

**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**Applications**

- Active Rectifier
- Air Conditioning
- Motor Drives

IGBT Absolute Maximum Ratings (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Conditions	Symbol	Values	Unit
Collector-emitter voltage	$T_{vj} = 25^\circ\text{C}$	V_{CES}	1200	V
Gate-emitter peak voltage		V_{GES}	± 20	V
Continuous collector current	$T_c = 100^\circ\text{C}$	I_C	50	A
Repetitive peak collector current	$t_P = 1\text{ms}$	I_{CRM}	100	A
Total power dissipation	$T_C = 25^\circ\text{C}, T_{vj} = 175^\circ\text{C}$	P_{tot}	380	W

**IGBT, Electrical Characteristics (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)**

Parameter	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$I_C = 50\text{A}$ $V_{GE} = 15\text{V}$	$T_{vj} = 25^\circ\text{C}$	$V_{CE(sat)}$		1.80	2.15	V
		$T_{vj} = 125^\circ\text{C}$			2.10		
Gate threshold voltage	$V_{CE}=V_{GE}$, $I_C=1\text{mA}$		$V_{GE(th)}$	5.6	6.2	6.8	V
Gate-emitter leakage current	$V_{CE} = 0\text{V}$, $V_{GE} = 20\text{V}$		I_{GES}			400	nA
Collector-emitter cut-off current	$V_{CE}=1200\text{V}$ $V_{GE}=0\text{V}$		I_{CES}			1	mA
Input capacitance	$f = 1\text{MHz}$, $T_{vj} = 25^\circ\text{C}$, $V_{CE} = 25\text{V}$, $V_{GE} = 0\text{V}$		C_{ies}		7.76		nF
Output capacitance			C_{oes}		0.22		nF
Gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$		Q_G		0.58		μC
Internal gate resistor			R_{Gint}		5.0		Ω
Turn-on delay time, inductive load	$V_{CE} = 600\text{V}$, $I_C = 50\text{A}$, $R_G = 15\ \Omega$, $V_{GE} = \pm 15\text{V}$, $T_{vj} = 25$		$t_{d(on)}$		158		ns
Rise time, inductive load			t_r		94		ns
Turn-off delay time, inductive load			$t_{d(off)}$		208		ns
Fall time, inductive load			t_f		142		ns
Turn-on energy loss per pulse			E_{on}		5.60		mJ
Turn-off energy loss per pulse			E_{off}		2.84		mJ
Turn-on delay time, inductive load	$V_{CE} = 600\text{V}$, $I_C = 50\text{A}$, $R_G = 15\ \Omega$, $V_{GE} = \pm 15\text{V}$, $T_{vj} = 125$		$t_{d(on)}$		152		μs
Rise time, inductive load			t_r		104		μs
Turn-off delay time, inductive load			$t_{d(off)}$		248		μs
Fall time, inductive load			t_f		179		μs
Turn-on energy loss per pulse			E_{on}		8.30		mJ
Turn-off energy loss per pulse			E_{off}		3.70		mJ
SC Data	$V_{GE} = 15\text{V}$ $V_{CC}=900\text{V}$ $T_{vj}=125$		I_{SC}		300		A
Thermal resistance, junction to case	per IGBT		$R_{th(j-c)}$			0.60	K/W
Temperature under switching conditions			$T_{vj\ op}$	-40		175	

**FRED, Inverter Absolute Maximum Ratings (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)**

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	$T_{vj} = 25^\circ\text{C}$	V_{RRM}	1200	V
Continuous DC forward current		I_F	50	A
Repetitive peak forward current	$t_p = 1\text{ms}$	I_{FRM}	100	A

FRED, Inverter Electrical Characteristics (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage	$I_F = 50A$, $V_{GE} = 0V$	$T_{vj} = 25^{\circ}C$	V_F		2.10	2.30	V
		$T_{vj} = 125^{\circ}C$			1.80		
Peak reverse recovery current	$I_F= 50A$, $V_R=600V$, $V_{GE}=-15V$, $di/dt=400 \text{ } \mu A/Vs$	$T_{vj} = 25^{\circ}C$	I_{RM}		11.7		A
		$T_{vj} = 125^{\circ}C$			18.5		
Recovery charge		$T_{vj} = 25^{\circ}C$	Q_{rr}		1.60		nC
		$T_{vj} = 125^{\circ}C$			4.74		
Peak reverse recovery energy		$T_{vj} = 25^{\circ}C$	E_{rec}		0.45		mJ
		$T_{vj} = 125^{\circ}C$			1.30		
Thermal resistance, junction to case	per diode		$R_{th(j-c)}$			1.06	K/W
Temperature under switching conditions			$T_{vj \text{ op}}$	-40		150	

**Diode, Rectifier Absolute Maximum Ratings (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)**

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage		T_{vj}		



IGBT, Brake-Chopper Electrical Characteristics (@ $T_c = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	$I_c = 40\text{A}$, $V_{GE} = 15\text{V}$	$V_{CE(sat)}$		1.80	2.15	V
				2.25		
Gate threshold voltage	$V_{CE}=V_{GE}$, $I_c=0.7\text{mA}$	$V_{GE(th)}$	5.6	6.2	6.8	V
Gate-emitter leakage current	$V_{CE} = 0\text{V}$, $V_{GE} = 20\text{V}$	I_{GES}			400	nA
Collector-emitter cut-off current	$V_{CE}=1200\text{V}$ $V_{GE}=0\text{V}$	I_{CES}			1	mA
Input capacitance	$f = 1\text{MHz}$, $T_{vj} = 25^\circ\text{C}$, $V_{CE} = 25\text{V}$, $V_{GE} = 0\text{V}$	C_{ies}		5.18		nF
Output capacitance		C_{oes}		0.15		nF
Gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$	Q_G		0.39		μC
Internal gate resistor		R_{Gint}		0		
Turn-on delay time, inductive load	$V_{CC} = 600\text{V}$, $I_c = 40\text{A}$, $R_G = 15\ \Omega$, $V_{GE} = \pm 15\text{V}$, $T_{vj} = 25$	$t_{d(on)}$		104		ns
Rise time, inductive load		t_r		89		ns
Turn-off delay time, inductive load		$t_{d(off)}$		188		ns
Fall time, inductive load		t_f		62		ns
Turn-on energy loss per pulse		E_{on}		3.50		mJ
Turn-off energy loss per pulse		E_{off}		1.68		mJ
Turn-on delay time, inductive load	$V_{CC} = 600\text{V}$, $I_c = 40\text{A}$, $R_G = 15\ \Omega$, $L = 35\text{ nH}$, $V_{GE} = \pm 15\text{V}$, $T_{vj} = 125$	$t_{d(on)}$		102		ns
Rise time, inductive load		t_r		100		ns
Turn-off delay time, inductive load		$t_{d(off)}$		211		ns
Fall time, inductive load		t_f		136		ns
Turn-on energy loss per pulse		E_{on}		5.39		mJ
Turn-off energy loss per pulse		E_{off}		2.30		mJ
SC Data	$V_{GE} = 15\text{V}$ $V_{CC}=900\text{V}$ $T_{vj}=125$	I_{sc}		250		A
Thermal resistance, junction to case	per IGBT	$R_{th(j-c)}$			0.90	K/W
Temperature under switching conditions		$T_{vj op}$	-40		150	

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

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{RRM}	1200	V
Continuous DC forward current		I_F	35	A
Repetitive peak forward current	$t_P = 1\text{ms}$	I_{FRM}	70	A

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

Parameter	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage	I _F = 35A, 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 = 35A, V _R = 600V, V _{GE} = -15V, di/dt =300 A/μs	T _{vj} = 25°C	I _{RM}		9.5		A
		T _{vj} = 125°C			15.7		
Recovered charge		T _{vj} = 25°C	Q _{rr}		1.36		nC
		T _{vj} = 125°C			3.57		
Peak reverse recovery energy		T _{vj} = 25°C	E _{rec}		0.45		mJ
		T _{vj} = 125°C			1.12		
Thermal resistance, junction to case	per diode		R _{th(j-c)}			1.43	K/W
Temperature under switching conditions			T _{vj op}	-40		175	

**NTC-Thermistor Characteristics (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)**

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	$T_C = 25$	R_{25}		5		K
Deviation of R_{100}	$T_C = 100^\circ\text{C}$, $R_{100} = 493 \Omega$	- R/R	-5		5	%
Power dissipation	$T_C = 25^\circ\text{C}$	P_{25}			20	mW
B-value	$R_2 = R_{25} \exp [B_{25}/50(1/T_2 - 1/(298,15 \text{ K}))]$	$B_{25}/50$		3375		K
B-value	$R_2 = R_{25} \exp [B_{25}/80(1/T_2 - 1/(298,15 \text{ K}))]$	$B_{25}/80$		3411		K
B-value	$R_2 = R_{25} \exp [B_{25}/100(1/T_2 - 1/(298,15 \text{ K}))]$	$B_{25}/100$		3433		K

Module Characteristics

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Isolation Voltage (All Terminals Shorted)	RMS, $f = 50\text{Hz}$, 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	$T_{vj \max}$			175	
	rectifier				150	
Stray inductance module		L_{SCE}		25		nH
Module lead resistance, terminals - chip	per switch	$R_{CC'+EE'}$		1.6		P
		$R_{AA'+CC'}$		1.1		P
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
JMG50PM12P3S1	JMG50PM12P3S1	P3	300g/PCS	10PCS	50PCS



Typical Electrical & Thermal Characteristics

Fig 1. IGBT Output Characteristics
Inverter (typical) $V_{GE}=15\text{ V}$

Fig 2. IGBT Output Characteristics
Inverter (typical)

Fig 3. IGBT Transfer Characteristics
Inverter (typical)



Fig 5. IGBT Switching Loss vs. R_g ,
Inverter (typical)
 $I_c=50\text{ A}$, $V_{CE}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$

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

Fig 7. FRED Forward Characteristics,
Inverter (typical) $I_{JTJ} = 0$ $T_c = 0.002$ $T_c = 0.005$ $c = 0.000$ $s = 1$ $T_{fd} = 5$ $T_d = (7)T_j$ 0.007 $T_c = -0.007$ $T_w = 0.569$ $T_d = (.)T_j$

Fig 9. FRED Switching Loss vs. R_g ,
Inverter (typical)
 $I_c=50\text{ A}$, $V_{CE}=600\text{ V}$

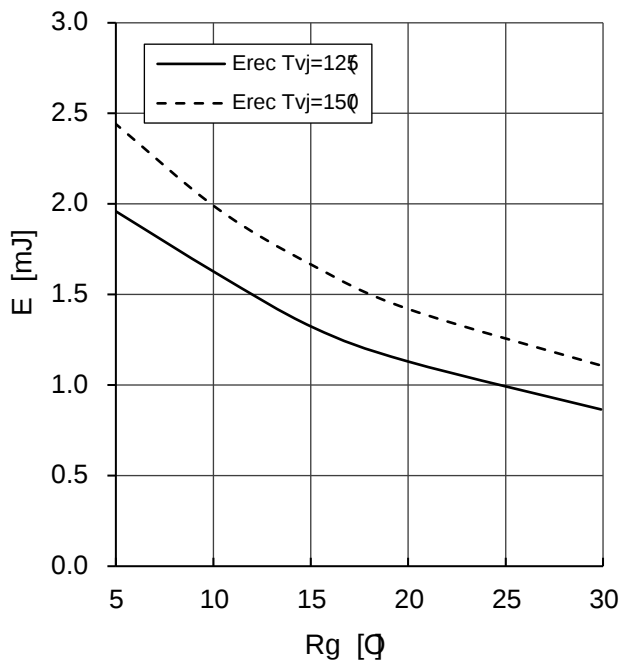


Fig 10. Diode Rectifier Forward Characteristics

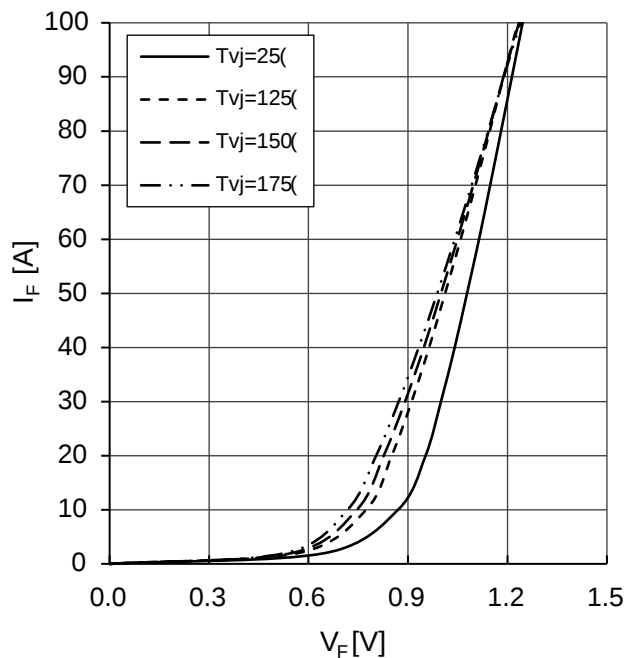


Fig 11. IGBT Output Characteristics
Brake-Chopper (typical) $V_{GE}=15\text{ V}$

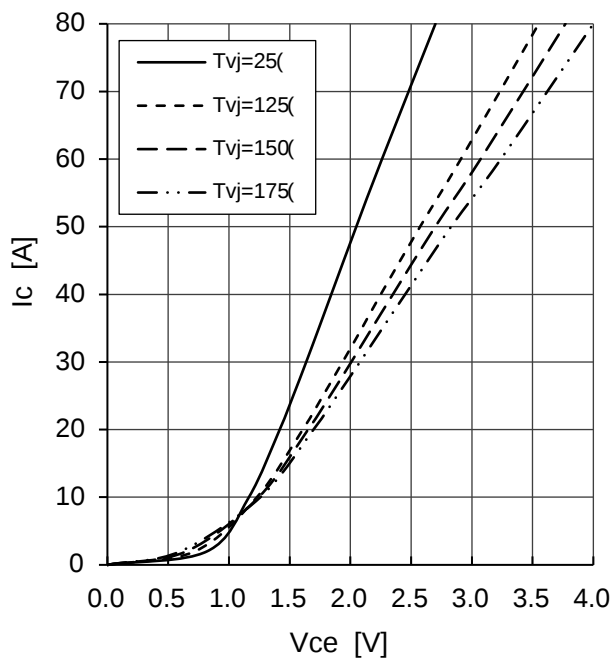


Fig 12. FRED Forward Characteristics,
Brake-Chopper (typical)

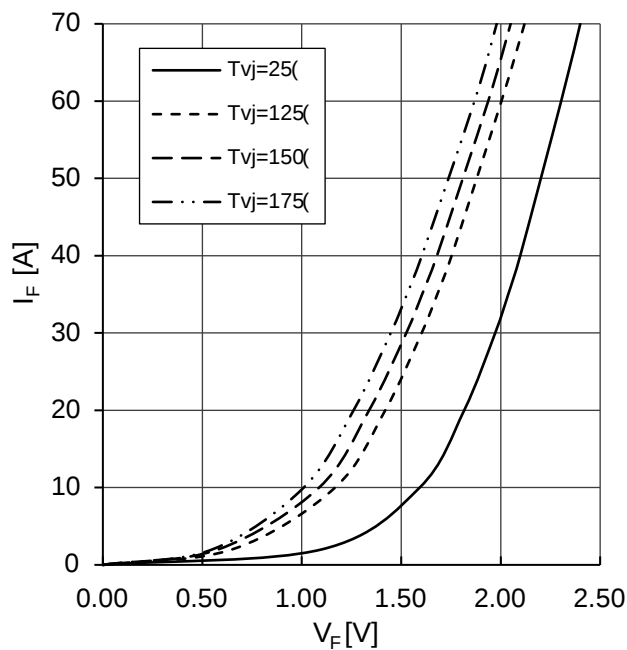
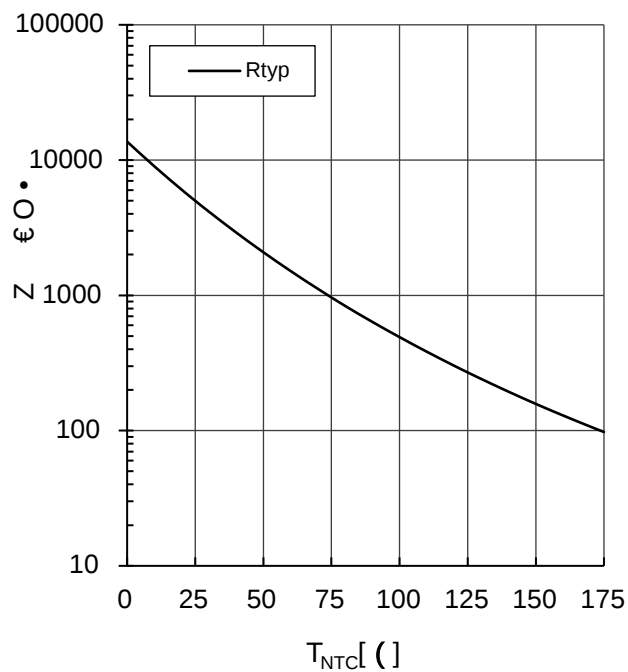


Fig 13. Temperature characteristics,
NTC thermistor (typical)





Information furnished in this document is believed to be accurate and reliable. However,
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