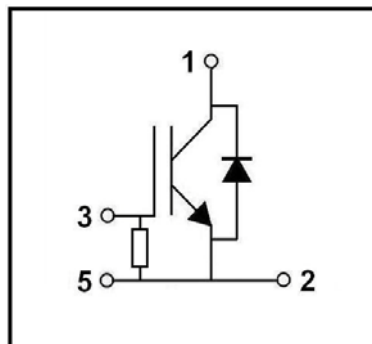


## FEATURES

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

## APPLICATIONS

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



## ABSOLUTE MAXIMUM RATINGS

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

Symbol	Parameter	Test Conditions	Values	Unit
<b>IGBT</b>				
$V_{CES}$	Collector - Emitter Voltage		1200	V
$V_{GES}$	Gate - Emitter Voltage		$\pm 20$	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
<b>Free-Wheeling Diode</b>				
$V_{RRM}$	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	$T_{vj}=45^\circ\text{C}, t=10\text{ms}, \text{Sine}$	2650	A
	Forward Current	$T_{vj}=45^\circ\text{C}, t=8.3\text{ms}, \text{Sine}$	2950	A

# MMG400K120U6TNB

## ELECTRICAL CHARACTERISTICS

T<sub>C</sub>=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>IGBT</b>						
V <sub>GE(th)</sub>	Gate - Emitter Threshold Voltage	V <sub>CE</sub> =V <sub>GE</sub> , I <sub>C</sub> =16mA	5.0	5.8	6.5	V
V <sub>CE(sat)</sub>	Collector - Emitter Saturation Voltage	I <sub>C</sub> =400A, V <sub>GE</sub> =15V, T <sub>vj</sub> =125°C		1.7		V
		I <sub>C</sub> =400A, V <sub>GE</sub> =15V, T <sub>vj</sub> =125°C		1.9		V
I <sub>CEs</sub>	Collector Leakage Current	V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>vj</sub> =25°C			5	mA
I <sub>GES</sub>	Gate Leakage Current	V <sub>CE</sub> =0V, V <sub>GE</sub> =±20V			400	nA
R <sub>Gint</sub>	Integrated Gate Resistor			1.9		Ω
Q <sub>ge</sub>	Gate Charge	V <sub>CC</sub> =600V, I <sub>C</sub> =400A, V <sub>GE</sub> = ±15V		3.7		μC
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f =1MHz		28		nF
C <sub>res</sub>	Reverse Transfer Capacitance				1.2	
t <sub>d(on)</sub>	Turn - on Delay Time	V <sub>CC</sub> =600V, I <sub>C</sub> =400A R <sub>G</sub> =1.8 Ω, V <sub>GE</sub> =±15V T <sub>vj</sub> =125°C Inductive Load		160		ns
t <sub>r</sub>	Rise Time			40		ns
t <sub>d(off)</sub>	Turn - off Delay Time			450		ns
t <sub>f</sub>	Fall Time			100		ns
t <sub>d(on)</sub>	Turn - on Delay Time			170		ns
t <sub>r</sub>	Rise Time	V <sub>CC</sub> =600V, I <sub>C</sub> =400A R <sub>G</sub> =1.8 Ω, V <sub>GE</sub> =±15V T <sub>vj</sub> =125°C Inductive Load		45		ns
t <sub>d(off)</sub>	Turn - off Delay Time			520		ns
t <sub>f</sub>	Fall Time			160		ns
E <sub>on</sub>	Turn - on Switching Energy		V <sub>CC</sub> =600V, I <sub>C</sub> =400A, T <sub>vj</sub> =125°C		18	
E <sub>off</sub>	Turn - off Switching Energy	R <sub>G</sub> =1.8 Ω, T <sub>vj</sub> =125°C		28		mJ
		V <sub>GE</sub> =±15V, T <sub>vj</sub> =25°C		30		mJ
		Inductive Load, T <sub>vj</sub> =125°C		45		mJ
<b>Free-Wheeling Diode</b>						
V <sub>F</sub>	Forward Voltage	I <sub>F</sub> =400A, V <sub>GE</sub> =0V, T <sub>vj</sub> =25°C		1.65	2.15	V
		I <sub>F</sub> =400A, V <sub>GE</sub> =0V, T <sub>vj</sub> =125°C		1.65		V
I <sub>RRM</sub>	Max. Reverse Recovery Current	I <sub>F</sub> =400A, V <sub>R</sub> =600V		480		A
Q <sub>rr</sub>	Reverse Recovery Charge	di <sub>F</sub> /dt=-8000A/μs		80		μC
E <sub>rec</sub>	Reverse Recovery Charge	T <sub>vj</sub> =125°C		37		mJ

## THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R <sub>thJC</sub>	Junction-to-Case Thermal Resistance	Per IGBT			0.065	K/W
R <sub>thJCD</sub>	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

**MMG400K120U6TNB**

Weight				325		g
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# MMG400K120U6TNB

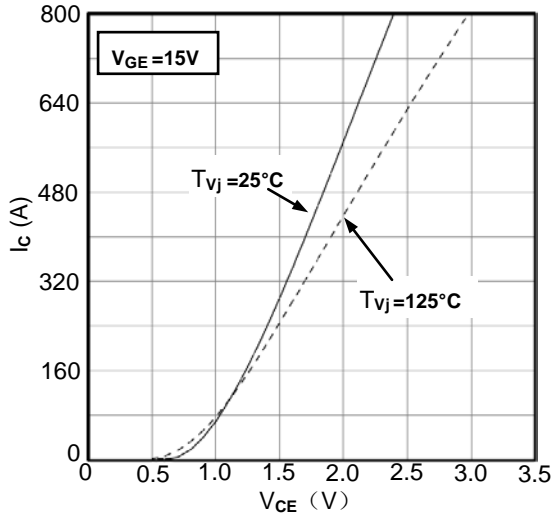


Figure1. Typical Output Characteristics

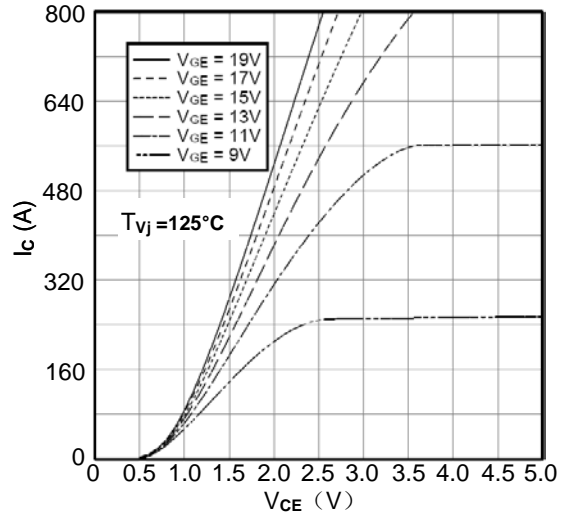


Figure2. Typical Output Characteristics

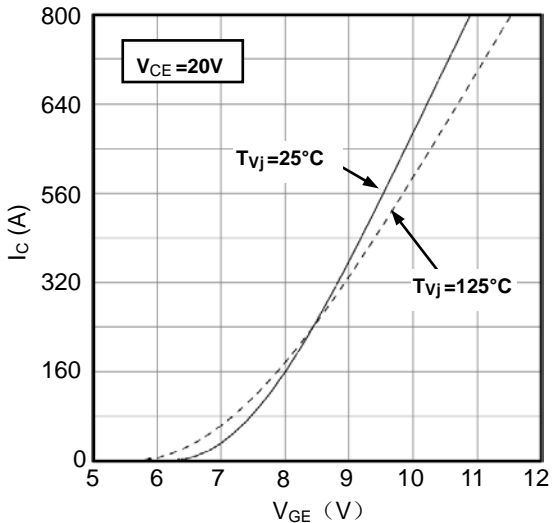


Figure3. Typical Transfer characteristics

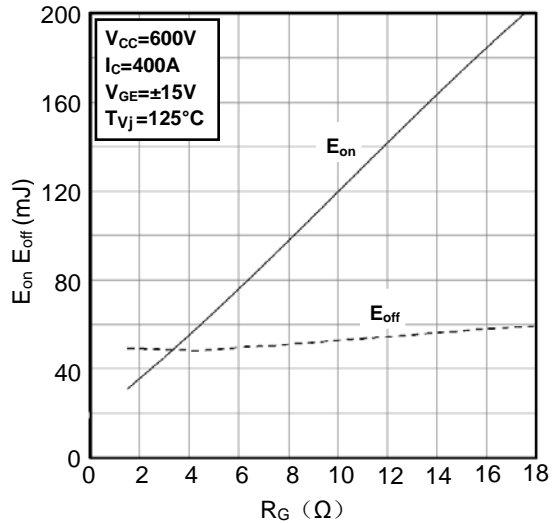


Figure4. Switching Energy vs. Gate Resistor

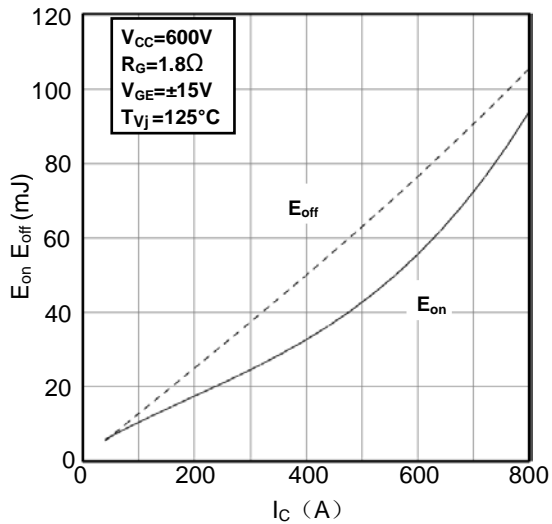


Figure5. Switching Energy vs. Collector Current

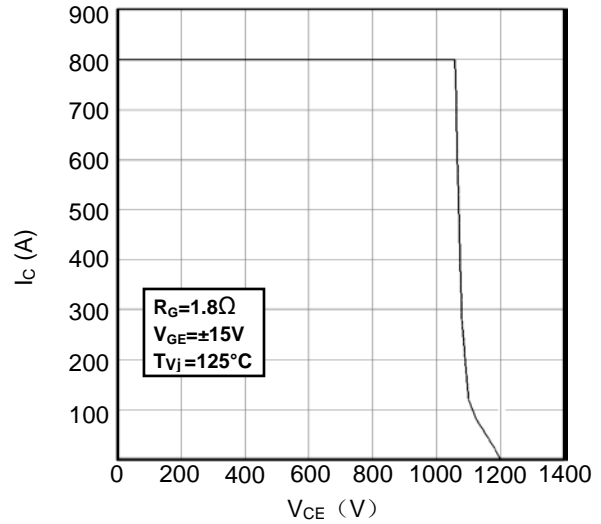


Figure6. Reverse Biased Safe Operating Area

# MMG400K120U6TNB

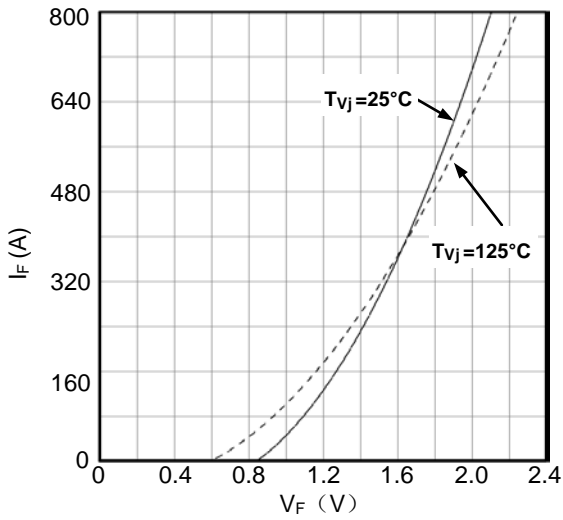


Figure 7. Diode Forward Characteristics

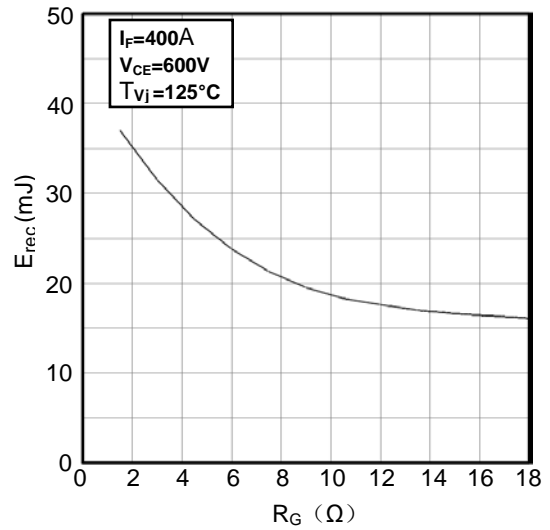


Figure 8. Switching Energy vs. Gate Resistor

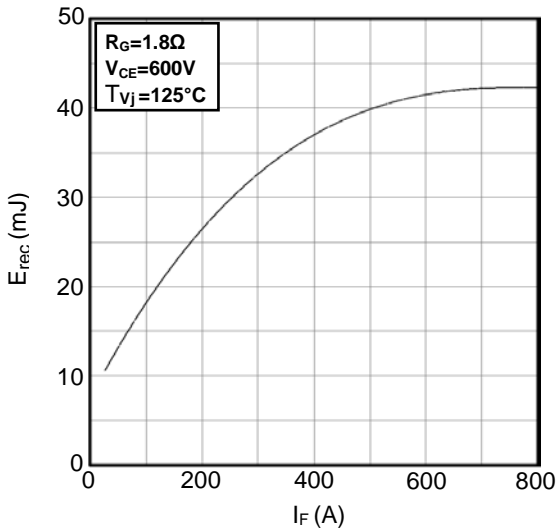


Figure 9. Switching Energy vs. Forward Current

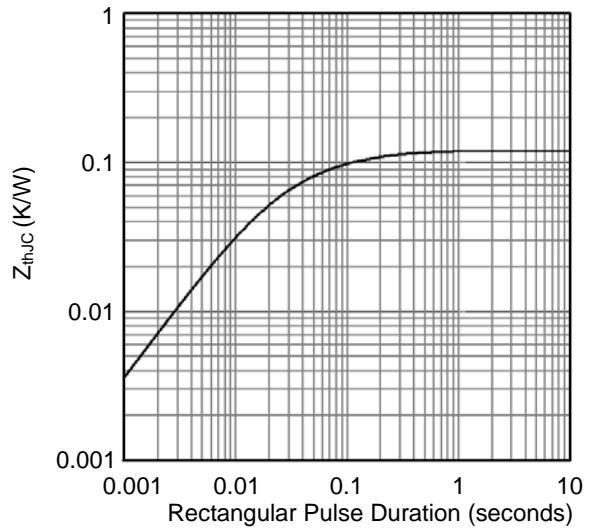


Figure 10. Transient Thermal Impedance of Diode

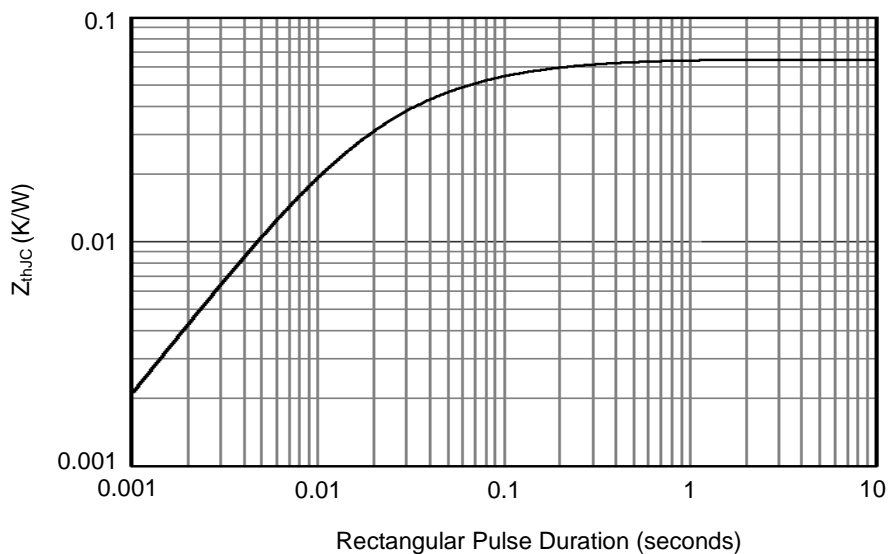


Figure 11. Transient Thermal Impedance of IGBT

