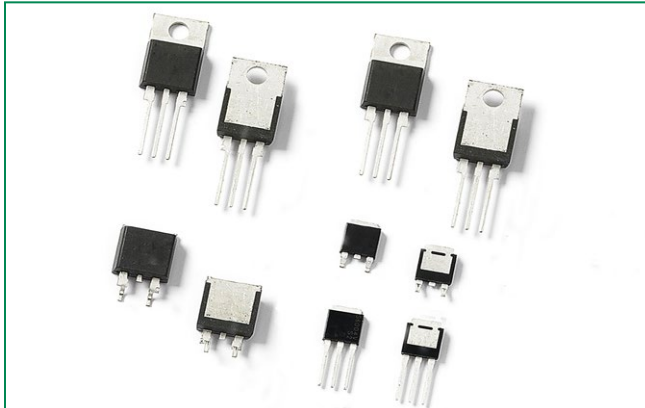


**SJxx12xx series**



**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
- Surge capability up to 120 A at 60 Hz half cycle
- 150°C maximum junction temperature

**Applications**

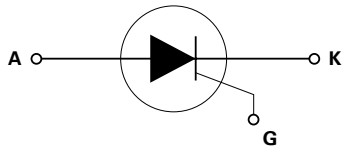
Typical applications include AC Generator (ACG) rectifiers, battery voltage regulators and generic converters and inrush current controller in various AC to DC applications. Additional applications include controls for power tools, home/brown good and white goods appliances.

Isolated packages offered for ease of heat sinking.

**Agency Approval**

Agency	Agency File Number
	L Packages: E71639

**Schematic Symbol**



**Main Features**

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

### Absolute Maximum Ratings

Symbol	Parameter	Test Conditions	Value	Unit
$V_{DSM} / V_{RSM}$	Peak non-repetitive blocking voltage	$P_w = 100 \mu s$	$V_{DRM} / V_{RRM} + 100$	V
$I_{T(RMS)}$	RMS on-state current	SJxx12Lx $T_c = 110^\circ C$	12	A
		SJxx12Rx SJxx12Nx $T_c = 135^\circ C$		
		SJxx12Dx SJxx12Vx $T_c = 125^\circ C$		
$I_{T(AV)}$	Average on-state current	SJxx12Lx $T_c = 110^\circ C$	7.6	A
		SJxx12Rx SJxx12Ny $T_c = 135^\circ C$		
		SJxx12Dx SJxx12Vx $T_c = 125^\circ C$		
$I_{TSM}$	Peak non-repetitive surge current (single half cycle, $T_J$ (initial) = $25^\circ C$ )	$f = 50Hz$	100	A
		$f = 60Hz$	120	
$I^2t$	$I^2t$ Value for fusing	$t_p = 8.3 ms$	60	$A^2s$
$di/dt$	Critical rate of rise of on-state current	$f = 60Hz; T_J = 150^\circ C$	100	$A/\mu s$
$I_{GM}$	Peak gate current	$T_J = 150^\circ C$	2	A
$P_{G(AV)}$	Average gate power dissipation	$T_J = 150^\circ C$	0.5	W
$T_{stg}$	Storage temperature range		-40 to 150	$^\circ C$
$T_J$	Operating junction temperature range		-40 to 150	

Note: xx=voltage/10, x=sensitivity

### Electrical Characteristics ( $T_J = 25^\circ C$ , 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; $T_J = 125^\circ C$	MIN.	800	70	500	$V/\mu s$
	$V_D = 67\% V_{DRM};$ gate open; $T_J = 150^\circ C$		400	-	200	
$V_{GD}$	$V_D = V_{DRM}, R_L = 3.3 k\Omega, T_J = 125^\circ C$	MIN.	0.2	0.2	0.2	V
$I_H$	$I_T = 200mA$ (initial)	MAX.	60	15	35	mA
$t_q$	$I_T = 2A; t_p = 50\mu s; dv/dt = 5V/\mu s; di/dt = 30A/\mu s$	MAX.	40	40	40	$\mu s$
$t_{gt}$	$I_G = 2 \times I_{GT}, PW = 15\mu s, I_T = 24A$	TYP.	2	2	2	$\mu s$

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	
$I_{GT}$	$V_D = 12\text{V}$ $R_L = 60\ \Omega$	MAX.	6	mA
		MIN.	2	
$V_{GT}$		MAX.	1.5	V
$dv/dt$	$V_D = V_{DRM}$ ; gate open; $T_J = 125^\circ\text{C}$	400V	100	V/ $\mu\text{s}$
		600V	75	
	$V_D = V_{DRM}$ ; gate open; $T_J = 150^\circ\text{C}$	400V	50	
		600V	10	
$V_{GD}$	$V_D = V_{DRM}$ $R_L = 3.3\ \text{k}\Omega$ $T_J = 125^\circ\text{C}$	MIN.	0.2	V
	$V_D = V_{DRM}$ $R_L = 3.3\ \text{k}\Omega$ $T_J = 150^\circ\text{C}$	MIN.	0.1	
$I_H$	$I_T = 200\text{mA}$ (initial)	MAX.	20	mA
$t_q$	$I_T = 2\text{A}$ ; $t_p = 50\ \mu\text{s}$ ; $dv/dt = 5\text{V}/\mu\text{s}$ ; $di/dt = 30\text{A}/\mu\text{s}$	MAX.	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	$\mu\text{s}$

Note: xx=voltage/10, x=package

### Static Characteristics

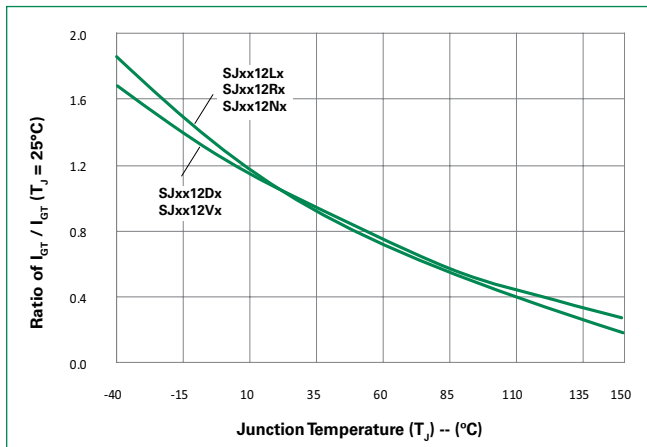
Symbol	Test Conditions	Value	Unit
$V_{TM}$	Component $I_T = 24\text{A}$ ; $t_p = 380\ \mu\text{s}$	MAX.	V
$I_{DRM} / I_{RRM}$	$V_{DRM} = V_{RRM}$	$T_J = 25^\circ\text{C}$	10
		$T_J = 125^\circ\text{C}$	500
		$T_J = 150^\circ\text{C}$	2000

### Thermal Resistances

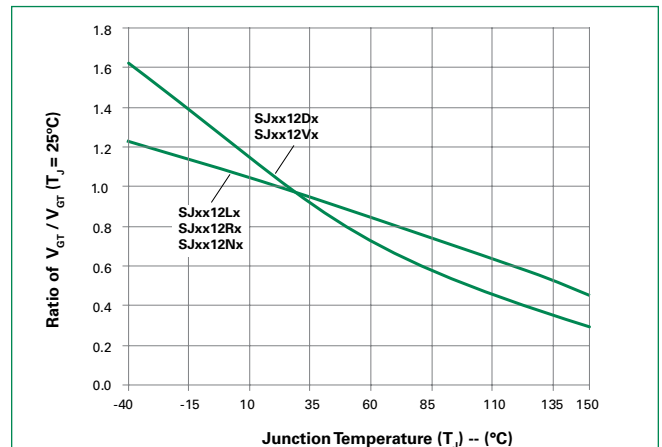
Symbol	Parameter	Value	Unit
$R_{\theta(JC)}$	Junction to case (AC)	SJxx12Lx	2.4
		SJxx12Rx SJxx12Nx	1.1
		SJxx12Dx SJxx12Vx	1.4

Note: xx=voltage/10, x=sensitivity

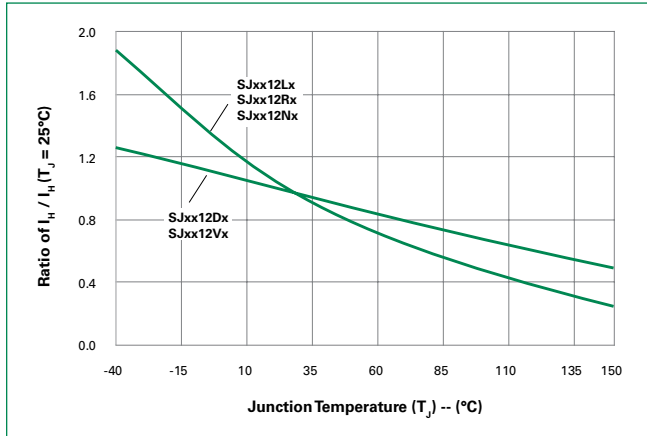
**Figure 1: Normalized DC Gate Trigger Current vs. Junction Temperature**



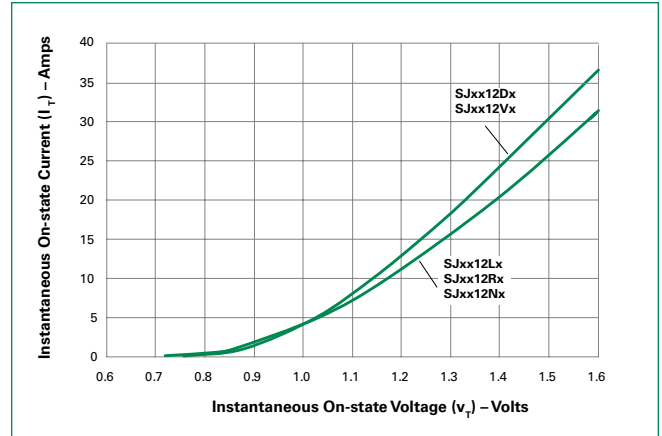
**Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature**



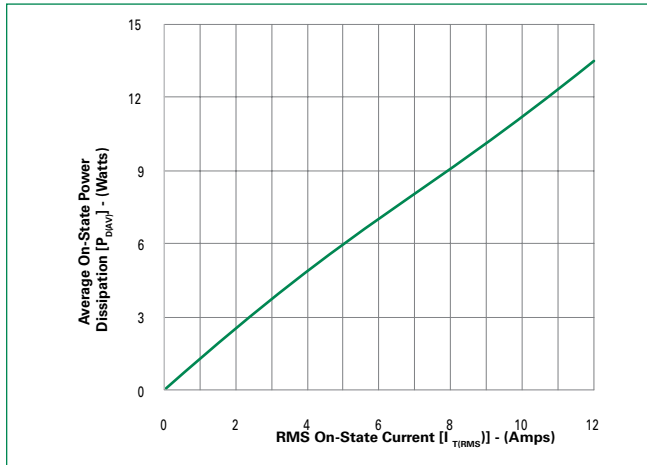
**Figure 3: Normalized DC Holding Current vs. Junction Temperature**



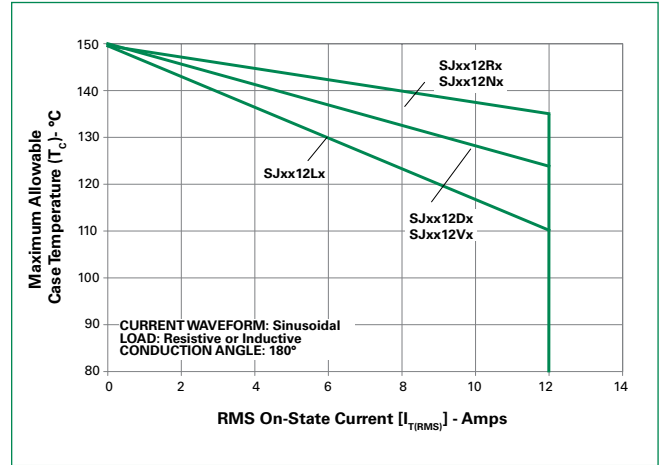
**Figure 4: On-State Current vs. On-State Voltage (Typical)**



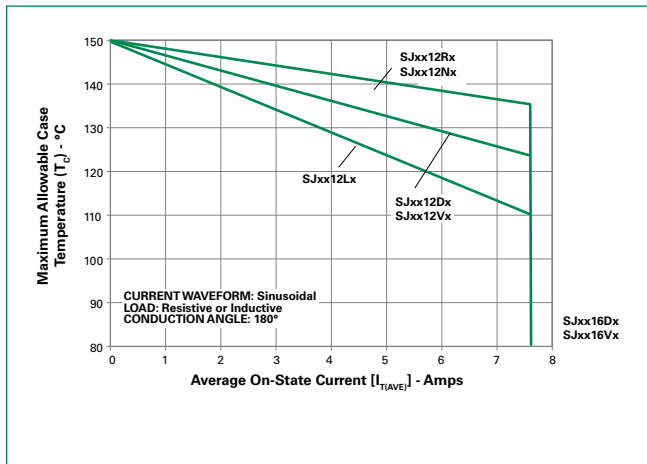
**Figure 5: Power Dissipation (Typical) vs. RMS On-State Current**



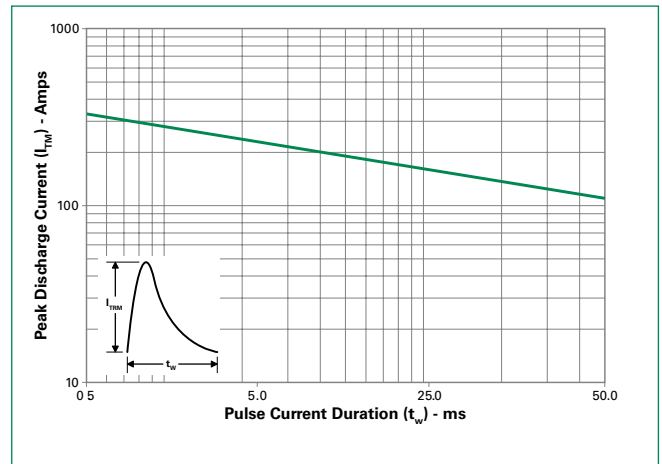
**Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current**



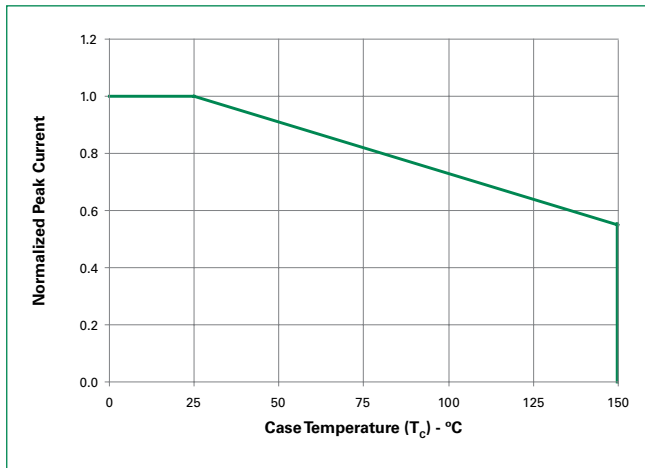
**Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current**



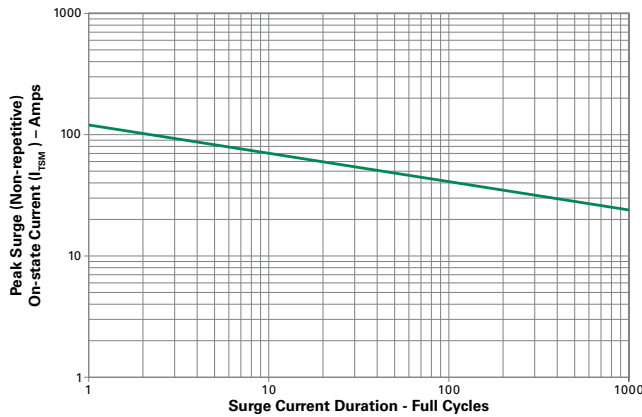
**Figure 8: Peak Capacitor Discharge Current**



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



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

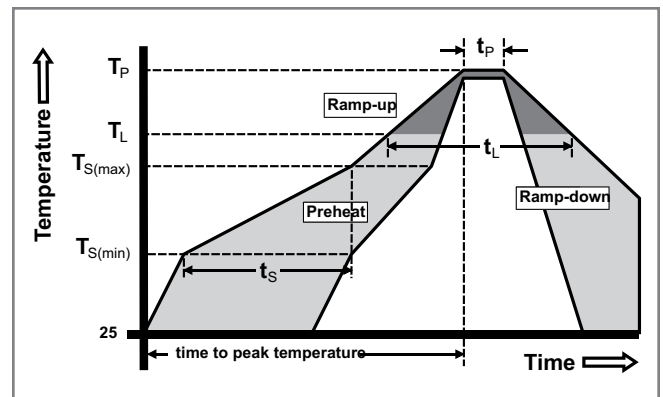


SUPPLY FREQUENCY: 60 Hz Sinusoidal  
LOAD: Resistive  
RMS On-State Current: [ $I_{T(RMS)}$ ]: Maximum Rated Value at Specified Case Temperature

- Notes:
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 ( $t_L$ )	60 – 150 seconds
Peak Temperature ( $T_p$ )		260 <sup>+0/-5</sup> °C
Time within 5°C of actual peak Temperature ( $t_p$ )		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

<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

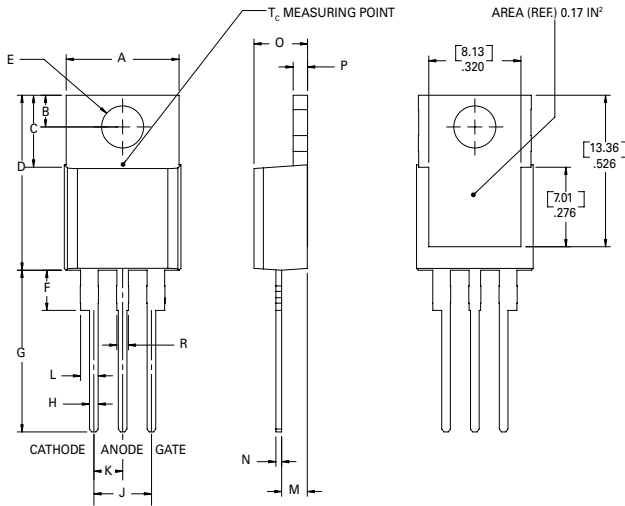
### Design Considerations

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

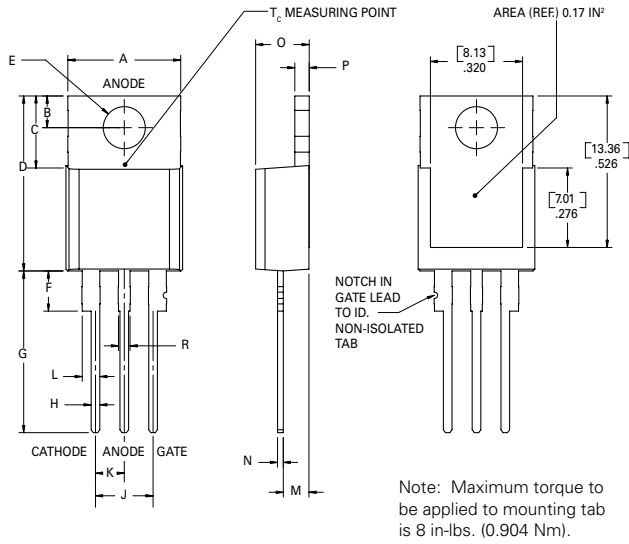
Test	Specifications and Conditions
<b>AC Blocking</b>	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours
<b>Temperature Cycling</b>	MIL-STD-750, M-1051, 100 cycles; -55°C to +150°C; 15-min dwell-time
<b>Temperature/Humidity</b>	EIA / JEDEC, JESD22-A101 1008 hours; 160V - DC: 85°C; 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 (L-Package) — Isolated Mounting Tab



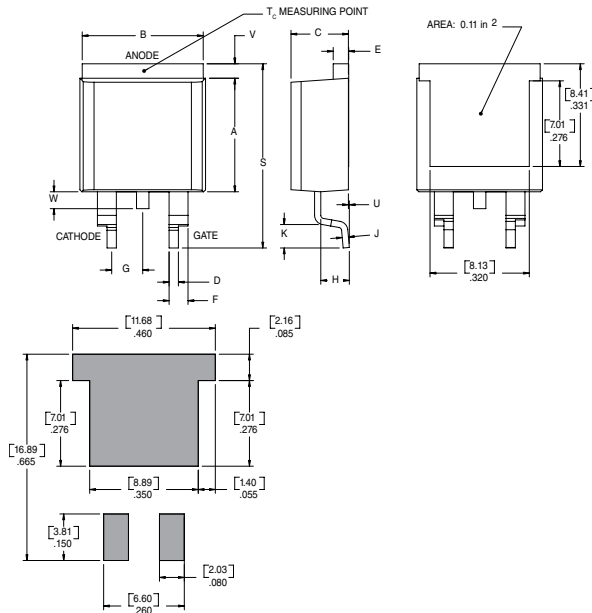
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.61
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060	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-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead**



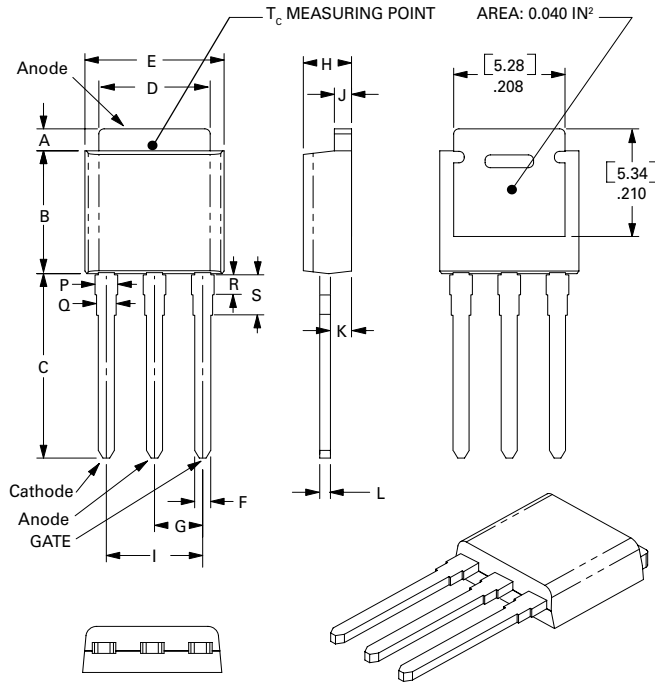
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.61
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060	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- 263AB (N-package) — D<sup>2</sup>-Pak Surface Mount**



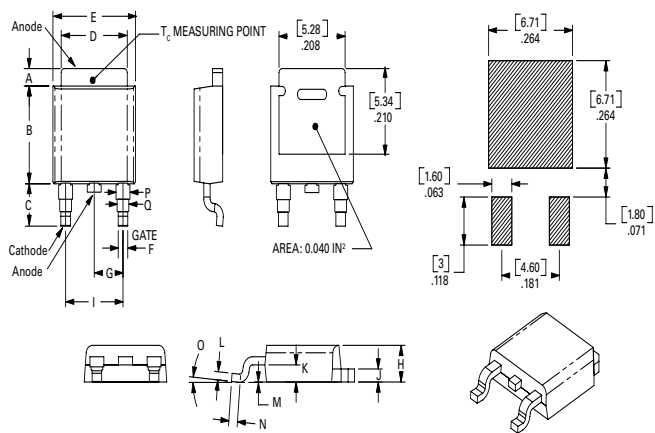
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.360	0.370	9.14	9.40
B	0.380	0.420	9.65	10.67
C	0.178	0.188	4.52	4.78
D	0.025	0.035	0.64	0.89
E	0.045	0.060	1.14	1.52
F	0.060	0.075	1.52	1.91
G	0.095	0.105	2.41	2.67
H	0.092	0.102	2.34	2.59
J	0.018	0.024	0.46	0.61
K	0.090	0.110	2.29	2.79
S	0.590	0.625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

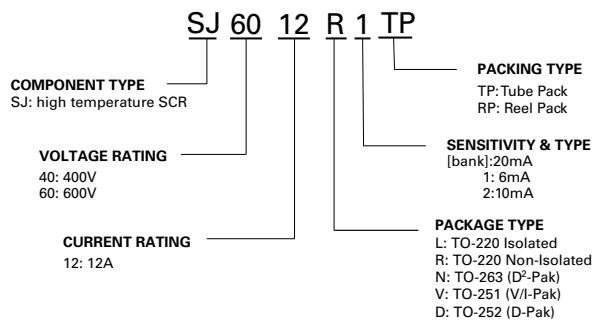
Note: xx = Voltage/10

### Packing Options

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

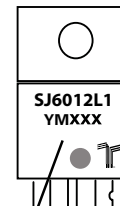
Note: xx=voltage/10, x=sensitivity

### Part Numbering System



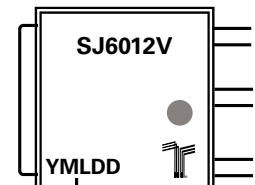
### Part Marking System

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

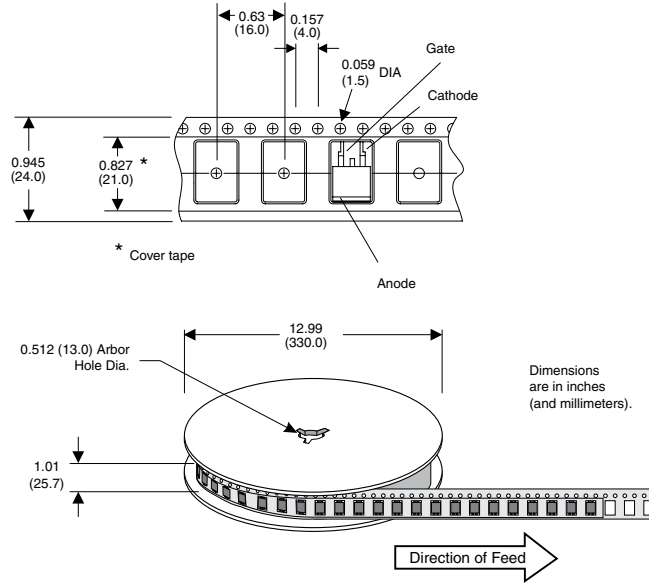
TO-251 (V/I-Pak)  
TO-252 (D-Pak)



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

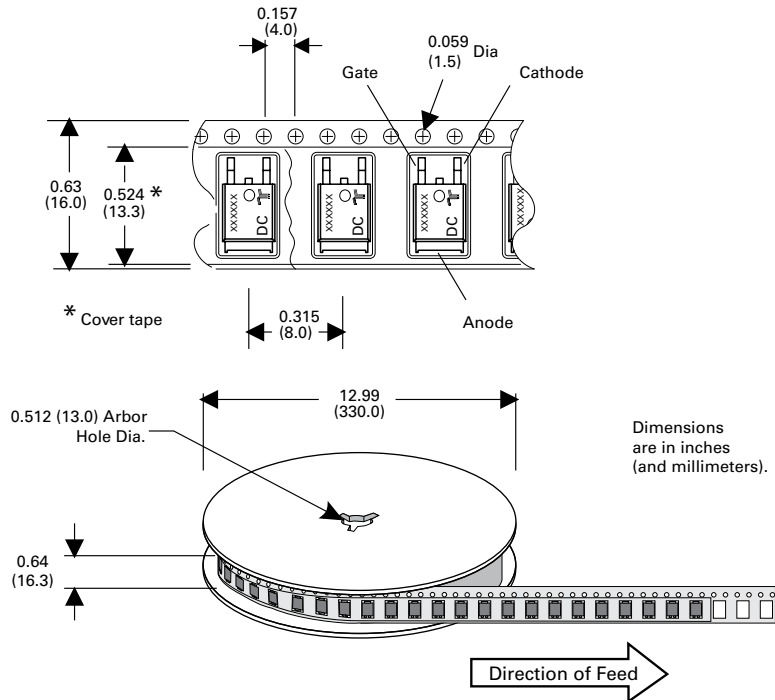
### TO-263 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards



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

Meets all EIA-481-2 Standards



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