

# STARPOWER

SEMICONDUCTOR

**IGBT**

## GD800HTX75P4S

**750V/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.

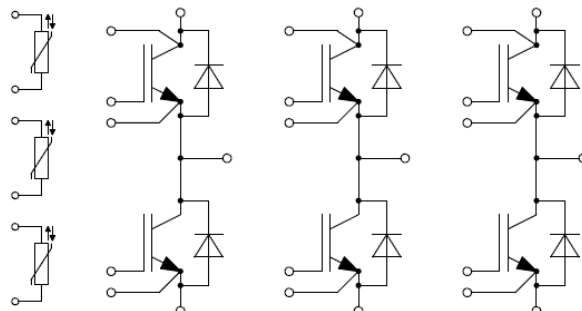
### Features

- Low  $V_{CE(sat)}$  Trench IGBT technology
- Low switching losses
- 6 $\mu$ 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	750	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_{CN}$	Implemented Collector Current	800	A
$I_C$	Collector Current @ $T_F=25^{\circ}\text{C}$	765	A
	@ $T_F=80^{\circ}\text{C}$	550	A
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	1600	A
$P_D$	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	1500	W

**Diode**

Symbol	Description	Value	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	750	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	$I_C=550\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.25	1.55	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		$\Omega$	
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, f=100\text{kHz}, V_{GE}=0\text{V}$		56.4		nF	
$C_{res}$	Reverse Transfer Capacitance				2.08		nF
$Q_G$	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		5.28		$\mu\text{C}$	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400\text{V}, I_C=550\text{A}, R_G=1.5\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		97		ns	
$t_r$	Rise Time			77		ns	
$t_{d(off)}$	Turn-Off Delay Time			390		ns	
$t_f$	Fall Time			78		ns	
$E_{on}$	Turn-On Switching Loss			10.7		mJ	
$E_{off}$	Turn-Off Switching Loss			23.2		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=400\text{V}, I_C=550\text{A}, R_G=1.5\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		110		ns
$t_r$	Rise Time				87		ns
$t_{d(off)}$	Turn-Off Delay Time				435		ns
$t_f$	Fall Time				136		ns
$E_{on}$	Turn-On Switching Loss			16.5		mJ	
$E_{off}$	Turn-Off Switching Loss			30.0		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400\text{V}, I_C=550\text{A}, R_G=1.5\Omega, V_{GE}=\pm 15\text{V}, T_j=175^{\circ}\text{C}$			114		ns
$t_r$	Rise Time				87		ns
$t_{d(off)}$	Turn-Off Delay Time			445		ns	
$t_f$	Fall Time			148		ns	
$E_{on}$	Turn-On Switching Loss			18.5		mJ	
$E_{off}$	Turn-Off Switching Loss			32.5		mJ	
$I_{SC}$	SC Data		$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=175^{\circ}\text{C}, V_{CC}=450\text{V}, V_{CEM} \leq 750\text{V}$		TBD		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	$I_F=550\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.50	1.85	V
		$I_F=550\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.45		
		$I_F=550\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.45		
$Q_r$	Recovered Charge	$V_R=400\text{V}, I_F=550\text{A},$ $-di/dt=6400\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		18.5		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			380		A
$E_{rec}$	Reverse Recovery Energy			6.20		mJ
$Q_r$	Recovered Charge	$V_R=400\text{V}, I_F=550\text{A},$ $-di/dt=5900\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		37.2		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			488		A
$E_{rec}$	Reverse Recovery Energy			13.8		mJ
$Q_r$	Recovered Charge	$V_R=400\text{V}, I_F=550\text{A},$ $-di/dt=5700\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=175^{\circ}\text{C}$		42.7		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			521		A
$E_{rec}$	Reverse Recovery Energy			16.0		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
$\Delta p$	Pressure Drop Cooling Circuit $\Delta V/\Delta t=10.0\text{dm}^3/\text{min}; T_F=25^{\circ}\text{C};$ Cooling Fluid=50% Water/50% 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 $\Omega$
$R_{thJF}$	Junction-to-Cooling Fluid (per IGBT) Junction-to-Cooling Fluid (per Diode)			0.100 0.130	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

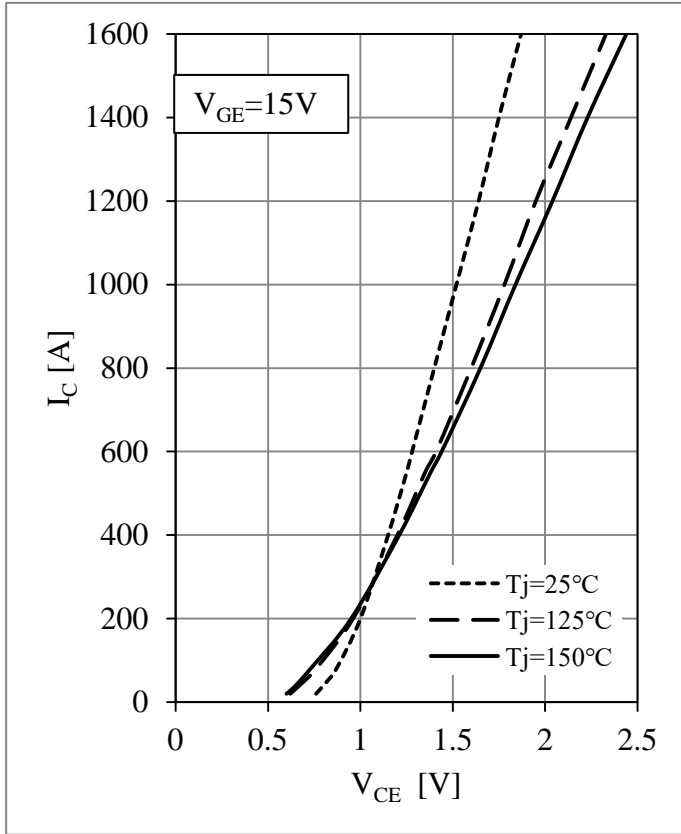


Fig 1. IGBT Output Characteristics

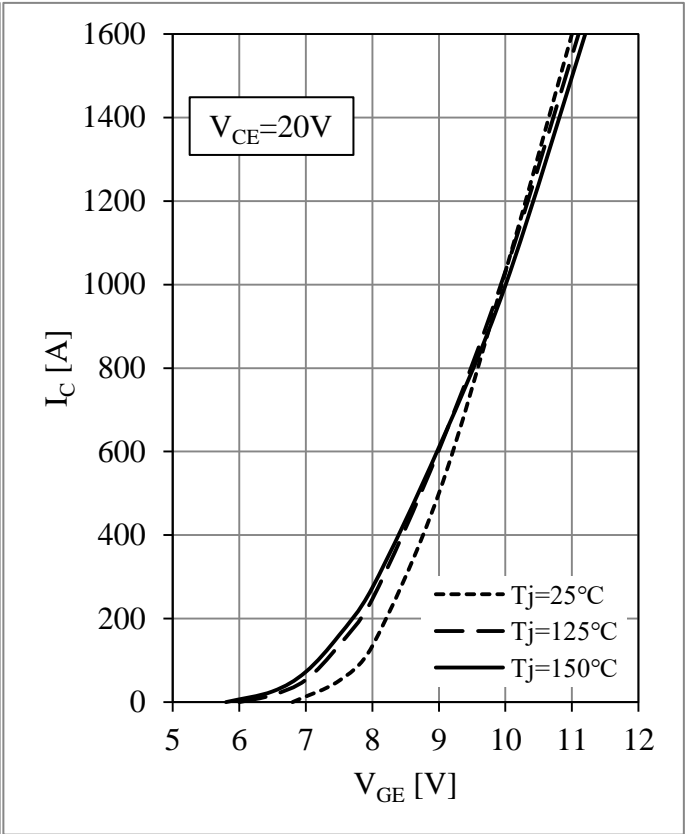


Fig 2. IGBT Transfer Characteristics

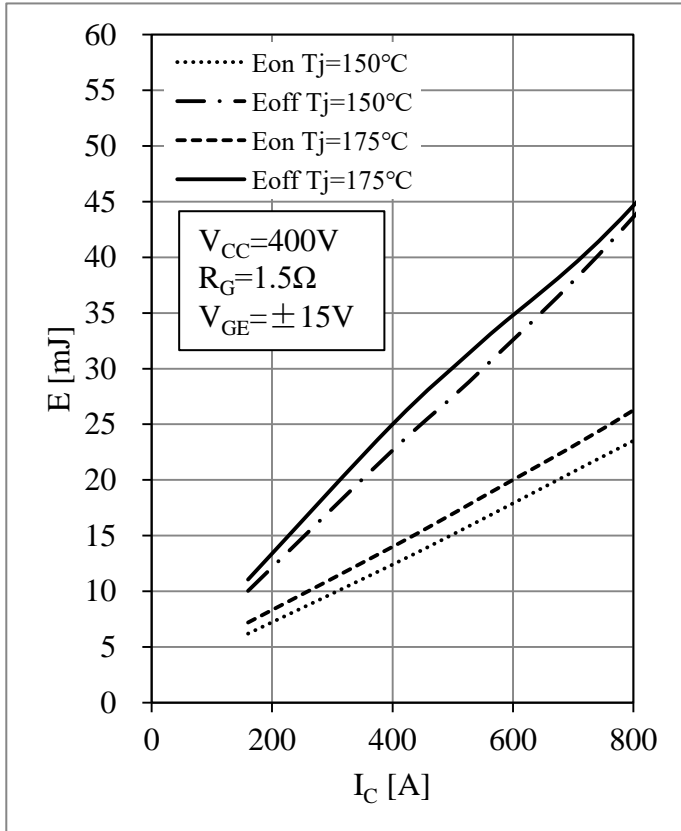


Fig 3. IGBT Switching Loss vs.  $I_C$

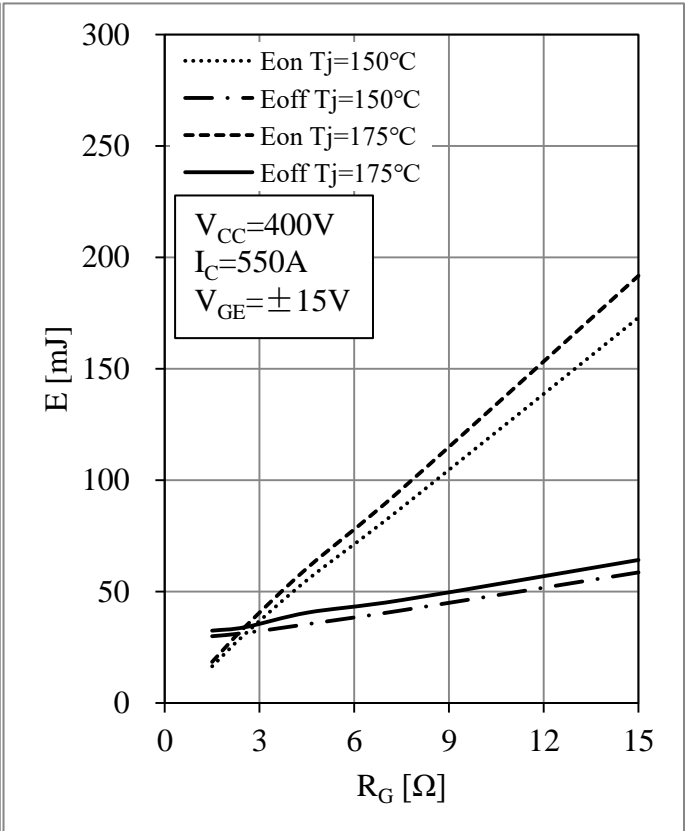


Fig 4. IGBT Switching Loss vs.  $R_G$

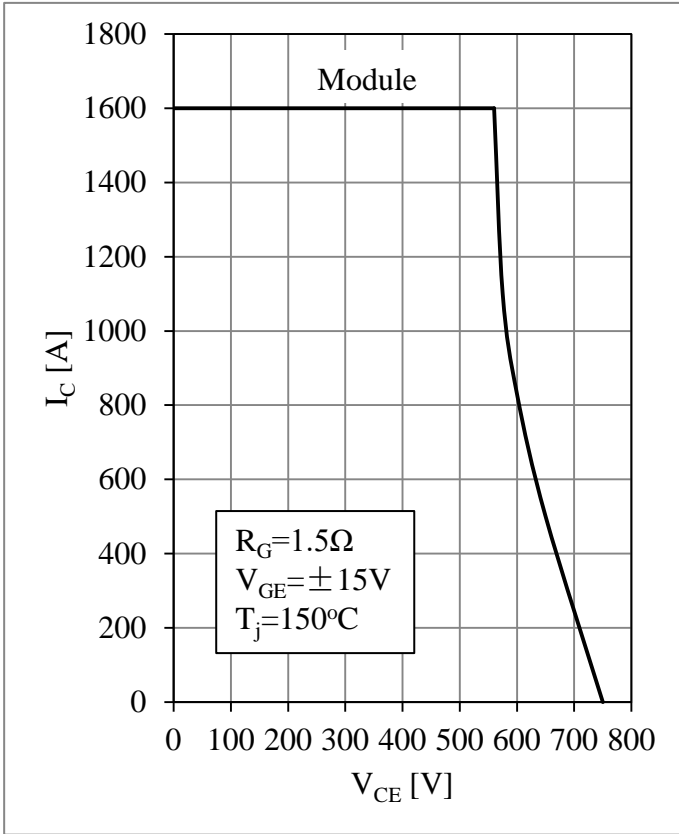


Fig 5. RBSOA

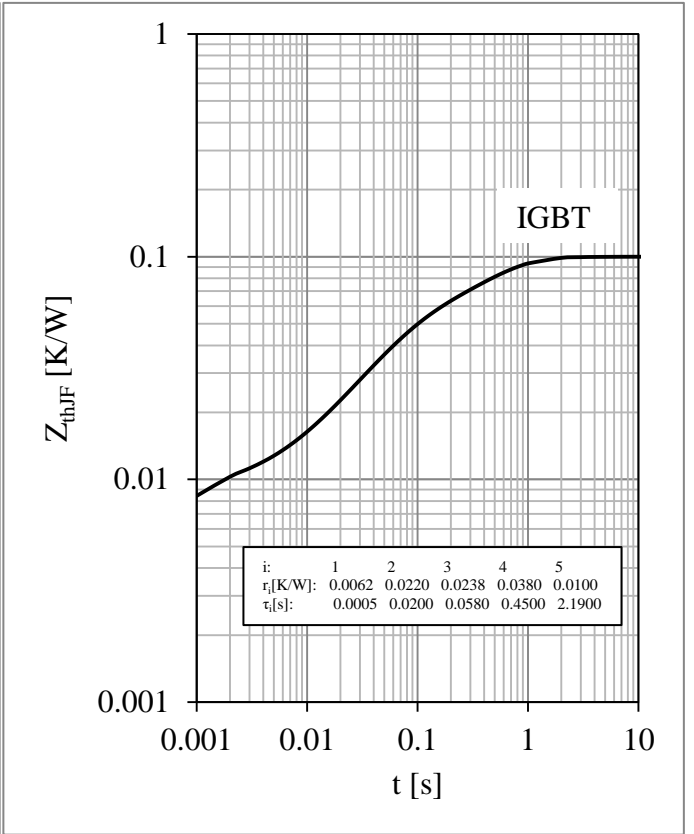


Fig 6. IGBT Transient Thermal Impedance

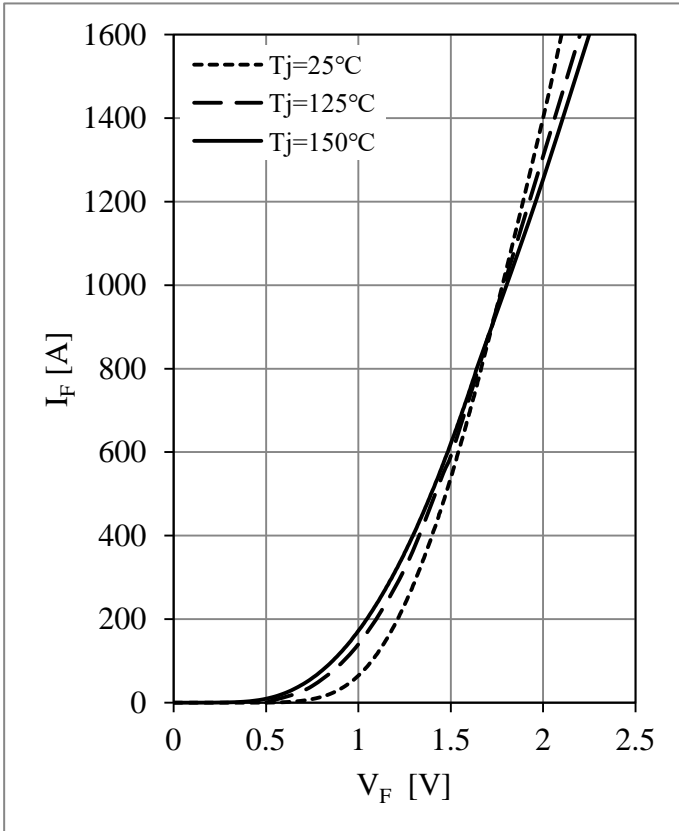


Fig 7. Diode Forward Characteristics

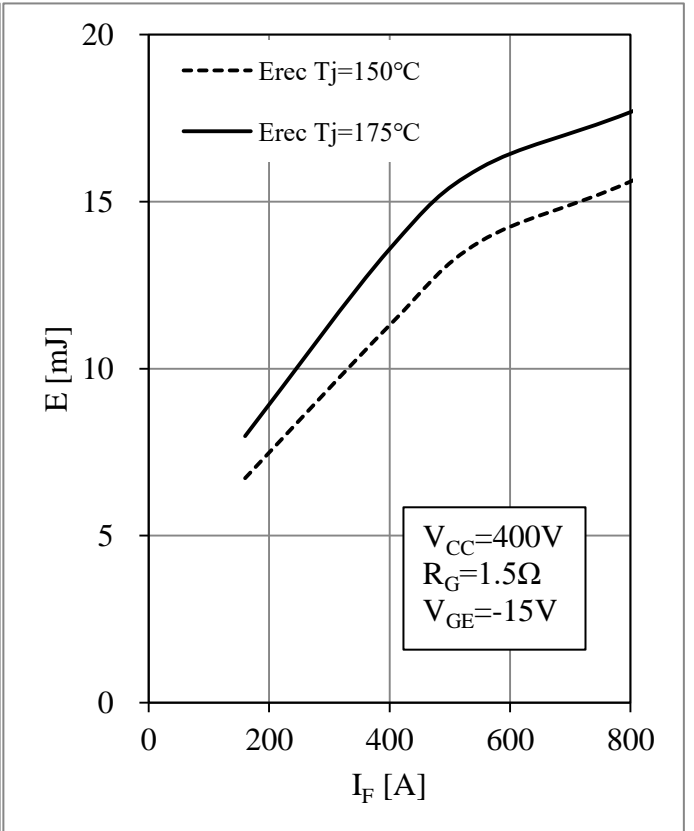


Fig 8. Diode Switching Loss vs.  $I_F$

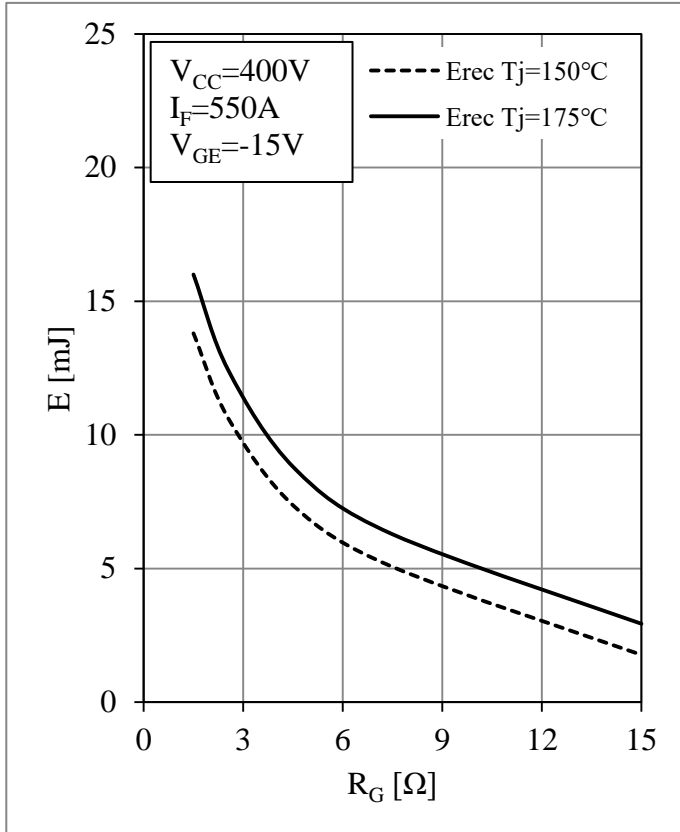


Fig 9. Diode Switching Loss vs.  $R_G$

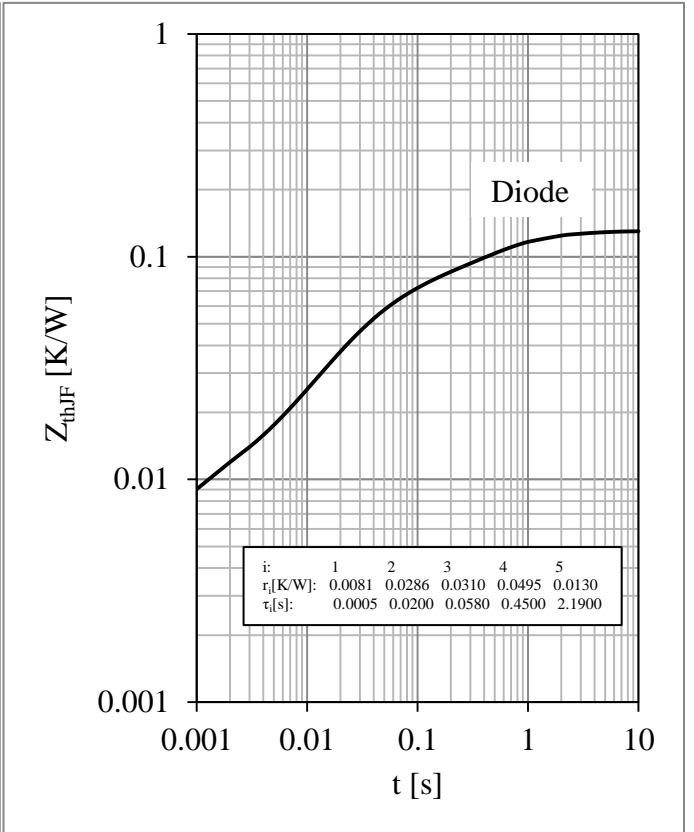


Fig 10. Diode Transient Thermal Impedance

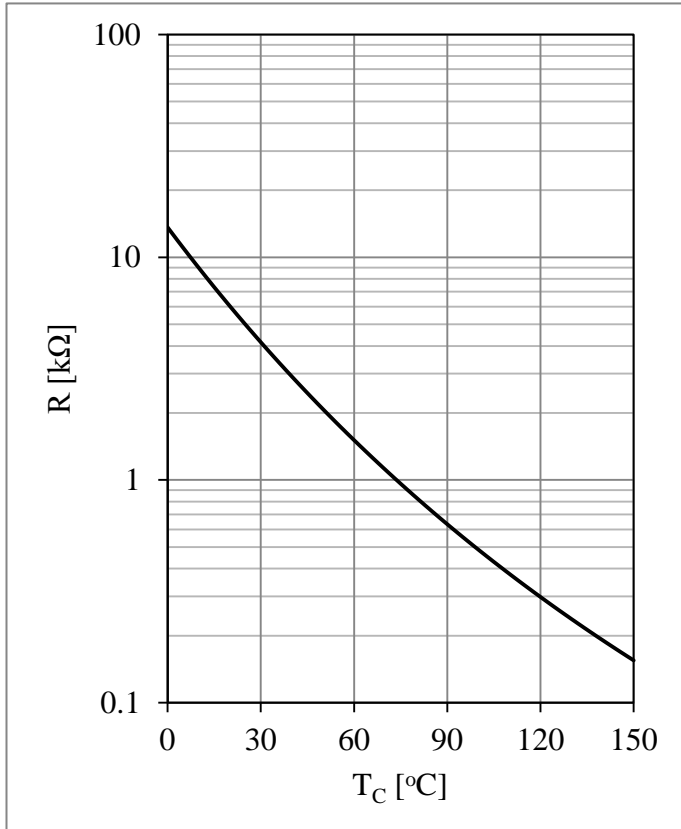
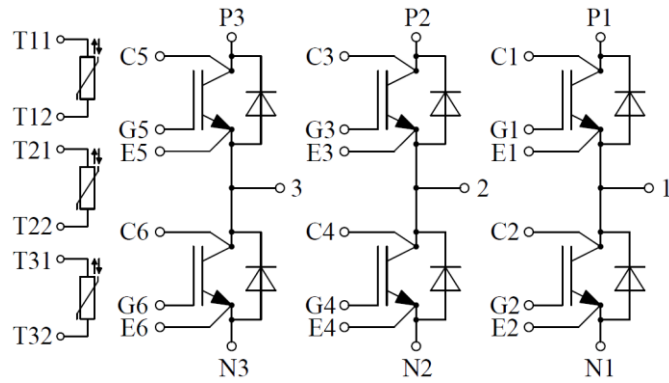


Fig 11. NTC Temperature Characteristic

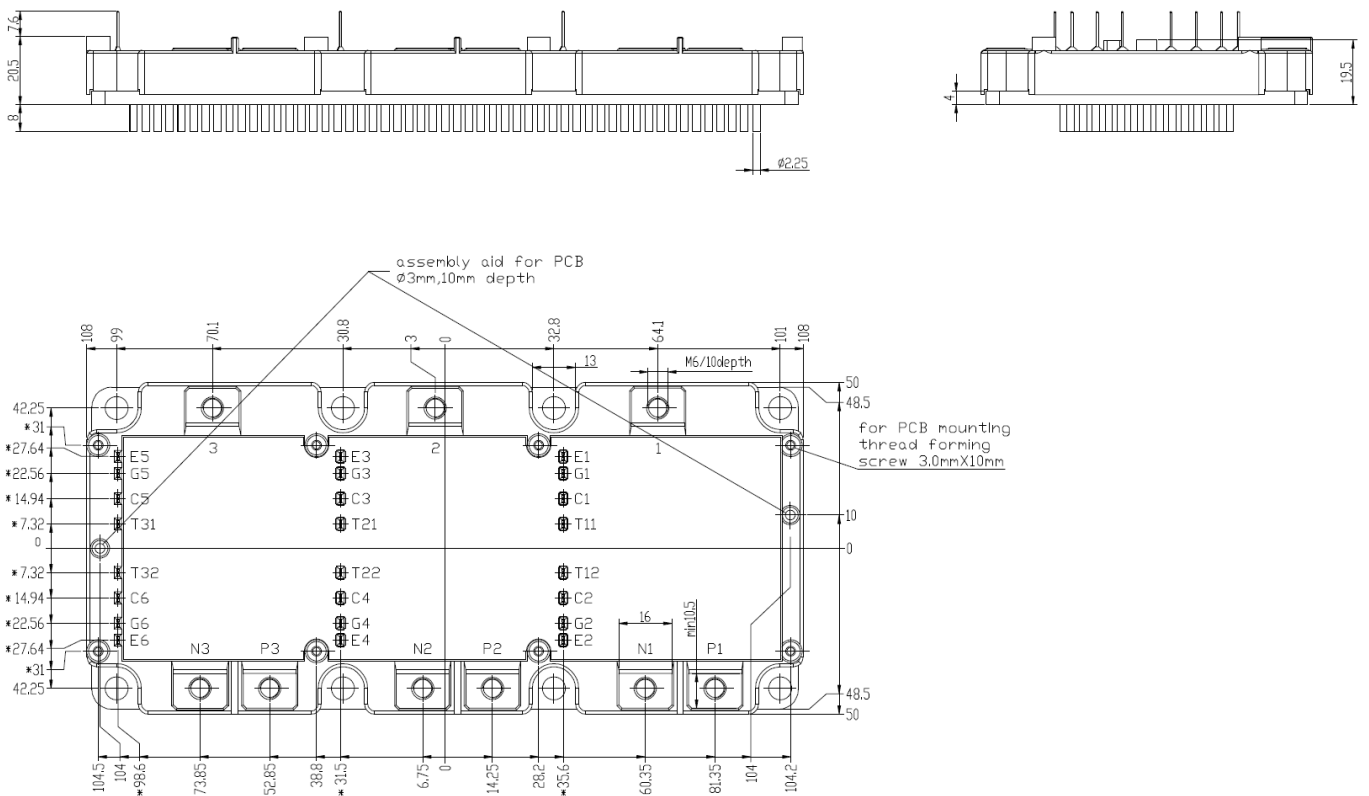


**Circuit Schematic**



**Package Dimensions**

Dimensions in Millimeters



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