

FEATURES

- ☐ High level of integration—only one power semiconductor module required for the whole drive
- ☐ Low saturation voltage and positive temperature coefficient
- ☐ Fast switching and short tail current
- ☐ Free wheeling diodes with fast and soft reverse recovery
- ☐ Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- ☐ Temperature sense included

APPLICATIONS

- ☐ AC motor control
- ☐ Motion/servo control
- ☐ Inverter and power supplies



PIM Three Phase Input Rectifier

INVERTER SECTOR

ABSOLUTE MAXIMUM RATINGS

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

Symbol	Parameter	Test Conditions	Values	Unit
IGBT				
V_{CES}	Collector - Emitter Voltage	$T_{vj}=25^{\circ}\text{C}$	1200	V
V_{GES}	Gate - Emitter Voltage		± 20	V
I_c	DC Collector Current	$T_c=25^{\circ}\text{C}$	55	A
		$T_c=80^{\circ}\text{C}$	40	A
I_{CM}	Repetitive Peak Collector Current	$t_p=1\text{ms}$	80	A
P_{tot}	Power Dissipation Per IGBT		195	W
Diode				
V_{RRM}	Repetitive Reverse Voltage	$T_{vj}=25^{\circ}\text{C}$	1200	V
$I_{F(AV)}$	Average Forward Current	$T_c=25^{\circ}\text{C}$	55	A
		$T_c=80^{\circ}\text{C}$	40	A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1\text{ms}$	80	A
I^2t		$T_{vj}=125^{\circ}\text{C}$, $t=10\text{ms}$, $V_R=0\text{V}$	300	A^2s

INVERTER SECTOR

ELECTRICAL AND THERMAL CHARACTERISTICS

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
IGBT						
$V_{GE(th)}$	Gate - Emitter Threshold Voltage	$V_{CE}=V_{GE}$, $I_C=1.5\text{mA}$	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector - Emitter Saturation Voltage	$I_C=40\text{A}$, $V_{GE}=15\text{V}$, $T_{VJ}=25^{\circ}\text{C}$		1.8		V
		$I_C=40\text{A}$, $V_{GE}=15\text{V}$, $T_{VJ}=125^{\circ}\text{C}$		2.05		V
I_{CES}	Collector Leakage Current	$V_{CE}=1200\text{V}$, $V_{GE}=0\text{V}$, $T_{VJ}=25^{\circ}\text{C}$			0.25	mA
		$V_{CE}=1200\text{V}$, $V_{GE}=0\text{V}$, $T_{VJ}=125^{\circ}\text{C}$			2	mA
I_{GES}	Gate Leakage Current	$V_{CE}=0\text{V}$, $V_{GE} \pm 15\text{V}$, $T_{VJ}=125^{\circ}\text{C}$	-400		400	nA
R_{Gint}	Integrated Gate Resistor			6.0		Ω
Q_{ge}	Gate Charge	$V_{CE}=600\text{V}$, $I_C=40\text{A}$, $V_{GE} = \pm 15\text{V}$		0.33		μC
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$		2.5		nF
C_{res}	Reverse Transfer Capacitance			0.11		nF
$t_{d(on)}$	Turn - on Delay Time	$V_{CC}=600\text{V}$, $I_C=40\text{A}$, $T_{VJ}=25^{\circ}\text{C}$		90		ns
		$R_G = 27\ \Omega$, $T_{VJ}=125^{\circ}\text{C}$		90		ns
t_r	Rise Time	$V_{GE} = \pm 15\text{V}$, $T_{VJ}=25^{\circ}\text{C}$		30		ns
		Inductive Load $T_{VJ}=125^{\circ}\text{C}$		50		ns
$t_{d(off)}$	Turn - off Delay Time	$V_{CC}=600\text{V}$, $I_C=40\text{A}$, $T_{VJ}=25^{\circ}\text{C}$		420		ns
		$R_G = 27\ \Omega$, $T_{VJ}=125^{\circ}\text{C}$		520		ns
t_f	Fall Time	$V_{GE} = \pm 15\text{V}$, $T_{VJ}=25^{\circ}\text{C}$		70		ns
		Inductive Load $T_{VJ}=125^{\circ}\text{C}$		90		ns
E_{on}	Turn - on Energy	$V_{CC}=600\text{V}$, $I_C=40\text{A}$, $T_{VJ}=25^{\circ}\text{C}$		4.1		mJ
		$R_G = 27\ \Omega$, $T_{VJ}=125^{\circ}\text{C}$		5.8		mJ
E_{off}	Turn - off Energy	$V_{GE} = \pm 15\text{V}$, $T_{VJ}=25^{\circ}\text{C}$		3.6		mJ
		Inductive Load $T_{VJ}=125^{\circ}\text{C}$		4.2		mJ
I_{sc}	Short Circuit Current	$t_{psc} \leq 10\ \mu\text{s}$, $V_{GE}=15\text{V}$ $T_{VJ}=125^{\circ}\text{C}$, $V_{CC}=900\text{V}$		160		A
R_{thJC}	Junction-to-Case Thermal Resistance (Per IGBT)				0.64	K /W
Diode						
V_F	Forward Voltage	$I_F=40\text{A}$, $V_{GE}=0\text{V}$, $T_{VJ}=25^{\circ}\text{C}$		1.80		V
		$I_F=40\text{A}$, $V_{GE}=0\text{V}$, $T_{VJ}=125^{\circ}\text{C}$		1.85		V
t_{rr}	Reverse Recovery Time	$I_F=40\text{A}$, $V_R=600\text{V}$ $di_F/dt=-400\text{A}/\mu\text{s}$ $T_{VJ}=125^{\circ}\text{C}$		240		ns
I_{RRM}	Max. Reverse Recovery Current			35		A
E_{rec}	Reverse Recovery Energy			2.8		mJ
R_{thJCD}	Junction-to-Case Thermal Resistance (Per Diode)				1.0	K /W

DIODE-RECTIFIER SECTOR
ABSOLUTE MAXIMUM RATINGS
T_C=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Values	Unit
V _{RRM}	Repetitive Reverse Voltage	T _{VJ} =25°C	1600	V
I _{F(AV)}	Average Forward Current	T _C =80°C	40	A
I _{FSM}	Non-Repetitive Surge Forward Current	T _{VJ} =45°C, t=10ms, 50Hz	320	A
		T _{VJ} =45°C, t=8.3ms, 60Hz	350	A
I ² t		T _{VJ} =45°C, t=10ms, 50Hz	512	A ² s
		T _{VJ} =45°C, t=8.3ms, 60Hz	612	A ² s

DIODE-RECTIFIER SECTOR
ELECTRICAL AND THERMAL CHARACTERISTICS
T_C=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _F	Forward Voltage	I _F =40A , T _{VJ} =25°C		1.2		V
		I _F =40A , T _{VJ} =125°C		1.15		V
I _R	Reverse Leakage Current	V _R =1600V, T _{VJ} =25°C			50	μA
		V _R =1600V, T _{VJ} =125°C			1	mA
R _{thJCD}	Junction-to-Case Thermal Resistance (Per Diode)				1.0	K /W

BRAKE-CHOPPER SECTOR
ABSOLUTE MAXIMUM RATINGS
T_C=25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Values	Unit
IGBT				
V _{CES}	Collector - Emitter Voltage	T _{VJ} =25°C	1200	V
V _{GES}	Gate - Emitter Voltage		± 20	V
I _C	DC Collector Current	T _C =25°C	25	A
		T _C =80°C	15	A
I _{CM}	Repetitive Peak Collector Current	t _p =1ms	30	A
P _{tot}	Power Dissipation Per IGBT		105	W
Diode				
V _{RRM}	Repetitive Reverse Voltage	T _{VJ} =25°C	1200	V
I _{F(AV)}	Average Forward Current	T _C =25°C	25	A
		T _C =80°C	15	A
I _{FRM}	Repetitive Peak Forward Current	t _p =1ms	30	A
I ² t		T _{VJ} =125°C, t=10ms, V _R =0V	60	A ² s

BRAKE-CHOPPER SECTOR**ELECTRICAL AND THERMAL 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 =0.5mA	5.0	5.8	6.5	V
V _{CE(sat)}	Collector - Emitter Saturation Voltage	I _C =15A, V _{GE} =15V, T _{VJ} =25°C		1.7		V
		I _C =15A, V _{GE} =15V, T _{VJ} =125°C		1.9		V
I _{CES}	Collector Leakage Current	V _{CE} =1200V, V _{GE} =0V, T _{VJ} =25°C			50	μA
		V _{CE} =1200V, V _{GE} =0V, T _{VJ} =125°C			1	mA
I _{GES}	Gate Leakage Current	V _{CE} =0V, V _{GE} ± 15V, T _{VJ} =125°C	-400		400	nA
R _{Gint}	Integrated Gate Resistor			0		Ω
Q _{ge}	Gate Charge	V _{CE} =600V, I _C =15A, V _{GE} = ± 15V		0.15		μC
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f =1MHz		1.1		nF
C _{res}	Reverse Transfer Capacitance			0.05		nF
t _{d(on)}	Turn - on Delay Time	V _{CC} =600V, I _C =15A, T _{VJ} =25°C		90		ns
		R _G =62 Ω, T _{VJ} =125°C		90		ns
t _r	Rise Time	V _{GE} = ± 15V, T _{VJ} =25°C		25		ns
		Inductive Load T _{VJ} =125°C		30		ns
t _{d(off)}	Turn - off Delay Time	V _{CC} =600V, I _C =15A, T _{VJ} =25°C		420		ns
		R _G =62 Ω, T _{VJ} =125°C		520		ns
t _f	Fall Time	V _{GE} = ± 15V, T _{VJ} =25°C		90		ns
		Inductive Load T _{VJ} =125°C		120		ns
E _{on}	Turn - on Energy	V _{CC} =600V, I _C =15A, T _{VJ} =25°C		1.4		mJ
		R _G =62 Ω, T _{VJ} =125°C		2.0		mJ
E _{off}	Turn - off Energy	V _{GE} = ± 15V, T _{VJ} =25°C		1.0		mJ
		Inductive Load T _{VJ} =125°C		1.2		mJ
I _{sc}	Short Circuit Current	t _{pse} ≤10μs, V _{GE} =15V T _{VJ} =125°C, V _{CC} =900V		55		A
R _{thJC}	Junction-to-Case Thermal Resistance (Per IGBT)				1.2	K /W
Diode						
V _F	Forward Voltage	I _F =15A, V _{GE} =0V, T _{VJ} =25°C		1.65		V
		I _F =15A, V _{GE} =0V, T _{VJ} =125°C		1.75		V
t _{rr}	Reverse Recovery Time	I _F =15A, V _R =600V		150		ns
I _{RRM}	Max. Reverse Recovery Current	di _F /dt=-400A/μs		15		A
E _{rec}	Reverse Recovery Energy	T _{VJ} =125°C		0.6		mJ
R _{thJCD}	Junction-to-Case Thermal Resistance (Per Diode)				2.1	K /W

NTC SECTOR

CHARACTERISTIC VALUES

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Resistance	$T_C = 25^{\circ}\text{C}$		5		$\text{K}\Omega$
$B_{25/50}$				3375		K

MODULE CHARACTERISTICS

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$T_{VJ\max}$	Max. Junction Temperature				150	$^{\circ}\text{C}$
$T_{VJ\text{op}}$	Operating Temperature		-40		125	$^{\circ}\text{C}$
T_{stg}	Storage Temperature		-40		125	$^{\circ}\text{C}$
V_{isol}	Insulation Test Voltage	AC, $t=1\text{min}$		3000		V
CTI	Comparative Tracking Index		250			
M_d	Mounting Torque	Recommended (M5)	2.5		5	$\text{N} \cdot \text{m}$
Weight				180		g

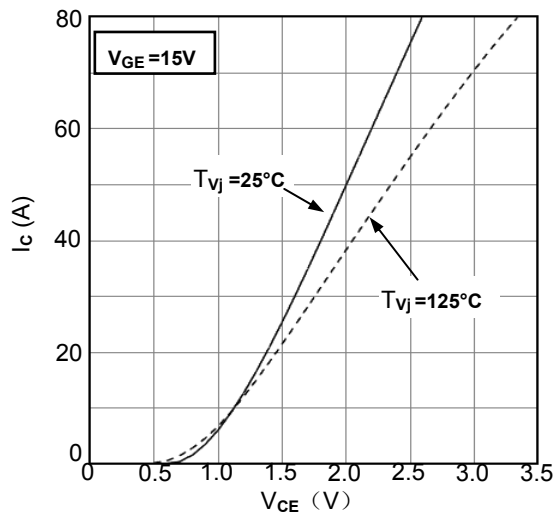


Figure1. Typical Output Characteristics
IGBT-inverter

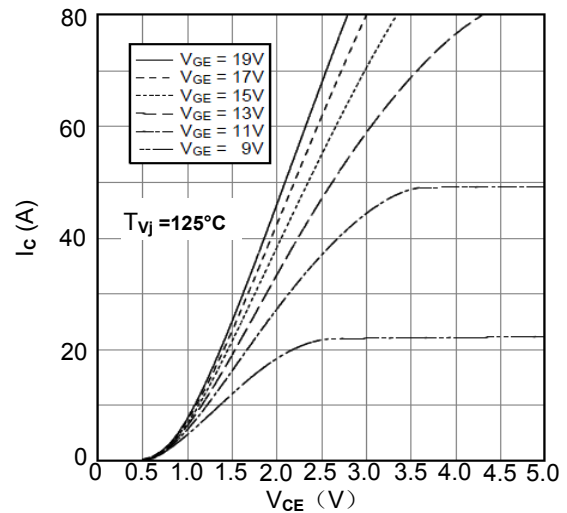


Figure2. Typical Output Characteristics
IGBT-inverter

MMG40H120XB6TN

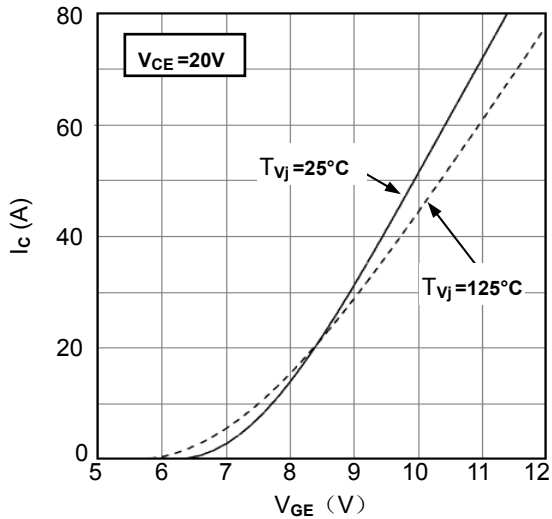


Figure3. Typical Transfer characteristics IGBT-inverter

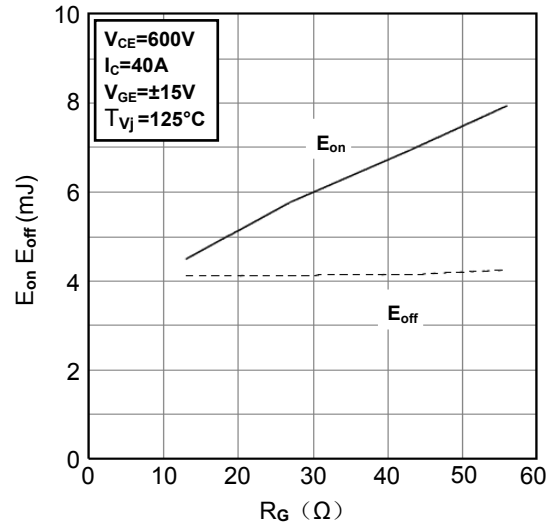


Figure4. Switching Energy vs. Gate Resistor IGBT-inverter

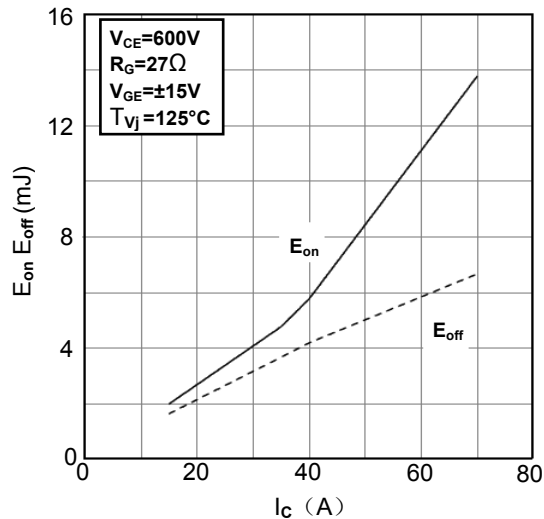


Figure5. Switching Energy vs. Collector Current IGBT-inverter

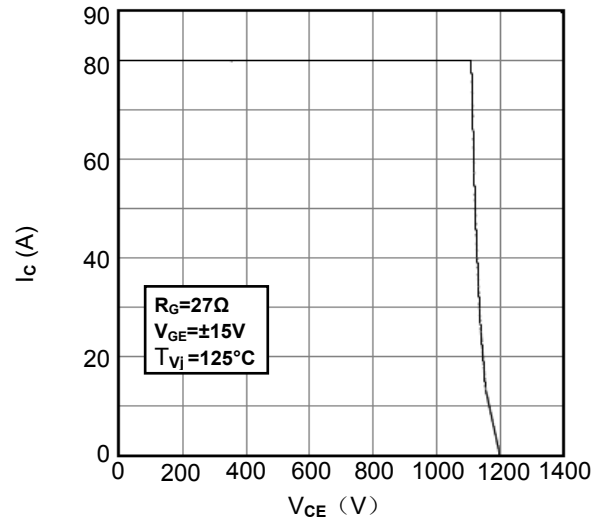


Figure6. Reverse Biased Safe Operating Area IGBT-inverter

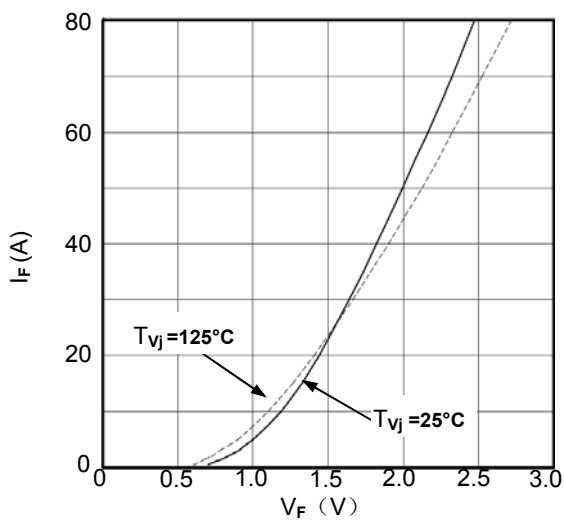


Figure7. Diode Forward Characteristics Diode -inverter

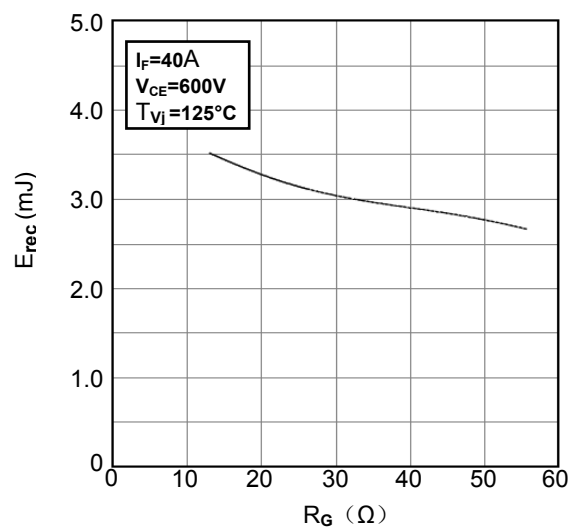


Figure8. Switching Energy vs. Gate Resistor Diode -inverter

MMG40H120XB6TN

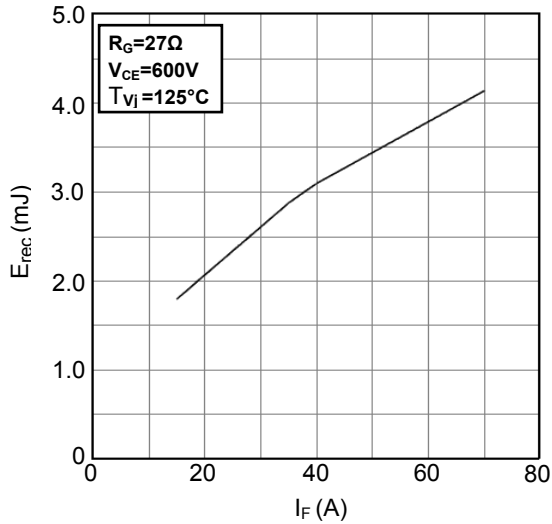


Figure9. Switching Energy vs. Forward Current
Diode-inverter

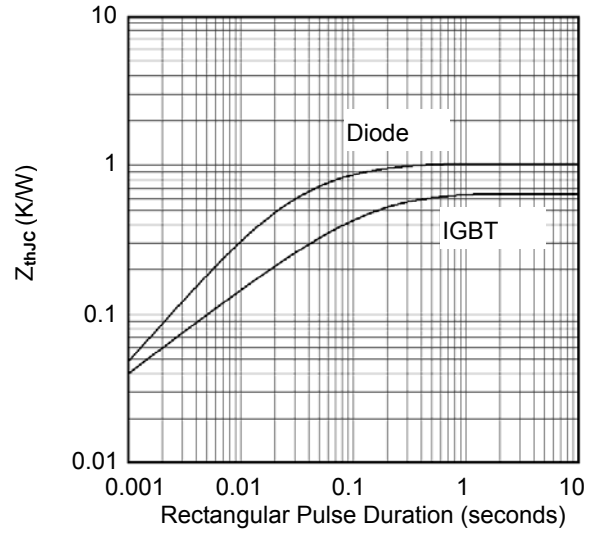


Figure10. Transient Thermal Impedance of
Diode and IGBT-inverter

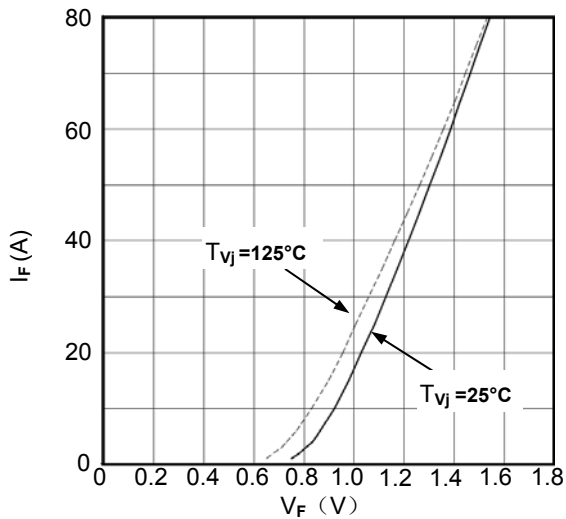


Figure11. Diode Forward Characteristics
Diode- rectifier

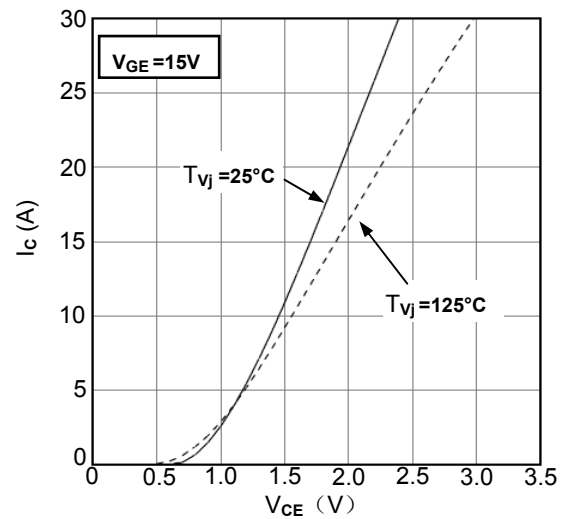


Figure12. Typical Output Characteristics
IGBT- brake chopper

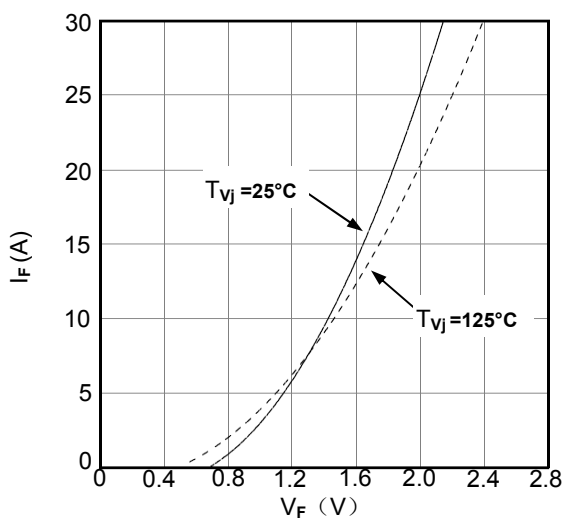


Figure13. Diode Forward Characteristics
Diode - brake chopper

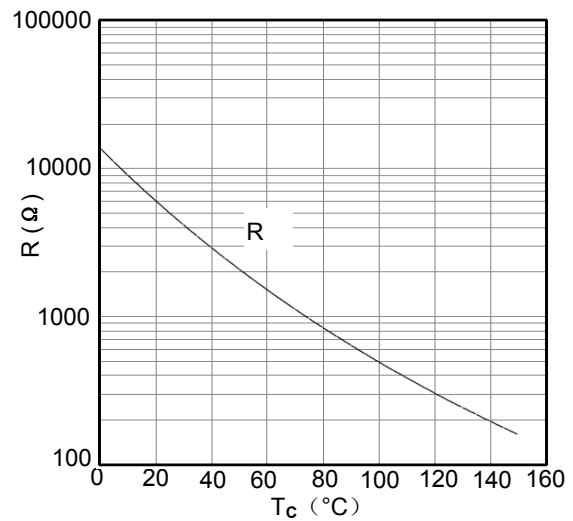


Figure14. NTC Characteristics

MMG40H120XB6TN

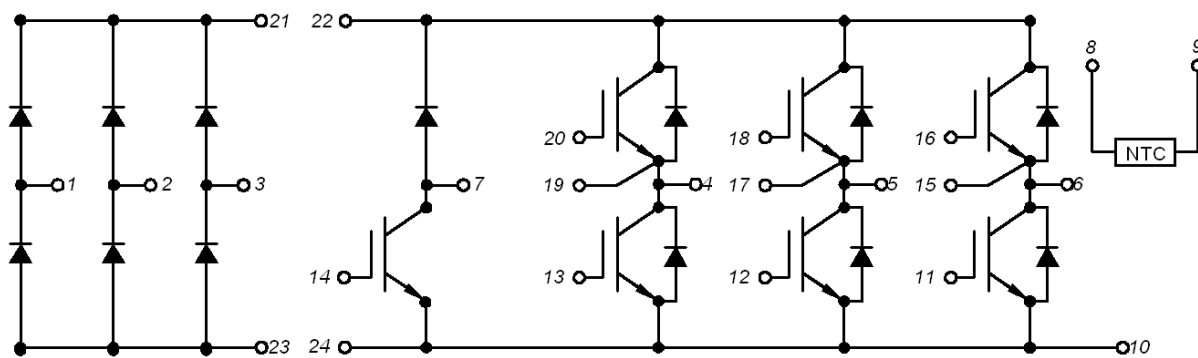
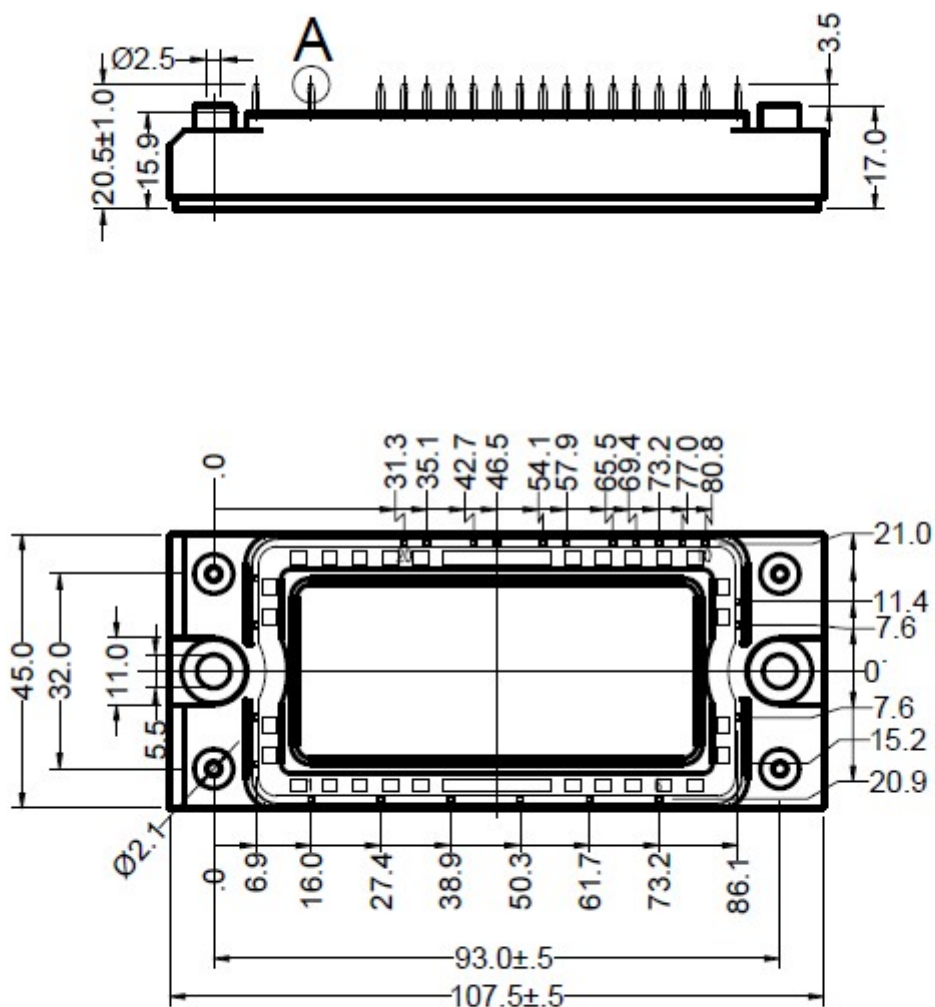


Figure15. Circuit Diagram



Dimensions (mm)
Figure16. Package Outline