2 IGBT,Inverter

2.1 Maximum Rated Values

Parameter	Conditions	Symbol	Value	Unit
Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	700	V
Continuous DC collector current	T_C = 75°C, $T_{vj\,max}$ = 175°C	$I_{C\,nom}$	400	A
Repetitive peak collector current	t_P = 1 ms	I_{CRM}	800	A
Total power dissipation	T_C = 25°C, $T_{vj\,max}$ = 175°C	P_{tot}	1500	W
Gate-emitter peak voltage		V_{GES}	+/-20	V

2.2 Characteristic Values

				min.	typ.	max.	
Collector-emitter saturation voltage	I_C = 400 A, V_{GE} = 15 V I_C = 400 A, V_{GE} = 15 V I_C = 400 A, V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$V_{CE\,sat}$		1.65 1.90 2.00	2.30	V
Gate threshold voltage	I_C = 4.85 mA, V_{CE} = V_{GE}	T_{vj} = 25°C	V_{GEth}	5.00	5.80	6.50	V
Gate charge	V_{GE} = -15 V ... 15 V		Q_G		2.90		µC
Internal gate resistor		T_{vj} = 25°C	R_{Gint}		0.0		Ω
Input capacitance	f = 1 MHz, V_{CE} = 25 V, V_{GE} = 0 V	T_{vj} = 25°C	C_{ies}		18.0		nF
Reverse transfer capacitance	f = 1 MHz, V_{CE} = 25 V, V_{GE} = 0 V	T_{vj} = 25°C	C_{res}		0.50		nF
Collector-emitter cut-off current	V_{CE} = 450 V, V_{GE} = 0 V	T_{vj} = 25°C	I_{CES}			0.1	mA
Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = 20 V	T_{vj} = 25°C	I_{GES}			400	nA
Turn-on delay time, inductive load	I_C = 400 A, V_{CE} = 300 V V_{GE} = -8/+15 V R_{Gon} = 3.6 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,on}$		0.06 0.06 0.06		µs
Rise time, inductive load	I_C = 400 A, V_{CE} = 300 V V_{GE} = -8/+15 V R_{Gon} = 3.6 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_r		0.08 0.08 0.08		µs
Turn-off delay time, inductive load	I_C = 400 A, V_{CE} = 300 V V_{GE} = -8/+15 V R_{Goff} = 3.6 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,off}$		0.43 0.44 0.48		µs
Fall time, inductive load	I_C = 400 A, V_{CE} = 300 V V_{GE} = -8/+15 V R_{Goff} = 3.6 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		0.04 0.04 0.05		µs
Turn-on energy loss per pulse	I_C = 400 A, V_{CE} = 300 V, L_S = 25 nH V_{GE} = -8/+15 V R_{Gon} = 3.6 Ω di/dt = 5.1 kA/µs (Tvj = 150°C)	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		5.70 7.40 7.90		mJ
Turn-off energy loss per pulse	I_C = 400 A, V_{CE} = 300 V, L_S = 25 nH V_{GE} = -8/+15 V R_{Goff} = 3.6 Ω du/dt = 3.0 kV/µs (Tvj = 150°C)	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		14.5 16.5 18.0		mJ
SC data	$V_{GE} \leq$ 15 V, V_{CC} = 360 V $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_P \leq$ 6 µs, T_{vj} = 150°C	I_{SC}		1900		A
Thermal resistance, junction to case	per IGBT		R_{thJC}			0.100[1)]	K/W
Thermal resistance, case to heatsink	per IGBT λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K) Clamping Force F = 700N		R_{thCH}		0.140[1)]		K/W
Temperature under switching conditions	t_{op} continuous for 18s within a period of 600s, occurrence maximum 200 times over lifetime		$T_{vj\,op}$	-40 150		150 175	°C

[1)] with double sided cooling, evaluation according to HybridPack™ DSC application note

3 Diode, Inverter

3.1 Maximum Rated Values

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	700	V
Continuous DC forward current		I_F	400	A
Repetitive peak forward current	t_P = 1 ms	I_{FRM}	800	A
I^2t - value	V_R = 0 V, t_P = 10 ms, T_{vj} = 125°C	I^2t	9000	A^2s

3.2 Characteristic Values

			min.	typ.	max.	
Forward voltage	I_F = 400 A, V_{GE} = 0 V I_F = 400 A, V_{GE} = 0 V I_F = 400 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F		1.95 1.84 1.80	2.55	V
Peak reverse recovery current	I_F = 400 A, - di_F/dt = 5000 A/µs (T_{vj} = 150°C) V_R = 300 V V_{GE} = -8 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		135 210 220		A
Recovered charge	I_F = 400 A, - di_F/dt = 5000 A/µs (T_{vj} = 150°C) V_R = 300 V V_{GE} = -8 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		12.0 23.0 27.0		µC
Reverse recovery energy	I_F = 400 A, - di_F/dt = 5000 A/µs (T_{vj} = 150°C) V_R = 300 V V_{GE} = -8 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		2.80 5.80 6.60		mJ
Thermal resistance, junction to case	per diode		R_{thJC}			0.150[1]	K/W
Thermal resistance, case to heatsink	per diode λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K) Clamping Force F = 700N		R_{thCH}		0.200[1]		K/W
Temperature under switching conditions	t_{op} continuous for 18s within a period of 600s, occurrence maximum 200 times over lifetime		$T_{vj\,op}$	-40 150		150 175	°C

4 Module

Parameter	Conditions	Symbol	Value	Unit
Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}	2.5	kV
Material of module baseplate			Cu	
Internal isolation	basic insulation (class 1, IEC 61140)		Al_2O_3	
Creepage distance	terminal to heatsink terminal to terminal	d_{Creep}	3.5	mm
Clearance	terminal to heatsink terminal to terminal	d_{Clear}	3.5	mm
Comperative tracking index		CTI	> 600	

			min.	typ.	max.	
Stray inductance module		L_{sCE}		15		nH
Storage temperature		T_{stg}	-40		125	°C
Terminal connection torque	Screw M5	M		-		Nm
Mounting force per clamp		F		-	900	N
Weight		G		30		g

5 Temperature Sensor

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Forward voltage	I_{TS} = 1.00 mA, T_{vj} = 150°C I_{TS} = 1.00 mA, T_{vj} = 25°C	V_{TS}		2.120 2.910		V

[1] with double sided cooling, evaluation according to HybridPack™ DSC application note