Trench Field-stop IGBT Module

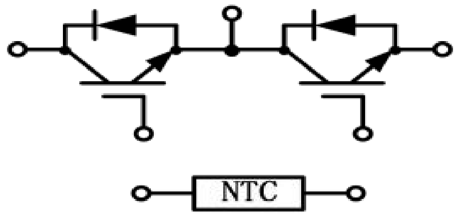
V_{CES}= 1200V, I_C= 900A, I_{CRM}= 1800A

FEATURES

- 1200V Trench with Field Stop technology
- Low switching-Loss rating
- Optimized for Fast Switching
- Vcesat with positive Temperature Coefficient

APPLICATIONS

- Static var generator
- UPS system
- Servo drives, Inverter for motor drive
- High Power Converters



IGBT Inverter

Absolute Maximum Ratings of IGBT (TJ= 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Value	Unit
VCES	Collector to Emitter Voltage	Tvj= 25°C	1200	V
VGES	Continuous Gate to Emitter Voltage		±20	V
IC	Continuous Collector Current	TC = 90℃, $T_{vj\ max}$ = 175℃	900	A
ICM	Pulse Collector Current	tp=1ms	1800	A
PD	Maximum Power Dissipation (per IGBT)	TC = 25℃, TJ = 175℃	3600	W

Electrical Characteristics of IGBT

Parameter	Conditions		Symbol	Value Min.	Value Typ.	Value Max.	Unit
Collector-Emitter saturation voltage	V_{GE}= 15V, I_C=900A	T_{vj}=25℃	$V_{CE\ sat}$		1.65	2.10	V
	V_{GE}= 15V, I_C=900A	T_{vj}= 125℃			1.95		
	V_{GE}= 15V, I_C=900A	T_{vj}= 175℃			2.10		
Gate-Emitter threshold voltage	I_C= 18mA, V_{GE}= V_{CE}， T_{vj}=25℃		V_{GEth}	5.2	5.8	6.4	V
Gate charge	V_{GE}=-15V...+15V		Q_G		11.5		μC
Internal gate resistor	T_{vj}=25℃		R_{Gint}		0.5		Ω
Input capacitance			C_{ies}		140		

Reverse transfer capacitance	f= 100KHz, V_{CE}=25V, V_{GE}=0 V T_{vj}=25℃		C_{res}		0.55		nF
Collector-emitter cut-off current	V_{CE}= 1200V , V_{GE}= 0 V T_{vj}=25℃		I_{CES}			0. 1	mA
Gate-emitter leakage current	V_{CE}=0 V, V_{GE}= 20 V T_{vj}=25℃		I_{GES}			100	nA
Turn-on delay time	I_C=900A, V_{CE}=600V V_{GE}=±15V, R_G=0.5Ω / (inductive load)	T_{vj}=25℃ T_{vj}= 125℃ T_{vj}= 175℃	$t_{d\ on}$		409 435 445		ns
Rise time	I_C=900A, V_{CE}=600V V_{GE}=±15V, R_G=0.5Ω / (inductive load)	T_{vj}=25℃ T_{vj}= 125℃ T_{vj}= 175℃	t_r		75 86 95		
Turn-off delay time	I_C=900A, V_{CE}=600V V_{GE}=±15V, R_G=0.5Ω / (inductive load)	T_{vj}=25℃ T_{vj}= 125℃ T_{vj}= 175℃	$t_{d\ off}$		510 575 620		
Fall time	I_C=900A, V_{CE}=600V V_{GE}=±15V, R_G=0.5Ω / (inductive load)	T_{vj}=25℃ T_{vj}= 125℃ T_{vj}= 175℃	t_f		147 238 295		
Turn-on energy loss per pulse	I_C=900A, V_{CE}=600V di/dt=7500A/us(Tvj=175 ℃) V_{GE}=±15V, R_G=0.5Ω	T_{vj}=25℃ T_{vj}= 125℃ T_{vj}= 175℃	E_{on}		36 69 93		mJ
Turn-off energy loss per pulse	I_C=900A, V_{CE}=600V dv/dt=3100V/us(Tvj=175 ℃) V_{GE}=±15V, R_G=0.5Ω	T_{vj}=25℃ T_{vj}= 125℃ T_{vj}= 175℃	E_{off}		94 122 139		mJ
SC data	V_{GE}≤15V, Vcc=800V V_{CEmax}=V_{CES}-L_{sCE}·di/dt	t_P ≤8us, T_{vj}= 150℃ t_P ≤6us, T_{vj}= 175℃	I_{SC}		3400 3200		A
Thermal resistance, junction to case	per IGBT		R_{thJC}			0.044	K/W
Temperature under switching conditions	Tvj op ＞150℃ is only allowed for operation at overload conditions.		Tvj op	-40		175	℃

Diode, Inverter

Absolute Maximum Ratings (TJ = 25°C, unless otherwise specified)

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	Tvj=25℃	VRRM	1200	V
Continuous DC forward current		IF	900	A
Repetitive peak forward current	tp= 1ms	IFRM	1800	A
I^2t-value	tp= 10ms， sin180°，Tj= 125℃	I^2t	30000	A^2s

Electrical Characteristics of Diode

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
Forward voltage	IF=900A, VGE=0V IF=900A, VGE=0V IF=900A, VGE=0V	Tvj=25℃ Tvj= 125℃ Tvj= 175℃	VF		2.05 2.25 2.25	2.35	V
Peak reverse recovery current	IF=900A -diF/dt=7500A/μs (Tvj=175℃) VR=600V, VGE=-15V	Tvj=25℃ Tvj= 125℃ Tvj= 175℃	IRM		512 544 556		A
Recovered charge	IF=900A -diF/dt=7500A/μs (Tvj=175℃) VR=600V, VGE=-15V	Tvj=25℃ Tvj= 125℃ Tvj= 175℃	Qr		85 148 189		μC
Reverse recovered energy	IF=900A -diF/dt=7500A/μs (Tvj=175℃) VR=600V, VGE=-15V	Tvj=25℃ Tvj= 125℃ Tvj= 175℃	Erec		42 68 83		mJ
Thermal resistance, junction to case	per diode		RthJC			0.069	K/W
Temperature under switching conditions	Tvj op ＞150℃ is only for overload conditions.	operation at	Tvj op	-40		175	℃

NTC Thermistor Characteristic

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Rated resistances	T_c=25℃，±3%	R_{25}		5.0		KΩ
B-value	$R_2 = R_{25}\exp[B_{25/50}(1/T2 - 1/(298, 15\ K))]$	$B_{25/50}$		3375		K
B-value	$R_2 = R_{25}\exp[B_{25/80}(1/T2 - 1/(298, 15\ K))]$	$B_{25/80}$		3425		K
B-value	$R_2 = R_{25}\exp[B_{25/100}(1/T2 - 1/(298, 15\ K))]$	$B_{25/100}$		3443		K

Module Characteristics

Parameter	Conditions	Symbol	Value			Unit
Isolation test voltage	RMS, f=50Hz, t= 1min	V_{ISOL}	3400			V
Internal isolation	basic insulation (class 1, IEC 61140)		Al_2O_3			
Comperative tracking index		CTI	>200			
RTI Elec.	housing	RTI	140			℃
Stray inductance module		L_{sCE}		20		nH

Storage temperature		T_{stg}	-40		125	℃
Mounting torque for module mounting		M	3.0		6.0	Nm
Terminal Connection Torque		M	3.0		6.0	Nm
Weight		W		357		g

Characteristics diagrams

Figure 1. Typical output characteristics (VGE= 15V)

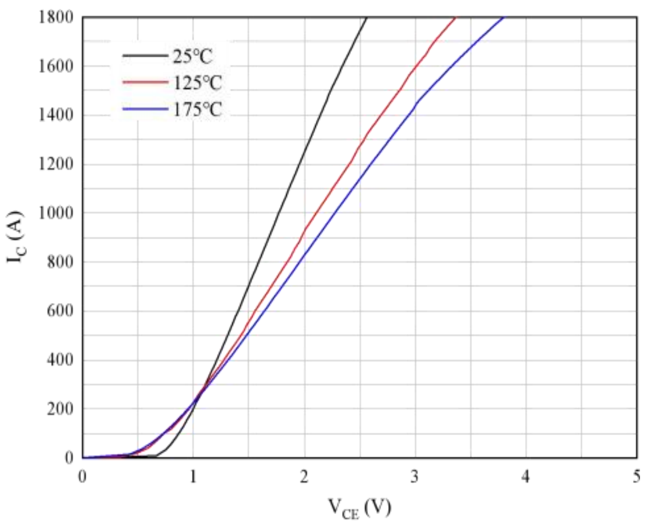


Figure 2. Typical output characteristics (Tvj= 175℃)

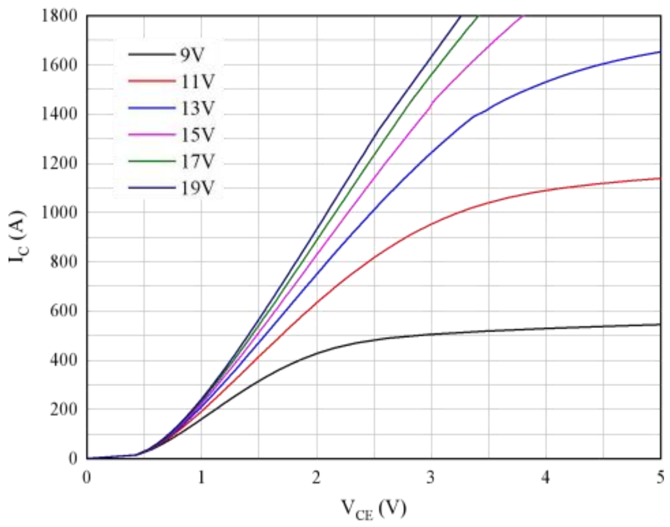


Figure 3. Typical transfer characteristic (VCE=20V)

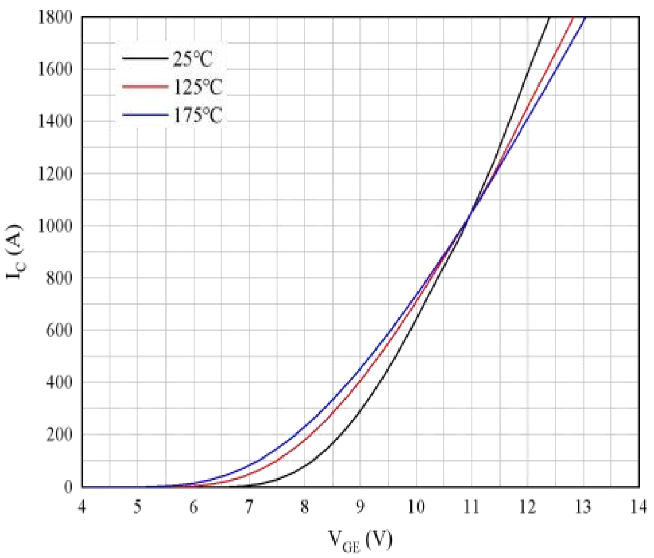


Figure 4. Forward characteristic of Diode

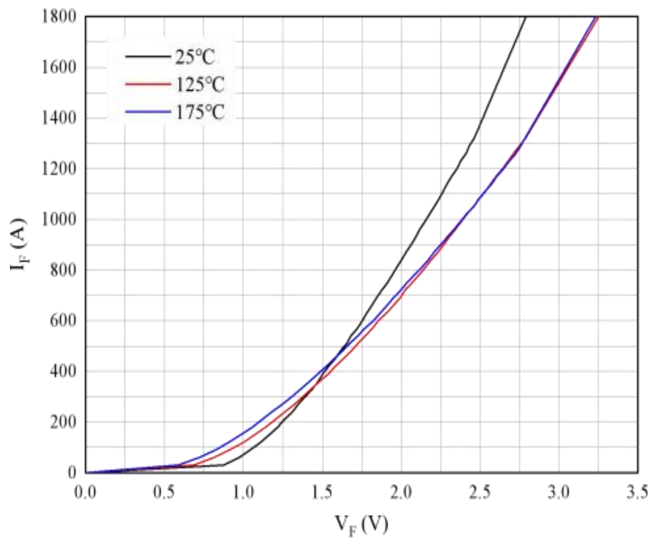


Figure 5. Switching losses of IGBT
VGE=±15V,RGon=0.5Ω, RGoff=0.5Ω, VCE=600V

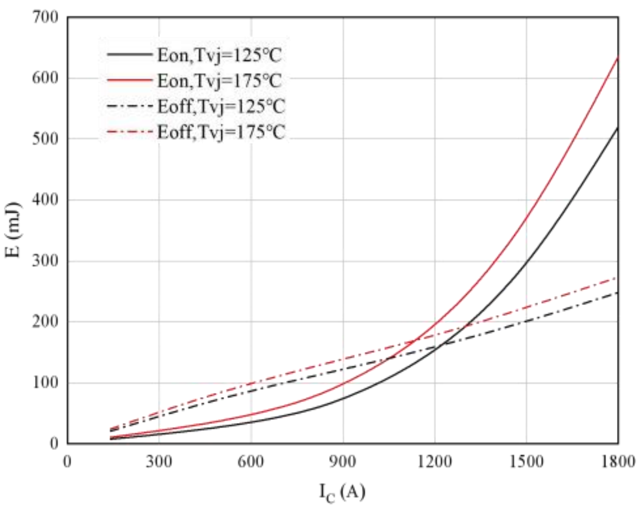


Figure 6. Switching losses of IGBT
VGE=±15V, I_C=900A , VCE=600V

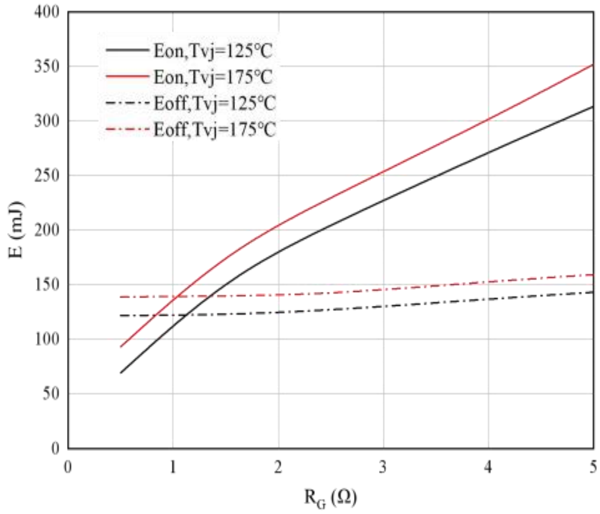
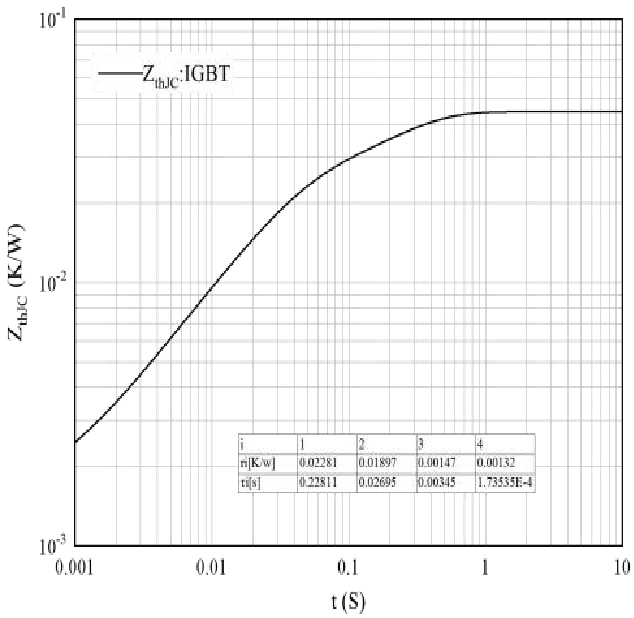
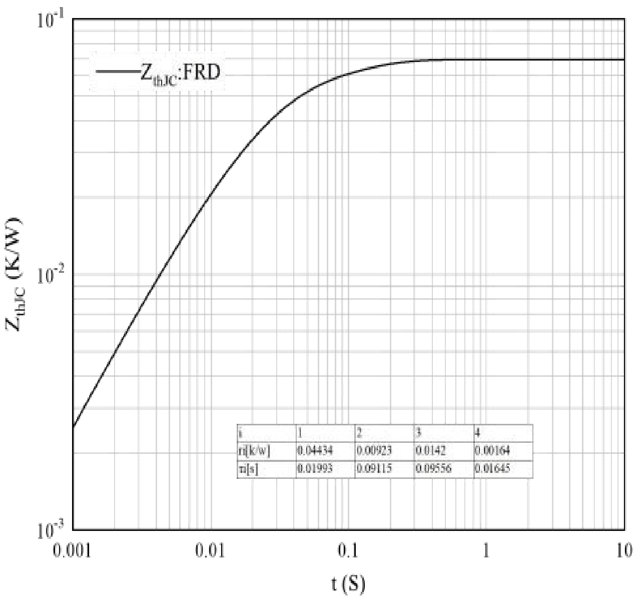


Figure7. Transient thermal impedance IGBT, Inverter Z_{thJC}=f(t)



i	1	2	3	4
ri[K/w]	0.02281	0.01897	0.00147	0.00132
τi[s]	0.22811	0.02695	0.00345	1.73535E-4

Figure 8. Transient thermal impedance FRD, Inverter
Z_{thJC}=f(t)



i	1	2	3	4
ri[k/w]	0.04434	0.00923	0.0142	0.00164
τi[s]	0.01993	0.09115	0.09556	0.01645

Figure 9. Switching losses of Diode
RGon=0.5Ω, VCE=600V

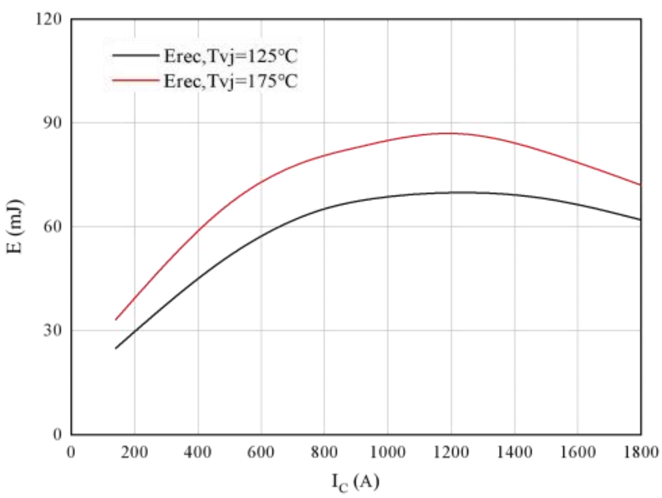


Figure 10. Switching losses of Diode
IF=900A, VCE=600V

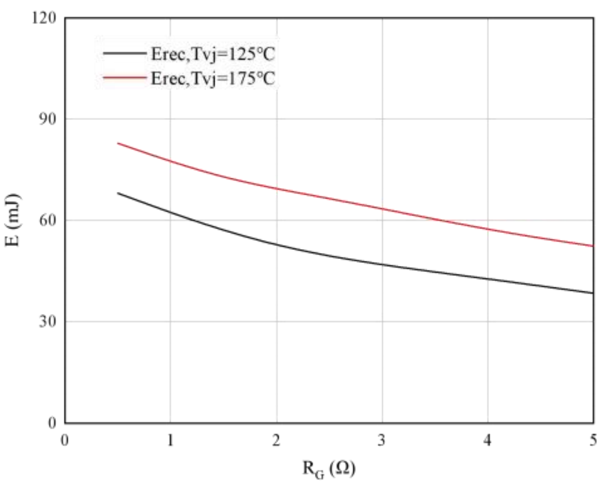


Figure 11.   Capacitance characteristic

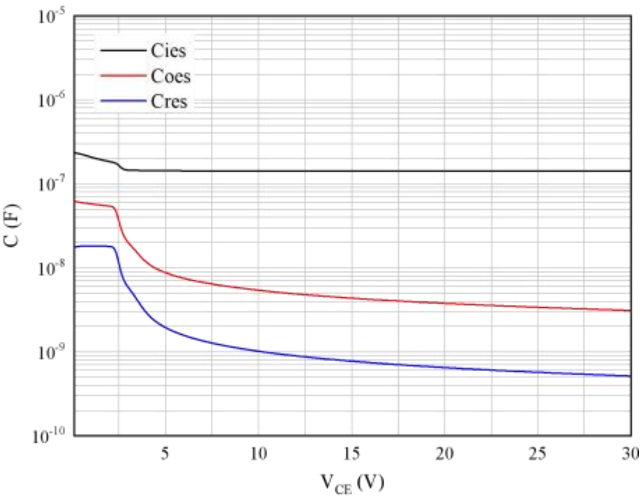


Figure12. RBSOA

VGE=±15V, RGoff=0.5Ω,Tvj=175°C

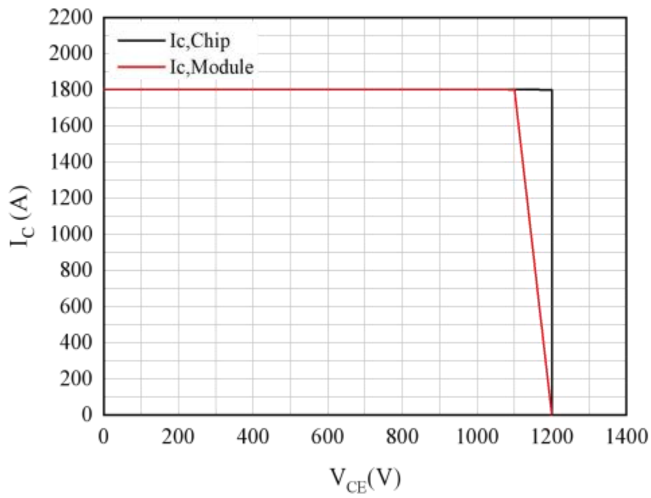
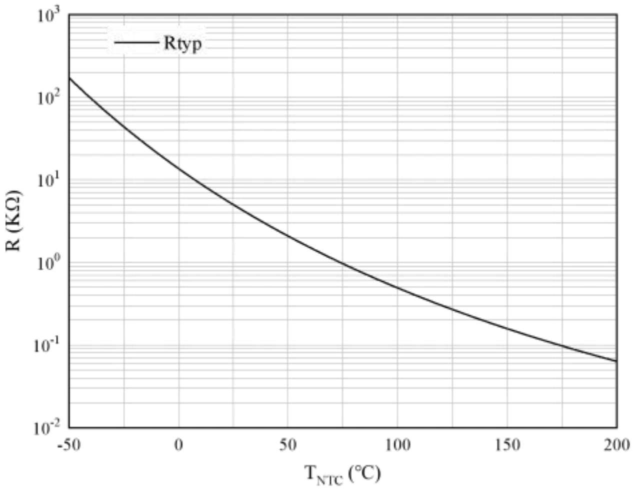
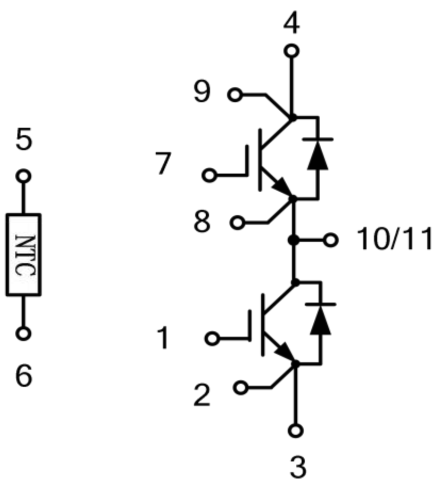


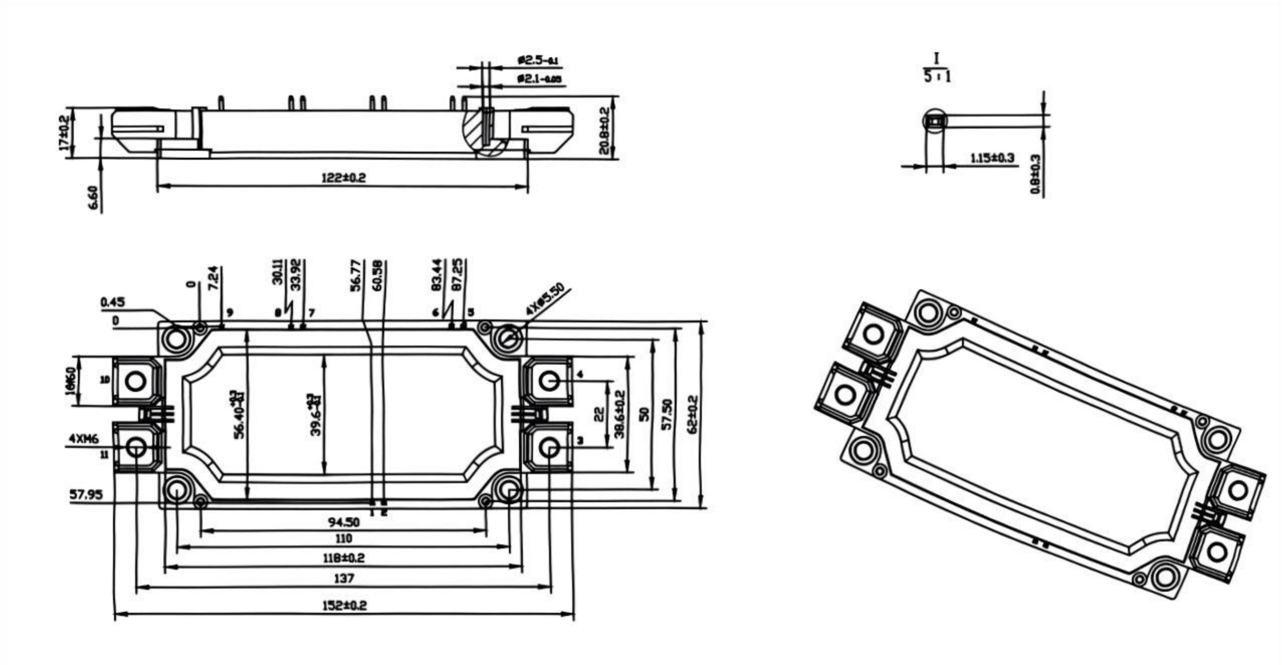
Figure13. NTC-Thermistor-temperature



Circuit Diagram:



Package Outline (Unit：mm)



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