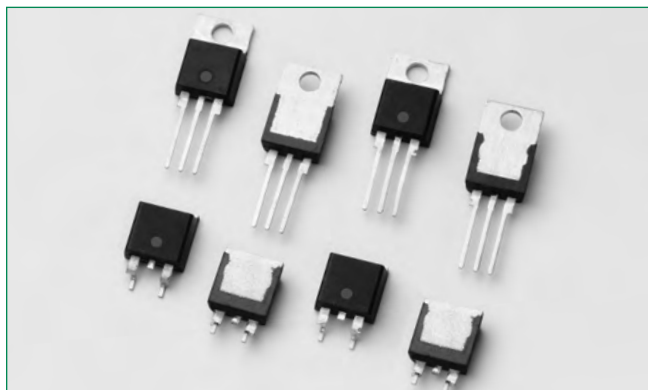


SJxx20xx Series

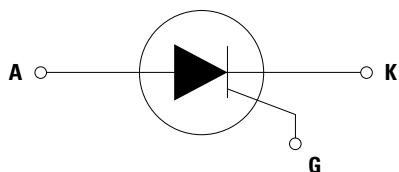


Agency Approvals

Agency	Agency File Number
	E71639*

* - L Package Only

Schematic Symbol



Description

This SJxx20xx high temperature SCR series is ideal for uni-directional switch applications such as phase control in heating, motor speed controls, converters/rectifiers and inrush current controllers.

These SCRs have a low gate current trigger level of 6 mA, 10 mA or 35 mA maximum at approximately 1.5 V.

Features & Benefits

- Halogen free and RoHS compliant
- 150°C maximum junction temperature
- Surge capability up to 300A at 60 Hz half cycle
- Recognized to UL 1557 as an Electrically Isolated Semiconductor Device

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
$I_{T(RMS)}$	20	A
V_{DRM}/V_{RRM}	400 or 600	V
I_{GT}	6, 10, or 35	mA

Absolute Maximum Ratings — 20A SCR

Symbol	Parameter	Test Conditions	Value	Unit
V_{DSM}/V_{RSM}	Peak non-repetitive blocking voltage	PW=100 μ s	$V_{DRM}/V_{RRM}+100$	V
$I_{T(RMS)}$	RMS on-state current	SJxx20Lx $T_c = 105^\circ\text{C}$ SJxx20Rx SJxx20Nx $T_c = 130^\circ\text{C}$	20	A
$I_{T(AV)}$	Average on-state current	SJxx20Lx $T_c = 105^\circ\text{C}$ SJxx20Rx SJxx20Nx $T_c = 130^\circ\text{C}$	12.8	A
I_{TSM}	Peak non-repetitive surge current	single half cycle; f = 50Hz; T_J (initial) = 25 $^\circ\text{C}$ single half cycle; f = 60Hz; T_J (initial) = 25 $^\circ\text{C}$	225 300	A
I^2t	I^2t Value for fusing	$t_p = 8.3$ ms	374	A ² s
di/dt	Critical rate of rise of on-state current	f = 60Hz ; $T_J = 150^\circ\text{C}$	125	A/ μ s
I_{GM}	Peak gate current	$T_J = 150^\circ\text{C}$	3	A
$P_{G(AV)}$	Average gate power dissipation	$T_J = 150^\circ\text{C}$	0.6	W
T_{stg}	Storage temperature range		-40 to 150	$^\circ\text{C}$
T_J	Operating junction temperature range		-40 to 150	$^\circ\text{C}$

Note: xx=voltage/10, x=sensitivity

Electrical Characteristics ($T_J = 25^\circ\text{C}$, unless otherwise specified)

Symbol	Test Conditions		SJxx16x	SJxx16x1	SJxx16x2	Unit
I_{GT}	$V_D = 12\text{V}; R_L = 60\ \Omega$	MIN.	8	2	5	mA
		MAX.	35	6	10	
V_{GT}		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/ μs
	$V_D = 67\% V_{DRM}$; gate open; $T_J = 150^\circ\text{C}$		400	-	200	
V_{GD}	$V_D = V_{DRM}$ $R_L = 3.3\ \text{k}\Omega$ $T_J = 110^\circ\text{C}$	MIN.	0.2	0.2	0.2	V
I_H	$I_T = 200\text{mA}$ (initial)	MAX.	75	15	35	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.	40	40	40	μs
t_{gt}	$I_G = 2 \times I_{GT}$ $PW = 15\mu\text{s}$ $I_T = 32\text{A}$	TYP.	2	2	2	μs

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}	$V_{DRM} = V_{RRM}$	$T_J = 25^\circ\text{C}$	10	μA
		$T_J = 125^\circ\text{C}$	1000	
		$T_J = 150^\circ\text{C}$	3000	

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{\theta(JC)}$	Junction to case (AC)	SJxx16Rx	1.0	$^\circ\text{C}/\text{W}$
		SJxx16Nx		
		SJxx16Lx	2.4	

Note: xx=voltage/10, x=sensitivity

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

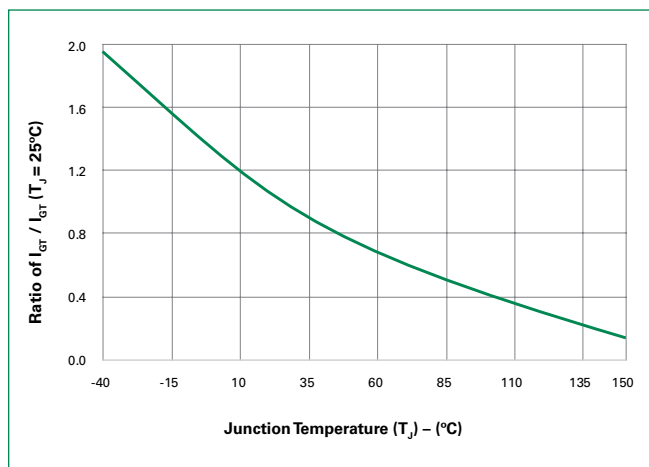


Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

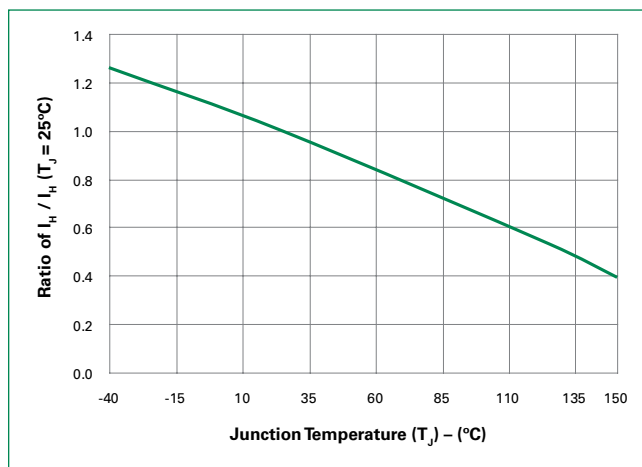


Figure 3: Normalized DC Holding Current vs. Junction Temperature

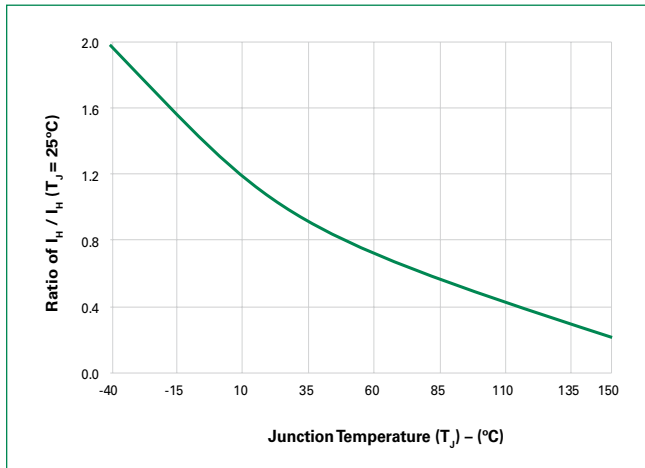


Figure 4: On-State Current vs. On-State Voltage (Typical)

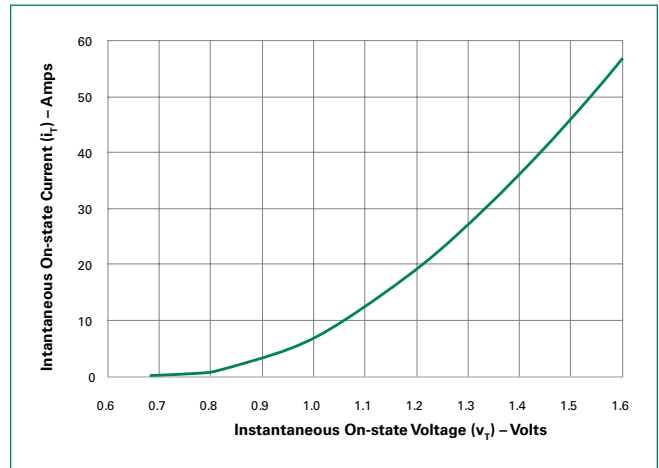


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

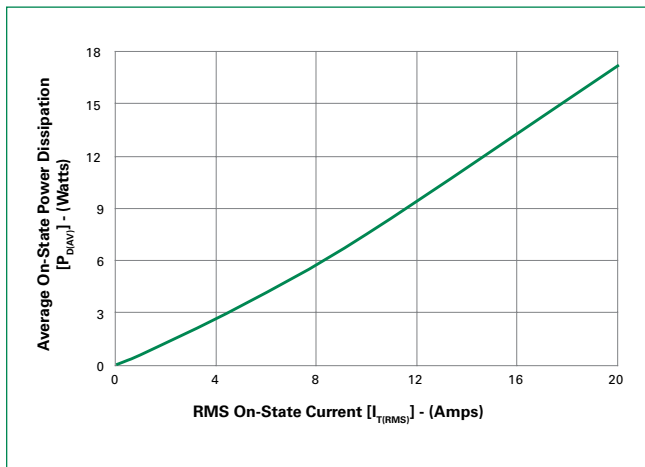


Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

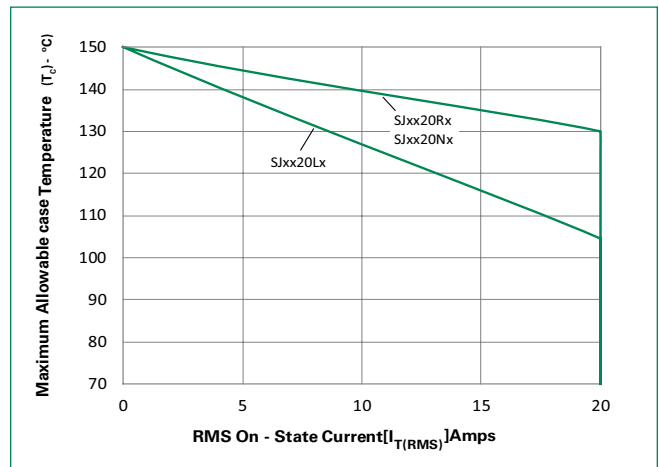


Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

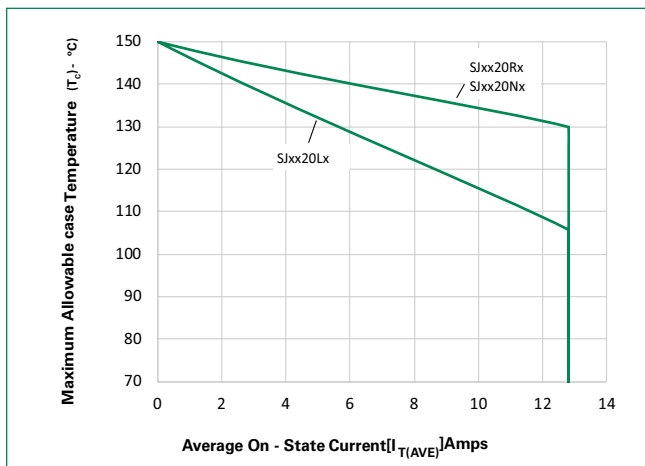


Figure 8: Peak Capacitor Discharge Current

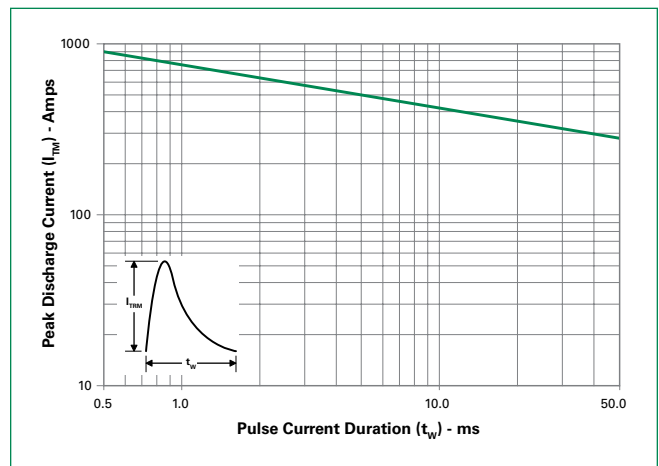


Figure 9: Peak Capacitor Discharge Current Derating

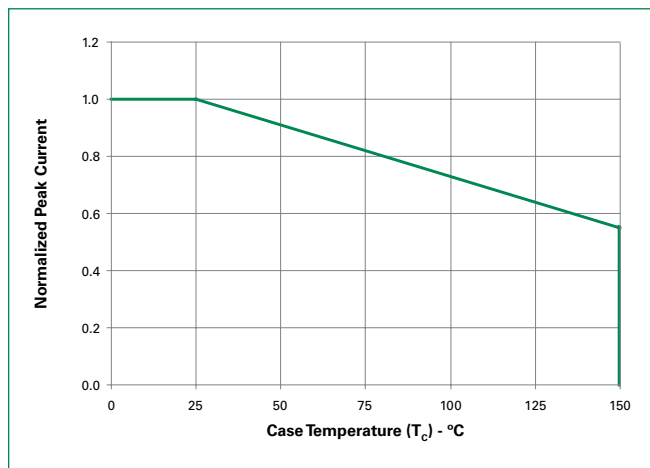
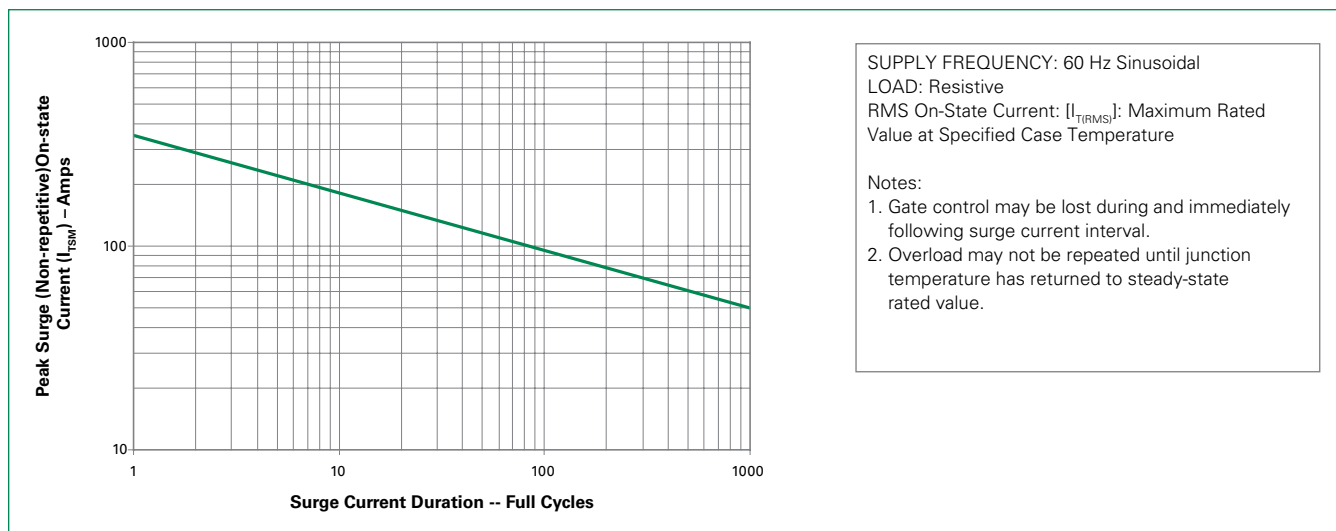
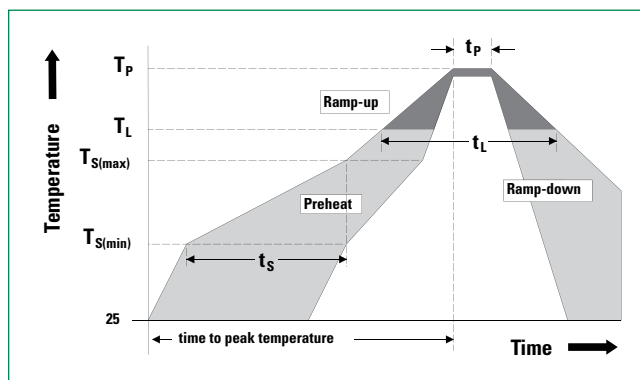


Figure 10: Surge Peak On-State Current vs. Number of Cycles



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 ^{+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 compound meeting flammability rating V-0
Lead Material	Copper Alloy

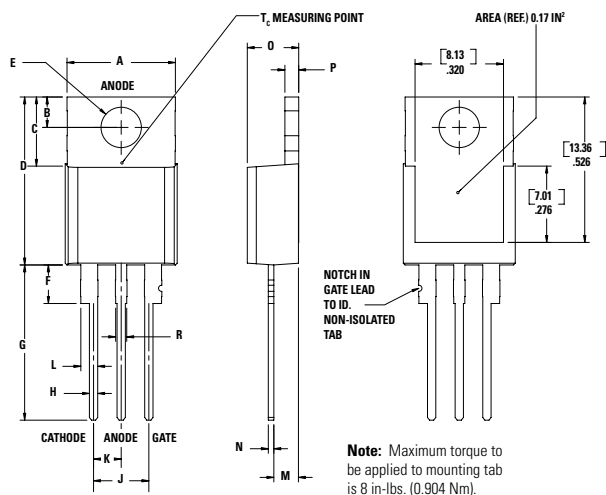
Design Considerations

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

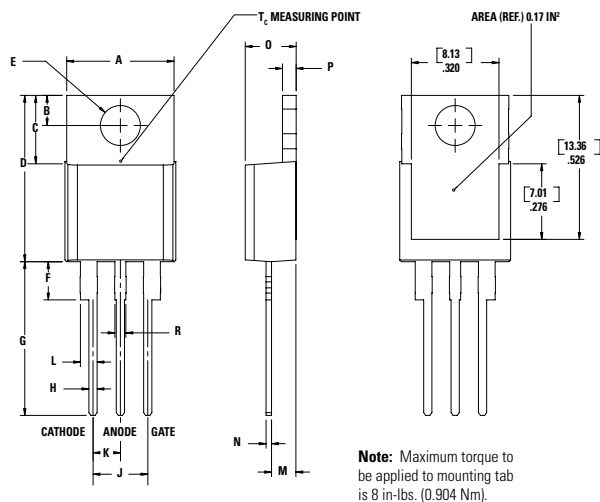
Test	Specifications and Conditions
AC Blocking	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours
Temperature Cycling	MIL-STD-750, M-1051, 1000 cycles; -55°C to +150°C; 15-min dwell-time
Temperature/Humidity	EIA / JEDEC, JESD22-A101 1008 hours; 160V - DC: 85°C; 85% rel humidity
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
Moisture Sensitivity Level	Level 1, JEDEC-J-STD-020D

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



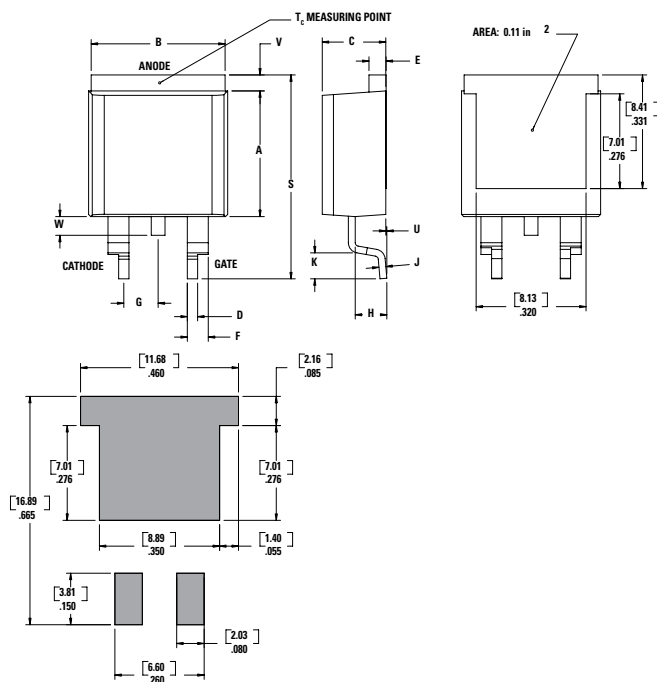
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.61
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060	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) — 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	1.02	1.78

Product Selector

Part Number	Voltage		Gate Sensitivity	Type	Package
	400V	600V			
SJxx20L	X	X	35mA	Standard SCR	TO-220L
SJxx20R	X	X	35mA	Standard SCR	TO-220R
SJxx20N	X	X	35mA	Standard SCR	TO-263
SJxx20L1	X	X	6mA	Standard SCR	TO-220L
SJxx20R1	X	X	6mA	Standard SCR	TO-220R
SJxx20N1	X	X	6mA	Standard SCR	TO-263
SJxx20L2	X	X	10mA	Standard SCR	TO-220L
SJxx20R2	X	X	10mA	Standard SCR	TO-220R
SJxx20N2	X	X	10mA	Standard SCR	TO-263

Note: xx = Voltage/10

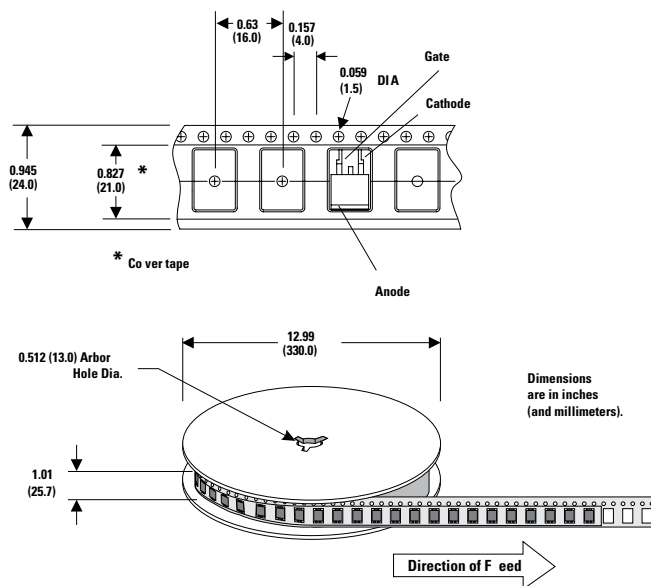
Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
SJxx20LxTP	SJxx20Lx	2.2g	Tube	1000 (50 per tube)
SJxx20RxTP	SJxx20Rx	2.2g	Tube	1000 (50 per tube)
SJxx20NxTP	SJxx20Nx	1.6g	Tube	1000 (50 per tube)
SJxx20NxRP	SJxx20Nx	1.6g	Embossed Carrier	500

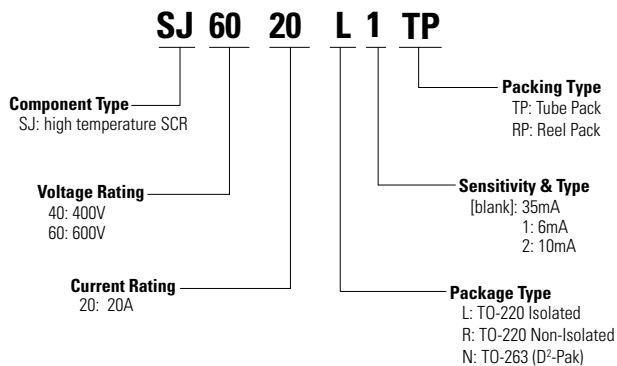
Note: xx=voltage/10, x=sensitivity

TO-263 Embossed Carrier Reel Pack (RP) Specifications

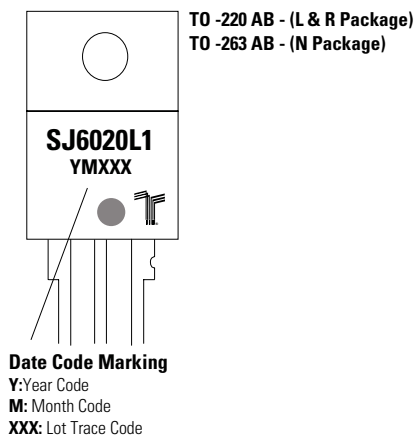
Meets all EIA-481-2 Standards



Part Numbering System



Part Marking System



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