MMG400K170U6EN

1700V 400A IGBT Module

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

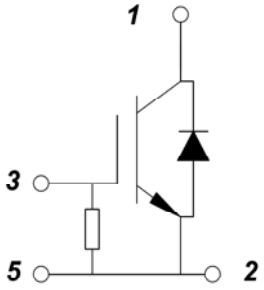
PRODUCT FEATURES



- ☐ IGBT3 CHIP(1700V Trench+Field Stop technology)
- ☐ Low turn-off losses, short tail current
- ☐ $V_{CE(sat)}$ with positive temperature coefficient
- ☐ DIODE CHIP(1700V EMCON 3 technology)
- ☐ Free wheeling diodes with fast and soft reverse recovery
- ☐ 5K Ω Gate Protected Resistance Inside

APPLICATIONS

- ☐ High frequency switching application
- ☐ Medical applications
- ☐ Motion/servo control
- ☐ UPS systems



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℃	1700	V
V_{GES}	Gate Emitter Voltage		±20	
I_C	DC Collector Current	T_C=25℃	600	A
		T_C=90℃	400	
I_{CM}	Repetitive Peak Collector Current	tp=1ms	800	
P_{tot}	Power Dissipation Per IGBT		2700	W

Reverse-Diode

ABSOLUTE MAXIMUM RATINGS

T_C=25°C unless otherwise specified

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_J=25℃	1700	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	24000	A^2S

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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		5.2	5.8	6.4	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=400A, V_{GE}=15V, T_J=25℃			2	2.45	
		I_C=400A, V_{GE}=15V, T_J=125℃			2.4		
I_{CES}	Collector Leakage Current	V_{CE}=1700V, V_{GE}=0V, T_J=25℃				3	mA
		V_{CE}=1700V, V_{GE}=0V, T_J=125℃				20	mA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±15V, T_J=25℃		-400		400	nA
R_{gint}	Integrated Gate Resistor				1.9		Ω
Q_g	Gate Charge	V_{CE}=900V, I_C=400A , V_{GE}=±15V			4.8		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			36		nF
C_{res}	Reverse Transfer Capacitance				1200		pF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=900V,I_C=400A R_G =3.3Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		380		ns
			T_J=125℃		420		ns
t_r	Rise Time		T_J=25℃		80		ns
			T_J=125℃		100		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=900V,I_C=400A R_G =3.3Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		800		ns
			T_J=125℃		1000		ns
t_f	Fall Time		T_J=25℃		180		ns
			T_J=125℃		300		ns
E_{on}	Turn on Energy	V_{CC}=900V,I_C=400A R_G =3.3Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		116		mJ
			T_J=125℃		156		mJ
E_{off}	Turn off Energy		T_J=25℃		83		mJ
			T_J=125℃		126		mJ
I_{SC}	Short Circuit Current	tpsc≤10μS , V_{GE}=15V T_J=125℃,V_{CC}=1000V			1600		A
R_{thJC}	Junction to Case Thermal Resistance （Per IGBT）					0.055	K /W

Reverse-Diode
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℃		1.8	2.2	V
		I_F=400A , V_{GE}=0V, T_J=125℃		1.9		
I_{RRM}	Max. Reverse Recovery Current	I_F=400A , V_R=900V dI_F/dt=-2700A/μs T_J =125℃		480		A
Q_{RR}	Reverse Recovery Charge			160		μC
E_{rec}	Reverse Recovery Energy			96		mJ
R_{thJCD}	Junction to Case Thermal Resistance （Per Diode）				0.1	K /W

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MODULE CHARACTERISTICS

T_C=25°C unless otherwise specified

Symbol	Parameter/Test Conditions		Values	Unit
T_{Jmax}	Max. Junction Temperature		175	℃
T_{Jop}	Operating Temperature		-40~150	
T_{stg}	Storage Temperature		-40~125	
V_{isol}	Isolation Breakdown Voltage	AC, 50Hz(R.M.S), t=1minute	4000	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

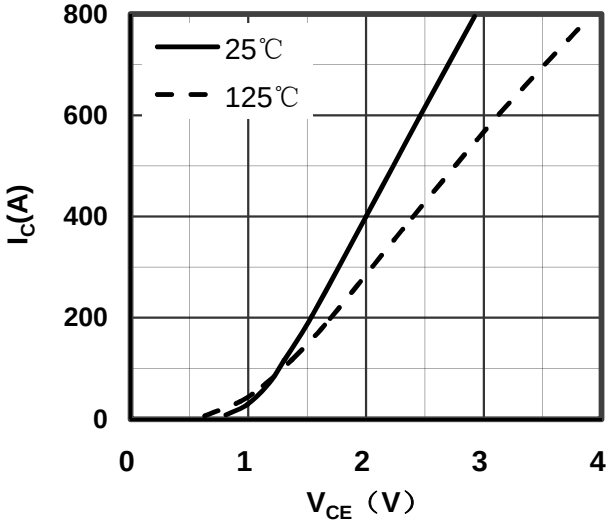


Figure 1. Typical Output Characteristics IGBT-inverter

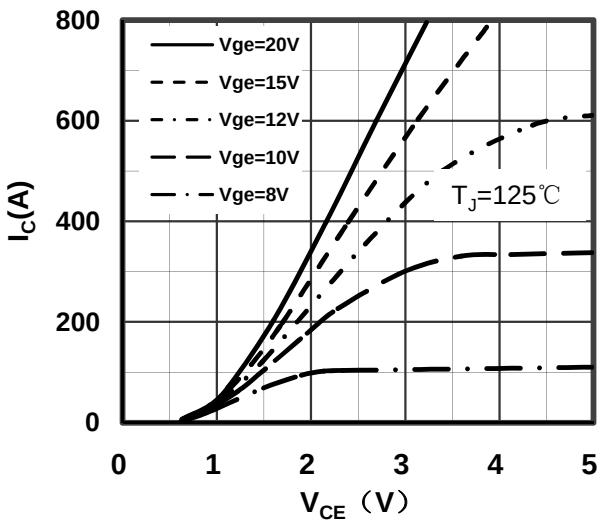


Figure 2. Typical Output Characteristics IGBT-inverter

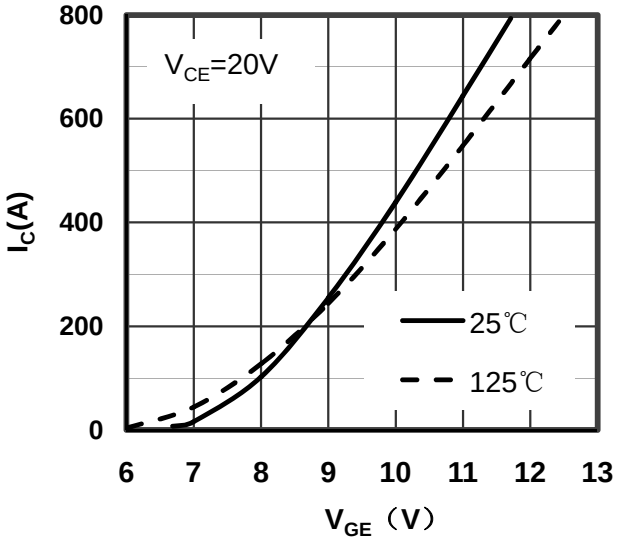


Figure 3. Typical Transfer Characteristics IGBT-inverter

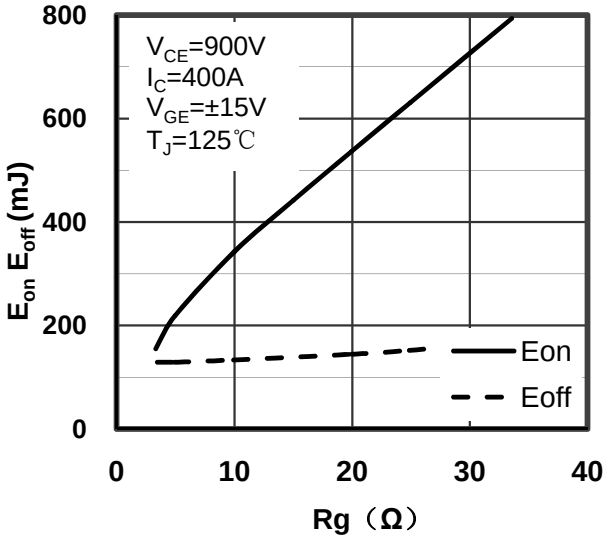


Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

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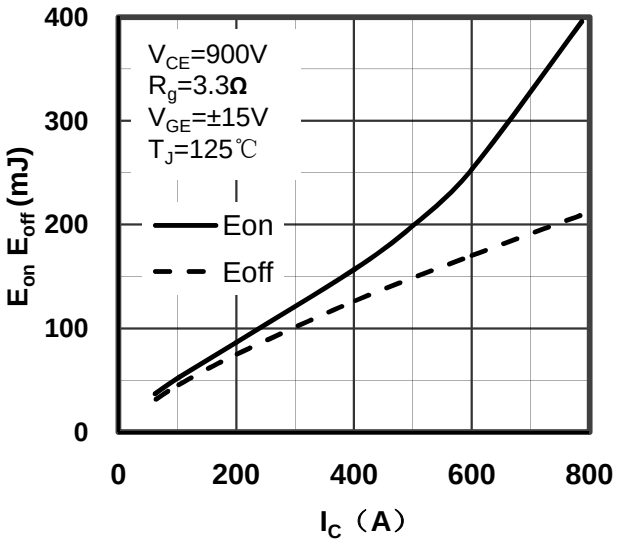


Figure 5. Switching Energy vs Collector Current IGBT-inverter

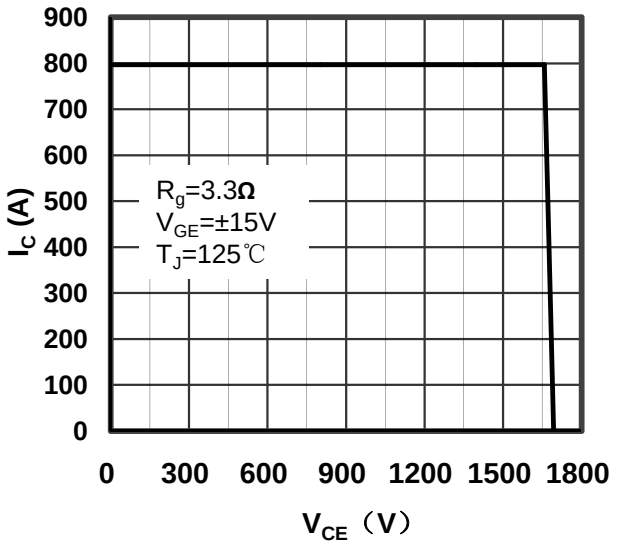


Figure 6. Reverse Biased Safe Operating Area IGBT-inverter

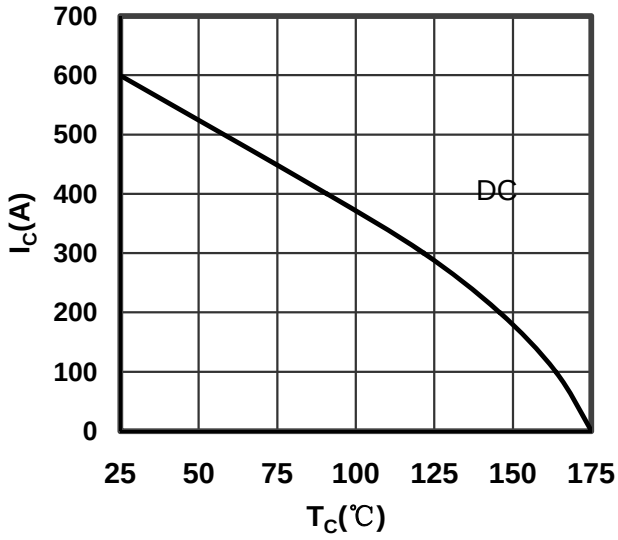


Figure 7. Collector Current vs Case temperature IGBT -inverter

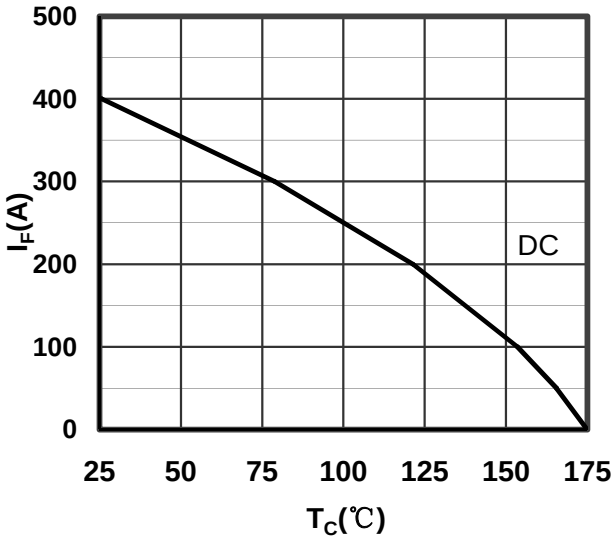


Figure 8. Forward current vs Case temperature Reverse-Diode

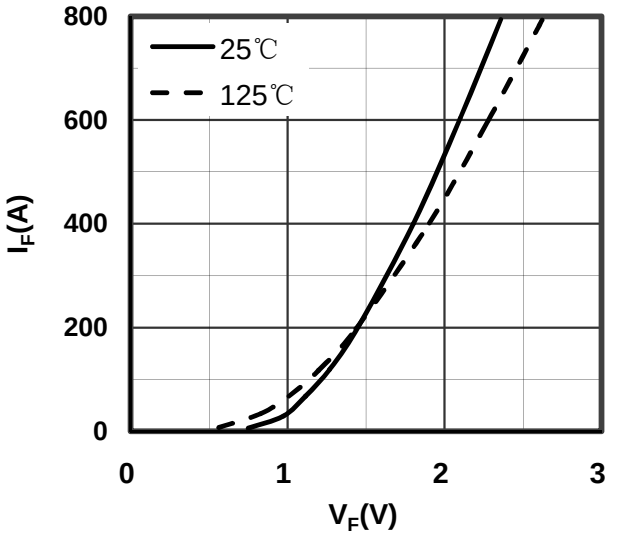


Figure 9. Diode Forward Characteristics Reverse-Diode

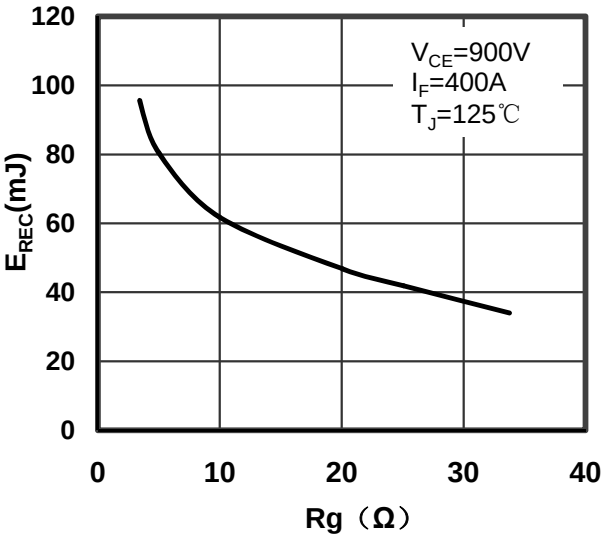


Figure 10. Switching Energy vs Gate Resistor Reverse-Diode

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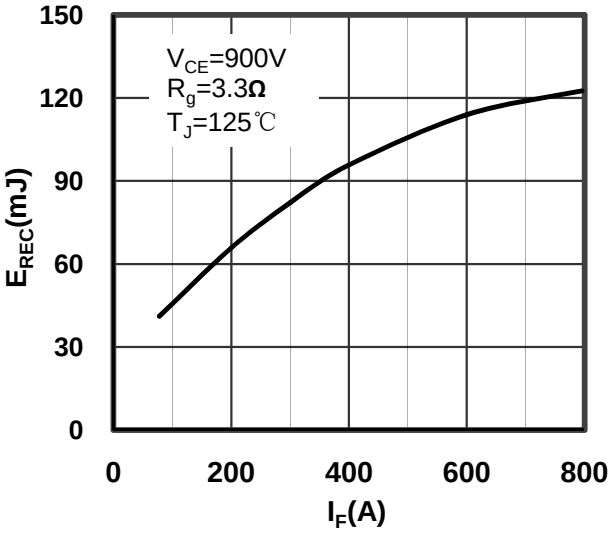


Figure 11. Switching Energy vs Forward Current Reverse-Diode

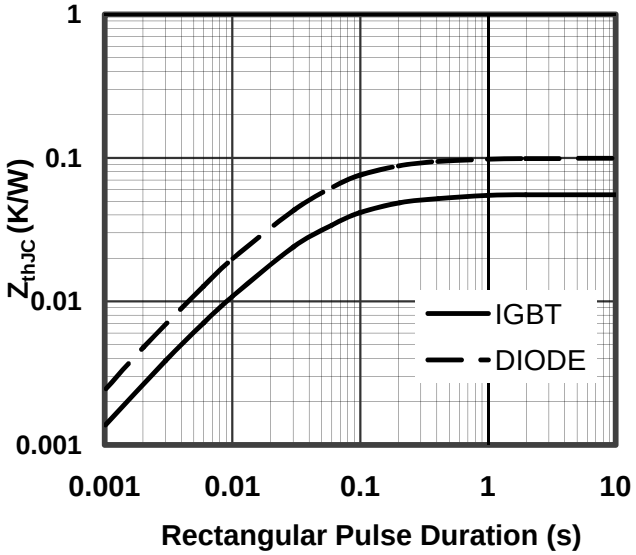
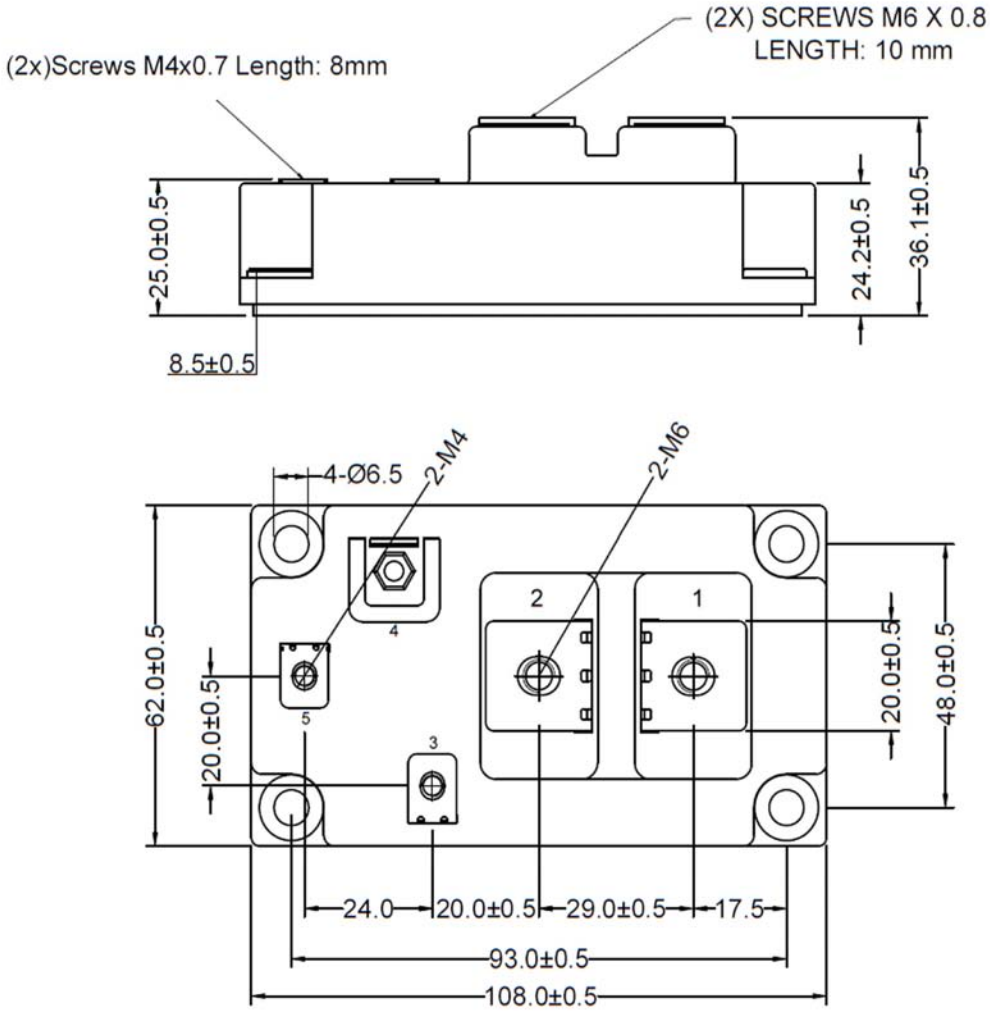


Figure 12. Transient Thermal Impedance of Reverse-Diode and IGBT-inverter



Dimensions in (mm)

Figure 13. Package Outline

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