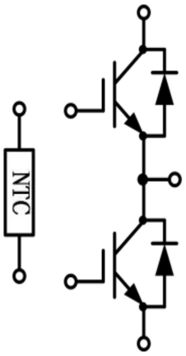
Econodual3 Half Bridge IGBT Module

V_{CES}= 750V, I_C= 450A, $V_{CE(sat)}$= 1.68V

Features

- High Short Circuit Capability, Self Limiting Short Circuit Current
- High Current Density
- High surge current capability
- High Power Density
- Integrated NTC temperature sensor



Applications

- Commercial Agriculture Vehicles
- Motor Drives
- Solar Applications
- UPS Systems

IGBT, Inverter

Maximum Ratings

Parameter	Symbol	Test Condition	Value	Unit
Collector-emitter voltage	V_{CES}	V_{CE}=750V, V_{GE}=0V, Tvj=25℃	750	V
Continuous DC collector current	I_C	T_C=100℃, $T_{vj\ max}$=175℃	450	A
Repetitive peak collector current	I_{CRM}	t_P=1ms	900	A
Total power dissipation	P_{tot}	T_C=25℃, $T_{vj\ max}$=175℃	1530	W
Gate-emitter peak voltage	V_{GES}		+/-20	V

Characteristics Values

Parameter	Symbol	Test Condition		Value			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	I_C= 450A, V_{GE}=15V	T_{vj}=25℃		1.68	2.1	V
			T_{vj}=125℃		1.92		
			T_{vj}=150℃		1.95		
Gate threshold voltage	V_{GEth}	I_C=10mA, V_{CE}=V_{GE}	T_{vj}=25℃	5.0	6.2	7.0	
			T_{vj}=125℃		3.8		
Gate charge	Q_G	V_{GE}= -15V ... +15V			5.20		μC
Internal gate resistor	R_{Gint}	T_{vj} =25℃			0.67		Ω

Input capacitance	C_{ies}	f=1MHz,T_{vj}=25℃, V_{CE}=25 V, V_{GE}=0V			28.84		nF
Output capacitance	C_{oes}	f=1MHz,T_{vj}=25℃, V_{CE}=25V, V_{GE}=0V			1.6		
Reverse transfer capacitance	C_{res}	f =1MHz,T_{vj}=25℃,V_{CE}=25 V, V_{GE}=0V			0.267		
Collector-emitter cut-off current	I_{CES}	V_{CE}=750V, V_{GE}=0V, T_{vj}=25℃				100	µA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V, T_{vj}=25℃				200	nA
Turn-on delay time, inductive load	t_{don}	I_C=450A, V_{CE}=450V, V_{GE}=±15V, R_{Gon}=15Ω	T_{vj}=25℃		0.11		µs
			T_{vj}=125℃		0.12		
			T_{vj}=175℃		0.12		
Rise time, inductive load	t_r	I_C=450A, V_{CE}=400V, V_{GE}= ±15 V, R_{Gon}=15Ω	T_{vj}=25℃		0.10		
			T_{vj}=125℃		0.11		
			T_{vj}=175℃		0.11		
Turn-off delay time, inductive load	$t_{d\ off}$	I_C=450A, V_{CE}=400V, V_{GE}= ±15V, R_{Gon}=15Ω	T_{vj}=25℃		0.41		
			T_{vj}=125℃		0.45		
			T_{vj}=175℃		0.45		
Fall time, inductive load	t_f	I_C=450A, V_{CE}=400V, V_{GE}=±15V, R_{Gon}=15Ω	T_{vj}=25℃		0.06		
			T_{vj}=125℃		0.08		
			T_{vj}=175℃		0.09		
Turn-on energy loss per pulse	E_{on}	I_C=450A,V_{CE}=400V,L_S=35nH, V_{GE}=±15V, di/dt=4800A/µs (T_{vj}=175℃), R_{Gon}=15Ω	T_{vj}=25℃		8.50		mJ
			T_{vj}=125℃		9.85		
			T_{vj}=175℃		10.5		
Turn-off energy loss per pulse	E_{off}	I_C=450A,V_{CE}=400V, L_S=35nH V_{GE}=±15V, di/dt=4800A/µs (T_{vj} =175℃) R_{Gon}=15Ω	T_{vj}=25℃		26.5		
			T_{vj}=125℃		28.7		
			T_{vj}=175℃		30.5		
SC data	I_{SC}	V_{GE}≤15V, V_{CC}=400V, t_P≤8µs, V_{CEmax}=V_{CES}-L_{sCE}·di/dt, t_P≤6µs	T_{vj}=25℃		3000		A
			T_{vj}=175℃		2600		
Thermal resistance,junction to case	R_{thJC}	per IGBT			0.098		K/W

Diode, Inverter

Maximum Ratings

Parameter	Symbol	Test Condition		Value	Unit
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25℃		750	V
Continuous DC forward current	I_F			450	A
Repetitive peak forward current	I_{FRM}	t_P=1ms		900	A
I²t-vaue	I^2t	V_R=0V , t_P=10ms	T_{vj}=125℃	14500	A^2s
			T_{vj}=175℃	14000	A^2s

Characteristics Values

Parameter	Symbol	Test Condition		Value			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=450A , V_{GE}=0V	T_{vj}=25℃		1.9		V
			T_{vj}=125℃		2.04		
			T_{vj}=175℃		2.1		
Peak reverse recovery current	I_{RM}	I_F=450A， -diF/dt=2400A/μs, V_R=300V, V_{GE}=-15V	T_{vj}=25℃		272		A
			T_{vj}=125℃		280		
			T_{vj}=175℃		295		
Recovered harge	Q_r		T_{vj}=25℃		26.5		μC
			T_{vj}=125℃		30.5		
			Tvj=175℃		35.5		
Reverse recovery energy	E_{rec}		T_{vj}=25℃		5.80		mJ
			T_{vj}=125℃		8.20		
			T_{vj}=175℃		10.1		
Thermal resistance, junction to case	R_{thJC}	per diode				0.145	K/W

NTC-Thermistor

Parameter	Symbol	Test Condition	Value			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_C=25℃		5.0		KΩ
Deviation of R100	△R/R	T_C=100℃, R_{100}=493Ω	-5		5	%
Power dissipation	P_{25}	T_C=25℃			20	mW
B-value	$B_{25/50}$	$R_2=R_{25}$ exp[$B_{25/50}$(1/T2-1/(298.15K))]		3375		K
B-value	$B_{25/80}$	$R_2=R_{25}$ exp[$B_{25/80}$(1/T2-1/(298.15K))]		3411		K
B-value	$B_{25/100}$	$R_2=R_{25}$ exp[$B_{25/100}$(1/T2-1/(298.15K))]		3433		K

Characteristics Values(Module)

Parameter	Symbol	Test Condition	Value			Unit
			Min.	Typ.	Max.	
Storage temperature	T_{stg}		-40		175	℃
Temperature under switching conditions	$T_{vj\ op}$		-40		175	℃
Stray inductance module	L_{sCE}			20		nH
Module lead resistance, terminals-chip	$R_{CC'+EE}$	T_{vj}=25℃, per switch		1.2		m Ω
Isolation test voltage	V_{isol}	AC, RMS, f=50Hz, t=1min		2.5		kV
Creepage distance	ds	Terminal to terminal		13.0		mm
		Terminal to base		14.5		mm

Clearance distance in air	da	Terminal to terminal		10.0		mm
		Terminal to base		12.5		mm
Comperative tracking index	CTI		>200			
Mounting torque for module mounting	F		3		6	
Internal isolation	-	Basic insulation (class1, IEC 61140)	Al$_2$O$_3$			-
Weight	G		350			g

Typical Characteristics

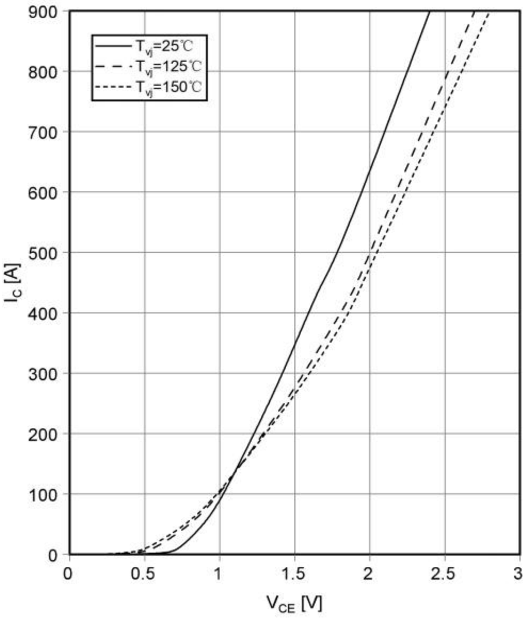


Fig 1. Output characteristic IGBT, Inverter(typical)
I_C=f(V_{CE}) , V_{GE}= 15V

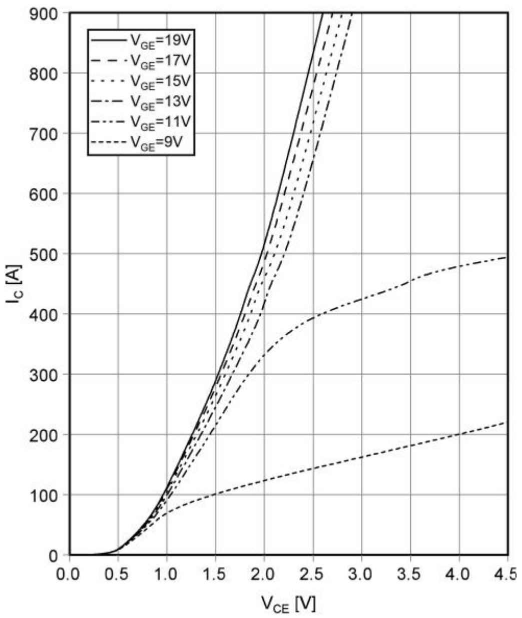


Fig 2. Output characteristic IGBT, Inverter(typical)
I_C=f(V_{CE}) , T_{vj}= 150℃

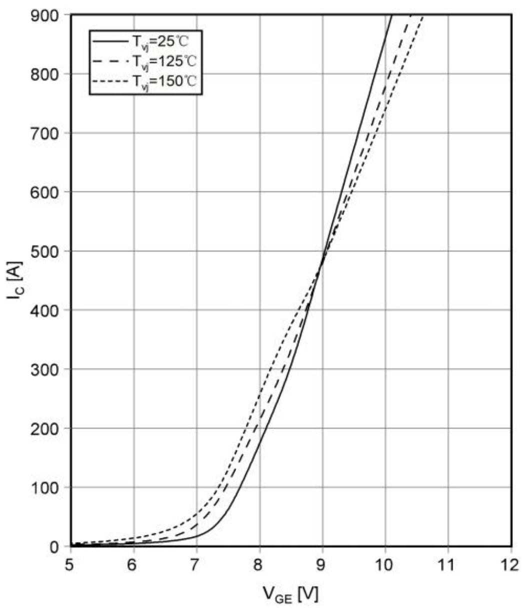


Fig 3. Transfer characteristic IGBT, Inverter(typical)
I_C=f(V_{GE}) , V_{CE}=20V

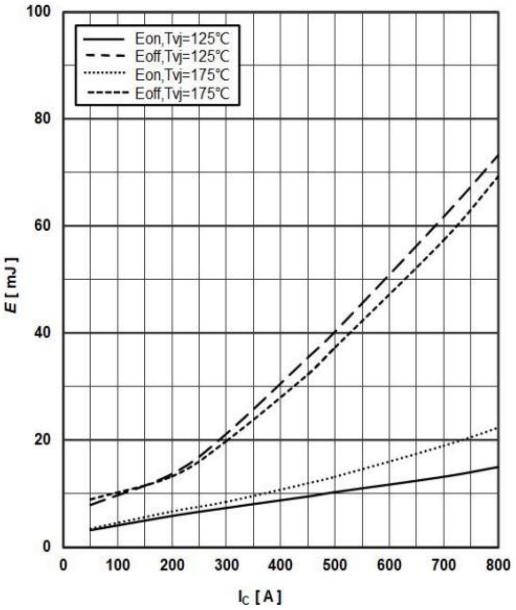


Fig 4. Switching losses IGBT, Inverter(typical)
E_{on}=f(I_C),E_{off}=f(I_C),V_{GE}=-8/+15V,R_{Gon}=R_{Goff}=15Ω,V_{CE}=400V

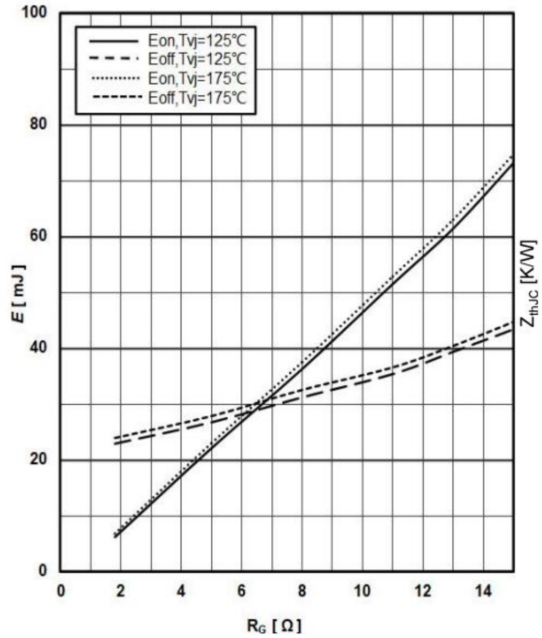


Fig 5. Switching losses IGBT, Inverter(typical), $E_{on}=f(R_G)$,$E_{off}=f(R_G)$, V_{GE}=-8/+15V, I_C=450A, V_{CE}=400V

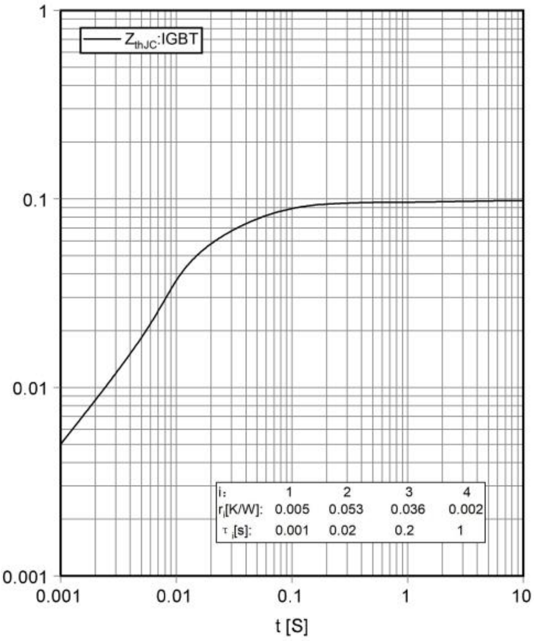


Fig 6. Transient thermal impedance IGBT, Inverter $Z_{thJC}=f(t)$

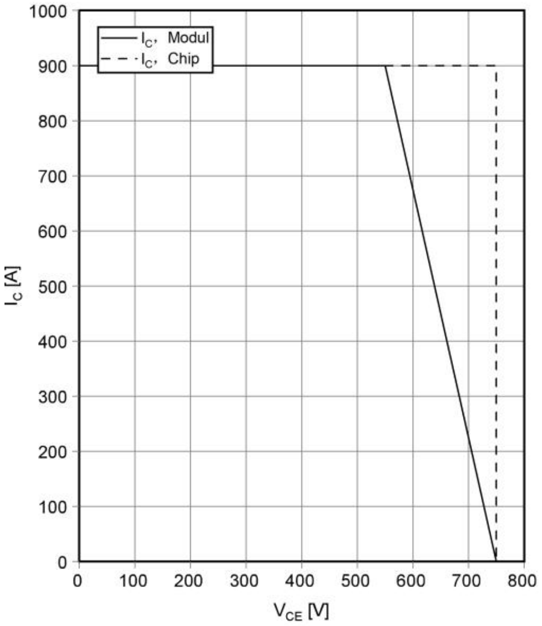


Fig 7. Reverse bias safe operating area IGBT, Inverter(RBSOA)
$I_C=f(V_{CE})$, V_{GE}=-8V/+15V, R_{Goff}=15Ω, T_{vj}= 150℃

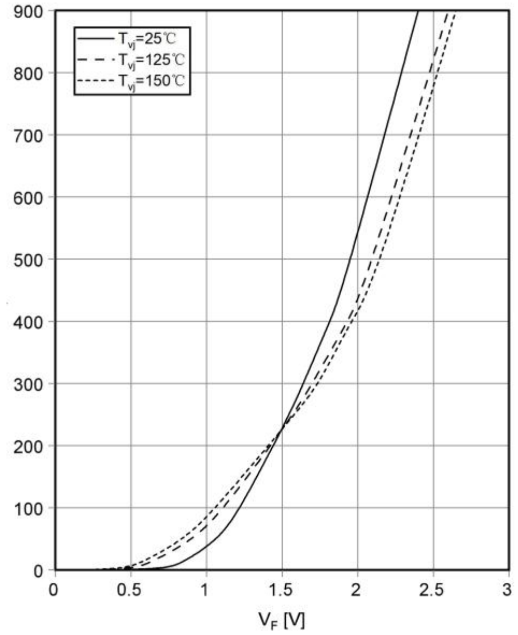


Fig 8. Forward characteristic of Diode, Inverter(typical)
$I_F=f(V_F)$

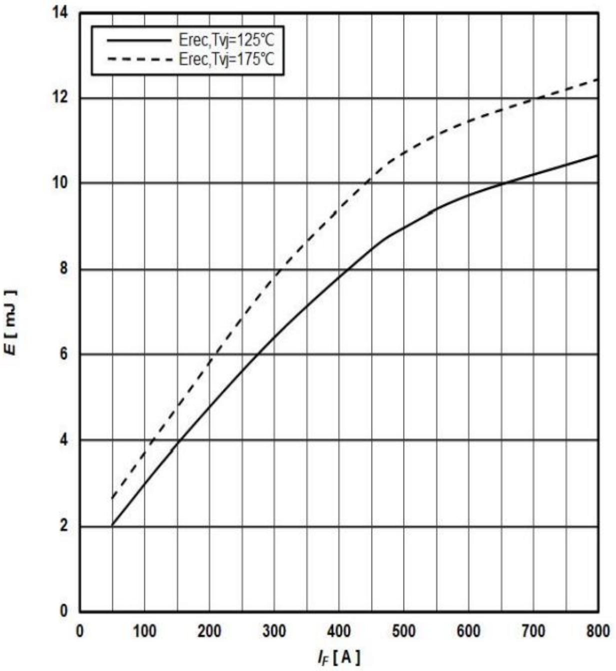


Fig 9. Switching losses Diode, Inverter(typical)
$E_{rec}=f(I_F)$, $R_{Gon}= 15\Omega$, $V_{CE}=400V$

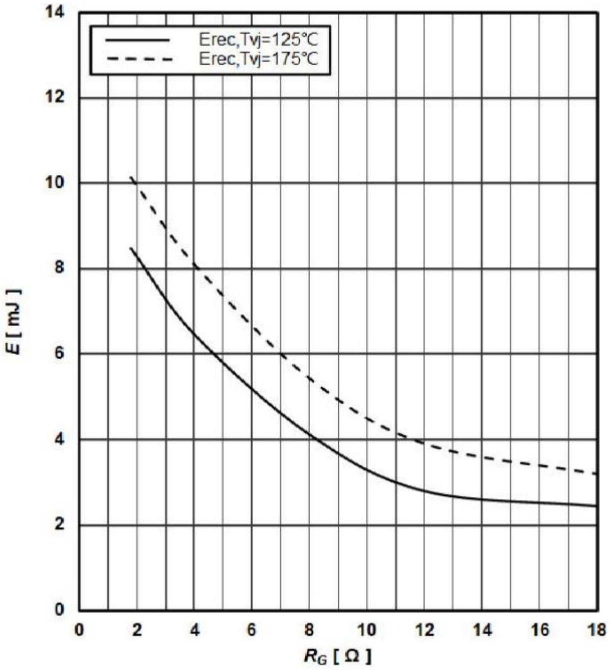
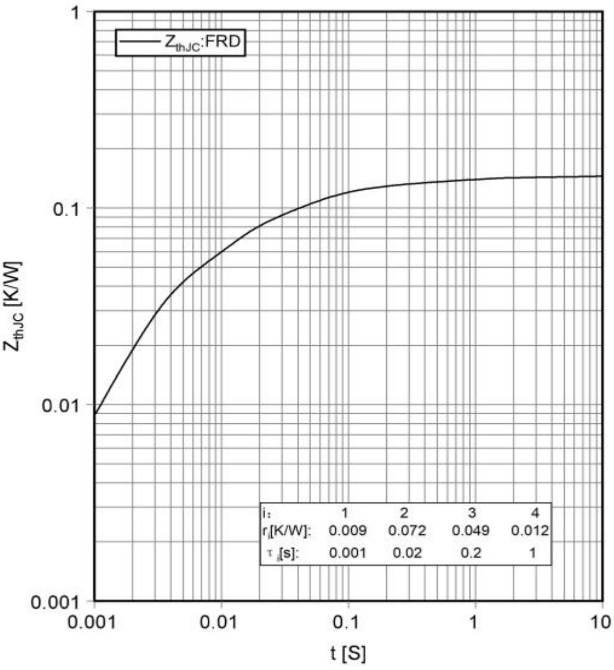


Fig 10. Switching losses Diode, Inverter(typical)
$E_{rec}=f(I_F)$, $I_F=450A$, $V_{CE}=400V$



i:	1	2	3	4
r_i[K/W]:	0.009	0.072	0.049	0.012
τ_i[s]:	0.001	0.02	0.2	1

Fig 11. Transient thermal impedance Diode,Inverter
$Z_{thJC}=f(t)$

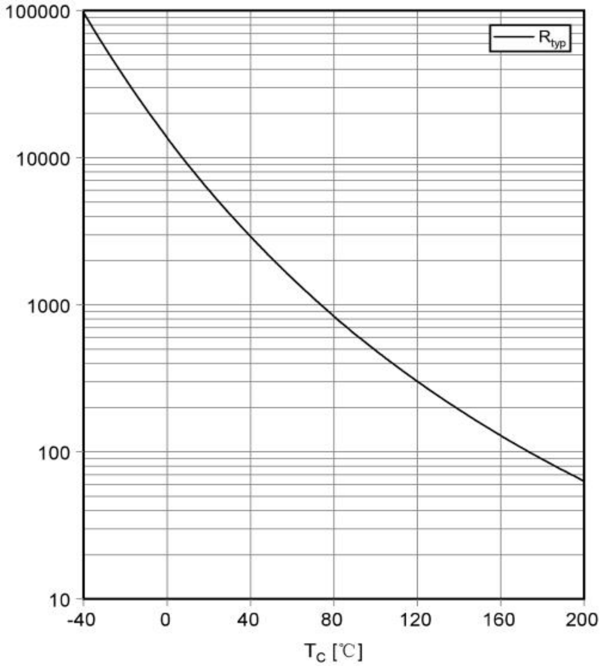
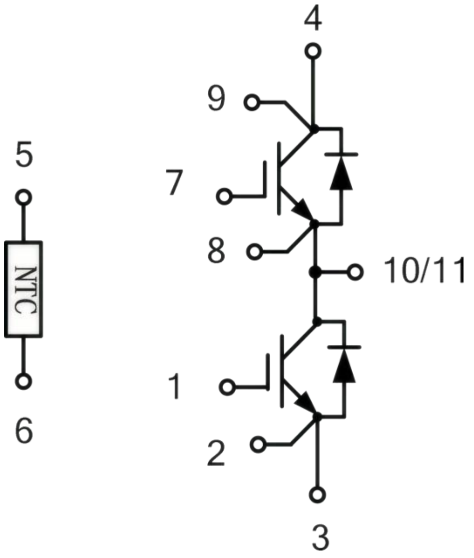
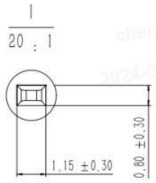


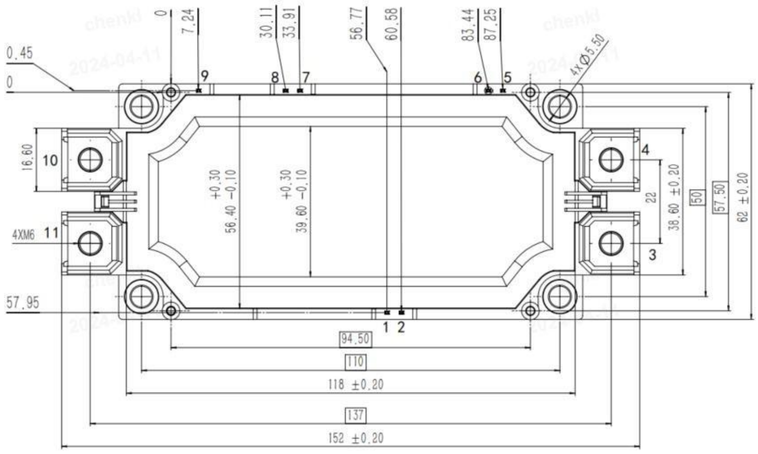
Fig 12. NTC-Thermistor-temperature
characteristic(typical) R=f(t)

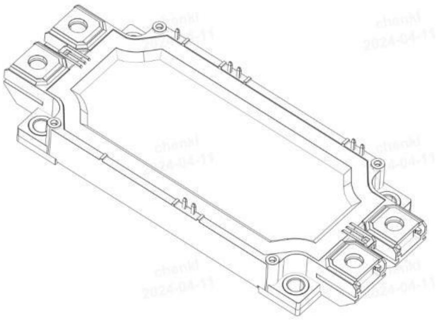
Circuit Diagram



Package Outlines(Unit：mm)







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