Littelfuse
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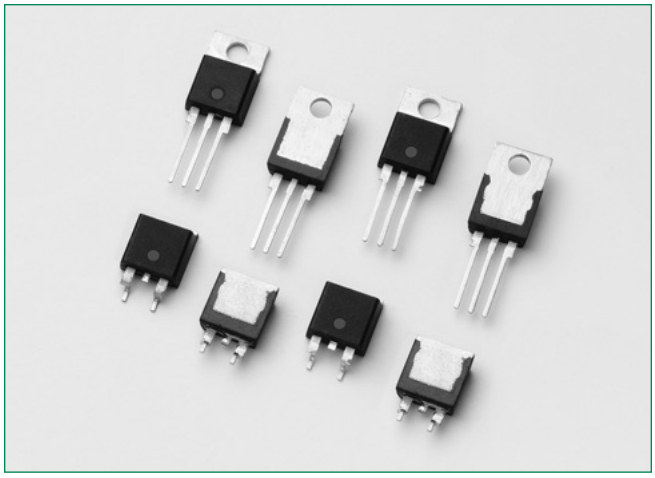
Thyristors
40 Amp Standard SCRs

Sxx40x 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 520 A

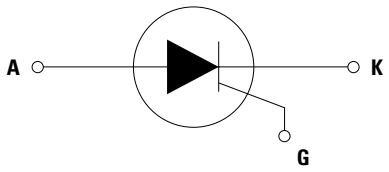
Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	40	A
V_{DRM}/V_{RRM}	400 to 1000	V
I_{GT}	40	mA

Applications

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

Schematic Symbol



Absolute Maximum Ratings

Symbol	Parameter	Test Conditions	Value	Unit
$I_{T(RMS)}$	RMS on-state current	T_C = 100°C	40	A
$I_{T(AV)}$	Average on-state current	T_C = 100°C	25.0	A
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 = 125°C	175	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

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

Symbol	Test Conditions			Value	Unit
I_{GT}	V_D = 12V; R_L = 30 Ω		MAX.	40	mA
			MIN.	5	
V_{GT}			MAX.	1.5	V
dv/dt	$V_D = V_{DRM}$; gate open; T_J = 100°C	400V	MIN.	650	V/µs
		600V		600	
		800V		500	
		1000V		250	
	$V_D = V_{DRM}$; gate open; T_J = 125°C	400V		550	
		600V		500	
		800V		475	
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.	60	mA
t_q	(1)		MAX.	35	µs
t_{gt}	I_G = 2 x I_{GT}; PW = 15µs; I_T = 80A		TYP.	2.5	µs

Note :
1. I_T=2A; t_p=50µs; dv/dt=5V/µs; di/dt=-30A/µs

Static Characteristics

Symbol	Test Conditions				Value	Unit
V_{TM}	I_T = 80A; t_p = 380µs			MAX.	1.8	V
I_{DRM} / I_{RRM}	V_{DRM} / V_{RRM}	T_J = 25°C	400 – 600V	MAX.	10	µA
			800 V		20	
			1000 V		30	
		T_J = 100°C	400 – 600V		1000	
			800V		1500	
			1000V		5000	
		T_J = 125°C	400 – 600V		2000	
			800V		3000	

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{\Theta(JC)}$	Junction to case (AC)	Sxx40R / Sxx40N	0.6	°C/W
$R_{\Theta(J-A)}$	Junction to ambient	Sxx40R	40	°C/W

Revised: 11/15/20

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

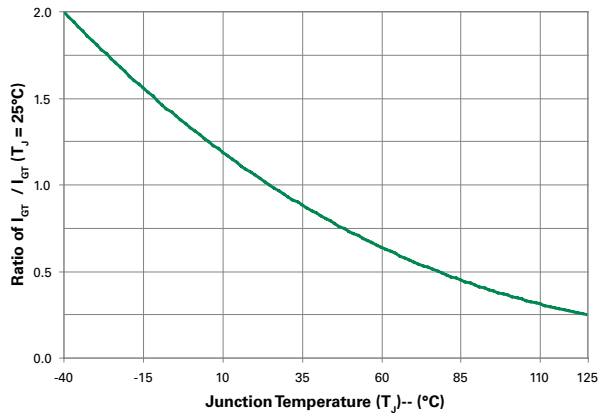

Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

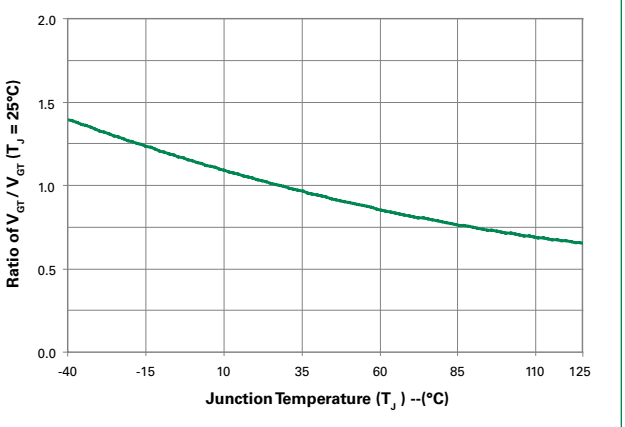

Figure 3: Normalized DC Holding Current vs. Junction Temperature

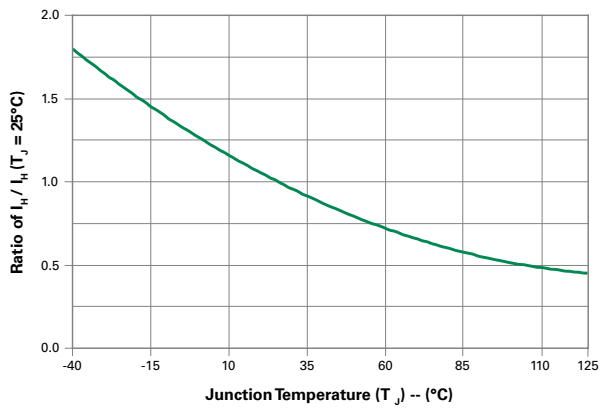

Figure 4: On-State Current vs. On-State Voltage (Typical)

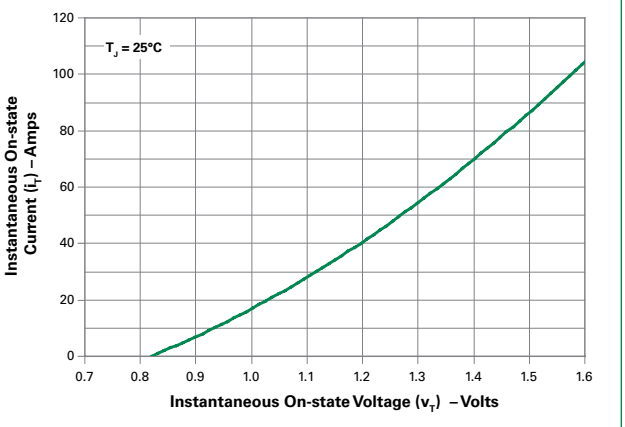

Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

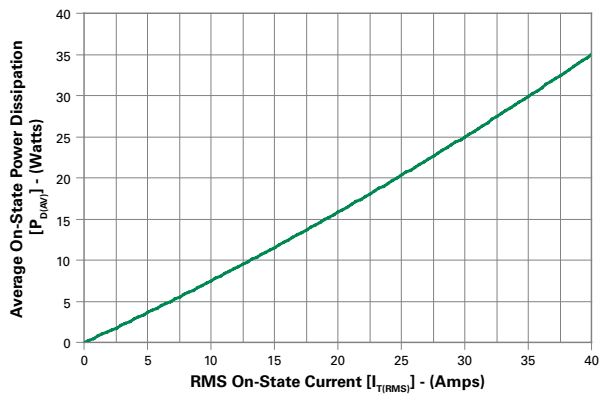

Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

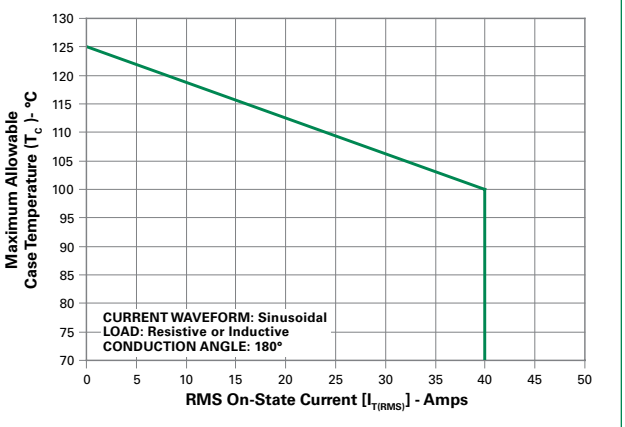

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Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

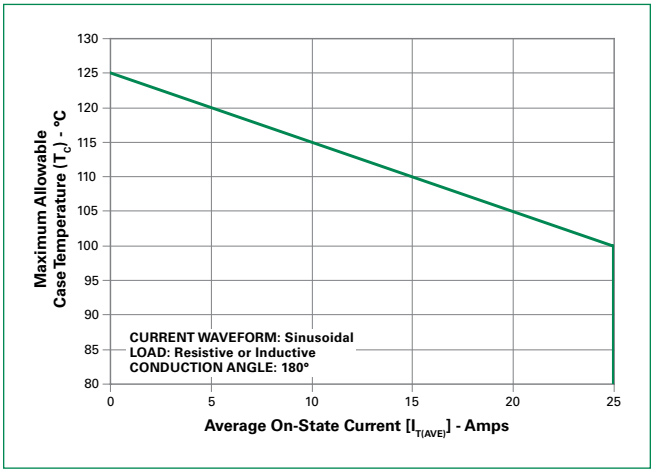


Figure 8: Maximum Allowable Ambient Temperature vs. RMS On-State Current

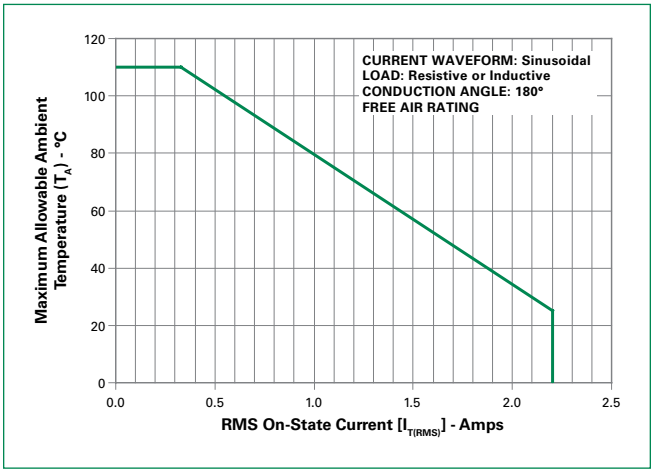


Figure 9: Maximum Allowable Ambient Temperature vs. Average On-State Current

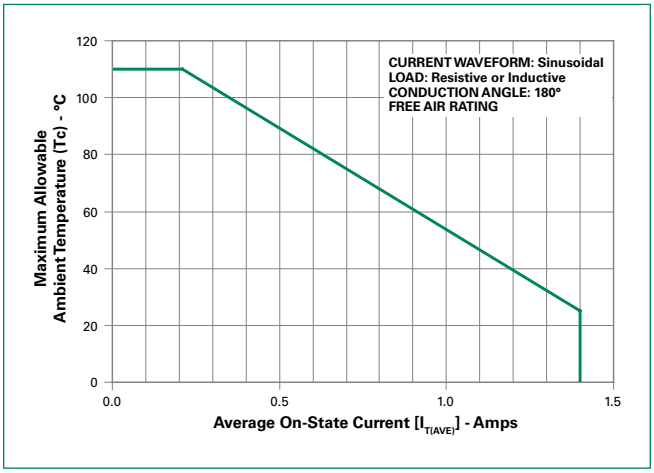


Figure 10: Peak Capacitor Discharge Current

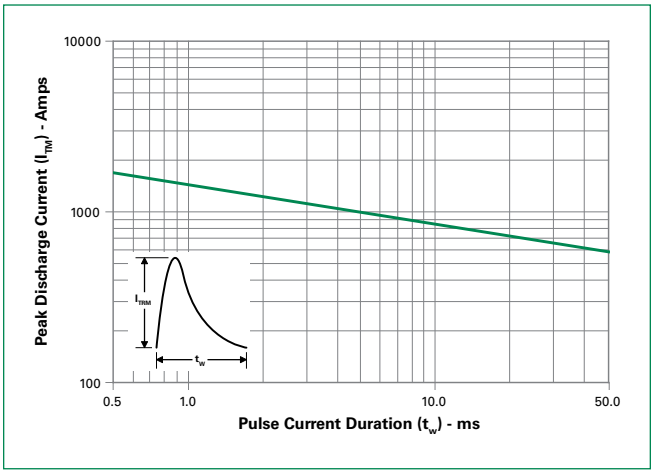


Figure 11: Peak Capacitor Discharge Current Derating

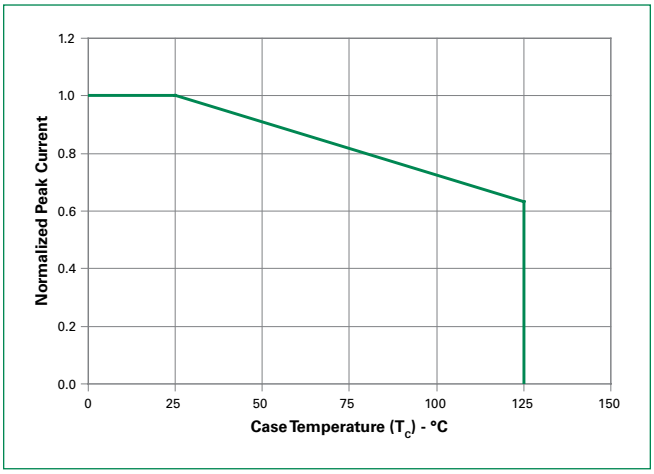
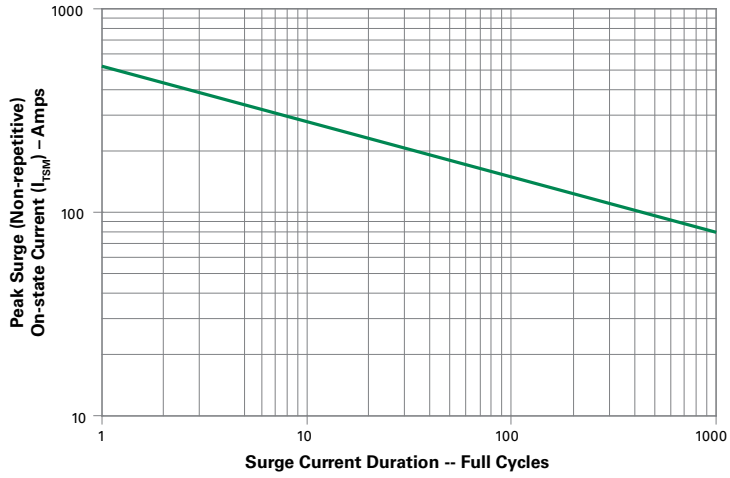


Figure 12: Surge Peak On-State Current vs. Number of Cycles

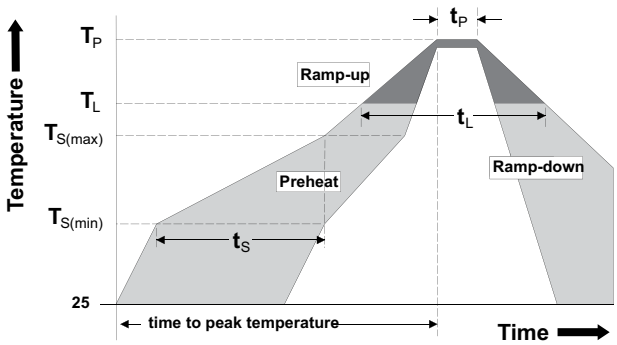


Supply Frequency: 60 Hz Sinusoidal
Load: Resistive
RMS On-State Current: [$I_{T(RMS)}$]: Maximum Rated Value at Specified Case Temperature

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.

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



Thyristors
40 Amp Standard SCRs

Physical Specifications

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

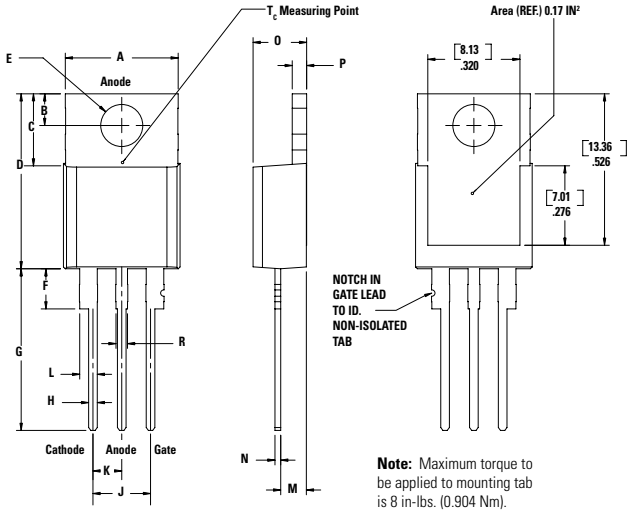
Design Considerations

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 @ 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

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

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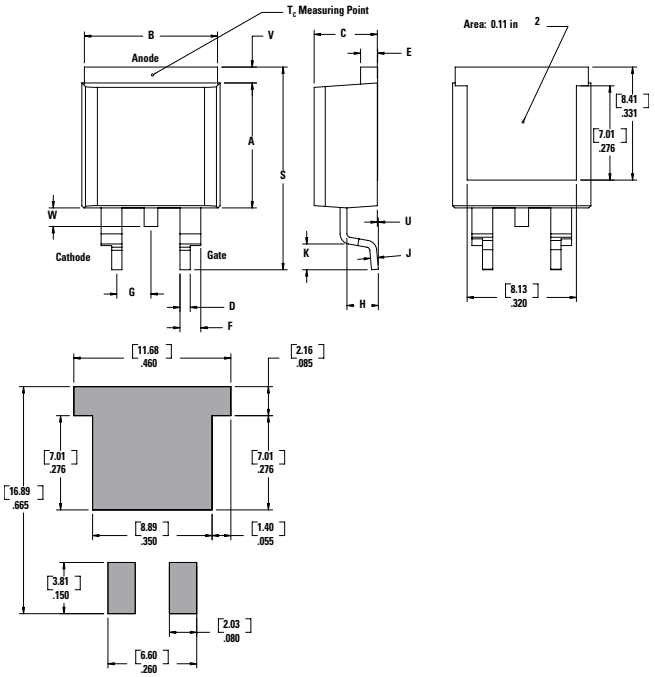
Dimensions – TO- 263 (N-package) — D²-Pak Surface Mount



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

S 60 40 R 56

Device Type
S: SCR

Voltage Rating
40: 400V
60: 600V
80: 800V
K0: 1000V

Currenting Rating
40: 40A

Package Type
R: TO-220 (Non-isolated)
N: TO-263 (D²-Pak)

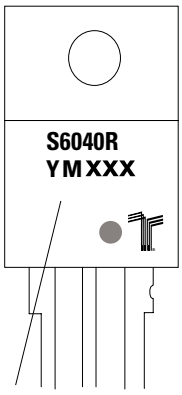
Sensitivity Type
[blank]: 40mA

Lead Form Dimensions
xx: Lead Form Option

Part Marking System

TO-220 AB - (R Package)

TO-263 AB - (N Package)



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

Revised: 11/15/20

Product Selector

Part Number	Voltage				Gate Sensitivity	Type	Package
	400V	600V	800V	1000V			
Sxx40R	X	X	X	X	40mA	Standard SCR	TO-220R
Sxx40N	X	X	X	X	40mA	Standard SCR	TO-263

Note: xx = Voltage

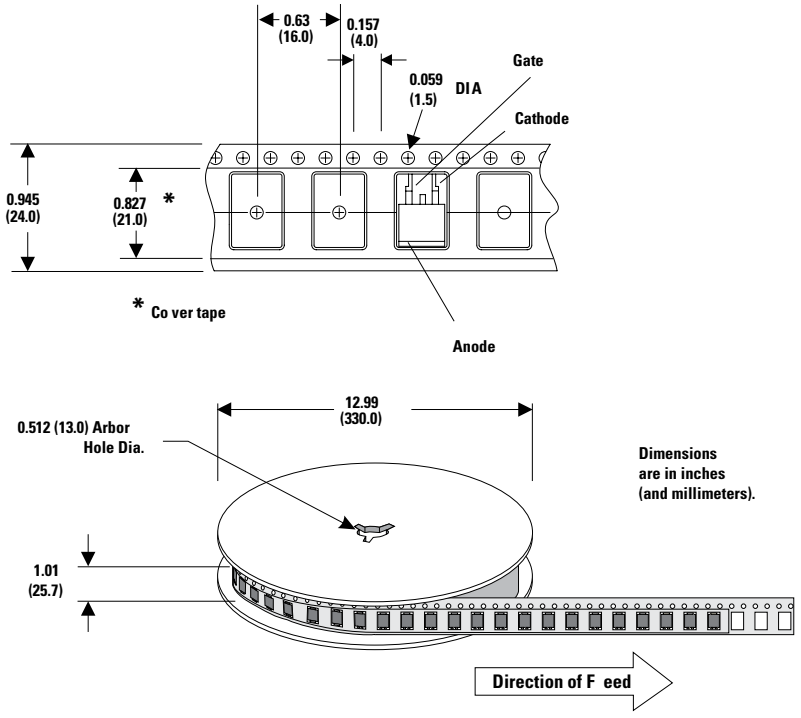
Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
Sxx40RTP	Sxx40R	2.2g	Tube	1000 (50 per tube)
Sxx40NTP	Sxx40N	1.6g	Tube	1000 (50 per tube)
Sxx40NRP	Sxx40N	1.6g	Embossed Carrier	500

Note: xx = Voltage

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

Meets all EIA-481-2 Standards



Mouser Electronics

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Littelfuse:

S8040NRP S2040NRP S2040R S8040R S6040NTP S2040NTP SK040R SK040NRP S6040R S6040NRP SK040NTP S4040NRP S4040R S8040NTP S4040RTP S4040NTP SK040RTP S6040RTP S8040RTP