MMG50HD120XB6TC

1200V 50A PIM Module

August 2018 Version 01 RoHS Compliant

PRODUCT FEATURES

☐ High level of integration

☐ IGBT CHIP(Trench+Field Stop technology)

☐ 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

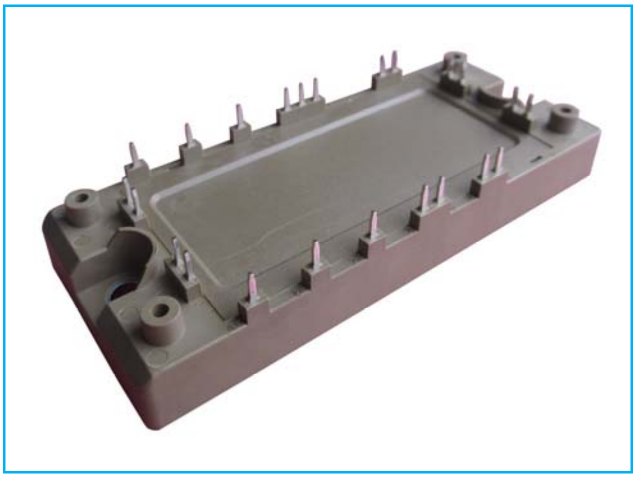
☐ Temperature sense included

APPLICATIONS

☐ AC motor control

☐ Motion/servo control

☐ Inverter and power supplies



Rectifier+Brake+Inverter

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=25℃, T_{Jmax}=175℃	77	A
		T_C=100℃, T_{Jmax}=175℃	50	
I_{CM}	Repetitive Peak Collector Current	tp=1ms	100	
P_{tot}	Power Dissipation Per IGBT	T_C=25℃, T_{Jmax}=175℃	278	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
$I_{F(AV)}$	Average Forward Current		50	A
I_{FRM}	Repetitive Peak Forward Current	tp=1ms	100	
I^2t		T_J=125℃, t=10ms, V_R=0V	560	A^2S

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=2mA		5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=50A, V_{GE}=15V, T_J=25℃			1.85	2.25	
		I_C=50A, V_{GE}=15V, T_J=125℃			2.15		
		I_C=50A, V_{GE}=15V, T_J=150℃			2.25		
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_J=25℃				1	mA
		V_{CE}=1200V, V_{GE}=0V, T_J=150℃				10	
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
R_{gint}	Integrated Gate Resistor				3.6		Ω
Q_g	Gate Charge	V_{CE}=600V, I_C=50A , V_{GE}=15V			0.27		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			3.85		nF
C_{res}	Reverse Transfer Capacitance				160		pF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=600V,I_C=50A R_G =10Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		35		ns
			T_J=125℃		40		ns
			T_J=150℃		40		ns
t_r	Rise Time		T_J=25℃		35		ns
			T_J=125℃		40		ns
			T_J=150℃		40		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=600V,I_C=50A R_G =10Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		250		ns
			T_J=125℃		290		ns
			T_J=150℃		310		ns
t_f	Fall Time		T_J=25℃		150		ns
			T_J=125℃		210		ns
			T_J=150℃		230		ns
E_{on}	Turn on Energy	V_{CC}=600V,I_C=50A R_G =10Ω, V_{GE}=±15V, Inductive Load	T_J=125℃		8		mJ
			T_J=150℃		8.5		mJ
E_{off}	Turn off Energy		T_J=125℃		4		mJ
			T_J=150℃		4.3		mJ
I_{SC}	Short Circuit Current	tpsc⩽10μS , V_{GE}=15V T_J=150℃,V_{CC}=600V			195		A
R_{thJC}	Junction to Case Thermal Resistance (Per IGBT)					0.54	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℃		1.7	2.15	V
		I_F=50A , V_{GE}=0V, T_J =125℃		1.65		
		I_F=50A , V_{GE}=0V, T_J =150℃		1.65		
t_{rr}	Reverse Recovery Time	I_F=50A , V_R=600V dI_F/dt=-1500A/μs T_J =150℃		390		ns
I_{RRM}	Max. Reverse Recovery Current			60		A
Q_{RR}	Reverse Recovery Charge			9.5		μC
E_{rec}	Reverse Recovery Energy			3.4		mJ
R_{thJCD}	Junction to Case Thermal Resistance （ Per Diode）				0.81	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=80℃	50	A
I_{FRMS}	R.M.S. Forward Current Per Diode		75	
I_{RMS}	R.M.S. Current at rectifier output		80	
I_{FSM}	Non Repetitive Surge Forward Current	T_J=45℃, t=10ms, 50Hz	480	
		T_J=45℃, t=8.3ms, 60Hz	527	
I^2t		T_J=45℃, t=10ms, 50Hz	1152	A^2S
		T_J=45℃, t=8.3ms, 60Hz	1152	

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℃		1.1	1.25	V
		I_F=50A , T_J =150℃		1.05		V
I_R	Reverse Leakage Current	V_R=1600V, T_J=25℃			50	μA
		V_R=1600V, T_J=150℃			1	mA
R_{thJCD}	Junction to Case Thermal Resistance （ Per Diode）				0.8	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=25℃, T_{Jmax}=175℃	54	A
		T_C=100℃, T_{Jmax}=175℃	35	
I_{CM}	Repetitive Peak Collector Current	tp=1ms	70	
P_{tot}	Power Dissipation Per IGBT	T_C=25℃, T_{Jmax}=175℃	208	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=125℃, t=10ms, V_R=0V	110	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=1.2mA		5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	I_C=35A, V_{GE}=15V, T_J=25℃			1.85	2.25	
		I_C=35A, V_{GE}=15V, T_J=125℃			2.15		
		I_C=35A, V_{GE}=15V, T_J=150℃			2.25		
I_{CES}	Collector Leakage Current	V_{CE}=1200V, V_{GE}=0V, T_J=25℃				1	mA
		V_{CE}=1200V, V_{GE}=0V, T_J=150℃				10	
I_{GES}	Gate Leakage Current	V_{CE}=0V,V_{GE}=±20V, T_J=25℃		-400		400	nA
R_{gint}	Integrated Gate Resistor				0		Ω
Q_g	Gate Charge	V_{CE}=600V, I_C=35A , V_{GE}=15V			0.21		μC
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f =1MHz			2.8		nF
C_{res}	Reverse Transfer Capacitance				110		pF
$t_{d(on)}$	Turn on Delay Time	V_{CC}=600V,I_C=35A R_G =20Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		35		ns
			T_J=125℃		40		ns
			T_J=150℃		40		ns
t_r	Rise Time		T_J=25℃		35		ns
			T_J=125℃		40		ns
			T_J=150℃		40		ns
$t_{d(off)}$	Turn off Delay Time	V_{CC}=600V,I_C=35A R_G =20Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		240		ns
			T_J=125℃		280		ns
			T_J=150℃		300		ns
t_f	Fall Time		T_J=25℃		190		ns
			T_J=125℃		210		ns
			T_J=150℃		230		ns
E_{on}	Turn on Energy	V_{CC}=600V,I_C=35A R_G =20Ω, V_{GE}=±15V, Inductive Load	T_J=125℃		4.4		mJ
			T_J=150℃		4.7		mJ
E_{off}	Turn off Energy		T_J=125℃		3.3		mJ
			T_J=150℃		3.5		mJ
I_{SC}	Short Circuit Current	tpsc≤10μS , V_{GE}=15V T_J=150℃,V_{CC}=600V			145		A
R_{thJC}	Junction to Case Thermal Resistance (Per IGBT)					0.72	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℃		1.9	2.3	V
		I_F=25A , V_{GE}=0V, T_J =125℃		1.7		
		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=-850A/μs T_J =150℃		300		ns
I_{RRM}	Max. Reverse Recovery Current			39		A
Q_{RR}	Reverse Recovery Charge			4.7		μC
E_{rec}	Reverse Recovery Energy			1.6		mJ
R_{thJCD}	Junction to Case Thermal Resistance （ Per Diode）				1.4	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		-40~150	
T_{stg}	Storage Temperature		-40~125	
V_{isol}	Isolation Breakdown Voltage	AC, 50Hz(R.M.S), t=1minute	3000	V
CTI	Comparative Tracking Index		>200	
Md	Mounting Torque	Recommended（M5）	2.5~5	Nm
Weight			180	g

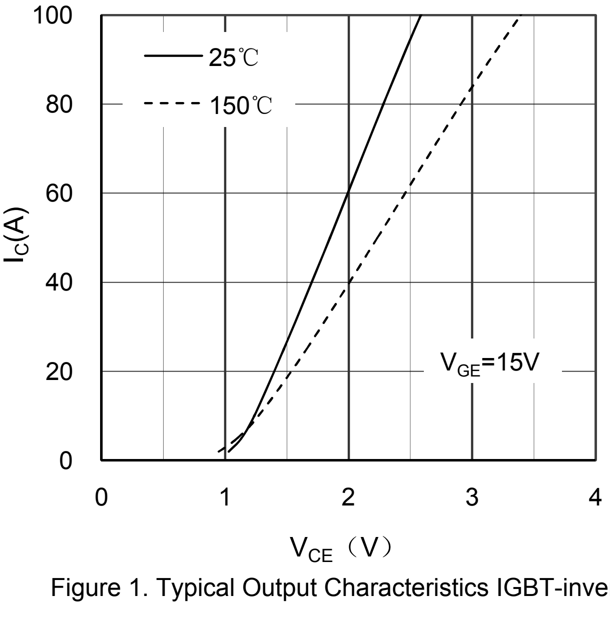


Figure 1. Typical Output Characteristics IGBT-inverter

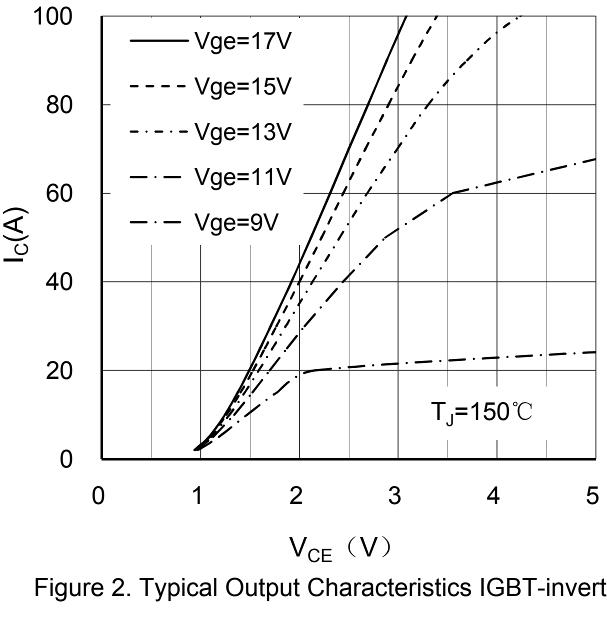


Figure 2. Typical Output Characteristics IGBT-inverter

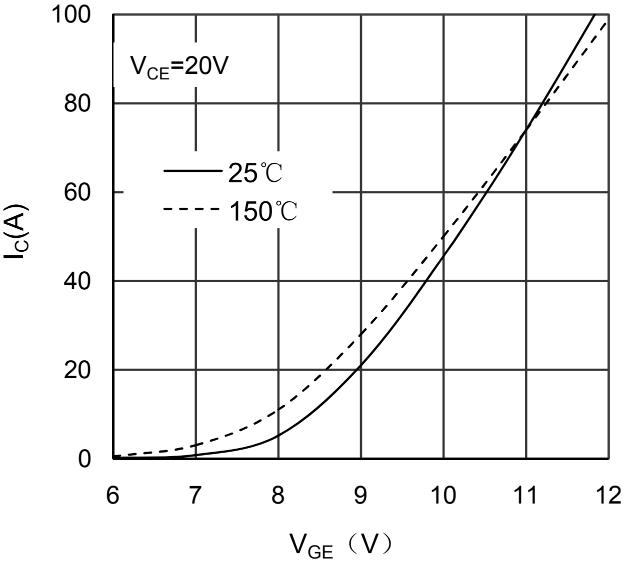


Figure 3. Typical Transfer characteristics IGBT-inverter

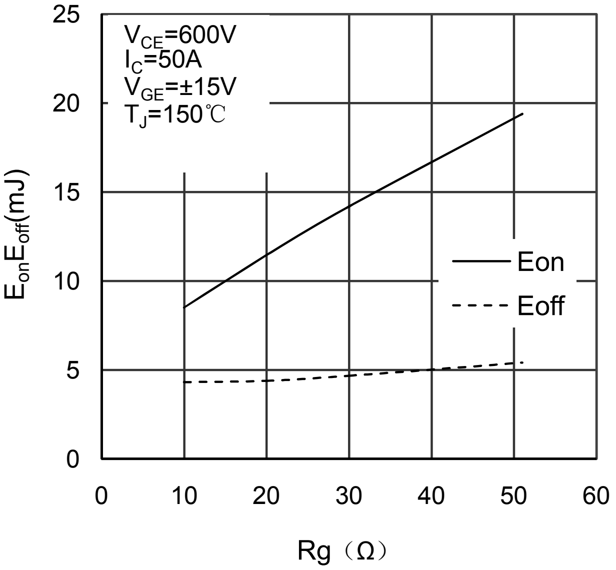


Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

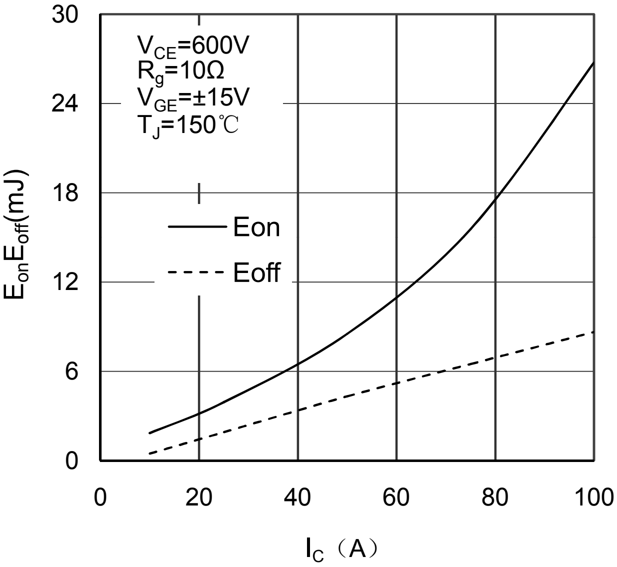


Figure 5. Switching Energy vs Collector Current IGBT-inverter

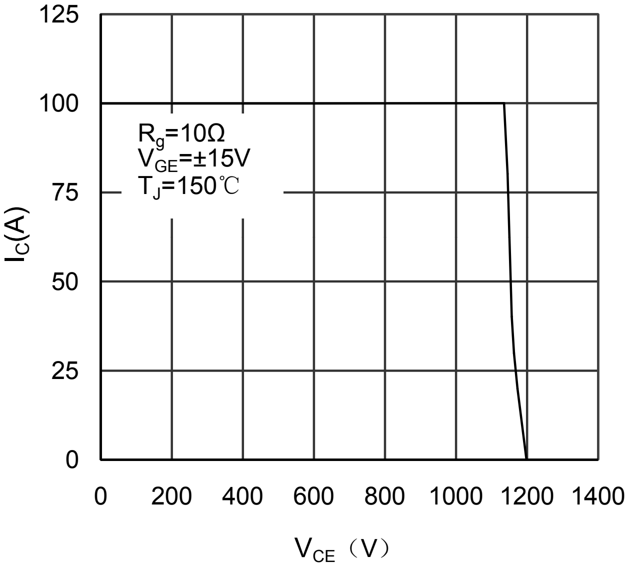


Figure 6. Reverse Biased Safe Operating Area IGBT-inverter

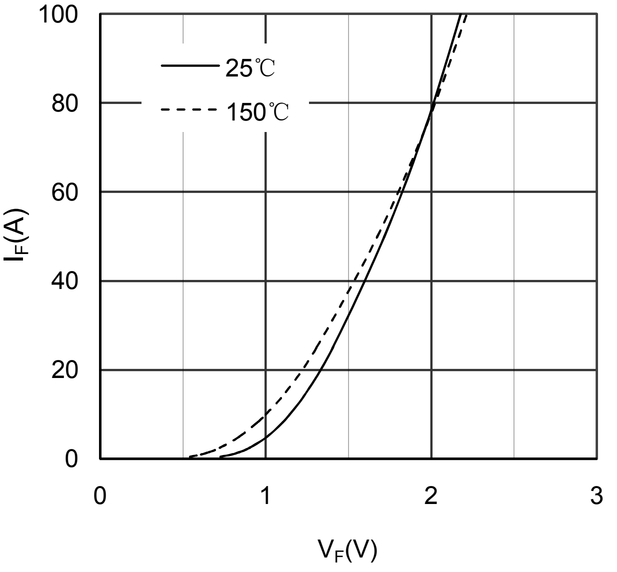


Figure 7. Diode Forward Characteristics Diode -inverter

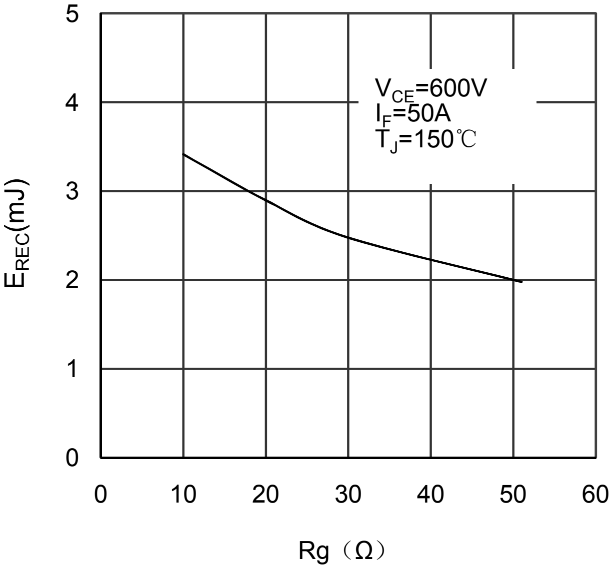


Figure 8. Switching Energy vs Gate Resistor Diode -inverter

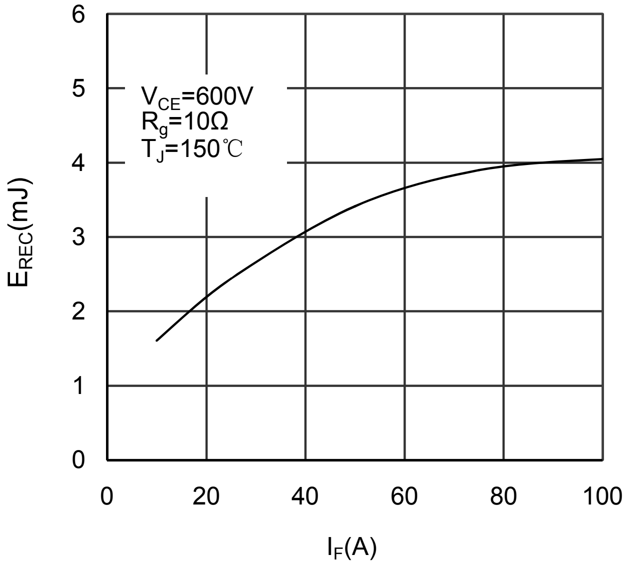


Figure 9. Switching Energy vs Forward Current Diode-inverter

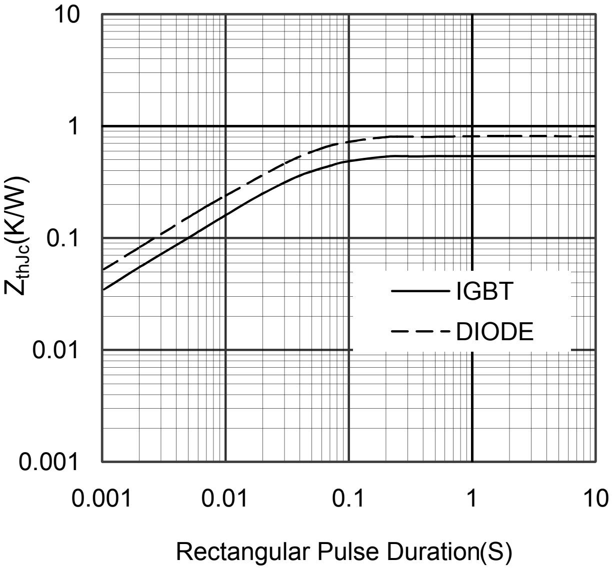


Figure 10. Transient Thermal Impedance of Diode and IGBT-inverter

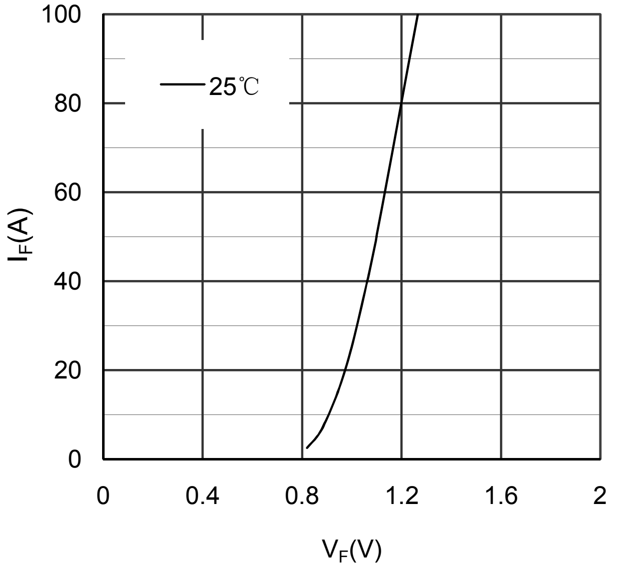


Figure 11. Diode Forward Characteristics Diode- rectifier

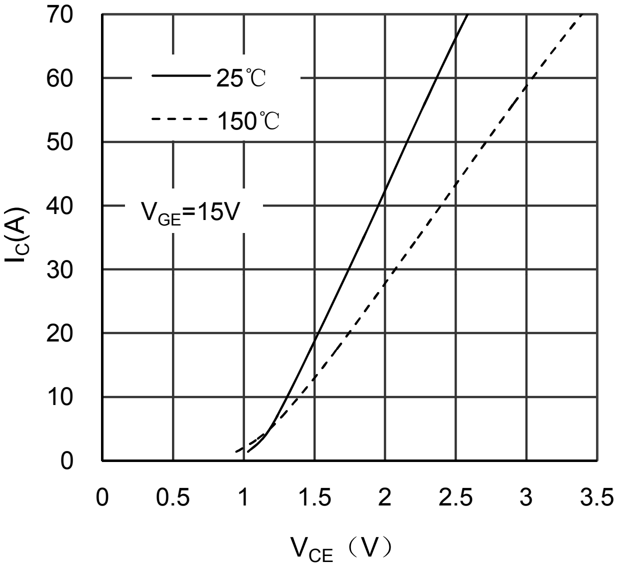


Figure 12. Typical Output Characteristics IGBT- brake chopper

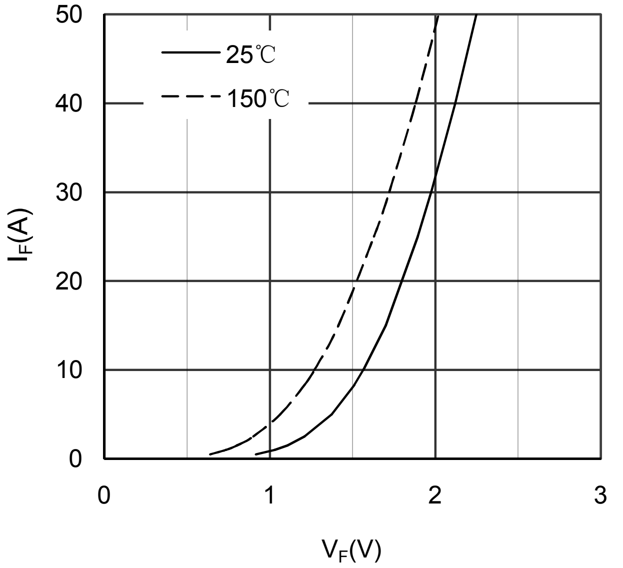


Figure 13. Diode Forward Characteristics Diode - brake chopper

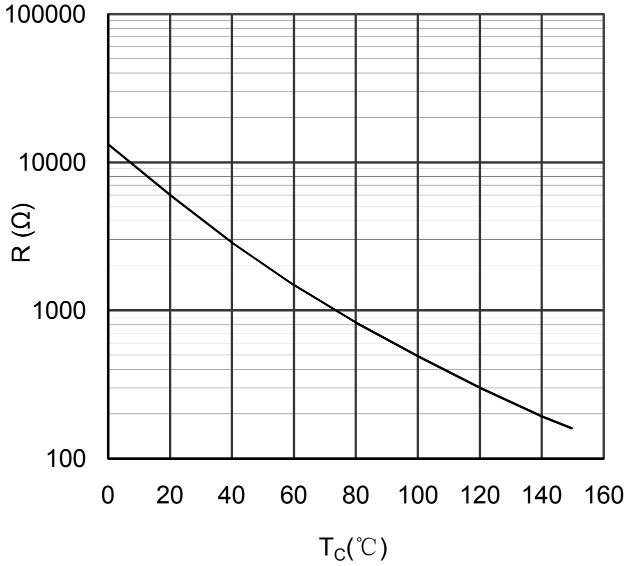


Figure 14. NTC Characteristics

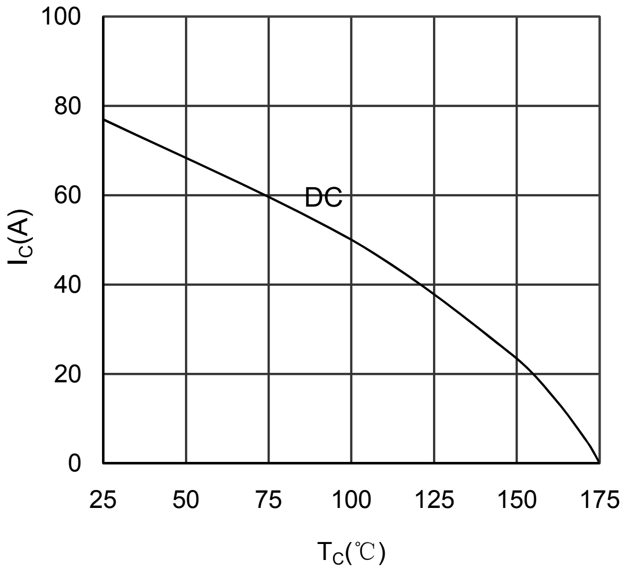


Figure 15. Collector Current vs Case temperature
IGBT -inverter

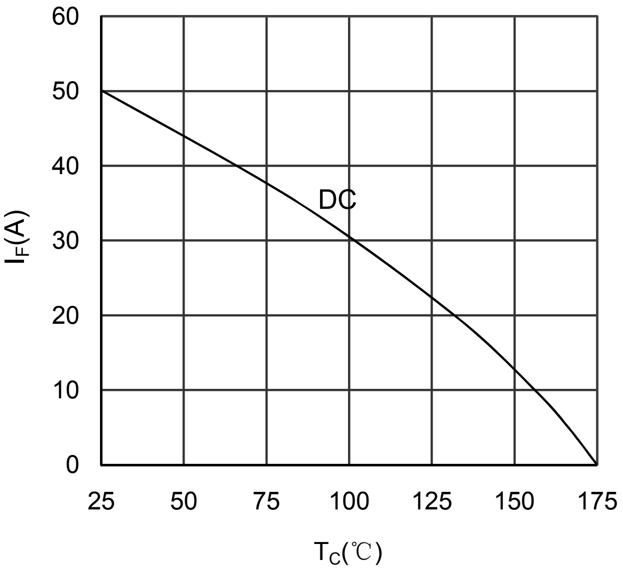


Figure 16. Forward current vs Case temperature
Diode -inverter

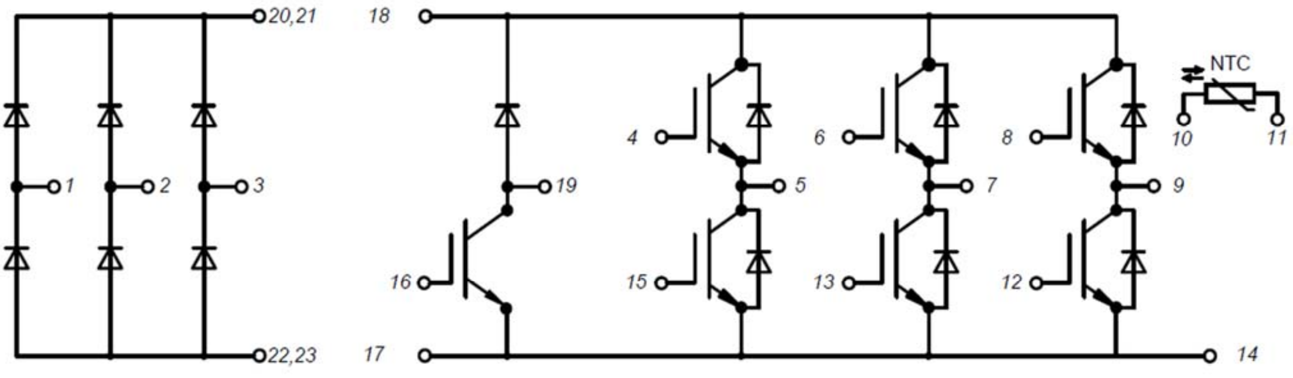
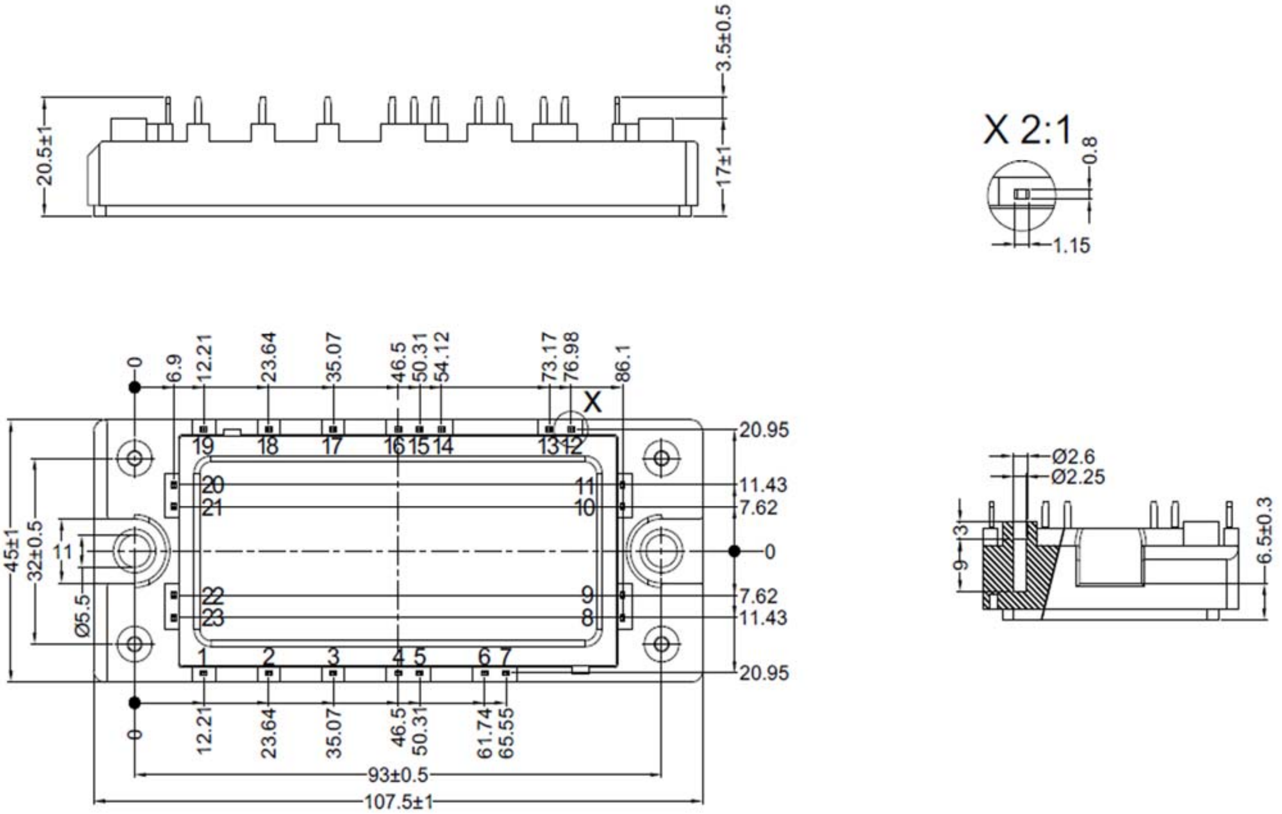


Figure 17. Circuit Diagram



Dimensions in (mm)

Figure 18. Package Outline