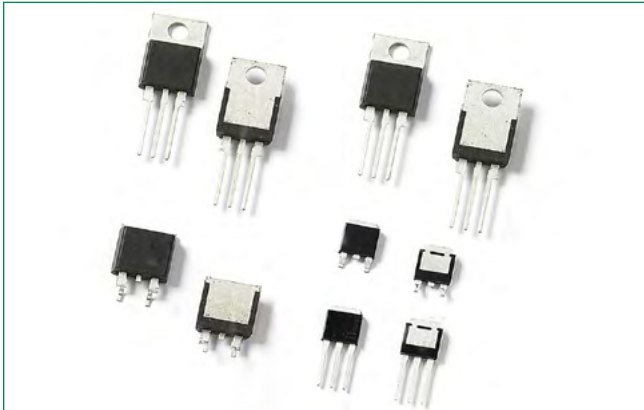


**SJxx12xx series**



**Description**

This SJxx12xx high junction temperature SCR series is ideal for uni-directional switch applications such as phase control in heating, motor speed controls, converters/rectifiers, inrush current control and capacitive discharge ignitions.

These SCRs have a low gate current trigger level of 6mA, 10mA or 20mA maximum at approximately 1.5V.

**Features & Benefits**

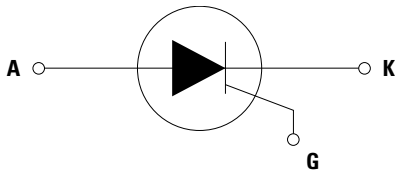
- Halogen free and RoHS compliant
- 150°C maximum junction temperature
- Surge capability up to 120 A at 60 Hz half cycle
- Recognized to UL 1557 as an Electrically Isolated Semiconductor Device

**Agency Approvals**

Agency	Agency File Number
	E71639*

\* - L Package Only

**Schematic Symbol**



**Applications**

Typical applications are capacitive discharge systems for strobe lights, nailers, staplers and gas engine ignition. Additional applications include various AC to DC applications, low power AC motor and controls for power tools, home/brown goods and white goods appliances.

Internally constructed isolated packages are offered for ease of heat sinking with high isolation voltage.

**Main Features**

Symbol	Value	Unit
$I_{T(RMS)}$	12	A
$V_{DRM}/V_{RRM}$	400 or 600	V
$I_{GT}$	6 - 20	mA

**Absolute Maximum Ratings**

Symbol	Parameter	Test Conditions	Value	Unit
$V_{DSM}/V_{RSM}$	Peak non-repetitive blocking voltage	PW=100 $\mu$ s	$V_{DRM}/V_{RRM} + 100$	V
$I_{T(RMS)}$	RMS on-state current	SJxx12Lx $T_c = 110^\circ\text{C}$	12	A
		SJxx12Rx SJxx12Nx $T_c = 135^\circ\text{C}$		
		SJxx12Dx SJxx12Vx $T_c = 125^\circ\text{C}$		
$I_{T(AV)}$	Average on-state current	SJxx12Lx $T_c = 110^\circ\text{C}$	76	A
		SJxx12Rx SJxx12Ny $T_c = 135^\circ\text{C}$		
		SJxx12Dx SJxx12Vx $T_c = 125^\circ\text{C}$		
$I_{TSM}$	Peak non-repetitive surge current (single half cycle, $T_j$ (initial) = 25°C)	$f = 50\text{Hz}$	100	A
		$f = 60\text{Hz}$	120	
$I^2t$	$I^2t$ Value for fusing	$t_p = 8.3\text{ms}$	60	A <sup>2</sup> s
di/dt	Critical rate of rise of on-state current	$f = 60\text{Hz}; T_j = 150^\circ\text{C}$	100	A/ $\mu$ s
$I_{GM}$	Peak gate current	$T_j = 150^\circ\text{C}$	2	A
$P_{G(AV)}$	Average gate power dissipation	$T_j = 150^\circ\text{C}$	0.5	W
$T_{stg}$	Storage temperature range		-40 to 150	°C
$T_j$	Operating junction temperature range		-40 to 150	

### Electrical Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise specified) - TO-220L, TO-220R and TO-263 package

Symbol	Test Conditions		SJxx12x	SJxx12x1	SJxx12x2	Unit
$I_{GT}$	$V_D = 12V$ $R_L = 60 \Omega$	MAX.	20	6	10	mA
		MIN.	8	2	5	
$V_{GT}$	$V_D = 12V$ $R_L = 60 \Omega$	MAX.	1.5	1.5	1.5	V
dv/dt	$V_D = 67\% V_{DRM}$ ; gate open; $T_J = 125^\circ\text{C}$	MIN.	800	70	500	V/ $\mu\text{s}$
	$V_D = 67\% V_{DRM}$ ; gate open; $T_J = 150^\circ\text{C}$		400	-	200	
$V_{GD}$	$V_D = V_{DRM}$ $R_L = 3.3 \text{ k}\Omega$ $T_J = 125^\circ\text{C}$	MIN.	0.2	0.2	0.2	V
$I_H$	$I_T = 200\text{mA}$ (initial)	MAX.	60	15	35	mA
$t_q$	$I_T = 2\text{A}$ ; $t_p = 50\mu\text{s}$ ; dv/dt = 5V/ $\mu\text{s}$ ; di/dt = 30A/ $\mu\text{s}$	MAX.	40	40	40	$\mu\text{s}$
$t_{gt}$	$I_G = 2 \times I_{GT}$ PW = 15 $\mu\text{s}$ $I_T = 24\text{A}$	TYP.	2	2	2	$\mu\text{s}$

Note: xx=voltage/10, x=package

### Electrical Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise specified) - TO-251 and TO-252 package

Symbol	Test Conditions		Value		Unit	
			SJxx12x1	SJxx12x		
$I_{GT}$	$V_D = 12V$ $R_L = 60 \Omega$	MAX.	6	20	mA	
		MIN.	2	5		
$V_{GT}$		MAX.	1.5	1.5	V	
dv/dt	$V_D = V_{DRM}$ ; gate open; $T_J = 125^\circ\text{C}$	400V	MIN.	100	250	V/ $\mu\text{s}$
		600V		75	225	
	$V_D = V_{DRM}$ ; gate open; $T_J = 150^\circ\text{C}$	400V		50	200	
		600V		10	175	
$V_{GD}$	$V_D = V_{DRM}$ $R_L = 3.3 \text{ k}\Omega$ $T_J = 125^\circ\text{C}$	MIN.	0.2	0.2	V	
	$V_D = V_{DRM}$ $R_L = 3.3 \text{ k}\Omega$ $T_J = 150^\circ\text{C}$	MIN.	0.1	0.1		
$I_H$	$I_T = 200\text{mA}$ (initial)	MAX.	20	40	mA	
$t_q$	$I_T = 2\text{A}$ ; $t_p = 50\mu\text{s}$ ; dv/dt = 5V/ $\mu\text{s}$ ; di/dt = 30A/ $\mu\text{s}$	MAX.	35	35	$\mu\text{s}$	
$t_{gt}$	$I_G = 2 \times I_{GT}$ PW = 15 $\mu\text{s}$ $I_T = 12\text{A}$	TYP.	0.5	2	$\mu\text{s}$	

Note: xx=voltage/10, x=package

### Static Characteristics

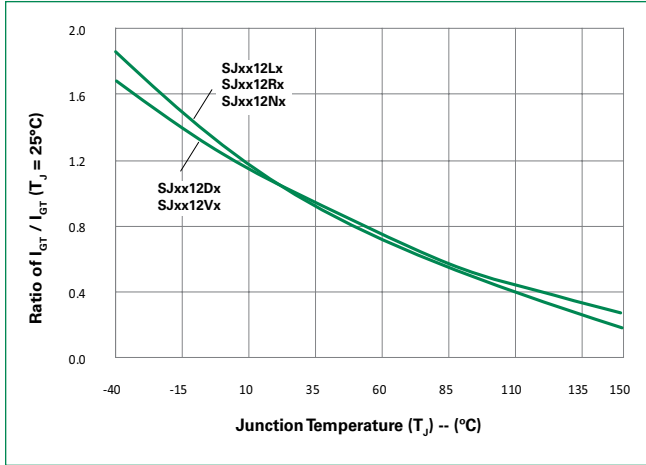
Symbol	Test Conditions		Value	Unit	
$V_{TM}$	Component $I_T = 32\text{A}$ ; $t_p = 380 \mu\text{s}$	MAX.	1.6	V	
$I_{DRM} / I_{RRM}$	$V_{DRM} = V_{RRM}$	$T_J = 25^\circ\text{C}$	MAX.	10	$\mu\text{A}$
		$T_J = 125^\circ\text{C}$		500	
		$T_J = 150^\circ\text{C}$		2000	

### Thermal Resistances

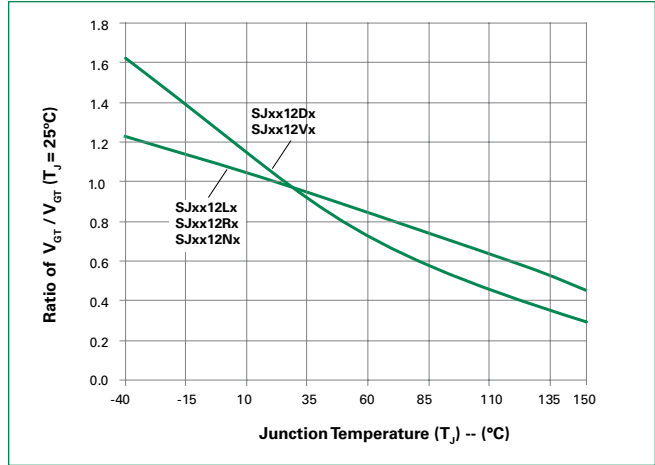
Symbol	Parameter	Value	Unit	
$R_{\theta(JC)}$	Junction to case (AC)	SJxx12Lx	2.4	$^\circ\text{C}/\text{W}$
		SJxx12Rx	1.1	
		SJxx12Nx		
		SJxx12Dx	1.4	
SJxx12Vx				

Note: xx=voltage/10, x=sensitivity

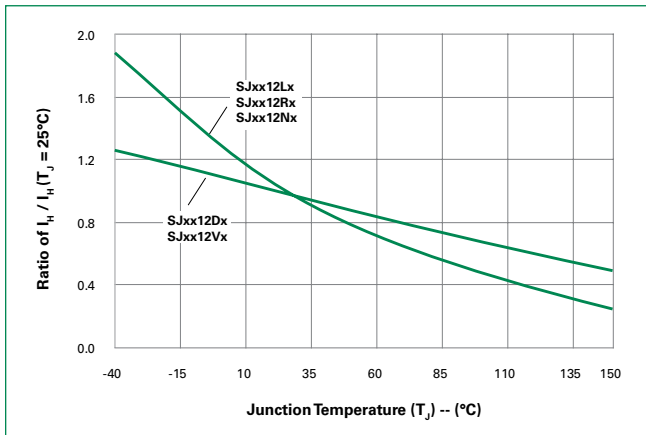
**Figure 1: Normalized DC Gate Trigger Current vs. Junction Temperature**



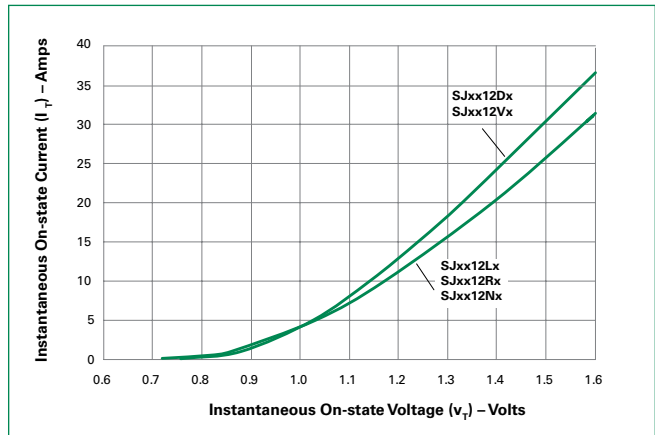
**Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature**



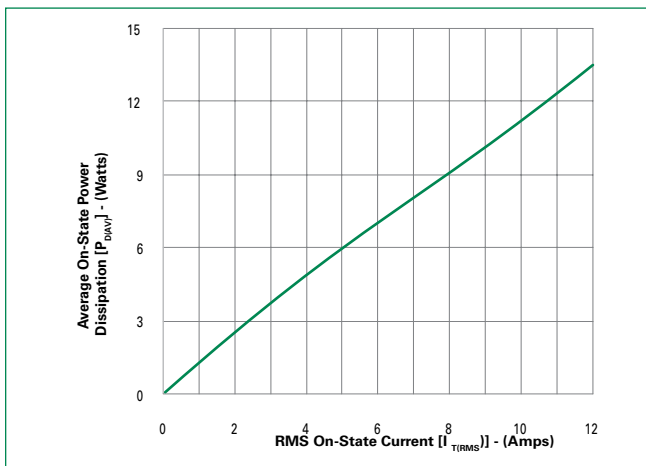
**Figure 3: Normalized DC Holding Current vs. Junction Temperature**



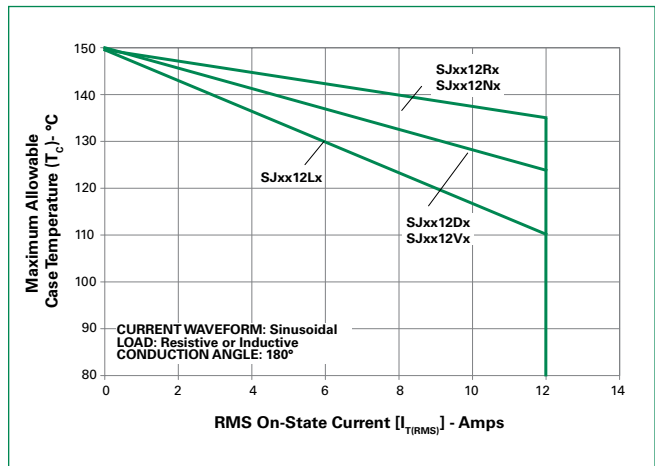
**Figure 4: On-State Current vs. On-State Voltage (Typical)**



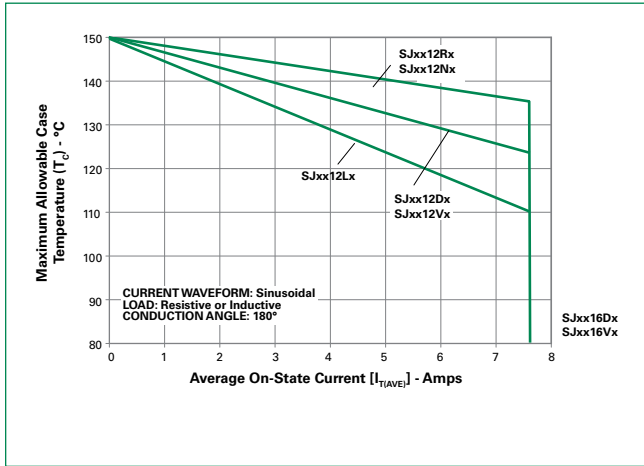
**Figure 5: Power Dissipation (Typical) vs. RMS On-State Current**



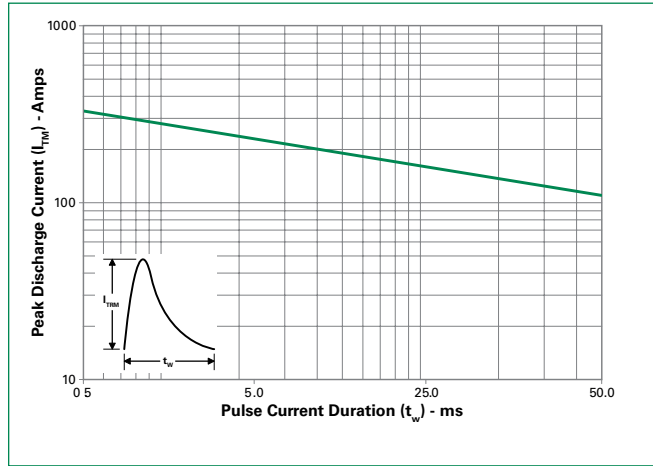
**Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current**



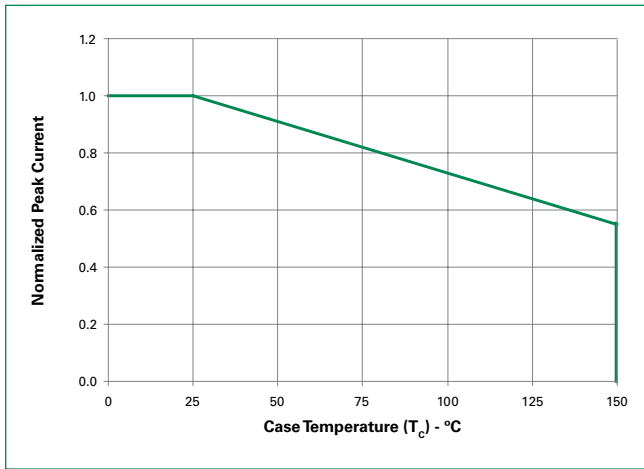
**Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current**



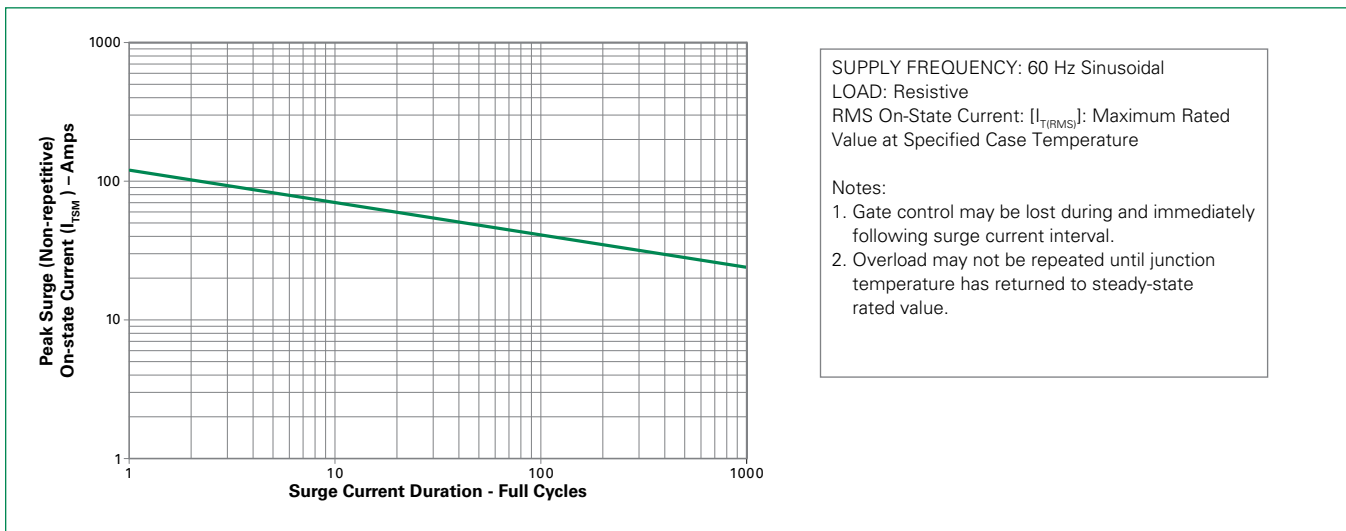
**Figure 8: Peak Capacitor Discharge Current**



**Figure 9: Peak Capacitor Discharge Current Derating**



**Figure 10: Surge Peak On-State Current vs. Number of Cycles**



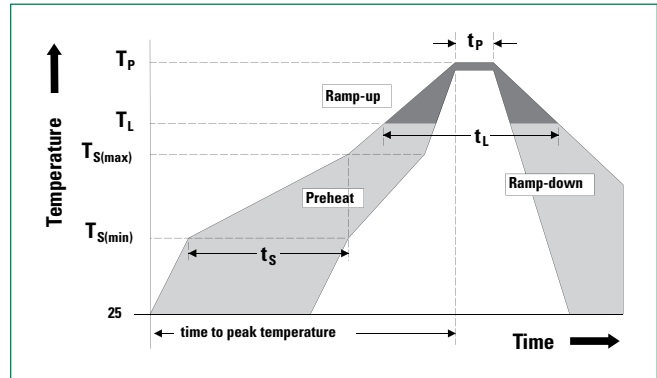
SUPPLY FREQUENCY: 60 Hz Sinusoidal  
LOAD: Resistive  
RMS On-State Current:  $I_{T(RMS)}$ : Maximum Rated Value at Specified Case Temperature

Notes:

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

### Soldering Parameters

<b>Reflow Condition</b>		Pb – Free assembly
<b>Pre Heat</b>	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_s$ )	60 – 180 secs
<b>Average ramp up rate (Liquidus Temp) (<math>T_L</math>) to peak</b>		5°C/second max
<b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>		5°C/second max
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Time ( $t_l$ )	60 – 150 seconds
<b>Peak Temperature (<math>T_p</math>)</b>		260 <sup>+0/-5</sup> °C
<b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>		20 – 40 seconds
<b>Ramp-down Rate</b>		5°C/second max
<b>Time 25°C to peak Temperature (<math>T_p</math>)</b>		8 minutes Max.
<b>Do not exceed</b>		280°C



### Physical Specifications

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

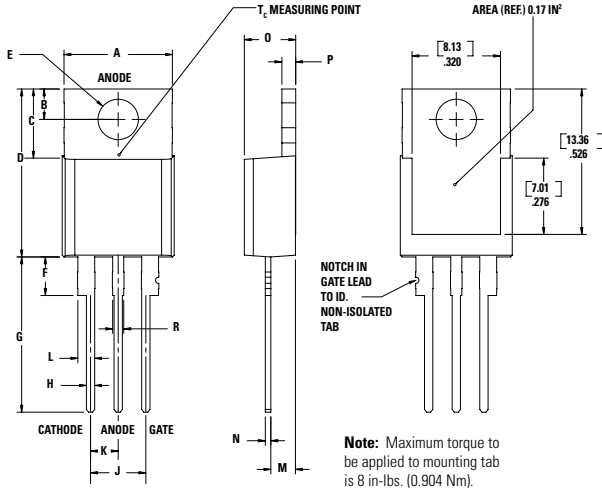
### Design Considerations

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.

### Environmental Specifications

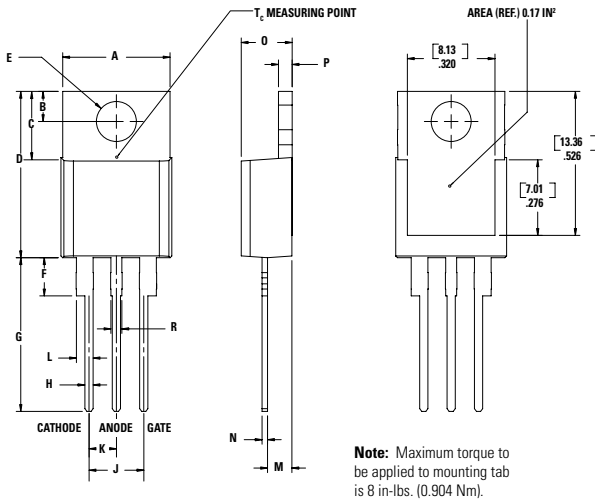
Test	Specifications and Conditions
<b>AC Blocking</b>	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours
<b>Temperature Cycling</b>	MIL-STD-750, M-1051, 1000 cycles; -55°C to +150°C; 15-min dwell-time
<b>Temperature/Humidity</b>	EIA / JEDEC, JESD22-A101 1008 hours; 160V - DC: 85°C; 85% rel humidity
<b>High Temp Storage</b>	MIL-STD-750, M-1031, 1008 hours; 150°C
<b>Low-Temp Storage</b>	1008 hours; -40°C
<b>Resistance to Solder Heat</b>	MIL-STD-750 Method 2031
<b>Solderability</b>	ANSI/J-STD-002, category 3, Test A
<b>Lead Bend</b>	MIL-STD-750, M-2036 Cond E
<b>Moisture Sensitivity Level</b>	Level 1, JEDEC-J-STD-020D

### Dimensions — TO-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead



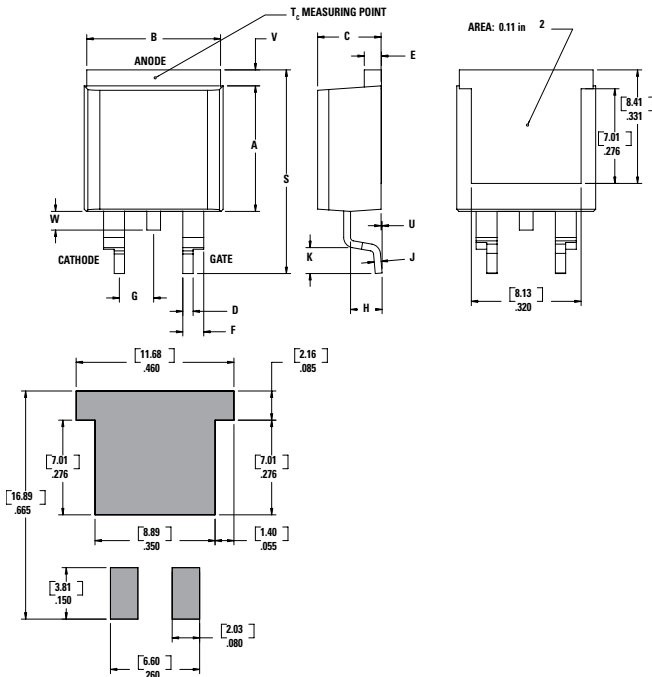
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.61
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060	0.075	1.52	1.91
M	0.085	0.095	2.16	2.41
N	0.018	0.024	0.46	0.61
O	0.178	0.188	4.52	4.78
P	0.045	0.060	1.14	1.52
R	0.038	0.048	0.97	1.22

### Dimensions — TO-220AB (L-Package) — Isolated Mounting Tab



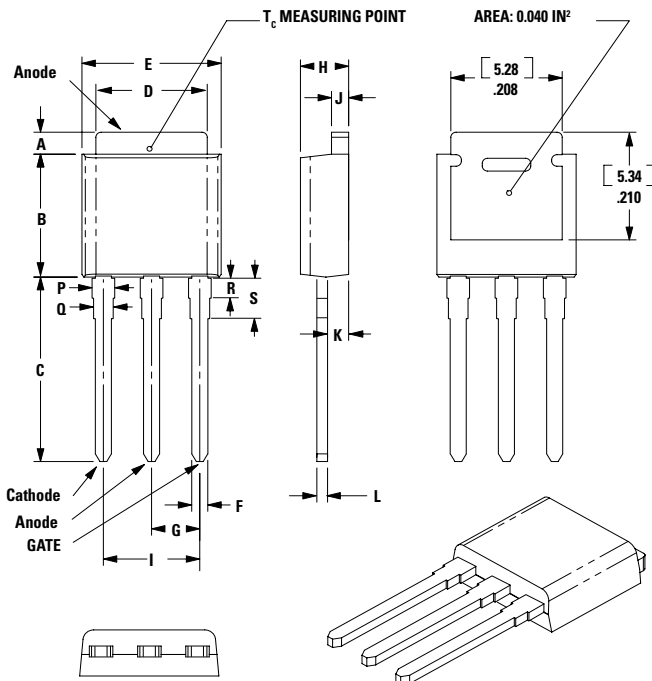
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.61
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060	0.075	1.52	1.91
M	0.085	0.095	2.16	2.41
N	0.018	0.024	0.46	0.61
O	0.178	0.188	4.52	4.78
P	0.045	0.060	1.14	1.52
R	0.038	0.048	0.97	1.22

### Dimensions — TO-263AB (N-package) — D<sup>2</sup>-Pak Surface Mount



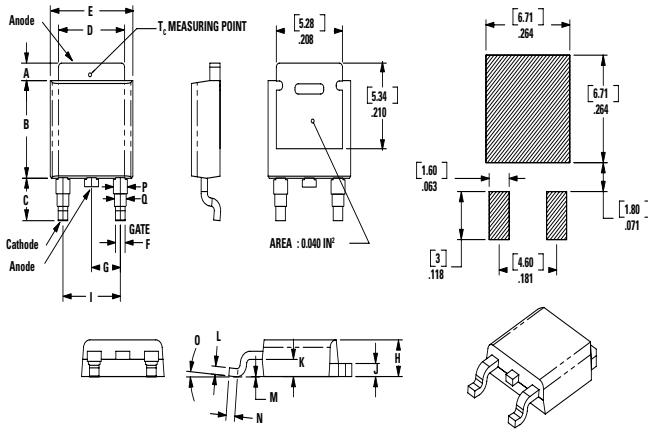
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.360	0.370	9.14	9.40
B	0.380	0.420	9.65	10.67
C	0.178	0.188	4.52	4.78
D	0.025	0.035	0.64	0.89
E	0.045	0.060	1.14	1.52
F	0.060	0.075	1.52	1.91
G	0.095	0.105	2.41	2.67
H	0.092	0.102	2.34	2.59
J	0.018	0.024	0.46	0.61
K	0.090	0.110	2.29	2.79
S	0.590	0.625	14.99	15.88
V	0.035	0.045	0.89	1.14
U	0.002	0.010	0.05	0.25
W	0.040	0.070	1.02	1.78

### Dimensions — TO-251AA (V/I-Package) — V/I-PAK Through Hole



Dimension	Inches			Millimeters		
	Min	Typ	Max	Min	Typ	Max
A	0.040	0.044	0.050	1.02	1.11	1.27
B	0.235	0.242	0.245	5.97	6.15	6.22
C	0.350	0.361	0.375	8.89	9.18	9.53
D	0.205	0.208	0.213	5.21	5.29	5.41
E	0.255	0.262	0.265	6.48	6.66	6.73
F	0.027	0.031	0.033	0.69	0.80	0.84
G	0.087	0.090	0.093	2.21	2.28	2.36
H	0.085	0.092	0.095	2.16	2.34	2.41
I	0.176	0.180	0.184	4.47	4.57	4.67
J	0.018	0.020	0.023	0.46	0.51	0.58
K	0.038	0.040	0.044	0.97	1.01	1.12
L	0.018	0.020	0.023	0.46	0.52	0.58
P	0.042	0.047	0.052	1.06	1.20	1.32
Q	0.034	0.039	0.044	0.86	1.00	1.11
R	0.034	0.039	0.044	0.86	1.00	1.11
S	0.074	0.079	0.084	1.86	2.00	2.11

### Dimensions — TO-252AA (D-Package) — D-PAK Surface Mount



Dimension	Inches			Millimeters		
	Min	Typ	Max	Min	Typ	Max
A	0.040	0.043	0.050	1.02	1.09	1.27
B	0.235	0.243	0.245	5.97	6.16	6.22
C	0.106	0.108	0.113	2.69	2.74	2.87
D	0.205	0.208	0.213	5.21	5.29	5.41
E	0.255	0.262	0.265	6.48	6.65	6.73
F	0.027	0.031	0.033	0.69	0.80	0.84
G	0.087	0.090	0.093	2.21	2.28	2.36
H	0.085	0.092	0.095	2.16	2.33	2.41
I	0.176	0.179	0.184	4.47	4.55	4.67
J	0.018	0.020	0.023	0.46	0.51	0.58
K	0.038	0.040	0.044	0.97	1.02	1.12
L	0.018	0.020	0.023	0.46	0.51	0.58
M	0.000	0.000	0.004	0.00	0.00	0.10
N	0.021	0.026	0.027	0.53	0.67	0.69
O	0°	0°	5°	0°	0°	5°
P	0.042	0.047	0.052	1.06	1.20	1.32
Q	0.034	0.039	0.044	0.86	1.00	1.11

### Product Selector

Part Number	Voltage		Gate Sensitivity	Type	Package
	400V	600V			
SJxx12L	X	X	20mA	Standard SCR	TO-220L
SJxx12R	X	X	20mA	Standard SCR	TO-220R
SJxx12N	X	X	20mA	Standard SCR	TO-263
SJxx12V	X	X	20mA	Standard SCR	TO-251
SJxx12D	X	X	20mA	Standard SCR	TO-252
SJxx12L1	X	X	6mA	Standard SCR	TO-220L
SJxx12R1	X	X	6mA	Standard SCR	TO-220R
SJxx12N1	X	X	6mA	Standard SCR	TO-263
SJxx12V1	X	X	6mA	Standard SCR	TO-251
SJxx12D1	X	X	6mA	Standard SCR	TO-252
SJxx12L2	X	X	10mA	Standard SCR	TO-220L
SJxx12R2	X	X	10mA	Standard SCR	TO-220R
SJxx12N2	X	X	10mA	Standard SCR	TO-263

Note: xx = Voltage/10

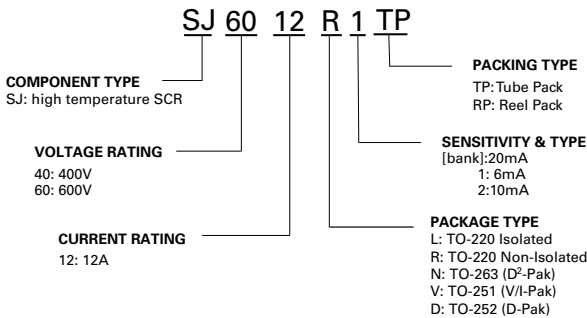


### Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
<b>SJxx12LxTP</b>	SJxx12Ly	2.2g	Tube	1000 (50 per tube)
<b>SJxx12RxTP</b>	SJxx12Ry	2.2g	Tube	1000 (50 per tube)
<b>SJxx12NxTP</b>	SJxx12Ny	1.6g	Tube	1000 (50 per tube)
<b>SJxx12NxRP</b>	SJxx12Ny	1.6g	Embossed Carrier	500
<b>SJxx12DxTP</b>	SJxx12Dx	0.3 g	Tube	750 (75 per tube)
<b>SJxx12DxRP</b>	SJxx12Dx	0.3 g	Embossed Carrier	2500
<b>SJxx12VxTP</b>	SJxx12Vx	0.4 g	Tube	750 (75 per tube)

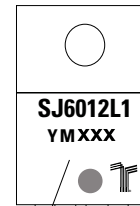
Note: xx=voltage/10, x=sensitivity

### Part Numbering System



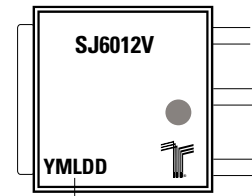
### Part Marking System

TO-220 AB - (L and R Package)  
TO-263 AB - (N Package)



**Date Code Marking**  
Y: Year Code  
M: Month Code  
XXX: Lot Trace Code

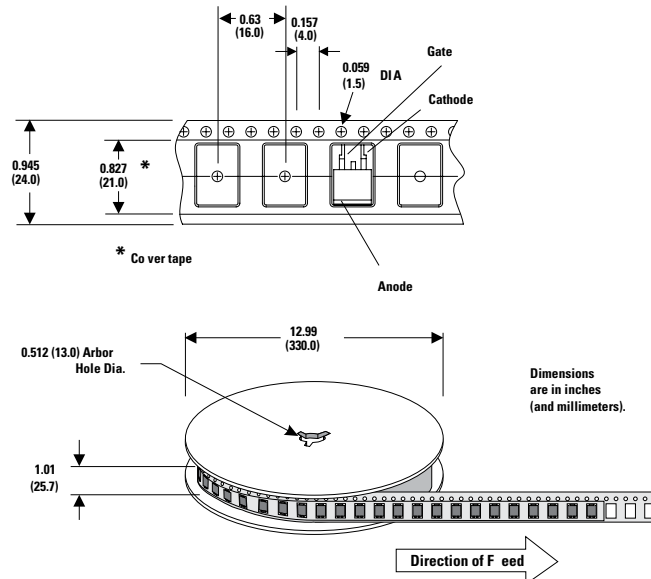
TO-251 (V/I-Pak)  
TO-252 (D-Pak)



**Date Code Marking**  
Y: Year Code  
M: Month Code  
L: Location Code  
DD: Calendar Code

### TO-263 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards



### TO-252 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards

