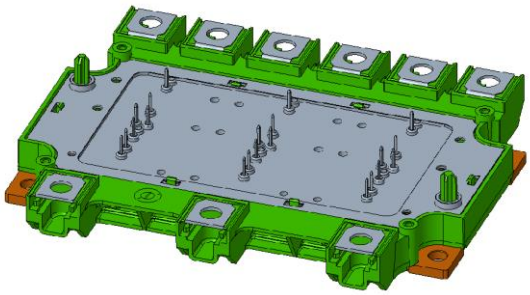
CHONGQING CLOUDCHILD TECHNOLOGY CO.,LTD

HP1-DC6i Trench-Field Stop IGBT MODULE

CCGN600T75SD HP1DC6i Trench-Field Stop IGBT module

V_{CES}	V_{CESat}		I_{CN} / I_{CRM}
750V	T_{vj}=25℃@350A	1.31V	600A/1200A
	T_{vj}=175℃@350A	1.35V	



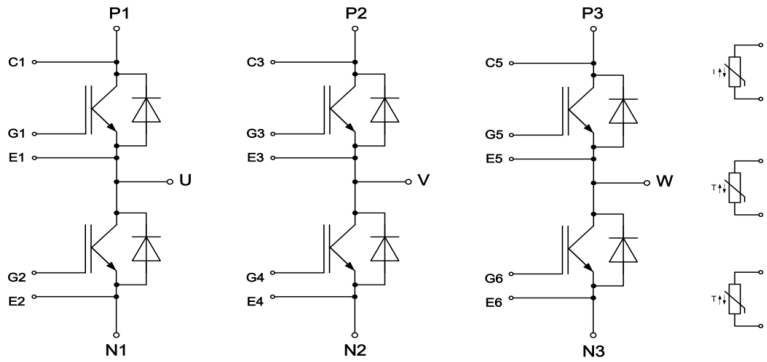
DESCRIPTION

CCGN600T75SD designed for a 150℃ junction operation temperature, the module accommodates a 3-phase Six-Pack configuration of Trench-Field Stop IGBT and matching emitter controlled diodes.

FEATURES

- Low Switching Losses
- Low V_{CEsat}
- 2.5kV AC 1min Insulation
- Blocking voltage 750V
- Low Qg and Crss
- Low Inductive Design
- High Power Density
- Direct Cooled Base Plate with Ribbon Bonds
- High Creepage and Clearance Distance
- Integrated NTC temperature sensor
- RoHS compliant
- AQG324 Qualified

EQUIVALENT CIRCUIT



APPLICATIONS

- Automotive Applications
- Hybrid Electrical Vehicles (H)EV
- Commercial Agriculture Vehicles
- Motor Drives
- Optimized for automotive applications with DC link voltages up to 470V

CHARACTERISTICS VALUES

MAXIMUM RATED VALUES(IGBT)

Parameter	Symbol	Conditions	Values	Units
Collector-emitter voltage	V_{CES}	T_{vj}=25℃, V_{GE}=0V	750	V
Implemented collector current	I_{CN}		600	A
Continuous DC collector current	$I_{C\ nom}$	T_F=80℃, $T_{vj\ max}$=175℃	350[1)]	A
Repetitive peak collector current	I_{CRM}	t_p=1ms, T_{vj}=25℃	1200	A
Gate-emitter peak voltage	V_{GES}	T_{vj}=25℃	±30	V
SC data	I_{SC}	V_{GE}≤15V, V_{CC}=400V,t_p≤5μs, V_{CEmax}=V_{CES}-L_{sCE}*di/dt,T_{vj}=150℃	3750	A
Total power dissipation	Ptot	T_F=75℃, $T_{vj\ max}$=175℃	625[1)]	W

1）Verified by characterization / design not by test.

CHARACTERISTICS VALUES(IGBT)

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\ sat}$	I_C=350A, V_{GE}=15V, T_{vj}=25℃			1.31	1.55	V
		I_C=350A, V_{GE}=15V, T_{vj}=150℃			1.35	1.61	V
		I_C=350A, V_{GE}=15V, T_{vj}=175℃			1.37	1.66	V
Gate-emitter thresholdvoltage	V_{GEth}	V_{CE}=V_{GE}, I_C=6.4mA	T_{vj}=25℃	5.9	6.1	6.3	V
			T_{vj}=175℃		3.9		
Gate charge	Q_G	V_{GE}=-8V...+15V			3.5		μC
Integrated gate resistor	R_G	T_{vj}=25℃			1		Ω
Input capacitance	C_{ies}	T_{vj}=25℃,f=1MHz,V_{GE}=0V,V_{CE}=50V			28		nF
Output capacitance	C_{oes}	T_{vj}=25℃,f=1MHz,V_{GE}=0V,V_{CE}=50V			0.65		nF
Reverse transfercapacitance	C_{res}	T_{vj}=25℃,f=1MHz,V_{GE}=0V,V_{CE}=50V			0.18		nF
Collector-emitter cut-offcurrent	I_{CES}	V_{CE}=750V, V_{GE}=0V	T_{vj}=25℃			0.85	mA
			T_{vj}=175℃		4		
Gate-emitter leakagecurrent	I_{GES}	V_{CE}=0V, V_{GE}=20V, T_{vj}=25℃				380	nA
Turn-on delay time,inductive load	t_{don}	I_C=350A, V_{CE}=400V, V_{GE}=-8V/+15V, R_{Gon}=R_{Goff}=5Ω	T_{vj}=25℃		315		ns
			T_{vj}=150℃		330		ns
			T_{vj}=175℃		340		ns
Rise time, inductive load	t_r		T_{vj}=25℃		75		ns
			T_{vj}=150℃		90		ns
			T_{vj}=175℃		95		ns
Turn-off delay time,inductive load	t_{doff}		T_{vj}=25℃		785		ns
			T_{vj}=150℃		885		ns
			T_{vj}=175℃		935		ns
Fall time, inductive load	t_f		T_{vj}=25℃		75		ns
			T_{vj}=150℃		75		ns
			T_{vj}=175℃		80		ns
Turn-on energy loss perpulse	E_{on}	I_C=350A, V_{CE}=400V, V_{GE}=-8V/+15V, R_{Gon}=R_{Goff}=5Ω,L_s=25nH,	T_{vj}=25℃		8.2		mJ
			T_{vj}=150℃		16		mJ
			T_{vj}=175℃		17.5		mJ
	E_{off}		T_{vj}=25℃		16.5		mJ

Turn-off energy loss perpulse		di/dt=6800A/μs(T_{vj}25℃)	T_{vj}=150℃		25.4		mJ
		di/dt=3500A/μs(T_{vj}150℃), dv/dt=3850V/μs(T_{vj}25℃), dv/dt=3300V/μs(T_{vj}150℃)	T_{vj}=175℃		26.6		mJ
Thermal resistance, junctionto cooling fluid	R_{thJF}	Per IGBT, ΔV/Δt=10dm³/min, T_F =75°C				0.16	K/W

MAXIMUM RATED VALUES(Diode)

Parameter	Symbol	Conditions	Values	Units
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25℃	750	V
Implemented forward current	I_{FN}		600	A
Continuous forward current	I_F		350[1)]	A
Maximum repetitive forward current	I_{FRM}	t_p=1ms	1200	A
I^2t-value	I^2t	V_R=0V, t_p=10ms, T_{vj}=150℃	14500	A^2s
		V_R=0V, t_p=10ms, T_{vj}=175℃	12500	

1) Verified by characterization / design not by test.

CHARACTERISTICS VALUES(Diode)

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=350A, V_{GE}=0V,	T_{vj}=25℃		1.47		V
			T_{vj}=150℃		1.37		V
			T_{vj}=175℃		1.33		V
Peak reverse recovery current	I_{RM}	I_F=350A, V_R=400V, V_{GE}=-8V di_F/dt=3950A/μs (T_{vj}150℃)	T_{vj}=25℃		207		A
			T_{vj}=150℃		317		A
			T_{vj}=175℃		337		A
Recovered charge	Q_r		T_{vj}=25℃		24.3		μC
			T_{vj}=150℃		47.9		μC
			T_{vj}=175℃		55.8		μC
Reverse recovery energy	E_{rec}		T_{vj}=25℃		2.1		mJ
			T_{vj}=150℃		5.5		mJ
			T_{vj}=175℃		7.2		mJ
Thermal resistance, junction to cooling fluid	R_{thJF}	Per diode, ΔV/Δt=10dm³/min, T_F =75°C				0.25	K/W

NTC-THERMISTOR

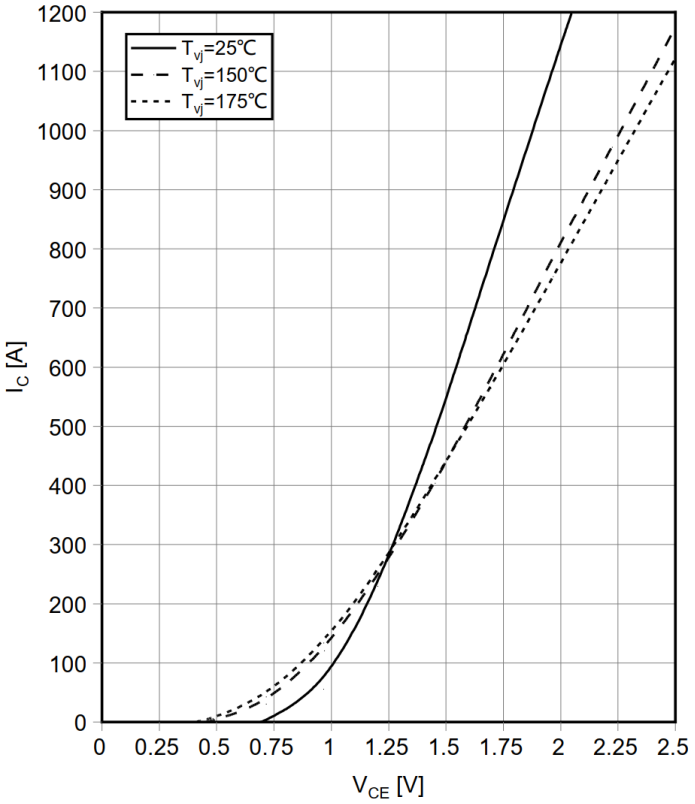
Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_C=25℃		5.0		KΩ
Deviation of R100	△R/R	T_C=100℃, R_{100}=493Ω	-3		3	%
Power dissipation	P_{25}	T_C=25℃			60	mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K
B-value	$B_{25/80}$	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$		3411		K
B-value	$B_{25/100}$	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$		3433		K

CHARACTERISTICS VALUES(MODULE)

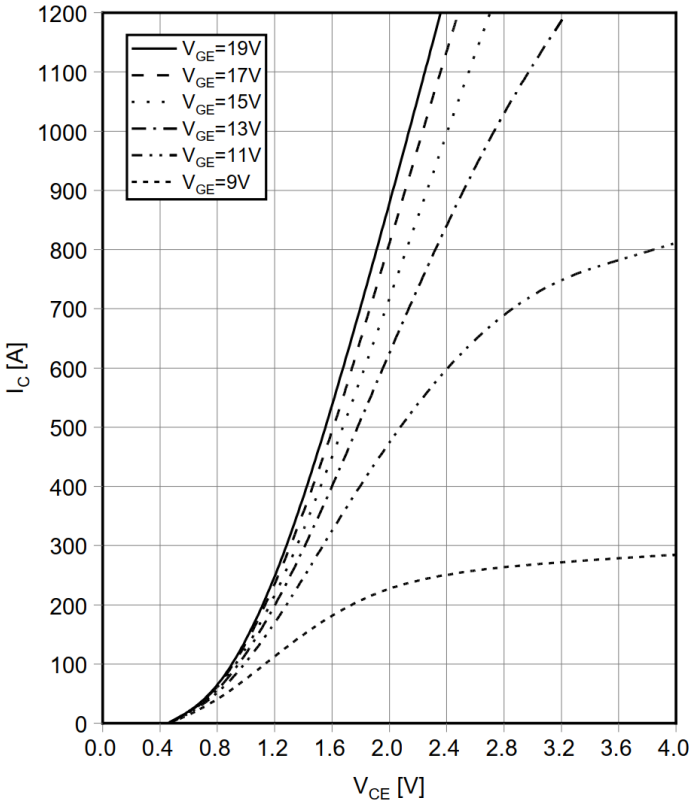
Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Maximum junction temperature	$T_{vj\ max}$				175	℃
Temperature under switchingconditions	$T_{vj\ op}$		-40		175	℃
Storage temperature	T_{stg}		-40		150	℃
Stray inductance module	L_{sCE}			15		nH
Module lead resistance, terminals-chip	$R_{CC'+EE}$	T_{vj}=25℃, per switch		0.9		mΩ
Isolation test voltage	V_{isol}	RMS, f=50Hz, t=1min		2.5		kV
Creepage distance	ds	Terminal to heatsink		18.2		mm
		Terminal to terminal		8.2		mm
Clearance distance in air	da	Terminal to heatsink		18.2		mm
		Terminal to terminal		5.9		mm
Comperative tracking index	CTI		>200			
Mounting torque for module mounting	M1	Screw M5 baseplate to heatsink	1.8	2.0	2.2	N.m
	M2	Screw M3 EJOT Delta PCB to frame	0.45	0.50	0.55	
Mounting torque for module mounting	M3	Screw M6	3		6	
Internal isolation	-	Basic insulation	Al_2O_3			-
Material of module baseplate	-		Cu+Ni			-
Dimensions	L x W x H		140x112.6x30.5			mm
Weight	G		620			g

CHARACTERISTICS DIAGRAMS

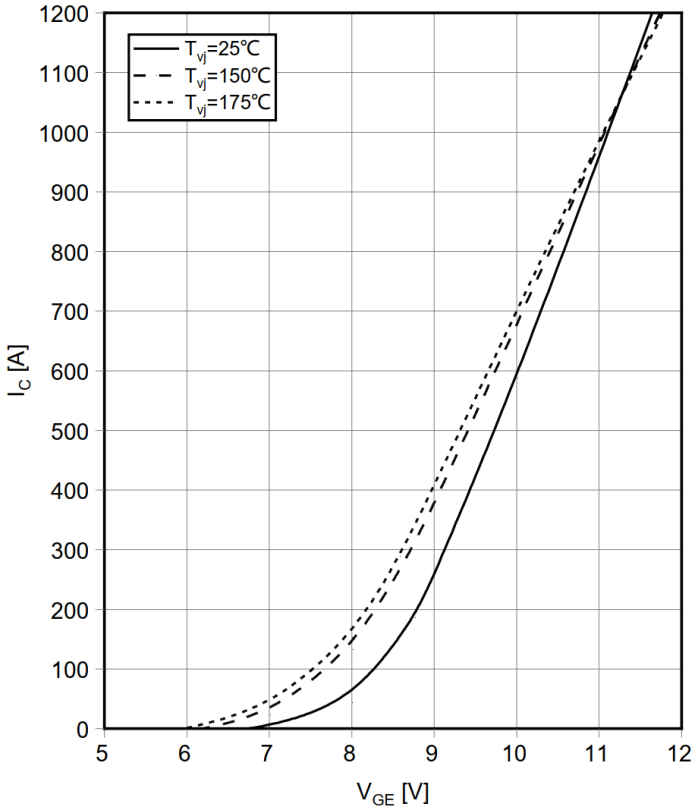
Output characteristic IGBT, Inverter(typical)
$I_C=f(V_{CE})$, V_{GE}=15V



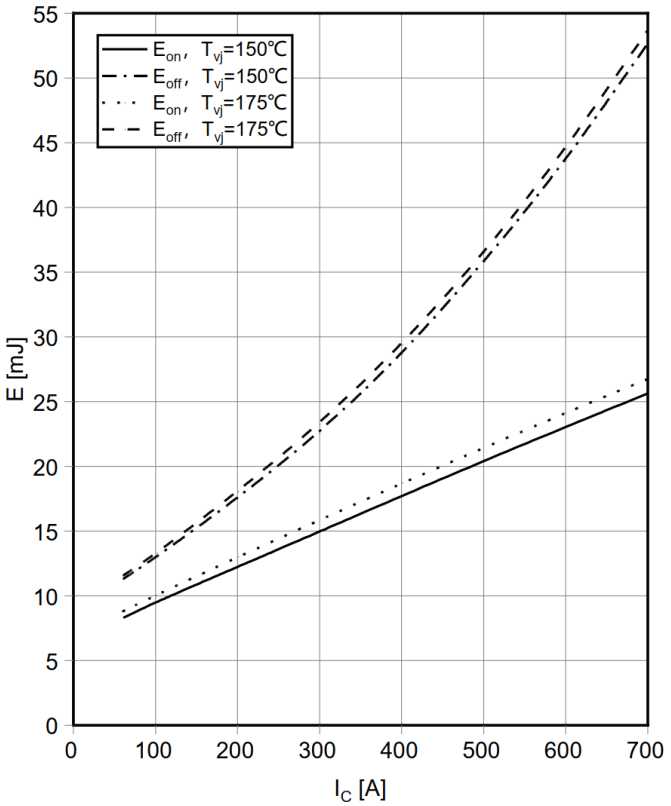
Output characteristic IGBT, Inverter(typical)
$I_C=f(V_{CE})$, T_{vj}=150℃



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

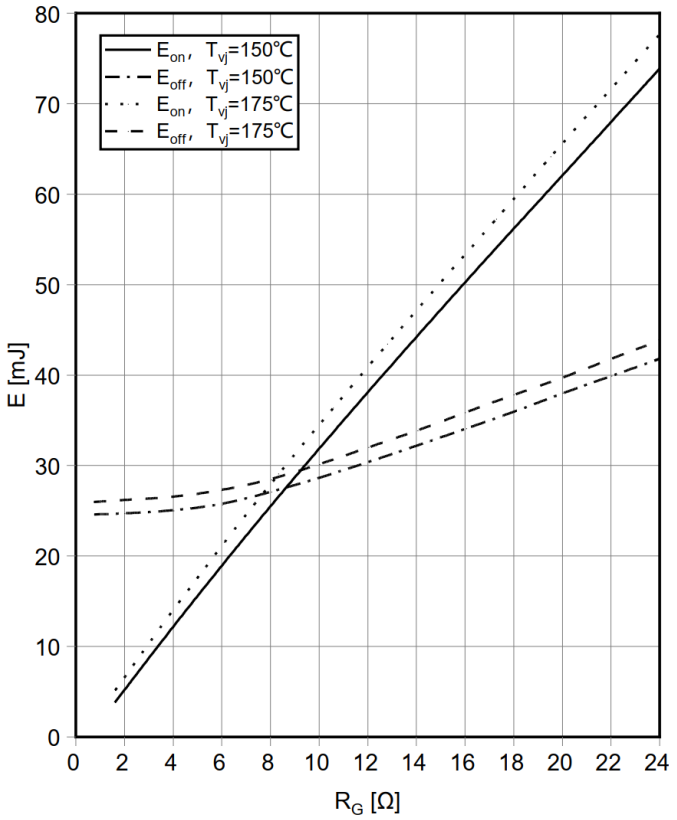


Switching losses IGBT, Inverter(typical)
$E_{on}=f(I_C)$, $E_{off}=f(I_C)$, V_{GE}=-8/+15V, $R_{Gon}=R_{Goff}$=5Ω, V_{CE}=400V



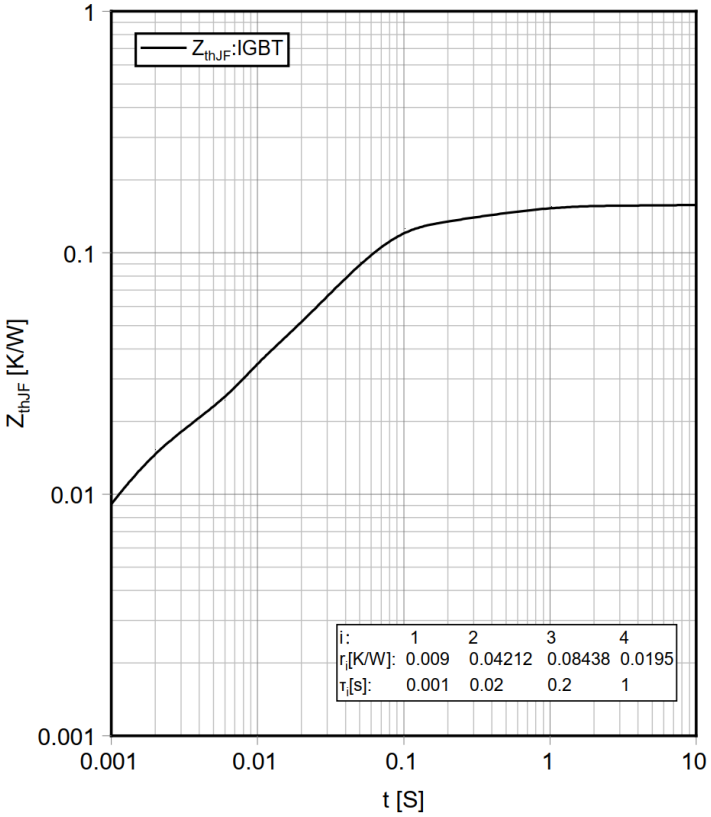
Switching losses IGBT, Inverter(typical)

$E_{on}=f(R_G)$, $E_{off}=f(R_G)$, V_{GE}=-8/+15V, I_C=350A, V_{CE}=400V



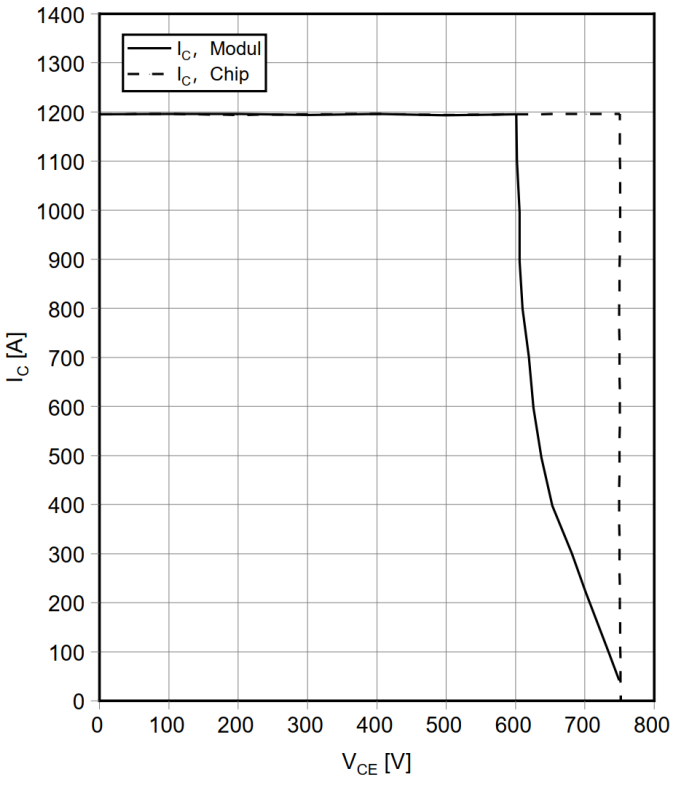
Transient thermal impedance IGBT, Inverter

$Z_{thJF}=f(t)$



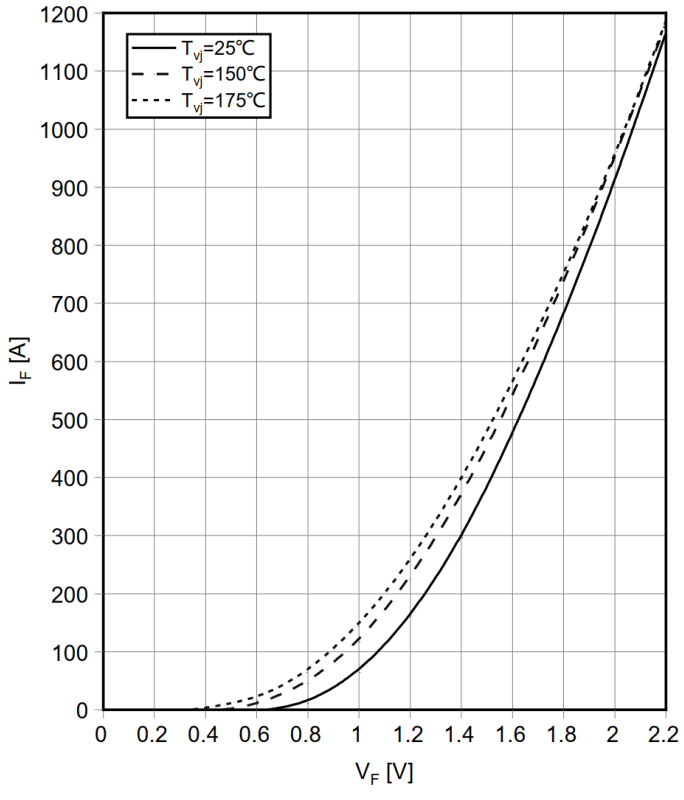
Reverse bias safe operating area IGBT, Inverter(RBSOA)

$I_C=f(V_{CE})$, V_{GE}=-8V/+15V, R_{Goff}=5Ω, T_{vj}=175℃



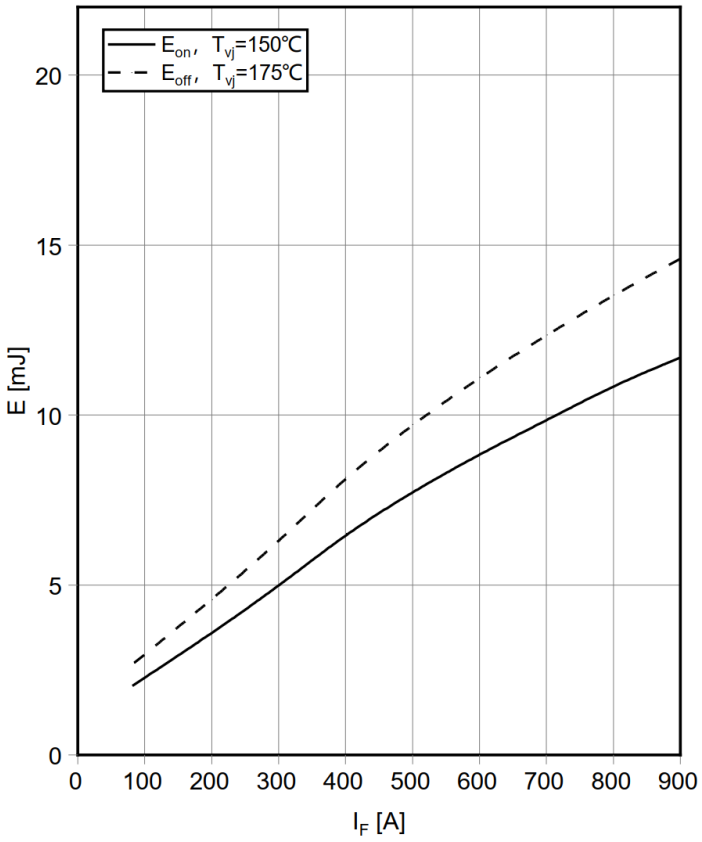
Forward characteristic of Diode, Inverter(typical)

$I_F=f(V_F)$



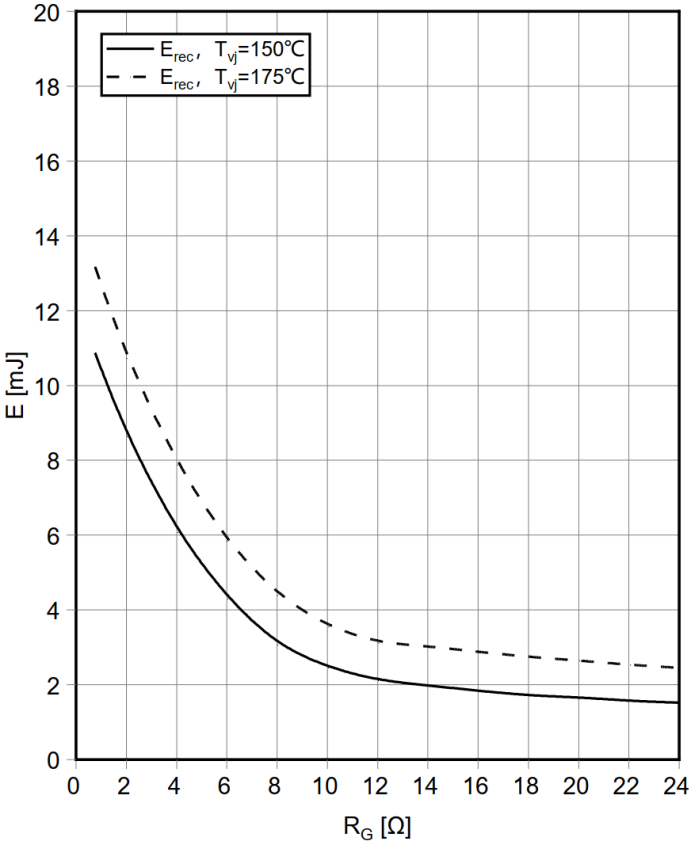
Switching losses Diode, Inverter(typical)

$E_{rec}=f(I_F)$, $R_{Gon}=5\Omega$, $V_{CE}=400V$



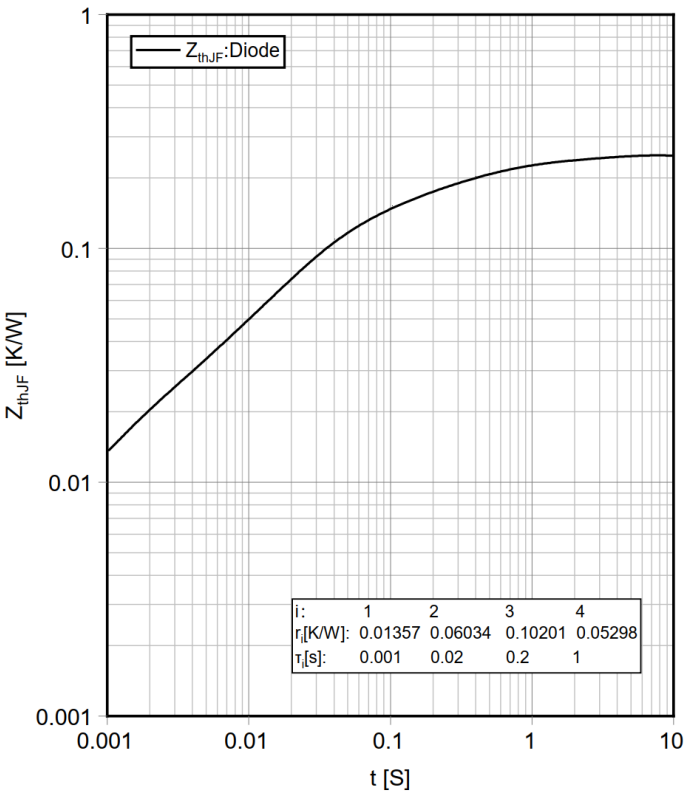
Switching losses Diode, Inverter(typical)

$E_{rec}=f(I_F)$, $I_F=350A$, $V_{CE}=400V$



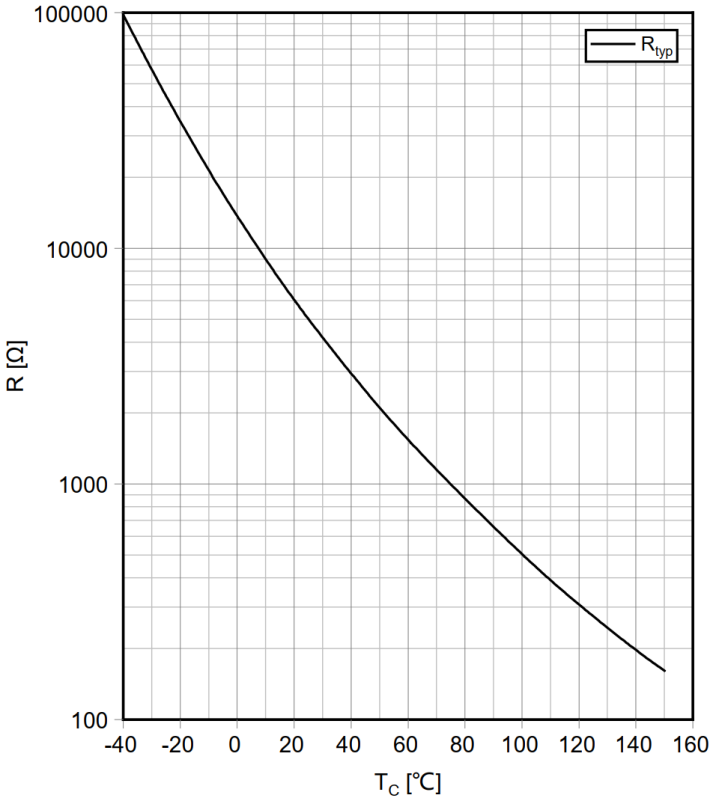
Transient thermal impedance Diode,Inverter

$Z_{thJF}=f(t)$

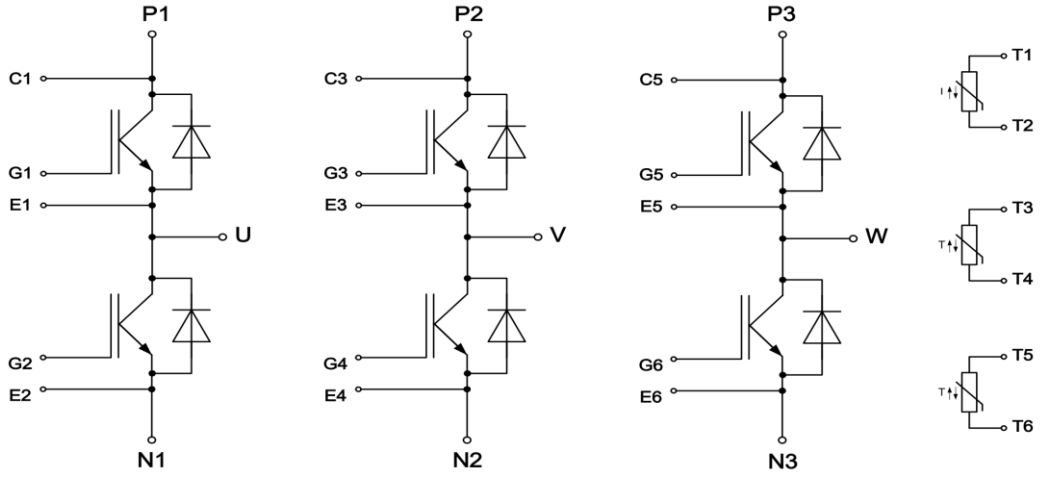


NTC-Thermistor-temperature characteristic(typical)

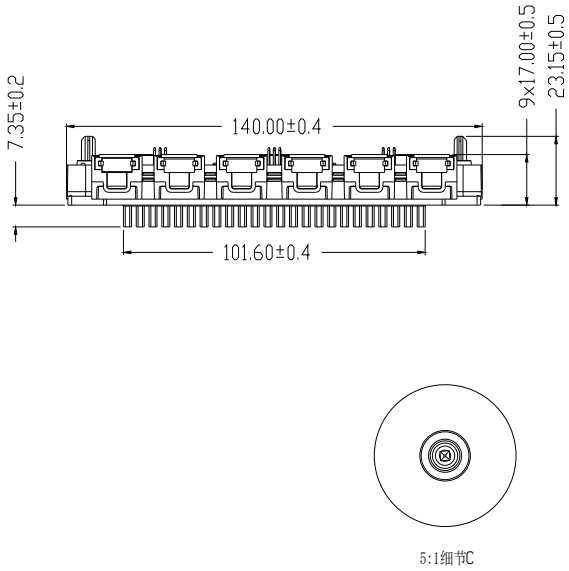
R=f(T)

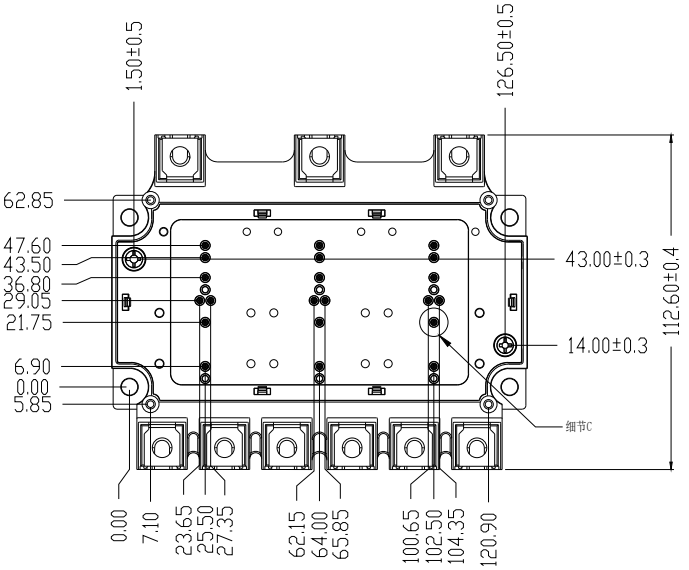


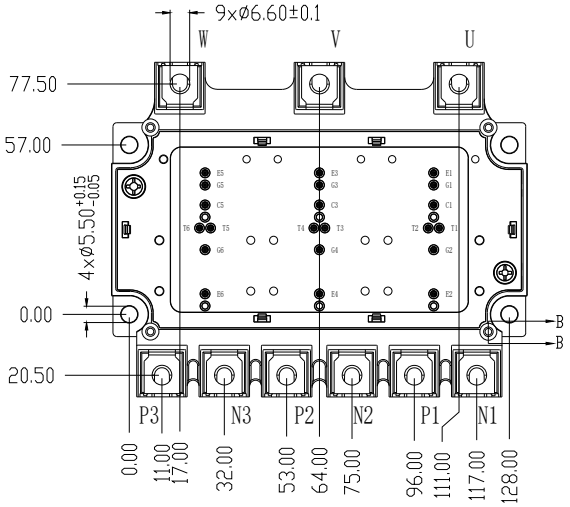
CIRCUIT DIAGRAM

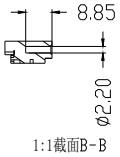


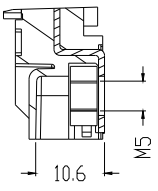
PACKAGE OUTLINES

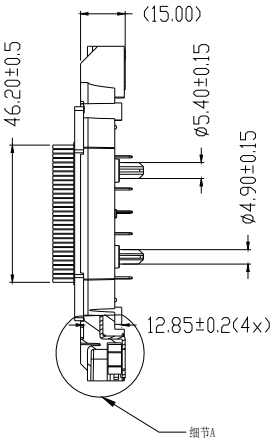












NOTICE

Cloudchild reserve the right to make modifications, enhancements, improvements, crrections or other changes without further notice to any product herein. Cloudchild does not assume any liability arising out of the application or use of any product described herein.

ChongQing Cloudchild Technology Co., Ltd. (short for Cloudchild) exerts the greatest possible effort to ensure high quality and reliability. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing Cloudchild products, to comply with the standards of safety in making a safe design for the entire system, including redundancy, fire-prevention measures, and malfunction prevention, to prevent any accidents, fires, or community damage that may ensue. In developing your designs, please ensure that Cloudchild products are used within specified operating ranges as set forth in the most recent Cloudchild products specifications.

Date of change	Rev #	revise content
2023/04/21	A/0	/