MMG400KR120U

1200V 400A IGBT Module

April 2015 **Version 01** **RoHS Compliant**

PRODUCT FEATURES

☐ High Short Circuit Capability

☐ Free wheeling diodes with fast and soft reverse recovery

☐ $V_{CE(sat)}$ with positive temperature coefficient

☐ Ultra Low Loss,High Ruggedness

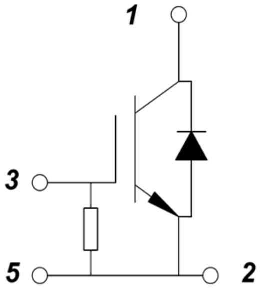
☐ 10K Ω Gate Protected Resistance Inside

APPLICATIONS

☐ Invertor Convertor

☐ Welder SMPS and UPS

☐ Induction Heating



IGBT-inverter

ABSOLUTE MAXIMUM RATINGS

T_C=25°C unless otherwise specified

Symbol	Parameter/Test Conditions		Values	Unit
V_{CES}	Collector Emitter Voltage	T_J=25℃	1200	V
V_{GES}	Gate Emitter Voltage		±20	
I_C	DC Collector Current	T_C=25℃	600	A
		T_C=80℃	400	
I_{CM}	Repetitive Peak Collector Current	tp=1ms	800	
P_{tot}	Power Dissipation Per IGBT		1925	W

Diode-inverter

ABSOLUTE MAXIMUM RATINGS

T_C=25°C unless otherwise specified

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_J=25℃	1200	V
$I_{F(AV)}$	Average Forward Current	T_C=25℃	400	A
I_{FRM}	Repetitive Peak Forward Current	tp=1ms	800	
I^2t		T_J=125℃, t=10ms, V_R=0V	51000	A^2S

IGBT-inverter
ELECTRICAL CHARACTERISTICS

T_C=25°C unless otherwise specified

Symbol	Parameter/Test Conditions			Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	V_{CE}=V_{GE}, I_C=16mA		5.0	6.2	7.0	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=400A, V_{GE}=15V, T_J=25℃			1.8	2.4	
		I_C=400A, V_{GE}=15V, T_J=125℃			2.0		
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_J=25℃				1	mA
		V_{CE}=1200V, V_{GE}=0V, T_J=125℃				10	mA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±15V, T_J=25℃		-400		400	nA
R_{gint}	Integrated Gate Resistor				0.5		Ω
Q_g	Gate Charge	V_{CE}=600V, I_C=400A , V_{GE}=±15V			4.2		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			29.8		nF
C_{res}	Reverse Transfer Capacitance				1.38		nF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=600V,I_C=400A R_G =1.8Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		130		ns
			T_J=125℃		140		ns
t_r	Rise Time		T_J=25℃		70		ns
			T_J=125℃		80		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=600V,I_C=400A R_G =1.8Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		500		ns
			T_J=125℃		580		ns
t_f	Fall Time		T_J=25℃		80		ns
			T_J=125℃		100		ns
E_{on}	Turn on Energy	V_{CC}=600V,I_C=400A R_G =1.8Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		21		mJ
			T_J=125℃		25		mJ
E_{off}	Turn off Energy		T_J=25℃		30		mJ
			T_J=125℃		42		mJ
I_{SC}	Short Circuit Current	tpsc≤10μS , V_{GE}=15V T_J=125℃,V_{CC}=900V			1800		A
R_{thJC}	Junction to Case Thermal Resistance （ Per IGBT）					0.065	K /W

Diode-inverter
ELECTRICAL CHARACTERISTICS

T_C=25°C unless otherwise specified

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=400A , V_{GE}=0V, T_J=25℃		1.95	2.4	V
		I_F=400A , V_{GE}=0V, T_J=125℃		1.95		
t_{rr}	Reverse Recovery Time	I_F=400A , V_R=600V dI_F/dt=-5500A/μs T_J =125℃		260		ns
I_{RRM}	Max. Reverse Recovery Current			450		A
Q_{RR}	Reverse Recovery Charge			68		μC
E_{rec}	Reverse Recovery Energy			30		mJ
R_{thJCD}	Junction to Case Thermal Resistance （ Per Diode）				0.11	K /W

MODULE CHARACTERISTICS

T_C=25°C unless otherwise specified

Symbol	Parameter/Test Conditions		Values	Unit
T_{Jmax}	Max. Junction Temperature		150	℃
T_{Jop}	Operating Temperature		-40~125	
T_{stg}	Storage Temperature		-40~125	
V_{isol}	Isolation Breakdown Voltage	AC, 50Hz(R.M.S), t=1minute	3000	V
Torque	to heatsink	Recommended（M6）	3~5	Nm
	to terminal	Recommended（M6）	2.5~5	Nm
	to terminal	Recommended（M4）	0.7~1.1	Nm
Weight			330	g

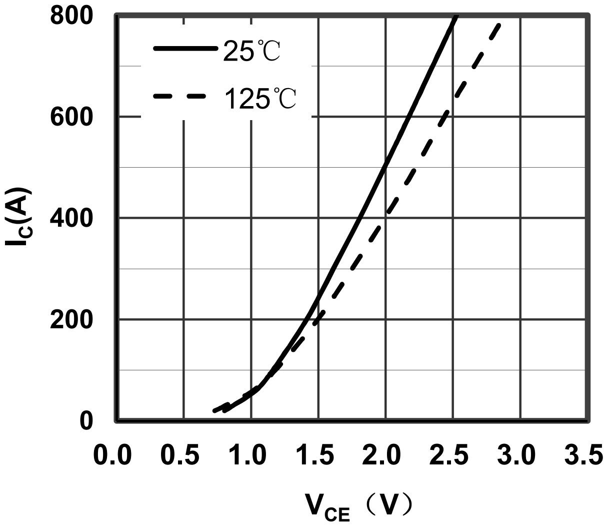


Figure 1. Typical Output Characteristics IGBT-inverter

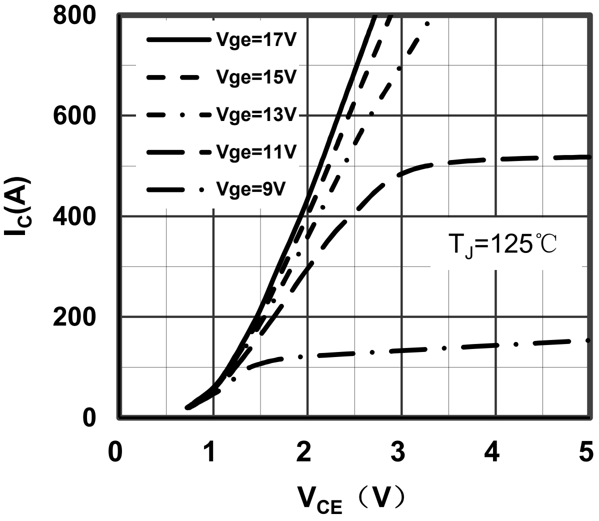


Figure 2. Typical Output Characteristics IGBT-inverter

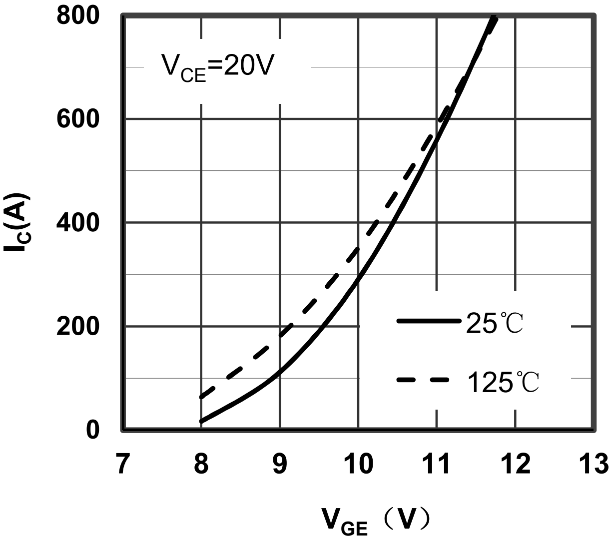


Figure 3. Typical Transfer characteristics IGBT-inverter

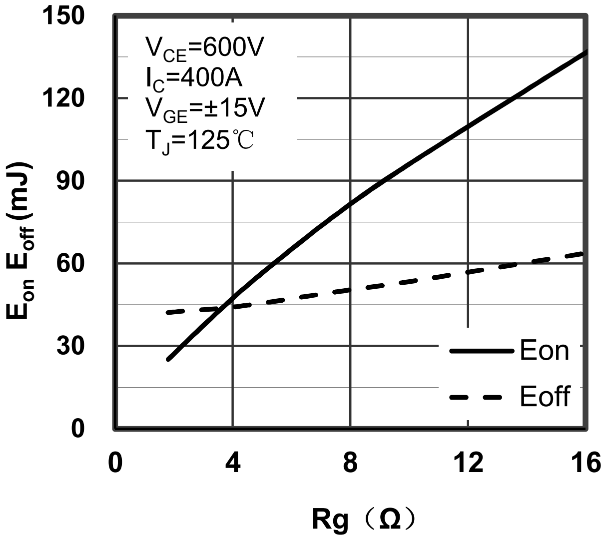


Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

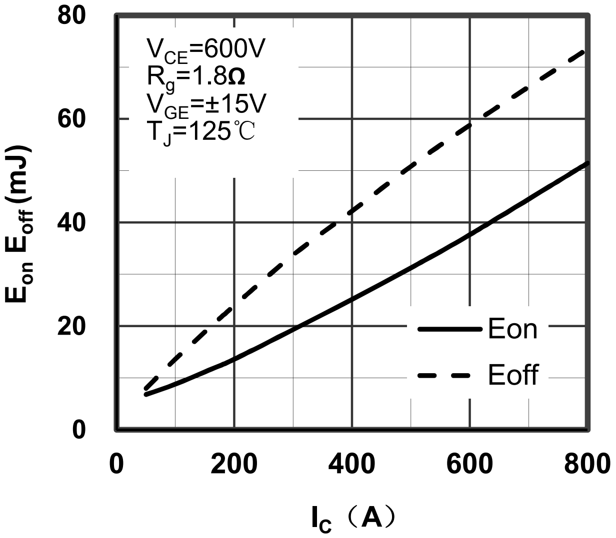


Figure 5. Switching Energy vs Collector Current IGBT-inverter

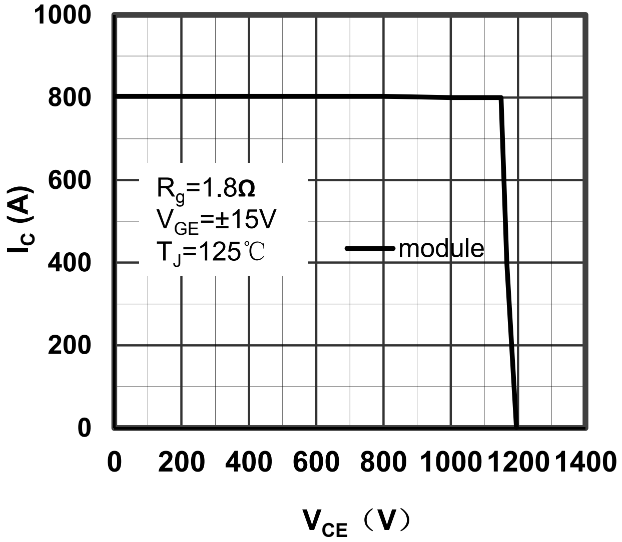


Figure 6. Reverse Biased Safe Operating Area IGBT-inverter

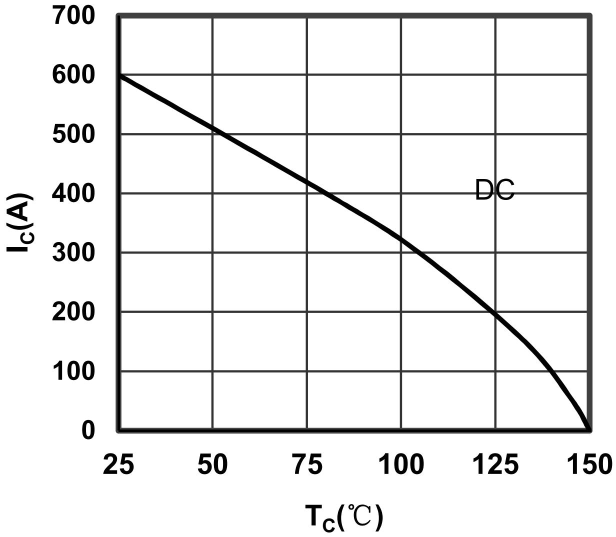


Figure 7. Collector Current vs Case temperature IGBT -inverter

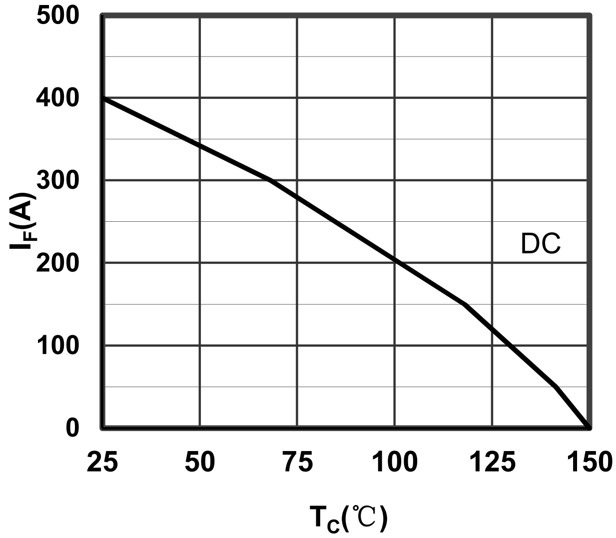


Figure 8. Forward current vs Case temperature Diode -inverter

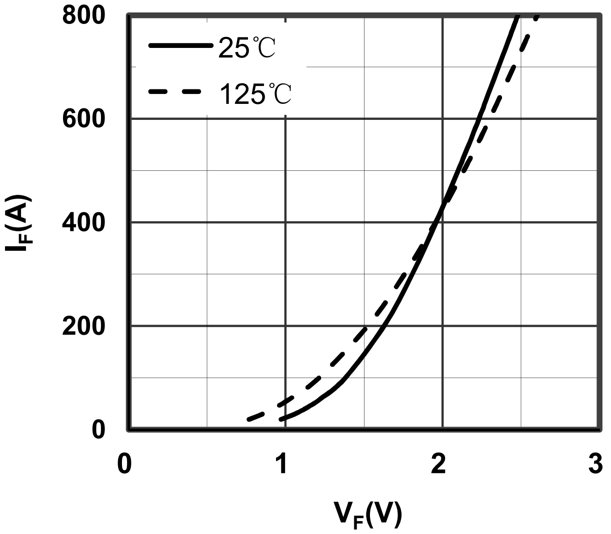


Figure 9. Diode Forward Characteristics Diode -inverter

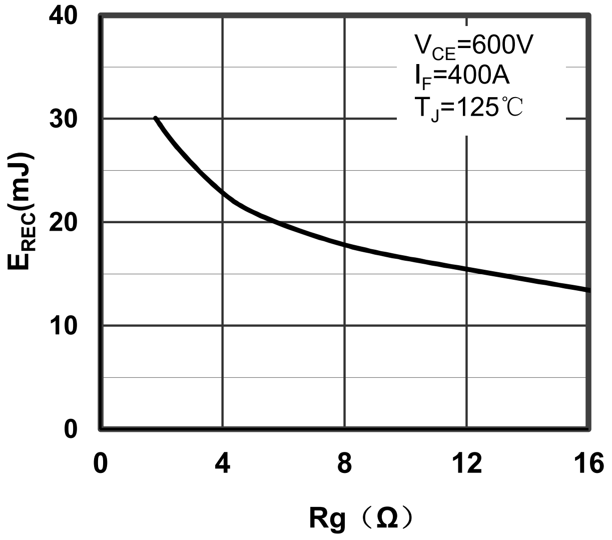


Figure 10. Switching Energy vs Gate Resistor Diode -inverter

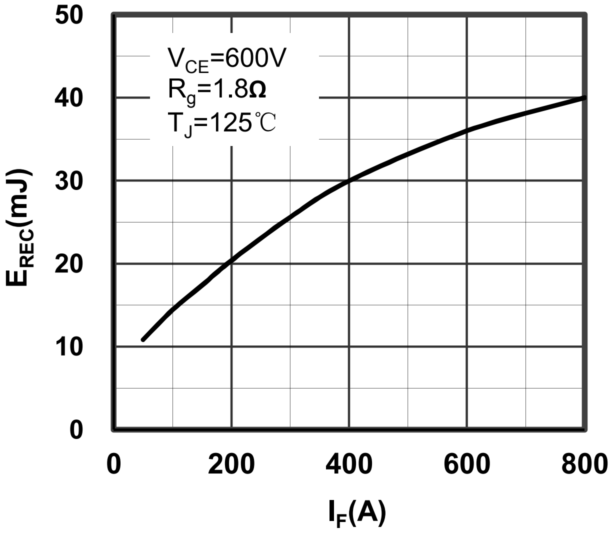


Figure 11. Switching Energy vs Forward Current Diode-inverter

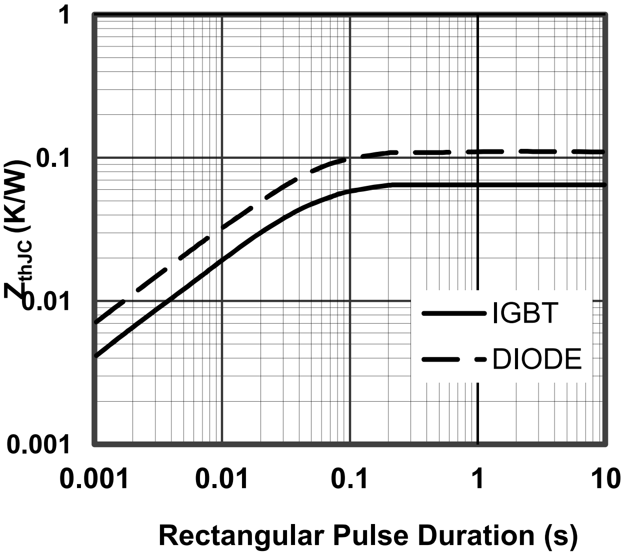
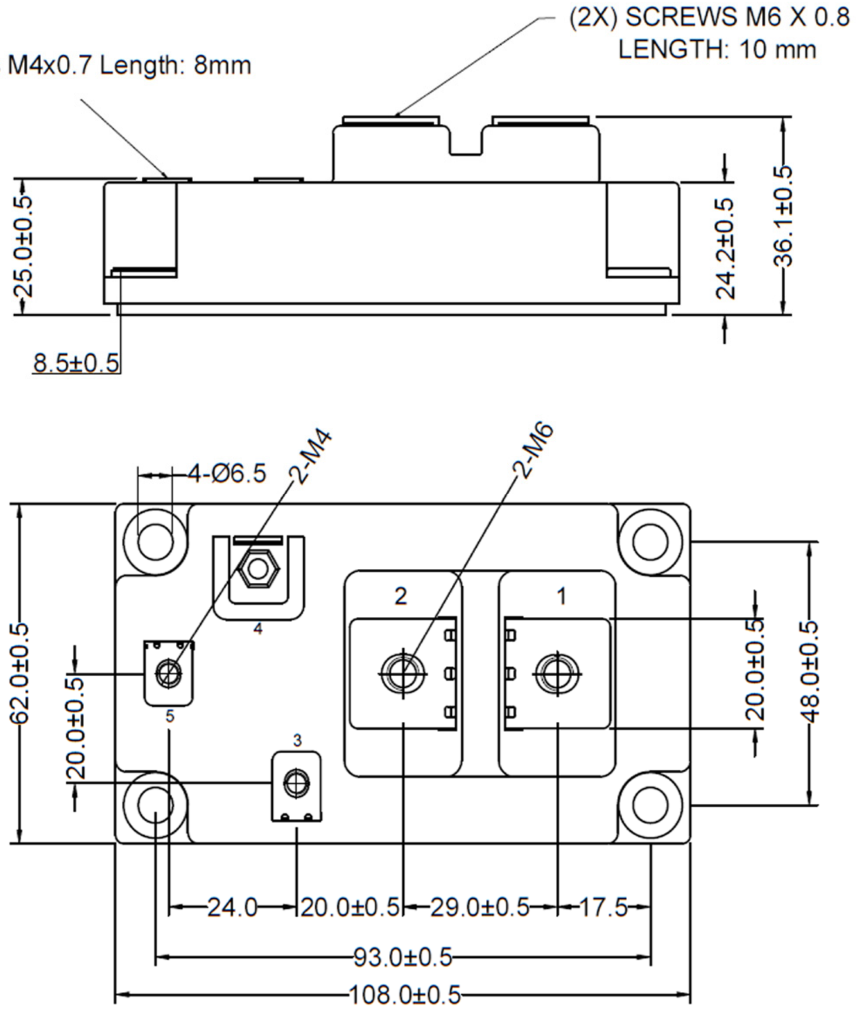


Figure 12. Transient Thermal Impedance of Diode and IGBT-inverter



Dimensions in (mm)
Figure 13. Package Outline