

STARPOWER

SEMICONDUCTOR

IGBT

GD800HTX65P4S

650V/800A 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.

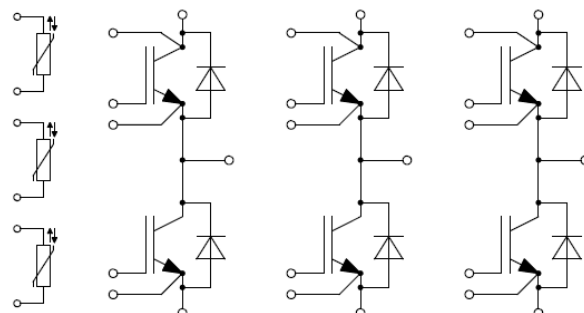
Features

- 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 DBC technology

Typical Applications

- Hybrid and electric vehicle
- Inverter for motor drive
- Uninterruptible power supply

Equivalent Circuit Schematic



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

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_{CN}	Implemented Collector Current	800	A
I_C	Collector Current @ $T_F=25^{\circ}\text{C}$ @ $T_F=70^{\circ}\text{C}$	700 550	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	1600	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	1485	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_{FN}	Implemented Forward Current	800	A
I_F	Diode Continuous Forward Current	550	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	1600	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40 to +150	$^{\circ}\text{C}$
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	$I_C=550\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.30	1.60	V
		$I_C=550\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		1.35		
		$I_C=550\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		1.40		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=12.80\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.1	5.8	6.5	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^{\circ}\text{C}$			400	nA
R_{Gint}	Internal Gate Resistance			0.5		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		92.7		nF
C_{res}	Reverse Transfer Capacitance			1.83		nF
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		5.54		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=550\text{A}, R_{Gon}=1.80\Omega, R_{Goff}=0.75\Omega, V_{GE}=\pm 15\text{V}, L_s=25\text{nH}, T_j=25^{\circ}\text{C}$		159		ns
t_r	Rise Time			74		ns
$t_{d(off)}$	Turn-Off Delay Time			348		ns
t_f	Fall Time			76		ns
E_{on}	Turn-On Switching Loss			3.03		mJ
E_{off}	Turn-Off Switching Loss			15.7		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=550\text{A}, R_{Gon}=1.80\Omega, R_{Goff}=0.75\Omega, V_{GE}=\pm 15\text{V}, L_s=25\text{nH}, T_j=125^{\circ}\text{C}$		169		ns
t_r	Rise Time			80		ns
$t_{d(off)}$	Turn-Off Delay Time			376		ns
t_f	Fall Time			92		ns
E_{on}	Turn-On Switching Loss			5.33		mJ
E_{off}	Turn-Off Switching Loss			19.6		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=550\text{A}, R_{Gon}=1.80\Omega, R_{Goff}=0.75\Omega, V_{GE}=\pm 15\text{V}, L_s=25\text{nH}, T_j=150^{\circ}\text{C}$		172		ns
t_r	Rise Time			82		ns
$t_{d(off)}$	Turn-Off Delay Time			384		ns
t_f	Fall Time			102		ns
E_{on}	Turn-On Switching Loss			5.63		mJ
E_{off}	Turn-Off Switching Loss			20.8		mJ
I_{SC}	SC Data	$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		4000		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	$I_F=550\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.40	1.75	V
		$I_F=550\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.35		
		$I_F=550\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.30		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=550\text{A},$ $-di/dt=7550\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_s=25\text{nH}, T_j=25^{\circ}\text{C}$		16.3		μC
I_{RM}	Peak Reverse Recovery Current			306		A
E_{rec}	Reverse Recovery Energy			5.68		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=550\text{A},$ $-di/dt=7100\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_s=25\text{nH}, T_j=125^{\circ}\text{C}$		30.8		μC
I_{RM}	Peak Reverse Recovery Current			392		A
E_{rec}	Reverse Recovery Energy			10.8		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=550\text{A},$ $-di/dt=7000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_s=25\text{nH}, T_j=150^{\circ}\text{C}$		36.9		μC
I_{RM}	Peak Reverse Recovery Current			427		A
E_{rec}	Reverse Recovery Energy			13.2		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 $\Delta V/\Delta t=10.0\text{dm}^3/\text{min}; T_F=25^{\circ}\text{C}; \text{Cooling Fluid}=50\% \text{ Water}/50\% \text{ Ethylene Glycol}$		100		mbar
p	Maximum Pressure In Cooling Circuit			2.5	bar
L_{CE}	Stray Inductance		14		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.80		m Ω
R_{thJF}	Junction-to-Cooling Fluid (per IGBT) Junction-to-Cooling Fluid (per Diode)			0.101 0.136	K/W
M	Terminal Connection Torque, Screw M6 Mounting Torque, Screw M6	2.5 3.0		5.0 6.0	N.m
G	Weight of Module		1250		g

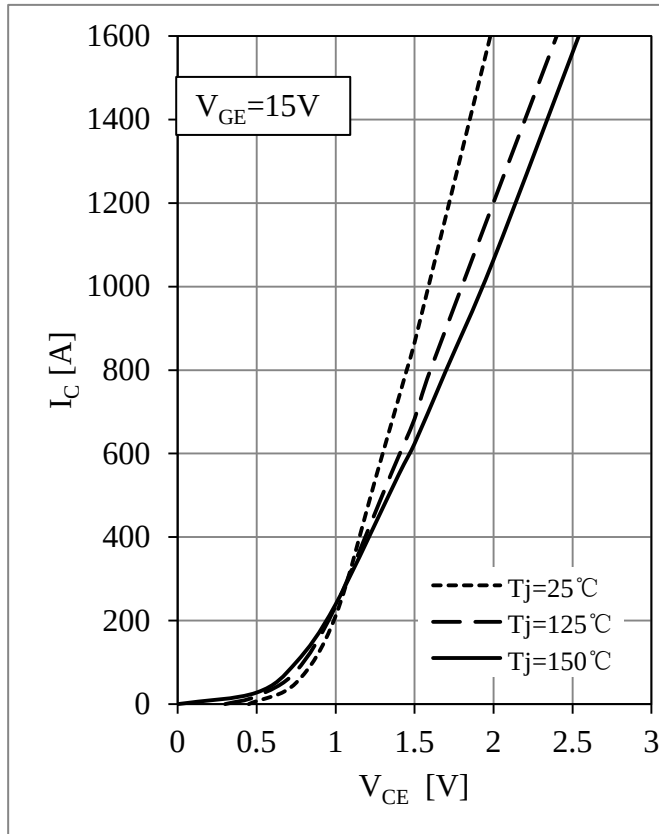


Fig 1. IGBT Output Characteristics

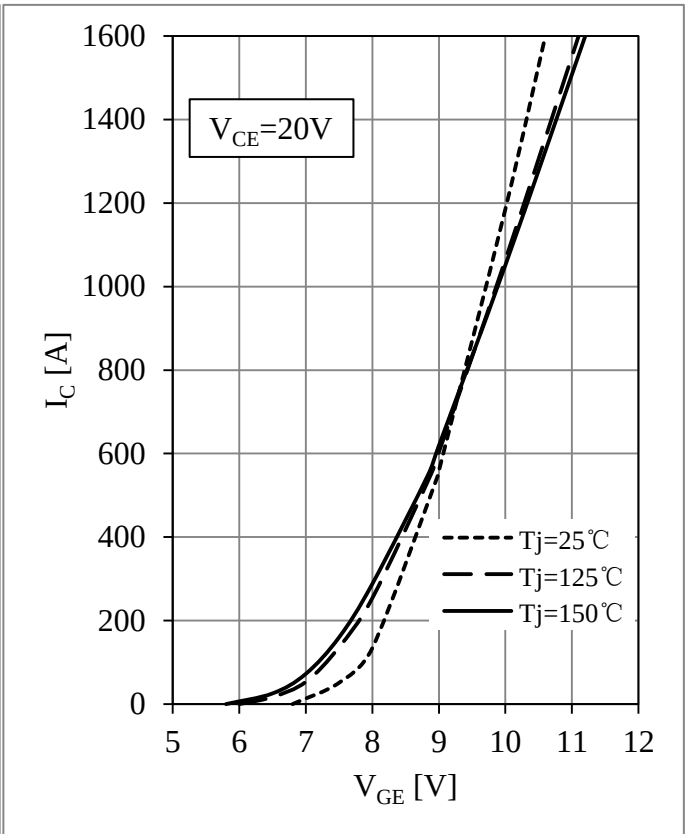
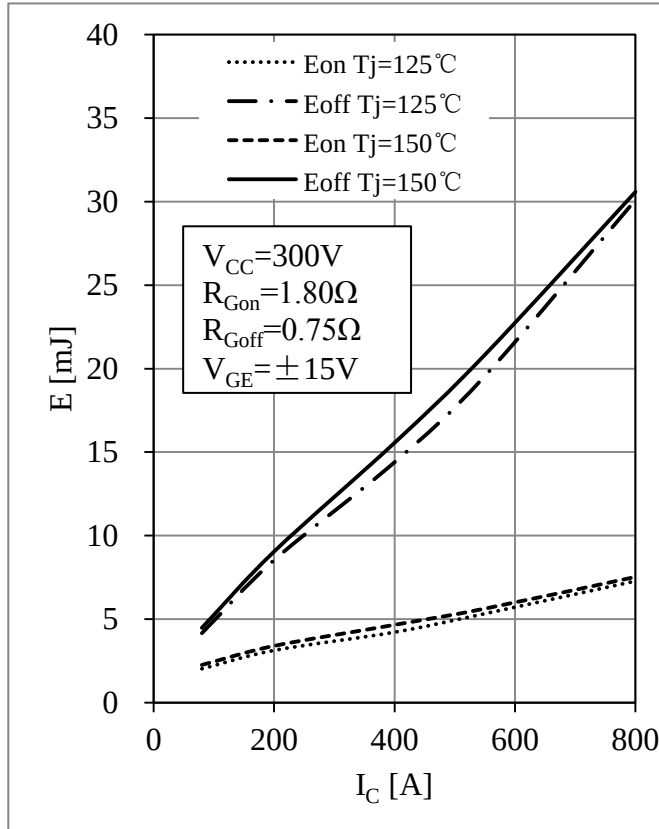
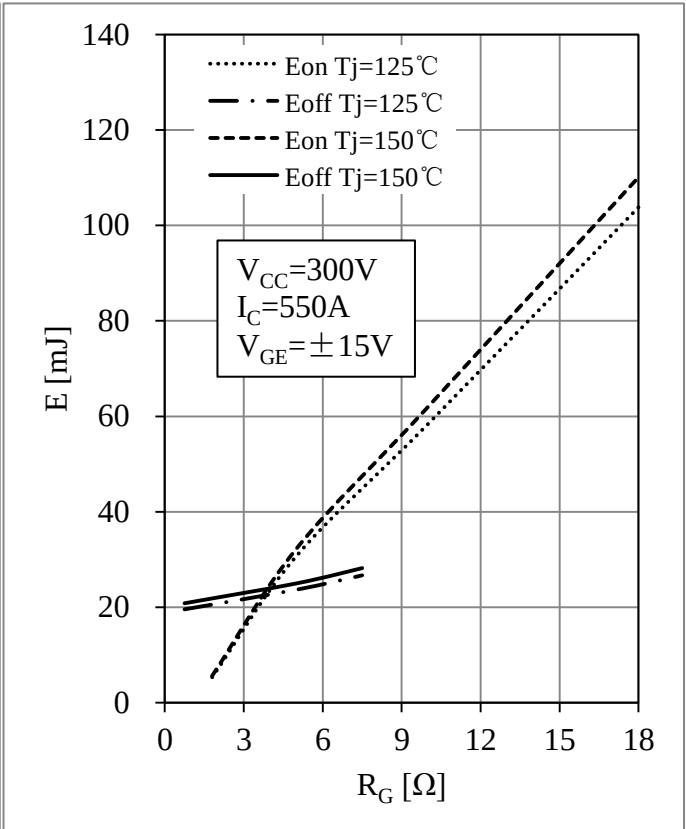


Fig 2. IGBT Transfer Characteristics

Fig 3. IGBT Switching Loss vs. I_C Fig 4. IGBT Switching Loss vs. R_G

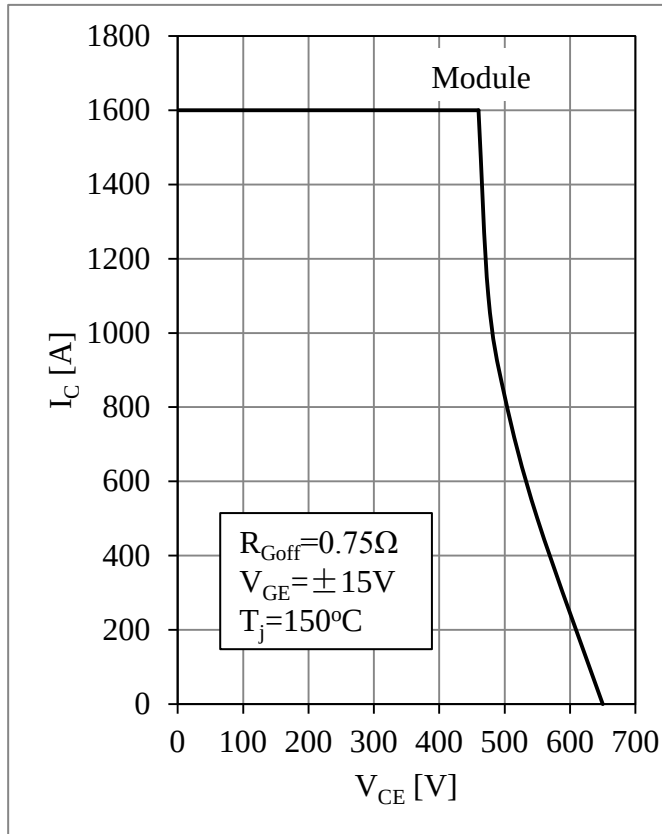


Fig 5. RBSOA

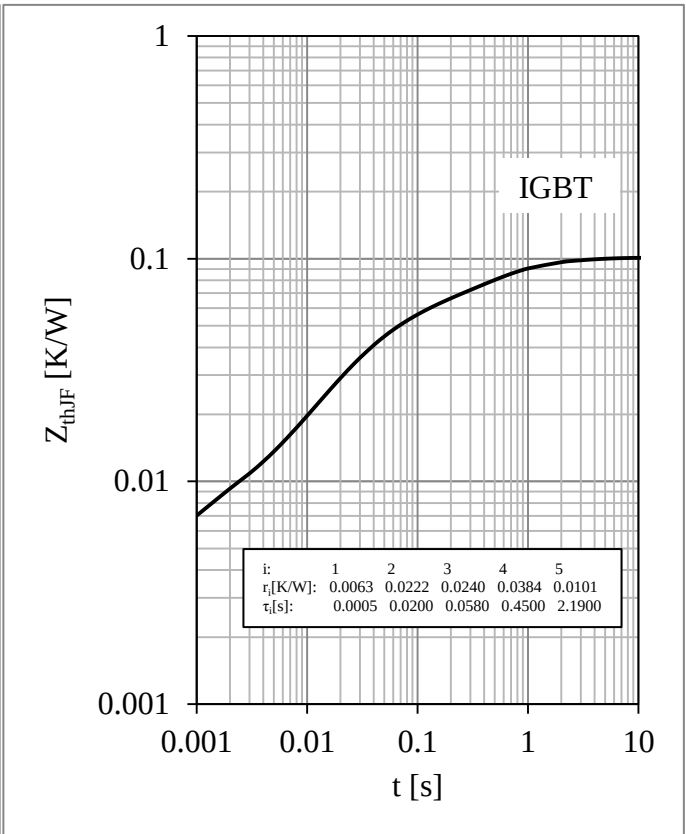


Fig 6. IGBT Transient Thermal Impedance

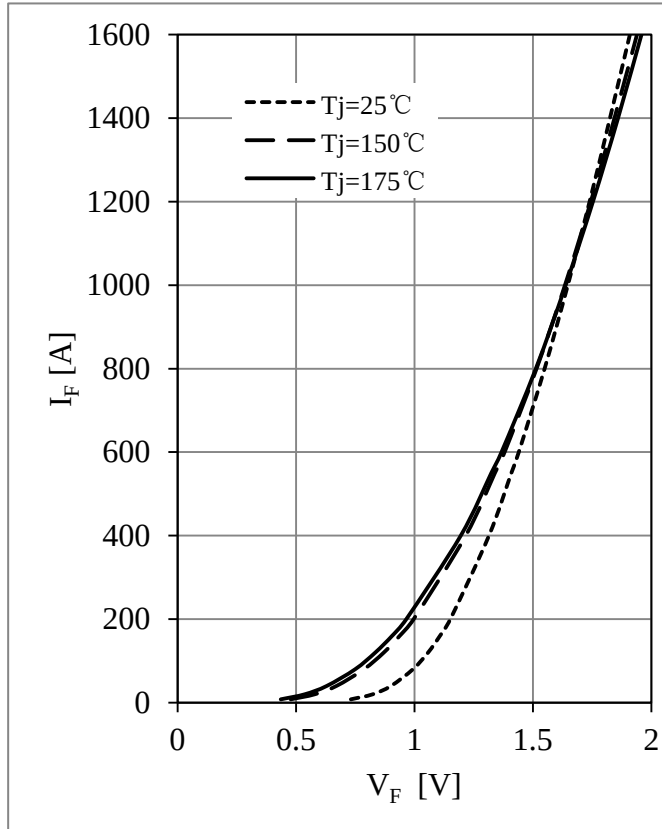
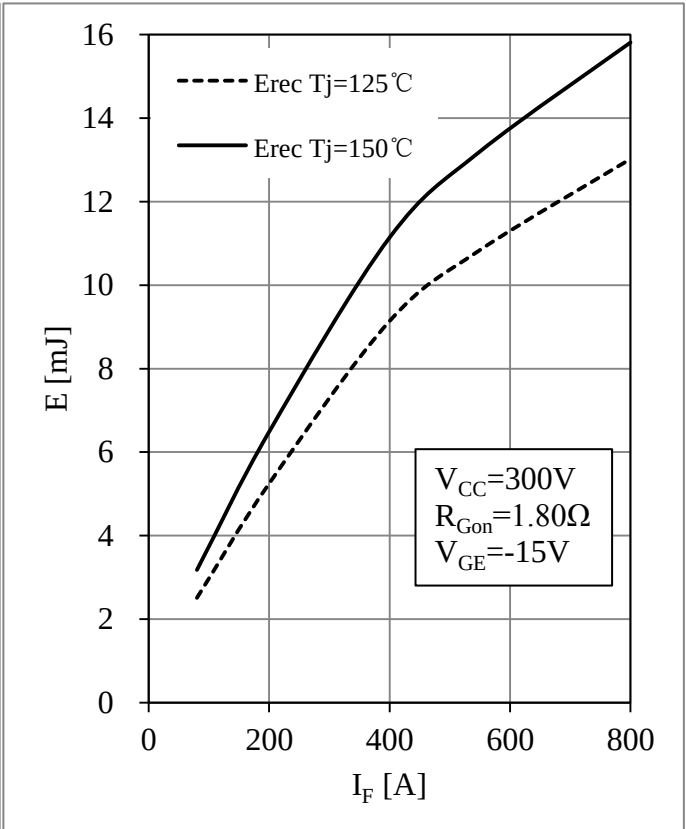


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

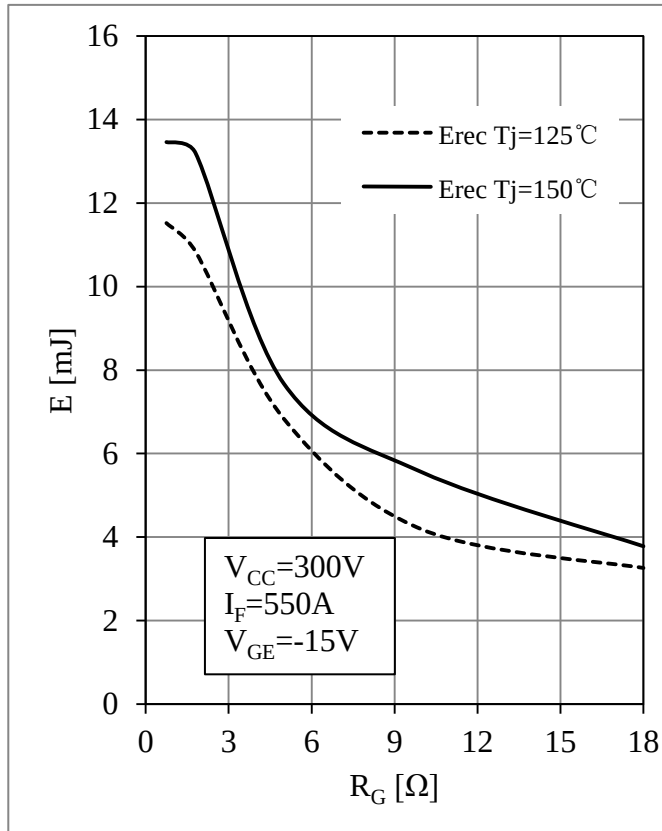
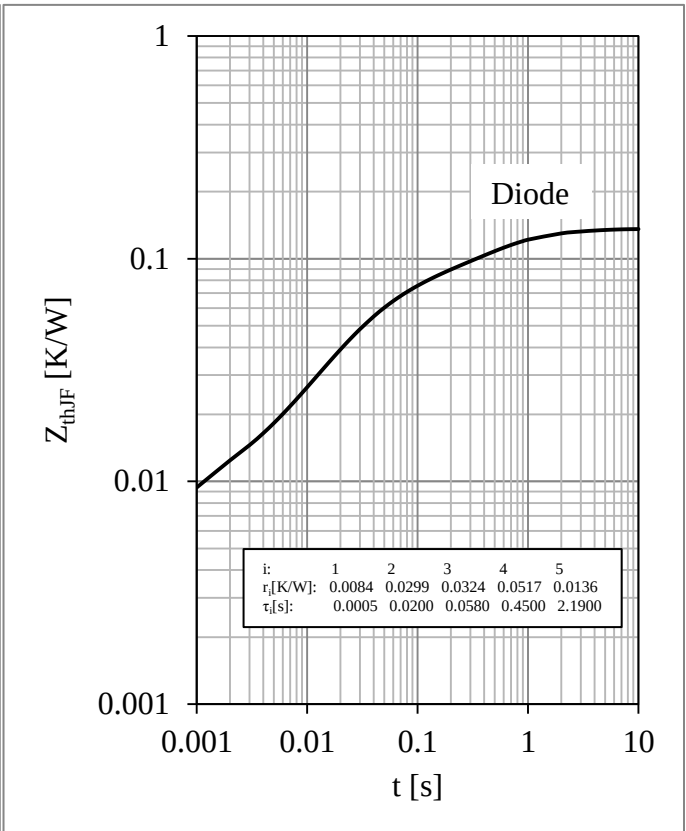
Fig 9. Diode Switching Loss vs. R_G 

Fig 10. Diode Transient Thermal Impedance

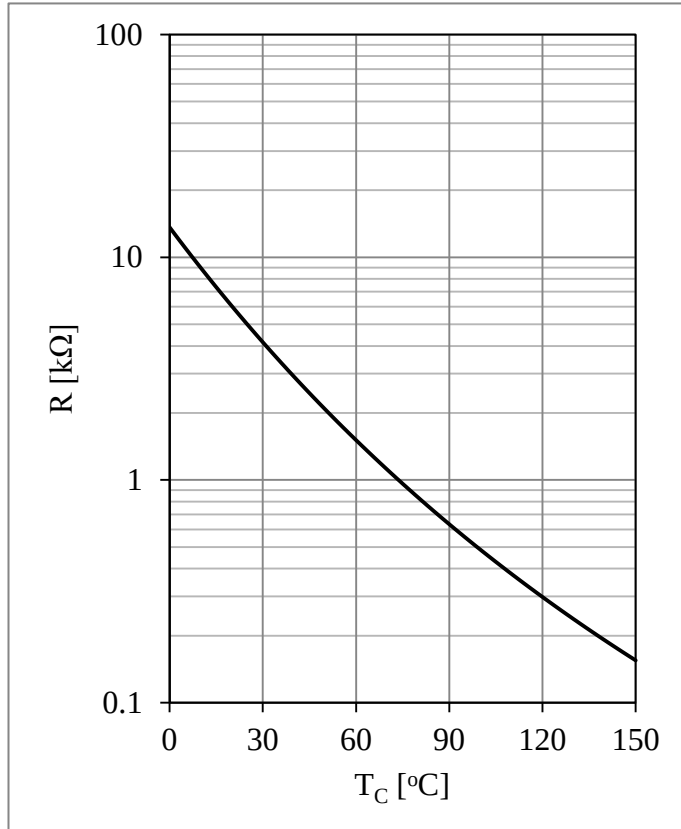
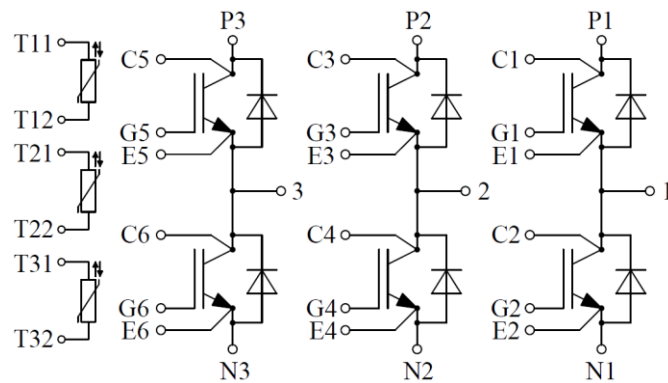


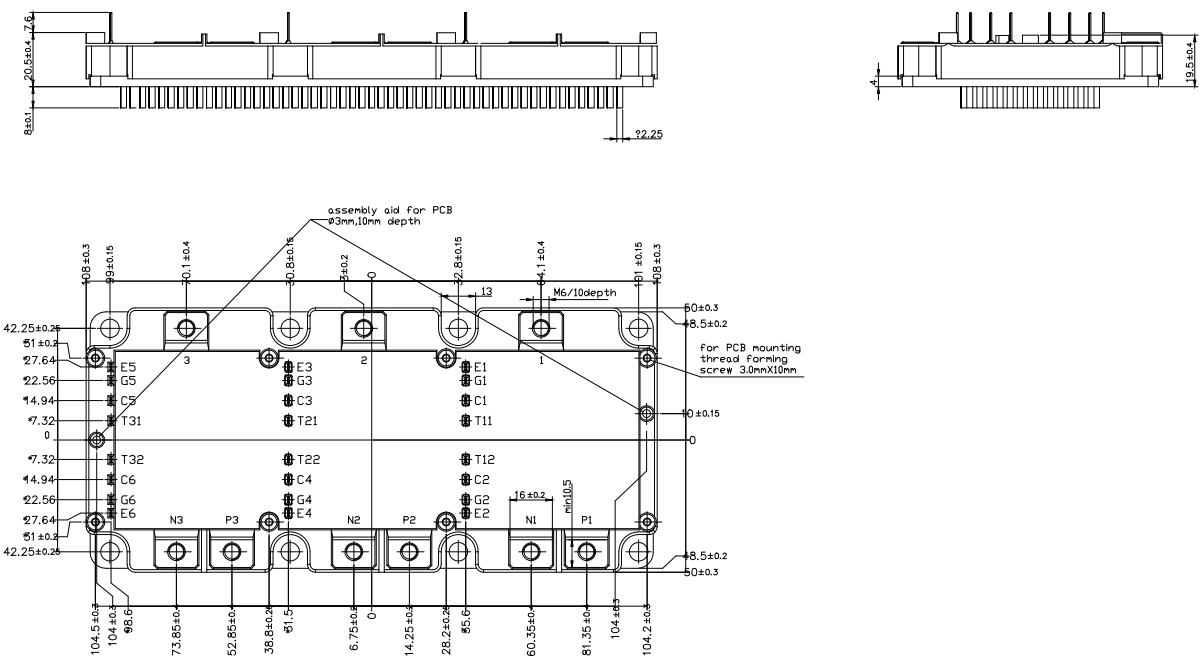
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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