



ME4 Trench-Field Stop IGBT MODULE

CCGF200T120SD

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V _{CES}	V _{CEsat}		I _{CN} /I _{CRM}
	T _{vj} =25°C@200A	1.85V	
1200V	T _{vj} =150°C@200A	2.2V	200A/400A



DESCRIPTION

CCGF200T120SD 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.

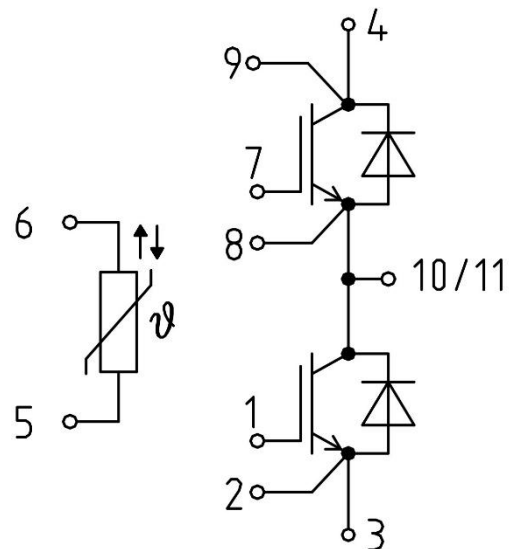
FEATURES

- Increased Blocking Voltage Capability To 1200V
- Increased Dc Ink Voltage
- High Short Circuit Capability, Self Limiting Short Circuit Current
- High Current Density
- Trench IGBT
- T_{vj op} = 150°C
- High Surge Current Capability
- High Power Density
- Integrated NTC temperature sensor
- Isolated Base Plate
- Copper Base Plate
- Standard Housing
- RoHS compliant
- AQG324 Qualified

APPLICATIONS

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

EQUIVALENT CIRCUIT



CHARACTERISTICS VALUES

MAXIMUM RATED VALUES(IGBT)

Parameter	Symbol	Conditions	Values	Units
Collector-emitter voltage	V_{CES}	$T_{vj}=25^{\circ}\text{C}$, $V_{GE}=0\text{V}$	1200	V
Continuous collector current	I_{CN}	$T_C=100^{\circ}\text{C}$, $T_{vj\text{max}}=175^{\circ}\text{C}$	200	A
Repetitive peak collector current	I_{CRM}	$t_p=1\text{ms}$, $T_{vj}=25^{\circ}\text{C}$	400	A
Gate-emitter peak voltage	V_{GES}	$T_{vj}=25^{\circ}\text{C}$	± 30	V
SC data	I_{SC}	$V_{GE}\leq 15\text{V}$, $V_{CC}=800\text{V}$ $V_{CE\text{max}}=V_{CES}-L_{Sce} \cdot di/dt$, $t_p\leq 10\mu\text{s}$, $T_{vj}=150^{\circ}\text{C}$	800	A
Total power dissipation	P_{tot}	$T_C=25^{\circ}\text{C}$, $T_{vj\text{max}}=150^{\circ}\text{C}$	796 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	$V_{CES\text{sat}}$	$I_C=200\text{A}$, $V_{GE}=15\text{V}$	$T_{vj}=25^{\circ}\text{C}$	1.85	2.1	V	
			$T_{vj}=125^{\circ}\text{C}$	2.1		V	
			$T_{vj}=150^{\circ}\text{C}$	2.2		V	
Gate-emitter threshold voltage	$V_{GE\text{th}}$	$I_C=6.4\text{mA}$, $V_{CE}=V_{GE}$	$T_{vj}=25^{\circ}\text{C}$	5	6	6.5	V
			$T_{vj}=150^{\circ}\text{C}$		4.6		V
Gate charge	Q_G	$V_{GE}=-8\text{V}/+15\text{V}$		2.3		μC	
Integrated gate resistor	R_G	$T_{vj}=25^{\circ}\text{C}$		4.8		Ω	
Input capacitance	C_{ies}	$T_{vj}=25^{\circ}\text{C}$ $f=1\text{MHz}$, $V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$		23.8		nF	
Output capacitance	C_{oes}	$T_{vj}=25^{\circ}\text{C}$ $f=1\text{MHz}$, $V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$		1.1		nF	
Reverse transfer capacitance	C_{res}	$T_{vj}=25^{\circ}\text{C}$, $f=1\text{MHz}$, $V_{GE}=0\text{V}$, $V_{CE}=25\text{V}$		0.22		nF	
Collector-emitter cut-off current	I_{CES}	$V_{CE}=1200\text{V}$, $V_{GE}=0\text{V}$	$T_{vj}=25^{\circ}\text{C}$			1	mA
			$T_{vj}=150^{\circ}\text{C}$			4	mA
Gate-emitter leakage current	I_{GES}	$V_{CE}=0\text{V}$, $V_{GE}=20\text{V}$, $T_{vj}=25^{\circ}\text{C}$			400	nA	
Turn-on delay time	$t_{d\text{on}}$	$I_C=200\text{A}$, $V_{CE}=600\text{V}$, $V_{GE}=-8\text{V}/+15\text{V}$, $R_{G\text{on}}=2\Omega$, $R_{G\text{off}}=2\Omega$, Inductive Load	$T_{vj}=25^{\circ}\text{C}$	0.18		μs	
			$T_{vj}=125^{\circ}\text{C}$	0.19		μs	
			$T_{vj}=150^{\circ}\text{C}$	0.2		μs	
Rise time	t_r		$T_{vj}=25^{\circ}\text{C}$	0.06		μs	
			$T_{vj}=125^{\circ}\text{C}$	0.06		μs	
			$T_{vj}=150^{\circ}\text{C}$	0.06		μs	
Turn-off delay time	$t_{d\text{off}}$		$T_{vj}=25^{\circ}\text{C}$	0.41		μs	
			$T_{vj}=125^{\circ}\text{C}$	0.48		μs	
			$T_{vj}=150^{\circ}\text{C}$	0.53		μs	
Fall time	t_f	$T_{vj}=25^{\circ}\text{C}$	0.09		μs		
		$T_{vj}=125^{\circ}\text{C}$	0.11		μs		
		$T_{vj}=150^{\circ}\text{C}$	0.13		μs		

Turn-on energy loss per pulse	E _{on}	I _C =200A, V _{CE} =600V, V _{GE} =-8V/+15V, R _{Gon} =2Ω, R _{Goff} =2Ω, L _S =80nH,	T _{vj} =25°C	6.1	mJ
			T _{vj} =125°C	11.1	mJ
			T _{vj} =150°C	13.3	mJ
Turn-off energy loss per pulse	E _{off}	di/dt=5000A/μs (T _{vj} =150°C), du/dt=3000V/μs (T _{vj} =150°C)	T _{vj} =25°C	15.5	mJ
			T _{vj} =125°C	23.6	mJ
			T _{vj} =150°C	26.3	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 ² t-value	I ² t	V _R =0V, t _p =10ms	T _{vj} =125°C	9000	A ² s
			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=5000A/μs (T _{vj} =150°C)	T _{vj} =25°C	260		A
			T _{vj} =125°C	285		A
			T _{vj} =150°C	300		A
Recovered charge	Q _r	I _F =200A, V _R =600V, V _{GE} =-8V, di _F /dt=5000A/μs (T _{vj} =150°C)	T _{vj} =25°C	20		μC
			T _{vj} =125°C	38		μC
			T _{vj} =150°C	44		μC
Reverse recovery energy	E _{rec}	I _F =200A, V _R =600V, V _{GE} =-8V, di _F /dt=5000A/μs (T _{vj} =150°C)	T _{vj} =25°C	11		mJ
			T _{vj} =125°C	19.5		mJ
			T _{vj} =150°C	22.2		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	ΔR/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

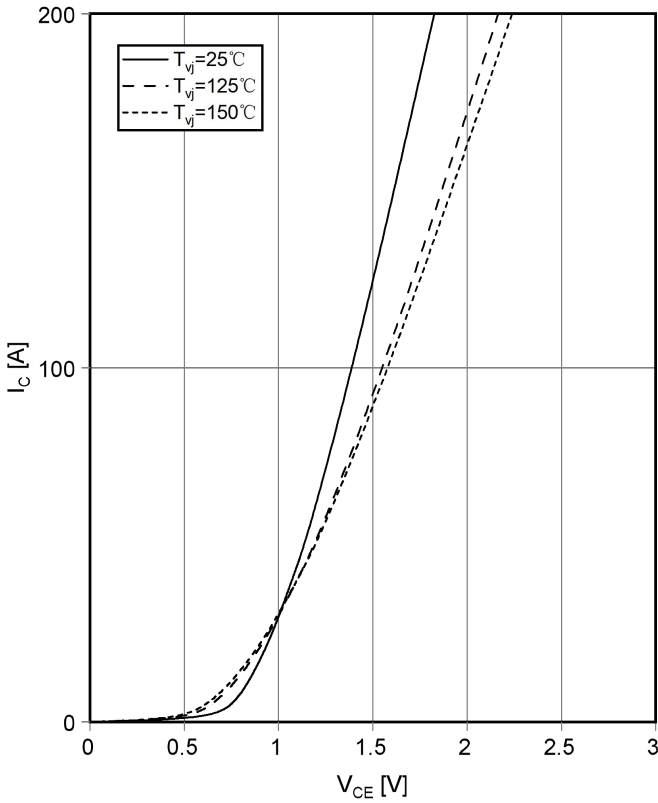
CHARACTERISTICS VALUES(MODULE)

Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Maximum junction temperature	$T_{vj\ max}$	-			150	°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	$R_{CC'+EE'}$	$T_{vj}=25^{\circ}C$, per switch		1.1		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 ₂ O ₃			-
Material of module baseplate	-	-	Cu+Ni			-
Dimensions	LxWxH	-	152.1x62x20.8			mm
Weight	G	-	338			g

CHARACTERISTICS DIAGRAMS

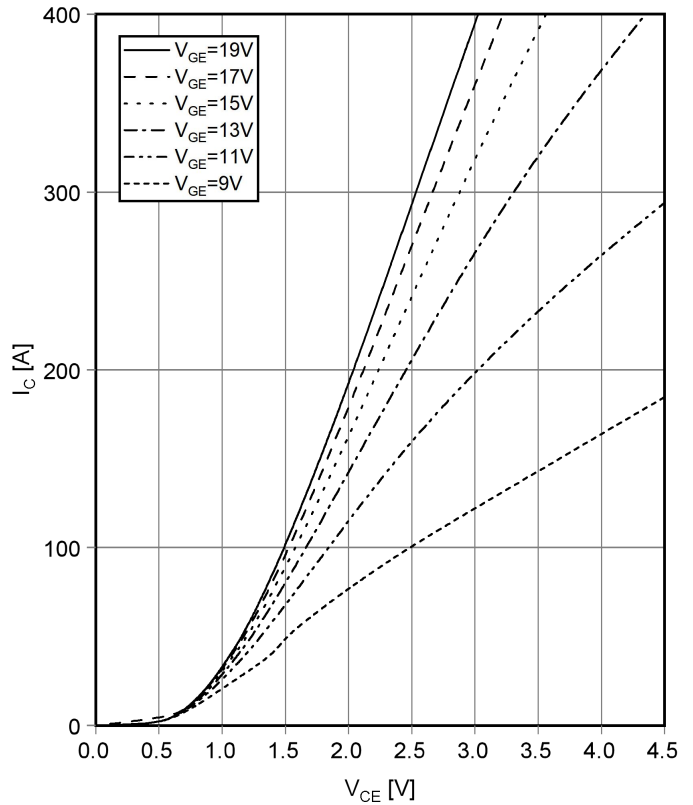
Output characteristic IGBT, Inverter(typical)

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



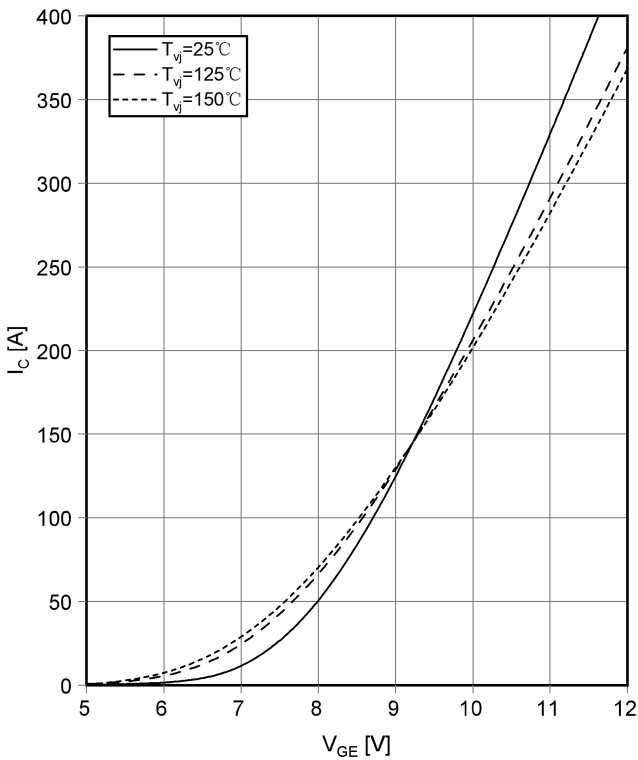
Output characteristic IGBT, Inverter(typical)

$I_c=f(V_{CE}), T_{vj}=150^\circ C$



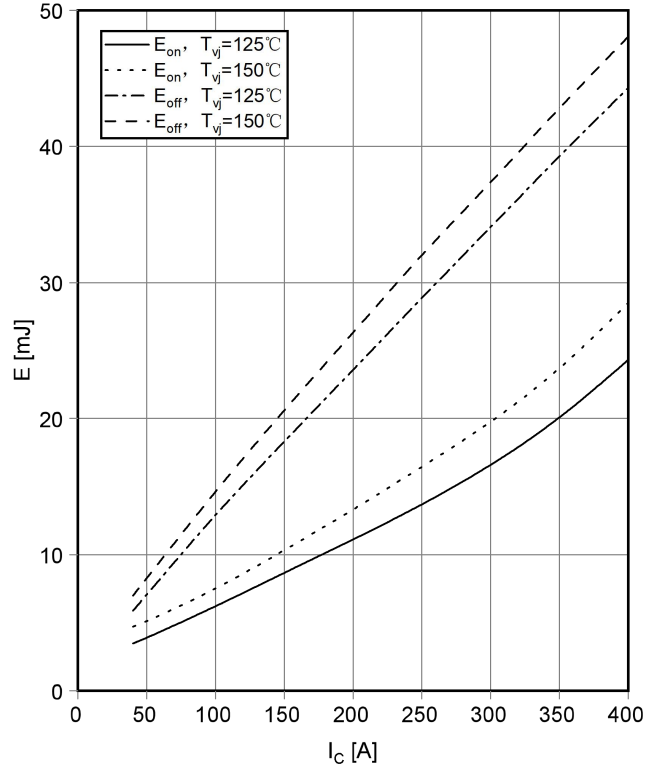
Transfer characteristic IGBT, Inverter(typical)

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



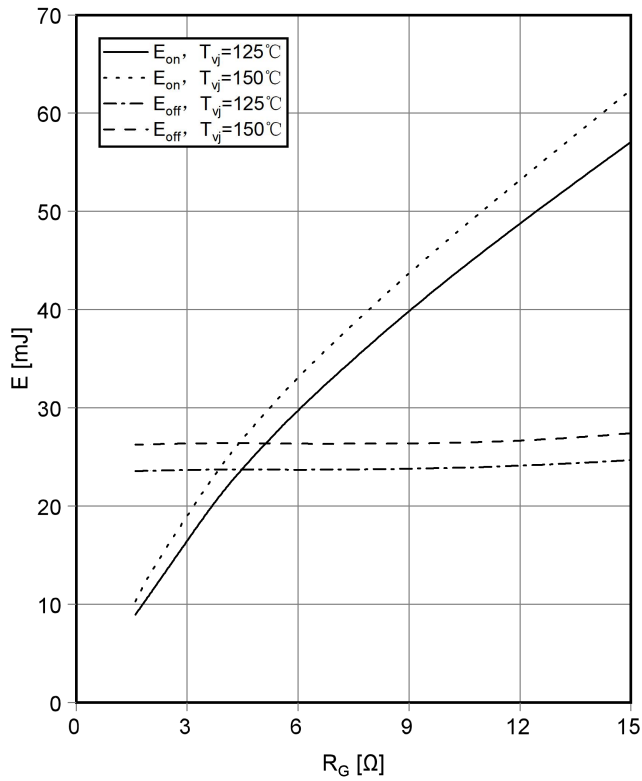
Switching losses IGBT, Inverter(typical)

$E_{on}=f(I_c), E_{off}=f(I_c), V_{GE}=15V, R_{Gon}=2\Omega, R_{Goff}=2\Omega, V_{CE}=600V$



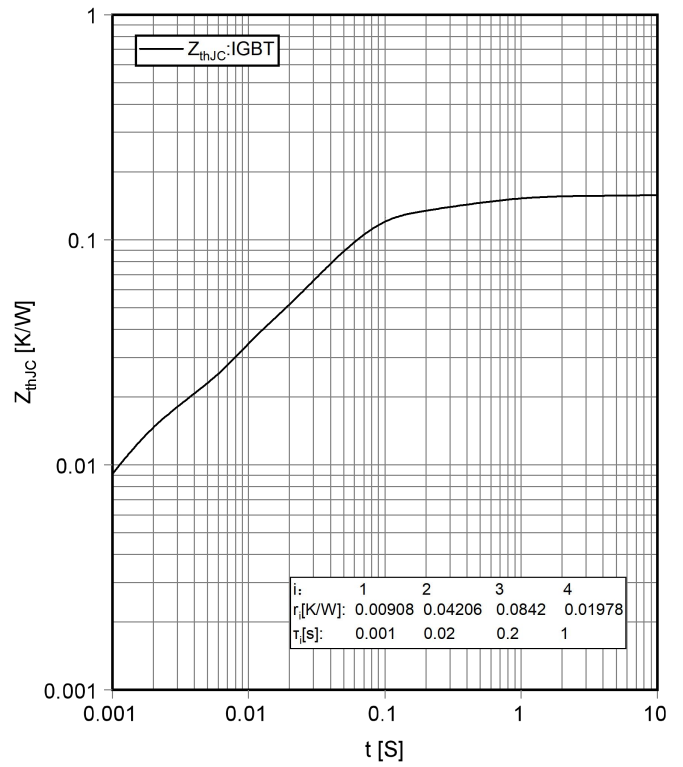
Switching losses IGBT, Inverter(typical)

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



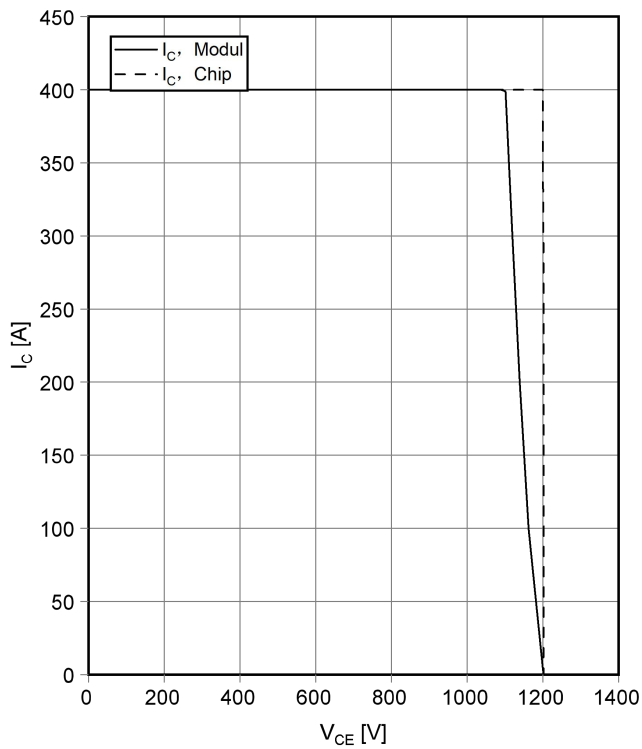
Transient thermal impedance IGBT, Inverter

$Z_{thJC}=f(t)$



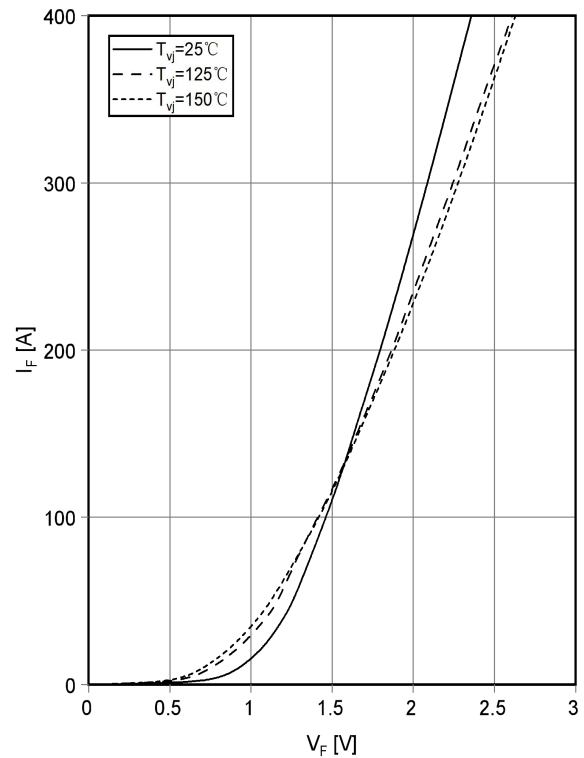
Reverse bias safe operating area IGBT, Inverter(RBSOA)

$I_C=f(V_{CE})$, $V_{GE}=15V$, $R_{Goff}=2\Omega$, $T_{vj}=150^\circ C$



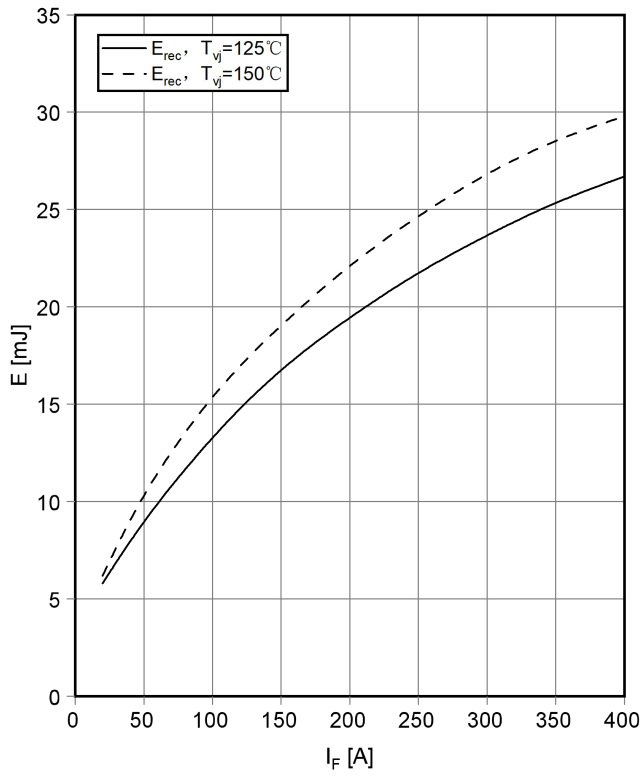
Forward characteristic of FRD, Inverter(typical)

$I_F=f(V_F)$



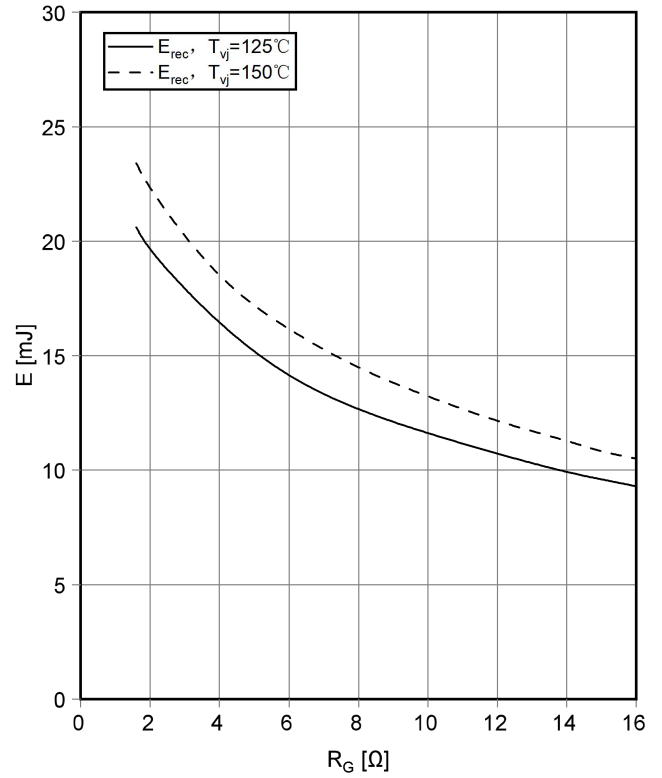
Switching losses FRD, Inverter(typical)

$E_{rec}=f(I_F)$, $R_{Gon}=2\Omega$, $V_{CE}=600V$



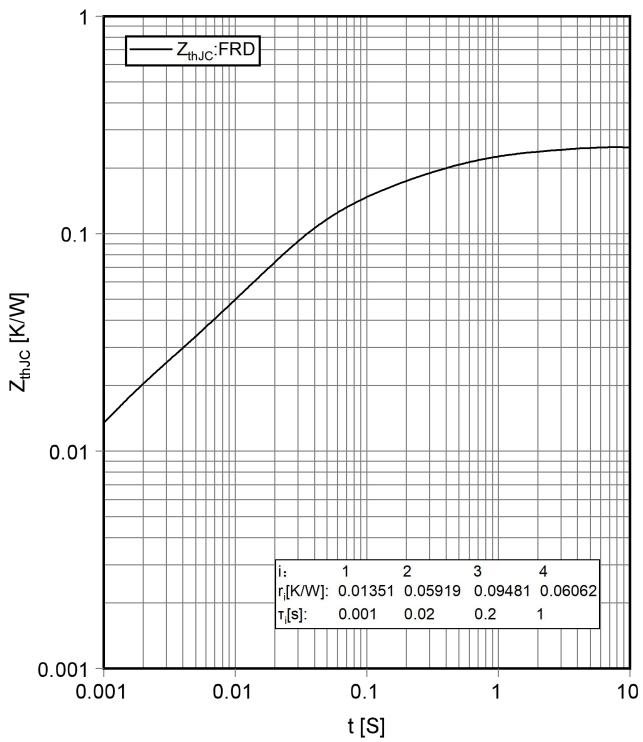
Switching losses FRD, Inverter(typical)

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



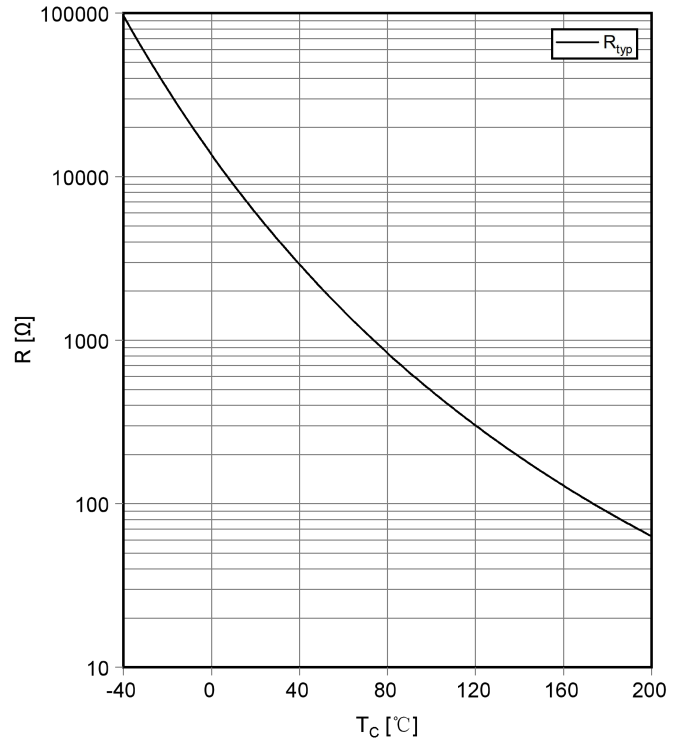
Transient thermal impedance FRD, Inverter

$Z_{thJC}=f(t)$

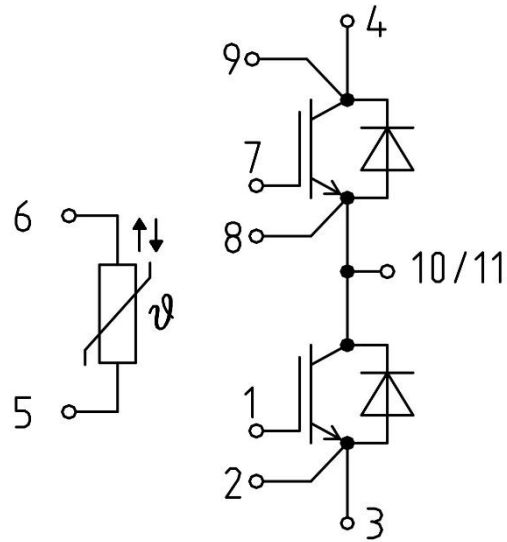


NTC-Thermistor-temperature characteristic(typical)

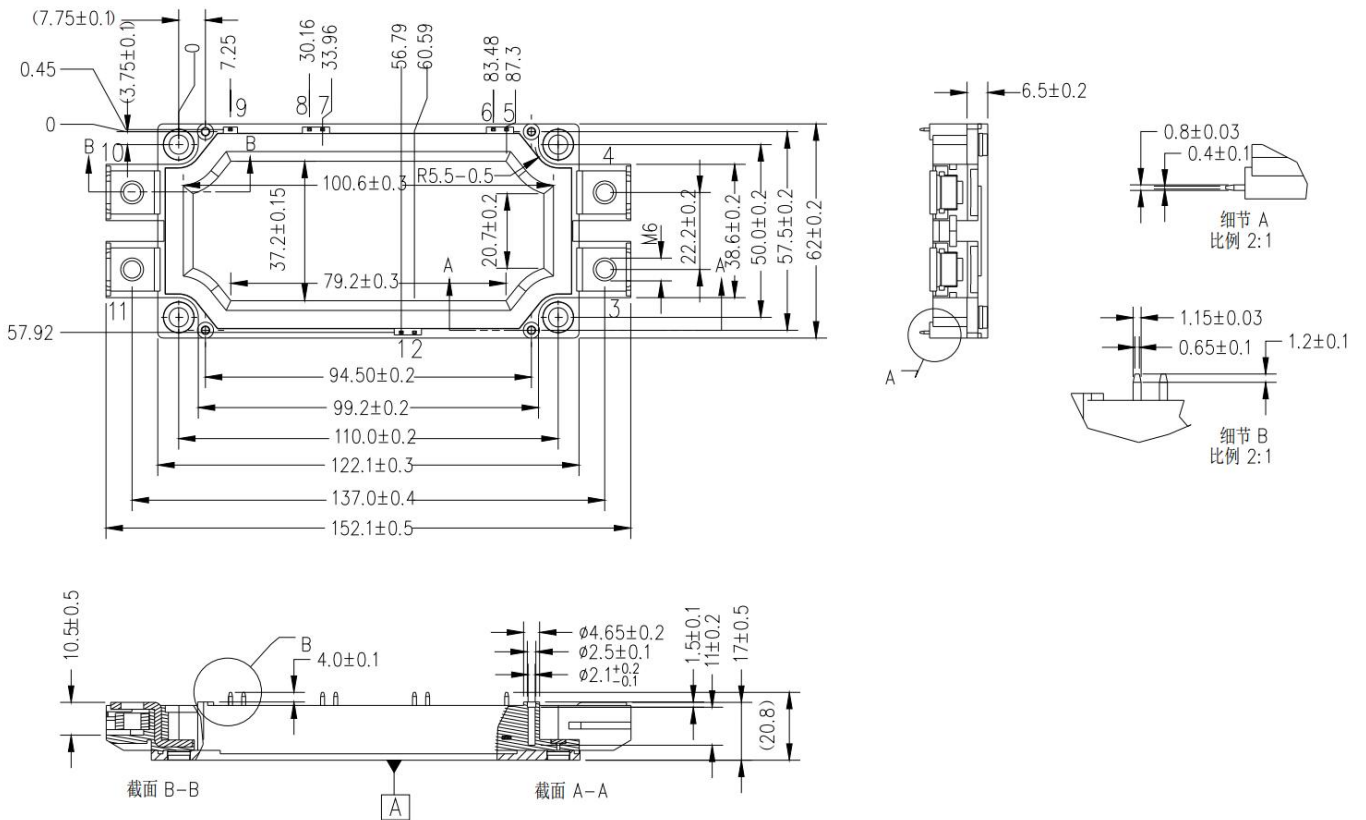
$R=f(T)$



CIRCUIT DIAGRAM



PACKAGE OUTLINES



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Date of change	Rev #	revise content
2023/09/26	A/0	Initial releases