MMG50CE120XB6T7

1200V 50A PIM Module

April 2025 Version 01 RoHS Compliant

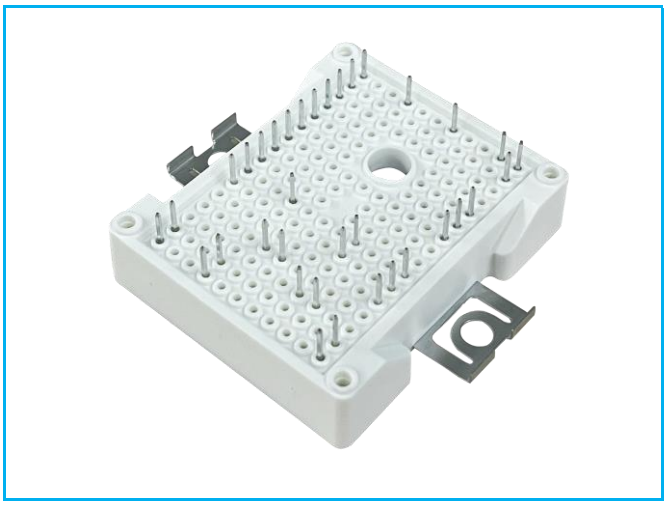
PRODUCT FEATURES

☐ Substrate for Low Thermal Resistance

☐ Low saturation voltage and positive temperature coefficient

☐ Solder Contact Technology, Rugged mounting due to integrated Mounting clamps

☐ High power density



Rectifier+Brake+Inverter

APPLICATIONS

☐ Air conditioning

☐ Auxiliary inverters

☐ Motor drives

IGBT-inverter

ABSOLUTE MAXIMUM RATINGS(T_C =25°C unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
V_{CES}	Collector Emitter Voltage	T_J=25℃	1200	V
V_{GES}	Gate Emitter Voltage		±20	
I_C	DC Collector Current	T_C=105℃, T_{Jmax}=175℃	50	A
I_{CM}	Repetitive Peak Collector Current	tp limited by T_{jop}	100	
P_{tot}	Power Dissipation Per IGBT	T_C=25℃, T_{Jmax}=175℃	340	W

Diode-inverter

ABSOLUTE MAXIMUM RATINGS (T_C =25°C unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_J=25℃	1200	V
I_F	Continue Forward Current	T_C=90℃, T_{Jmax}=175℃	50	A
I_{FRM}	Repetitive Peak Forward Current	tp=1ms	100	
I^2t		T_J=25℃, t=10ms, V_R=0V	600	A^2s
		T_J=150℃, t=10ms, V_R=0V	440	A^2s

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IGBT-inverter

ELECTRICAL CHARACTERISTICS *(T_C =25°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=3mA		5.5	6.4	7.0	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=50A, V_{GE}=15V, T_J=25℃			1.45		
		I_C=50A, V_{GE}=15V, T_J=125℃			1.66		
		I_C=50A, V_{GE}=15V, T_J=175℃			1.75		
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_J=25℃				100	μA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
R_{Gint}	Integrated Gate Resistor				4.4		Ω
Q_G	Gate Charge	V_{CE}=600V, I_C=50A , V_{GE}=15V			0.3		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =100kHz			6.75		nF
C_{oes}	Output Capacitance				1.85		nF
C_{res}	Reverse Transfer Capacitance				0.04		nF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=600V,I_C=50A, R_G =2Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		40		ns
			T_J=125℃		42		ns
			T_J=175℃		42		ns
t_r	Rise Time		T_J=25℃		18		ns
			T_J=125℃		22		ns
			T_J=175℃		24		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=600V,I_C=50A, R_G =2Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		292		ns
			T_J=125℃		334		ns
			T_J=175℃		346		ns
t_f	Fall Time		T_J=25℃		84		ns
			T_J=125℃		130		ns
			T_J=175℃		166		ns
E_{on}	Turn on Energy	V_{CC}=600V,I_C=50A, R_G =2Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		2.04		mJ
			T_J=125℃		4.00		mJ
			T_J=175℃		5.45		mJ
E_{off}	Turn off Energy		T_J=25℃		3.14		mJ
			T_J=125℃		4.27		mJ
			T_J=175℃		4.82		mJ
I_{SC}	Short Circuit Current	tpsc≤10μs , V_{GE}=15V T_J=150℃,V_{CC}=800V			180		A
I_{SC}	Short Circuit Current	tpsc≤7μs , V_{GE}=15V T_J=175℃,V_{CC}=800V			170		A
R_{thJC}	Junction to Case Thermal Resistance （ Per IGBT）					0.44	K /W

Diode-inverter

ELECTRICAL CHARACTERISTICS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=50A , V_{GE}=0V, T_J=25℃		1.98		V
		I_F=50A , V_{GE}=0V, T_J=125℃		1.72		
		I_F=50A , V_{GE}=0V, T_J=175℃		1.58		
t_{rr}	Reverse Recovery Time	I_F=50A , V_R=600V dI_F/dt=-3350A/μs T_J =25℃		60		ns
I_{RRM}	Max. Reverse Recovery Current			87		A
Q_{RR}	Reverse Recovery Charge			2.8		μC
E_{rec}	Reverse Recovery Energy			1.8		mJ
t_{rr}	Reverse Recovery Time	I_F=50A , V_R=600V dI_F/dt=-2350A/μs T_J =125℃		100		ns
I_{RRM}	Max. Reverse Recovery Current			105		A
Q_{RR}	Reverse Recovery Charge			5.6		μC
E_{rec}	Reverse Recovery Energy			3.6		mJ
t_{rr}	Reverse Recovery Time	I_F=50A , V_R=600V dI_F/dt=-1950A/μs T_J =175℃		135		ns
I_{RRM}	Max. Reverse Recovery Current			112		A
Q_{RR}	Reverse Recovery Charge			7.8		μC
E_{rec}	Reverse Recovery Energy			5.03		mJ
R_{thJCD}	Junction to Case Thermal Resistance (Per Diode)				0.66	K /W

Diode-RECTIFIER

ABSOLUTE MAXIMUM RATINGS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_J=25℃	1600	V
$I_{F(AV)}$	Average Forward Current Per Diode	T_C=90℃	50	A
I_{FSM}	Non Repetitive Surge Forward Current	T_J=25℃, t=10ms, 50Hz	520	
		T_J=150℃, t=10ms, 50Hz	430	
I^2t		T_J=25℃, t=10ms, 50Hz	1352	A^2s
		T_J=150℃, t=10ms, 50Hz	924	

Diode-RECTIFIER

ELECTRICAL CHARACTERISTICS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=50A , T_J=25℃		1.15	1.4	V
		I_F=50A , T_J=125℃		1.09		
		I_F=50A , T_J=150℃		1.07	1.35	
I_R	Reverse Leakage Current	V_R=1600V, T_J=25℃			5	μA
		V_R=1600V, T_J=150℃			1	mA
R_{thJCD}	Junction to Case Thermal Resistance （Per Diode）				0.62	K /W

IGBT-Brake chopper

ABSOLUTE MAXIMUM RATINGS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Values	Unit
V_{CES}	Collector Emitter Voltage	T_J=25℃	1200	V
V_{GES}	Gate Emitter Voltage		±20	
I_C	DC Collector Current	T_C=130℃, T_{Jmax}=175℃	35	A
I_{CM}	Repetitive Peak Collector Current	tp=1ms	70	
P_{tot}	Power Dissipation Per IGBT	T_C=25℃, T_{Jmax}=175℃	340	W

Diode-Brake chopper

ABSOLUTE MAXIMUM RATINGS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Values	Unit
V_{RRM}	Repetitive Reverse Voltage	T_J=25℃	1200	V
$I_{F(AV)}$	Average Forward Current		25	A
I_{FRM}	Repetitive Peak Forward Current	tp=1ms	50	
I^2t		T_J=25℃, t=10ms, V_R=0V	85	A^2s
		T_J=150℃, t=10ms, V_R=0V	68	A^2s

IGBT-Brake chopper

ELECTRICAL CHARACTERISTICS *(T_C =25°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=3mA		5.5	6.4	7.0	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=35A, V_{GE}=15V, T_J=25℃			1.28		
		I_C=35A, V_{GE}=15V, T_J=125℃			1.4		
		I_C=35A, V_{GE}=15V, T_J=175℃			1.45		
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_J=25℃				1	mA
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
R_{Gint}	Integrated Gate Resistor				5		Ω
Q_G	Gate Charge	V_{CE}=600V, I_C=35A , V_{GE}=15V			0.3		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =100kHz			6.75		nF
C_{oes}	Output Capacitance				1.85		nF
C_{res}	Reverse Transfer Capacitance				0.04		nF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=600V,I_C=35A, R_G =5.6Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		44		ns
			T_J=125℃		44		ns
			T_J=175℃		42		ns
t_r	Rise Time		T_J=25℃		16		ns
			T_J=125℃		22		ns
			T_J=175℃		26		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=600V,I_C=35A, R_G =5.6Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		346		ns
			T_J=125℃		394		ns
			T_J=175℃		412		ns
t_f	Fall Time		T_J=25℃		74		ns
			T_J=125℃		120		ns
			T_J=175℃		130		ns
E_{on}	Turn on Energy	V_{CC}=600V,I_C=35A, R_G =5.6Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		1.3		mJ
			T_J=125℃		2.8		mJ
			T_J=175℃		3.5		mJ
E_{off}	Turn off Energy		T_J=25℃		2.3		mJ
			T_J=125℃		3.1		mJ
			T_J=175℃		3.5		mJ
I_{SC}	Short Circuit Current	tpsc≤8μs , V_{GE}=15V T_J=150℃,V_{CC}=800V			180		A
I_{SC}	Short Circuit Current	tpsc≤7μs , V_{GE}=15V T_J=175℃,V_{CC}=800V			170		A
R_{thJC}	Junction to Case Thermal Resistance （ Per IGBT）					0.44	K /W

Diode-Brake chopper

ELECTRICAL CHARACTERISTICS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F=25A , V_{GE}=0V, T_J=25℃		2.15		V
		I_F=25A , V_{GE}=0V, T_J=125℃		1.83		
		I_F=25A , V_{GE}=0V, T_J=150℃		1.65		
t_{rr}	Reverse Recovery Time	I_F=25A , V_R=600V dI_F/dt=-2250A/μs T_J =25℃		42		ns
I_{RRM}	Max. Reverse Recovery Current			48.5		A
Q_{RR}	Reverse Recovery Charge			1.15		μC
E_{rec}	Reverse Recovery Energy			0.8		mJ
t_{rr}	Reverse Recovery Time	I_F=25A , V_R=600V dI_F/dt=-1650A/μs T_J =125℃		68		ns
I_{RRM}	Max. Reverse Recovery Current			51.7		A
Q_{RR}	Reverse Recovery Charge			2		μC
E_{rec}	Reverse Recovery Energy			1.45		mJ
t_{rr}	Reverse Recovery Time	I_F=25A , V_R=600V dI_F/dt=-1550A/μs T_J =175℃		120		ns
I_{RRM}	Max. Reverse Recovery Current			53		A
Q_{RR}	Reverse Recovery Charge			3		μC
E_{rec}	Reverse Recovery Energy			2.02		mJ
R_{thJCD}	Junction to Case Thermal Resistance (Per Diode)				1.33	K /W

NTC CHARACTERISTICS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
R_{25}	Resistance	T_C =25℃		5		kΩ
$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\ K))]$			3375		K

MODULE CHARACTERISTICS *(T_C=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Values	Unit
T_{Jmax}	Max. Junction Temperature	Inverter, Brake-Chopper	175	℃
		Rectifier	150	
T_{Jop}	Operating Temperature	Inverter, Brake-Chopper	-40~175	
		Rectifier	-40~150	
T_{stg}	Storage Temperature		-40~125	
V_{isol}	Isolation Breakdown Voltage	AC, 50Hz(R.M.S), t=1minute	2500	V
CTI	Comparative Tracking Index		>200	
F	Mounting Force Per Clamp		40~80	N
Weight			40	g

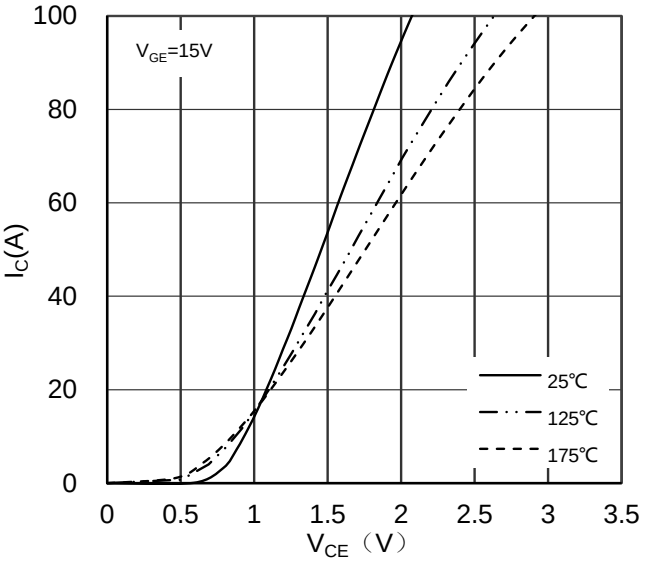


Figure 1. Typical Output Characteristics IGBT-inverter

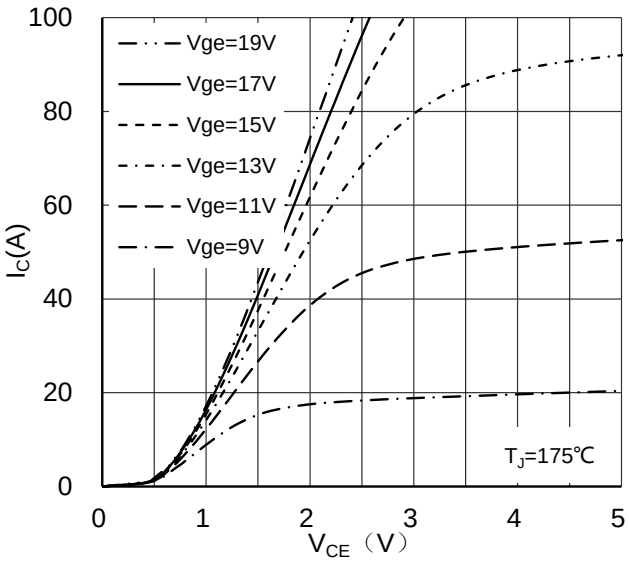


Figure 2. Typical Output Characteristics IGBT-inverter

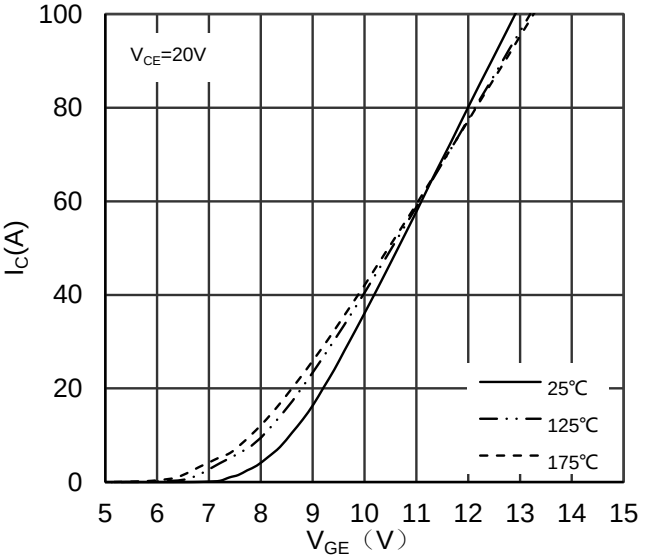


Figure 3. Typical Transfer characteristics IGBT-inverter

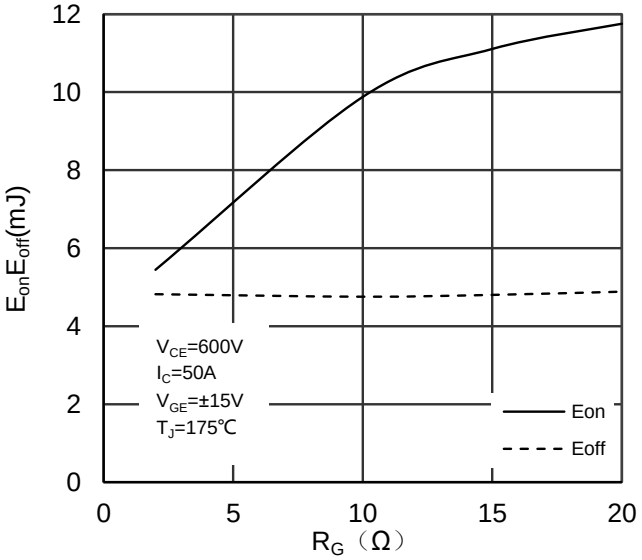


Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

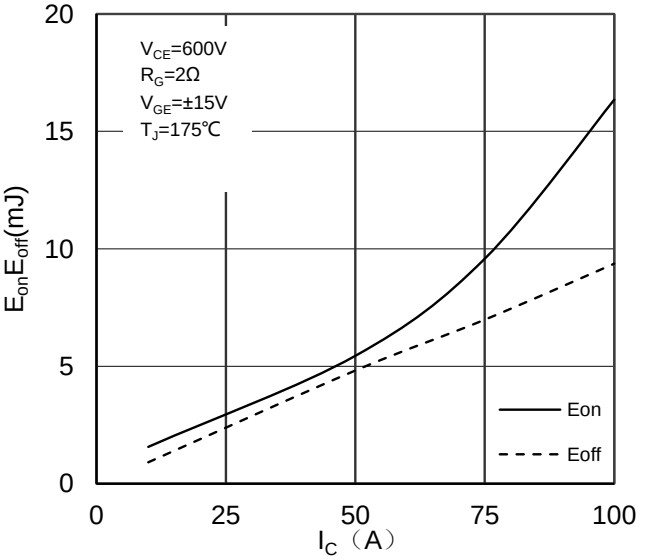


Figure 5. Switching Energy vs Collector Current IGBT-inverter

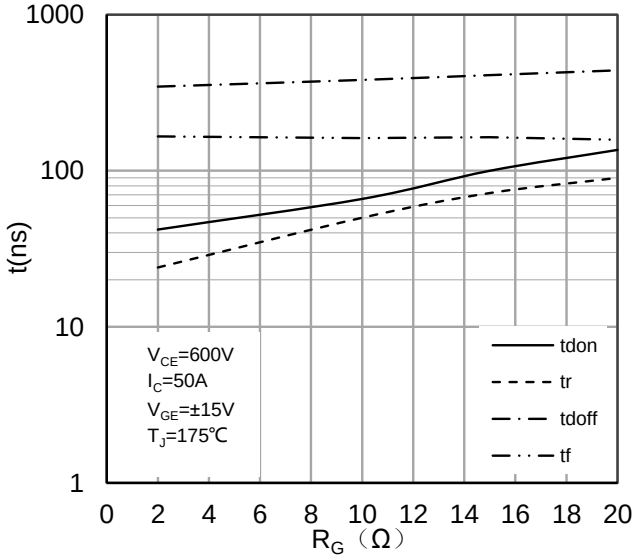


Figure 6. Switching Time vs Gate Resistor IGBT-inverter

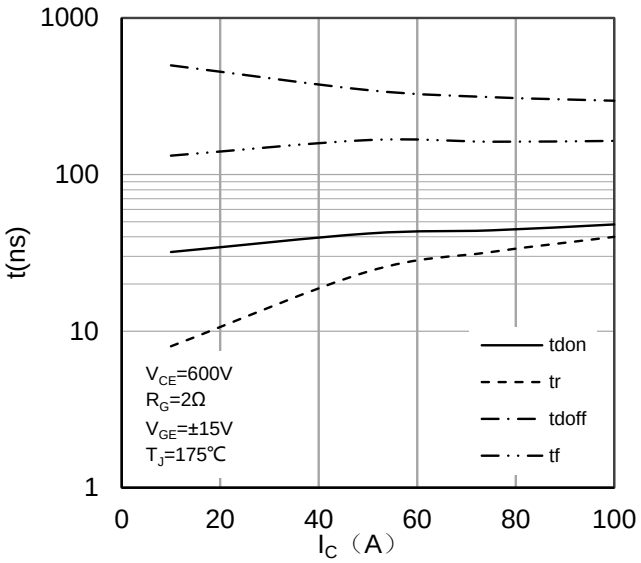


Figure 7. Switching Time vs Collector Current IGBT-inverter

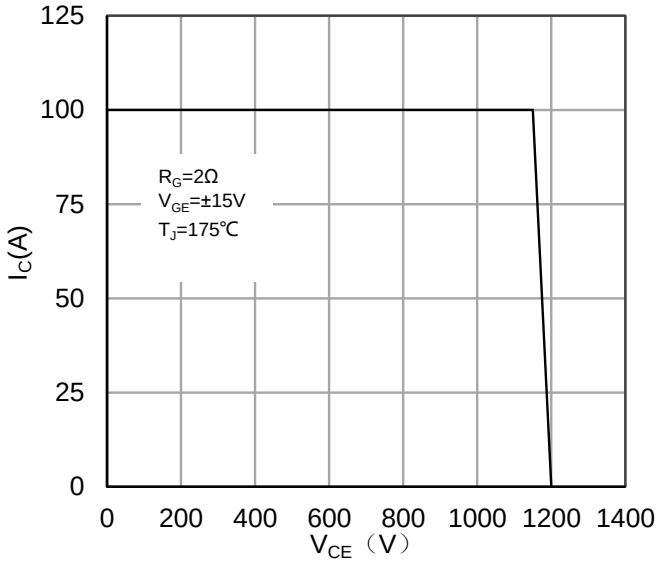


Figure 8. Reverse Bias Safe Operating Area IGBT-inverter

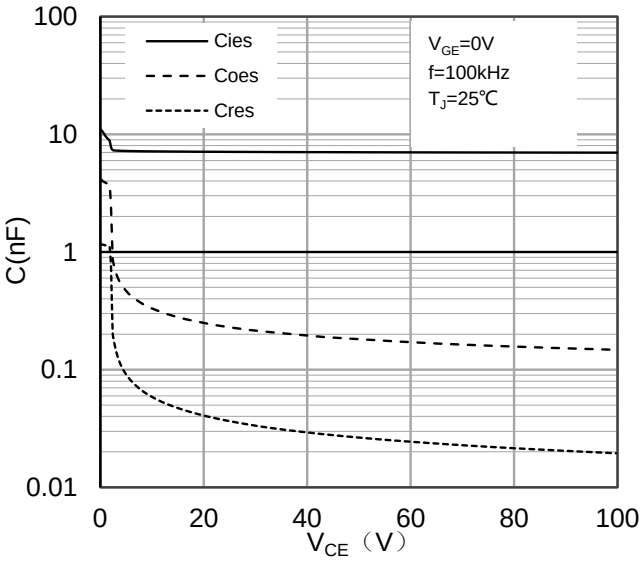


Figure 9. Typical capacitance of IGBT-inverter

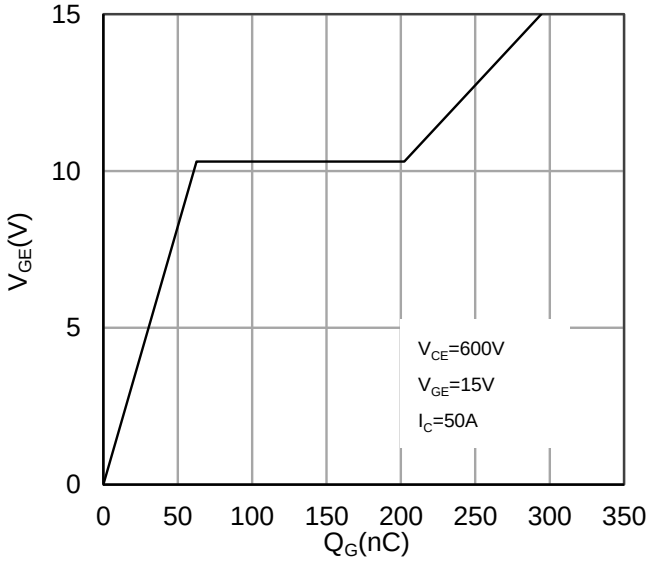


Figure 10. Typical Gate Charge of IGBT-inverter

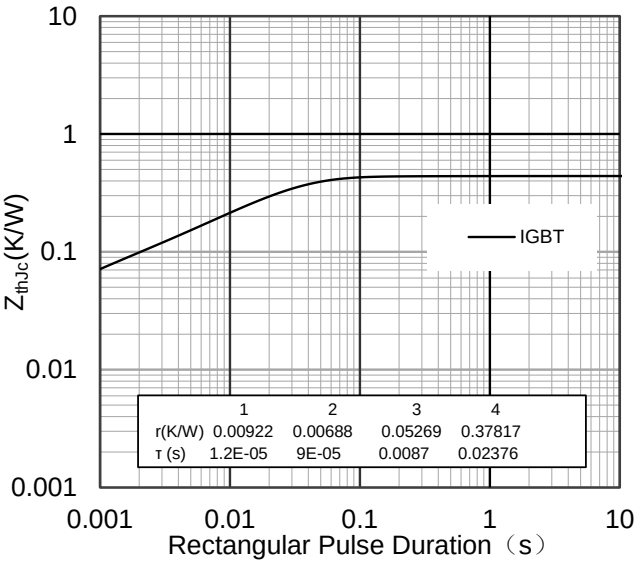


Figure 11. Transient Thermal Impedance of IGBT-inverter

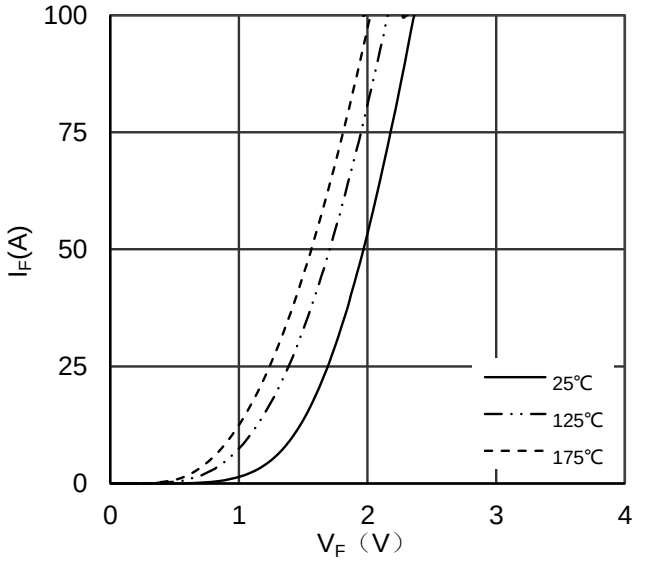


Figure 12. Diode Forward Characteristics Diode -inverter

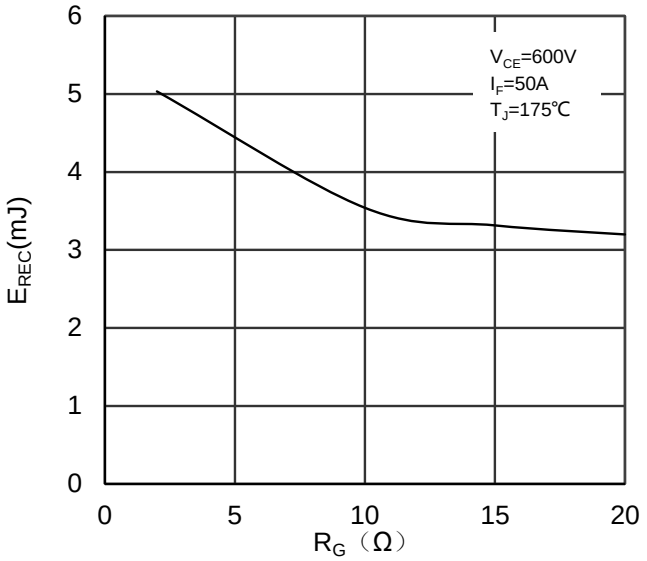


Figure 13. Switching Energy vs Gate Resistor Diode - inverter

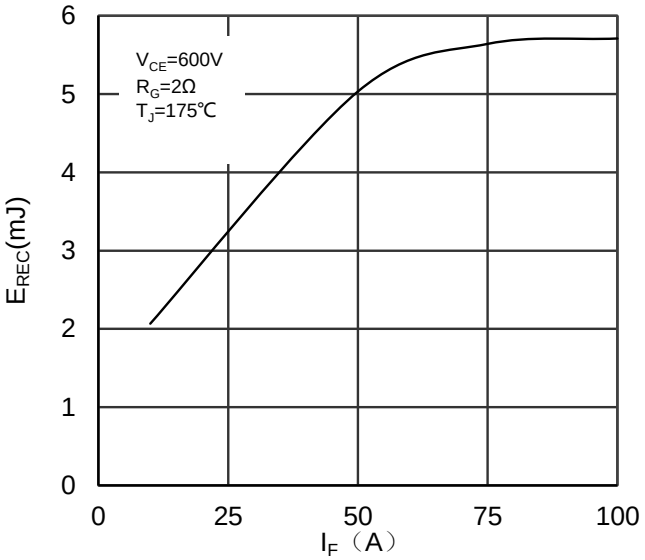


Figure 14. Switching Energy vs Forward Current Diode- inverter

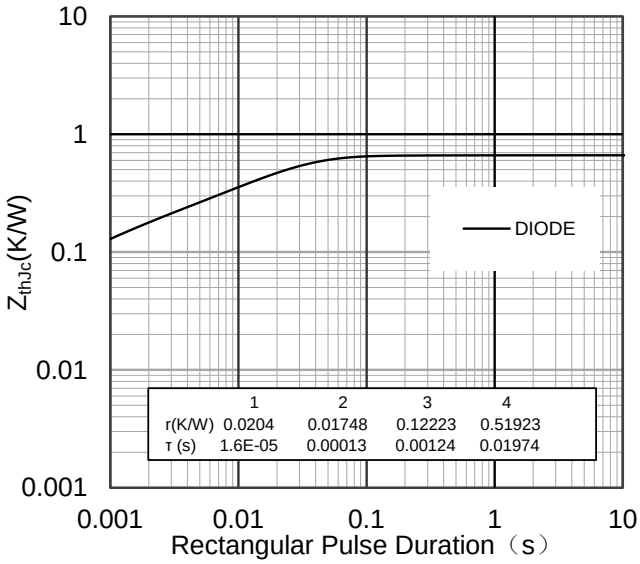


Figure 15. Transient Thermal Impedance of Diode-inverter

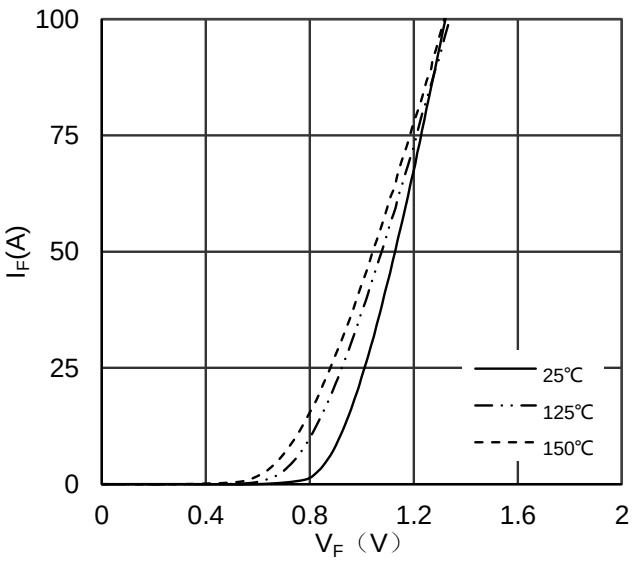


Figure 16. Diode Forward Characteristics Diode- rectifier

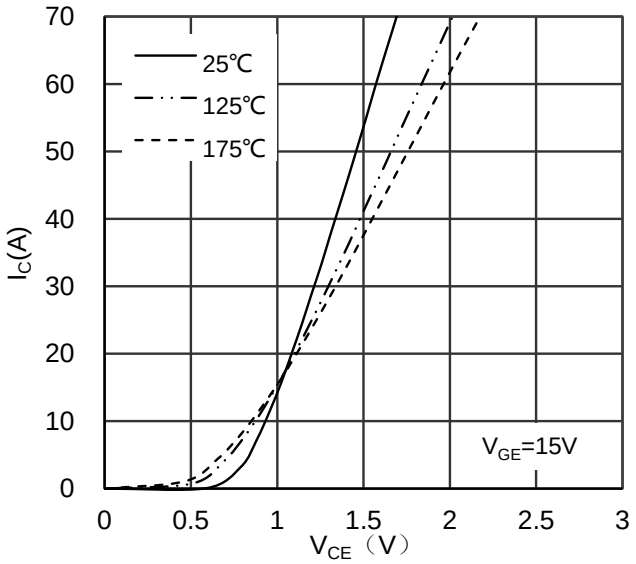


Figure 17. Typical Output Characteristics IGBT- brake chopper

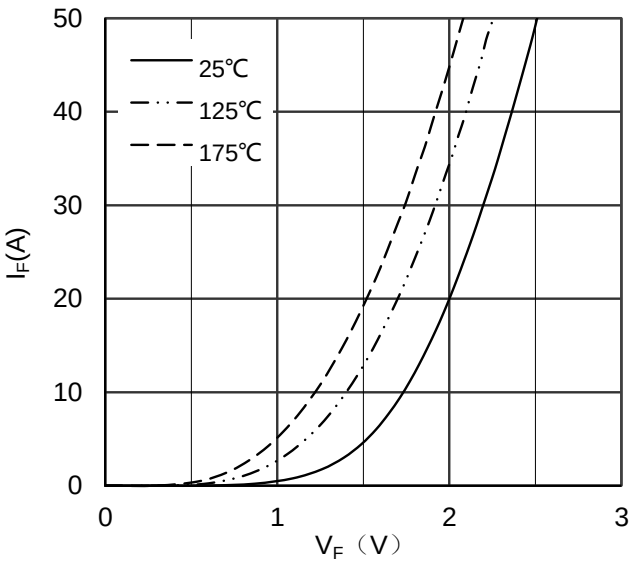


Figure 18. Diode Forward Characteristics Diode - brake chopper

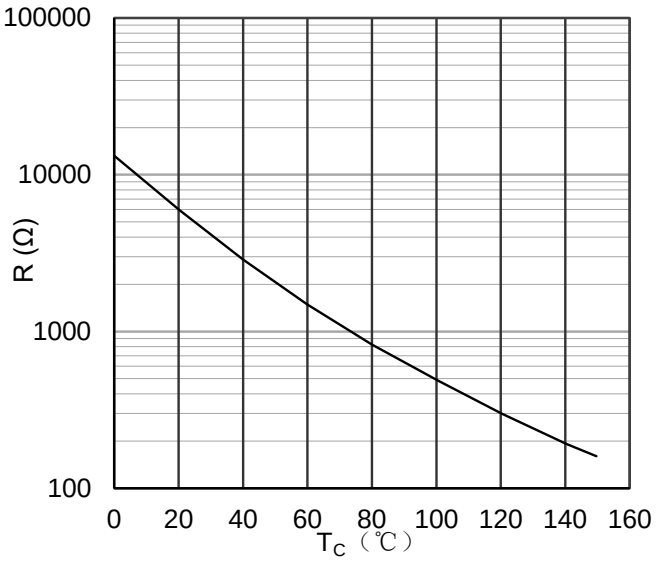


Figure 19. NTC Characteristics

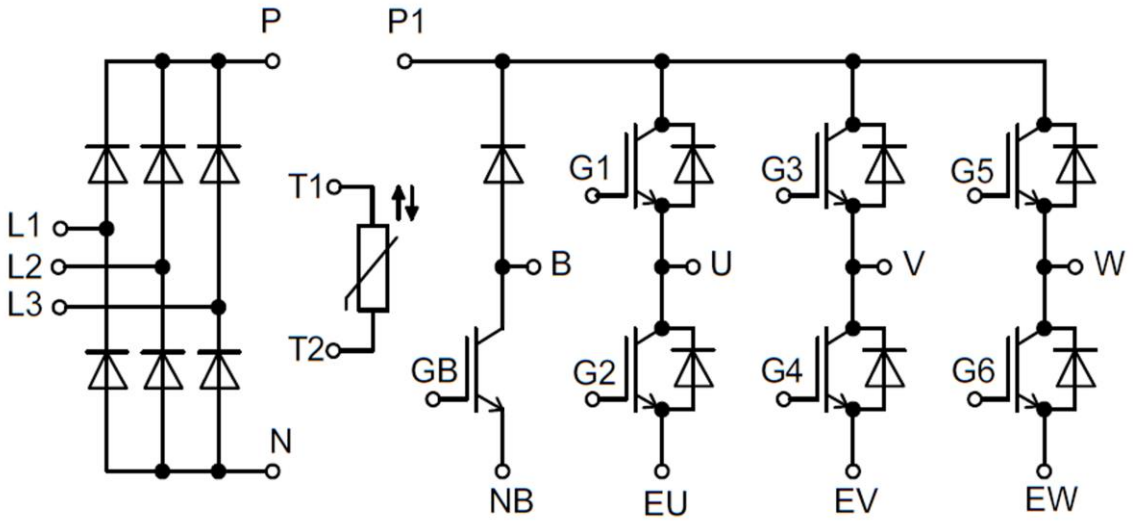
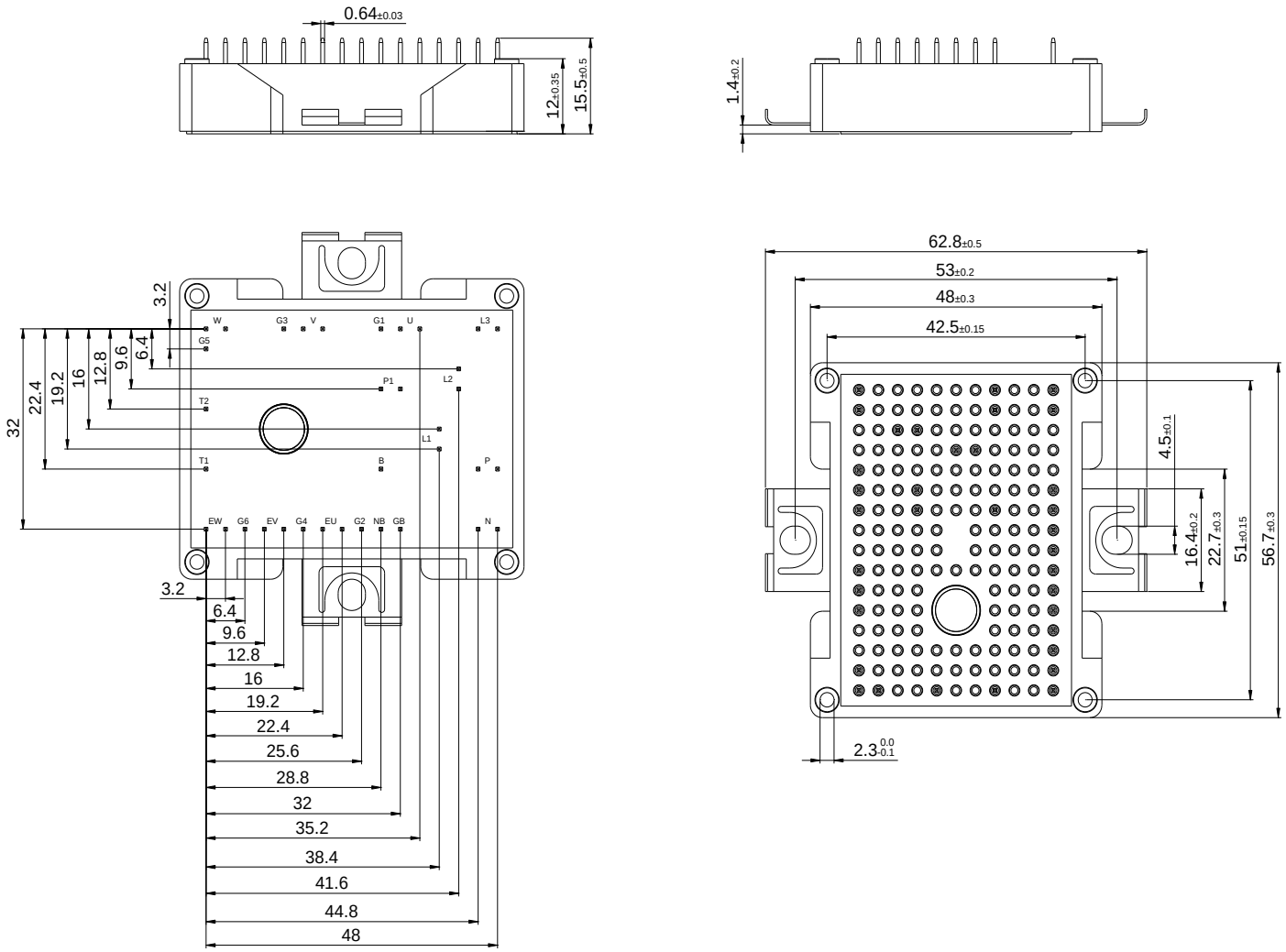


Figure 20. Circuit Diagram



Dimensions in （mm）

Figure 21. Package Outline