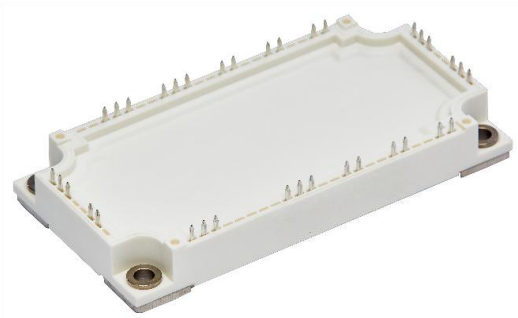
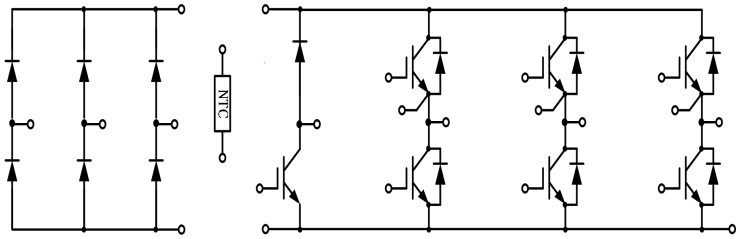
EconoPIM3 PIM IGBT Module

V_{CES}=1200V,I_C=100A,$V_{CE(sat)}$=1.92V



Features

- 1200V Trench Gate/Field Termination Process
- Low Switching Losses
- $V_{CE(Sat)}$ With Positive Temperature Coefficient
- Integrated NTC Temperature Sensor



Applications

- Power Conversion System
- Inverter
- Servo Drives

IGBT, Inverter

Maximum Ratings

Parameter	Symbol	Condition	Value	Unit
Collector-emitter voltage	V_{CES}	T_{vj}=25℃, V_{GE}=0V	1200	V
Continuous DC collector current	$I_{C\ nom}$	T_C=100℃, $T_{vj\ max}$=175℃	100	A
Repetitive peak collector current	I_{CRM}	t_P=1ms	200	A
Total power dissipation	P_{tot}	T_C=25℃, $T_{vj\ max}$=175℃	515	W
Gate-emitter peak voltage	V_{GES}	T_{vj}=25℃	±20	V

Characteristics Values

Parameter	Symbol	Conditions		Value			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE(sat)}$	I_C=100A, V_{GE}=15V	T_{vj}=25℃		1.92	2.5	V
			T_{vj}=125℃		2.34		V
			T_{vj}=150℃		2.44		V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=3.8mA, V_{CE}=V_{GE}	T_{vj}=25℃	5.2	5.8	6.4	V
Gate charge	Q_G	V_{GE}=-15V...+15V			0.47		μC
Integrated gate resistor	$R_{G\ int}$	T_{vj}=25℃			5.86		Ω
Input capacitance	C_{ies}	f=1MHz, V_{CE}=25V, V_{GE}=0V	T_{vj}=25℃		7.47		nF
Reverse transfer capacitance	C_{res}	f=1MHz, V_{CE}=25V, V_{GE}=0V	T_{vj}=25℃		0.28		nF
Collector-emitter cut-off current	I_{CES}	V_{CE}=1200V, V_{GE}=0V	T_{vj}=25℃			1	mA

Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	T_{vj}=25℃			100	nA
Turn-on delay time	$t_{d\ on}$	I_C=100A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=2Ω, Inductive Load	T_{vj}=25℃		104		ns
			T_{vj}=125℃		113		ns
			T_{vj}=150℃		118		ns
Rise time	t_r	I_C=100A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=2Ω, Inductive Load	T_{vj}=25℃		27		ns
			T_{vj}=125℃		32		ns
			T_{vj}=150℃		34		ns
Turn-off delay time	$t_{d\ off}$	I_C=100A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=2Ω, Inductive Load	T_{vj}=25℃		203		ns
			T_{vj}=125℃		251		ns
			T_{vj}=150℃		259		ns
Fall time	t_f	I_C=100A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=2Ω, Inductive Load	T_{vj}=25℃		181		ns
			T_{vj}=125℃		184		ns
			T_{vj}=150℃		197		ns
Turn-on energy loss per pulse	E_{on}	I_C=100A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=2Ω, di/dt=2300A/μs (T_{vj}=150℃) Inductive Load	T_{vj}=25℃		3.04		mJ
			T_{vj}=125℃		6.17		mJ
			Tvj=150℃		7.22		mJ
Turn-off energy loss per pulse	E_{off}	I_C=100A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=2Ω, du/dt=5000V/μs (T_{vj}=150℃) Inductive Load	T_{vj}=25℃		6.11		mJ
			T_{vj}=125℃		8.24		mJ
			T_{vj}=150℃		8.77		mJ
SC data	I_{SC}	V_{GE}≤15V, V_{CE}=800V V_{CEmax}=V_{CES}-L_{sCE}*di/dt, t_P≤10μs,	T_{vj}=150℃		329		A
Temperature under switching conditions	$T_{vj\ op}$			-40		150	℃

Diode, Inverter

Maximum Ratings

Parameter	Symbol	Conditions		Value	Unit
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25℃		1200	V
Continuous forward current	I_F			100	A
Repetitive peak forward current	I_{FRM}	t_P= 1ms		200	A
I^2t-value	I^2t	t_P=10ms, sin180°	T_{vj}=125℃	1360	A^2s

Characteristics Values

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=100A, V_{GE}=0V	T_{vj}=25℃		2.2	2.8	V
			T_{vj}=125℃		2.15		V
			T_{vj}=150℃		2.07		V
Peak reverse recovery current	I_{rr}	I_F=100A, V_R=600V, V_{GE}=-15V, -diF/dt=2300A/μs	T_{vj}=25℃		109		A
			T_{vj}=125℃		121		A
			T_{vj}=150℃		124		A

Recovered charge	Q_{rr}	(T_{vj}=150℃)	T_{vj}=25℃		6.04		μC
			T_{vj}=125℃		12.58		μC
			T_{vj}=150℃		15.34		μC
Reverse recovery energy	E_{rec}	I_F=100A, V_R=600V, V_{GE}=-15V, -diF/dt=2300A/μs (T_{vj}=150℃)	T_{vj}=25℃		2.09		mJ
			T_{vj}=125℃		4.72		mJ
			T_{vj}=150℃		5.79		mJ
Temperature under switching conditions	$T_{vj\ op}$			-40		150	℃

Diode, Rectifier
Maximum Ratings

Parameter	Symbol	Conditions		Value	Unit
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25℃, I_{RRM}=5uA		1800	V
Non-Repetitive peak reverse voltage	V_{RSM}	T_{vj}=25℃, I_{RRM}=5uA		2000	V
Maximum average forward current	$I_{F(AV)}$	T_s=80℃, T_{vj}=25℃		80	A
Surge forward current	I_{FSM}	t_P=10ms, sin180°	T_{vj}=25℃	960	A
I^2t-value	I^2t	t_P=10ms, sin180°	T_{vj}=25℃	4600	A^2s

Characteristics Values

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=80A	T_{vj}=25℃		1.1	1.2	V
Reverse current	I_R	V_R=V_{RRM}	T_{vj}=25℃			10	uA
Temperature under switching conditions	$T_{vj\ op}$			-40		150	℃

IGBT, Brake-Chopper
Maximum Ratings

Parameter	Symbol	Condition	Value	Unit
Collector-emitter voltage	V_{CES}	T_{vj}=25°C,	1200	V
Continuous DC collector current	$I_{C\ nom}$	T_C=100° C, $T_{vj\ max}$=175℃	50	A
Repetitive peak collector current	I_{CRM}	t_P=1ms	100	A
Total power dissipation	P_{tot}	T_C=25℃, $T_{vj\ max}$=175℃	270	W
Gate-emitter peak voltage	V_{GE}	T_C=25° C, $T_{vj\ max}$=175℃	±20	V

Characteristics Values

Parameter	Symbol	Conditions		Value			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE(sat)}$	I_C=50A, V_{GE}=15V	T_{vj}=25℃		2.1	2.9	V
			T_{vj}=125℃		2.53		V
			T_{vj}=150℃		2.61		V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=1.6mA, V_{CE}=V_{GE}	T_{vj}=25℃	5.20	5.8	6.4	V
Gate charge	Q_G	V_{GE}=-15V...+15V			0.24		μC

Integrated gate resistor	$R_{G\ int}$	T_{vj}=25℃			2.78		Ω
Input capacitance	C_{ies}	f=1MHz, V_{CE}=25V, V_{GE}=0V	T_{vj}=25℃		2.96		nF
Reverse transfer capacitance	C_{res}	f=1MHz, V_{CE}=25V, V_{GE}=0V	T_{vj}=25℃		0.11		nF
Collector-emitter cut-off current	I_{CES}	V_{CE}=1200V, V_{GE}=0V	T_{vj}=25℃			1	mA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	T_{vj}=25℃			100	nA
Turn-on delay time	$t_{d\ on}$	I_C=50A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=15Ω, Inductive Load	T_{vj}=25℃		56		ns
			T_{vj}=125℃		60		ns
			T_{vj}=150℃		61		ns
Rise time	t_r	I_C=50A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=15Ω, Inductive Load	T_{vj}=25℃		36		ns
			T_{vj}=125℃		43		ns
			T_{vj}=150℃		45		ns
Turn-off delay time	$t_{d\ off}$	I_C=50A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=15Ω, Inductive Load	T_{vj}=25℃		189		ns
			T_{vj}=125℃		235		ns
			T_{vj}=150℃		245		ns
Fall time	t_f	I_C=50A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=15Ω, Inductive Load	T_{vj}=25℃		184		ns
			T_{vj}=125℃		221		ns
			T_{vj}=150℃		244		ns
Turn-on energy loss per pulse	E_{on}	I_C=50A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=15Ω, di/dt=800A/μs (T_{vj}=150℃) Inductive Load	T_{vj}=25℃		3.50		mJ
			T_{vj}=125℃		5.83		mJ
			Tvj=150℃		6.59		mJ
Turn-off energy loss per pulse	E_{off}	I_C=50A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=15Ω, du/dt=5600V/μs (T_{vj}=150℃) Inductive Load	T_{vj}=25℃		2.93		mJ
			T_{vj}=125℃		4.05		mJ
			T_{vj}=150℃		4.42		mJ
SC data	I_{SC}	V_{GE}≤15V, V_{CE}=800V V_{CEmax}=V_{CES}-L_{sCE}*di/dt, t_P≤10μs,	Tvj=150℃		190		A
Temperature under switching conditions	$T_{vj\ op}$			-40		150	℃

Diode, Brake-Chopper

Maximum Ratings

Parameter	Symbol	Conditions		Value	Unit
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25℃		1200	V
Continuous forward current	I_F			30	A
Repetitive peak forward current	I_{FRM}	t_P= 1ms		60	A
I^2t-value	I^2t	t_P=10ms, sin180°	T_{vj}=125℃	120	A^2s

Characteristics Values

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=30A, V_{GE}=0V	T_{vj}=25℃		1.94	2.4	V
			T_{vj}=125℃		1.64		V
			T_{vj}=150℃		1.57		V

Peak reverse recovery current	I_{rr}	I_F=30A, V_R=600V, V_{GE}=-15V, -diF/dt=800A/μs (T_{vj}=150℃)	T_{vj}=25℃		20		A
			T_{vj}=125℃		29		A
			T_{vj}=150℃		31		A
Recovered charge	Q_{rr}	I_F=30A, V_R=600V, V_{GE}=-15V, -diF/dt=800A/μs (T_{vj}=150℃)	T_{vj}=25℃		2.04		μC
			T_{vj}=125℃		5.23		μC
			T_{vj}=150℃		6.18		μC
Reverse recovery energy	E_{rec}		T_{vj}=25℃		0.95		mJ
			T_{vj}=125℃		2.01		mJ
			T_{vj}=150℃		2.28		mJ
Temperature under switching conditions	$T_{vj\ op}$			-40		150	℃

NTC-Thermistor
Characteristics Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_C=25℃, ±5%		5.0		kΩ
B-value	$B_{25/50}$	±2%		3375		K

Module
Characteristics Values

Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Isolation test voltage	V_{ISOL}	RMS, f=50Hz, t=1min		2.5		kV
Internal isolation	-		Al_2O_3			-
Storage temperature	T_{stg}		-40		125	℃
Mounting torque for module mounting	M		3	-	6	N·m
Weight	G			300		g

Typical Characteristics

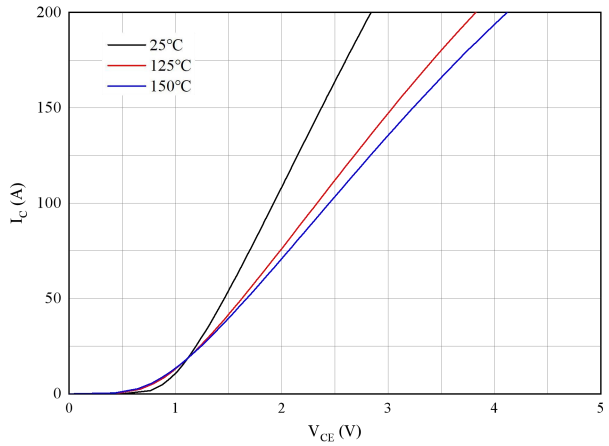


Fig 1. Typical output characteristics (V_{GE}=15V)

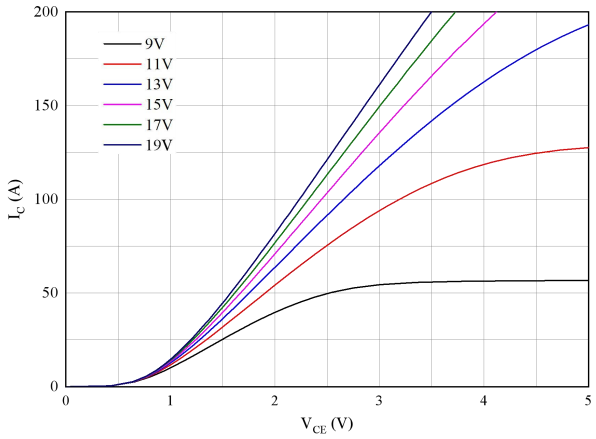


Fig 2. Typical output characteristics (T_{vj}=150℃)

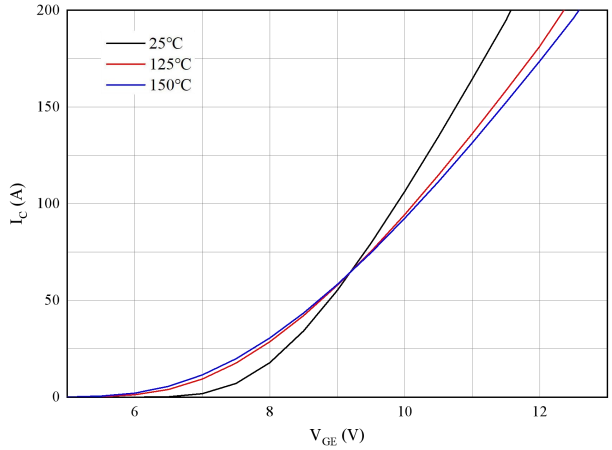


Fig 3. Typical transfer characteristics (V_{CE}=20V)

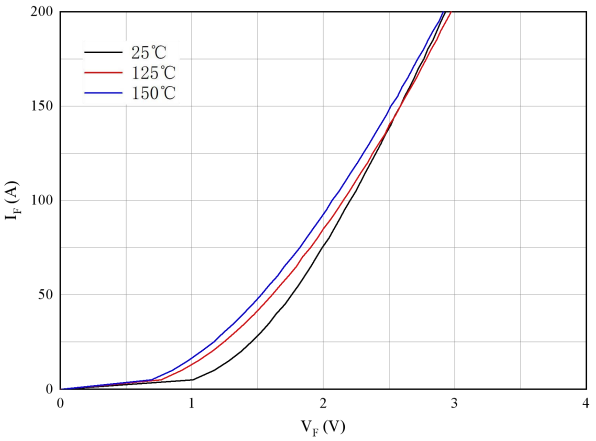


Figure 4. Forward characteristics of Diode

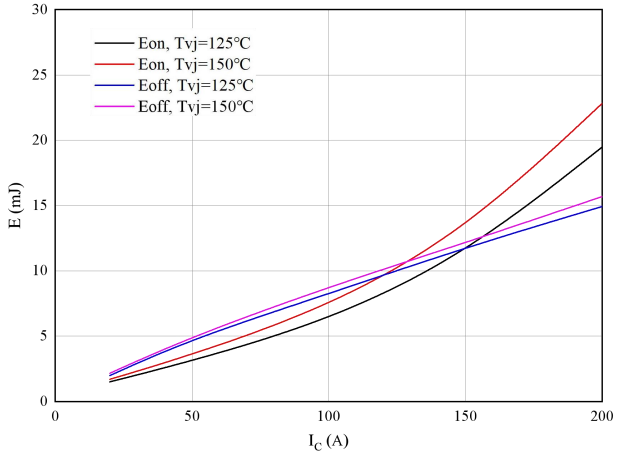


Fig 5. Switching losses of IGBT, Inverter
V_{GE}=±15V, R_{Gon}=R_{Goff}=2Ω, V_{CE}=600V

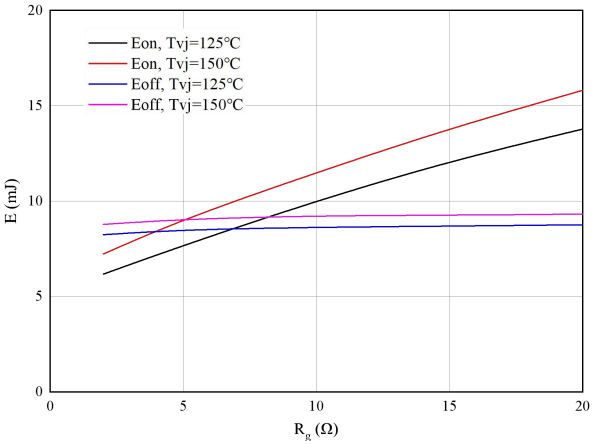


Fig 6. Switching losses of IGBT, Inverter
V_{GE}=±15V, I_C=100A, V_{CE}=600V

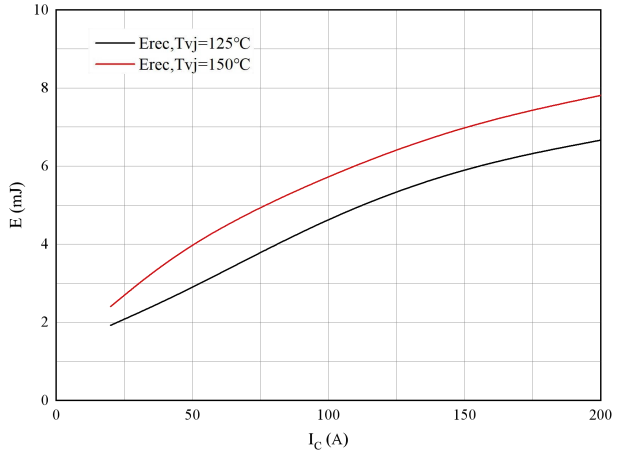


Fig 7. Switching losses of Diode
$R_{Gon}=R_{Goff}=2\Omega$, $V_{CE}=600V$

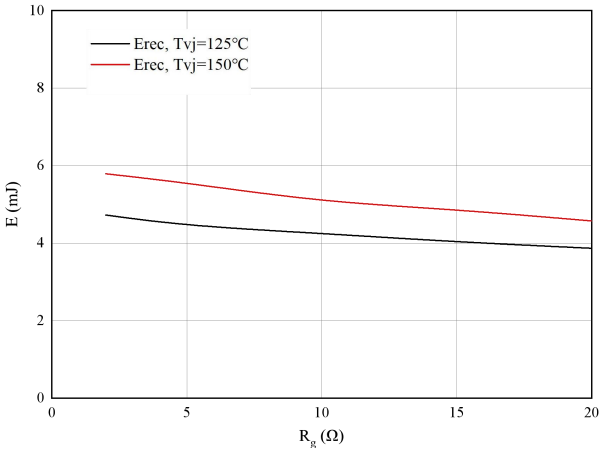


Fig 8. Switching losses of Diode
$I_F=100A$, $V_{CE}=600V$

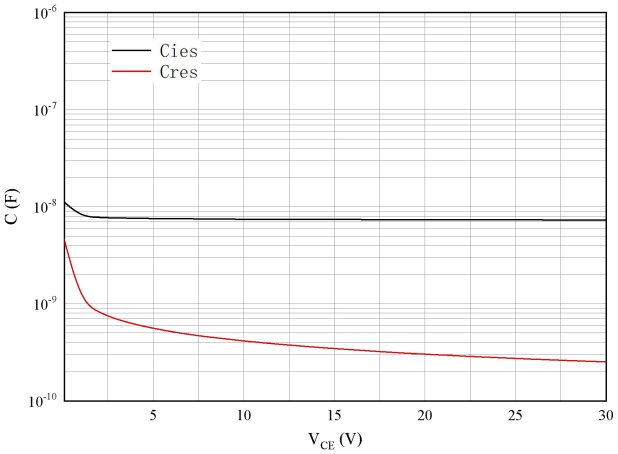


Fig 9. Capacitance characteristics

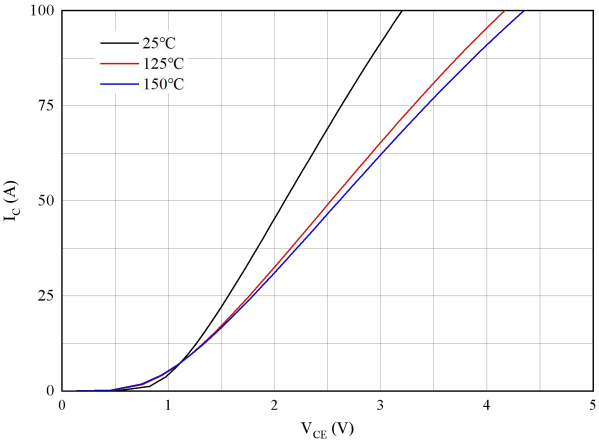


Fig10. Typical output characteristics ($V_{GE}=15V$), Brake-Chopper

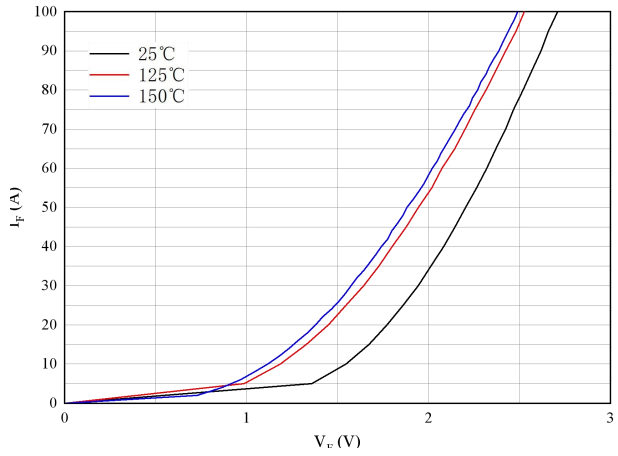


Fig 11.Forward characteristic of Diode, Brake-Chopper

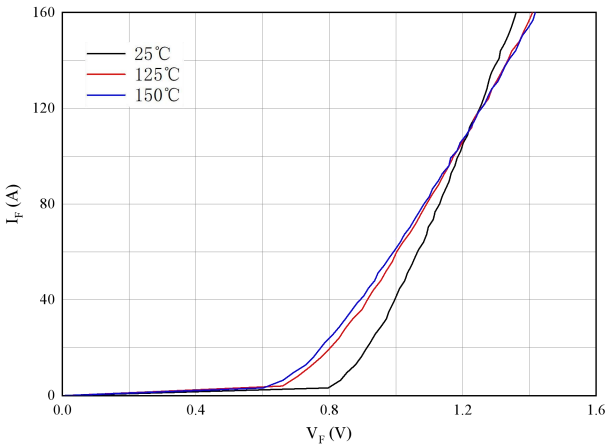


Fig 12.Forward characteristic of Diode, Inverter

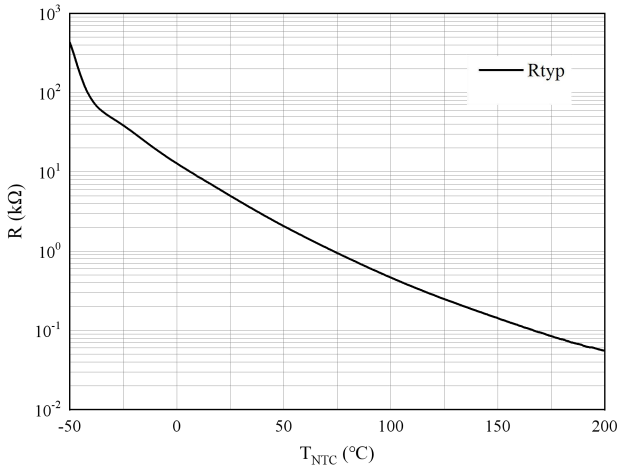
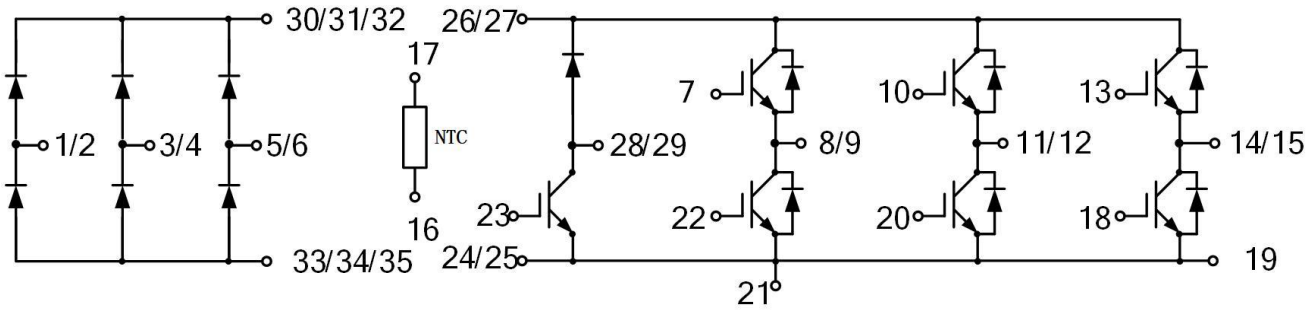
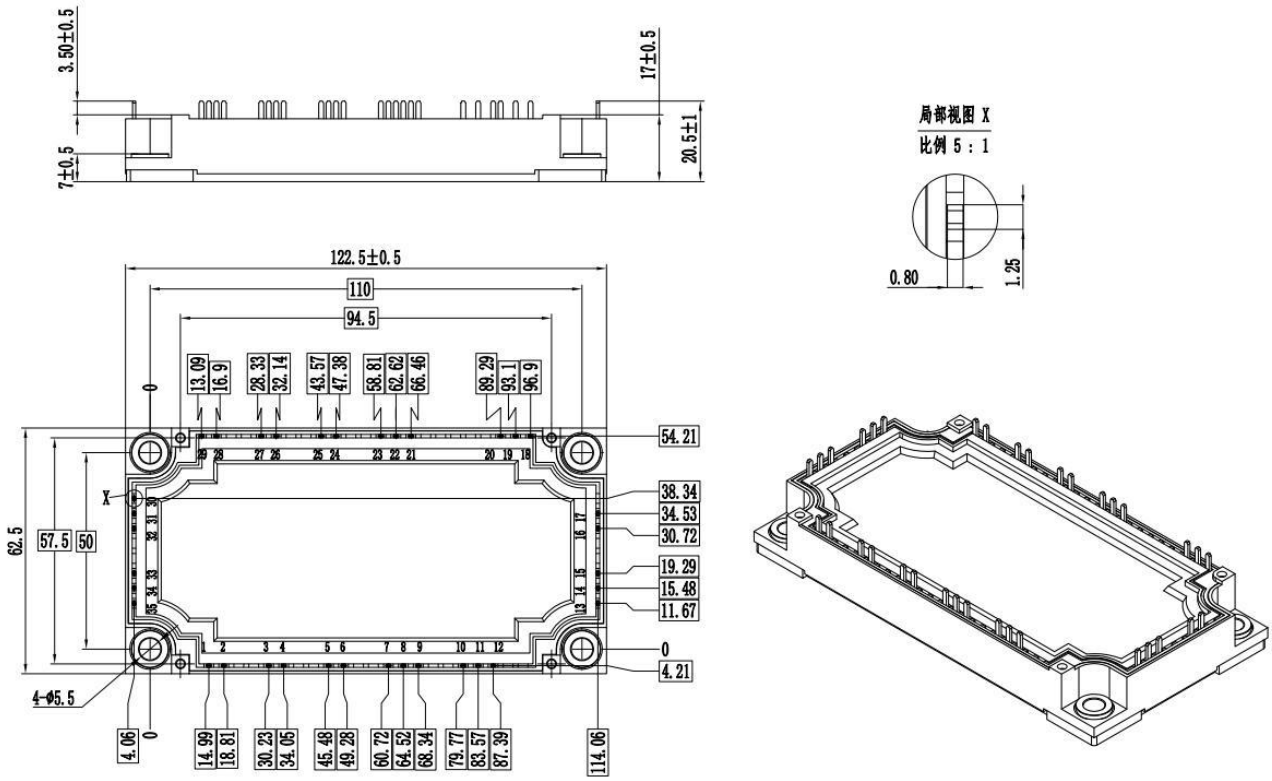


Fig 13.NTC-Themistor-temperature characteristic

Circuit Diagram



Package Outlines (Unit:mm)



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