

2 IGBT, Inverter

2.1 Maximum Rated Values

Parameter	Conditions	Symbol	Value	Unit
Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{CES}	750	V
Implemented collector current		I_{CN}	900	A
Continuous DC collector current	$T_F = 105^{\circ}\text{C}$, $T_{vj\max} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$	550	A
Repetitive peak collector current	$t_p = 1\text{ ms}$	I_{CRM}	1800	A
Total power dissipation	$T_F = 25^{\circ}\text{C}$, $T_{vj\max} = 175^{\circ}\text{C}$	P_{tot}	1546	W
Gate-emitter peak voltage		V_{GES}	+/-20	V

2.2 Characteristic Values

Parameter	Conditions	Symbol	min. typ. max.			Unit	
Collector-emitter saturation voltage	$I_C = 550\text{ A}$, $V_{GE} = 15\text{ V}$ $I_C = 550\text{ A}$, $V_{GE} = 15\text{ V}$ $I_C = 550\text{ A}$, $V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	1.10 1.10 1.10	1.25	V	
Gate threshold voltage	$I_C = 13.0\text{ mA}$, $V_{CE} = V_{GE}$	$T_{vj} = 25^{\circ}\text{C}$	$V_{GE\text{th}}$	4.90	5.80	6.50	V
Gate charge	$V_{GE} = -8\text{ V} \dots 15\text{ V}$, $V_{CE} = 400\text{ V}$		Q_G	5.80			μC
Internal gate resistor		$T_{vj} = 25^{\circ}\text{C}$	$R_{G\text{int}}$	0.5			Ω
Input capacitance	$f = 1\text{ MHz}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	C_{ies}	105			nF
Reverse transfer capacitance	$f = 1\text{ MHz}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	C_{res}	0.50			nF
Collector-emitter cut-off current	$V_{CE} = 450\text{ V}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	I_{CES}		0.5		mA
Gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = 20\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	I_{GES}		400		nA
Turn-on delay time, inductive load	$I_C = 550\text{ A}$, $V_{CE} = 400\text{ V}$ $V_{GE} = -8\text{ V} / +15\text{ V}$ $R_{G\text{on}} = 3.3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{on}}$	0.39 0.39 0.39			μs
Rise time, inductive load	$I_C = 550\text{ A}$, $V_{CE} = 400\text{ V}$ $V_{GE} = -8\text{ V} / +15\text{ V}$ $R_{G\text{on}} = 3.3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	0.09 0.11 0.11			μs
Turn-off delay time, inductive load	$I_C = 550\text{ A}$, $V_{CE} = 400\text{ V}$ $V_{GE} = -8\text{ V} / +15\text{ V}$ $R_{G\text{off}} = 2.0\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{off}}$	0.63 0.71 0.74			μs
Fall time, inductive load	$I_C = 550\text{ A}$, $V_{CE} = 400\text{ V}$ $V_{GE} = -8\text{ V} / +15\text{ V}$ $R_{G\text{off}} = 2.0\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	0.06 0.08 0.08			μs
Turn-on energy loss per pulse	$I_C = 550\text{ A}$, $V_{CE} = 400\text{ V}$, $L_S = 20\text{ nH}$ $V_{GE} = -8\text{ V} / +15\text{ V}$ $R_{G\text{on}} = 3.3\ \Omega$ $di/dt (T_{vj} = 150^{\circ}\text{C}) = 4100\text{ A}/\mu\text{s}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	21.0 29.0 30.5			mJ
Turn-off energy loss per pulse	$I_C = 550\text{ A}$, $V_{CE} = 400\text{ V}$, $L_S = 20\text{ nH}$ $V_{GE} = -8\text{ V} / +15\text{ V}$ $R_{G\text{off}} = 2.0\ \Omega$ $dv/dt (T_{vj} = 150^{\circ}\text{C}) = 2600\text{ V}/\mu\text{s}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	27.5 36.0 38.5			mJ
SC data	$V_{GE} \leq 15\text{ V}$, $V_{CC} = 400\text{ V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$ $t_p \leq 4\ \mu\text{s}$, $T_{vj} = 150^{\circ}\text{C}$		I_{SC}	4500			A
Thermal resistance, junction to cooling fluid	per IGBT; $\Delta V/\Delta t = 10\text{ dm}^3/\text{min}$		R_{thJF}		0.097		K/W
Temperature under switching conditions	t_{op} continuous $t_{\text{op max}}$ 30h over life time, for 10s within period of 10min		$T_{vj\text{op}}$	-40 150	150 175		$^{\circ}\text{C}$

3 Diode, Inverter

3.1 Maximum Rated Values

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{RRM}	750	V
Implemented forward current		I_{FN}	860	A
Continuous DC forward current		I_F	550	A
Repetitive peak forward current	$t_p = 1 \text{ ms}$	I_{FRM}	1720	A
I^2t - value	$V_R = 0 \text{ V}, t_p = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0 \text{ V}, t_p = 10 \text{ ms}, T_{vj} = 150^{\circ}\text{C}$	I^2t	19500 19000	A^2s A^2s

3.2 Characteristic Values

Parameter	Conditions	Symbol	min. typ. max.			Unit	
Forward voltage	$I_F = 550 \text{ A}, V_{GE} = 0 \text{ V}$ $I_F = 550 \text{ A}, V_{GE} = 0 \text{ V}$ $I_F = 550 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F		1.40 1.30 1.25	1.65	V
Peak reverse recovery current	$I_F = 550 \text{ A}, -di_F/dt = 4100 \text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_R = 400 \text{ V}$ $V_{GE} = -8 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}		265 385 420		A
Recovered charge	$I_F = 550 \text{ A}, -di_F/dt = 4100 \text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_R = 400 \text{ V}$ $V_{GE} = -8 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r		23.0 49.5 58.5		μC
Reverse recovery energy	$I_F = 550 \text{ A}, -di_F/dt = 4100 \text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_R = 400 \text{ V}$ $V_{GE} = -8 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}		7.20 15.0 17.5		mJ
Thermal resistance, junction to cooling fluid	per diode; $\Delta V/\Delta t = 10 \text{ dm}^3/\text{min}$		R_{thJF}			0.125	K/W
Temperature under switching conditions	t_{op} continuous $t_{op \text{ max}}$ 30h over life time, for 10s within period of 10min		$T_{vj \text{ op}}$	-40 150		150 175	$^{\circ}\text{C}$

4 NTC-Thermistor

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

Specification according to the valid application note.