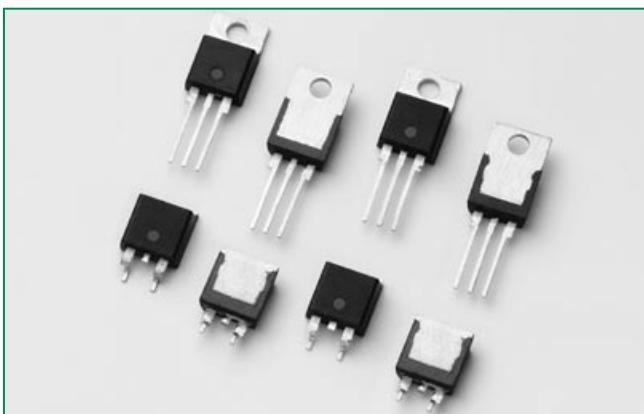


RoHS

Sxx40x Series



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

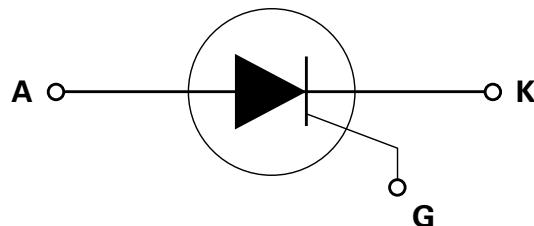
Symbol	Value	Unit
$I_{T(RMS)}$	40	A
V_{DRM}/V_{RRM}	400 to 1000	V
I_{GT}	40	mA

Applications

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

Internally constructed isolated packages are offered for ease of heat sinking with highest isolation voltage.

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_{TSM}	Peak non-repetitive surge current	single half cycle; $f = 50\text{Hz}$; T_j (initial) = 25°C	430	A
		single half cycle; $f = 60\text{Hz}$; T_j (initial) = 25°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}	$V_D = 12\text{V}; R_L = 60 \Omega$	MAX.	40	mA
		MIN.	5	
V_{GT}		MAX.	1.5	V
dv/dt	$V_D = V_{DRM}$; gate open; $T_j = 100^\circ\text{C}$	400V	650	V/ μs
		600V	600	
		800V	500	
		1000V	250	
	$V_D = V_{DRM}$; 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	$I_T = 200\text{mA}$ (initial)	MAX.	60	mA
t_q	(1)	MAX.	35	μs
t_{gt}	$I_G = 2 \times I_{GT}; PW = 15\mu\text{s}; I_T = 80\text{A}$	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	μA
			800V	
			1000V	
		$T_j = 100^\circ\text{C}$	400 – 600V	
			800V	
	V_{DRM} / V_{RRM}	$T_j = 125^\circ\text{C}$	1000V	
			400 – 600V	
			800V	
			2000	
			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	$^\circ\text{C}/\text{W}$

Note: xx = voltage

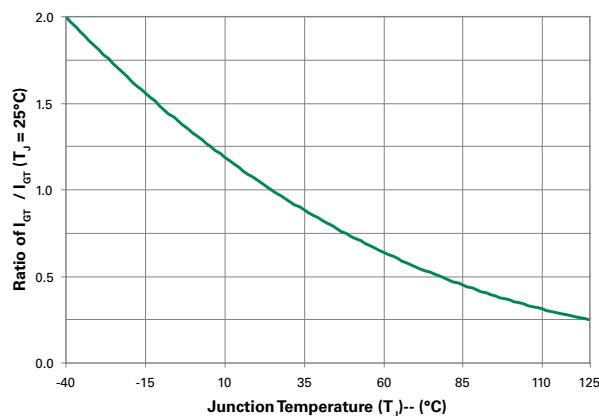
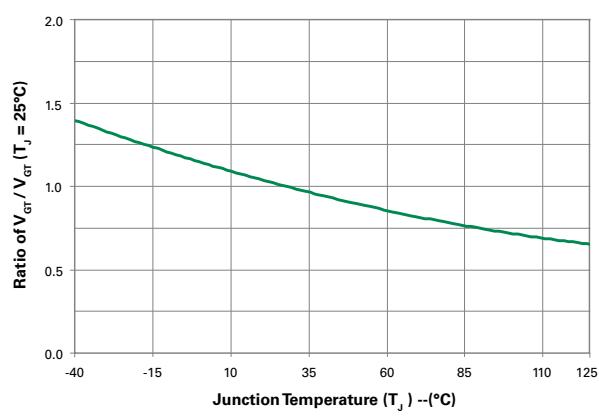
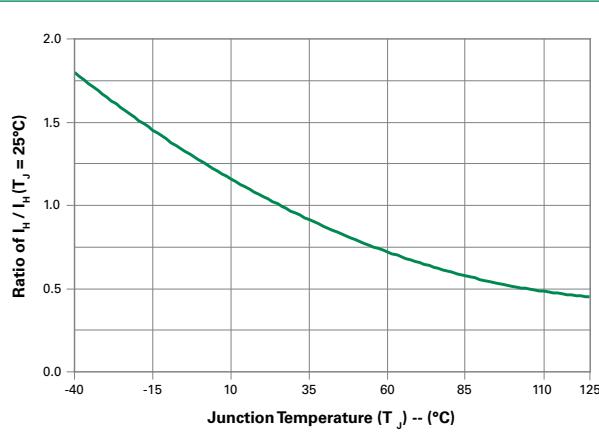
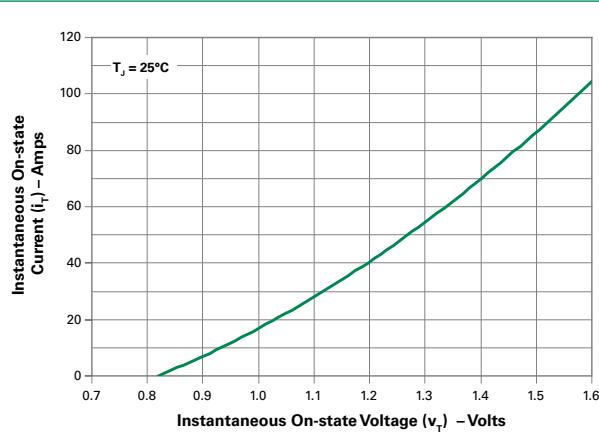
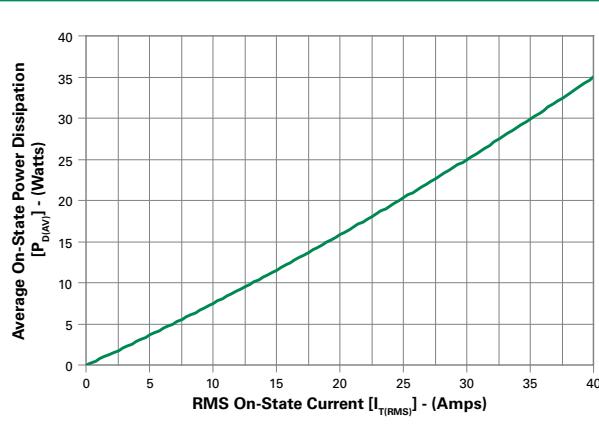
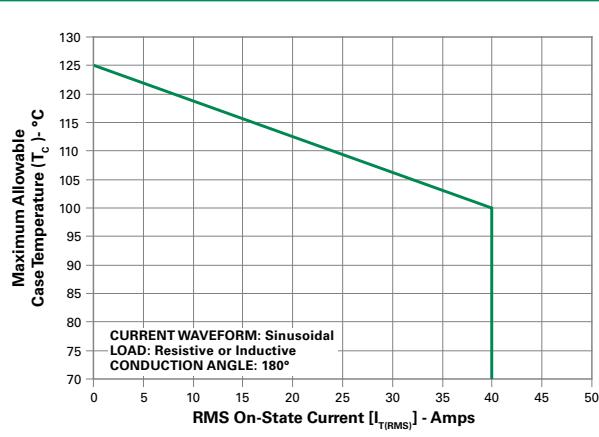
Figure 1: Normalized DC Gate Trigger Current vs. Junction Temperature

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

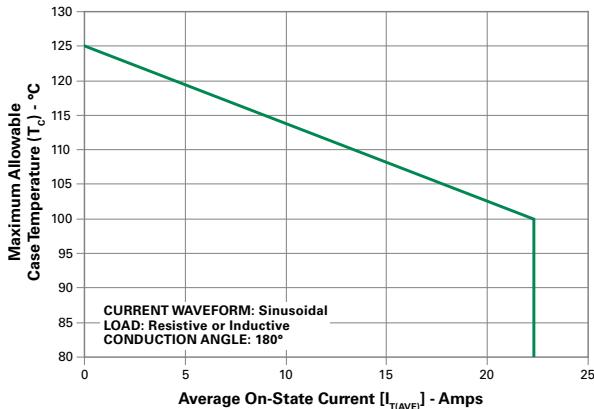


Figure 8: Maximum Allowable Ambient Temperature vs. RMS On-State Current

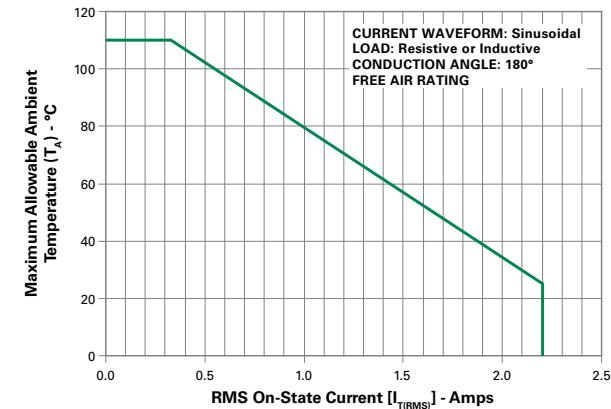


Figure 9: Maximum Allowable Ambient Temperature vs. Average On-State Current

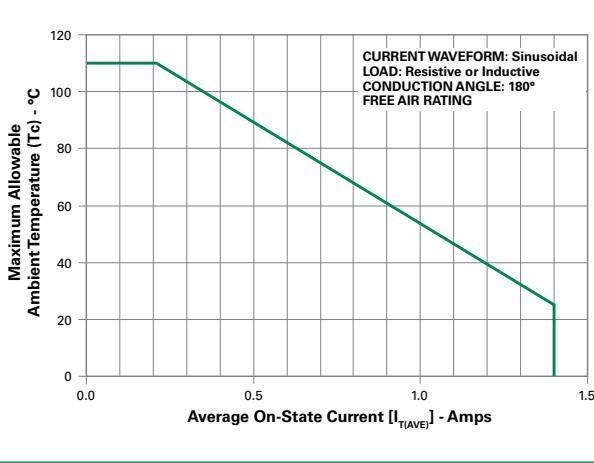


Figure 10: Peak Capacitor Discharge Current

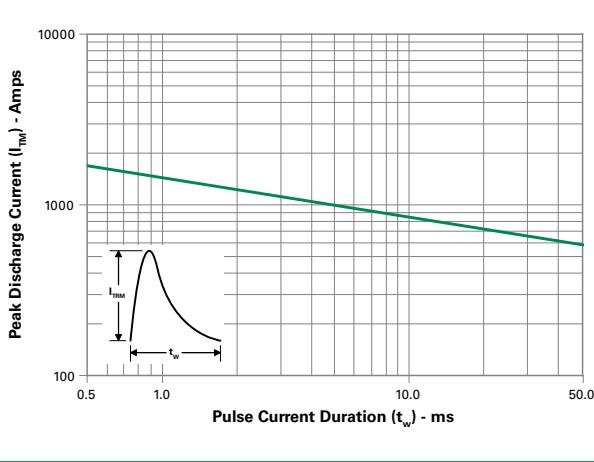


Figure 11: Peak Capacitor Discharge Current Derating

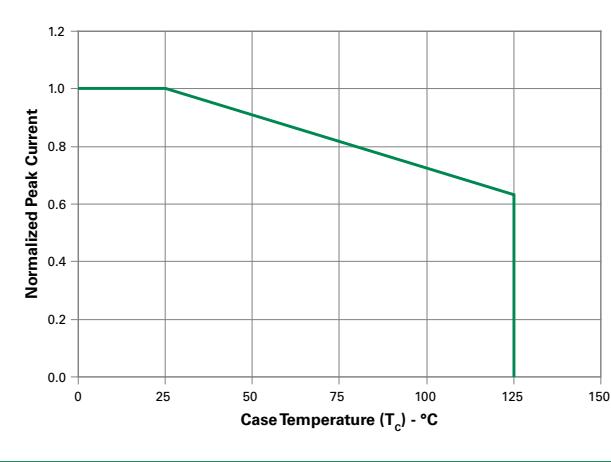
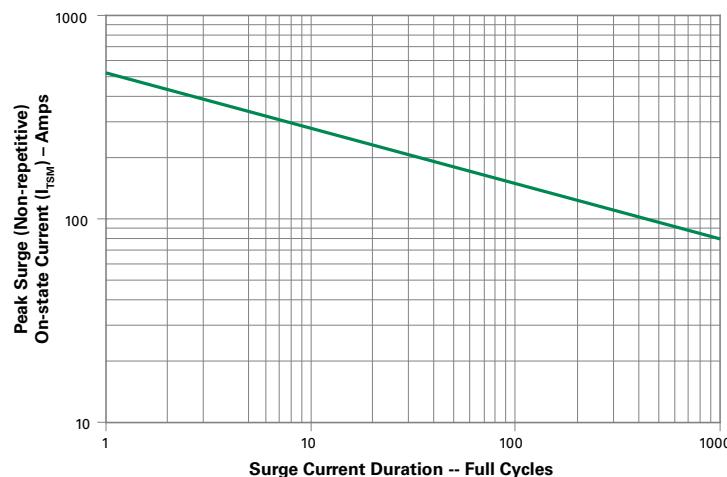


Figure 12: Surge Peak On-State Current vs. Number of Cycles


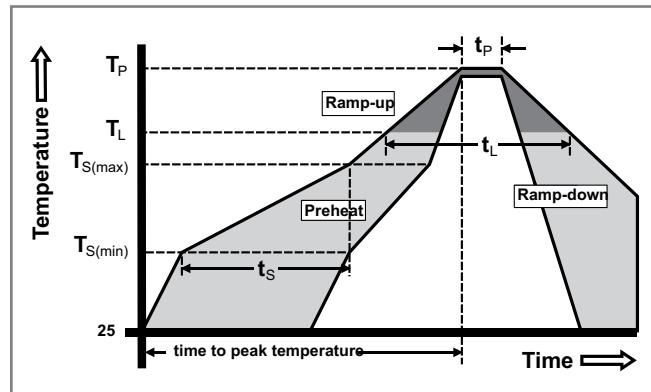
SUPPLY FREQUENCY: 60 Hz Sinusoidal
 LOAD: Resistive
 RMS On-State Current: $I_{T_{RMS}}$: Maximum Rated Value at Specified Case Temperature

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 – 190 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)		$260^{+0/-5}$ °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 epoxy meeting flammability classification 94V-0
Lead Material	Copper Alloy

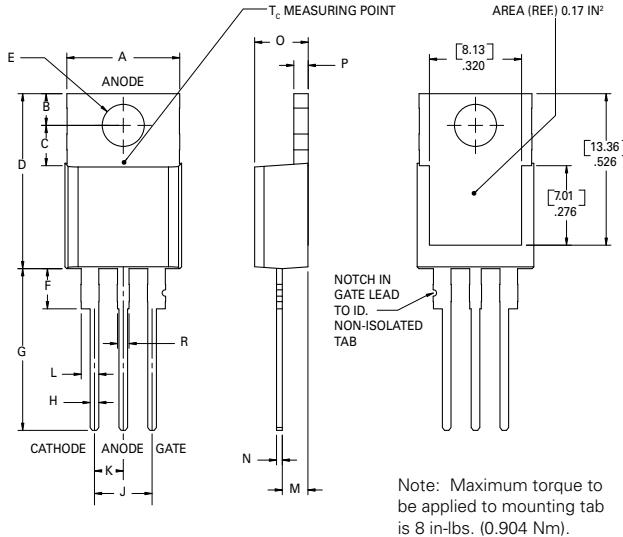
Design Considerations

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.

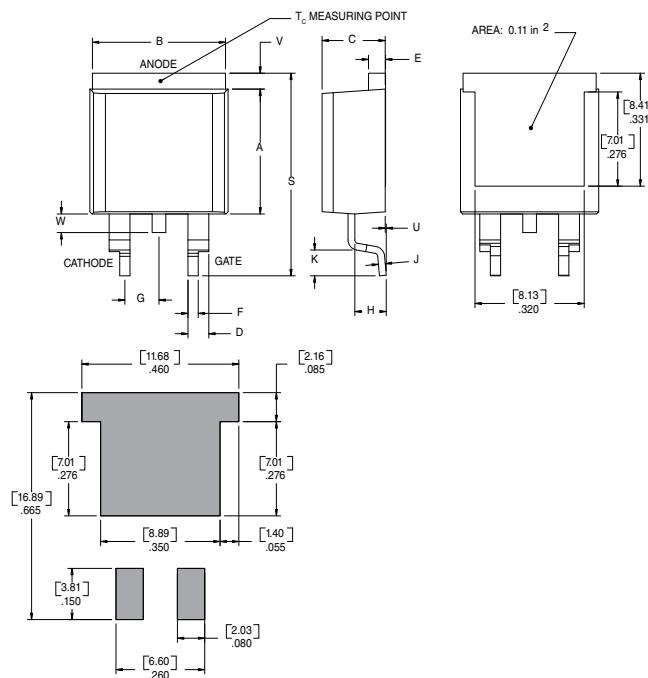
Environmental Specifications

Test	Specifications and Conditions
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
Thermal Shock	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
Autoclave	EIA / JEDEC, JESD22-A102 168 hours (121°C at 2 ATMs) and 100% R/H
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

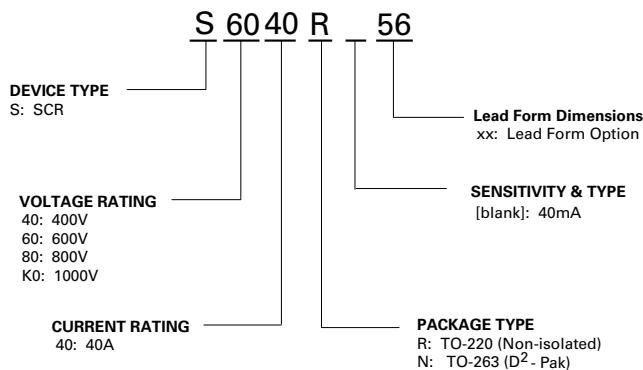
Dimensions — TO-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead

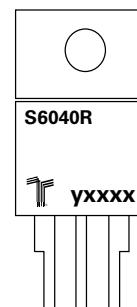


Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.61
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060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


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
Sxx40NTP	Sxx40N	1.6g	Tube	500
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

