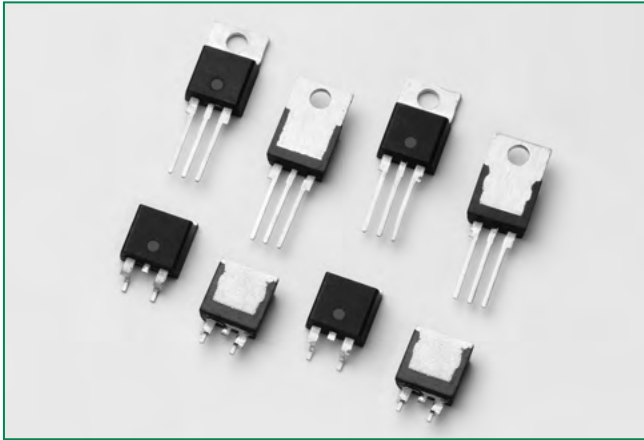


SJxx40xx Series



Description

This SJxx40xx high temperature SCR series is ideal for uni-directional switch applications such as phase control in heating, motor speed controls and AC rectifier and voltage regulator.

This SCR series offer low gate current trigger levels of 15 mA or 40 mA at approximately 1.5V.

Features & Benefits

- High junction temperature
- Voltage capability up to 600 V
- Surge capability up to 520 A at 60 Hz half cycle
- Halogen free and RoHS compliant

Applications

Typical applications are AC rectifier, voltage regulator, 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.

Agency Approvals

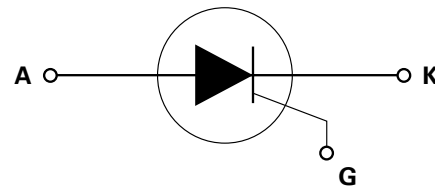
Agency	Agency File Number
	E71639*

* - L Package Only

Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	40	A
V_{DRM}/V_{RRM}	400 or 600	V
I_{GT}	15 or 40	mA

Schematic Symbol



Absolute Maximum Ratings

Symbol	Parameter	Test Conditions	Value	Unit
V_{DSM}/V_{RSM}	Peak non-repetitive blocking voltage	$P_w = 100\mu s$	700	V
$I_{T(RMS)}$	RMS on-state current	SJxx40Ly $T_c = 55^\circ C$ SJxx40Ry/SJxx40Ny $T_c = 115^\circ C$	40	A
$I_{T(AV)}$	Average on-state current	SJxx40Ly $T_c = 55^\circ C$ SJxx40Ry/SJxx40Ny $T_c = 115^\circ C$	25.0	A
I_{TSM}	Peak non-repetitive surge current	single half cycle; $f = 50Hz$; $T_J (initial) = 25^\circ C$	430	A
		single half cycle; $f = 60Hz$; $T_J (initial) = 25^\circ C$	520	A
I^2t	I^2t Value for fusing	$t_p = 8.3 ms$	1122	A ² s
di/dt	Critical rate of rise of on-state current	$f = 60Hz$; $T_J = 150^\circ C$	150	A/ μs
I_{GM}	Peak gate current	$t_p \leq 10\mu s$; $T_J = 150^\circ C$	4	A
$P_{G(AV)}$	Average gate power dissipation	$t_p \leq 10\mu s$; $T_J = 150^\circ C$	1	W
T_{stg}	Storage temperature range		-40 to 150	$^\circ C$
T_J	Operating junction temperature range		-40 to 150	$^\circ C$

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

Symbol	Test Conditions		SJxx40x	SJxx40x2	Unit
I_{GT}	$V_D = 12\text{V}; R_L = 30\ \Omega$	MAX.	40	15	mA
		MIN.	5	3	
V_{GT}		MAX.	1.5		V
dv/dt	$V_D = V_{DRM}; \text{gate open}; T_J = 125^\circ\text{C}$	400V	650	400	V/ μs
		600V	600	350	
	$V_D = V_{DRM}; \text{gate open}; T_J = 150^\circ\text{C}$	400V	550	-	
		600V	500	-	
	$V_D = 67\%V_{DRM}; \text{gate open}; T_J = 150^\circ\text{C}$	400V	-	300	
		600V	-	250	
V_{GD}	$V_D = V_{DRM}; R_L = 3.3\ \text{k}\Omega; T_J = 150^\circ\text{C}$	MIN.	0.2		V
I_H	$I_T = 400\text{mA (initial)}$	MAX.	60	50	mA
t_q	$I_T = 2\text{A}; t_p = 50\ \mu\text{s}; \text{dv/dt} = 5\text{V}/\mu\text{s}; \text{di/dt} = -30\text{A}/\mu\text{s}$	MAX.	35		μs
t_{gt}	$I_G = 2 \times I_{GT}; \text{PW} = 15\ \mu\text{s}; I_T = 80\text{A}$	TYP.	2		μs

Note: xx = voltage, x = package

Static Characteristics

Symbol	Test Conditions		Value	Unit
V_{TM}	$I_T = 80\text{A}; t_p = 380\ \mu\text{s}$	MAX.	1.7	V
I_{DRM} / I_{RRM}	@ V_{DRM} / V_{RRM}	$T_J = 25^\circ\text{C}$	10	μA
		$T_J = 125^\circ\text{C}$	2000	
		$T_J = 150^\circ\text{C}$	4000	

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{\theta(JC)}$	Junction to case (AC)	SJxx40Ly	1.9	$^\circ\text{C}/\text{W}$
		SJxx40Ry/SJxx40Ny	0.8	$^\circ\text{C}/\text{W}$

Note: xx = voltage, y = sensitivity & type

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

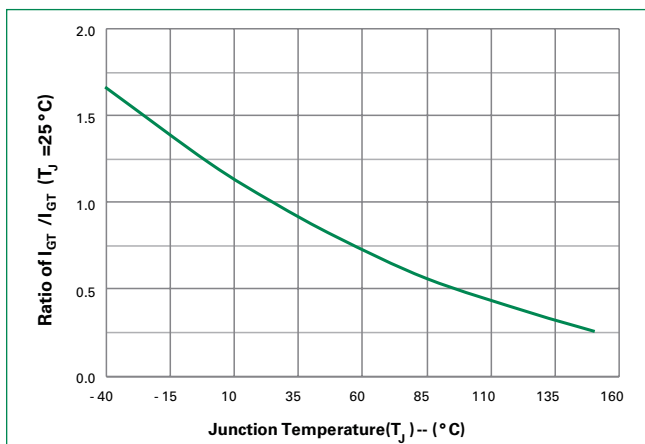


Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

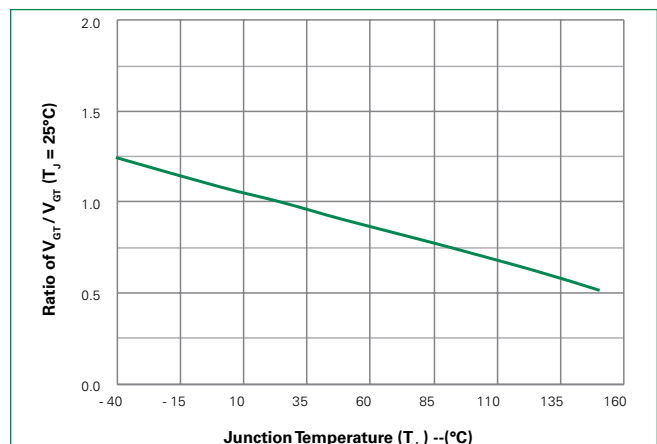


Figure 3: Normalized DC Holding Current vs. Junction Temperature

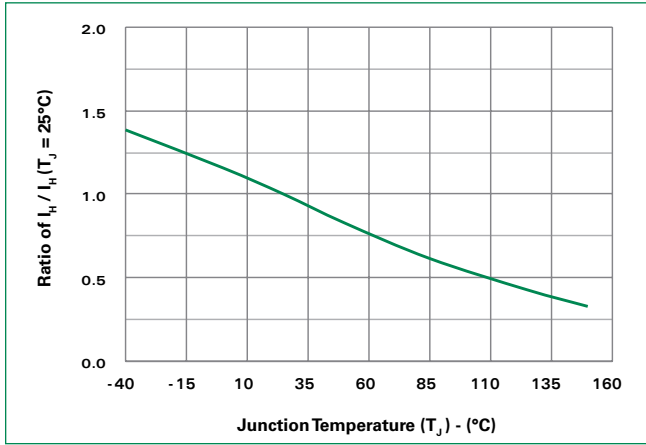


Figure 4: On-State Current vs. On-State Voltage (Typical)

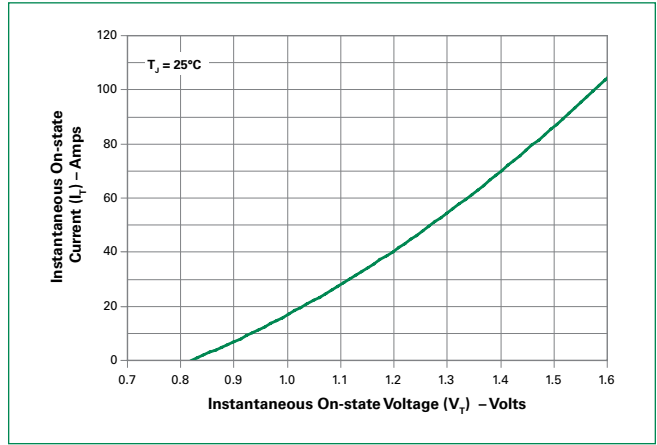


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

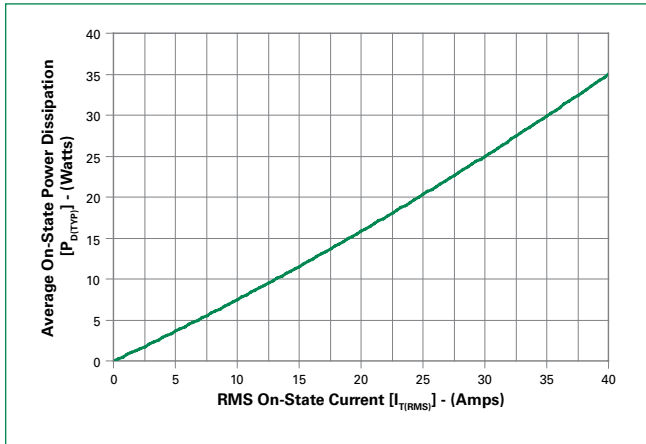


Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

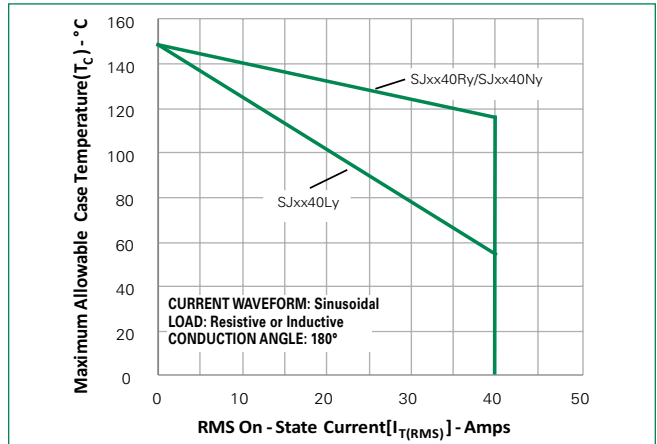


Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

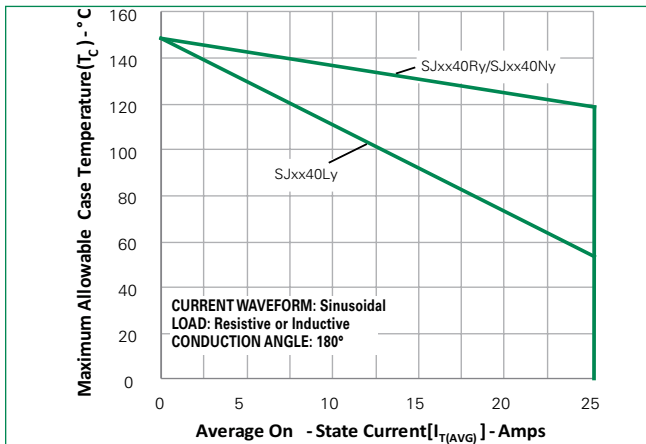


Figure 8: Peak Capacitor Discharge Current

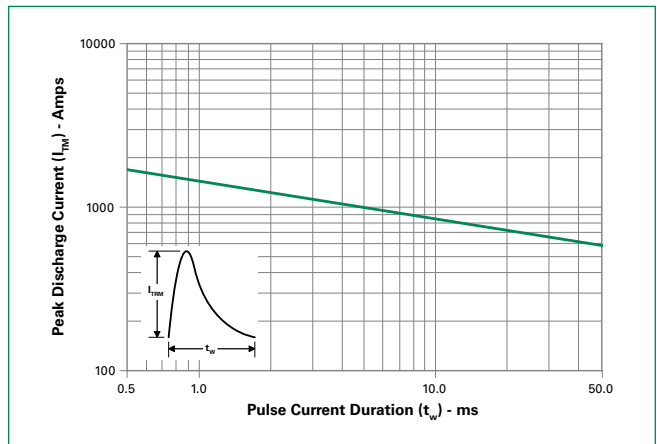


Figure 9: Peak Capacitor Discharge Current Derating

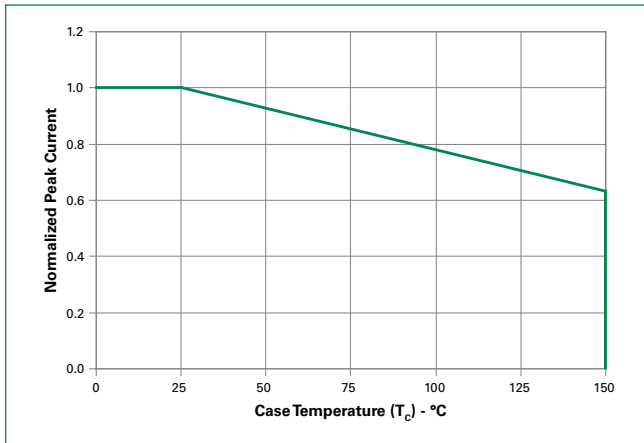
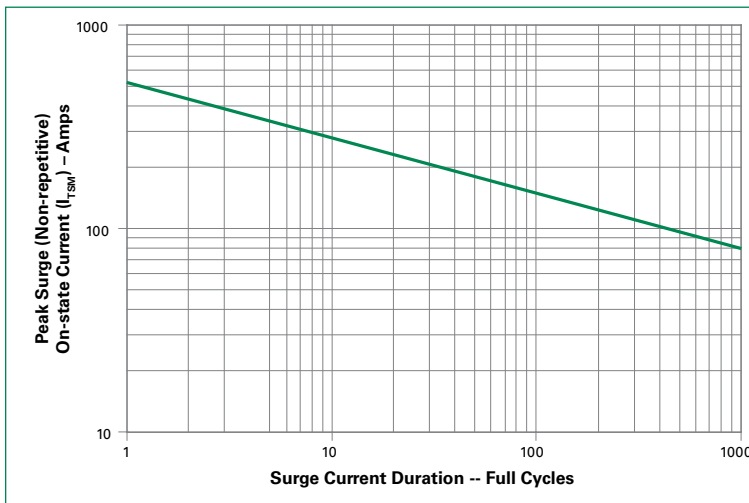


Figure 10: Surge Peak On-State Current vs. Number of Cycles

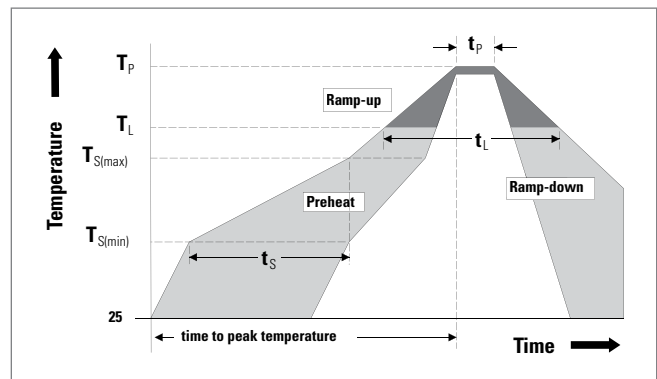


SUPPLY FREQUENCY: 60 Hz Sinusoidal
 LOAD: Resistive
 RMS On-State Current: $I_{T(RMS)}$: Maximum Rated Value at Specified Case Temperature

- 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_r)	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

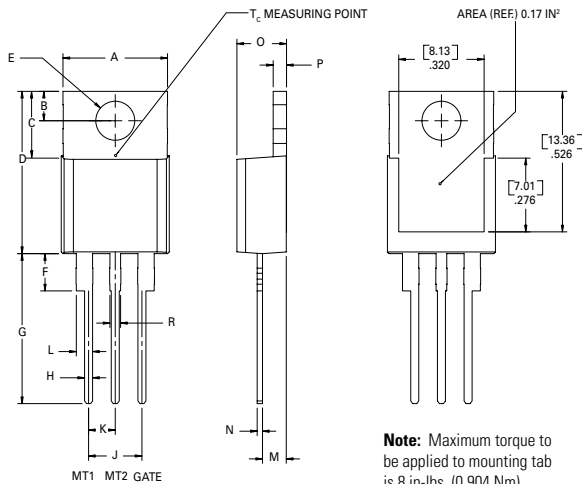
Design Considerations

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

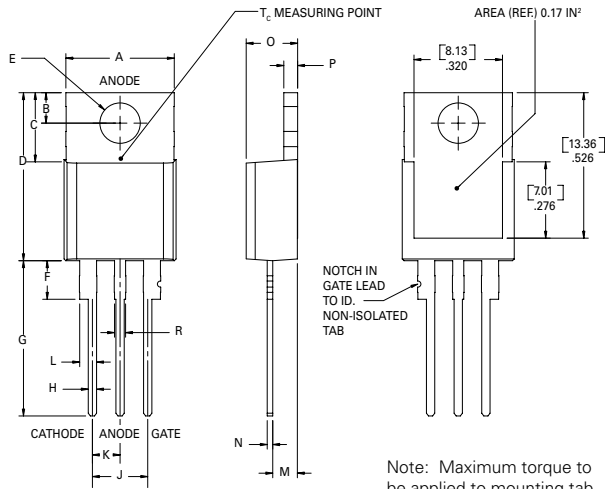
Test	Specifications and Conditions
AC Blocking	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours
Temperature Cycling	MIL-STD-750, M-1051, 1000 cycles; -55°C to +150°C; 15-min dwell-time
Temperature/Humidity	EIA / JEDEC, JESD22-A101 1008 hours; 160VDC - DC: 85°C; 85% rel humidity
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 (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	2.66	2.92
C	0.230	0.250	5.85	6.35
D	0.590	0.620	14.98	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.80	3.30
G	0.540	0.575	13.71	14.60
H	0.025	0.035	0.63	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	1.78	2.16
N	0.018	0.024	0.45	0.61
O	0.178	0.188	4.52	4.78
P	0.045	0.060	1.14	1.53
R	0.038	0.048	0.97	1.22

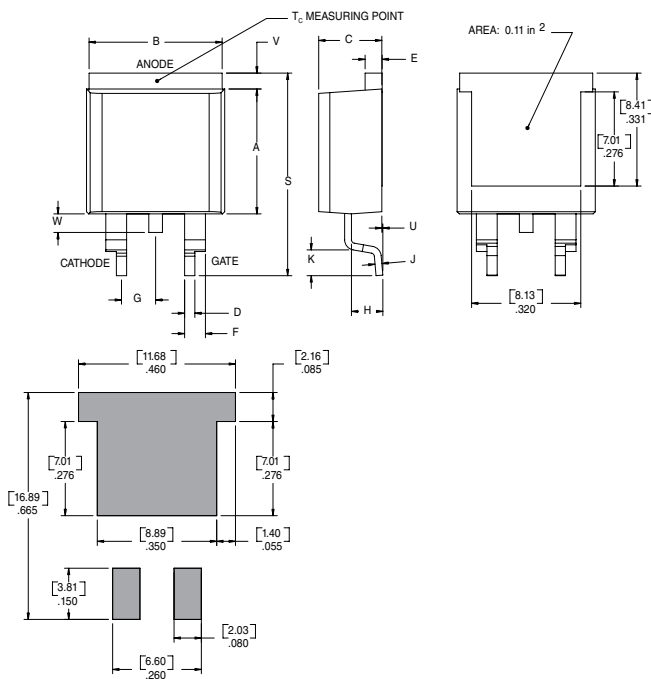
Dimensions – TO-220AB (R-Package) – Non-Isolated Mounting Tab Common with Center Lead



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

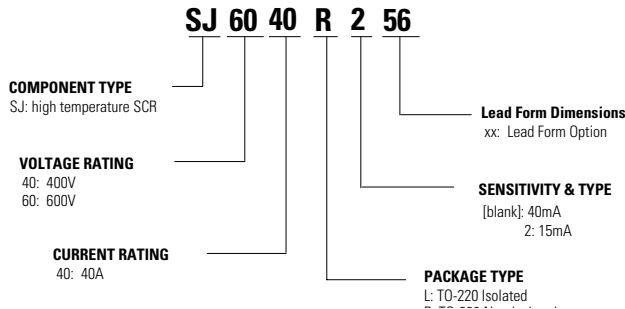
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.61
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060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

Dimensions – TO- 263 (N-package) – D²-Pak Surface Mount

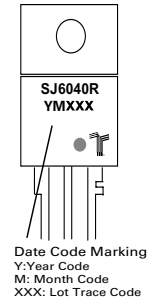


Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.360	0.370	9.14	9.40
B	0.380	0.420	9.65	10.67
C	0.178	0.188	4.52	4.78
D	0.025	0.035	0.63	0.89
E	0.048	0.055	1.22	1.40
F	0.060	0.075	1.52	1.91
G	0.095	0.105	2.41	2.67
H	0.083	0.093	2.11	2.36
J	0.018	0.024	0.46	0.61
K	0.090	0.110	2.29	2.79
S	0.590	0.625	14.99	15.87
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

Part Numbering System



Part Marking System



Product Selector

Part Number	Voltage		Gate Sensitivity	Type	Package
	400V	600V			
SJxx40L	X	X	40mA	Standard SCR	TO-220L
SJxx40R	X	X	40mA	Standard SCR	TO-220R
SJxx40N	X	X	40mA	Standard SCR	TO-263
SJxx40L2	X	X	15mA	Standard SCR	TO-220L
SJxx40R2	X	X	15mA	Standard SCR	TO-220R
SJxx40N2	X	X	15mA	Standard SCR	TO-263

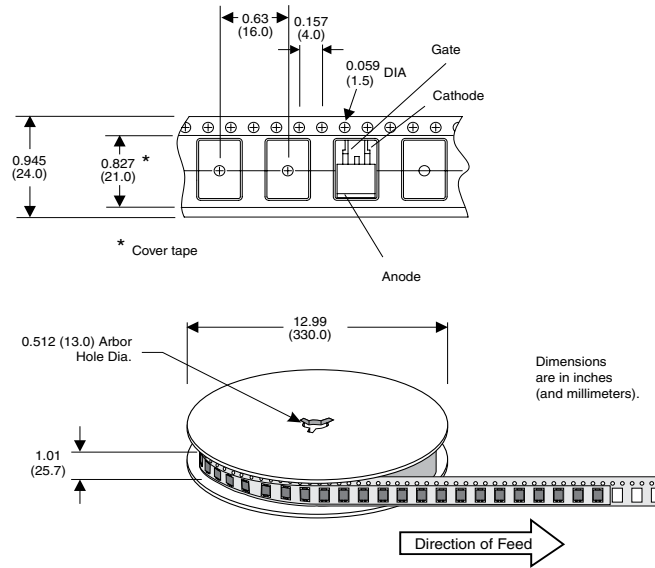
Note: xx = Voltage

Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
SJxx40LTP	SJxx40L	2.2g	Tube	1000 (50 per tube)
SJxx40RTP	SJxx40R	2.2g	Tube	1000 (50 per tube)
SJxx40NTP	SJxx40N	1.6g	Tube	1000 (50 per tube)
SJxx40NRP	SJxx40N	1.6g	Embossed Carrier	500
SJxx40L2TP	SJxx40L2	2.2g	Tube	1000 (50 per tube)
SJxx40R2TP	SJxx40R2	2.2g	Tube	1000 (50 per tube)
SJxx40N2RP	SJxx40N2	1.6g	Embossed Carrier	500

Note: xx = Voltage

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



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