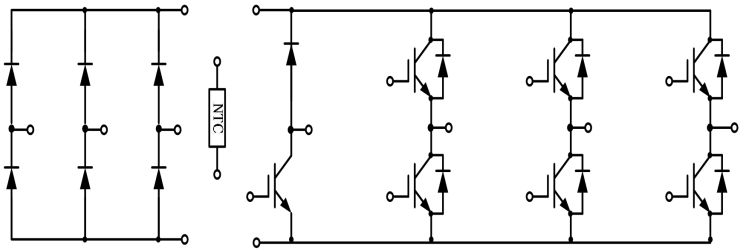
EconoPIM2 PIM IGBT Module

V_{CES}=1200V, I_C=50A, $V_{CE(sat)}$=2.15V

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
- Windgeneratoren
- Static Var Generator

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℃	50	A
Repetitive peak collector current	I_{CRM}	t_P=1ms	100	A
Gate-emitter peak voltage	V_{GES}	T_{vj}=25℃	±20	V
Total power dissipation	P_{tot}	T_C=25℃, $T_{vj\ max}$=175℃	280	W

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℃		2.15	2.59	V
			T_{vj}=125℃		2.55		V
			T_{vj}=150℃		2.64		V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=1.7mA, V_{CE}=V_{GE}	T_{vj}=25℃	5.2	5.9	6.4	V
Integrated gate resistor	$R_{G\ int}$	T_{vj}=25℃			2.82		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℃		0.12		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℃		54		ns
			T_{vj}=125℃		52		ns
			T_{vj}=150℃		52		ns

Rise time	t_r	I_C=50A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=15Ω, Inductive Load	T_{vj}=25℃		29		ns
			T_{vj}=125℃		30		ns
			T_{vj}=150℃		31		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℃		190		ns
			T_{vj}=125℃		229		ns
			T_{vj}=150℃		239		ns
Fall time	t_f	I_C=50A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=15Ω, Inductive Load	T_{vj}=25℃		146		ns
			T_{vj}=125℃		187		ns
			T_{vj}=150℃		206		ns
Turn-on energy loss per pulse	E_{on}	I_C=50A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=15Ω, di/dt=1250A/μs (T_{vj}=150℃) Inductive Load	T_{vj}=25℃		3.51		mJ
			T_{vj}=125℃		5.50		mJ
			T_{vj}=150℃		6.06		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℃		2.48		mJ
			T_{vj}=125℃		3.28		mJ
			T_{vj}=150℃		3.50		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℃		190		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			50	A
Repetitive peak forward current	I_{FRM}	t_P= 1ms		100	A
I^2t-value	I^2t	t_P=10ms, sin180°	T_{vj}=125℃	1100	A^2s

Characteristics Values

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=50A, V_{GE}=0V	T_{vj}=25℃		2.17	2.6	V
			T_{vj}=125℃		1.8		V
			T_{vj}=150℃		1.72		V
Peak reverse recovery current	I_{rr}	I_F=50A, V_R=600V, V_{GE}=-15V, -diF/dt=1300A/μs (T_{vj}=150℃)	T_{vj}=25℃		27		A
			T_{vj}=125℃		45		A
			T_{vj}=150℃		50		A
Recovered charge	Q_{rr}		T_{vj}=25℃		2.16		μC
			T_{vj}=125℃		5.83		μC
			T_{vj}=150℃		7.31		μC
Reverse recovery energy	E_{rec}		T_{vj}=25℃		0.59		mJ
			T_{vj}=125℃		1.64		mJ
			T_{vj}=150℃		2.12		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}=0.05mA		1600	V
Non-Repetitive peak reverse voltage	V_{RSM}	T_{vj}=25℃, I_{RRM}=0.05mA		2000	v
Maximum average forward current	$I_{F(AV)}$	T_s=80℃, T_{vj}=25℃		25	A
Surge forward current	I_{FSM}	t_P=10ms, sin180°	T_{vj}=25℃	320	A
I^2t-value	I^2t	t_P=10ms, sin180°	T_{vj}=25℃	512	A^2s

Characteristics Values

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=25A	T_{vj}=25℃		1	1.2	V
Reverse current	I_R	V_R=V_{RRM}	T_{vj}=25℃			50	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, V_{GE}=0V	1200	V
Continuous DC collector current	$I_{C\ nom}$	T_C=100° C, $T_{vj\ max}$=175℃	25	A
Repetitive peak collector current	I_{CRM}	t_P=1ms	50	A
Gate-emitter peak voltage	V_{GE}	T_{vj}=25℃	±20	V

Characteristics Values

Parameter	Symbol	Conditions		Value			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE(sat)}$	I_C=25A, V_{GE}=15V	T_{vj}=25℃		1.81	=2.2	V
			T_{vj}=125℃		2.11		V
			T_{vj}=150℃		2.20		V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=0.85mA, V_{CE}=V_{GE}	T_{vj}=25℃	5.3	5.85	6.4	V
Gate charge	Q_G	V_{GE}=-15V...+15V			4.6		μC
Integrated gate resistor	$R_{G\ int}$				None		Ω
Input capacitance	C_{ies}	f=1MHz, V_{CE}=25V, V_{GE}=0V	T_{vj}=25℃		1.66		nF
Reverse transfer capacitance	C_{res}	f=1MHz, V_{CE}=25V, V_{GE}=0V	T_{vj}=25℃		0.08		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=25A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=40Ω, Inductive Load	T_{vj}=25℃		72		ns
			T_{vj}=125℃		60		ns
			T_{vj}=150℃		58		ns
Rise time	t_r	I_C=25A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=40Ω, Inductive Load	T_{vj}=25℃		57		ns
			T_{vj}=125℃		62		ns
			T_{vj}=150℃		63		ns
Turn-off delay time	$t_{d\ off}$	I_C=25A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=40Ω, Inductive Load	T_{vj}=25℃		283		ns
			T_{vj}=125℃		324		ns
			T_{vj}=150℃		335		ns
Fall time	t_f	I_C=25A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=40Ω, Inductive Load	T_{vj}=25℃		171		ns
			T_{vj}=125℃		238		ns
			T_{vj}=150℃		250		ns
Turn-on energy loss per pulse	E_{on}	I_C=25A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=40Ω, di/dt=370A/μs (T_{vj}=150℃) Inductive Load	T_{vj}=25℃		2.66		mJ
			T_{vj}=125℃		3.55		mJ
			T_{vj}=150℃		3.89		mJ
Turn-off energy loss per pulse	E_{off}	I_C=25A, V_{CE}=600V, V_{GE}=-15V/+15V,R_G=40Ω, du/dt=4800V/μs (T_{vj}=150℃) Inductive Load	T_{vj}=25℃		1.37		mJ
			T_{vj}=125℃		1.87		mJ
			T_{vj}=150℃		2.02		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℃		116		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			15	A
Repetitive peak forward current	I_{FRM}	t_P= 1ms		30	A
I^2t-value	I^2t	t_P=10ms, sin180°	T_{vj}=125℃	50	A^2s

Characteristics Values

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=15A, V_{GE}=0V	T_{vj}=25℃		2.05	2.7	V
			T_{vj}=125℃		1.67		V
			T_{vj}=150℃		1.60		V
Peak reverse recovery current	I_{rr}	I_F=15A, V_R=600V, V_{GE}=-15V, -diF/dt=360A/μs (T_{vj}=150℃)	T_{vj}=25℃		4		A
			T_{vj}=125℃		10		A
			T_{vj}=150℃		13		A

Recovered charge	Q_{rr}	I_F=15A, V_R=600V, V_{GE}=-15V, -diF/dt=360A/μs (T_{vj}=150℃)	T_{vj}=25℃		0.26		μC
			T_{vj}=125℃		1.02		μC
			T_{vj}=150℃		1.31		μC
Reverse recovery energy	E_{rec}		T_{vj}=25℃		0.05		mJ
			T_{vj}=125℃		0.25		mJ
			T_{vj}=150℃		0.35		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	$B_{25/50}$	±1%		3380		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			170		g

Typical Characteristics

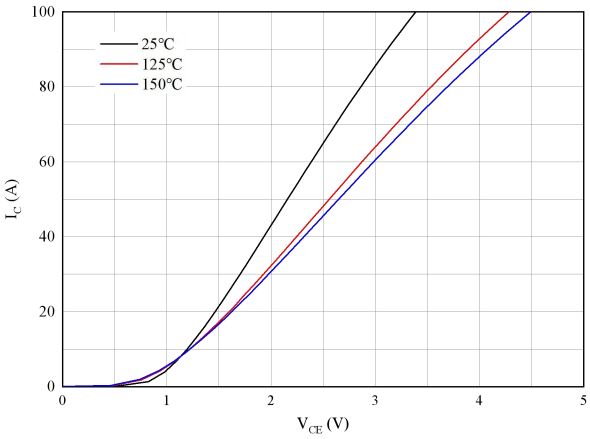


Fig 1. Typical output characteristics (V_{GE}=15V)

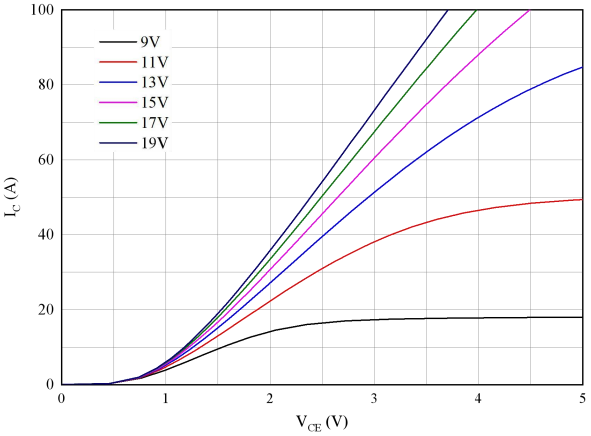


Fig 2. Typical output characteristics (T_{vj}=150℃)

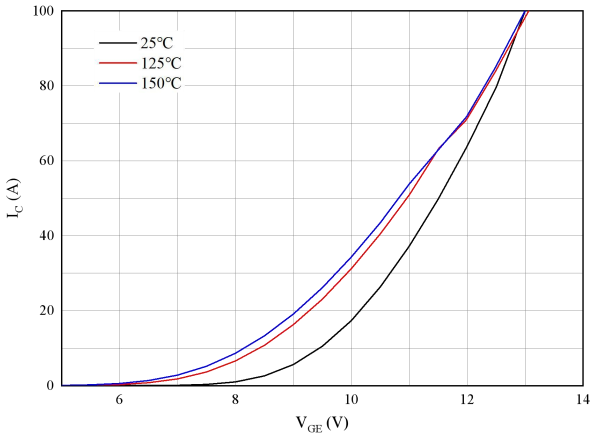


Fig 3. Typical transfer characteristics (V_{CE}=20V)

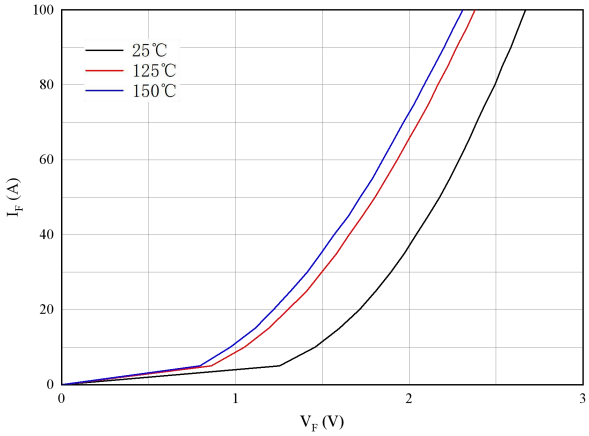


Fig 4. Forward characteristics of Diode

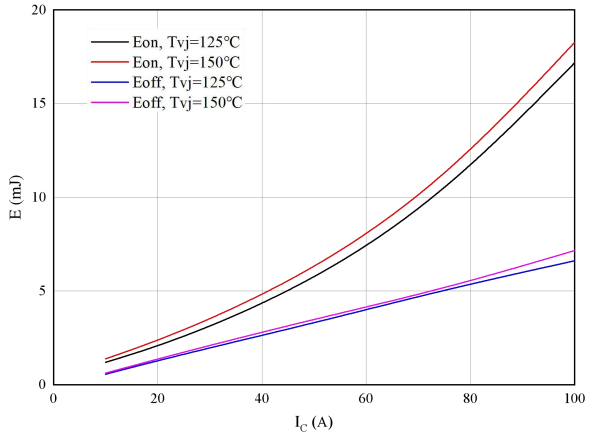


Fig 5. Switching losses of IGBT
V_{GE}=±15V, R_{Gon}=R_{Goff}=15Ω, V_{CE}=600V

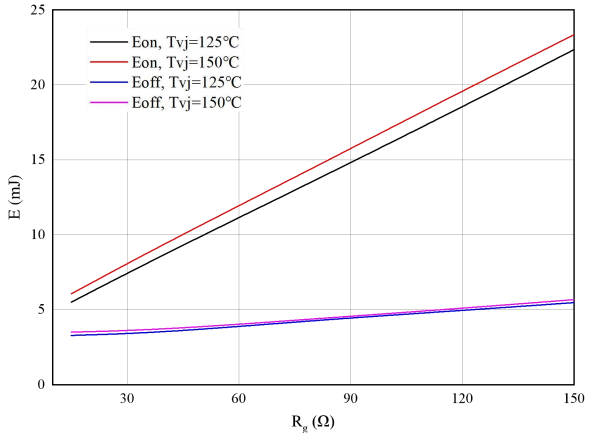


Fig 6. Switching losses of IGBT
V_{GE}=±15V, I_C=50A, V_{CE}=600V

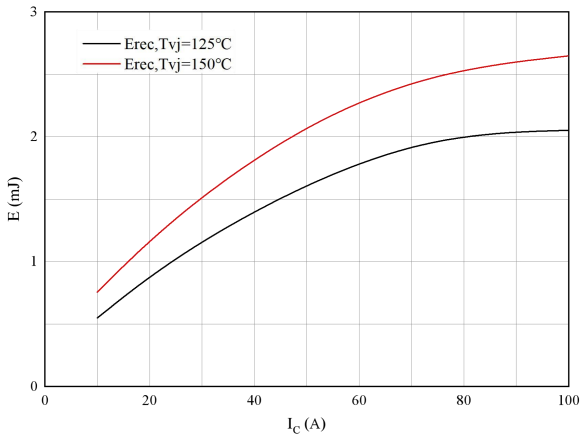


Fig 7. Switching losses of Diode
R_{Gon}=R_{Goff}=15Ω, V_{CE}=600V

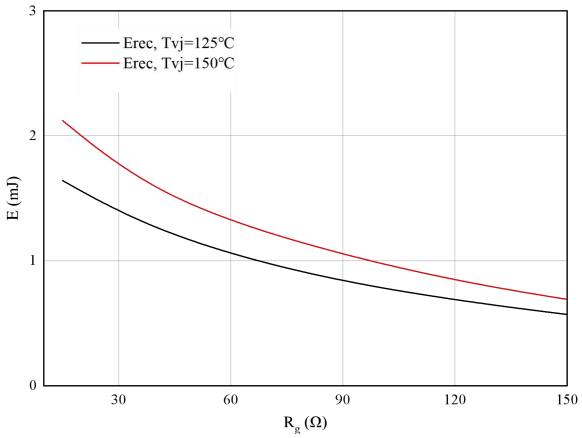


Fig 8. Switching losses of Diode
I_F=50A, V_{CE}=600V

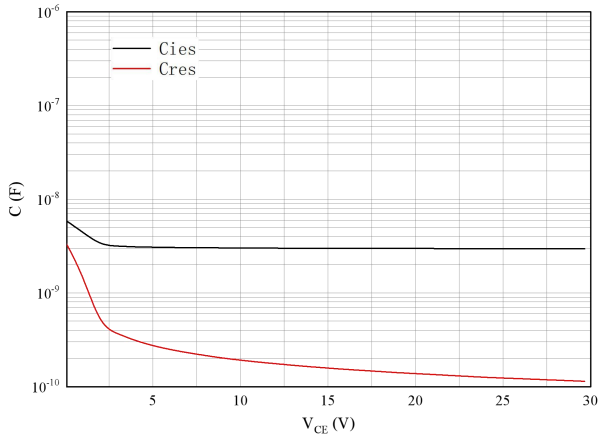


Fig 9. Capacitance characteristics

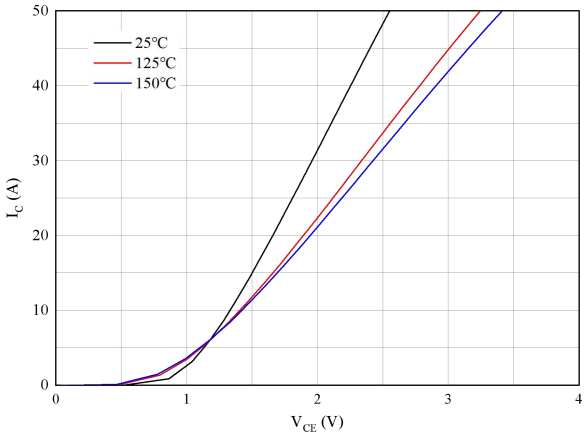


Fig 10. Typical output characteristics
(V_{GE}=15V)，Brake-Chopper

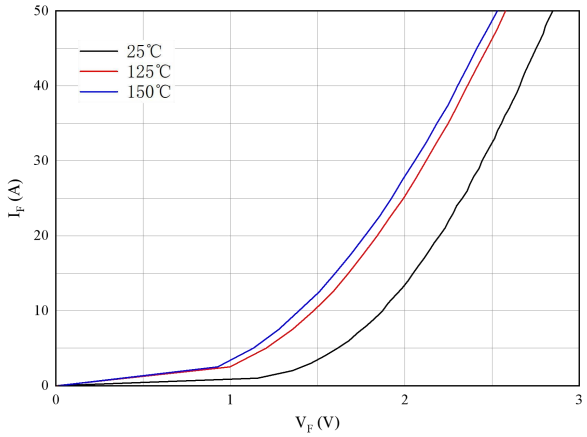


Fig 11.Forward characteristic of Diode,
Brake-Chopper

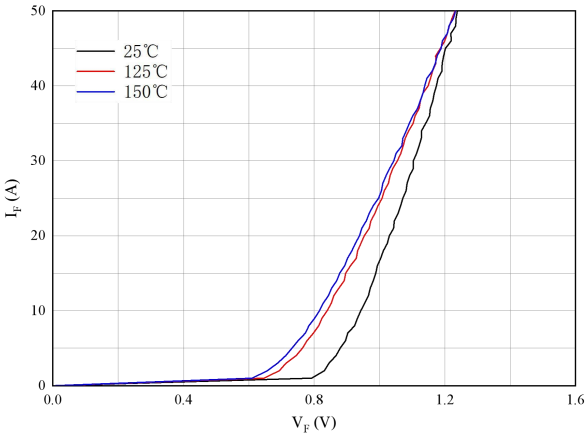


Fig 12.Forward characteristic of Diode,
Rectifier

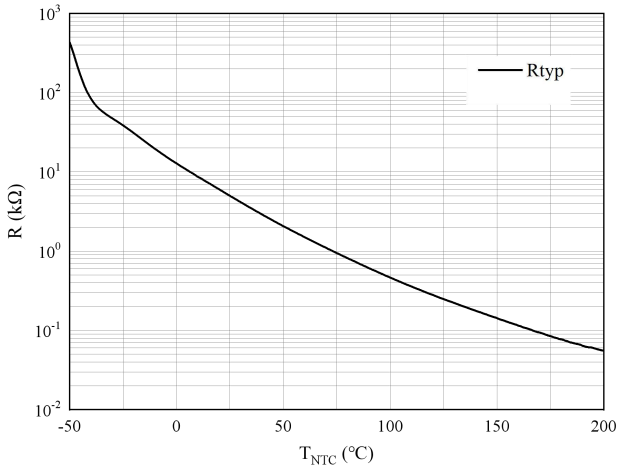
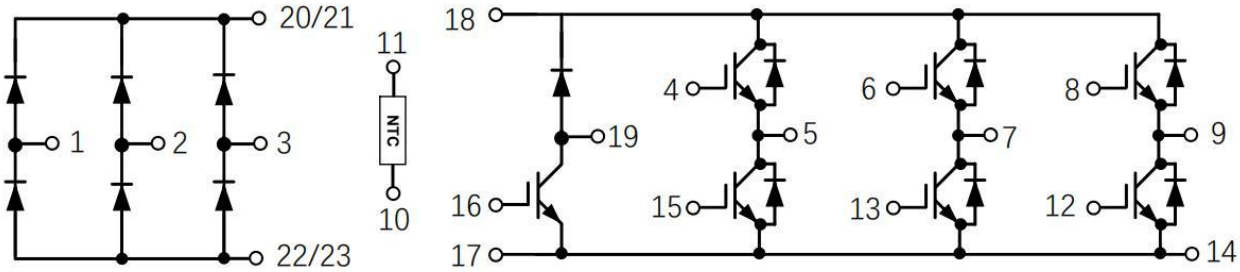
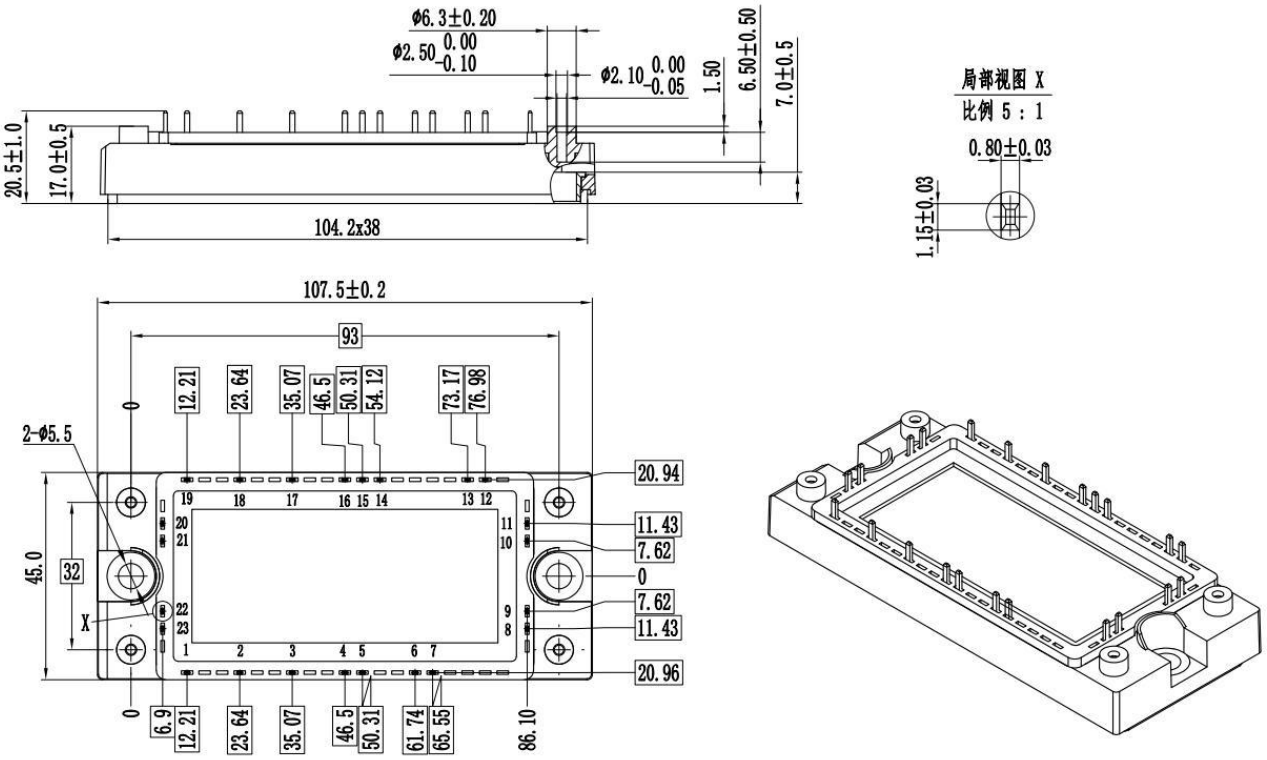


Fig 13.NTC-Themistor-temperature characteristic

Circuit Diagram



Package Outlines (Unit:mm)



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