

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**

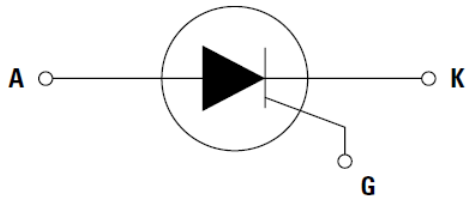
Product Summary

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	$\mu A$

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

- 1. Maximum Ratings.....3
- 2. Thermal Characteristics .....3
- 3. Electrical Characteristics ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise specified) .....3
- 4. Static Characteristics ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise specified).....3
- 5. Performance Curves .....4
- 6. Soldering Parameters .....6
- 7. Physical Specifications.....6
- 8. Environmental Specifications.....6
- 9. Design Considerations.....6
- 10. Package Dimensions .....7
- 11. Part Numbering and Marking.....8
- 12. Product Selector .....8
- 13. Packing Options.....8
- 14. Packing Specifications .....8

## 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	$\text{A}^2\text{s}$
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	$\mu\text{A}$	
$V_{GT}$	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	$\mu\text{s}$	
$t_{gt}$	Turn-on Time	$I_G = 10\text{ mA}$ , $P_w = 15\text{ }\mu\text{s}$ , $I_T = 1.6\text{ A}_{PK}$	-	2.3	-	$\mu\text{s}$	

## 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	$\mu\text{A}$
		$T_J = 125\text{ }^\circ\text{C}$	500	

### 5. Performance Curves

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

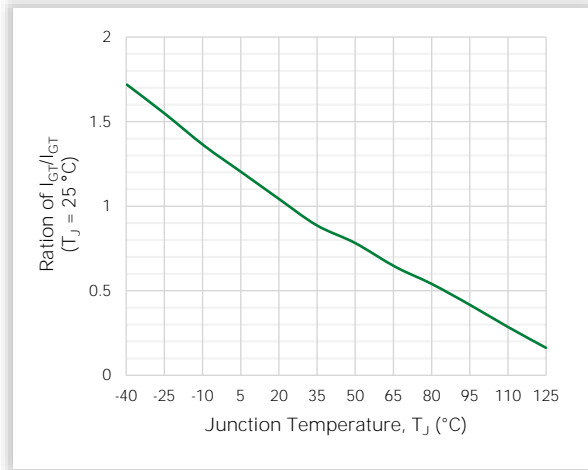


Figure 2. Normalized DC Holding Current vs. Junction Temperature

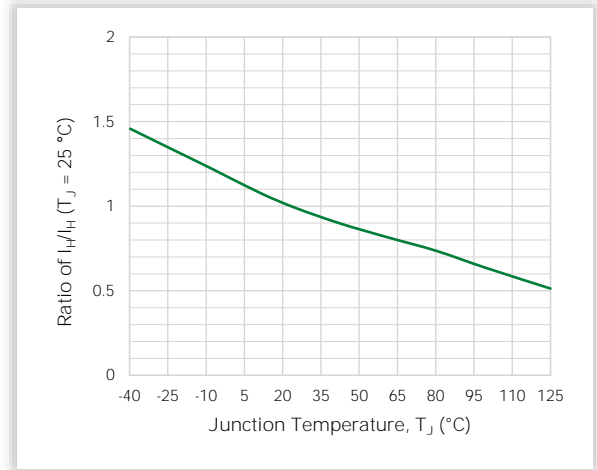


Figure 3. Normalized DC Gate Trigger Voltage vs. Junction Temperature

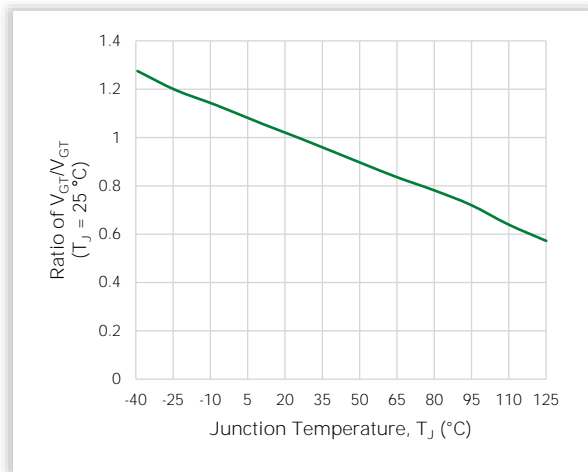


Figure 4. Typical On-state Current vs. On-state Voltage

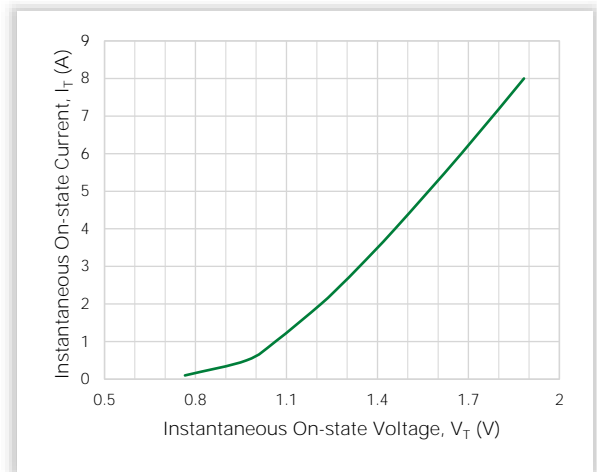


Figure 5. Typical Power Dissipation vs. RMS On-state Current

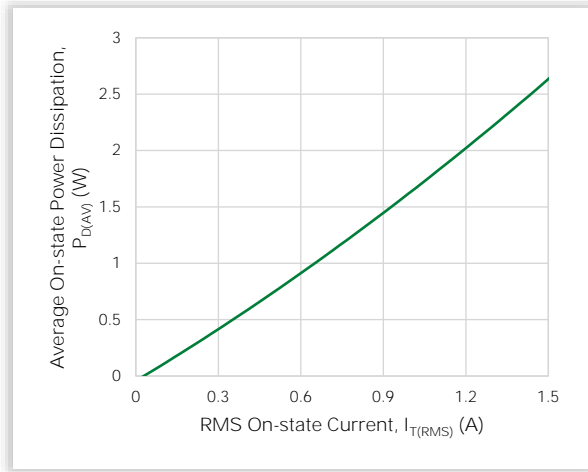


Figure 6. Maximum Allowable Case Temperature vs. On-state Current

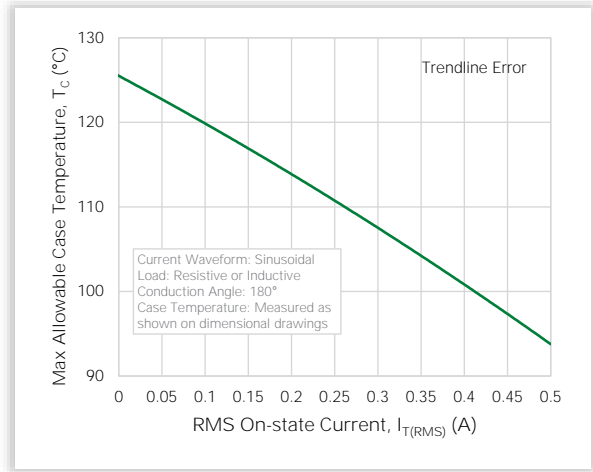
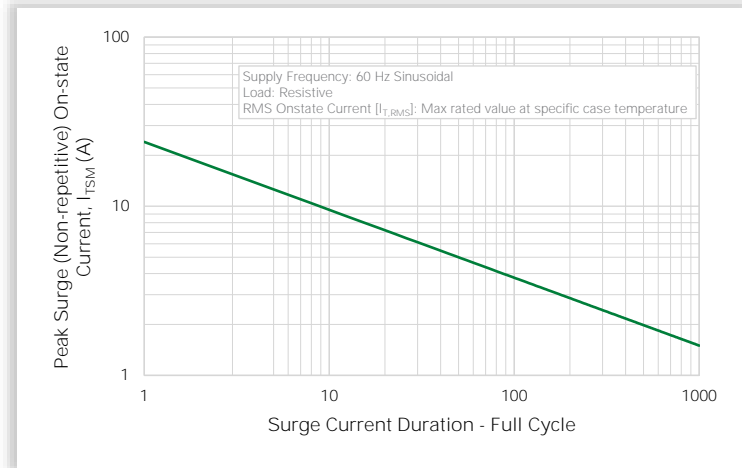


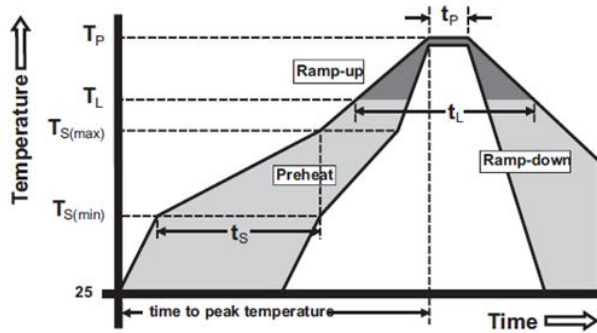
Figure 7. Surge Peak On-state Current vs. Number of Cycles



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 <sub>S(Min)</sub>	150 °C
	Temperature Max, T <sub>S(Max)</sub>	200 °C
	Time (Min to Max), t <sub>s</sub>	60 to 120 s
Average Ramp-up Rate Liquidus Temp., T <sub>L</sub> to peak	3 °C/s (Max)	
T <sub>S(Max)</sub> to T <sub>L</sub> Ramp-up Rate	3 °C/s (Max)	
Reflow	Temperature, T <sub>L</sub> Liquidus	217 °C
	Time (min to max), t <sub>s</sub>	60 to 150 s
Peak Temperature, T <sub>P</sub>	260 °C (+0/-5 °C)	
Time within 5 °C of Actual Peak Temperature, t <sub>p</sub>	30* s	
Ramp-down Rate	6 °C/s (Max)	
Time 25 °C to Peak Temperature, T <sub>P</sub>	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

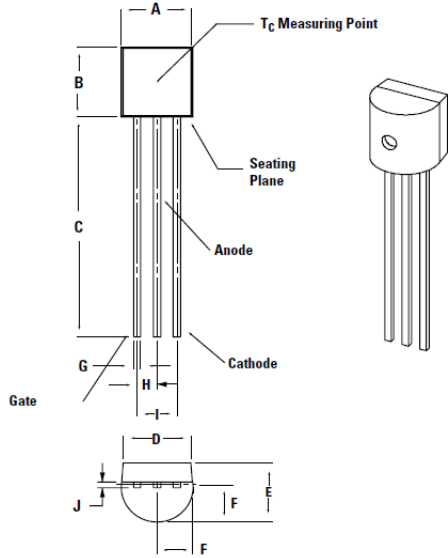
Careful selection of the correct component for the application's operating parameters and environment will go a long way toward extending the operating life of the Thyristor. Good design practice should limit the maximum continuous current through the main terminals to 75% of the component rating. Other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

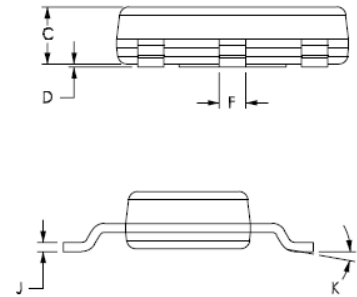
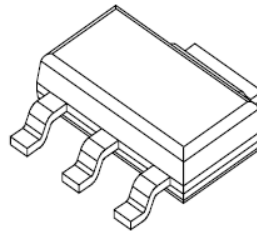
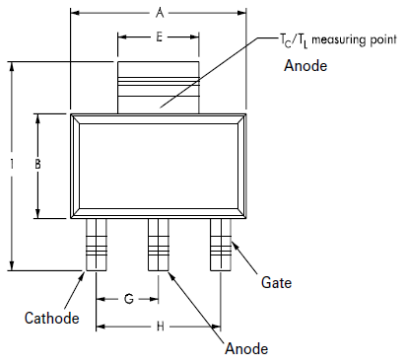
10. Package Dimensions

TO-92

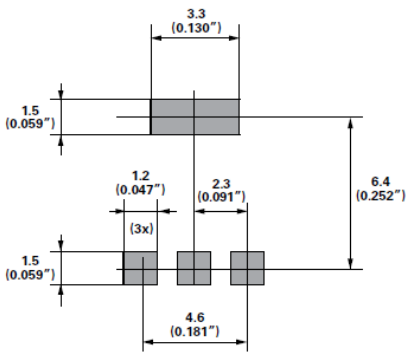


Dimension	Millimeters		Inches	
	Min	Max	Min	Max
A	4.450	5.200	0.175	0.205
B	4.320	5.330	0.170	0.210
C	12.700	-	0.500	-
D	3.430	-	0.135	-
E	3.180	4.190	0.125	0.165
F	2.040	2.660	0.080	0.105
G	0.407	0.533	0.016	0.021
H	1.150	1.390	0.045	0.055
I	2.420	2.660	0.095	0.105
J	0.380	0.500	0.015	0.020

SOT-223



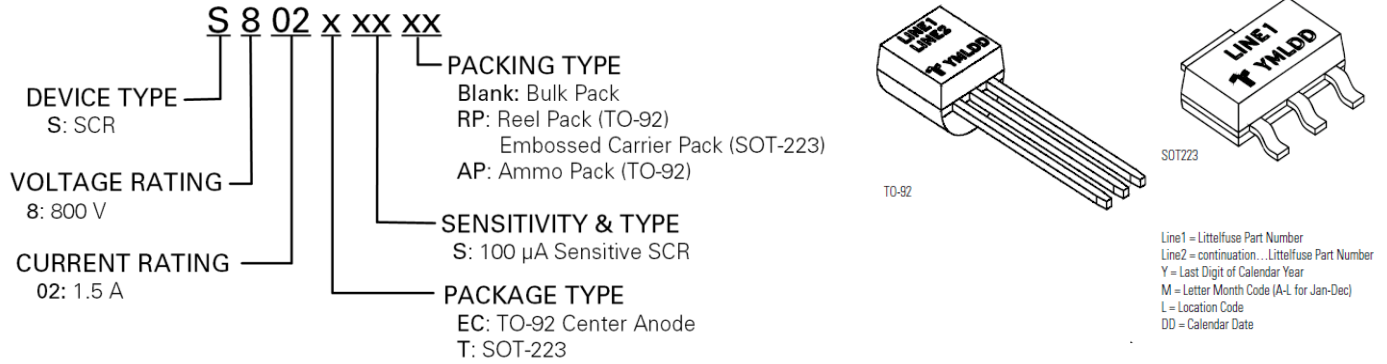
Pad Layout for SOT-223



\*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 $\mu$ A	TO-92
S802TS	X	100 $\mu$ A	SOT-223

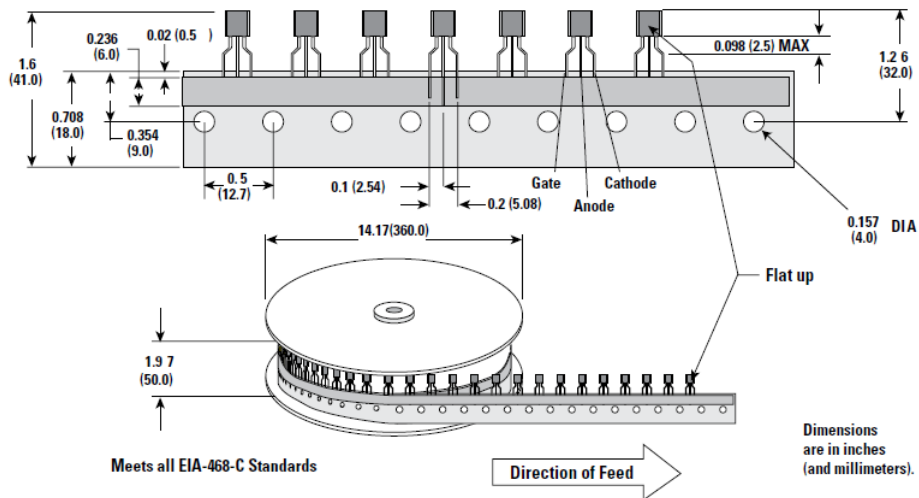
### 13. Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
S802ECS	S802ECS	0.217 g	Bulk	2500
S802ECSRP	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

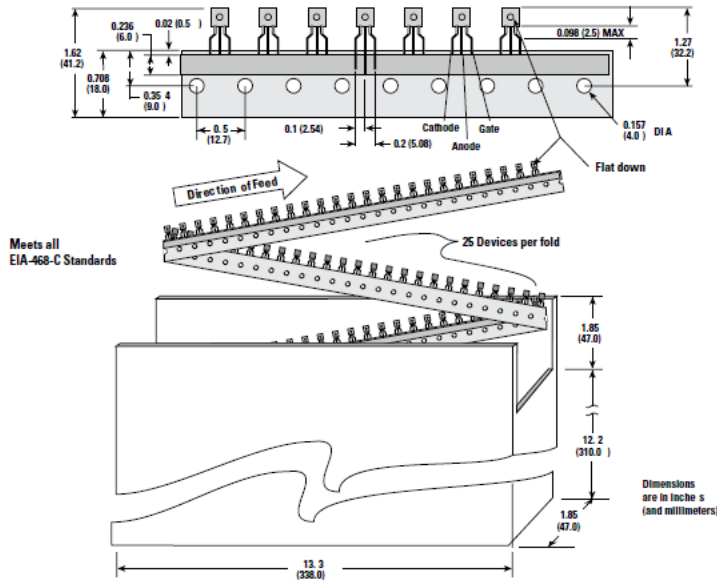
Meets all EIA-468-C Standards



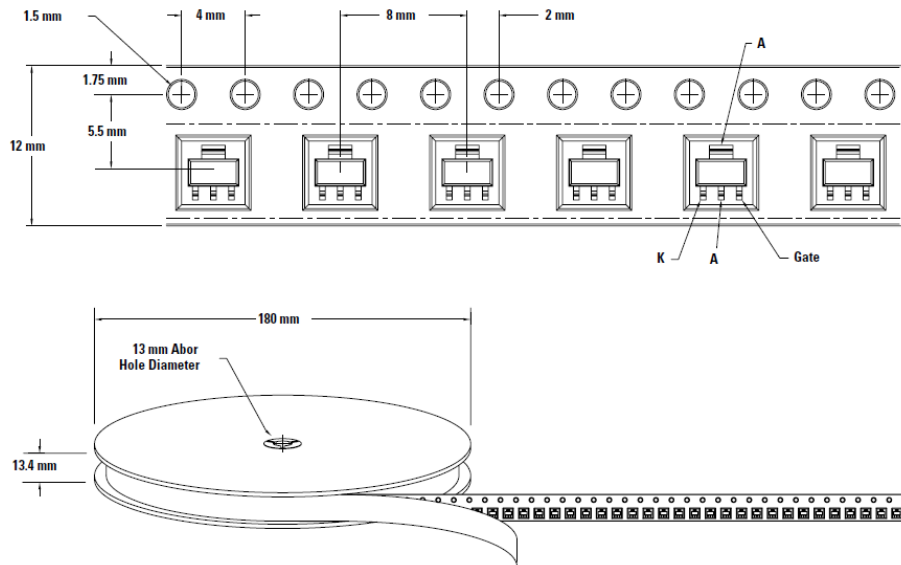


TO-92 (3-lead) Ammo Pack (AP) Radial Leaded Specifications

Meets all EIA-468-C Standards



SOT-223 Reel Pack (RP) Specifications



For additional information please visit [www.Littelfuse.com/powersemi](http://www.Littelfuse.com/powersemi)

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