

< HIGH VOLTAGE DIODE MODULES >

# RM450DG-90X

HIGH POWER SWITCHING USE  
INSULATED TYPE

High Voltage Diode Modules

RM450DG-90X



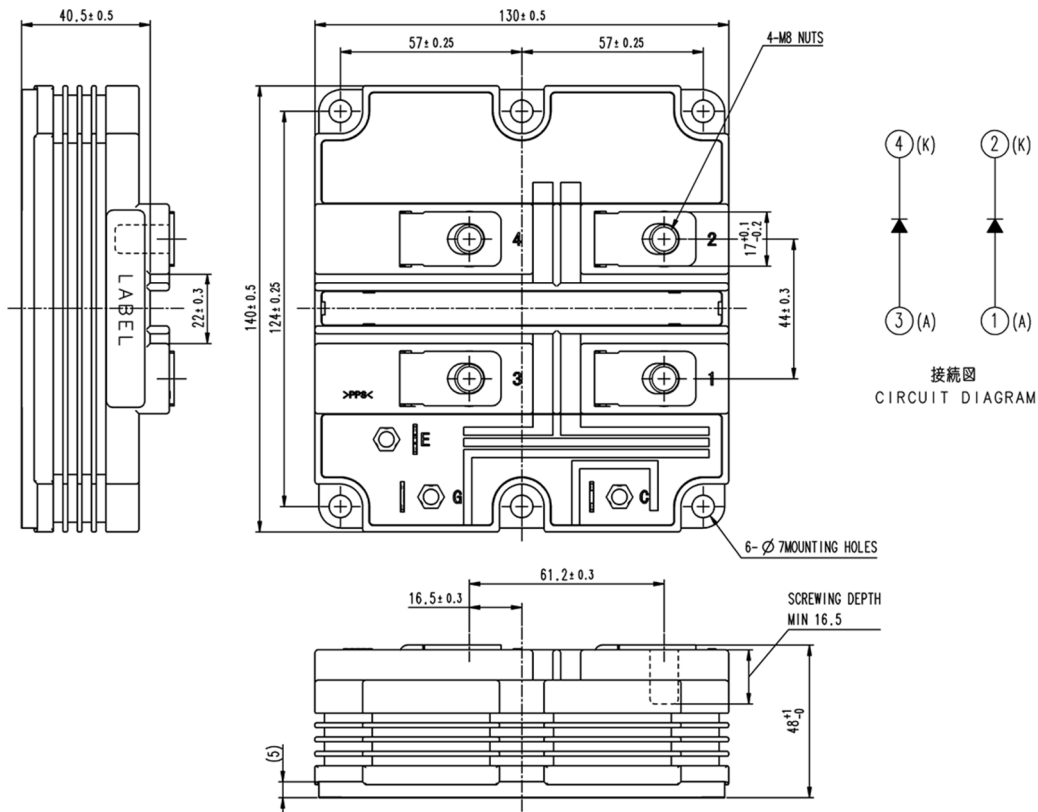
- $I_F$ ..... 2 x 450A
- $V_{RRM}$ ..... 4500V
- 2-element in a Pack
- High Insulated Type
- RFC Diode
- AISiC Baseplate

## APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

## OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



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**MAXIMUM RATINGS**

Symbol	Item	Conditions	Ratings	Unit
V <sub>RRM</sub>	Repetitive peak reverse voltage	V <sub>GE</sub> = 0 V, T <sub>j</sub> = -40...+150 °C	4500	V
		V <sub>GE</sub> = 0 V, T <sub>j</sub> = -50 °C	4400	
I <sub>F</sub>	Forward current (Note 1)	DC, T <sub>c</sub> = 85°C	450	A
I <sub>FRM</sub>		Pulse (Note 4)	900	A
I <sub>FSM</sub>	Surge (non-repetitive) forward current	T <sub>j_start</sub> = 150°C, t <sub>p</sub> = 10 ms, Half-sine wave, V <sub>R</sub> = 0 V	4.4	kA
I <sub>t</sub> <sup>2</sup>	Surge current load integral		97.6	kA <sup>2</sup> s
P <sub>tot</sub>	Maximum power dissipation	T <sub>c</sub> = 25°C	3200	W
V <sub>iso</sub>	Isolation voltage	RMS, sinusoidal, f = 60 Hz, t = 1 min.	10200	V
V <sub>e</sub>	Partial discharge extinction voltage	RMS, sinusoidal, f = 60 Hz, Q <sub>PD</sub> ≤ 10 pC	5100	V
T <sub>j</sub>	Junction temperature		-50 ~ +150	°C
T <sub>jop</sub>	Operating junction temperature		-50 ~ +150	°C
T <sub>stg</sub>	Storage temperature		-55 ~ +150	°C

**ELECTRICAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
I <sub>RRM</sub>	Repetitive reverse current	V <sub>RM</sub> = V <sub>RRM</sub>	T <sub>j</sub> = 25°C	—	—	0.8	mA
			T <sub>j</sub> = 125°C	—	0.8	—	
			T <sub>j</sub> = 150°C	—	—	16	
V <sub>FM</sub> (Terminal)	Forward voltage (Note 1)	I <sub>F</sub> = 450 A	T <sub>j</sub> = 25°C	—	2.50	—	V
			T <sub>j</sub> = 125°C	—	3.10	—	
			T <sub>j</sub> = 150°C	—	3.20	—	
V <sub>FM</sub> (Chip)	Forward voltage (Note 1)	I <sub>F</sub> = 450 A	T <sub>j</sub> = 25°C	—	2.35	—	V
			T <sub>j</sub> = 125°C	—	2.90	—	
			T <sub>j</sub> = 150°C	—	3.00	3.50	
t <sub>rr</sub>	Reverse recovery time (Note 1)	V <sub>CC</sub> = 2800 V I <sub>F</sub> = 450 A	T <sub>j</sub> = 125°C	—	1.60	—	μs
			T <sub>j</sub> = 150°C	—	1.85	—	
I <sub>rr</sub>	Reverse recovery current (Note 1)	V <sub>CC</sub> = 2800 V I <sub>F</sub> = 450 A	T <sub>j</sub> = 125°C	—	650	—	A
			T <sub>j</sub> = 150°C	—	650	—	
Q <sub>rr(10%)</sub>	Reverse recovery charge (Note 1,2)	-d <sub>IF</sub> /d <sub>t</sub> ≅ 1500 A/μs @ T <sub>j</sub> = 25°C 1400 A/μs @ T <sub>j</sub> = 125°C 1350 A/μs @ T <sub>j</sub> = 150°C	T <sub>j</sub> = 125°C	—	915	—	μC
			T <sub>j</sub> = 150°C	—	935	—	
Q <sub>rr</sub>	Reverse recovery charge (Note 1,2)	L <sub>s</sub> = 450 nH Inductive load	T <sub>j</sub> = 125°C	—	955	—	μC
			T <sub>j</sub> = 150°C	—	965	—	
			T <sub>j</sub> = 25°C	—	1.15	—	
E <sub>rec(10%)</sub>	Reverse recovery energy per pulse (Note 1,3)	L <sub>s</sub> = 450 nH Inductive load	T <sub>j</sub> = 125°C	—	1.50	—	J
			T <sub>j</sub> = 150°C	—	1.55	—	
			T <sub>j</sub> = 25°C	—	1.20	—	
E <sub>rec</sub>	Reverse recovery energy per pulse (Note 1,3)	L <sub>s</sub> = 450 nH Inductive load	T <sub>j</sub> = 125°C	—	1.60	—	J
			T <sub>j</sub> = 150°C	—	1.65	—	
			T <sub>j</sub> = 25°C	—	1.20	—	

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**THERMAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)}$	Thermal resistance	Junction to Case (per 1/2 module)	—	—	39.0	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, $\lambda_{grease} = 1 \text{ W/m}^2\text{K}$ $D_{(c-s)} = 80 \mu\text{m}$ (per 1/2 module)	—	25.6	—	K/kW

**MECHANICAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$M_t$	Mounting torque	M8 : Main terminals screw	7.0	—	19.0	N·m
$M_s$		M6 : Mounting screw	3.0	—	6.0	N·m
$m$	Mass		—	1.0	—	kg
CTI	Comparative tracking index		600	—	—	—
$d_a$	Clearance		26.0	—	—	mm
$d_s$	Creepage distance		56.0	—	—	mm
$L_{PAK}$	Parasitic stray inductance	1/2 module	—	41	—	nH
$R_{AA+KK}$	Internal lead resistance	$T_c = 25^\circ\text{C}$ , 1/2 module	—	0.36	—	mΩ

Note 1. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWD).

Note 2.  $Q_{rr(10\%)}$  is the integral of  $I_{rr} \times dt$  ( $t(0A_F) - t(-0.1I_F)$ )

Note 3.  $E_{rec(10\%)}$  is the integral of  $0.1V_R \times 0.1I_F \times dt$ .

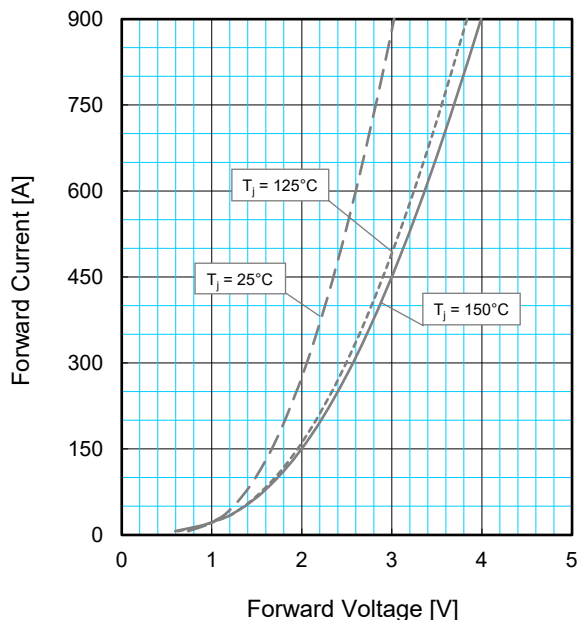
Note 4. Pulse width and repetition rate should be such that junction temperature ( $T_j$ ) does not exceed  $T_{opmax}$  rating (150°C)

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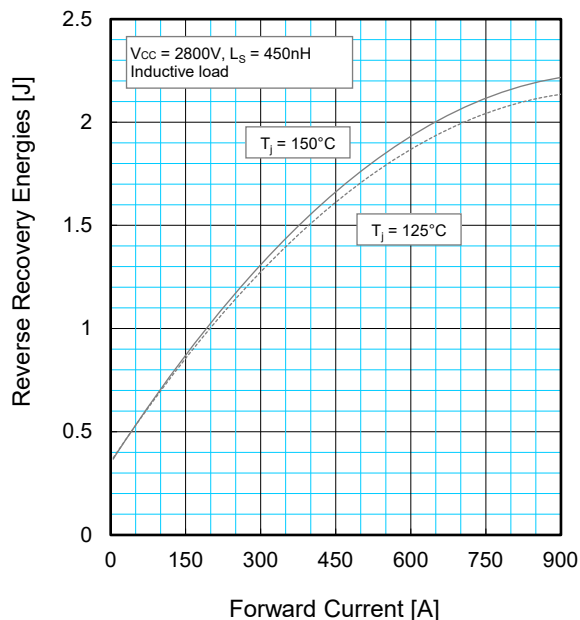
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## PERFORMANCE CURVES

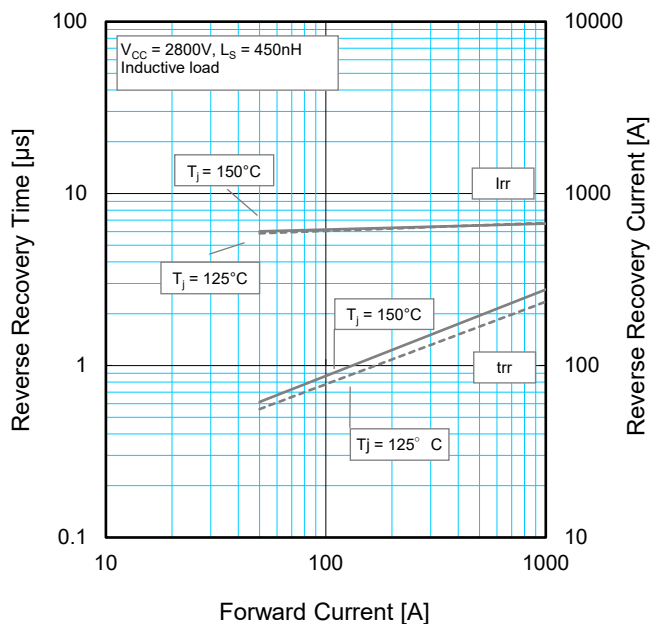
**FORWARD CHARACTERISTICS (TYPICAL)**



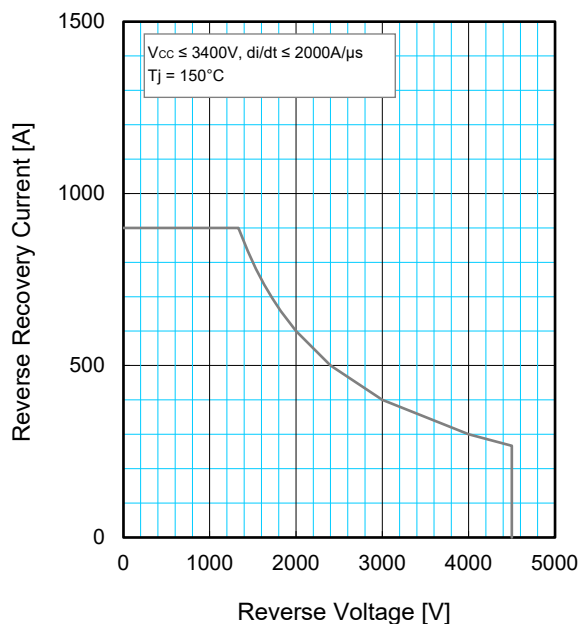
**REVERSE RECOVERY ENERGY CHARACTERISTICS (TYPICAL)**



**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**

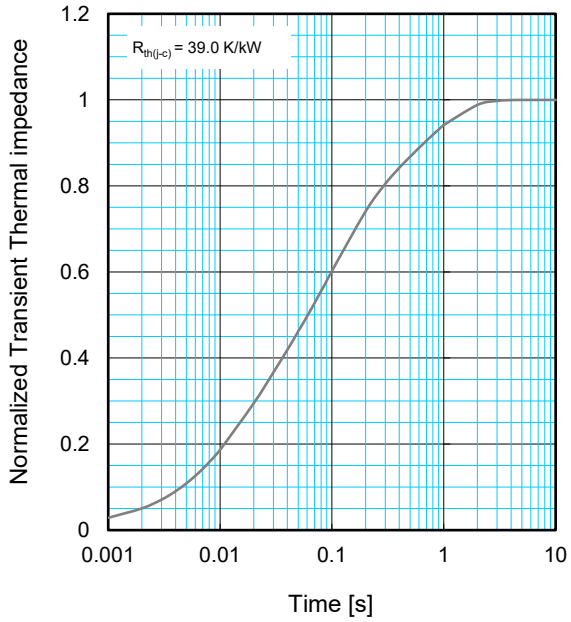


**REVERSE RECOVERY SAFE OPERATING AREA (RRSOA)**



PERFORMANCE CURVES

**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS**



$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_i \left\{ 1 - \exp\left(-\frac{t}{\tau_i}\right) \right\}$$

	1	2	3	4
$R_i / R_{th(j-c)}$ :	0.0096	0.1893	0.4044	0.3967
$\tau_i$ [sec]:	0.0001	0.0058	0.0602	0.3512

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