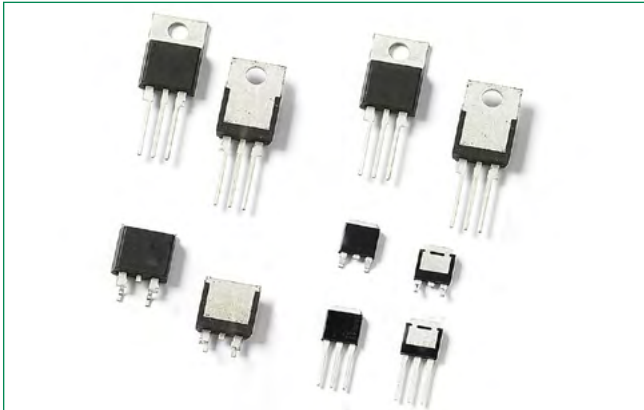


SJxx12xx series

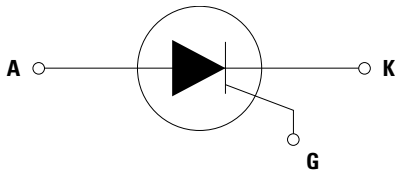


Agency Approvals

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

* - L Package Only

Schematic Symbol



Description

This SJxx12xx high junction temperature SCR series is ideal for uni-directional switch applications such as phase control in heating, motor speed controls, converters/rectifiers, inrush current control and capacitive discharge ignitions.

These SCRs have a low gate current trigger level of 6mA, 10mA or 20mA maximum at approximately 1.5V.

Features & Benefits

- Halogen free and RoHS compliant
- 150°C maximum junction temperature
- Surge capability up to 120 A at 60 Hz half cycle
- Recognized to UL 1557 as an Electrically Isolated Semiconductor Device

Applications

Typical applications are capacitive discharge systems for strobe lights, nailers, staplers and gas engine ignition. Additional applications include various AC to DC applications, low power AC motor and controls for power tools, home/brown goods and white goods appliances.

Internally constructed isolated packages are offered for ease of heat sinking with high isolation voltage.

Main Features

| Symbol | Value | Unit |
|-------------------|------------|------|
| $I_{T(RMS)}$ | 12 | A |
| V_{DRM}/V_{RRM} | 400 or 600 | V |
| I_{GT} | 6 - 20 | mA |

Absolute Maximum Ratings

| Symbol | Parameter | Test Conditions | Value | Unit |
|-------------------|---|---|-------------------------|------------------|
| V_{DSM}/V_{RSM} | Peak non-repetitive blocking voltage | PW=100 μ s | $V_{DRM}/V_{RRM} + 100$ | V |
| $I_{T(RMS)}$ | RMS on-state current | SJxx12Lx $T_c = 110^\circ\text{C}$ | 12 | A |
| | | SJxx12Rx SJxx12Nx $T_c = 135^\circ\text{C}$ | | |
| | | SJxx12Dx SJxx12Vx $T_c = 125^\circ\text{C}$ | | |
| $I_{T(AV)}$ | Average on-state current | SJxx12Lx $T_c = 110^\circ\text{C}$ | 76 | A |
| | | SJxx12Rx SJxx12Ny $T_c = 135^\circ\text{C}$ | | |
| | | SJxx12Dx SJxx12Vx $T_c = 125^\circ\text{C}$ | | |
| I_{TSM} | Peak non-repetitive surge current (single half cycle, T_j (initial) = 25°C) | $f = 50\text{Hz}$ | 100 | A |
| | | $f = 60\text{Hz}$ | 120 | |
| I^2t | I^2t Value for fusing | $t_p = 8.3\text{ms}$ | 60 | A ² s |
| di/dt | Critical rate of rise of on-state current | $f = 60\text{Hz}; T_j = 150^\circ\text{C}$ | 100 | A/ μ s |
| I_{GM} | Peak gate current | $T_j = 150^\circ\text{C}$ | 2 | A |
| $P_{G(AV)}$ | Average gate power dissipation | $T_j = 150^\circ\text{C}$ | 0.5 | W |
| T_{stg} | Storage temperature range | | -40 to 150 | °C |
| T_j | Operating junction temperature range | | -40 to 150 | |

Electrical Characteristics ($T_J = 25^\circ\text{C}$, unless otherwise specified) - TO-220L, TO-220R and TO-263 package

| Symbol | Test Conditions | | SJxx12x | SJxx12x1 | SJxx12x2 | Unit |
|----------|--|------|---------|----------|----------|------------------|
| I_{GT} | $V_D = 12V$ $R_L = 60\ \Omega$ | MAX. | 20 | 6 | 10 | mA |
| | | MIN. | 8 | 2 | 5 | |
| V_{GT} | $V_D = 12V$ $R_L = 60\ \Omega$ | MAX. | 1.5 | 1.5 | 1.5 | V |
| dv/dt | $V_D = 67\% V_{DRM}$; gate open; $T_J = 125^\circ\text{C}$ | MIN. | 800 | 70 | 500 | V/ μs |
| | $V_D = 67\% V_{DRM}$; gate open; $T_J = 150^\circ\text{C}$ | | 400 | - | 200 | |
| V_{GD} | $V_D = V_{DRM}$ $R_L = 3.3\ \text{k}\Omega$ $T_J = 125^\circ\text{C}$ | MIN. | 0.2 | 0.2 | 0.2 | V |
| I_H | $I_T = 200\text{mA}$ (initial) | MAX. | 60 | 15 | 35 | mA |
| t_q | $I_T = 2\text{A}$; $t_p = 50\ \mu\text{s}$; dv/dt = 5V/ μs ; di/dt = 30A/ μs | MAX. | 40 | 40 | 40 | μs |
| t_{gt} | $I_G = 2 \times I_{GT}$ PW = 15 μs $I_T = 24\text{A}$ | TYP. | 2 | 2 | 2 | μs |

Note: xx=voltage/10, x=package

Electrical Characteristics ($T_J = 25^\circ\text{C}$, unless otherwise specified) - TO-251 and TO-252 package

| Symbol | Test Conditions | | Value | | Unit | |
|----------|--|------|----------|---------|---------------|------------------|
| | | | SJxx12x1 | SJxx12x | | |
| I_{GT} | $V_D = 12V$ $R_L = 60\ \Omega$ | MAX. | 6 | 20 | mA | |
| | | MIN. | 2 | 5 | | |
| V_{GT} | | MAX. | 1.5 | 1.5 | V | |
| dv/dt | $V_D = V_{DRM}$; gate open; $T_J = 125^\circ\text{C}$ | 400V | MIN. | 100 | 250 | V/ μs |
| | | 600V | | 75 | 225 | |
| | $V_D = V_{DRM}$; gate open; $T_J = 150^\circ\text{C}$ | 400V | | 50 | 200 | |
| | | 600V | | 10 | 175 | |
| V_{GD} | $V_D = V_{DRM}$ $R_L = 3.3\ \text{k}\Omega$ $T_J = 125^\circ\text{C}$ | MIN. | 0.2 | 0.2 | V | |
| | $V_D = V_{DRM}$ $R_L = 3.3\ \text{k}\Omega$ $T_J = 150^\circ\text{C}$ | MIN. | 0.1 | 0.1 | | |
| I_H | $I_T = 200\text{mA}$ (initial) | MAX. | 20 | 40 | mA | |
| t_q | $I_T = 2\text{A}$; $t_p = 50\ \mu\text{s}$; dv/dt = 5V/ μs ; di/dt = 30A/ μs | MAX. | 35 | 35 | μs | |
| t_{gt} | $I_G = 2 \times I_{GT}$ PW = 15 μs $I_T = 12\text{A}$ | TYP. | 0.5 | 2 | μs | |

Note: xx=voltage/10, x=package

Static Characteristics

| Symbol | Test Conditions | | Value | Unit |
|---------------------|---|---------------------------|-------|---------------|
| V_{TM} | Component $I_T = 32\text{A}$; $t_p = 380\ \mu\text{s}$ | MAX. | 1.6 | V |
| I_{DRM} / I_{RRM} | $V_{DRM} = V_{RRM}$ | $T_J = 25^\circ\text{C}$ | 10 | μA |
| | | $T_J = 125^\circ\text{C}$ | 500 | |
| | | $T_J = 150^\circ\text{C}$ | 2000 | |

Thermal Resistances

| Symbol | Parameter | Value | Unit |
|------------------|-----------------------|----------------------|---------------------------|
| $R_{\theta(JC)}$ | Junction to case (AC) | SJxx12Lx | 2.4 |
| | | SJxx12Rx SJxx12Nx | 1.1 |
| | | SJxx12Dx SJxx12Vx | 1.4 |
| | | | $^\circ\text{C}/\text{W}$ |

Note: xx=voltage/10, x=sensitivity

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

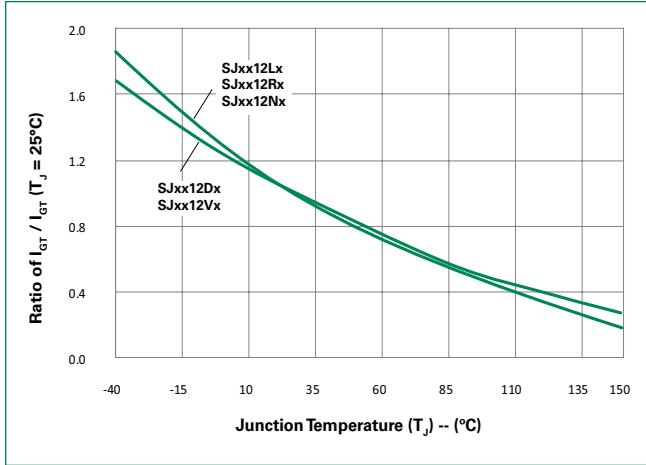


Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

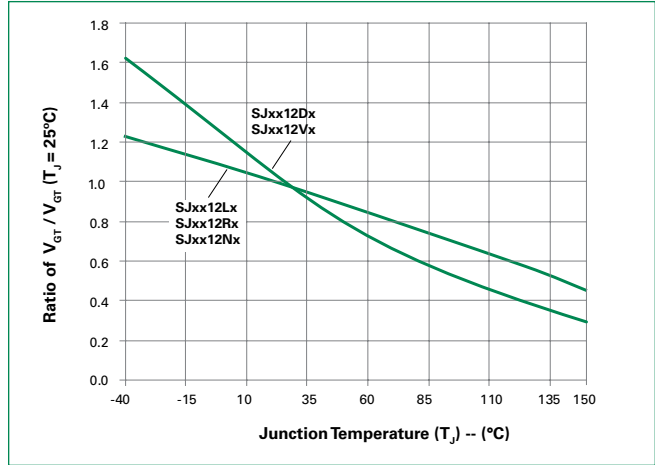


Figure 3: Normalized DC Holding Current vs. Junction Temperature

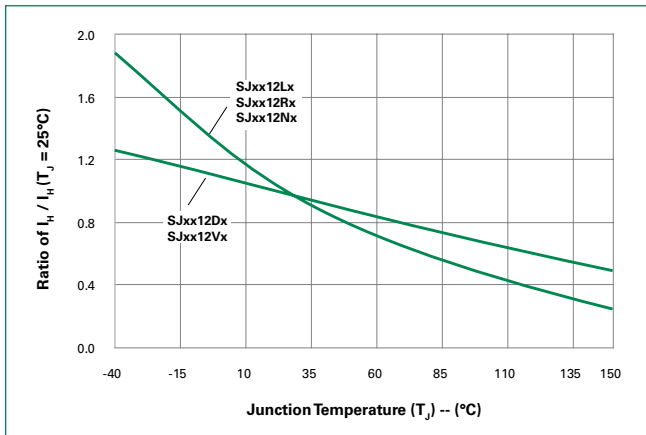


Figure 4: On-State Current vs. On-State Voltage (Typical)

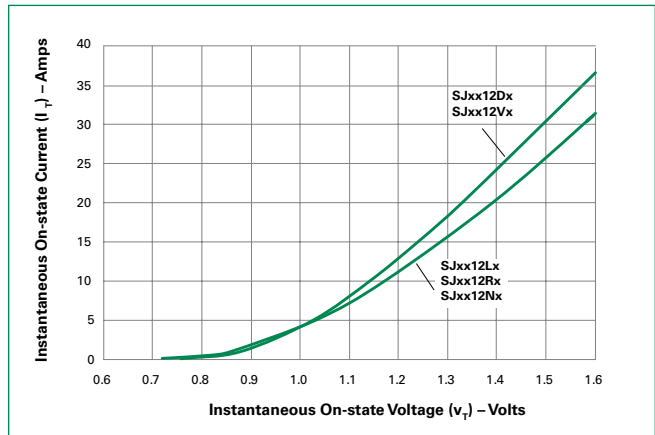


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

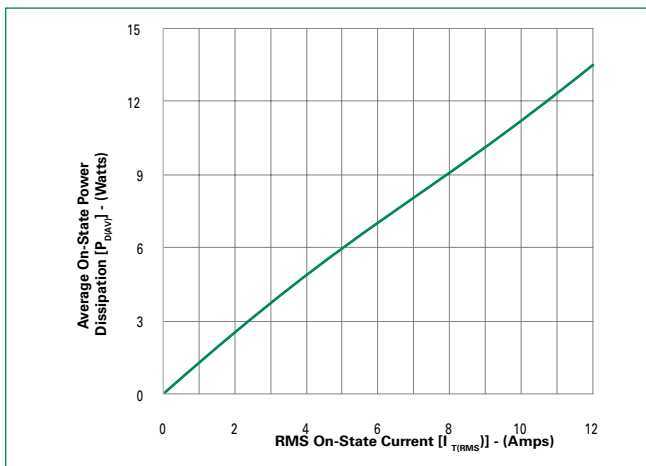


Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

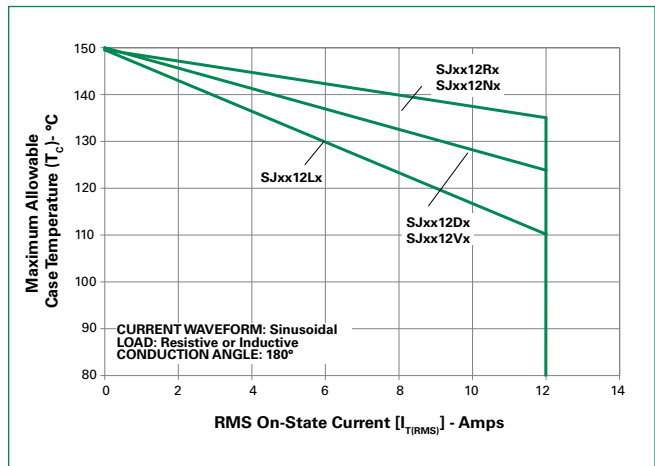


Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

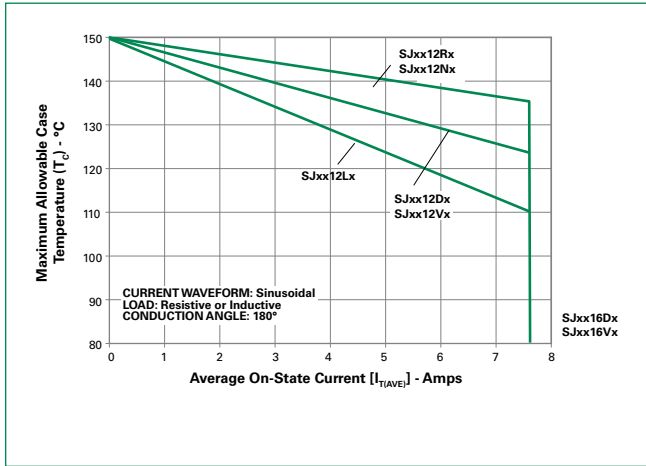


Figure 8: Peak Capacitor Discharge Current

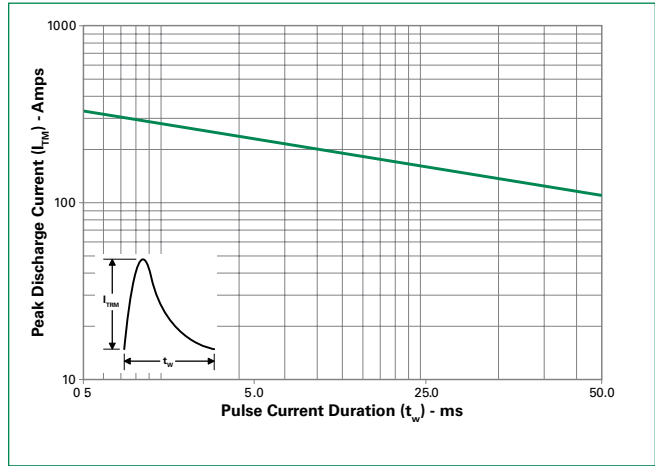


Figure 9: Peak Capacitor Discharge Current Derating

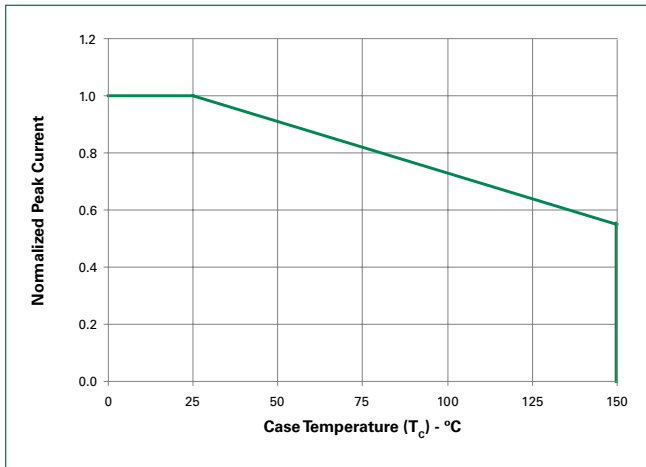
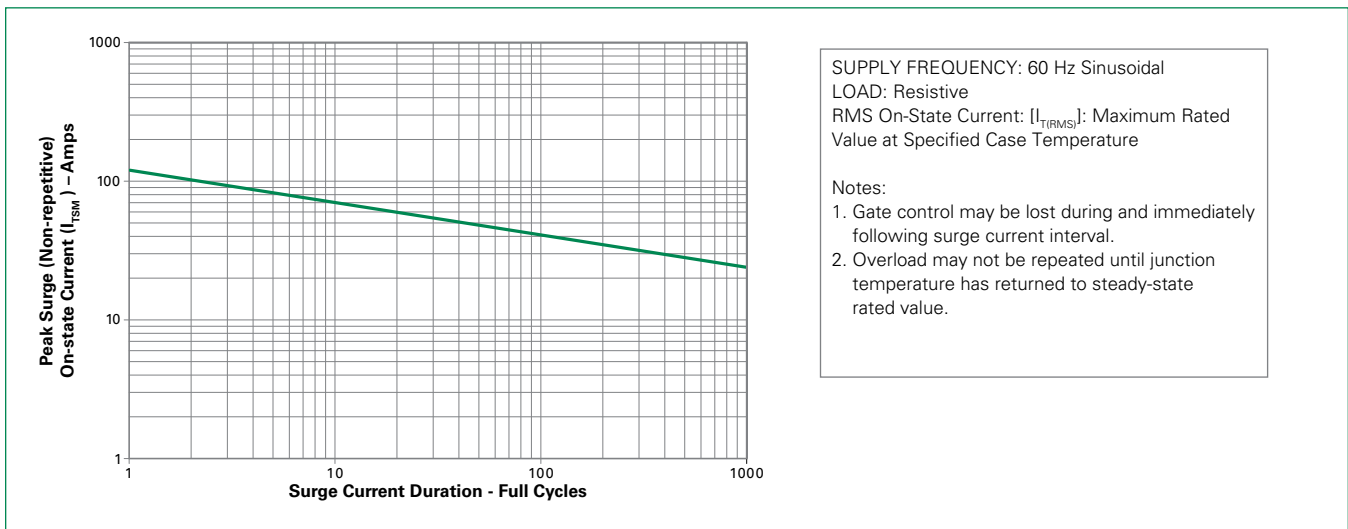
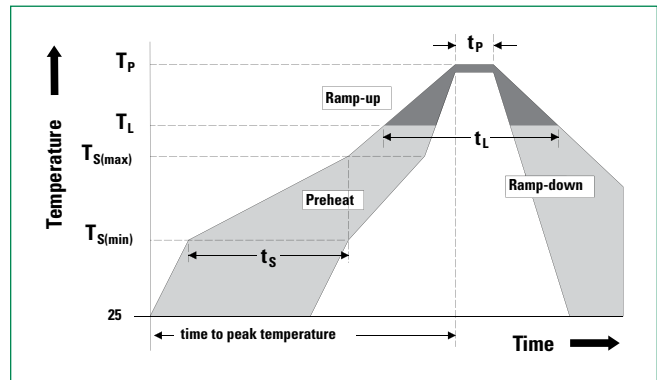


Figure 10: Surge Peak On-State Current vs. Number of Cycles



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 |

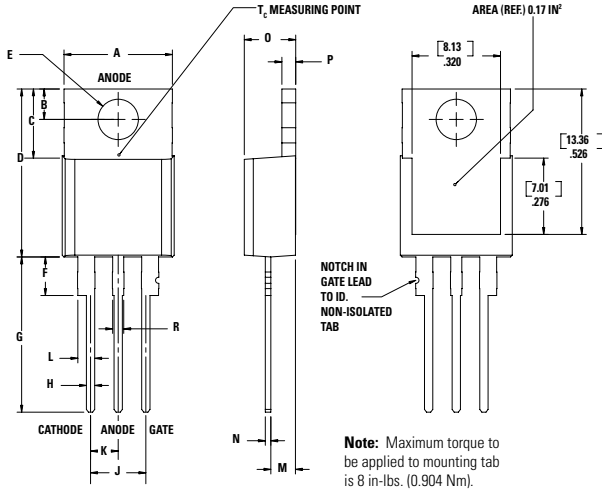
Design Considerations

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

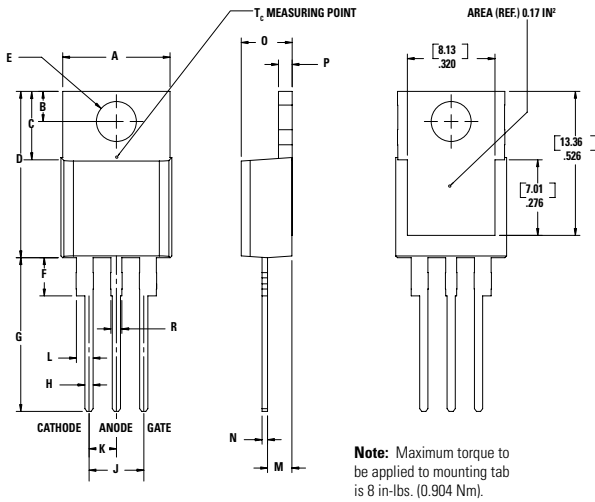
| Test | Specifications and Conditions |
|-----------------------------------|--|
| AC Blocking | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours |
| Temperature Cycling | MIL-STD-750, M-1051, 1000 cycles; -55°C to +150°C; 15-min dwell-time |
| Temperature/Humidity | EIA / JEDEC, JESD22-A101 1008 hours; 160V - 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 (R-Package) — Non-Isolated Mounting Tab Common with Center Lead



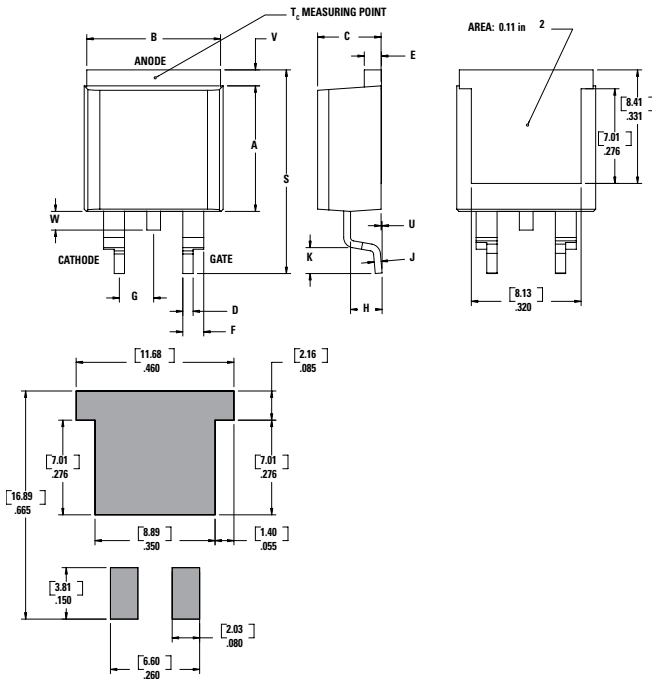
| Dimension | Inches | | Millimeters | |
|-----------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.380 | 0.420 | 9.65 | 10.67 |
| B | 0.105 | 0.115 | 2.67 | 2.92 |
| C | 0.230 | 0.250 | 5.84 | 6.35 |
| D | 0.590 | 0.620 | 14.99 | 15.75 |
| E | 0.142 | 0.147 | 3.61 | 3.73 |
| 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-220AB (L-Package) — Isolated Mounting Tab



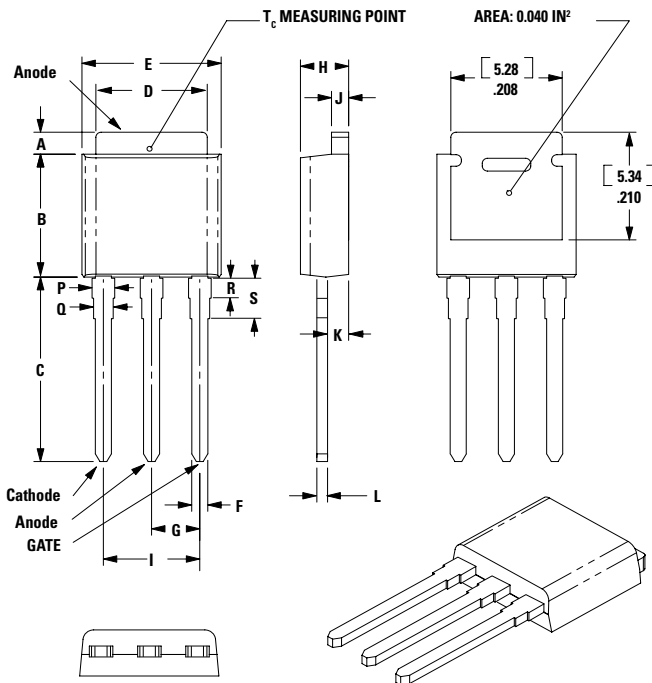
| Dimension | Inches | | Millimeters | |
|-----------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.380 | 0.420 | 9.65 | 10.67 |
| B | 0.105 | 0.115 | 2.67 | 2.92 |
| C | 0.230 | 0.250 | 5.84 | 6.35 |
| D | 0.590 | 0.620 | 14.99 | 15.75 |
| E | 0.142 | 0.147 | 3.61 | 3.73 |
| 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-263AB (N-package) — D²-Pak Surface Mount



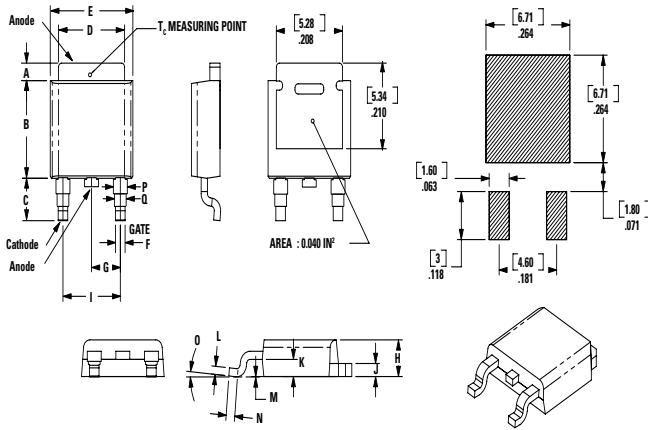
| Dimension | Inches | | Millimeters | |
|-----------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.360 | 0.370 | 9.14 | 9.40 |
| B | 0.380 | 0.420 | 9.65 | 10.67 |
| C | 0.178 | 0.188 | 4.52 | 4.78 |
| D | 0.025 | 0.035 | 0.64 | 0.89 |
| E | 0.045 | 0.060 | 1.14 | 1.52 |
| 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 | 1.02 | 1.78 |

Dimensions — TO-251AA (V/I-Package) — V/I-PAK Through Hole



| Dimension | Inches | | | Millimeters | | |
|-----------|--------|-------|-------|-------------|------|------|
| | Min | Typ | Max | Min | Typ | Max |
| A | 0.040 | 0.044 | 0.050 | 1.02 | 1.11 | 1.27 |
| B | 0.235 | 0.242 | 0.245 | 5.97 | 6.15 | 6.22 |
| C | 0.350 | 0.361 | 0.375 | 8.89 | 9.18 | 9.53 |
| D | 0.205 | 0.208 | 0.213 | 5.21 | 5.29 | 5.41 |
| E | 0.255 | 0.262 | 0.265 | 6.48 | 6.66 | 6.73 |
| F | 0.027 | 0.031 | 0.033 | 0.69 | 0.80 | 0.84 |
| G | 0.087 | 0.090 | 0.093 | 2.21 | 2.28 | 2.36 |
| H | 0.085 | 0.092 | 0.095 | 2.16 | 2.34 | 2.41 |
| I | 0.176 | 0.180 | 0.184 | 4.47 | 4.57 | 4.67 |
| J | 0.018 | 0.020 | 0.023 | 0.46 | 0.51 | 0.58 |
| K | 0.038 | 0.040 | 0.044 | 0.97 | 1.01 | 1.12 |
| L | 0.018 | 0.020 | 0.023 | 0.46 | 0.52 | 0.58 |
| P | 0.042 | 0.047 | 0.052 | 1.06 | 1.20 | 1.32 |
| Q | 0.034 | 0.039 | 0.044 | 0.86 | 1.00 | 1.11 |
| R | 0.034 | 0.039 | 0.044 | 0.86 | 1.00 | 1.11 |
| S | 0.074 | 0.079 | 0.084 | 1.86 | 2.00 | 2.11 |

Dimensions — TO-252AA (D-Package) — D-PAK Surface Mount



| Dimension | Inches | | | Millimeters | | |
|-----------|--------|-------|-------|-------------|------|------|
| | Min | Typ | Max | Min | Typ | Max |
| A | 0.040 | 0.043 | 0.050 | 1.02 | 1.09 | 1.27 |
| B | 0.235 | 0.243 | 0.245 | 5.97 | 6.16 | 6.22 |
| C | 0.106 | 0.108 | 0.113 | 2.69 | 2.74 | 2.87 |
| D | 0.205 | 0.208 | 0.213 | 5.21 | 5.29 | 5.41 |
| E | 0.255 | 0.262 | 0.265 | 6.48 | 6.65 | 6.73 |
| F | 0.027 | 0.031 | 0.033 | 0.69 | 0.80 | 0.84 |
| G | 0.087 | 0.090 | 0.093 | 2.21 | 2.28 | 2.36 |
| H | 0.085 | 0.092 | 0.095 | 2.16 | 2.33 | 2.41 |
| I | 0.176 | 0.179 | 0.184 | 4.47 | 4.55 | 4.67 |
| J | 0.018 | 0.020 | 0.023 | 0.46 | 0.51 | 0.58 |
| K | 0.038 | 0.040 | 0.044 | 0.97 | 1.02 | 1.12 |
| L | 0.018 | 0.020 | 0.023 | 0.46 | 0.51 | 0.58 |
| M | 0.000 | 0.000 | 0.004 | 0.00 | 0.00 | 0.10 |
| N | 0.021 | 0.026 | 0.027 | 0.53 | 0.67 | 0.69 |
| O | 0° | 0° | 5° | 0° | 0° | 5° |
| P | 0.042 | 0.047 | 0.052 | 1.06 | 1.20 | 1.32 |
| Q | 0.034 | 0.039 | 0.044 | 0.86 | 1.00 | 1.11 |

Product Selector

| Part Number | Voltage | | Gate Sensitivity | Type | Package |
|-------------|---------|------|------------------|--------------|---------|
| | 400V | 600V | | | |
| SJxx12L | X | X | 20mA | Standard SCR | TO-220L |
| SJxx12R | X | X | 20mA | Standard SCR | TO-220R |
| SJxx12N | X | X | 20mA | Standard SCR | TO-263 |
| SJxx12V | X | X | 20mA | Standard SCR | TO-251 |
| SJxx12D | X | X | 20mA | Standard SCR | TO-252 |
| SJxx12L1 | X | X | 6mA | Standard SCR | TO-220L |
| SJxx12R1 | X | X | 6mA | Standard SCR | TO-220R |
| SJxx12N1 | X | X | 6mA | Standard SCR | TO-263 |
| SJxx12V1 | X | X | 6mA | Standard SCR | TO-251 |
| SJxx12D1 | X | X | 6mA | Standard SCR | TO-252 |
| SJxx12L2 | X | X | 10mA | Standard SCR | TO-220L |
| SJxx12R2 | X | X | 10mA | Standard SCR | TO-220R |
| SJxx12N2 | X | X | 10mA | Standard SCR | TO-263 |

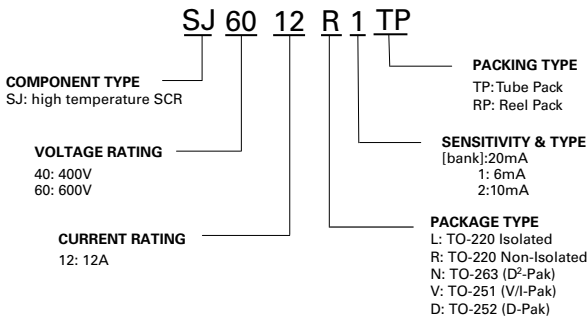
Note: xx = Voltage/10

Packing Options

| Part Number | Marking | Weight | Packing Mode | Base Quantity |
|-------------------|----------|--------|------------------|--------------------|
| SJxx12LxTP | SJxx12Ly | 2.2g | Tube | 1000 (50 per tube) |
| SJxx12RxTP | SJxx12Ry | 2.2g | Tube | 1000 (50 per tube) |
| SJxx12NxTP | SJxx12Ny | 1.6g | Tube | 1000 (50 per tube) |
| SJxx12NxRP | SJxx12Ny | 1.6g | Embossed Carrier | 500 |
| SJxx12DxTP | SJxx12Dx | 0.3 g | Tube | 750 (75 per tube) |
| SJxx12DxRP | SJxx12Dx | 0.3 g | Embossed Carrier | 2500 |
| SJxx12VxTP | SJxx12Vx | 0.4 g | Tube | 750 (75 per tube) |

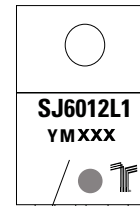
Note: xx=voltage/10, x=sensitivity

Part Numbering System



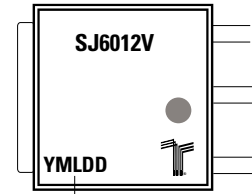
Part Marking System

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



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

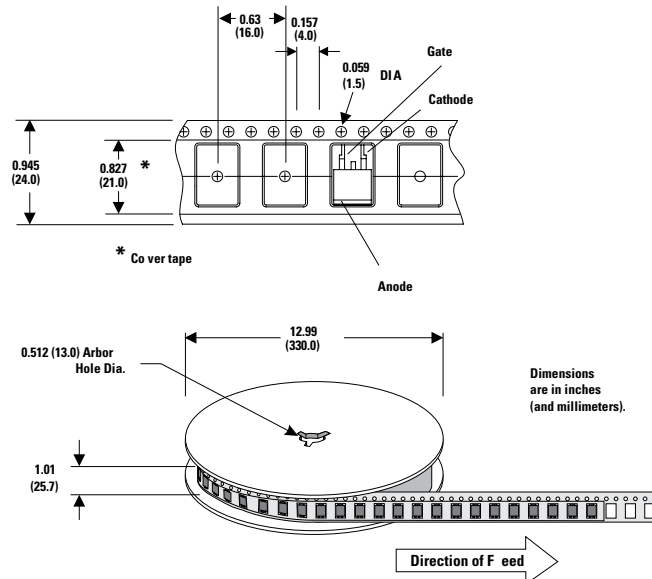
TO-251 (V/I-Pak)
TO-252 (D-Pak)



Date Code Marking
Y: Year Code
M: Month Code
L: Location Code
DD: Calendar Code

TO-263 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards



TO-252 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards

