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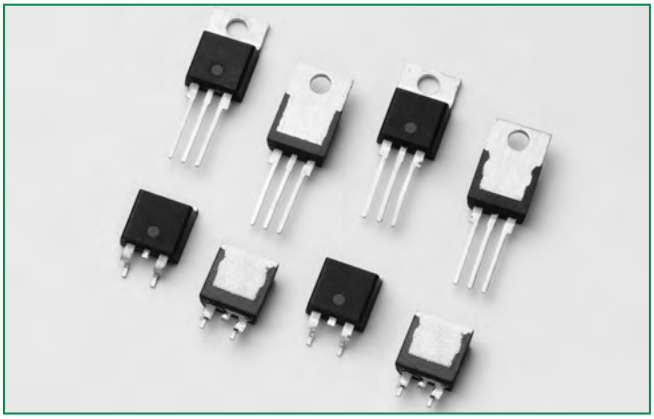
Thyristors

40 Amp Standard High Temperature SCRs

SJxx40xxA Series

AUTOMOTIVE GRADE HF RoHS



Description

This SJxx40xxA 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

- 150°C junction temperature
- Voltage capability up to 600 V
- Surge capability up to 520 A at 60 Hz half cycle
- Halogen-free and RoHS compliant
- Recognized to UL 1557 as an Electrically Isolated Semiconductor Device
- AEC-Q101 qualified

-Applications

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

Agency Recognitions

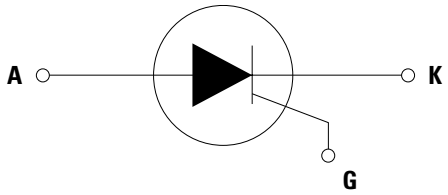
Agency	Agency File Number
	E71639

Note: 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	Pw = 100µs	700	V
$I_{T(RMS)}$	RMS on-state current	SJxx40LxA T_C = 55°C	40	A
		SJxx40RxA/SJxx40NxA T_C = 115°C		
$I_{T(AV)}$	Average on-state current	SJxx40LxA T_C = 55°C	25.0	A
		SJxx40RxA/SJxx40NxA T_C = 115°C		
I_{TSM}	Peak non-repetitive surge current	single half cycle; f = 50Hz; T_J (initial) = 25°C	430	A
		single half cycle; f = 60Hz; T_J (initial) = 25°C	520	
I^2t	I^2t Value for fusing	t_p = 8.3 ms	1122	A^2s
di/dt	Critical rate of rise of on-state current	f = 60Hz ; T_J = 150°C	150	A/µs
I_{GM}	Peak gate current	$t_p \leq$ 10µs ; T_J = 150°C	4	A
$P_{G(AV)}$	Average gate power dissipation	$t_p \leq$ 10µs ; T_J = 150°C	1	W
T_{stg}	Storage temperature range		-40 to 150	°C
T_J	Operating junction temperature range		-40 to 150	°C

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

Symbol	Test Conditions			SJxx40xA	SJxx40x2A	Unit
I_{GT}	V_D = 12V; R_L = 30 Ω		MAX.	40	15	mA
			MIN.	5	3	
V_{GT}			MAX.	1.5		V
dv/dt	$V_D = V_{DRM}$; gate open; T_J = 125°C	400V	MIN.	650	400	V/µs
		600V		600	350	
	$V_D = V_{DRM}$; gate open; T_J = 150°C	400V		550	-	
		600V		500	-	
	V_D = 67%V_{DRM}; gate open; T_J = 150°C	400V		-	300	
		600V		-	250	
V_{GD}	$V_D = V_{DRM}$; R_L = 3.3 kΩ; T_J = 150°C		MIN.	0.2		V
I_H	I_T = 400mA (initial)		MAX.	60	50	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 = 80A		TYP.	2		µs

Note:xx=voltage/10, x=package

Static Characteristics

Symbol	Test Conditions			Value	Unit
V_{TM}	I_T = 80A; t_p = 380µs		MAX.	1.7	V
I_{DRM} / I_{RRM}	@ V_{DRM} / V_{RRM}	T_J = 25°C	MAX.	10	µA
		T_J = 125°C		2000	
		T_J = 150°C		4000	

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{\theta(JC)}$	Junction to case (AC)	SJxx40LxA	1.9	°C/W
		SJxx40RxA/SJxx40NxA	0.8	°C/W

Note: xx = voltage, x = sensitivity & type

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

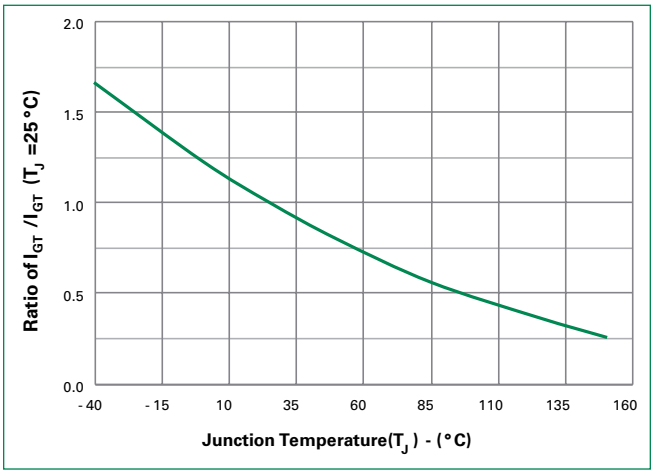

Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

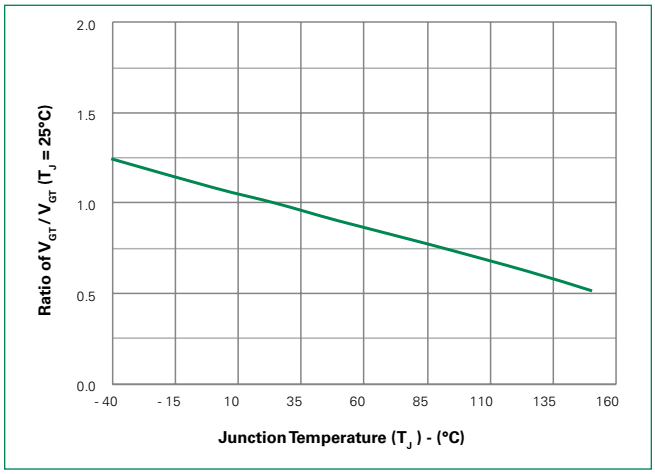

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Figure 3: Normalized DC Holding Current vs. Junction Temperature

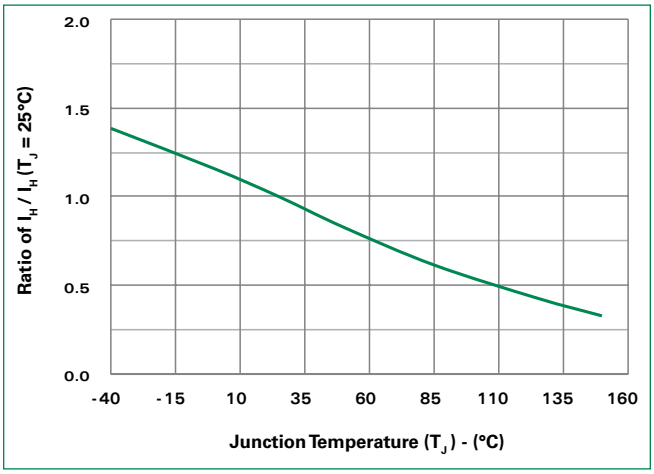

Figure 4: On-State Current vs. On-State Voltage (Typical)

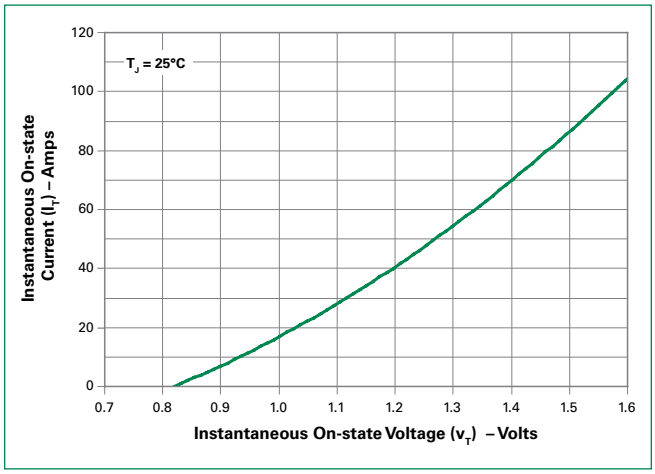

Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

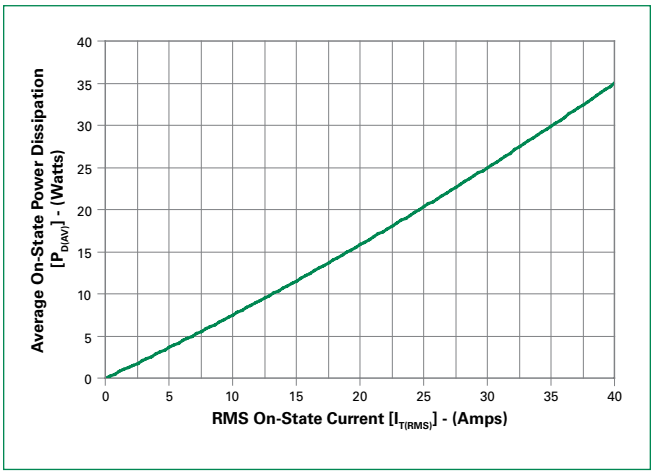

Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

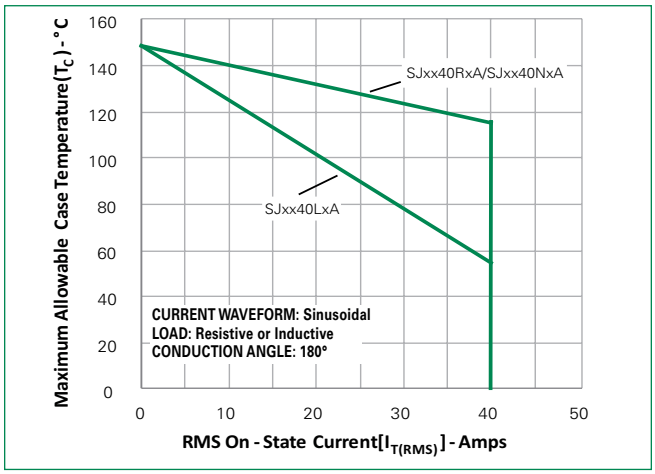

Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

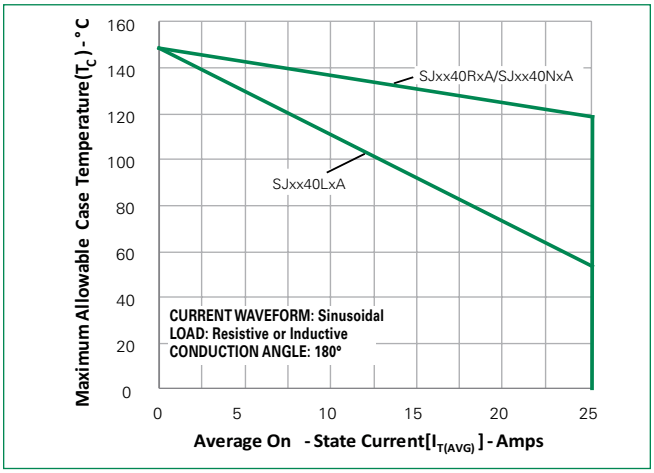

Figure 8: Peak Capacitor Discharge Current

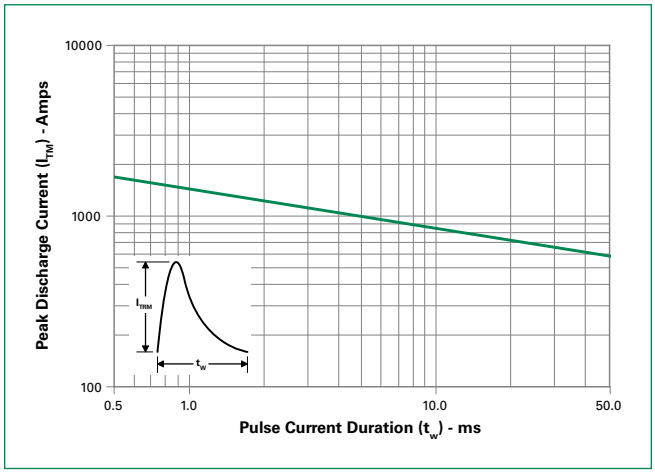

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Figure 9: Peak Capacitor Discharge Current Derating

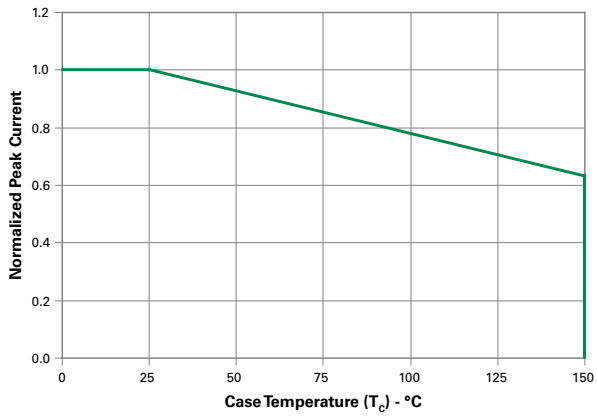
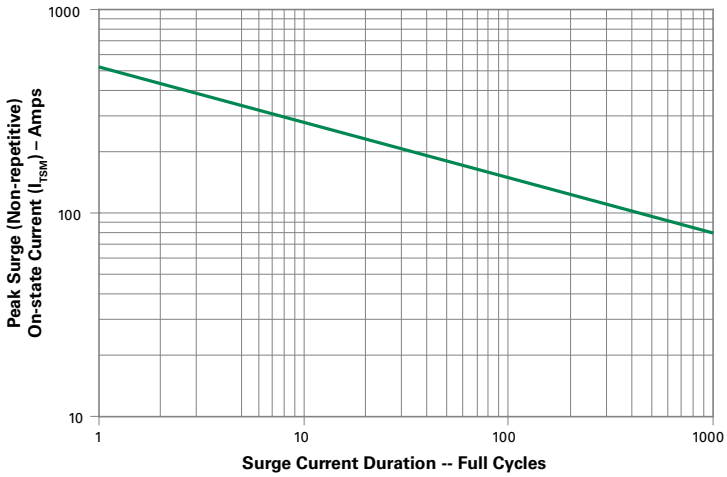


Figure 10: Surge Peak On-State Current vs. Number of Cycles

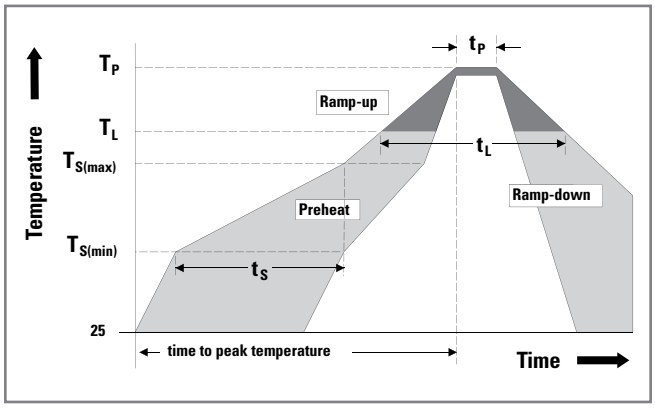


SUPPLY FREQUENCY: 60 Hz Sinusoidal
LOAD: Resistive
RMS On-State Current: [$I_{T(RMS)}$]: Maximum Rated Value at Specified Case Temperature

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.

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



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Thyristors
40 Amp Standard High Temperature SCRs

Physical Specifications

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

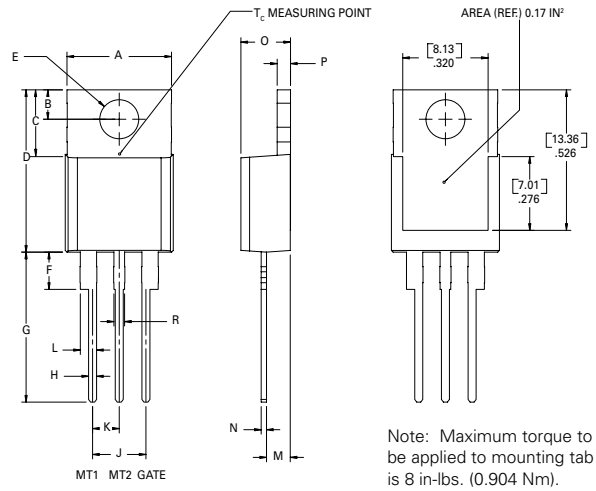
Design Considerations

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
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
UHAST	JESD22A-118, 96 hrs, 130°C / 85% RH
IOL	MIL-STD-750 Method 1037

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	2.66	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

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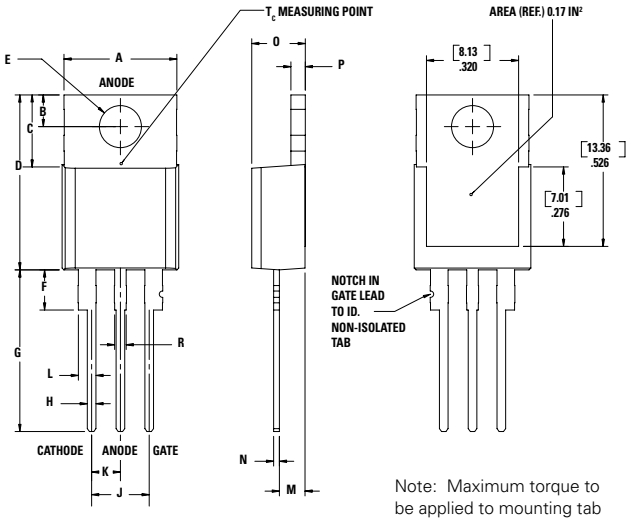
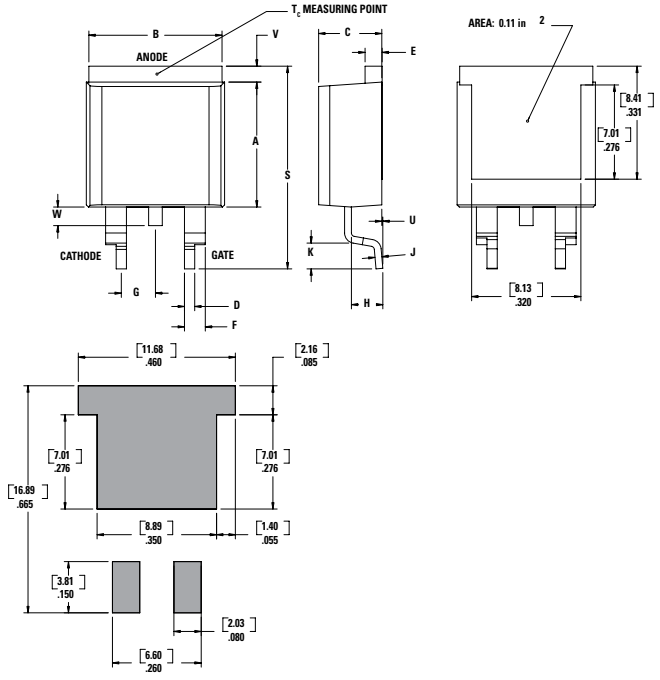
Dimensions — TO-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead



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- 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

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40 Amp Standard High Temperature SCRs

Part Numbering System

SJ 60 40 R 2 A 56

COMPONENT TYPE
SJ: high temperature SCR

VOLTAGE RATING
40: 400V
60: 600V

CURRENT RATING
40: 40A

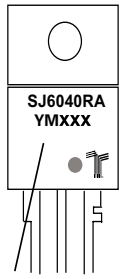
PACKAGE TYPE
L: TO-220 Isolated
R: TO-220 Non-isolated
N: TO-263 (D^2-Pak)

SENSITIVITY & TYPE
[blank]: 40mA
2: 15mA

AEC-Q101 Qualified

Lead Form Dimensions
xx: Lead Form Option

Part Marking System



Date Code Marking
Y:Year Code
M: Month Code
XXX: Lot Trace Code

Product Selector

Part Number	Voltage		Gate Sensitivity	Type	Package
	400V	600V			
SJxx40LA	X	X	40mA	Standard SCR	TO-220L
SJxx40RA	X	X	40mA	Standard SCR	TO-220R
SJxx40NA	X	X	40mA	Standard SCR	TO-263
SJxx40L2A	X	X	15mA	Standard SCR	TO-220L
SJxx40R2A	X	X	15mA	Standard SCR	TO-220R
SJxx40N2A	X	X	15mA	Standard SCR	TO-263

Note: xx = Voltage

Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
SJxx40LATP	SJxx40LA	2.2g	Tube	1000 (50 per tube)
SJxx40RATP	SJxx40RA	2.2g	Tube	1000 (50 per tube)
SJxx40NATP	SJxx40NA	1.6g	Tube	1000 (50 per tube)
SJxx40NARP	SJxx40NA	1.6g	Embossed Carrier	500
SJxx40L2ATP	SJxx40L2A	2.2g	Tube	1000 (50 per tube)
SJxx40R2ATP	SJxx40R2A	2.2g	Tube	1000 (50 per tube)
SJxx40N2ATP	SJxx40N2A	1.6g	Tube	1000 (50 per tube)
SJxx40N2ARP	SJxx40N2A	1.6g	Embossed Carrier	500

Note: xx = Voltage

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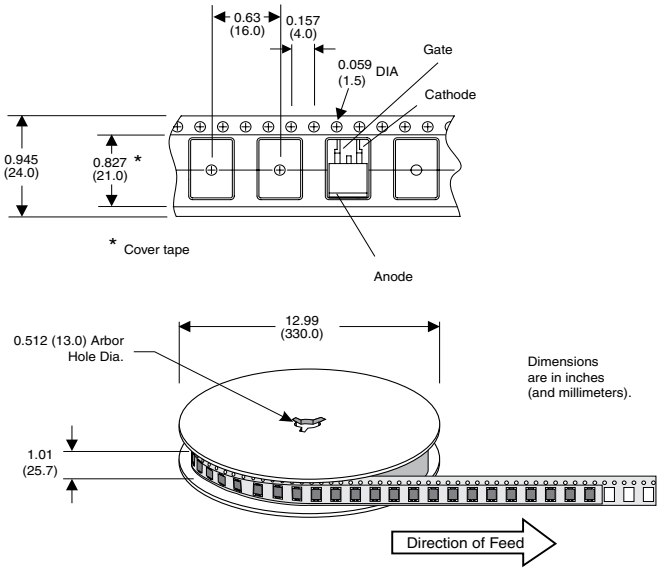
Reel Pack (RP) for TO-263 Embossed Carrier Specifications



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