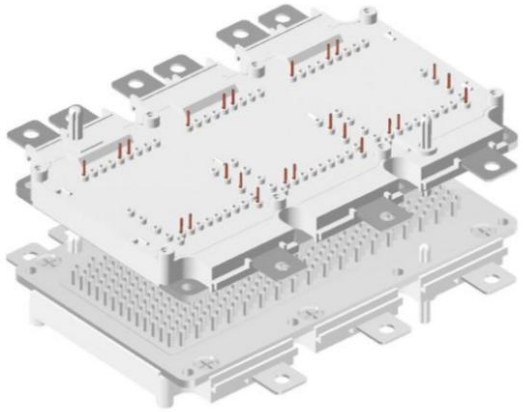
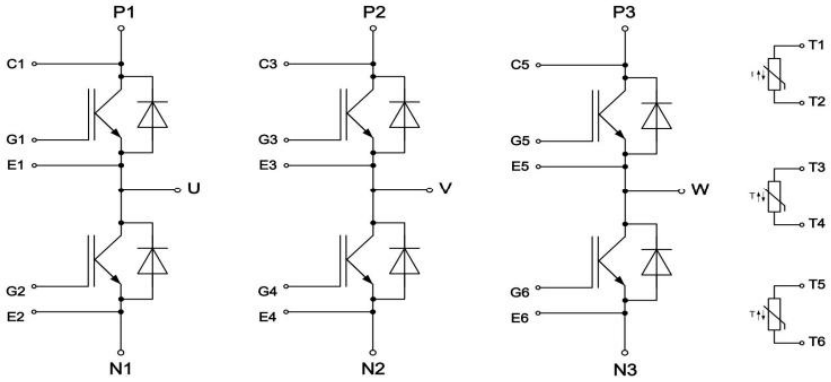
HPD IGBT Power Module

V_{CES}=750V, I_C=950A, $V_{CE(sat)}$=1.53V



Features

- 750V Trench and Field Stop technology
- High short circuit capability
- High Power Density
- Low conduction and switching losses
- Vcesat positive temperature coefficient
- Fast & soft recovery anti-parallel FRD
- Integrated NTC temperature sensor



Applications

- Motor Drives
- Hybrid Electrical Vehicles(H)EV
- Commercial Agriculture Vehicles

IGBT, Inverter
Maximum Ratings

Parameter	Symbol	Test Condition	Values	Units
Collector-emitter voltage	V_{CES}	T_{vj}=25℃, V_{GE}=0V	750	V
Implemented collector current	I_{CN}		950	A
Continuous DC collector current	$I_{C\ nom}$	T_F=95℃, $T_{vj\ max}$=175℃	520[1])	A
Repetitive peak collector current	I_{CRM}	t_p=1ms， T_{vj}=25℃	1900	A
Gate-emitter peak voltage	V_{GES}	T_{vj}=25℃	±30	V
SC data	I_{SC}	V_{GE}≤15V, V_{CC}=400V V_{CEmax}=$V_{CES-LsCE}$*di/dt t_p≤5μs, T_{vj}=150℃	4500	A
Total power dissipation	P_{tot}	T_F=75℃, $T_{vj\ max}$=175℃	769[1])	W

1) Verified by characterization / design not by test.

Characteristics Values

Parameter	Symbol	Test Condition	Values			Units
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	I_C=520A, V_{GE}=15V, T_{vj}=25℃		1.53	1.85	V
		I_C=520A, V_{GE}=15V, T_{vj}=150℃		1.65	2.1	V
		I_C=520A, V_{GE}=15V, T_{vj}=175℃		1.68	2.2	V

Gate-emitter threshold voltage	V_{GEth}	V_{CE}=V_{GE}, I_C=10mA	Tvj=25℃	5.0	6.1	7.0	V
			Tvj=175℃		3.9		V
Gate charge	Q_G	V_{GE}=-8V...+15V ,V_{CE} = 400V			4.3		uC
Integrated gate resistor	R_G	Tvj=25℃			1		Ω
Input capacitance	C_{ies}	Tvj=25℃,f=1MHz,V_{GE}=0V,V_{CE}=50V			37		nF
Output capacitance	C_{oes}	Tvj=25℃,f=1MHz,V_{GE}=0V,V_{CE}=50V			0.88		nF
Reverse transfer capacitance	C_{res}	Tvj=25℃,f=1MHz,V_{GE}=0V,V_{CE}=50V			0.25		nF
Collector-emitter cut-off current	I_{CES}	V_{CE}=750V, V_{GE}=0V	Tvj=25℃			1	mA
			Tvj=175℃		4		mA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V, Tvj=25℃				400	nA
Turn-on delay time, inductive load	$t_{d\ on}$	I_C=520A, V_{CE}=400V, V_{GE}=-8V/+15V, R_{Gon}=5Ω, R_{Goff}=5Ω	Tvj=25℃		292		ns
			Tvj=150℃		300		ns
			Tvj=175℃		308		ns
Rise time, inductive load	t_r		Tvj=25℃		78		ns
			Tvj=150℃		89		ns
			Tvj=175℃		92		ns
Turn-off delay time, inductive load	$t_{d\ off}$		Tvj=25℃		960		ns
			Tvj=150℃		1073		ns
			Tvj=175℃		1078		ns
Fall time, inductive load	t_f		Tvj=25℃		48		ns
			Tvj=150℃		58		ns
			Tvj=175℃		70		ns
Turn-on energy loss per pulse	E_{on}	I_C=520A, V_{CE}=400V, V_{GE}=-8V/+15V, R_{Gon}=5Ω, R_{Goff}=5Ω,L_s=20nH, di/dt($T_{vj25℃}$)=5500A/μs, di/dt($T_{vj150℃}$)=5000A/μs, dv/dt($T_{vj25℃}$)=3100V/μs, dv/dt($T_{vj150℃}$)=2500V/μs	Tvj=25℃		17.0		mJ
			Tvj=150℃		28.1		mJ
			Tvj=175℃		30.5		mJ
Turn-off energy loss per pulse	E_{off}		Tvj=25℃		33.2		mJ
			Tvj=150℃		37.5		mJ
			Tvj=175℃		38.2		mJ
IGBT, thermal resistance, junction to cooling fluid	$R_{thjF\ IGBT}$	Per IGBT, ΔV/Δt=10dm³/min, T_F=75℃				0.13	K/W

Diode, Inverter
Maximum Ratings

Parameter	Symbol	Test Condition	Values	Units
Repetitive peak reverse voltage	V_{RRM}	Tvj=25℃	750	V
Implemented forward current	I_{FN}		950	A

Continuous DC forward current	I_F		520[1])	A
Repetitive peak forward current	I_{FRM}	t_p=1ms	1900	A
I^2t-value	I^2t	V_R=0V, t_p=10ms, T_{vj}=150℃	18500	A^2s
		V_R=0V, t_p=10ms, T_{vj}=175℃	15700	A^2s

Characteristics Values

Parameter	Symbol	Test Condition		Values			Units
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=520A, V_{GE}=0V	T_{vj}=25℃		1.70	1.90	V
			T_{vj}=150℃		1.73		V
			T_{vj}=175℃		1.75		V
Peak reverse recovery current	I_{RM}	I_F=520A,V_R=400V, V_{GE}=-8V -diF/dt=5000A/μs (T_{vj}=150℃)	T_{vj}=25℃		230		A
			T_{vj}=150℃		340		A
			T_{vj}=175℃		360		A
Recovered charge	Q_r		T_{vj}=25℃		19.4		μC
			T_{vj}=150℃		38.5		μC
			T_{vj}=175℃		43.6		μC
Reverse recovery energy	E_{rec}		T_{vj}=25℃		3.7		mJ
			T_{vj}=150℃		6.6		mJ
			T_{vj}=175℃		7.3		mJ
Diode,thermal resistance, junction to cooling fluid	R_{thjF} Diode	Per diode,ΔV/Δt =10dm³/min, T_F= 75℃				0.17	K/W

NTC Thermistor

Characteristics Values

Parameter	Symbol	Test Condition	Values			Units
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_C=25℃		5.0		KΩ
Deviation of R100	△R/R	T_C=100℃, R_{100}=493Ω	-3		3	%
Power dissipation	P_{25}	T_C=25℃			60	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	Values			Units
			Min.	Typ.	Max.	
Maximum junction temperature	$T_{vj\ max}$				175	℃

Temperature under switching conditions	$T_{vj\ op}$		-40		175	℃
Storage temperature	T_{stg}		-40		150	℃
Stray inductance module	L_{sCE}			7		nH
Module lead resistance, terminals-chip	$R_{CC,+EE}$	T_{vj}=25℃, per switch		0.72		mΩ
Isolation test voltage	V_{isol}	AC,RMS, f=50Hz, t=1min		3.5		kV
Creepage distance	d_s	Terminal to terminal		9.0		mm
		Terminal to base		9.0		mm
Clearance distance in air	d_a	Terminal to terminal		4.5		mm
		Terminal to base		4.5		mm
Comperative tracking index	C_{TI}		>200			
Mounting torque for module mounting	M_1	Screw M4 base plate to heat sink	1.8	2.0	2.2	N·m
	M_2	Screw M4 EJOT Delta PCB to frame	0.45	0.50	0.55	
Terminal connection torque	M_3	Screw M5	3		6	
Internal isolation	-	Basic insulation (class1, IEC 61140)	AIN			-
Material of module base plate	-		Cu+Ni			-
Dimensions	L_{xWxH}		154.5x126.5x32			mm
Weight	G		720			g

Typical Characteristics

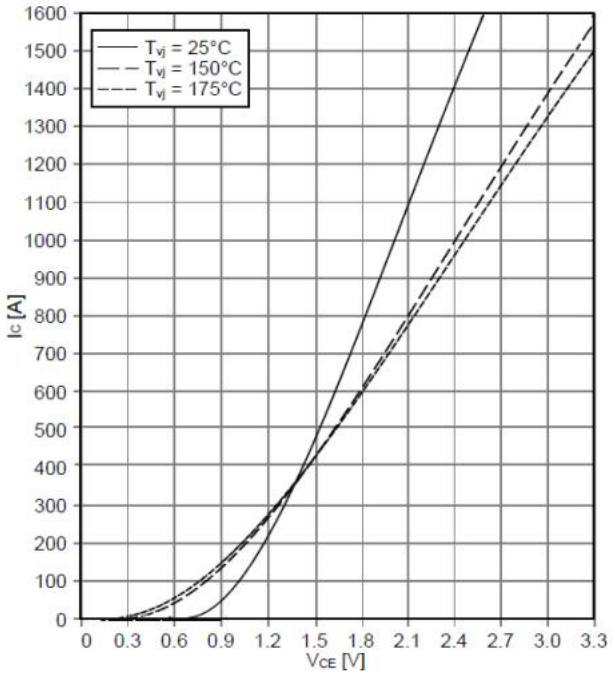


Fig 1.Output characteristic IGBT, Inverter(typical)
$I_C=f(V_{CE}),V_{GE}=15V$

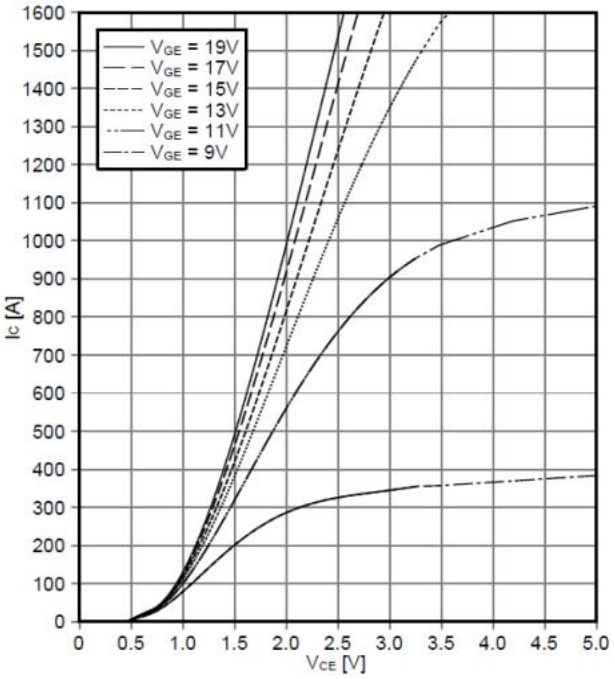


Fig 2.Output characteristic IGBT, Inverter(typical)
$I_C=f(V_{CE}),T_{vj}$=150℃

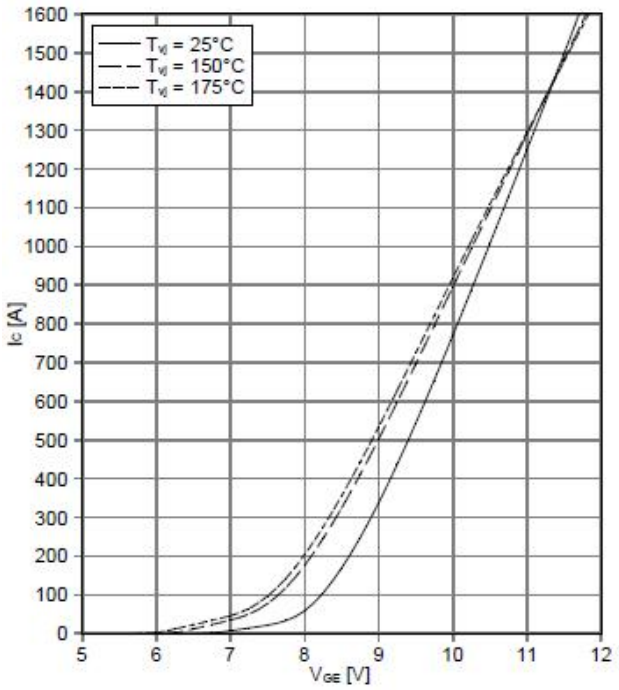


Fig 3.Transfer characteristic IGBT, Inverter(typical)
$I_C=f(V_{GE}),V_{CE}=20V$

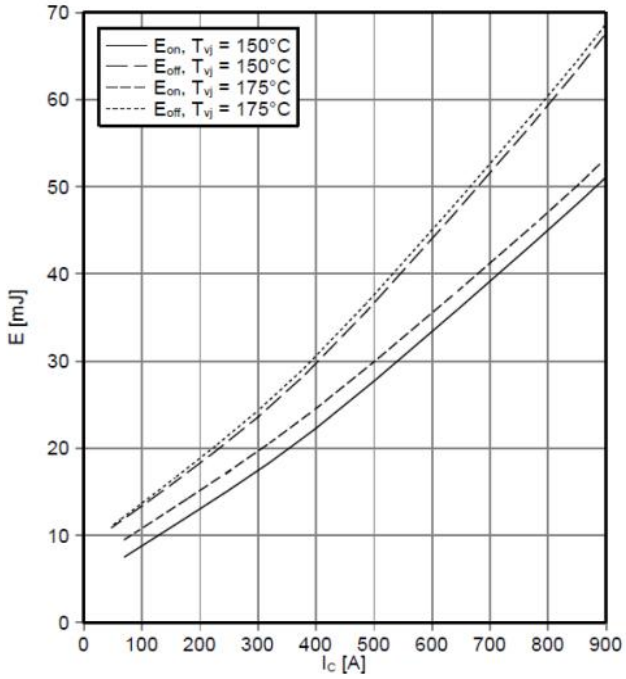


Fig 4.Switching losses IGBT, Inverter(typical)
$E_{on}=f(I_C),E_{off}=f(I_C),V_{GE}=8V/+15V,R_{Gon}=5\Omega,R_{Goff}=5\Omega,V_{CE}=400V$

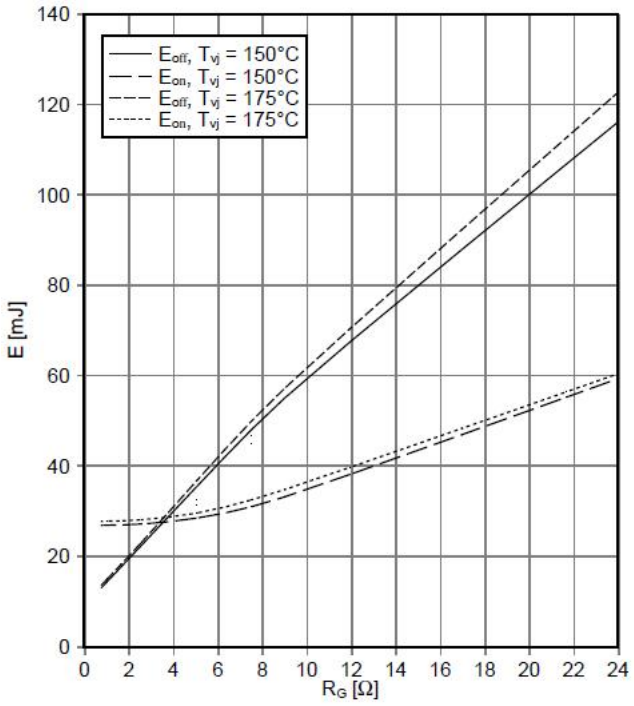


Fig 5.Switching losses IGBT, Inverter(typical)
$E_{on}=f(R_G)$, $E_{off}=f(R_G)$, $V_{GE}=-8V/+15V$, $I_C=520A$, $V_{CE}=400V$

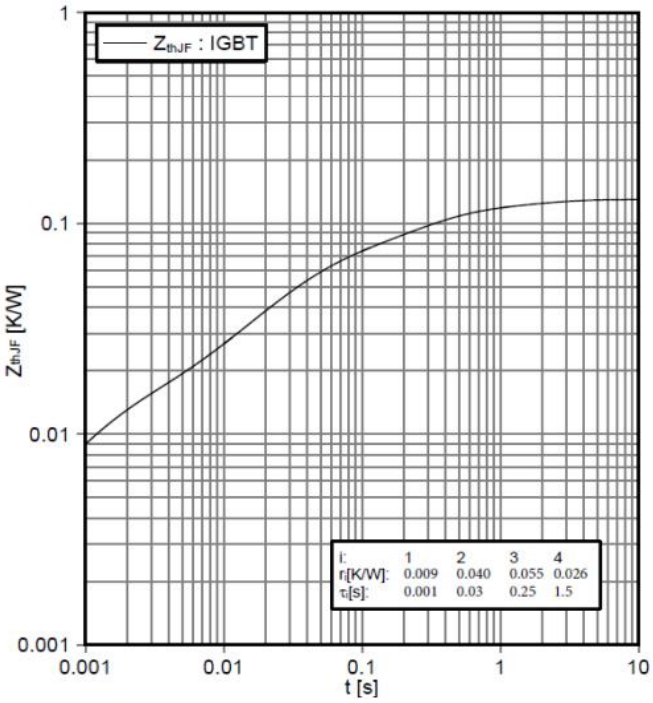


Fig 6.Transient thermal impedance IGBT, Inverter
$Z_{thJF}=f(t)$

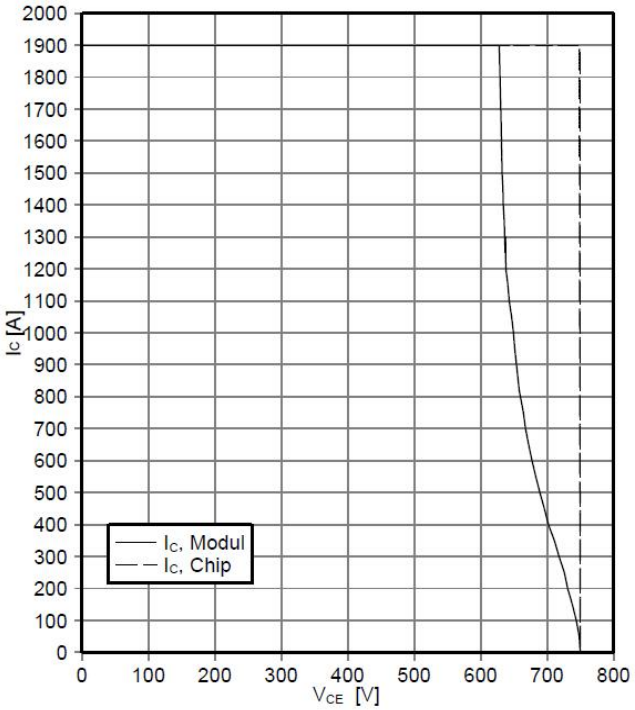


Fig 7.Reverse bias safe operating area IGBT, Inverter(R_{BSOA})
$I_C=f(V_{CE})$,V_{GE}=±15V, R_{Goff}=5Ω, T_{vj}=150℃

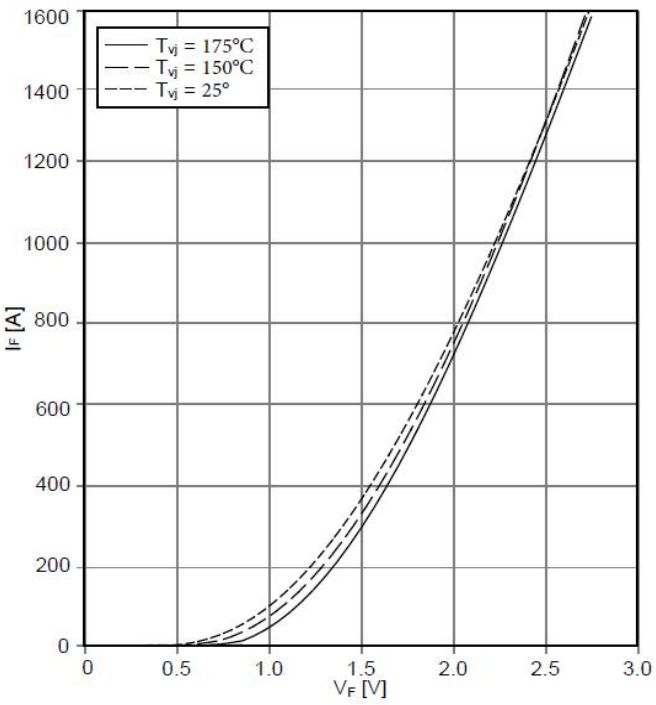


Fig 8.Forward characteristic of Diode, Inverter(typical)
$I_F=f(V_F)$

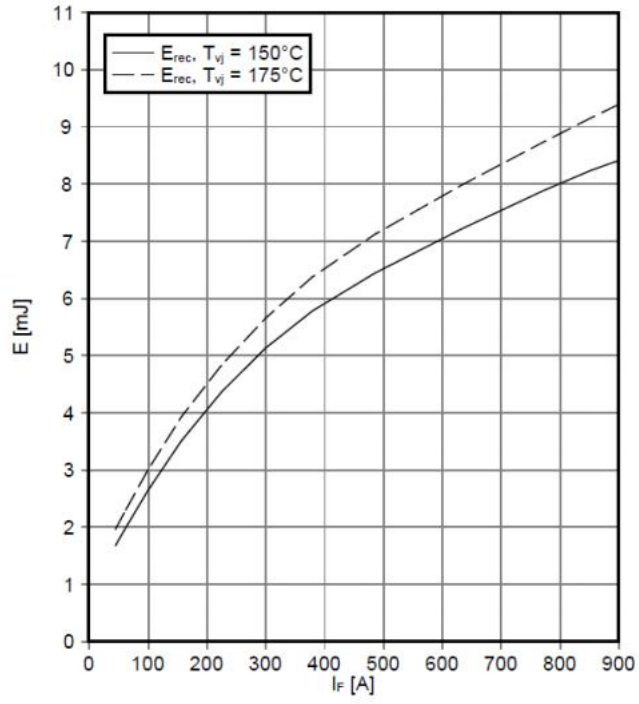


Fig 9.Switching losses Diode, Inverter(typical)
$E_{rec}=f(I_F)$， R_{Gon}=5Ω,V_{CE}=400V

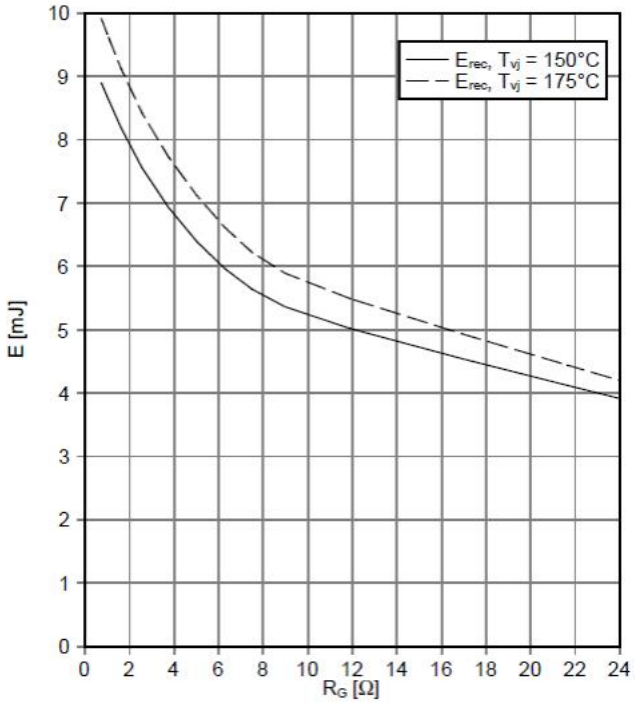


Fig 10.Switching losses Diode, Inverter(typical)
Erec=f(R_G),I_F=450A, V_{CE}=400V

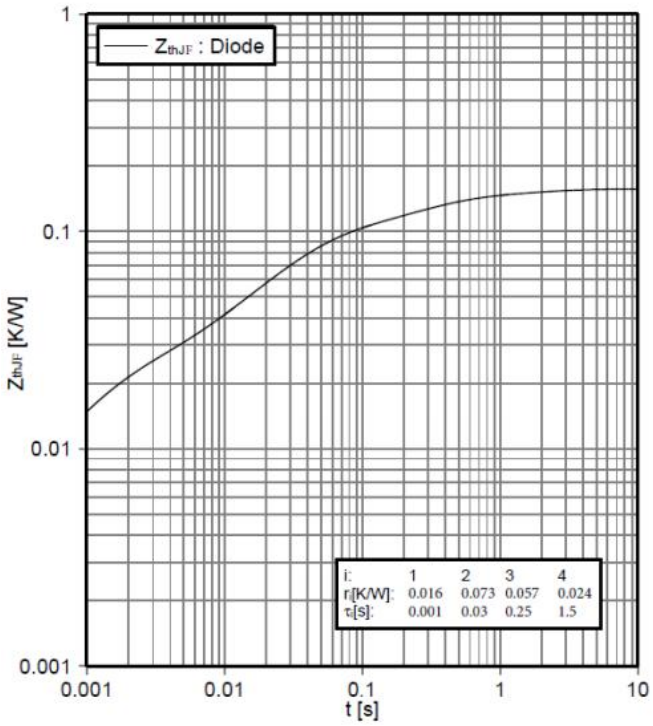


Fig 9.Transient thermal impedance Diode, Inverter $Z_{thJF}=f(t)$

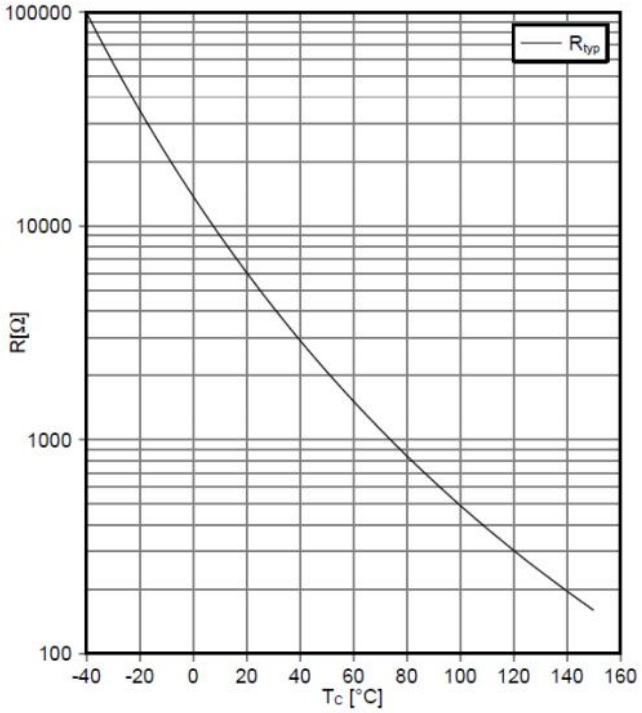
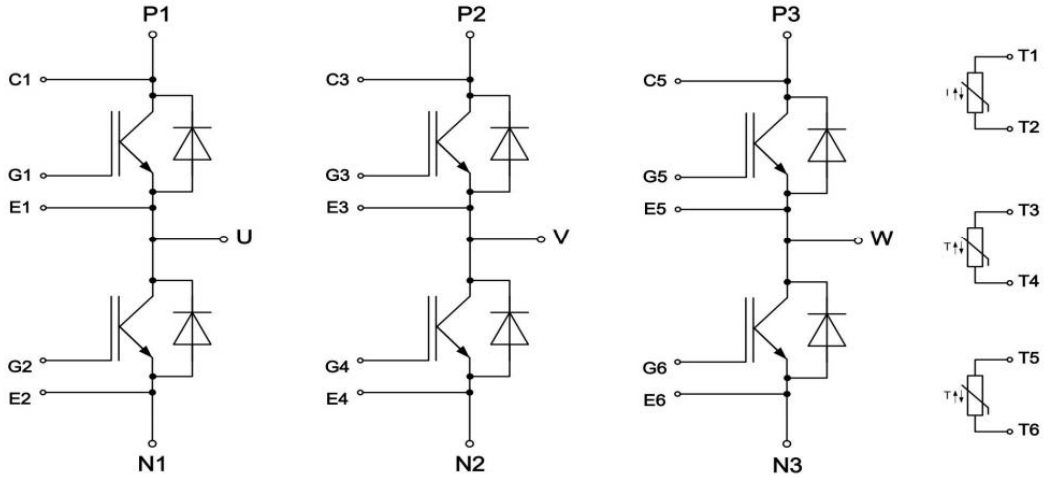
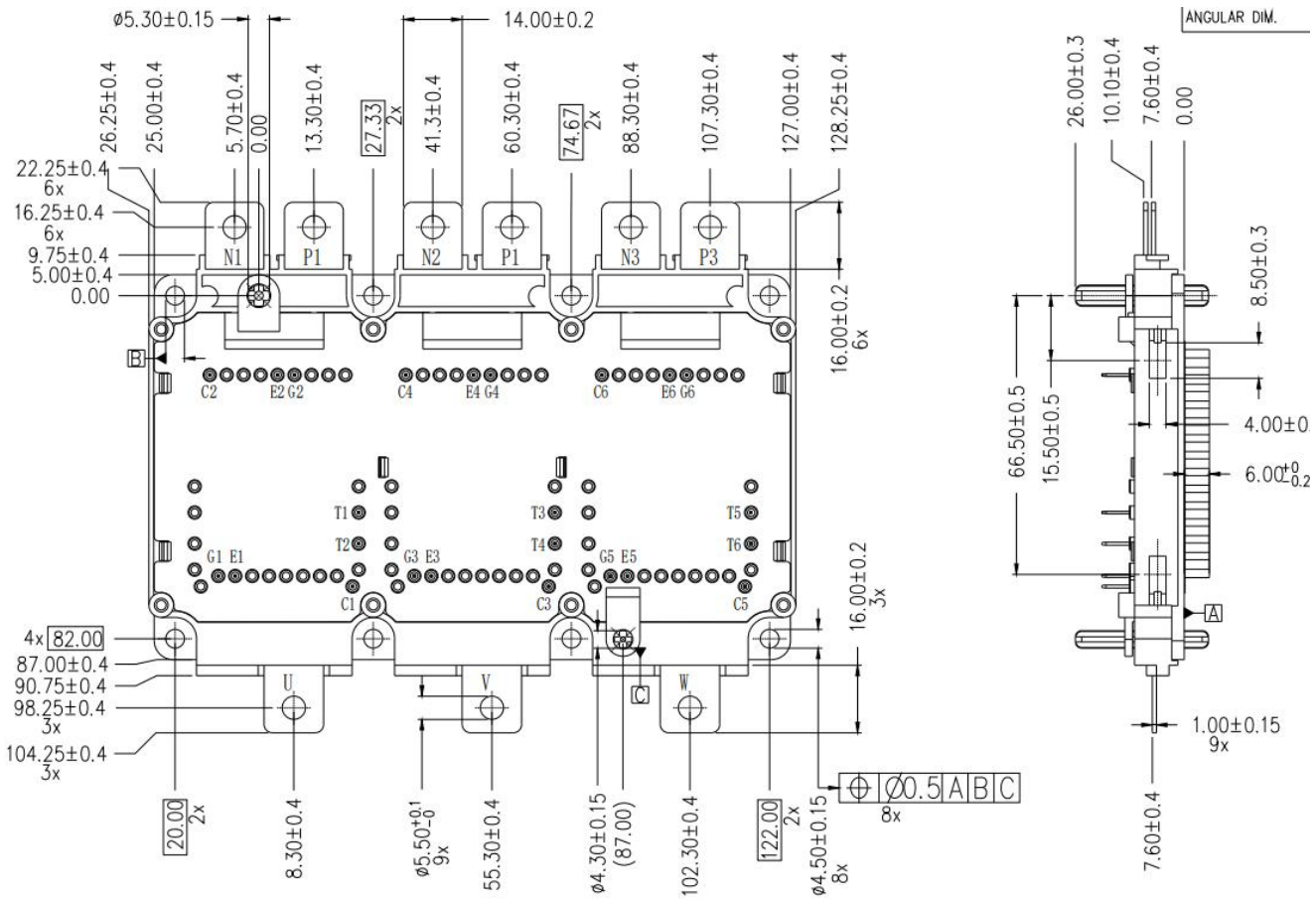


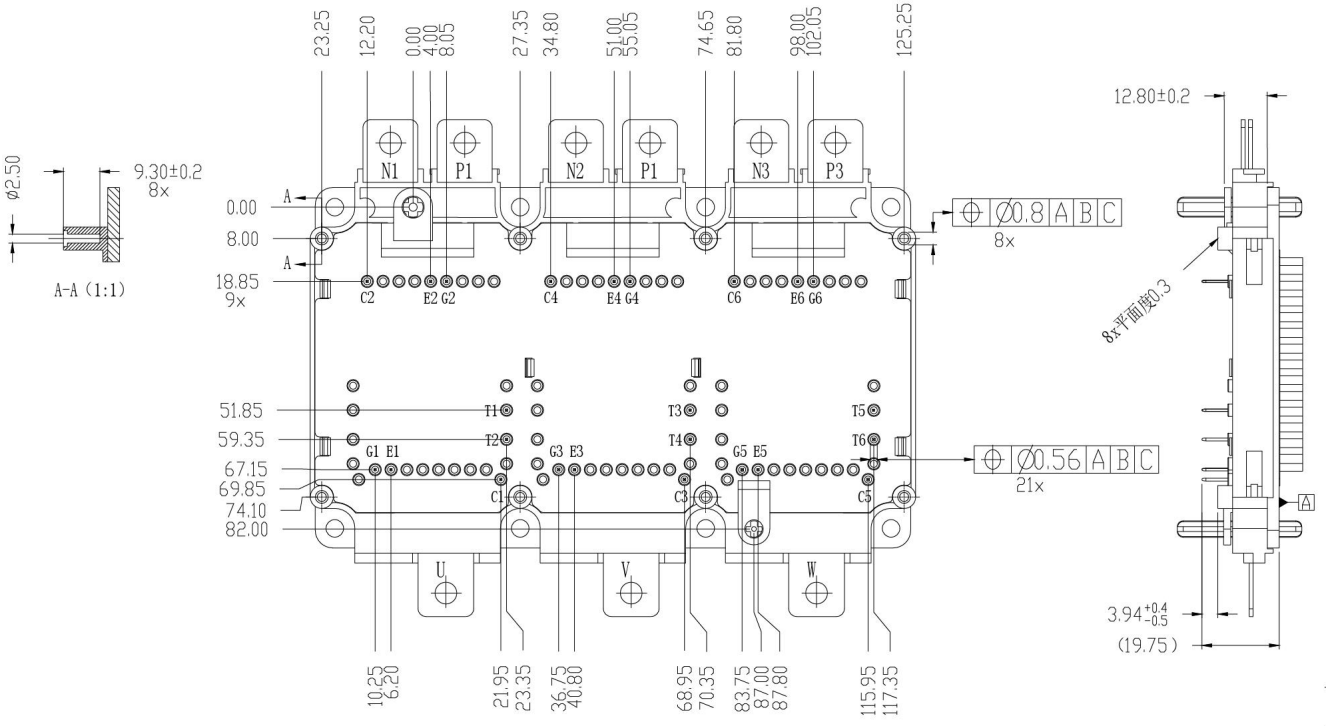
Fig 10.NTC thermistor temperature, characteristic(typical) $R=f(T)$

Circuit Diagram



Package Outlines(Unit：mm)





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