Littelfuse®
Expertise Applied | Answers Delivered

Thyristors

EV Series 0.8 Amp Sensitive SCRs

SxX8xSx EV Series

HF RoHS

Description

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

Main Features

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

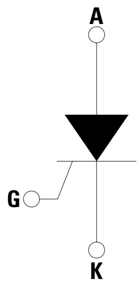
Features

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

Applications

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

Schematic Symbol



Absolute Maximum Ratings

Symbol	Parameter			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	0.8	A
		SOT-223	T_L = 60°C	0.8	A
$I_{T(AV)}$	Average on-state current	TO-92	T_C = 55°C	0.51	A
		SOT-89	T_C = 60°C	0.51	A
		SOT-223	T_L = 60°C	0.51	A
I_{TSM}	Non repetitive surge peak on-state current (Single cycle, T_J initial = 25°C)	TO-92 SOT-89 SOT-223	F= 50Hz	8	A
			F= 60Hz	10	A
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	A^2s
di/dt	Critical rate of rise of on-state current I_G = 10mA	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

Revised: 01/27/20

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

Symbol	Description	Test Conditions	Limit	Value			Unit
				SxX8yS1	SxX8yS2	SxX8yS	
I_{GT}	DC Gate Trigger Current	V_D = 6V R_L = 100 Ω	MIN.	0.5	1	15	µA
			MAX.	5	50	200	µA
V_{GT}	DC Gate Trigger Voltage	V_D = 6V R_L = 100 Ω	MAX.	0.8			V
V_{GRM}	Peak Reverse Gate Voltage	I_{RG} = 10µA	MIN.	5			V
I_H	Holding Current	R_{GK} = 1 KΩ Initial Current = 20mA	MAX.	5			mA
(dv/dt)s	Critical Rate-of-Rise of Off-State Voltage	T_J = 125°C V_D = V_{DRM} /V_{RRM} Exp. Waveform R_{GK} =1 kΩ	MIN.	75			V/µs
V_{GD}	Gate Non-Trigger Voltage	V_D = V_{DRM} R_{GK} =1 kΩ T_J = 125°C	MIN.	0.2			V
t_q	Turn-Off Time	T_J = 25°C @ 600 V R_{GK} =1 kΩ	MAX.	30	25	25	µs
t_{gt}	Turn-On Time	I_G=10mA PW = 15µsec I_T = 1.6A(pk)	TYP.	2.0	2.0	2.0	µs

Note: x = voltage/100, y = package

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

Symbol	Description	Test Conditions	Limit	Value	Unit
V_{TM}	Peak On-State Voltage	I_{TM} = 1.6A (pk)	MAX.	1.70	V
I_{DRM}	Off-State Current, Peak Repetitive	T_J = 25°C @ V_D = V_{DRM} R_{GK} =1 kΩ	MAX.	3	µA
		T_J = 125°C @ VD = V_{DRM} R_{GK} =1 kΩ	MAX.	500	µA

Thermal Resistances

Symbol	Description	Test Conditions		Value	Unit
$R_{ΘJC}$	Junction to case (AC)	I_T = 0.8A $_{(RMS)}$ [1]	TO-92	75	°C/W
			SOT-223	30	°C/W
			SOT-89	50	°C/W
$R_{ΘJC}$	Junction to ambient	I_T = 0.8A $_{(RMS)}$ [1]	TO-92	150	°C/W
			SOT-223	60	°C/W
			SOT-89	90	°C/W

1 - 60Hz AC resistive load condition, 100% conduction.

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

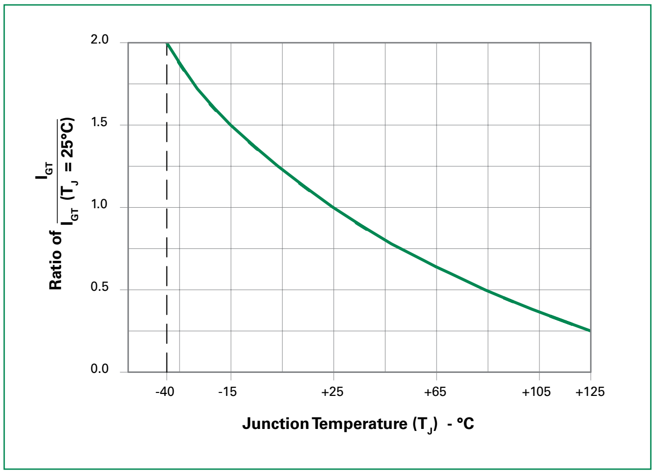


Figure 2: Normalized DC Holding Current vs. Junction Temperature

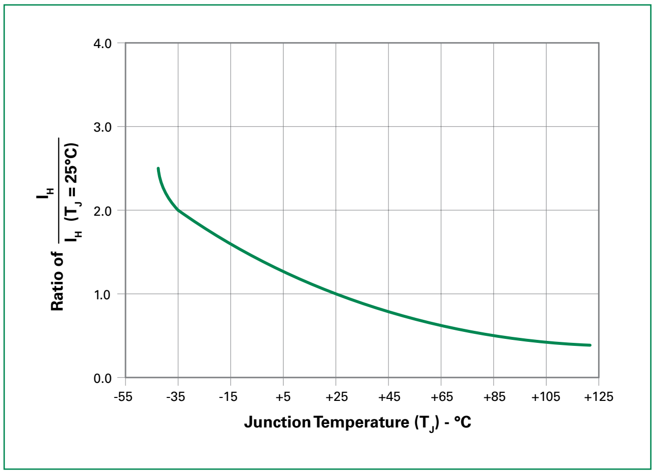


Figure 3: Normalized DC Gate Trigger Voltage vs. Junction Temperature

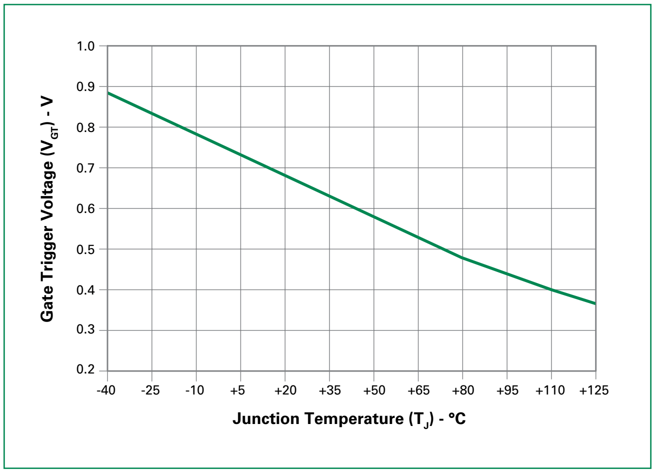


Figure 4: On-State Current vs. On-State Voltage (Typical)

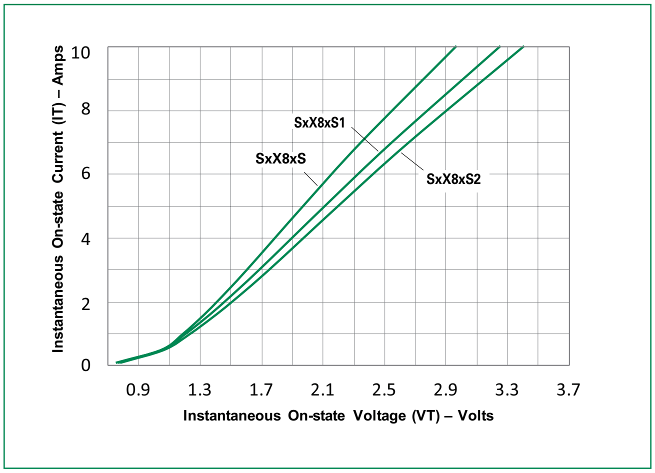


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

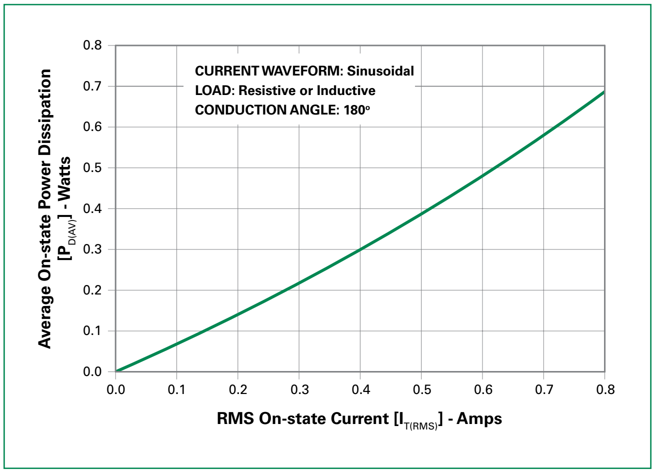


Figure 6: Maximum Allowable Case Temperature vs. On-State Current

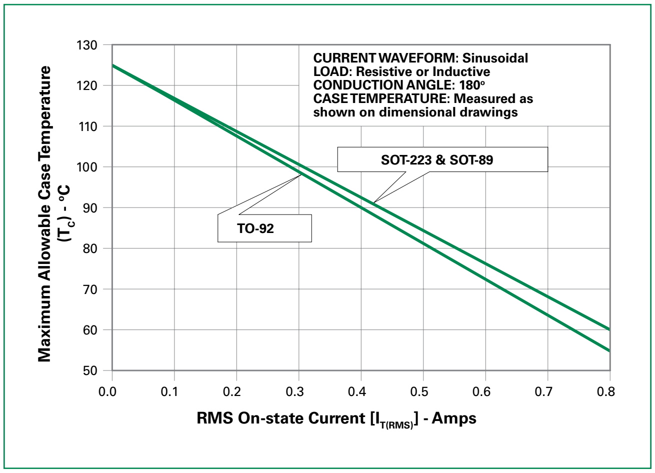


Figure 7-1: Typical DC Gate Trigger Current with R_{GK} vs. Junction Temperature for S6X8BS

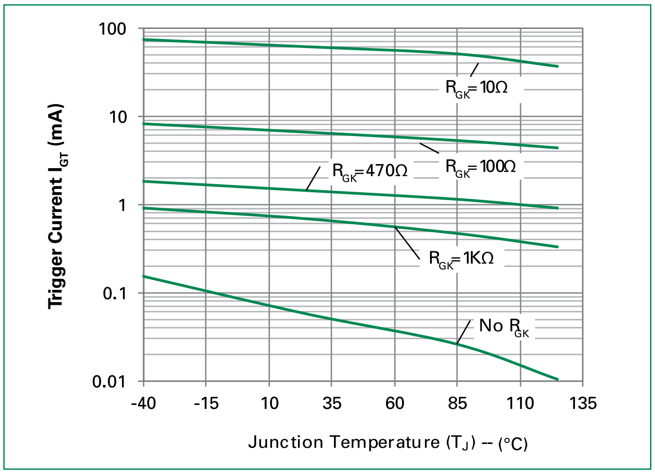


Figure 7-2: Typical DC Gate Trigger Current with R_{GK} vs. Junction Temperature for S8X8ESRP

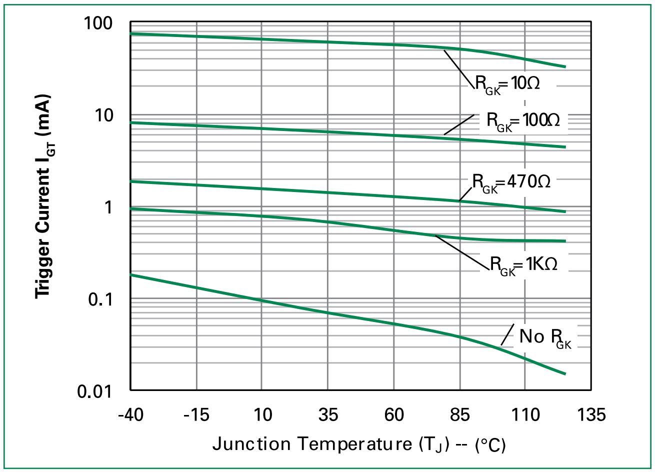


Figure 8-1: Typical DC Holding Current with RGK vs. Junction Temperature for S6X8BS

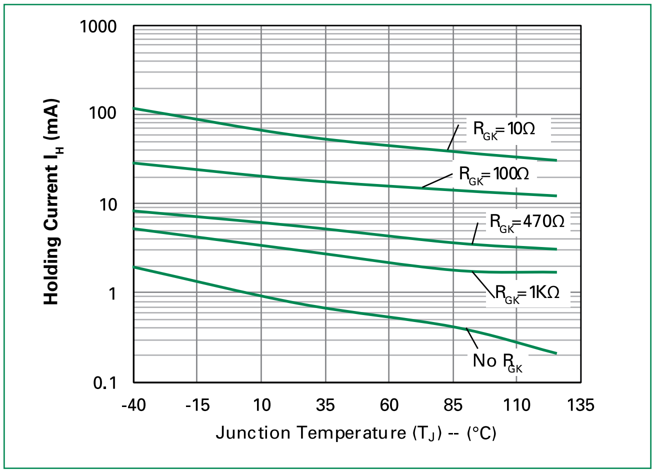


Figure 7-2: Typical DC Holding Current with R_{GK} vs. Junction Temperature for S8X8ESRP

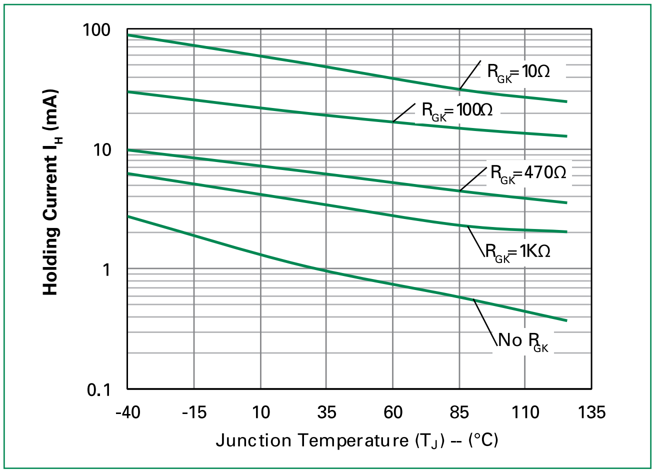


Figure 9-1: Typical DC Static dv/dt with R_{GK} vs. Junction Temperature for S6X8BS

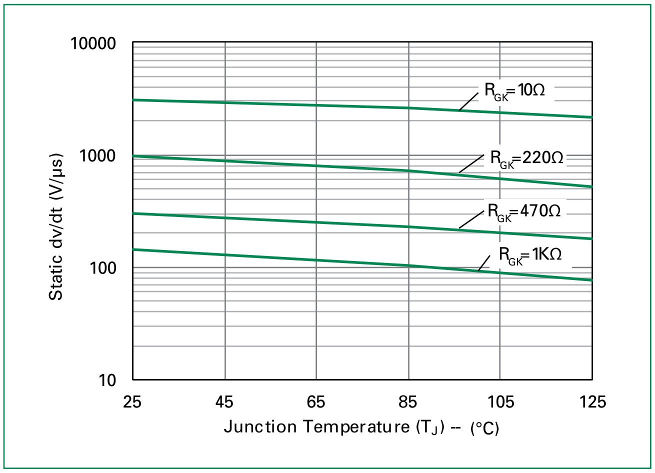


Figure 9-2: Typical DC Static dv/dt with R_{GK} vs. Junction Temperature for S8X8ESRP

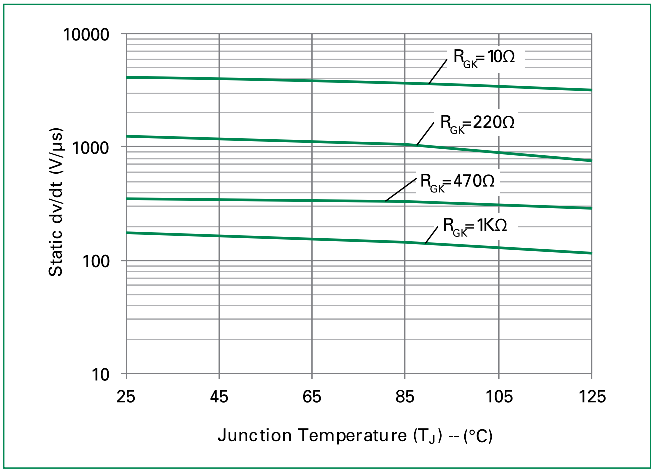


Figure 10-1: Typical DC turn off time with R_{GK} vs. Junction Temperature for S6X8BS

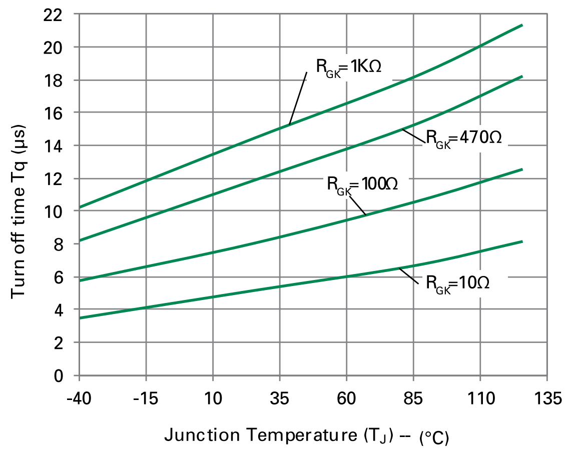


Figure 10-2: Typical DC turn off time with R_{GK} vs. Junction Temperature for S8X8ESRP

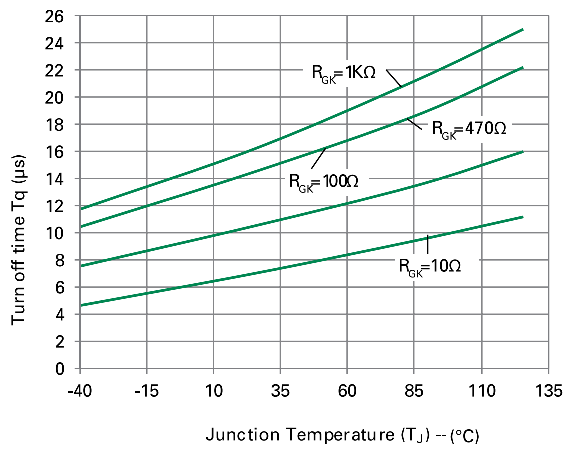
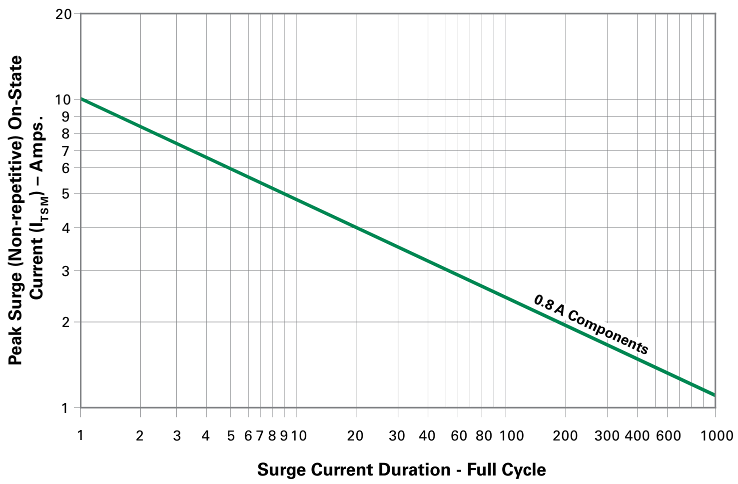


Figure 11: Surge Peak On-State Current vs. Number of Cycles

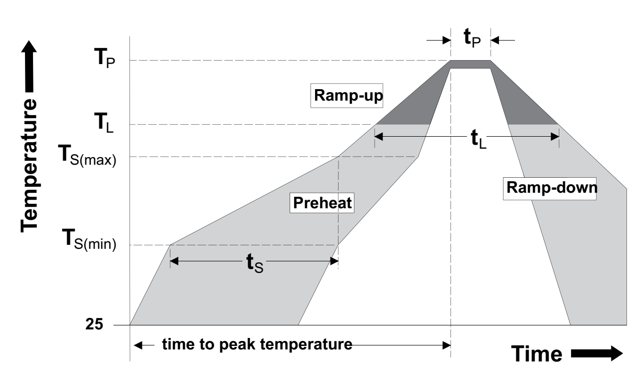


Supply Frequency: 60Hz Sinusoidal
Load: Resistive
RMS On-State Current [$I_{T(RMS)}$]: Max Rated Value at Specific Case Temperature

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.

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)		$260^{+0/-5}$ °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



Additional Information

Datasheet | Resources | Samples

Physical Specifications

Terminal Finish	100% Matte Tin-plated.
Body Material	UL Recognized compound meeting flammability rating V-0
Lead Material	Copper Alloy

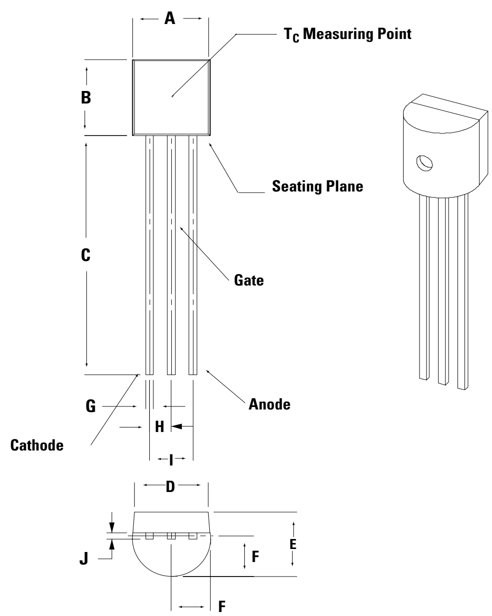
Design Considerations

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.

Reliability/Environmental Tests

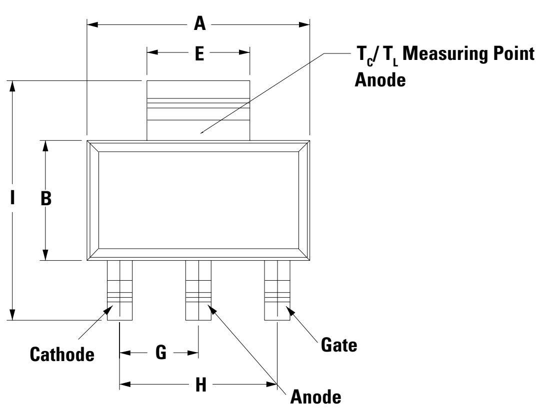
Test	Specifications and Conditions
AC Blocking	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 110°C for 1008 hours
Temperature Cycling	MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15-min dwell-time
Temperature/Humidity	EIA / JEDEC, JESD22-A101 1008 hours; 320V - DC: 85°C; 85% rel humidity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

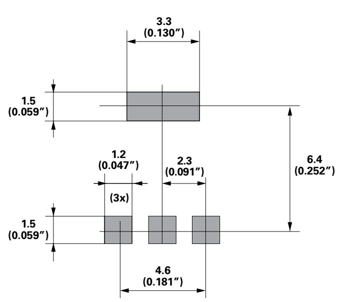
Dimensions – TO-92



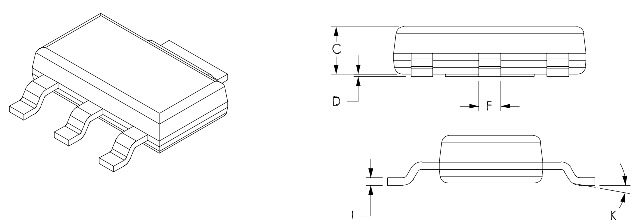
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.175	0.205	4.450	5.200
B	0.170	0.210	4.320	5.330
C	0.500		12.70	
D	0.135		3.430	
E	0.125	0.165	3.180	4.190
F	0.080	0.105	2.040	2.660
G	0.016	0.021	0.407	0.533
H	0.045	0.055	1.150	1.390
I	0.095	0.105	2.420	2.660
J	0.015	0.020	0.380	0.500

Dimensions – SOT-223



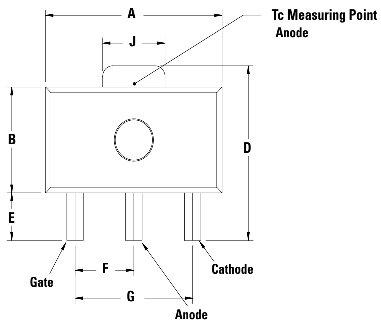


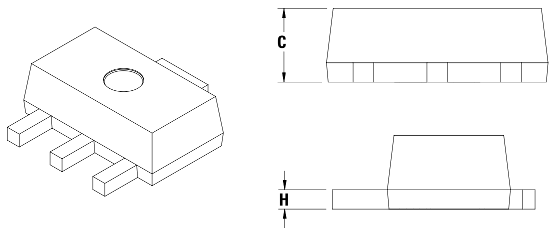
Dimensions in Millimeters (Inches)



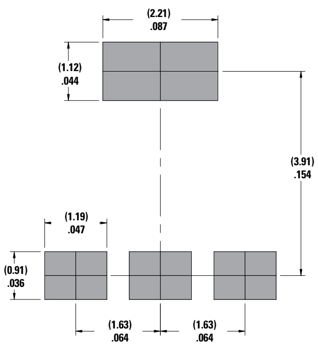
Dimensions	Inches			Millimeters		
	Min	Typ	Max	Min	Typ	Max
A	0.248	0.256	0.264	6.30	6.50	6.70
B	0.130	0.138	0.146	3.30	3.50	3.70
C	—	—	0.071	—	—	1.80
D	0.001	—	0.004	0.02	—	0.10
E	0.114	0.118	0.124	2.90	3.00	3.15
F	0.024	0.027	0.034	0.60	0.70	0.85
G	—	0.090	—	—	2.30	—
H	—	0.181	—	—	4.60	—
I	0.264	0.276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

Dimensions – SOT-89





Pad Layout for SOT-89



Dimensions in Millimeters (Inches)

Dimension	Inches			Millimeters		
	Min	Typ	Max	Min	Typ	Max
A	0.173	—	0.181	4.40	—	4.60
B	0.090	—	0.102	2.29	—	2.60
C	0.055	—	0.063	1.40	—	1.60
D	0.155	—	0.167	3.94	—	4.25
E	0.035	—	0.047	0.89	—	1.20
F	0.056	—	0.062	1.42	—	1.57
G	0.115	—	0.121	2.92	—	3.07
H	0.014	—	0.017	0.35	—	0.44
I	0.014	—	0.019	0.36	—	0.48
J	0.064	—	0.072	1.62	—	1.83

Product Selector

Part Numbr	Voltage			Gate Sensitivity	Package
	400V	600V	800V		
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

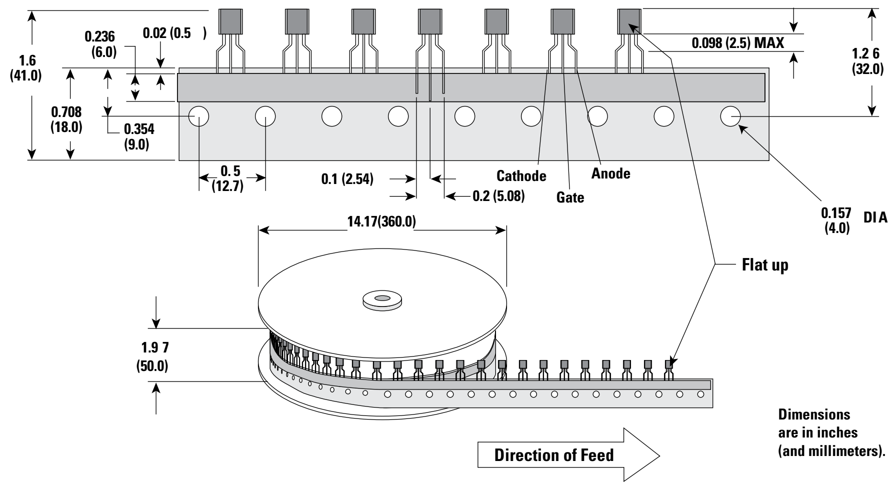
Packing Options

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

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

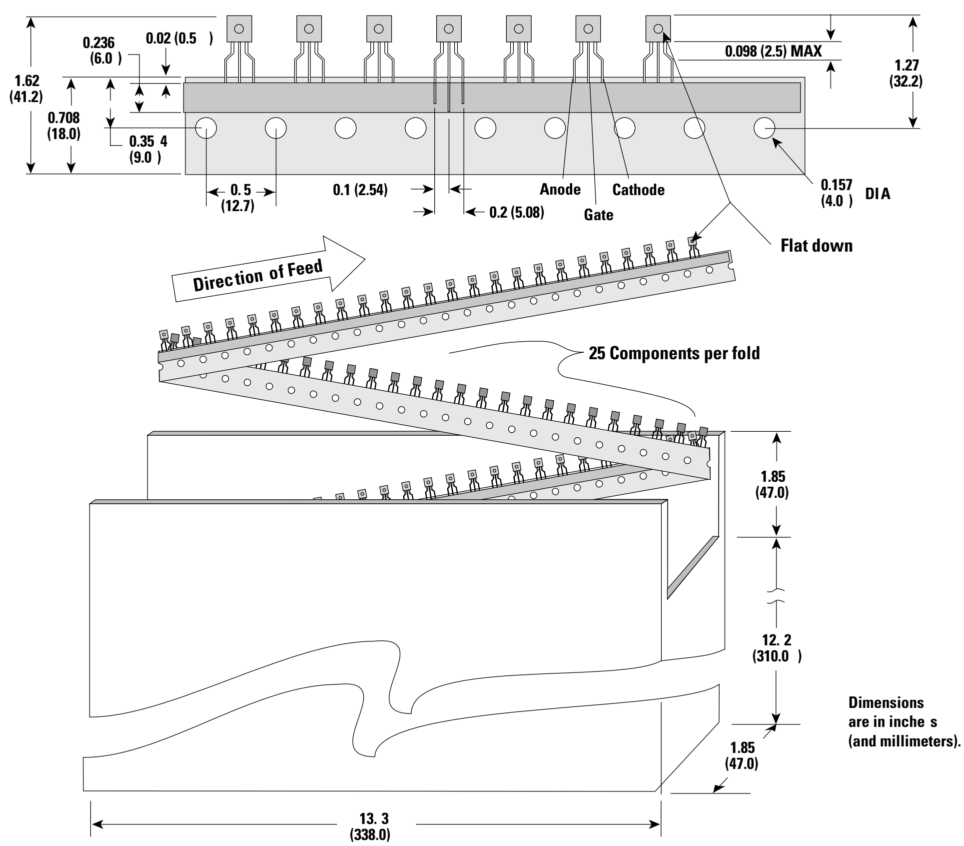
TO-92 (3-lead) Reel Pack (RP) Radial Leaded Specifications

Meets all EIA-468-C Standards

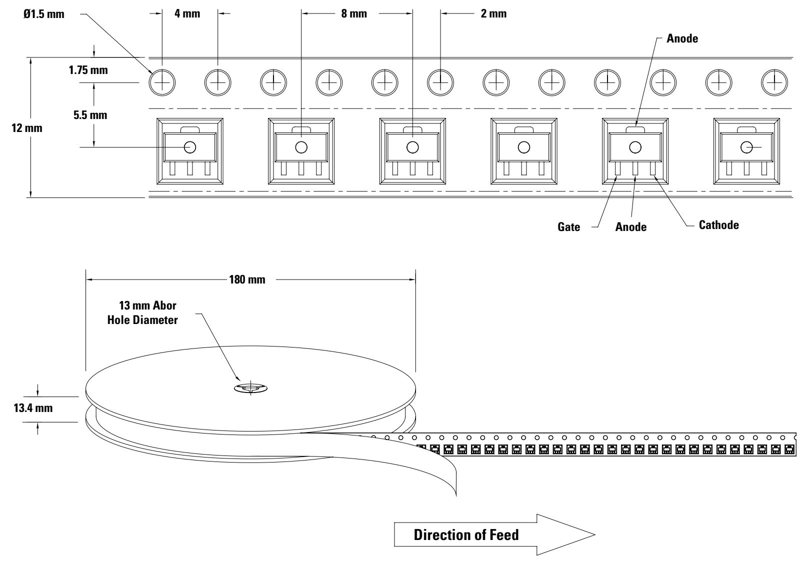


TO-92 (3-lead) Ammo Pack (AP) Radial Leaded Specifications

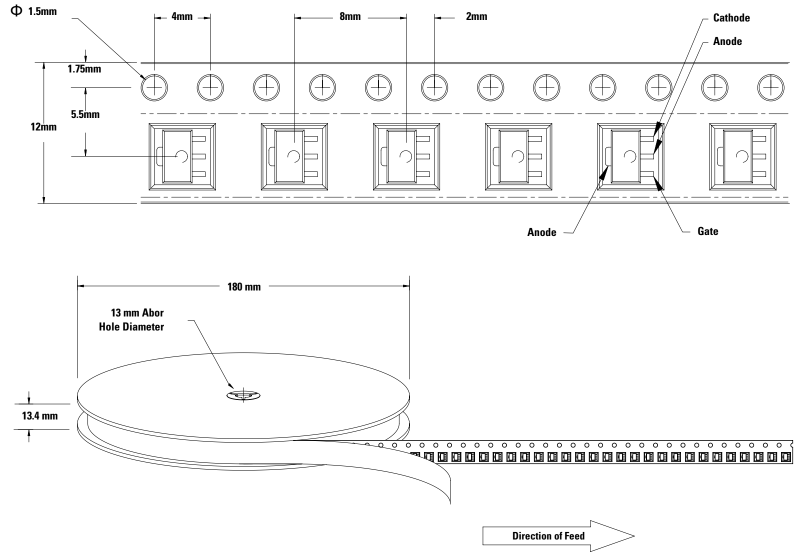
Meets all EIA-468-C Standards



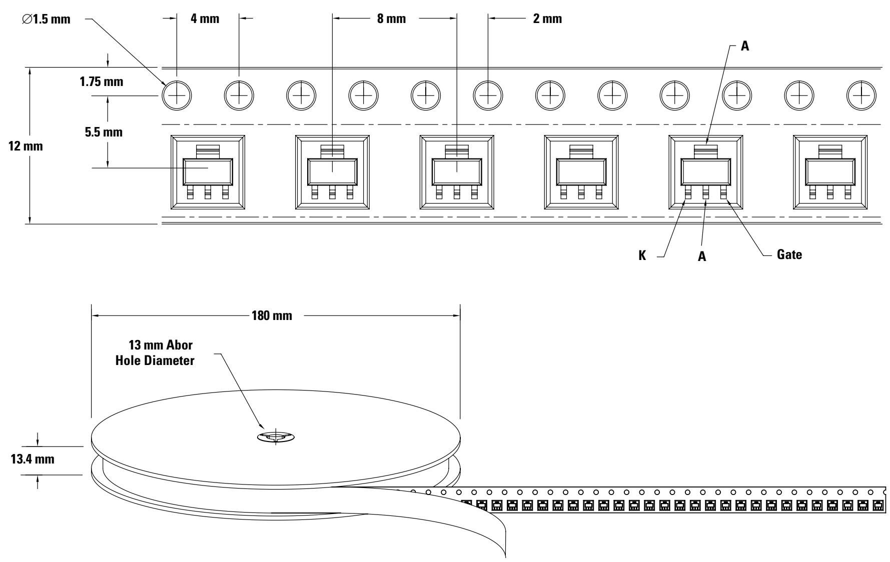
SOT-89 Reel Pack (RP) Specifications



SOT-89 Reel Pack (RP1) Specifications



SOT-223 Reel Pack (RP) Specifications



Part Numbering System

S xX8 x xx xx

SERIES
S: SCR

Voltage
4: 400V
6: 600V
8: 800V

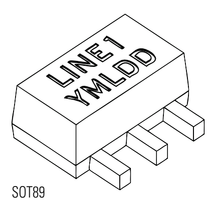
Current
X8: 0.8A

Package Type
E: TO-92
T: SOT-223
B: SOT-89

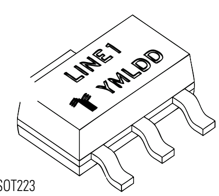
Sensitivity & Type
S1: 5µA Sensitive SCR
S2: 50µA Sensitive SCR
S: 200µA Sensitive SCR

Packing Type
Blank: Bulk Pack
RP: Reel Pack (TO-92)
Embossed Carrier Pack (SOT-223)
Embossed Carrier Pack (SOT-89)
RP1: Embossed Carrier Pack (SOT-89)
(alternate orientation)
AP: Ammo Pack (TO-92)

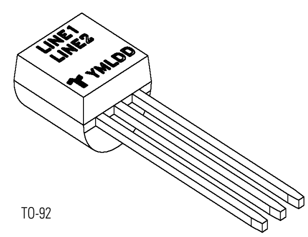
Part Marking System



SOT89



SOT223



TO-92

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