

S802xSx Series
EV Series 1.5 Amp Sensitive SCRs



Product Description

The S802xSx offers a high static dv/dt with a low turn off (t_q) time. It is specifically designed for GFCI (Ground Fault Circuit Interrupter) and AFCI (Arc Fault Circuit Interrupter), RCD (Residual Current Device) and RCBO (Residual Current Circuit Breaker with Overload Protection) applications. All SCR junctions are glass-passivated to ensure long term reliability and parametric stability.

Agency Approvals and Environmental

Environmental Approvals

RoHS **HF**

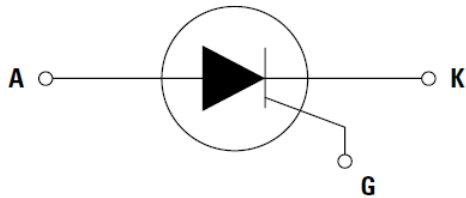
Product Summary

| Characteristic | Value | Unit |
|----------------------------|-----------|---------|
| $I_{T(RMS)}$ | 1.5 | A |
| V_{DRM} / V_{RRM} | 800 | V |
| $V_{DSM} (t_p = 50 \mu s)$ | 1250 | V |
| $V_{RSM} (t_p = 50 \mu s)$ | 900 | V |
| I_{GT} | 20 to 100 | μA |

Features

- Surge current capability up to 24 A
- Blocking voltage (V_{DRM} / V_{RRM}) capability up to 800 V
- Non-repetitive direct surge peak off-state voltage (V_{DSM}) up to 1250 V
- Non-repetitive reverse surge peak off-state voltage (V_{RSM}) up to 900 V
- High dv/dt noise immunity
- Improved turn-off time (t_q)
- Sensitive gate for direct microprocessor interface
- Halogen-free and RoHS compliant

Schematic Symbol



Applications

- GFCI
- AFCI
- RCD
- RCBO

*TO-92 with GAK pin output

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1. Maximum Ratings

| Symbol | Characteristic | Conditions | | Value | Unit |
|--------------|--|-----------------------------------|-----------------------------------|------------|------------------------|
| $I_{T(RMS)}$ | RMS On-state Current (Full Sine Wave) | TO-92 | $T_c = 65\text{ }^\circ\text{C}$ | 1.5 | A |
| | | SOT-223 | $T_c = 80\text{ }^\circ\text{C}$ | | |
| $I_{T(AV)}$ | Average On-state Current | TO-92 | $T_c = 65\text{ }^\circ\text{C}$ | 0.9 | A |
| | | SOT-223 | $T_c = 80\text{ }^\circ\text{C}$ | | |
| I_{TSM} | Non-repetitive Surge Peak On-state Current (Sine Half Wave, $T_{J,Initial} = 25\text{ }^\circ\text{C}$) | $f = 50\text{ Hz}$ | | 20.0 | A |
| | | $f = 60\text{ Hz}$ | | 24.0 | |
| I^2t | I^2t Value for Fusing | $t_p = 10\text{ ms}$ | $f = 50\text{ Hz}$ | 2.0 | A^2s |
| di/dt | Critical Rate of Rise of On-state Current $I_G = 10\text{ mA}$ | $T_J = 125\text{ }^\circ\text{C}$ | | 80 | $\text{A}/\mu\text{s}$ |
| I_{GM} | Peak Gate Current | $t_p = 20\text{ }\mu\text{s}$ | $T_J = 125\text{ }^\circ\text{C}$ | 0.5 | A |
| $P_{G(AV)}$ | Average Gate Power Dissipation | - | $T_J = 125\text{ }^\circ\text{C}$ | 0.2 | W |
| T_{STG} | Storage Junction Temperature Range | - | - | -40 to 150 | $^\circ\text{C}$ |
| T_J | Operating Junction Temperature Range | - | - | -40 to 125 | $^\circ\text{C}$ |

2. Thermal Characteristics

| Symbol | Characteristic | | Value | Unit | |
|--------------|--|------------------------------|---------|------|---------------------------|
| $R_{th(JC)}$ | Thermal Resistance, junction-to-case (AC) | $I_T = 1.5\text{ A}_{RMS}^1$ | TO-92 | 35 | $^\circ\text{C}/\text{W}$ |
| | | | SOT-223 | 25 | |
| $R_{th(JA)}$ | Thermal Resistance, junction-to-ambient (AC) | $I_T = 1.5\text{ A}_{RMS}^1$ | TO-92 | 150 | $^\circ\text{C}/\text{W}$ |
| | | | SOT-223 | 60 | |

Footnote 1: 60 Hz AC resistive load condition, 100% conduction

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

| Symbol | Description | Conditions | Value | | | Unit | |
|-----------|--|---|------------------------------|-----|-----|---------------|------------------------|
| | | | Min | Typ | Max | | |
| I_{GT} | DC Gate Trigger Current | $V_D = 6\text{ V}, R_L = 100\text{ }\Omega$ | 20 | 60 | 100 | μA | |
| V_{GT} | DC Gate Trigger Voltage | $V_D = 6\text{ V}, R_L = 100\text{ }\Omega$ | - | - | 0.8 | V | |
| V_{GRM} | Peak Reverse Gate Voltage | $I_{RG} = 10\text{ }\mu\text{A}$ | 8 | - | - | V | |
| I_H | Holding Current | $R_{GK} = 1\text{ k}\Omega$, Initial current = 20 mA | - | - | 3 | mA | |
| dv/dt | Critical Rate-of-rise of Off-stage Voltage | $T_J = 125\text{ }^\circ\text{C}$, $V_D = 67\%$ of V_{DRM} , Exponential waveform | $R_{GK} = 1\text{ k}\Omega$ | 40 | - | - | $\text{V}/\mu\text{s}$ |
| | | | $R_{GK} = 220\text{ }\Omega$ | 250 | - | - | |
| V_{GD} | Gate Non-trigger Voltage | $V_D = \frac{1}{2} V_{DRM}$, $R_{GK} = 1\text{ k}\Omega$, $T_J = 125\text{ }^\circ\text{C}$ | 0.2 | - | - | V | |
| t_q | Turn-off Time | $I_T = 0.5\text{ A}$ | - | - | 35 | μs | |
| t_{gt} | Turn-on Time | $I_G = 10\text{ mA}$, $P_w = 15\text{ }\mu\text{s}$, $I_T = 1.6\text{ A}_{PK}$ | - | 2.3 | - | μs | |

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

| Symbol | Description | Conditions | Maximum Value | Unit |
|-------------------|------------------------------------|--|---------------|------------------|
| V_{TM} | Peak On-state Voltage | 1.5 A device, $I_{TM} = 4\text{ A}$, $t_p = 380\text{ }\mu\text{s}$ | 1.8 | V |
| V_{TO} | Threshold Voltage | - | 1.03 | V |
| R_D | Dynamic Resistance | - | 106 | $\text{m}\Omega$ |
| I_{DRM}/I_{RRM} | Off-state Current, Peak Repetitive | $T_J = 25\text{ }^\circ\text{C}$ | 3 | μA |
| | | $T_J = 125\text{ }^\circ\text{C}$ | 500 | |

5. Performance Curves

Figure 1. Normalized DC Gate Trigger Current for All Quadrants vs. Junction Temperature

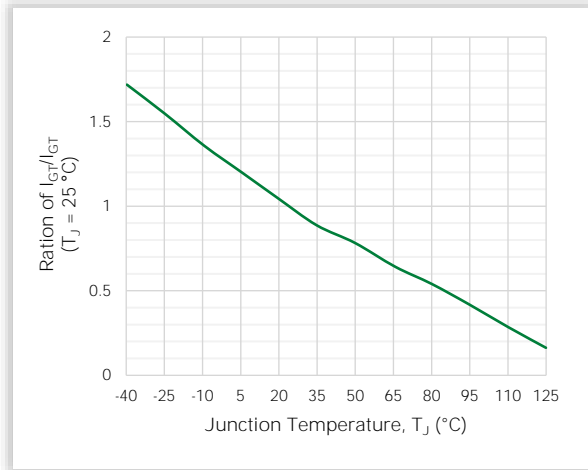


Figure 2. Normalized DC Holding Current vs. Junction Temperature

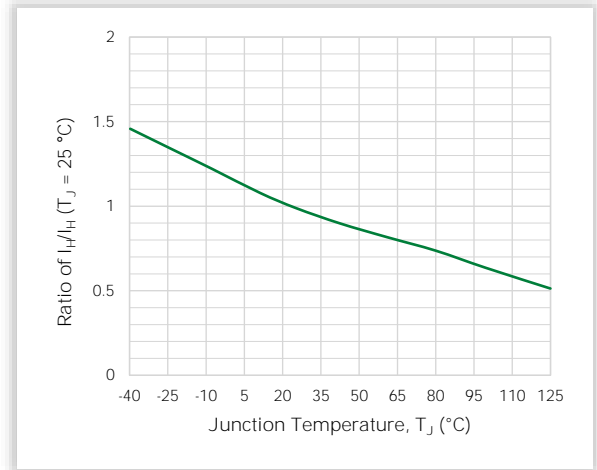


Figure 3. Normalized DC Gate Trigger Voltage vs. Junction Temperature

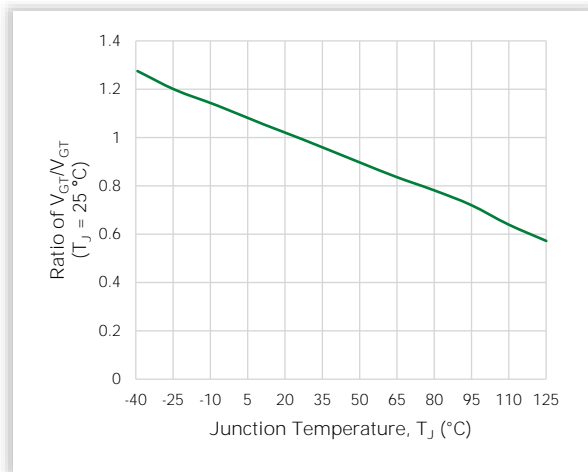


Figure 4. Typical On-state Current vs. On-state Voltage

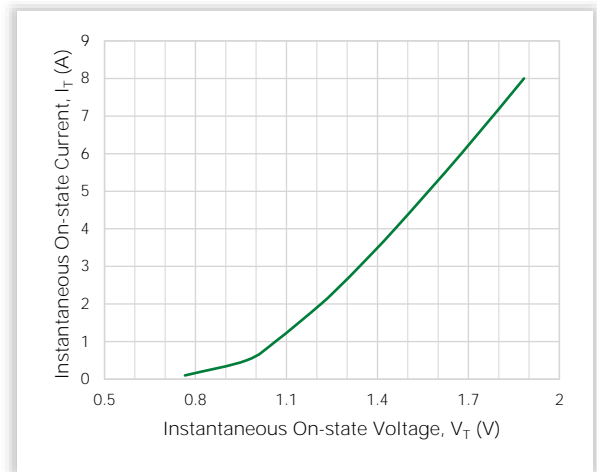


Figure 5. Typical Power Dissipation vs. RMS On-state Current

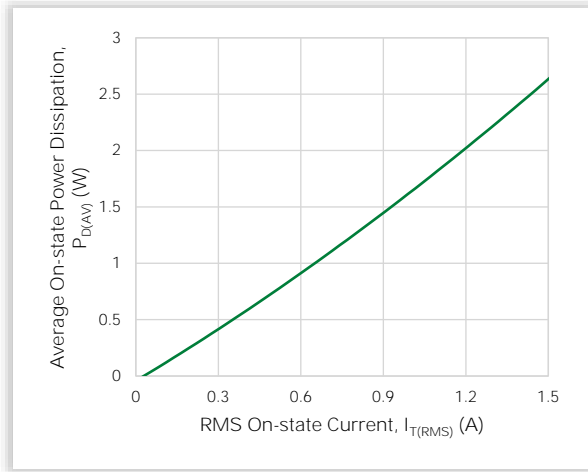


Figure 6. Maximum Allowable Case Temperature vs. On-state Current

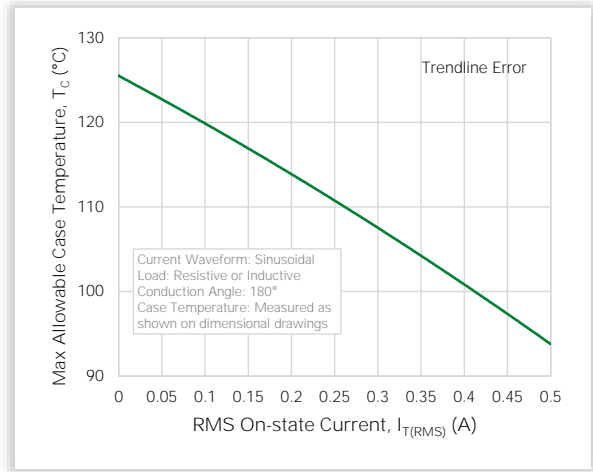
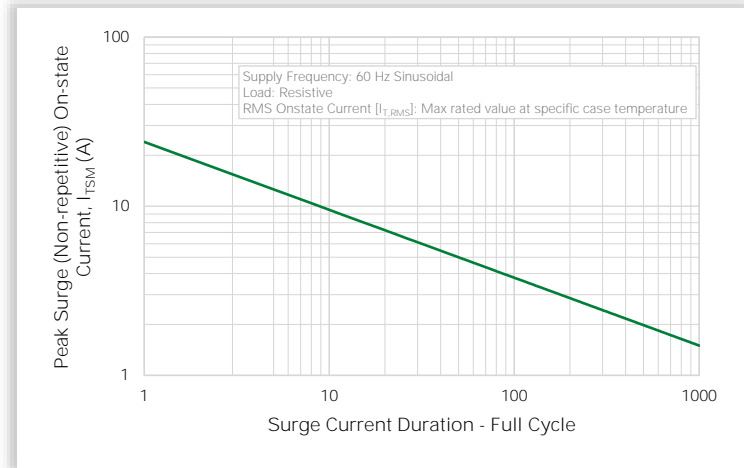


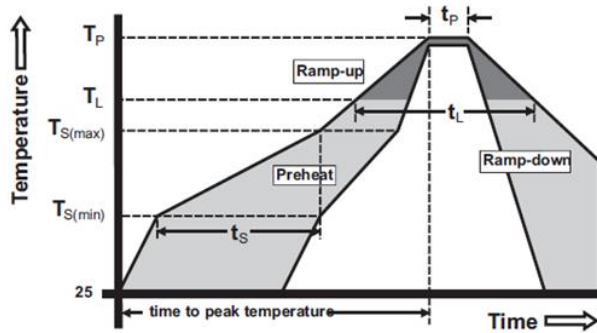
Figure 7. Surge Peak On-state Current vs. Number of Cycles



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.

6. Soldering Parameters



| Parameter | Value | |
|--|--------------------------------------|-------------|
| Reflow Condition | Pb-free Assembly | |
| Pre-Heat | Temperature Min, $T_{S(\text{Min})}$ | 150 °C |
| | Temperature Max, $T_{S(\text{Max})}$ | 200 °C |
| | Time (Min to Max), t_s | 60 to 120 s |
| Average Ramp-up Rate Liquidus Temp., T_L to peak | 3 °C/s (Max) | |
| $T_{S(\text{Max})}$ to T_L Ramp-up Rate | 3 °C/s (Max) | |
| Reflow | Temperature, T_L Liquidus | 217 °C |
| | Time (min to max), t_s | 60 to 150 s |
| Peak Temperature, T_P | 260 °C (+0/-5 °C) | |
| Time within 5 °C of Actual Peak Temperature, t_p | 30* s | |
| Ramp-down Rate | 6 °C/s (Max) | |
| Time 25 °C to Peak Temperature, T_P | 8 minutes (Max) | |
| Do Not Exceed | 260 °C | |

7. Physical Specifications

| Device Feature | Detail |
|-----------------|--|
| Terminal Finish | 100% Matte Tin-plated |
| Body Material | UL Recognized Compound meeting Flammability Rating V-0 |
| Lead Material | Copper Alloy |

9. Design Considerations

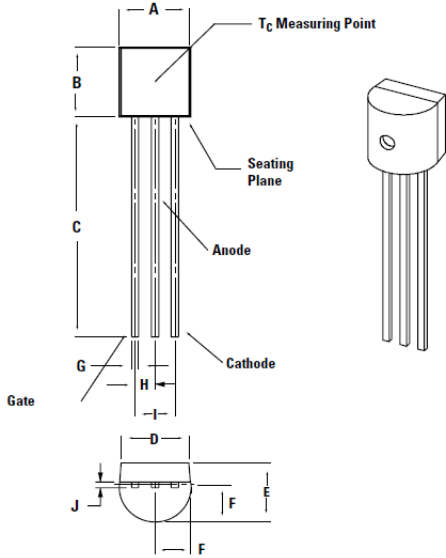
Careful selection of the correct component for the application's operating parameters and environment will go a long way toward extending the operating life of the Thyristor. Good design practice should limit the maximum continuous current through the main terminals to 75% of the component rating. Other 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.

8. 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, 1000 cycles; -55°C to +150°C; 15 min dwell time |
| Temperature/Humidity | EIA / JEDEC, JESD22-A101 1008 hours; 320V - DC; 85°C; 85% relative humidity |
| UHAST | JESD22-A118, 96 hours, 130°C, 85%RH |
| 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 |

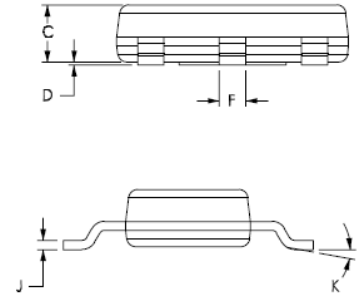
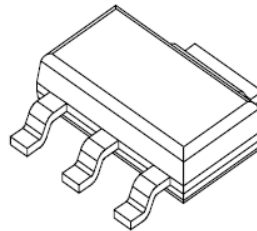
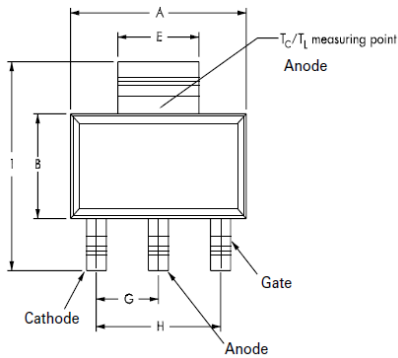
10. Package Dimensions

TO-92

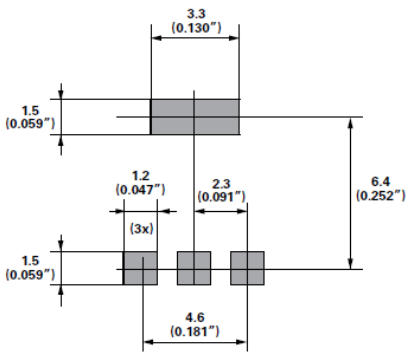


| Dimension | Millimeters | | Inches | |
|-----------|-------------|-------|--------|-------|
| | Min | Max | Min | Max |
| A | 4.450 | 5.200 | 0.175 | 0.205 |
| B | 4.320 | 5.330 | 0.170 | 0.210 |
| C | 12.700 | - | 0.500 | - |
| D | 3.430 | - | 0.135 | - |
| E | 3.180 | 4.190 | 0.125 | 0.165 |
| F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

SOT-223



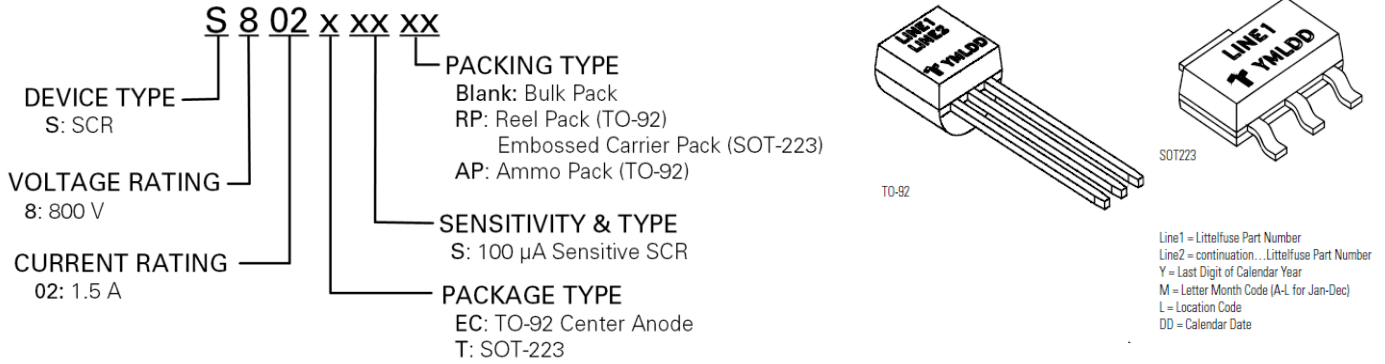
Pad Layout for SOT-223



*Dimensions in millimeters (inches)

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

11. Part Numbering and Marking



12. Product Selector

| Part Number | Voltage | Gate Sensitivity | Package |
|-------------|---------|------------------|---------|
| | 800 V | | |
| S802ECS | X | 100 μ A | TO-92 |
| S802TS | X | 100 μ A | SOT-223 |

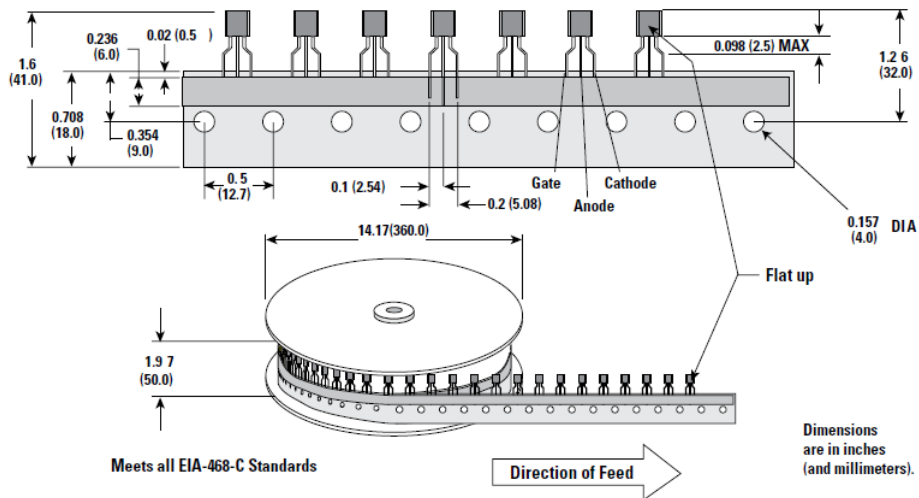
13. Packing Options

| Part Number | Marking | Weight | Packing Mode | Base Quantity |
|-------------|---------|---------|--------------|---------------|
| S802ECS | S802ECS | 0.217 g | Bulk | 2500 |
| S802ECSR | S802ECS | 0.217 g | Tape & Reel | 2000 |
| S802ECSAP | S802ECS | 0.217 g | Ammo Pack | 2000 |
| S802TSRP | S802TS | 0.120 g | Tape & Reel | 1000 |

14. Packing Specifications

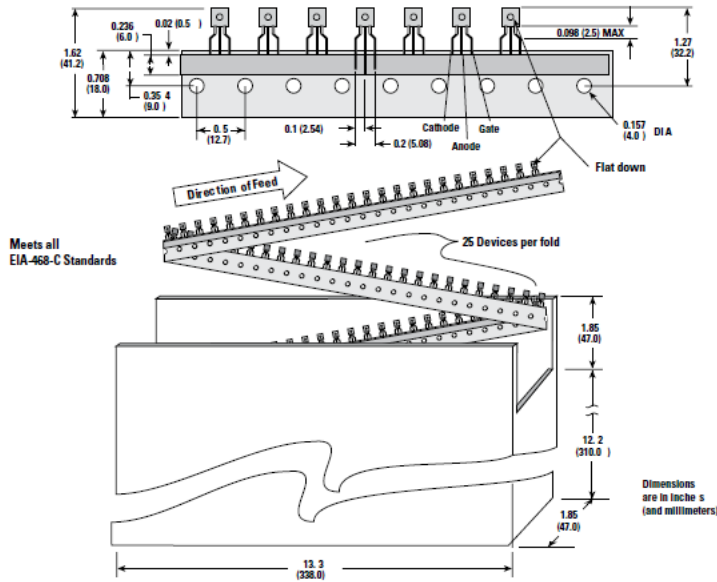
TO-92 (3-lead) Reel Pack (RP) Radial Leaded Specifications

Meets all EIA-468-C Standards

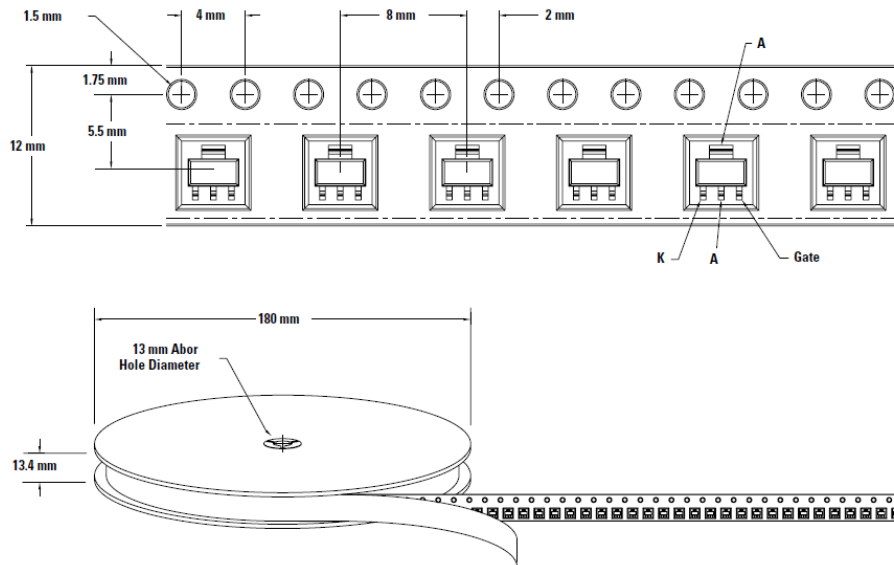


TO-92 (3-lead) Ammo Pack (AP) Radial Leaded Specifications

Meets all EIA-468-C Standards



SOT-223 Reel Pack (RP) Specifications



For additional information please visit www.Littelfuse.com/powersemi

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