



# IGBT Power Module 1200V/75A

Preliminary

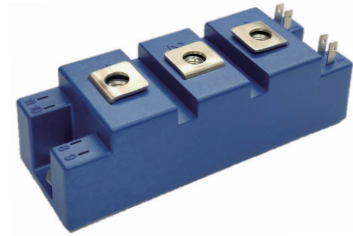
## Features

- ◆ 34mm Fast Switching IGBT Trench Technology
- ◆ Low Switching Loss
- ◆ Super Fast Diodes
- ◆ High Short Circuit Capability

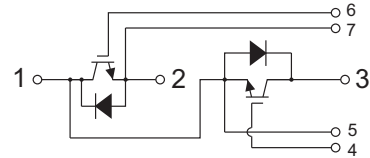
## Applications

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

HD-9434



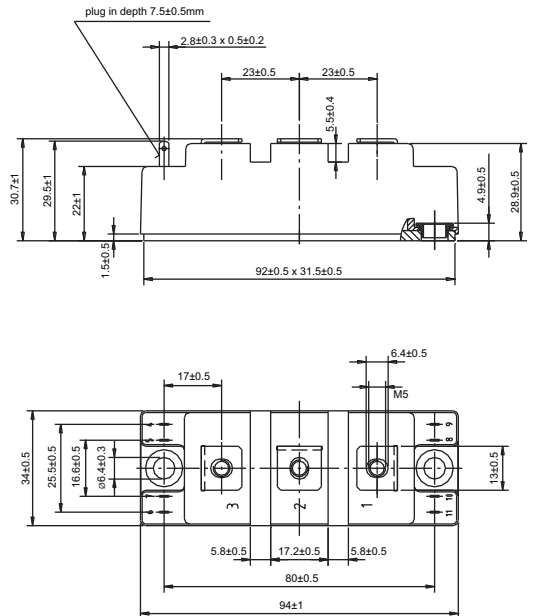
Circuit Diagram Headline



## Maximum Ratings (T<sub>c</sub>=25°C)

Item	Symbol	Rated Value	Unit
Collector-Emitter Voltage	V <sub>CES</sub>	1200	V
Gate-Emitter Peak Voltage	V <sub>GES</sub>	±20	V
DC-Collector Current	T <sub>c</sub> = 100°C I <sub>C,nom.</sub>	75	A
Repetitive Peak Collector Current	t <sub>p</sub> = 1ms I <sub>CRM</sub>	150	A
Total Power Dissipation	P <sub>tot</sub>	395	W
Isolation Voltage	RMS, f=50Hz, t=1min V <sub>iso</sub>	3000	V
DC Forward Current	I <sub>F</sub>	75	A
Repetitive Peak Forward Current	t <sub>p</sub> = 1ms I <sub>FRM</sub>	150	A
Temperature under switching conditions	T <sub>vj op</sub>	-40~+150	°C
Storage Temperature Range	T <sub>stg</sub>	-40~+125	°C
Mounting Torque	Module Base to Heatsink	3~5	N.m
	Busbar to Terminal	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	$V_{CE\ sat}$	$I_C = 75A, V_{GE} = 15V$ $T_{vj} = 25^\circ C$		1.9	2.35	V
		$I_C = 75A, V_{GE} = 15V$ $T_{vj} = 125^\circ C$		2.2		
		$I_C = 75A, V_{GE} = 15V$ $T_{vj} = 150^\circ C$		2.3		
Gate threshold voltage	$V_{GEth}$	$I_C = 2.4mA, V_{CE} = V_{GE}, T_{vj} = 25^\circ C$	5.2	5.8	6.4	V
Gate charge	$Q_G$	$V_{GE} = -15V \dots +15V$		1		$\mu C$
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25^\circ C$		1.3		$\Omega$
Input capacitance	$C_{ies}$	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		14		nF
Output Capacitance	$C_{oes}$	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		0.55		nF
Reverse transfer capacitance	$C_{res}$	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		0.33		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 1200V, V_{GE} = 0V, T_{vj} = 25^\circ C$			1	mA
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25^\circ C$			100	nA
Turn-on delay time, inductive load	$t_{d\ on}$	$I_C = 75A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.12		$\mu s$
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.14		
		$R_{Gon} = 2.2\Omega$ $T_{vj} = 150^\circ C$		0.14		
Rise time, inductive load	$t_r$	$I_C = 75A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.02		$\mu s$
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.03		
		$R_{Gon} = 2.2\Omega$ $T_{vj} = 150^\circ C$		0.035		
Turn-off delay time, inductive load	$t_{d\ off}$	$I_C = 75A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.2		$\mu s$
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.28		
		$R_{Goff} = 2.2\Omega$ $T_{vj} = 150^\circ C$		0.3		
Fall time, inductive load	$t_f$	$I_C = 75A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.08		$\mu s$
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.115		
		$R_{Goff} = 2.2\Omega$ $T_{vj} = 150^\circ C$		0.125		
Turn-on energy loss per pulse	$E_{on}$	$I_C = 75A, V_{CE} = 600V, L_S = 30nH$ $T_{vj} = 25^\circ C$		1.09		mJ
		$V_{GE} = \pm 15V, di/dt = 1900A/\mu s (T_{vj} = 150^\circ C)$ $T_{vj} = 125^\circ C$		4.59		
		$R_{Gon} = 2.2\Omega$ $T_{vj} = 150^\circ C$		5.59		
Turn-off energy loss per pulse	$E_{off}$	$I_C = 75A, V_{CE} = 600V, L_S = 30nH$ $T_{vj} = 25^\circ C$		3.55		mJ
		$V_{GE} = \pm 15V, du/dt = 3700V/\mu s (T_{vj} = 150^\circ C)$ $T_{vj} = 125^\circ C$		6.05		
		$R_{Goff} = 2.2\Omega$ $T_{vj} = 150^\circ C$		6.55		
SC data	$I_{sc}$	$V_{GE} \leq 15V, V_{CC} = 800V$ $V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$ $t_p \leq 10\mu s,$ $T_{vj} = 150^\circ C$		270		A
Thermal resistance, junction to case	$R_{thJC}$	per IGBT			0.38	$^\circ C/W$
Thermal resistance, case to heatsink	$R_{thCH}$	per IGBT		0.083		$^\circ C/W$



■ **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	$I_F$		75	A
Repetitive peak forward current	$I_{FRM}$	$t_p = 1ms$	150	A
Pft - value	$Pft$	$V_R = 0V, t_p = 10ms, T_{vj} = 125^{\circ}C$	1200	A <sup>2</sup> s
		$V_R = 0V, t_p = 10ms, T_{vj} = 150^{\circ}C$	1100	

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Forward voltage	$V_F$	$I_F = 75A, V_{GE} = 0V$ $T_{vj} = 25^{\circ}C$		1.9	2.35	V
		$I_F = 75A, V_{GE} = 0V$ $T_{vj} = 125^{\circ}C$		1.85		
		$I_F = 75A, V_{GE} = 0V$ $T_{vj} = 150^{\circ}C$		1.85		
Peak reverse recovery current	$I_{RM}$	$I_F = 75A, -di_F/dt = 1900A/\mu s (T_{vj} = 150^{\circ}C)$ $T_{vj} = 25^{\circ}C$		94		A
		$V_R = 600V$ $T_{vj} = 125^{\circ}C$		99		
		$V_{GE} = -15V$ $T_{vj} = 150^{\circ}C$		104		
Recovered charge	$Q_r$	$I_F = 75A, -di_F/dt = 1900A/\mu s (T_{vj} = 150^{\circ}C)$ $T_{vj} = 25^{\circ}C$		6.7		$\mu C$
		$V_R = 600V$ $T_{vj} = 125^{\circ}C$		12.2		
		$V_{GE} = -15V$ $T_{vj} = 150^{\circ}C$		14.2		
Reverse recovery energy	Erec	$I_F = 75A, -di_F/dt = 1900A/\mu s (T_{vj} = 150^{\circ}C)$ $T_{vj} = 25^{\circ}C$		4.4		mJ
		$V_R = 600V$ $T_{vj} = 125^{\circ}C$		5.9		
		$V_{GE} = -15V$ $T_{vj} = 150^{\circ}C$		6.4		
Reverse Recovery Time	$T_{rr}$	$I_F = 75A, -di_F/dt = 1900A/\mu s, V_R = 600V, V_{GE} = -15V, T_{vj} = 25^{\circ}C$		95		ns
Thermal resistance, junction to case	$R_{thJC}$	per diode			0.58	$^{\circ}C/W$
Thermal resistance, case to heatsink	$R_{thCH}$	per diode		0.125		$^{\circ}C/W$
Temperature under switching conditions	$T_{vj op}$		-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)	$Al_2O_3$	
Creepage distance		terminal to heatsink	17	mm
		terminal to terminal	20	
Clearance		terminal to heatsink	17	mm
		terminal to terminal	9.5	
Comperative tracking index	CTI		>200	



Typical Characteristics

Preliminary Data

Fig.1 Output characteristic IGBT, Inverter (typical)

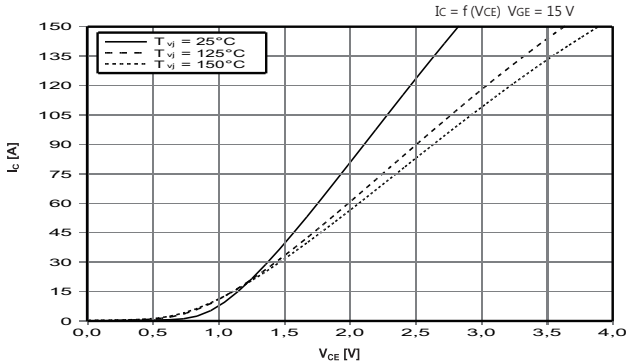


Fig.2 Output characteristic IGBT, Inverter (typical)

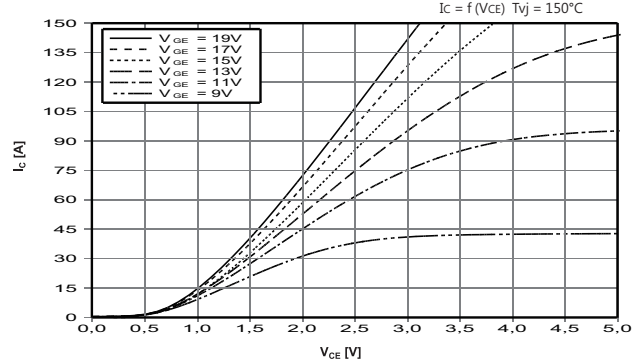


Fig.3 Transfer characteristic IGBT, Inverter (typical)

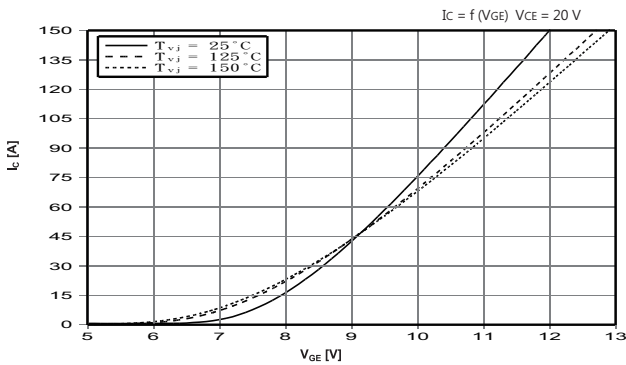


Fig.4 Switching losses IGBT, Inverter (typical)

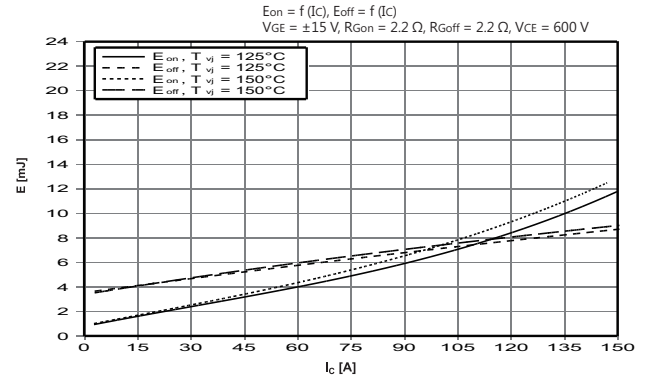


Fig.5 Switching losses IGBT, Inverter (typical)

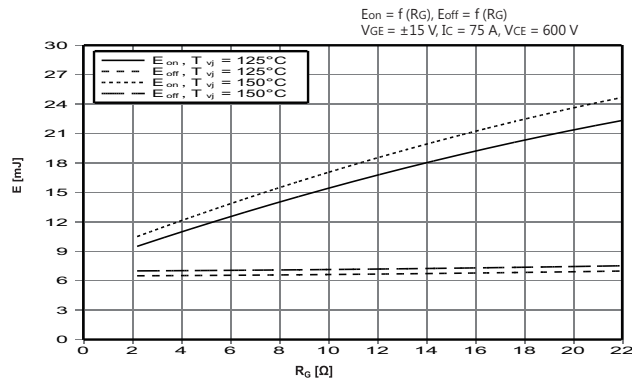


Fig.6 Transient thermal impedance IGBT, Inverter

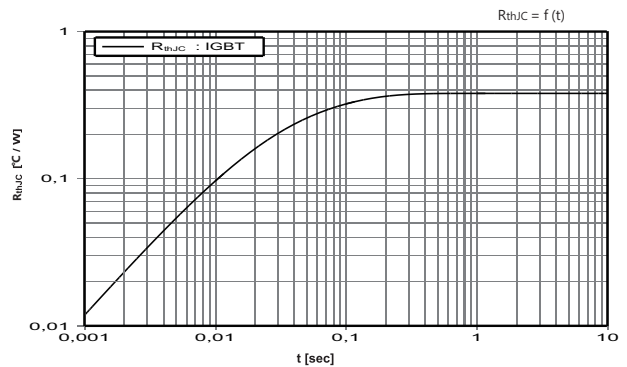


Fig.7 Reverse bias safe operating area IGBT, Inverter (RBSOA)

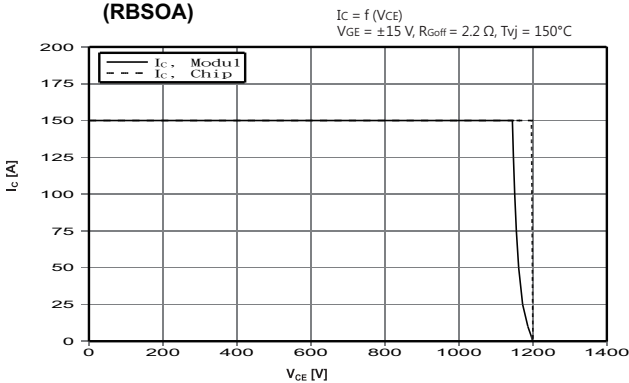
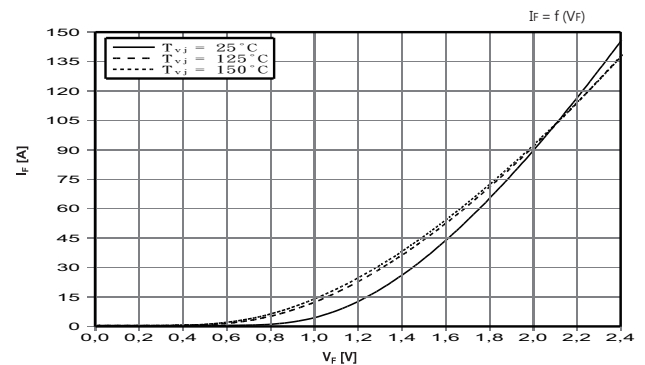


Fig.8 Forward characteristic of Diode, Inverter (typical)





Typical Characteristics

Preliminary Data

Fig.9 Switching losses Diode, Inverter (typical)

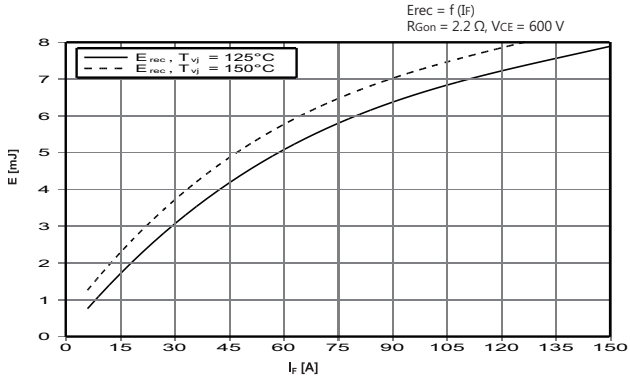


Fig.10 Switching losses Diode, Inverter (typical)

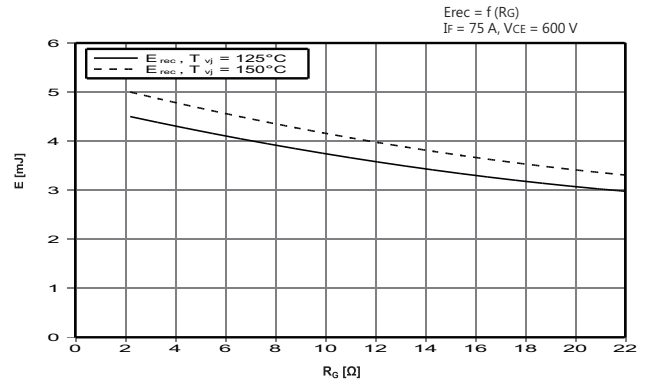
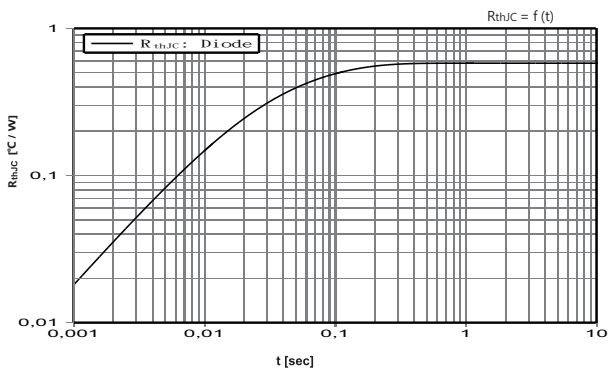


Fig.11 Transient thermal impedance Diode, Inverter





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