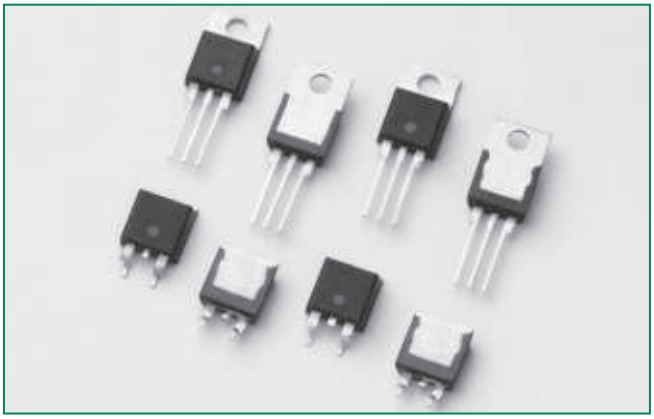
Littelfuse
Expertise Applied | Answers Delivered

Teccor® brand Thyristors
40 Amp Low T_q SCR

S4040xQx Series

RoHS



Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	40	A
V_{DRM}/V_{RRM}	400	V
I_{GT}	15 to 65	mA

Description

The S4040xQx series of SCRs offer fast turn-off time (tq) characteristics required for applications such as power inverters, switching regulator, and high frequency pulse circuits.

These fast turn-off time SCRs offer high dv/dt and high di/dt characteristics required in higher frequency (>1000 PPS) switching circuits.

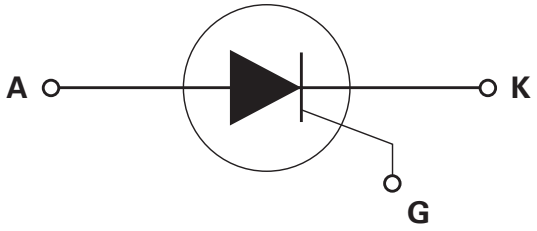
Features & Benefits

- RoHS compliant
- Glass – passivated junctions
- Voltage capability up to 400 V
- Surge capability up to 520 A
- TO-220 and TO-263 packages

Applications

Fast turn-off time SCRs are ideal for multi phase voltage regulator circuits, DC/AC inverters, and higher frequency pulsing power supplies.

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		Sxx40xQ	Sxx40xQ2	Sxx40xQ3	Unit
I_{GT}	V_D = 12V; R_L = 30 Ω	MAX.	35	45	65	mA
		MIN.	15	30	38	
V_{GT}		MAX.	1.5			V
I_{GT}	V_D = 12V; R_L = 30Ω; T_J = -40°C	MAX.	75	95	160	mA
dv/dt	$V_D = V_{DRM}$; gate open; T_J = 100°C	MIN.	650			V/µs
	$V_D = V_{DRM}$; gate open; T_J = 125°C		550			
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.	70	120	200	mA
t_q	(1)	MAX.	15	12	5	µs
t_{gt}	$I_G = 2 \times I_{GT}$; PW = 15µs; I_T = 80A	TYP.	3.0		3.5	µs

Note :
(1) I_T=0.5A; t_p=50µs; dv/dt=5V/µs; di/dt=-30A/µs

Static Characteristics

Symbol	Test Conditions		S4040xQ	S4040xQ2	S4040xQ3	Unit
V_{TM}	I_T = 80A; t_p = 380µs	MAX.	1.8		2.2	V
I_{DRM} / I_{RRM}	V_{DRM} / V_{RRM}	T_J = 25°C	MAX.	10		µA
		T_J = 100°C		1000		
		T_J = 125°C		2000		

Thermal Resistances

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

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

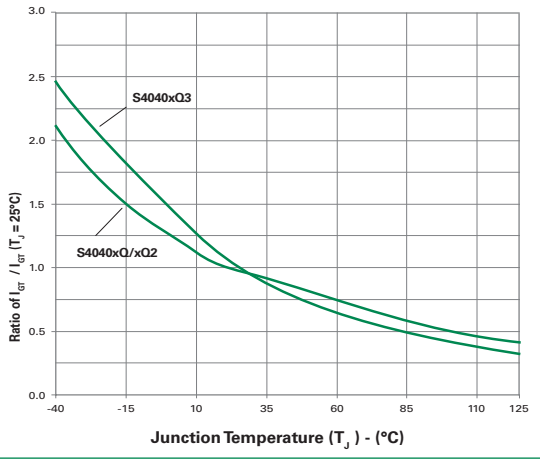


Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

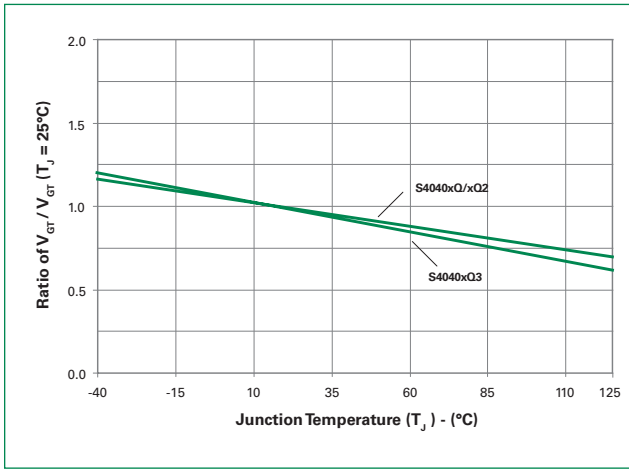


Figure 3: Normalized DC Holding Current vs. Junction Temperature

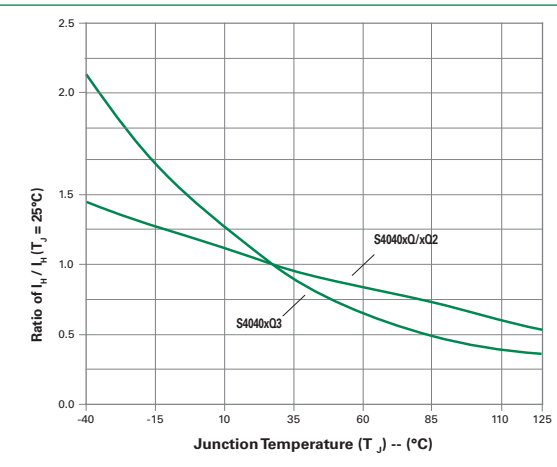


Figure 4: On-State Current vs. On-State Voltage (Typical)

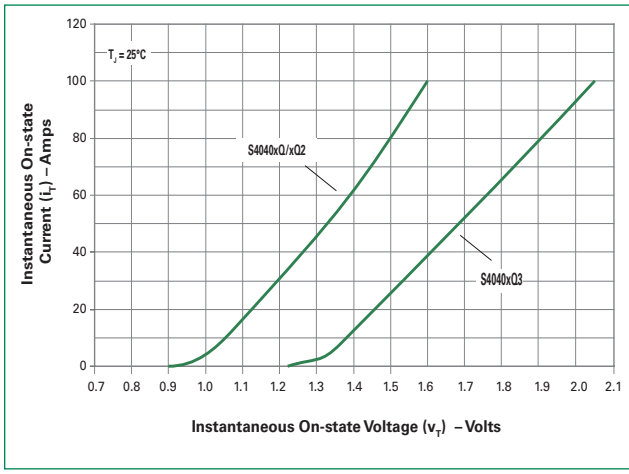


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

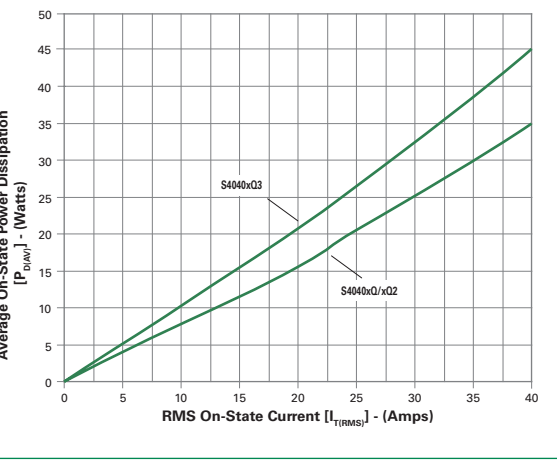
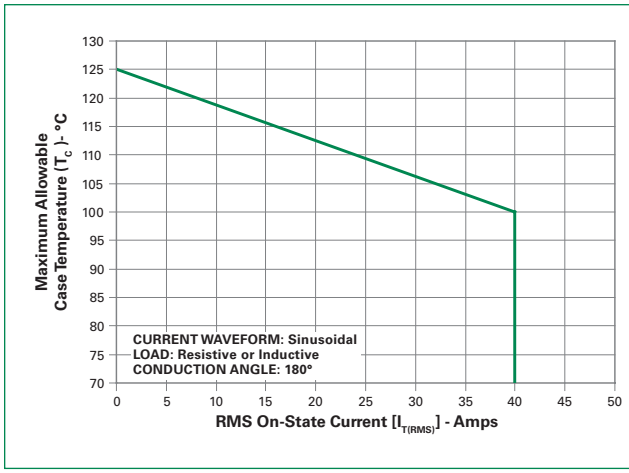


Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current



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

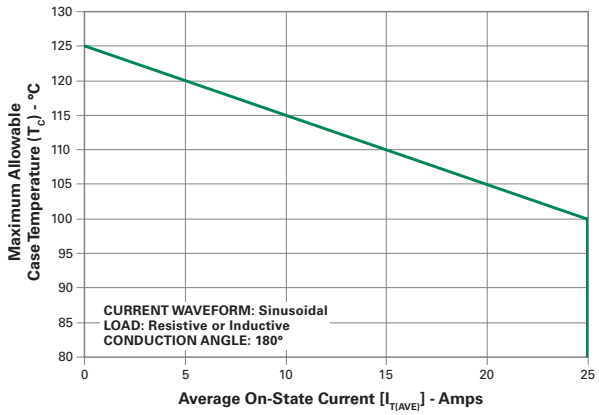


Figure 8: Maximum Allowable Ambient Temperature vs. RMS On-State Current

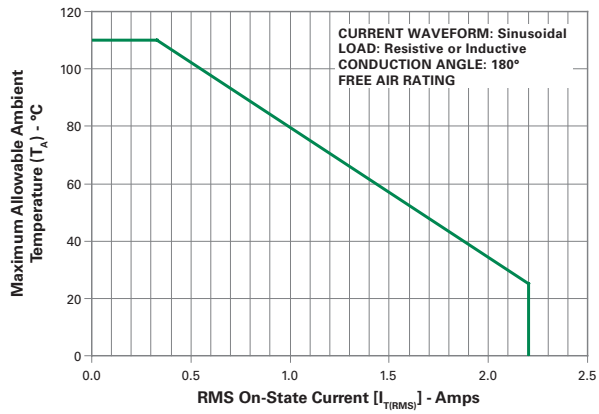


Figure 9: Maximum Allowable Ambient Temperature vs. Average On-State Current

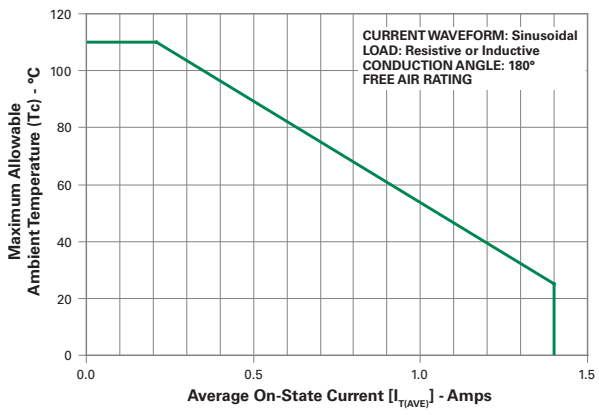


Figure 10: Peak Capacitor Discharge Current

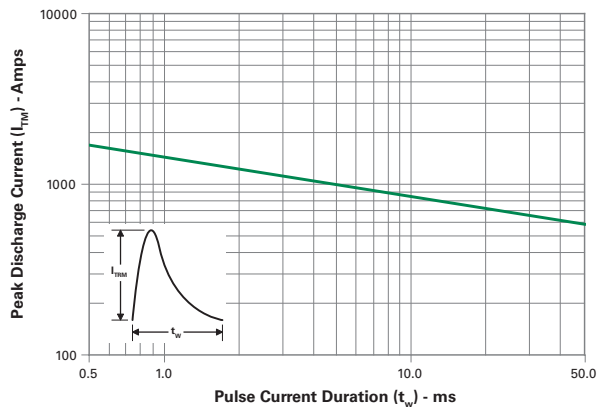
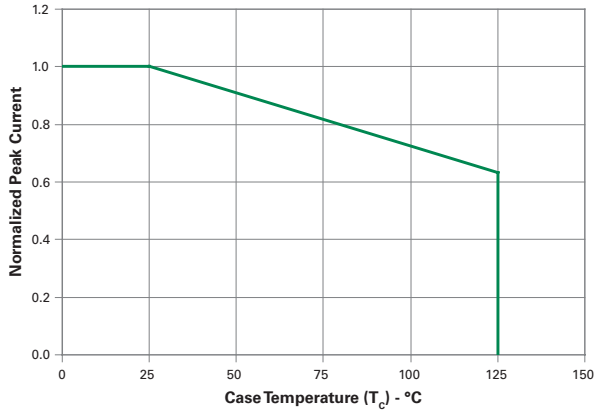


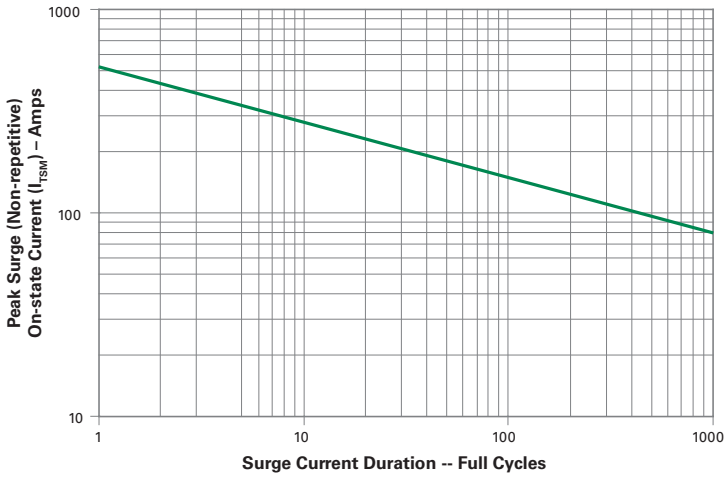
Figure 11: Peak Capacitor Discharge Current Derating



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

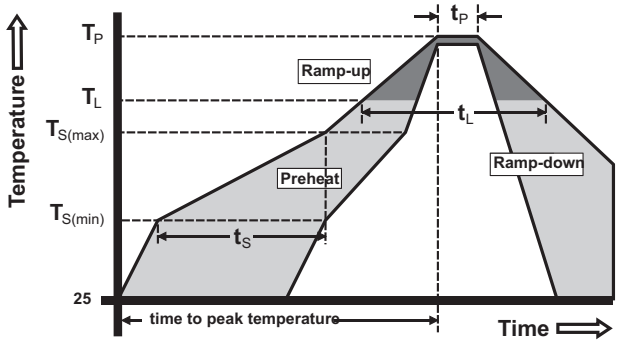


SUPPLY FREQUENCY: 60 Hz Sinusoidal
LOAD: Resistive
RMS On-State Current: [$I_{T(RMS)}$]: Maximum Rated Value at Specified Case Temperature

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
	-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



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Physical Specifications

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

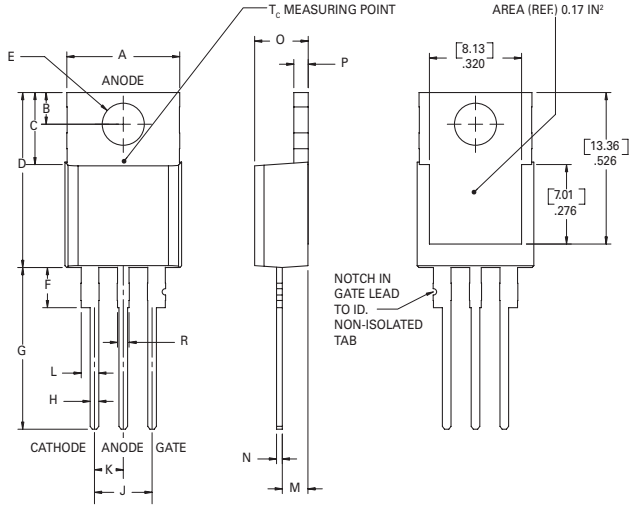
Design Considerations

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
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

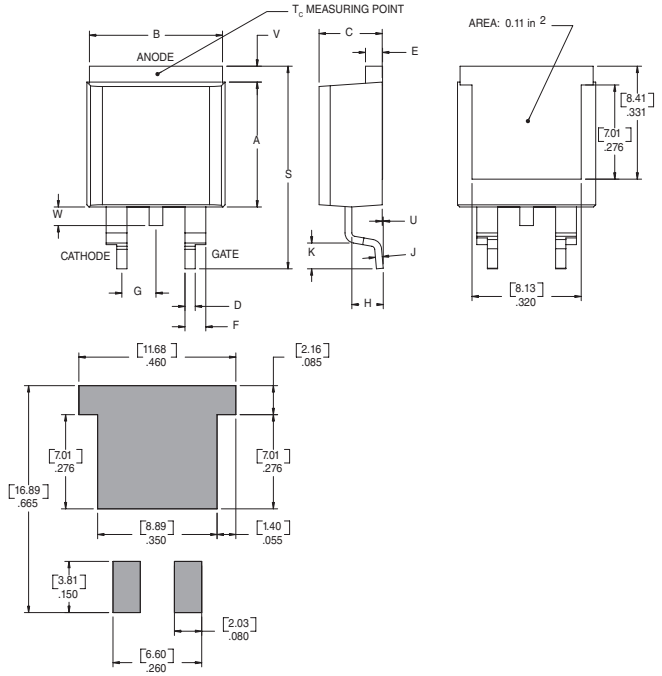


Note: Maximum torque to be applied to mounting tab is 8 in-lbs. (0.904 Nm).

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 40 40 R Q _ 56

DEVICE TYPE
S: SCR

VOLTAGE RATING
40: 400V

CURRENT RATING
40: 40A

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

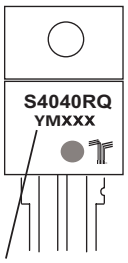
LOW TURN OFF TIME TYPE

TURN-OFF TIME
[blank]: 15µs
2: 12µs
3: 5µs

Lead Form Dimensions
xx: Lead Form Option

Part Marking System

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



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

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Product Selector

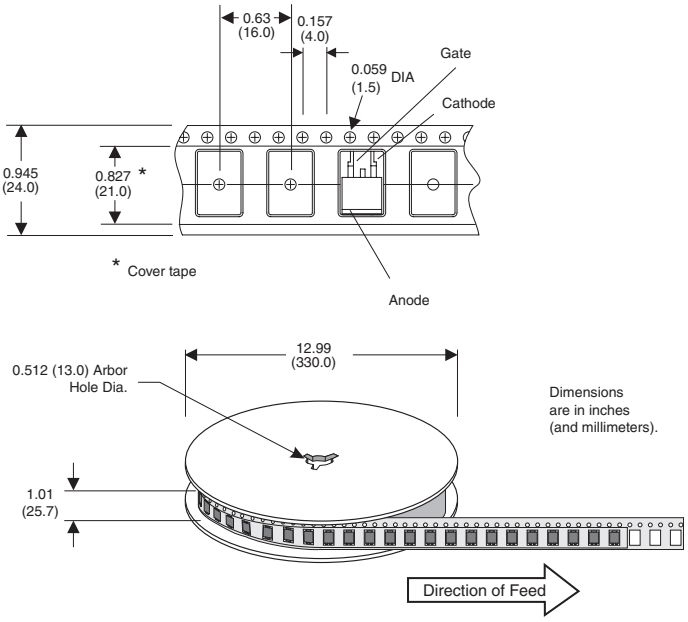
Part Number	Voltage	Gate Sensitivity	Type	Package
	400V			
S4040RQ	X	15-35	Standard SCR	TO-220AB
S4040NQ	X	15-35	Standard SCR	TO-263
S4040RQ2	X	30-45	Standard SCR	TO-220AB
S4040NQ2	X	30-45	Standard SCR	TO-263
S4040RQ3	X	38-65	Standard SCR	TO-220AB
S4040NQ3	X	38-65	Standard SCR	TO-263

Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
S4040RQTP	S4040RQ	2.2g	Tube	500 (50 per tube)
S4040RQ2TP	S4040RQ2	2.2g	Tube	500 (50 per tube)
S4040RQ3TP	S4040RQ3	2.2g	Tube	500 (50 per tube)
S4040NQRP	S4040NQ	1.6g	Embossed Carrier	500
S4040NQ2RP	S4040NQ2	1.6g	Embossed Carrier	500
S4040NQ3RP	S4040NQ3	1.6g	Embossed Carrier	500

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

Meets all EIA-481-2 Standards



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