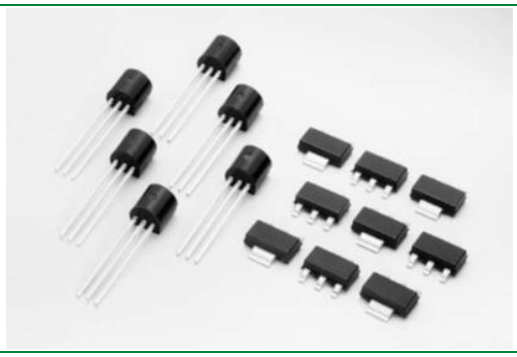
S802xSx Series
EV Series 1.5 Amp Sensitive SCRs



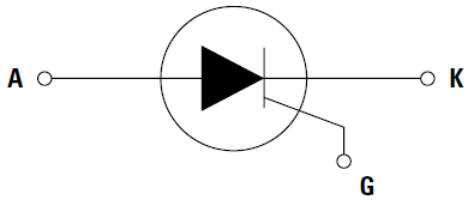
Agency Approvals and Environmental

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 µs)	1250	V
V_{RSM} (t_p = 50 µs)	900	V
I_{GT}	20 to 100	µA

Schematic Symbol



* TO-92 with GAK pin output

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.

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

Applications

- GFCI
- AFCI
- RCD
- RCBO

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

2. Thermal Characteristics

Symbol	Characteristic			Value	Unit
$R_{th(JC)}$	Thermal Resistance, junction-to-case (AC)	I_T = 1.5 A_{RMS}[1]	TO-92	35	°C/W
			SOT-223	25	
$R_{th(JA)}$	Thermal Resistance, junction-to-ambient (AC)	I_T = 1.5 A_{RMS}[1]	TO-92	150	°C/W
			SOT-223	60	

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

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

Symbol	Description	Conditions		Value			Unit
				Min	Typ	Max	
I_{GT}	DC Gate Trigger Current	V_D = 6 V, R_L = 100 Ω		20	60	100	µA
V_{GT}	DC Gate Trigger Voltage	V_D = 6 V, R_L = 100 Ω		-	-	0.8	V
V_{GRM}	Peak Reverse Gate Voltage	I_{RG} = 10 µA		8	-	-	V
I_H	Holding Current	R_{GK} = 1 kΩ, Initial current = 20 mA		-	-	3	mA
dv/dt	Critical Rate-of-rise of Off-stage Voltage	T_J = 125 °C, V_D = 67% of V_{DRM}, Exponential waveform	R_{GK} = 1 kΩ	40	-	-	V/µs
			R_{GK} = 220 Ω	250	-	-	
V_{GD}	Gate Non-trigger Voltage	V_D = ½ V_{DRM}, R_{GK} = 1 kΩ, T_J = 125 °C		0.2	-	-	V
t_q	Turn-off Time	I_T = 0.5 A		-	-	35	µs
t_{gt}	Turn-on Time	I_G = 10 mA, P_W = 15 µs, I_T = 1.6 A_{PK}		-	2.3	-	µs

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

Symbol	Description	Conditions	Maximum Value	Unit
V_{TM}	Peak On-state Voltage	1.5 A device, I_{TM} = 4 A, t_p = 380 µs	1.8	V
V_{TO}	Threshold Voltage	-	1.03	V
R_D	Dynamic Resistance	-	106	mΩ
I_{DRM}/I_{RRM}	Off-state Current, Peak Repetitive	T_J = 25 °C	3	µA
		T_J = 125 °C	500	

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5. Performance Curves

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

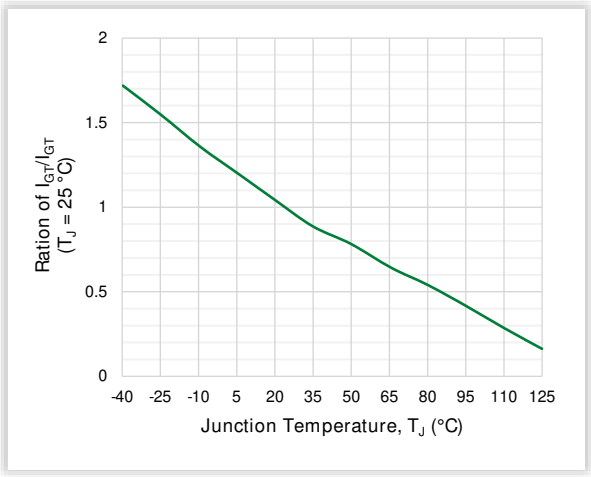

Figure 2. Normalized DC Holding Current vs. Junction Temperature

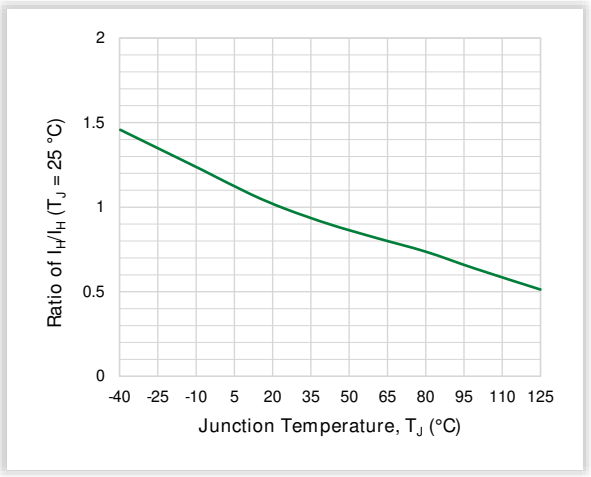

Figure 3. Normalized DC Gate Trigger Voltage vs. Junction Temperature

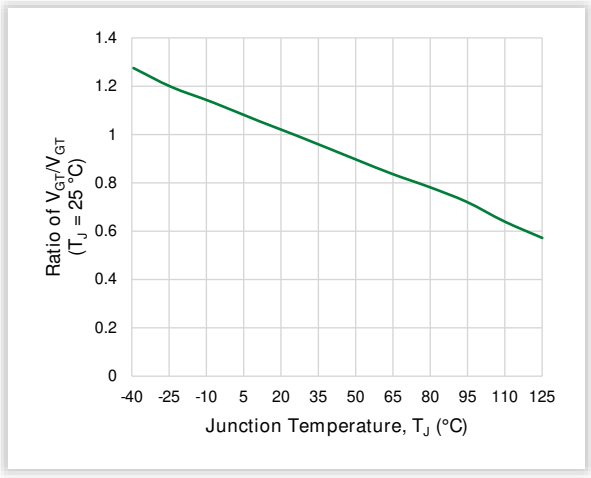

Figure 4. Typical On-state Current vs. On-state Voltage

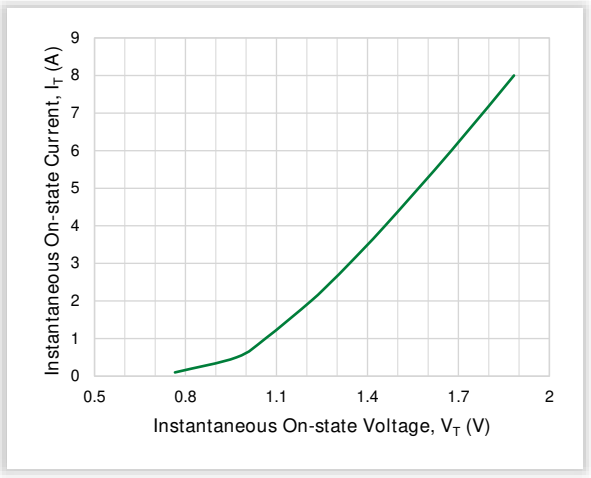

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Figure 5. Typical Power Dissipation vs. RMS On-state Current

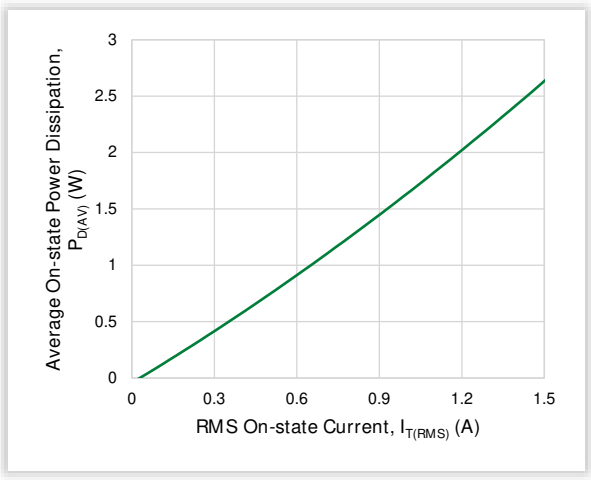


Figure 6. Maximum Allowable Case Temperature vs. On-state Current

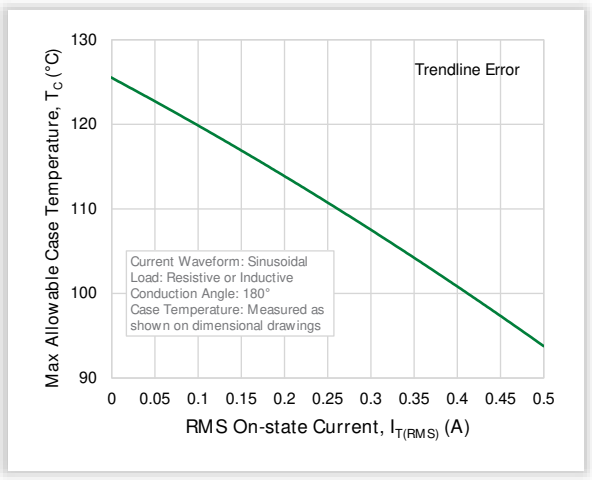
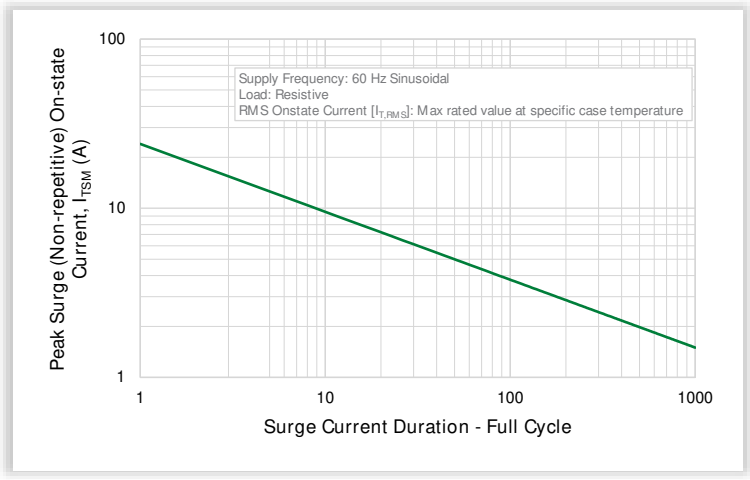


Figure 7. Surge Peak On-state Current vs. Number of Cycles



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.

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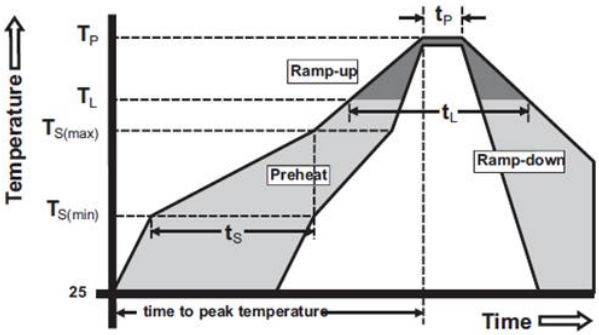
6. Soldering Parameters



Parameter		Value
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 to 120 s
Average Ramp-up Rate Liquidus Temp., T_L to peak		3 °C/s (Max)
$T_{S(Max)}$ 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

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

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.

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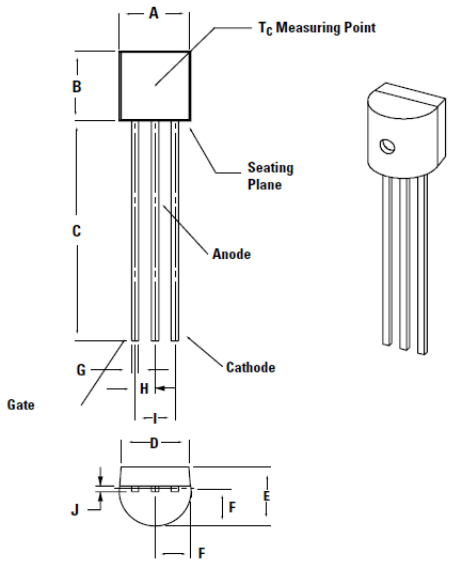
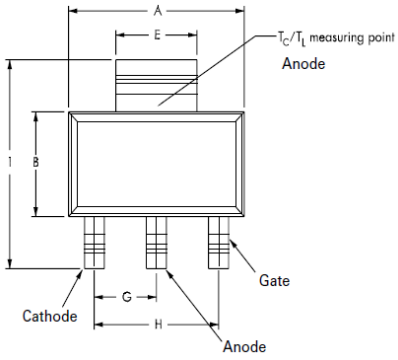
10. Package Dimensions

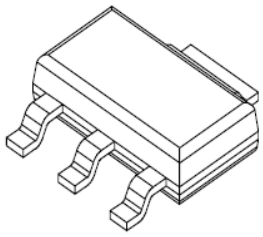
TO-92

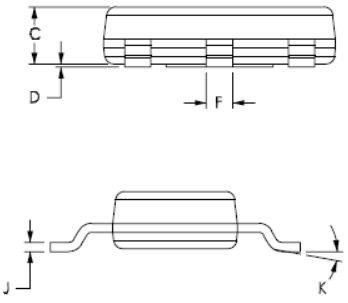


Dimension	Millimeters		Inches	
	Min	Max	Min	Max
A	4.450	5.200	0.175	0.205
B	4.320	5.330	0.170	0.210
C	12.700	-	0.500	-
D	3.430	-	0.135	-
E	3.180	4.190	0.125	0.165
F	2.040	2.660	0.080	0.105
G	0.407	0.533	0.016	0.021
H	1.150	1.390	0.045	0.055
I	2.420	2.660	0.095	0.105
J	0.380	0.500	0.015	0.020

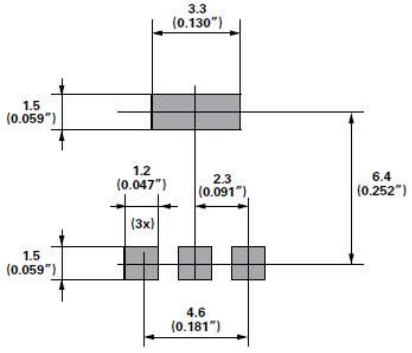
SOT-223







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					

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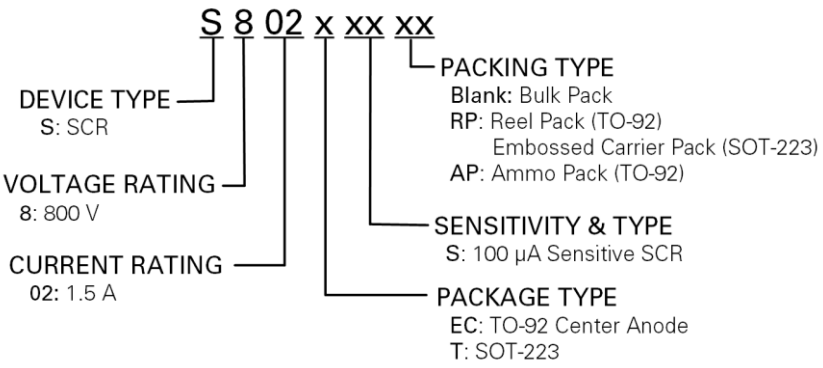
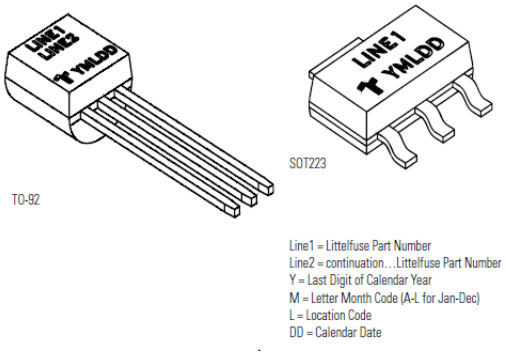
11. Part Numbering and Marking





Line1 = Littelfuse Part Number
Line2 = continuation…Littelfuse Part Number
Y = Last Digit of Calendar Year
M = Letter Month Code (A-L for Jan-Dec)
L = Location Code
DD = Calendar Date

12. Product Selector

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

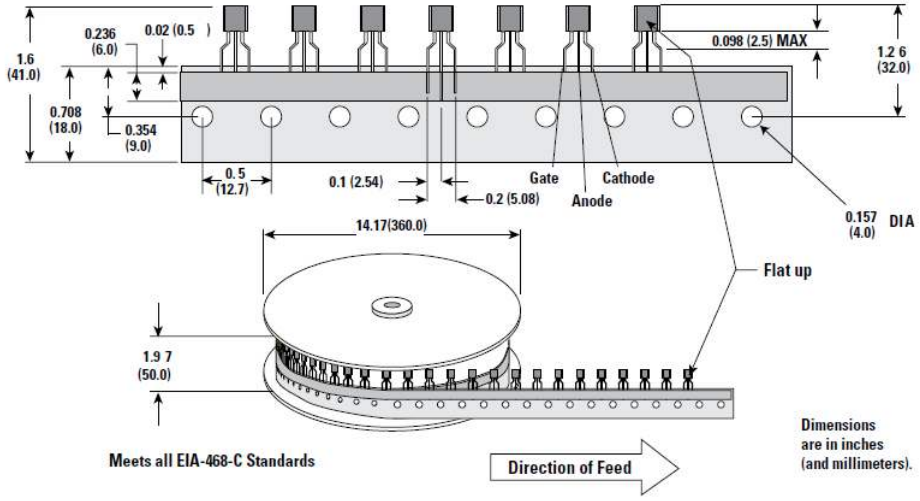
13. Packing Options

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



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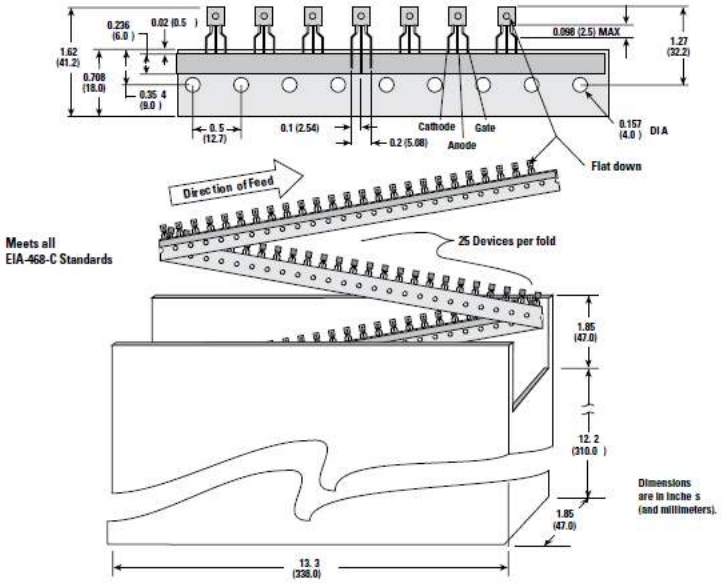
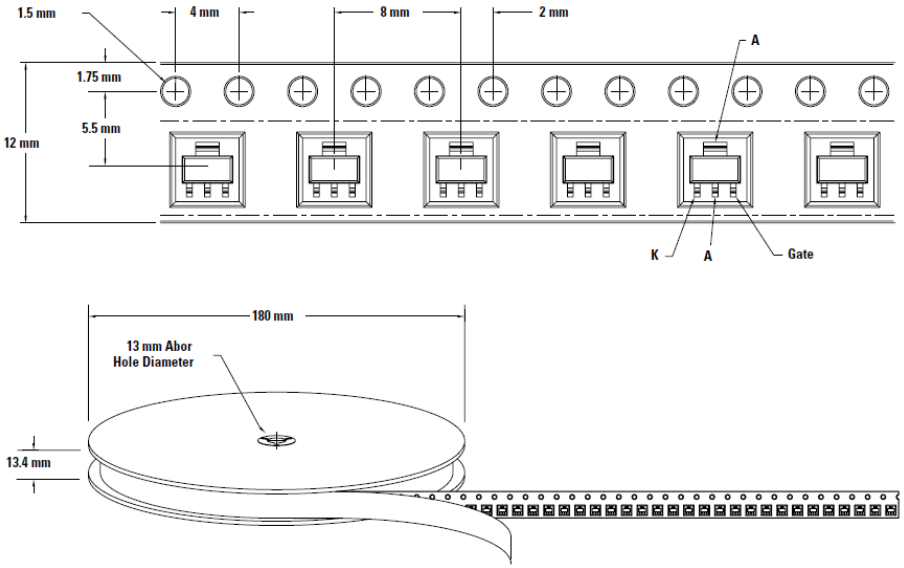
TO-92 (3-lead) Ammo Pack (AP) Radial Leaded Specifications

Meets all EIA-468-C Standards



SOT-223 Reel Pack (RP) Specifications



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