



# IGBT Power Module 600V/200A

Preliminary

## Features

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

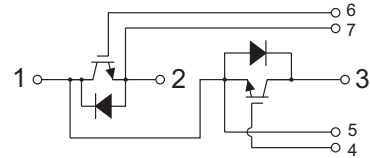
## Applications

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

HD-9434



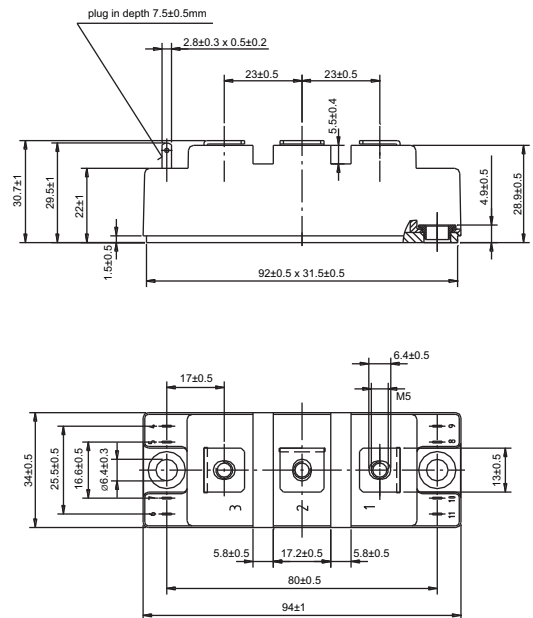
Circuit Diagram Headline



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

Item	Symbol	Rated Value	Unit
Collector-Emitter Voltage	V <sub>CES</sub>	600	V
Gate-Emitter Voltage	V <sub>GES</sub>	±20	V
DC-Collector Current	T <sub>c</sub> = 70°C I <sub>C,nom.</sub>	200	A
Repetitive Peak Collector Current	t <sub>p</sub> = 1ms I <sub>CRM</sub>	400	A
Total Power Dissipation	P <sub>tot</sub>	730	W
Isolation Voltage	RMS, f=50Hz, t=1min V <sub>iso</sub>	3000	V
DC Forward Current	I <sub>F</sub>	200	A
Repetitive Peak Forward Current	t <sub>p</sub> = 1ms I <sub>FRM</sub>	400	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	$V_{CE\ sat}$	$I_C = 200A, V_{GE} = 15V$ $T_{vj} = 25^\circ C$		1.95	2.45	V
		$I_C = 200A, V_{GE} = 15V$ $T_{vj} = 125^\circ C$		2.2		
Gate threshold voltage	$V_{GEth}$	$I_C = 4mA, V_{CE} = V_{GE}, T_{vj} = 25^\circ C$	4.5	5.5	6.5	V
Gate charge	$Q_G$	$V_{GE} = -15V \dots +15V$		1.22		$\mu C$
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25^\circ C$		2.3		$\Omega$
Input capacitance	$C_{ies}$	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		20		nF
Output capacitance	$C_{oes}$	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		1.318		nF
Reverse transfer capacitance	$C_{res}$	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		0.75		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 600V, V_{GE} = 0V, T_{vj} = 25^\circ C$		1	500	$\mu A$
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	$t_{d\ on}$	$I_C = 200A, V_{CE} = 300V$ $T_{vj} = 25^\circ C$		193		ns
		$V_{GE} = \pm 15V, R_{Gon} = 3\Omega$ $T_{vj} = 125^\circ C$		210		
Rise time, inductive load	$t_r$	$I_C = 200A, V_{CE} = 300V$ $T_{vj} = 25^\circ C$		170		ns
		$V_{GE} = \pm 15V, R_{Gon} = 3\Omega$ $T_{vj} = 125^\circ C$		176		
Turn-off delay time, inductive load	$t_{d\ off}$	$I_C = 200A, V_{CE} = 300V$ $T_{vj} = 25^\circ C$		265		ns
		$V_{GE} = \pm 15V, R_{Goff} = 3\Omega$ $T_{vj} = 125^\circ C$		297		
Fall time, inductive load	$t_f$	$I_C = 200A, V_{CE} = 300V$ $T_{vj} = 25^\circ C$		105		ns
		$V_{GE} = \pm 15V, R_{Goff} = 3\Omega$ $T_{vj} = 125^\circ C$		113		
Turn-on energy loss per pulse	$E_{on}$	$I_C = 200A, V_{CE} = 300V, L_S = 15nH$ $T_{vj} = 125^\circ C$ $V_{GE} = 15V, R_{Gon} = 3\Omega$		2.36		mJ
Turn-off energy loss per pulse	$E_{off}$	$I_C = 200A, V_{CE} = 300V, L_S = 15nH$ $T_{vj} = 125^\circ C$ $V_{GE} = 15V, R_{Goff} = 3\Omega$		13.4		mJ
SC data	$I_{SC}$	$V_{GE} \leq 15V, V_{CC} = 360V$ $t_p \leq 10\mu s,$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ $T_{vj} \leq 125^\circ C$		900		A
Thermal resistance, junction to case	$R_{thJC}$	per IGBT			0.17	$^\circ C/W$
Thermal resistance, case to heatsink	$R_{thCH}$	per IGBT		0.08		$^\circ C/W$
External gate resistance	$R_{Gext}$	$T_{vj} = 25^\circ C$	3.3		20	$\Omega$



■ **Diode Ratings & Characteristics**

Characteristics	Symbol	Test Conditions	Value	Unit
Repetitive peak reverse voltage	$V_{RRM}$	$T_{vj} = 25^{\circ}C$	600	V
Continuous DC forward current	$I_F$		200	A
Repetitive peak forward current	$I_{FRM}$	$t_p = 1ms$	400	A
$I^2t$ - value	$I^2t$	$V_R = 0V, t_p = 10ms, T_{vj} = 125^{\circ}C$	4050	A <sup>2</sup> s

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Forward voltage	$V_F$	$I_F = 200A, V_{GE} = 0V$ $T_{vj} = 25^{\circ}C$		1.9	2.5	V
		$I_F = 200A, V_{GE} = 0V$ $T_{vj} = 125^{\circ}C$		1.85		
Peak reverse recovery current	$I_{RM}$	$I_F = 200A, R_G = 3\Omega$ $T_{vj} = 25^{\circ}C$		41		A
		$V_R = 300V, V_{GE} = -15V$ $T_{vj} = 125^{\circ}C$		75		
Recovered charge	$Q_r$	$I_F = 200A, R_G = 3\Omega$ $T_{vj} = 25^{\circ}C$		3.16		$\mu C$
		$V_R = 300V, V_{GE} = -15V$ $T_{vj} = 125^{\circ}C$		10.76		
Reverse recovery energy	Erec	$I_F = 200A, R_G = 3\Omega$ $T_{vj} = 25^{\circ}C$		1.07		mJ
		$V_R = 300V, V_{GE} = -15V$ $T_{vj} = 125^{\circ}C$		-		
Reverse Recovery Time	$T_{rr}$	$I_F = 200A, R_G = 3\Omega, V_R = 300V, V_{GE} = -15V, T_{vj} = 25^{\circ}C$		132		ns
Thermal resistance, junction to case	$R_{thJC}$	per diode			0.29	$^{\circ}C/W$
Thermal resistance, case to heatsink	$R_{thCH}$	per diode		0.13		$^{\circ}C/W$
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 (Typical)

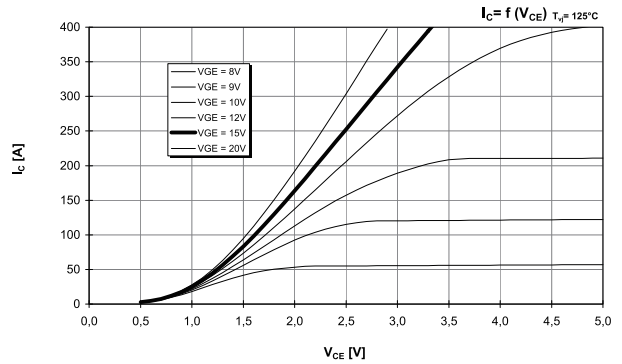
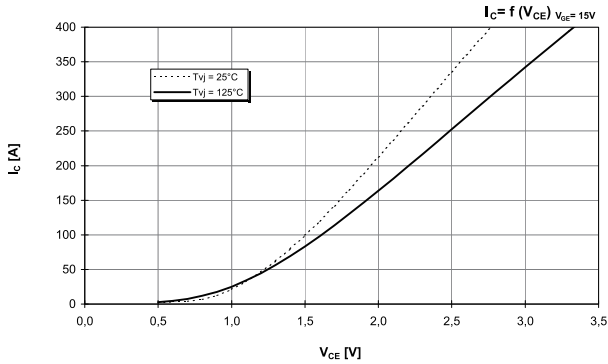


Fig.2 Transfer characteristic (Typical)

Fig.3 Forward characteristic of inverse diode (typical)

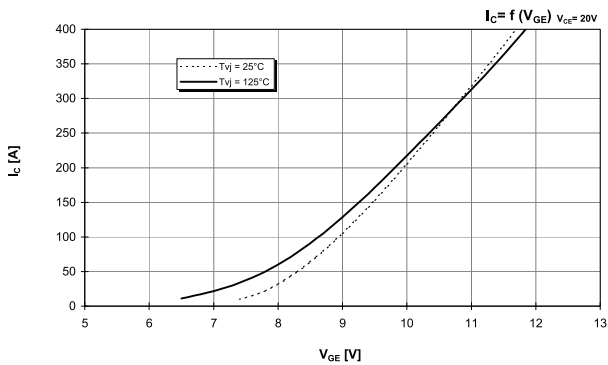


Fig.4 Switching losses (Typical)

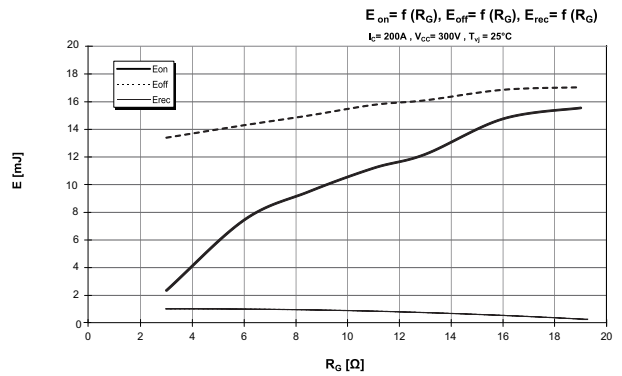
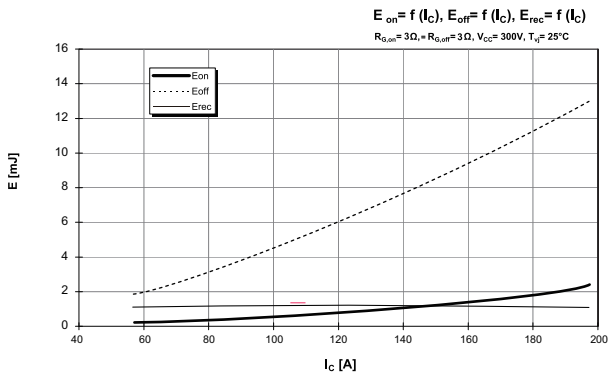
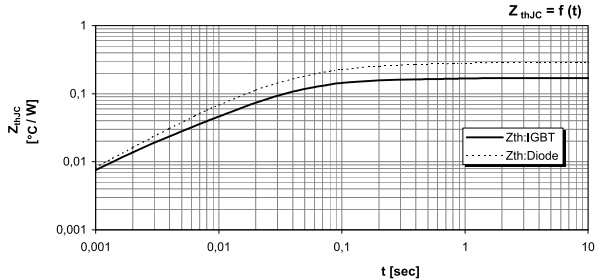


Fig.5 Transient thermal impedance

Fig.6 Reverse bias safe operation area (RBSOA)





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