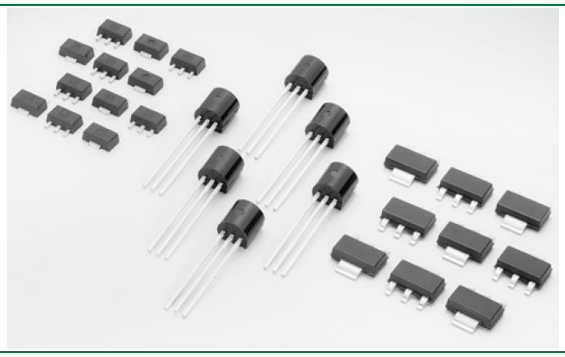
SxX8xSx Series
EV Series 0.8 A Sensitive SCRs



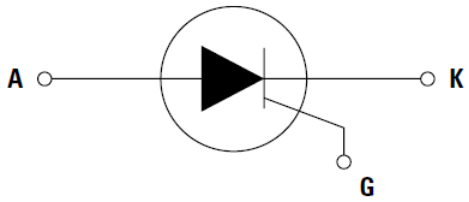
Agency Approvals and Environmental

Environmental Approvals
RoHS HF

Product Summary

Characteristic	Value	Unit
$I_{T(RMS)}$	0.8	A
V_{DRM} / V_{RRM}	400, 600, or 800	V
I_{GT}	5 to 200	µA

Schematic Symbol



Product Description

This new component series offers high static dv/dt and low turn off time (tq) sensitive SCR. It is specifically designed for Ground Fault Circuit Interrupter (GFCI) and Gas Ignition applications. All SCRs junctions are glass-passivated to ensure long term reliability and parametric stability.

Features

- Surge capability > 10 A
- Blocking voltage (V_{DRM} / V_{RRM}) capability up to 800 V
- High dv/dt noise immunity
- Improved turn-off time (t_q) < 25 µsec
- Sensitive gate for direct microprocessor interface
- Through-hole and surface-mount packages
- RoHS compliant and Halogen-Free

Applications

The SxX8xSx EV series is specifically designed for Ground Fault Circuit Interrupter (GFCI) and gas ignition applications.

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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 = 55 °C	0.8	A
		SOT-89	T_C = 60 °C		
		SOT-223	T_L = 60 °C		
$I_{T(AV)}$	Average On-state Current	TO-92	T_C = 55 °C	0.51	A
		SOT-89	T_C = 60 °C		
		SOT-223	T_L = 60 °C		
I_{TSM}	Non-repetitive Surge Peak On-state Current (Single Cycle, $T_{J,Initial}$ = 25 °C)	TO-92 SOT-89 SOT-223	f = 50 Hz	8	A
			f = 60 Hz	10	
I^2t	I^2t Value for Fusing	t_p = 10 ms	f = 50 Hz	0.32	A^2s
		t_p = 8.3 ms	f = 60 Hz	0.41	
di/dt	Critical Rate of Rise of On-state Current I_G =10 mA	TO-92 SOT-89 SOT-223	T_J = 125 °C	50	A/µs
I_{GM}	Peak Gate Current	t_p = 10 µs	T_J = 125 °C	1.0	A
$P_{G(AV)}$	Average Gate Power Dissipation	-	T_J = 125 °C	0.1	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 = 0.8 $A_{(RMS)}$[1]	TO-92	75	°C/W
			SOT-223	30	
			SOT-89	50	
$R_{th(JA)}$	Thermal Resistance, junction-to-ambient	I_T = 0.8 $A_{(RMS)}$[1]	TO-92	150	°C/W
			SOT-223	60	
			SOT-89	90	

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

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

Symbol	Description	Conditions	SxX8yS1			SxX8yS2			SxX8yS			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{GT}	DC Gate Trigger Current	V_D = 6 V, R_L = 100 Ω	0.5		5	1		50	15		200	µA
V_{GT}	DC Gate Trigger Voltage	V_D = 6 V, R_L = 100 Ω	-	-	0.8	-	-	0.8	-	-	0.8	V
V_{GRM}	Peak Reverse Gate Voltage	I_{RG} = 10 µA	5		-	5		-	5		-	V
I_H	Holding Current	R_{GK} = 1 kΩ, Initial current = 20 A	-		5	-		5	-		5	mA
(dv/dt)s	Critical Rate-of-rise of Off-stage Voltage	T_J = 125 °C, V_D =V_{DRM}/V_{RRM}, R_{GK} = 1 kΩ, Exponential waveform	75		-	75		-	75		-	V/µs
t_q	Turn-off Time	T_J = 25 °C @ 600 V, R_{GK} = 1 kΩ	-		30	-		25	-		25	µs
t_{gt}	Turn-on Time	I_G = 10 mA, P_W = 15 µs, I_T = 1.6 A_{PK}	-	2	-	-	2	-	-	2	-	µs
V_{GD}	Gate Non-trigger Voltage	V_D = V_{DRM}, R_{GK} = 1 kΩ, T_J = 125 °C	0.2		-	0.2		-	0.2		-	V

Note: x = voltage /100, y = package

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

Symbol	Description	Conditions	Value		Unit
			Min	Max	
V_{TM}	Peak On-state Voltage	I_{TM} = 1.6 A_{pk}	-	1.70	V
I_{DRM}	Off-state Current, Peak Repetitive	T_J = 25 °C @ V_D = V_{DRM}, R_{GK} = 1 kΩ	-	3	µA
		T_J = 125 °C @ V_D = V_{DRM}, R_{GK} = 1 kΩ	-	500	

5. Performance Curves

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

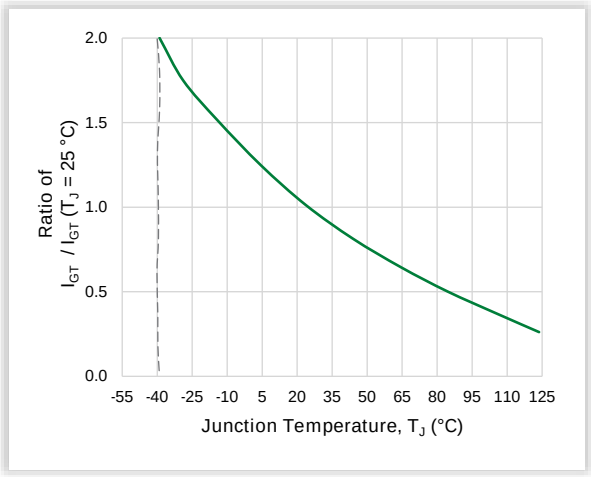


Figure 2. Normalized DC Holding Current vs. Junction Temperature

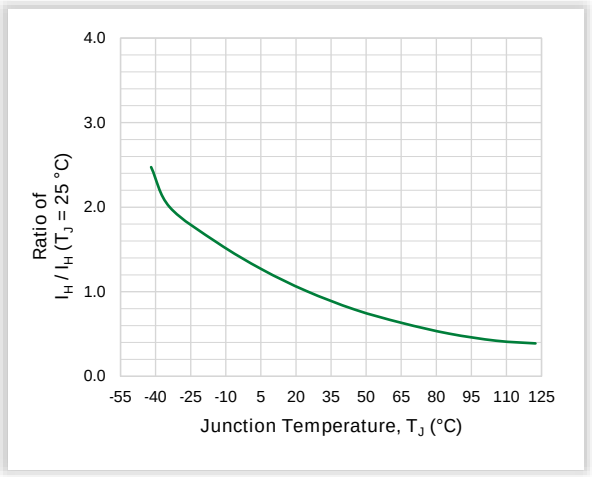


Figure 3. Normalized DC Gate Trigger Voltage vs. Junction Temperature

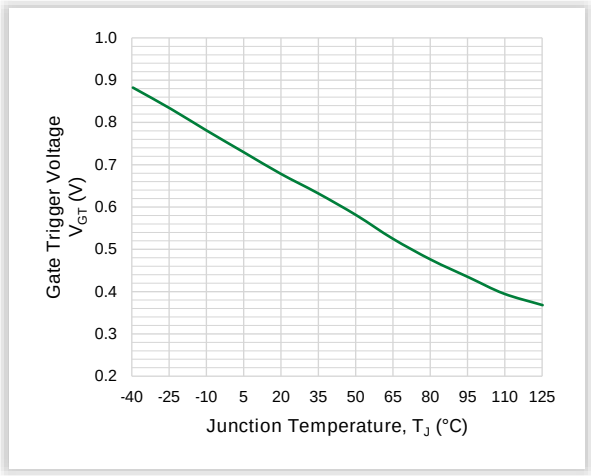


Figure 4. Typical On-state Current vs. On-state Voltage

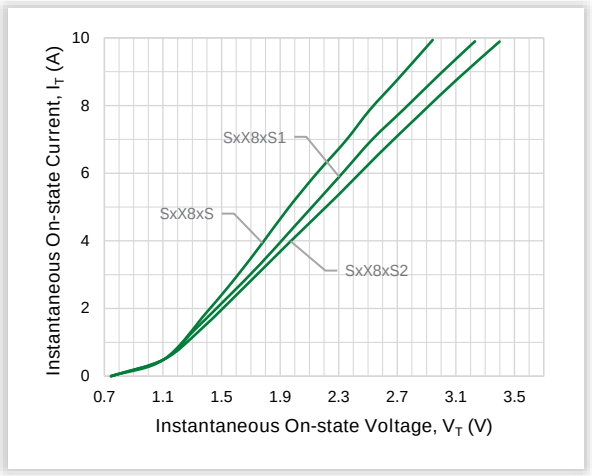


Figure 5. Typical Power Dissipation vs. RMS On-state Current

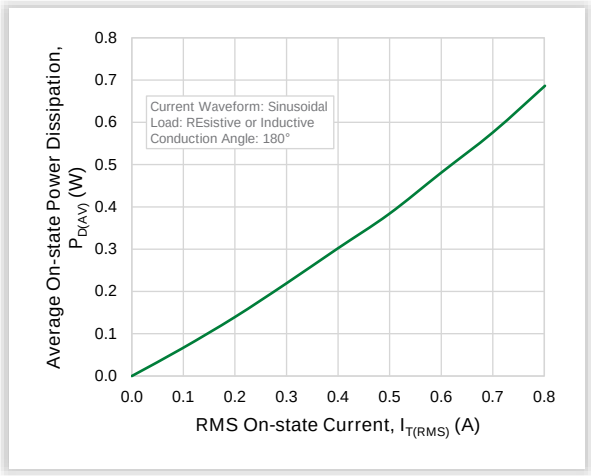


Figure 6. Maximum Allowable Case Temperature vs. On-state Current

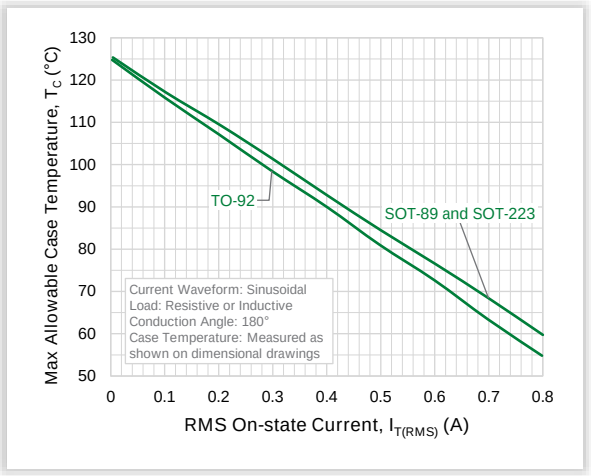


Figure 7. Typical DC Gate Trigger Current with R_{GK} vs. Junction Temperature for S6X8xS

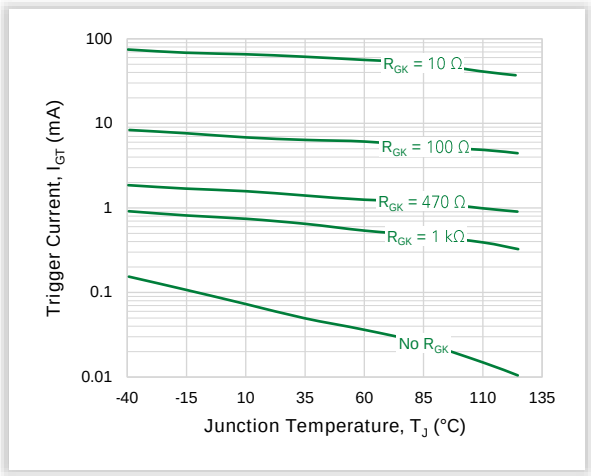


Figure 8. Typical DC Gate Trigger Current with R_{GK} vs. Junction Temperature for S8X8xS

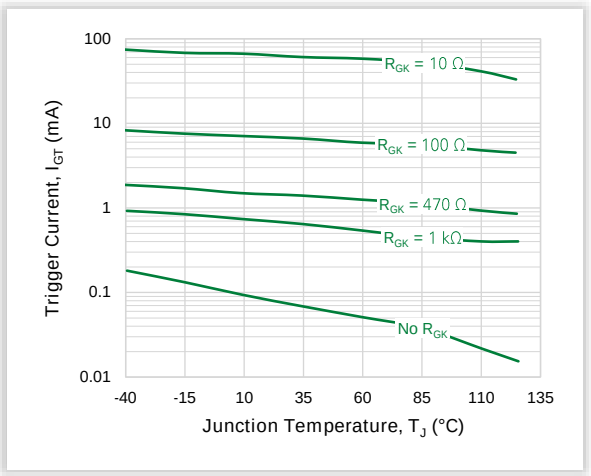


Figure 9. Typical DC Holding Current with R_{GK} vs. Junction Temperature for S6X8xS

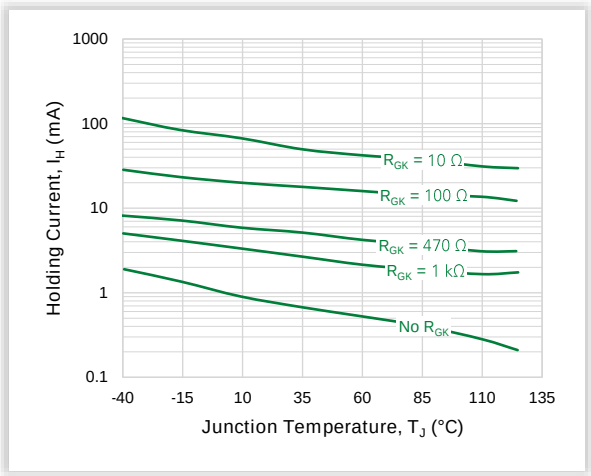


Figure 10. Typical DC Holding Current with R_{GK} vs. Junction Temperature for S8X8xS

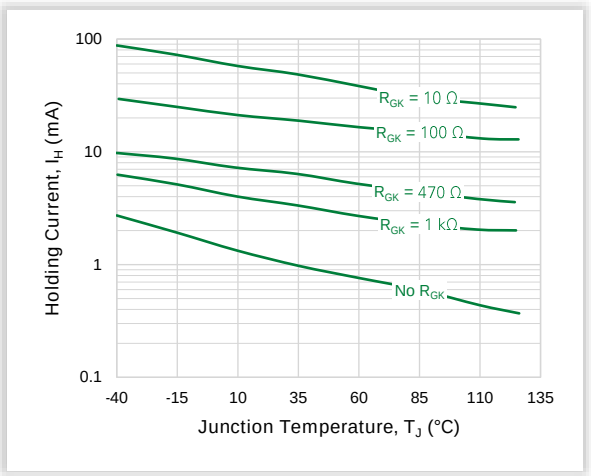


Figure 11. Typical DC Static dv/dt with R_{GK} vs. Junction Temperature for S6X8xS

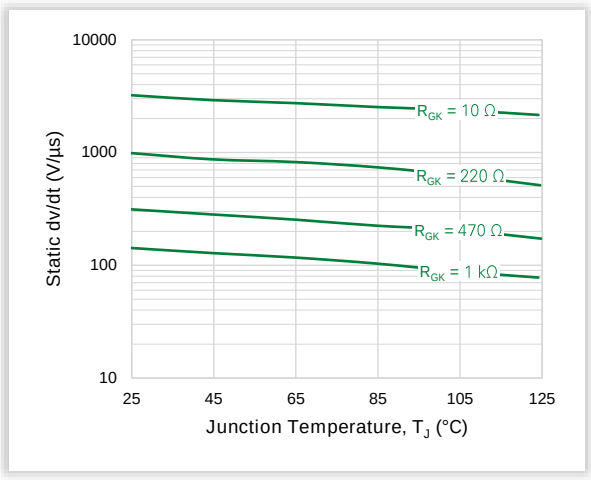


Figure 12. Typical DC Static dv/dt with R_{GK} vs. Junction Temperature for S8X8xS

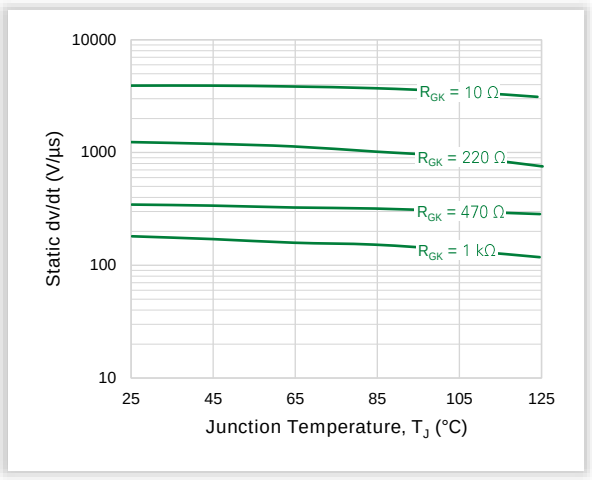


Figure 13. Typical DC Turn-off Time with R_{GK} vs. Junction Temperature for S6X8xS

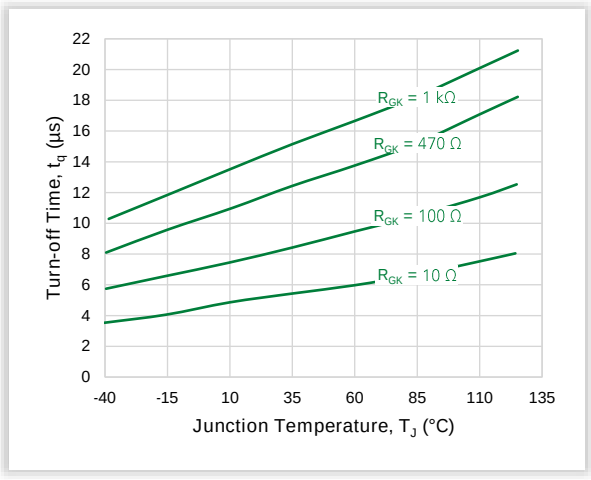


Figure 14. Typical DC Turn-off Time with R_{GK} vs. Junction Temperature for S8X8xS

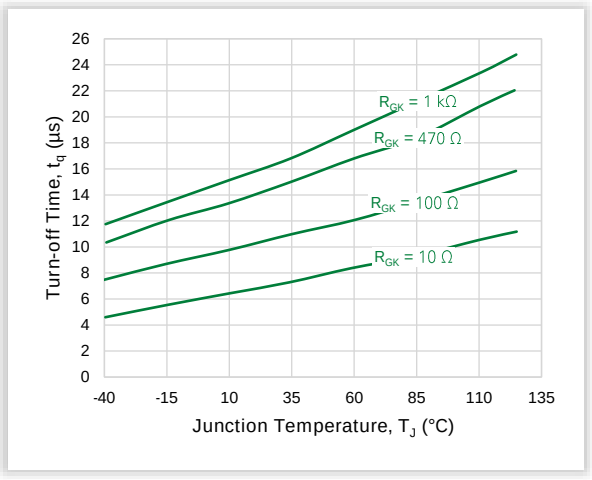
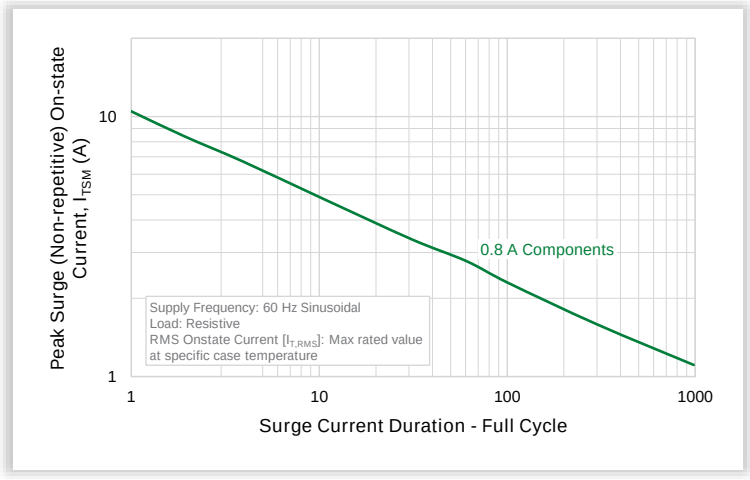


Figure 15. Surge Peak On-state Current vs. Number of Cycles

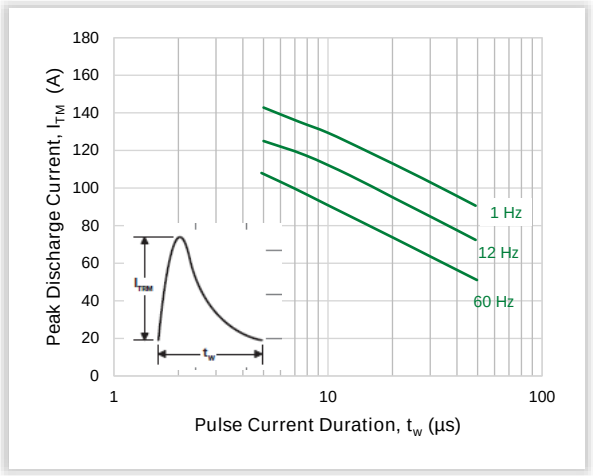


Notes

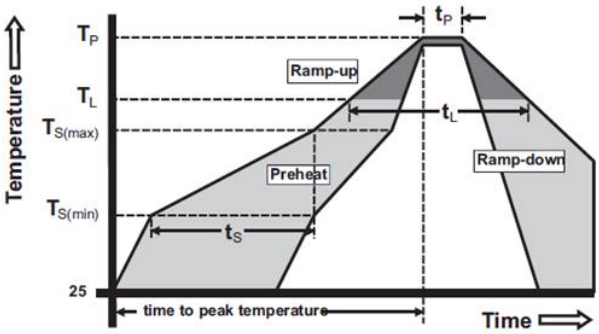
1. Gate control may be lost during and immediately following surge current interval.

2. Overload may not be repeated until junction temperature has returned to steady-state rated value.

Figure 16. Peak Repetitive Sinusoidal Pulse Current



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 180 s
Average Ramp-up Rate Liquidus Temp., T_L to peak		5 °C/s (Max)
$T_{S(Max)}$ to T_L Ramp-up Rate		5 °C/s (Max)
Reflow	Temperature, T_L Liquidus	217 °C
	Time, t_S	60 to 150 s
Peak Temperature, T_P		260 °C (±5 °C)
Time within 5 °C of Actual Peak Temperature, t_P		20 to 40 s
Ramp-down Rate		5 °C/s (Max)
Time 25 °C to Peak Temperature, T_P		8 minutes (Max)
Do Not Exceed		280 °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

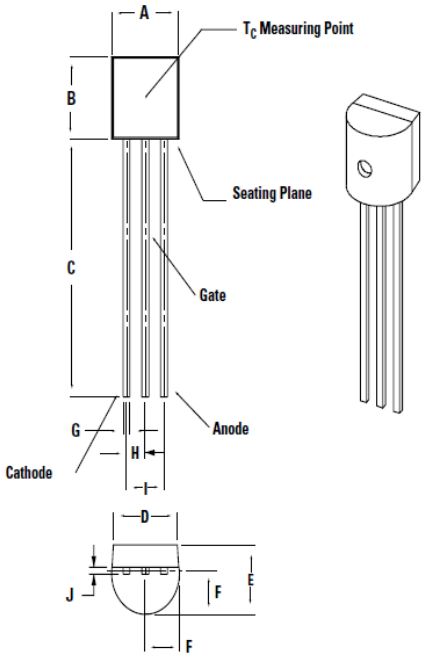
Test	Specifications and Conditions
AC Blocking	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 110°C for 1008 hours
Temperature Cycling	MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15 min dwell time
Temperature/Humidity	EIA / JEDEC, JESD22-A101 1008 hours; 320V - DC: 85°C; 85% relative humidity
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
Lead Bend	MIL-STD-750, M-2036 Cond E

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.

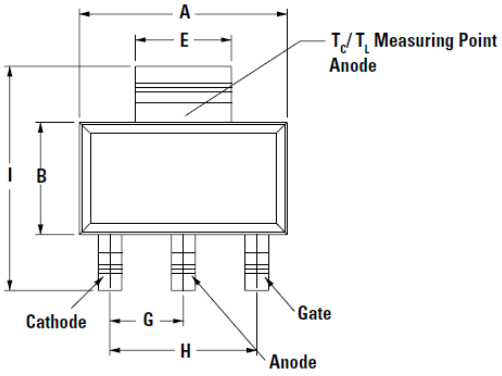
10. Package Dimensions

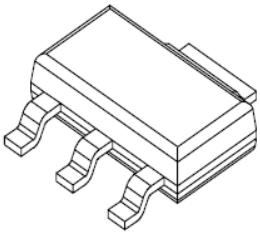
TO-92

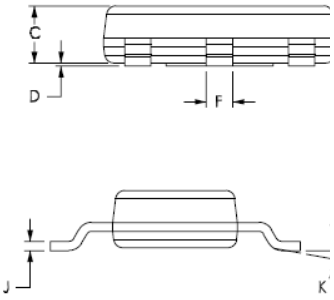


Dimension	Millimeters		Inches	
	Min	Max	Min	Max
A	4.450	5.200	0.175	0.205
B	4.320	5.330	0.170	0.210
C	12.700	-	0.500	-
D	3.430	-	0.135	-
E	3.180	4.190	0.125	0.165
F	2.040	2.660	0.080	0.105
G	0.407	0.533	0.016	0.021
H	1.150	1.390	0.045	0.055
I	2.420	2.660	0.095	0.105
J	0.380	0.500	0.015	0.020

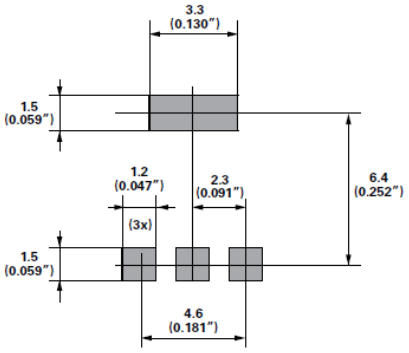
SOT-223







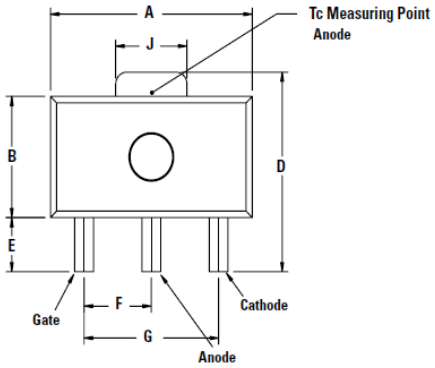
Pad Layout for SOT-223



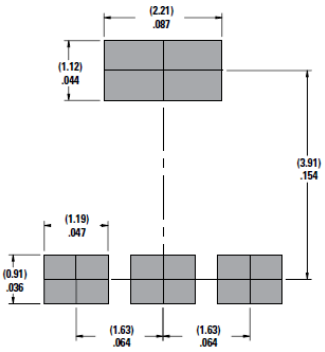
*Dimensions in millimeters (inches)

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					

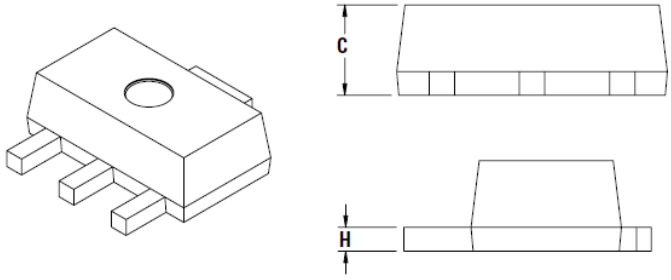
SOT-89



Pad Layout for SOT-89

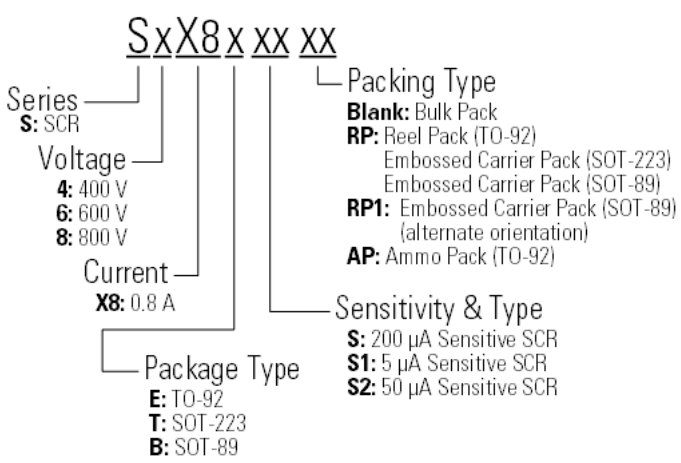


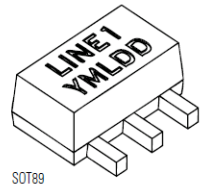
*Dimensions in millimeters (inches)



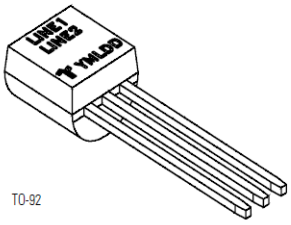
Dimension	Millimeters			Inches		
	Min	Typ	Max	Min	Typ	Max
A	4.40	-	4.60	0.173	-	0.181
B	2.29	-	2.60	0.090	-	0.102
C	1.40	-	1.60	0.055	-	0.063
D	3.94	-	4.25	0.155	-	0.167
E	0.81	-	1.20	0.032	-	0.047
F	-	1.50	-	-	0.059	-
G	-	3	-	-	0.118	-
H	0.35	-	0.44	0.014	-	0.017
I	0.36	-	0.48	0.014	-	0.019
J	-	1.65	-	-	0.065	-

11. Part Numbering and Marking





SOT89



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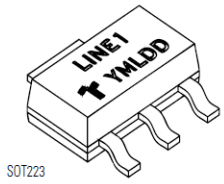


SOT223

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
	400 V	600 V	800 V		
SxX8BS	X	X	-	200 µA	SOT-89
SxX8ES	X	X	X	200 µA	TO-92
SxX8TS	X	X	X	200 µA	SOT-223
SxX8BS1	X	X	-	5 µA	SOT-89
SxX8ES1	X	X	X	5 µA	TO-92
SxX8TS1	X	X	X	5 µA	SOT-223
SxX8BS2	X	X	-	50 µA	SOT-89
SxX8ES2	X	X	X	50 µA	TO-92
SxX8TS2	X	X	X	50 µA	SOT-223

13. Packing Options

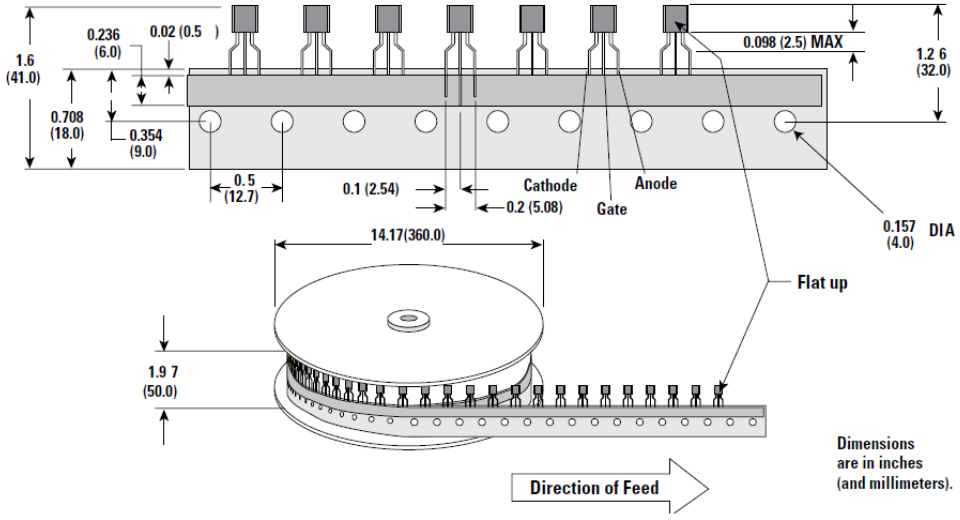
Part Number	Marking	Weight	Packing Mode	Base Quantity
SxX8ESy	SxX8ESy	0.217 g	Bulk	2500
SxX8ESyAP	SxX8ESy	0.217 g	Ammo Pack	2000
SxX8ESyRP	SxX8ESy	0.217 g	Tape & Reel	2000
SxX8TSyRP	SxX8TSy	0.120 g	Tape & Reel	1000
SxX8BSyRP	xX8y	0.053 g	Tape & Reel	1000
SxX8BSyRP1	xX8y	0.053 g	Tape & Reel	1000

Note: x = voltage/100, y = gate sensitivity

14. Packing Specifications

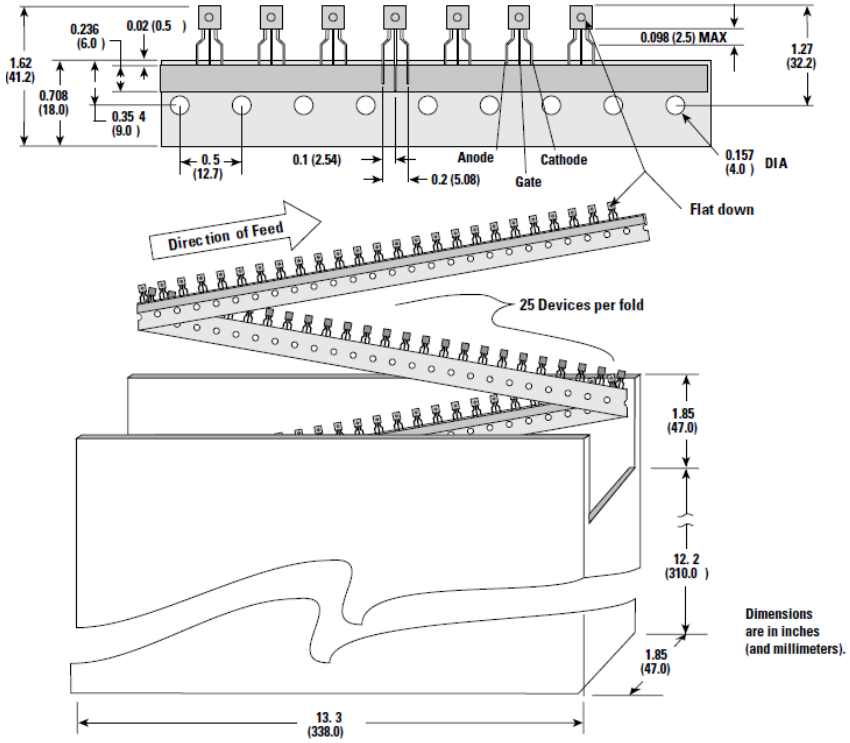
TO-92 (3-lead) Reel Pack (RP) Radial Leaded Specifications

Meets all EIA-468-C Standards



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

Meets all EIA-468-C Standards



SOT-89 Reel Pack (RP) Specifications