

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

**Applications**

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

**Main Features**

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

**Additional Information**



Datasheet



Resources



Samples

**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; $f = 50\text{Hz}$ ; $T_j$ (initial) = $25^\circ\text{C}$	430	A
		single half cycle; $f = 60\text{Hz}$ ; $T_j$ (initial) = $25^\circ\text{C}$	520	
$I^2t$	$I^2t$ Value for fusing	$t_p = 8.3 \text{ ms}$	1122	$\text{A}^2\text{s}$
$di/dt$	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<sub>J</sub> = 25°C, unless otherwise specified)

Symbol	Test Conditions			Value	Unit
I <sub>GT</sub>	V <sub>D</sub> = 12V; R <sub>L</sub> = 30 Ω		MAX.	40	mA
			MIN.	5	
V <sub>GT</sub>			MAX.	1.5	V
dv/dt	V <sub>D</sub> = V <sub>DRM</sub> ; gate open; T <sub>J</sub> = 100°C	400V	MIN.	650	V/μs
		600V		600	
		800V		500	
		1000V		250	
	V <sub>D</sub> = V <sub>DRM</sub> ; gate open; T <sub>J</sub> = 125°C	400V		550	
		600V		500	
800V		475			
V <sub>GD</sub>	V <sub>D</sub> = V <sub>DRM</sub> ; R <sub>L</sub> = 3.3 kΩ; T <sub>J</sub> = 125°C		MIN.	0.2	V
I <sub>H</sub>	I <sub>T</sub> = 400mA (initial)		MAX.	60	mA
t <sub>q</sub>	(1)		MAX.	35	μs
t <sub>gt</sub>	I <sub>G</sub> = 2 x I <sub>GT</sub> ; PW = 15μs; I <sub>T</sub> = 80A		TYP.	2.5	μs

Note :

(1) I<sub>T</sub>=2A; t<sub>p</sub>=50μs; dv/dt=5V/μs; di/dt=-30A/μs

### Static Characteristics

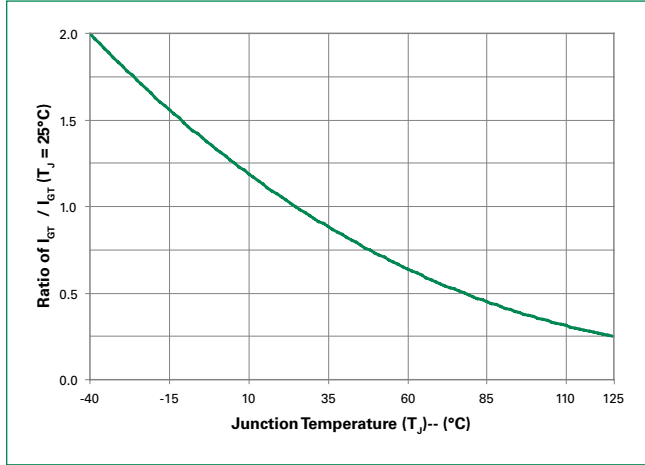
Symbol	Test Conditions			Value	Unit
V <sub>TM</sub>	I <sub>T</sub> = 80A; t <sub>p</sub> = 380μs			MAX.	1.8 V
I <sub>DRM</sub> / I <sub>RRM</sub>	V <sub>DRM</sub> / V <sub>RRM</sub>	T <sub>J</sub> = 25°C	400 – 600V	MAX.	10
			800 V		20
			1000 V		30
		T <sub>J</sub> = 100°C	400 – 600V		1000
			800V		1500
			1000V		5000
		T <sub>J</sub> = 125°C	400 – 600V		2000
			800V		3000

### Thermal Resistances

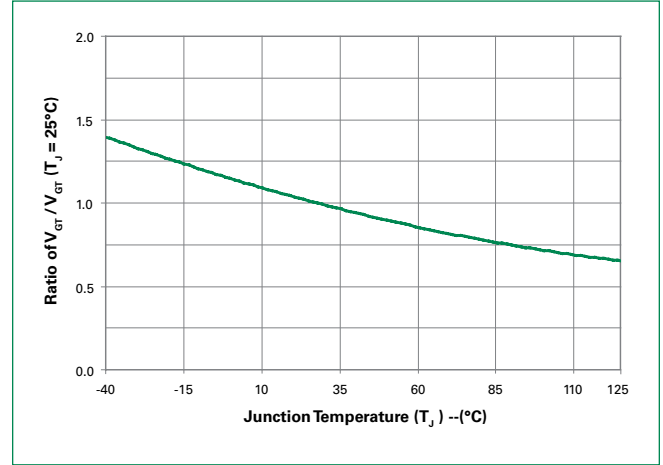
Symbol	Parameter		Value	Unit
R <sub>θ(J-C)</sub>	Junction to case (AC)	Sxx40R / Sxx40N	0.6	°C/W
R <sub>θ(J-A)</sub>	Junction to ambient	Sxx40R	40	°C/W

Note: xx = voltage

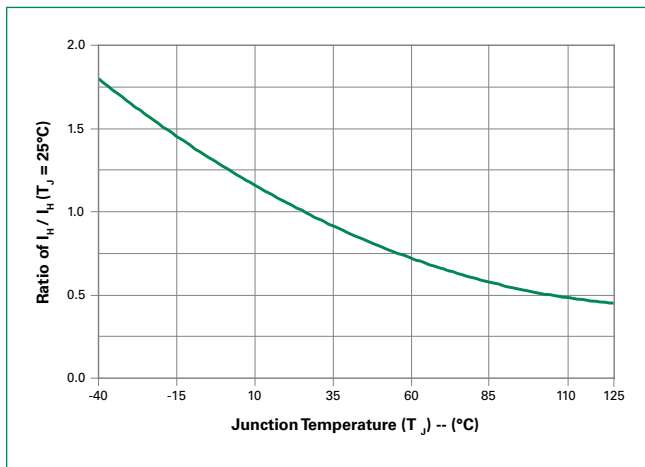
**Figure 1: Normalized DC Gate Trigger Current vs. Junction Temperature**



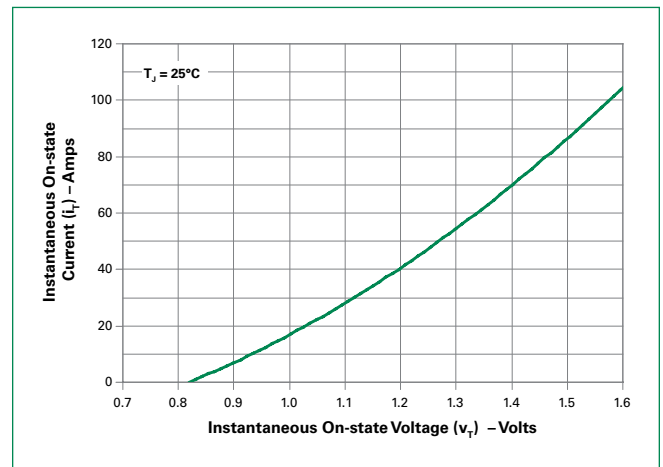
**Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature**



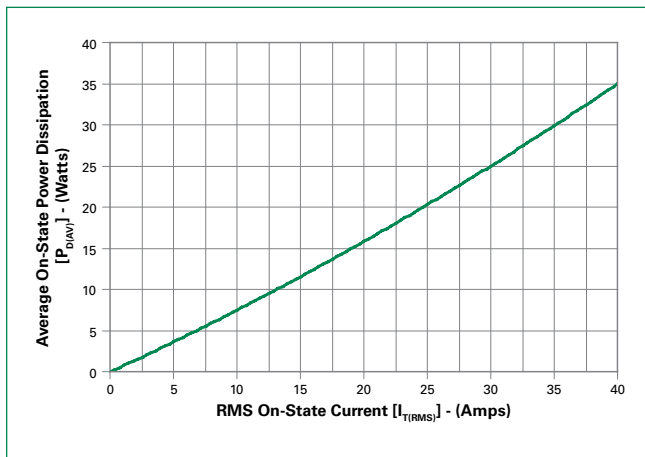
**Figure 3: Normalized DC Holding Current vs. Junction Temperature**



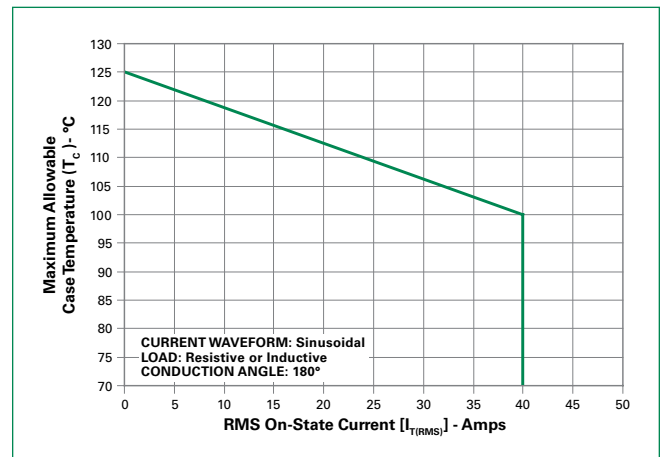
**Figure 4: On-State Current vs. On-State Voltage (Typical)**



**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**

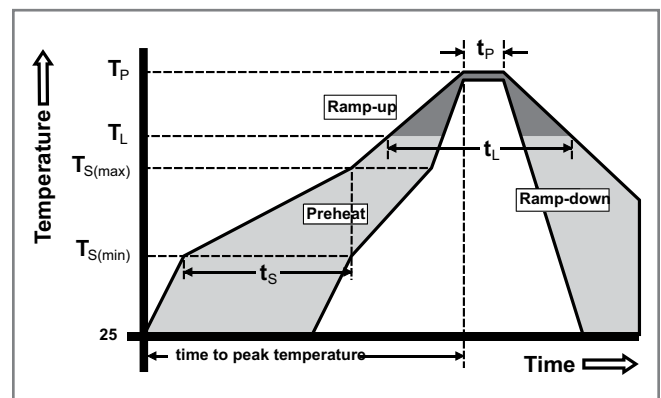


**Figure 12: Surge Peak On-State Current vs. Number of Cycles**



**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
	- Temperature ( $t_L$ )	60 – 150 seconds
Peak Temperature ( $T_p$ )		260 <sup>+0/-5</sup> °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**

<b>Terminal Finish</b>	100% Matte Tin-plated
<b>Body Material</b>	UL recognized epoxy meeting flammability classification 94V-0
<b>Lead Material</b>	Copper Alloy

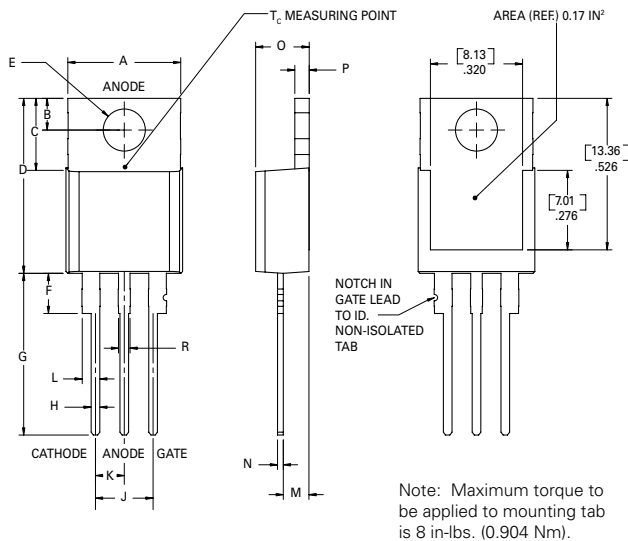
**Design Considerations**

Careful selection of the correct device 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 device 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**

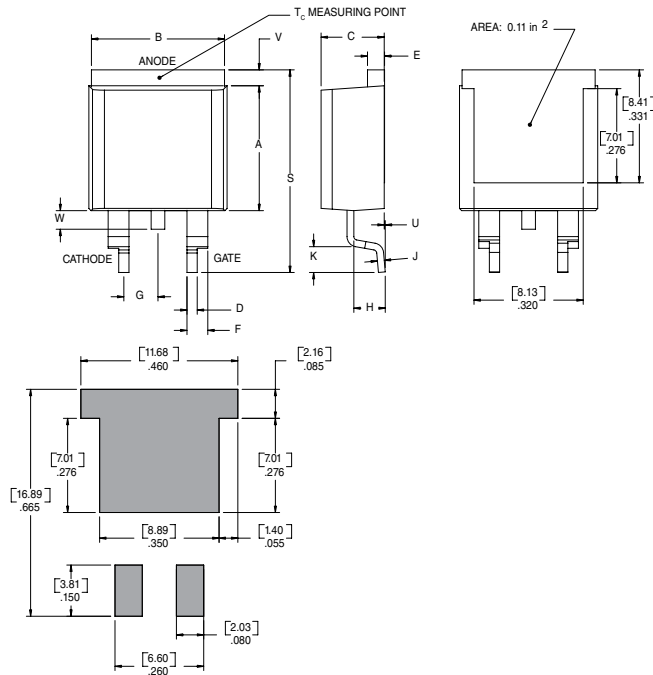
Test	Specifications and Conditions
<b>AC Blocking</b>	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 125°C for 1008 hours
<b>Temperature Cycling</b>	MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15-min dwell-time
<b>Temperature/Humidity</b>	EIA / JEDEC, JESD22-A101 1008 hours; 320V - DC: 85°C; 85% rel humidity
<b>High Temp Storage</b>	MIL-STD-750, M-1031, 1008 hours; 150°C
<b>Low-Temp Storage</b>	1008 hours; -40°C
<b>Thermal Shock</b>	MIL-STD-750, M-1056 10 cycles; 0°C to 100°C; 5-min dwelltime at each temperature; 10 sec (max) transfer time between temperature
<b>Autoclave</b>	EIA / JEDEC, JESD22-A102 168 hours (121°C at 2 ATMs) and 100% R/H
<b>Resistance to Solder Heat</b>	MIL-STD-750 Method 2031
<b>Solderability</b>	ANSI/J-STD-002, category 3, Test A
<b>Lead Bend</b>	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) – D<sup>2</sup>-Pak Surface Mount**



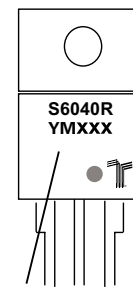
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.360	0.370	9.14	9.40
B	0.380	0.420	9.65	10.67
C	0.178	0.188	4.52	4.78
D	0.025	0.035	0.63	0.89
E	0.048	0.055	1.22	1.40
F	0.060	0.075	1.52	1.91
G	0.095	0.105	2.41	2.67
H	0.083	0.093	2.11	2.36
J	0.018	0.024	0.46	0.61
K	0.090	0.110	2.29	2.79
S	0.590	0.625	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
Sxx40R	Sxx40R	2.2g	Bulk	500
Sxx40RTP	Sxx40R	2.2g	Tube	500 (50 per tube)
Sxx40NTP	Sxx40N	1.6g	Tube	500 (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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