

IGBT Power Module

1200V / 300A

Preliminary

Features

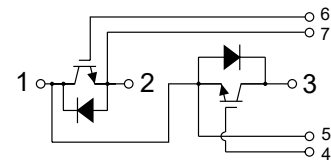
- ◆ 62mm Fast Switching / Trench Field Stop IGBT Technology
- ◆ Low Switching Losses
- ◆ Super Fast Diodes
- ◆ High Short Circuit Capability

Applications

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



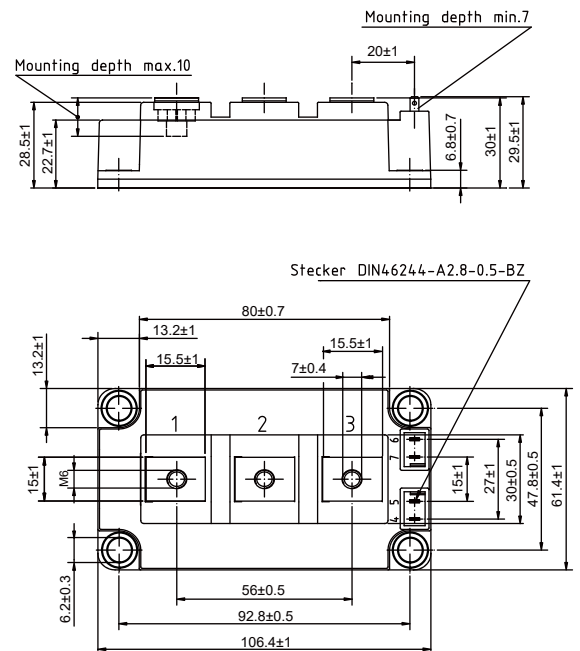
Circuit Diagram Headline



Maximum Ratings (T_c=25°C)

Item	Symbol	Rated Value	Unit
Collector-Emitter Voltage	T _{VJ} = 25°C V _{CES}	1200	V
Gate-Emitter Peak Voltage	V _{GES}	±20	V
Continuous DC Collector Current	T _c = 80°C T _c = 25°C I _{C,nom.} I _C	300 450	A
Repetitive Peak Collector Current	t _p = 1ms I _{CRM}	600	A
Total Power Dissipation	P _{tot}	1600	W
Isolation Voltage	RMS, f=50Hz, t=1min V _{iso}	2500	V
Temperature Under Switching Conditions	T _{VJ op}	-40~+150	°C
Storage Temperature	T _{stg}	-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	$V_{CE\ sat}$	$I_C = 300A, V_{GE} = 15V$ $T_{vj} = 25^\circ C$		1.90	2.15	V
		$I_C = 300A, V_{GE} = 15V$ $T_{vj} = 125^\circ C$		2.00		
		$I_C = 300A, V_{GE} = 15V$ $T_{vj} = 150^\circ C$		2.05		
Gate threshold voltage	V_{GEth}	$I_C = 11.5mA, V_{CE} = V_{GE}, T_{vj} = 25^\circ C$	5.2	5.8	6.4	V
Gate charge	Q_G	$V_{GE} = -15V \dots +15V$		3.6		μC
Input capacitance	C_{ies}	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		52		nF
Output capacitance	C_{oes}	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		1.3		nF
Reverse transfer capacitance	C_{res}	$f = 1MHz, T_{vj} = 25^\circ C, V_{CE} = 25V, V_{GE} = 0V$		0.7		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	$t_{d\ on}$	$I_C = 300A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.24		μs
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.31		
		$R_{Gon} = 1.3\Omega$ $T_{vj} = 150^\circ C$		0.32		
Rise time, inductive load	t_r	$I_C = 300A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.08		μs
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.075		
		$R_{Gon} = 1.3\Omega$ $T_{vj} = 150^\circ C$		0.08		
Turn-off delay time, inductive load	$t_{d\ off}$	$I_C = 300A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.40		μs
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.43		
		$R_{Goff} = 1.3\Omega$ $T_{vj} = 150^\circ C$		0.45		
Fall time, inductive load	t_f	$I_C = 300A, V_{CE} = 600V$ $T_{vj} = 25^\circ C$		0.08		μs
		$V_{GE} = \pm 15V$ $T_{vj} = 125^\circ C$		0.13		
		$R_{Goff} = 1.3\Omega$ $T_{vj} = 150^\circ C$		0.15		
Turn-on energy loss per pulse	E_{on}	$I_C = 300A, V_{CE} = 600V, L_S = 30nH$ $T_{vj} = 25^\circ C$		14.5		mJ
		$V_{GE} = \pm 15V, di/dt = 6000A/\mu s (T_{vj} = 150^\circ C)$ $T_{vj} = 125^\circ C$		23.0		
		$R_{Gon} = 1.3\Omega$ $T_{vj} = 150^\circ C$		28.0		
Turn-off energy loss per pulse	E_{off}	$I_C = 300A, V_{CE} = 600V, L_S = 30nH$ $T_{vj} = 25^\circ C$		24.5		mJ
		$V_{GE} = \pm 15V, du/dt = 4500V/\mu s (T_{vj} = 150^\circ C)$ $T_{vj} = 125^\circ C$		34.5		
		$R_{Goff} = 1.3\Omega$ $T_{vj} = 150^\circ C$		37.5		
SC data	I_{SC}	$V_{GE} \leq 15V, V_{CC} = 900V$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ $T_{vj} = 125^\circ C$		$t_p \leq 10\mu s$ 1200		A
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.093	$^\circ C/W$
Thermal resistance, case to heatsink	R_{thCH}	per IGBT			0.032	$^\circ C/W$

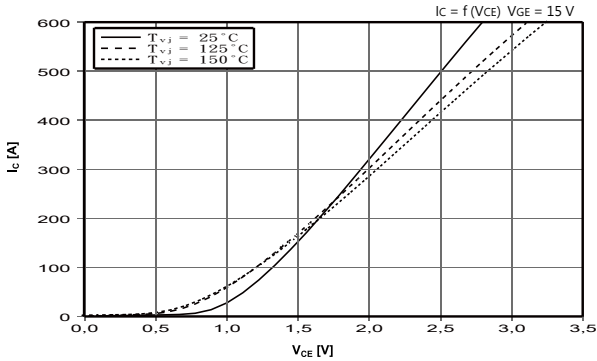
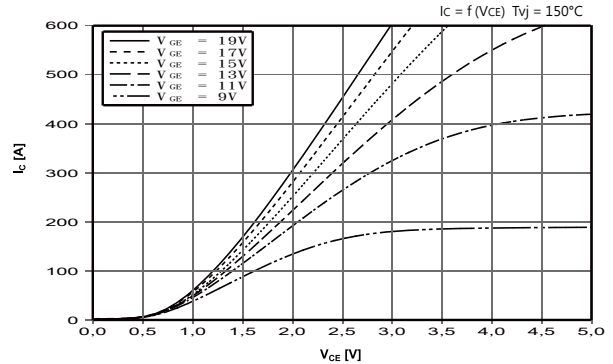
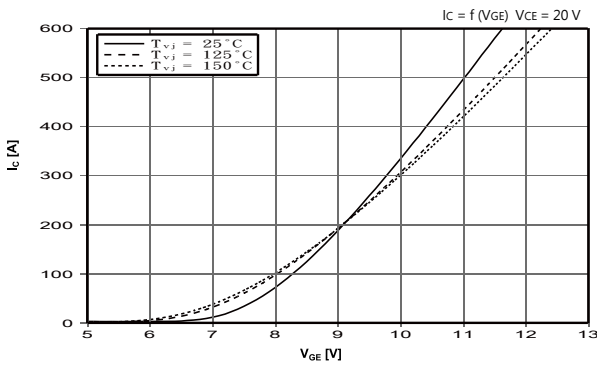
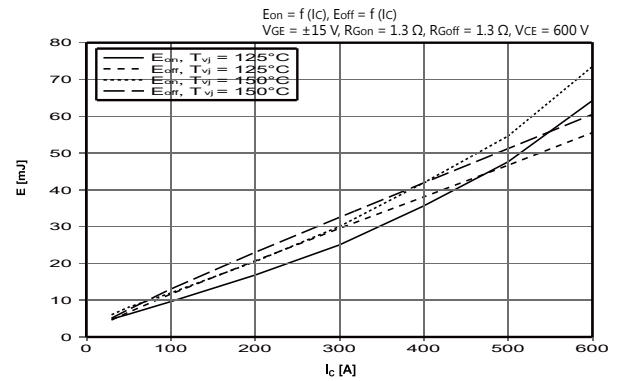
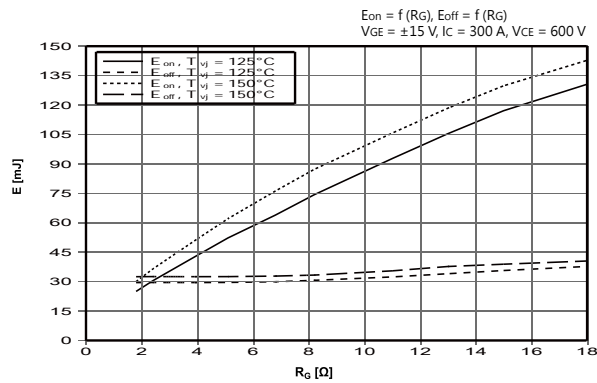
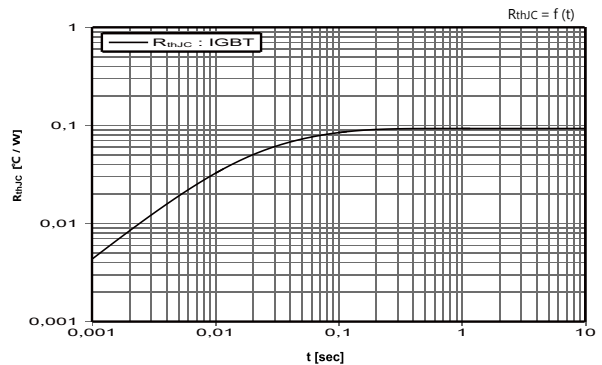
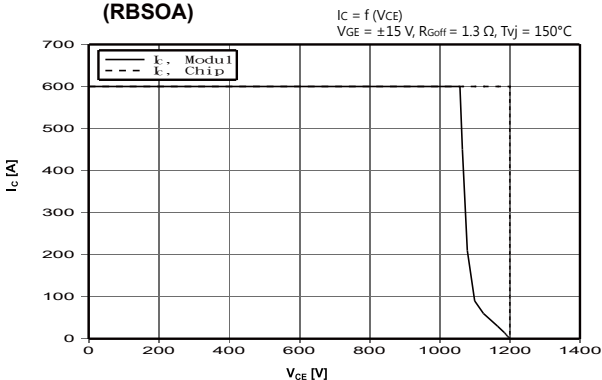
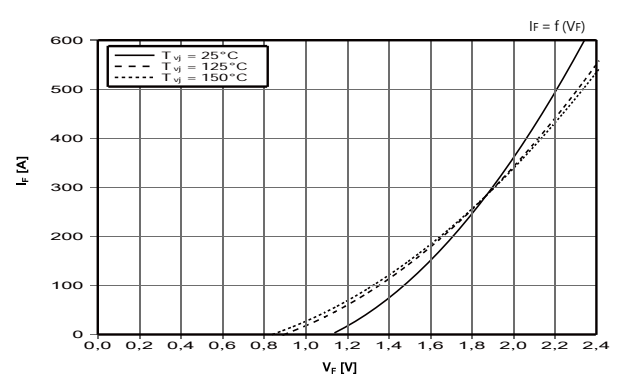
■ Diode Ratings & Characteristics

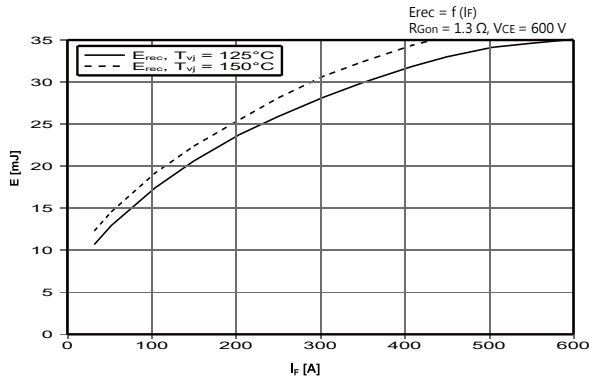
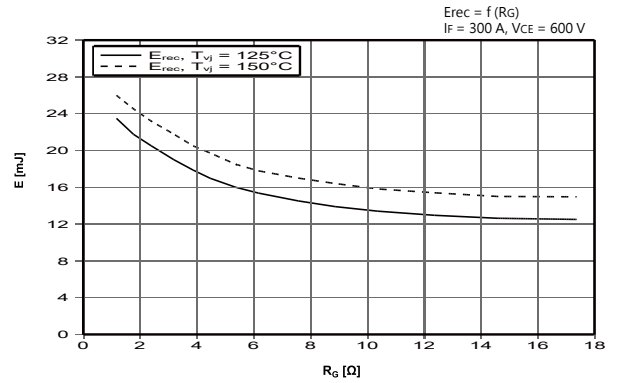
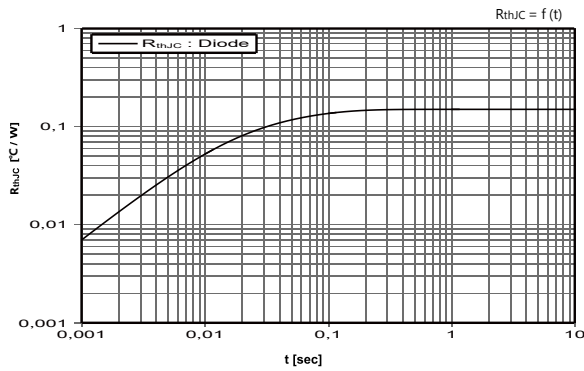
Characteristics	Symbol	Test Conditions	Value	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = 25^{\circ}\text{C}$	1200	V
Continuous DC forward current	I_F		300	A
Repetitive peak forward current	I_{FRM}	$t_p = 1\text{ms}$	600	A
I^2t - value	I^2t	$V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125^{\circ}\text{C}$	19000	A ² s
		$V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 150^{\circ}\text{C}$	18000	

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Forward voltage	V_F	$I_F = 300\text{A}, V_{GE} = 0\text{V}$ $T_{vj} = 25^{\circ}\text{C}$		1.9	2.35	V
		$I_F = 300\text{A}, V_{GE} = 0\text{V}$ $T_{vj} = 125^{\circ}\text{C}$		1.9		
		$I_F = 300\text{A}, V_{GE} = 0\text{V}$ $T_{vj} = 150^{\circ}\text{C}$		1.9		
Peak reverse recovery current	I_{RM}	$I_F = 300\text{A}, -di_F/dt = 6000\text{A}/\mu\text{s}$ ($T_{vj} = 150^{\circ}\text{C}$) $T_{vj} = 25^{\circ}\text{C}$		164		A
		$V_R = 600\text{V}$ $T_{vj} = 125^{\circ}\text{C}$		228		
		$V_{GE} = -15\text{V}$ $T_{vj} = 150^{\circ}\text{C}$		238		
Recovered charge	Q_r	$I_F = 300\text{A}, -di_F/dt = 6000\text{A}/\mu\text{s}$ ($T_{vj} = 150^{\circ}\text{C}$) $T_{vj} = 25^{\circ}\text{C}$		25		μC
		$V_R = 600\text{V}$ $T_{vj} = 125^{\circ}\text{C}$		42		
		$V_{GE} = -15\text{V}$ $T_{vj} = 150^{\circ}\text{C}$		61		
Reverse recovery energy	E_{rec}	$I_F = 300\text{A}, -di_F/dt = 6000\text{A}/\mu\text{s}$ ($T_{vj} = 150^{\circ}\text{C}$) $T_{vj} = 25^{\circ}\text{C}$		14.8		mJ
		$V_R = 600\text{V}$ $T_{vj} = 125^{\circ}\text{C}$		28		
		$V_{GE} = -15\text{V}$ $T_{vj} = 150^{\circ}\text{C}$		30.5		
Reverse Recovery Time	T_{rr}	$I_F = 300\text{A}, -di_F/dt = 6000\text{A}/\mu\text{s}, V_R = 600\text{V}, V_{GE} = -15\text{V}, T_{vj} = 25^{\circ}\text{C}$		246		ns
Thermal resistance, junction to case	R_{thJC}	per diode			0.15	$^{\circ}\text{C}/\text{W}$
Thermal resistance, case to heatsink	R_{thCH}	per diode		0.052		$^{\circ}\text{C}/\text{W}$
Temperature under switching conditions	$T_{vj\ ep}$		-40		150	$^{\circ}\text{C}$

■ 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	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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