Trench FS IGBT

Features

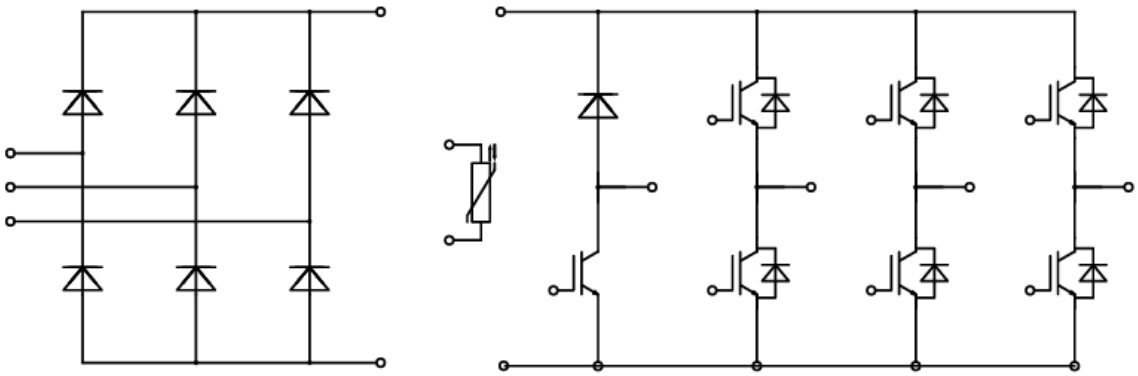
- High Power Density
- High mechanical robustness
- Compact design
- Isolated heatsink using DBC technology
- Very low forward voltage drop
- Fast & soft reverse recovery anti-parallel FWD

Product Summary

Parameter	Value	Unit
V_{CES}	1200	V
I_C(@ T_C= 100℃)	150	A
I_{CRM}(@ t_P= 1ms)	300	A
$V_{CE(sat)}$(Typ)	1.90	V

Applications

- Active Rectifier
- Air Conditioning
- Motor Drives



IGBT, Inverter Absolute Maximum Ratings (@ T_C = 25°C unless otherwise specified)

Parameter	Conditions	Symbol	Values	Unit
Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1200	V
Gate-emitter peak voltage		V_{GES}	±20	V
Continuous collector current	T_C = 100°C	I_C	150	A
Repetitive peak collector current	t_P = 1ms	I_{CRM}	300	A
Total power dissipation	T_C = 25°C, T_{vj} = 175°C	P_{tot}	511	W

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IGBT, Inverter Electrical Characteristics (@ T_C = 25°C unless otherwise specified)

Parameter	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	I_C = 150A, V_{GE} = 15V	T_{vj} = 25°C	$V_{CE(sat)}$		1.90	2.25	V
		T_{vj} = 125°C			2.25		
Gate threshold voltage	V_{CE}=V_{GE}, I_C=4.0mA		$V_{GE(th)}$	5.6	6.2	6.8	V
Gate-emitter leakage current	V_{CE} = 0V, V_{GE} = 20V		I_{GES}			100	nA
Collector leakage current	V_{CE}=1200V，V_{GE}=0V		I_{CES}			1	mA
Input capacitance	f = 1MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{ies}		10.4		nF
Output capacitance			C_{oes}		0.29		nF
Gate charge	V_{GE} = -15V…+15V		Q_G		0.78		µC
Internal gate resistor			R_{Gint}		7.5		Ω
Turn-on delay time, inductive load	V_{CE} = 600V, I_C = 150A, R_G =6.9Ω, V_{GE} = ±15V, T_{vj} = 25℃		$t_{d(on)}$		240		ns
Rise time, inductive load			t_r		126		ns
Turn-off delay time, inductive load			$t_{d(off)}$		350		ns
Fall time, inductive load			t_f		25		ns
Turn-on energy loss per pulse			E_{on}		26.27		mJ
Turn-off energy loss per pulse			E_{off}		7.51		mJ
Turn-on delay time, inductive load	V_{CE} = 600V, I_C = 150A, R_G =6.9Ω, V_{GE} = ±15V, T_{vj} = 125℃		$t_{d(on)}$		244		µs
Rise time, inductive load			t_r		145		µs
Turn-off delay time, inductive load			$t_{d(off)}$		374		µs
Fall time, inductive load			t_f		51		µs
Turn-on energy loss per pulse			E_{on}		36.93		mJ
Turn-off energy loss per pulse			E_{off}		8.73		mJ
SC Data	tp≤10us，V_{GE}≤15V，V_{CC}=900V，T_{vj}=125℃		I_{SC}		770		A
Thermal resistance, junction to case	per IGBT		$R_{th(j-c)}$			0.29	K/W
Temperature under switching conditions			$T_{vj\ op}$	-40		175	℃

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FRED, Inverter Absolute Maximum Ratings (@ T_C = 25°C unless otherwise specified)

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1200	V
Continuous DC forward current		I_F	150	A
Repetitive peak forward current	t_P = 1ms	I_{FRM}	300	A

FRED, Inverter Electrical Characteristics (@ T_C = 25°C unless otherwise specified)

Parameter	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage	I_F = 150A, V_{GE} = 0V	T_{vj} = 25°C	V_F		1.80	2.20	V
		T_{vj} = 125°C			1.60		
Peak reverse recovery current	I_F=150A, V_R=600V, V_{GE}=-15V, di/dt=900A/μs	T_{vj} = 25°C	I_{RM}		39.1		A
		T_{vj} = 125°C			58.4		
Recovery charge		T_{vj} = 25°C	Q_{rr}		6.92		μC
		T_{vj} = 125°C			18.34		
Peak reverse recovery energy		T_{vj} = 25°C	Erec		1.65		mJ
		T_{vj} = 125°C			4.29		
Thermal resistance, junction to case	per diode		$R_{th(j-c)}$			0.46	K/W
Temperature under switching conditions			$T_{vj\ op}$	-40		150	℃

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Diode, Rectifier Absolute Maximum Ratings (@ T_C = 25°C unless otherwise specified)

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1600	V
Bridge output current	T_C = 80℃	$I_{D(AV)}$	150	A
Repetitive peak forward current	t_P = 10 ms, T_{vj} = 25°C	I_{FSM}	1150	A
	t_P = 10 ms, T_{vj} = 150°C		880	
I^2t value for fusing	t_P = 10 ms, T_{vj} = 25°C	I^2t	6600	A^2s
	t_P = 10 ms, T_{vj} = 150°C		3850	

Diode, Rectifier Electrical Characteristics (@ T_C = 25°C unless otherwise specified)

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	T_{vj} = 150°C, I_F=150A	V_F		1.10		V
Reverse current	T_{vj} = 150°C, V_R=1600V	I_R		2.0		mA
Thermal resistance, junction to case	per diode	$R_{th(j-c)}$			0.33	K/W
Temperature under switching conditions		$T_{vj\ op}$	-40		150	℃

IGBT, Brake-Chopper Absolute Maximum Ratings (@ T_C = 25°C unless otherwise specified)

Parameter	Conditions	Symbol	Values	Unit
Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1200	V
Gate-emitter peak voltage		V_{GES}	±20	V
Continuous collector current	T_C = 100°C	I_C	100	A
Repetitive peak collector current	t_P = 1ms	I_{CRM}	200	A
Total power dissipation	T_C = 25°C, T_{vj} = 175°C	P_{tot}	308	W

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IGBT, Brake-Chopper Electrical Characteristics (@ T_C = 25°C unless otherwise specified)

Parameter	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	I_C = 100A, V_{GE} = 15V	T_{vj} = 25°C	$V_{CE(sat)}$		1.80	2.15	V
		T_{vj} = 125°C			2.15		
Gate threshold voltage	V_{CE}=V_{GE}, I_C=2.0mA，		$V_{GE(th)}$	5.6	6.2	6.8	V
Gate-emitter leakage current	V_{CE} = 0V, V_{GE} = 20V		I_{GES}			400	nA
Collector leakage current	V_{CE}=1200V， V_{GE}=0V		I_{CES}			1	mA
Input capacitance	f = 1MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{ies}		5.18		nF
Output capacitance			C_{oes}		0.15		nF
Gate charge	V_{GE} = -15V…+15V		Q_G		0.39		µC
Internal gate resistor			R_{Gint}		0		Ω
Turn-on delay time, inductive load	V_{CC} = 600V, I_C = 100A, R_G = 6.9Ω, V_{GE} = ±15V, T_{vj} = 25℃		$t_{d(on)}$		172		ns
Rise time, inductive load			t_r		126		ns
Turn-off delay time, inductive load			$t_{d(off)}$		302		ns
Fall time, inductive load			t_f		30		ns
Turn-on energy loss per pulse			E_{on}		11.30		mJ
Turn-off energy loss per pulse			E_{off}		4.34		mJ
Turn-on delay time, inductive load	V_{CC} = 600V, I_C = 100A, R_G = 6.9Ω, L_σ = 35 nH, V_{GE} = ±15V, T_{vj} = 125℃		$t_{d(on)}$		203		ns
Rise time, inductive load			t_r		129		ns
Turn-off delay time, inductive load			$t_{d(off)}$		342		ns
Fall time, inductive load			t_f		72		ns
Turn-on energy loss per pulse			E_{on}		16.21		mJ
Turn-off energy loss per pulse			E_{off}		5.62		mJ
SC Data	tp≤10us， V_{GE}≤15V， V_{CC}=900V， T_{vj}=125℃		I_{SC}		550		A
Thermal resistance, junction to case	per IGBT		$R_{th(j-c)}$			0.37	K/W
Temperature under switching conditions			$T_{vj\ op}$	-40		150	℃

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FRED, Brake-Chopper Absolute Maximum Ratings (@ T_C = 25°C unless otherwise specified)

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1200	V
Continuous DC forward current		I_F	75	A
Repetitive peak forward current	t_P = 1ms	I_{FRM}	50	A

FRED, Brake-Chopper Electrical Characteristics (@ T_C = 25°C unless otherwise specified)

Parameter	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage	I_F = 75A, V_{GE} = 0V	T_{vj} = 25°C	V_F		2.00	2.30	V
		T_{vj} = 125°C			1.70		
Peak reverse recovery current	I_F = 75A, V_R = 600V, V_{GE} = -15V, di/dt =900A/μs	T_{vj} = 25°C	I_{RM}		20.5		A
		T_{vj} = 125°C			34.4		
Recovered charge		T_{vj} = 25°C	Q_{rr}		3.5		μC
		T_{vj} = 125°C			9.0		
Peak reverse recovery energy		T_{vj} = 25°C	Erec		1.15		mJ
		T_{vj} = 125°C			2.75		
Thermal resistance, junction to case	per diode		$R_{th(j-c)}$			0.72	K/W
Temperature under switching conditions			$T_{vj\ op}$	-40		175	℃

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NTC-Thermistor Characteristics (@ T_C = 25°C unless otherwise specified)

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	T_C=25℃	R_{25}		5		KΩ
Deviation of R100	T_C = 100°C, R_{100} = 493 Ω	△R/R	-5		5	%
Power dissipation	T_C = 25°C	P_{25}			20	mW
B-value	$R_2 = R_{25} \exp [B25/50(1/T2 - 1/(298,15\ K))]$	$B_{25/50}$		3375		K
B-value	$R_2 = R_{25} \exp [B25/80(1/T2 - 1/(298,15\ K))]$	$B_{25/80}$		3411		K
B-value	$R_2 = R_{25} \exp [B25/100(1/T2 - 1/(298,15\ K))]$	$B_{25/100}$		3433		K

Module Characteristics

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Isolation Voltage (All Terminals Shorted)	RMS, f = 50Hz,1minute	V_{iso}	2.5			KV
Thermal resistance, case to heatsink	per module	$R_{th(c-s)}$		0.009		K/W
Maximum Junction Temperature	Inverter, brake-chopper	Tvj_{max}			175	℃
	rectifier				150	℃
Stray inductance module		L_{SCE}		25		nH
Module lead resistance, terminals - chip	per switch	$R_{CC'+EE'}$		1.6		mΩ
		$R_{AA'+CC'}$		1.1		mΩ
Storage Temperature		T_{stg}	-40		125	℃
Mounting force per clamp		F	3.0		6.0	N

Ordering Information

Device	Marking	Package	Weight	Inner Box	Per Carton
JMG150PM12P3S1	JMG150PM12P3S1	P3	300g/PCS	10PCS	50PCS

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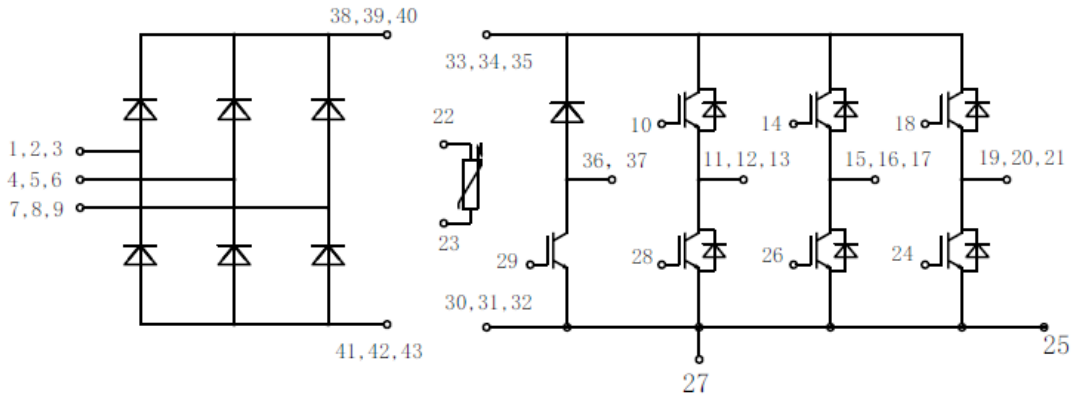
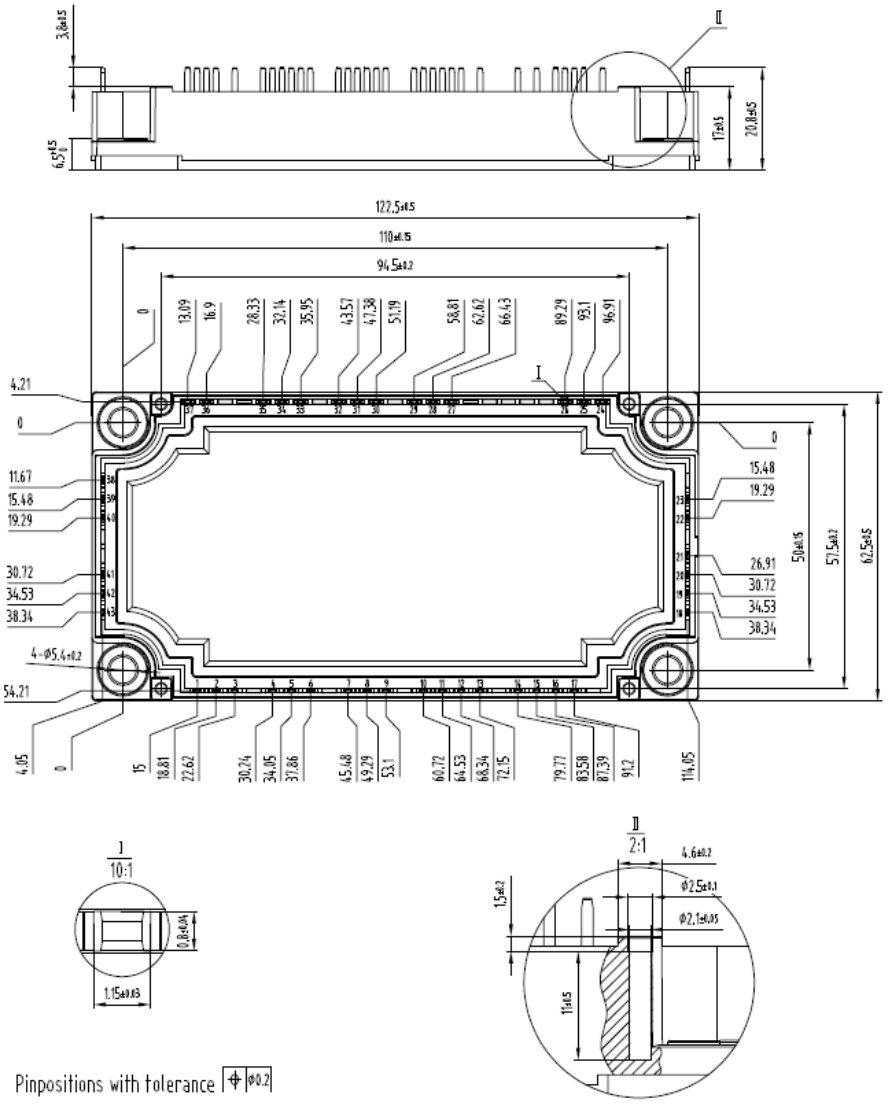
Circuit Diagram



Package Outlines (mm)



Unit of measurement: mm

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Typical Electrical & Thermal Characteristics

Fig 1. IGBT Output Characteristics
Inverter (typical) VGE=15 V

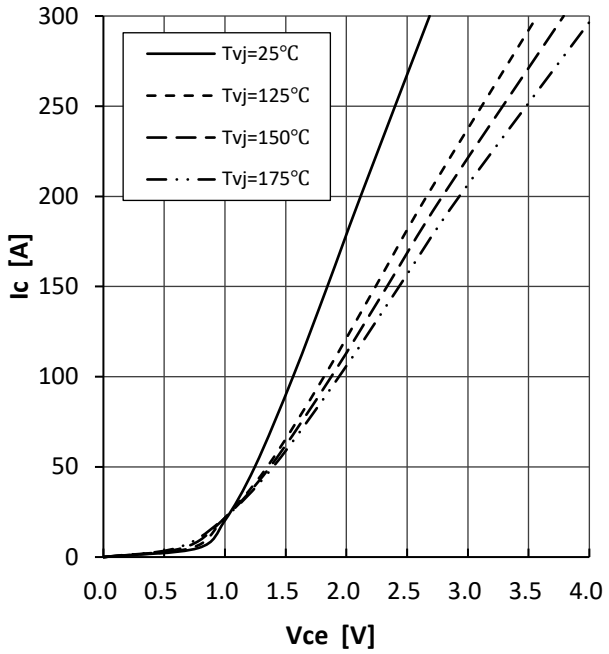

Fig 2. IGBT Output Characteristics
Inverter (typical)

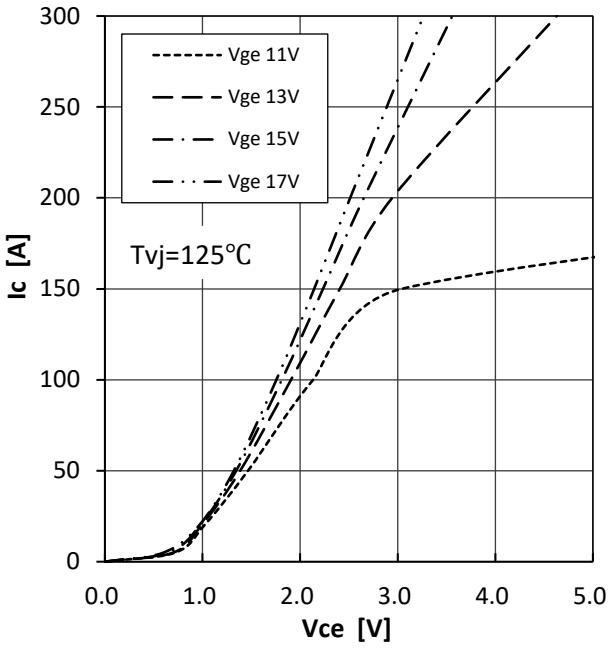

Fig 3. IGBT Transfer Characteristics
Inverter (typical) VCE=20 V

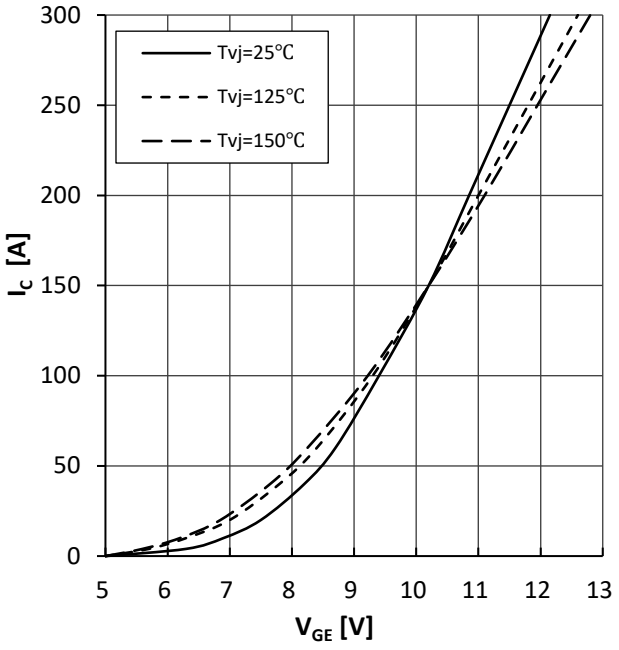

Fig 4. IGBT Switching Loss vs Ic
Inverter (typical)
Rg=6.9 Ω, VCE=600 V, VGE=±15 V

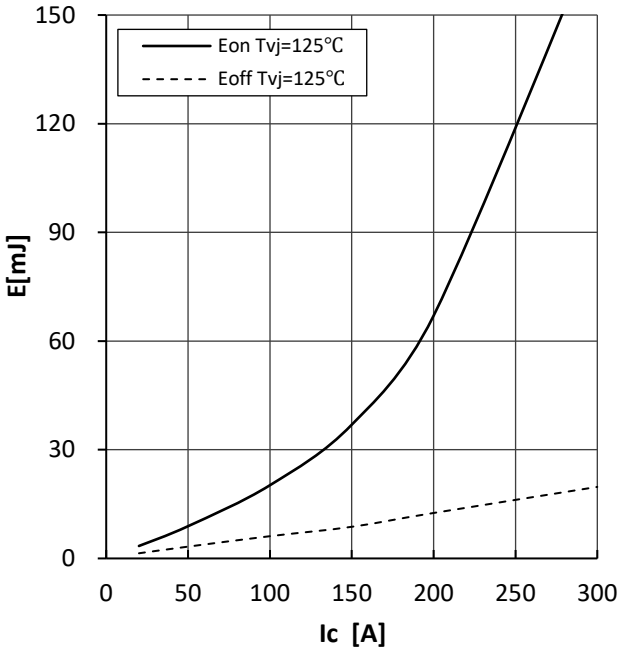

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Fig 5. IGBT Switching Loss vs. Rg,
Inverter (typical）
Ic=150 A, VCE=600 V, VGE=±15 V

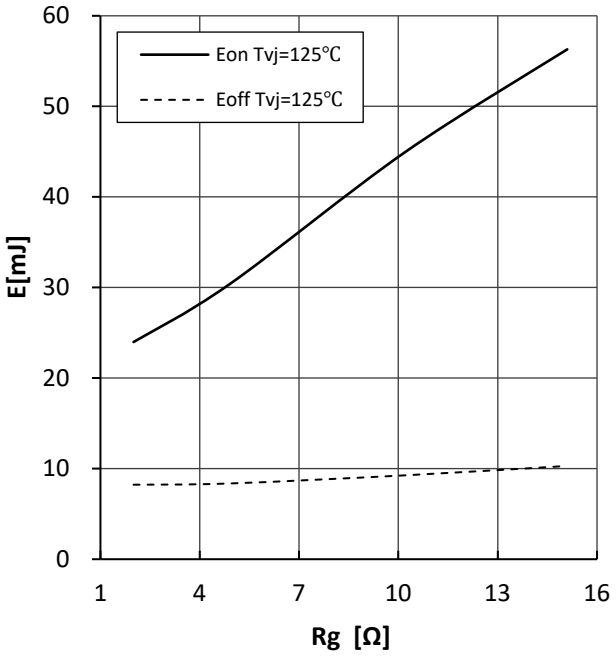

Fig 6. Reverse bias safe operating area
IGBT, Inverter (RBSOA)

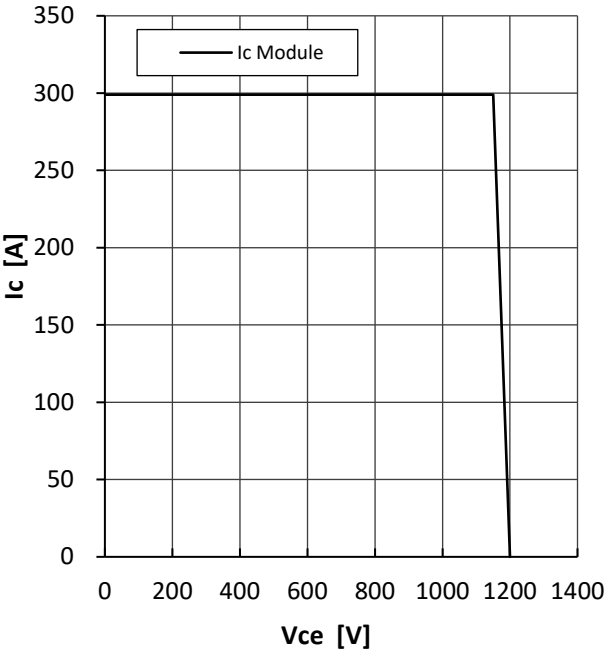

Fig 7. FRED Forward Characteristics,
Inverter (typical)

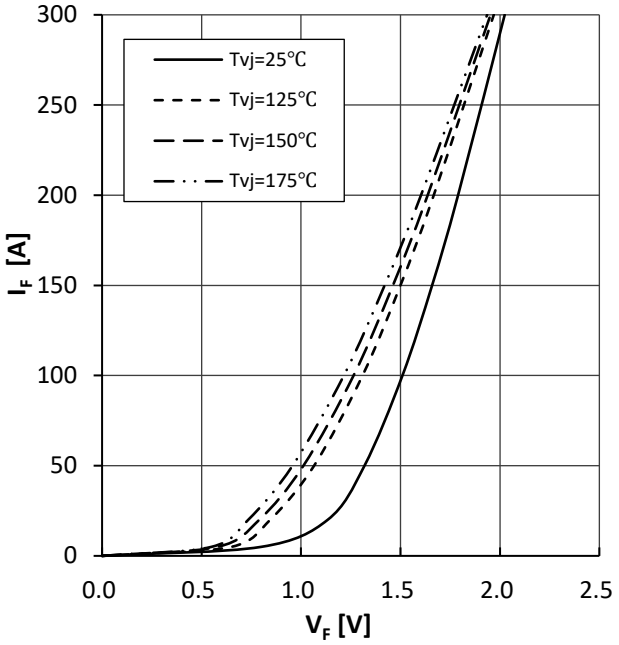

Fig 8. FRED Switching Loss vs. Ic,
Inverter (typical)
Rg=6.9 Ω, VCE=600 V

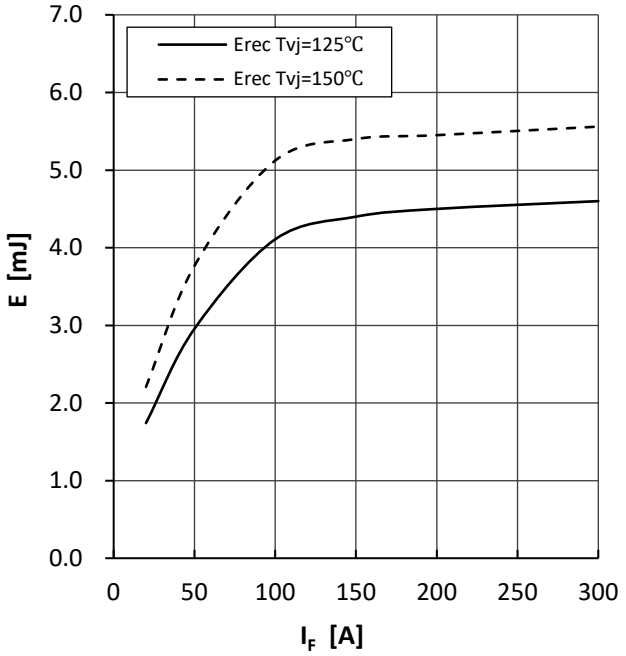

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Fig 9. FRED Switching Loss vs. Rg,
Inverter (typical)
Ic=150 A, VCE=600 V

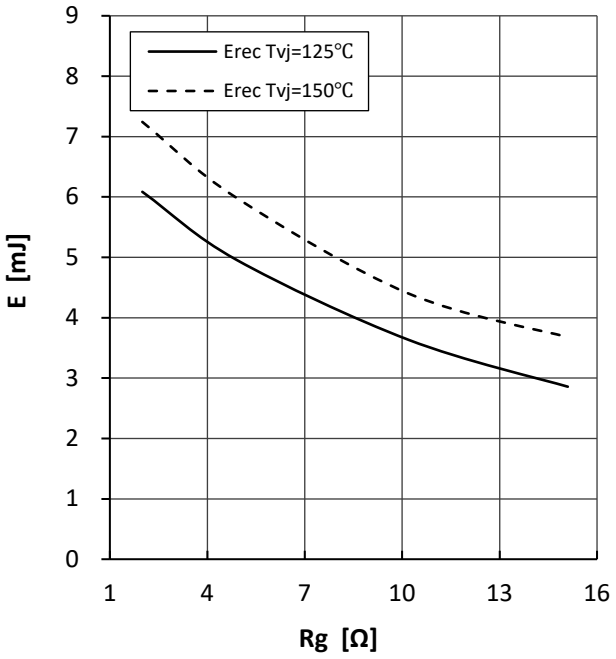

Fig 10. Diode Rectifier Forward Characteristics

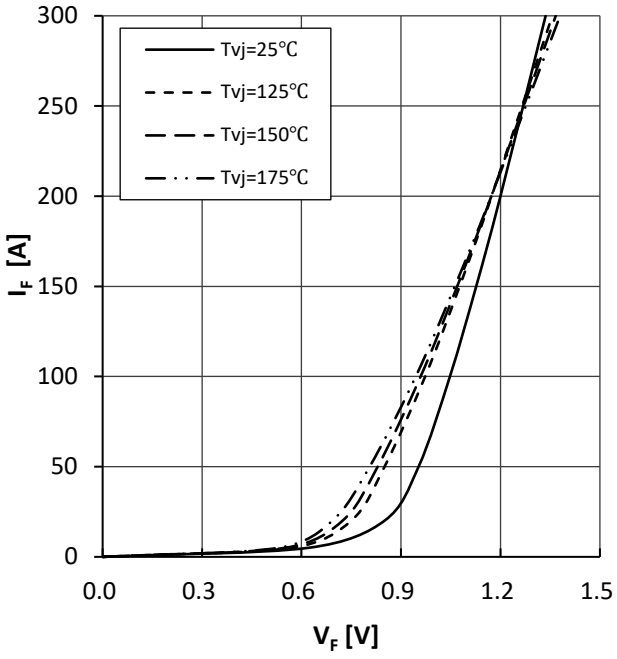

Fig 11. IGBT Output Characteristics，
Brake-Chopper (typical) VGE=15 V

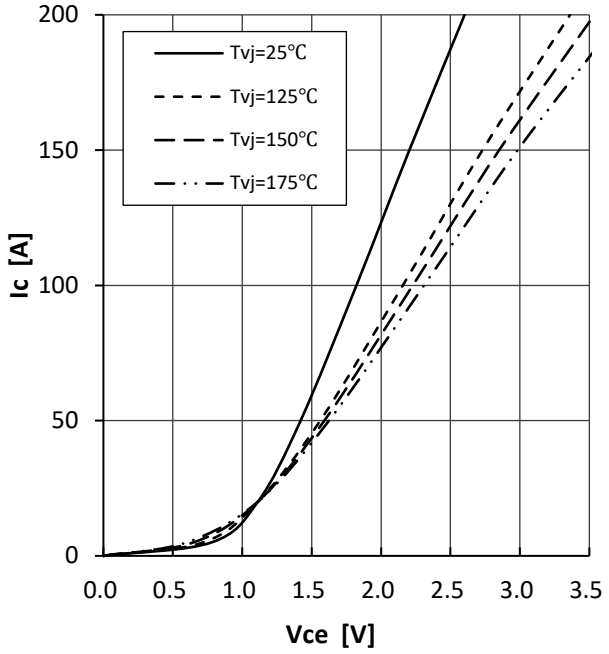

Fig 12. FRED Forward Characteristics,
Brake-Chopper (typical)

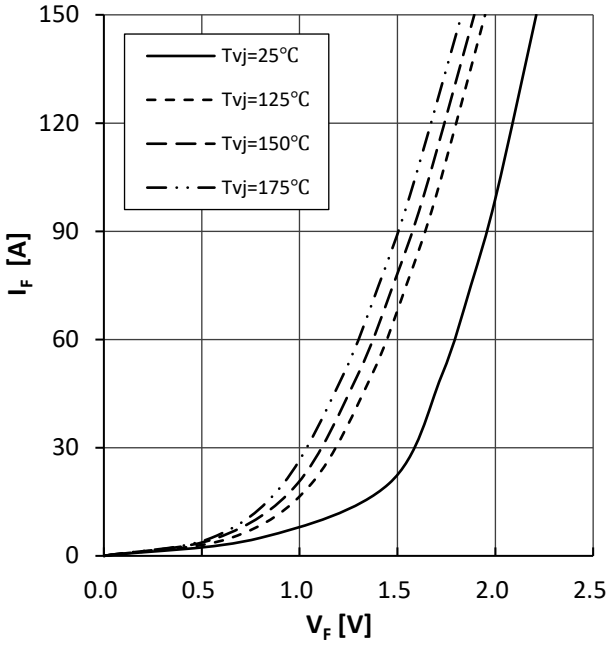

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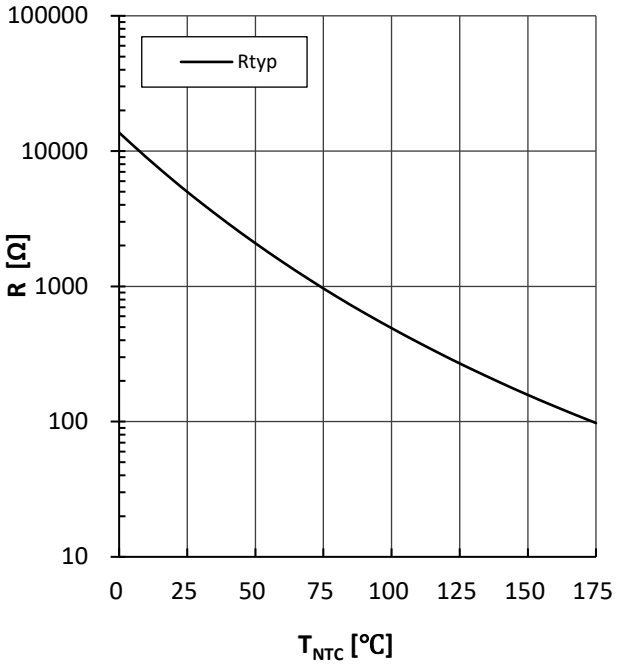
Fig 13. Temperature characteristics,
NTC thermistor (typical)



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