – 150 seconds        |
| Peak Temperature ( $T_p$ )                             |                                    | 260 <sup>+0/-5</sup> °C |
| Time within 5°C of actual peak Temperature ( $t_p$ )   |                                    | 20 – 40 seconds         |
| Ramp-down Rate                                         |                                    | 5°C/second max          |
| Time 25°C to peak Temperature ( $T_p$ )                |                                    | 8 minutes Max.          |
| Do not exceed                                          |                                    | 280°C                   |



### Physical Specifications

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

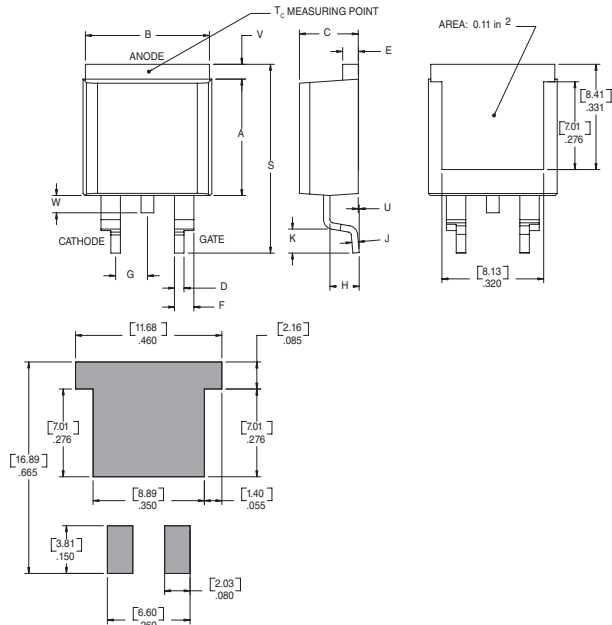
### Design Considerations

Careful selection of the correct component for the application's operating parameters and environment will go a long way toward extending the operating life of the Thyristor. Good design practice should limit the maximum continuous current through the main terminals to 75% of the component rating. Other ways to ensure long life for a power discrete semiconductor are proper heat sinking and selection of voltage ratings for worst case conditions. Overheating, overvoltage (including dv/dt), and surge currents are the main killers of semiconductors. Correct mounting, soldering, and forming of the leads also help protect against component damage.

### Environmental Specifications

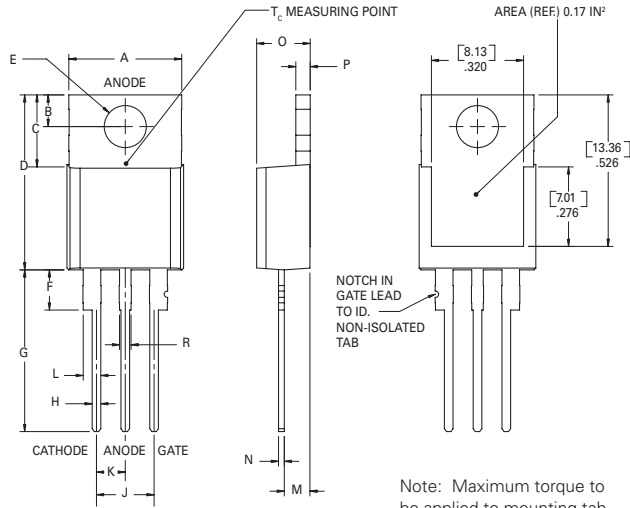
| Test                                     | Specifications and Conditions                                                 |
|------------------------------------------|-------------------------------------------------------------------------------|
| <b>AC Blocking</b>                       | MIL-STD-750, M-1040, Cond A Applied<br>Peak AC voltage @ 125°C for 1008 hours |
| <b>Temperature Cycling</b>               | JESD22 A-104 Appendix 6<br>-55°C to 150°C, 15-minute dwell,<br>1000 cycles    |
| <b>Autoclave (Pressure Cooker Test)</b>  | EIA/JEDEC: JESD22-A102<br>121°C, 100%RH, 15psig, 96hours                      |
| <b>Biased Temperature &amp; Humidity</b> | EIA / JEDEC, JESD22-A101<br>1008 hours; 320V - DC: 85°C;<br>85% rel humidity  |
| <b>Intermittent Operational Life</b>     | T <sub>A</sub> =25°C, ΔTJ ≥ 100°C, 1008hrs                                    |
| <b>Resistance to Solder Heat</b>         | JESD22 A-111: 260°C, 10 seconds                                               |
| <b>Solderability</b>                     | ANSI/J-STD-002, category 3, Test A                                            |

### Dimensions –TO- 263AB (N-package) — D<sup>2</sup>-Pak Surface Mount



| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.360  | 0.370 | 9.14        | 9.40  |
| B         | 0.380  | 0.420 | 9.65        | 10.67 |
| C         | 0.178  | 0.188 | 4.52        | 4.78  |
| D         | 0.025  | 0.035 | 0.64        | 0.89  |
| E         | 0.045  | 0.060 | 1.14        | 1.52  |
| F         | 0.060  | 0.075 | 1.52        | 1.91  |
| G         | 0.095  | 0.105 | 2.41        | 2.67  |
| H         | 0.092  | 0.102 | 2.34        | 2.59  |
| J         | 0.018  | 0.024 | 0.46        | 0.61  |
| K         | 0.090  | 0.110 | 2.29        | 2.79  |
| S         | 0.590  | 0.625 | 14.99       | 15.88 |
| V         | 0.035  | 0.045 | 0.89        | 1.14  |
| U         | 0.002  | 0.010 | 0.05        | 0.25  |
| W         | 0.040  | 0.070 | 1.016       | 1.78  |

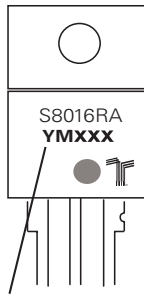
**Dimensions — TO-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead**



| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.380  | 0.420 | 9.65        | 10.67 |
| B         | 0.105  | 0.115 | 2.67        | 2.92  |
| C         | 0.230  | 0.250 | 5.84        | 6.35  |
| D         | 0.590  | 0.620 | 14.99       | 15.75 |
| E         | 0.142  | 0.147 | 3.61        | 3.73  |
| F         | 0.110  | 0.130 | 2.79        | 3.30  |
| G         | 0.540  | 0.575 | 13.72       | 14.61 |
| H         | 0.025  | 0.035 | 0.64        | 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        | 1.91  |
| M         | 0.085  | 0.095 | 2.16        | 2.41  |
| N         | 0.018  | 0.024 | 0.46        | 0.61  |
| O         | 0.178  | 0.188 | 4.52        | 4.78  |
| P         | 0.045  | 0.060 | 1.14        | 1.52  |
| R         | 0.038  | 0.048 | 0.97        | 1.22  |

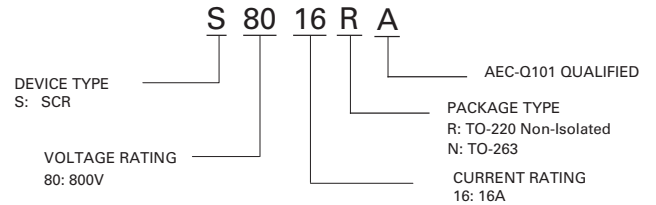
**Part Marking System**

TO-220 AB - (R Package)  
TO-263 (N Package)



Date Code Marking  
Y: Year Code  
M: Month Code  
XXX: Lot Trace Code

**Part Numbering System**

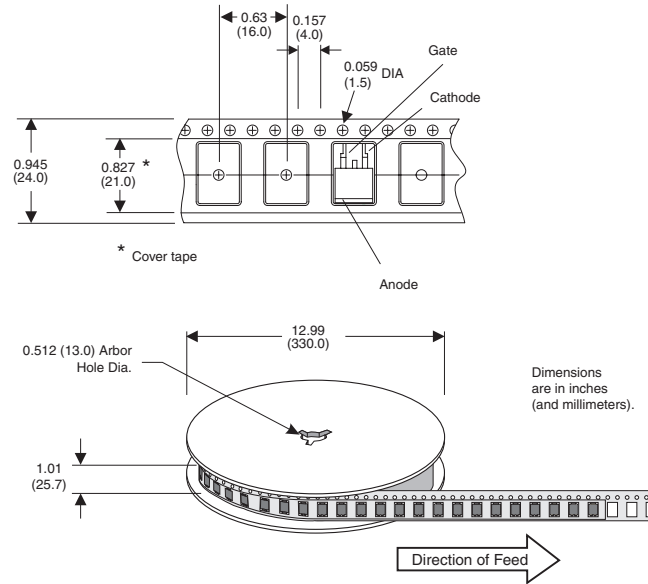


**Packing Options**

| Part Number | Marking | Weight | Packing Mode     | Base Quantity     | Package |
|-------------|---------|--------|------------------|-------------------|---------|
| S8016RATP   | S8016RA | 1.6g   | Tube             | 500 (50 per tube) | TO-220R |
| S8016NARP   | S8016NA | 1.6g   | Embossed Carrier | 500               | TO-263  |

## TO-263 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards



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