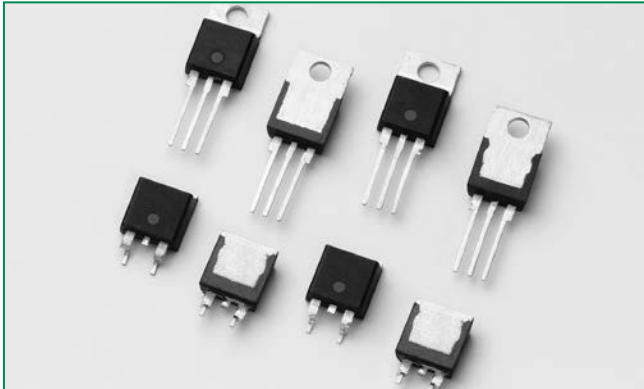


SJxx40xx Series



Description

This SJxx40xx 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

- 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.

Agency Approvals

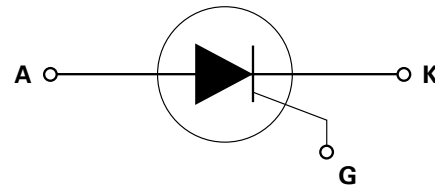
| AGENCY | AGENCY FILE NUMBER |
|--------|--------------------|
| | E71639* |

* - 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 |

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 | SJxx40Ly $T_c = 55^\circ C$ | 40 | A |
| | | SJxx40Ry/SJxx40Ny $T_c = 120^\circ C$ | | |
| $I_{T(AV)}$ | Average on-state current | SJxx40Ly $T_c = 55^\circ C$ | 25.0 | A |
| | | SJxx40Ry/SJxx40Ny $T_c = 120^\circ C$ | | |
| I_{TSM} | Peak non-repetitive surge current | single half cycle; $f = 50Hz$; T_j (initial) = $25^\circ C$ | 430 | A |
| | | single half cycle; $f = 60Hz$; 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 | $V_D = V_{DRM}$; gate open; $T_J = 125^\circ\text{C}$ | 400V | MIN. | 650 | 400 | V/ μs |
| | | 600V | | 600 | 350 | |
| | $V_D = V_{DRM}$; 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 | | μs |
| t_{gt} | $I_G = 2 \times I_{GT}$; $PW = 15\ \mu\text{s}$; $I_T = 80\text{A}$ | | TYP. | 2 | | μs |

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 |
| | | $T_J = 125^\circ\text{C}$ | 2000 |
| | | $T_J = 150^\circ\text{C}$ | 4000 |

Thermal Resistances

| Symbol | Parameter | Value | Unit |
|------------------|-----------------------|-------------------|-------------------------------|
| $R_{\theta(JC)}$ | Junction to case (AC) | SJxx40Ly | 1.9 $^\circ\text{C}/\text{W}$ |
| | | SJxx40Ry/SJxx40Ny | 0.8 $^\circ\text{C}/\text{W}$ |

Note: xx = voltage, y = sensitivity & type

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

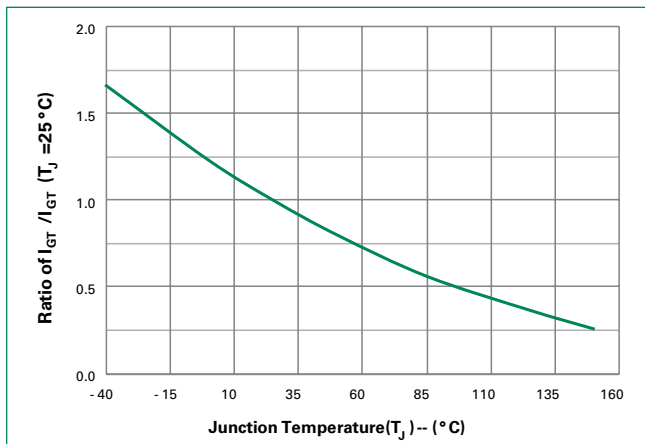


Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

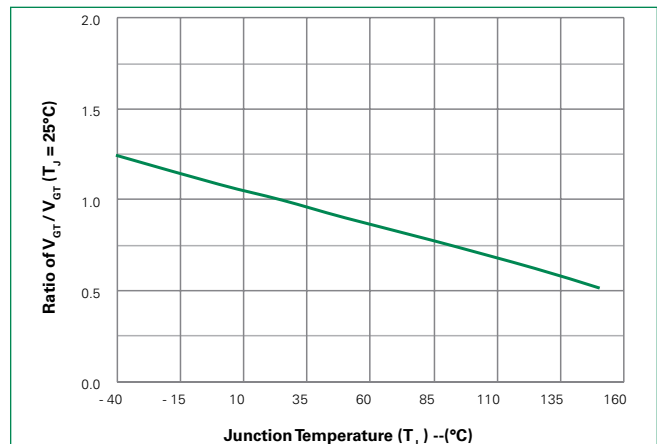


Figure 3: Normalized DC Holding Current vs. Junction Temperature

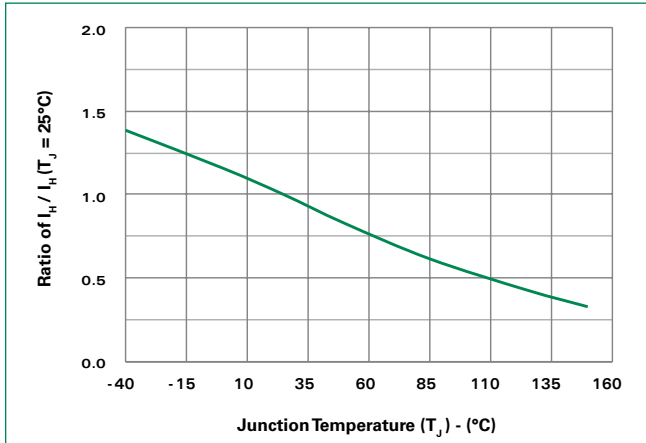


Figure 4: On-State Current vs. On-State Voltage (Typical)

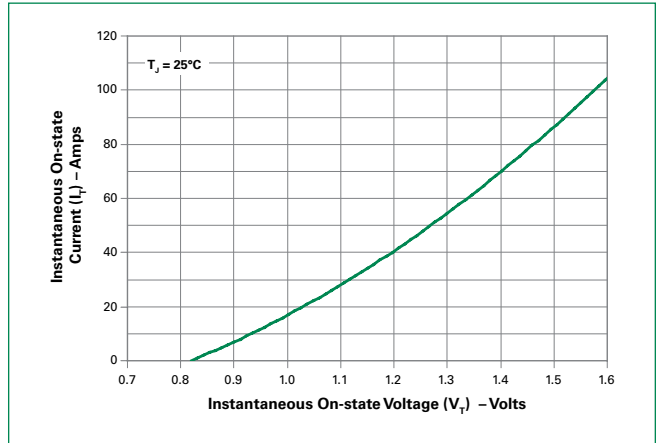


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

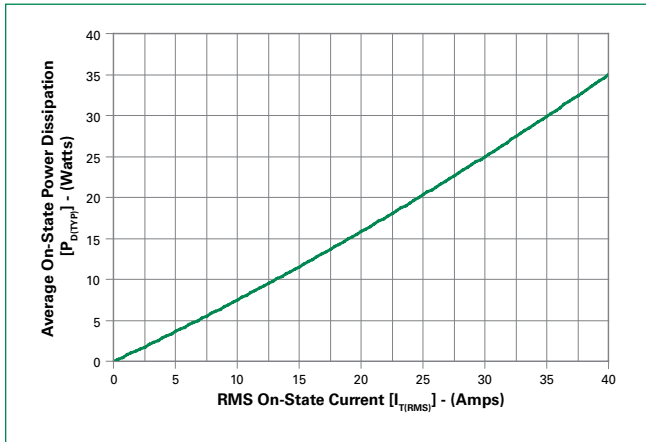


Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

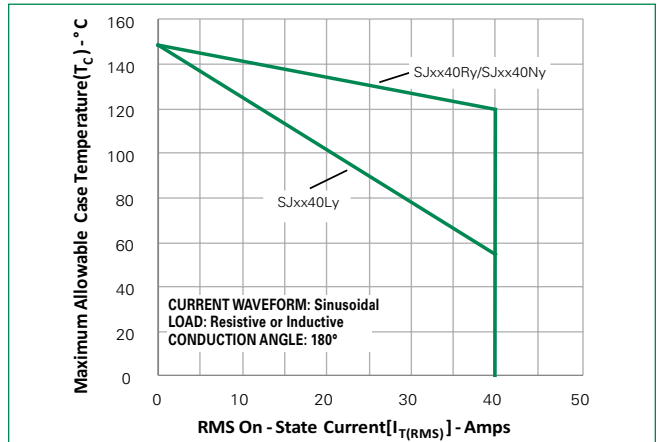


Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

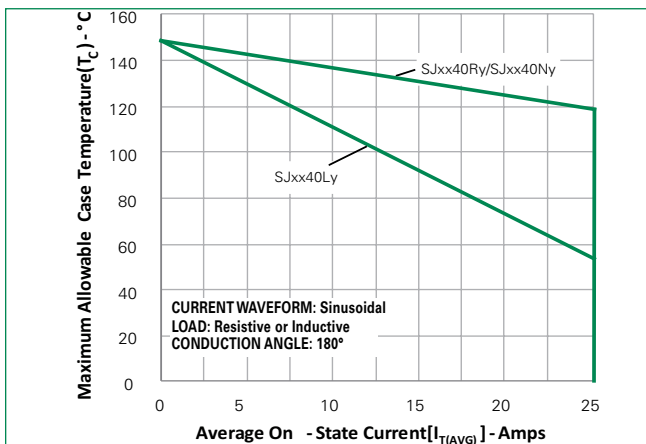


Figure 8: Peak Capacitor Discharge Current

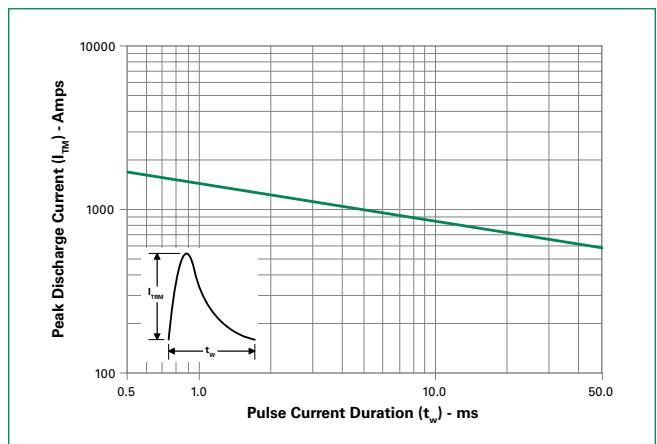


Figure 9: Peak Capacitor Discharge Current Derating

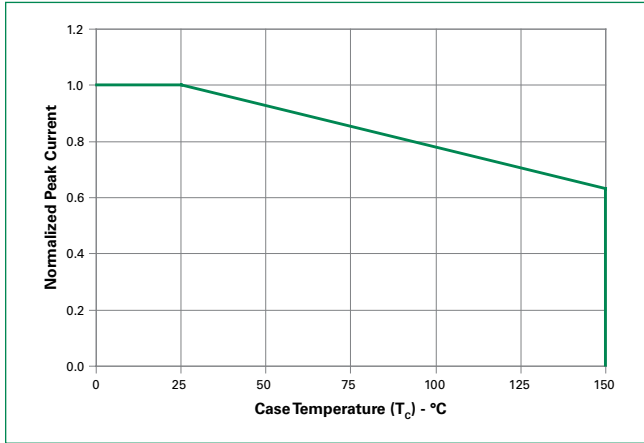
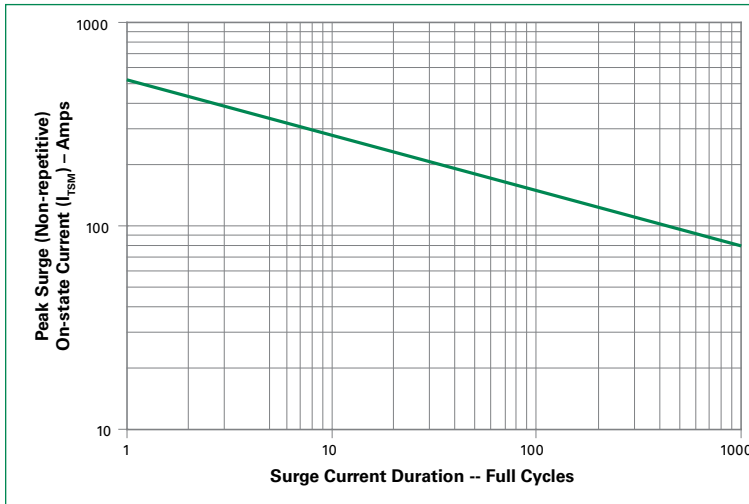


Figure 10: Surge Peak On-State Current vs. Number of Cycles

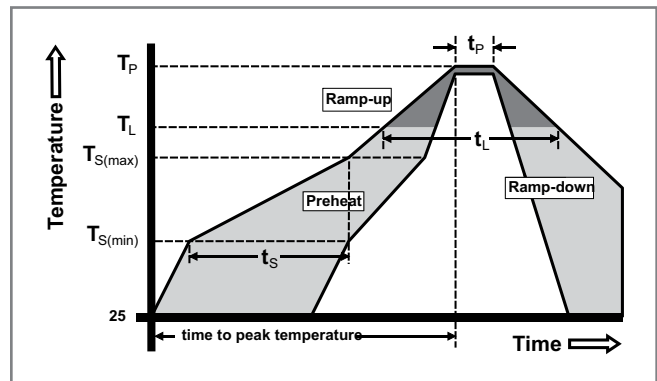


SUPPLY FREQUENCY: 60 Hz Sinusoidal
 LOAD: Resistive
 RMS On-State Current: $I_{T(RMS)}$: Maximum Rated Value at Specified Case Temperature

- 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 ^{+0/-5} °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

| | |
|------------------------|--|
| Terminal Finish | 100% Matte Tin-plated |
| Body Material | UL Recognized compound meeting flammability rating V-0 |
| Lead Material | Copper Alloy |

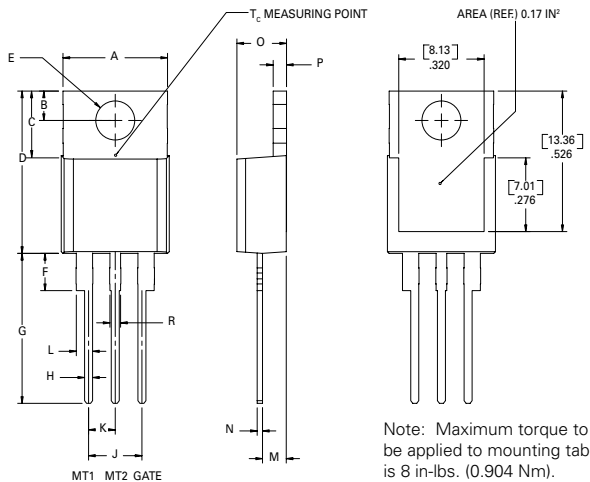
Design Considerations

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

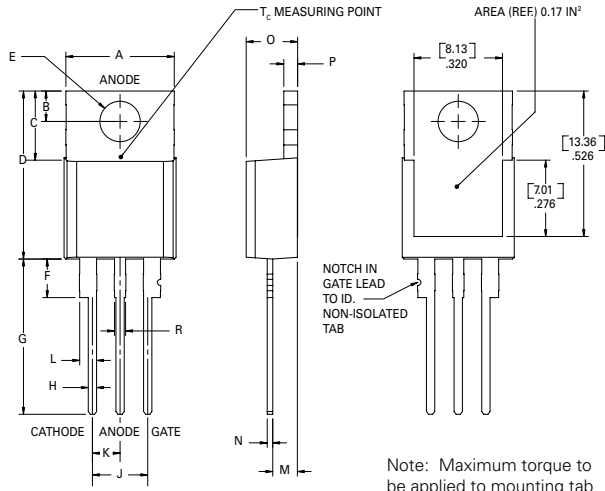
| Test | Specifications and Conditions |
|-----------------------------------|--|
| AC Blocking | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours |
| Temperature Cycling | MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15-min dwell-time |
| Temperature/Humidity | EIA / JEDEC, JESD22-A101 1008 hours; 160VDC - DC: 85°C; 85% rel humidity |
| High Temp Storage | MIL-STD-750, M-1031, 1008 hours; 150°C |
| Low-Temp Storage | 1008 hours; -40°C |
| Resistance to Solder Heat | MIL-STD-750 Method 2031 |
| Solderability | ANSI/J-STD-002, category 3, Test A |
| Lead Bend | MIL-STD-750, M-2036 Cond E |
| Moisture Sensitivity Level | Level 1, JEDEC-J-STD-020D |

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



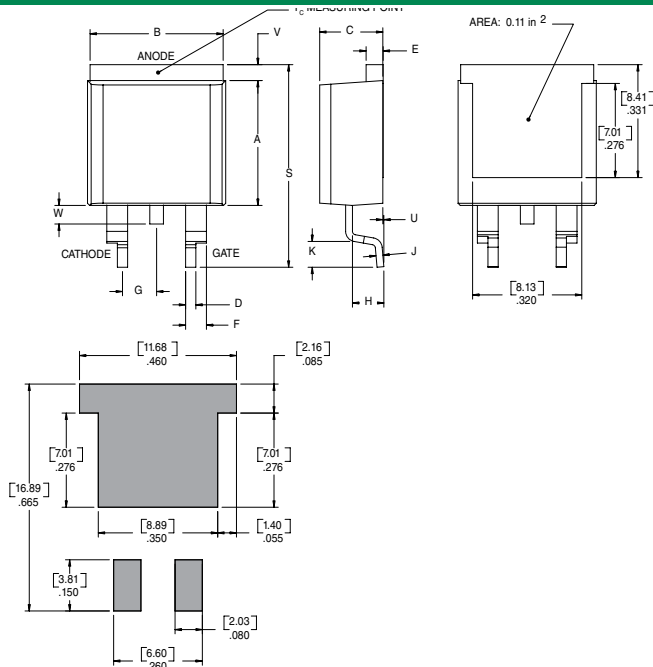
| Dimension | Inches | | Millimeters | |
|-----------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.380 | 0.420 | 9.65 | 10.67 |
| B | 0.105 | 0.115 | 2.66 | 2.92 |
| C | 0.230 | 0.250 | 5.85 | 6.35 |
| D | 0.590 | 0.620 | 14.98 | 15.75 |
| E | 0.142 | 0.147 | 3.61 | 3.73 |
| 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



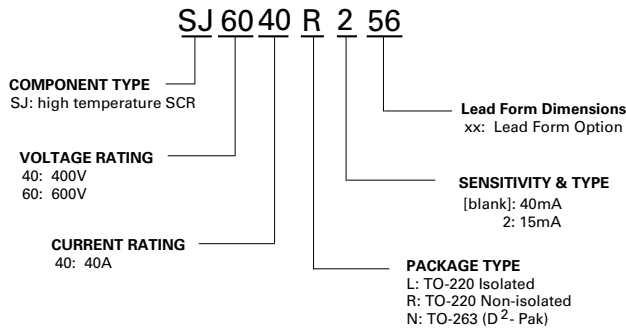
| Dimension | Inches | | Millimeters | |
|-----------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.380 | 0.420 | 9.65 | 10.67 |
| B | 0.105 | 0.115 | 2.67 | 2.92 |
| C | 0.230 | 0.250 | 5.84 | 6.35 |
| D | 0.590 | 0.620 | 14.99 | 15.75 |
| E | 0.142 | 0.147 | 3.61 | 3.73 |
| 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) – D²-Pak Surface Mount

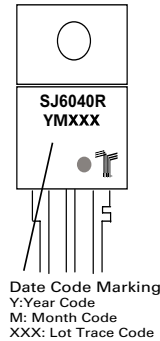


| Dimension | Inches | | Millimeters | |
|-----------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.360 | 0.370 | 9.14 | 9.40 |
| B | 0.380 | 0.420 | 9.65 | 10.67 |
| C | 0.178 | 0.188 | 4.52 | 4.78 |
| D | 0.025 | 0.035 | 0.63 | 0.89 |
| E | 0.048 | 0.055 | 1.22 | 1.40 |
| 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 | | | |
| SJxx40L | X | X | 40mA | Standard SCR | TO-220L |
| SJxx40R | X | X | 40mA | Standard SCR | TO-220R |
| SJxx40N | X | X | 40mA | Standard SCR | TO-263 |
| SJxx40L2 | X | X | 15mA | Standard SCR | TO-220L |
| SJxx40R2 | X | X | 15mA | Standard SCR | TO-220R |
| SJxx40N2 | X | X | 15mA | Standard SCR | TO-263 |

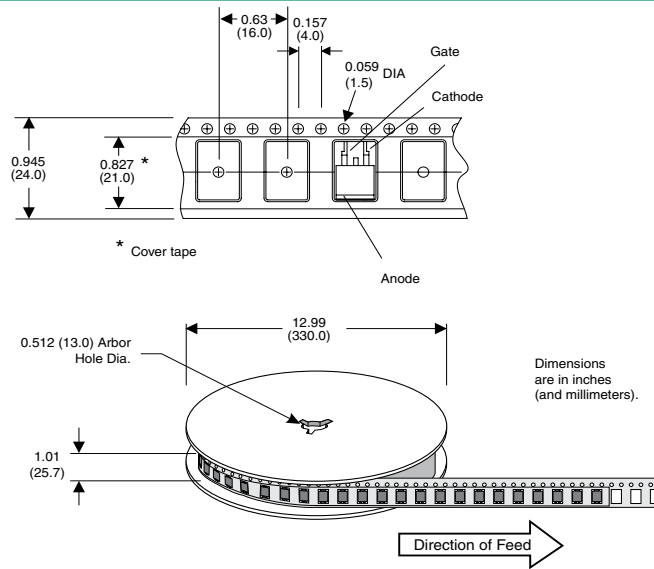
Note: xx = Voltage

Packing Options

| Part Number | Marking | Weight | Packing Mode | Base Quantity |
|-------------|----------|--------|------------------|-------------------|
| SJxx40LTP | SJxx40L | 2.2g | Tube | 500 (50 per tube) |
| 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 |
| SJxx40L2TP | SJxx40L | 2.2g | Tube | 500 (50 per tube) |
| 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



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