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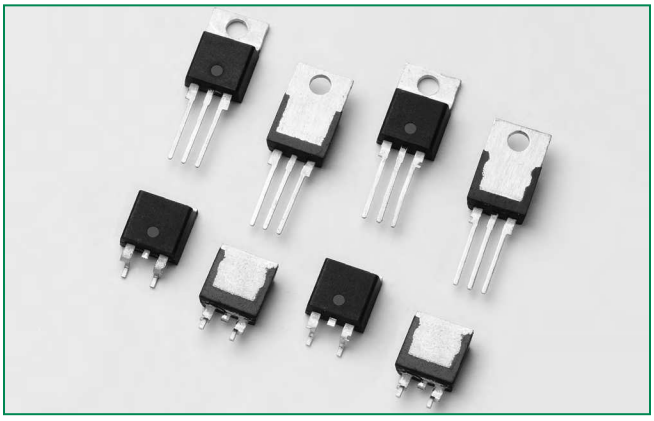
Teccor® brand Thyristors

20 / 25 Amp Standard SCRs

Littelfuse®
Expertise Applied | Answers Delivered

Sxx20x & Sxx25x Series

RoHS



Description

Excellent unidirectional switches for phase control applications such as heating and motor speed controls.

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 1000 V
- Surge capability up to 350 A

Agency Approval

Agency	Agency File Number
	L Package: E71639

Applications

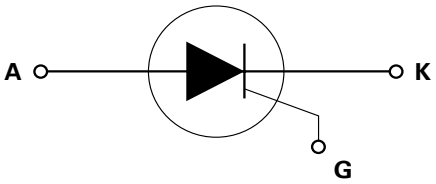
Typical applications are AC solid-state switches, industrial power tools, exercise equipment, white goods and commercial appliances.

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

Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	20 & 25	A
V_{DRM}/V_{RRM}	400 to 1000	V
I_{GT}	30 to 35	mA

Schematic Symbol



Additional Information

Datasheet | Resources | Samples

Absolute Maximum Ratings — 20A SCR

Symbol	Parameter	Test Conditions		Value	Unit
$I_{T(RMS)}$	RMS on-state current	T_C = 80°C		20	A
$I_{T(AV)}$	Average on-state current	Sxx20x & Sxx20L	T_C = 80°C	12.8	A
I_{TSM}	Peak non-repetitive surge current	single half cycle; f = 50Hz; T_J (initial) = 25°C		255	A
		single half cycle; f = 60Hz; T_J (initial) = 25°C		300	
I^2t	I^2t Value for fusing	t_p = 8.3 ms		374	A^2s
di/dt	Critical rate of rise of on-state current	f = 60Hz ; T_J = 125°C		125	A/µs
I_{GM}	Peak gate current	T_J = 125°C		3	A
$P_{G(AV)}$	Average gate power dissipation	T_J = 125°C		0.6	W
T_{stg}	Storage temperature range			-40 to 150	°C
T_J	Operating junction temperature range			-40 to 125	°C

Revised: 06/14/16

Absolute Maximum Ratings — 25A SCR

Symbol	Parameter	Test Conditions		Value	Unit
$I_{T(RMS)}$	RMS on-state current	Sxx25L: T_C=75°C		25	A
		Sxx25R/Sxx25N: T_C=100°C			
$I_{T(AV)}$	Average on-state current	Sxx25L	T_C = 75°C	16	A
		Sxx25R/Sxx25N	T_C = 100°C		
I_{TSM}	Peak non-repetitive surge current	single half cycle; f = 50Hz; T_J (initial) = 25°C		300	A
		single half cycle; f = 60Hz; T_J (initial) = 25°C		350	
I^2t	I^2t Value for fusing	t_p = 8.3 ms		510	A^2s
di/dt	Critical rate of rise of on-state current	f = 60Hz ; T_J = 125°C		150	A/µs
I_{GM}	Peak gate current	T_J = 125°C		3.5	A
$P_{G(AV)}$	Average gate power dissipation	T_J = 125°C		0.8	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
				Sxx20L	Sxx25x	
I_{GT}	V_D = 12V R_L = 30 Ω		MAX.	30	35	mA
			MIN.	1	1	
V_{GT}	V_D = 12V R_L = 30 Ω		MAX.	1.5		V
dv/dt	V_D = V_{DRM}; gate open; T_J = 100°C	400V	MIN.	450		V/µs
		600V		425		
		800V		400		
		1000V		200		
	V_D = V_{DRM}; gate open; T_J = 125°C	400V		350		
		600V		325		
		800V		300		
V_{GD}	V_D = V_{DRM} R_L = 3.3 kΩ T_J = 125°C		MIN.	0.2		V
I_H	I_T = 400mA (initial)		MAX.	40	50	mA
t_q	(1)		MAX.	35		µs
t_{gt}	I_G = 2 x I_{GT} PW = 15µs I_T = 40A		TYP.	2		µs

Note: xx = voltage, x = package
(1) I_T=2A; t_p=50µs; dv/dt=5V/µs; di/dt=-30A/µs

Revised: 06/14/16

Static Characteristics

Symbol	Test Conditions				Value	Unit
V_{TM}	20A Device I_T = 40A; t_p = 380µs			MAX.	1.6	V
	25A Device I_T = 50A; t_p = 380µs					
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 – 600V		500	
			800V		1000	
			1000V		3000	
		T_J = 125°C	400 – 600V		1000	
			800V		2000	

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{\theta(J-C)}$	Junction to case (AC)	Sxx25R / Sxx25N	1.0	°C/W
		Sxx20L/ Sxx25L	2.4	
$R_{\theta(J-A)}$	Junction to ambient	Sxx25R	40	°C/W
		Sxx20L / Sxx25L	50	

Note: xx = voltage

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

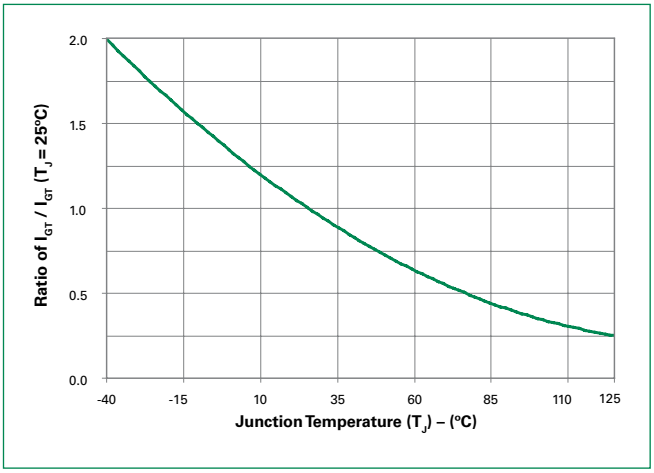


Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

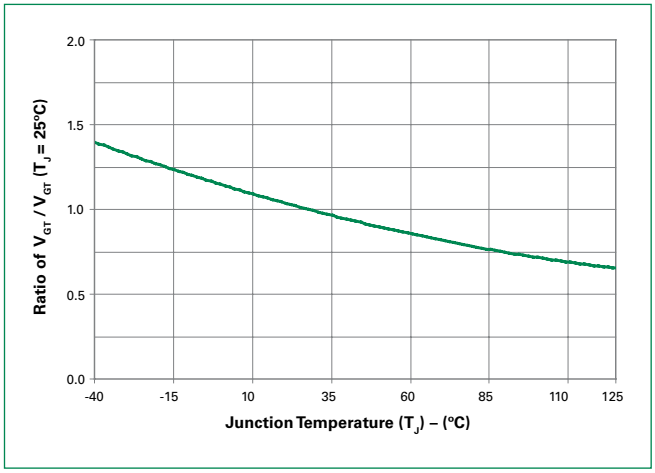


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Figure 3: Normalized DC Holding Current vs. Junction Temperature

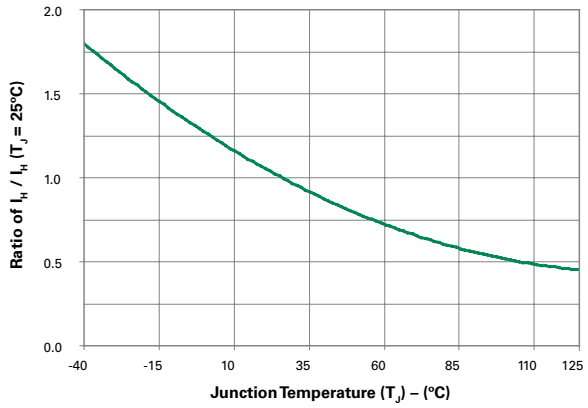

Figure 4: On-State Current vs. On-State Voltage (Typical)

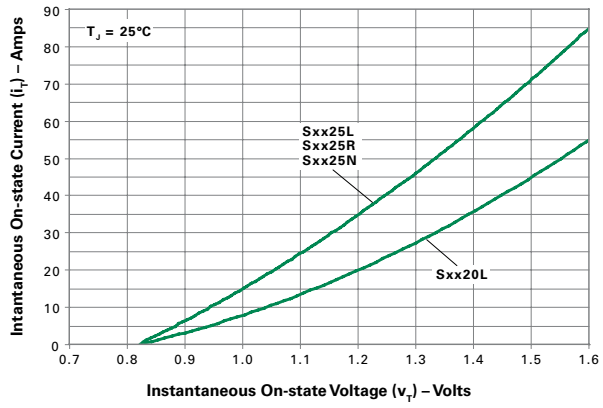

Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

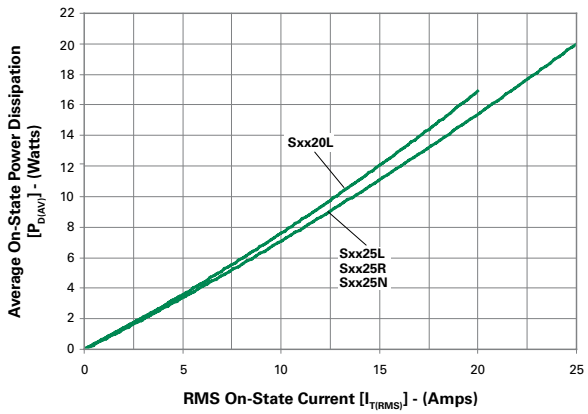

Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

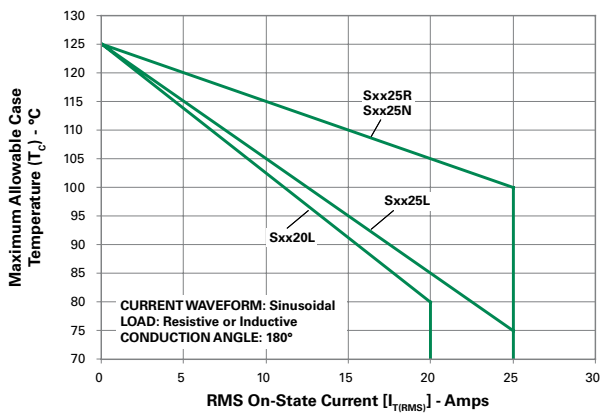

Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

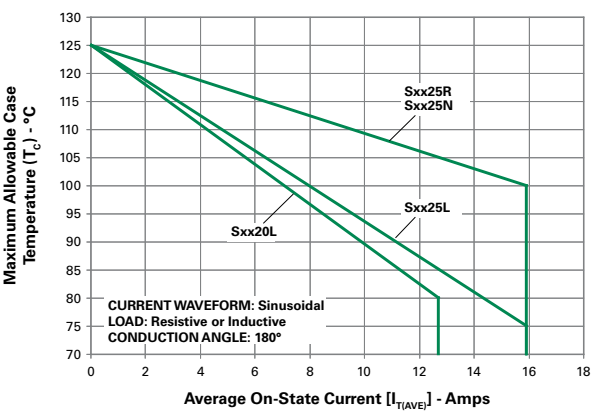

Figure 8: Maximum Allowable Ambient Temperature vs. RMS On-State Current

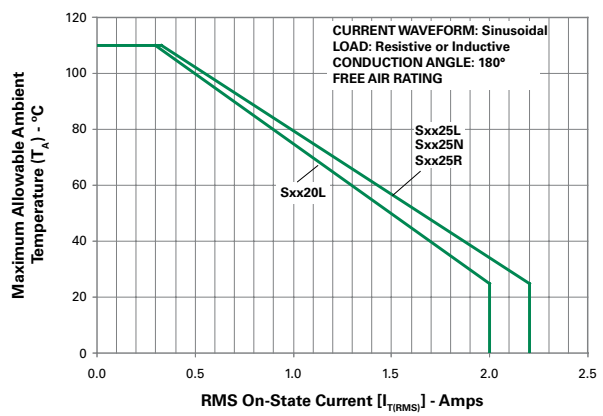

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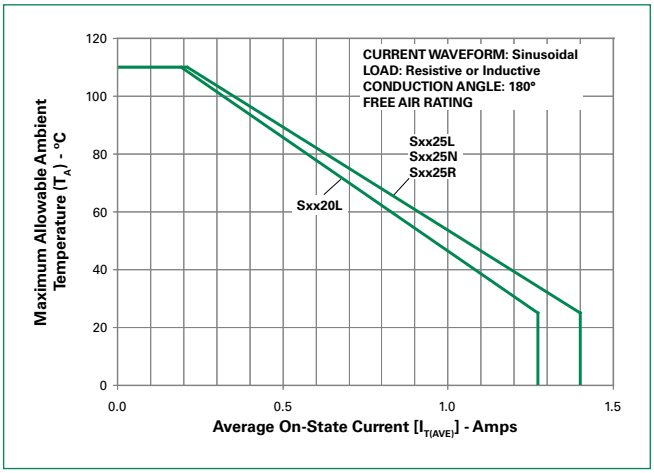
Figure 9: Maximum Allowable Ambient Temperature vs. Average On-State Current



Note: xx = voltage

Figure 10: Peak Capacitor Discharge Current

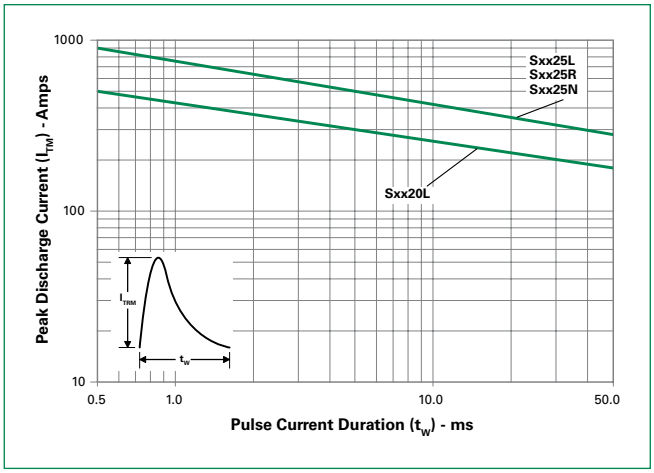


Figure 11: Peak Capacitor Discharge Current Derating

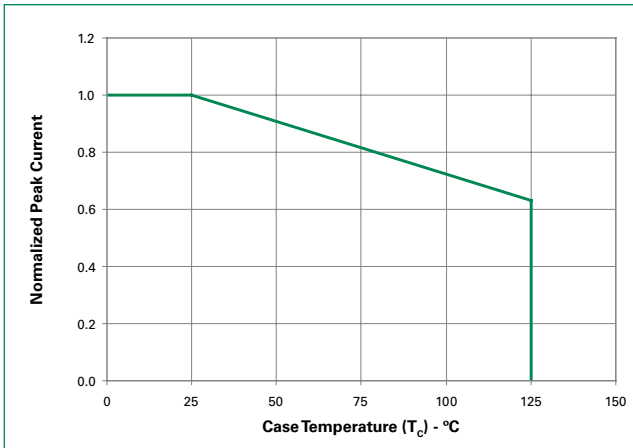
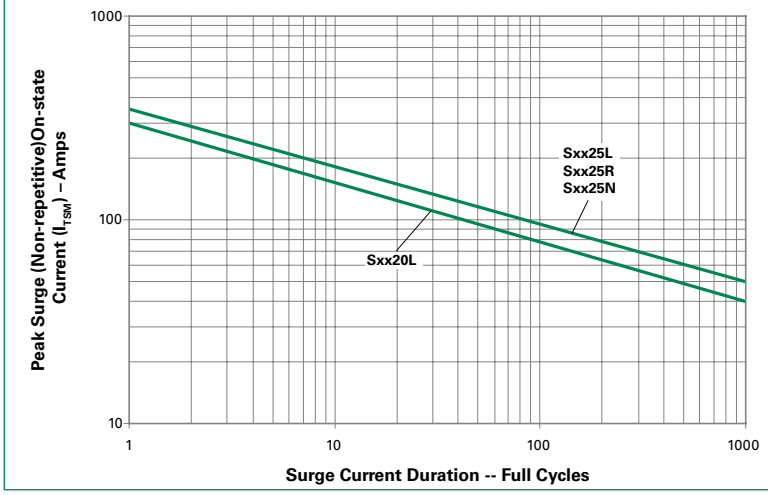


Figure 12: Surge Peak On-State Current vs. Number of Cycles



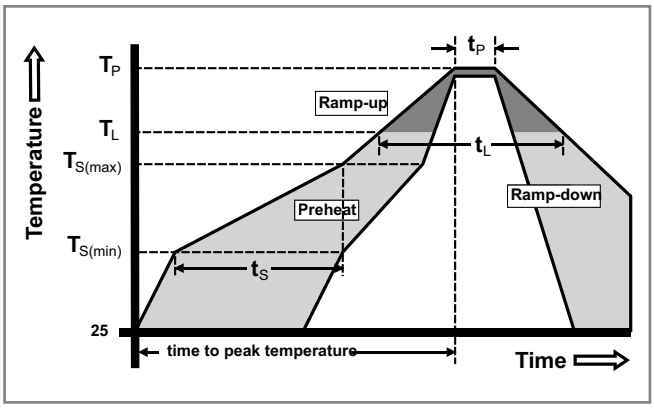
SUPPLY FREQUENCY: 60 Hz Sinusoidal
LOAD: Resistive
RMS On-State Current: [$I_{T(RMS)}$]: Maximum Rated Value at Specified Case Temperature

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.

Revised: 06/14/16

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

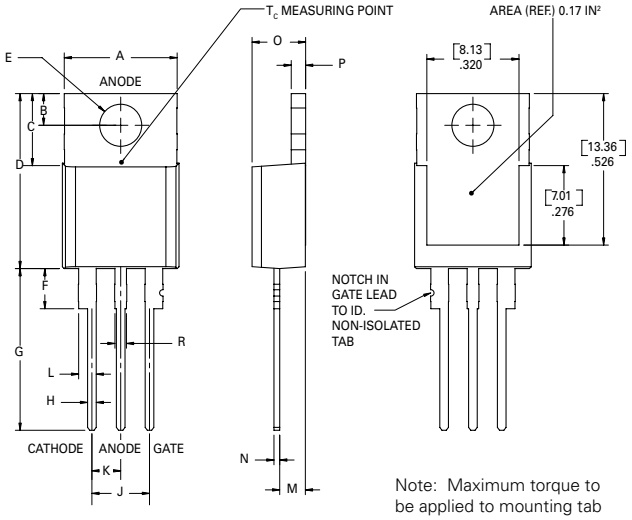
Careful selection of the correct device for the application's operating parameters and environment will go a long way toward extending the operating life of the Thyristor. Good design practice should limit the maximum continuous current through the main terminals to 75% of the device rating. Other ways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

Revised: 06/14/16

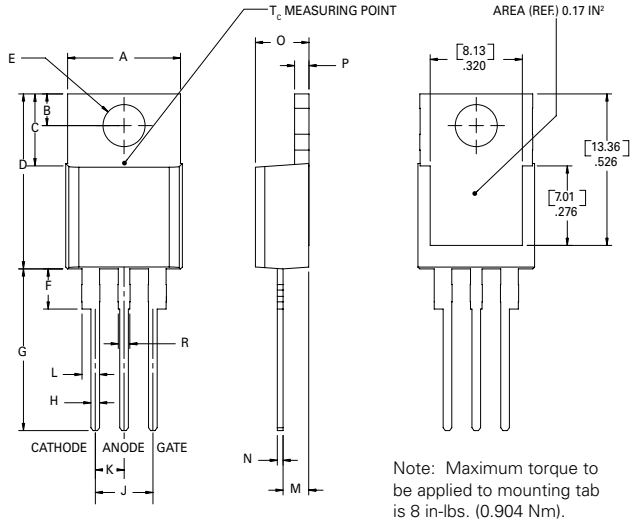
Dimensions — TO-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead



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

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



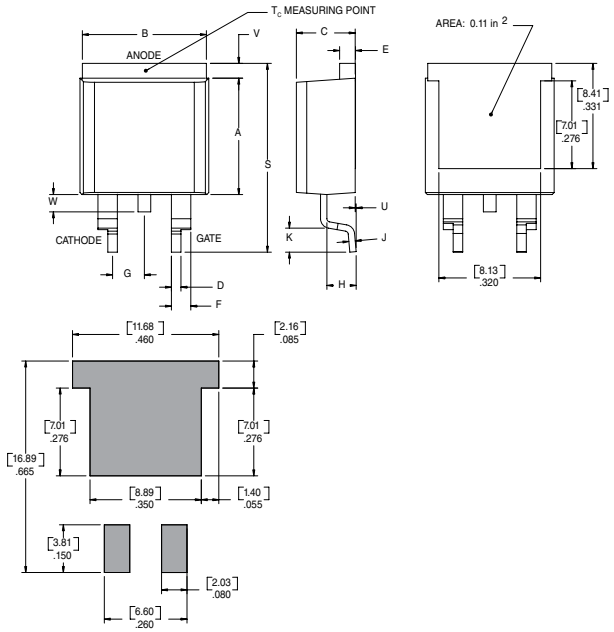
Note: Maximum torque to be applied to mounting tab is 8 in-lbs. (0.904 Nm).

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

Revised: 06/14/16

Teccor® brand Thyristors
20 / 25 Amp Standard SCRs

Dimensions –TO- 263AB (N-package) — D²-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	1.016	1.78

Product Selector

Part Number	Voltage				Gate Sensitivity	Type	Package
	400V	600V	800V	1000V			
Sxx20L	X	X	X	X	30mA	Standard SCR	TO-220L
Sxx25L	X	X	X	X	35mA	Standard SCR	TO-220L
Sxx25R	X	X	X	X	35mA	Standard SCR	TO-220R
Sxx25N	X	X	X	X	35mA	Standard SCR	TO-263

Note: xx = Voltage

Packing Options

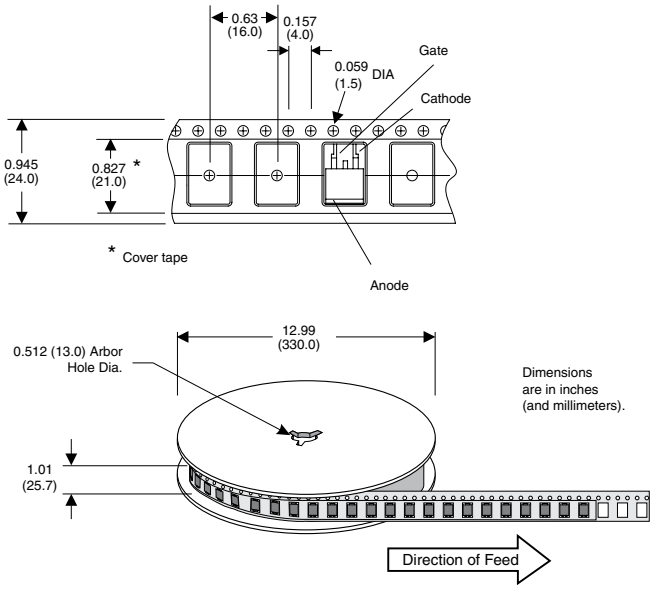
Part Number	Marking	Weight	Packing Mode	Base Quantity
Sxx20LTP	Sxx20L	2.2g	Tube	500 (50 per tube)
Sxx25LTP	Sxx25L	2.2g	Tube	500 (50 per tube)
Sxx25RTP	Sxx25R	2.2g	Tube	500 (50 per tube)
Sxx25NTP	Sxx25N	1.6g	Tube	500 (50 per tube)
Sxx25NRP	Sxx25N	1.6g	Embossed Carrier	500

Note: xx = Voltage

Revised: 06/14/16

TO-263 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards



Part Numbering System

S 60 20 L 56

DEVICE TYPE
S: SCR

VOLTAGE RATING
40: 400V
60: 600V
80: 800V
K0: 1000V

CURRENT RATING
20: 20A
25: 25A

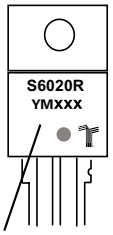
PACKAGE TYPE
L: TO-220 Isolated
R: TO-220 Non-Isolated
N: TO-263 (D²-Pak)

SENSITIVITY & TYPE
(blank): Sxx20L = 30mA
Sxx25x = 35mA

LEAD FORM DIMENSIONS
xx: Lead Form Option

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

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