

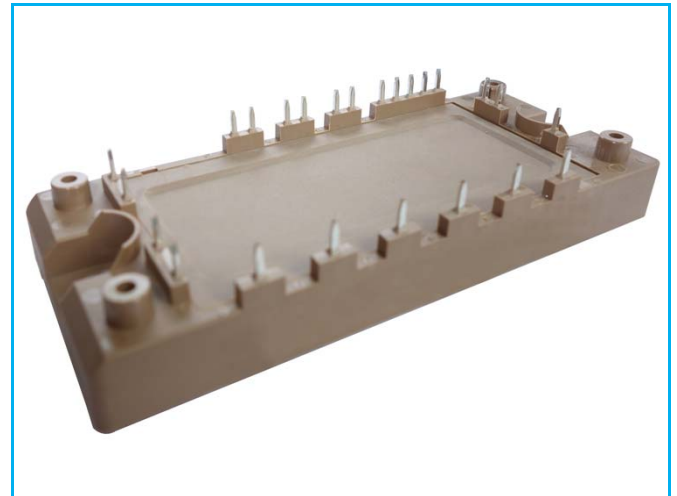
PRODUCT FEATURES

- 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($T_C=25^{\circ}\text{C}$ 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		± 20	
I_C	DC Collector Current	$T_C=25^{\circ}\text{C}, T_{Jmax}=175^{\circ}\text{C}$	60	A
		$T_C=100^{\circ}\text{C}, T_{Jmax}=175^{\circ}\text{C}$	40	
I_{CM}	Repetitive Peak Collector Current	$t_p=1\text{ms}$	80	
P_{tot}	Power Dissipation Per IGBT	$T_C=25^{\circ}\text{C}, T_{Jmax}=175^{\circ}\text{C}$	258	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		40	A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1\text{ms}$	80	
I^2t		$T_J=125^{\circ}\text{C}, t=10\text{ms}, V_R=0\text{V}$	392	A^2S

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MMGT40H120XB6C

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	$I_C=40\text{A}, V_{GE}=15\text{V}, T_J=25^\circ\text{C}$		1.85	2.3		
		$I_C=40\text{A}, V_{GE}=15\text{V}, T_J=125^\circ\text{C}$		2.15			
		$I_C=40\text{A}, V_{GE}=15\text{V}, T_J=150^\circ\text{C}$		2.25			
I_{CES}	Collector Leakage Current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$			100	μA	
		$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=150^\circ\text{C}$			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		Ω	
Q_g	Gate Charge	$V_{CE}=600\text{V}, I_C=40\text{A}, V_{GE}=15\text{V}$		0.21		nC	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		5.65		nF	
C_{res}	Reverse Transfer Capacitance				53		pF
$t_{d(on)}$	Turn on Delay Time	$V_{CC}=600\text{V}, I_C=40\text{A}$ $R_G=15\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$	50		ns	
			$T_J=125^\circ\text{C}$	60		ns	
			$T_J=150^\circ\text{C}$	60		ns	
t_r	Rise Time		$T_J=25^\circ\text{C}$	40		ns	
			$T_J=125^\circ\text{C}$	45		ns	
			$T_J=150^\circ\text{C}$	50		ns	
$t_{d(off)}$	Turn off Delay Time	$T_J=25^\circ\text{C}$		220	ns		
		$T_J=125^\circ\text{C}$		250	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	$V_{CC}=600\text{V}, I_C=40\text{A}$ $R_G=15\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=125^\circ\text{C}$	4.2		mJ	
			$T_J=150^\circ\text{C}$	4.5		mJ	
E_{off}	Turn off Energy		$T_J=125^\circ\text{C}$	3.4		mJ	
			$T_J=150^\circ\text{C}$	3.6		mJ	
I_{SC}	Short Circuit Current		$tpsc \leq 10\mu\text{S}, V_{GE}=15\text{V}$ $T_J=125^\circ\text{C}, V_{CC}=600\text{V}$		240		A
R_{thJC}	Junction to Case Thermal Resistance (Per IGBT)				0.58	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	$I_F=40\text{A}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$		1.9	2.4	V
		$I_F=40\text{A}, V_{GE}=0\text{V}, T_J=150^\circ\text{C}$		1.60		
t_{rr}	Reverse Recovery Time	$I_F=40\text{A}, V_R=600\text{V}$ $dI_F/dt=-1000\text{A}/\mu\text{s}$ $T_J=150^\circ\text{C}$		300		ns
I_{RRM}	Max. Reverse Recovery Current			54		A
Q_{RR}	Reverse Recovery Charge			8		μC
E_{rec}	Reverse Recovery Energy			3		mJ
R_{thJCD}	Junction to Case Thermal Resistance (Per Diode)				0.95	K/W

MMGT40H120XB6C

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	$T_J=45^\circ\text{C}$, $t=10\text{ms}$, 50Hz	480	
		$T_J=45^\circ\text{C}$, $t=8.3\text{ms}$, 60Hz	527	
I^2t		$T_J=45^\circ\text{C}$, $t=10\text{ms}$, 50Hz	1152	A^2S
		$T_J=45^\circ\text{C}$, $t=8.3\text{ms}$, 60Hz	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	μA
		$V_R=1600\text{V}$, $T_J=150^\circ\text{C}$			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
V_{GES}	Gate Emitter Voltage		± 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-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		25	A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1\text{ms}$	50	
I^2t		$T_J=125^\circ\text{C}$, $t=10\text{ms}$, $V_R=0\text{V}$	200	A^2S

MMGT40H120XB6C

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	$V_{CE}=V_{GE}, I_C=1\text{mA}$	5.0	5.8	6.5	V	
$V_{CE(sat)}$	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	μA	
		$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=150^\circ\text{C}$			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		Ω	
Q_g	Gate Charge	$V_{CE}=600\text{V}, I_C=25\text{A}, V_{GE}=15\text{V}$		145		nC	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		3.5		nF	
C_{res}	Reverse Transfer Capacitance				40		pF
$t_{d(on)}$	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	
$t_{d(off)}$	Turn off Delay Time	$T_J=25^\circ\text{C}$		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	mJ	
			$T_J=150^\circ\text{C}$		2.8	mJ	
E_{off}	Turn off Energy		$T_J=125^\circ\text{C}$		2	mJ	
			$T_J=150^\circ\text{C}$		2.2	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_{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	$I_F=25\text{A}, V_R=600\text{V}$		260		ns
I_{RRM}	Max. Reverse Recovery Current	$dI_F/dt=-900\text{A}/\mu\text{s}$		40		A
E_{rec}	Reverse Recovery Energy	$T_J=150^\circ\text{C}$		1.9		mJ
R_{thJCD}	Junction to Case Thermal Resistance (Per Diode)				1.2	K/W

MMGT40H120XB6C

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	$^\circ\text{C}$
		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

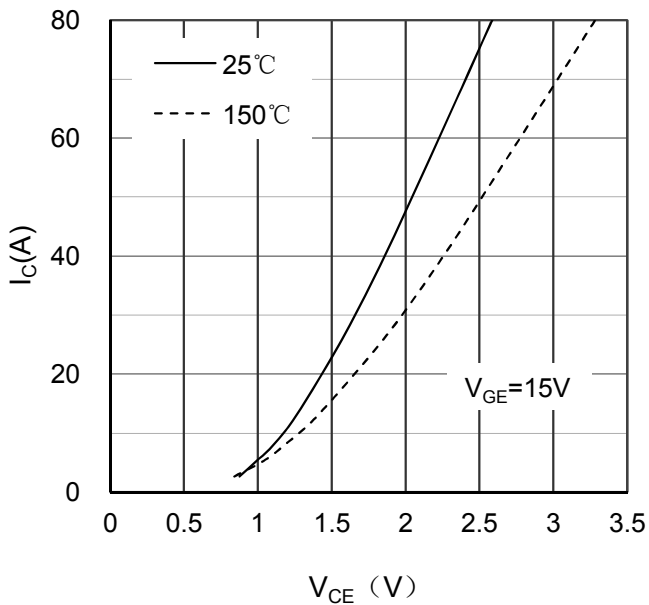


Figure 1. Typical Output Characteristics IGBT-inverter

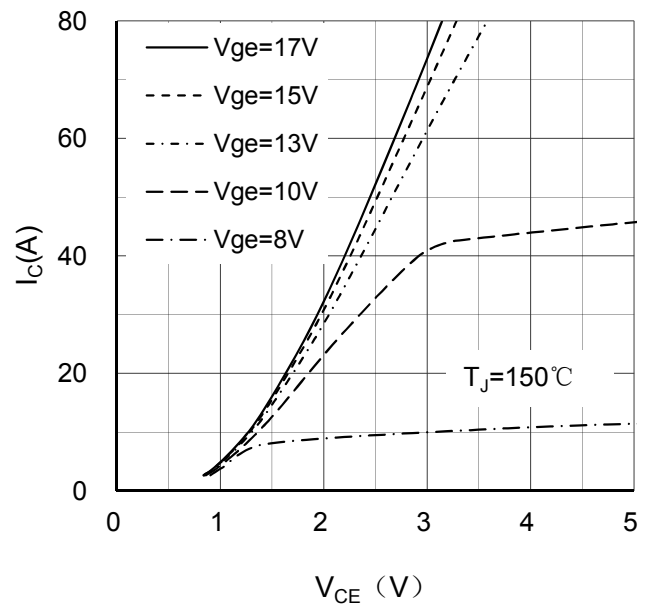


Figure 2. Typical Output Characteristics IGBT-inverter

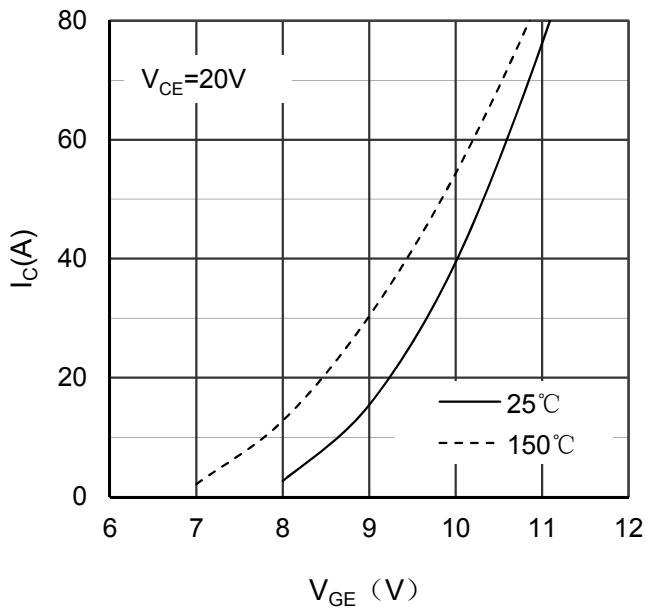


Figure 3. Typical Transfer characteristics IGBT-inverter

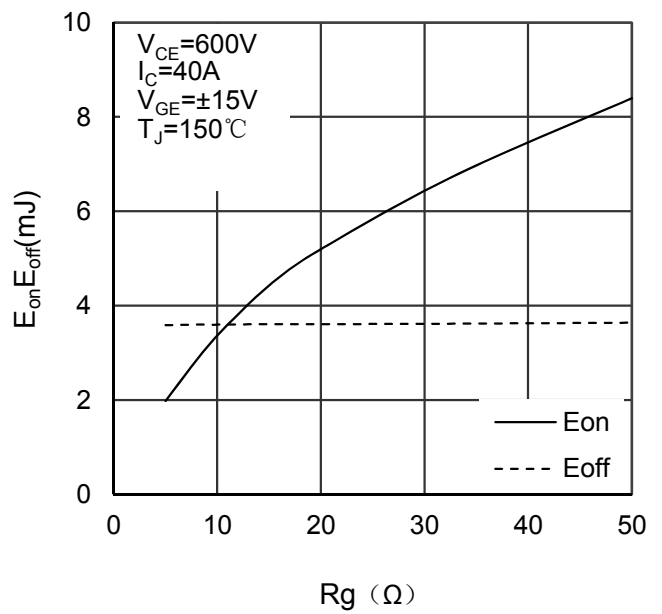


Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

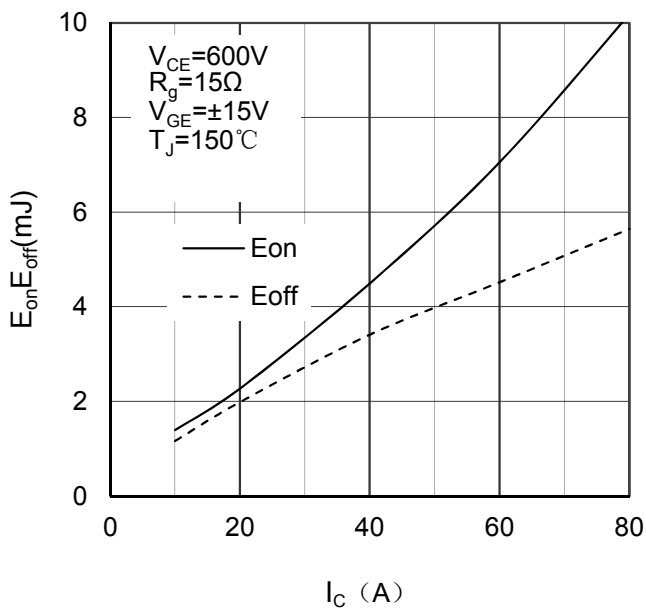


Figure 5. Switching Energy vs Collector Current IGBT-inverter

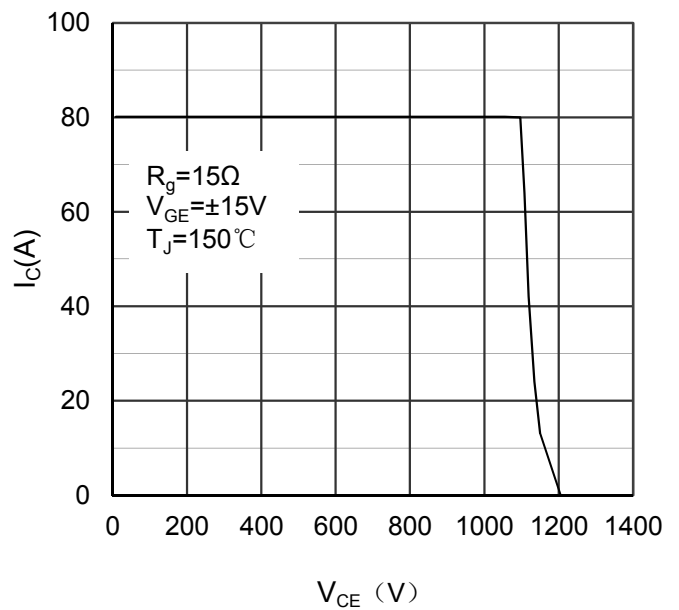


Figure 6. Reverse Biased Safe Operating Area IGBT-inverter

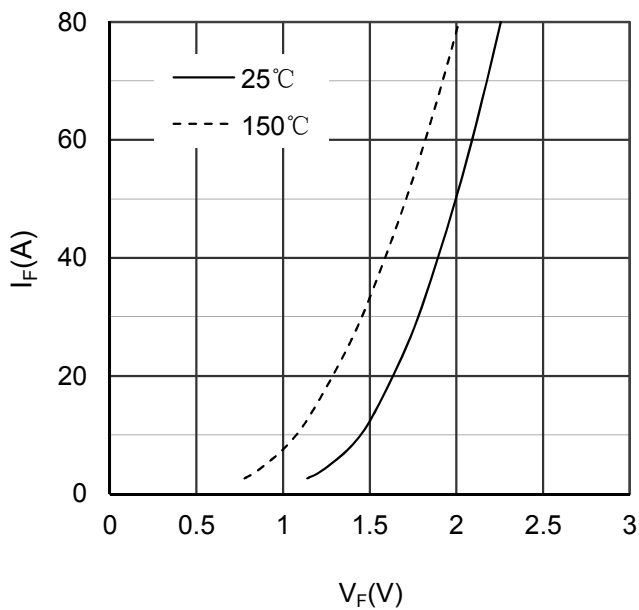


Figure 7. Diode Forward Characteristics Diode -inverter

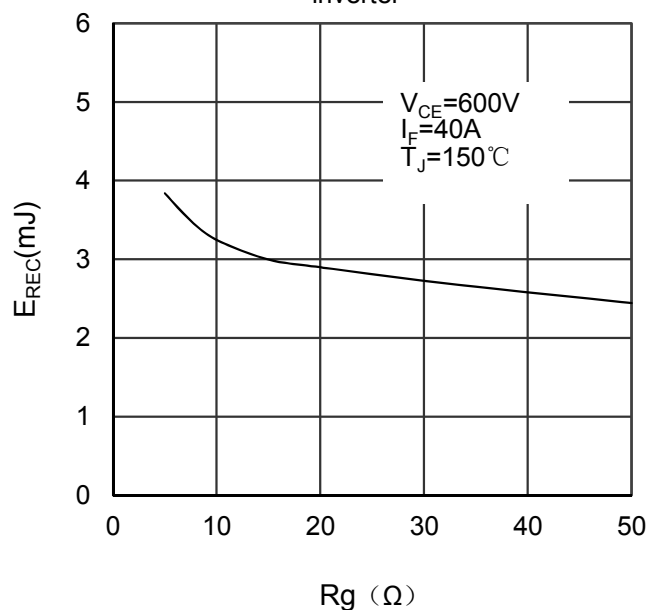


Figure 8. Switching Energy vs Gate Resistor Diode -inverter

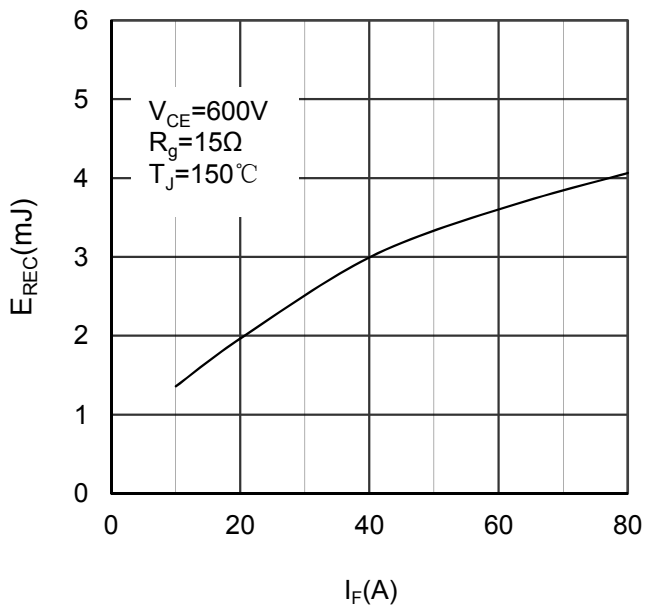


Figure 9. Switching Energy vs Forward Current Diode-inverter

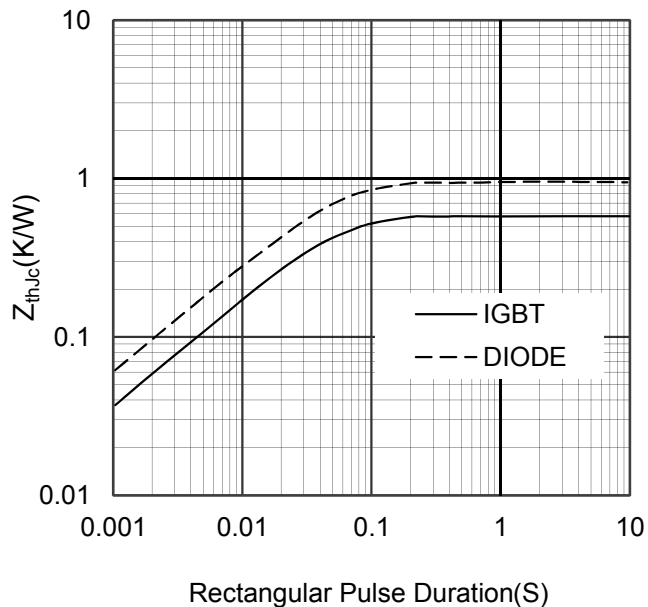


Figure 10. Transient Thermal Impedance of Diode and IGBT-inverter

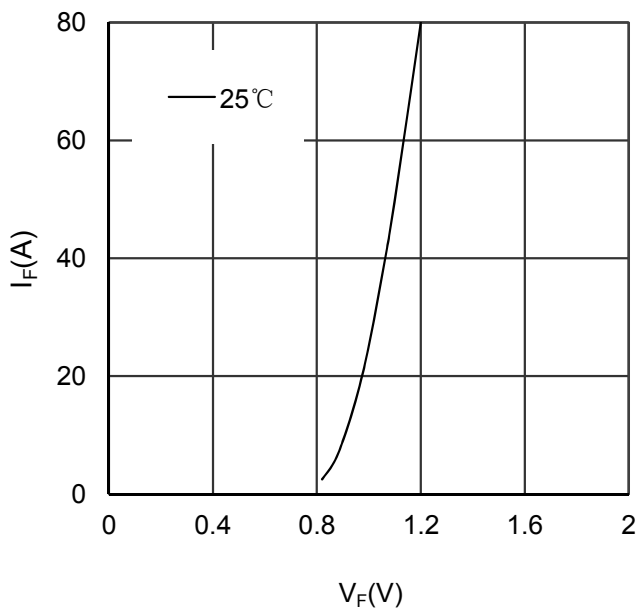


Figure 11. Diode Forward Characteristics Diode-rectifier

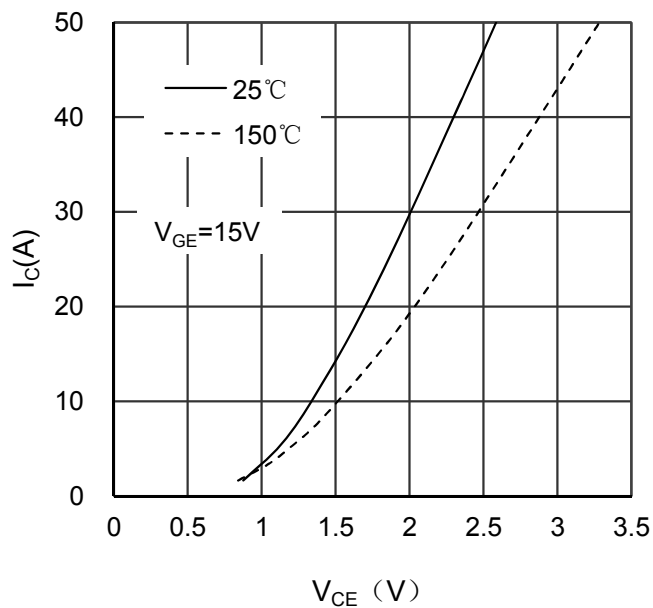


Figure 12. Typical Output Characteristics IGBT-brake chopper

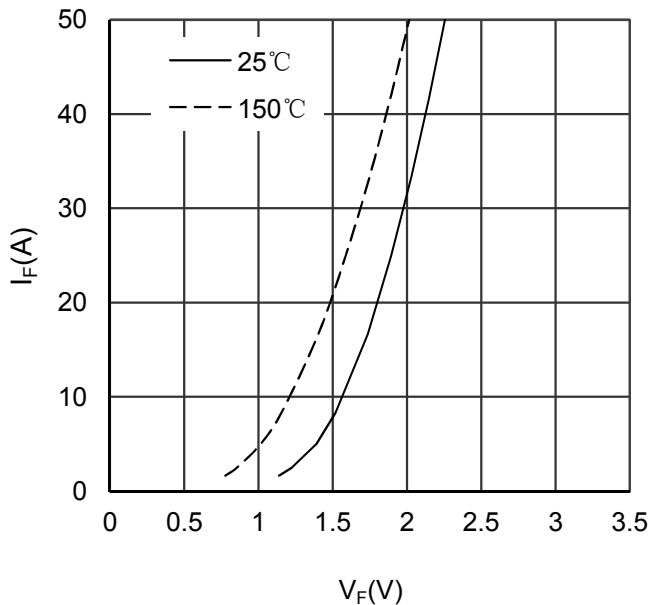


Figure 13. Diode Forward Characteristics Diode-brake chopper

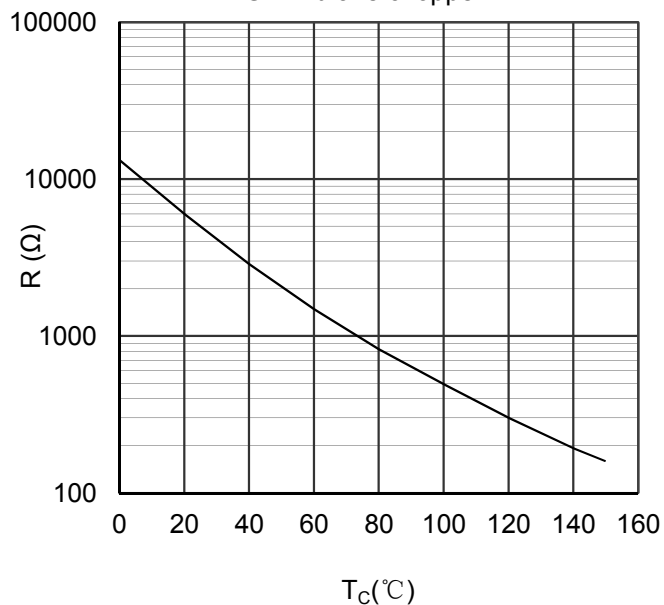


Figure 14. NTC Characteristics

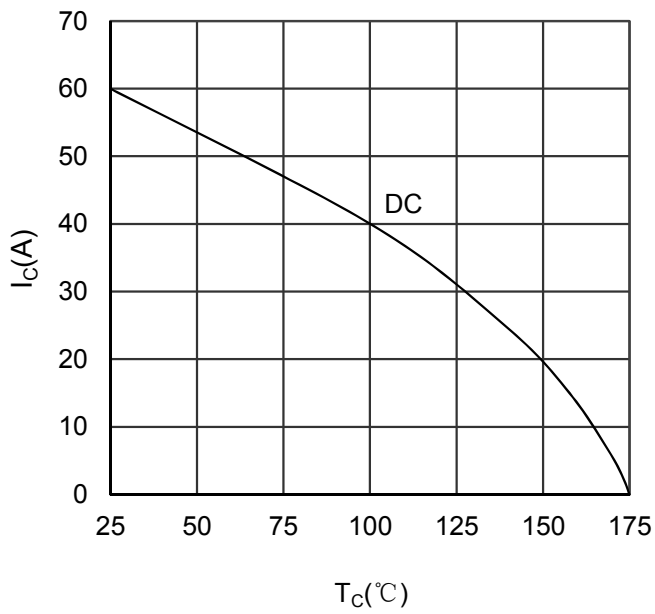


Figure 15. Collector Current vs Case temperature IGBT-inverter

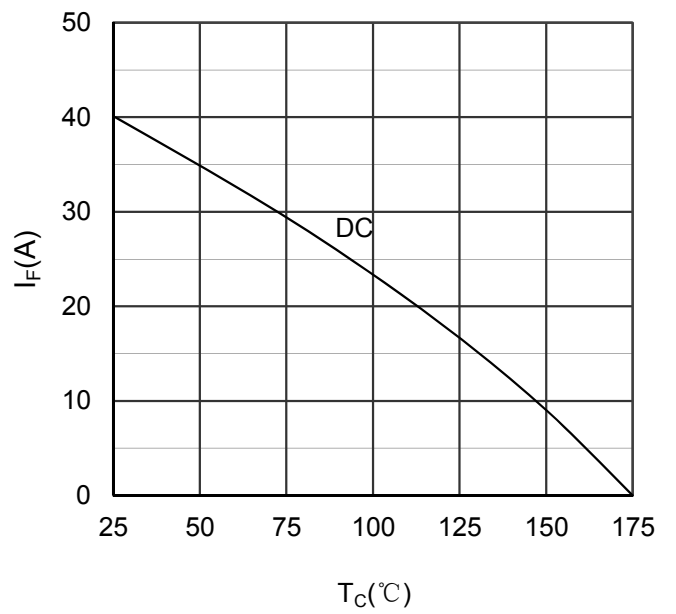


Figure 16. Forward current vs Case temperature Diode-inverter

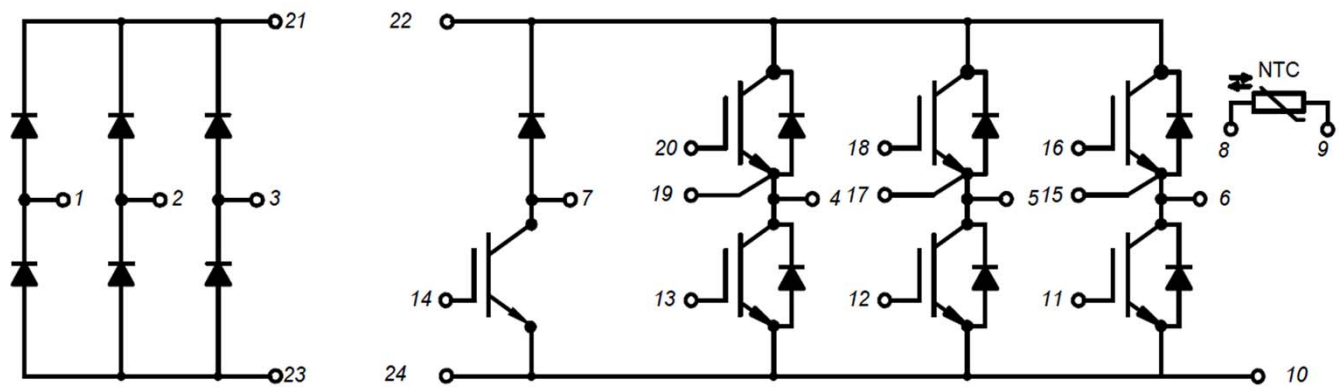
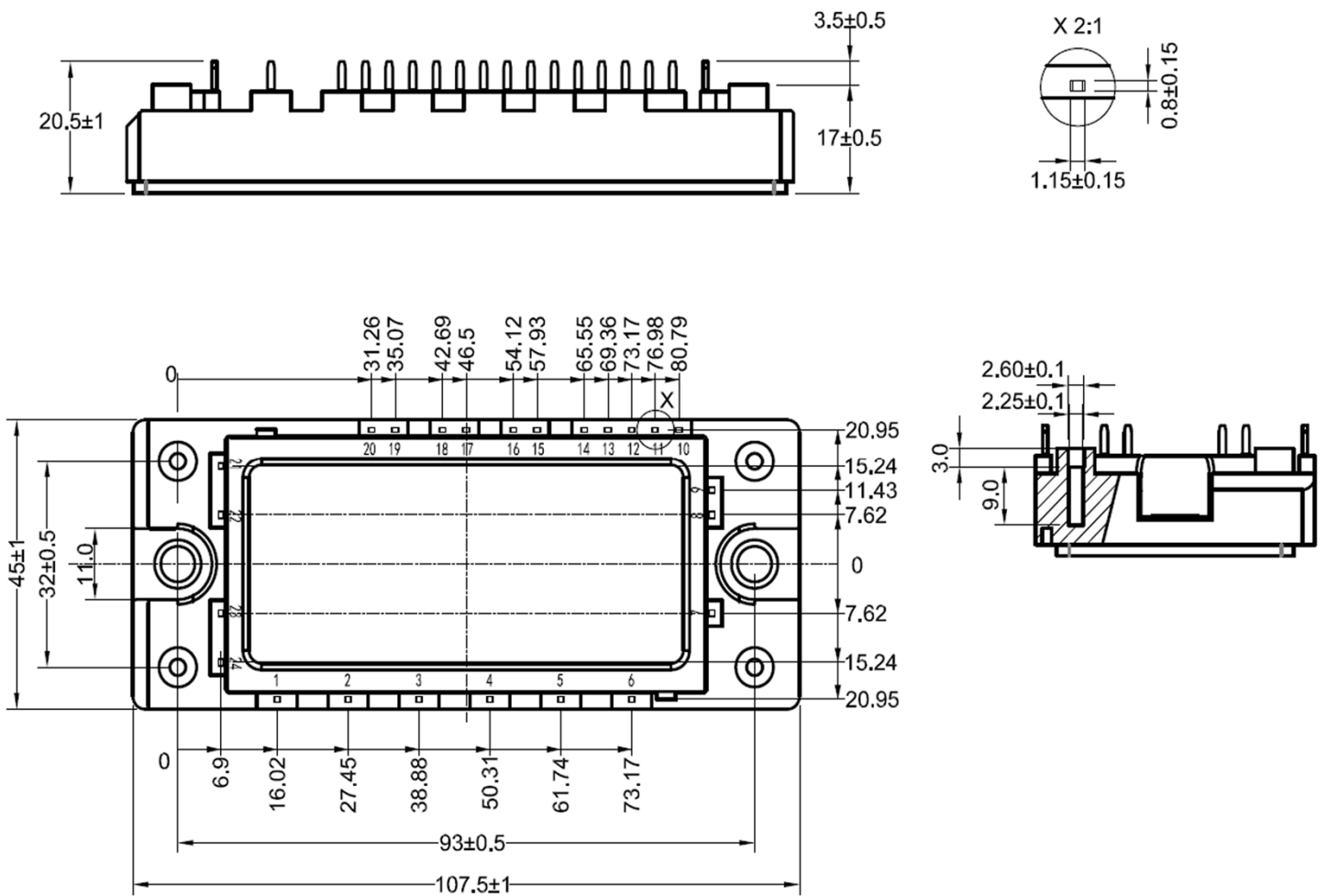


Figure 17. Circuit Diagram



Dimensions in (mm)
Figure 18. Package Outline