

PRODUCT FEATURES

- ☐ High level of integration
- ☐ 600V IGBT³ 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		± 20	
I_C	DC Collector Current	$T_C=25^{\circ}\text{C}, T_{Jmax}=175^{\circ}\text{C}$	60	A
		$T_C=80^{\circ}\text{C}, T_{Jmax}=175^{\circ}\text{C}$	50	
I_{CM}	Repetitive Peak Collector Current	$t_p=1\text{ms}$	100	
P_{tot}	Power Dissipation Per IGBT	$T_C=25^{\circ}\text{C}, T_{Jmax}=175^{\circ}\text{C}$	190	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		50	A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1\text{ms}$	100	
I^2t		$T_J=125^{\circ}\text{C}, t=10\text{ms}, V_R=0\text{V}$	330	A^2S

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MMG50W060XB6EN

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 =0.8mA	4.9	5.8	6.5	V
V _{CE(sat)}	Collector Emitter Saturation Voltage	I _C =50A, V _{GE} =15V, T _J =25℃		1.45	1.9	
		I _C =50A, V _{GE} =15V, T _J =125℃		1.6		
		I _C =50A, V _{GE} =15V, T _J =150℃		1.7		
I _{CES}	Collector Leakage Current	V _{CE} =600V, V _{GE} =0V, T _J =25℃			1	mA
		V _{CE} =600V, V _{GE} =0V, T _J =150℃			10	mA
I _{GES}	Gate Leakage Current	V _{CE} =0V, V _{GE} =±15V, T _J =25℃	-200		200	nA
R _{gint}	Integrated Gate Resistor			0		Ω
Q _g	Gate Charge	V _{CE} =300V, I _C =50A , V _{GE} =±15V		500		nC
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f =1MHz		3.1		nF
C _{res}	Reverse Transfer Capacitance			95		pF
t _{d(on)}	Turn on Delay Time	V _{CC} =300V, I _C =50A R _G =43Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		100	ns
			T _J =150℃		100	ns
t _r	Rise Time		T _J =25℃		60	ns
			T _J =150℃		70	ns
t _{d(off)}	Turn off Delay Time	V _{CC} =300V, I _C =50A R _G =43Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		600	ns
			T _J =150℃		700	ns
t _f	Fall Time		T _J =25℃		40	ns
			T _J =150℃		60	ns
E _{on}	Turn on Energy	V _{CC} =300V, I _C =50A R _G =43Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		2.3	mJ
			T _J =125℃		2.75	mJ
			T _J =150℃		2.9	mJ
E _{off}	Turn off Energy		T _J =25℃		1.75	mJ
			T _J =125℃		2.1	mJ
			T _J =150℃		2.15	mJ
I _{SC}	Short Circuit Current	tpsc≤6μS , V _{GE} =15V T _J =150℃, V _{CC} =360V		250		A
R _{thJC}	Junction to Case Thermal Resistance (Per IGBT)				0.8	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	$I_F=50\text{A}, V_{GE}=0\text{V}, T_J=25^{\circ}\text{C}$		1.55	1.95	V
		$I_F=50\text{A}, V_{GE}=0\text{V}, T_J=125^{\circ}\text{C}$		1.50		
		$I_F=50\text{A}, V_{GE}=0\text{V}, T_J=150^{\circ}\text{C}$		1.45		
I_{RRM}	Max. Reverse Recovery Current	$I_F=50\text{A}, V_R=300\text{V}$		36		A
Q_{RR}	Reverse Recovery Charge	$dI_F/dt=-900\text{A}/\mu\text{s}$		3.55		μC
E_{rec}	Reverse Recovery Energy	$T_J=150^{\circ}\text{C}$		0.6		mJ
R_{thJCD}	Junction to Case Thermal Resistance (Per Diode)				1.2	K/W

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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	$T_C=80^{\circ}\text{C}$	55	A
I_{FRMS}	R.M.S. Forward Current Per Diode		85	
I_{RMS}	R.M.S. Current at rectifier output		125	
I_{FSM}	Non Repetitive Surge Forward Current	$T_J=45^{\circ}\text{C}$, $t=10\text{ms}$, 50Hz	645	
		$T_J=45^{\circ}\text{C}$, $t=8.3\text{ms}$, 60Hz	710	
I^2t		$T_J=45^{\circ}\text{C}$, $t=10\text{ms}$, 50Hz	2080	A^2S
		$T_J=45^{\circ}\text{C}$, $t=8.3\text{ms}$, 60Hz	2090	

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	$I_F=50\text{A}$, $T_J=25^{\circ}\text{C}$		1.05	1.2	V
		$I_F=50\text{A}$, $T_J=150^{\circ}\text{C}$		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_{thJC}	Junction to Case Thermal Resistance (Per Diode)				0.62	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		± 20	
I_C	DC Collector Current	$T_C=25^{\circ}\text{C}$, $T_{Jmax}=175^{\circ}\text{C}$	27	A
		$T_C=80^{\circ}\text{C}$, $T_{Jmax}=175^{\circ}\text{C}$	20	
I_{CM}	Repetitive Peak Collector Current	$t_p=1\text{ms}$	40	
P_{tot}	Power Dissipation Per IGBT	$T_C=25^{\circ}\text{C}$, $T_{Jmax}=175^{\circ}\text{C}$	83	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		20	A
I_{FRM}	Repetitive Peak Forward Current	$t_p=1\text{ms}$	40	
I^2t		$T_J=125^{\circ}\text{C}$, $t=10\text{ms}$, $V_R=0\text{V}$	49	A^2S

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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 =0.3mA	4.9	5.8	6.5	V
V _{CE(sat)}	Collector Emitter Saturation Voltage	I _C =20A, V _{GE} =15V, T _J =25°C		1.55	2	
		I _C =20A, V _{GE} =15V, T _J =125°C		1.7		
		I _C =20A, V _{GE} =15V, T _J =150°C		1.8		
I _{CES}	Collector Leakage Current	V _{CE} =600V, V _{GE} =0V, T _J =25°C			1	mA
		V _{CE} =600V, V _{GE} =0V, T _J =150°C			10	mA
I _{GES}	Gate Leakage Current	V _{CE} =0V, V _{GE} =±15V, T _J =25°C	-400		400	nA
R _{gint}	Integrated Gate Resistor					Ω
Q _g	Gate Charge	V _{CE} =300V, I _C =20A , V _{GE} =±15V		200		nC
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f =1MHz		1.1		nF
C _{res}	Reverse Transfer Capacitance			32		pF
t _{d(on)}	Turn on Delay Time	V _{CC} =300V, I _C =20A R _G =18Ω, V _{GE} =±15V, Inductive Load	T _J =25°C		20	ns
			T _J =150°C		20	ns
t _r	Rise Time		T _J =25°C		13	ns
			T _J =150°C		17	ns
t _{d(off)}	Turn off Delay Time	V _{CC} =300V, I _C =20A R _G =18Ω, V _{GE} =±15V, Inductive Load	T _J =25°C		120	ns
			T _J =150°C		150	ns
t _f	Fall Time		T _J =25°C		70	ns
			T _J =150°C		100	ns
E _{on}	Turn on Energy	V _{CC} =300V, I _C =20A R _G =18Ω, V _{GE} =±15V, Inductive Load	T _J =25°C		0.32	mJ
			T _J =125°C		0.44	mJ
			T _J =150°C		0.49	mJ
E _{off}	Turn off Energy		T _J =25°C		0.44	mJ
			T _J =125°C		0.56	mJ
			T _J =150°C		0.59	mJ
I _{SC}	Short Circuit Current	tpsc≤6μS , V _{GE} =15V T _J =150°C, V _{CC} =360V		100		A
R _{thJC}	Junction to Case Thermal Resistance (Per IGBT)				1.8	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	$I_F=20\text{A}, V_{GE}=0\text{V}, T_J=25^{\circ}\text{C}$		1.60	2.00	V
		$I_F=20\text{A}, V_{GE}=0\text{V}, T_J=125^{\circ}\text{C}$		1.55		
		$I_F=20\text{A}, V_{GE}=0\text{V}, T_J=150^{\circ}\text{C}$		1.50		
I_{RRM}	Max. Reverse Recovery Current	$I_F=20\text{A}, V_R=300\text{V}$		40		A
Q_{RR}	Reverse Recovery Charge	$dI_F/dt=-1800\text{A}/\mu\text{s}$		2.2		μC
E_{rec}	Reverse Recovery Energy	$T_J=150^{\circ}\text{C}$		0.47		mJ
R_{thJCD}	Junction to Case Thermal Resistance (Per Diode)				2.5	K/W

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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
$T_{J\text{max}}$	Max. Junction Temperature	Inverter, Brake-Chopper	175	$^\circ\text{C}$
		Rectifier	150	
$T_{J\text{op}}$	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			300	g

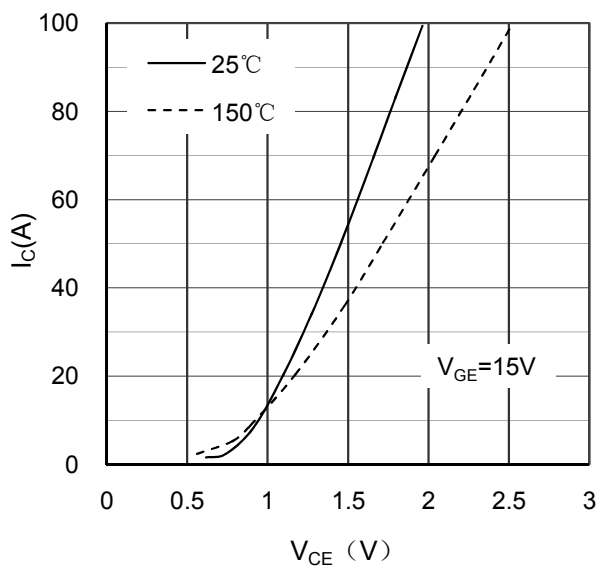


Figure 1. Typical Output Characteristics IGBT-inverter

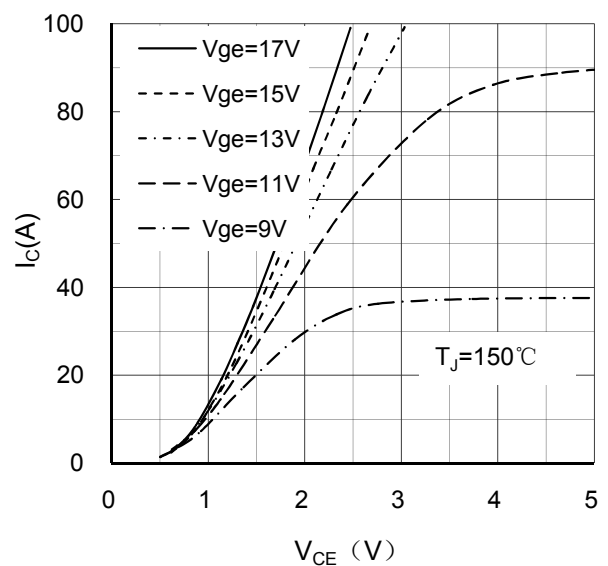


Figure 2. Typical Output Characteristics IGBT-inverter

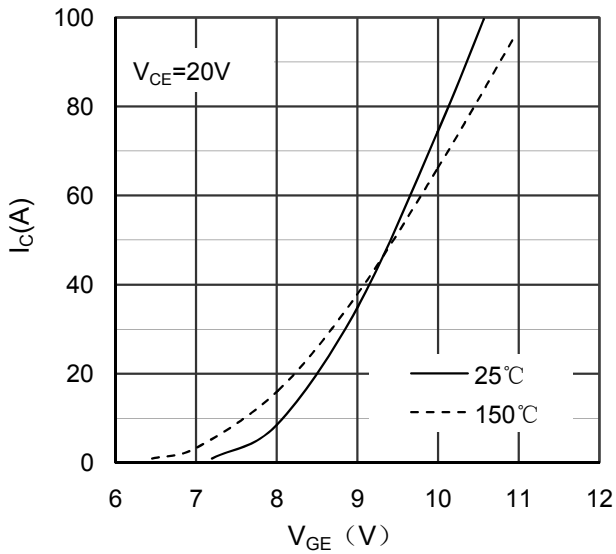


Figure 3. Typical Transfer characteristics IGBT-inverter

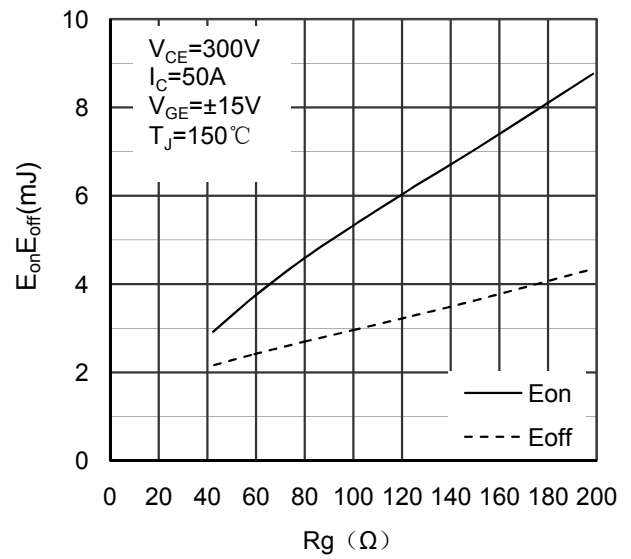


Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

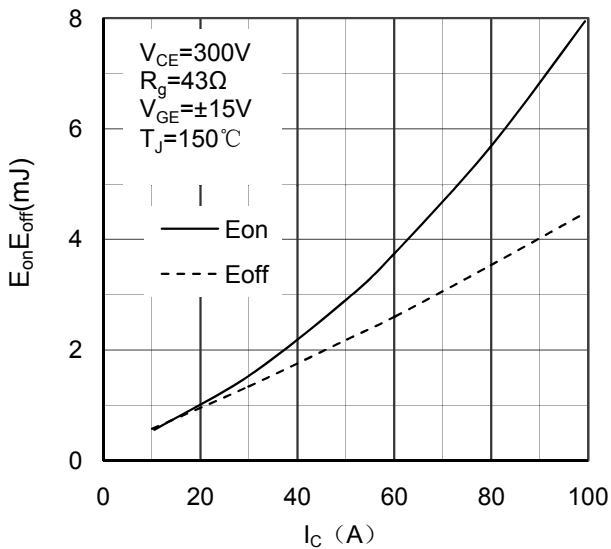


Figure 5. Switching Energy vs Collector Current IGBT-inverter

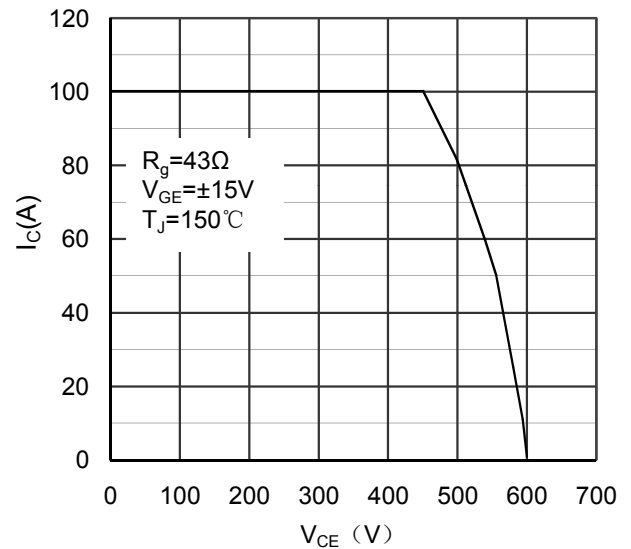


Figure 6. Reverse Biased Safe Operating Area IGBT-inverter

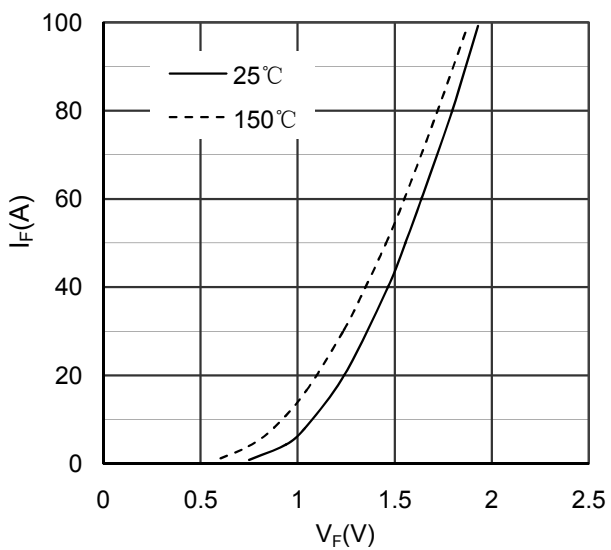


Figure 7. Diode Forward Characteristics Diode -inverter

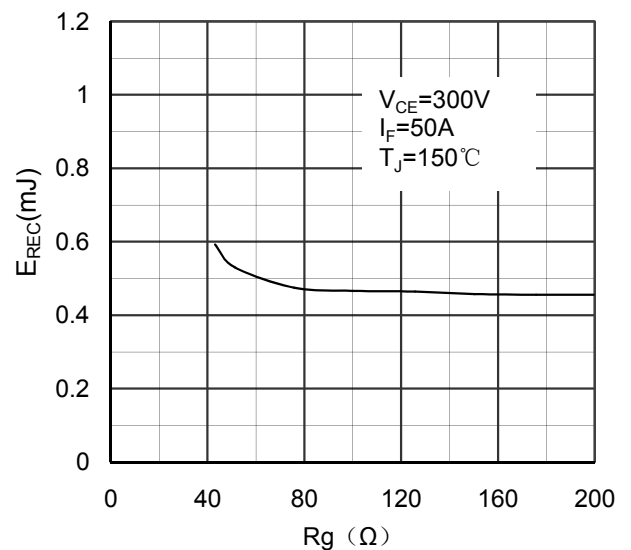


Figure 8. Switching Energy vs Gate Resistor Diode -inverter

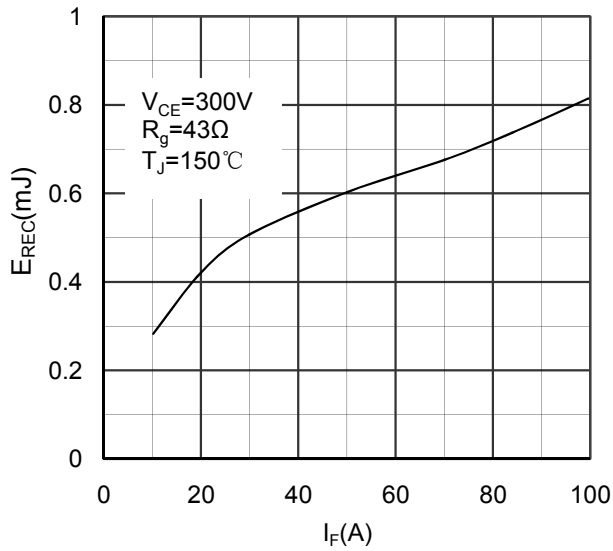


Figure 9. Switching Energy vs Forward Current Diode-inverter

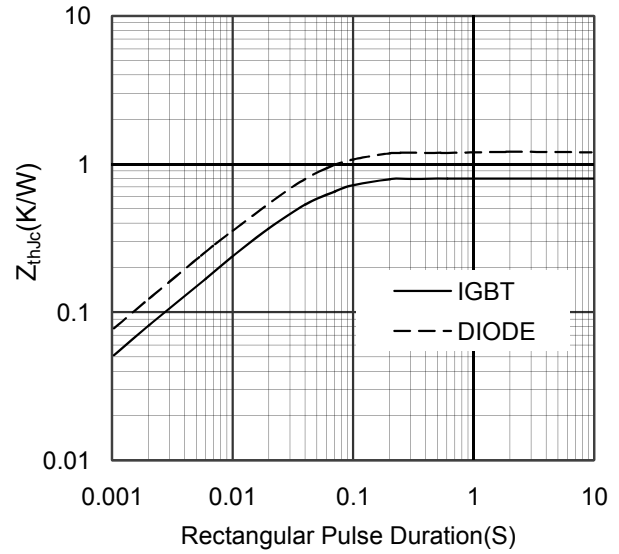


Figure 10. Transient Thermal Impedance of Diode and IGBT-inverter

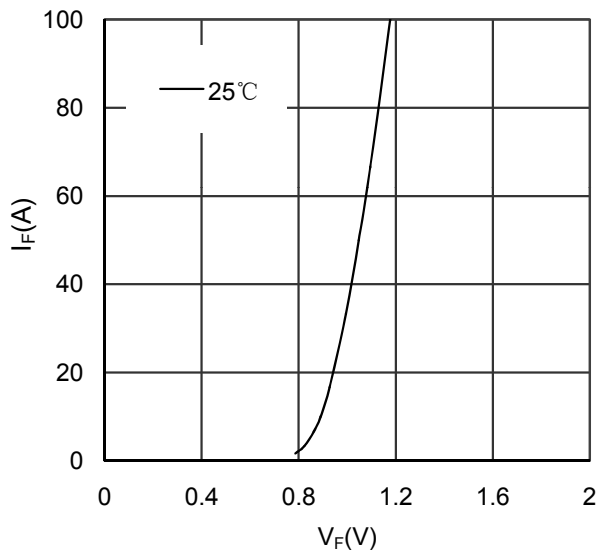


Figure 11. Diode Forward Characteristics Diode- rectifier

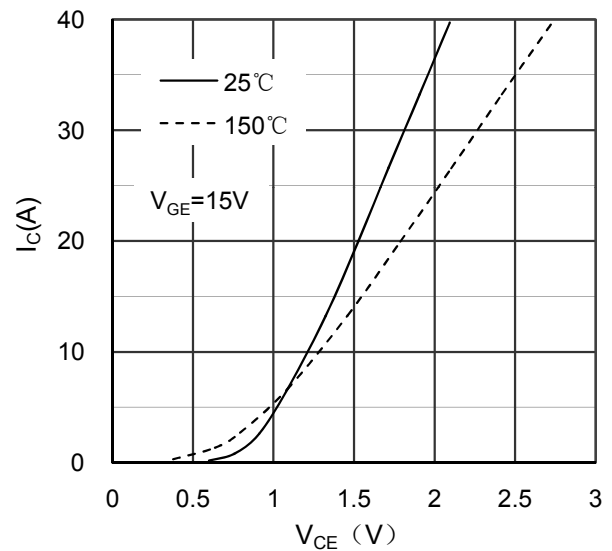


Figure 12. Typical Output Characteristics IGBT- brake chopper

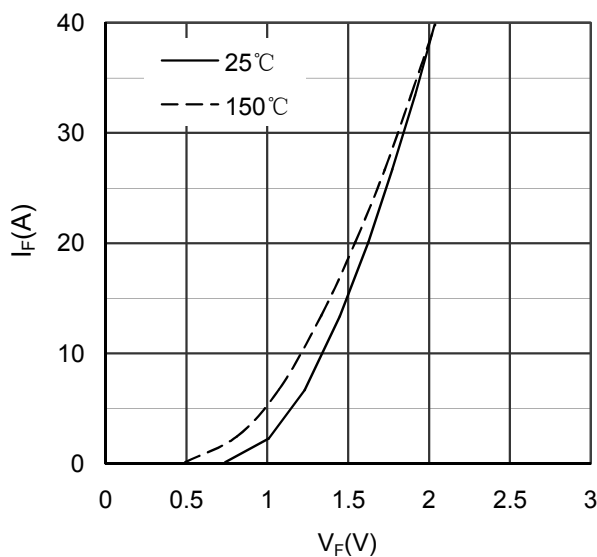


Figure 13. Diode Forward Characteristics Diode - brake chopper

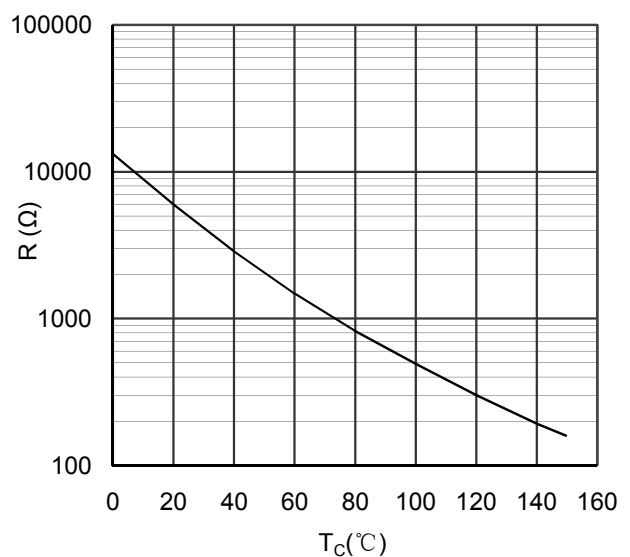


Figure 14. NTC Characteristics

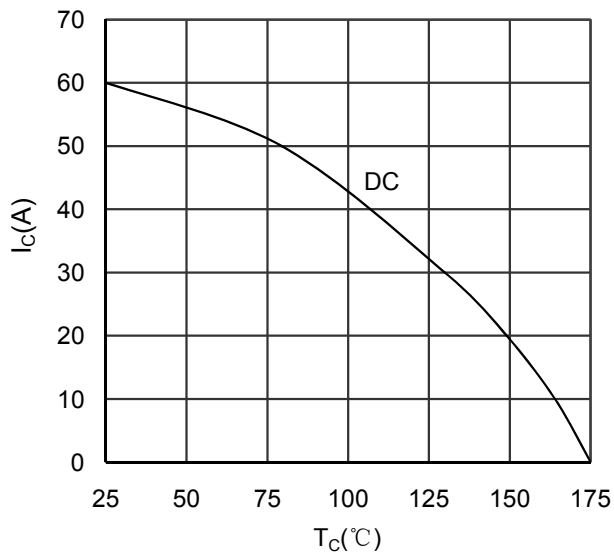


Figure 15. Collector Current vs Case temperature
IGBT -inverter

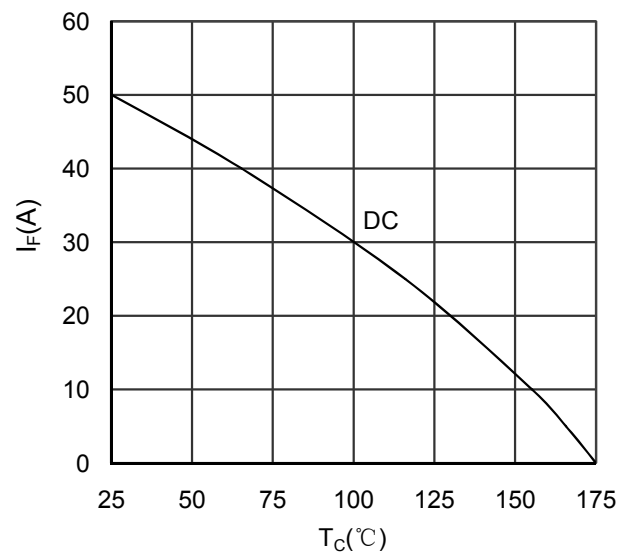


Figure 16. Forward current vs Case temperature
Diode -inverter

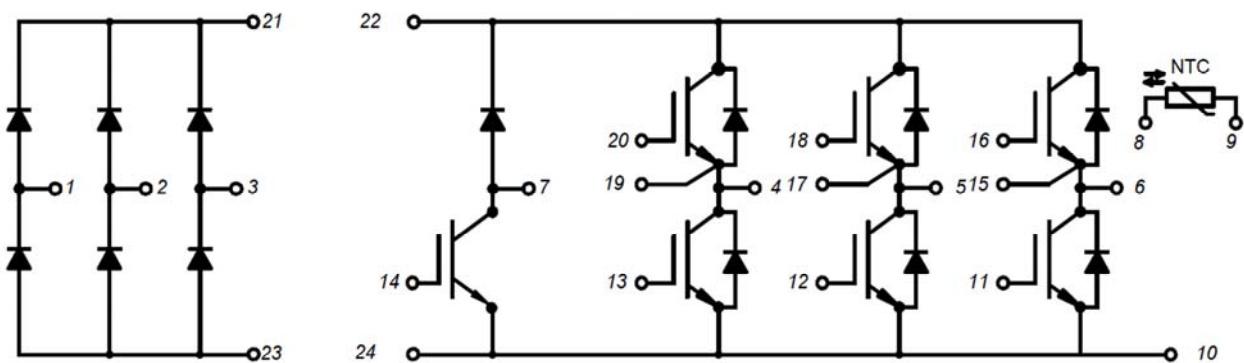
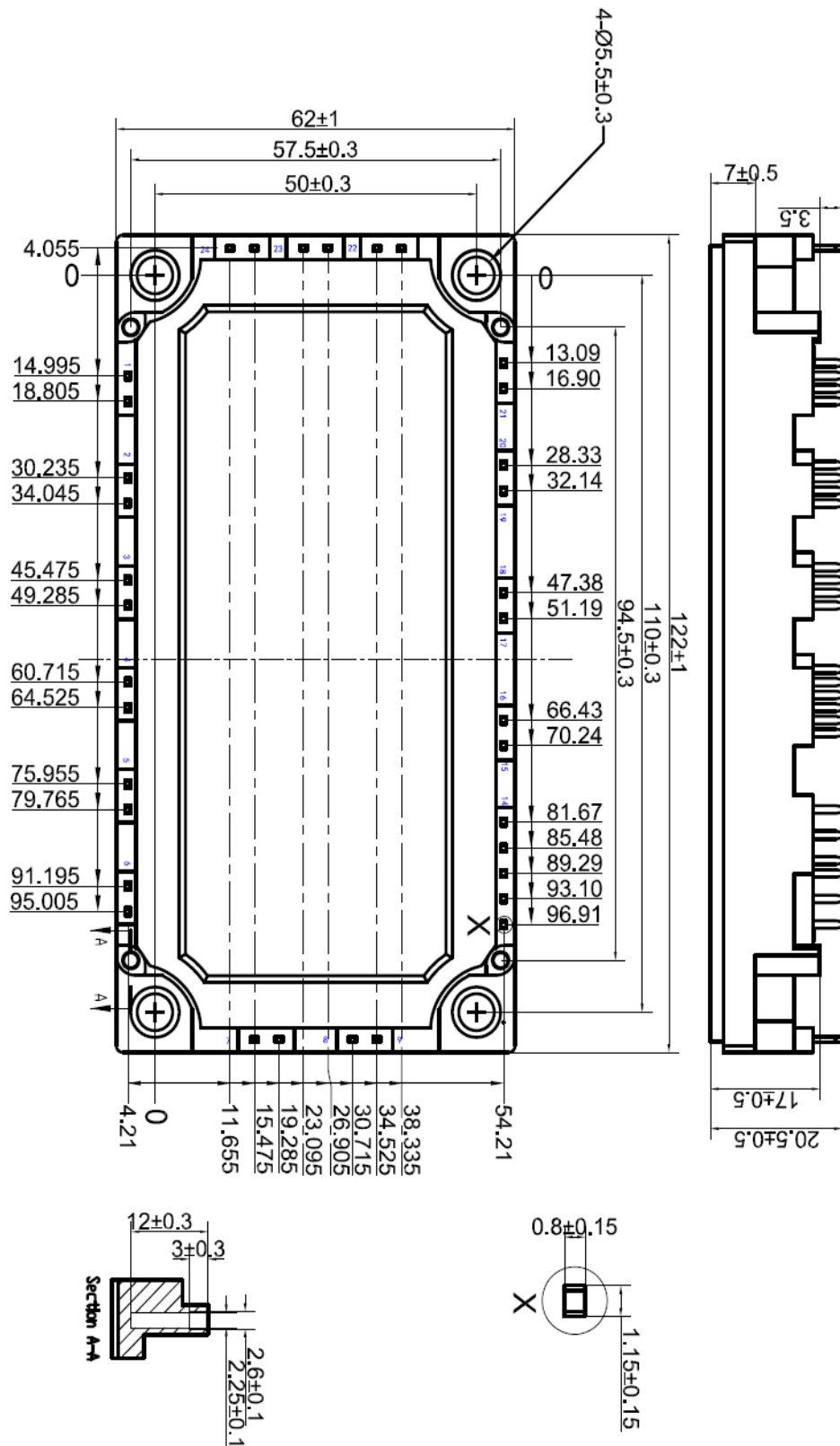


Figure 17. Circuit Diagram



Dimensions in (mm)

Figure 18. Package Outline