



### IGBT Power Module 1200V / 200A

Preliminary

#### Features

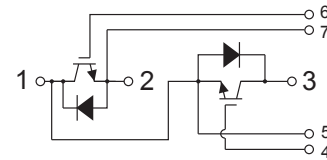
- ◆ 62mm Fast Switching / Trench Field Stop IGBT Technology
- ◆ Low Switching Losses
- ◆ Super Fast Diodes
- ◆ High Short Circuit Capability

#### Applications

- ◆ Welder / Power Supply
- ◆ UPS / Inverter
- ◆ Industrial Motor Drive



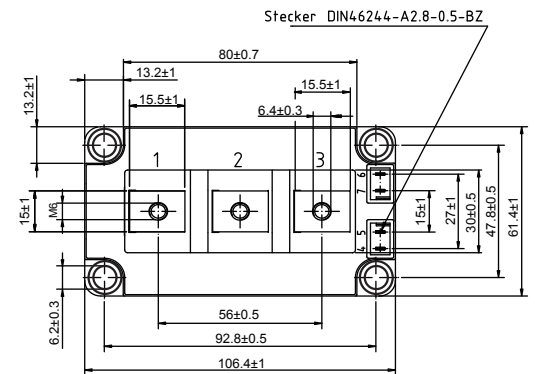
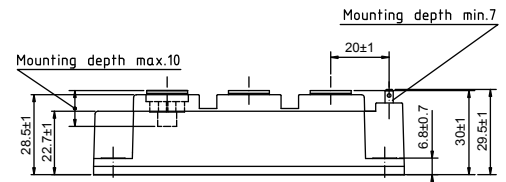
#### Circuit Diagram Headline



#### Maximum Ratings (Tc=25°C)

Item	Symbol	Rated Value	Unit
Collector-Emitter Voltage	$T_{VJ} = 25^{\circ}\text{C}$ V <sub>CES</sub>	1200	V
Gate-Emitter Peak Voltage	V <sub>GES</sub>	±20	V
Continuous DC Collector Current	$T_c = 80^{\circ}\text{C}$ $T_c = 25^{\circ}\text{C}$ I <sub>C,nom.</sub> I <sub>C</sub>	200 240	A
Repetitive Peak Collector Current	t <sub>p</sub> = 1ms I <sub>CRM</sub>	400	A
Total Power Dissipation	P <sub>tot</sub>	1100	W
Isolation Voltage	RMS, f=50Hz, t=1min V <sub>iso</sub>	2500	V
Temperature Under Switching Conditions	T <sub>VJ op</sub>	-40 ~ +150	°C
Storage Temperature	T <sub>stg</sub>	-40 ~ +125	°C
Mounting Torque	Module Base to Heatsink (M6)	3~6	N.m
	Busbar to Terminal (M6)	2.5~5	

#### Package Outlines



Dimensions in mm (1 mm = 0.0394")



■ **Electrical Characteristics**

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Collector-emitter saturation voltage	$V_{CE\ sat}$	$I_C = 200A, V_{GE} = 15V$ $T_{vj} = 25^\circ C$		1.90	2.15	V
		$I_C = 200A, V_{GE} = 15V$ $T_{vj} = 125^\circ C$		2.00		
		$I_C = 200A, V_{GE} = 15V$ $T_{vj} = 150^\circ C$		2.05		
Gate threshold voltage	$V_{GEth}$	$I_C = 7.6mA, V_{CE} = V_{GE}, T_{vj} = 25^\circ C$	5.8	6.2	6.8	V
Gate charge	$Q_G$	$V_{GE} = -15V \dots +15V$		2.53		$\mu C$
Input capacitance	$C_{ies}$	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		40		nF
Output capacitance	$C_{oes}$	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		0.9		nF
Reverse transfer capacitance	$C_{res}$	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		0.66		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 1200V, V_{GE} = 0V, T_{vj} = 25^\circ C$			5	mA
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25^\circ C$			400	nA
Turn-on delay time, inductive load	$t_{d\ on}$	$I_C = 200A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.22		$\mu s$
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.27		
		$R_{Gon} = 1\Omega$ $T_{vj} = 150^\circ C$		0.29		
Rise time, inductive load	$t_r$	$I_C = 200A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.06		$\mu s$
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.08		
		$R_{Gon} = 1\Omega$ $T_{vj} = 150^\circ C$		0.10		
Turn-off delay time, inductive load	$t_{d\ off}$	$I_C = 200A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.29		$\mu s$
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.39		
		$R_{Goff} = 1\Omega$ $T_{vj} = 150^\circ C$		0.41		
Fall time, inductive load	$t_f$	$I_C = 200A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.06		$\mu s$
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.12		
		$R_{Goff} = 1\Omega$ $T_{vj} = 150^\circ C$		0.18		
Turn-on energy loss per pulse	$E_{on}$	$I_C = 200A, V_{CE} = 600V, L_S = 30nH$ $T_{vj} = 25^\circ C$		4.4		mJ
		$V_{GE} = \pm 15V, di/dt = 4000A/\mu s (T_{vj} = 150^\circ C)$ $T_{vj} = 125^\circ C$		6.62		
		$R_{Gon} = 1\Omega$ $T_{vj} = 150^\circ C$		8.62		
Turn-off energy loss per pulse	$E_{off}$	$I_C = 200A, V_{CE} = 600V, L_S = 30nH$ $T_{vj} = 25^\circ C$		18.2		mJ
		$V_{GE} = \pm 15V, du/dt = 4000V/\mu s (T_{vj} = 150^\circ C)$ $T_{vj} = 125^\circ C$		21.7		
		$R_{Goff} = 1\Omega$ $T_{vj} = 150^\circ C$		24.7		
SC data	$I_{SC}$	$V_{GE} \leq 15V, V_{CC} = 800V$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_p \leq 10\mu s,$ $T_{vj} = 150^\circ C$	800		A
Thermal resistance, junction to case	$R_{thJC}$	per IGBT			0.135	$^\circ C/W$
Thermal resistance, case to heatsink	$R_{thCH}$	per IGBT		0.034		$^\circ C/W$



### ■ Diode Ratings & Characteristics

Characteristics	Symbol	Test Conditions	Value	Unit
Repetitive peak reverse voltage	$V_{RRM}$	$T_{vj} = 25^{\circ}C$	1200	V
Continuous DC forward current	$I_F$		225	A
Repetitive peak forward current	$I_{FRM}$	$t_p = 1ms$	450	A
P <sub>t</sub> - value	P <sub>t</sub>	$V_R = 0V, t_p = 10ms, T_{vj} = 125^{\circ}C$	10000	A <sup>2</sup> s
		$V_R = 0V, t_p = 10ms, T_{vj} = 150^{\circ}C$	8100	

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Forward voltage	$V_F$	$I_F = 200A, V_{GE} = 0V, T_{vj} = 25^{\circ}C$		2.0	2.5	V
		$I_F = 200A, V_{GE} = 0V, T_{vj} = 125^{\circ}C$		1.9		
		$I_F = 200A, V_{GE} = 0V, T_{vj} = 150^{\circ}C$		1.9		
Peak reverse recovery current	$I_{RM}$	$I_F = 200A, -di_F/dt = 4000A/\mu s (T_{vj} = 150^{\circ}C), T_{vj} = 25^{\circ}C$		146		A
		$V_R = 600V, T_{vj} = 125^{\circ}C$		166		
		$V_{GE} = -15V, T_{vj} = 150^{\circ}C$		176		
Recovered charge	Q <sub>r</sub>	$I_F = 200A, -di_F/dt = 4000A/\mu s (T_{vj} = 150^{\circ}C), T_{vj} = 25^{\circ}C$		15.2		$\mu C$
		$V_R = 600V, T_{vj} = 125^{\circ}C$		27.2		
		$V_{GE} = -15V, T_{vj} = 150^{\circ}C$		40.2		
Reverse recovery energy	E <sub>rec</sub>	$I_F = 200A, -di_F/dt = 4000A/\mu s (T_{vj} = 150^{\circ}C), T_{vj} = 25^{\circ}C$		9.85		mJ
		$V_R = 600V, T_{vj} = 125^{\circ}C$		16.85		
		$V_{GE} = -15V, T_{vj} = 150^{\circ}C$		18.35		
Reverse Recovery Time	T <sub>rr</sub>	$I_F = 200A, -di_F/dt = 4000A/\mu s, V_R = 600V, V_{GE} = -15V, T_{vj} = 25^{\circ}C$		158		ns
Thermal resistance, junction to case	R <sub>thJC</sub>	per diode			0.2	$^{\circ}C/W$
Thermal resistance, case to heatsink	R <sub>thCH</sub>	per diode		0.05		$^{\circ}C/W$
Temperature under switching conditions	T <sub>vj op</sub>		-40		150	$^{\circ}C$

### ■ Module Ratings & Characteristics

Characteristics	Symbol	Test Conditions	Value	Unit
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al <sub>2</sub> O <sub>3</sub>	
Creepage distance		terminal to heatsink	29	mm
		terminal to terminal	23	
Clearance		terminal to heatsink	23	mm
		terminal to terminal	11	
Comperative tracking index	CTI		>400	



Typical Characteristics

Preliminary Data

Fig.1 Output characteristic IGBT, Inverter (typical)

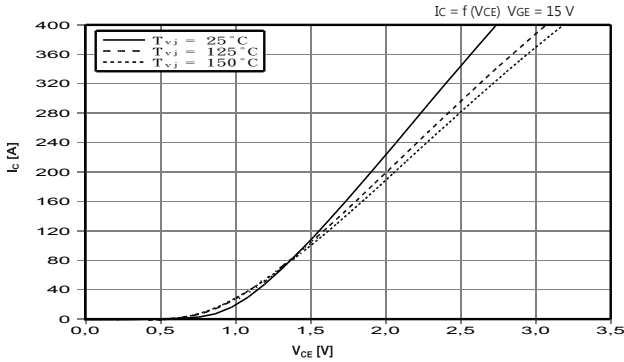


Fig.2 Output characteristic IGBT, Inverter (typical)

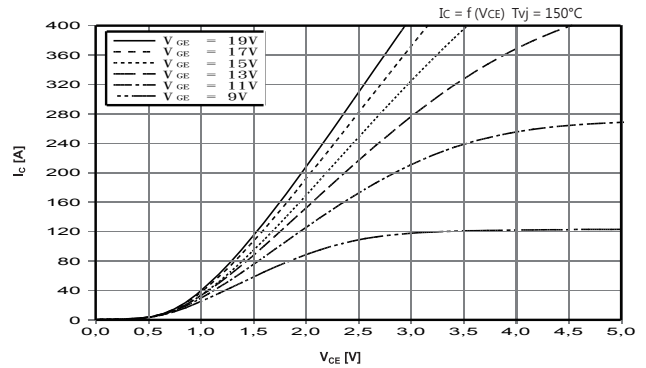


Fig.3 Transfer characteristic IGBT, Inverter (typical)

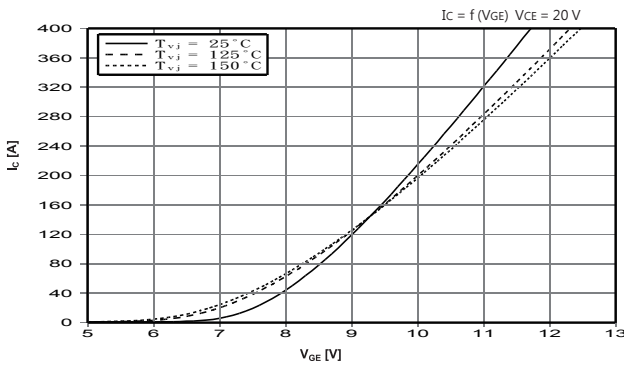


Fig.4 Switching losses IGBT, Inverter (typical)

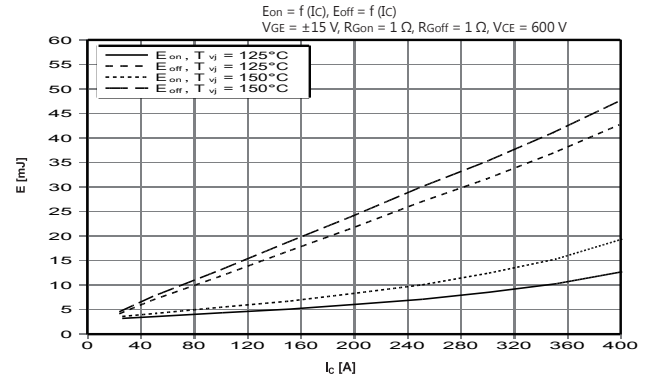


Fig.5 Switching losses IGBT, Inverter (typical)

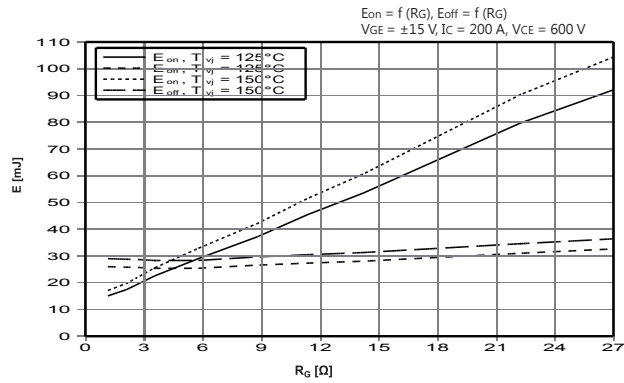


Fig.6 Transient thermal impedance IGBT, Inverter

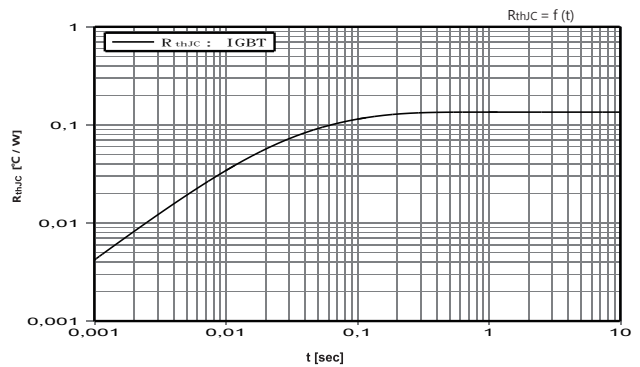


Fig.7 Reverse bias safe operating area IGBT, Inverter (RBSOA)

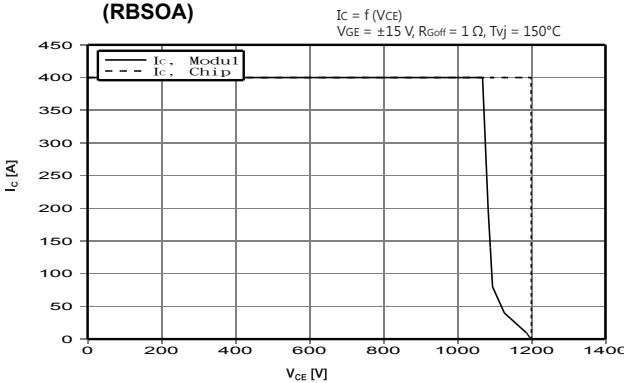
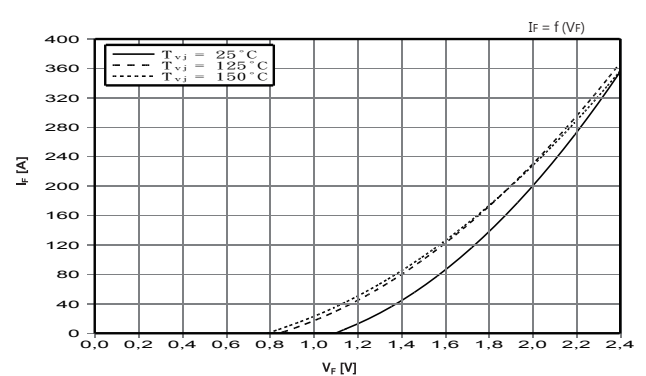


Fig.8 Forward characteristic of Diode, Inverter (typical)





Typical Characteristics

Preliminary Data

Fig.9 Switching losses Diode, Inverter (typical)

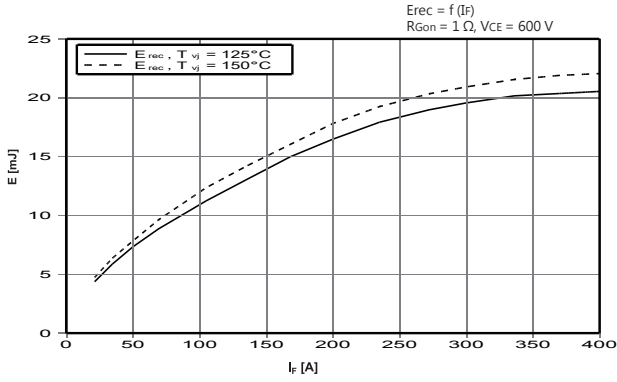


Fig.10 Switching losses Diode, Inverter (typical)

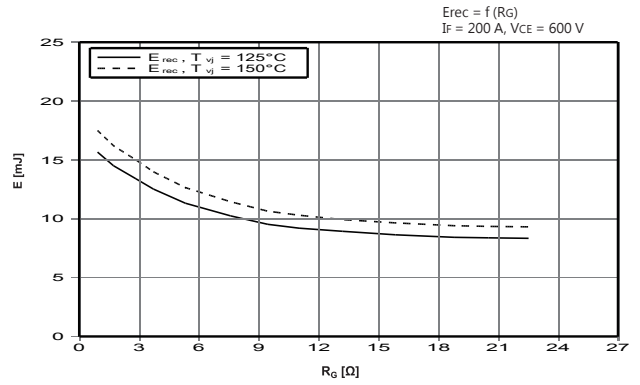
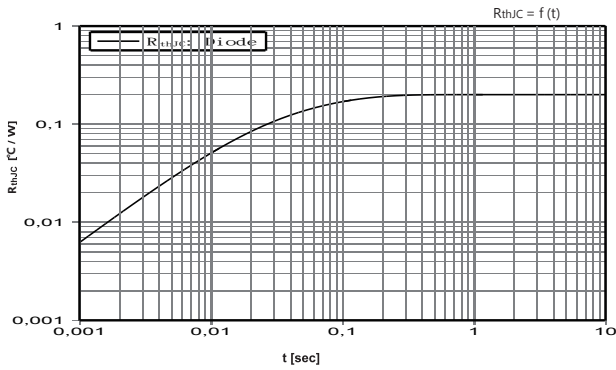


Fig.11 Transient thermal impedance Diode, Inverter





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