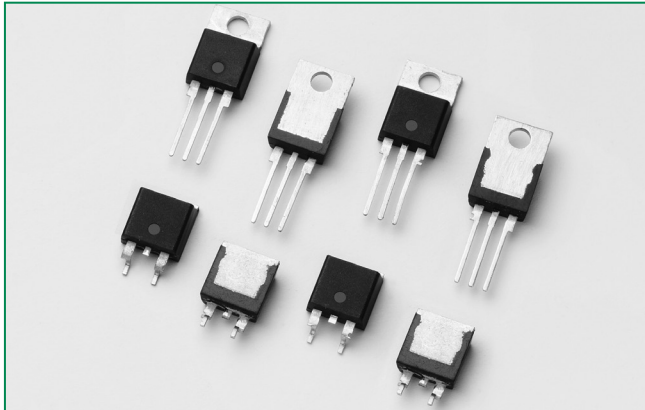


**SJxx40x Series**



**Description**

This SJxx40x high temperature SCR series is ideal for uni-directional switch applications such as phase control in heating, motor speed controls and AC rectifier and voltage regulator.

These SCRs have a low gate current trigger level of 40 mA maximum at approximately 1.5 V, with a sensitive version of this series having a gate trigger current of 15 mA maximum.

**Features & Benefits**

- High junction temperature
- Voltage capability up to 600 V
- Surge capability up to 520 A at 60 Hz half cycle
- Halogen free and RoHS compliant

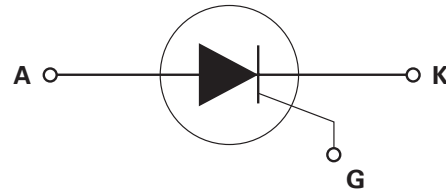
**Applications**

Typical applications are AC rectifier, voltage regulator, AC solid-state switches, industrial power tools, exercise equipment, white goods and commercial appliances.

**Main Features**

| Symbol            | Value      | Unit |
|-------------------|------------|------|
| $I_{T(RMS)}$      | 40         | A    |
| $V_{DRM}/V_{RRM}$ | 400 or 600 | V    |
| $I_{GT}$          | 40         | mA   |

**Schematic Symbol**



**Absolute Maximum Ratings**

| Symbol            | Parameter                                 | Test Conditions   | Value      | Unit       |
|-------------------|---|---|------------|------------|
| $V_{DSM}/V_{RSM}$ | Peak non-repetitive blocking voltage      | $P_w = 100\mu s$  | 700        | V          |
| $I_{T(RMS)}$      | RMS on-state current                      | $T_c = 120^\circ C$   | 40         | A          |
| $I_{T(AV)}$       | Average on-state current                  | $T_c = 120^\circ C$   | 25.0       | A          |
| $I_{TSM}$         | Peak non-repetitive surge current         | single half cycle; $f = 50Hz$ ;<br>$T_J$ (initial) = $25^\circ C$ | 430        | A          |
|                   |   | single half cycle; $f = 60Hz$ ;<br>$T_J$ (initial) = $25^\circ C$ | 520        |            |
| $I^2t$            | $I^2t$ Value for fusing                   | $t_p = 8.3 ms$  | 1122       | $A^2s$     |
| $di/dt$           | Critical rate of rise of on-state current | $f = 60Hz$ ; $T_J = 150^\circ C$                                  | 150        | $A/\mu s$  |
| $I_{GM}$          | Peak gate current                         | $t_p \leq 10\mu s$ ; $T_J = 150^\circ C$                          | 4          | A          |
| $P_{G(AV)}$       | Average gate power dissipation            | $t_p \leq 10\mu s$ ; $T_J = 150^\circ C$                          | 1          | W          |
| $T_{stg}$         | Storage temperature range                 |   | -40 to 150 | $^\circ C$ |
| $T_J$             | Operating junction temperature range      |   | -40 to 150 | $^\circ C$ |

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

| Symbol   | Test Conditions  |      | SJxx40x | SJxx40x2 | Unit          |                  |
|----------|--|------|---------|----------|---------------|------------------|
| $I_{GT}$ | $V_D = 12\text{V}; R_L = 30\ \Omega$   | MAX. | 40      | 15       | mA            |                  |
|          |  | MIN. | 5       | 3        |               |                  |
| $V_{GT}$ |  | MAX. | 1.5     |          | V             |                  |
| dv/dt    | $V_D = V_{DRM}; \text{gate open}; T_J = 125^\circ\text{C}$   | 400V | MIN.    | 650      | 400           | V/ $\mu\text{s}$ |
|          |  | 600V |         | 600      | 350           |                  |
|          | $V_D = V_{DRM}; \text{gate open}; T_J = 150^\circ\text{C}$   | 400V |         | 550      | 300           |                  |
|          |  | 600V |         | 500      | 250           |                  |
| $V_{GD}$ | $V_D = V_{DRM}; R_L = 3.3\ \text{k}\Omega; T_J = 150^\circ\text{C}$                                    | MIN. | 0.2     |          | V             |                  |
| $I_H$    | $I_T = 400\text{mA}$ (initial)   | MAX. | 60      | 50       | mA            |                  |
| $t_q$    | $I_T = 2\text{A}; t_p = 50\mu\text{s}; dv/dt = 5\text{V}/\mu\text{s}; di/dt = -30\text{A}/\mu\text{s}$ | MAX. | 35      |          | $\mu\text{s}$ |                  |
| $t_{gt}$ | $I_G = 2 \times I_{GT}; \text{PW} = 15\mu\text{s}; I_T = 80\text{A}$                                   | TYP. | 2       |          | $\mu\text{s}$ |                  |

NOTE: xx = voltage, x = package

**Static Characteristics**

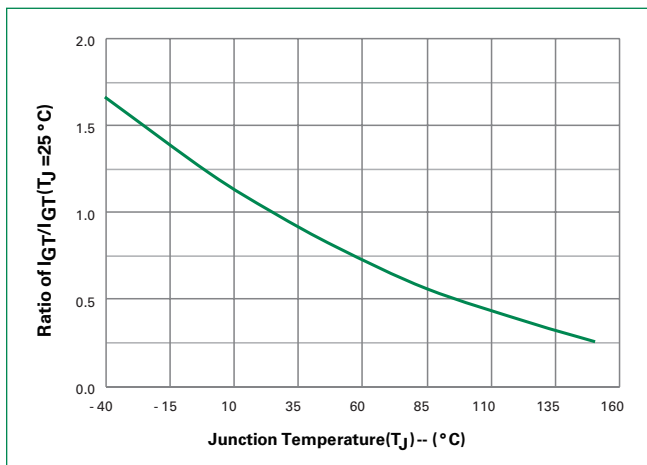
| Symbol              | Test Conditions                          |                           | Value | Unit          |
|---------------------|--|---------------------------|-------|---------------|
| $V_{TM}$            | $I_T = 80\text{A}; t_p = 380\mu\text{s}$ | MAX.                      | 1.7   | V             |
| $I_{DRM} / I_{RRM}$ | @ $V_{DRM} / V_{RRM}$                    | $T_J = 25^\circ\text{C}$  | 10    | $\mu\text{A}$ |
|                     |  | $T_J = 125^\circ\text{C}$ | 2000  |               |
|                     |  | $T_J = 150^\circ\text{C}$ | 4000  |               |

**Thermal Resistances**

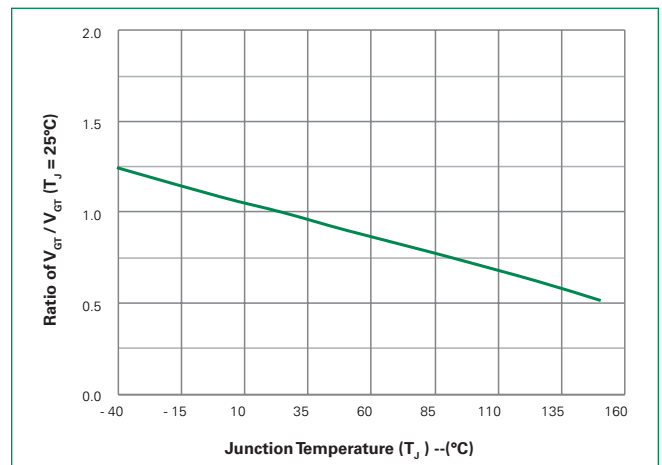
| Symbol            | Parameter             |                   | Value | Unit                      |
|-------------------|-----------------------|-------------------|-------|---------------------------|
| $R_{\theta(J-C)}$ | Junction to case (AC) | SJxx40Ry/SJxx40Ny | 0.8   | $^\circ\text{C}/\text{W}$ |
| $R_{\theta(J-A)}$ | Junction to ambient   | Sxx40Ry           | 40    | $^\circ\text{C}/\text{W}$ |

Note: xx = voltage, y = sensitivity & type

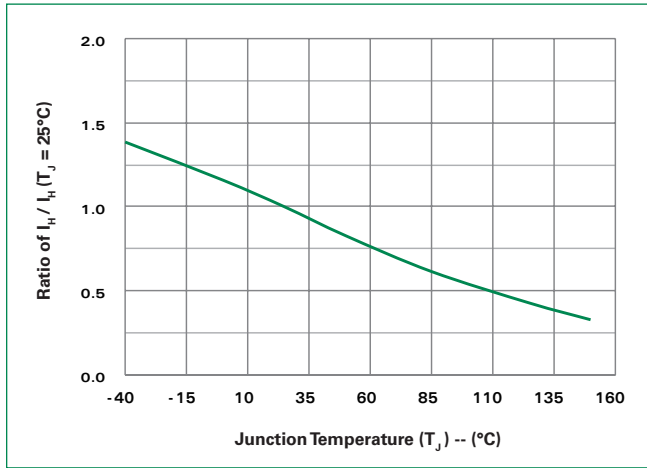
**Figure 1: Normalized DC Gate Trigger Current vs. Junction Temperature**



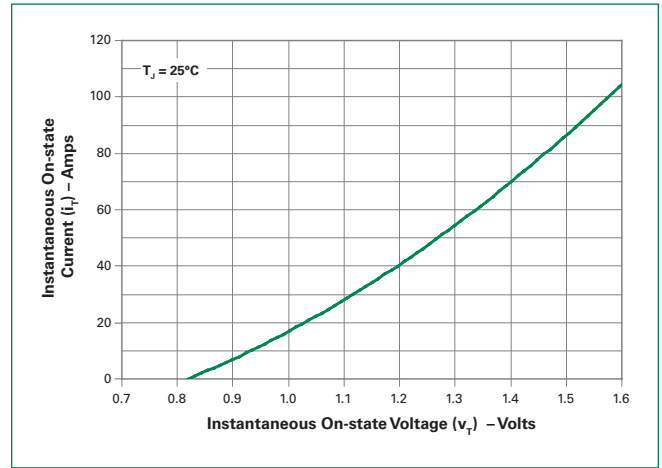
**Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature**



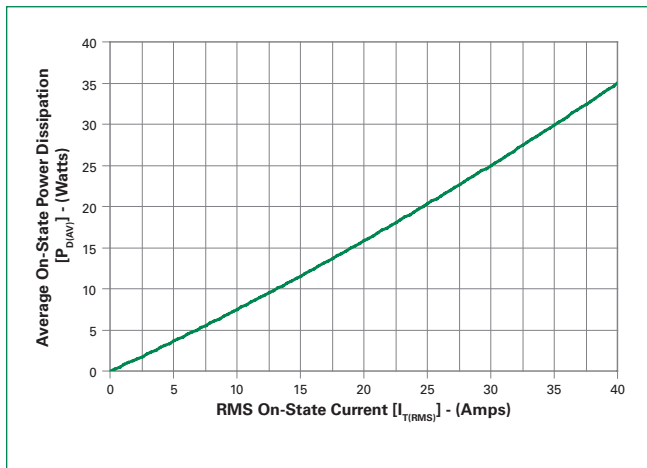
**Figure 3: Normalized DC Holding Current vs. Junction Temperature**



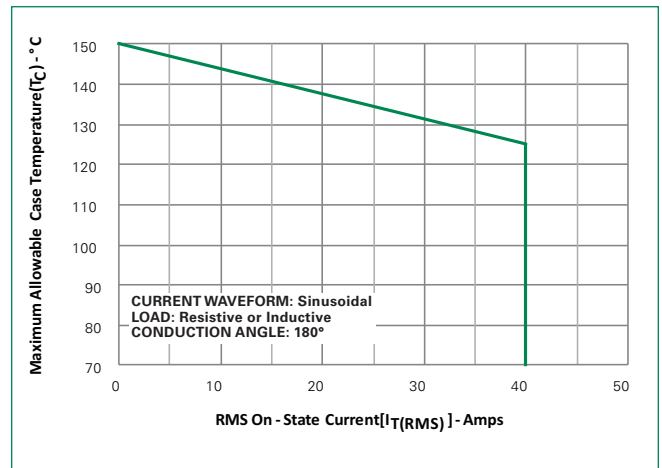
**Figure 4: On-State Current vs. On-State Voltage (Typical)**



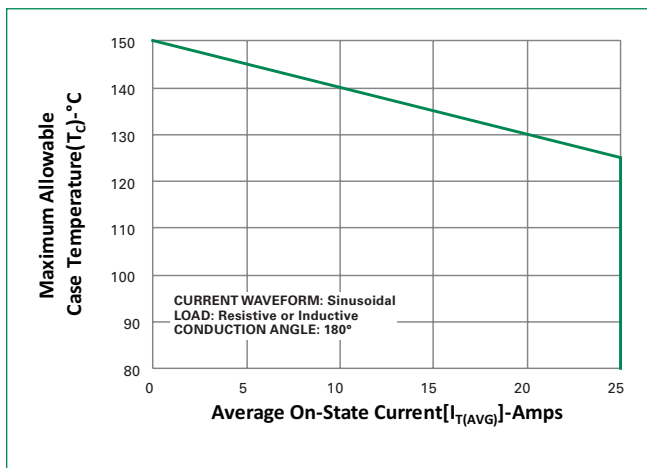
**Figure 5: Power Dissipation (Typical) vs. RMS On-State Current**



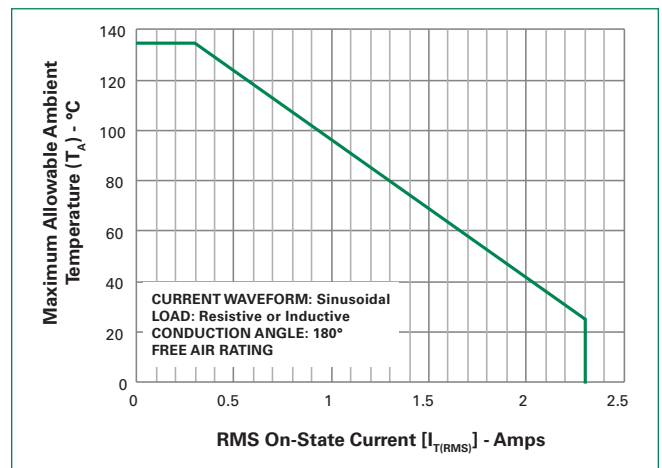
**Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current**



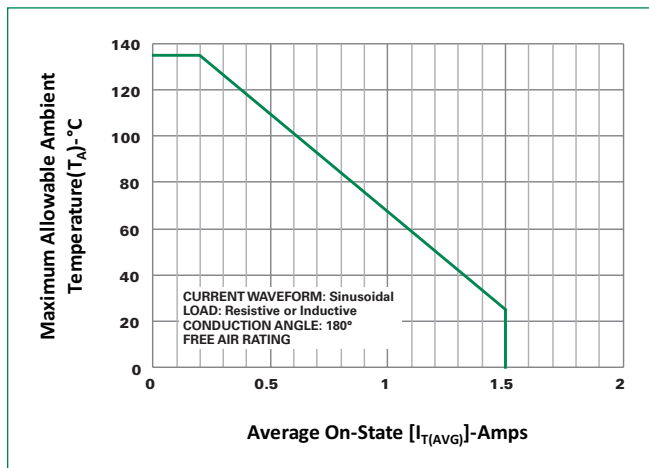
**Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current**



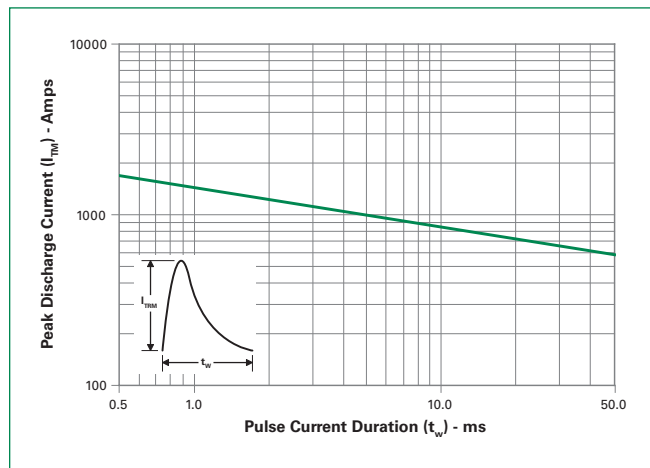
**Figure 8: Maximum Allowable Ambient Temperature vs. RMS On-State Current**



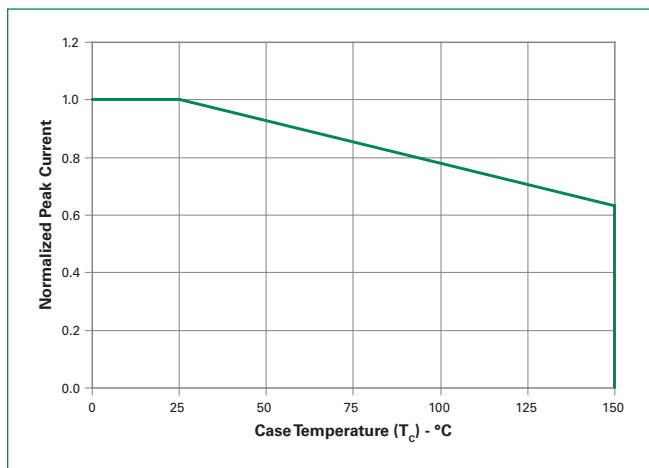
**Figure 9: Maximum Allowable Ambient Temperature vs. Average On-State Current**



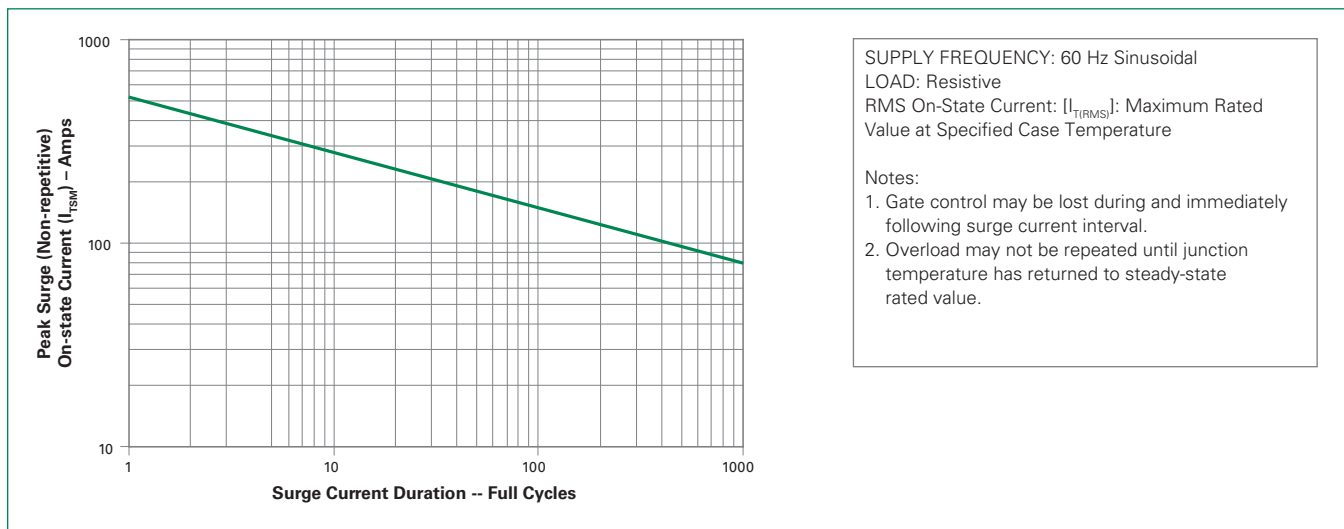
**Figure 10: Peak Capacitor Discharge Current**



**Figure 11: Peak Capacitor Discharge Current Derating**

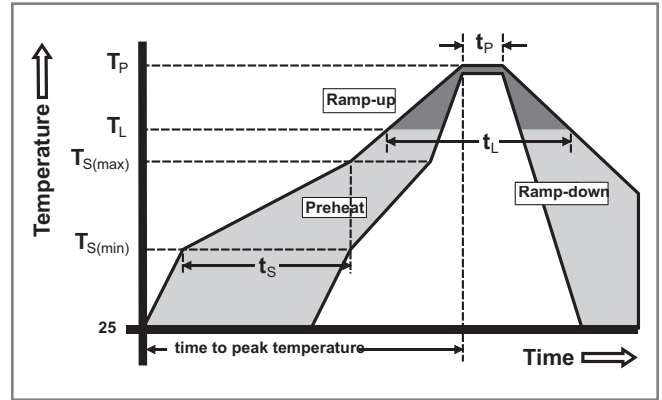


**Figure 12: Surge Peak On-State Current vs. Number of Cycles**



**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  |

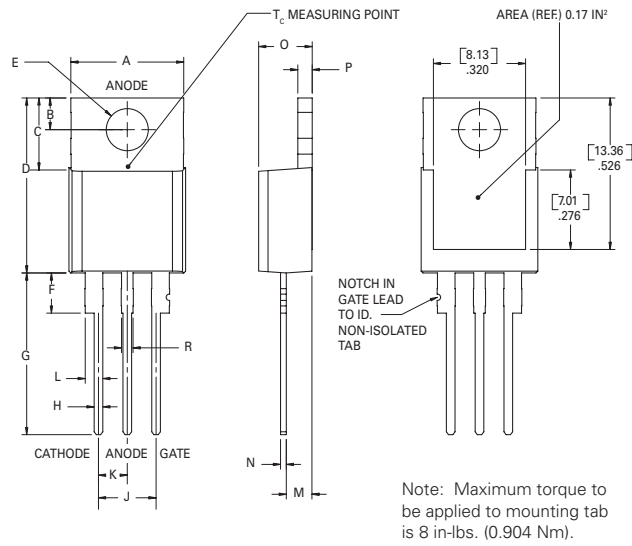
**Design Considerations**

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**

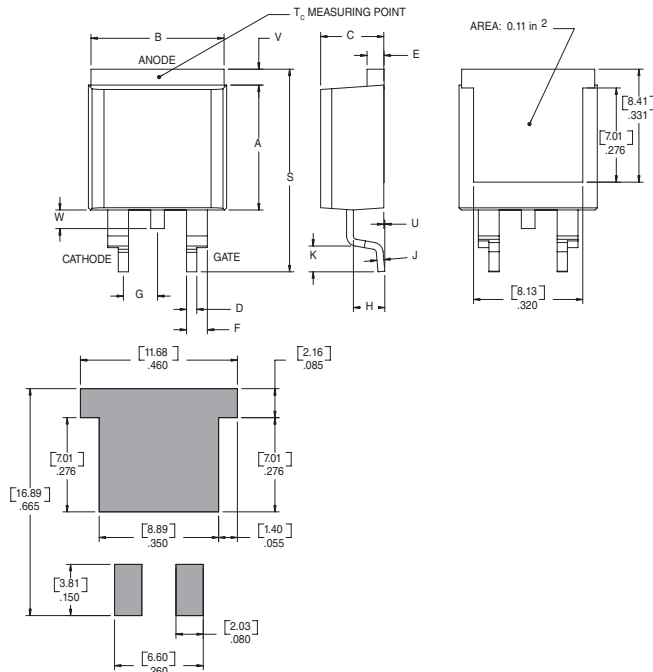
| Test                              | Specifications and Conditions  |
|-----------------------------------|--|
| <b>AC Blocking</b>                | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours |
| <b>Temperature Cycling</b>        | MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15-min dwell-time        |
| <b>Temperature/Humidity</b>       | EIA / JEDEC, JESD22-A101 1008 hours; 320V - DC: 85°C; 85% rel humidity     |
| <b>High Temp Storage</b>          | MIL-STD-750, M-1031, 1008 hours; 150°C                                     |
| <b>Low-Temp Storage</b>           | 1008 hours; -40°C  |
| <b>Resistance to Solder Heat</b>  | MIL-STD-750 Method 2031  |
| <b>Solderability</b>              | ANSI/J-STD-002, category 3, Test A   |
| <b>Lead Bend</b>                  | MIL-STD-750, M-2036 Cond E   |
| <b>Moisture Sensitivity Level</b> | Level 1, JEDEC-J-STD-020D  |

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



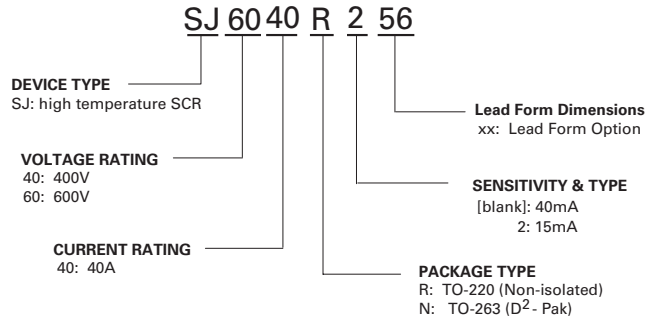
| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.380  | 0.420 | 9.65        | 10.67 |
| B         | 0.105  | 0.115 | 2.67        | 2.92  |
| C         | 0.230  | 0.250 | 5.84        | 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  |

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

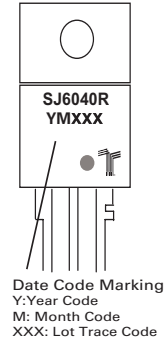


| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.360  | 0.370 | 9.14        | 9.40  |
| B         | 0.380  | 0.420 | 9.65        | 10.67 |
| C         | 0.178  | 0.188 | 4.52        | 4.78  |
| D         | 0.025  | 0.035 | 0.63        | 0.89  |
| E         | 0.048  | 0.055 | 1.22        | 1.40  |
| F         | 0.060  | 0.075 | 1.52        | 1.91  |
| G         | 0.095  | 0.105 | 2.41        | 2.67  |
| H         | 0.083  | 0.093 | 2.11        | 2.36  |
| 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       | 15.87 |
| V         | 0.035  | 0.045 | 0.89        | 1.14  |
| U         | 0.002  | 0.010 | 0.05        | 0.25  |
| W         | 0.040  | 0.070 | 1.02        | 1.78  |

**Part Numbering System**



**Part Marking System**



**Product Selector**

| Part Number | Voltage |      | Gate Sensitivity | Type         | Package |
|-------------|---------|------|------------------|--------------|---------|
|             | 400V    | 600V |                  |              |         |
| SJxx40R     | X       | X    | 40mA             | Standard SCR | TO-220R |
| SJxx40N     | X       | X    | 40mA             | Standard SCR | TO-263  |
| SJxx40R2    | X       | X    | 15mA             | Standard SCR | TO-220R |
| SJxx40N2    | X       | X    | 15mA             | Standard SCR | TO-263  |

Note: xx = Voltage

**Packing Options**

| Part Number | Marking  | Weight | Packing Mode     | Base Quantity     |
|-------------|----------|--------|------------------|-------------------|
| SJxx40RTP   | SJxx40R  | 2.2g   | Tube             | 500 (50 per tube) |
| SJxx40NTP   | SJxx40N  | 1.6g   | Tube             | 500 (50 per tube) |
| SJxx40NRP   | SJxx40N  | 1.6g   | Embossed Carrier | 500               |
| SJxx40R2TP  | SJxx40R2 | 2.2g   | Tube             | 500 (50 per tube) |
| SJxx40N2RP  | SJxx40N2 | 1.6g   | Embossed Carrier | 500               |

Note: xx = Voltage

**Reel Pack (RP) for TO-263 Embossed Carrier Specifications**

**Meets all EIA-481-2 Standards**

