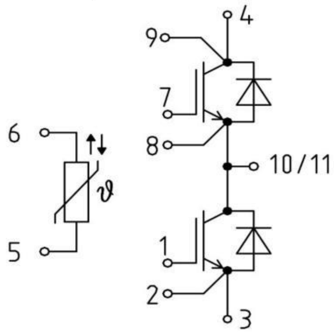
EconoDUAL3 Trench-Field Stop IGBT Module

DESCRIPTION

HGF200MJ120XXX designed for a 150° C junction operation temperature, the module accommodates a Half bridge configuration of Trench-Field Stop IGBT and matching emitter controlled diodes and NTC.

V_{CES}	V_{CEsat}		I_{CN}/I_{CRM}
1200V	T_{vj}=25°C@200A	1.85V	200A/400A
	T_{vj}=150°C@200A	2.2V	



FEATURES

- Increased Blocking Voltage Capability To 1200V,Tvjop = 150° C
- High Short Circuit Capability, Self Limiting Short Circuit Current
- High Surge Current Capability and Density
- High Power Density,Increased Dc Ink Voltage
- Integrated NTC temperature sensor
- Standard Housing

APPLICATIONS

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

CHARACTERISTICS VALUES

MAXIMUM RATED VALUES(IGBT)

Parameter	Symbol	Conditions	Values	Units
Collector-emitter voltage	V_{CES}	T_{vj}=25°C, V_{GE}=0V	1200	V
Continuous collector current	I_{CN}	T_C= 100° C, $T_{vj\ max}$= 175°C	200	A
Repetitive peak collector current	I_{CRM}	t_P= 1ms, T_{vj}=25°C	400	A
Gate-emitter peak voltage	V_{GES}	T_{vj}=25°C	±30	V
SC data	I_{SC}	V_{GE}≤15V, V_{CC}=800V V_{CEmax}=V_{CES}-L_{Sce}*di/dt, t_P≤10μs, T_{vj}= 150°C	800	A
Total power dissipation	P_{tot}	T_C=25°C, $T_{vj\ max}$= 175°C	955[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_{CEsat}	I_C=200A, V_{GE}= 15V	T_{vj}=25°C		1.85	2.1	V
			T_{vj}= 125°C		2.1		V
			T_{vj}= 150°C		2.2		V
			T_{vj}=25°C	5	6	6.5	V

Gate-emitter threshold voltage	V_{GEth}	I_C=6.4mA, V_{CE}=V_{GE}	T_{vj}= 150°C		4.6		V
Gate charge	Q_G	V_{GE}=-8V/+15V			2.3		μC
Integrated gate resistor	R_G	T_{vj}=25°C			5		Ω
Input capacitance	C_{ies}	T_{vj}=25°C f= 1MHz, V_{CE}=25V, V_{GE}=0V			23.8		nF
Output capacitance	C_{oes}	T_{vj}=25°C f= 1MHz, V_{CE}=25V, V_{GE}=0V			1.1		nF
Reverse transfer capacitance	C_{res}	T_{vj}=25°C, f= 1MHz, V_{GE}=0V, V_{CE}=25V			0.22		nF
Collector-emitter cut-off current	I_{CES}	V_{CE}= 1200V, V_{GE}=0V	T_{vj}=25°C			1	mA
			T_{vj}= 150°C			4	mA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V, T_{vj}=25°C				400	nA
Turn-on delay time	$t_{d\ on}$	I_C=200A, V_{CE}=600V, V_{GE}=-8V/+15V, R_{Gon}=0.22Ω, R_{Goff}=6. 1Ω, Inductive Load	T_{vj}=25°C		0.26		μs
			T_{vj}= 125°C		0.27		μs
			T_{vj}= 150°C		0.27		μs
Rise time	t_r		T_{vj}=25°C		0.04		μs
			T_{vj}= 125°C		0.05		μs
			T_{vj}= 150°C		0.06		μs
Turn-off delay time	$t_{d\ off}$		T_{vj}=25°C		0.95		μs
			T_{vj}= 125°C		1.08		μs
			T_{vj}= 150°C		1.12		μs
Fall time	t_f		T_{vj}=25°C		0.06		μs
			T_{vj}= 125°C		0.18		μs
			T_{vj}= 150°C		0.22		μs
Turn-on energy loss per pulse	E_{on}	I_C=200A, V_{CE}=600V, V_{GE}=-8V/+15V, R_{Gon}=0.22Ω, R_{Goff}=6.1Ω, L_s=35nH, di/dt=3600A/μs (T_{vj}= 150°C), du/dt=4700V/μs (T_{vj}=150°C)	T_{vj}=25°C		11.7		mJ
			T_{vj}= 125°C		16.9		mJ
			T_{vj}= 150°C		18.6		mJ
Turn-off energy loss per pulse	E_{off}		T_{vj}=25°C		24.8		mJ
			T_{vj}= 125°C		27.8		mJ
			T_{vj}= 150°C		29.2		mJ
Thermal resistance, junction to case	R_{thJC}	per IGBT				0.157	K/W

MAXIMUM RATED VALUES(FRD)

Parameter	Symbol	Conditions		Values	Units
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25°C		1200	V
Continuous forward current	I_{FN}	T_C= 100°C, $T_{vj\ max}$= 175°C		200	A
Maximum repetitive forward current	I_{FRM}	t_P= 1ms		400	A
I^2t-value	I^2t	V_R=0V, t_P= 10ms	T_{vj}= 125°C	9000	A^2s
			T_{vj}= 150°C	7200	

CHARACTERISTICS VALUES(FRD)

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=200A, V_{GE}=0V	T_{vj}=25°C		1.8		V
			T_{vj}= 125°C		1.87		V
			T_{vj}= 150°C		1.9		V
Peak reverse recovery current	I_{RM}	I_F=200A, V_R=600V, V_{GE}=-8V, di_F/dt=3600A/μs (T_{vj}= 150°C)	T_{vj}=25°C		172		A
			T_{vj}= 125°C		183		A
			T_{vj}= 150°C		200		A
Recovered charge	Q_r		T_{vj}=25°C		11.3		μC
			T_{vj}= 125°C		21.1		μC
			T_{vj}= 150°C		28.3		μC
Reverse recovery energy	E_{rec}		T_{vj}=25°C		5		mJ
			T_{vj}= 125°C		8.5		mJ
			T_{vj}= 150°C		11.6		mJ
Thermal resistance, junction to case	R_{thJC}	per FRD				0.22	K/W

NTC-THERMISTOR

Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_C=25°C		5.0		kΩ
Deviation of R100	△R/R	T_C= 100°C, R_{100}=493Ω	-3		3	%
Power dissipation	P_{25}	T_C=25°C			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)

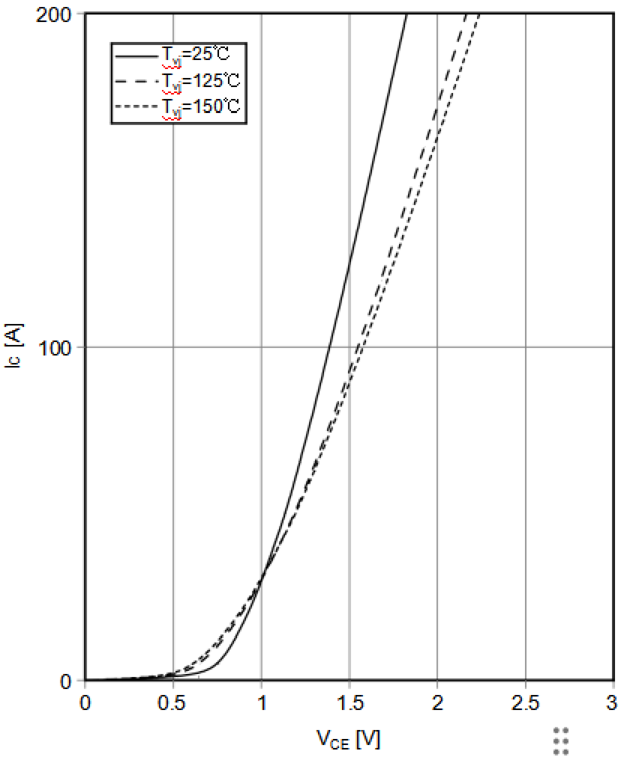
Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Maximum junction temperature	$T_{vj\ max}$	-			175	°C
Temperature under switching conditions	$T_{vj\ op}$	-	-40		150	°C
Storage temperature	T_{stg}	-	-40		125	°C
Stray inductance module	L_{sCE}	-		21		nH
Module lead resistance, terminals-chip	$R_{CC'+EE'}$	Tvj=25°C, per switch		1.2		mΩ
Isolation test voltage	V_{ISOL}	RMS, f=50Hz, t= 1min		2.5		kV
Creepage distance	ds	Terminal to heatsink		14.5		mm
		Terminal to terminal		13		mm

Clearance distance	da	Terminal to heatsink		12.5		mm
		Terminal to terminal		10		mm
Comperative tracking index	CTI	-		>200		-
Mounting torque for module mounting	M1	Screw M5	3	-	6	N·m
Terminal connection torque	M2	Screw M6	3	-	6	N·m
Internal isolation	-	Basic insulation (class1, IEC 61140)		Al_2O_3		-
Material of module baseplate	-	-		Cu+Ni		-
Dimensions	LxWxH	-		152.1x62x20.8		mm
Weight	G	-		338		g

CHARACTERISTICS DIAGRAMS

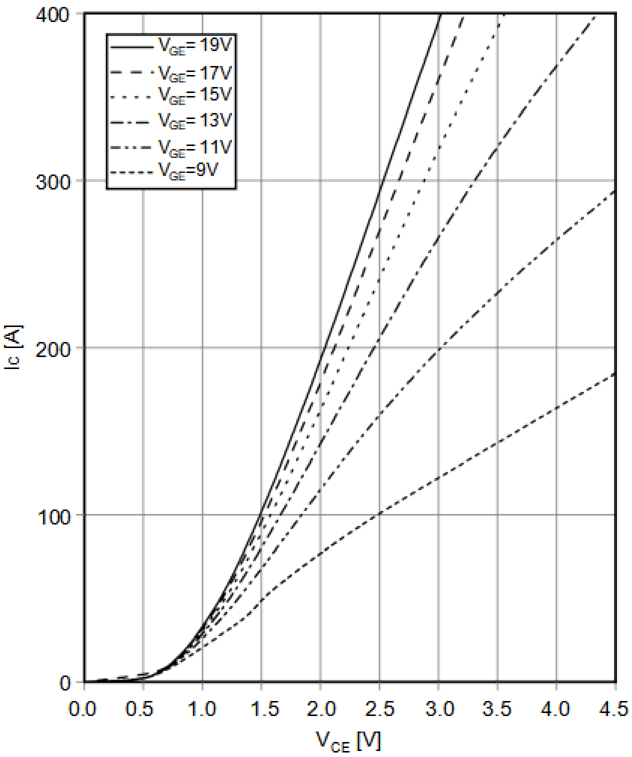
Output characteristic IGBT, Inverter(typical)

$I_C=f(V_{CE})$, V_{GE}= 15V



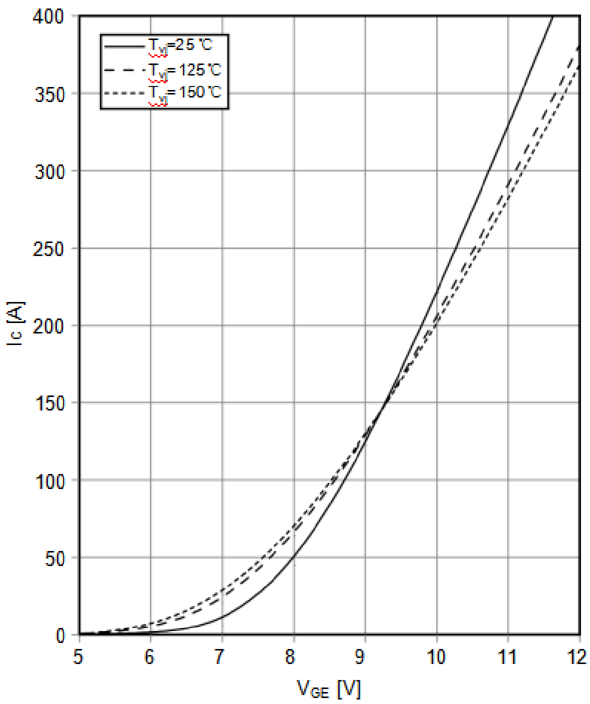
Output characteristic IGBT, Inverter(typical)

$I_C=f(V_{CE})$, T_{vj}= 150°C



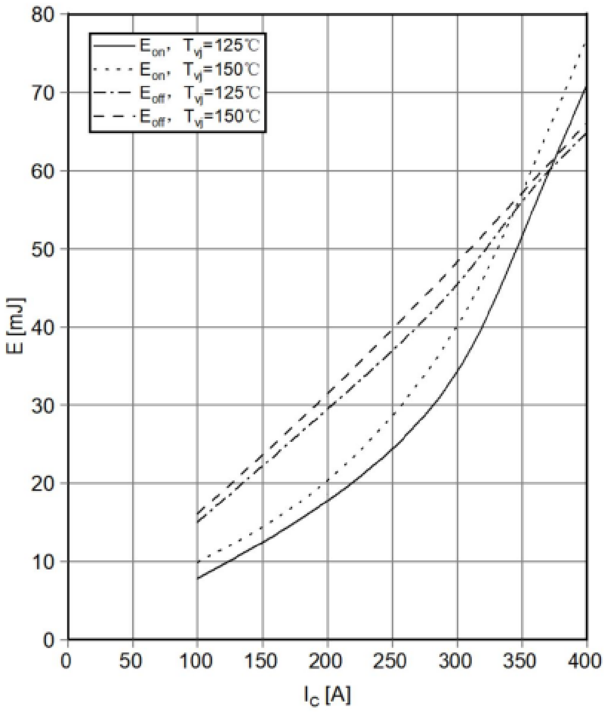
Transfer characteristic IGBT, Inverter(typical)

I_C=f(V_{GE}), V_{CE}=20V



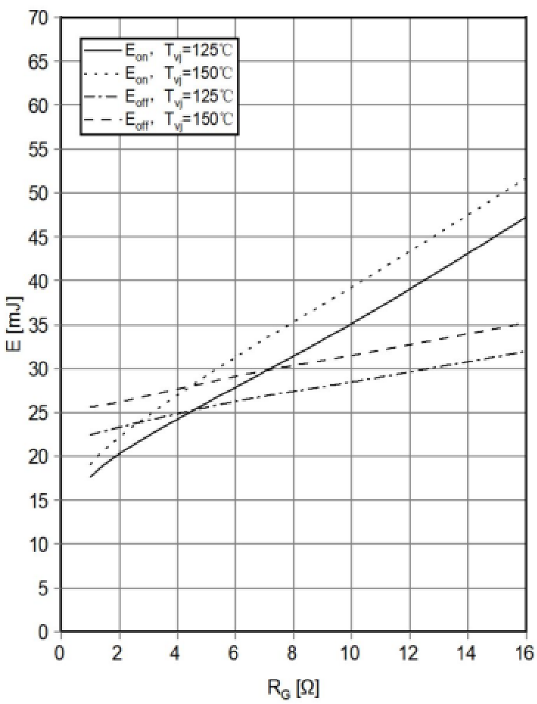
Switching losses IGBT, Inverter(typical)

E_{on}=f(I_C), E_{off}=f(I_C), V_{GE}=-8V/+15V, R_{Gon}=0.22Ω, R_{Goff}=6.1Ω, V_{CE}=600V



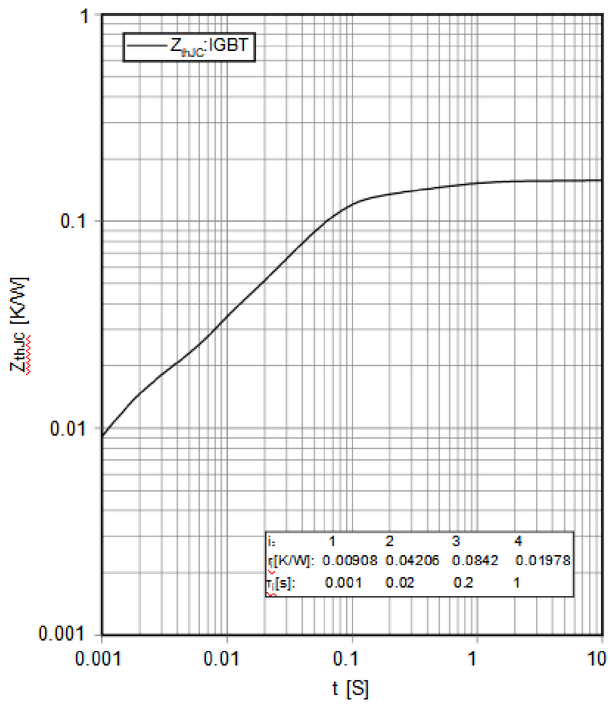
Switching losses IGBT, Inverter(typical)

E_{on}=f(R_G), E_{off}=f(R_G), V_{GE}=-8/+15V, I_C=200A, V_{CE}=600V



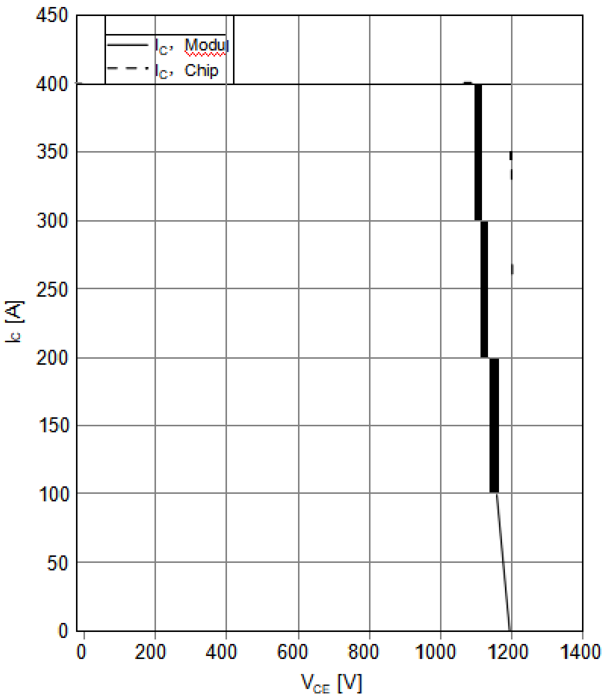
Transient thermal impedance IGBT, Inverter

Z_{thJC}=f(t)



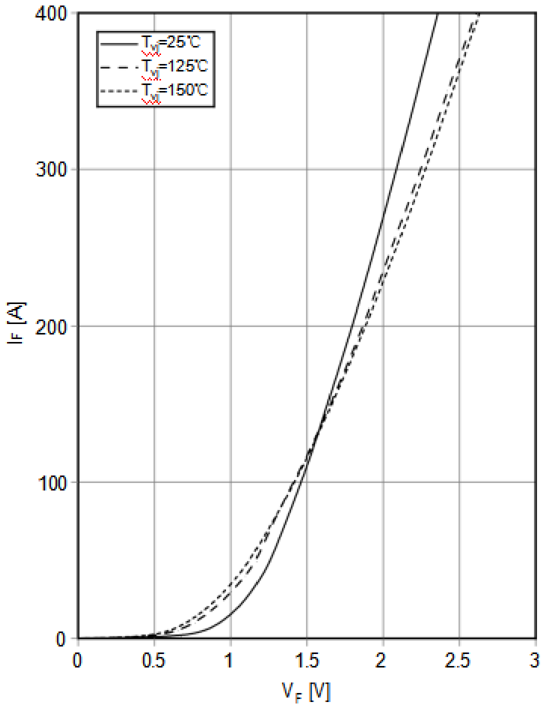
Everse bias safe operating area IGBT, Inverter(RBSOA)

$I_C=f(V_{CE})$, $V_{GE}=15V$, $R_{Goff}=0.22\Omega$, $T_{vj}=150°C$



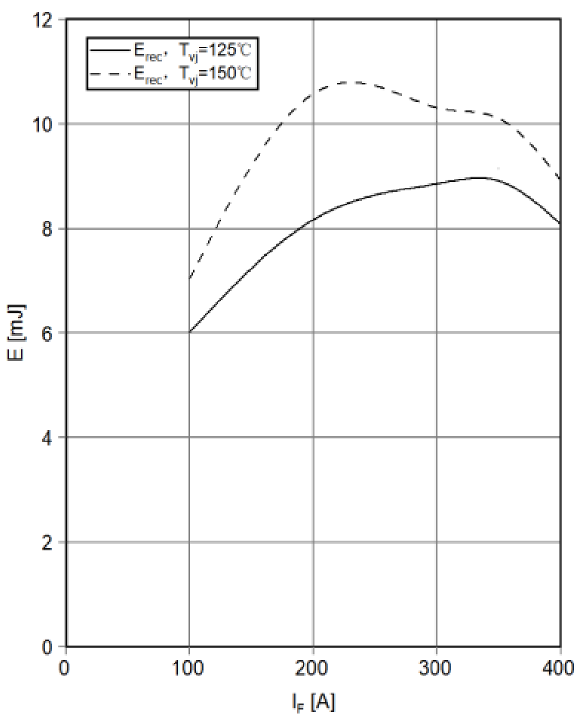
Forward characteristic of FRD, Inverter(typical)

$I_F=f(V_F)$



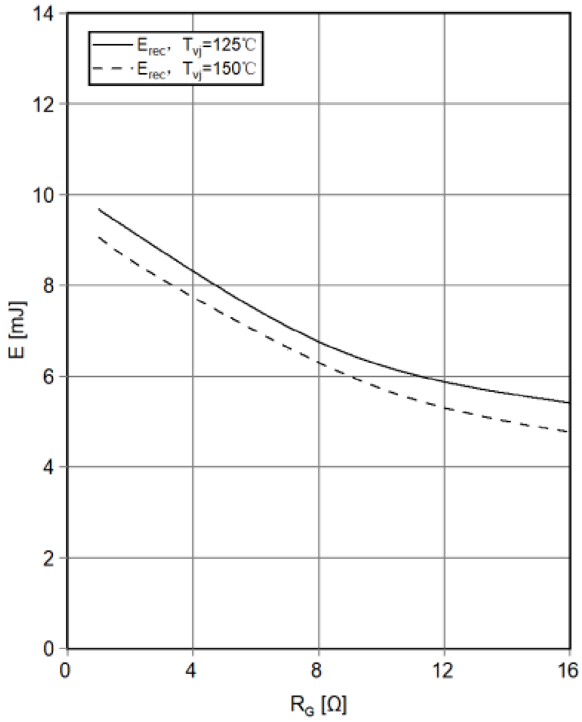
Switching losses FRD, Inverter(typical)

$E_{rec}=f(I_F)$, $R_{Gon}=0.22\Omega$, $V_{CE}=600V$



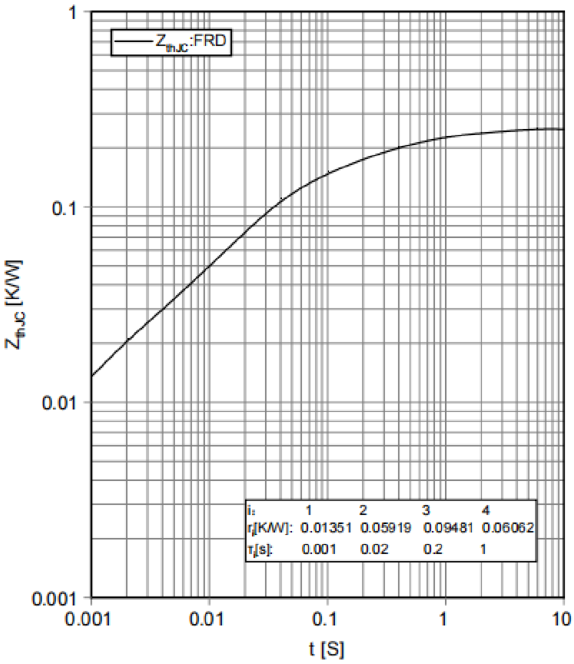
Switching losses FRD, Inverter(typical)

$E_{rec}=f(R_G)$, $I_F=200A$, $V_{CE}=600V$



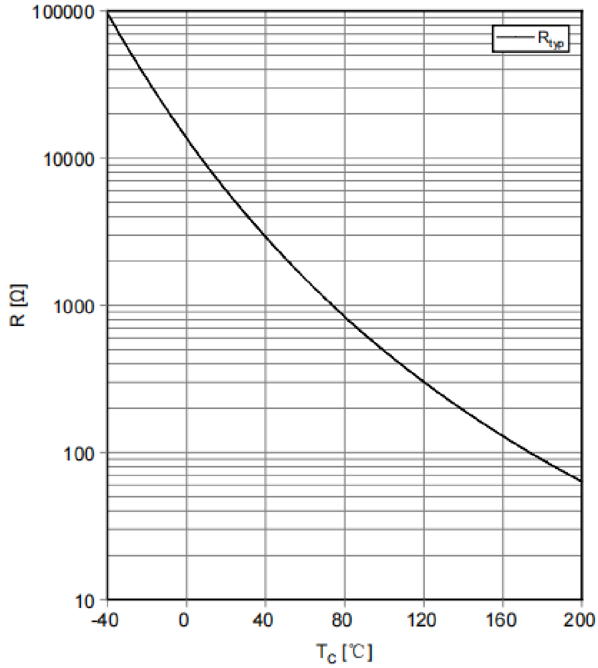
Transient thermal impedance FRD, Inverter

$Z_{thJC}=f(t)$

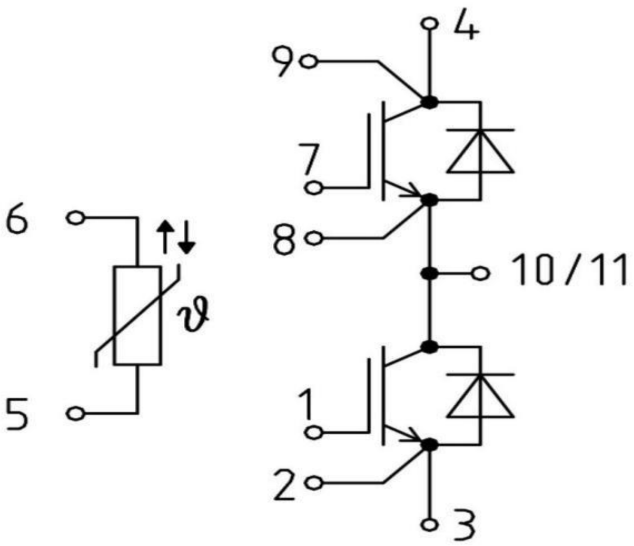


NTC-Thermistor-temperature characteristic(typical)

R=f(T)



CIRCUIT DIAGRAM



PACKAGE OUTLINES

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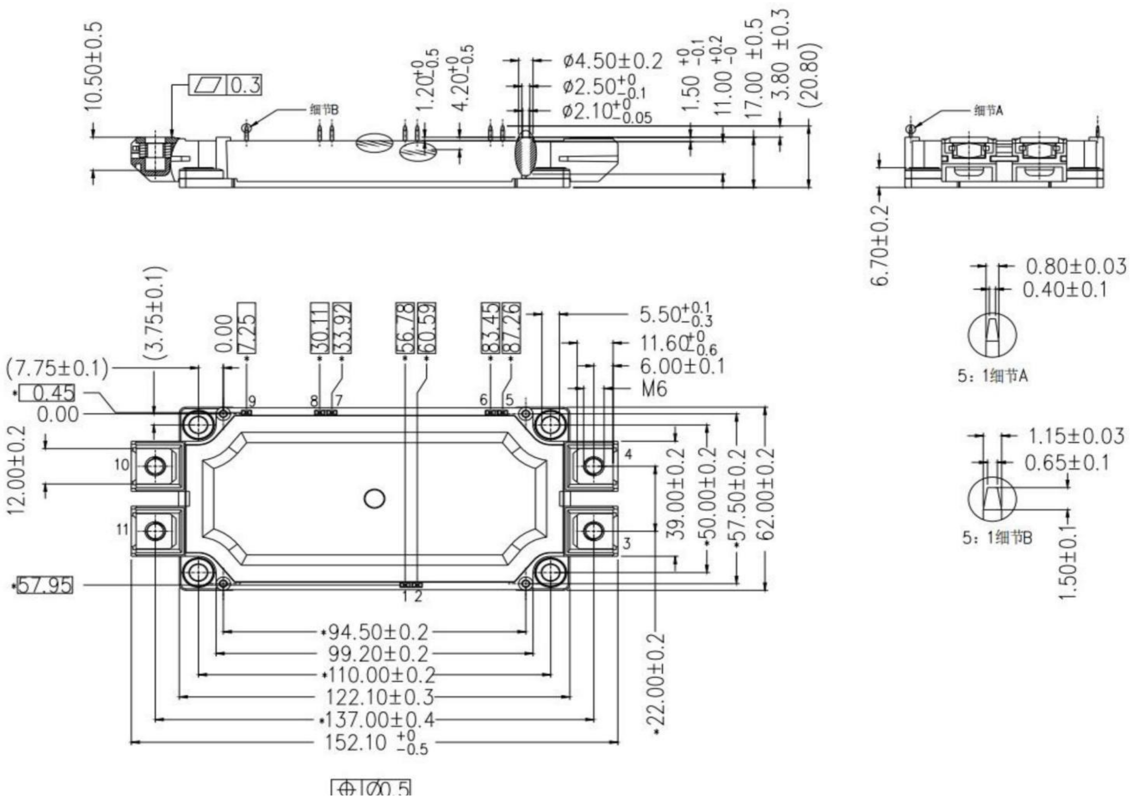

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Date of change	Rev #	revise content
2023/09/26	A/0	Initial releases
2024/05/06	A/1	Update test data