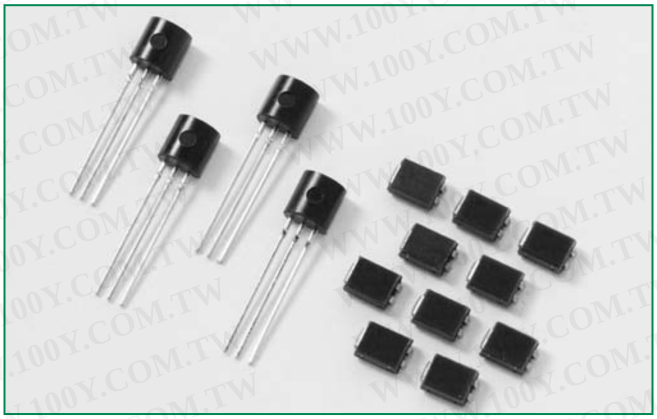
RoHS

Sx01E & SxN1 Series



Description

Excellent for lower current heat, lamp, and audible alarm controls for home goods.

Standard phase control SCRs are triggered with few milliamperes of current at less than 1.5V potential.

Features & Benefits

- RoHS compliant
- Glass – passivated junctions
- Voltage capability up to 600 V
- Surge capability up to 30 A

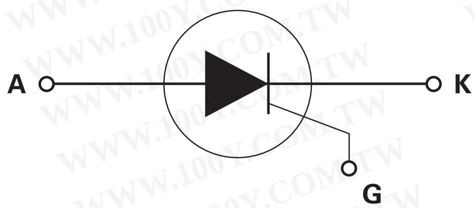
Applications

Typical applications are AC solid-state switches, fluidlevel sensors, strobes, and capacitive-discharge ignition systems.

Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	1	A
V_{DRM}/V_{RRM}	400 to 600	V
I_{GT}	10	mA

Schematic Symbol



Absolute Maximum Ratings — Standard SCRs

Symbol	Parameter	Test Conditions	Value	Unit
$I_{T(RMS)}$	RMS on-state current	T_C = 90°C	1	A
$I_{T(AV)}$	Average on-state current	T_C = 90°C	0.64	A
I_{TSM}	Peak non-repetitive surge current	single half cycle; f = 50Hz; T_J (initial) = 25°C	25	A
		single half cycle; f = 60Hz; T_J (initial) = 25°C	30	
I^2t	I^2t Value for fusing	t_p = 8.3 ms	3.7	A^2s
di/dt	Critical rate of rise of on-state current	f = 60Hz ; T_J = 125°C	50	A/μs
I_{GM}	Peak gate current	T_J = 125°C	1.5	A
$P_{G(AV)}$	Average gate power dissipation	T_J = 125°C	0.3	W
T_{stg}	Storage temperature range		-40 to 150	°C
T_J	Operating junction temperature range		-40 to 125	°C

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

Symbol	Test Conditions		Value	Unit
I_{GT}	V_D = 12V; R_L = 60 Ω	MAX.	10	mA
		MIN.	1	
V_{GT}		MAX.	1.5	V
dv/dt	$V_D = V_{DRM}$; gate open; T_J = 100°C	MIN.	20	V/µs
	$V_D = V_{DRM}$; gate open; T_J = 125°C		40	
V_{GD}	$V_D = V_{DRM}$; R_L = 3.3 kΩ; T_J = 125°C	MIN.	0.2	V
I_H	I_T = 200mA (initial)	MAX.	30	mA
t_q	(1)	MAX.	35	µs
t_{gt}	$I_G = 2 \times I_{GT}$; PW = 15µs; I_T = 2A	TYP.	2	µs

(1) I_T=1A; t_p=50µs; dv/dt=20V/µs; di/dt=-10A/µs

Static Characteristics

Symbol	Test Conditions			Value	Unit
V_{TM}	I_T = 2A; t_p = 380 µs		MAX.	1.6	V
I_{DRM} / I_{RRM}	$V_{DRM} = V_{RRM}$	T_J = 25°C	MAX.	10	µA
		T_J = 100°C		200	
		T_J = 125°C		500	

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{\theta(J-C)}$	Junction to case (AC)	Sx01E	50	°C/W
		SxN1	35*	
$R_{\theta(J-A)}$	Junction to ambient	Sx01E	145	°C/W

Notes : x = voltage
* = Mounted on 1 cm² copper (two-ounce) foil surface

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

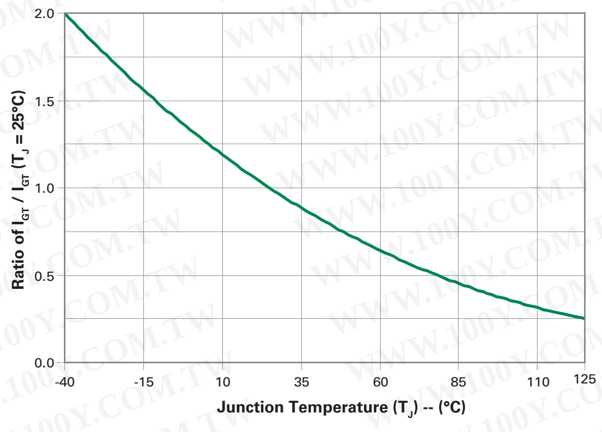


Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

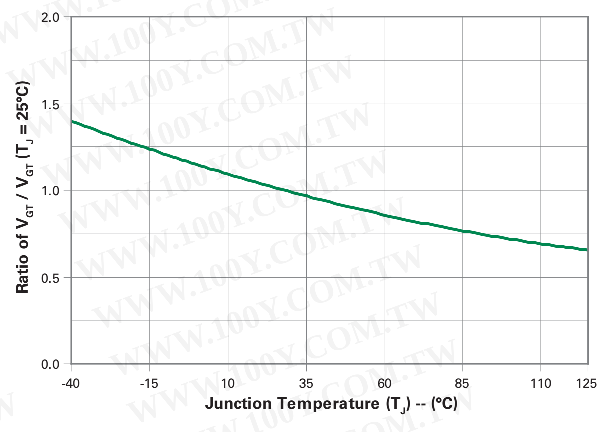


Figure 3: Normalized DC Holding Current vs. Junction Temperature

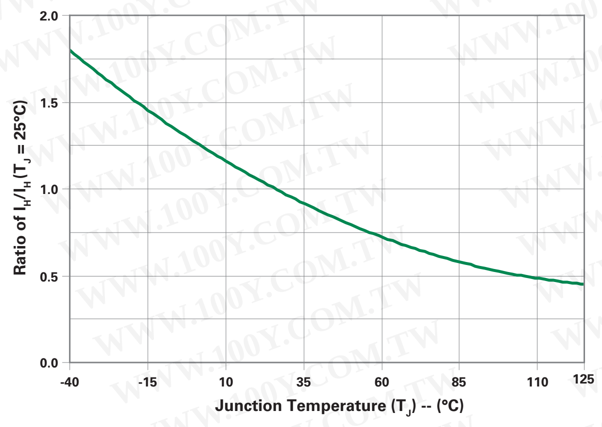


Figure 4: On-State Current vs. On-State Voltage (Typical)

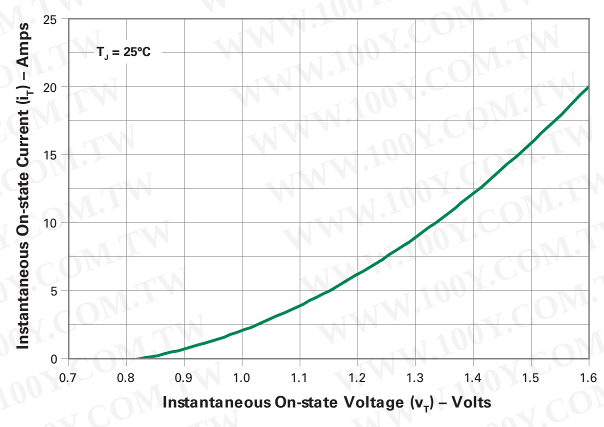


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

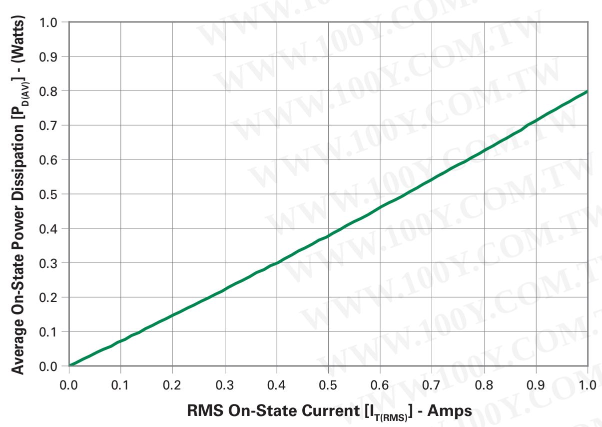


Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

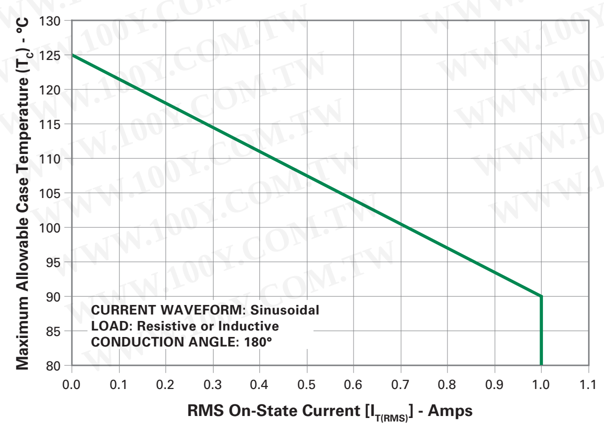


Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

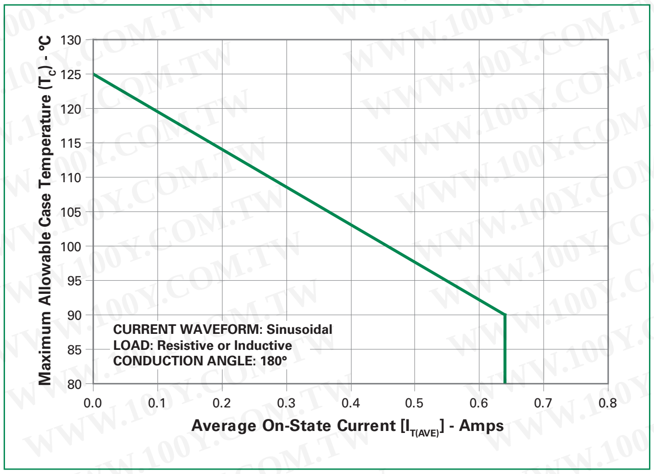


Figure 8: Maximum Allowable Ambient Temperature vs. RMS On-State Current

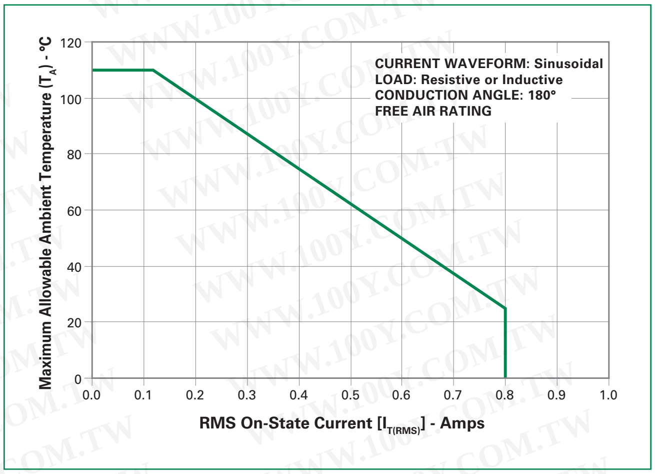


Figure 9: Maximum Allowable Ambient Temperature vs. Average On-State Current

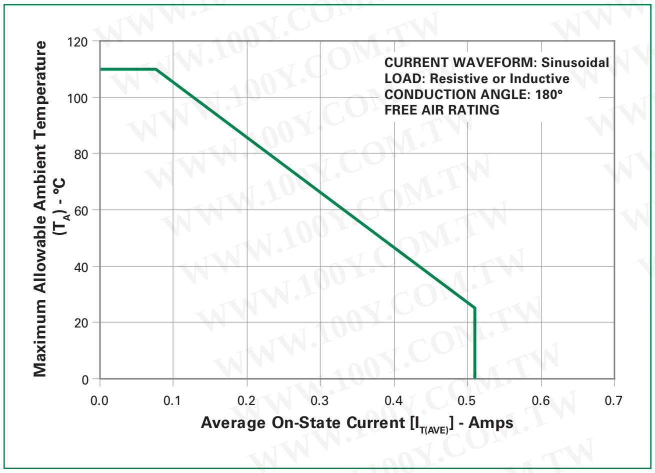


Figure 10: Peak Capacitor Discharge Current

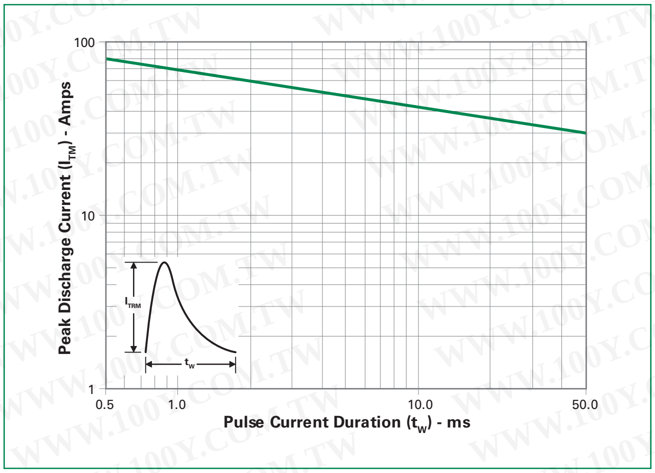


Figure 11: Peak Capacitor Discharge Current Derating

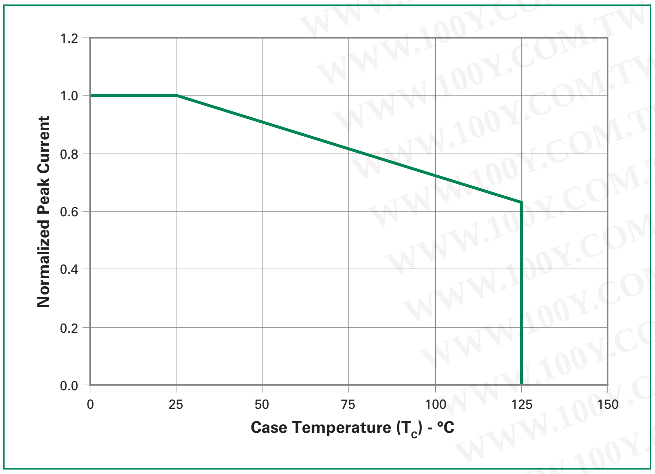
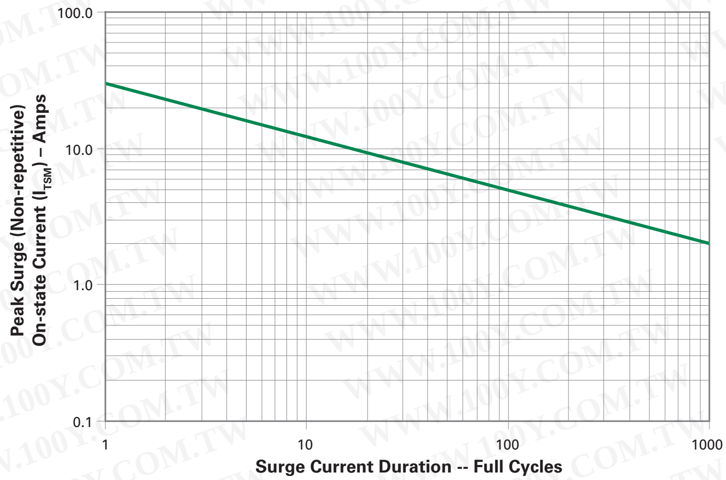


Figure 12: Surge Peak On-State Current vs. Number of Cycles

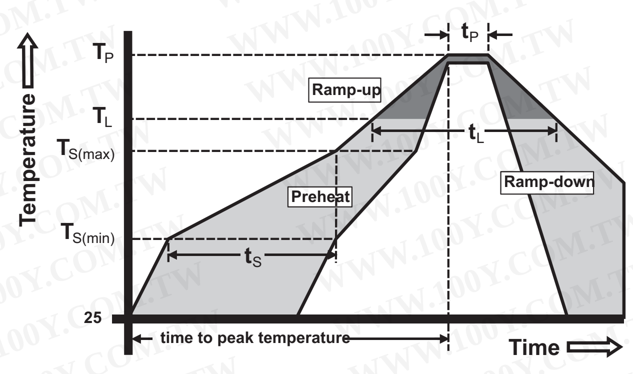


SUPPLY FREQUENCY: 60 Hz Sinusoidal
LOAD: Resistive
RMS On-State Current: [$I_{T(RMS)}$]: Maximum Rated Value at Specified Case Temperature

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
	-Temperature (t_L)	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



Physical Specifications

Terminal Finish	100% Matte Tin-plated
Body Material	UL recognized epoxy meeting flammability classification 94V-0
Lead Material	Copper Alloy

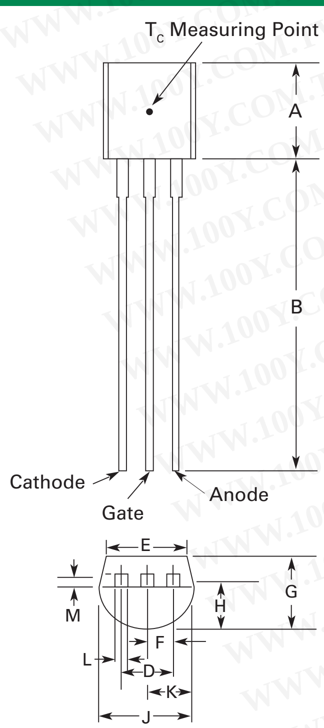
Design Considerations

Careful selection of the correct device 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 device 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.

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, 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
Thermal Shock	MIL-STD-750, M-1056 10 cycles; 0°C to 100°C; 5-min dwell-time at each temperature; 10 sec (max) transfer time between temperature
Autoclave	EIA / JEDEC, JESD22-A102 168 hours (121°C at 2 ATMs) and 100% R/H
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

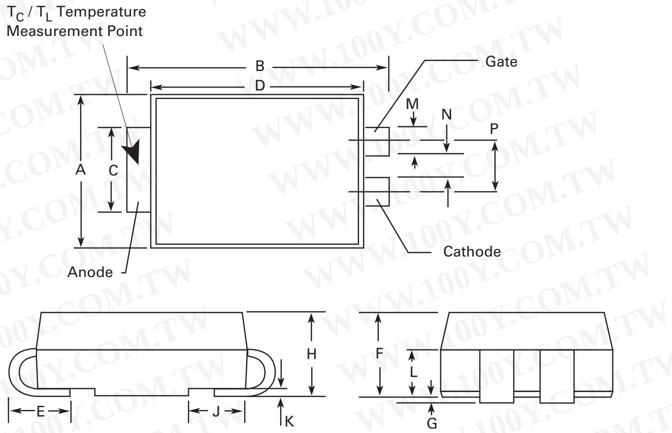
Dimensions – TO-92 (E Package)

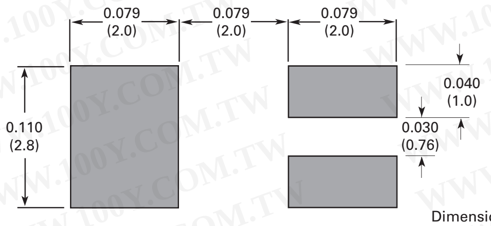


Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.176	0.196	4.47	4.98
B	0.500		12.70	
D	0.095	0.105	2.41	2.67
E	0.150		3.81	
F	0.046	0.054	1.16	1.37
G	0.135	0.145	3.43	3.68
H	0.088	0.096	2.23	2.44
J	0.176	0.186	4.47	4.73
K	0.088	0.096	2.23	2.44
L	0.013	0.019	0.33	0.48
M	0.013	0.017	0.33	0.43

All leads insulated from case. Case is electrically nonconductive.

Dimensions - Compak (C Package)





Pad Outline

Dimensions are in inches (and millimeters).

Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.130	0.156	3.30	3.95
B	0.201	0.220	5.10	5.60
C	0.077	0.087	1.95	2.20
D	0.159	0.181	4.05	4.60
E	0.030	0.063	0.75	1.60
F	0.075	0.096	1.90	2.45
G	0.002	0.008	0.05	0.20
H	0.077	0.104	1.95	2.65
J	0.043	0.053	1.09	1.35
K	0.006	0.016	0.15	0.41
L	0.030	0.055	0.76	1.40
M	0.022	0.028	0.56	0.71
N	0.027	0.033	0.69	0.84
P	0.052	0.058	1.32	1.47

Product Selector

Part Number	Voltage				Gate Sensitivity	Type	Package
	400V	600V	800V	1000V			
Sx01E	X	X			10mA	Standard SCR	TO-92
SxN1	X	X			10mA	Standard SCR	Compak

Note: x = Voltage

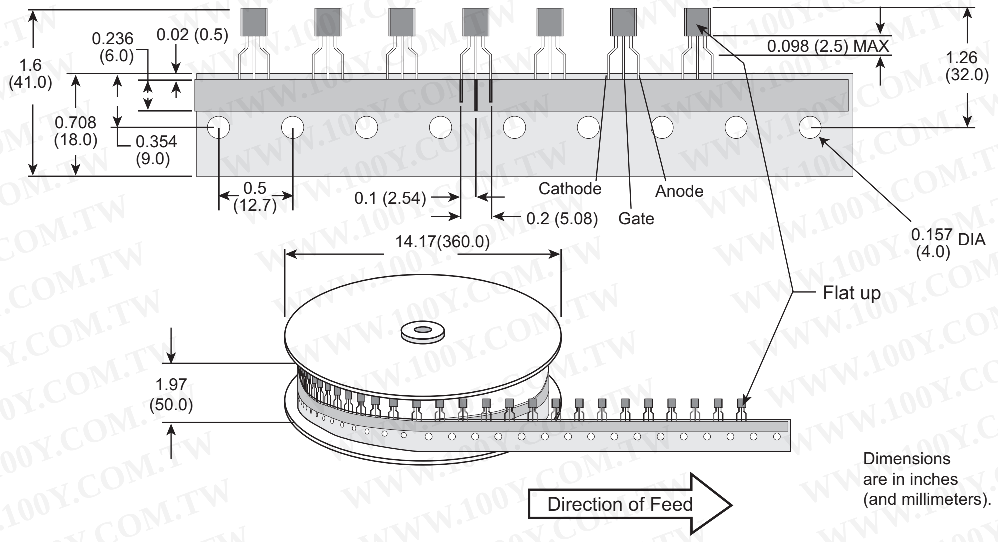
Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
Sx01E	Sx01E	0.19 g	Bulk	2000
Sx01ERP	Sx01E	0.19 g	Reel Pack	2000
Sx01EAP	Sx01E	0.19 g	Ammo Pack	2000
SxN1RP	SxN1	0.08 g	Embossed Carrier	2500

Note: x = Voltage

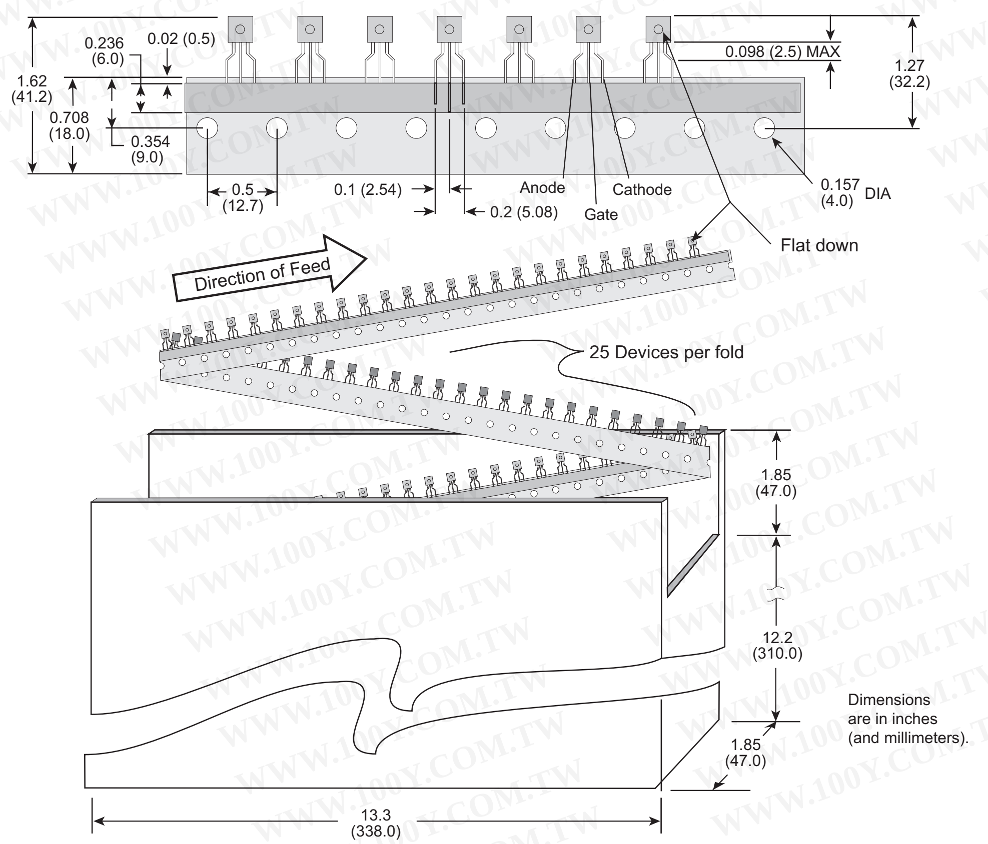
TO-92 (3-lead) Reel Pack (RP) Radial Leaded Specifications

Meets all EIA-468-B 1994 Standards



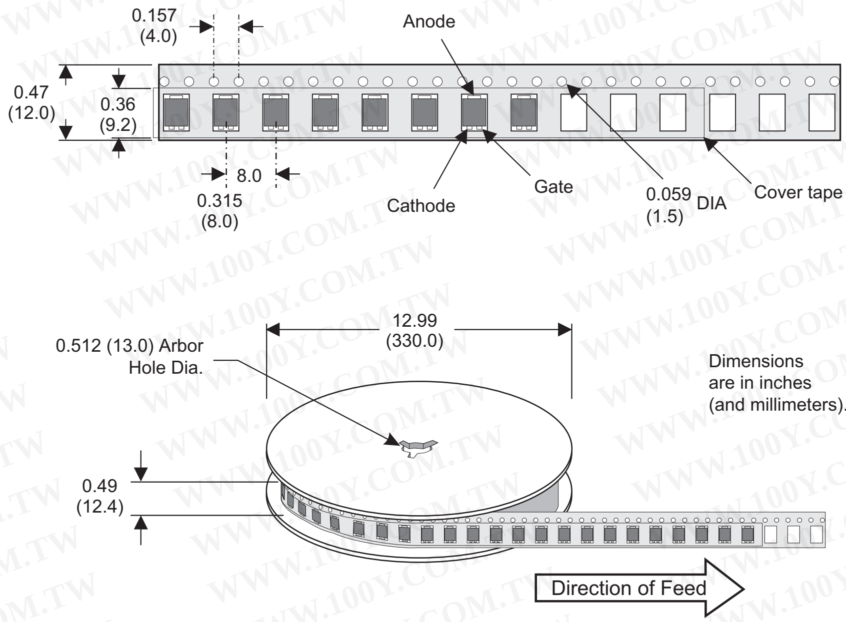
TO-92 (3-lead) Ammo Pack (AP) Radial Leaded Specifications

Meets all EIA-468-B 1994 Standards



Compak Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-1 Standards



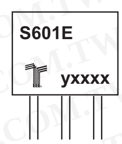
Part Numbering System

S 6 01 E 75

- **DEVICE TYPE** — S: SCR
- **VOLTAGE RATING** — 4: 400V; 6: 600V
- **CURRENT RATING** — 01: 1A (TO-92); N: 1A (Compak)
- **PACKAGE TYPE** — E: TO-92 SCR; N: Compak
- **SENSITIVITY & TYPE** — [blank]: 10 mA (TO-92); 1: 10 mA (Compak)
- **Lead Form Dimensions** — xx: Lead Form Option

Part Marking System

TO-92 (E Package)



Compak (C Package)

1.0A SCRs