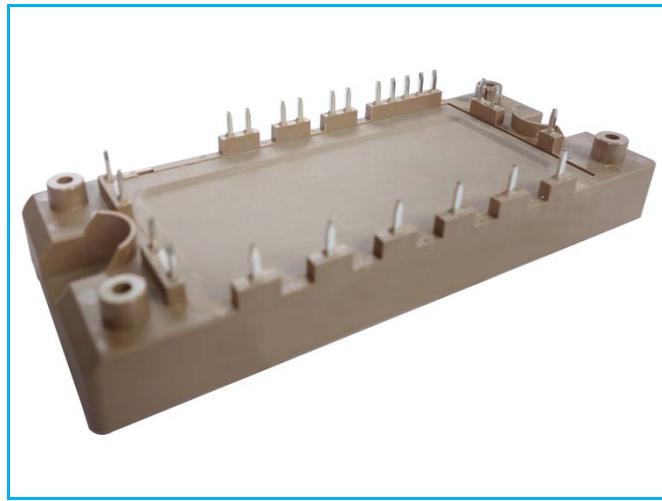


## **PRODUCT FEATURES**

- 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


Rectifier+Brake+Inverter

## **APPLICATIONS**

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

### 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	$T_J=25^\circ\text{C}$	1200	V
$V_{GES}$	Gate Emitter Voltage		$\pm 20$	
$I_C$	DC Collector Current	$T_c=25^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$	40	A
		$T_c=100^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$	25	
$I_{CM}$	Repetitive Peak Collector Current	$t_p=1\text{ms}$	50	
$P_{tot}$	Power Dissipation Per IGBT	$T_c=25^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$	192	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	$T_J=25^\circ\text{C}$	1200	V
$I_{F(AV)}$	Average Forward Current		25	
$I_{FRM}$	Repetitive Peak Forward Current	$t_p=1\text{ms}$	50	A
$I^2t$		$T_J=125^\circ\text{C}, t=10\text{ms}, V_R=0\text{V}$	100	$\text{A}^2\text{s}$

MacMic Science & Technology Co., Ltd.

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## IGBT-inverter

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

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit	
$V_{GE(\text{th})}$	Gate Emitter Threshold Voltage	$V_{CE}=V_{GE}$ , $I_C=1\text{mA}$	5.0	5.8	6.5	V	
$V_{CE(\text{sat})}$	Collector - Emitter Saturation Voltage	$I_C=25\text{A}$ , $V_{GE}=15\text{V}$ , $T_J=25^\circ\text{C}$		1.85	2.3		
		$I_C=25\text{A}$ , $V_{GE}=15\text{V}$ , $T_J=125^\circ\text{C}$		2.15			
		$I_C=25\text{A}$ , $V_{GE}=15\text{V}$ , $T_J=150^\circ\text{C}$		2.25			
$I_{CES}$	Collector Leakage Current	$V_{CE}=1200\text{V}$ , $V_{GE}=0\text{V}$ , $T_J=25^\circ\text{C}$			100	$\mu\text{A}$	
		$V_{CE}=1200\text{V}$ , $V_{GE}=0\text{V}$ , $T_J=150^\circ\text{C}$			10	$\text{mA}$	
$I_{GES}$	Gate Leakage Current	$V_{CE}=0\text{V}$ , $V_{GE}=\pm 15\text{V}$ , $T_J=25^\circ\text{C}$	-400		400	$\text{nA}$	
$R_{\text{gint}}$	Integrated Gate Resistor			0		$\Omega$	
$Q_g$	Gate Charge	$V_{CE}=600\text{V}$ , $I_C=25\text{A}$ , $V_{GE}=15\text{V}$		0.145		$\mu\text{C}$	
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}$ , $V_{GE}=0\text{V}$ , $f=1\text{MHz}$		3.5		$\text{nF}$	
$C_{res}$	Reverse Transfer Capacitance			40		$\text{pF}$	
$t_{d(\text{on})}$	Turn on Delay Time	$V_{CC}=600\text{V}$ , $I_C=25\text{A}$ $R_G=20\Omega$ , $V_{GE}=\pm 15\text{V}$ , Inductive Load	$T_J=25^\circ\text{C}$	30		ns	
			$T_J=125^\circ\text{C}$	40		ns	
			$T_J=150^\circ\text{C}$	45		ns	
$t_r$	Rise Time		$T_J=25^\circ\text{C}$	35		ns	
			$T_J=125^\circ\text{C}$	40		ns	
			$T_J=150^\circ\text{C}$	45		ns	
$t_{d(\text{off})}$	Turn off Delay Time	$V_{CC}=600\text{V}$ , $I_C=25\text{A}$ $R_G=20\Omega$ , $V_{GE}=\pm 15\text{V}$ , Inductive Load	$T_J=25^\circ\text{C}$	200		ns	
			$T_J=125^\circ\text{C}$	240		ns	
			$T_J=150^\circ\text{C}$	260		ns	
$t_f$	Fall Time		$T_J=25^\circ\text{C}$	80		ns	
			$T_J=125^\circ\text{C}$	150		ns	
			$T_J=150^\circ\text{C}$	170		ns	
$E_{on}$	Turn on Energy	$V_{CC}=600\text{V}$ , $I_C=25\text{A}$ $R_G=20\Omega$ , $V_{GE}=\pm 15\text{V}$ , Inductive Load	$T_J=125^\circ\text{C}$	2.6		$\text{mJ}$	
			$T_J=150^\circ\text{C}$	2.8		$\text{mJ}$	
$E_{off}$	Turn off Energy		$T_J=125^\circ\text{C}$	2		$\text{mJ}$	
			$T_J=150^\circ\text{C}$	2.2		$\text{mJ}$	
$I_{sc}$	Short Circuit Current	$tpsc \leq 10\mu\text{s}$ , $V_{GE}=15\text{V}$ $T_J=125^\circ\text{C}$ , $V_{CC}=600\text{V}$		150		A	
$R_{\text{thJC}}$	Junction to Case Thermal Resistance (Per IGBT)				0.78	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	$I_F=25\text{A}$ , $V_{GE}=0\text{V}$ , $T_J=25^\circ\text{C}$		1.9	2.4	V
		$I_F=25\text{A}$ , $V_{GE}=0\text{V}$ , $T_J=125^\circ\text{C}$		1.65		
		$I_F=25\text{A}$ , $V_{GE}=0\text{V}$ , $T_J=150^\circ\text{C}$		1.6		
$t_{rr}$	Reverse Recovery Time			260		ns
$I_{RRM}$	Max. Reverse Recovery Current	$I_F=25\text{A}$ , $V_R=600\text{V}$ $dl_F/dt=-900\text{A}/\mu\text{s}$ $T_J=150^\circ\text{C}$		40		A
$Q_{RR}$	Reverse Recovery Charge			5.1		$\mu\text{C}$
$E_{rec}$	Reverse Recovery Energy			1.9		$\text{mJ}$
$R_{\text{thJCD}}$	Junction to Case Thermal Resistance ( Per Diode)				1.2	K/W

## 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	$T_C=80^\circ\text{C}$	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		480	
		$T_J=45^\circ\text{C}, t=10\text{ms}, 50\text{Hz}$	527	
$I^2t$		$T_J=45^\circ\text{C}, t=10\text{ms}, 50\text{Hz}$	1152	$\text{A}^2\text{S}$
		$T_J=45^\circ\text{C}, t=8.3\text{ms}, 60\text{Hz}$	1152	

## 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	$I_F=40\text{A}, T_J=25^\circ\text{C}$		1.06	1.2	V
		$I_F=40\text{A}, T_J=150^\circ\text{C}$		1.00		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
$R_{thJCD}$	Junction to Case Thermal Resistance (Per Diode)				0.8	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	$T_J=25^\circ\text{C}$	1200	
$V_{GES}$	Gate Emitter Voltage		$\pm 20$	V
$I_C$	DC Collector Current	$T_C=25^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$	40	A
		$T_C=100^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$	25	
$I_{CM}$	Repetitive Peak Collector Current	$t_p=1\text{ms}$	50	
$P_{tot}$	Power Dissipation Per IGBT	$T_C=25^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$	192	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	$T_J=25^\circ\text{C}$	1200	V
$I_{F(AV)}$	Average Forward Current	$t_p=1\text{ms}$	25	A
$I_{FRM}$	Repetitive Peak Forward Current		50	
$I^2t$	$T_J=125^\circ\text{C}, t=10\text{ms}, V_R=0\text{V}$		200	$\text{A}^2\text{S}$

## IGBT-Brake chopper

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

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit	
$V_{GE(\text{th})}$	Gate Emitter Threshold Voltage	$V_{CE}=V_{GE}$ , $I_C=1\text{mA}$	5.0	5.8	6.5	V	
$V_{CE(\text{sat})}$	Collector Emitter Saturation Voltage	$I_C=25\text{A}$ , $V_{GE}=15\text{V}$ , $T_J=25^\circ\text{C}$		1.85	2.3		
		$I_C=25\text{A}$ , $V_{GE}=15\text{V}$ , $T_J=125^\circ\text{C}$		2.15			
		$I_C=25\text{A}$ , $V_{GE}=15\text{V}$ , $T_J=150^\circ\text{C}$		2.25			
$I_{CES}$	Collector Leakage Current	$V_{CE}=1200\text{V}$ , $V_{GE}=0\text{V}$ , $T_J=25^\circ\text{C}$			100	$\mu\text{A}$	
		$V_{CE}=1200\text{V}$ , $V_{GE}=0\text{V}$ , $T_J=150^\circ\text{C}$			10	$\text{mA}$	
$I_{GES}$	Gate Leakage Current	$V_{CE}=0\text{V}$ , $V_{GE}=\pm 15\text{V}$ , $T_J=25^\circ\text{C}$	-400		400	$\text{nA}$	
$R_{\text{gint}}$	Integrated Gate Resistor			0		$\Omega$	
$Q_g$	Gate Charge	$V_{CE}=600\text{V}$ , $I_C=25\text{A}$ , $V_{GE}=15\text{V}$		145		$\text{nC}$	
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}$ , $V_{GE}=0\text{V}$ , $f=1\text{MHz}$		3.5		$\text{nF}$	
$C_{res}$	Reverse Transfer Capacitance			40		$\text{pF}$	
$t_{d(\text{on})}$	Turn on Delay Time	$V_{CC}=600\text{V}$ , $I_C=25\text{A}$ $R_G=20\Omega$ , $V_{GE}=\pm 15\text{V}$ , Inductive Load	$T_J=25^\circ\text{C}$	30		ns	
			$T_J=125^\circ\text{C}$	40		ns	
			$T_J=150^\circ\text{C}$	45		ns	
$t_r$	Rise Time		$T_J=25^\circ\text{C}$	35		ns	
			$T_J=125^\circ\text{C}$	40		ns	
			$T_J=150^\circ\text{C}$	45		ns	
$t_{d(\text{off})}$	Turn off Delay Time	$V_{CC}=600\text{V}$ , $I_C=25\text{A}$ $R_G=20\Omega$ , $V_{GE}=\pm 15\text{V}$ , Inductive Load	$T_J=25^\circ\text{C}$	200		ns	
			$T_J=125^\circ\text{C}$	240		ns	
			$T_J=150^\circ\text{C}$	260		ns	
$t_f$	Fall Time		$T_J=25^\circ\text{C}$	80		ns	
			$T_J=125^\circ\text{C}$	150		ns	
			$T_J=150^\circ\text{C}$	170		ns	
$E_{on}$	Turn on Energy	$V_{CC}=600\text{V}$ , $I_C=25\text{A}$ $R_G=20\Omega$ , $V_{GE}=\pm 15\text{V}$ , Inductive Load	$T_J=125^\circ\text{C}$	2.6		$\text{mJ}$	
			$T_J=150^\circ\text{C}$	2.8		$\text{mJ}$	
$E_{off}$	Turn off Energy		$T_J=125^\circ\text{C}$	2		$\text{mJ}$	
			$T_J=150^\circ\text{C}$	2.2		$\text{mJ}$	
$I_{sc}$	Short Circuit Current	$tpsc \leq 10\mu\text{s}$ , $V_{GE}=15\text{V}$ $T_J=125^\circ\text{C}$ , $V_{CC}=600\text{V}$		150		A	
$R_{\text{thJC}}$	Junction to Case Thermal Resistance (Per IGBT)				0.78	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	$I_F=25\text{A}$ , $V_{GE}=0\text{V}$ , $T_J=25^\circ\text{C}$		1.9	2.4	V
		$I_F=25\text{A}$ , $V_{GE}=0\text{V}$ , $T_J=150^\circ\text{C}$		1.6		
$t_{rr}$	Reverse Recovery Time	$I_F=25\text{A}$ , $V_R=600\text{V}$ $di_F/dt=-900\text{A}/\mu\text{s}$		260		ns
$I_{RRM}$	Max. Reverse Recovery Current			40		
$E_{rec}$	Reverse Recovery Energy	$T_J=150^\circ\text{C}$		1.9		$\text{mJ}$
$R_{\text{thJCD}}$	Junction to Case Thermal Resistance (Per Diode)				1.2	K/W

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		$\text{k}\Omega$
$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15 \text{ K}))]$			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	V
CTI	Comparative Tracking Index	>200	
Md	Mounting Torque	Recommended (M5)	Nm
Weight		180	g

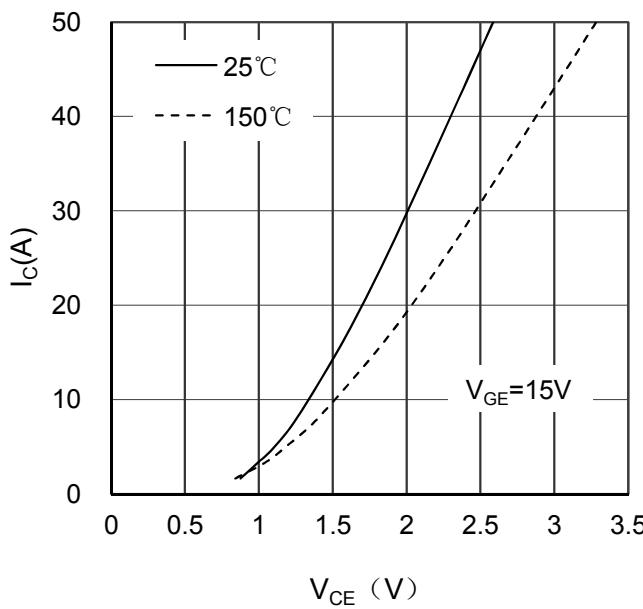


Figure 1. Typical Output Characteristics IGBT-inverter

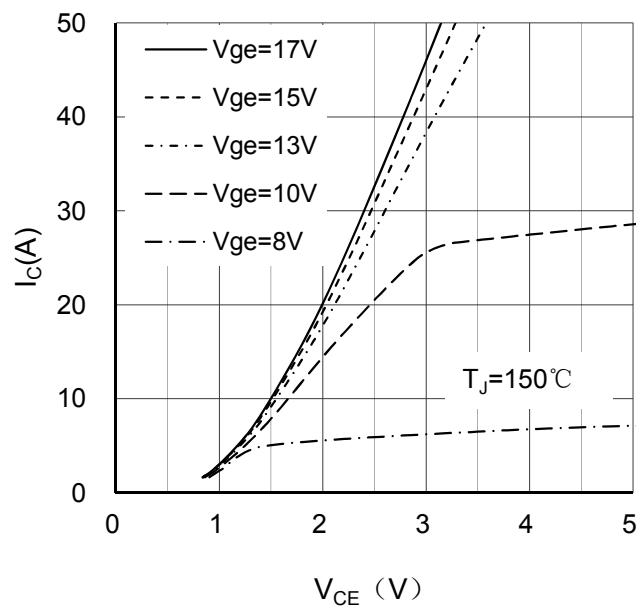


Figure 2. Typical Output Characteristics IGBT-inverter

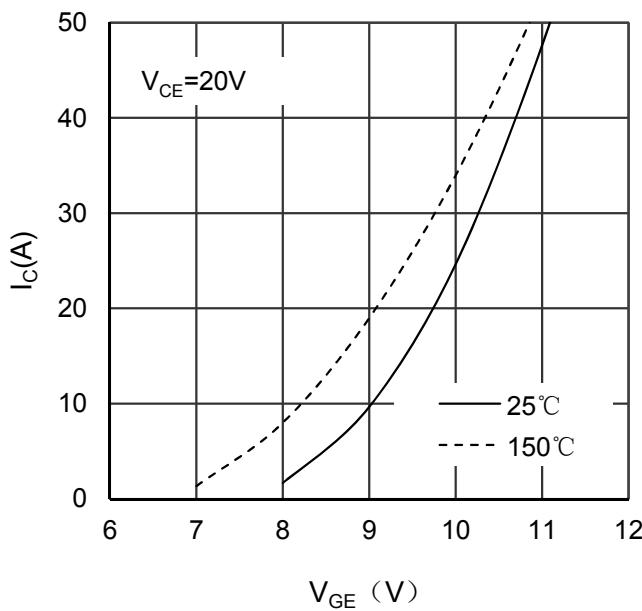


Figure 3. Typical Transfer characteristics IGBT-inverter

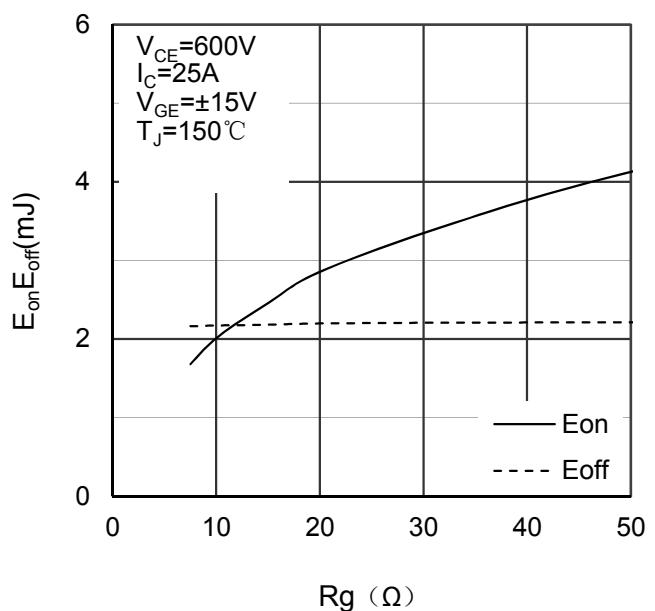


Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

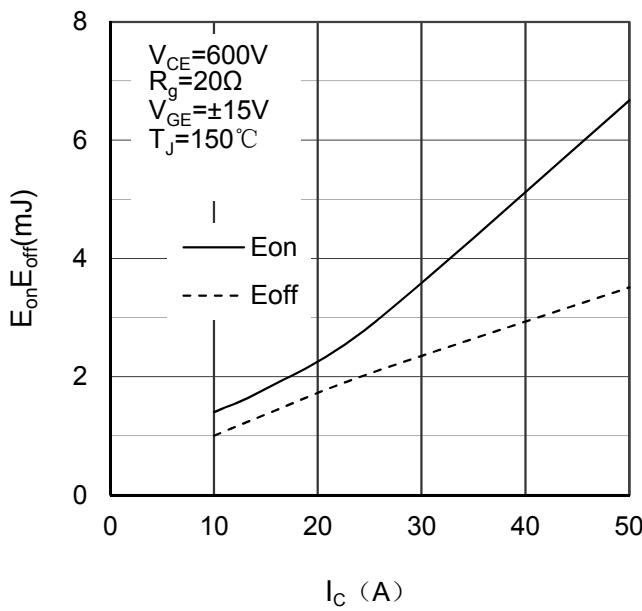


Figure 5. Switching Energy vs Collector Current IGBT-inverter

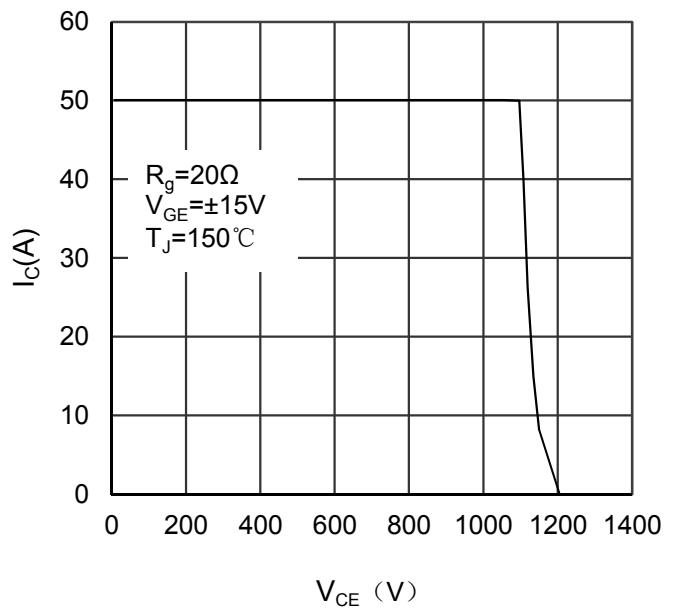


Figure 6. Reverse Biased Safe Operating Area IGBT-inverter

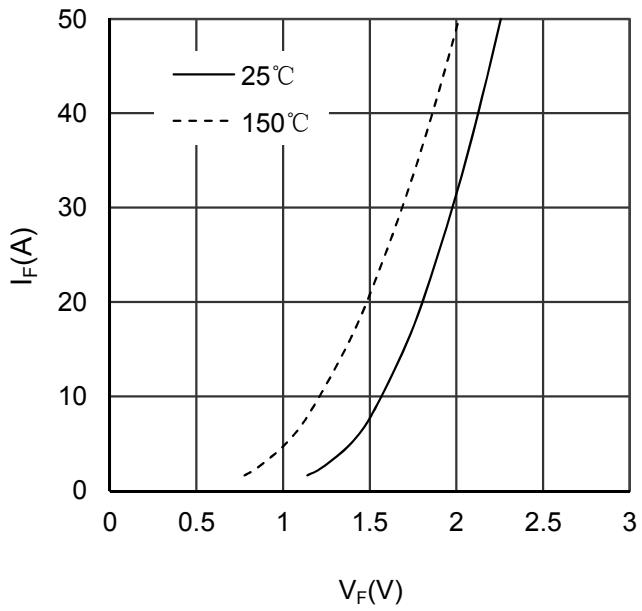


Figure 7. Diode Forward Characteristics Diode -inverter

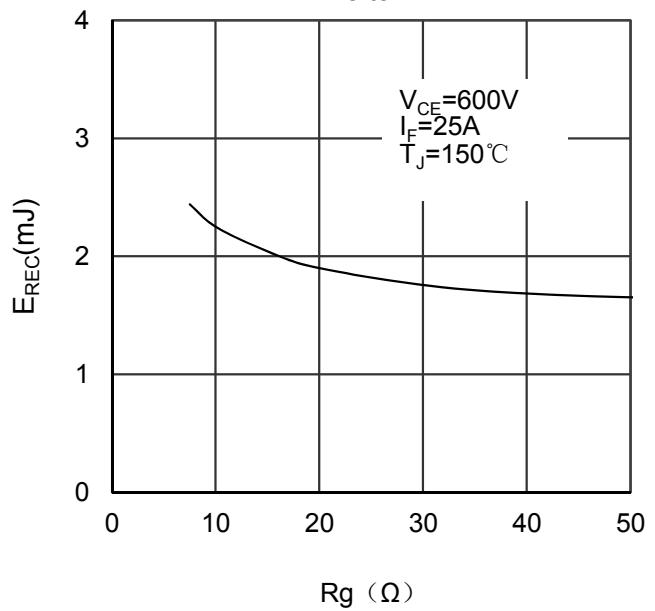
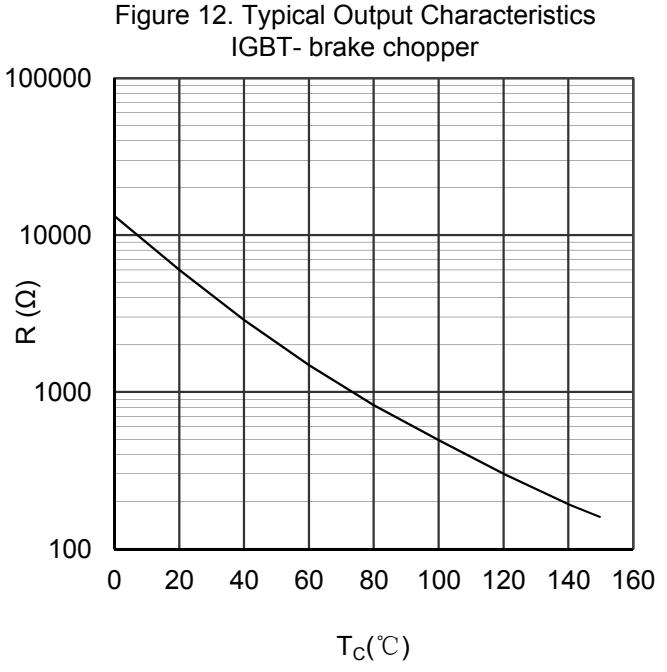
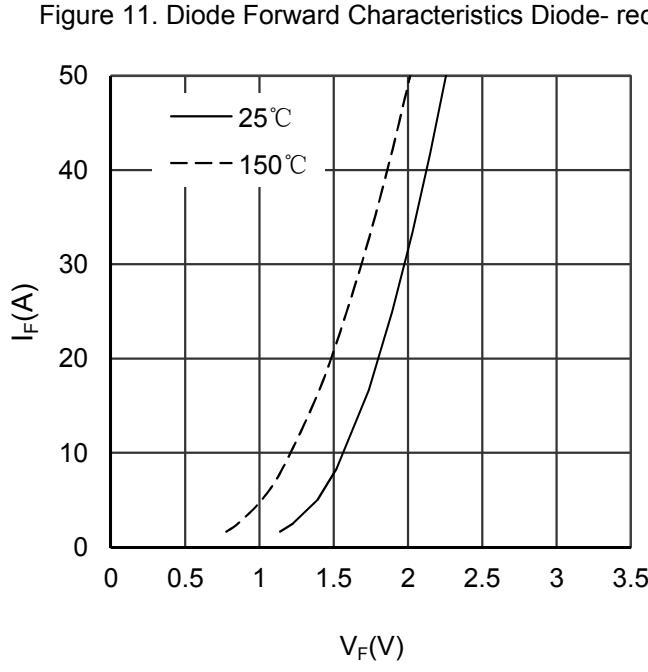
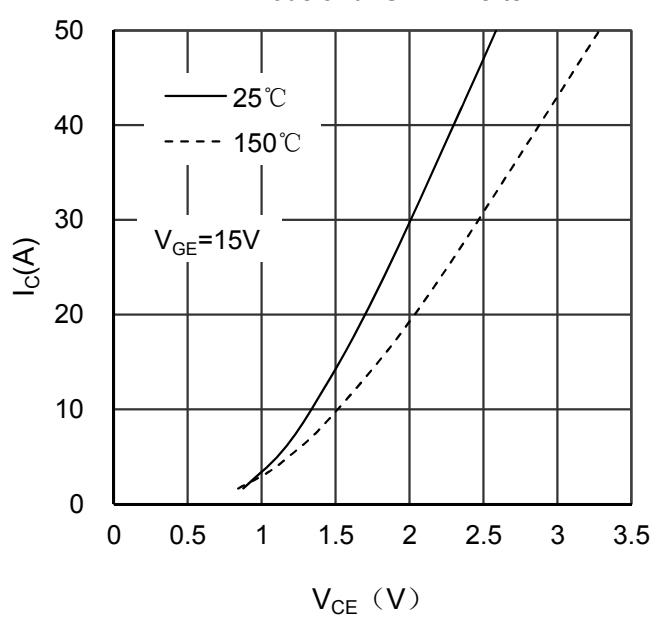
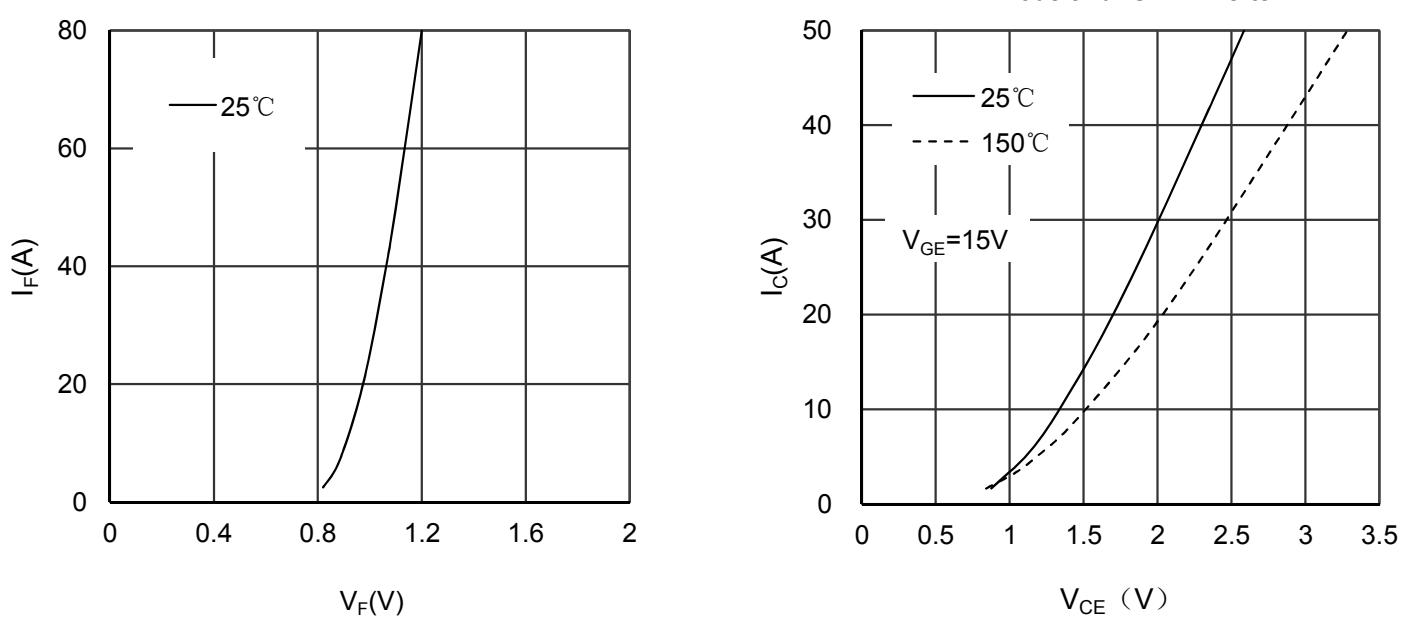
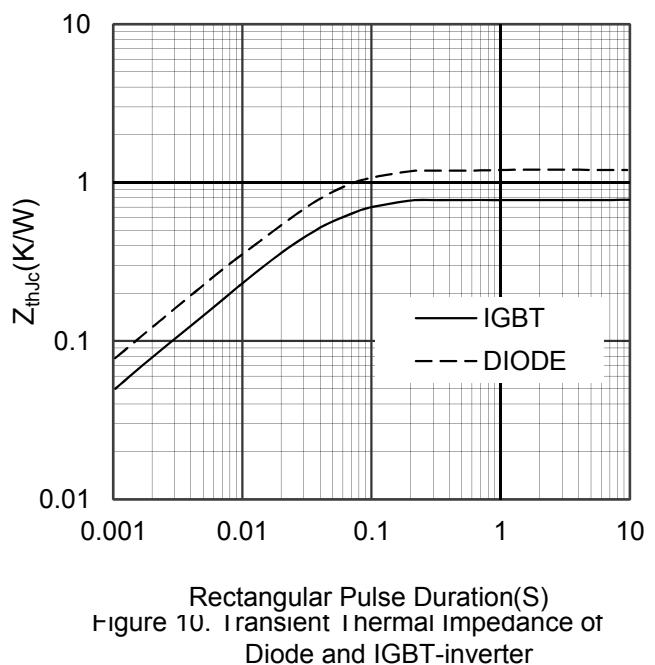
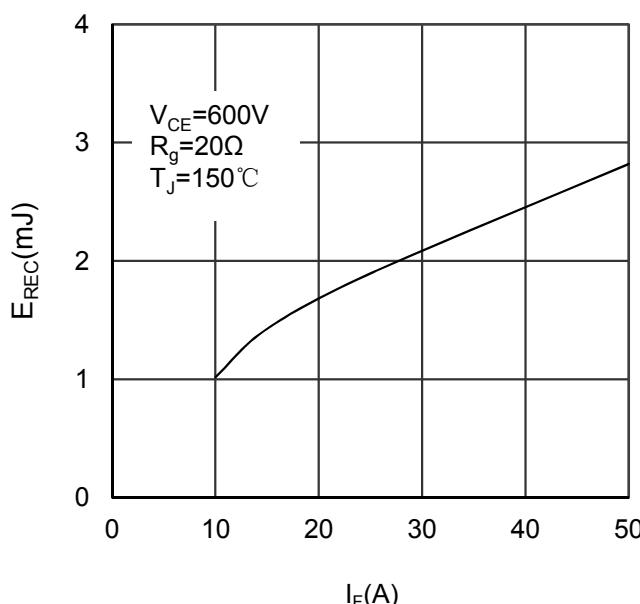


Figure 8. Switching Energy vs Gate Resistor Diode -inverter



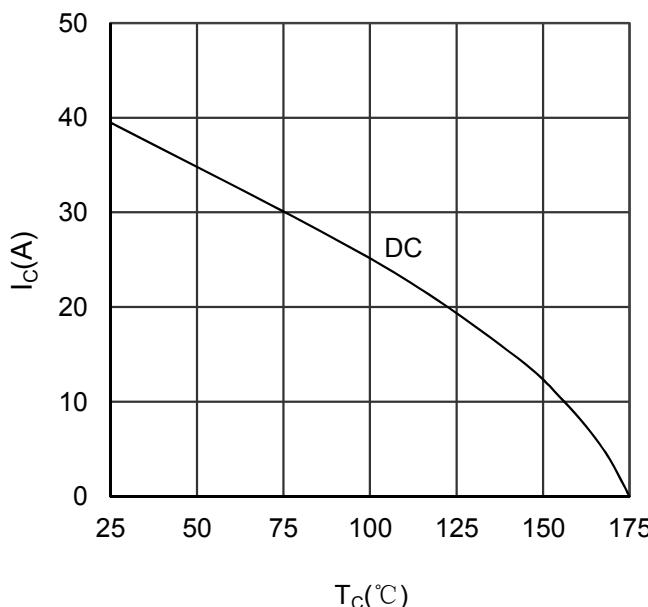


Figure 15. Collector Current vs Case temperature  
IGBT -inverter

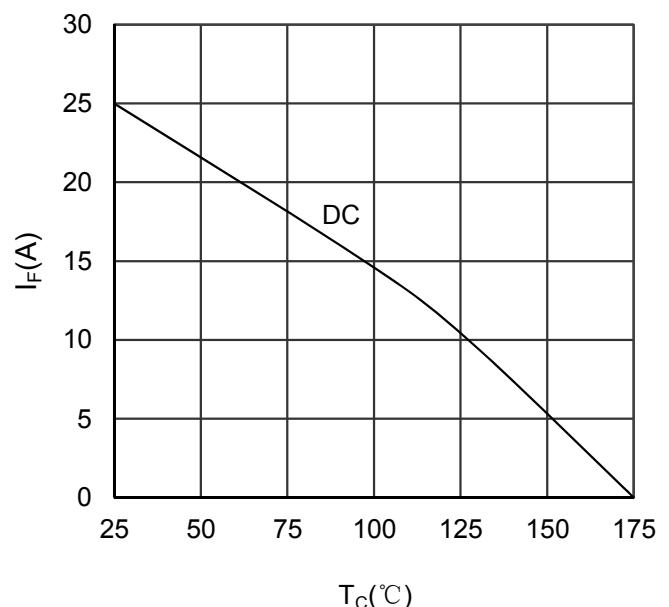


Figure 16. Forward current vs Case temperature  
Diode -inverter

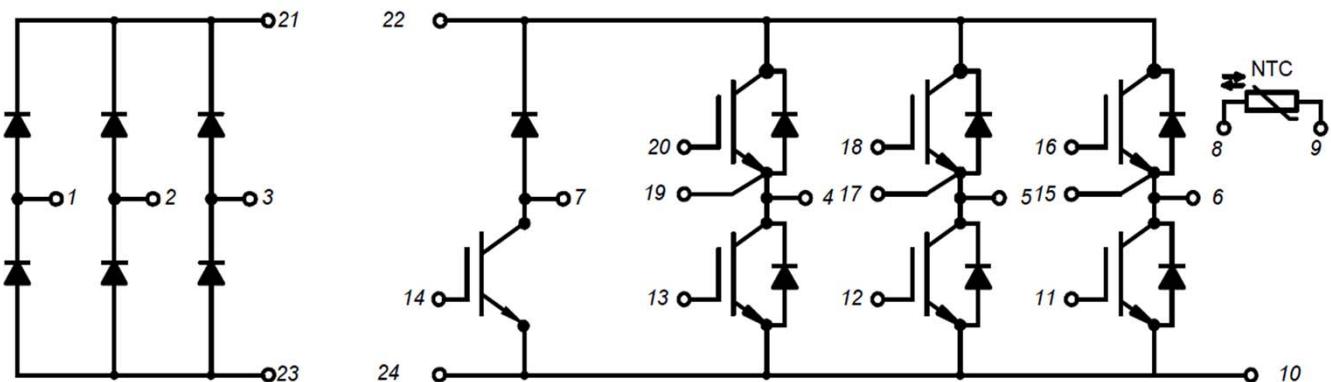


Figure 17. Circuit Diagram

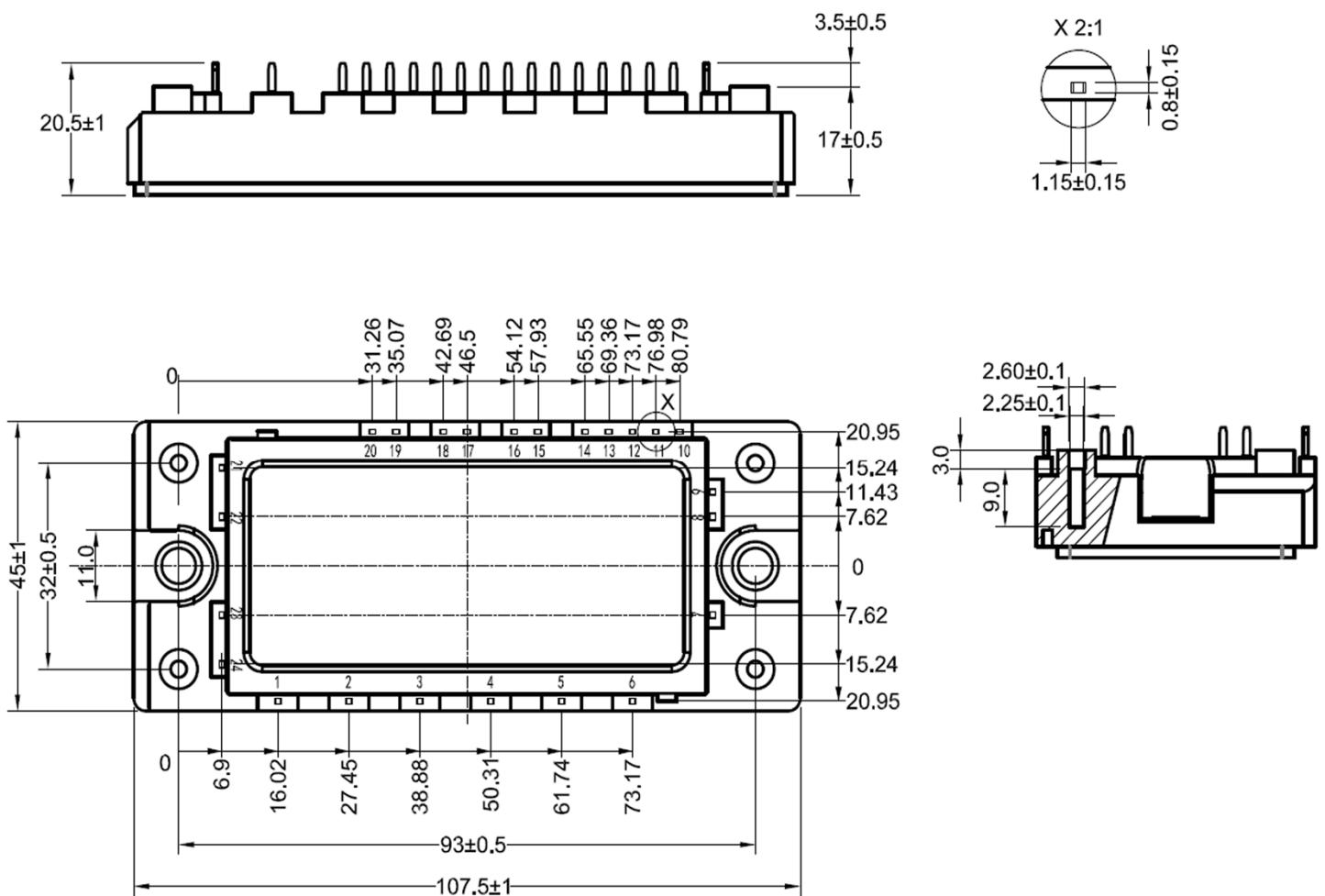


Figure 18. Package Outline