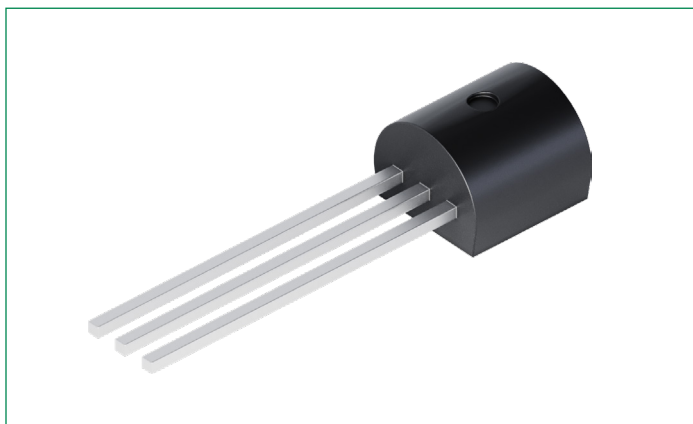


# S8X5ECs EV Series

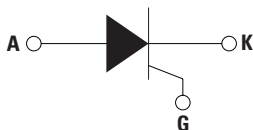
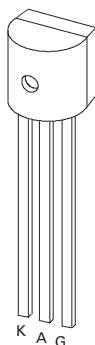
0.5 A Sensitive SCRs

HF RoHS



## Pinout Diagram

TO-92



**A:** Anode; **G:** Gate; **K:** Cathode

## Description

The S8X5ECs series offers a high static  $dv/dt$  with a low turn off ( $t_q$ ) time. It is specifically designed for Ground Fault Circuit Interrupter (GFCI), Arc-Fault Circuit Interrupter (AFCI), Residual Current Device (RCD), and Residual Current Circuit Breaker with Overload Protection (RCBO) applications. All SCR junctions are glass-passivated to ensure long term reliability and parametric stability.

## Features

- RoHS compliant and halogen-free
- Through-hole package
- Blocking voltage ( $V_{DRM} / V_{RRM}$ ) capability up to 800 V
- Surge current capability < 20 A
- Sensitive gate for direct microprocessor interface
- High  $dv/dt$  noise immunity
- Improved turn-off time ( $t_q$ )
- 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

## Applications

- Ground Fault Circuit Interrupter (GFCI) applications
- Arc-Fault Circuit Interrupter (AFCI) applications
- Residual Current Device (RCD) applications
- Residual Current Circuit Breaker with Overload Protection (RCBO) applications

## Product Summary

Characteristic	Value	Unit
$I_{T(RMS)}$	0.5	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
$I_{GT}$	1 to 100	$\mu A$

## Maximum Ratings

Symbol	Characteristics	Conditions			Value	Units
I <sub>T(RMS)</sub>	RMS On-state Current	T <sub>C</sub> =85 °C			0.5	A
I <sub>T(AV)</sub>	Average On-state Current	T <sub>C</sub> = 85 °C			0.3	A
I <sub>TSM</sub>	Non-repetitive Surge On-state Current	Half-sine wave	f = 50 Hz	T <sub>vj</sub> initial = 25 °C	10	A
			f = 60 Hz		12	
I <sup>2</sup> t	I <sup>2</sup> t Value	t <sub>p</sub> = 10 ms		f = 50 Hz	0.5	A <sup>2</sup> s
di/dt <sub>(cr)</sub>	Critical Rate of Rise of On-state Current	I <sub>G</sub> = 10 mA		T <sub>vj</sub> = 125 °C	80	A/μs
I <sub>GM</sub>	Peak Gate Current	t <sub>p</sub> = 20 μs		T <sub>vj</sub> = 125 °C	0.5	A
P <sub>G(AV)</sub>	Average Gate Power Dissipation	T <sub>vj</sub> = 125 °C			0.2	W
T <sub>stg</sub>	Storage Temperature Range	–			–40 to 150	°C
T <sub>vj</sub>	Virtual Junction Temperature Range	–			–40 to 125	°C

## Electrical Characteristics ( $T_{vj} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

Symbol	Characteristics	Conditions	S8X5ECS1			S8X5ECS2			S8X5ECS			Units
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
$I_{GT}$	Gate Trigger Current	$V_D = 6\text{ V}$ , $R_L = 100\text{ }\Omega$	1	–	30	20	–	50	20	–	100	$\mu\text{A}$
$V_{GT}$	Gate Trigger Voltage	$V_D = 6\text{ V}$ , $R_L = 100\text{ }\Omega$	–	–	0.8	–	–	0.8	–	–	0.8	V
$V_{RGM}$	Peak Reverse Gate Voltage	$I_{RG} = 10\text{ }\mu\text{A}$	8	–	–	8	–	–	8	–	–	V
$V_{GD}$	Gate Non-trigger Voltage	$V_D = \frac{1}{2} V_{DRM}$ , $R_{GK} = 1\text{ k}\Omega$ , $T_{vj} = 125\text{ }^{\circ}\text{C}$	0.2	–	–	0.2	–	–	0.2	–	–	V
$I_H$	Holding Current	$R_{GK} = 1\text{ k}\Omega$ , Initial current = 20 mA	–	–	3	–	–	3	–	–	3	mA
$dv/dt_{(cr)}$	Critical Rate-of-rise of Off-stage Voltage	$T_{vj} = 125\text{ }^{\circ}\text{C}$ , $V_D = \frac{2}{3} V_{DRM}$ , Exp. Waveform, $R_{GK} = 1\text{ k}\Omega$	60	–	–	100	–	–	200	–	–	$\text{V}/\mu\text{s}$
$t_q$	Turn-off Time	$I_T = 0.5\text{ A}$	–	40	–	–	40	–	–	40	–	$\mu\text{s}$
$t_{gt}$	Turn-on Time	$I_G = 10\text{ mA}$ , $t_p = 15\text{ }\mu\text{s}$ , $I_T = 1.6\text{ A}_{pk}$	–	2.3	–	–	2.3	–	–	2.3	–	$\mu\text{s}$

## Static Characteristics ( $T_{vj} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

Symbol	Characteristics	Conditions	Maximum Value	Units
$V_{TM}$	Peak Sinusoidal On-state Voltage	0.5 A device, $I_{TM} = 4\text{ A}$ , $t_p = 380\text{ }\mu\text{s}$	1.8	V
$V_{T0}$	Threshold Voltage	–	1.03	V
$r_T$	Slope Resistance	–	140	$\text{m}\Omega$
$I_{DRM}/I_{RRM}$	Repetitive Peak Off-state Current	$T_{vj} = 25\text{ }^{\circ}\text{C}$	3	$\mu\text{A}$
		$T_{vj} = 125\text{ }^{\circ}\text{C}$	500	

## Thermal Characteristics

Symbol	Characteristics	Conditions	Value	Units
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (AC)	$I_T = 0.8\text{ A}_{(RMS)}$ <sup>1</sup>	35	$\text{K}/\text{W}$
$R_{th(j-a)}$	Thermal Resistance, Junction to Ambient	$I_T = 0.8\text{ A}_{(RMS)}$ <sup>1</sup>	150	$\text{K}/\text{W}$

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

## Characteristic Curves

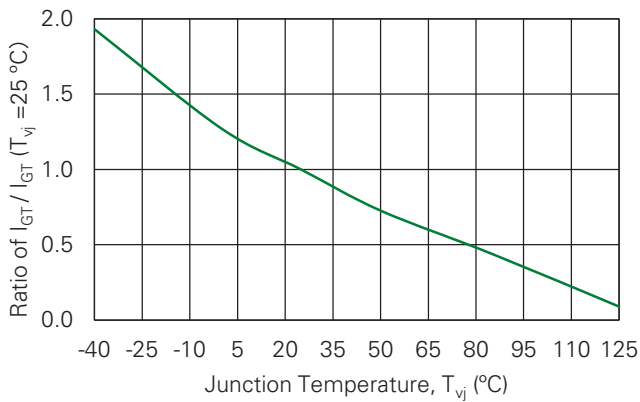
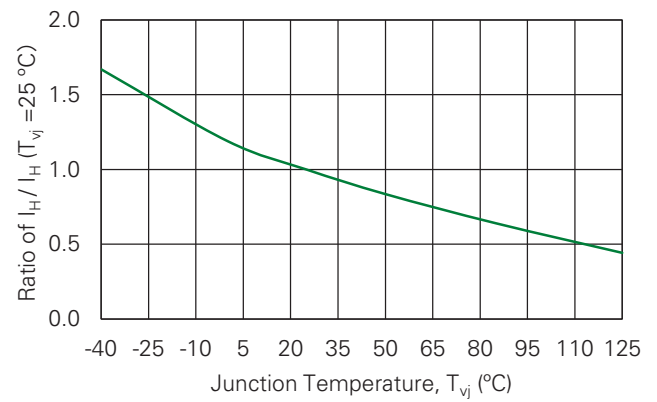
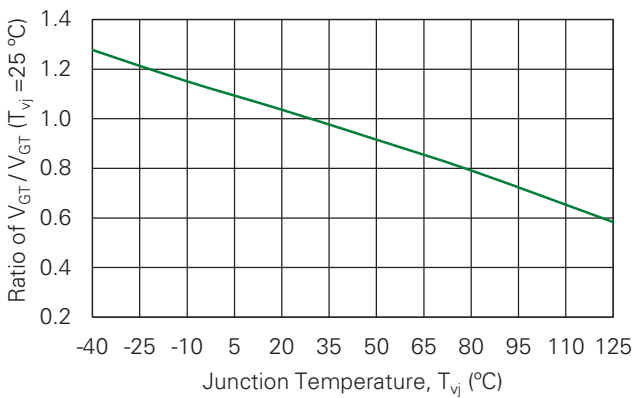
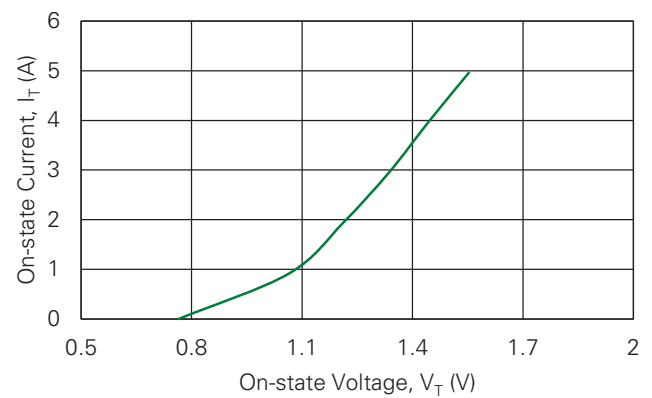
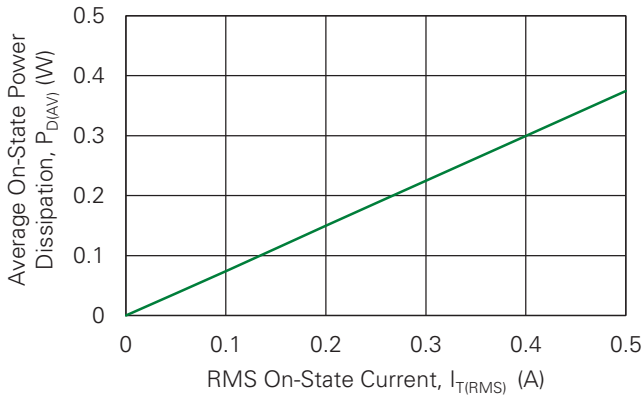
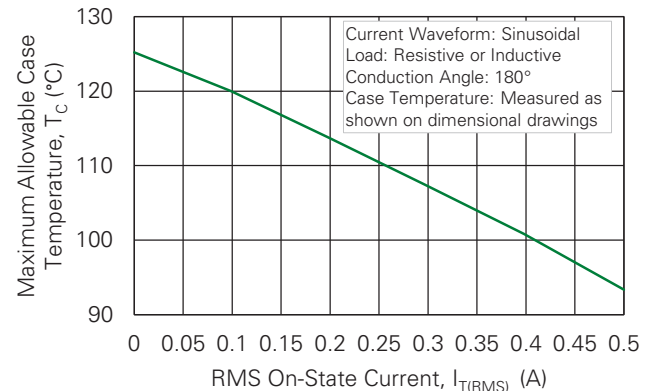
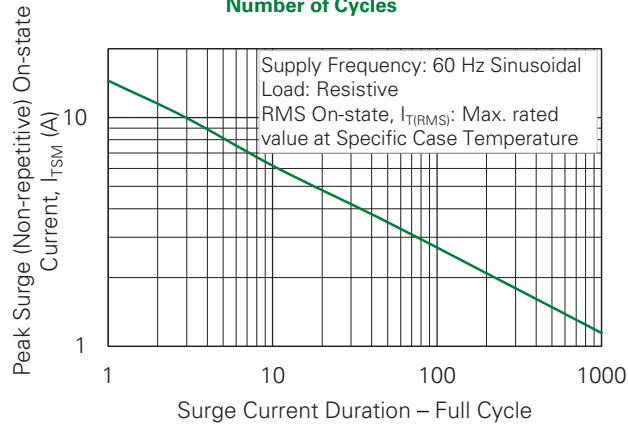
**Fig. 1. Normalized DC Gate Trigger Current for all Quadrants vs. Junction Temperature****Fig. 2. Normalized DC Holding Current vs. Junction Temperature****Fig. 3. Normalized DC Gate Trigger Voltage vs. Junction Temperature****Fig. 4. Typical On-state Current vs. On-state Voltage****Fig. 5. Typical Power Dissipation vs. RMS On-state Current****Fig. 6. Maximum Allowable Case Temperature vs. On-state Current**

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



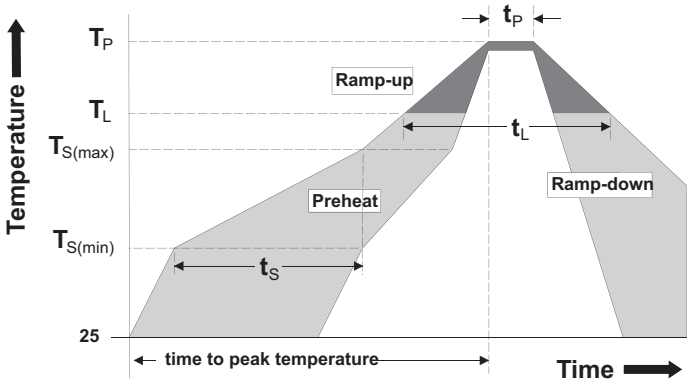
- Notes:
- 1. Gate control may be lost during and immediately following surge current interval.
  - 2. Overload may not be repeated until junction temperature has returned to steady-state rated value.

Soldering Parameters

Characteristic		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 – 120 secs
Average ramp up rate (Liquidus Temp)( $T_L$ ) to peak		3 °C/second max
$T_{s(max)}$ to $T_L$ - Ramp-up Rate		3 °C/second max
Reflow	Temperature ( $T_L$ ) (Liquidus)	217 °C
	Time ( $t_L$ )	60 – 150 seconds
Peak Temperature ( $T_p$ )		260 <sup>+0/-5</sup> °C
Time within 5°C of actual peak Temperature ( $t_p$ )		30 seconds max.
Ramp-down Rate		6 °C/second max.
Time 25°C to peak Temperature ( $T_p$ )		8 minutes max.
Do Not Exceed		260 °C

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; 320 V - DC: 85 °C; 85 % relative humidity
UHASt	JESD22-A118, 96 hours, 130 °C, 85 %RH
High-temperature Storage	MIL-STD-750, M-1031, 1008 hours; 150 °C
Low-temperature 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



Physical Specifications

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

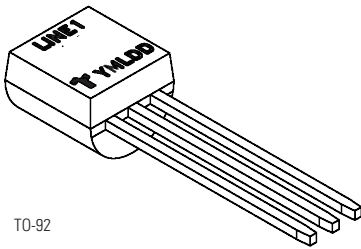
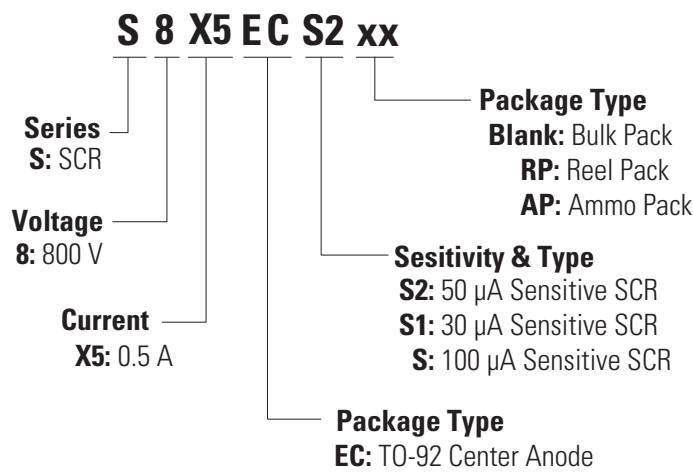
Design Considerations

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.

Packing Options

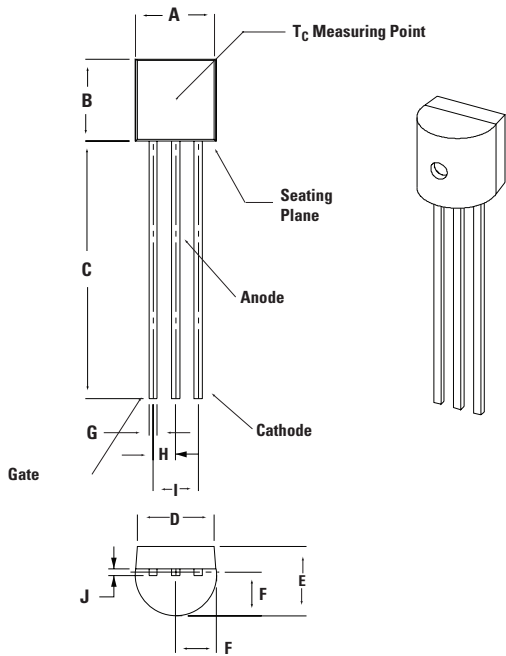
Part Number	Marking	Weight	Packing Mode	Base Quantity
S8X5ECS1	S8X5ECS1	0.217 g	Bulk	2500
S8X5ECS1RP	S8X5ECS1	0.217 g	Tape & Reel	2000
S8X5ECS1AP	S8X5ECS1	0.217 g	Ammo Pack	2000
S8X5ECS2	S8X5ECS2	0.217 g	Bulk	2500
S8X5ECS2RP	S8X5ECS2	0.217 g	Tape & Reel	2000
S8X5ECS2AP	S8X5ECS2	0.217 g	Ammo Pack	2000
S8X5ECS	S8X5ECS	0.217 g	Bulk	2500
S8X5ECSRP	S8X5ECS	0.217 g	Tape & Reel	2000
S8X5ECSAP	S8X5ECS	0.217 g	Ammo Pack	2000

Part Numbering and Marking



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

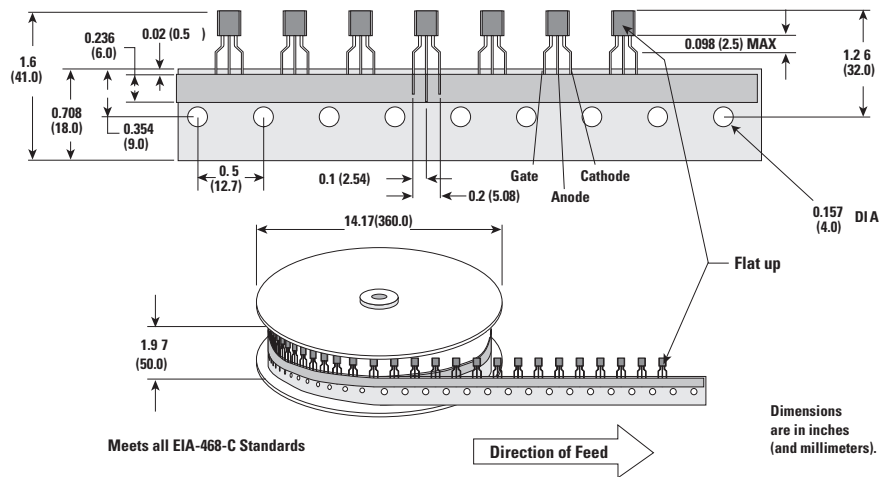
Package Dimensions TO-92



Symbol	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	12.70	–	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

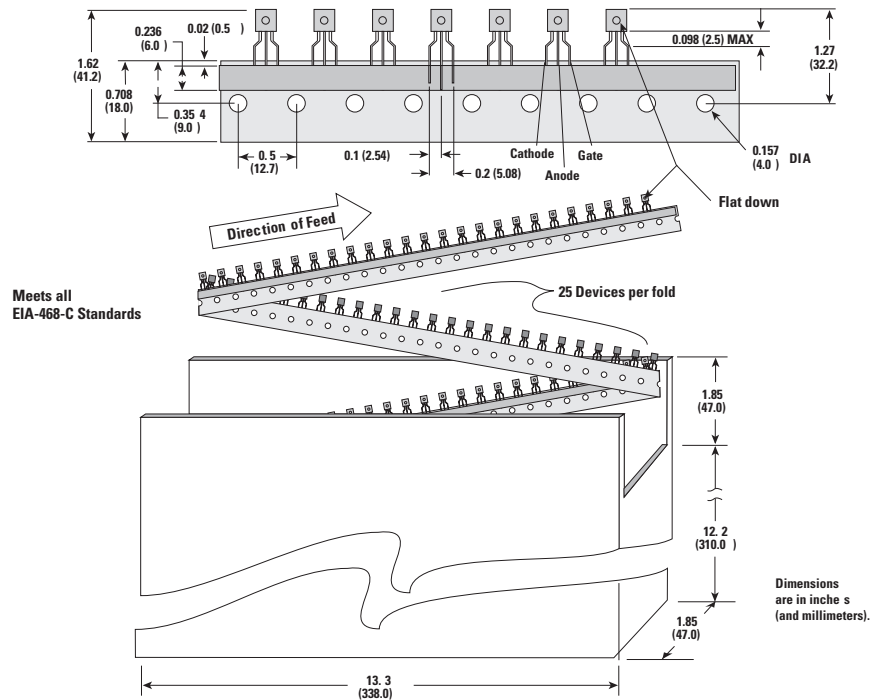
## TO-92 (3-lead) Reel Pack (RP) Radial Leaded Specifications

Meets all EIA-468-C Standards



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

Meets all EIA-468-C Standards



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