

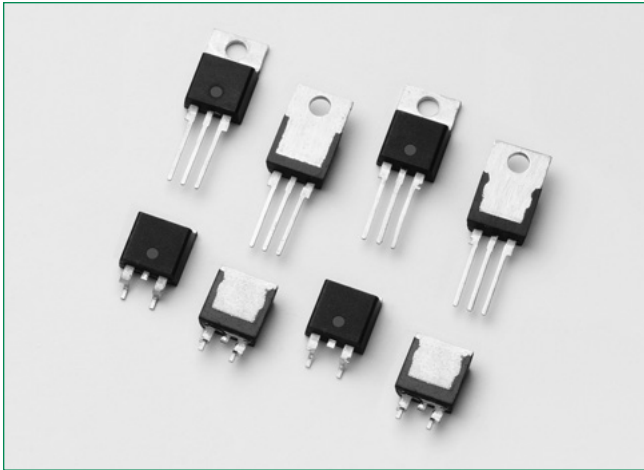


THE DATASHEET OF S6040NTP



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

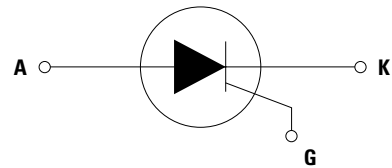
Main Features

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	$T_c = 100^\circ\text{C}$	40	A
$I_{T(AV)}$	Average on-state current	$T_c = 100^\circ\text{C}$	25.0	A
I_{TSM}	Peak non-repetitive surge current	single half cycle; $f = 50\text{Hz}$; $T_j(\text{initial}) = 25^\circ\text{C}$	430	A
		single half cycle; $f = 60\text{Hz}$; $T_j(\text{initial}) = 25^\circ\text{C}$	520	
I^2t	I^2t Value for fusing	$t_p = 8.3 \text{ ms}$	1122	A^2s
di/dt	Critical rate of rise of on-state current	$f = 60\text{Hz}$; $T_j = 125^\circ\text{C}$	175	$\text{A}/\mu\text{s}$
I_{GM}	Peak gate current	$T_j = 125^\circ\text{C}$	3.5	A
$P_{G(AV)}$	Average gate power dissipation	$T_j = 125^\circ\text{C}$	0.8	W
T_{stg}	Storage temperature range		-40 to 150	$^\circ\text{C}$
T_j	Operating junction temperature range		-40 to 125	$^\circ\text{C}$

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

Symbol	Test Conditions			Value	Unit
I_{GT}	$V_D = 12\text{V}; R_L = 30\ \Omega$		MAX.	40	mA
			MIN.	5	
V_{GT}			MAX.	1.5	V
dv/dt	$V_D = V_{DRM}; \text{gate open}; T_J = 100^\circ\text{C}$	400V	MIN.	650	V/ μs
		600V		600	
		800V		500	
	1000V	250			
	$V_D = V_{DRM}; \text{gate open}; T_J = 125^\circ\text{C}$	400V		550	
		600V		500	
800V		475			
V_{GD}	$V_D = V_{DRM}; R_L = 3.3\ \text{k}\Omega; T_J = 125^\circ\text{C}$		MIN.	0.2	V
I_H	$I_T = 400\text{mA}$ (initial)		MAX.	60	mA
t_q	(1)		MAX.	35	μs
t_{gt}	$I_G = 2 \times I_{GT}; \text{PW} = 15\mu\text{s}; I_T = 80\text{A}$		TYP.	2.5	μs

Note :

 1. $I_T = 2\text{A}; t_p = 50\mu\text{s}; dv/dt = 5\text{V}/\mu\text{s}; di/dt = 30\text{A}/\mu\text{s}$

Static Characteristics

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

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{\theta(J-C)}$	Junction to case (AC)	Sxx40R / Sxx40N	0.6	$^\circ\text{C}/\text{W}$
$R_{\theta(J-A)}$	Junction to ambient	Sxx40R	40	$^\circ\text{C}/\text{W}$

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

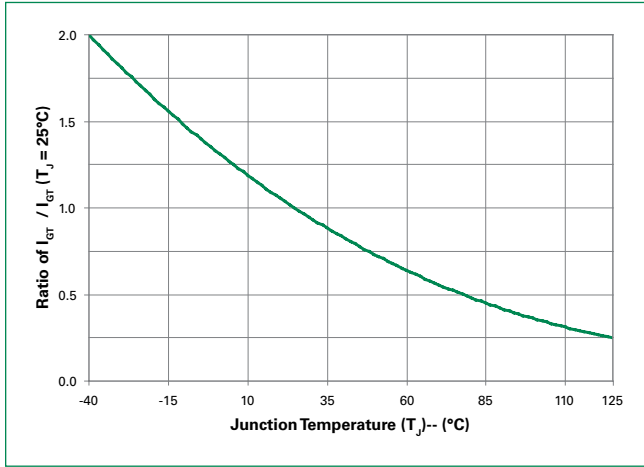


Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

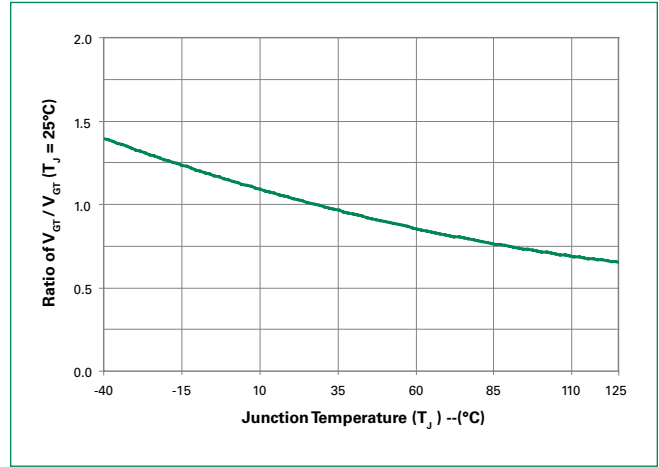


Figure 3: Normalized DC Holding Current vs. Junction Temperature

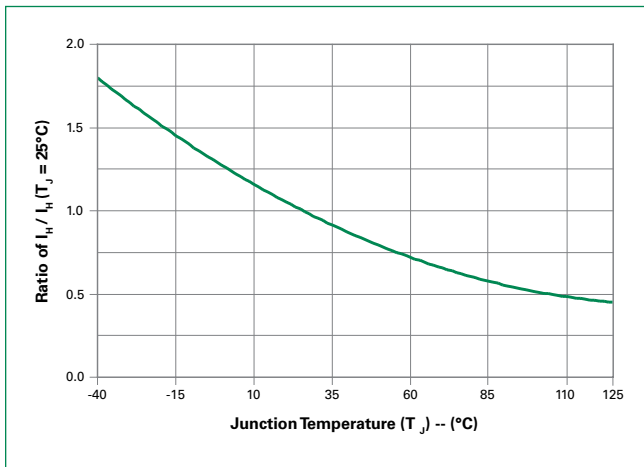


Figure 4: On-State Current vs. On-State Voltage (Typical)

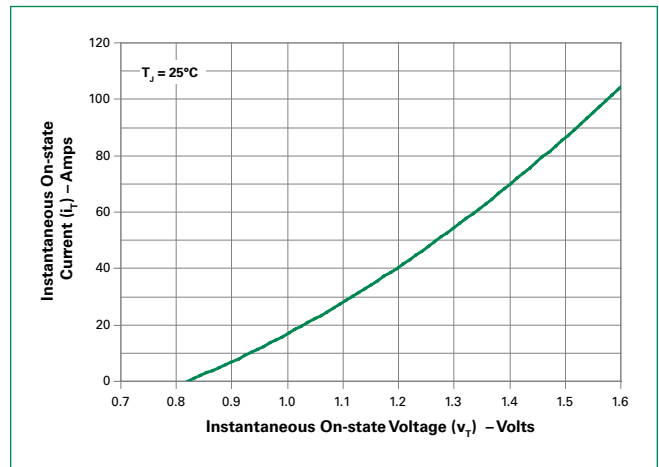


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

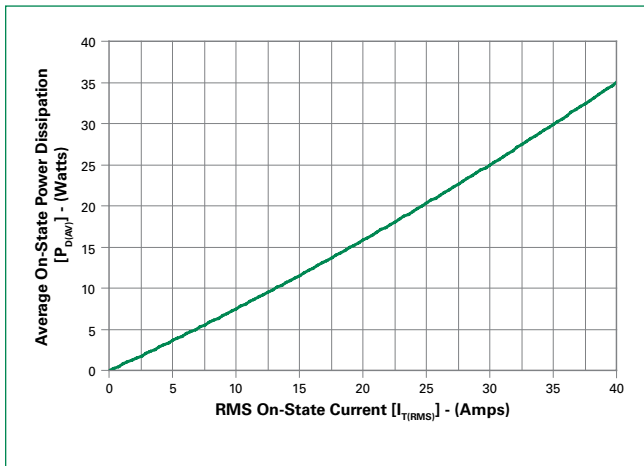


Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

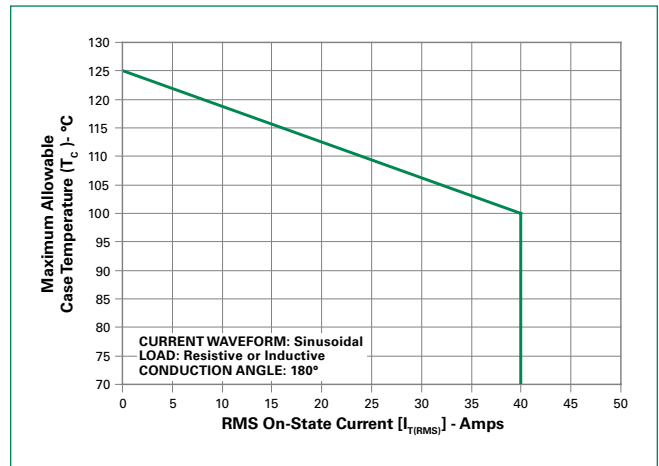


Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

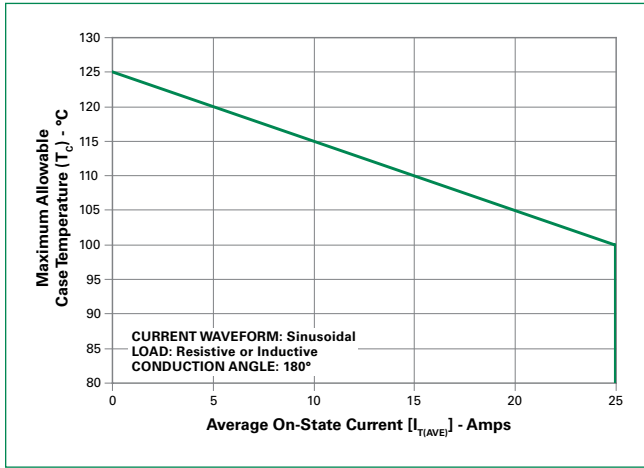


Figure 8: Maximum Allowable Ambient Temperature vs. RMS On-State Current

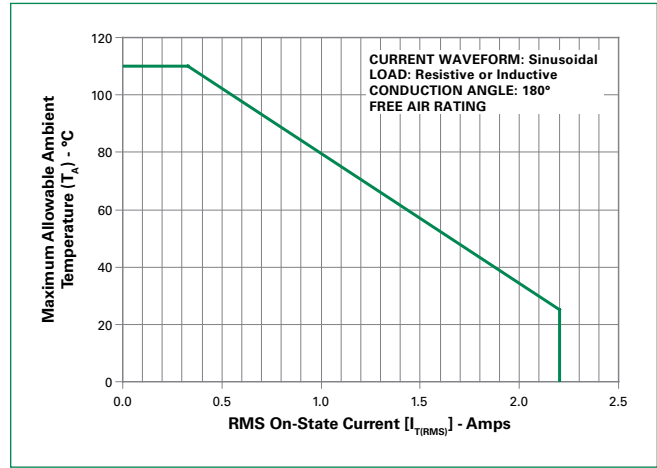


Figure 9: Maximum Allowable Ambient Temperature vs. Average On-State Current

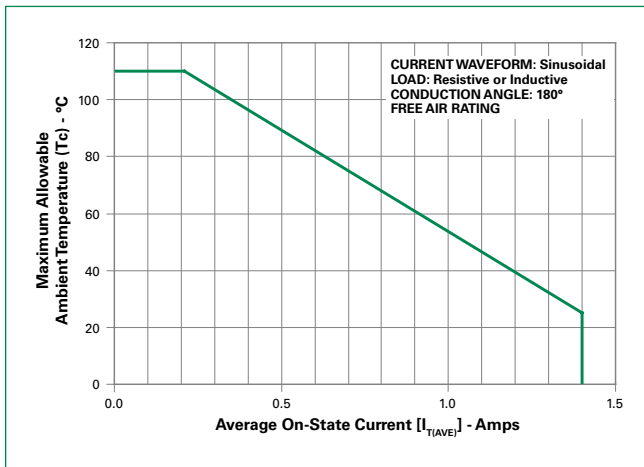


Figure 10: Peak Capacitor Discharge Current

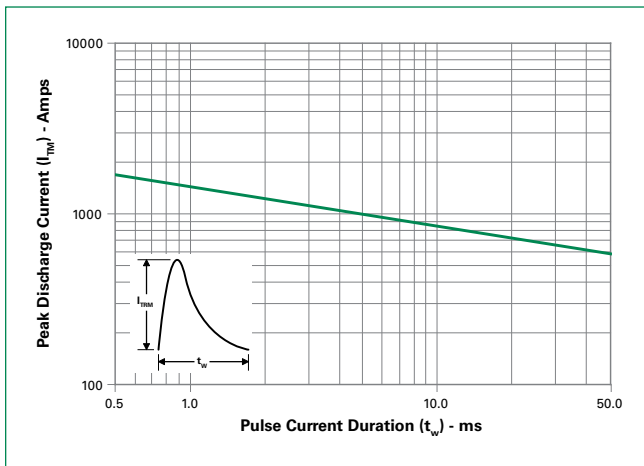


Figure 11: Peak Capacitor Discharge Current Derating

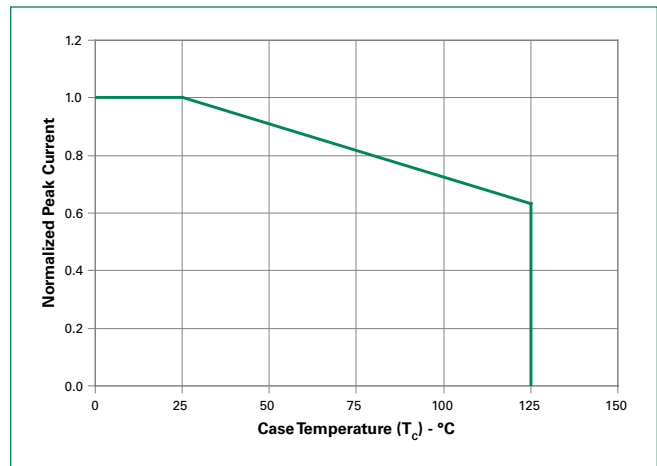
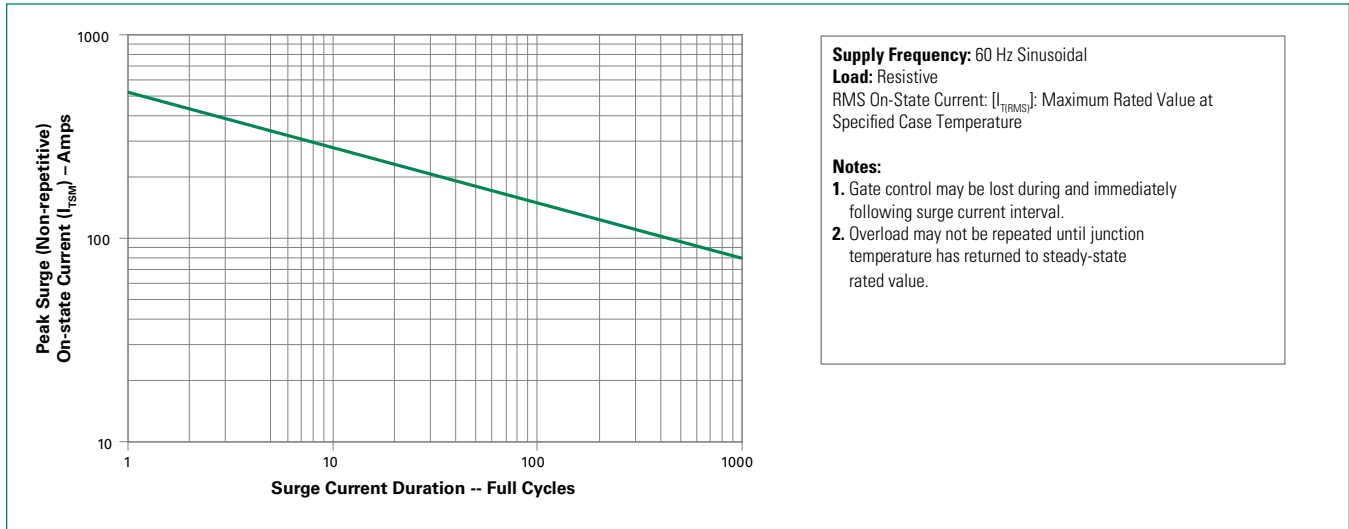
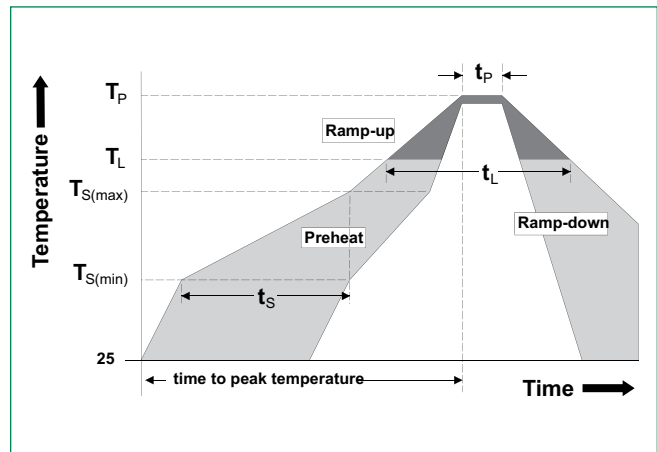


Figure 12: Surge Peak On-State Current vs. Number of Cycles



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

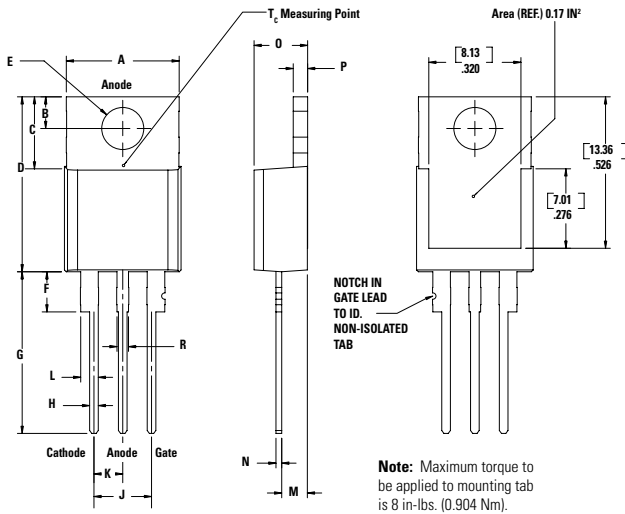
Design Considerations

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

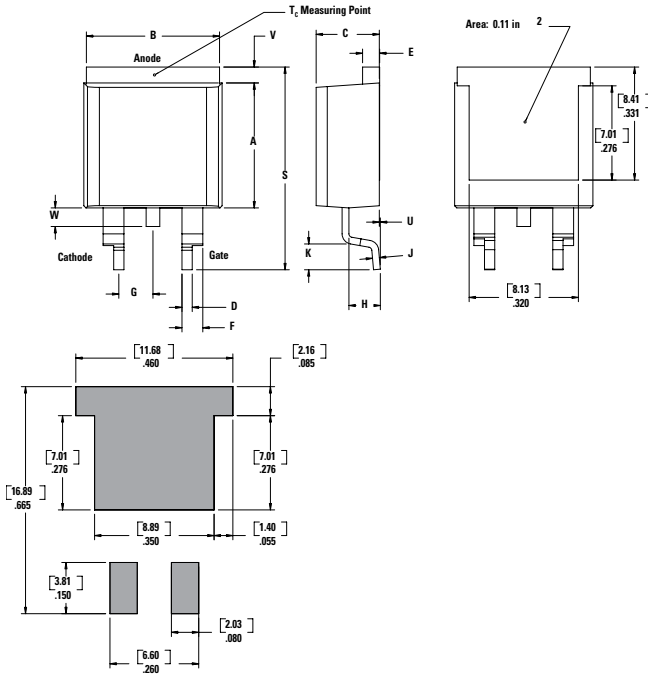
Test	Specifications and Conditions
AC Blocking	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 125°C for 1008 hours
Temperature Cycling	MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15-min dwell-time
Temperature/Humidity	EIA / JEDEC, JESD22-A101 1008 hours; 320V - DC: 85°C; 85% rel humidity
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



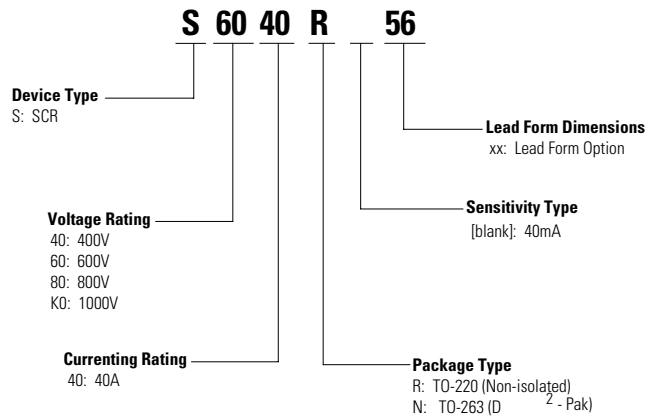
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.61
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060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



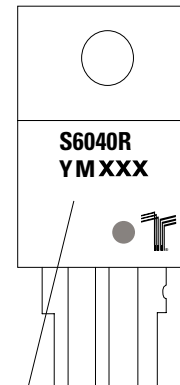
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.360	0.370	9.14	9.40
B	0.380	0.420	9.65	10.67
C	0.178	0.188	4.52	4.78
D	0.025	0.035	0.63	0.89
E	0.048	0.055	1.22	1.40
F	0.060	0.075	1.52	1.91
G	0.095	0.105	2.41	2.67
H	0.083	0.093	2.11	2.36
J	0.018	0.024	0.46	0.61
K	0.090	0.110	2.29	2.79
S	0.590	0.625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

TO-220 AB - (R Package)
TO-263 AB - (N Package)



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

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

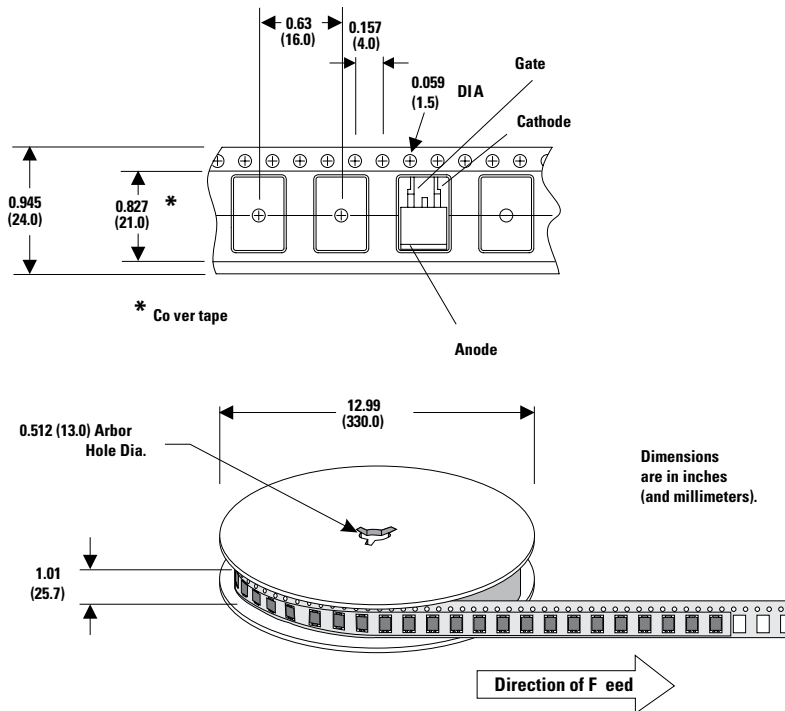
Packing Options

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



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