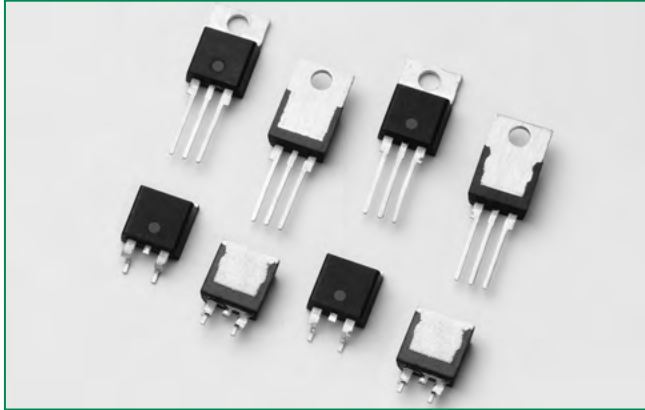



## SJxx40xxA Series



### Agency Recognitions

| Agency  | Agency File Number |
|---|--------------------|
|  | E71639             |

Note: L package only

### Main Features

| Symbol            | Value      | Unit |
|-------------------|------------|------|
| $I_{T(RMS)}$      | 40         | A    |
| $V_{DRM}/V_{RRM}$ | 400 or 600 | V    |
| $I_{GT}$          | 15 or 40   | mA   |

### Description

This SJxx40xxA 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.

This SCR series offer low gate current trigger levels of 15 mA or 40 mA at approximately 1.5V.

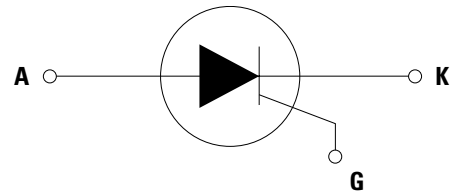
### Features & Benefits

- 150°C junction temperature
- Voltage capability up to 600 V
- Surge capability up to 520 A at 60 Hz half cycle
- Halogen-free and RoHS compliant
- Recognized to UL 1557 as an Electrically Isolated Semiconductor Device
- AEC-Q101 qualified

### -Applications

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

### 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                      | SJxx40LxA $T_c = 55^\circ C$                                      | 40         | A          |
|                   |   | SJxx40RxA/SJxx40NxA $T_c = 115^\circ C$                           |            |            |
| $I_{T(AV)}$       | Average on-state current                  | SJxx40LxA $T_c = 55^\circ C$                                      | 25.0       | A          |
|                   |   | SJxx40RxA/SJxx40NxA $T_c = 115^\circ C$                           |            |            |
| $I_{TSM}$         | 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  |      | SJxx40xA | SJxx40x2A | 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       | -    |                  |
|          |  | 600V |          | 500       | -    |                  |
|          | $V_D = 67\%V_{DRM}; \text{gate open}; T_J = 150^\circ\text{C}$   | 400V |          | -         | 300  |                  |
|          |  | 600V |          | -         | 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        |      | $\mu\text{s}$    |
| $t_{gt}$ | $I_G = 2 \times I_{GT}; \text{PW} = 15\mu\text{s}; I_T = 80\text{A}$                                   |      | TYR.     | 2         |      | $\mu\text{s}$    |

Note: xx=voltage/10, x=package

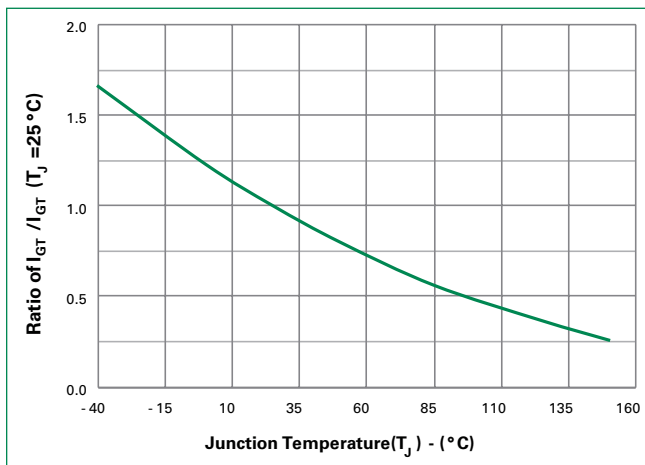
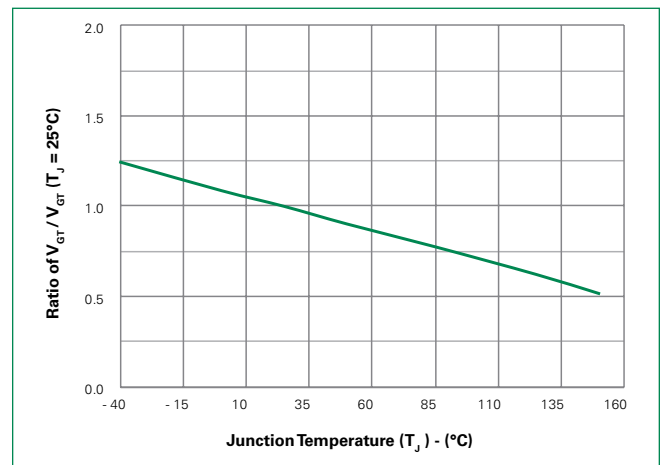
**Static Characteristics**

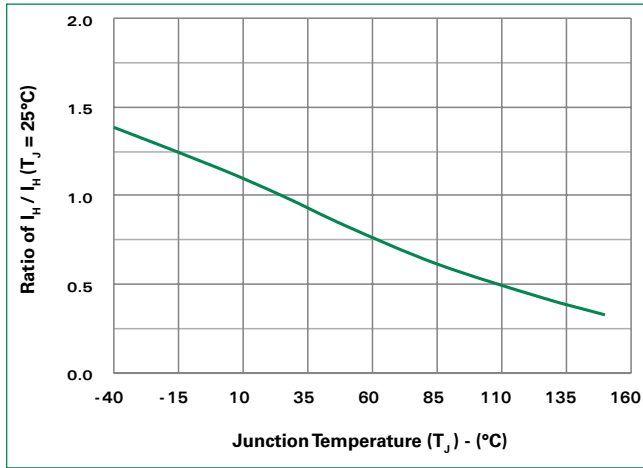
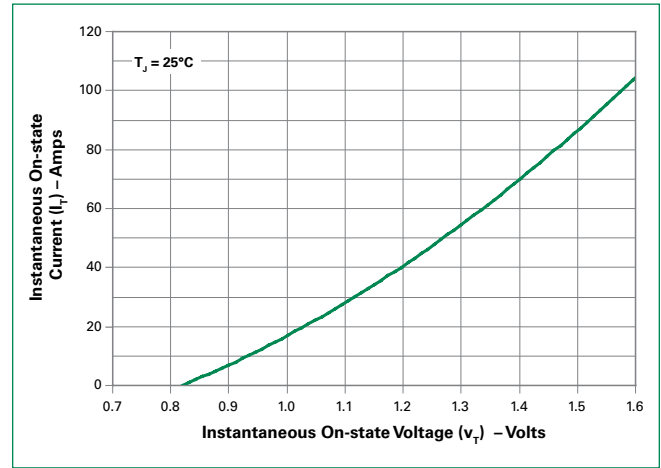
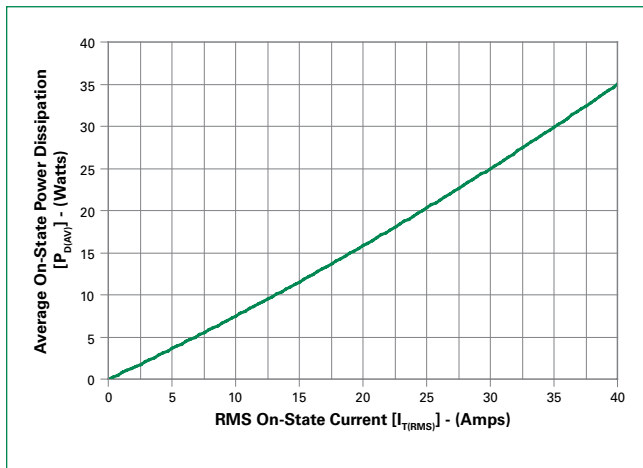
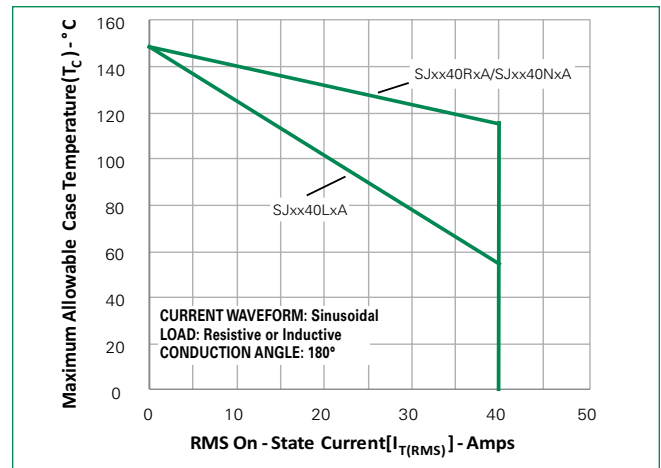
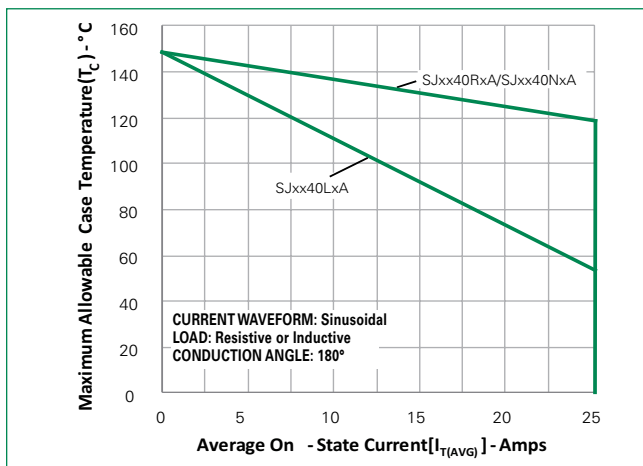
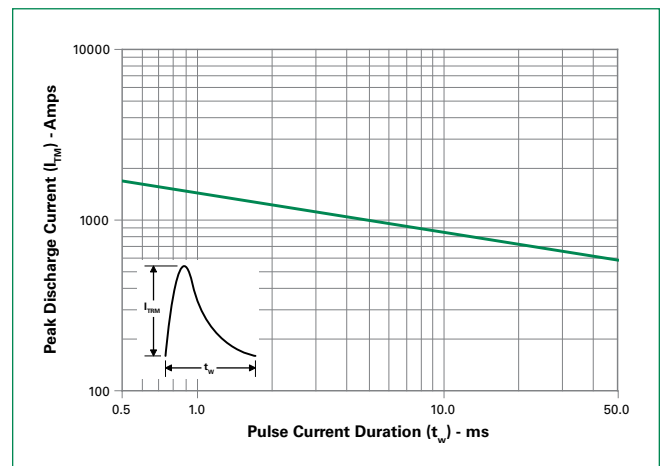
| Symbol              | Test Conditions                          | Value                     | Unit |               |
|---------------------|--|---------------------------|------|---------------|
| $V_{TM}$            | $I_T = 80\text{A}; t_p = 380\mu\text{s}$ | MAX.                      | 1.7  | V 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

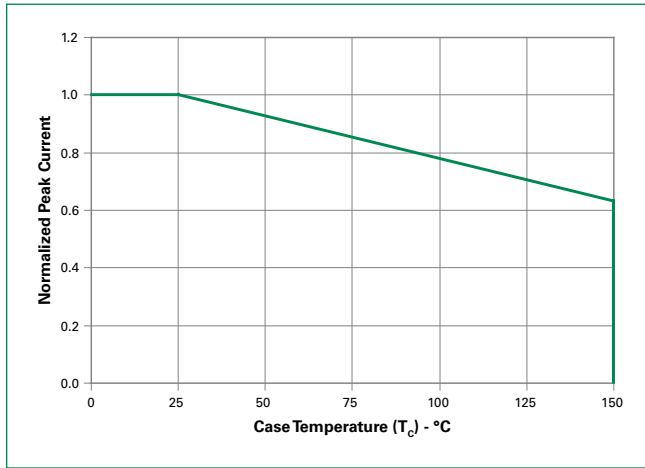
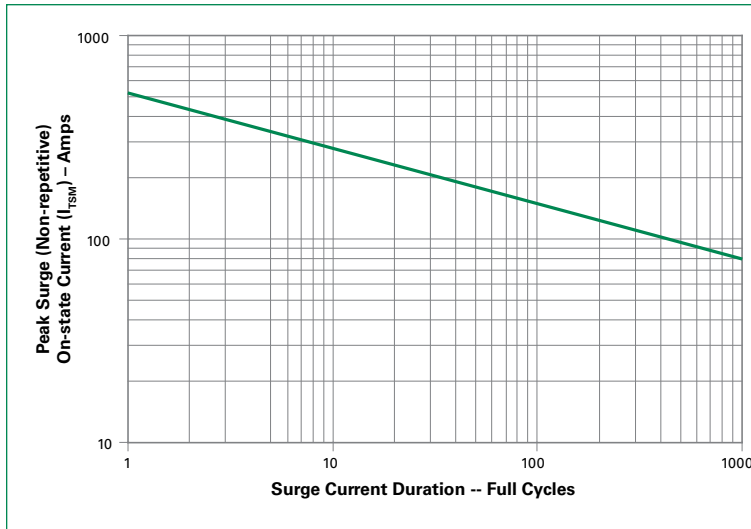
**Thermal Resistances**

| Symbol           | Parameter             | Value               | Unit |                           |
|------------------|-----------------------|---------------------|------|---------------------------|
| $R_{\theta(UC)}$ | Junction to case (AC) | SJxx40LxA           | 1.9  | $^\circ\text{C}/\text{W}$ |
|                  |                       | SJxx40RxA/SJxx40NxA | 0.8  | $^\circ\text{C}/\text{W}$ |

Note: xx = voltage, x = sensitivity &amp; 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: Peak Capacitor Discharge Current**


**Figure 9: Peak Capacitor Discharge Current Derating**

**Figure 10: Surge Peak On-State Current vs. Number of Cycles**


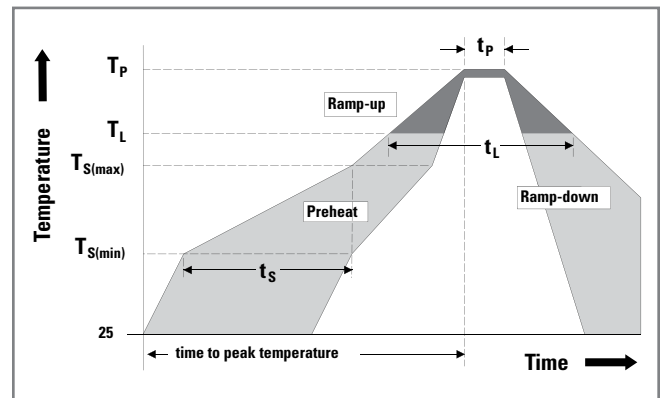
SUPPLY FREQUENCY: 60 Hz Sinusoidal  
 LOAD: Resistive  
 RMS On-State Current: [ $I_{T(RMS)}$ ]: Maximum Rated Value at Specified Case Temperature

**Notes:**

1. Gate control may be lost during and immediately following surge current interval.
2. Overload may not be repeated until junction temperature has returned to steady-state rated value.

**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 compound meeting flammability rating V-0 |
| <b>Lead Material</b>   | Copper Alloy   |

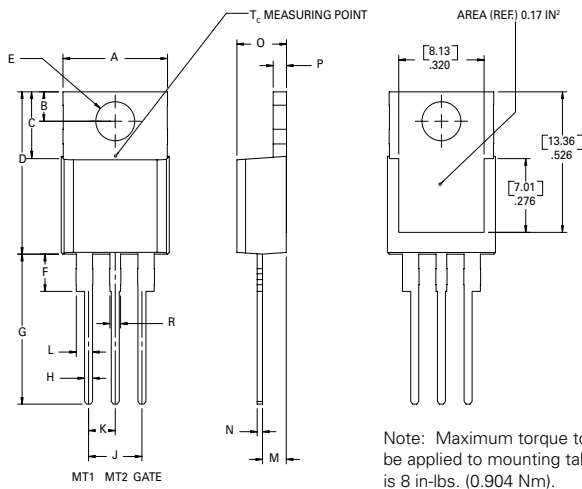
### Design Considerations

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

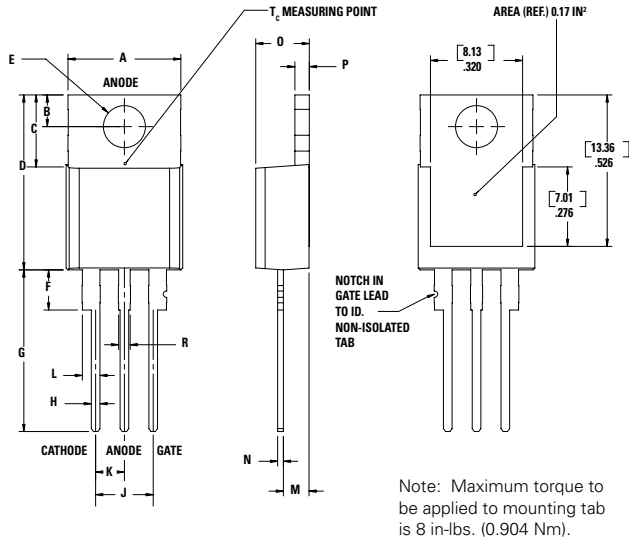
| Test                              | Specifications and Conditions  |
|-----------------------------------|--|
| <b>AC Blocking</b>                | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours |
| <b>Temperature Cycling</b>        | MIL-STD-750, M-1051, 1000 cycles; 55°C to +150°C; 15-min dwell-time        |
| <b>Temperature/Humidity</b>       | EIA / JEDEC, JESD22-A101 1008 hours; 160VDC - DC: 85°C; 85% rel humidity   |
| <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  |
| <b>UHASt</b>                      | JESD22A-118, 96 hrs, 130°C / 85% RH  |
| <b>IOL</b>                        | MIL-STD-750 Method 1037  |

### Dimensions — TO-220AB (L Package) — Isolated Mounting Tab



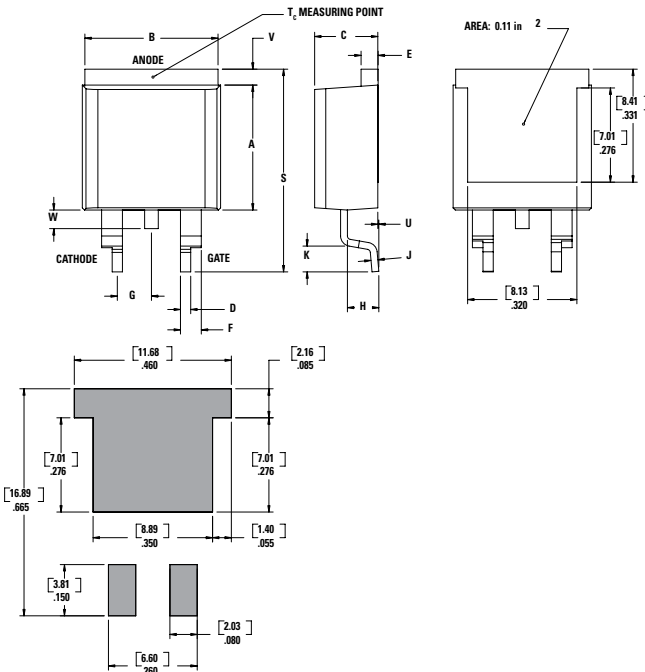
| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.380  | 0.420 | 9.65        | 10.67 |
| B         | 0.105  | 0.115 | 2.66        | 2.92  |
| C         | 0.230  | 0.250 | 5.85        | 6.35  |
| D         | 0.590  | 0.620 | 14.98       | 15.75 |
| E         | 0.142  | 0.147 | 3.61        | 3.73  |
| F         | 0.110  | 0.130 | 2.80        | 3.30  |
| G         | 0.540  | 0.575 | 13.71       | 14.60 |
| 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        | 1.91  |
| M         | 0.085  | 0.095 | 1.78        | 2.16  |
| N         | 0.018  | 0.024 | 0.45        | 0.61  |
| O         | 0.178  | 0.188 | 4.52        | 4.78  |
| P         | 0.045  | 0.060 | 1.14        | 1.53  |
| R         | 0.038  | 0.048 | 0.97        | 1.22  |

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



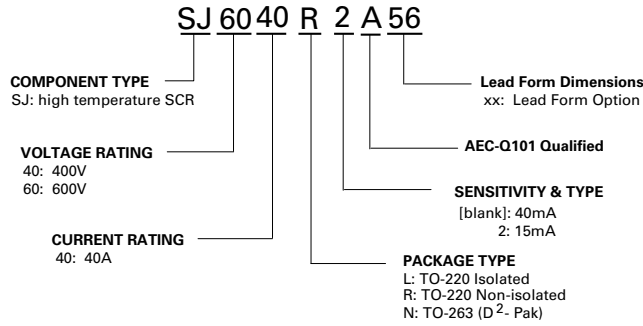
| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.380  | 0.420 | 9.65        | 10.67 |
| B         | 0.105  | 0.115 | 2.67        | 2.92  |
| C         | 0.230  | 0.250 | 5.84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

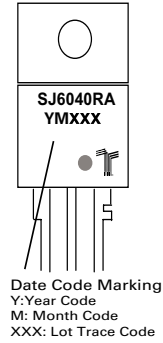


| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.360  | 0.370 | 9.14        | 9.40  |
| B         | 0.380  | 0.420 | 9.65        | 10.67 |
| C         | 0.178  | 0.188 | 4.52        | 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 |                  |              |         |
| SJxx40LA    | X       | X    | 40mA             | Standard SCR | TO-220L |
| SJxx40RA    | X       | X    | 40mA             | Standard SCR | TO-220R |
| SJxx40NA    | X       | X    | 40mA             | Standard SCR | TO-263  |
| SJxx40L2A   | X       | X    | 15mA             | Standard SCR | TO-220L |
| SJxx40R2A   | X       | X    | 15mA             | Standard SCR | TO-220R |
| SJxx40N2A   | X       | X    | 15mA             | Standard SCR | TO-263  |

Note: xx = Voltage

### Packing Options

| Part Number | Marking   | Weight | Packing Mode     | Base Quantity      |
|-------------|-----------|--------|------------------|--------------------|
| SJxx40LATP  | SJxx40LA  | 2.2g   | Tube             | 1000 (50 per tube) |
| SJxx40RATP  | SJxx40RA  | 2.2g   | Tube             | 1000 (50 per tube) |
| SJxx40NATP  | SJxx40NA  | 1.6g   | Tube             | 1000 (50 per tube) |
| SJxx40NARP  | SJxx40NA  | 1.6g   | Embossed Carrier | 500                |
| SJxx40L2ATP | SJxx40L2A | 2.2g   | Tube             | 1000 (50 per tube) |
| SJxx40R2ATP | SJxx40R2A | 2.2g   | Tube             | 1000 (50 per tube) |
| SJxx40N2ATP | SJxx40N2A | 1.6g   | Tube             | 1000 (50 per tube) |
| SJxx40N2ARP | SJxx40N2A | 1.6g   | Embossed Carrier | 500                |

Note: xx = Voltage