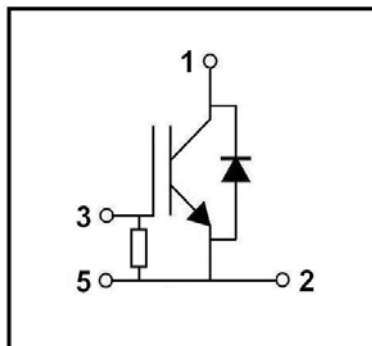


## FEATURES

- IGBT<sup>3</sup> 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  $\Omega$  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
<b>IGBT</b>				
$V_{CES}$	Collector - Emitter Voltage		1700	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		2270	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		1700	V
$I_{F(AV)}$	Average Forward Current	$T_C=25^\circ\text{C}$	400	A
$I_{FRM}$	Repetitive Peak Forward Current	$t_p=1\text{ms}$	800	A
$I_{FSM}$	Non-Repetitive Surge Forward Current	$T_{vj}=45^\circ\text{C}, t=10\text{ms}, \text{Sine}$	2250	A
		$T_{vj}=45^\circ\text{C}, t=8.3\text{ms}, \text{Sine}$	2450	A

## MMG400K170U6EN

### ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>IGBT</b>						
$V_{GE(th)}$	Gate - Emitter Threshold Voltage	$V_{CE}=V_{GE}, I_C=16\text{mA}$	5.2	5.8	6.4	V
$V_{CE(sat)}$	Collector - Emitter Saturation Voltage	$I_C=400\text{A}, V_{GE}=15\text{V}, T_{Vj}=125^\circ\text{C}$		2.0	2.45	V
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_{Vj}=125^\circ\text{C}$		2.4		V
$I_{CES}$	Collector Leakage Current	$V_{CE}=1700\text{V}, V_{GE}=0\text{V}, T_{Vj}=25^\circ\text{C}$			3	mA
$I_{GES}$	Gate Leakage Current	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}$	-400		400	nA
$R_{Gint}$	Integrated Gate Resistor			2.0		$\Omega$
$Q_g$	Gate Charge	$V_{CC}=900\text{V}, I_C=400\text{A}, V_{GE}=15\text{V}$		4.6		$\mu\text{C}$
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		36		nF
$C_{res}$	Reverse Transfer Capacitance				1.2	
$t_{d(on)}$	Turn - on Delay Time	$V_{CC}=900\text{V}, I_C=400\text{A}$ $R_G=3.3\ \Omega, V_{GE}=\pm 15\text{V}$ $T_{Vj}=25^\circ\text{C}$ Inductive Load		300		ns
$t_r$	Rise Time			80		ns
$t_{d(off)}$	Turn - off Delay Time			900		ns
$t_f$	Fall Time			120		ns
$t_{d(on)}$	Turn - on Delay Time	$V_{CC}=900\text{V}, I_C=400\text{A}$ $R_G=3.3\ \Omega, V_{GE}=\pm 15\text{V}$ $T_{Vj}=125^\circ\text{C}$ Inductive Load		400		ns
$t_r$	Rise Time			100		ns
$t_{d(off)}$	Turn - off Delay Time			1100		ns
$t_f$	Fall Time			200		ns
$E_{on}$	Turn - on Switching Energy	$V_{CC}=900\text{V}, I_C=400\text{A}, T_{Vj}=25^\circ\text{C}$		116		mJ
		$R_G=3.3\ \Omega, T_{Vj}=125^\circ\text{C}$		156		mJ
$E_{off}$	Turn - off Switching Energy	$V_{GE}=\pm 15\text{V}, T_{Vj}=25^\circ\text{C}$		86		mJ
		Inductive Load $T_{Vj}=125^\circ\text{C}$		126		mJ
<b>Free-Wheeling Diode</b>						
$V_F$	Forward Voltage	$I_F=400\text{A}, V_{GE}=0\text{V}, T_{Vj}=25^\circ\text{C}$		1.8	2.2	V
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_{Vj}=125^\circ\text{C}$		1.9		V
$I_{RRM}$	Max. Reverse Recovery Current	$I_F=400\text{A}, V_R=900\text{V}$		400		A
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt=-5000\text{A}/\mu\text{s}$		160		$\mu\text{C}$
$E_{rec}$	Reverse Recovery Energy	$T_{Vj}=125^\circ\text{C}$		96		mJ

### THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$R_{thJC}$	Junction-to-Case Thermal Resistance	Per IGBT			0.055	K /W
$R_{thJCD}$	Junction-to-Case Thermal Resistance	Per Inverse Diode			0.085	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				330		g

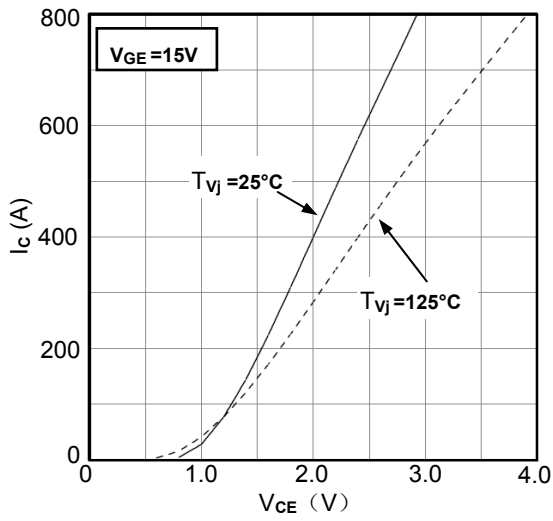


Figure1. Typical Output Characteristics

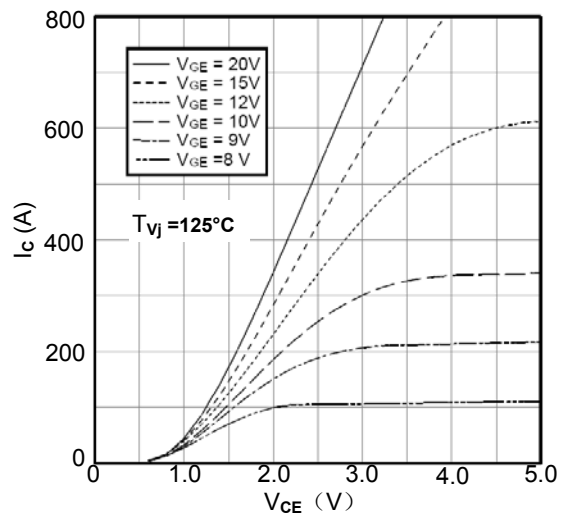


Figure2. Typical Output Characteristics

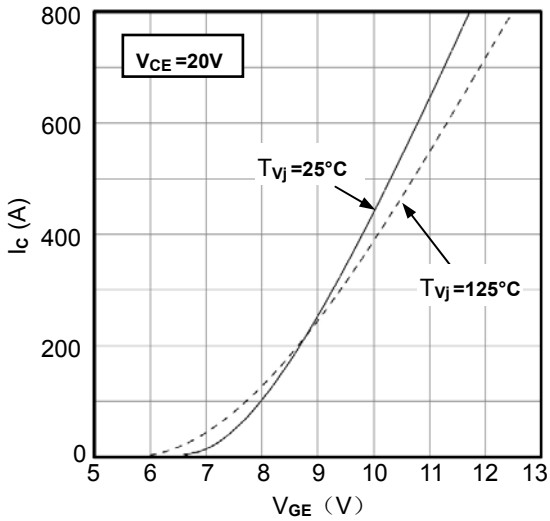


Figure3. Typical Transfer characteristics

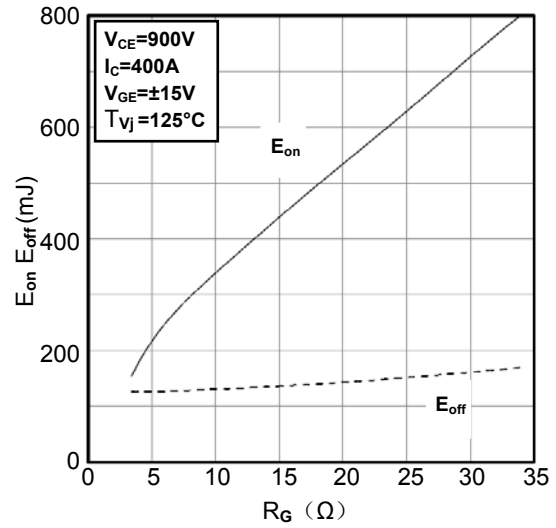


Figure4. Switching Energy vs. Gate Resistor

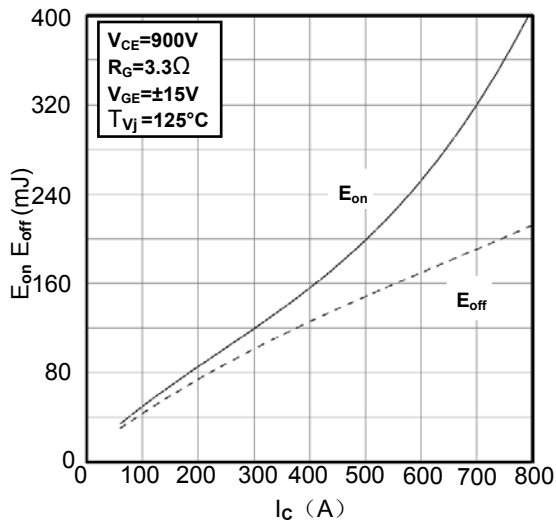


Figure5. Switching Energy vs. Collector Current

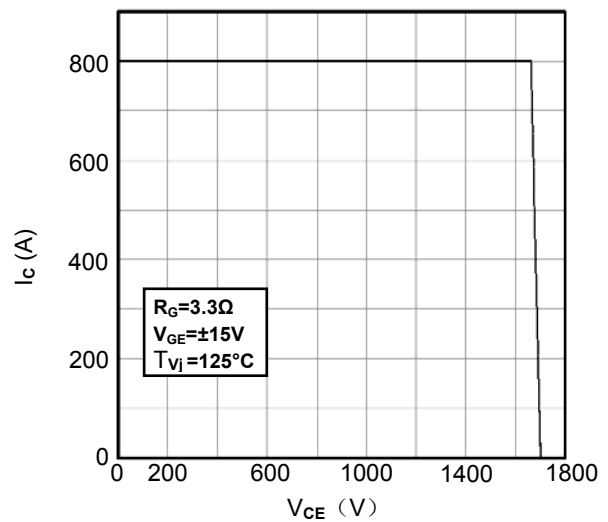


Figure6. Reverse Biased Safe Operating Area

**MMG400K170U6EN**

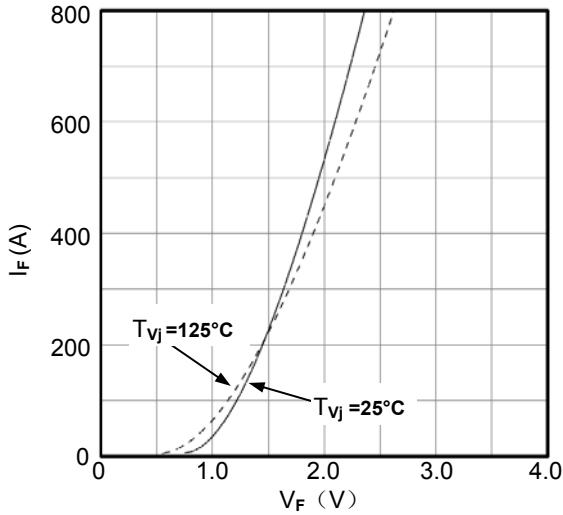


Figure7. Diode Forward Characteristics

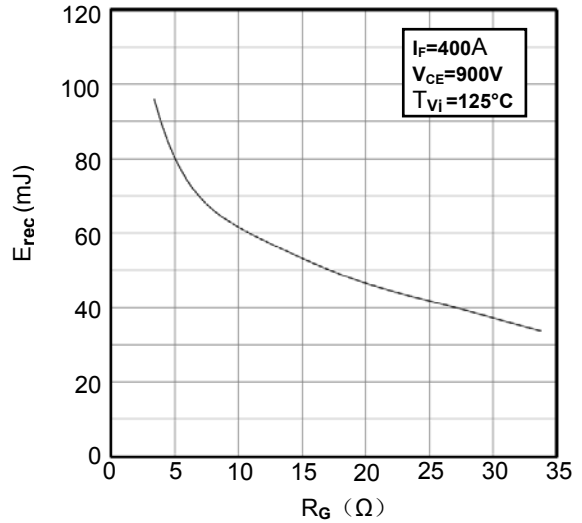


Figure8. Switching Energy vs. Gate Resistor

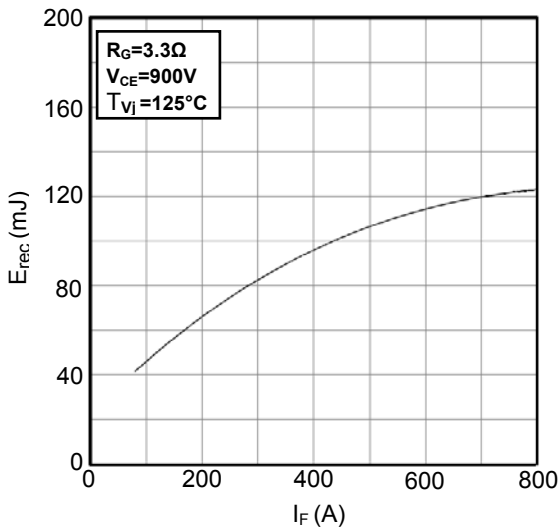


Figure9. Switching Energy vs. Forward Current

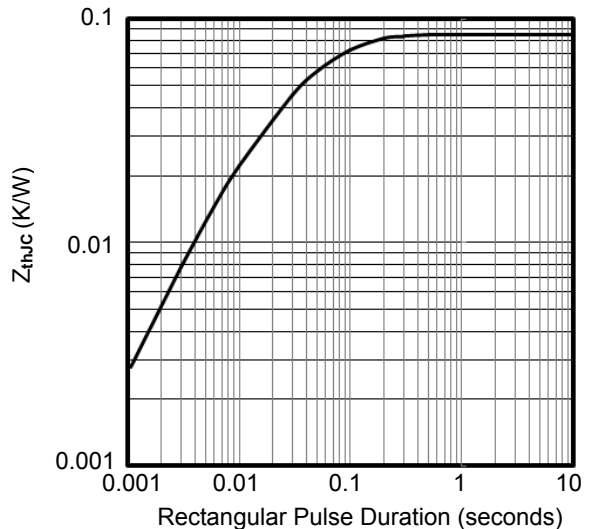


Figure10. Transient Thermal Impedance of Diode

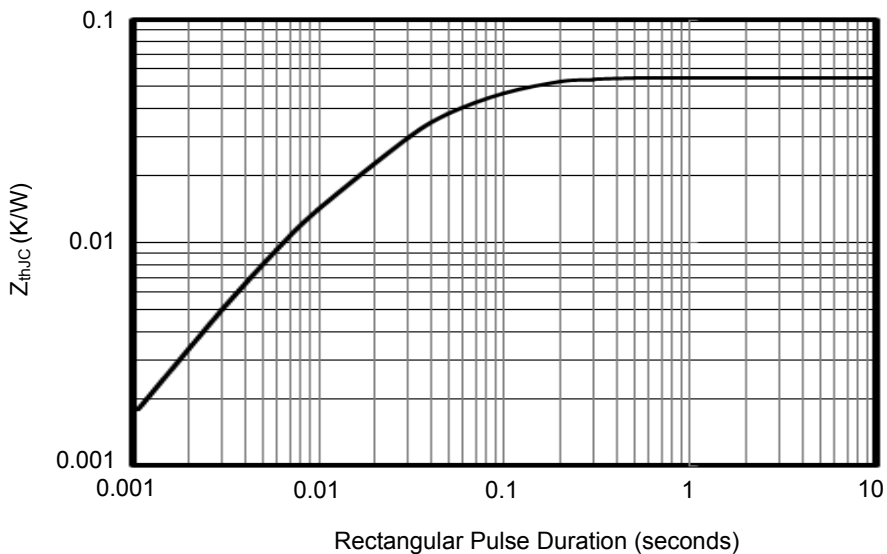


Figure11. Transient Thermal Impedance of IGBT

