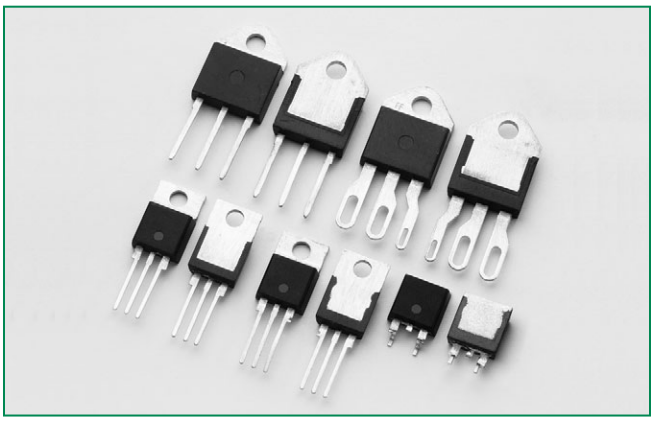
RoHS

Sxx55x 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 650 A

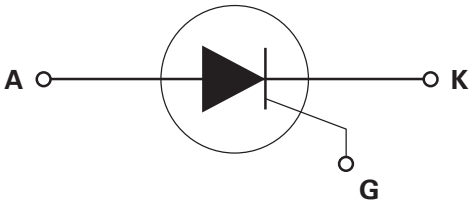
Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	55	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 = 90°C	55	A
$I_{T(AV)}$	Average on-state current	T_C = 90°C	35.0	A
I_{TSM}	Peak non-repetitive surge current	single half cycle; f = 50Hz; T_J (initial) = 25°C	550	A
		single half cycle; f = 60Hz; T_J (initial) = 25°C	650	
I^2t	I^2t Value for fusing	t_p = 8.3 ms	1750	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 P_W = 10µS	4.0	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}	$I_G = 2 \times I_{GT}$; PW = 15µs; I_T = 110A		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 = 110A; 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
$R_{\theta(J-C)}$	Junction to case (AC)	Sxx55R Sxx55N	0.5	°C/W
		Sxx55W Sxx55M	0.53	
$R_{\theta(J-A)}$	Junction to ambient	Sxx55R	40	°C/W

Note: xx = voltage

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

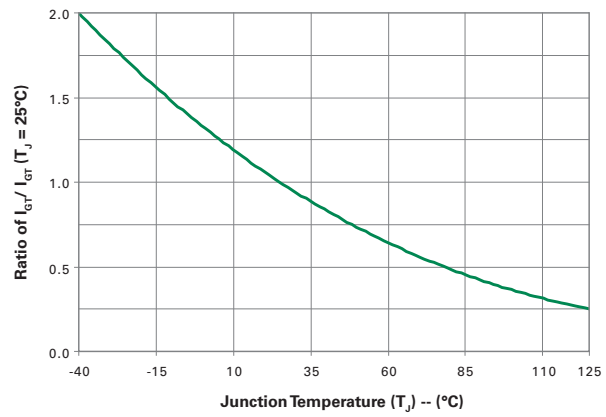


Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

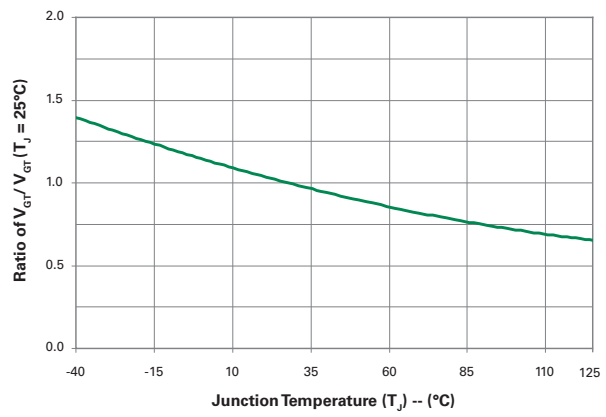


Figure 3: Normalized DC Holding Current vs. Junction Temperature

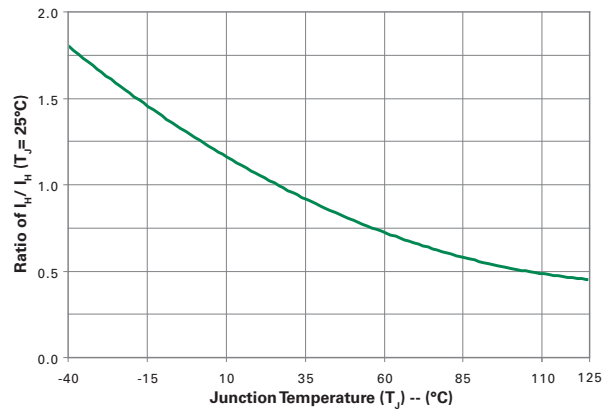


Figure 4: On-State Current vs. On-State Voltage (Typical)

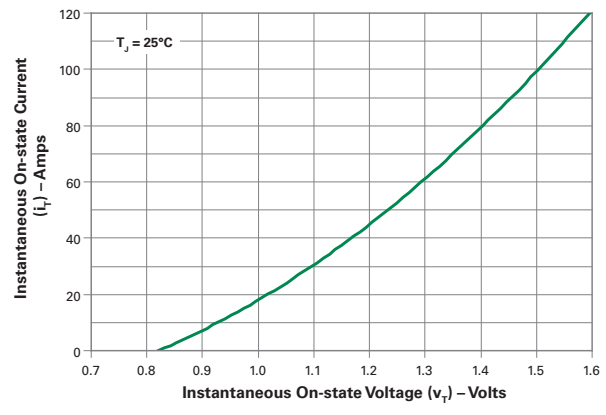


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

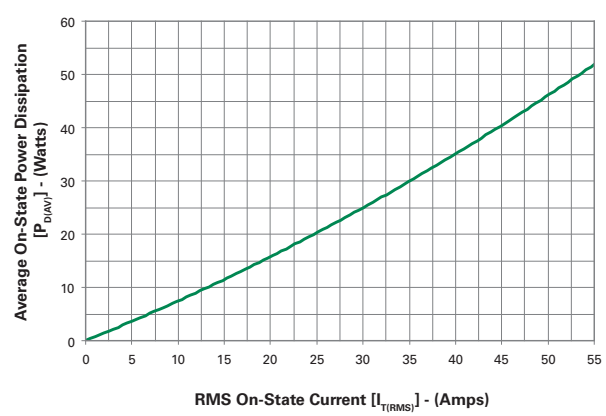
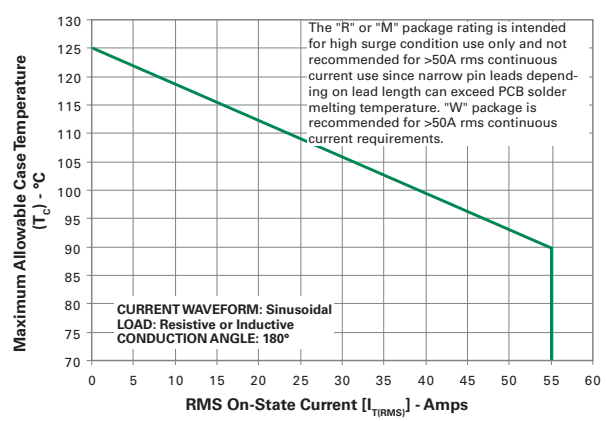


Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current



Note: xx = voltage

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

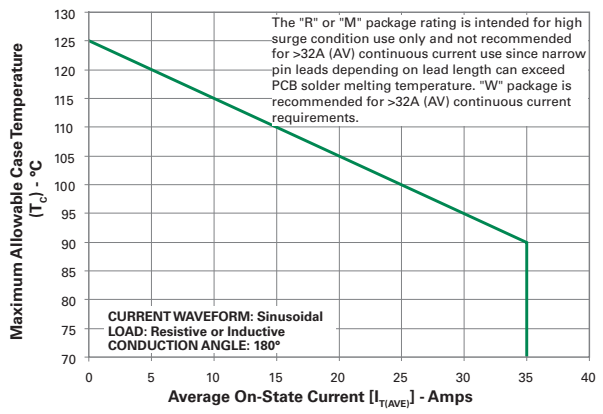


Figure 8: Maximum Allowable Ambient Temperature vs. RMS On-State Current

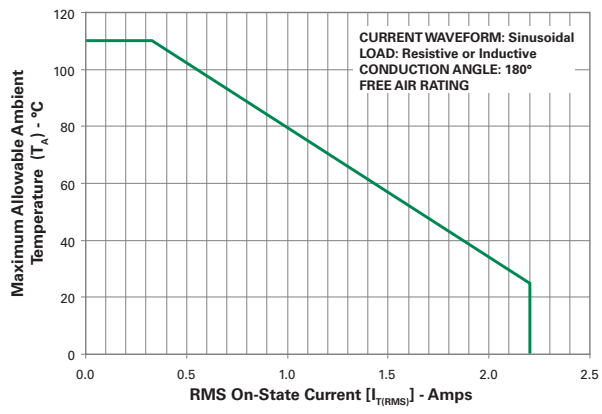


Figure 9: Maximum Allowable Ambient Temperature vs. Average On-State Current

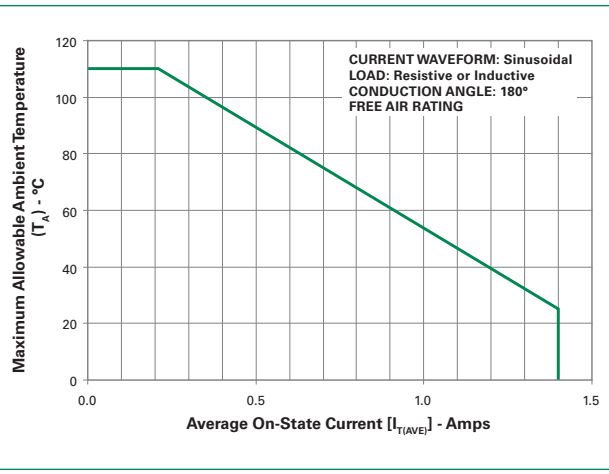


Figure 10: Peak Capacitor Discharge Current

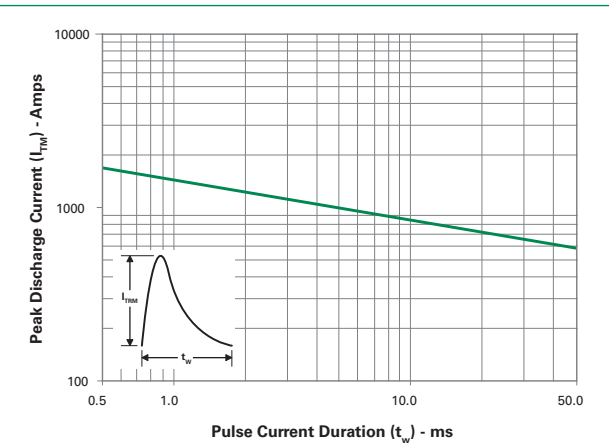
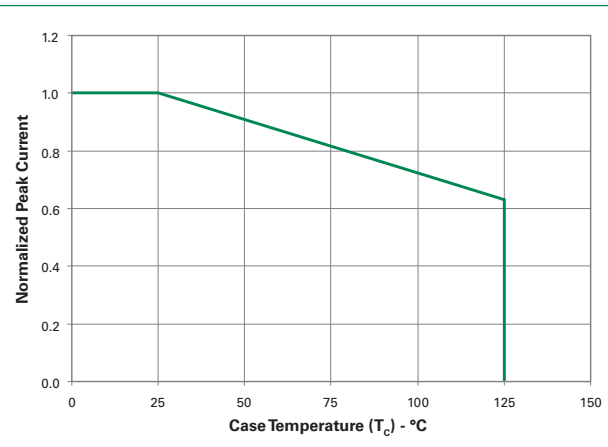


Figure 11: Peak Capacitor Discharge Current Derating



Note: xx = voltage

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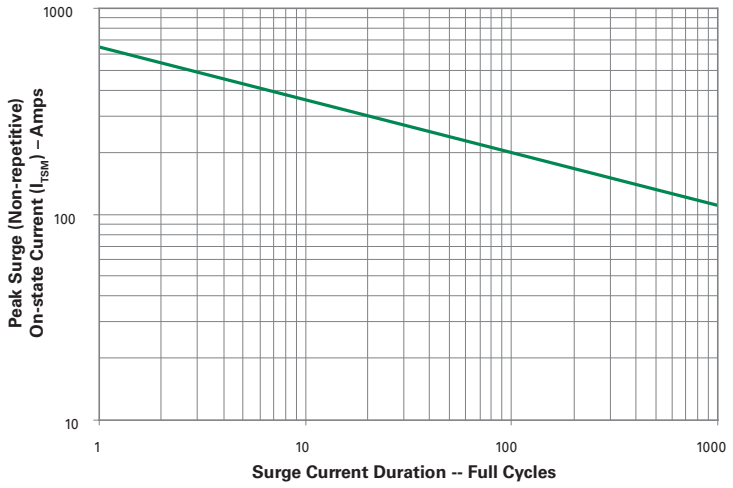
Figure 12: Surge Peak On-State Current vs. Number of Cycles

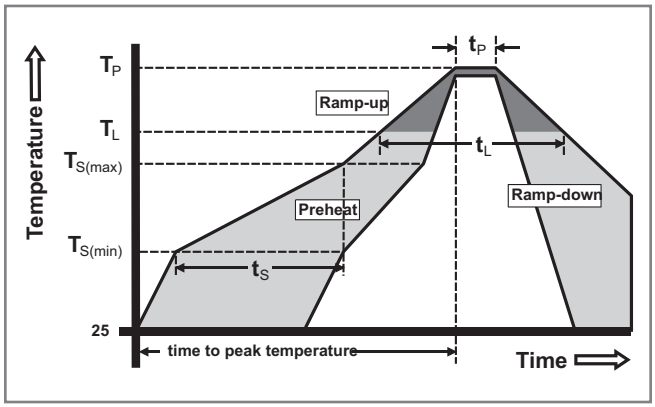


SUPPLY FREQUENCY: 60 Hz Sinusoidal
LOAD: Resistive
RMS On-State Current: [$I_{T(RMS)}$]: Maximum Rated Value at Specified Case Temperature

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



Physical Specifications

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

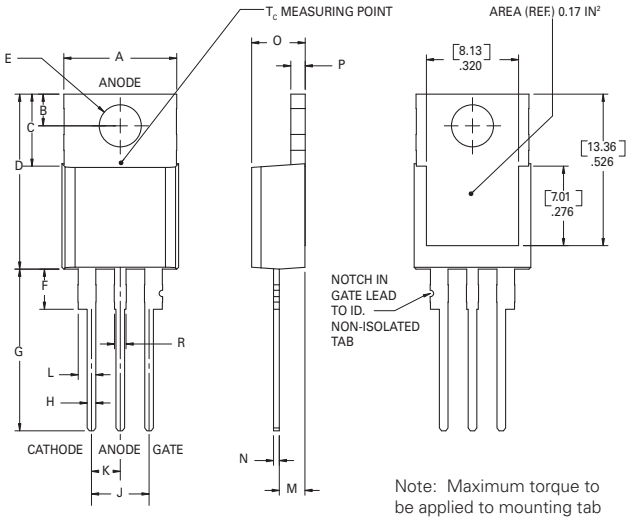
Design Considerations

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



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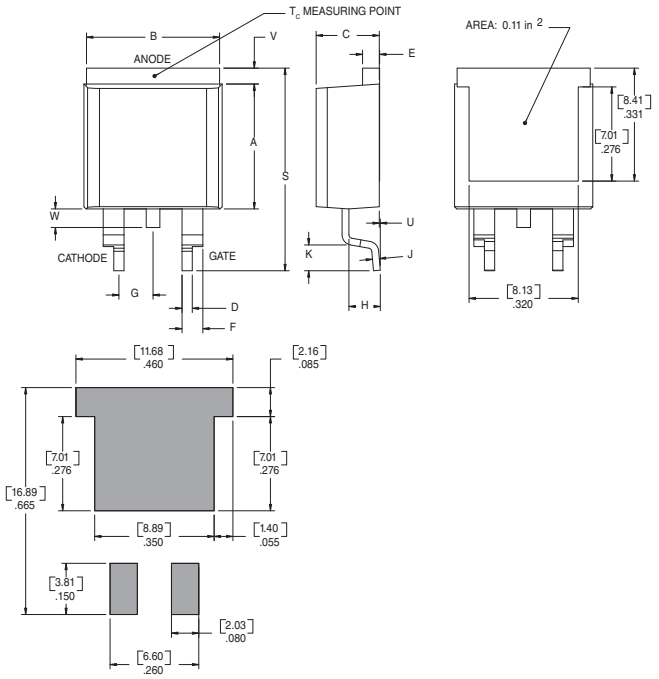
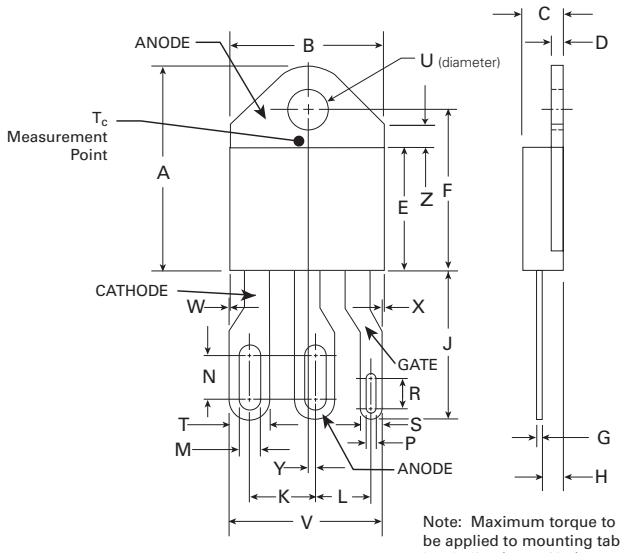
Dimensions – TO-263AA (N-package) — D²-Pak Surface Mount



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

Dimensions – TO-218X (W 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	0.810	0.835	20.57	21.21
B	0.610	0.630	15.49	16.00
C	0.178	0.188	4.52	4.78
D	0.055	0.070	1.40	1.78
E	0.487	0.497	12.37	12.62
F	0.635	0.655	16.13	16.64
G	0.022	0.029	0.56	0.74
H	0.075	0.095	1.91	2.41
J	0.575	0.625	14.61	15.88
K	0.256	0.264	6.50	6.71
L	0.220	0.228	5.58	5.79
M	0.080	0.088	2.03	2.24
N	0.169	0.177	4.29	4.49
P	0.034	0.042	0.86	1.07
R	0.113	0.121	2.87	3.07
S	0.086	0.096	2.18	2.44
T	0.156	0.166	3.96	4.22
U	0.164	0.165	4.10	4.20
V	0.603	0.618	15.31	15.70
W	0.000	0.005	0.00	0.13
X	0.003	0.012	0.07	0.30
Y	0.028	0.032	0.71	0.81
Z	0.085	0.095	2.17	2.42

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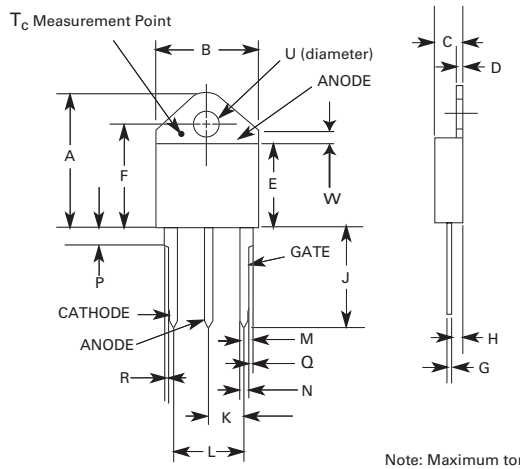
Dimensions – TO-218AC (M Package) — Non-isolated Mounting Tab Common with Center Lead



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

Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.810	0.835	20.57	21.21
B	0.610	0.630	15.49	16.00
C	0.178	0.188	4.52	4.78
D	0.055	0.070	1.40	1.78
E	0.487	0.497	12.37	12.62
F	0.635	0.655	16.13	16.64
G	0.022	0.029	0.56	0.74
H	0.075	0.095	1.91	2.41
J	0.575	0.625	14.61	15.88
K	0.211	0.219	5.36	5.56
L	0.422	0.437	10.72	11.10
M	0.058	0.068	1.47	1.73
N	0.045	0.055	1.14	1.40
P	0.095	0.115	2.41	2.92
Q	0.008	0.016	0.20	0.41
R	0.008	0.016	0.20	0.41
U	0.164	0.165	4.10	4.20
W	0.085	0.095	2.17	2.42

Product Selector

Part Number	Voltage				Gate Sensitivity	Type	Package
	400V	600V	800V	1000V			
Sxx55R	X	X	X	X	40mA	Standard SCR	TO-220R
Sxx55N	X	X	X	X	40mA	Standard SCR	TO-263
Sxx55W	X	X	X		40mA	Standard SCR	TO-218X
Sxx55M	X	X	X	X	40mA	Standard SCR	TO-218AC

Note: xx = Voltage

Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
Sxx55R	Sxx55R	2.2g	Bulk	500
Sxx55RTP	Sxx55R	2.2g	Tube	500 (50 per tube)
Sxx55NTP	Sxx55N	1.6g	Tube	500 (50 per tube)
Sxx55NRP	Sxx55N	1.6g	Embossed Carrier	500
Sxx55WTP	Sxx55W	5.23g	Tube	250 (25 per tube)
Sxx55MTP	Sxx55M	4.40g	Tube	250 (25 per tube)

Note: xx = Voltage

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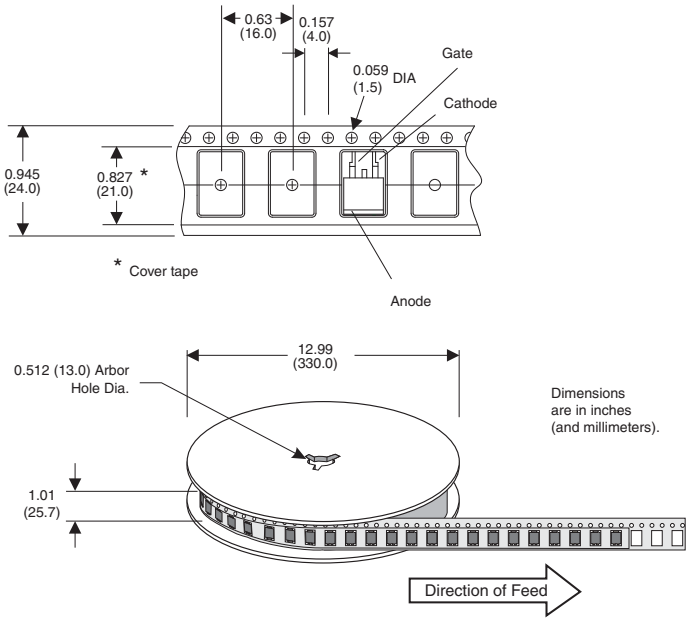
TO-263 Embossed Carrier Reel Pack (RP) Specification

Meets all EIA-481-2 Standards



Part Numbering System

S 60 55 R 56

DEVICE TYPE
S: SCR

VOLTAGE RATING
40: 400V
60: 600V
80: 800V
K0: 1000V

CURRENT RATING
55: 55A

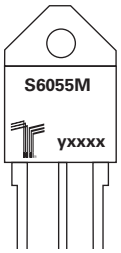
PACKAGE TYPE
R: TO-220 (Non-isolated)
N: TO-263 (D 2 - Pak)
M: TO-218AC (Non-isolated)
W: TO-218X (Non-isolated)

SENSITIVITY & TYPE
[blank]: 40mA

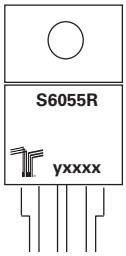
Lead Form Dimensions
xx: Lead Form Option

Part Marking System

TO-218AC - (M Package)
TO-218X - (W Package)



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



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S4055NTP SK055NRP SK055NTP S8055NRP S8055R67RP S6055M S6055W S8055RTP S6055NRP S4055M S8055NTP SK055R SK055M S4055NRP S6055NTP S4055W SK055MTP S4055MTP S6055WTP S6055MTP S4055WTP S8055MTP S8055WTP