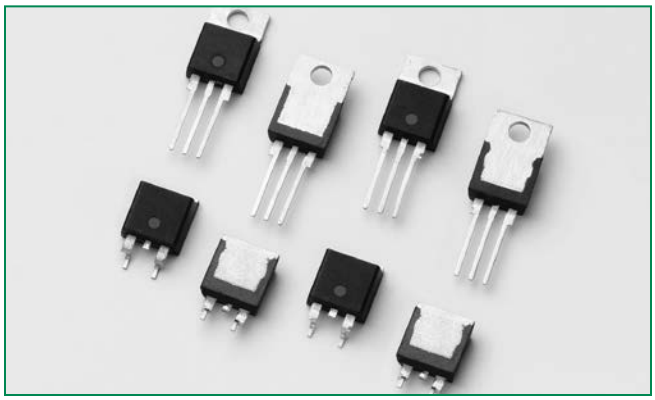
Littelfuse Power Semiconductors

Thyristors
16 Amps High Junction Temperature SCRs

SJxx16xx Series

HF RoHS



Description

This SJxx16xx high junction 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 offer low gate current trigger levels of 6 mA, 10 mA, or 30 mA at approximately 1.5V.

Features & Benefits

- Halogen free and RoHS compliant
- 150°C maximum junction temperature
- Surge capability up to 225A at 60 Hz half cycle

Agency Approvals

AGENCY	AGENCY FILE NUMBER
UL	E71639*

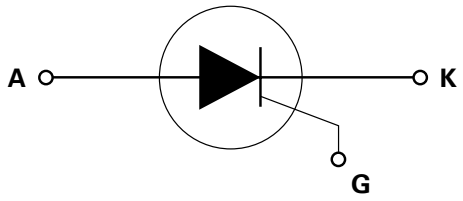
* - L Package Only

Applications

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

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

Schematic Symbol



Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	16	A
V_{DRM}/V_{RRM}	400 or 600	V
I_{GT}	6, 10 or 30	mA

Absolute Maximum Ratings — Standard SCRs

Symbol	Parameter	Test Conditions		Value	Unit
V_{DRM}/V_{RSM}	Peak non-repetitive blocking voltage	Pw=100 µs		V_{DRM}/V_{RRM}+100	V
$I_{T(RMS)}$	RMS on-state current	SJxx16Lx	T_C = 110°C	16	A
		SJxx16Rx SJxx16Nx	T_C = 135°C	16	
$I_{T(AV)}$	Average on-state current	SJxx16Lx	T_C = 110°C	10	A
		SJxx16Rx SJxx16Nx	T_C = 135°C	10	
I_{TSM}	Peak non-repetitive surge current	single half cycle; f = 50Hz; T_J (initial) = 25°C		188	A
		single half cycle; f = 60Hz; T_J (initial) = 25°C		225	
I^2t	I^2t Value for fusing	t_p = 8.3 ms		210	A^2s
di/dt	Critical rate of rise of on-state current	f = 60 Hz ; T_J = 150°C		125	A/µs
I_{GM}	Peak gate current	T_J = 150°C		3	A
$P_{G(AV)}$	Average gate power dissipation	T_J = 150°C		0.6	W
T_{stg}	Storage temperature range			-40 to 150	°C
T_J	Operating junction temperature range			-40 to 150	°C

Note: xx=voltage/10, x=sensitivity

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

Symbol	Test Conditions		SJxx16x	SJxx16x1	SJxx16x2	Unit
I_{GT}	V_D = 12V; R_L = 60 Ω	MIN.	8	2	5	mA
		MAX.	30	6	10	
V_{GT}		MAX.	1.5	1.5	1.5	V
dv/dt	V_D = 67%V_{DRM}; gate open; T_J = 125°C	MIN.	800	70	500	V/µs
	V_D = 67% V_{DRM}; gate open; T_J = 150°C		400	-	200	
V_{GD}	V_D = V_{DRM} R_L = 3.3 kΩ T_J = 110°C	MIN.	0.2	0.2	0.2	V
I_H	I_T = 200mA (initial)	MAX.	75	15	35	mA
t_q	I_T=2A; t_p=50µs; dv/dt=5V/µs; di/dt=-30A/µs	MAX.	40	40	40	µs
t_{gt}	I_G = 2 x I_{GT} PW = 15µs I_T = 32A	TYP.	2	2	2	µs

Note: xx=voltage/10, x=package

Static Characteristics

Symbol	Test Conditions		Value	Unit
V_{TM}	Component I_T = 32A; t_p = 380 µs	MAX.	1.6	V
I_{DRM} / I_{RRM}	V_{DRM} = V_{RRM}	T_J = 25°C	10	µA
		T_J = 125°C	1000	
		T_J = 150°C	3000	

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{\Theta(JC)}$	Junction to case (AC)	SJxx16Rx SJxx16Nx	1.0	°C/W
		SJxx16Lx	2.5	

Note: xx=voltage/10, x=sensitivity

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

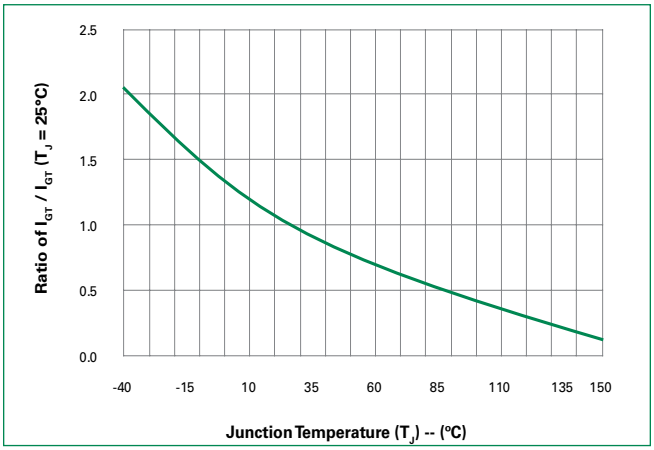

Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

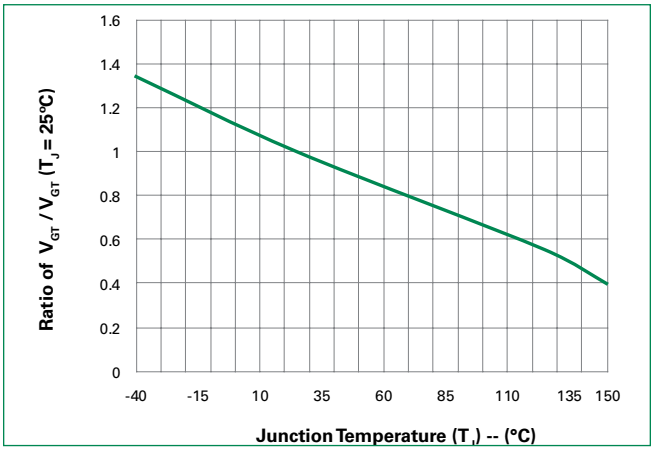

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Figure 3: Normalized DC Holding Current vs. Junction Temperature

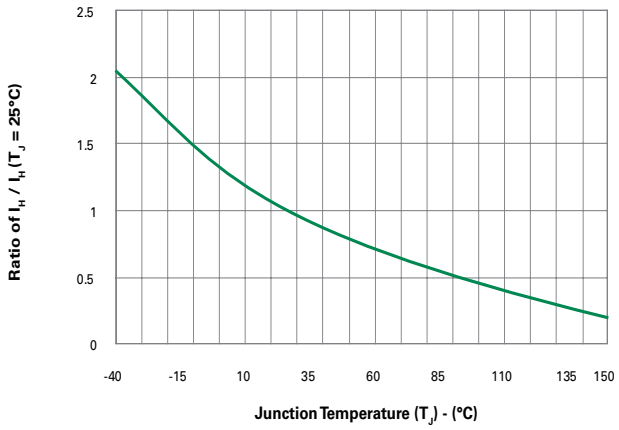

Figure 4: On-State Current vs. On-State Voltage (Typical)

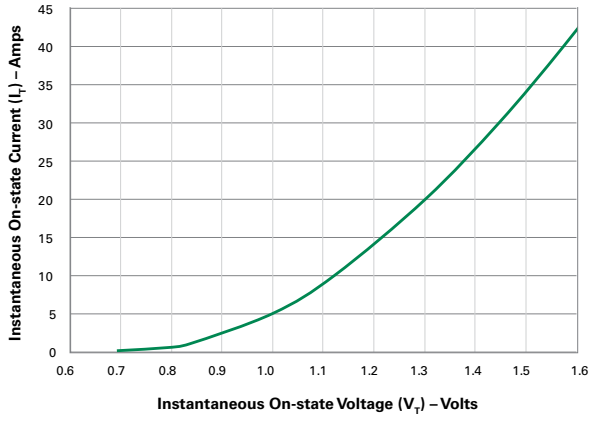

Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

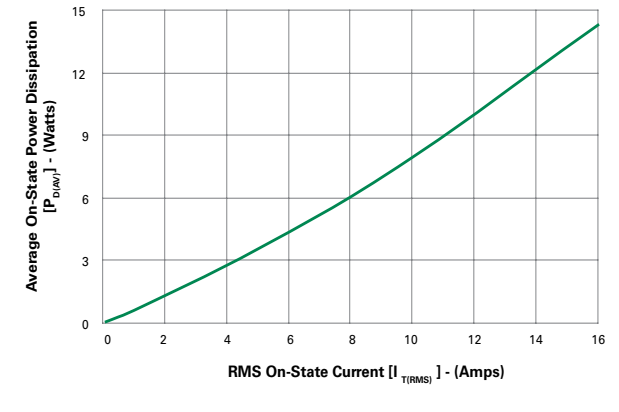

Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

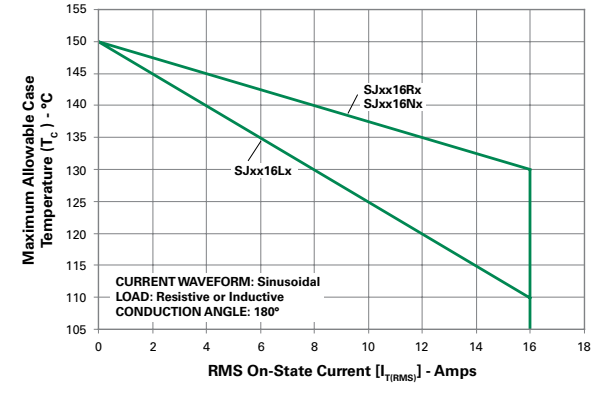

Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

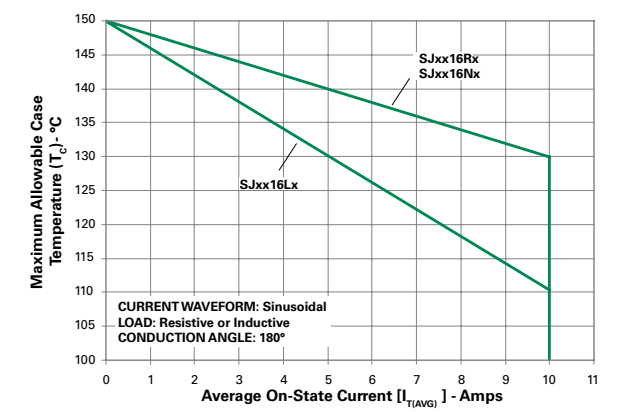

Figure 8: Peak Capacitor Discharge Current

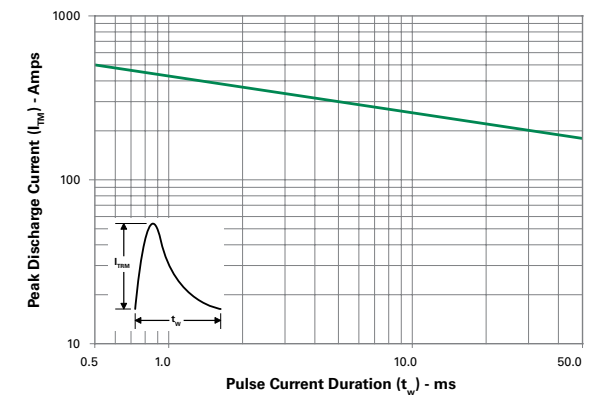

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Figure 9: Peak Capacitor Discharge Current Derating

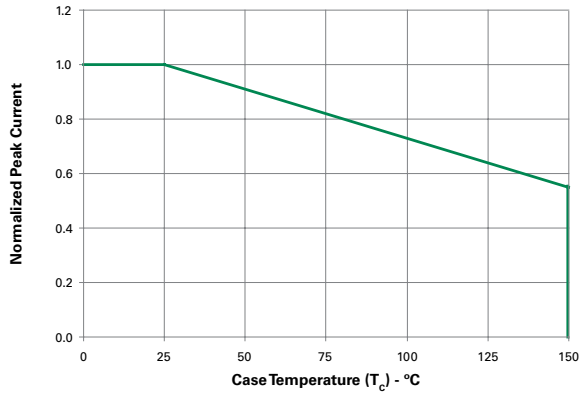
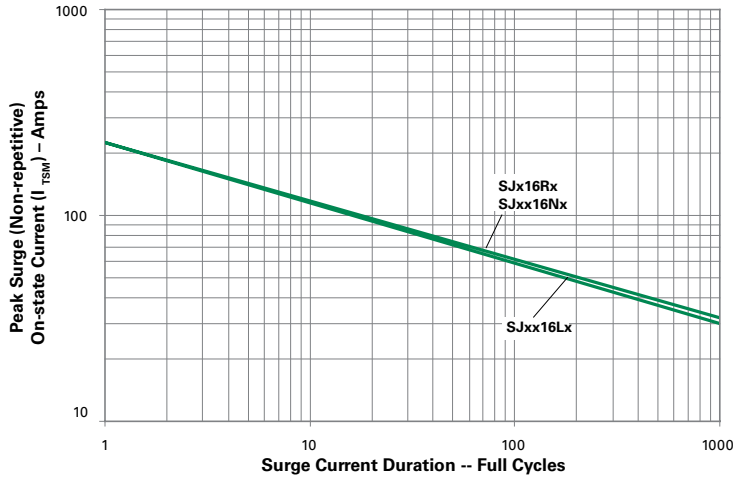


Figure 10: Surge Peak On-State Current vs. Number of Cycles



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.

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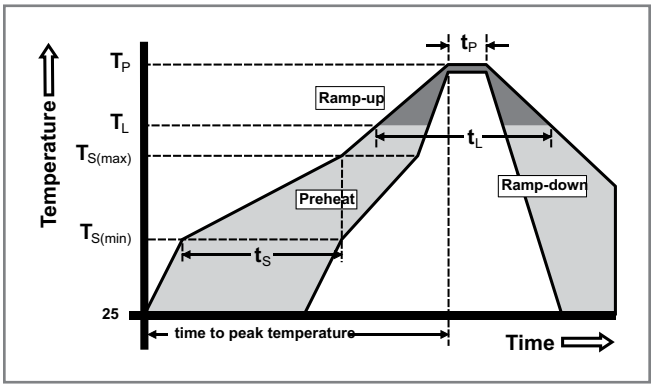
Soldering Parameters

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 – 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

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, 100 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

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.

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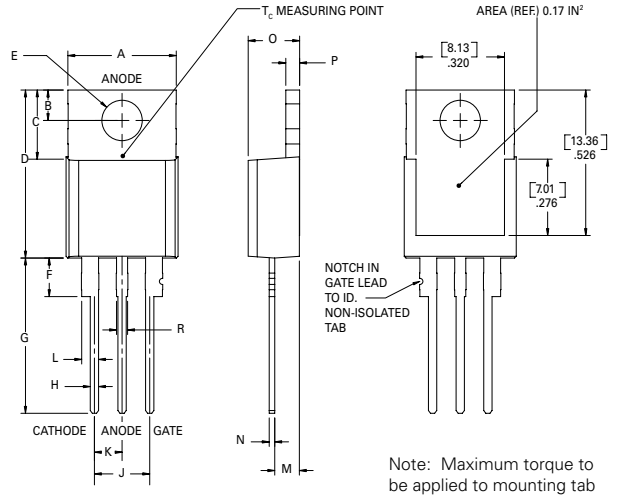
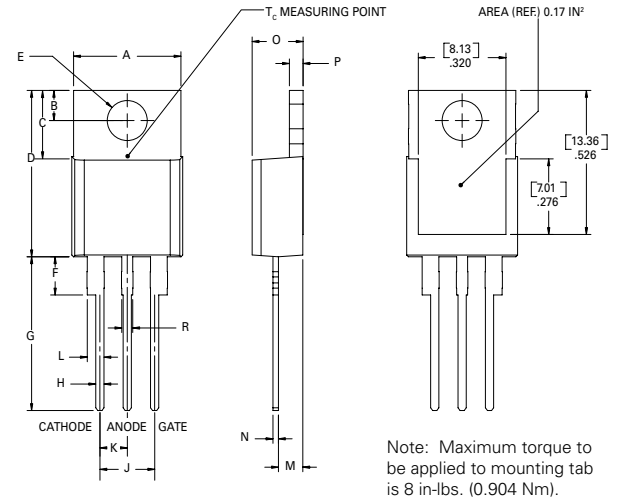
Dimensions — TO-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead



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

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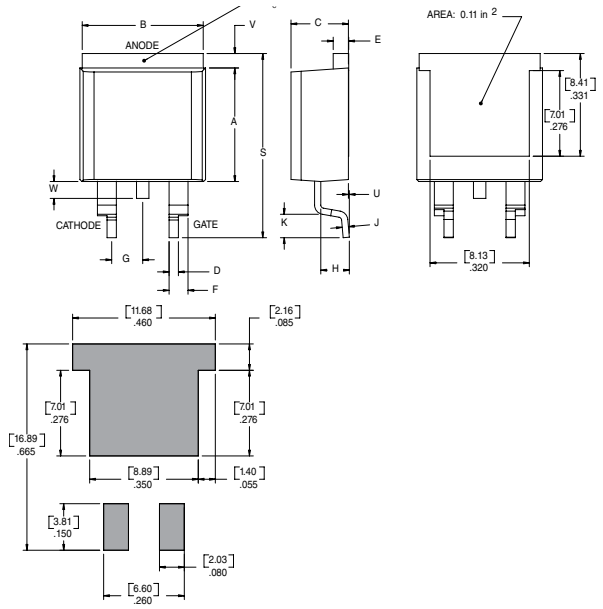
Thyristors
16 Amps High Junction Temperature SCRs

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	1.02	1.78

Product Selector

Part Number	Voltage		Gate Sensitivity	Type	Package
	400V	600V			
SJxx16L	X	X	30mA	Standard SCR	TO-220L
SJxx16R	X	X	30mA	Standard SCR	TO-220R
SJxx16N	X	X	30mA	Standard SCR	TO-263
SJxx16L1	X	X	6mA	Standard SCR	TO-220L
SJxx16R1	X	X	6mA	Standard SCR	TO-220R
SJxx16N1	X	X	6mA	Standard SCR	TO-263
SJxx16L2	X	X	10mA	Standard SCR	TO-220L
SJxx16R2	X	X	10mA	Standard SCR	TO-220R
SJxx16N2	X	X	10mA	Standard SCR	TO-263

Note: xx = Voltage/10

Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
SJxx16LxTP	SJxx16Lx	2.2g	Tube	500 (50 per tube)
SJxx16RxTP	SJxx16Rx	2.2g	Tube	500 (50 per tube)
SJxx16NxTP	SJxx16Nx	1.6g	Tube	500 (50 per tube)
SJxx16NxRP	SJxx16Nx	1.6g	Embossed Carrier	500

Note: xx=voltage/10, x=sensitivity

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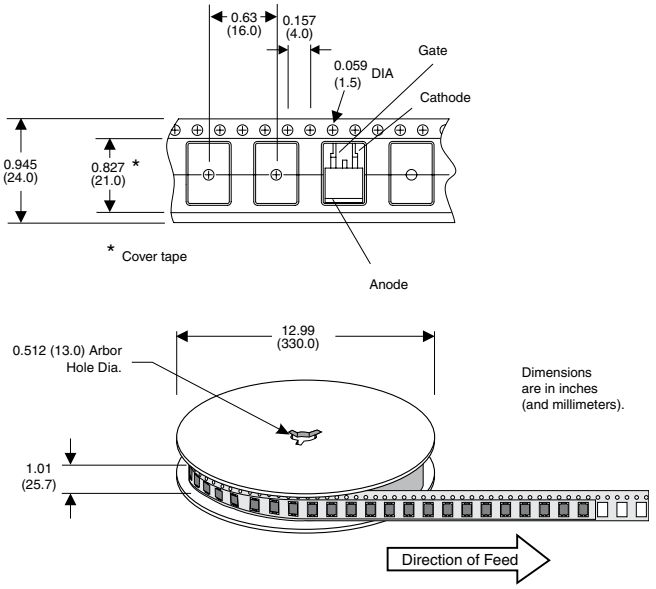
TO-263 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards



Part Numbering System

SJ 60 16 L 1 TP

COMPONENT TYPE
SJ: high temperature SCR

VOLTAGE RATING
40: 400V
60: 600V

CURRENT RATING
16: 16A

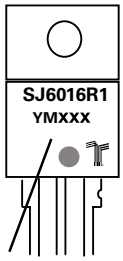
PACKAGE TYPE
L: TO-220 Isolated
R: TO-220 Non-Isolated
N: TO-263 (D^2-Pak)

SENSITIVITY & TYPE
[blank]: 30mA
1: 6mA
2: 10mA

PACKING TYPE
TP: Tube Pack
RP: Reel Pack

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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