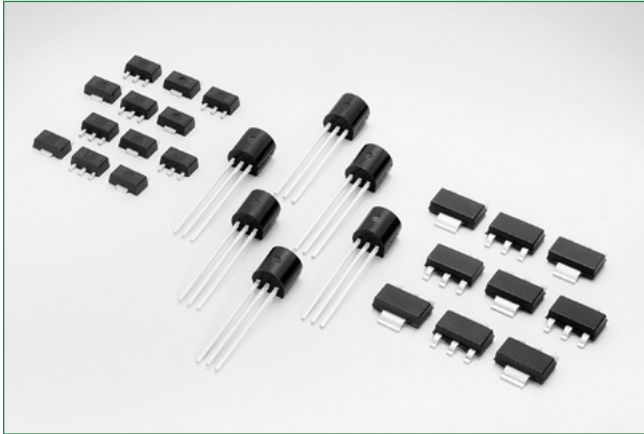


Sx02xSx EV Series

EV Series 1.5 Amp Sensitive SCRs

HF RoHS


Additional Information



Resources



Accessories



Samples

Main Features

| Symbol | Value | Unit |
|-------------------|------------|---------|
| $I_{T(RMS)}$ | 1.5 | A |
| V_{DRM}/V_{RRM} | 400 or 600 | V |
| I_{GT} | 200 | μ A |

Description

This new 1.5A sensitive gate SCR component series offers high static dv/dt and low turn-off time (tq) All SCR junctions are glass-passivated to ensure long term reliability and parametric stability.

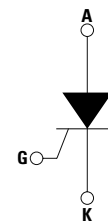
Features

- Surge capability > 15Amps
- Blocking voltage (VDRM/VRRM) capability — up to 600V
- High dv/dt noise immunity
- Improved turn-off time (tq) < 35 μ sec.
- Sensitive gate for direct microprocessor interface
- Thru hole and surface mount packages
- RoHS compliant and Halogen-Free

Applications

The Sx02xSx EV series is specifically designed for solenoid drive often seen in GFCI and similar safety cut-off devices.

Schematic Symbol



Absolute Maximum Ratings

| Symbol | Parameter | Value | Unit | |
|--------------|--|--|------------|------------------------|
| $I_{T(RMS)}$ | RMS on-state current (full sine wave) | TO-92 $T_c = 65^\circ\text{C}$ | 1.5 | A |
| | | SOT-89 $T_c = 80^\circ\text{C}$ | | |
| | | SOT-223 $T_c = 95^\circ\text{C}$ | | |
| $I_{T(AV)}$ | Average on-state current | TO-92 $T_c = 65^\circ\text{C}$ | 0.95 | A |
| | | SOT-89 $T_c = 80^\circ\text{C}$ | | |
| | | SOT-223 $T_c = 95^\circ\text{C}$ | | |
| I_{TSM} | Non repetitive surge peak on-state current (Single cycle, T_j initial = 25°C) | TO-92 $F = 50$ Hz | 12.5 | A |
| | | SOT-89 $F = 60$ Hz | 15.0 | |
| | | SOT-223 | | |
| I^2t | I^2t Value for fusing | $t_p = 10$ ms $F = 50$ Hz | 0.78 | A^2s |
| | | $t_p = 8.3$ ms $F = 60$ Hz | 0.93 | |
| di/dt | Critical rate of rise of on-state current $I_G = 10\text{mA}$ | TO-92 $T_j = 125^\circ\text{C}$ SOT-89 $T_j = 125^\circ\text{C}$ SOT-223 | 50 | $\text{A}/\mu\text{s}$ |
| I_{GM} | Peak gate current | $t_p = 10$ μs $T_j = 125^\circ\text{C}$ | 1.0 | A |
| $P_{G(AV)}$ | Average gate power dissipation | $T_j = 125^\circ\text{C}$ | 0.1 | W |
| T_{stg} | Storage junction temperature range | | -40 to 150 | $^\circ\text{C}$ |
| T_j | Operating junction temperature range | | -40 to 125 | $^\circ\text{C}$ |

Sx02xSx EV Series

EV Series 1.5 Amp Sensitive SCRs

Electrical Characteristics (T_J = 25°C, unless otherwise specified)

| Symbol | Description | Test Conditions | Sx02xS | | Sx02xS1 | | Sx02xS2 | | Units |
|----------------------|--|--|--------|-----|---------|-----|---------|-----|-------|
| | | | Min | Max | Min | Max | Min | Max | |
| I _{GT} | DC Gate Trigger Current | V _D = 12V; R _L = 60 Ω | 15 | 200 | 15 | 100 | 15 | 50 | μA |
| V _{GT} | DC Gate Trigger Voltage | V _D = 12V; R _L = 60 Ω | — | 0.8 | — | 0.8 | — | 0.8 | V |
| V _{GRRM} | Peak Reverse Gate Voltage | I _{RG} = 10μA | 5 | — | 5 | — | 5 | — | V |
| I _H | Holding Current | R _{GK} = 1 kΩ | — | 5 | — | 3 | — | 3 | mA |
| (dv/dt) _s | "Critical Rate-of-Rise of Off-State Voltage" | "T _J = 125°C V _D = V _{DRM} / V _{RDM} Exponential Waveform R _{GK} = 1 kΩ" | 25 | — | 25 | — | 25 | — | V/μs |
| t _q | Turn-Off Time | "T _J = 125°C @ 600 V R _{GK} = 1 kΩ" | — | 35 | — | 35 | — | 35 | μs |
| t _{gt} | Turn-On Time | "I _G = 10mA PW = 15μsec I _T = 3.0A (pk)" | — | 3 | — | 3 | — | 3 | μs |
| V _{GD} | Gate Non-Trigger Voltage | "V _D = V _{DRM} , T _J = 125°C, R _L = 3.3kΩ" | 0.2 | — | 0.2 | — | 0.2 | — | V |

x0 = voltage/10

Static Characteristics (T_J = 25°C, unless otherwise specified)

| Symbol | Description | Test Conditions | Value | | Unit |
|------------------|------------------------------------|--|-------|------|------|
| | | | Min | Max | |
| V _{TM} | Peak On-State Voltage | I _{TM} = 3.0A (pk) | — | 1.70 | V |
| I _{DRM} | Off-State Current, Peak Repetitive | T _J = 25°C @ V _D = V _{DRM} R _{GK} = 1 kΩ | — | 5 | μA |
| | | T _J = 125°C @ V _D = V _{DRM} R _{GK} = 1 kΩ | — | 500 | μA |

Thermal Resistances

| Symbol | Parameter | Test Conditions | Value | Unit | |
|---------------------|-----------------------|---|---------|------|------|
| R _{θ(J-C)} | Junction to case (AC) | I _T = 1.5A _(RMS) ¹ | TO-92 | 50 | °C/W |
| | | | SOT-89 | 35 | |
| | | | SOT-223 | 25 | |
| R _{θ(J-A)} | Junction to ambient | I _T = 1.5A _(RMS) ¹ | TO-92 | 160 | °C/W |
| | | | SOT-89 | 90 | |
| | | | SOT-223 | 60 | |

¹ 60Hz AC resistive load condition, 100% conduction.

Sx02xSx EV Series

EV Series 1.5 Amp Sensitive SCRs

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

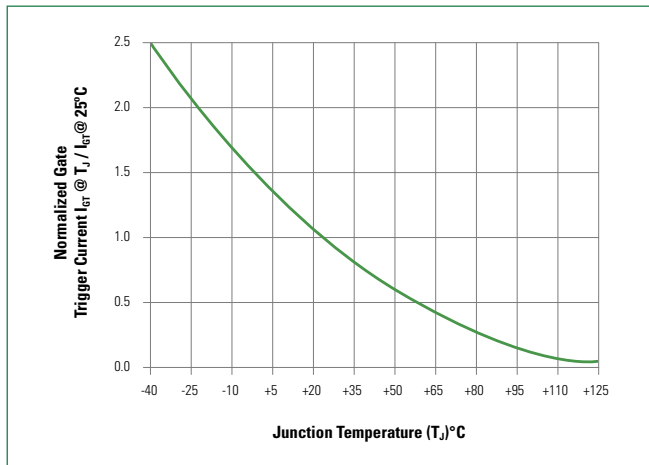


Figure 2: Normalized DC Holding Current vs. Junction Temperature

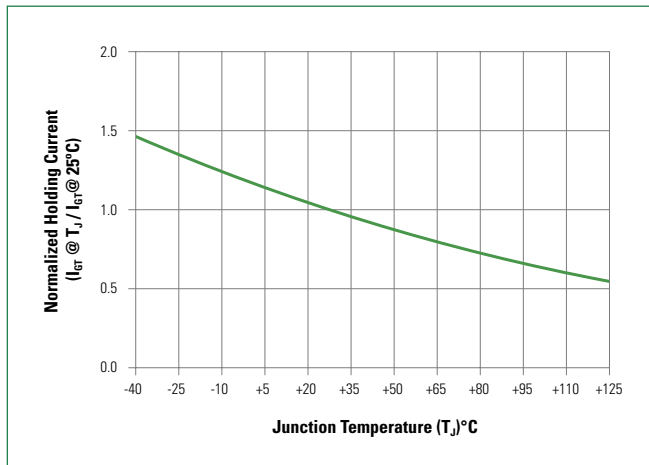


Figure 3: Normalized DC Gate Trigger Voltage vs. Junction Temperature

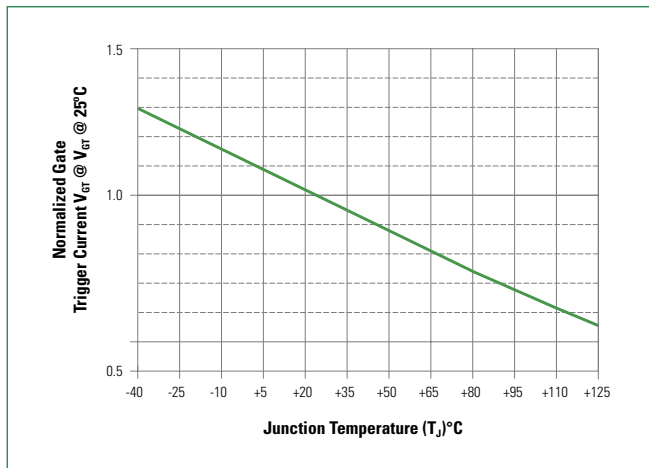


Figure 4: On-State Current vs. On-State Voltage (Typical)

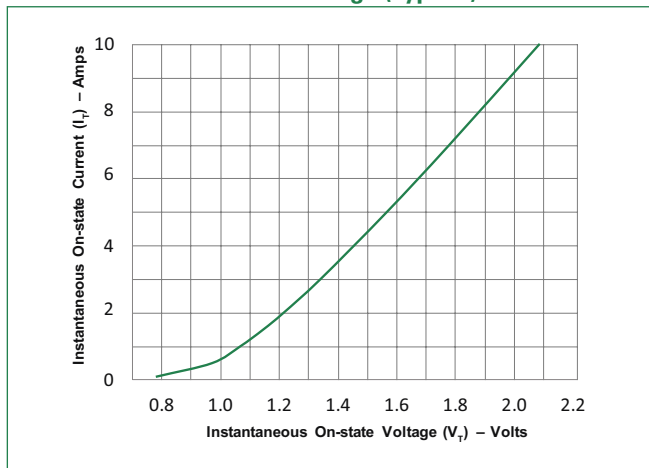


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

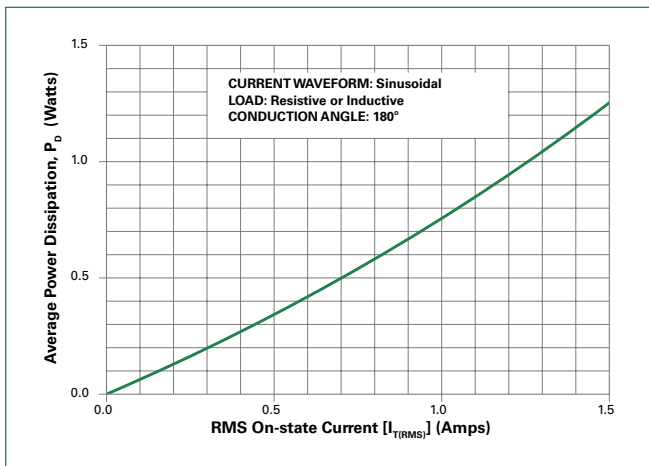
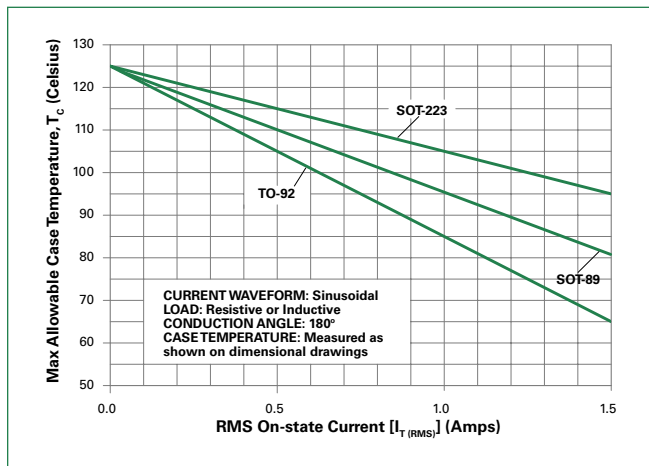


Figure 6: Maximum Allowable Case Temperature vs. On-State Current



Sx02xSx EV Series

EV Series 1.5 Amp Sensitive SCRs

Figure 7: Typical DC Gate Trigger Current with R_{GK} vs. Junction Temperature for Sx02xS

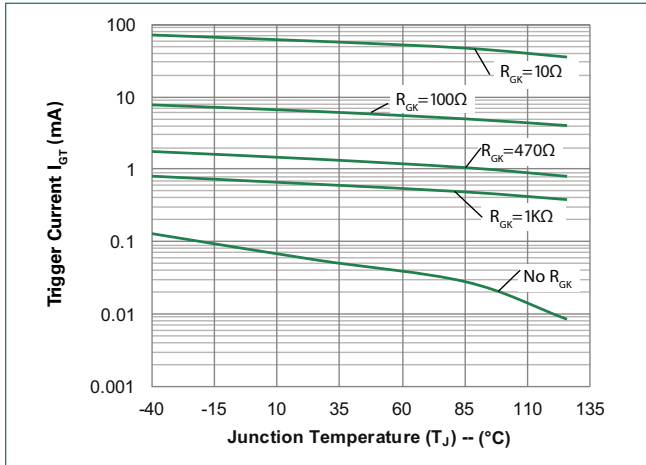


Figure 8: Typical DC Holding Current with R_{GK} vs. Junction Temperature for Sx02xS

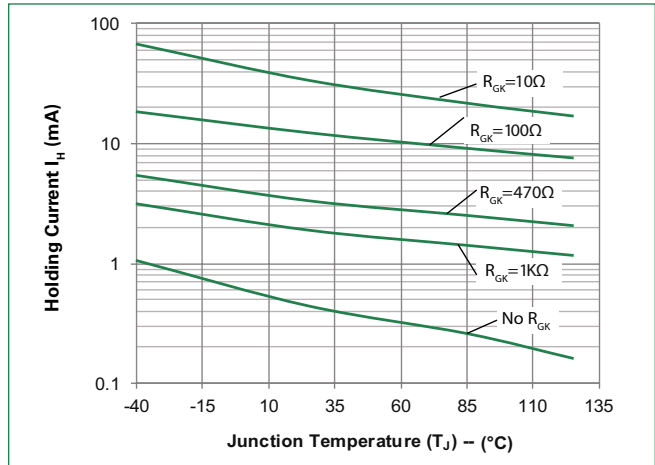


Figure 9: Typical Static dv/dt with R_{GK} vs. Junction Temperature for Sx02xS

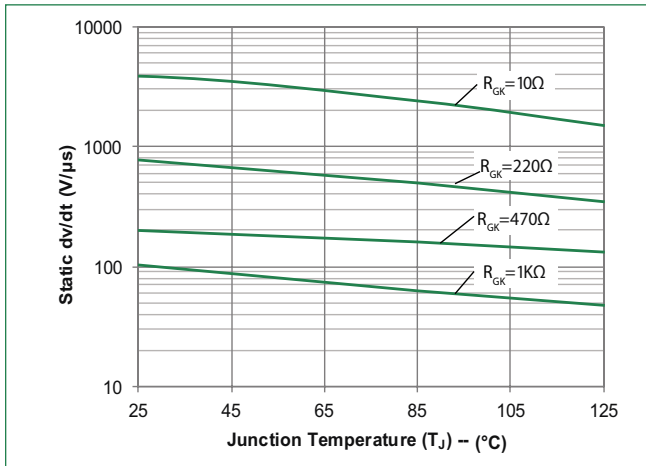


Figure 10: Typical turn off time with R_{GK} vs. Junction Temperature for Sx02xS

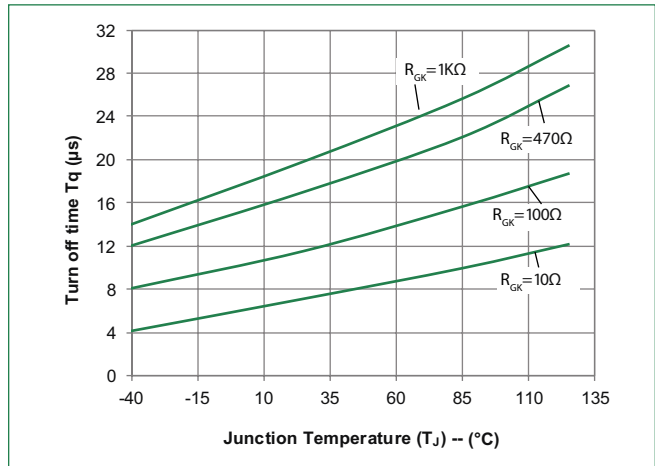
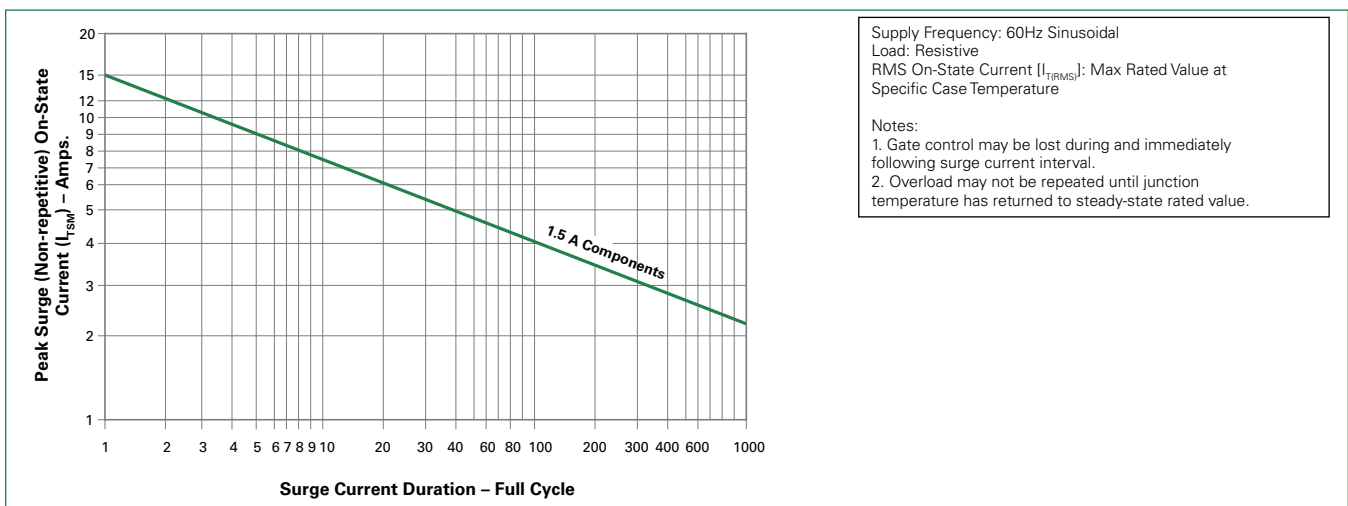


Figure 11: Surge Peak On-State Current vs. Number of Cycles

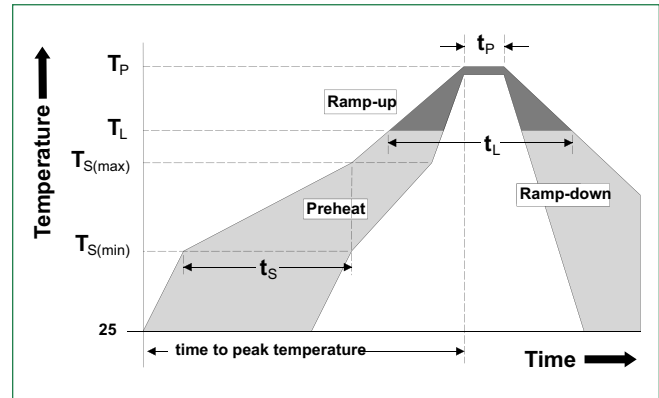


Sx02xSx EV Series

EV Series 1.5 Amp Sensitive SCRs

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 (min to max) (t_s) | 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.

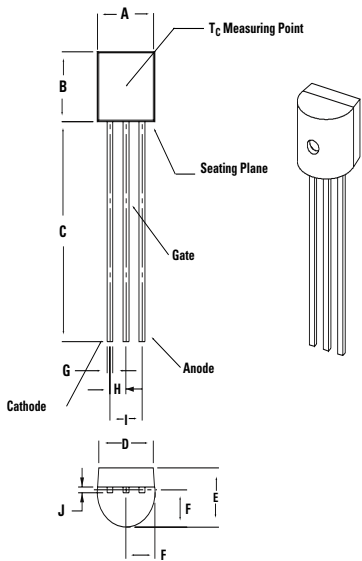
Environmental Specifications

| Test | Specifications and Conditions |
|----------------------------------|--|
| AC Blocking | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 125°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; 160V - DC; 85°C; 85% rel humidity |
| 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 |

Sx02xSx EV Series

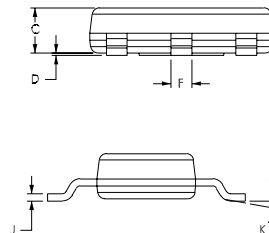
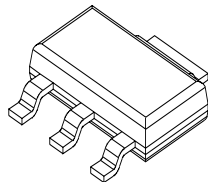
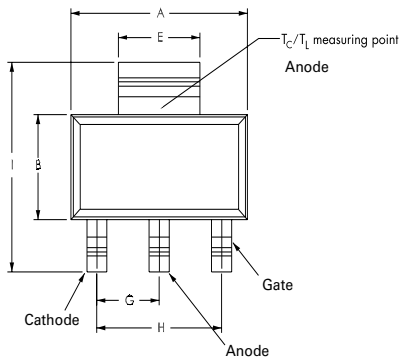
EV Series 1.5 Amp Sensitive SCRs

Dimensions – TO-92 (E Package)

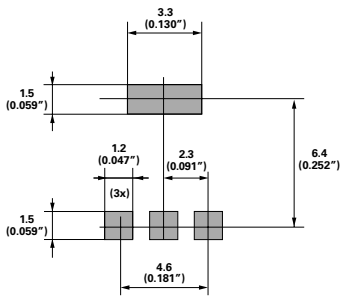


| Dimensions | Inches | | Millimeters | |
|------------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.175 | 0.205 | 4.450 | 5.200 |
| B | 0.170 | 0.210 | 4.320 | 5.330 |
| C | 0.500 | — | 12.700 | — |
| D | 0.135 | — | 3.430 | — |
| E | 0.125 | 0.165 | 3.180 | 4.190 |
| F | 0.080 | 0.105 | 2.040 | 2.660 |
| G | 0.016 | 0.021 | 0.407 | 0.533 |
| H | 0.045 | 0.055 | 1.150 | 1.390 |
| I | 0.095 | 0.105 | 2.420 | 2.660 |
| J | 0.015 | 0.020 | 0.380 | 0.500 |

Dimensions – SOT-223



Pad Layout for SOT-223



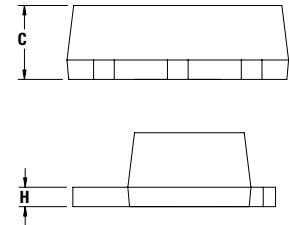
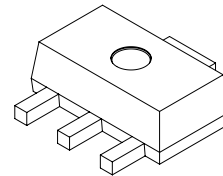
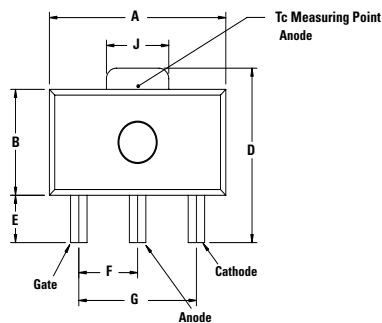
Dimensions in Millimeters (Inches)

| Dimensions | Inches | | | Millimeters | | |
|------------|---------|-------|-------|-------------|------|------|
| | Min | Typ | Max | Min | Typ | Max |
| A | 0.248 | 0.256 | 0.264 | 6.30 | 6.50 | 6.70 |
| B | 0.130 | 0.138 | 0.146 | 3.30 | 3.50 | 3.70 |
| C | — | — | 0.071 | — | — | 1.80 |
| D | 0.001 | — | 0.004 | 0.02 | — | 0.10 |
| E | 0.114 | 0.118 | 0.124 | 2.90 | 3.00 | 3.15 |
| F | 0.024 | 0.027 | 0.034 | 0.60 | 0.70 | 0.85 |
| G | — | 0.090 | — | — | 2.30 | — |
| H | — | 0.181 | — | — | 4.60 | — |
| I | 0.264 | 0.276 | 0.287 | 6.70 | 7.00 | 7.30 |
| J | 0.009 | 0.010 | 0.014 | 0.24 | 0.26 | 0.35 |
| K | 10° MAX | | | | | |

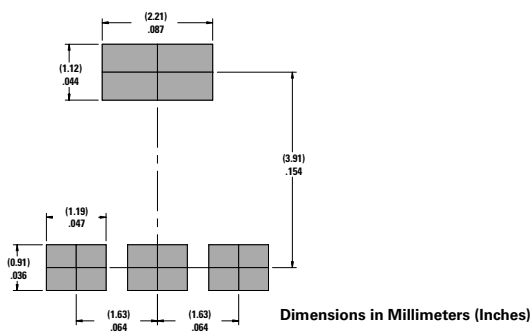
Sx02xSx EV Series

EV Series 1.5 Amp Sensitive SCRs

Dimensions – SOT-89



Pad Layout for SOT-89



| Dimension | Inches | | | Millimeters | | |
|-----------|--------|-----|-------|-------------|-----|------|
| | Min | Typ | Max | Min | Typ | Max |
| A | 0.173 | — | 0.181 | 4.40 | — | 4.60 |
| B | 0.090 | — | 0.102 | 2.29 | — | 2.60 |
| C | 0.055 | — | 0.063 | 1.40 | — | 1.60 |
| D | 0.155 | — | 0.167 | 3.94 | — | 4.25 |
| E | 0.035 | — | 0.047 | 0.89 | — | 1.20 |
| F | 0.056 | — | 0.062 | 1.42 | — | 1.57 |
| G | 0.115 | — | 0.121 | 2.92 | — | 3.07 |
| H | 0.014 | — | 0.017 | 0.35 | — | 0.44 |
| I | 0.014 | — | 0.019 | 0.36 | — | 0.48 |
| J | 0.064 | — | 0.072 | 1.62 | — | 1.83 |

Product Selector

| Part Numbr | Voltage | | Gate Sensitivity | Package |
|------------|---------|------|------------------|---------|
| | 400V | 600V | | |
| Sx02BS | X | X | 200 μ A | SOT-89 |
| Sx02ES | X | X | 200 μ A | TO-92 |
| Sx02TS | X | X | 200 μ A | SOT-223 |
| Sx02BS1 | X | X | 100 μ A | SOT-89 |
| Sx02ES1 | X | X | 100 μ A | TO-92 |
| Sx02TS1 | X | X | 100 μ A | SOT-223 |
| Sx02BS2 | — | X | 50 μ A | SOT-89 |

Note: x = voltage/100

Packing Options

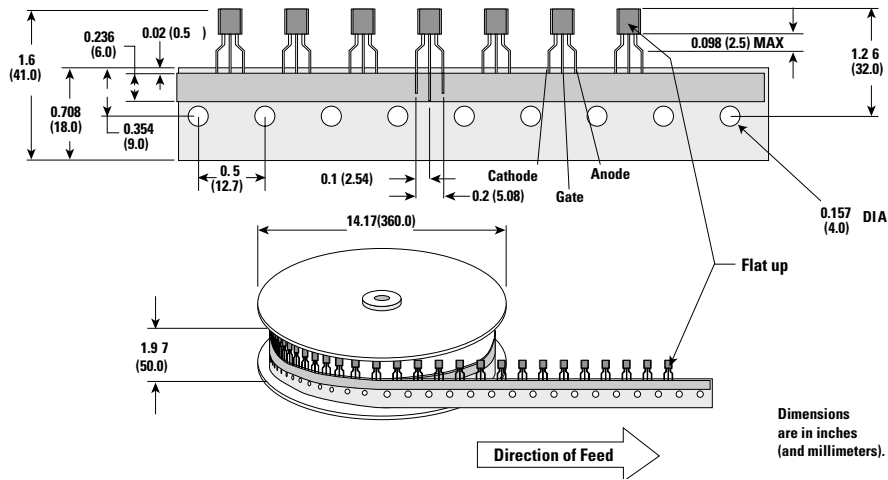
| Part Number | Marking | Weight | Packing Mode | Base Quantity |
|-------------|---------|---------|--------------|---------------|
| Sx02ESy | Sx02ESy | 0.217 g | Bulk | 2500 |
| Sx02ESyAP | Sx02ESy | 0.217 g | Ammo Pack | 2000 |
| Sx02ESyRP | Sx02ESy | 0.217 g | Tape & Reel | 2000 |
| Sx02TSyRP | Sx02TSy | 0.120 g | Tape & Reel | 1000 |
| Sx02BSyRP | x02y | 0.053 g | Tape & Reel | 1000 |
| Sx02BSyRP1 | x02y | 0.053 g | Tape & Reel | 1000 |

Sx02xSx EV Series

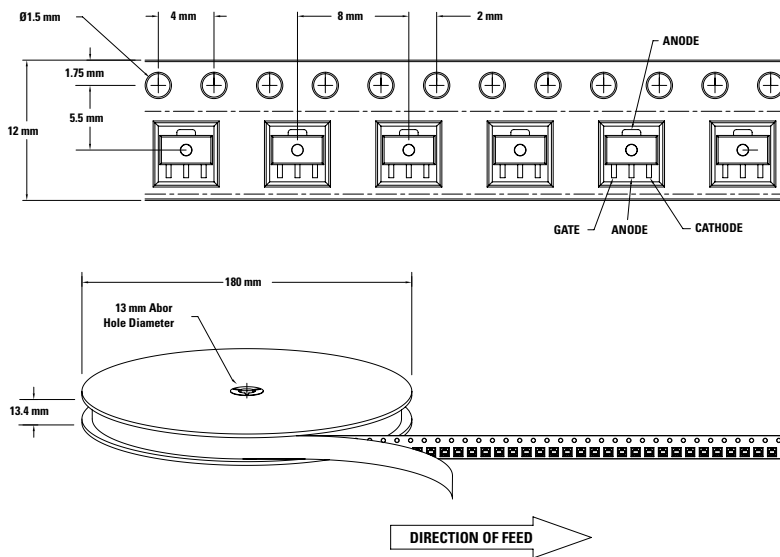
EV Series 1.5 Amp Sensitive SCRs

TO-92 (3-lead) Reel Pack (RP) Radial Leaded Specifications

Meets all EIA-468-C Standards



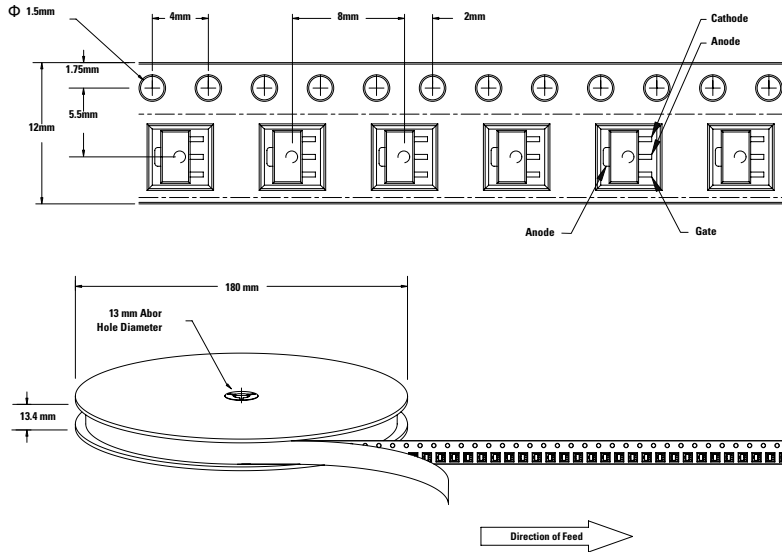
SOT-89 Reel Pack (RP) Specifications



Sx02xSx EV Series

EV Series 1.5 Amp Sensitive SCRs

SOT-89 Reel Pack (RP1) Specifications



TO-92 (3-lead) Ammo Pack (AP) Radial Leaded Specifications

Meets all EIA-468-C Standards

