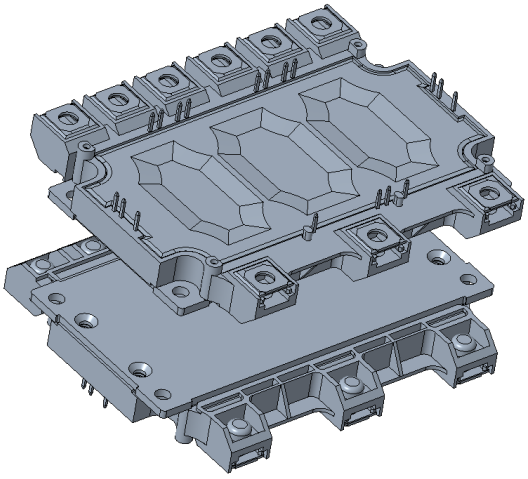
CHONGQING CLOUDCHILD TECHNOLOGY CO.,LTD

HP1-DC6 Trench-FS IGBT MODULE

CCGN450T75SD HP1DC6 Trench-FS IGBT module

V_{CES}	V_{CESat}		I_C / I_{CRM}
750V	T_{vj}=25℃@250A	1.28V	450A/900A
	T_{vj}=175℃@250A	1.32V	



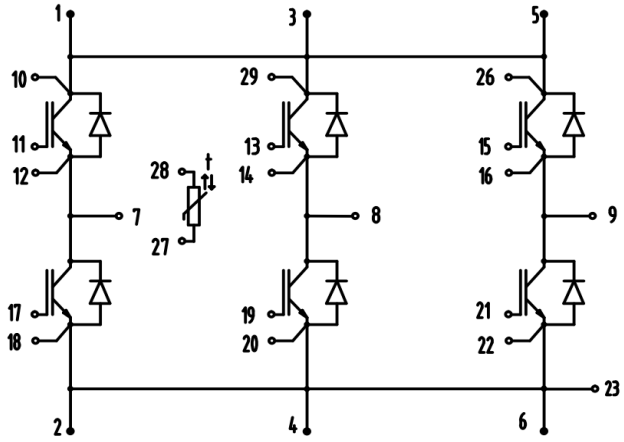
DESCRIPTION

CCGN450T75SD 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
- Al_2O_3 Substrate with Low Thermal Resistance
- High mechanical robustness
- Integrated NTC temperature sensor
- Copper Base Plate
- 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 420V

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}		450	A
Continuous DC collector current	$I_{C\ nom}$	T_C=80℃, $T_{vj\ max}$=175℃	250[1)]	A
Repetitive peak collector current	I_{CRM}	t_p=1ms, T_{vj}=25℃	900	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℃	2100	A
Total power dissipation	Ptot	T_C=25℃, $T_{vj\ max}$=175℃	1200[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=250A, V_{GE}=15V, T_{vj}=25℃			1.28	1.48	V
		I_C=250A, V_{GE}=15V, T_{vj}=150℃			1.30	1.54	V
		I_C=250A, V_{GE}=15V, T_{vj}=175℃			1.32	1.7	V
Gate-emitter thresholdvoltage	V_{GEth}	V_{CE}=V_{GE}, I_C=6.4mA	T_{vj}=25℃	5.5	6.2	7.0	V
			T_{vj}=175℃		3.8		
Gate charge	Q_G	V_{GE}=-8V...+15V， V_{CE}=400V			2.7		μC
Integrated gate resistor	R_G	T_{vj}=25℃			1.4		Ω
Input capacitance	C_{ies}	T_{vj}=25℃,f=1MHz,V_{GE}=0V,V_{CE}=25V			30		nF
Output capacitance	C_{oes}	T_{vj}=25℃,f=1MHz,V_{GE}=0V,V_{CE}=25V			0.66		nF
Reverse transfercapacitance	C_{res}	T_{vj}=25℃,f=1MHz,V_{GE}=0V,V_{CE}=25V			0.19		nF
Collector-emitter cut-offcurrent	I_{CES}	V_{CE}=750V, V_{GE}=0V	T_{vj}=25℃			0.64	mA
			T_{vj}=175℃		4		
Gate-emitter leakagecurrent	I_{GES}	V_{CE}=0V, V_{GE}=20V, T_{vj}=25℃				285	nA
Turn-on delay time,inductive load	$t_{d\ on}$	I_C=250A, V_{CE}=400V, V_{GE}=-8V/+15V, R_{Gon}=R_{Goff}=5.1Ω	T_{vj}=25℃		105		ns
			T_{vj}=150℃		120		ns
			T_{vj}=175℃		130		ns
Rise time, inductive load	t_r		T_{vj}=25℃		60		ns
			T_{vj}=150℃		75		ns
			T_{vj}=175℃		80		ns
Turn-off delay time,inductive load	$t_{d\ off}$		T_{vj}=25℃		320		ns
			T_{vj}=150℃		370		ns
			T_{vj}=175℃		385		ns
Fall time, inductive load	t_f		T_{vj}=25℃		55		ns
			T_{vj}=150℃		75		ns
			T_{vj}=175℃		85		ns
Turn-on energy loss perpulse	E_{on}	I_C=250A, V_{CE}=400V	T_{vj}=25℃		7.5		mJ
			T_{vj}=150℃		16.5		mJ

		V_{GE}=-8V/+15V,	T_{vj}=175℃		18		mJ
Turn-off energy loss perpulse	E_{off}	R_{Gon}=R_{Goff}=5.1Ω,L_s=28nH	T_{vj}=25℃		15		mJ
		di/dt=6000A/μs(T_{vj}25℃),	T_{vj}=150℃		24.5		mJ
		di/dt=3050A/μs(T_{vj}150℃), dv/dt=3700V/μs(T_{vj}25℃), dv/dt=3150V/μs(T_{vj}150℃)	T_{vj}=175℃		25.5		mJ
Thermal resistance, junction to case	R_{thJC}	Per IGBT				0.125	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}		450	A
Continuous forward current	I_F		250	A
Maximum repetitive forward current	I_{FRM}	t_p=1ms	900	A
I^2t-value	I^2t	V_R=0V, t_p=10ms, T_{vj}=150℃	9200	A^2s
		V_R=0V, t_p=10ms, T_{vj}=175℃	8800	

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=250A, V_{GE}=0V	T_{vj}=25℃		1.45	1.6	V
			T_{vj}=150℃		1.35		V
			T_{vj}=175℃		1.3		V
Peak reverse recovery current	I_{RM}	I_F=250A, V_R=400V, V_{GE}=-8V, di_F/dt=2400A/μs(T_{vj}150℃)	T_{vj}=25℃		90		A
			T_{vj}=150℃		110		A
			T_{vj}=175℃		120		A
Recovered charge	Q_r		T_{vj}=25℃		7.0		μC
			T_{vj}=150℃		12.0		μC
			T_{vj}=175℃		13.5		μC
Reverse recovery energy	E_{rec}		T_{vj}=25℃		1.3		mJ
			T_{vj}=150℃		1.95		mJ
			T_{vj}=175℃		2.55		mJ
Thermal resistance, junction to case	R_{thJC}	Per diode				0.21	K/W

NTC-THERMISTOR

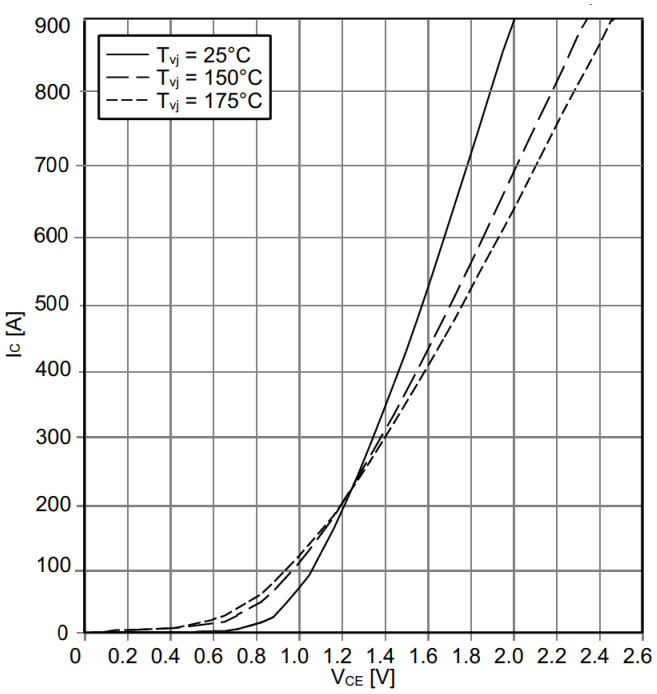
Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_C=25℃		5.0		KΩ
Deviation of R100	△R/R	T_C=100℃, R_{100}=493Ω	-3		3	%
Power dissipation	P_{25}	T_C=25℃			60	mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K
B-value	$B_{25/80}$	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$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

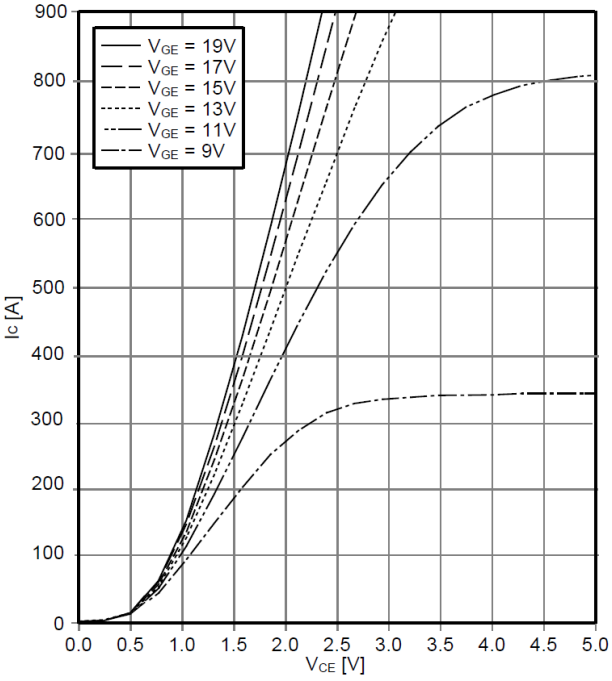
Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Maximum junction temperature	$T_{vj\,max}$				175	℃
Temperature under switchingconditions	$T_{vj\,op}$		-40		175	℃
Storage temperature	T_{stg}		-40		150	℃
Stray inductance module	L_{sCE}			32		nH
Module lead resistance, terminals-chip	$R_{CC'+EE}$	T_{vj}=25℃, per switch		1.1		mΩ
Isolation test voltage	V_{isol}	RMS, f=50Hz, t=1min		2.5		kV
Creepage distance	ds	Terminal to heatsink		12		mm
		Terminal to terminal		6.1		mm
Clearance distance in air	da	Terminal to heatsink		12		mm
		Terminal to terminal		6.1		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			140x112.6x28		mm
Weight	G			510		g

CHARACTERISTICS DIAGRAMS

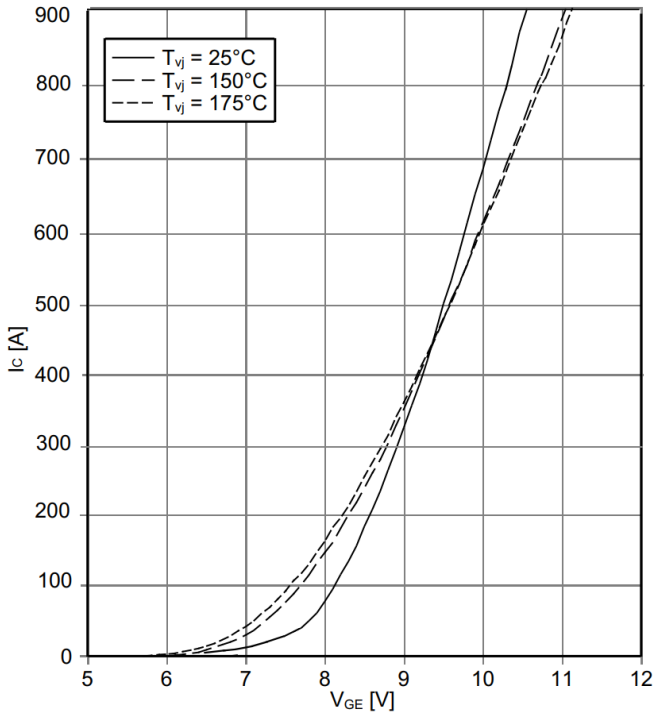
Output characteristic IGBT, Inverter(typical)
$I_C=f(V_{CE})$, $V_{GE}=15V$



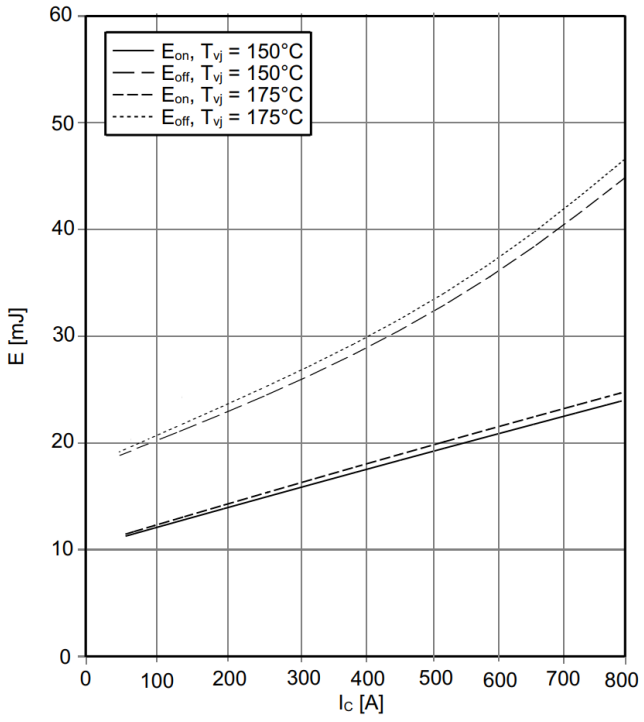
Output characteristic IGBT, Inverter(typical)
$I_C=f(V_{CE})$, $T_{vj}=150℃$



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

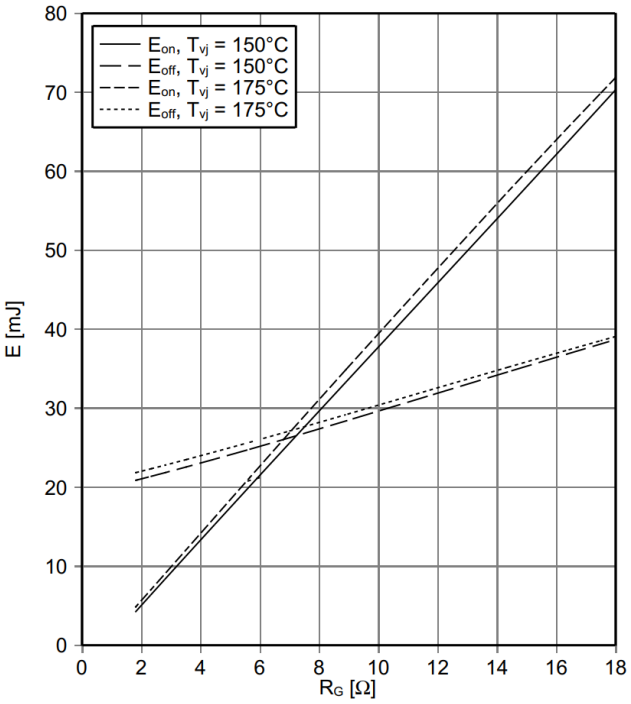


Switching losses IGBT, Inverter(typical)
$E_{on}=f(I_C)$, $E_{off}=f(I_C)$, $V_{GE}=-8V/+15V$, $R_{Gon}=R_{Goff}=5.1\Omega$, $V_{CE}=400V$



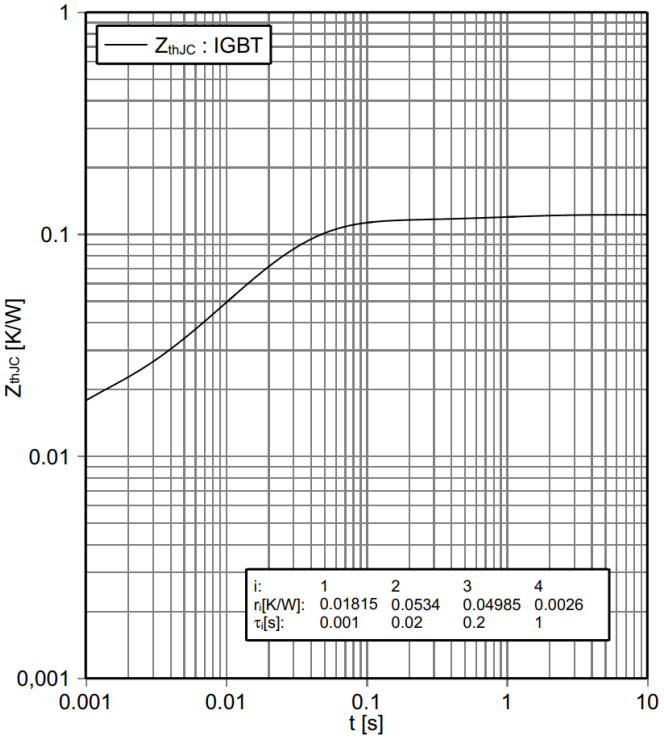
Switching losses IGBT, Inverter(typical)

$E_{on}=f(R_G)$, $E_{off}=f(R_G)$, V_{GE}=-8V/+15V, I_C=250A, V_{CE}=400V



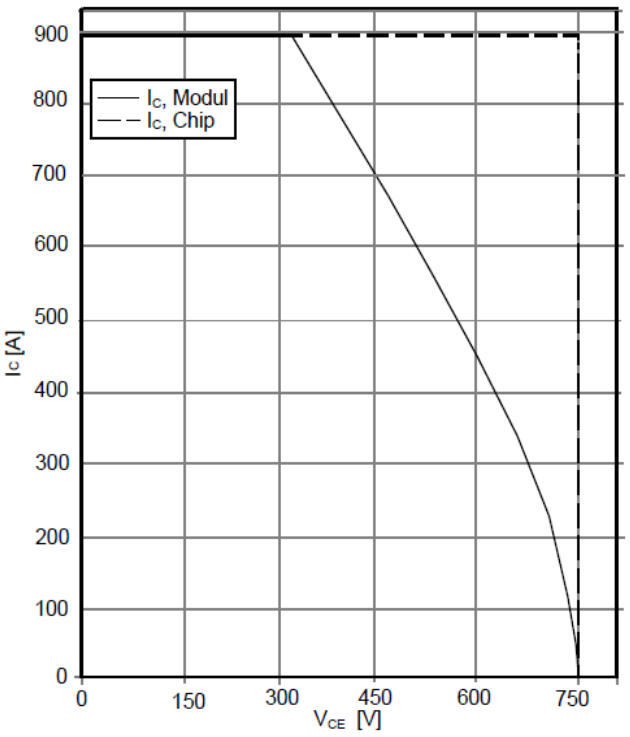
Transient thermal impedance IGBT, Inverter

$Z_{thJC}=f(t)$



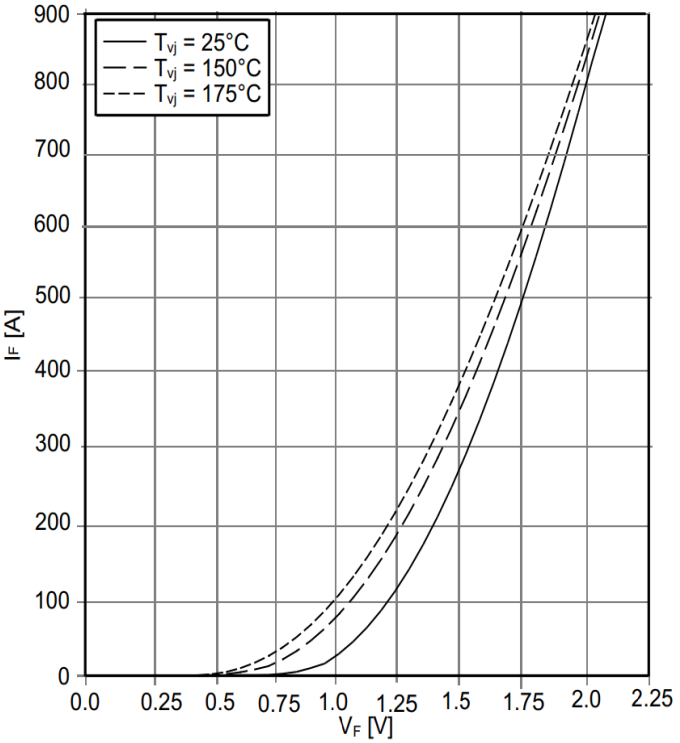
Reverse bias safe operating area IGBT, Inverter(RBSOA)

$I_C=f(V_{CE})$, V_{GE}=-8V/+15V, R_{Goff}=5.1Ω, T_{vj}=175℃



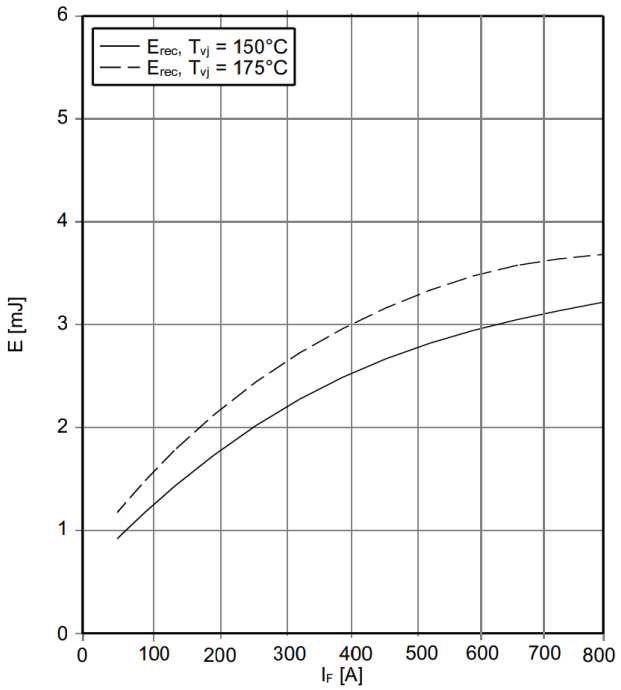
Forward characteristic of Diode, Inverter(typical)

$I_F=f(V_F)$



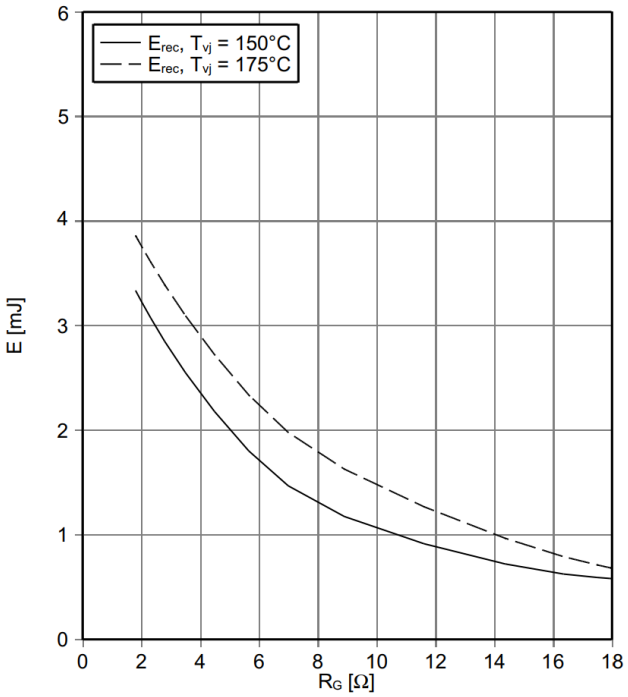
Switching losses Diode, Inverter(typical)

$E_{rec}=f(I_F)$, $R_{Gon}=5.1\Omega$, $V_{CE}=400V$



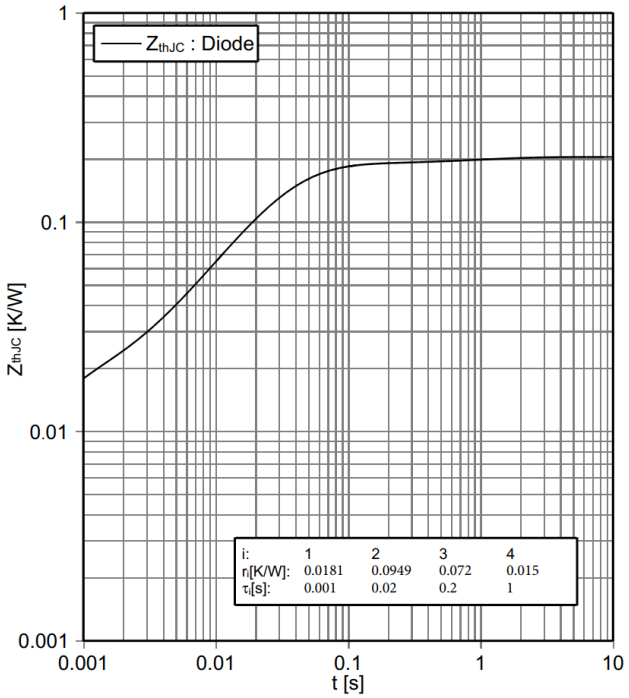
Switching losses Diode, Inverter(typical)

$E_{rec}=f(R_G)$, $I_F=250A$, $V_{CE}=400V$



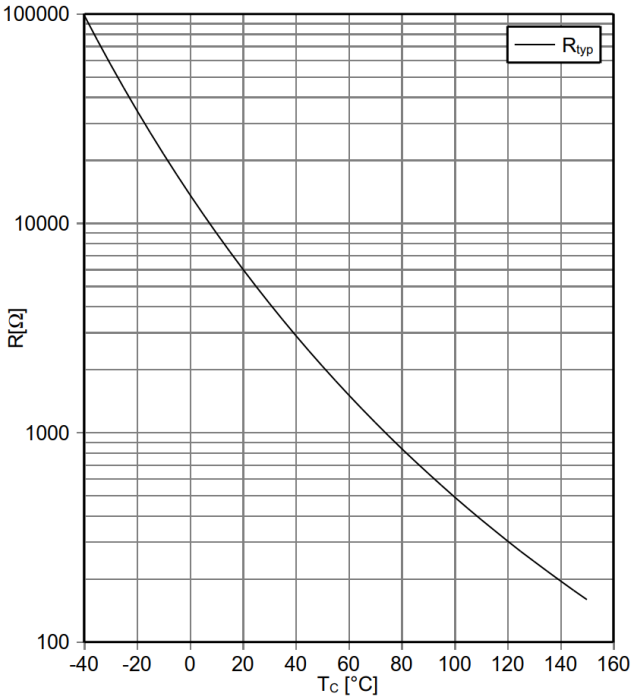
Transient thermal impedance Diode,Inverter

$Z_{thJC}=f(t)$

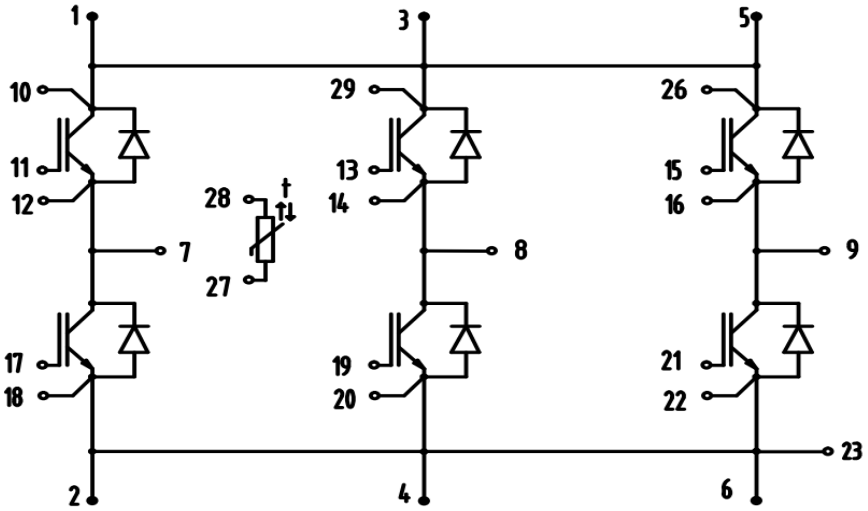


NTC Thermistor temperature characteristic(typical)

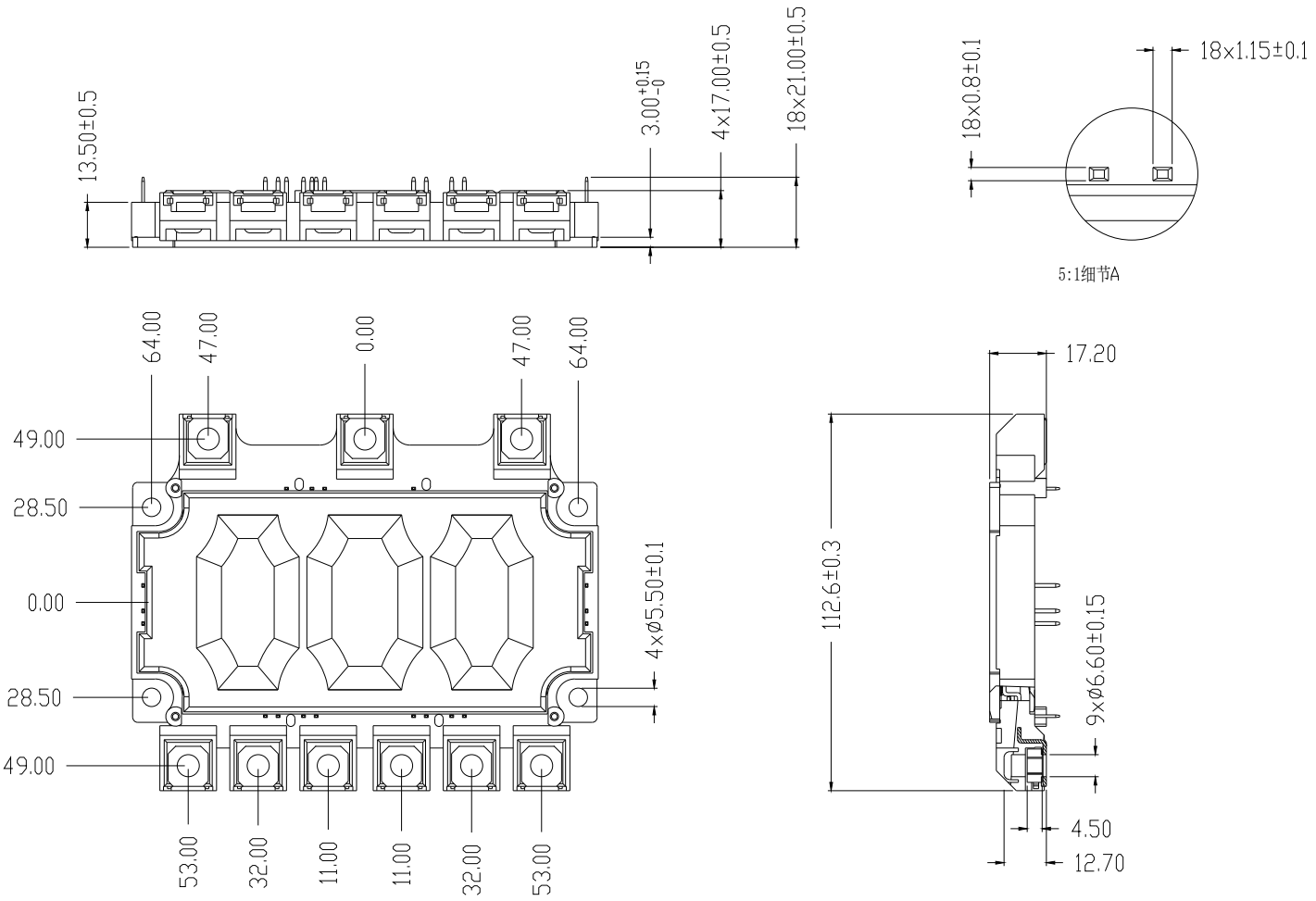
R=f(T)

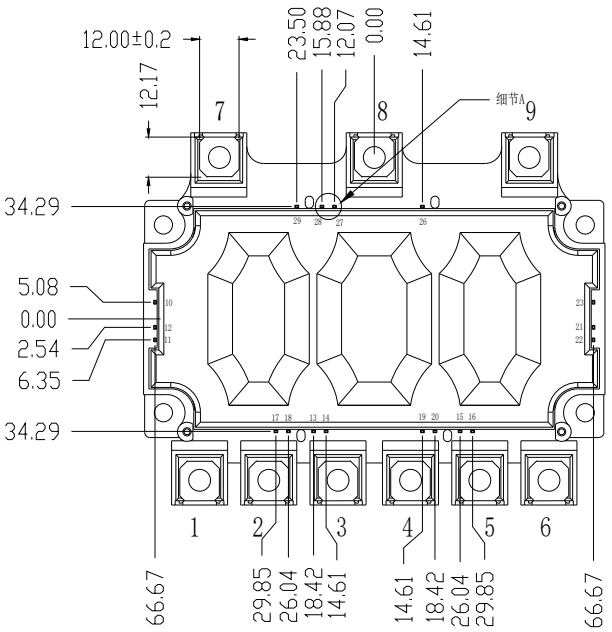


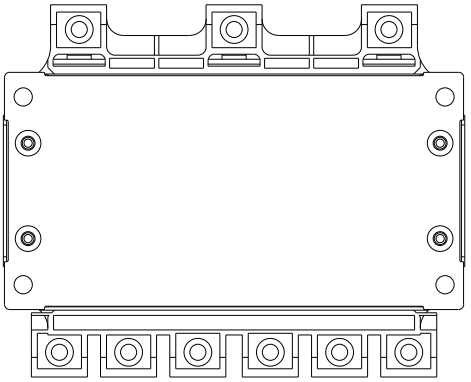
CIRCUIT DIAGRAM

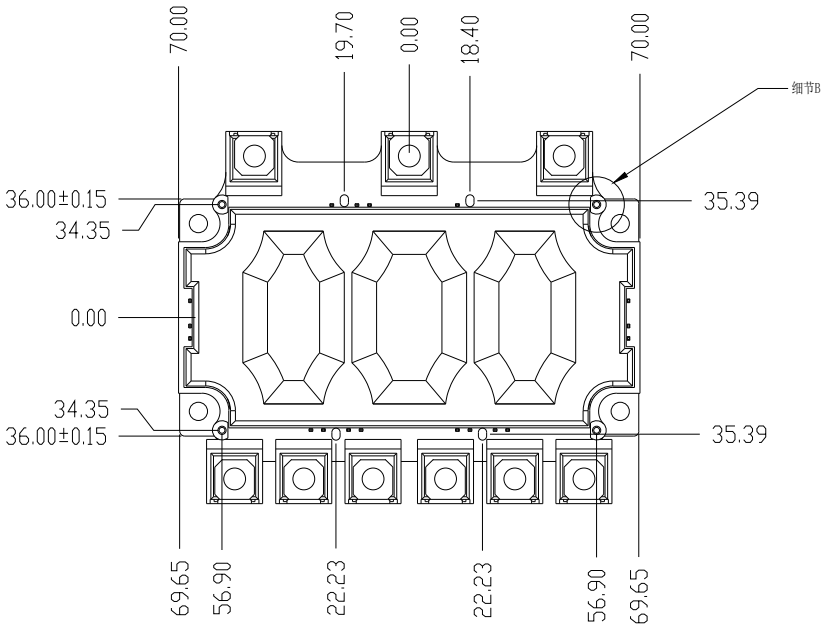


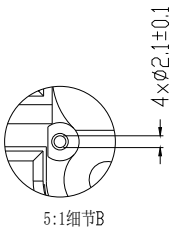
PACKAGE OUTLINES











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