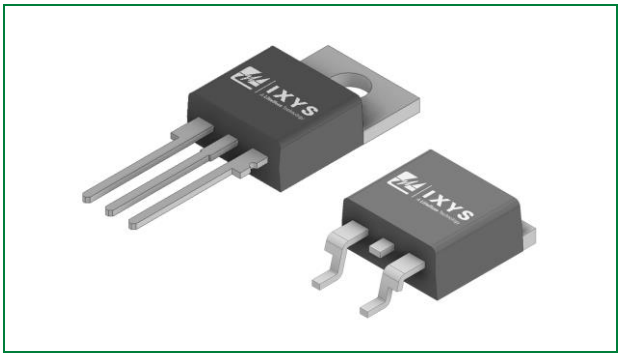
SVxx50xAx Series
50 A High Junction Temperature SCRs



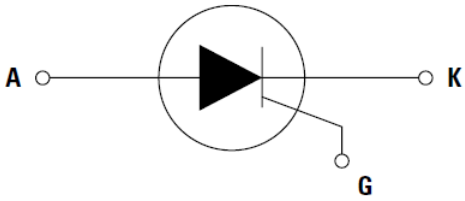
Agency Approvals and Environmental

Environmental Approvals
RoHS HF AUTOMOTIVE GRADE

Product Summary

Characteristic	Value	Unit
$I_{T(RMS)}$	50	A
V_{DRM} / V_{RRM}	600	V
I_{GT}	15	mA

Schematic Symbol



Product Description

This SV6050xAx high temperature SCR series is ideal for unidirectional switch applications such as phase controls, motor speed controls, Solid State Relays, and inrush current controllers.

Standard phase control SCRs are triggered with few milliamperes of current at less than 1.5 V potential.

Features

- Halogen-free and RoHS compliant
- 150 °C maximum junction temperature
- High dv/dt performance up to 1000 V/µs
- Surge capability up to 550 A at 60 Hz half cycle
- AEC-Q101 qualified

Applications

- Typical applications are AC solid-state switches, phase controller, rectifier and voltage regulator, inrush current limit circuit.

1. Maximum Ratings

Symbol	Characteristic	Conditions		Value	Unit
V_{DSM}/V_{RSM}	Peak Non-repetitive Blocking Voltage	Pulse Width = 100 µs		700	V
$I_{T(RMS)}$	RMS On-state Current	SVxx50RAx/ SVxx50NAx	T_C = 110 °C	50	A
$I_{T(AV)}$	Average On-state Current	SVxx50RAx/ SVxx50NAx	T_C = 110 °C	31.5	A
I_{TSM}	Non-repetitive Surge Peak On-state Current (Single Half Cycle, T_J Initial = 25 °C)	f = 50 Hz, t = 20 ms		456	A
		f = 60 Hz, t = 16.7 ms		550	
I^2t	I^2t Value for Fusing	t_p = 8.3 ms		1255	A^2s
di/dt	Critical Rate of Rise of On-state Current	f = 60 Hz, T_J =150 °C		100	A/µs
I_{GTM}	Peak Gate Trigger Current	t_p = 20 µs, T_J =150 °C		4	A
$P_{G(AV)}$	Average Gate Power Dissipation	T_J =150 °C		1	W
T_{STG}	Storage Temperature	-		-40 to 150	°C
T_J	Operating Junction Temperature	-		-40 to 150	°C

2. Thermal Characteristics

Symbol	Characteristic		Value	Unit
$R_{th(JC)}$	Thermal Resistance, junction-to-case (AC)	SVxx50RAx/ SVxx50NAx	0.7	°C/W

3. Electrical Characteristics

Symbol	Description	Conditions		Value			Unit
				Min	Typ	Max	
I_{GT}	DC Gate Trigger Current	V_D = 12 V, R_L = 60 Ω		6	-	15	mA
V_{GT}	DC Gate Trigger Voltage	V_D = 12 V, R_L = 60 Ω		-	-	1.3	V
I_H	Holding Current	I_T = 400 mA (initial)		-	-	50	mA
V_{GD}	Gate Non-trigger Voltage	V_D = V_{DRM}, R_L = 3.3 kΩ, T_J = 150 °C		0.2	-	-	V
dv/dt	Critical Rate-of-rise of Off-stage Voltage	Gate Open, T_J = 150 °C	V_D = 2/3 V_{DRM}	1000	-	-	V/µs
			V_D = V_{DRM}	500	-	-	
t_q	Turn-off Time	I_T = 2 A; tp = 50 µs; dv/dt = 5 V/µs; di/dt = 30 A/µs		-	-	25	µs
t_{gt}	Turn-on Time	I_G = 2 x I_{GT}, P_W = 15 µs, I_T = 100 A		-	2	-	µs

4. Static Characteristics

Symbol	Description	Conditions	Maximum Value	Unit
V_{TM}	Peak On-state Voltage	I_{TM} = 100 A, t_P = 380 µs	1.6	V
V_{T0}	Threshold Voltage	T_J =150 °C	0.8	V
R_D	Dynamic Resistance	T_J =150 °C	9	mΩ
I_{DRM}/I_{RRM}	Off-state Current, Peak Repetitive	T_J = 25 °C	5	µA
		T_J = 150 °C	5	mA

5. Performance Curves

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

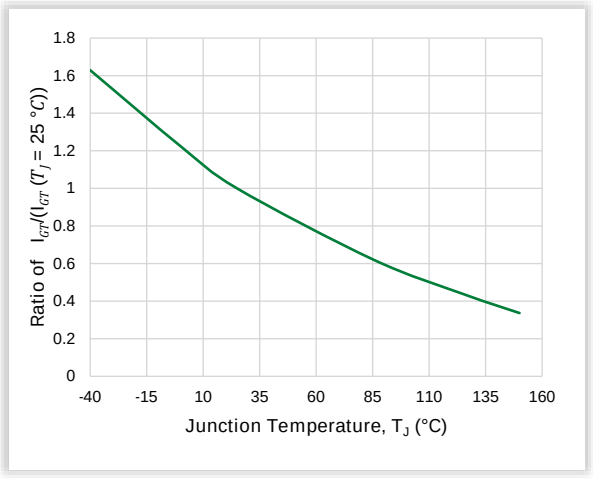


Figure 2. Normalized DC Gate Trigger Voltage vs. Junction Temperature

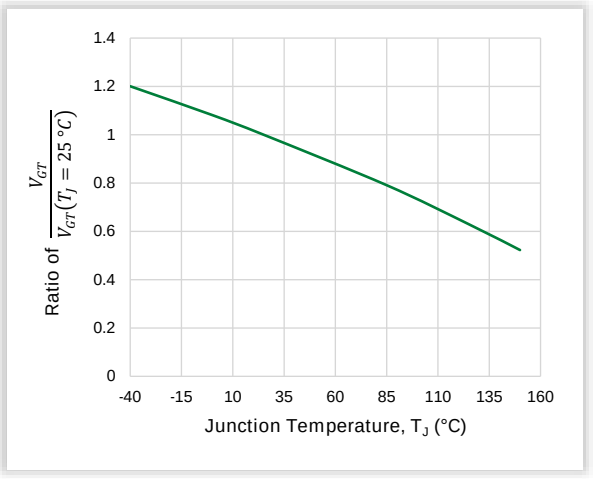


Figure 3. Normalized DC Holding Current vs. Junction Temperature

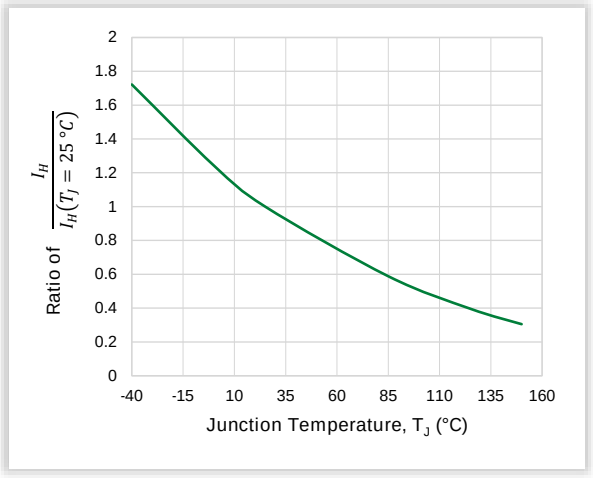


Figure 4. Typical On-state Current vs. On-state Voltage

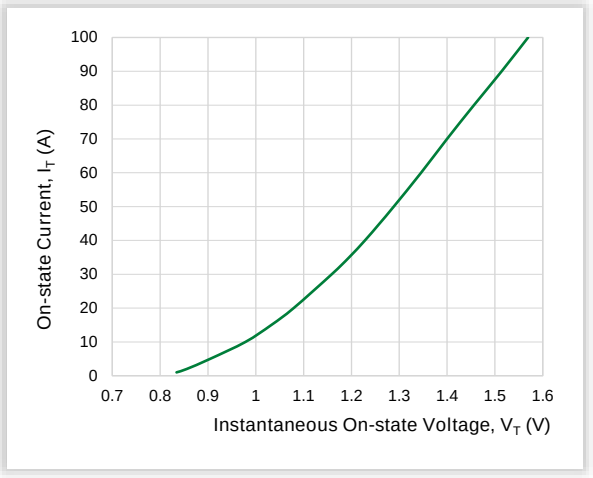


Figure 5. Typical Power Dissipation vs. RMS On-state Current

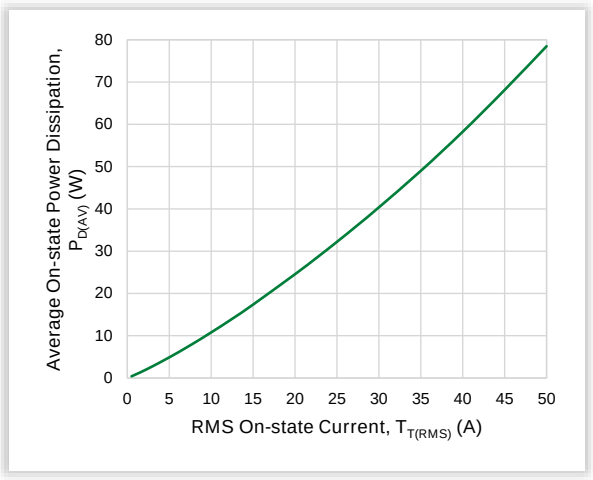


Figure 6. Maximum Allowable Case Temperature vs. RMS On-state Current

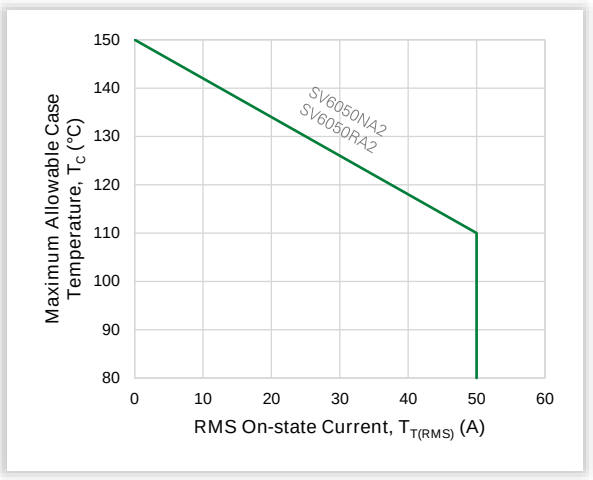


Figure 7. Maximum Allowable Case Temperature vs. Average On-state Current

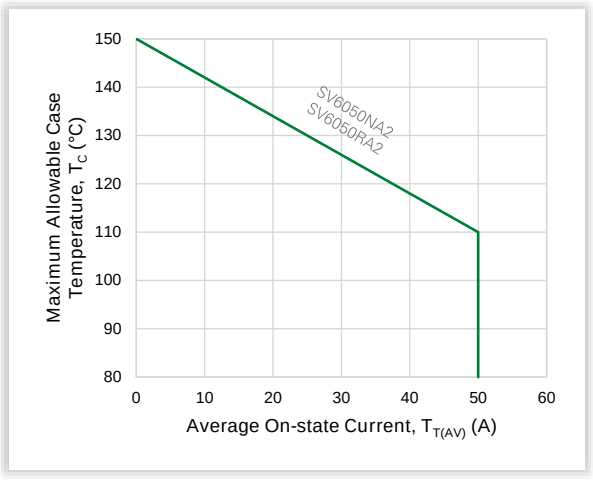
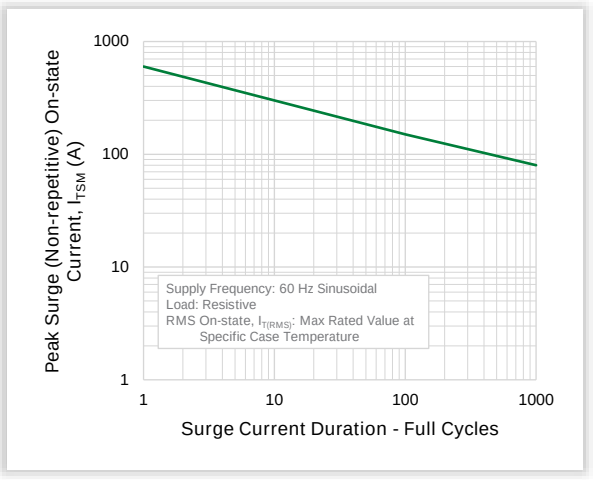


Figure 8. Surge Peak On-state Current vs. Number of Cycles

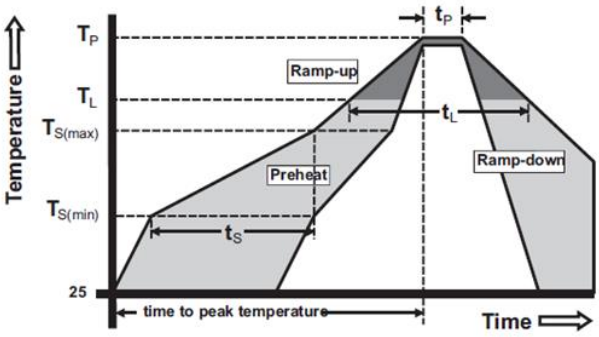


Notes:

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.

6. Soldering Parameters



Parameter		Value
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 to 180 s
Average Ramp-up Rate Liquidus Temp., T_L to peak		5 °C/s (Max)
$T_{S(Max)}$ to T_L Ramp-up Rate		5 °C/s (Max)
Reflow	Temperature, T_L Liquidus	217 °C
	Time, t_L	60 to 150 s
Peak Temperature, T_P		260 °C (±5 °C)
Time within 5 °C of Actual Peak Temperature, t_P		20 to 40 s
Ramp-down Rate		5 °C/s (Max)
Time 25 °C to Peak Temperature, T_P		8 minutes (Max)
Do Not Exceed		280 °C

7. Physical Specifications

Device Feature	Detail
Terminal Finish	100% Matte Tin-plated
Body Material	UL Recognized Compound meeting Flammability Rating V-0
Terminal Material	Copper Alloy

8. Environmental Specifications

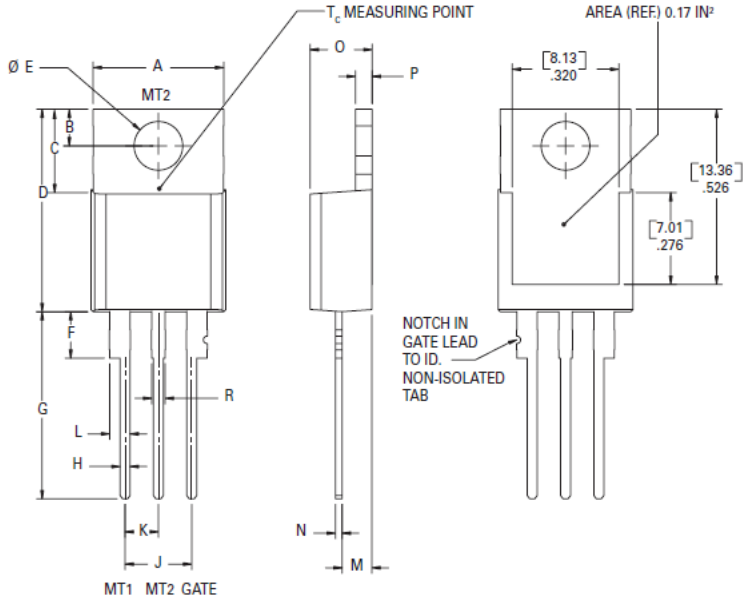
Test	Specifications and Conditions
AC Blocking	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours
Temperature Cycling	MIL-STD-750, M-1051, 1000 cycles; -55°C to +150°C; 15 min dwell time
Temperature/Humidity	EIA / JEDEC, JESD22-A101 1008 hours; 160V - DC: 85°C; 85% relative humidity
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
Moisture Sensitivity Level	Level 1, JEDEC-J-STD-020D
UHAST	JESD22A-118 , 96 hours, 130°C; 85% relative humidity
IOL	MIL-STD-750 Method 1037

9. 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.

10. Package Dimensions

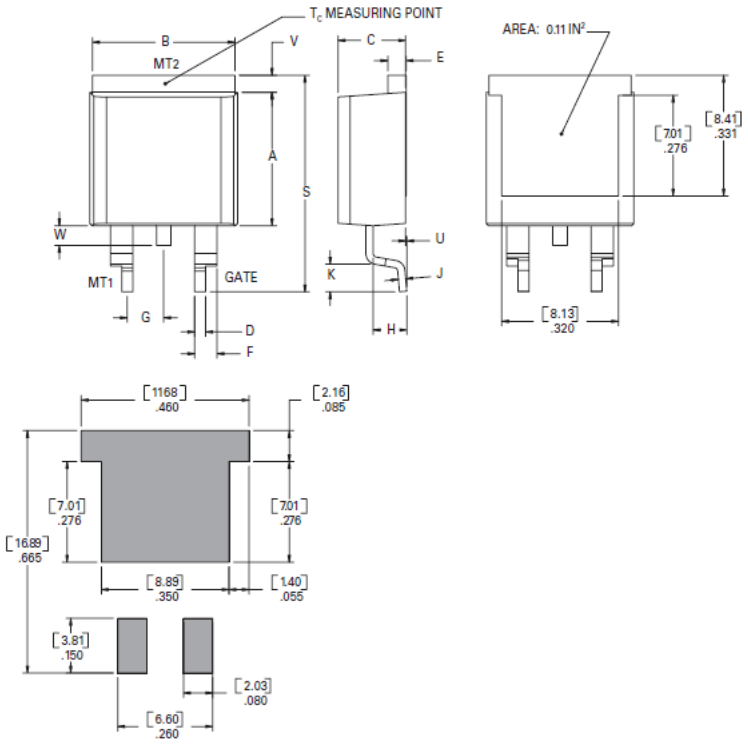
TO-220 AB (R- Package) – Non-isolated Mounting Tab Common with Center Lead



Dimension	Millimeters		Inches	
	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

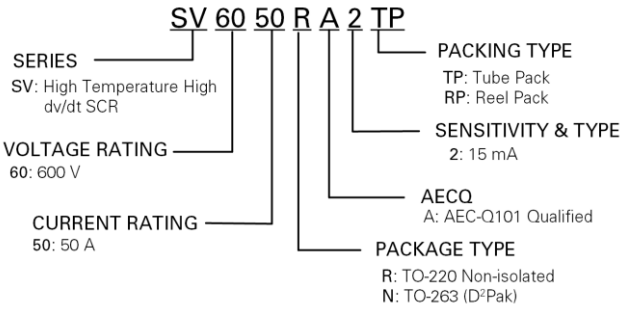
Note: Maximum Torque to be applied to mounting tab is 8-in lbs. (0.904 Nm)

TO-263 AB (N- Package) – D^{2}Pak Surface Mount

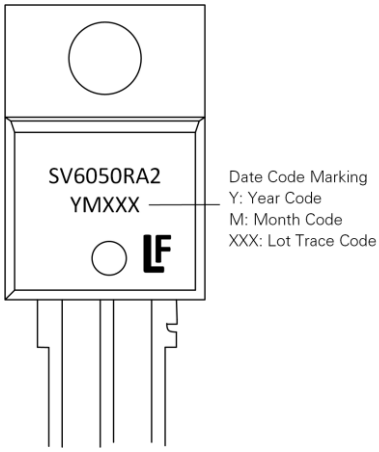


Dimension	Millimeters		Inches	
	Min	Max	Min	Max
A	0.360	0.370	9.14	9.40
B	0.380	0.420	9.65	10.67
C	0.178	0.188	4.52	4.78
D	0.025	0.035	0.64	0.89
E	0.045	0.060	1.14	1.52
F	0.060	0.075	1.52	1.91
G	0.095	0.105	2.41	2.67
H	0.092	0.102	2.34	2.59
J	0.018	0.024	0.46	0.61
K	0.090	0.110	2.29	2.79
S	0.590	0.625	14.99	15.88
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

11. Part Numbering and Marking



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



12. Product Selector

Part Number	Voltage	Gate Sensitivity	Type	Package
	600 V			
SV6050RA2TP	X	15 mA	Standard SCR	TO-220R
SV6050NA2TP	X	15 mA	Standard SCR	TO-263
SV6050NA2RP	X	15 mA	Standard SCR	TO-263

13. Packing Options

Part Number	Marking	Weight	Packing Mode	M.O.Q
SV6050RA2TP	SV6050RA2	2.2 g	Tube Pack	1000 (50 per tube)
SV6050NA2TP	SV6050NA2	1.6 g	Tube Pack	1000 (50 per tube)
SV6050NA2RP	SV6050NA2	1.6 g	Embossed Carrier	500