

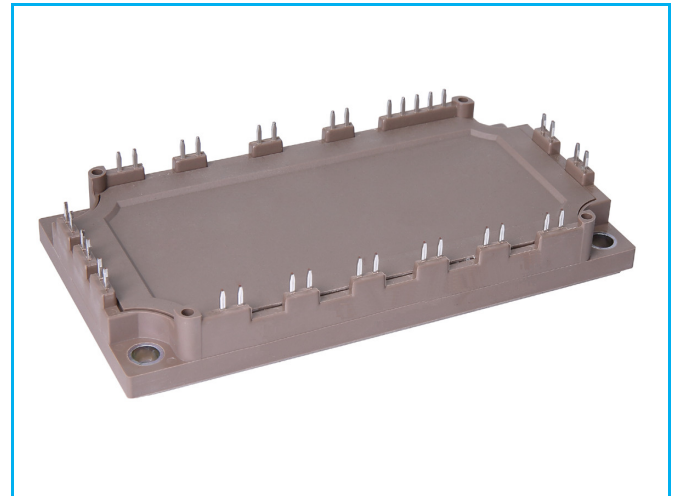
## PRODUCT FEATURES

- High level of integration
- 600V IGBT<sup>3</sup> 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( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
$V_{CES}$	Collector Emitter Voltage	$T_J=25^{\circ}\text{C}$	600	V
$V_{GES}$	Gate Emitter Voltage		$\pm 20$	
$I_C$	DC Collector Current	$T_C=25^{\circ}\text{C}, T_{Jmax}=175^{\circ}\text{C}$	125	A
		$T_C=70^{\circ}\text{C}, T_{Jmax}=175^{\circ}\text{C}$	100	
$I_{CM}$	Repetitive Peak Collector Current	$t_p=1\text{ms}$	200	
$P_{tot}$	Power Dissipation Per IGBT	$T_C=25^{\circ}\text{C}, T_{Jmax}=175^{\circ}\text{C}$	330	W

### Diode-inverter

ABSOLUTE MAXIMUM RATINGS ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
$V_{RRM}$	Repetitive Reverse Voltage	$T_J=25^{\circ}\text{C}$	600	V
$I_{F(AV)}$	Average Forward Current		100	A
$I_{FRM}$	Repetitive Peak Forward Current	$t_p=1\text{ms}$	200	
$I^2t$		$T_J=125^{\circ}\text{C}, t=10\text{ms}, V_R=0\text{V}$	1000	$\text{A}^2\text{s}$

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# MMG100W060XB6TC

## IGBT-inverter

### ELECTRICAL CHARACTERISTICS ( $T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	$V_{CE}=V_{GE}, I_C=1.6\text{mA}$	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$I_C=100\text{A}, V_{GE}=15\text{V}, T_J=25^\circ\text{C}$		1.5	1.9	
		$I_C=100\text{A}, V_{GE}=15\text{V}, T_J=125^\circ\text{C}$		1.7		
		$I_C=100\text{A}, V_{GE}=15\text{V}, T_J=150^\circ\text{C}$		1.75		
$I_{CES}$	Collector Leakage Current	$V_{CE}=600\text{V}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$			1	mA
		$V_{CE}=600\text{V}, V_{GE}=0\text{V}, T_J=150^\circ\text{C}$			5	mA
$I_{GES}$	Gate Leakage Current	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}, T_J=25^\circ\text{C}$	-400		400	nA
$R_{Gint}$	Integrated Gate Resistor			2		$\Omega$
$Q_G$	Gate Charge	$V_{CE}=300\text{V}, I_C=100\text{A}, V_{GE}=15\text{V}$		0.58		$\mu\text{C}$
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		6.8		nF
$C_{res}$	Reverse Transfer Capacitance				300	
$t_{d(on)}$	Turn on Delay Time	$V_{CC}=300\text{V}, I_C=100\text{A}$ $R_G=5.1\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		35	ns
			$T_J=150^\circ\text{C}$		45	ns
$t_r$	Rise Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		40	ns
			$T_J=150^\circ\text{C}$		45	ns
$t_{d(off)}$	Turn off Delay Time	$V_{CC}=300\text{V}, I_C=100\text{A}$ $R_G=5.1\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		220	ns
			$T_J=150^\circ\text{C}$		260	ns
$t_f$	Fall Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		60	ns
			$T_J=150^\circ\text{C}$		70	ns
$E_{on}$	Turn on Energy	$V_{CC}=300\text{V}, I_C=100\text{A}$ $R_G=5.1\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		2	mJ
			$T_J=125^\circ\text{C}$		2.55	mJ
			$T_J=150^\circ\text{C}$		2.75	mJ
$E_{off}$	Turn off Energy	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		1.6	mJ
			$T_J=125^\circ\text{C}$		2.15	mJ
			$T_J=150^\circ\text{C}$		2.25	mJ
$I_{SC}$	Short Circuit Current	$tpsc \leq 6\mu\text{s}, V_{GE}=15\text{V}$ $T_J=125^\circ\text{C}, V_{CC}=360\text{V}$		500		A
$R_{thJC}$	Junction to Case Thermal Resistance ( Per IGBT )				0.46	K /W

## Diode-inverter

### ELECTRICAL CHARACTERISTICS ( $T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
$V_F$	Forward Voltage	$I_F=100\text{A}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$		1.75	2.2	V
		$I_F=100\text{A}, V_{GE}=0\text{V}, T_J=125^\circ\text{C}$		1.65		
		$I_F=100\text{A}, V_{GE}=0\text{V}, T_J=150^\circ\text{C}$		1.60		
$t_{rr}$	Reverse Recovery Time	$I_F=100\text{A}, V_R=300\text{V}$ $dI_F/dt=-4150\text{A}/\mu\text{s}$ $T_J=150^\circ\text{C}$		100		ns
$I_{RRM}$	Max. Reverse Recovery Current			140		A
$Q_{RR}$	Reverse Recovery Charge			11		$\mu\text{C}$
$E_{rec}$	Reverse Recovery Energy			3.1		mJ
$R_{thJCD}$	Junction to Case Thermal Resistance ( Per Diode )				0.8	K /W

# MMG100W060XB6TC

## Diode-RECTIFIER

### ABSOLUTE MAXIMUM RATINGS ( $T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
$V_{RRM}$	Repetitive Reverse Voltage	$T_J=25^\circ\text{C}$	1600	V
$I_{F(AV)}$	Average Forward Current Per Diode	$T_C=80^\circ\text{C}$	80	A
$I_{FRMS}$	R.M.S. Forward Current Per Diode		125	
$I_{RMS}$	R.M.S. Current at rectifier output		150	
$I_{FSM}$	Non Repetitive Surge Forward Current	$T_J=45^\circ\text{C}$ , $t=10\text{ms}$ , 50Hz	1050	
		$T_J=45^\circ\text{C}$ , $t=8.3\text{ms}$ , 60Hz	1151	
$I^2t$		$T_J=45^\circ\text{C}$ , $t=10\text{ms}$ , 50Hz	5510	$\text{A}^2\text{s}$
		$T_J=45^\circ\text{C}$ , $t=8.3\text{ms}$ , 60Hz	5508	

## Diode-RECTIFIER

### ELECTRICAL CHARACTERISTICS ( $T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
$V_F$	Forward Voltage	$I_F=100\text{A}$ , $T_J=25^\circ\text{C}$		1.1	1.3	V
		$I_F=100\text{A}$ , $T_J=150^\circ\text{C}$		1.04		V
$I_R$	Reverse Leakage Current	$V_R=1600\text{V}$ , $T_J=25^\circ\text{C}$			50	$\mu\text{A}$
		$V_R=1600\text{V}$ , $T_J=150^\circ\text{C}$			1	mA
$R_{thJC}$	Junction to Case Thermal Resistance ( Per Diode )				0.46	K/W

## IGBT-Brake chopper

### ABSOLUTE MAXIMUM RATINGS ( $T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
$V_{CES}$	Collector Emitter Voltage	$T_J=25^\circ\text{C}$	600	V
$V_{GES}$	Gate Emitter Voltage		$\pm 20$	
$I_C$	DC Collector Current	$T_C=25^\circ\text{C}$ , $T_{Jmax}=175^\circ\text{C}$	95	A
		$T_C=70^\circ\text{C}$ , $T_{Jmax}=175^\circ\text{C}$	75	
$I_{CM}$	Repetitive Peak Collector Current	$t_p=1\text{ms}$	150	
$P_{tot}$	Power Dissipation Per IGBT	$T_C=25^\circ\text{C}$ , $T_{Jmax}=175^\circ\text{C}$	250	W

## Diode-Brake chopper

### ABSOLUTE MAXIMUM RATINGS ( $T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
$V_{RRM}$	Repetitive Reverse Voltage	$T_J=25^\circ\text{C}$	600	V
$I_{F(AV)}$	Average Forward Current		50	A
$I_{FRM}$	Repetitive Peak Forward Current	$t_p=1\text{ms}$	100	
$I^2t$		$T_J=125^\circ\text{C}$ , $t=10\text{ms}$ , $V_R=0\text{V}$	392	$\text{A}^2\text{s}$

# MMG100W060XB6TC

IGBT-Brake chopper

ELECTRICAL CHARACTERISTICS ( $T_C=25^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	$V_{CE}=V_{GE}, I_C=1.2\text{mA}$	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$I_C=75\text{A}, V_{GE}=15\text{V}, T_J=25^\circ\text{C}$		1.55	2.0	
		$I_C=75\text{A}, V_{GE}=15\text{V}, T_J=125^\circ\text{C}$		1.75		
		$I_C=75\text{A}, V_{GE}=15\text{V}, T_J=150^\circ\text{C}$		1.80		
$I_{CES}$	Collector Leakage Current	$V_{CE}=600\text{V}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$			1	mA
		$V_{CE}=600\text{V}, V_{GE}=0\text{V}, T_J=150^\circ\text{C}$			10	mA
$I_{GES}$	Gate Leakage Current	$V_{CE}=0\text{V}, V_{GE}=\pm 15\text{V}, T_J=25^\circ\text{C}$	-400		400	nA
$R_{Gint}$	Integrated Gate Resistor			0		$\Omega$
$Q_G$	Gate Charge	$V_{CE}=300\text{V}, I_C=75\text{A}, V_{GE}=\pm 15\text{V}$		0.36		$\mu\text{C}$
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		4.8		nF
$C_{res}$	Reverse Transfer Capacitance				200	
$t_{d(on)}$	Turn on Delay Time	$V_{CC}=300\text{V}, I_C=75\text{A}$ $R_G=5.1\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		20	ns
			$T_J=150^\circ\text{C}$		25	ns
$t_r$	Rise Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		30	ns
			$T_J=150^\circ\text{C}$		32	ns
$t_{d(off)}$	Turn off Delay Time	$V_{CC}=300\text{V}, I_C=75\text{A}$ $R_G=5.1\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		190	ns
			$T_J=150^\circ\text{C}$		230	ns
$t_f$	Fall Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		60	ns
			$T_J=150^\circ\text{C}$		70	ns
$E_{on}$	Turn on Energy	$V_{CC}=300\text{V}, I_C=75\text{A}$ $R_G=5.1\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		0.66	mJ
			$T_J=125^\circ\text{C}$		0.88	mJ
			$T_J=150^\circ\text{C}$		0.93	mJ
$E_{off}$	Turn off Energy	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		1.6	mJ
			$T_J=125^\circ\text{C}$		2.15	mJ
			$T_J=150^\circ\text{C}$		2.25	mJ
$I_{SC}$	Short Circuit Current	$tp_{sc}\leq 6\mu\text{s}, V_{GE}=15\text{V}$ $T_J=150^\circ\text{C}, V_{CC}=360\text{V}$		400		A
$R_{thJC}$	Junction to Case Thermal Resistance ( Per IGBT )				0.6	K /W

Diode-Brake chopper

ELECTRICAL CHARACTERISTICS ( $T_C=25^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
$V_F$	Forward Voltage	$I_F=50\text{A}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$		1.90	2.30	V
		$I_F=50\text{A}, V_{GE}=0\text{V}, T_J=125^\circ\text{C}$		1.75		
		$I_F=50\text{A}, V_{GE}=0\text{V}, T_J=150^\circ\text{C}$		1.70		
$I_{RRM}$	Max. Reverse Recovery Current	$I_F=50\text{A}, V_R=300\text{V}$		30		A
$Q_{RR}$	Reverse Recovery Charge	$di_F/dt=-1000\text{A}/\mu\text{s}$		2.85		$\mu\text{C}$
$E_{rec}$	Reverse Recovery Energy	$T_J=150^\circ\text{C}$		0.6		mJ
$R_{thJCD}$	Junction to Case Thermal Resistance ( Per Diode )				1.3	K /W

# MMG100W060XB6TC

## NTC CHARACTERISTICS ( $T_C=25^\circ\text{C}$ unless otherwise specified)

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

## MODULE CHARACTERISTICS ( $T_C=25^\circ\text{C}$ 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	$^\circ\text{C}$
$T_{stg}$	Storage Temperature	-40~125	
$V_{isol}$	Isolation Breakdown Voltage	AC, 50Hz(R.M.S), t=1minute	3000
CTI	Comparative Tracking Index		>200
Md	Mounting Torque	Recommended (M5)	2.5~5
Weight			300
			g

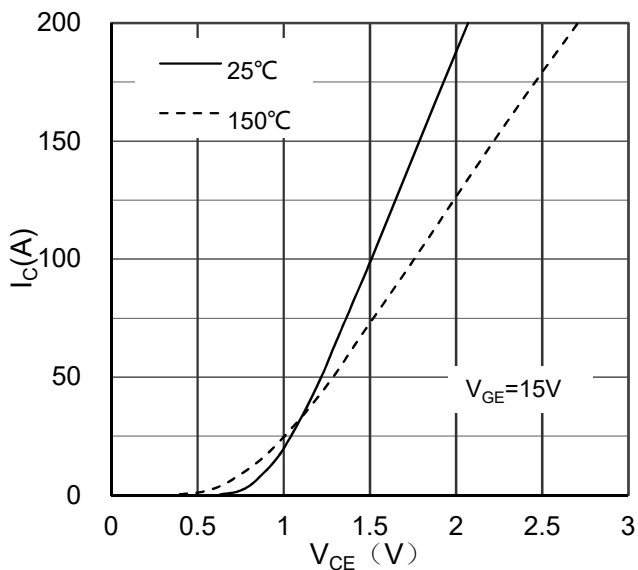


Figure 1. Typical Output Characteristics IGBT-inverter

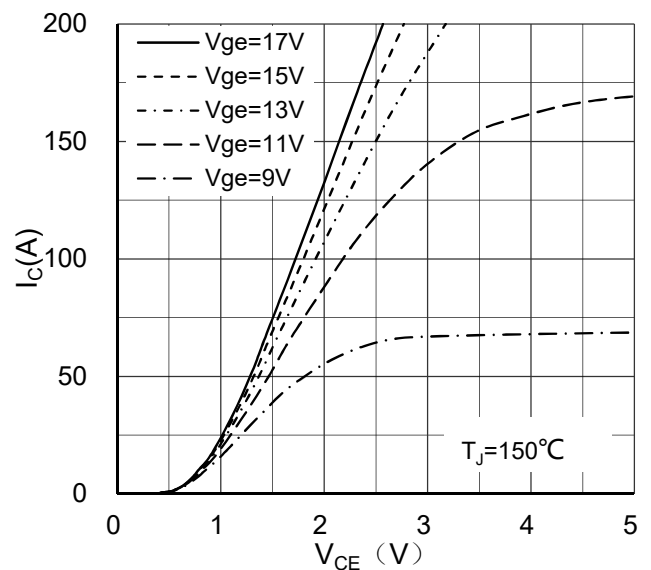


Figure 2. Typical Output Characteristics IGBT-inverter

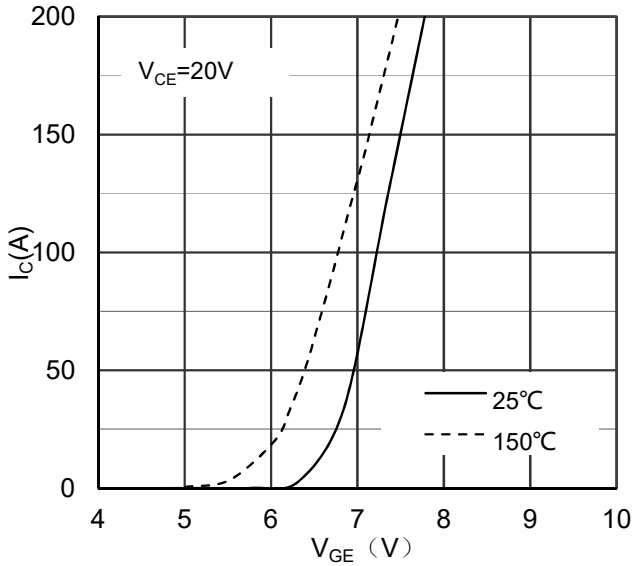


Figure 3. Typical Transfer characteristics IGBT-inverter

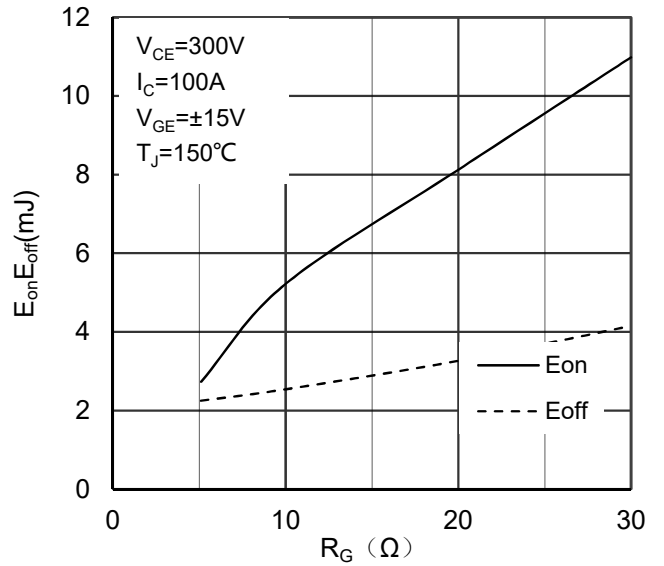


Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

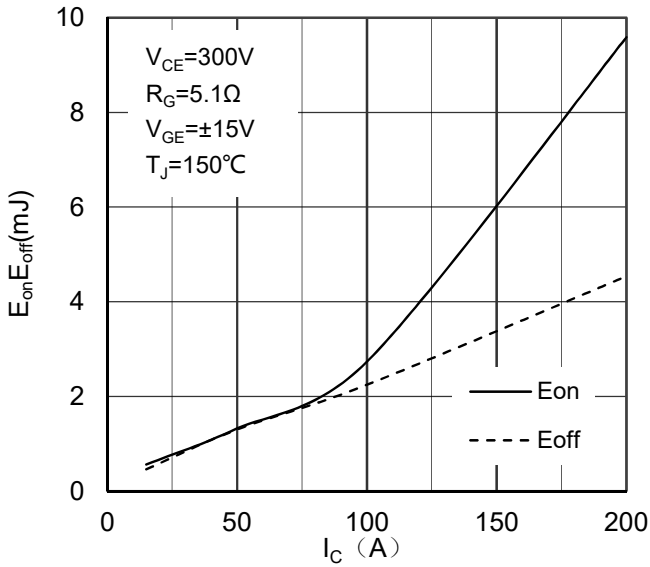


Figure 5. Switching Energy vs Collector Current IGBT-inverter

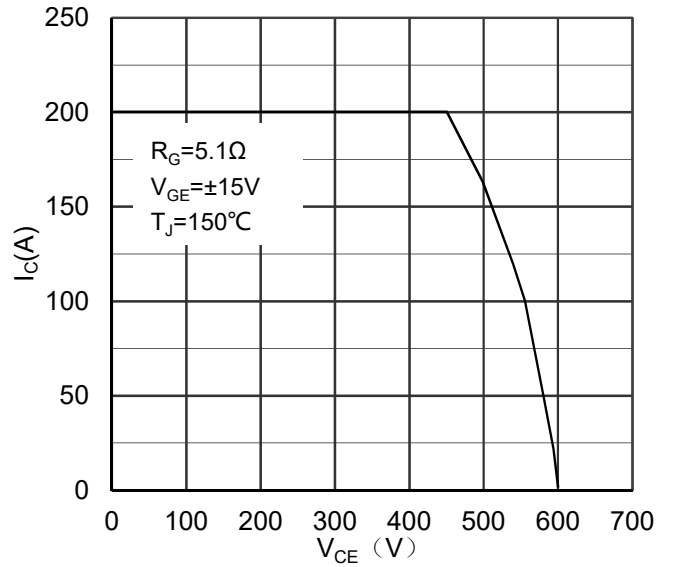


Figure 6. Reverse Biased Safe Operating Area IGBT-inverter

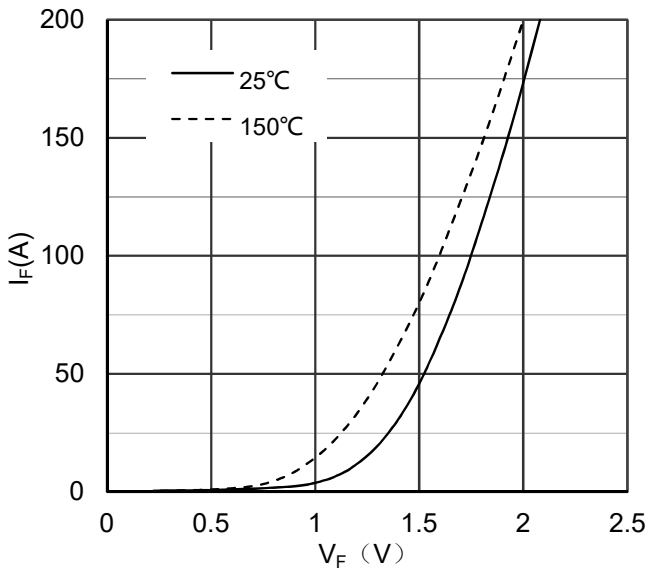


Figure 7. Diode Forward Characteristics Diode -inverter

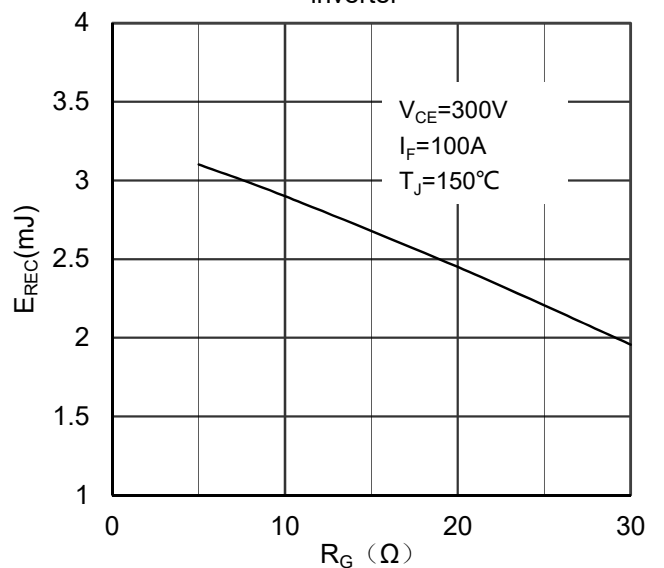


Figure 8. Switching Energy vs Gate Resistor Diode -inverter

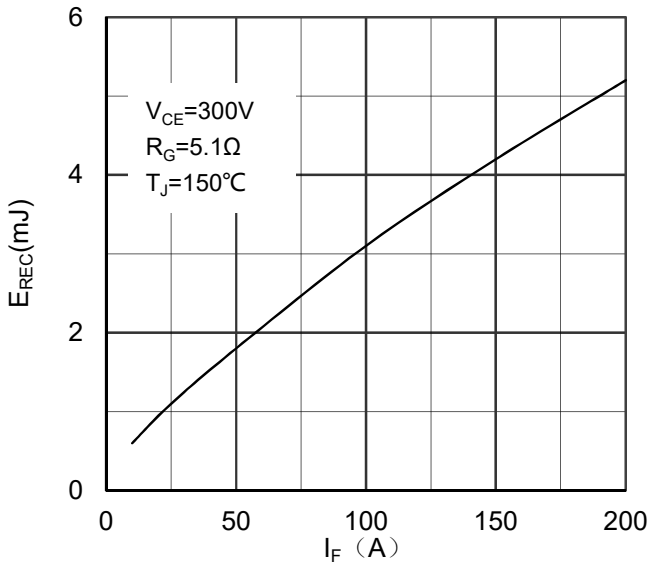


Figure 9. Switching Energy vs Forward Current Diode-inverter

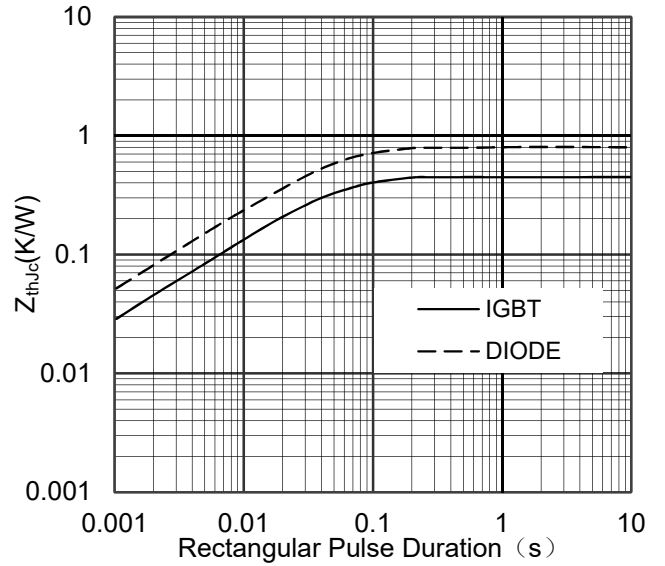


Figure 10. Transient Thermal Impedance of Diode and IGBT-inverter

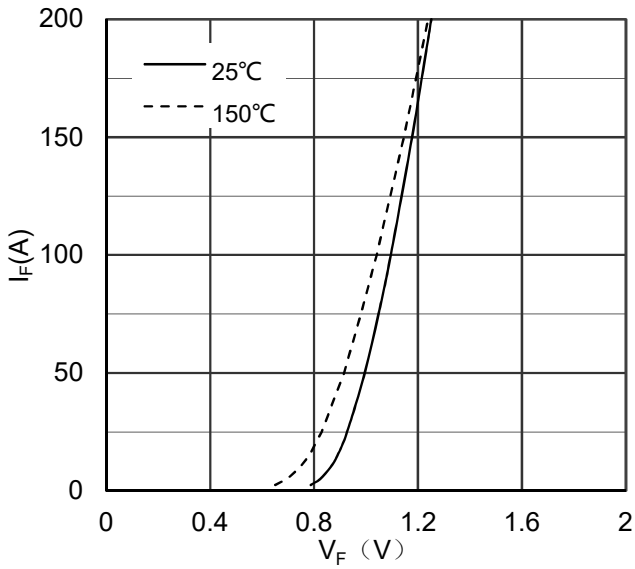


Figure 11. Diode Forward Characteristics Diode-rectifier

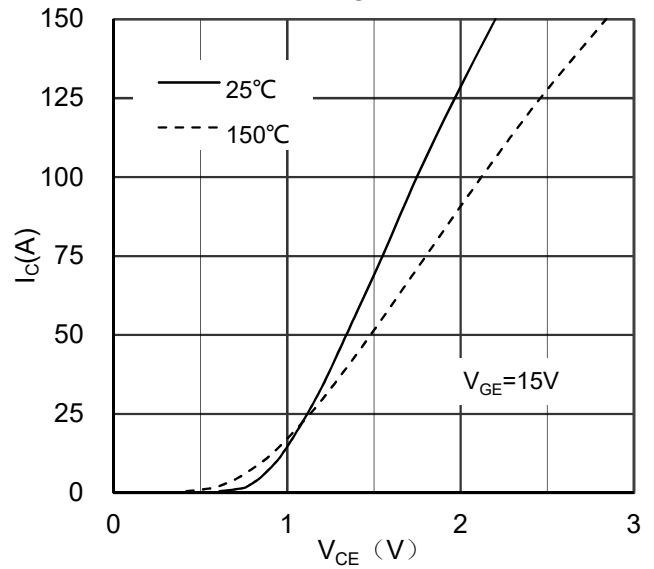


Figure 12. Typical Output Characteristics IGBT-brake chopper

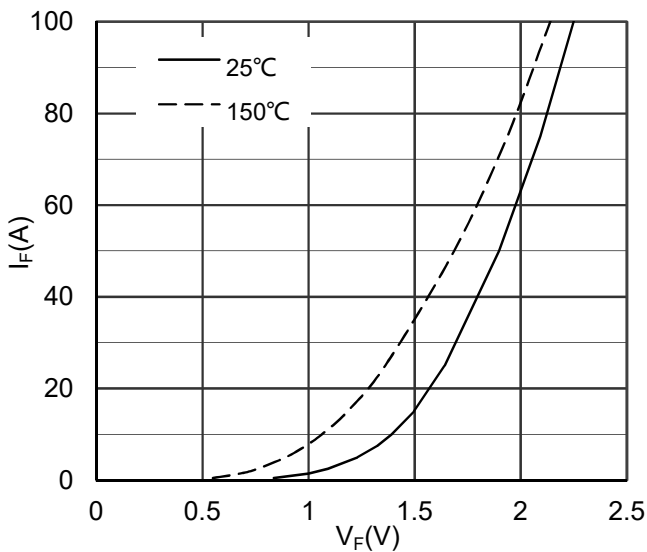


Figure 13. Diode Forward Characteristics Diode-brake chopper

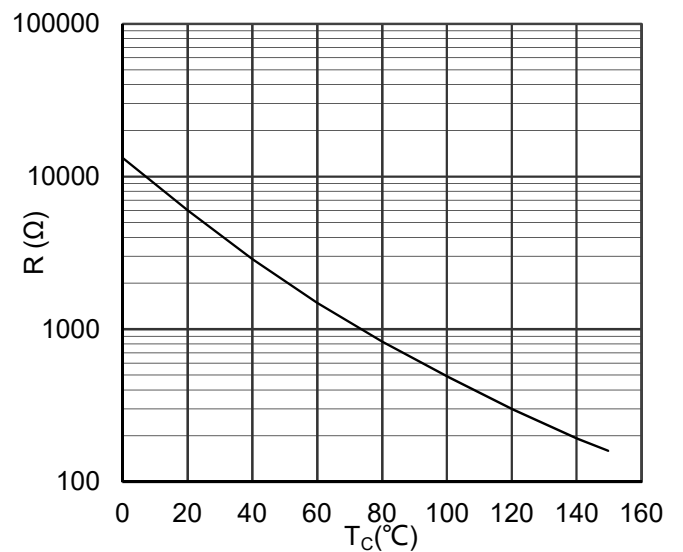


Figure 14. NTC Characteristics

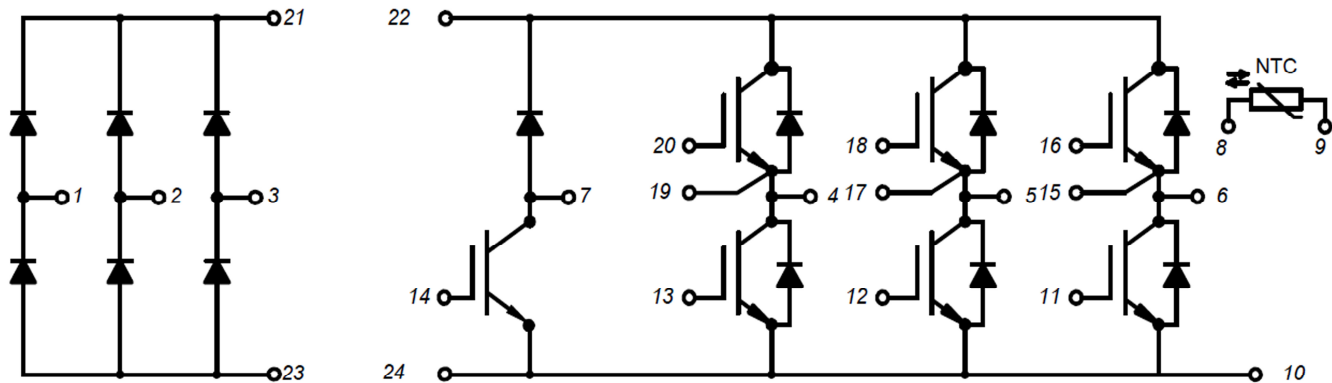
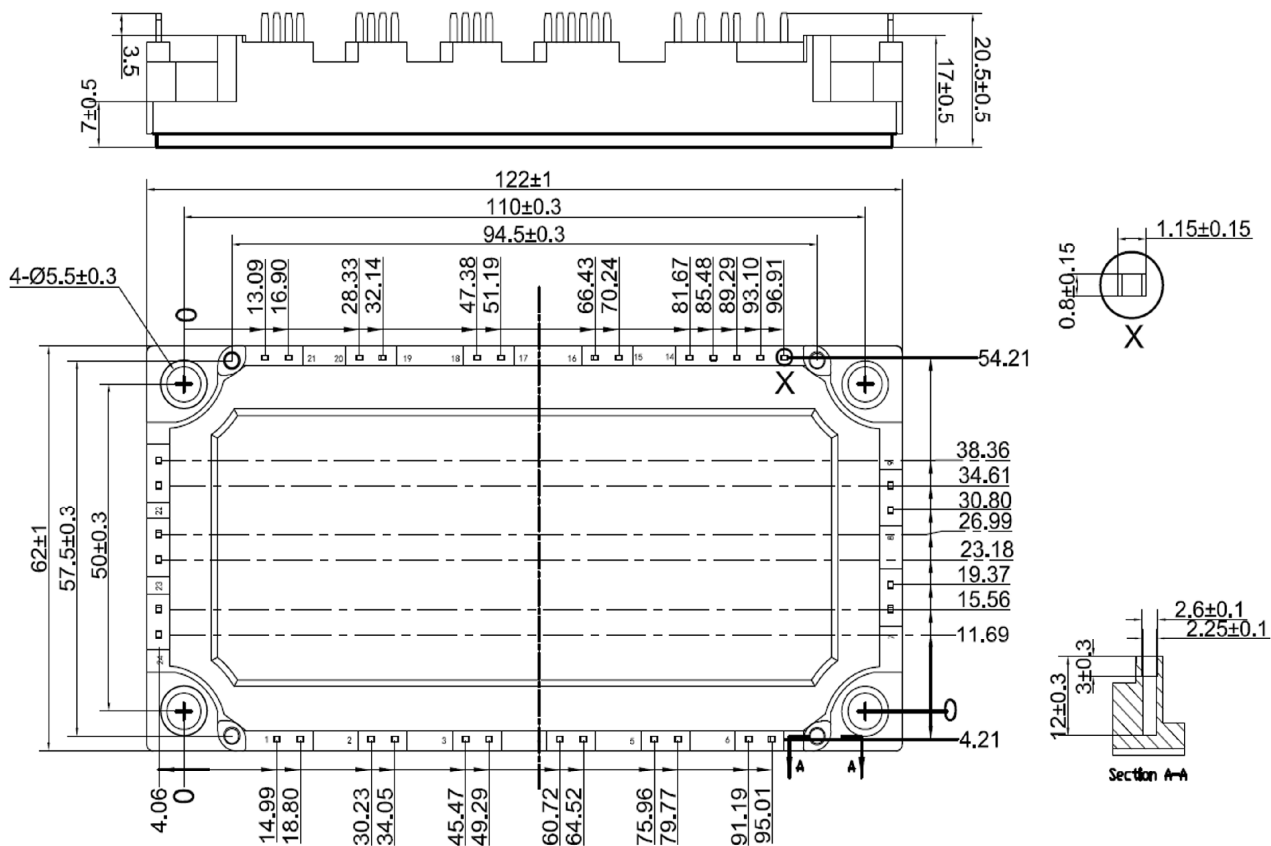


Figure 15. Circuit Diagram



Dimensions in (mm)

Figure 16. Package Outline