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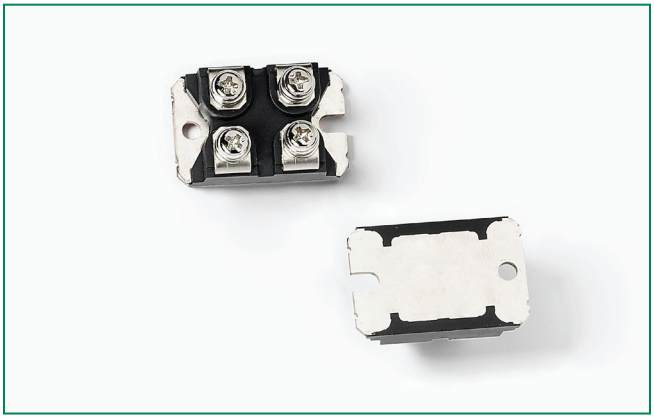
Thyristors Module
90A AC Controller Module

MS0690J-DL1TE

RoHS



Description

Thyristor AC controller module for mains frequency (50Hz/60Hz), utilizing two SCR dies in anti-parallel configuration for applications such as heating.

Robust SOT227B package with isolation voltage 2500V minimum

Features & Benefits

- Compact and robust SOT227B package
- Glass – passivated junctions
- High current handling capability, $I_{T(RMS)}$=90A
- Surge capability up to 950 A

Applications

High power electrical tankless water heater

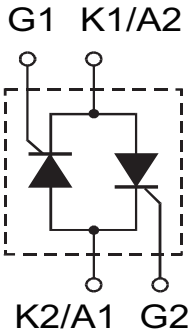
Agency Approval

Agency	Agency File Number
	E71639

Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	90	A
V_{DRM}/V_{RRM}	600	V
I_{GT}	50	mA

Schematic Symbol



Revised: 10/19/15

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Absolute Maximum Ratings

Symbol	Parameter	Test Conditions	Value	Unit
$I_{T(RMS)}$	On-State RMS Current - 360° as module	T_C = 92°C	90	A
	On-State RMS Current - 180° as single SCR		65	
$I_{T(AV)}$	Average On-State Current - 360° as module	T_C = 92°C	64	A
	Average On-State Current - 180° as single SCR		41	
I_{TSM}	Peak Non-Repetitive Surge Current, single cycle 60Hz		950	A
I^2t	I^2t Value for fusing	t_p =8.3ms	3745	A^2s
di/dt	Critical Rate-of-Rise of On-State Current	I_G = 150mA, f=60Hz, T_J=125°C	200	A/µs
P_{GM}	Peak Gate Power Dissipation	T_J = 125°C, Tp=30µs	10	W
		T_J = 125°C, Tp=300µs	5	
$P_{G(AV)}$	Average Gate Power Dissipation	T_J = 125°C	1.0	W
T_{stg}	Storage Junction Temperature Range		-40 to 150	°C
T_J	Operating junction Temperature Range		-40 to 125	°C

Electrical Characteristics (T_J = 25°C, unless otherwise specified)

Symbol	Parameter	Test Conditions	Value		Unit
			min.	max.	
I_{GT}	DC Gate Trigger Current	V_D = 12V; R_L = 30 Ω	5	50	mA
V_{GT}	DC Gate Trigger Voltage			1.6	V
I_H	Holding Current	I_T=400mA (initial)		80	mA
dv/dt	Critical Rate-of-Rise of Off-State Voltage	T_J = 125°C, V_D = V_{DRM}/V_{RRM}, Exponential Waveform, Gate Open	500		V/µs
t_q	Turn-Off Time	I_T=2A, T_P=50µs, dv/dt=5V/µs, di/dt=-30A/µs		35	µs
t_{gt}	Turn-On Time	I_G = 150mA, PW =15 µs, I_T = 130A(pk)		3	µs

Static Characteristics

Symbol	Test Conditions			Value	Unit
V_{TM}	Peak On-State Voltage	I_T = 130 A Peak, T_P =380µs	MAX.	1.8	V
I_{DRM} I_{RRM}	V_D = V_{DRM} / V_{RRM}	T_J = 25°C	MAX.	20	µA
		T_J = 125°C		3000	µA

Thermal Resistances

Symbol	Parameter	Value	Unit
$R_{\theta(J-C)}$	Thermal Resistance, Junction to Case	0.3	°C/W

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

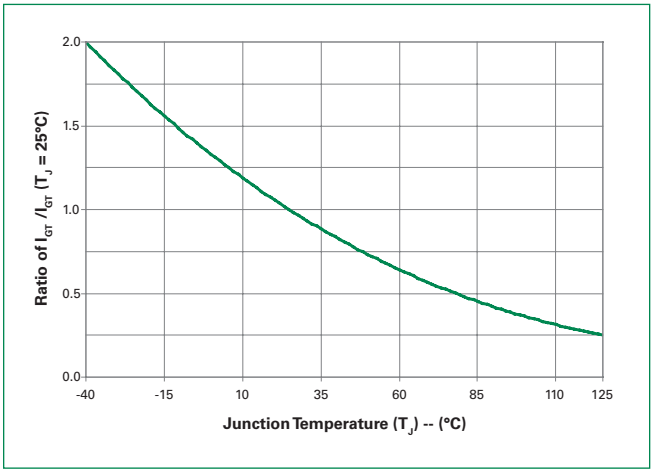

Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature

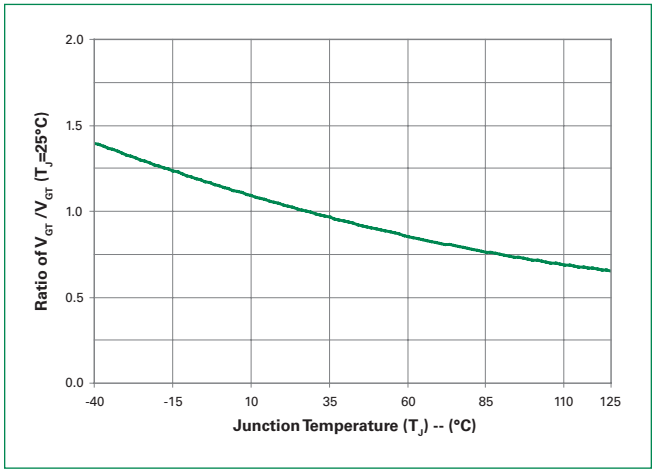

Figure 3: Normalized DC Holding Current vs. Junction Temperature

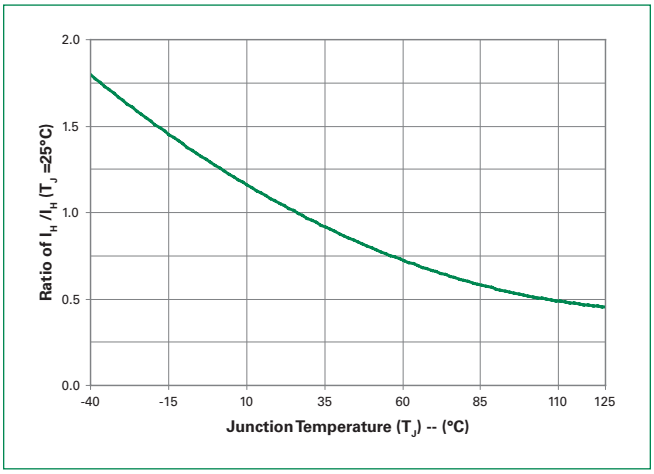

Figure 4: On-State Current vs. On-State Voltage (Typical, per SCR)

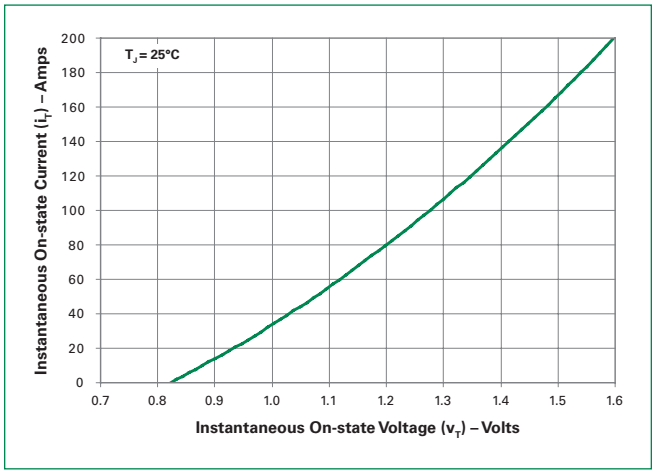

Figure 5: Power Dissipation (Typical) vs. RMS On-State Current per SCR

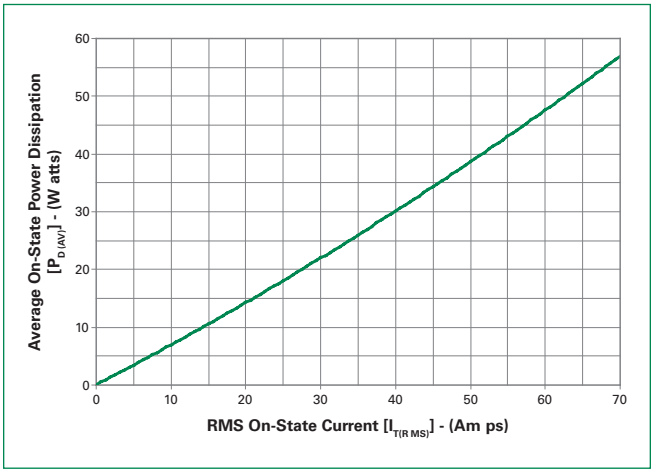

Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current per module

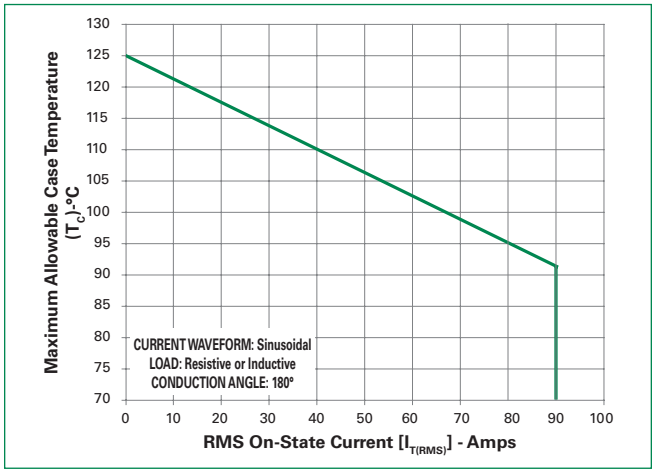

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Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current per module

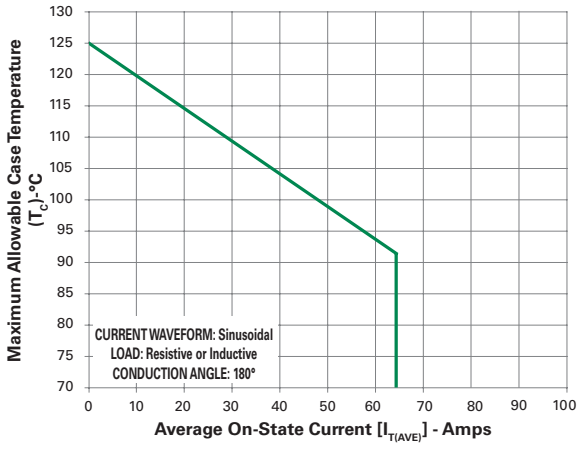
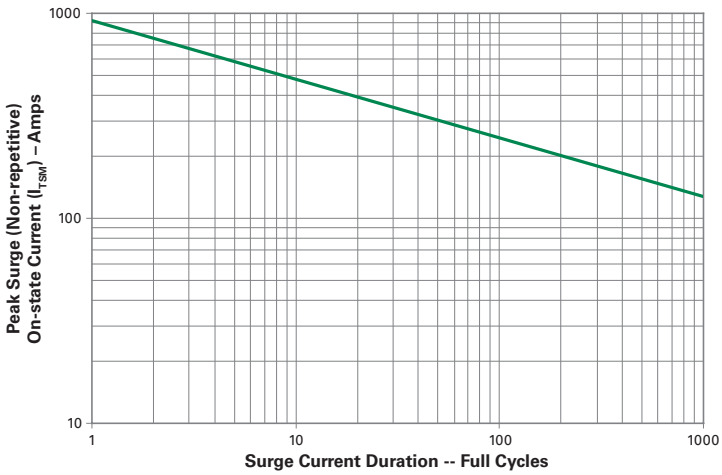


Figure 7: Surge Peak On-State Current vs. Number of Cycles



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.

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Physical Specifications

Terminal Finish	100% Nickel Plated
Body	UL recognized epoxy meeting flammability classification 94V-0
Lead Material	Copper Alloy

Environmental Specifications

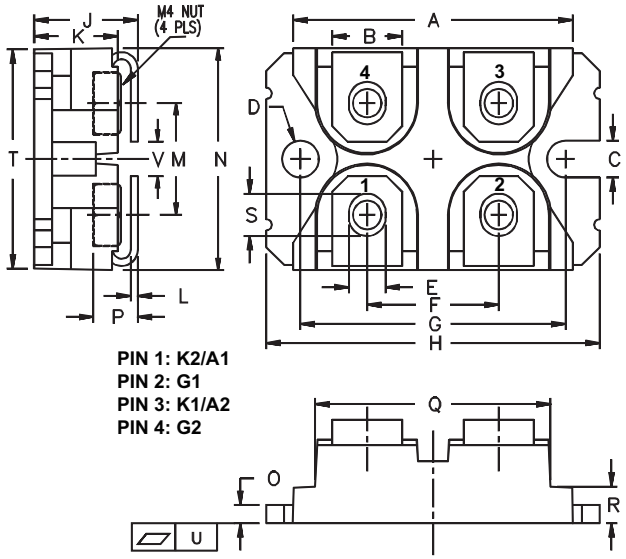
Test	Specifications and Conditions
AC Blocking	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 125°C for 1008 hours
Intermittent Operational Life	MIL-STD-750, Method 1037, 15000cycles, ΔTJ ≥ 100°C
Temperature/ Humidity	EIA / JEDEC, JESD22-A101 504 hours; 160V - DC: 85°C; 85% rel humidity
High Temp Storage	MIL-STD-750, M-1031, 1008 hours; 150°C
Low-Temp Storage	1008 hours; -40°C
Temperature Cycling	MIL-STD-750, M-1051, 20 cycles; -25°C to +125°C; 15-min dwell-time

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.

Dimensions

SOT-227 B



PIN 1: K2/A1
PIN 2: G1
PIN 3: K1/A2
PIN 4: G2

Note: M4x7.5MM screw, 4 screws per unit.

Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	1.240	1.256	31.50	31.90
B	0.307	0.323	7.80	8.20
C	0.161	0.169	4.09	4.29
D	0.161	0.169	4.09	4.29
E	0.161	0.169	4.09	4.29
F	0.587	0.595	14.91	15.11
G	1.186	1.193	30.12	30.30
H	1.489	1.505	37.80	38.20
J	0.460	0.481	11.68	12.22
K	0.351	0.378	8.92	9.60
L	0.030	0.033	0.76	0.84
M	0.497	0.507	12.62	12.88
N	0.990	1.001	25.15	25.42
O	0.078	0.084	1.98	2.13
P	0.193	0.232	4.90	5.89
Q	1.045	1.059	26.54	26.90
R	0.155	0.174	3.94	4.42
S	0.186	0.191	4.72	4.85
T	0.968	0.987	24.50	25.07
U	0	0.005	0	0.127
V	0.130	0.180	3.30	4.57

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Packing Options

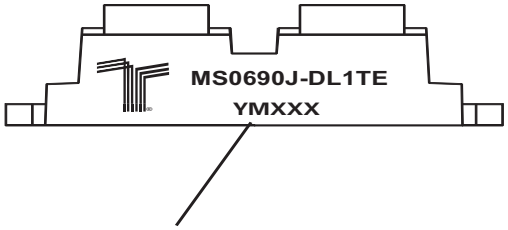
Part Number	Weight	Packing Mode	Base Quantity
MS0690J-DL1TE	30g	Tube	160

Part Numbering System

M S 0690 J - D L1TE

- **Module products**
- **SCR module**
- **Voltage Rating**
  60: 600V
- **Current Rating**
  90: 90A
- **Package Type**
  J: SOT227B
- **Circuit Variation**
  D: 2 SCR die in anti-parallel configuration
- **Manufacturing Location Code**

Part Marking System



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

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