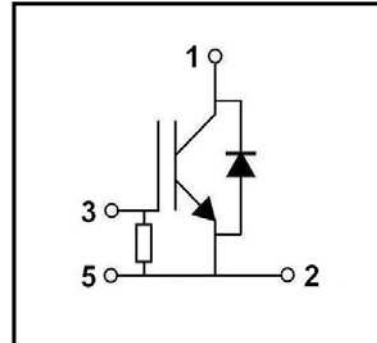


FEATURES

- Ultra Low Loss
- High Ruggedness
- High Short Circuit Capability
- Positive Temperature Coefficient
- With Fast Free-Wheeling Diodes
- 5K Ω Gate Protected Resistance Inside

APPLICATIONS

- Inverter
- Converter
- Welder
- SMPS and UPS
- Induction Heating



ABSOLUTE MAXIMUM RATINGS

$T_C=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Test Conditions	Values	Unit
IGBT				
V_{CES}	Collector - Emitter Voltage		1200	V
V_{GES}	Gate - Emitter Voltage		± 20	V
I_C	DC Collector Current	$T_C=25^\circ\text{C}$	600	A
		$T_C=80^\circ\text{C}$	400	A
I_{Cpuls}	Pulsed Collector Current	$T_C=25^\circ\text{C}, t_p=1\text{ms}$	1200	A
		$T_C=80^\circ\text{C}, t_p=1\text{ms}$	800	A
P_{tot}	Power Dissipation Per IGBT		1925	W
T_J	Junction Temperature Range		-40 to +150	$^\circ\text{C}$
T_{STG}	Storage Temperature Range		-40 to +125	$^\circ\text{C}$
V_{isol}	Insulation Test Voltage	AC, $t=1\text{min}$	3000	V
Free-Wheeling Diode				
V_{RRM}	Repetitive Reverse Voltage		1200	V
$I_{F(AV)}$	Average Forward Current	$T_C=25^\circ\text{C}$	600	A
		$T_C=80^\circ\text{C}$	400	A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1\text{ms}$	800	A
I_{FSM}	Non-Repetitive Surge Forward Current	$T_{vj}=45^\circ\text{C}, t=10\text{ms}, \text{Sine}$	3000	A
		$T_{vj}=45^\circ\text{C}, t=8.3\text{ms}, \text{Sine}$	3500	A

MMG400KR120U

ELECTRICAL CHARACTERISTICS

T_C=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
IGBT						
V _{GE(th)}	Gate - Emitter Threshold Voltage	V _{CE} =V _{GE} , I _C =16mA	5.2	6	6.5	V
V _{CE(sat)}	Collector - Emitter Saturation Voltage	I _C =400A, V _{GE} =15V, T _{Vj} =125°C		1.8		V
		I _C =400A, V _{GE} =15V, T _{Vj} =125°C		2.0		V
I _{CEs}	Collector Leakage Current	V _{CE} =1200V, V _{GE} =0V, T _{Vj} =25°C			1	mA
		V _{CE} =1200V, V _{GE} =0V, T _{Vj} =125°C			5	mA
I _{GES}	Gate Leakage Current	V _{CE} =0V, V _{GE} =± 15V, T _{Vj} =125°C	-400		400	nA
Q _{ge}	Gate Charge	V _{CC} =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				1.4	
t _{d(on)}	Turn - on Delay Time	V _{CC} =600V, I _C =400A R _G =2.5 Ω, V _{GE} =± 15V T _{Vj} =25°C Inductive Load		130		ns
t _r	Rise Time			65		ns
t _{d(off)}	Turn - off Delay Time			430		ns
t _f	Fall Time			65		ns
t _{d(on)}	Turn - on Delay Time	V _{CC} =600V, I _C =400A R _G =2.5 Ω, V _{GE} =± 15V T _{Vj} =125°C Inductive Load		140		ns
t _r	Rise Time			65		ns
t _{d(off)}	Turn - off Delay Time			500		ns
t _f	Fall Time			80		ns
E _{on}	Turn - on Switching Energy	V _{CC} =600V, I _C =400A T _{Vj} =125°C		34.4		mJ
		R _G =2.5 Ω T _{Vj} =125°C		49.6		mJ
E _{off}	Turn - off Switching Energy	V _{GE} =± 15V T _{Vj} =25°C		27.2		mJ
		Inductive Load T _{Vj} =125°C		43.2		mJ
Free-Wheeling Diode						
V _F	Forward Voltage	I _F =400A, V _{GE} =0V, T _{Vj} =25°C		1.95		V
		I _F =400A, V _{GE} =0V, T _{Vj} =125°C		1.95		V
I _{RRM}	Max. Reverse Recovery Current	I _F =400A, V _R =600V		310		A
Q _{rr}	Reverse Recovery Charge	di _F /dt=-4800A/μs		35		μC
E _{rec}	Reverse Recovery Charge	T _{Vj} =125°C		17		mJ

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R _{thJC}	Junction-to-Case Thermal Resistance	Per IGBT			0.065	K/W
R _{thJCD}	Junction-to-Case Thermal Resistance	Per Inverse Diode			0.11	K/W
Torque	Module-to-Sink	Recommended (M6)	3		5	N · m
Torque	Module Electrodes	Recommended (M6)	2.5		5	N · m
Torque	Module Electrodes	Recommended (M4)	0.7		1.1	N · m
Weight				325		g

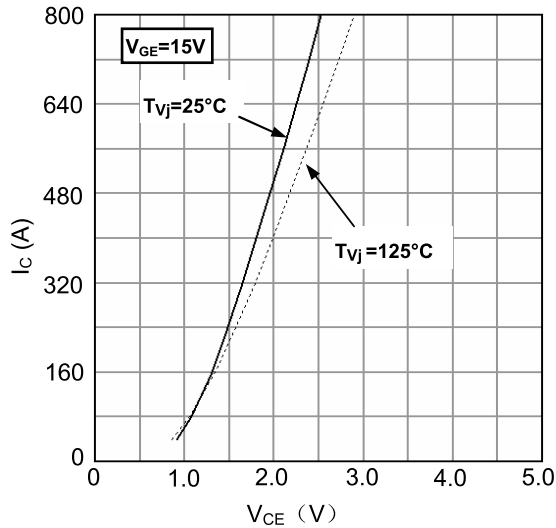


Figure1. Typical Output characteristics

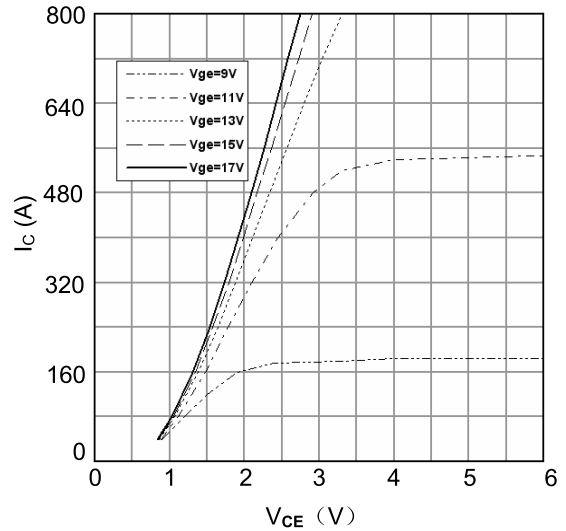


Figure2. Typical Output characteristics

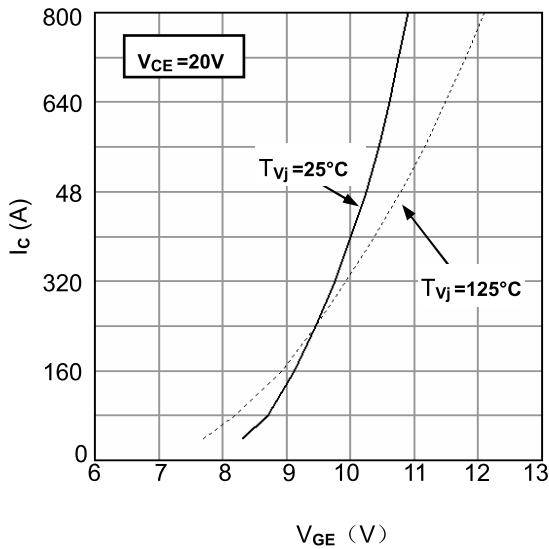


Figure3. Typical Transfer characteristics

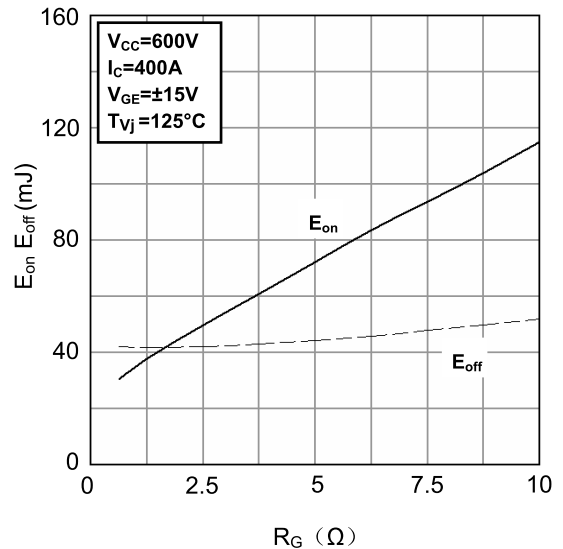


Figure4. Switching Energy vs. Gate Resistor

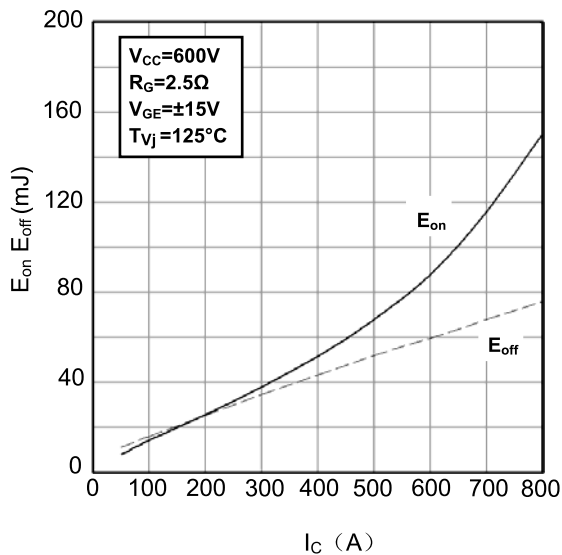


Figure5. Switching Energy vs. Collector Current

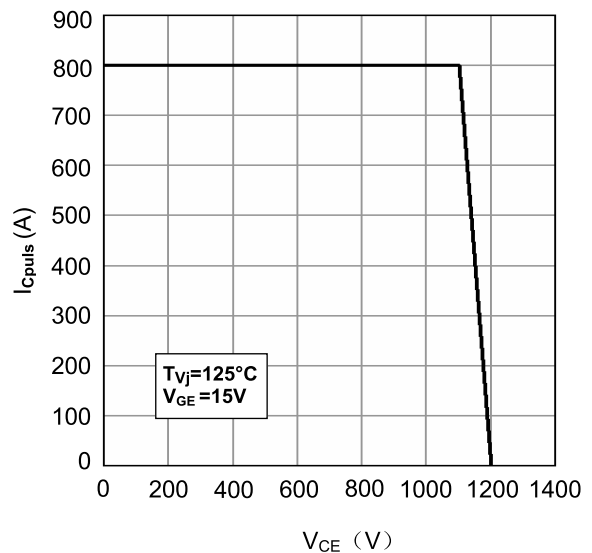


Figure8. Reverse Biased Safe Operating Area

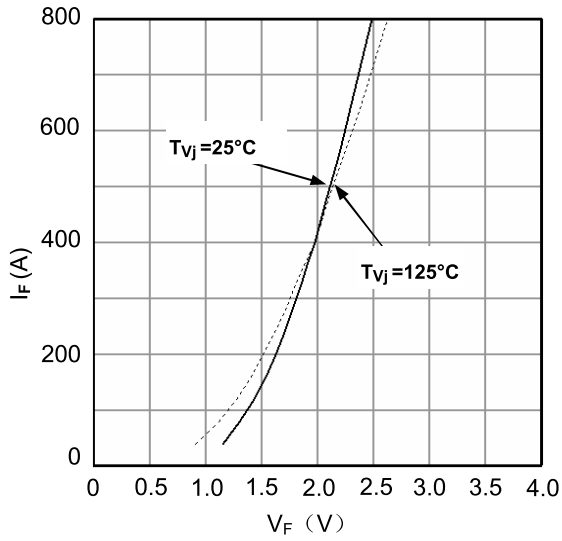


Figure7. Diode Forward Characteristics

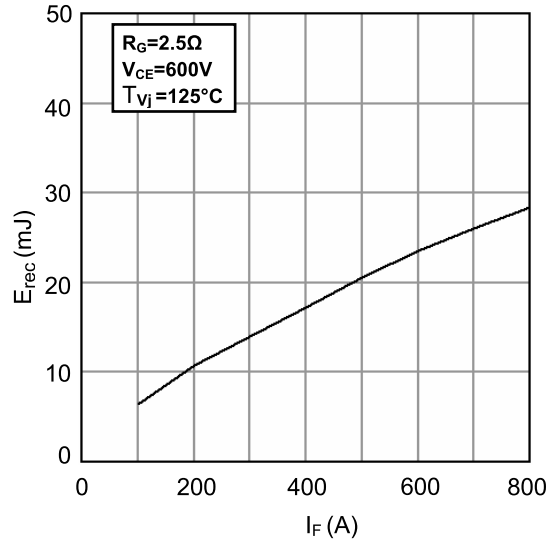


Figure8. Switching Energy vs. I_F

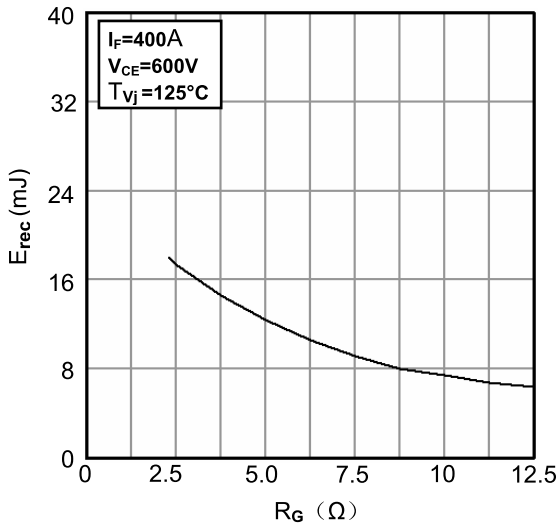


Figure8. Switching Energy vs. Gate Resistor

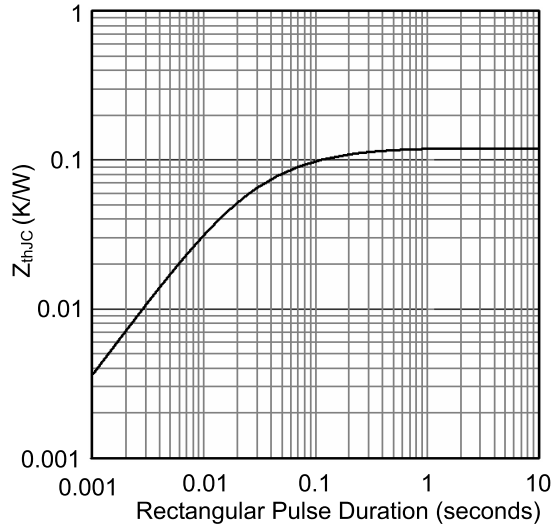


Figure10. Transient Thermal Impedance of Diode

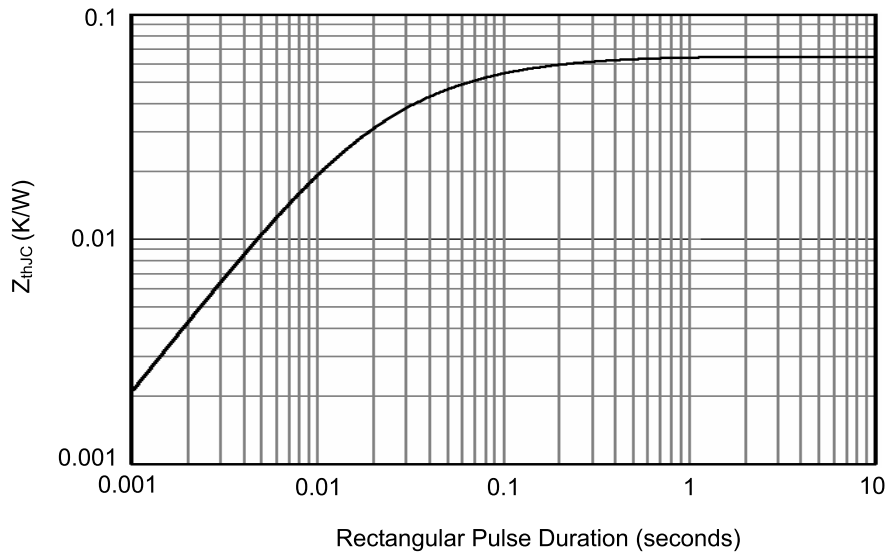


Figure11. Transient Thermal Impedance of IGBT

