2 IGBT,Inverter

2.1 Maximum Rated Values

Parameter	Conditions	Symbol	Value	Unit
Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	750	V
Implemented collector current		I_{CN}	650	A
Continuous DC collector current	T_F = 65°C, $T_{vj\,max}$ = 175°C	$I_{C\,nom}$	375[1]	A
Repetitive peak collector current	t_P = 1 ms	I_{CRM}	1300	A
Total power dissipation	T_F = 75°C, $T_{vj\,max}$ = 175°C	P_{tot}	488[1]	W
Gate-emitter peak voltage		V_{GES}	+/-20	V

2.2 Characteristic Values

			min.	typ.	max.	
Collector-emitter saturation voltage	I_C = 375 A, V_{GE} = 15 V I_C = 375 A, V_{GE} = 15 V I_C = 375 A, V_{GE} = 15 V I_C = 650 A, V_{GE} = 15 V I_C = 650 A, V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 150°C T_{vj} = 175°C T_{vj} = 25°C T_{vj} = 175°C	$V_{CE\,sat}$		1.10 1.15 1.15 1.30 1.45	1.35	V
Gate threshold voltage	I_C = 11.5 mA, V_{CE} = V_{GE}	T_{vj} = 25°C T_{vj} = 175°C	V_{GEth}	4.90	5.80 4,10	6.50	V
Gate charge	V_{GE} = -8 V ... 15 V, V_{CE} = 400V		Q_G		3.55		µC
Internal gate resistor		T_{vj} = 25°C	R_{Gint}		1.0		Ω
Input capacitance	f = 1 MHz, V_{CE} = 50 V, V_{GE} = 0 V	T_{vj} = 25°C	C_{ies}		65.0		nF
Output capacitance	f = 1 MHz, V_{CE} = 50 V, V_{GE} = 0 V	T_{vj} = 25°C	C_{oes}		0.83		nF
Reverse transfer capacitance	f = 1 MHz, V_{CE} = 50 V, V_{GE} = 0 V	T_{vj} = 25°C	C_{res}		0.25		nF
Collector-emitter cut-off current	V_{CE} = 750 V, V_{GE} = 0 V	T_{vj} = 25°C	I_{CES}			1.0	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 = 375 A, V_{CE} = 400 V V_{GE} = -8 V / +15 V R_{Gon} = 2.4 Ω	T_{vj} = 25°C T_{vj} = 150°C T_{vj} = 175°C	$t_{d\,on}$		0.30 0.32 0.33		µs
Rise time, inductive load	I_C = 375 A, V_{CE} = 400 V V_{GE} = -8 V / +15 V R_{Gon} = 2.4 Ω	T_{vj} = 25°C T_{vj} = 150°C T_{vj} = 175°C	t_r		0.07 0.08 0.08		µs
Turn-off delay time, inductive load	I_C = 375 A, V_{CE} = 400 V V_{GE} = -8 V / +15 V R_{Goff} = 5.1 Ω	T_{vj} = 25°C T_{vj} = 150°C T_{vj} = 175°C	$t_{d\,off}$		0.80 0.88 0.92		µs
Fall time, inductive load	I_C = 375 A, V_{CE} = 400 V V_{GE} = -8 V / +15 V R_{Goff} = 5.1 Ω	T_{vj} = 25°C T_{vj} = 150°C T_{vj} = 175°C	t_f		0.06 0.07 0.08		µs
Turn-on energy loss per pulse	I_C = 375 A, V_{CE} = 400 V, L_S = 20 nH V_{GE} = -8 V / +15 V R_{Gon} = 2.4 Ω di/dt (T_{vj} 25°C) = 7000 A/µs di/dt (T_{vj} 175°C) = 4000 A/µs	T_{vj} = 25°C T_{vj} = 150°C T_{vj} = 175°C	E_{on}		8.00 11.5 13.0		mJ
Turn-off energy loss per pulse	I_C = 375 A, V_{CE} = 400 V, L_S = 20 nH V_{GE} = -8 V / +15 V R_{Goff} = 5.1 Ω dv/dt (T_{vj} 25°C) = 3800 V/µs dv/dt (T_{vj} 175°C) = 3300 V/µs	T_{vj} = 25°C T_{vj} = 150°C T_{vj} = 175°C	E_{off}		18.0 23.5 24.5		mJ
SC data	$V_{GE} \le$ 15 V, V_{CC} = 400 V V_{CEmax} = V_{CES} -L_{sCE} ·di/dt	$t_P \le$ 6 µs, T_{vj} = 25°C $t_P \le$ 3 µs, T_{vj} = 175°C	I_{SC}		3900 3200		A
Thermal resistance, junction to cooling fluid	per IGBT; ΔV/Δt = 10 dm³/min, T_F = 75°C		R_{thJF}		0.170[2]	0.205[2]	K/W
Temperature under switching conditions	t_{op} continuous for 10s within a period of 30s, occurence maximum 3000 times over lifetime		$T_{vj\,op}$	-40 150		150[3] 175	°C

[1] Verified by characterization / design not by test.
[2] Cooler design and flow direction according to application note AN-HPDC6i-AN-HP1-DC6i-Assembly-Instructions. Cooling fluid 50% water / 50% ethylenglycol.
[3] For Tvjop > 150°C: Baseplate temperature has to be limited to 125°C.

3 Diode, Inverter

3.1 Maximum Rated Values

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	750	V
Implemented forward current		I_{FN}	650	A
Continuous DC forward current		I_F	375[1)]	A
Repetitive peak forward current	t_P = 1 ms	I_{FRM}	1300	A
I^2t - value	V_R = 0 V, t_P = 10 ms, T_{vj} = 150°C V_R = 0 V, t_P = 10 ms, T_{vj} = 175°C	I^2t	16500 14000	A^2s A^2s

3.2 Characteristic Values

			min.	typ.	max.	
Forward voltage	I_F = 375 A, V_{GE} = 0 V I_F = 375 A, V_{GE} = 0 V I_F = 375 A, V_{GE} = 0 V I_F = 650 A, V_{GE} = 0 V I_F = 650 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 150°C T_{vj} = 175°C T_{vj} = 25°C T_{vj} = 175°C	V_F		1.45 1.35 1.30 1.70 1.60	1.65	V
Peak reverse recovery current	I_F = 375 A, - di_F/dt = 4000 A/µs (T_{vj} = 150°C) V_R = 400 V V_{GE} = -8 V	T_{vj} = 25°C T_{vj} = 150°C T_{vj} = 175°C	I_{RM}		205 320 345		A
Recovered charge	I_F = 375 A, - di_F/dt = 4000 A/µs (T_{vj} = 150°C) V_R = 400 V V_{GE} = -8 V	T_{vj} = 25°C T_{vj} = 150°C T_{vj} = 175°C	Q_r		24.5 47.5 56.0		µC
Reverse recovery energy	I_F = 375 A, - di_F/dt = 4000 A/µs (T_{vj} = 150°C) V_R = 400 V V_{GE} = -8 V	T_{vj} = 25°C T_{vj} = 150°C T_{vj} = 175°C	E_{rec}		8.60 16.0 19.0		mJ
Thermal resistance, junction to cooling fluid	per diode; $\Delta V/\Delta t$ = 10 dm^3/min, T_F = 75°C		R_{thJF}		0.230[2)]	0.275[2)]	K/W
Temperature under switching conditions	t_{op} continuous for 10s within a period of 30s, occurence maximum 3000 times over lifetime		$T_{vj\,op}$	-40 150		150[3)] 175	°C

4 NTC-Thermistor

Parameter	Conditions	Symbol	min.	typ.	max.	Unit
Rated resistance	T_C = 25°C	R_{25}		5.00		kΩ
Deviation of R100	T_C = 100°C, R_{100} = 493 Ω	ΔR/R	-5		5	%
Power dissipation	T_C = 25°C	P_{25}			20.0	mW
B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/50}$		3375		K
B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/80}$		3411		K
B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/100}$		3433		K

Specification according to the valid application note.

[1)] Verified by characterization / design not by test.
[2)] Cooler design and flow direction according to application note AN-HPDC6i-AN-HP1-DC6i-Assembly-Instructions. Cooling fluid 50% water / 50% ethylenglycol.
[3)] For Tvjop > 150°C: Baseplate temperature has to be limited to 125°C.