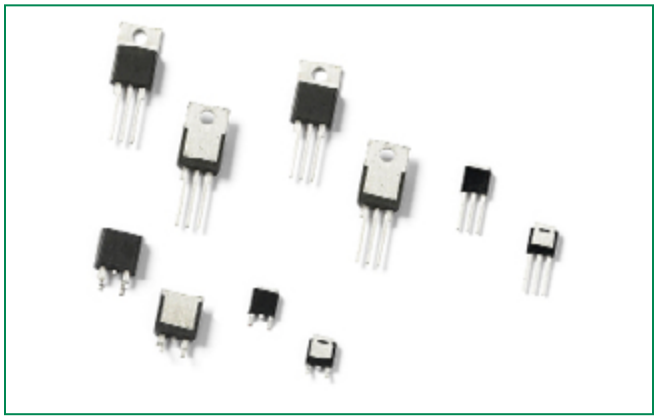
Thyristors
12 Amp Standard SCRs

Sxx12x Series



Description

This Sxx12x SCR series is ideal for uni-directional switch applications such as phase control, heating, motor speed controls, converters/rectifiers and capacitive discharge ignitions.

These SCRs have a low gate current trigger level of 20 mA at approximately 1.5V.

Features & Benefits

- Halogen-free and RoHS-compliant
- Glass – passivated junctions
- Electrically isolated "L-Package" is UL Recognized for 2500Vrms
- Voltage capability up to 1000 V
- Surge capability up to 120 A at 60 Hz half cycle

Agency Approval

Agency	Agency File Number
	E71639*

* - L Packages Only

Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	12	A
V_{DRM}/V_{RRM}	400 to 1000	V
I_{GT}	20	mA

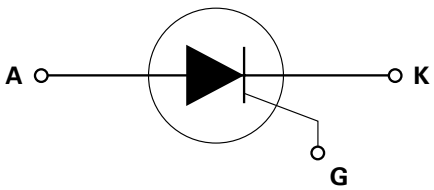
Applications

Typical applications includes capacitive discharge system for motorcycle engine CDI, portable generator engine ignition, strobe lights and nailers, as well as generic rectifiers, battery voltage regulators and converters. Also AC control & rectification for power tools, home/brown goods, white goods appliances and 2-wheeler rectifier/ battery regulators.
Internally constructed isolated packages are offered for ease of heat sinking with highest isolation voltage.

Additional Information

Datasheet | Resources | Samples

Schematic Symbol



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Absolute Maximum Ratings

Symbol	Parameter	Test Conditions		Value	Unit
$I_{T(RMS)}$	RMS on-state current	Sxx12L	T_C = 72°C	12	A
		Sxx12R / Sxx12N Sxx12D Sxx12V	T_C = 105°C		
$I_{T(AV)}$	Average on-state current	Sxx12L	T_C =72°C	7.6	A
		Sxx12R Sxx12D Sxx12V	T_C =105°C		
I_{TSM}	Peak non-repetitive surge current (single half cycle, T_J (initial) = 25°C)	Sxx12L Sxx12R / Sxx12N	f = 50Hz	120	A
			f = 60Hz	130	
		Sxx12D Sxx12V	f = 50Hz	100	
			f = 60Hz	120	
I^2t	I^2t Value for fusing	Sxx12L Sxx12R / Sxx12N	t_p = 8.3 ms	70	A^2s
		Sxx12D Sxx12V		60	
di/dt	Critical rate of rise of on-state current	f = 60Hz; T_J = 125°C		100	A/µs
I_{GM}	Peak gate current	T_J = 125°C		2	A
$P_{G(AV)}$	Average gate power dissipation	T_J = 125°C		0.5	W
T_{stg}	Storage temperature range			-40 to 150	°C
T_J	Operating junction temperature range			-40 to 125	

Note: xx = voltage

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

Symbol	Test Conditions			Value	Unit
I_{GT}	V_D = 12V R_L = 60 Ω		MAX.	20	mA
			MIN.	1	
V_{GT}	V_D = 12V R_L = 60 Ω		MAX.	1.5	V
dv/dt	$V_D = V_{DRM}$; gate open; T_J = 100°C	400V	MIN.	350	V/µs
		600V		300	
		800V		250	
		1000V		100	
	$V_D = V_{DRM}$; gate open; T_J = 125°C	400V		250	
		600V		225	
		800V		200	
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.	40	mA
t_q	I_T = 2A; t_p = 50µs; dv/dt = 5V/µs; di/dt = 30A/µs		MAX.	35	µs
t_{gt}	I_G = 2 x I_{GT} PW = 15µs I_T = 20A		TYP.	2	µs

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Static Characteristics

Symbol	Test Conditions				Value	Unit
V_{TM}	I_T = 24A; t_p = 380 µs			MAX.	1.6	V
I_{DRM} / I_{RRM}	$V_{DRM} = V_{RRM}$	T_J = 25°C	400 – 600V	MAX.	10	µA
			800 – 1000V		20	
		T_J = 100°C	400 – 800V		500	
			1000V		3000	
		T_J = 125°C	400 – 800V		1000	

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{\theta(J-C)}$	Junction to case (AC)	Sxx12L	3.2	°C/W
		Sxx12R / Sxx12N	1.5	
		Sxx12V	1.6	
		Sxx12D	1.4	
$R_{\theta(J-A)}$	Junction to ambient	Sxx12L	50	°C/W
		Sxx12R	40	
		Sxx12V	70	

Note: xx = voltage

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

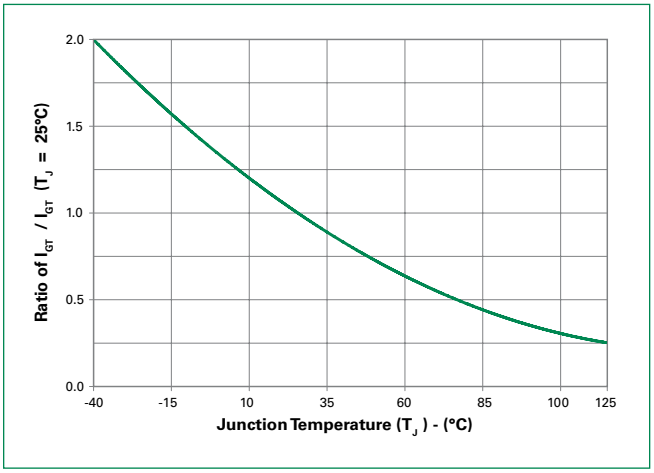
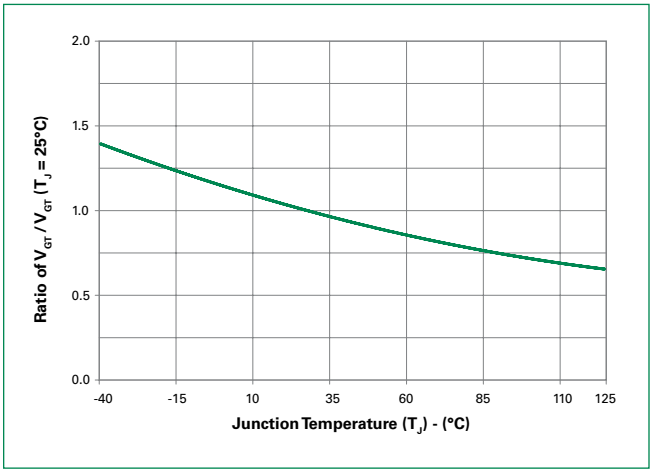


Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature



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Figure 3: Normalized DC Holding Current vs. Junction Temperature

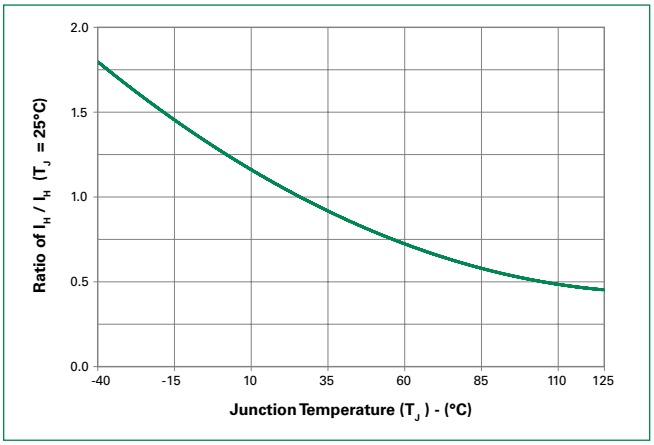


Figure 4: On-State Current vs. On-State Voltage (Typical)

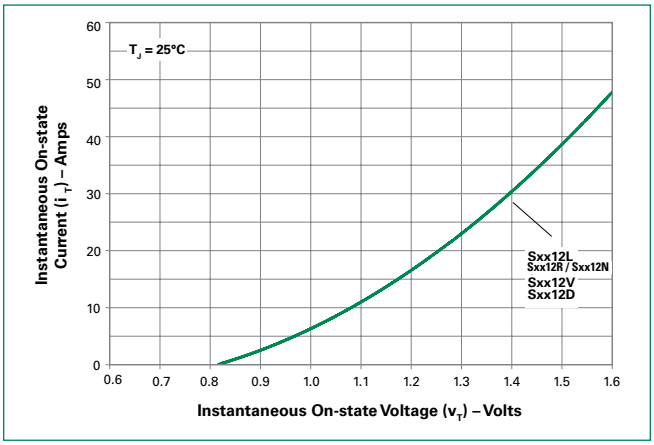


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

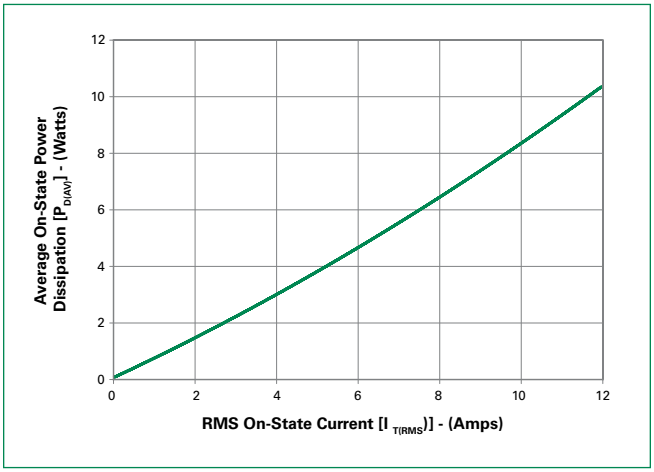


Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

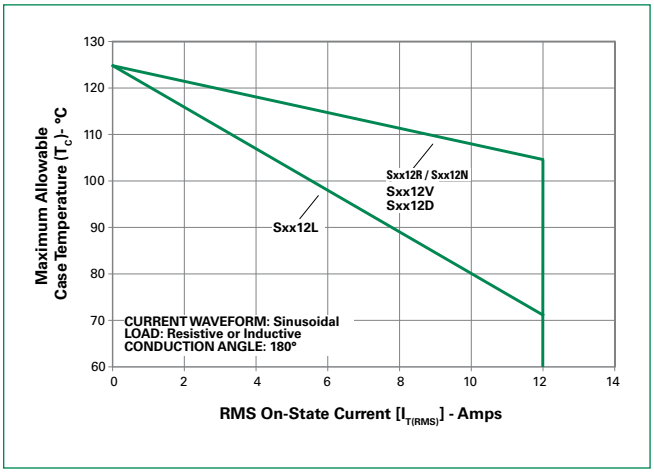


Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

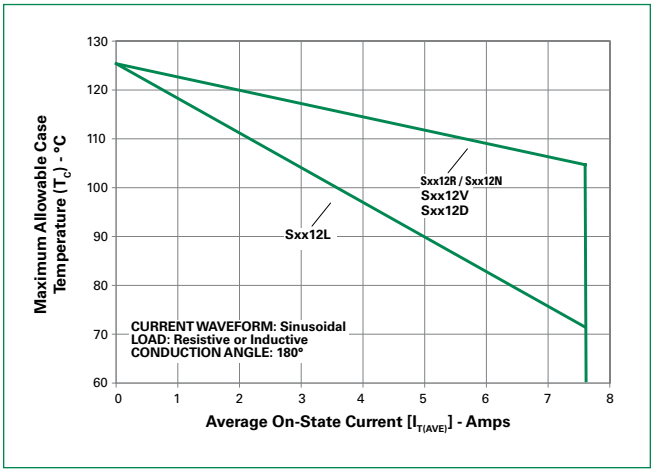
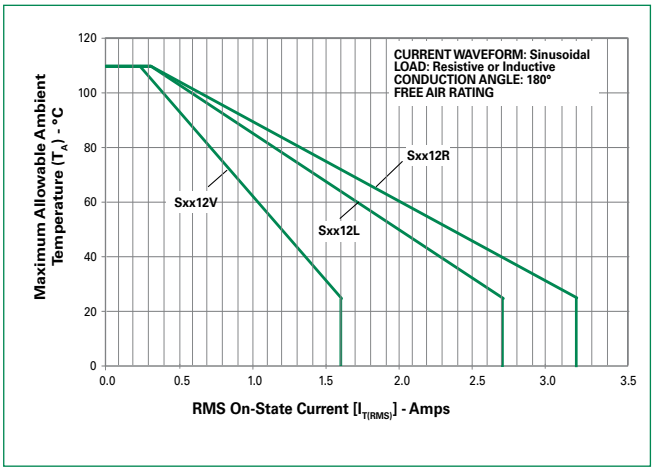


Figure 8: Maximum Allowable Ambient Temperature vs. RMS On-State Current



Note: xx = voltage

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

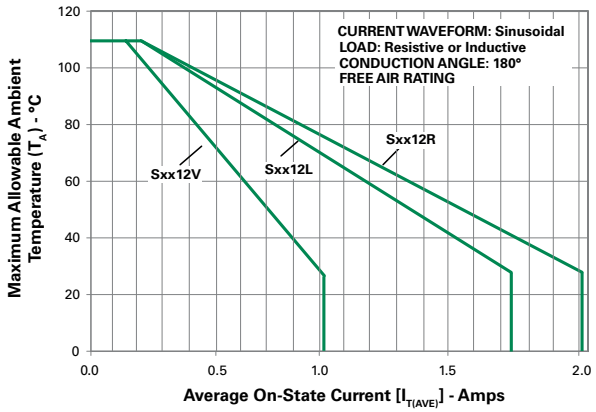


Figure 10: Peak Capacitor Discharge Current

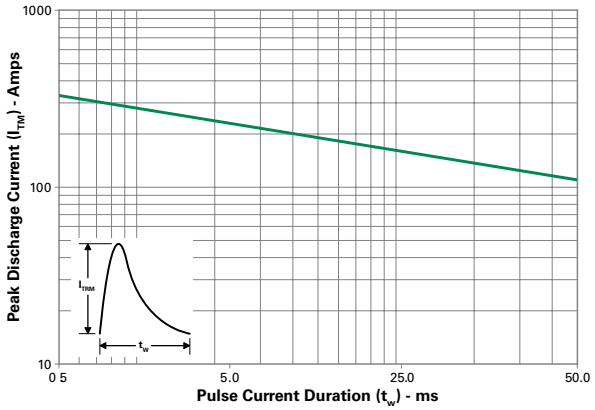


Figure 11: Peak Capacitor Discharge Current Derating

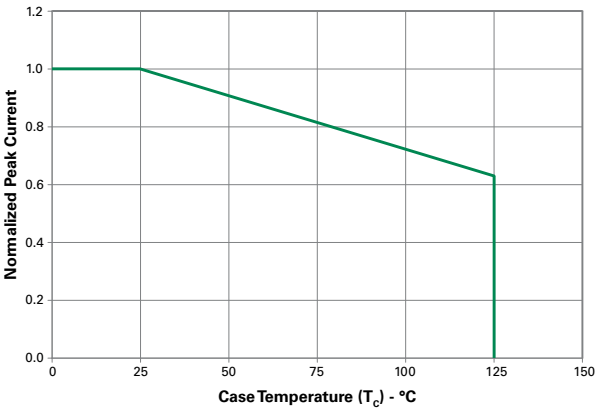
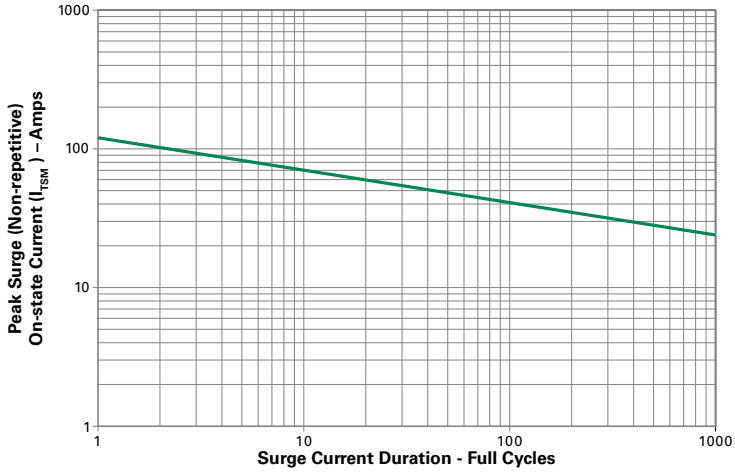


Figure 12: Surge Peak On-State Current vs. Number of Cycles



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

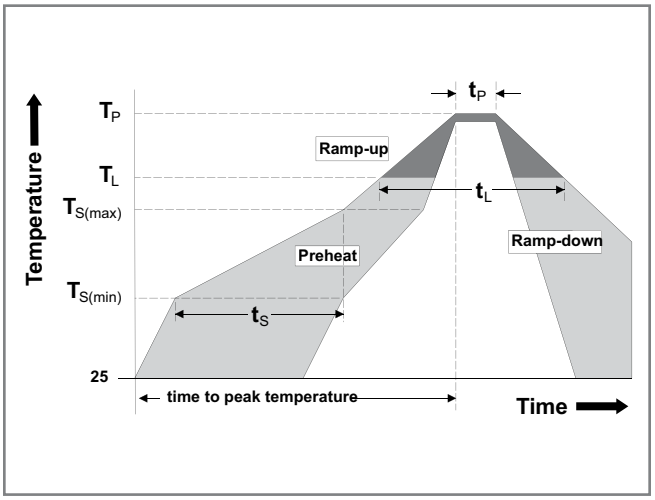
Notes:

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.

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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 – 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
	- Temperature (t_L)	60 – 150 seconds
Peak Temperature (T_P)		$260^{+0/-5}$ °C
Time within 5°C of actual peak Temperature (t_p)		30 seconds
Ramp-down Rate		6°C/second max
Time 25°C to peak Temperature (T_P)		8 minutes Max.
Do not exceed		260°C



Physical Specifications

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

Design Considerations

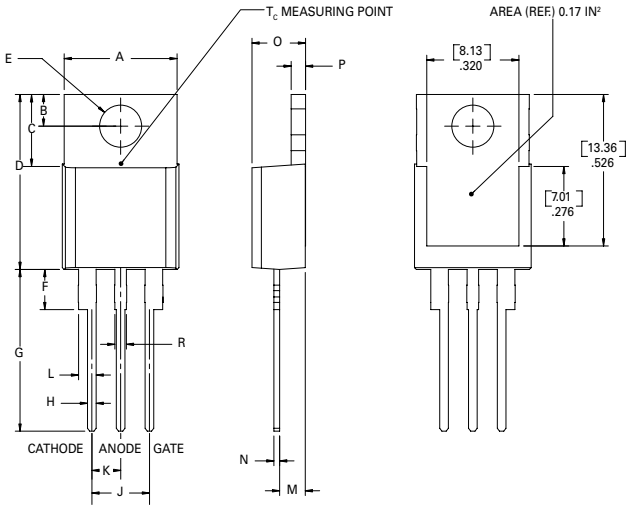
Careful selection of the correct component for the application's operating parameters and environment will go a long way toward extending the operating life of the Thyristor. Good design practice should limit the maximum continuous current through the main terminals to 75% of the component rating. Other 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.

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
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

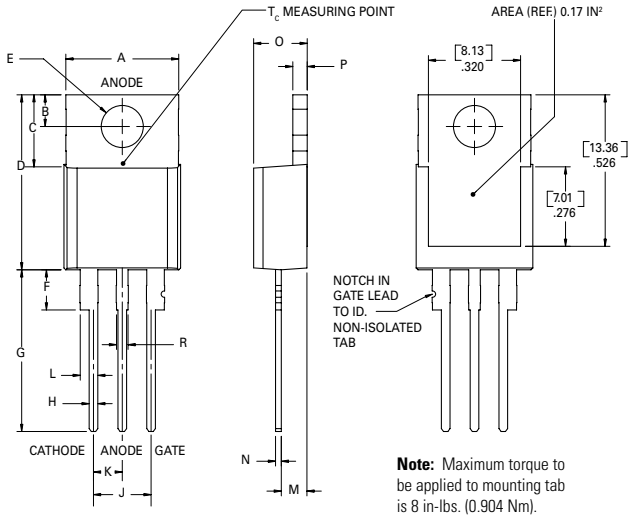
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Dimensions — TO-220AB (L-Package) — Isolated Mounting Tab



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

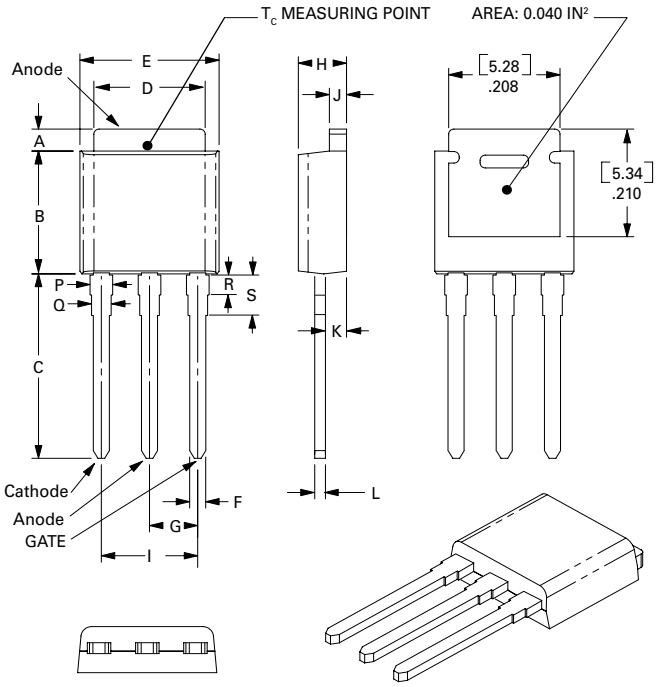


Note: Maximum torque to be applied to mounting tab is 8 in-lbs. (0.904 Nm).

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

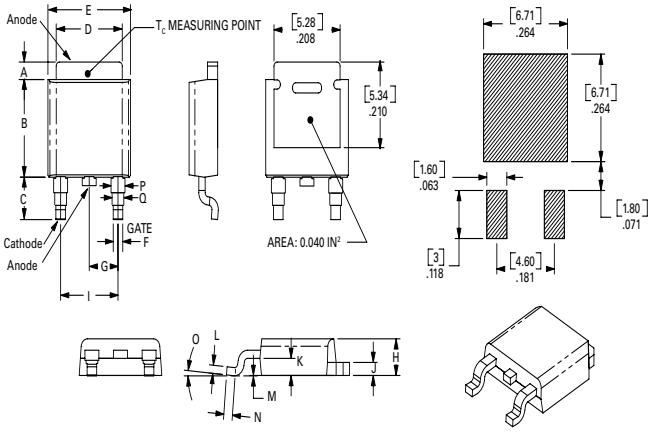
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Dimensions — TO-251AA (V/I-Package) — V/I-PAK Through Hole



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

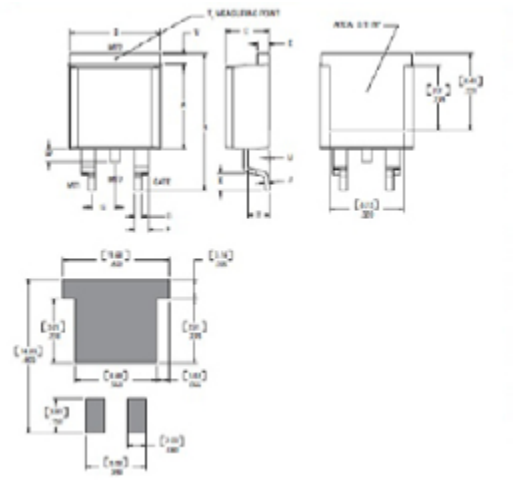
Dimensions — TO-252AA (D-Package) — D-PAK Surface Mount



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

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Dimensions — TO-263 (N-Package) — D²PAK 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

Product Selector

Part Number	Voltage				Gate Sensitivity	Type	Package
	400V	600V	800V	1000V			
Sxx12L	X	X	X	X	20mA	Sensitive SCR	TO-220L
Sxx12R	X	X	X	X	20mA	Sensitive SCR	TO-220R
Sxx12V	X	X	X	X	20mA	Standard SCR	TO-251
Sxx12D	X	X	X	X	20mA	Standard SCR	TO-252
Sxx12N	X	X	X	X	20mA	Standard SCR	TO-263

Note: xx = voltage/10

Packing Options

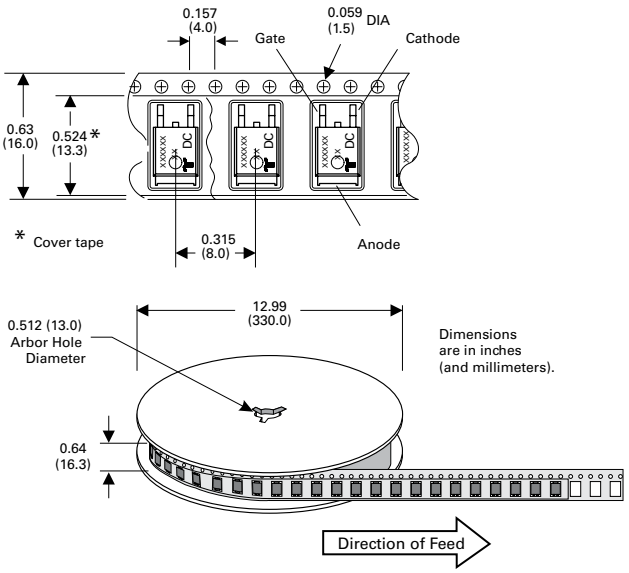
Part Number	Marking	Weight	Packing Mode	Base Quantity
Sxx12LTP	Sxx12L	2.2 g	Tube	1000 (50 per tube)
Sxx12RTP	Sxx12R	2.2 g	Tube	1000 (50 per tube)
Sxx12DTP	Sxx12D	0.3 g	Tube	750 (75 per tube)
Sxx12DRP	Sxx12D	0.3 g	Embossed Carrier	2500
Sxx12VTP	Sxx12V	0.4 g	Tube	750 (75 per tube)
Sxx12NRP	Sxx12N	1.6g	Embossed Carrier	2500
Sxx12NTP	Sxx12N	1.6 g	Tube	1000 (50 per tube)

Note: xx = Voltage/10

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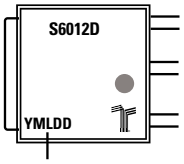
TO-252 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards



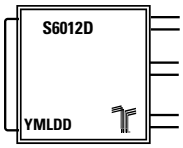
Part Marking System

TO-251AA - (V Package)

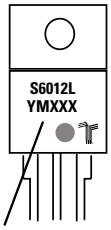


Date Code Marking
Y:Year Code
M: Month Code
L: Location Code
DD: Calendar Code

TO-252AA - (D Package)

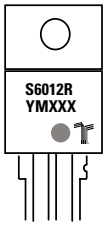


TO-220 AB - (L Package)

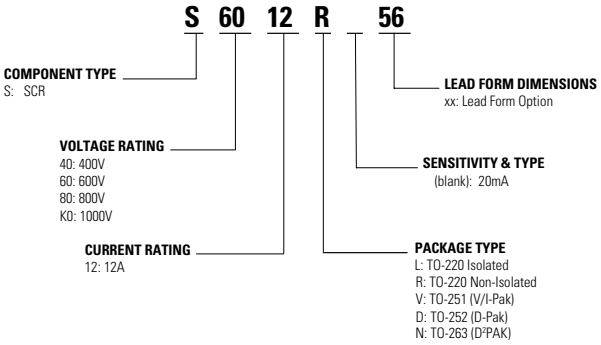


Date Code Marking
Y:Year Code

TO-263AA (N Package)
TO-220 AB - (R Package)



Part Numbering System



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