

PRODUCT FEATURES

- IGBT³ CHIP(Trench+Field Stop technology)
- High short circuit capability,self limiting short circuit current
- $V_{CE(sat)}$ with positive temperature coefficient
- Fast switching and short tail current
- Free wheeling diodes with fast and soft reverse recovery
- Low switching losses



APPLICATIONS

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

IGBT

ABSOLUTE MAXIMUM RATINGS($T_C=25^{\circ}C$ unless otherwise specified)

Symbol	Parameter/Test Conditions	Values	Unit	
V_{CES}	Collector Emitter Voltage	$T_J=25^{\circ}C$	1200	V
V_{GES}	Gate Emitter Voltage		± 20	
I_C	DC Collector Current	$T_C=25^{\circ}C, T_{Jmax}=150^{\circ}C$	580	A
		$T_C=80^{\circ}C, T_{Jmax}=150^{\circ}C$	400	
I_{CM}	Repetitive Peak Collector Current	$t_p=1ms$	800	
P_{tot}	Power Dissipation Per IGBT	$T_C=25^{\circ}C, T_{Jmax}=150^{\circ}C$	1925	W

Diode

ABSOLUTE MAXIMUM RATINGS ($T_C=25^{\circ}C$ unless otherwise specified)

Symbol	Parameter/Test Conditions	Values	Unit	
V_{RRM}	Repetitive Reverse Voltage	$T_J=25^{\circ}C$	1200	V
$I_{F(AV)}$	Average Forward Current		400	A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1ms$	800	
I^2t		$T_J=125^{\circ}C, t=10ms, V_R=0V$	30000	A ² S

MacMic Science & Technology Co., Ltd.

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MMG400D120UA6TN

IGBT

ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	$V_{CE}=V_{GE}, I_C=16\text{mA}$	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$I_C=400\text{A}, V_{GE}=15\text{V}, T_J=25^\circ\text{C}$		1.7	2.15	
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_J=125^\circ\text{C}$		1.9		
I_{CES}	Collector Leakage Current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$			1	mA
		$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=125^\circ\text{C}$			10	mA
I_{GES}	Gate Leakage Current	$V_{CE}=0\text{V}, V_{GE}=\pm 15\text{V}, T_J=25^\circ\text{C}$	-400		400	nA
R_{gint}	Integrated Gate Resistor			1.9		Ω
Q_g	Gate Charge	$V_{CE}=600\text{V}, I_C=400\text{A}, V_{GE}=\pm 15\text{V}$		3.8		μC
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		28		nF
C_{res}	Reverse Transfer Capacitance			1000		pF
$t_{d(on)}$	Turn on Delay Time	$V_{CC}=600\text{V}, I_C=400\text{A}$ $R_G=1.8\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		160	ns
			$T_J=125^\circ\text{C}$		170	ns
t_r	Rise Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		40	ns
			$T_J=125^\circ\text{C}$		45	ns
$t_{d(off)}$	Turn off Delay Time	$V_{CC}=600\text{V}, I_C=400\text{A}$ $R_G=1.8\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		450	ns
			$T_J=125^\circ\text{C}$		520	ns
t_f	Fall Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		100	ns
			$T_J=125^\circ\text{C}$		160	ns
E_{on}	Turn on Energy	$V_{CC}=600\text{V}, I_C=400\text{A}$ $R_G=1.8\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		20	mJ
			$T_J=125^\circ\text{C}$		30	mJ
E_{off}	Turn off Energy	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		33	mJ
			$T_J=125^\circ\text{C}$		50	mJ
I_{SC}	Short Circuit Current	$t_{psc} \leq 10\mu\text{S}, V_{GE}=15\text{V}$ $T_J=125^\circ\text{C}, V_{CC}=900\text{V}$		1550		A
R_{thJC}	Junction to Case Thermal Resistance (Per IGBT)				0.065	K/W

Diode

ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	$I_F=400\text{A}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$		1.65	2.15	V
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_J=125^\circ\text{C}$		1.65		
t_{rr}	Reverse Recovery Time	$I_F=400\text{A}, V_R=600\text{V}$ $dI_F/dt=-8000\text{A}/\mu\text{s}$ $T_J=125^\circ\text{C}$		360		ns
I_{RRM}	Max. Reverse Recovery Current			450		A
Q_{RR}	Reverse Recovery Charge			75		μC
E_{rec}	Reverse Recovery Energy			35		mJ
R_{thJCD}	Junction to Case Thermal Resistance (Per Diode)				0.12	K/W

MMG400D120UA6TN

MODULE CHARACTERISTICS ($T_c=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions	Values	Unit	
T_{Jmax}	Max. Junction Temperature	150	$^\circ\text{C}$	
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
CTI	Comparative Tracking Index		> 225	
Torque	to heatsink	Recommended (M6)	3~5	Nm
	to terminal	Recommended (M6)	2.5~5	Nm
Weight			300	g

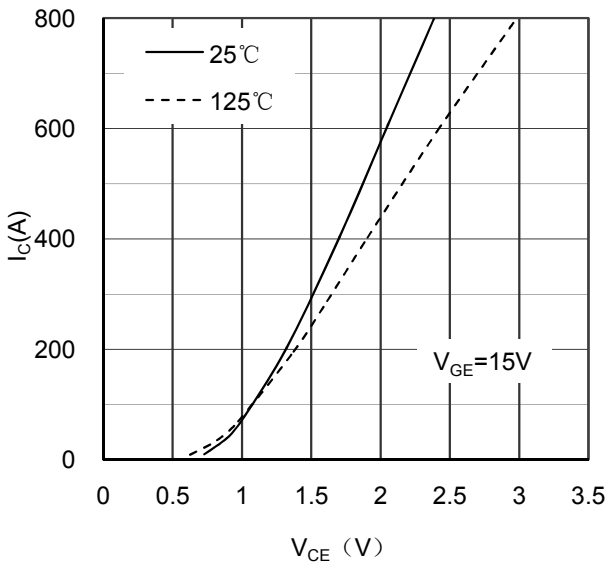


Figure 1. Typical Output Characteristics IGBT

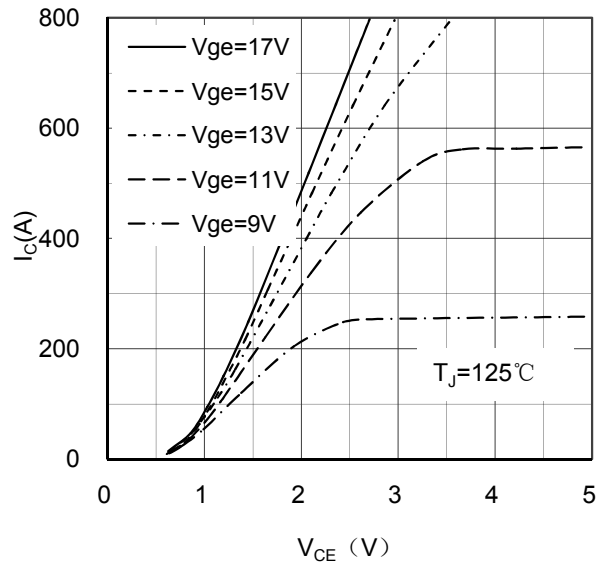


Figure 2. Typical Output Characteristics IGBT

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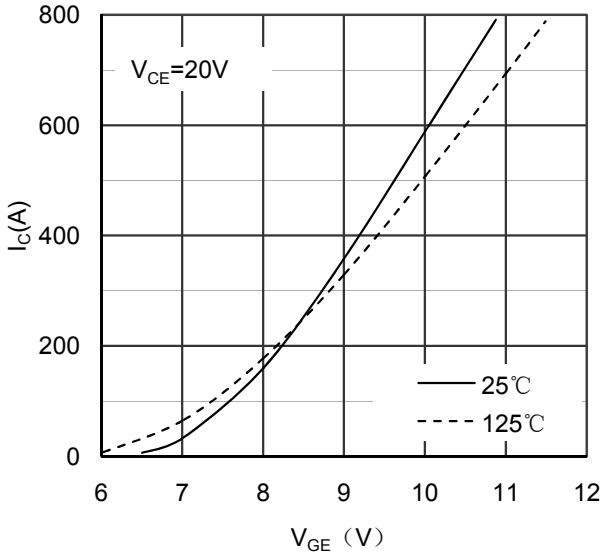


Figure 3. Typical Transfer characteristics IGBT

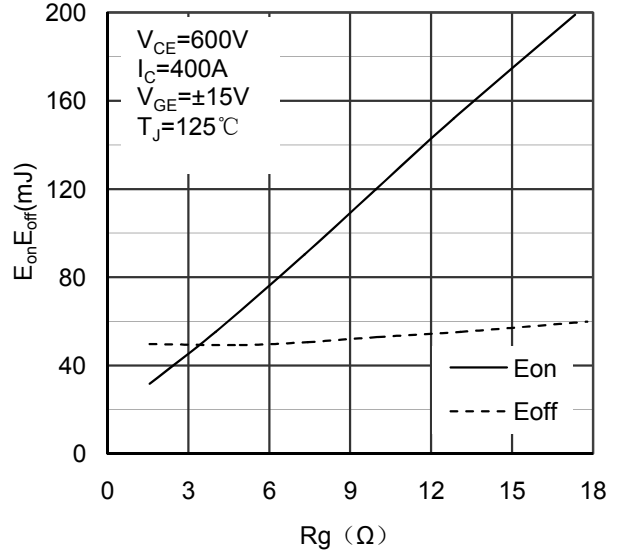


Figure 4. Switching Energy vs Gate Resistor IGBT

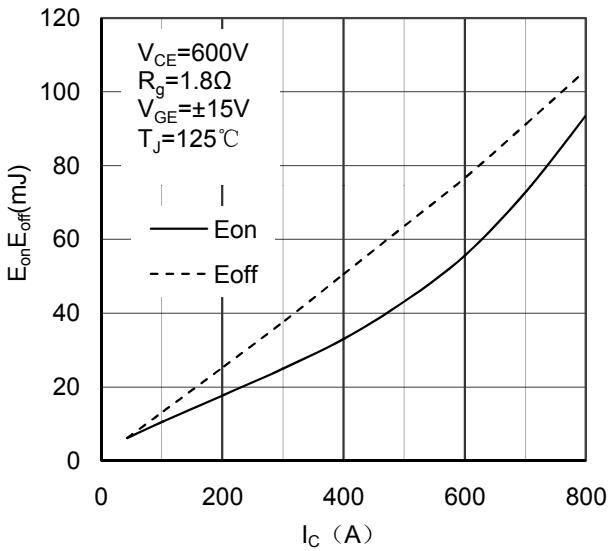


Figure 5. Switching Energy vs Collector Current IGBT

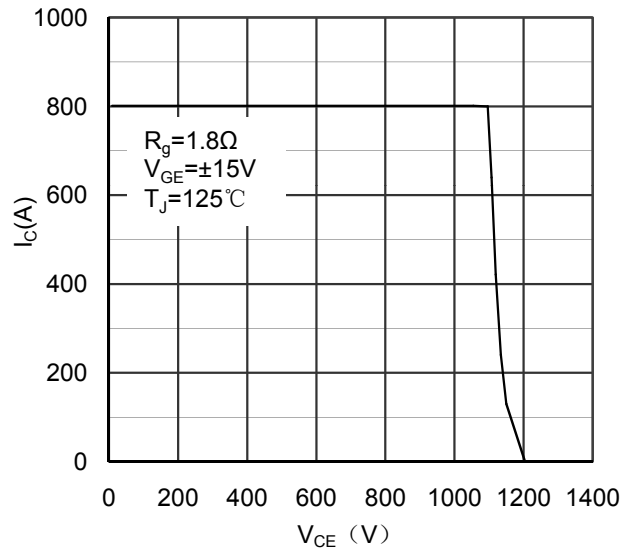


Figure 6. Reverse Biased Safe Operating Area IGBT

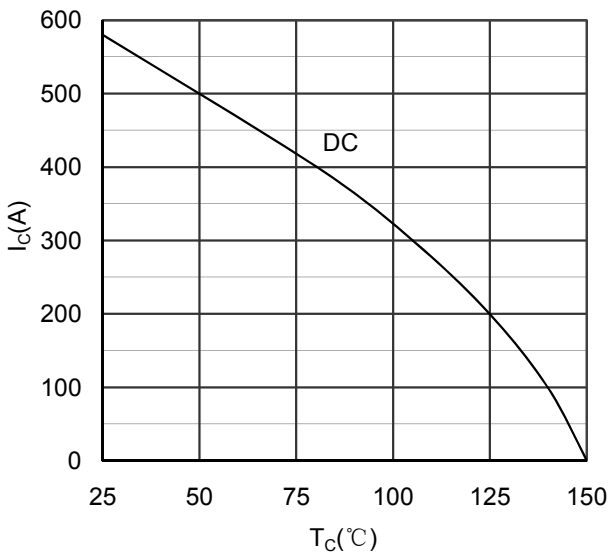


Figure 7. Collector Current vs Case temperature IGBT

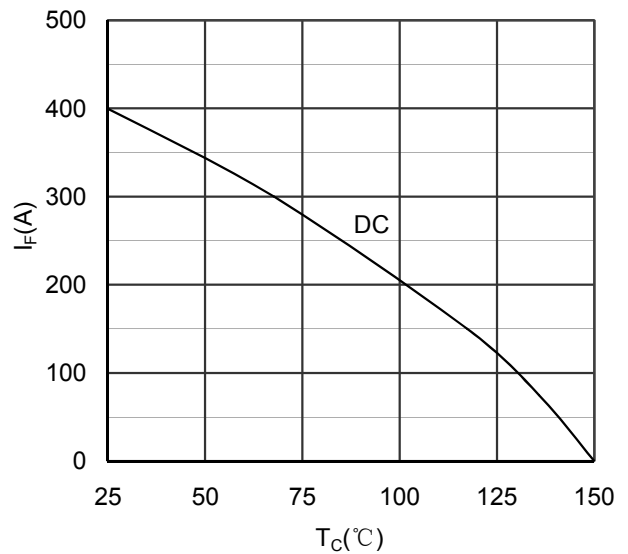


Figure 8. Forward current vs Case temperature Diode

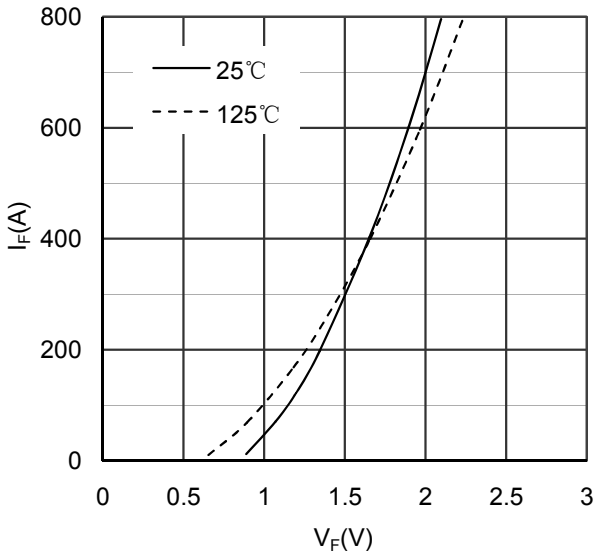


Figure 9. Diode Forward Characteristics Diode

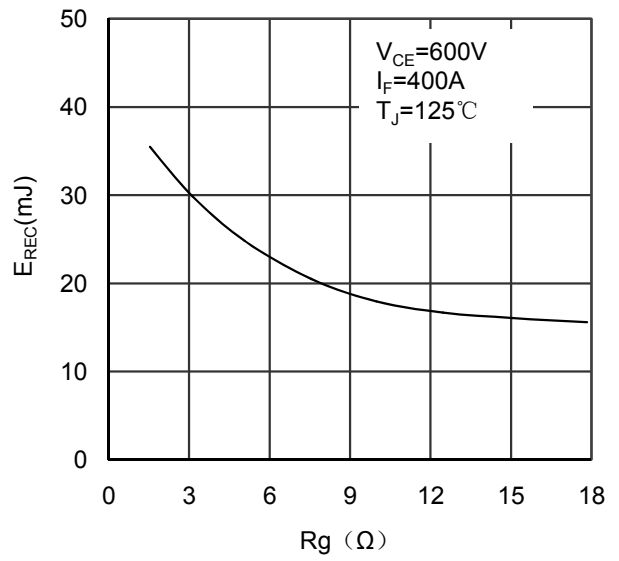


Figure 10. Switching Energy vs Gate Resistor Diode

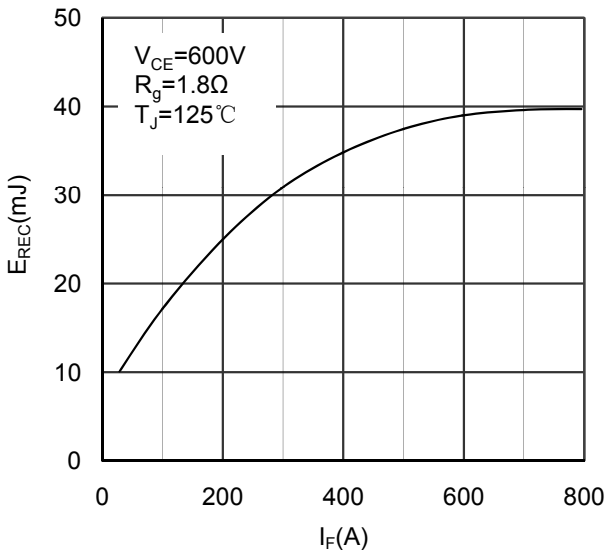


Figure 11. Switching Energy vs Forward Current Diode

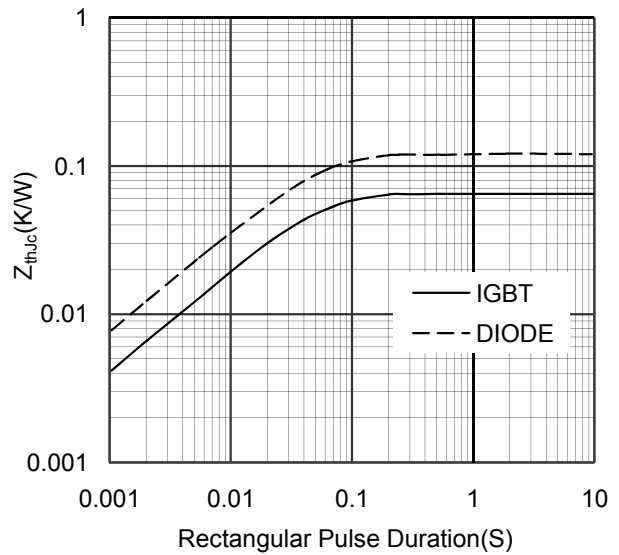


Figure 12. Transient Thermal Impedance of Diode and IGBT

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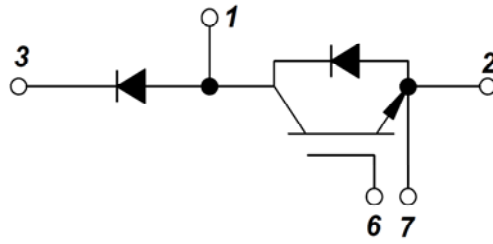
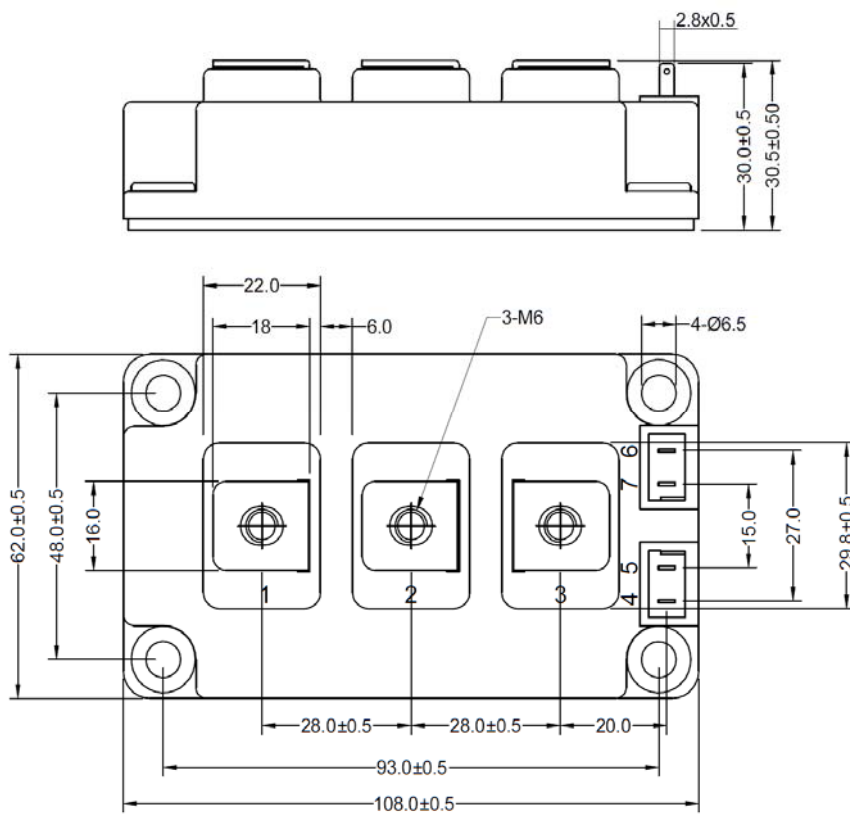


Figure 13. Circuit Diagram



Dimensions in (mm)

Figure 14. Package Outline

江苏宏微科技股份有限公司

MacMic Science & Technology Co.,Ltd.

MMG400D120UA6TN 规格书

文件类别： 产品规格书		文件编号： M-3W-MR-C-019		版本： 1
职责部门	模块事业部	撰写人	审核人	批准人
分发控制	文件控制中心	张若鸿	麻长胜	李小明
机密等级	C级	受控章		
生效日期：		2017. 3. 7		

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		$T_C=80^{\circ}C, T_{Jmax}=150^{\circ}C$	400	
I_{CM}	Repetitive Peak Collector Current	$t_p=1ms$	800	
P_{tot}	Power Dissipation Per IGBT	$T_C=25^{\circ}C, T_{Jmax}=150^{\circ}C$	1925	W

Diode

ABSOLUTE MAXIMUM RATINGS ($T_C=25^{\circ}C$ unless otherwise specified)

Symbol	Parameter/Test Conditions	Values	Unit	
V_{RRM}	Repetitive Reverse Voltage	$T_J=25^{\circ}C$	1200	V
$I_{F(AV)}$	Average Forward Current		400	A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1ms$	800	
I^2t		$T_J=125^{\circ}C, t=10ms, V_R=0V$	30000	A ² S

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$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$I_C=400\text{A}, V_{GE}=15\text{V}, T_J=25^\circ\text{C}$		1.7	2.15	
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_J=125^\circ\text{C}$		1.9		
I_{CES}	Collector Leakage Current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$			1	mA
		$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=125^\circ\text{C}$			10	mA
I_{GES}	Gate Leakage Current	$V_{CE}=0\text{V}, V_{GE}=\pm 15\text{V}, T_J=25^\circ\text{C}$	-400		400	nA
R_{gint}	Integrated Gate Resistor			1.9		Ω
Q_g	Gate Charge	$V_{CE}=600\text{V}, I_C=400\text{A}, V_{GE}=\pm 15\text{V}$		3.8		μC
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		28		nF
C_{res}	Reverse Transfer Capacitance			1000		pF
$t_{d(on)}$	Turn on Delay Time	$V_{CC}=600\text{V}, I_C=400\text{A}$ $R_G=1.8\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		160	ns
			$T_J=125^\circ\text{C}$		170	ns
t_r	Rise Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		40	ns
			$T_J=125^\circ\text{C}$		45	ns
$t_{d(off)}$	Turn off Delay Time	$V_{CC}=600\text{V}, I_C=400\text{A}$ $R_G=1.8\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		450	ns
			$T_J=125^\circ\text{C}$		520	ns
t_f	Fall Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		100	ns
			$T_J=125^\circ\text{C}$		160	ns
E_{on}	Turn on Energy	$V_{CC}=600\text{V}, I_C=400\text{A}$ $R_G=1.8\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		20	mJ
			$T_J=125^\circ\text{C}$		30	mJ
E_{off}	Turn off Energy	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		33	mJ
			$T_J=125^\circ\text{C}$		50	mJ
I_{SC}	Short Circuit Current	$t_{psc} \leq 10\mu\text{S}, V_{GE}=15\text{V}$ $T_J=125^\circ\text{C}, V_{CC}=900\text{V}$		1550		A
R_{thJC}	Junction to Case Thermal Resistance (Per IGBT)				0.065	K/W

Diode

ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	$I_F=400\text{A}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$		1.65	2.15	V
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_J=125^\circ\text{C}$		1.65		
t_{rr}	Reverse Recovery Time	$I_F=400\text{A}, V_R=600\text{V}$ $dI_F/dt=-8000\text{A}/\mu\text{s}$ $T_J=125^\circ\text{C}$		360		ns
I_{RRM}	Max. Reverse Recovery Current			450		A
Q_{RR}	Reverse Recovery Charge			75		μC
E_{rec}	Reverse Recovery Energy			35		mJ
R_{thJCD}	Junction to Case Thermal Resistance (Per Diode)				0.12	K/W

MMG400D120UA6TN

MODULE CHARACTERISTICS ($T_c=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions	Values	Unit	
T_{Jmax}	Max. Junction Temperature	150	$^\circ\text{C}$	
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
CTI	Comparative Tracking Index		> 225	
Torque	to heatsink	Recommended (M6)	3~5	Nm
	to terminal	Recommended (M6)	2.5~5	Nm
Weight			300	g

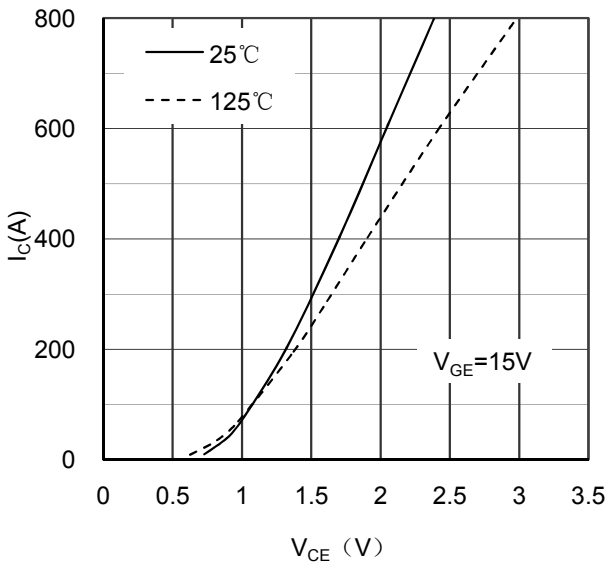


Figure 1. Typical Output Characteristics IGBT

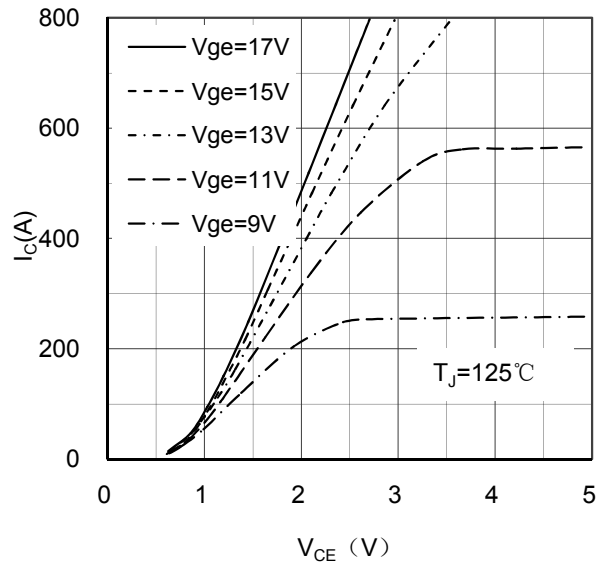


Figure 2. Typical Output Characteristics IGBT

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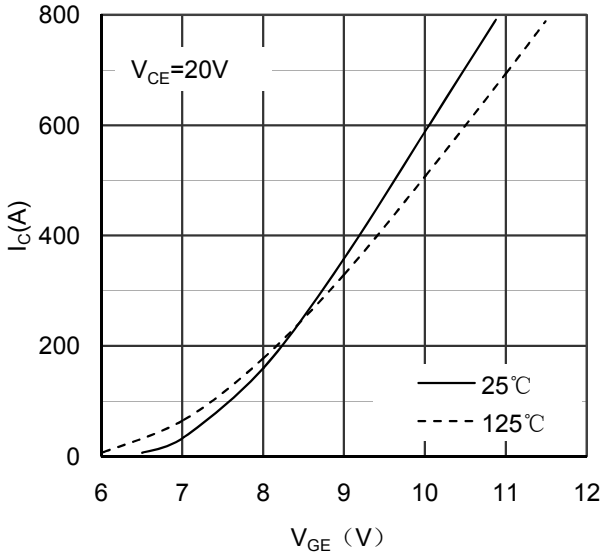


Figure 3. Typical Transfer characteristics IGBT

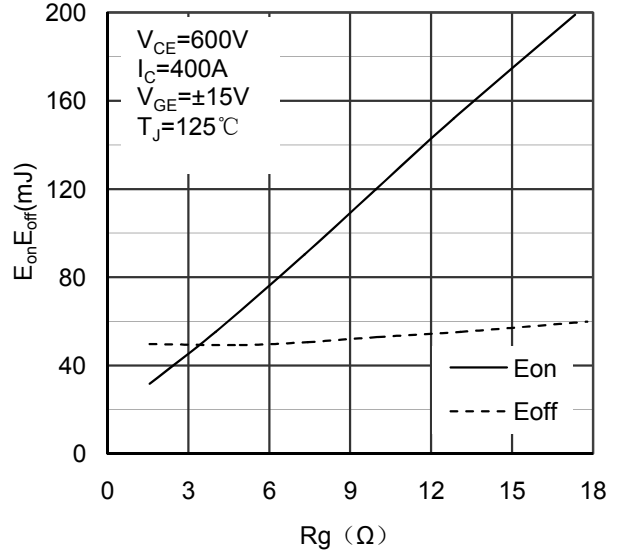


Figure 4. Switching Energy vs Gate Resistor IGBT

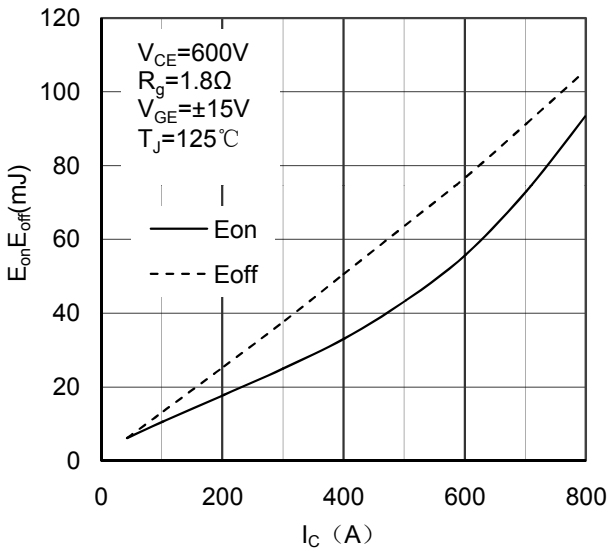


Figure 5. Switching Energy vs Collector Current IGBT

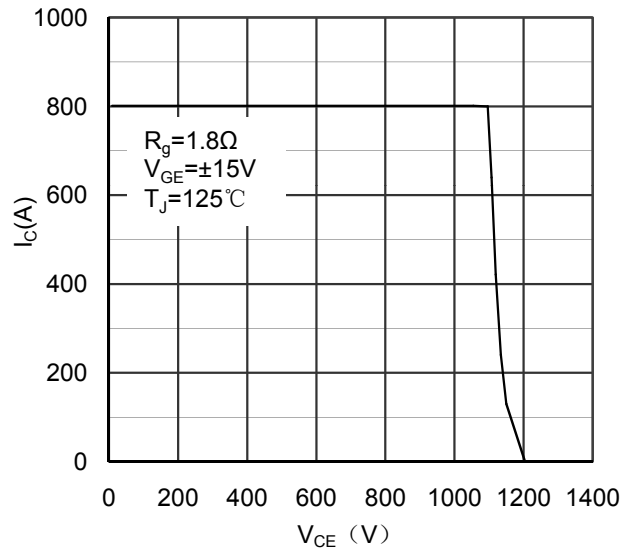


Figure 6. Reverse Biased Safe Operating Area IGBT

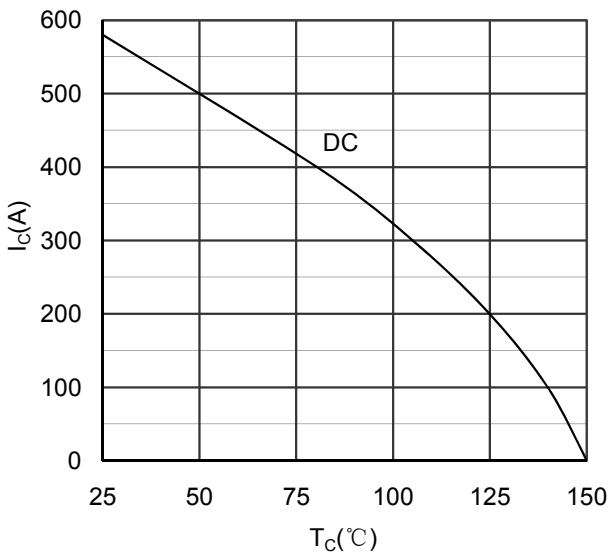


Figure 7. Collector Current vs Case temperature IGBT

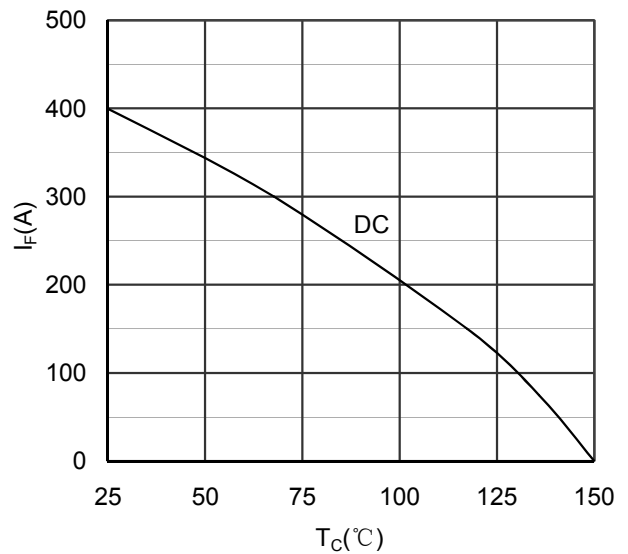


Figure 8. Forward current vs Case temperature Diode

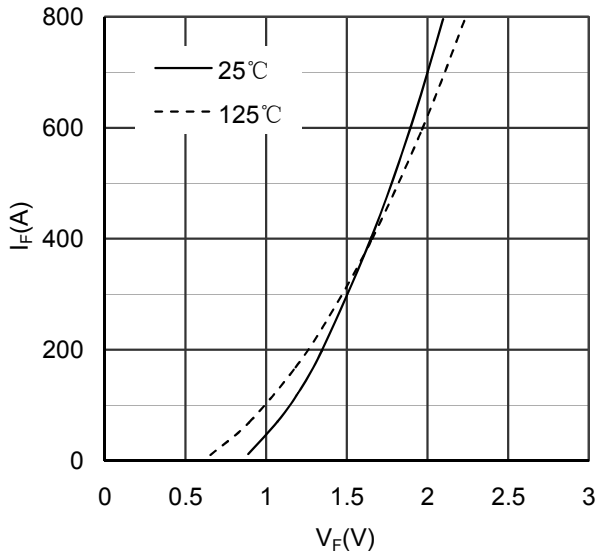


Figure 9. Diode Forward Characteristics Diode

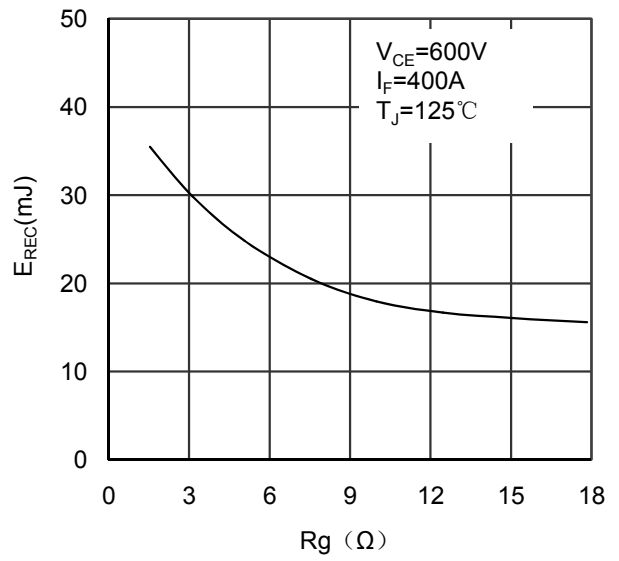


Figure 10. Switching Energy vs Gate Resistor Diode

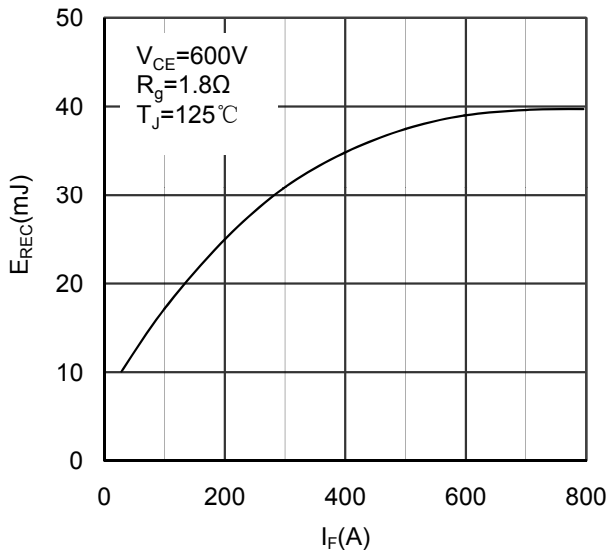


Figure 11. Switching Energy vs Forward Current Diode

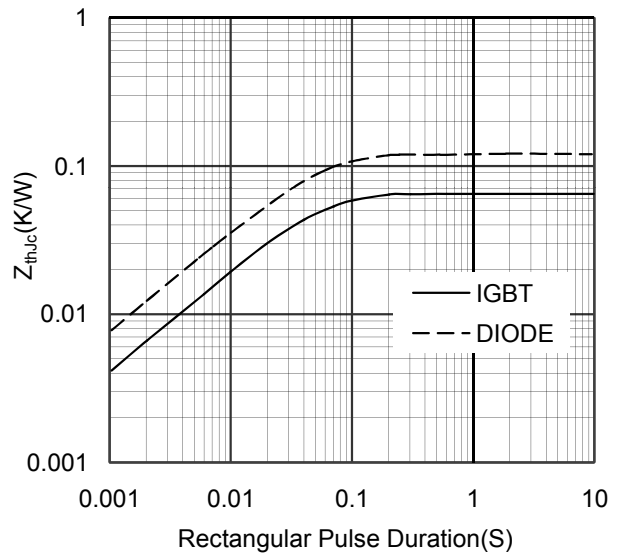


Figure 12. Transient Thermal Impedance of Diode and IGBT

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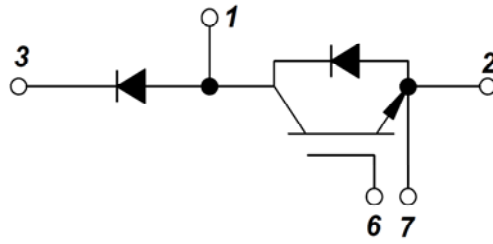
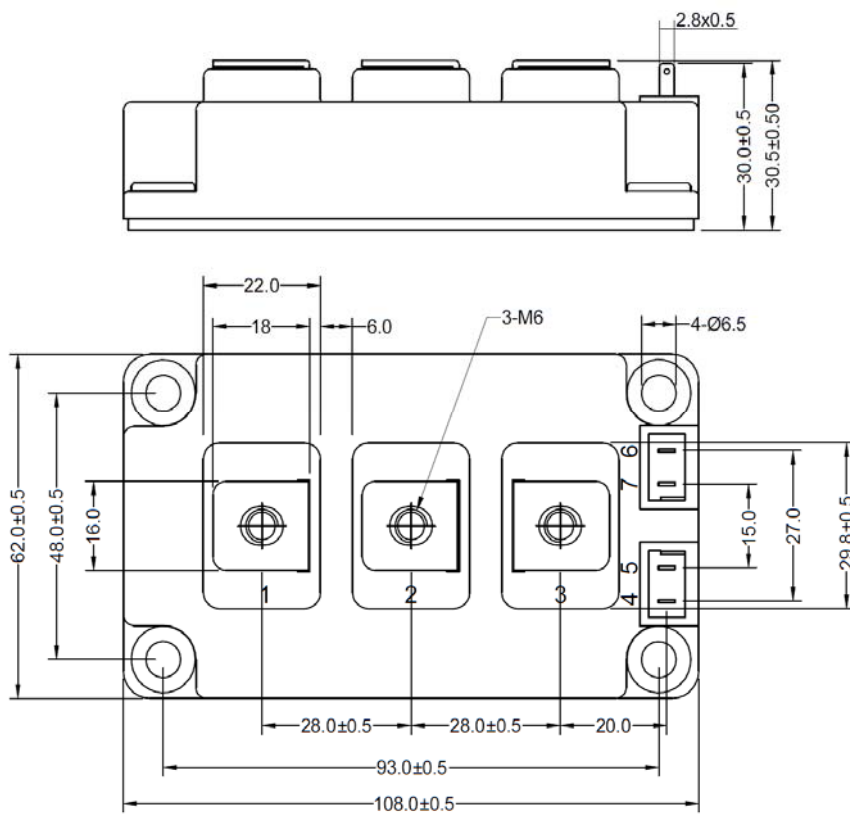


Figure 13. Circuit Diagram



Dimensions in (mm)

Figure 14. Package Outline