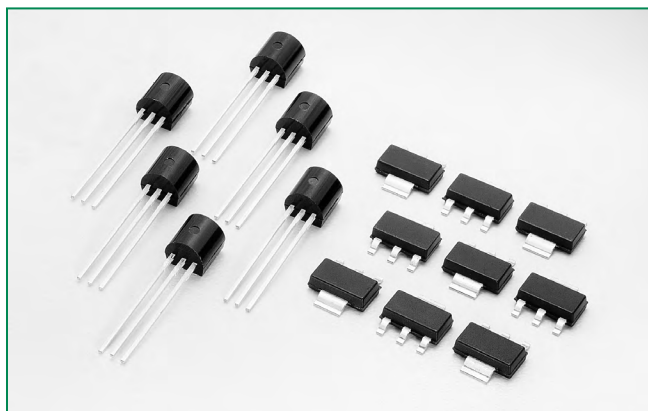


## Sx02xS Series

RoHS



### Main Features

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

### Applications

The Sx02xS EV series is specifically designed for Gas Ignition applications that require high pulse surge current capability.

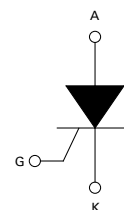
### Description

New 1.5 Amp sensitive gate SCR series offers high static dv/dt with low turn off time (tq) through small die planar construction design. All SCR's junctions are glass-passivated to ensure long term reliability and parametric stability.

### Features

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

### Schematic Symbol



### Absolute Maximum Ratings

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

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

| Symbol    | Description                                | Test Conditions                                                                                                | Sx02xS |     | Unit             |
|-----------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------|-----|------------------|
|           |                                            |                                                                                                                | Min    | Max |                  |
| $I_{GT}$  | DC Gate Trigger Current                    | $V_D = 12\text{V}$<br>$R_L = 60\ \Omega$                                                                       | 15     | 200 | $\mu\text{A}$    |
| $V_{GT}$  | DC Gate Trigger Voltage                    |                                                                                                                | —      | 0.8 | V                |
| $V_{GRM}$ | Peak Reverse Gate Voltage                  | $I_{RG} = 10\mu\text{A}$                                                                                       | 5      | —   | V                |
| $I_H$     | Holding Current                            | $R_{GK} = 1\ \text{k}\Omega$                                                                                   | —      | 5   | mA               |
| (dv/dt)s  | Critical Rate-of-Rise of Off-State Voltage | $T_J = 125^\circ\text{C}$<br>$V_D = V_{DRM} / V_{RRM}$<br>Exponential Waveform<br>$R_{GK} = 1\ \text{k}\Omega$ | 25     | —   | V/ $\mu\text{s}$ |
| $t_q$     | Turn-Off Time                              | $T_J = 125^\circ\text{C} @ 600\text{V}$<br>$R_{GK} = 1\ \text{k}\Omega$                                        | —      | 35  | $\mu\text{s}$    |
| $t_{gt}$  | Turn-On Time                               | $I_G = 10\text{mA}$<br>$PW = 15\mu\text{sec}$<br>$I_T = 3.0\text{A (pk)}$                                      | —      | 3   | $\mu\text{s}$    |

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

| Symbol    | Description                        | Test Conditions                                                           | Value |      | Unit          |
|-----------|------------------------------------|---------------------------------------------------------------------------|-------|------|---------------|
|           |                                    |                                                                           | Min   | Max  |               |
| $V_{TM}$  | Peak On-State Voltage              | $I_{TM} = 3.0\text{A (pk)}$                                               | —     | 1.70 | V             |
| $I_{DRM}$ | Off-State Current, Peak Repetitive | $T_J = 25^\circ\text{C} @ V_D = V_{DRM}$<br>$R_{GK} = 1\ \text{k}\Omega$  | —     | 5    | $\mu\text{A}$ |
|           |                                    | $T_J = 125^\circ\text{C} @ V_D = V_{DRM}$<br>$R_{GK} = 1\ \text{k}\Omega$ | —     | 500  | $\mu\text{A}$ |

### Thermal Resistances

| Symbol            | Parameter             |                               | Value   | Unit |
|-------------------|-----------------------|-------------------------------|---------|------|
| $R_{\theta(J-C)}$ | Junction to case (AC) | $I_T = 1.5\text{A}_{(RMS)}^1$ | TO-92   | 50   |
|                   |                       |                               | SOT-223 | 25   |
| $R_{\theta(J-A)}$ | Junction to ambient   | $I_T = 1.5\text{A}_{(RMS)}^1$ | TO-92   | 160  |
|                   |                       |                               | SOT-223 | 60   |

<sup>1</sup> 60Hz AC resistive load condition, 100% conduction.

### Additional Information



**Datasheet**

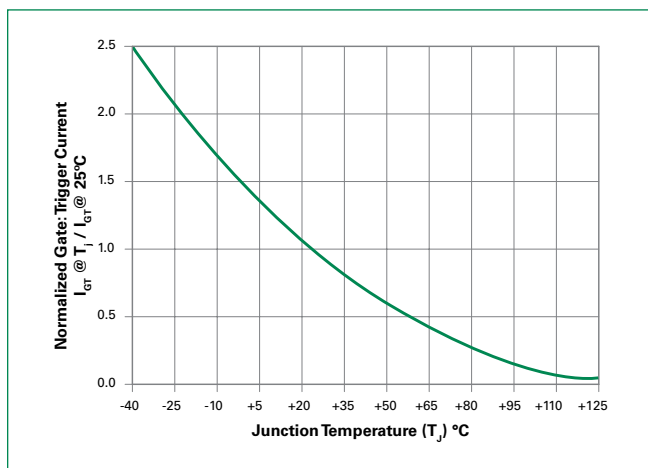


**Resources**

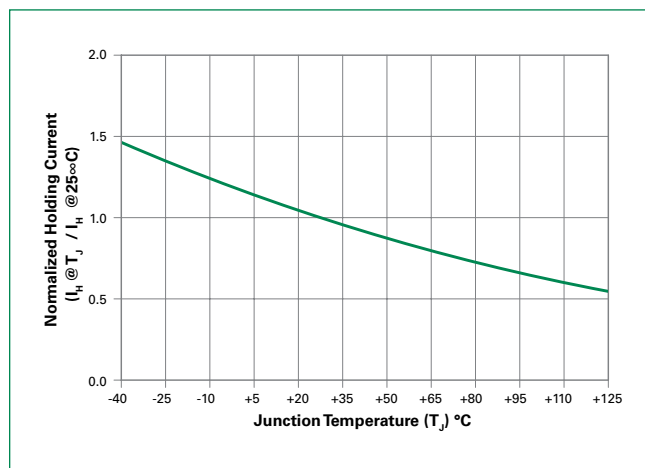


**Samples**

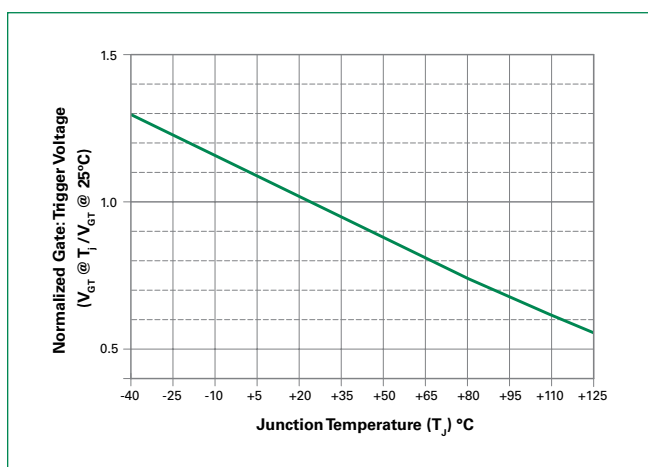
**Figure 1: Normalized DC Gate Trigger Current vs. Junction Temperature**



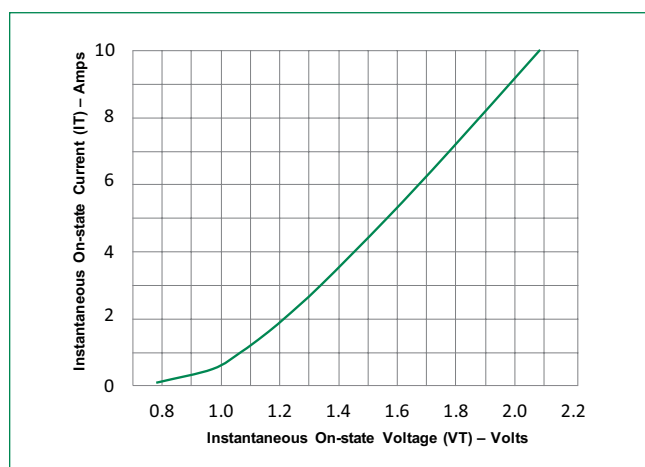
**Figure 2: Normalized DC Holding Current vs. Junction Temperature**



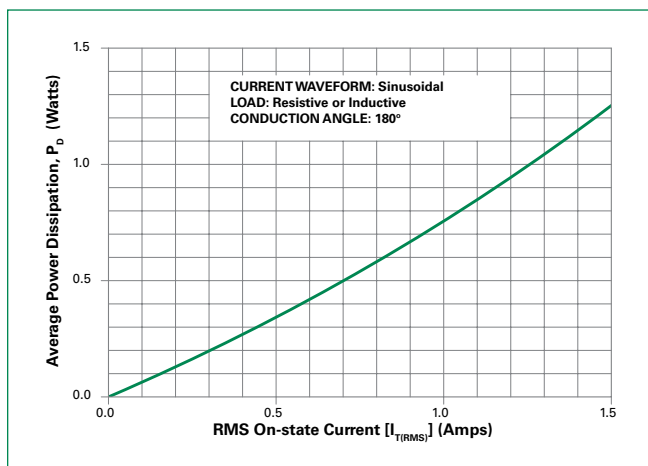
**Figure 3: Normalized DC Gate Trigger Voltage vs. Junction Temperature**



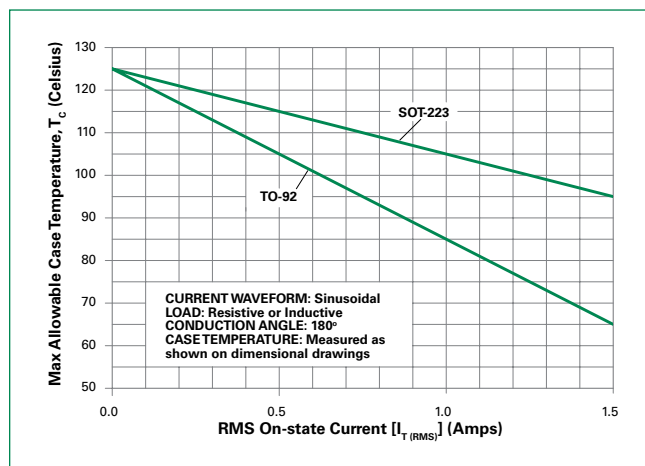
**Figure 4: On-State Current vs. On-State Voltage (Typical)**



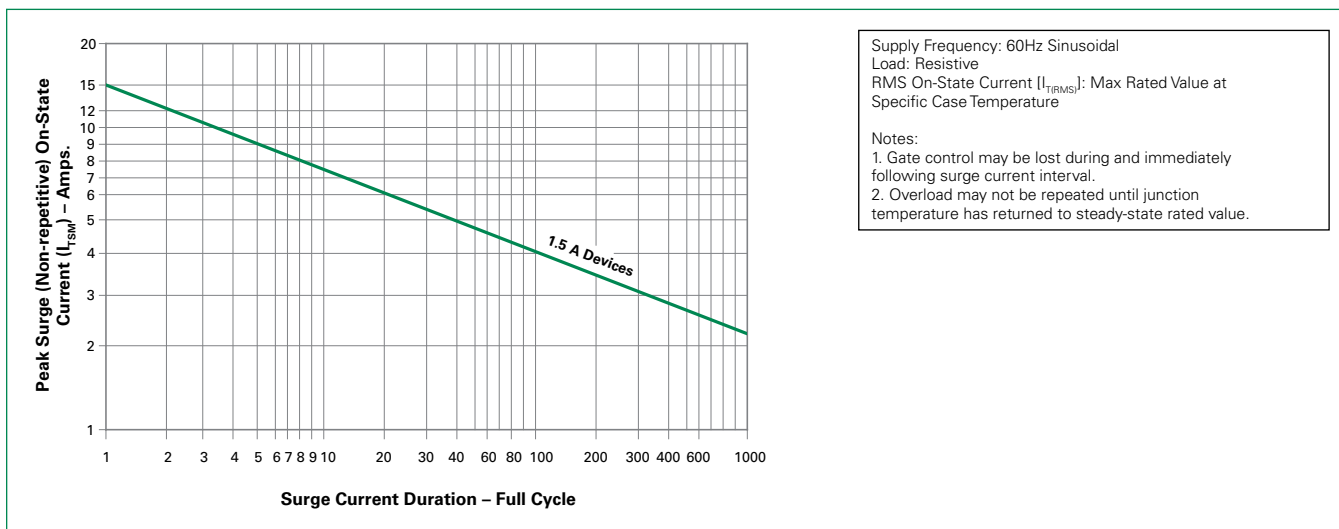
**Figure 5: Power Dissipation (Typical) vs. RMS On-State Current**



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

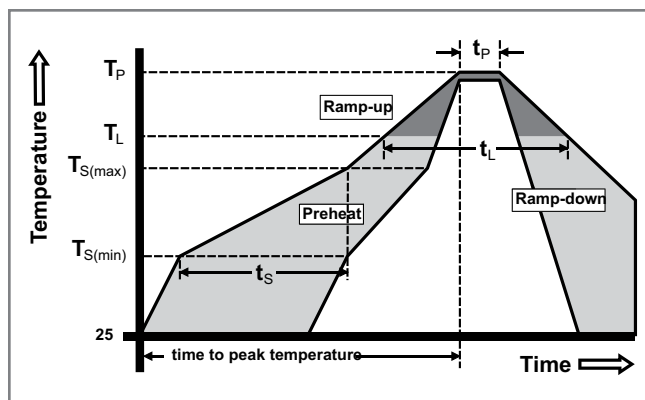


**Figure 7: Surge Peak On-State Current vs. Number of Cycles**



## 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 (min to max) ( $t_s$ )      | 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 classification 94V-0. |
| <b>Lead Material</b>   | Copper Alloy                                                   |

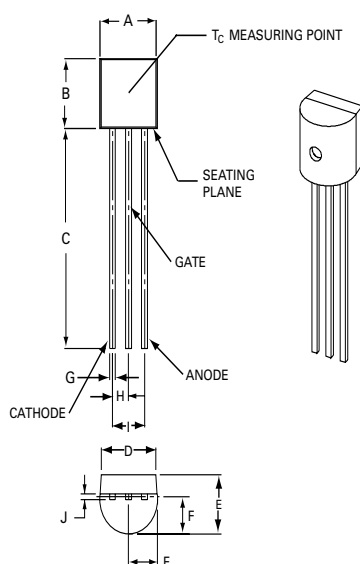
### Design Considerations

Careful selection of the correct device 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 device 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

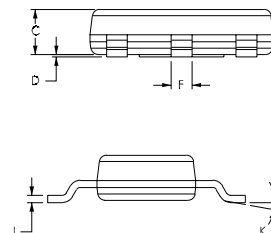
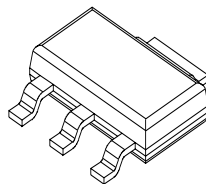
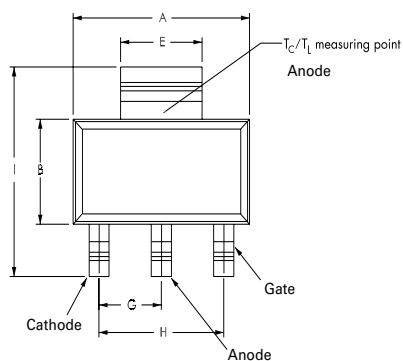
| Test                             | Specifications and Conditions                                                                                                     |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>AC Blocking</b>               | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 125°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>Thermal Shock</b>             | MIL-STD-750, M-1056 10 cycles; 0°C to 100°C; 5-min dwell-time at each temperature; 10 sec (max) transfer time between temperature |
| <b>Autoclave</b>                 | EIA / JEDEC, JESD22-A102 168 hours (121°C at 2 ATMs) and 100% R/H                                                                 |
| <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                                                                                                        |

### Dimensions — TO-92 (E Package)

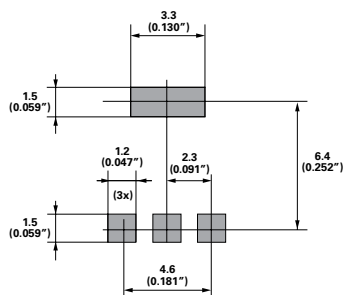


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.175  | 0.205 | 4.450       | 5.200 |
| B          | 0.170  | 0.210 | 4.320       | 5.330 |
| C          | 0.500  | —     | 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 |       |       |             |      |      |

## Product Selector

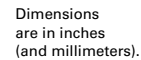
| Part Number | Voltage |      | Gate Sensitivity | Package |
|-------------|---------|------|------------------|---------|
|             | 400V    | 600V |                  |         |
| S402ES      | X       | —    | 200 $\mu$ A      | TO-92   |
| S602ES      | —       | X    | 200 $\mu$ A      | TO-92   |
| S402TS      | X       | —    | 200 $\mu$ A      | SOT-223 |
| S602TS      | —       | X    | 200 $\mu$ A      | SOT-223 |

## Packing Options

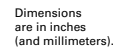
| Part Number | Marking | Weight  | Packing Mode | Base Quantity |
|-------------|---------|---------|--------------|---------------|
| Sx02ES      | Sx02ES  | 0.170 g | Bulk         | 2500          |
| Sx02ESAP    | Sx02ES  | 0.170 g | Ammo Pack    | 2000          |
| Sx02ESRP    | Sx02ES  | 0.170 g | Tape & Reel  | 2000          |
| Sx02TSRP    | Sx02TS  | 0.120 g | Tape & Reel  | 1000          |

Note: x = voltage

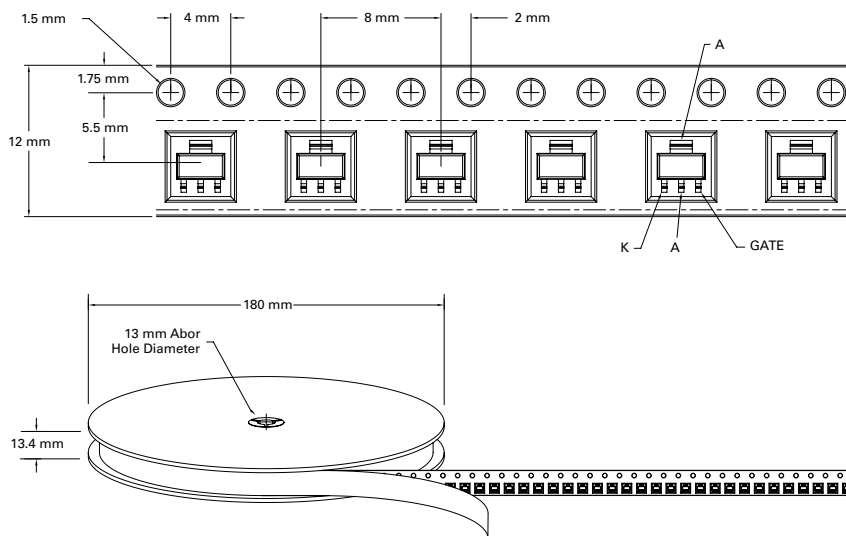
## Meets all EIA-468-C Standards



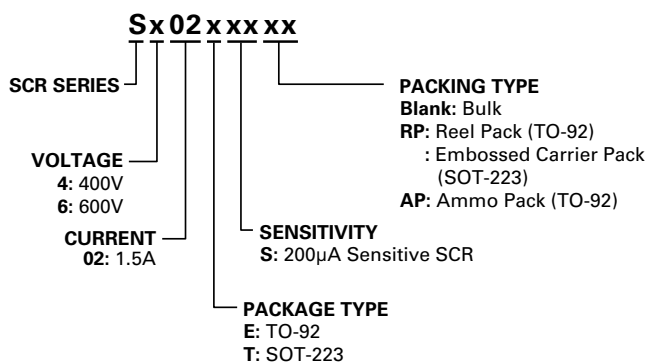
## Meets all EIA-468-C Standards



## SOT-223 Reel Pack (RP) Specifications



## Part Numbering System



## Part Marking System

