

STARPOWER

SEMICONDUCTOR

IGBT

GD480HTA120P7HT_T2

1200V/480A 6 in one-package

General Description

STARPOWER IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as hybrid and electric vehicle.

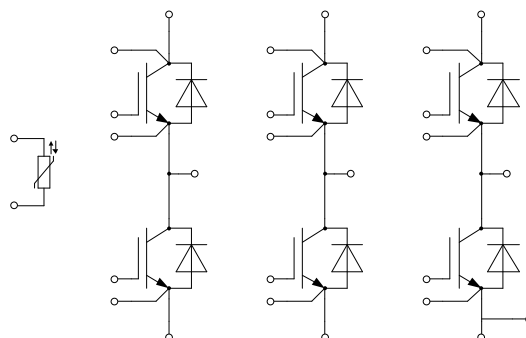
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- Low switching losses
- 6 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper pinfin baseplate using Si_3N_4 AMB technology

Typical Applications

- Automotive application
- Hybrid and electric vehicle
- Inverter for motor drive

Equivalent Circuit Schematic



Absolute Maximum Ratings $T_F=25^{\circ}\text{C}$ unless otherwise noted**IGBT**

Symbol	Description	Values	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_{CN}	Implemented Collector Current	480	A
I_C	Collector Current @ $T_F=95^{\circ}\text{C}$	270	A
I_{CRM}	Repetitive Peak Collector Current $t_p=1\text{ms}$	960	A
P_D	Maximum Power Dissipation @ $T_F=75^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	694	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_{FN}	Implemented Collector Current	480	A
I_F	Diode Continuous Forward Current	270	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	960	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{vjop}	Operating Junction Temperature continuous For 10s within a period of 30s, occurrence maximum 3000 times over lifetime	-40 to +150 +150 to +175	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500	V

IGBT Characteristics $T_F=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=360\text{A}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.40	1.85	V
		$I_C=360\text{A}, V_{GE}=15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.65		
		$I_C=360\text{A}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=10.4\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$		6.0		V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			400	nA
R_{Gint}	Internal Gate Resistance			2.5		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=100\text{kHz}, V_{GE}=0\text{V}$		32.5		nF
C_{oes}	Output Capacitance			1.03		nF
C_{res}	Reverse Transfer Capacitance			0.17		nF
Q_G	Gate Charge	$V_{CE}=800\text{V}, I_C=400\text{A}, V_{GE}=-15\dots+15\text{V}$		2.35		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=800\text{V}, I_C=270\text{A}, R_{Gon}=4.3\Omega, R_{Goff}=1.5\Omega, L_S=20\text{nH}, V_{GE}=-8/+15\text{V}, T_{vj}=25^{\circ}\text{C}$		168		ns
t_r	Rise Time			43		ns
$t_{d(off)}$	Turn-Off Delay Time			679		ns
t_f	Fall Time			91		ns
E_{on}	Turn-On Switching Loss			21.7		mJ
E_{off}	Turn-Off Switching Loss			28.2		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=800\text{V}, I_C=270\text{A}, R_{Gon}=4.3\Omega, R_{Goff}=1.5\Omega, L_S=20\text{nH}, V_{GE}=-8/+15\text{V}, T_{vj}=125^{\circ}\text{C}$		178		ns
t_r	Rise Time			49		ns
$t_{d(off)}$	Turn-Off Delay Time			740		ns
t_f	Fall Time			167		ns
E_{on}	Turn-On Switching Loss			30.9		mJ
E_{off}	Turn-Off Switching Loss			37.7		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=800\text{V}, I_C=270\text{A}, R_{Gon}=4.3\Omega, R_{Goff}=1.5\Omega, L_S=20\text{nH}, V_{GE}=-8/+15\text{V}, T_{vj}=150^{\circ}\text{C}$		181		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			764		ns
t_f	Fall Time			186		ns
E_{on}	Turn-On Switching Loss			33.3		mJ
E_{off}	Turn-Off Switching Loss			39.3		mJ
I_{SC}	SC Data	$t_p \leq 5\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}, V_{CC}=800\text{V}, V_{CEM} \leq 1200\text{V}$		1950		A

Diode Characteristics $T_F=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=360\text{A}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$		1.90	2.35	V
		$I_F=360\text{A}, V_{GE}=0\text{V}, T_{vj}=125^{\circ}\text{C}$		1.90		
		$I_F=360\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		1.85		
Q_r	Recovered Charge	$V_R=800\text{V}, I_F=270\text{A},$ $-di/dt=6302\text{A}/\mu\text{s}, V_{GE}=-8\text{V},$ $L_s=20\text{nH}, T_{vj}=25^{\circ}\text{C}$		19.6		μC
I_{RM}	Peak Reverse Recovery Current			226		A
E_{rec}	Reverse Recovery Energy			7.88		mJ
Q_r	Recovered Charge	$V_R=800\text{V}, I_F=270\text{A},$ $-di/dt=5679\text{A}/\mu\text{s}, V_{GE}=-8\text{V},$ $L_s=20\text{nH}, T_{vj}=125^{\circ}\text{C}$		33.0		μC
I_{RM}	Peak Reverse Recovery Current			262		A
E_{rec}	Reverse Recovery Energy			14.2		mJ
Q_r	Recovered Charge	$V_R=800\text{V}, I_F=270\text{A},$ $-di/dt=5462\text{A}/\mu\text{s}, V_{GE}=-8\text{V},$ $L_s=20\text{nH}, T_{vj}=150^{\circ}\text{C}$		37.8		μC
I_{RM}	Peak Reverse Recovery Current			276		A
E_{rec}	Reverse Recovery Energy			16.4		mJ

NTC Characteristics $T_F=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_C=100^{\circ}\text{C}, R_{100}=493.3\Omega$	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$		3433		K

Module Characteristics $T_F=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
Δp	Pressure Drop Cooling Circuit $\Delta V/\Delta t=10.0\text{dm}^3/\text{min}; T_F=25^{\circ}\text{C}; \text{Cooling Fluid}=50\% \text{ Water}/50\% \text{ Ethylene Glycol}$		50		mbar
p	Maximum Pressure In Cooling Circuit			2.0	bar
R_{thJF}	Junction-to-Cooling Fluid (per IGBT) Junction-to-Cooling Fluid (per Diode) $\Delta V/\Delta t=10.0\text{dm}^3/\text{min}, T_F=75^{\circ}\text{C}$		0.125 0.178	0.144 0.205	K/W
M	Terminal Connection Torque, Screw M6 Mounting Torque, Screw M5	3.0 3.0		6.0 6.0	N.m
G	Weight of Module		685		g

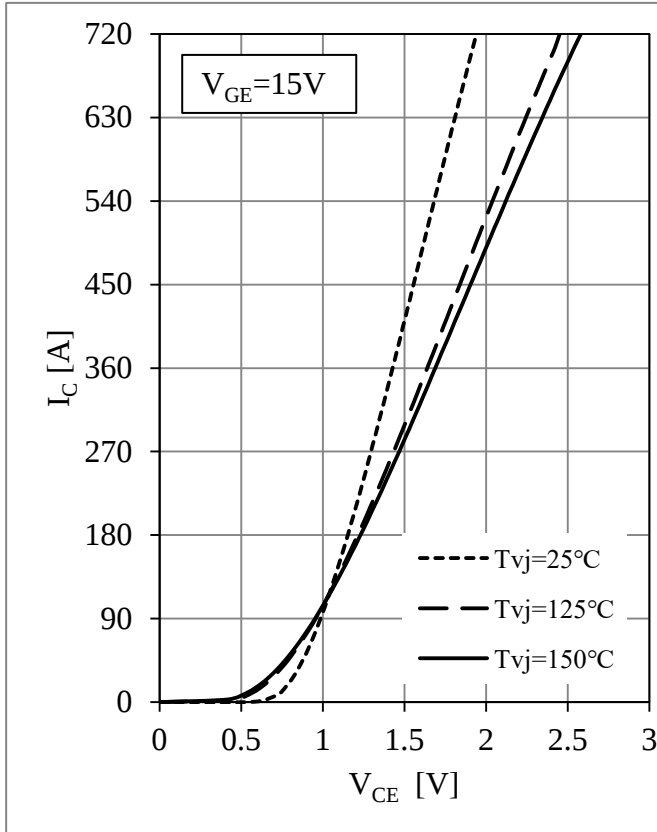


Fig 1. IGBT Output Characteristics

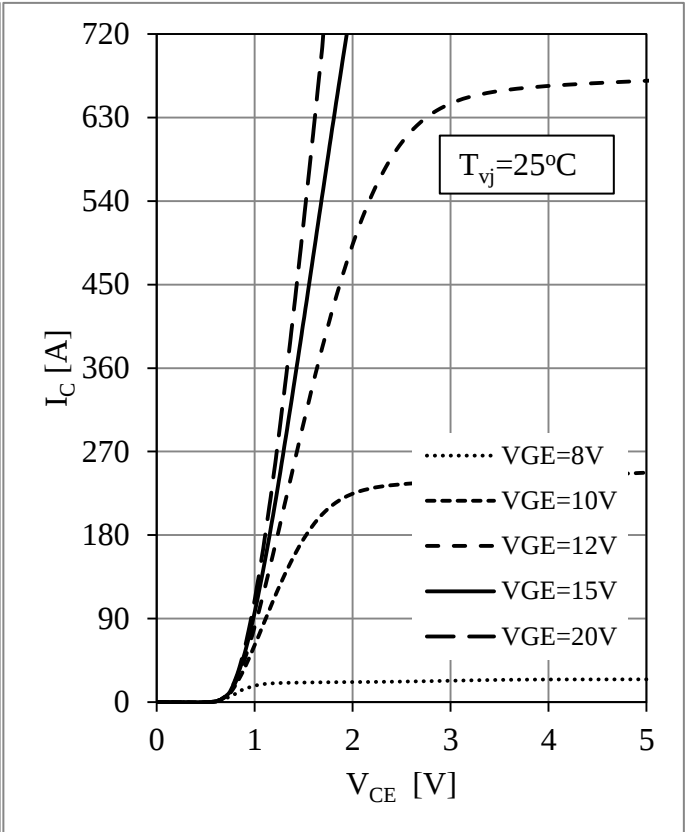


Fig 2. IGBT Output Characteristics

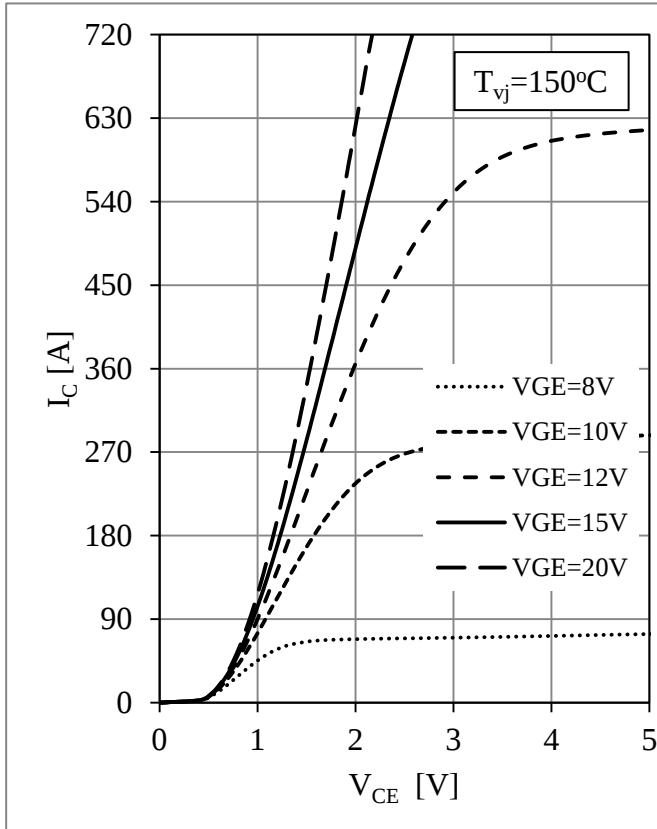


Fig 3. IGBT Output Characteristics

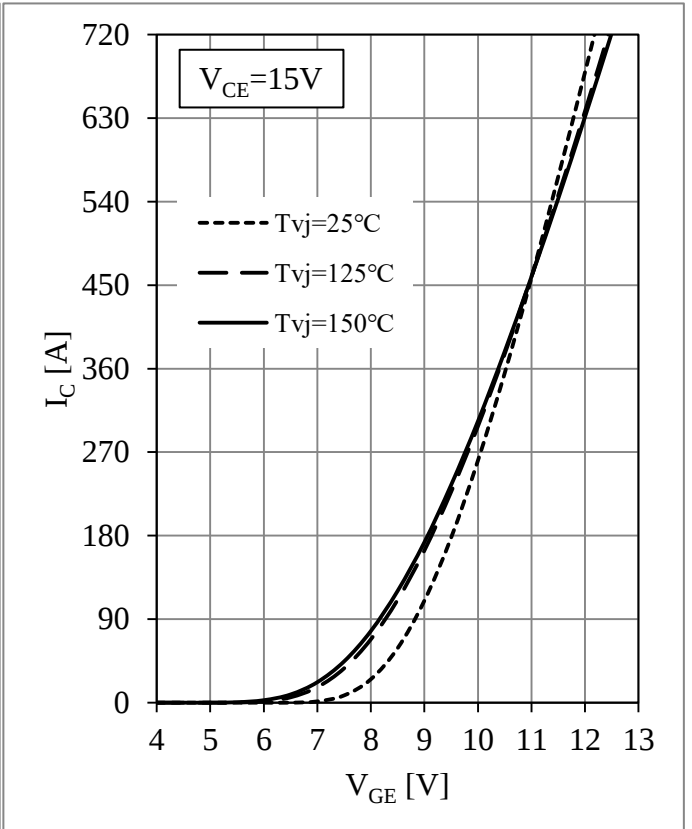


Fig 4. IGBT Transfer Characteristics

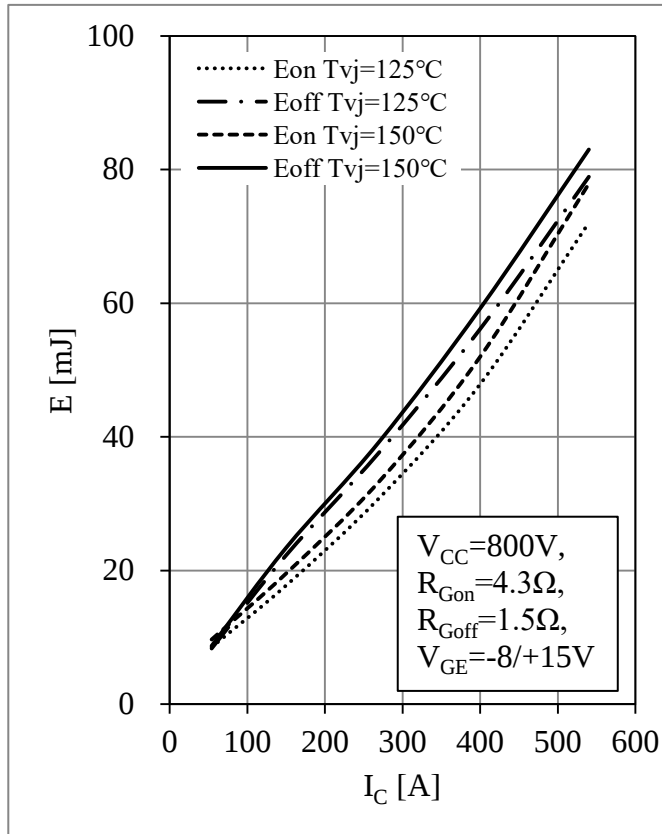
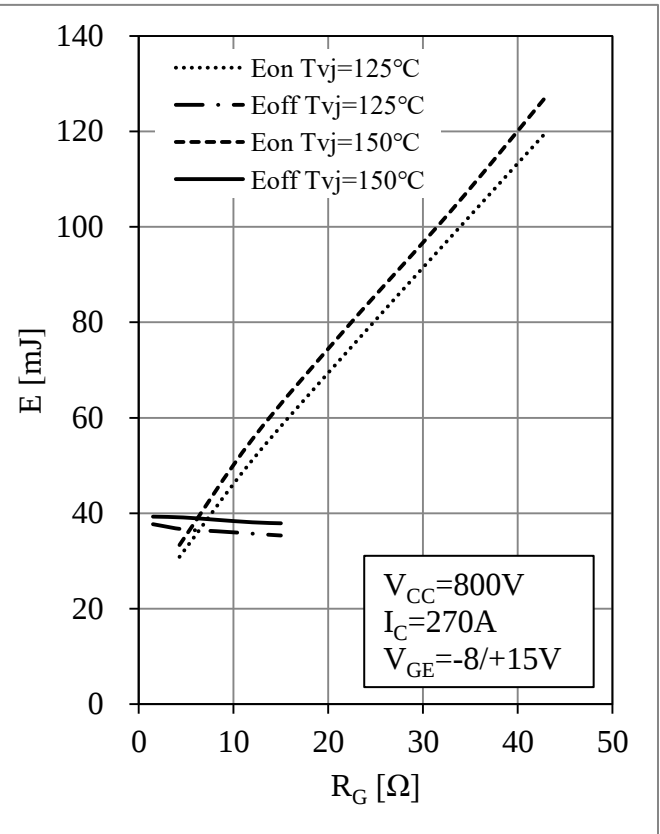
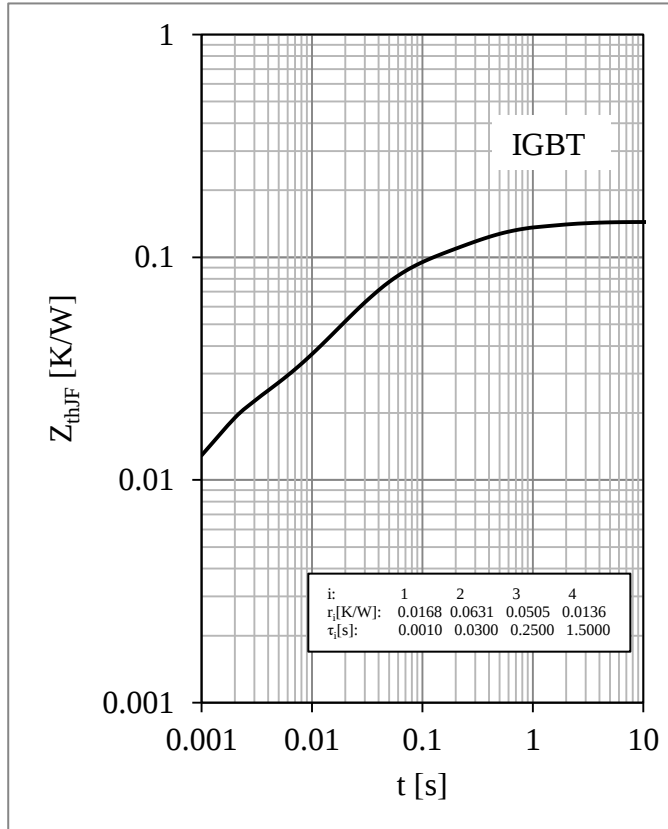
Fig 5. IGBT Switching Loss vs. I_C Fig 6. IGBT Switching Loss vs. R_G 

Fig 7. IGBT Transient Thermal Impedance

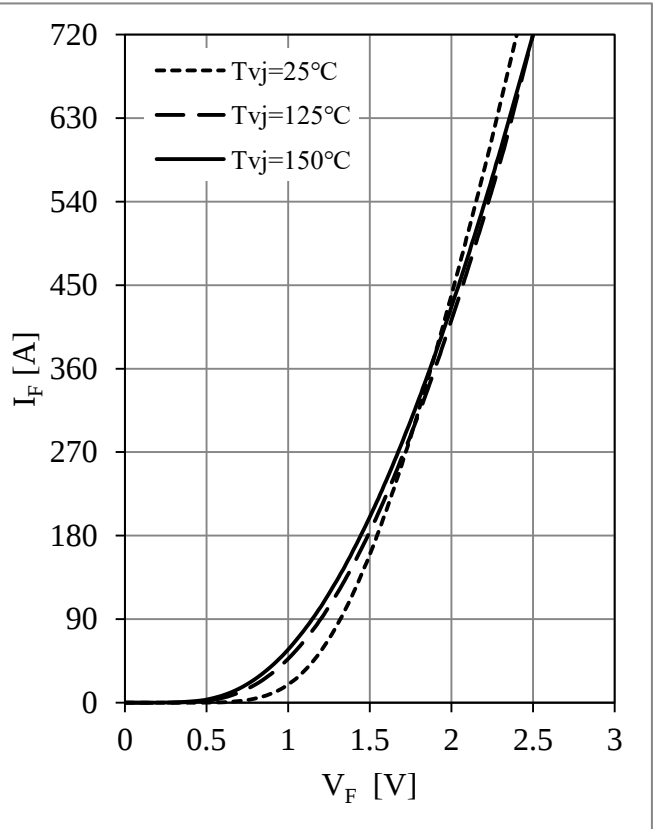


Fig 8. Diode Forward Characteristics

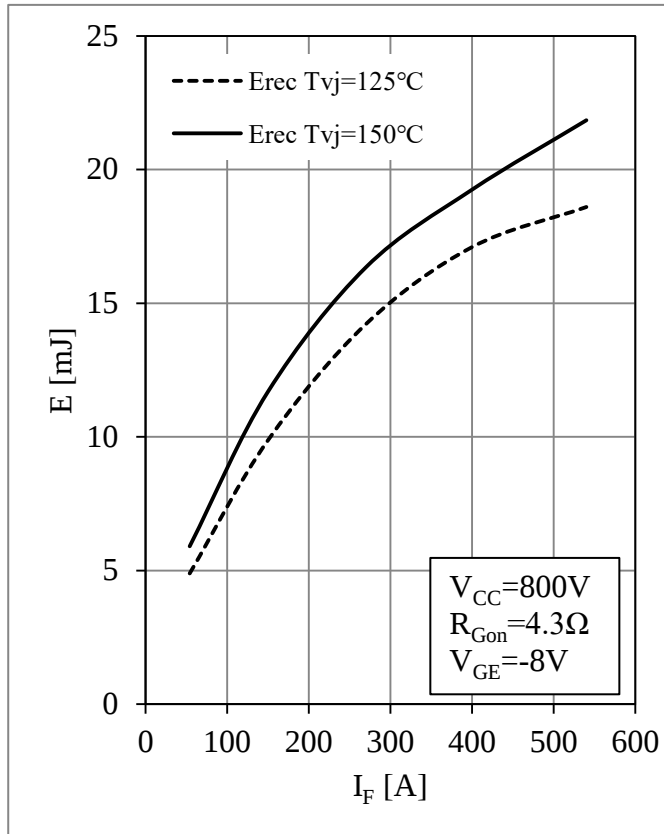
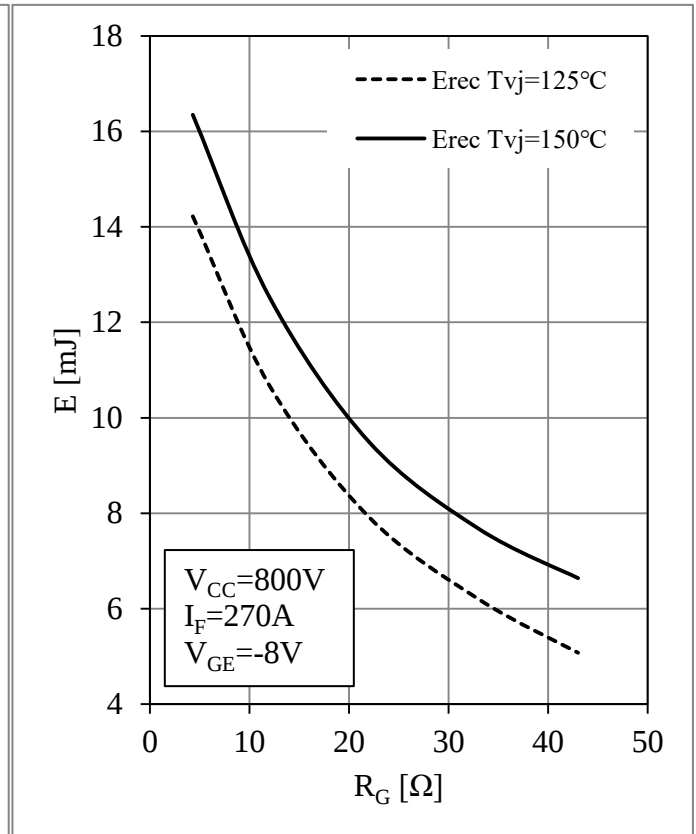
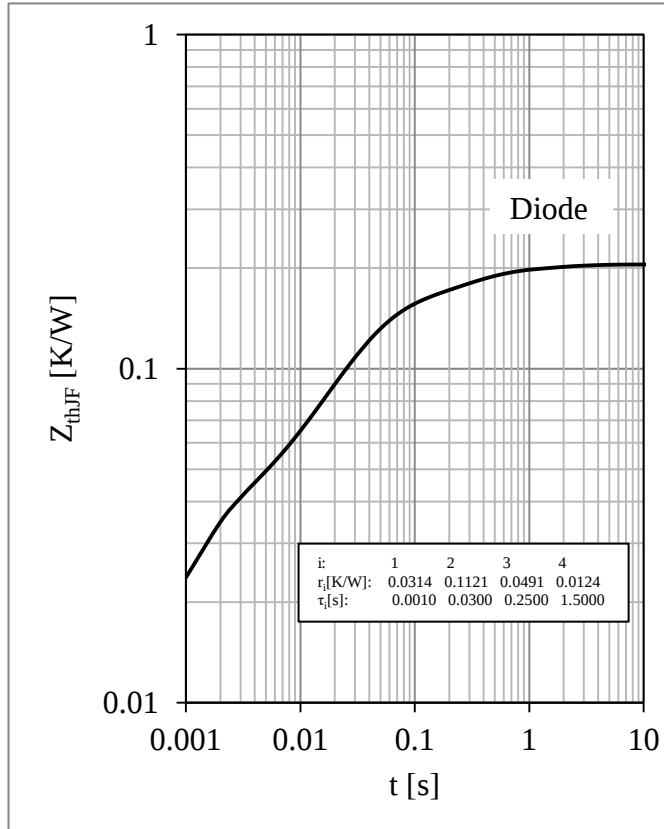
Fig 9. Diode Switching Loss vs. I_F Fig 10. Diode Switching Loss vs. R_G 

Fig 11. Diode Transient Thermal Impedance

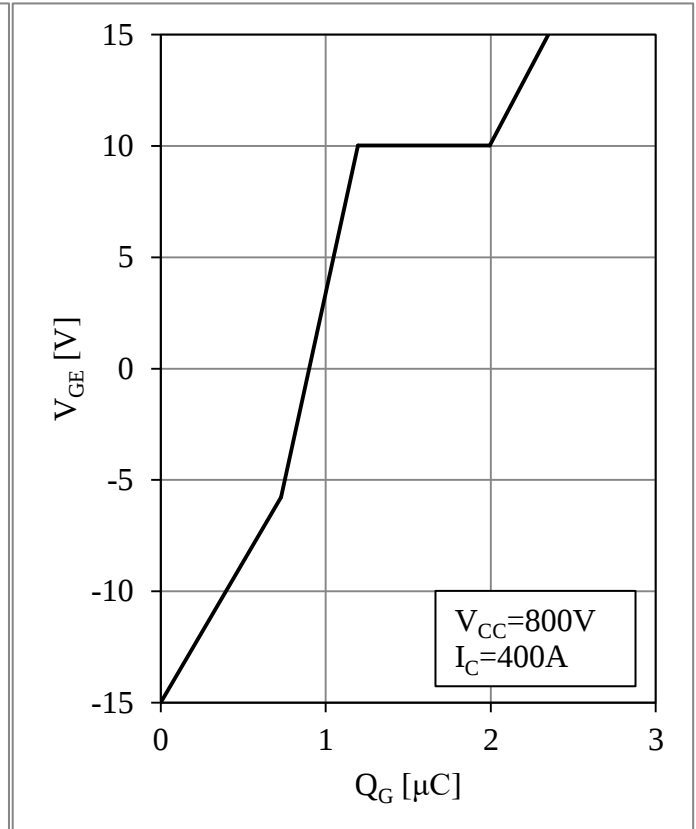


Fig 12. IGBT Gate Charge Characteristic

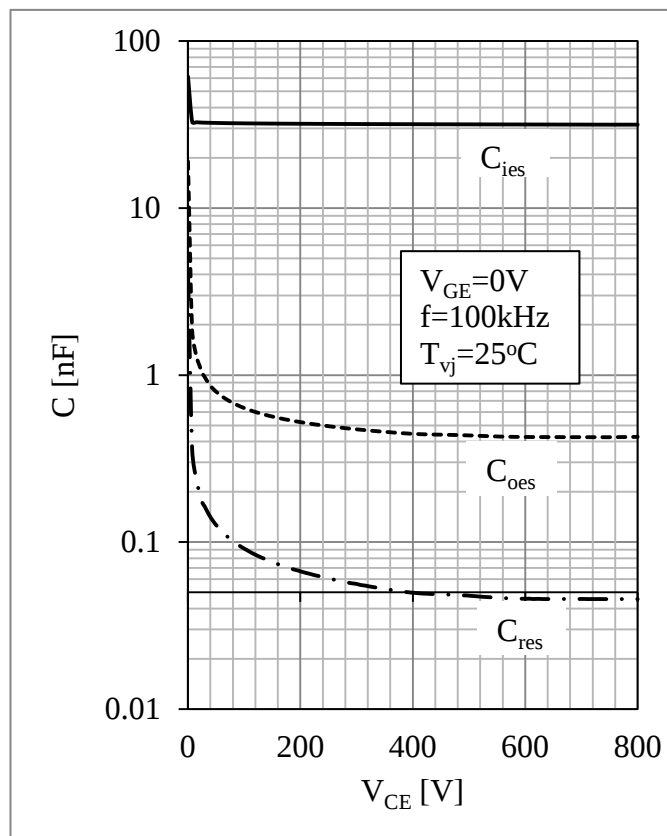


Fig 13. IGBT Capacity Characteristic

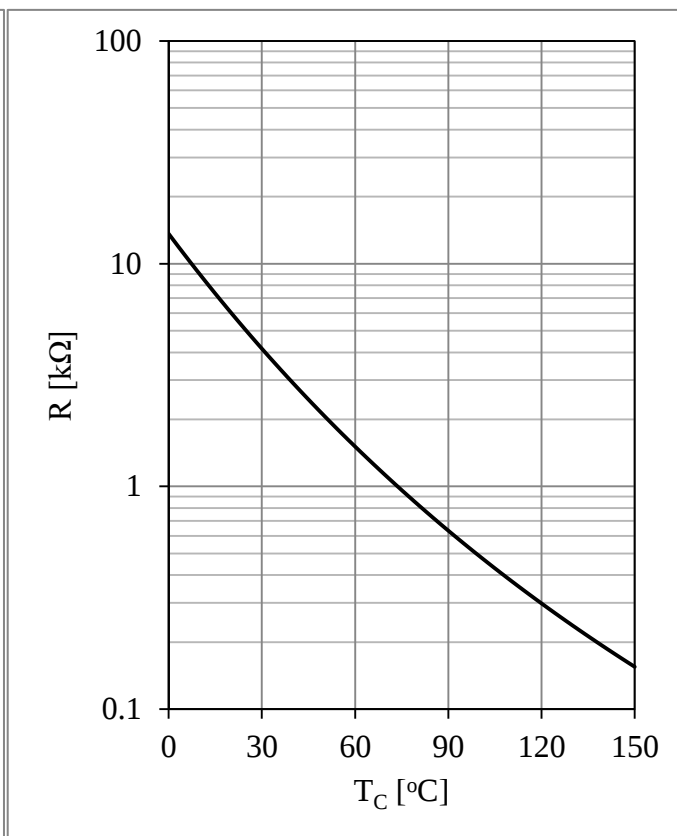
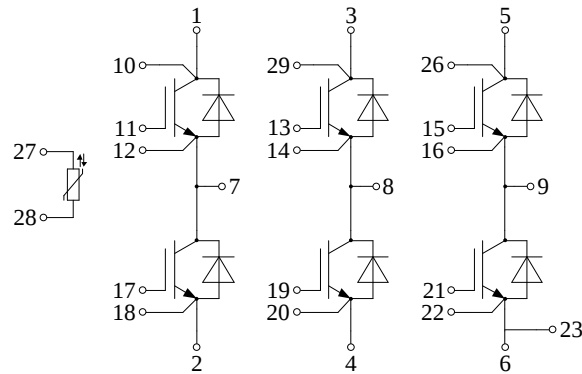


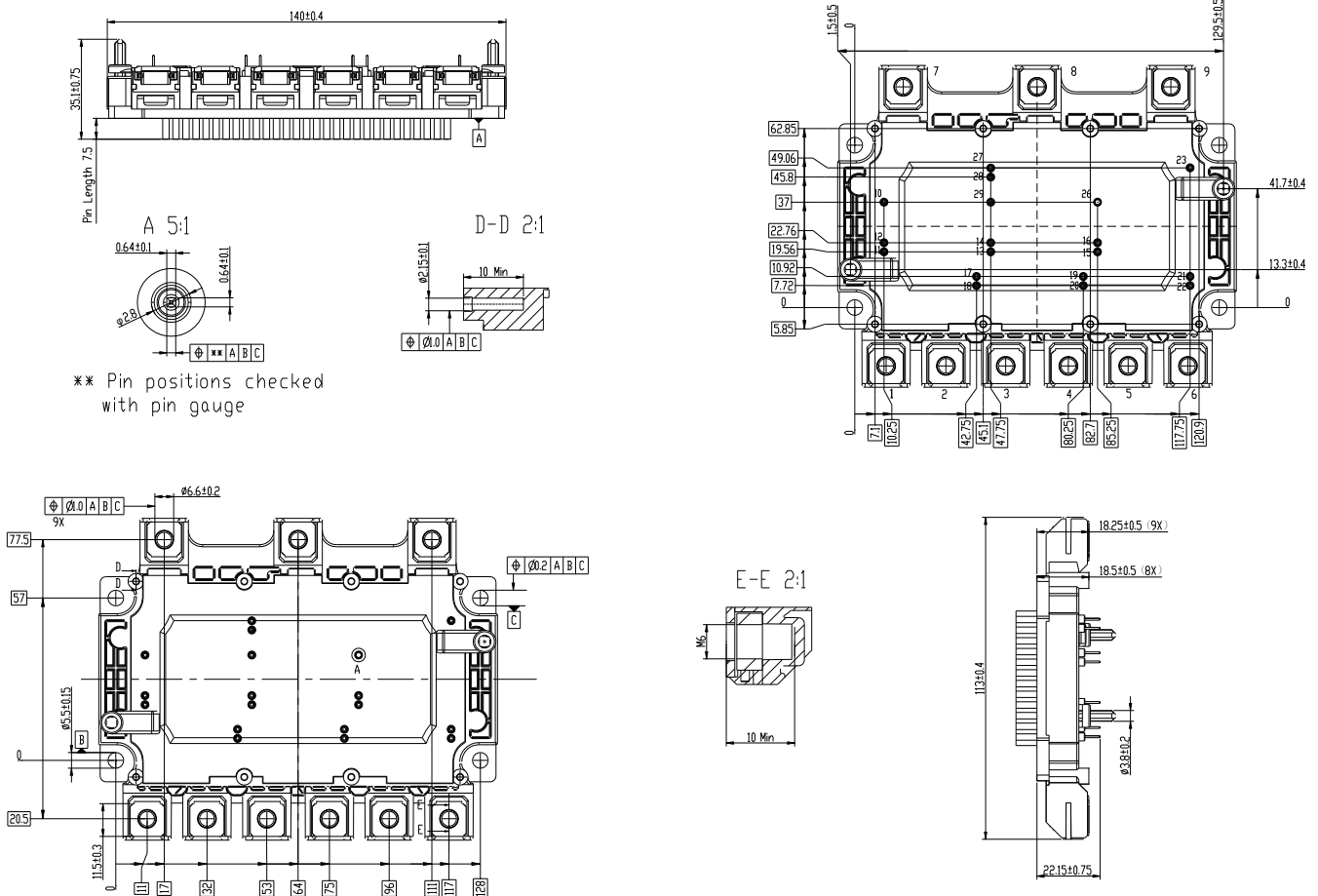
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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