

STARPOWER

SEMICONDUCTOR

IGBT

GD820HTX75P6HL

750V/820A 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.

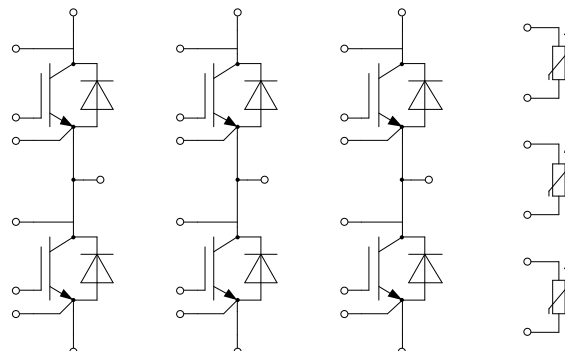
Features

- 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

- 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	750	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_{CN}	Implemented Collector Current	820	A
I_C	Collector Current @ $T_F=60^{\circ}\text{C}$	450	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	1640	A
P_D	Maximum Power Dissipation @ $T_F=75^{\circ}\text{C}$ $T_j=175^{\circ}\text{C}$	751	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	750	V
I_{FN}	Implemented Collector Current	820	A
I_F	Diode Continuous Forward Current	450	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	1640	A
I^2t	I^2t -value, $t_p=10\text{ms}$ @ $T_j=150^{\circ}\text{C}$ @ $T_j=175^{\circ}\text{C}$	20402 14129	A^2s

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{jop}	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, $f=50\text{Hz}$, $t=1\text{min}$	4000	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	$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.35	1.60	V
		$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		1.60		
		$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=175^{\circ}\text{C}$		1.65		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=9.60\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	4.9	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			0.7		Ω
C_{ies}	Input Capacitance	$V_{CE}=50\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		69.1		nF
C_{oes}	Output Capacitance			2.31		nF
C_{res}	Reverse Transfer Capacitance			1.05		nF
Q_G	Gate Charge	$V_{CE}=400\text{V}, I_C=450\text{A}, V_{GE}=-8\dots+15\text{V}$		3.29		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400\text{V}, I_C=450\text{A}, R_G=2.4\Omega, V_{GE}=-8\text{V}/15\text{V}, T_j=25^{\circ}\text{C}$		308		ns
t_r	Rise Time			77		ns
$t_{d(off)}$	Turn-Off Delay Time			865		ns
t_f	Fall Time			38		ns
E_{on}	Turn-On Switching Loss			14.9		mJ
E_{off}	Turn-Off Switching Loss			22.3		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400\text{V}, I_C=450\text{A}, R_G=2.4\Omega, V_{GE}=-8\text{V}/15\text{V}, T_j=150^{\circ}\text{C}$		319		ns
t_r	Rise Time			88		ns
$t_{d(off)}$	Turn-Off Delay Time			998		ns
t_f	Fall Time			48		ns
E_{on}	Turn-On Switching Loss			19.3		mJ
E_{off}	Turn-Off Switching Loss			27.6		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400\text{V}, I_C=450\text{A}, R_G=2.4\Omega, V_{GE}=-8\text{V}/15\text{V}, T_j=175^{\circ}\text{C}$		330		ns
t_r	Rise Time			88		ns
$t_{d(off)}$	Turn-Off Delay Time			998		ns
t_f	Fall Time			57		ns
E_{on}	Turn-On Switching Loss			19.8		mJ
E_{off}	Turn-Off Switching Loss			28.5		mJ
I_{SC}	SC Data	$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}, V_{CC}=400\text{V}, V_{CEM} \leq 750\text{V}$		4800		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	$I_F=450\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.40	1.65	V
		$I_F=450\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.35		
		$I_F=450\text{A}, V_{GE}=0\text{V}, T_j=175^{\circ}\text{C}$		1.30		
Q_r	Recovered Charge	$V_R=400\text{V}, I_F=450\text{A},$ $-di/dt=4500\text{A}/\mu\text{s}, V_{GE}=-8\text{V}$ $T_j=25^{\circ}\text{C}$		18.0		μC
I_{RM}	Peak Reverse Recovery Current			225		A
E_{rec}	Reverse Recovery Energy			6.30		mJ
Q_r	Recovered Charge	$V_R=400\text{V}, I_F=450\text{A},$ $-di/dt=4500\text{A}/\mu\text{s}, V_{GE}=-8\text{V}$ $T_j=150^{\circ}\text{C}$		36.0		μC
I_{RM}	Peak Reverse Recovery Current			315		A
E_{rec}	Reverse Recovery Energy			11.7		mJ
Q_r	Recovered Charge	$V_R=400\text{V}, I_F=450\text{A},$ $-di/dt=4500\text{A}/\mu\text{s}, V_{GE}=-8\text{V}$ $T_j=175^{\circ}\text{C}$		40.5		μC
I_{RM}	Peak Reverse Recovery Current			333		A
E_{rec}	Reverse Recovery Energy			13.5		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		k Ω
$\Delta R/R$	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
L_{CE}	Stray Inductance		8		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.75		m Ω
Δp	$\Delta V/\Delta t=10.0\text{dm}^3/\text{min}, T_F=75^{\circ}\text{C}$		64		mbar
p	Maximum Pressure In Cooling Circuit			2.5	bar
R_{thJF}	Junction-to-Cooling Fluid (per IGBT) Junction-to-Cooling Fluid (per Diode)			0.133 0.217	K/W
M	Terminal Connection Torque, Screw M4	1.8		2.2	N.m
G	Weight of Module		755		g

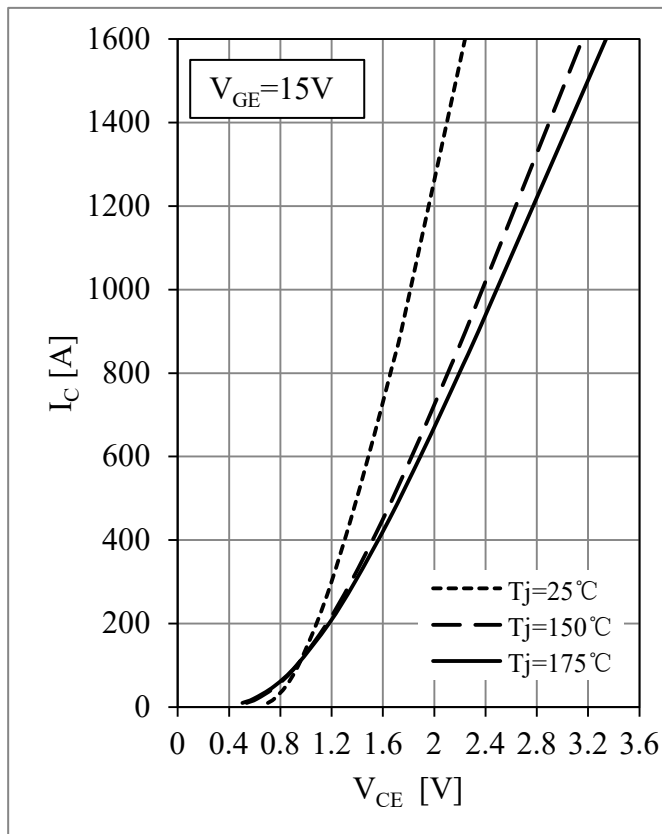


Fig 1. IGBT Output Characteristics

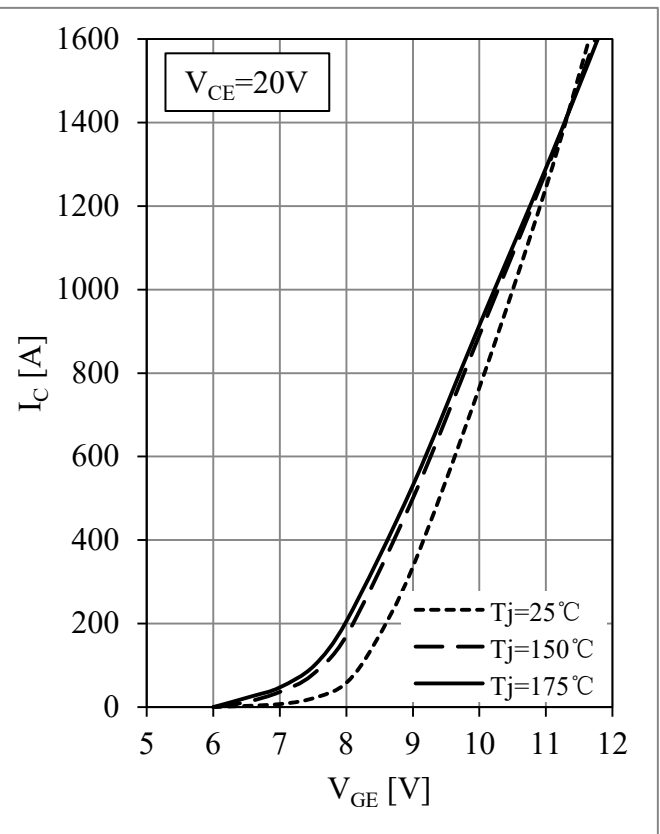
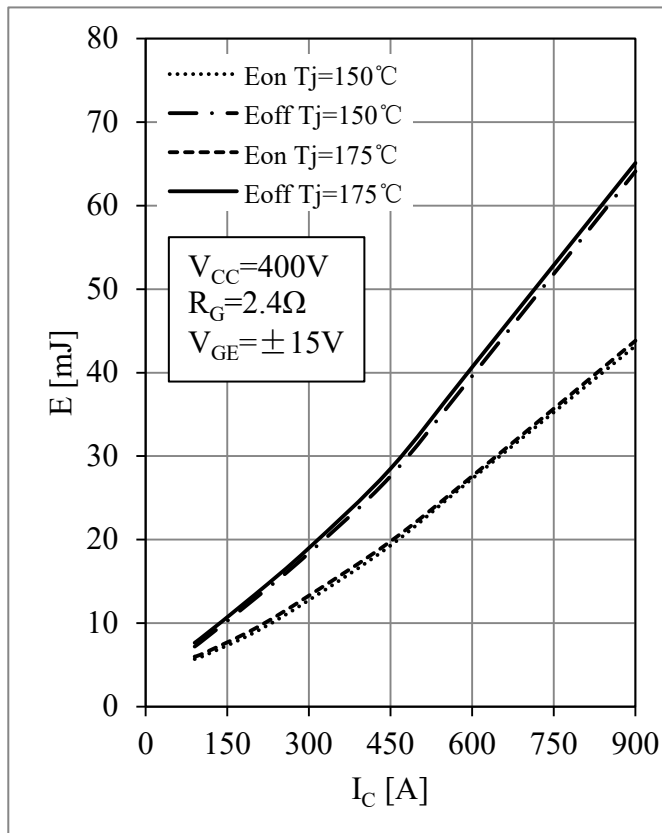
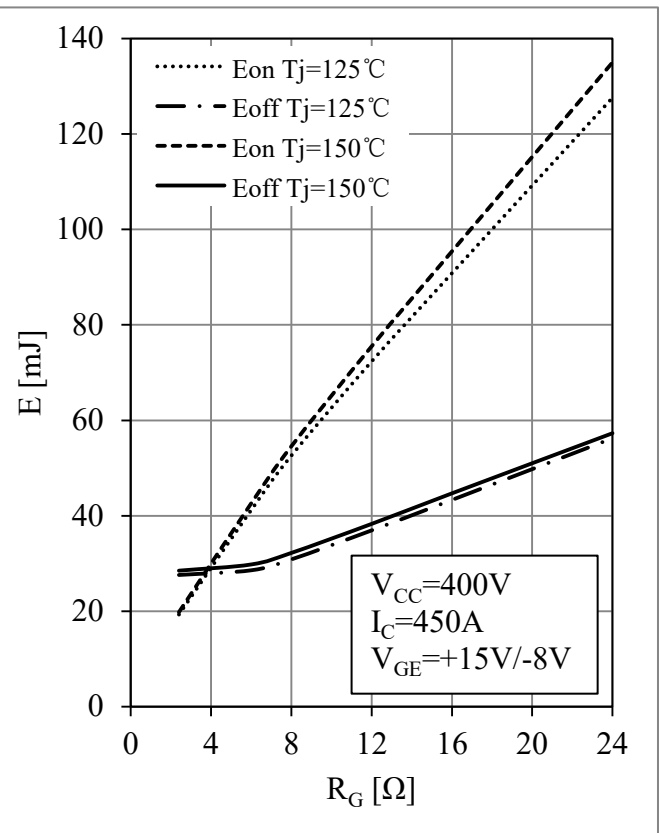


Fig 2. IGBT Transfer Characteristics

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

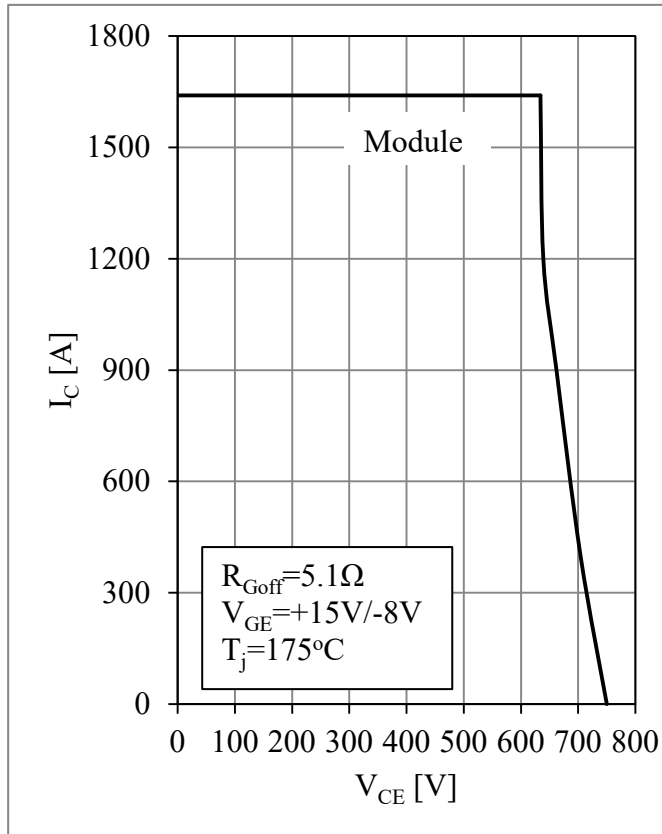


Fig 5. RBSOA

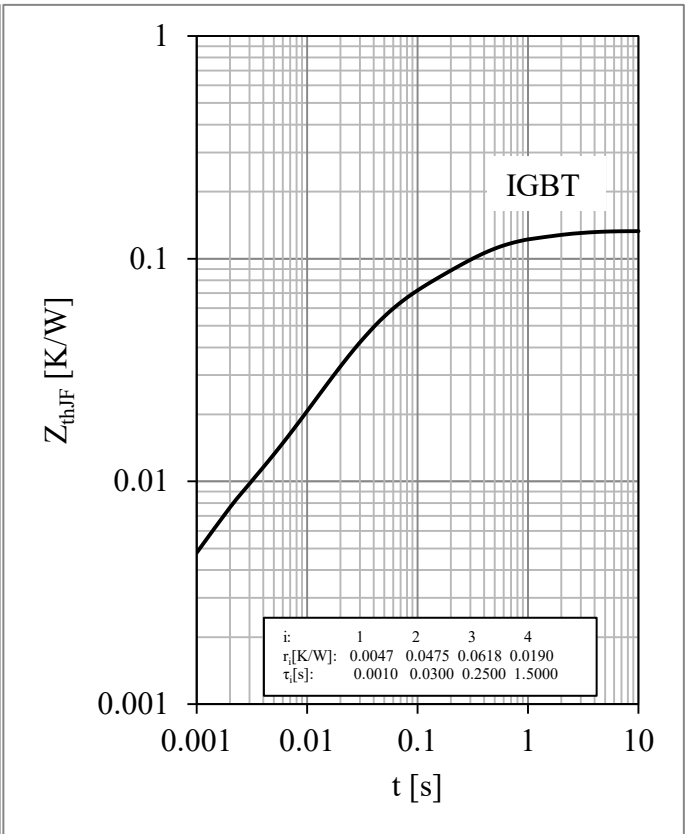


Fig 6. IGBT Transient Thermal Impedance

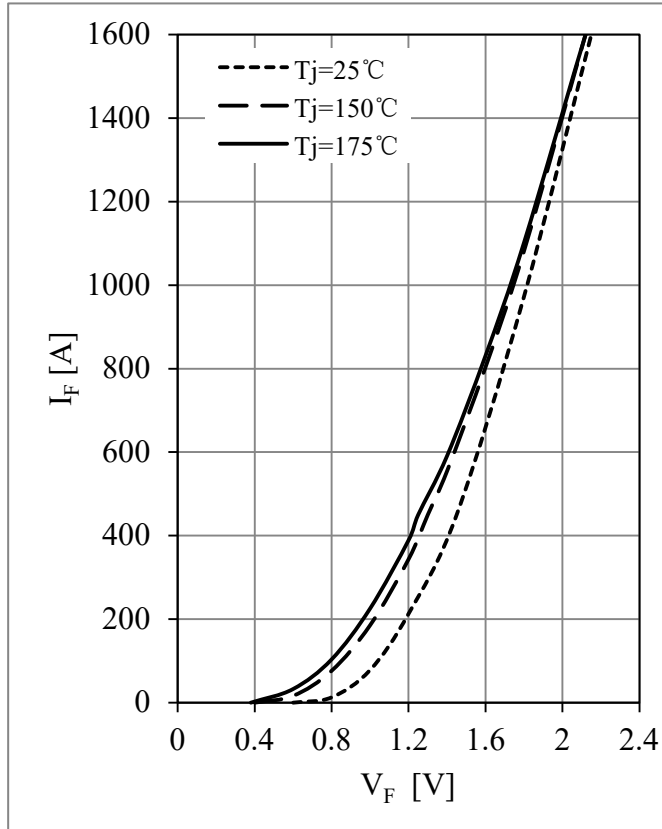
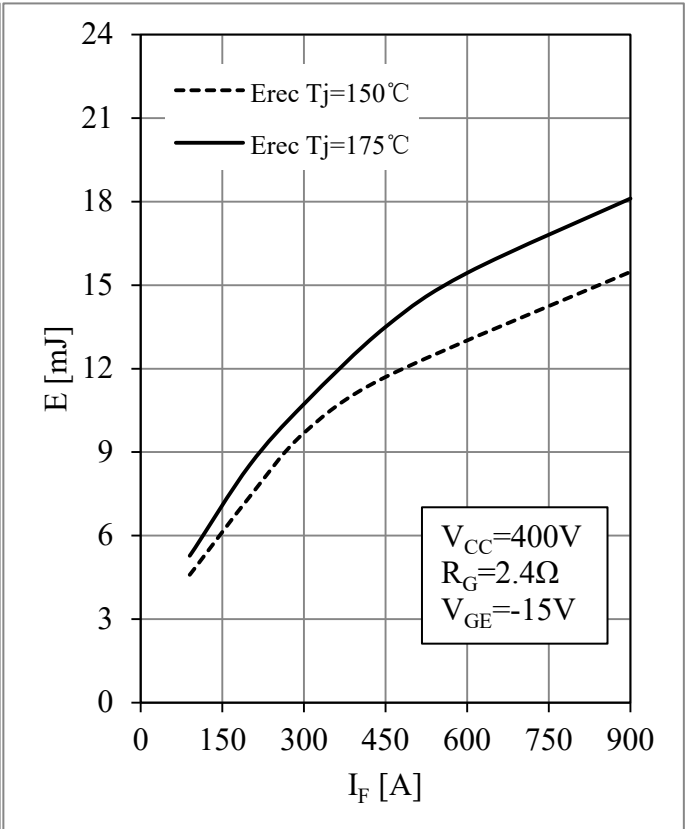


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

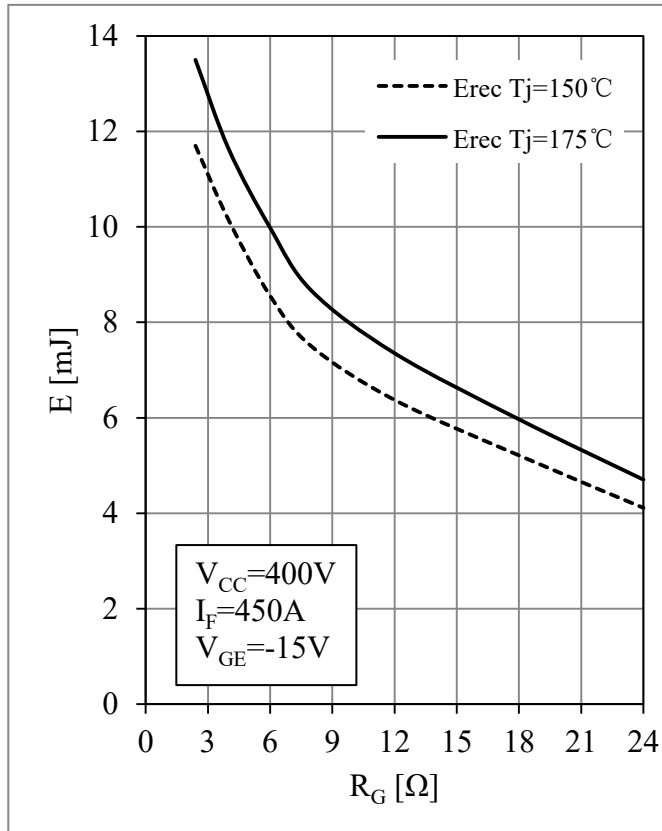
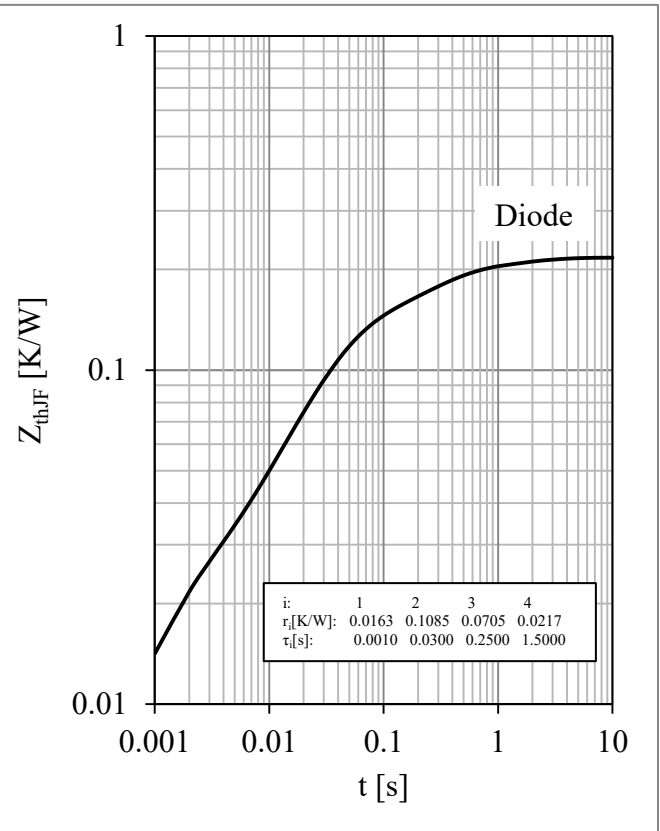
Fig 9. Diode Switching Loss vs. R_G 

Fig 10. Diode Transient Thermal Impedance

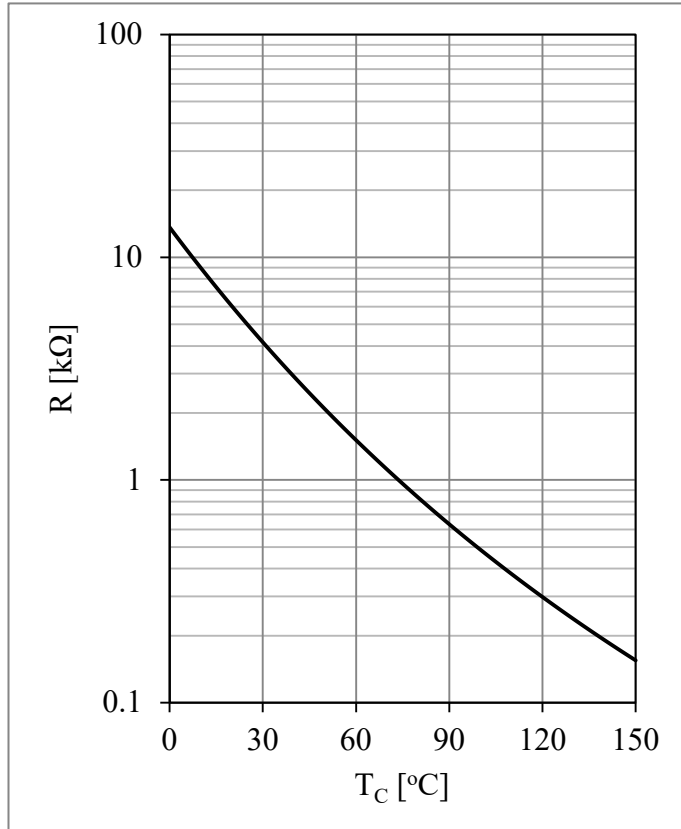
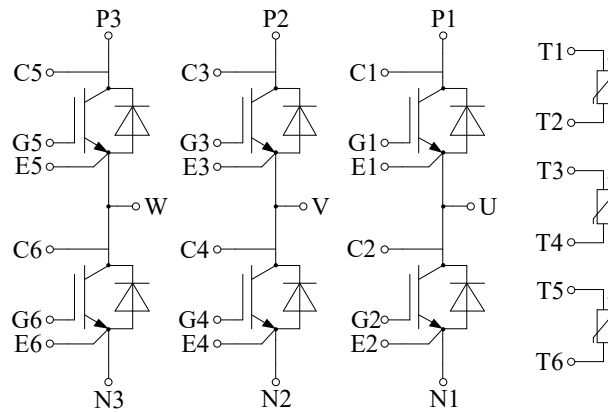


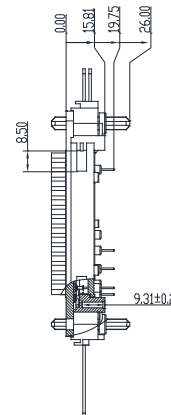
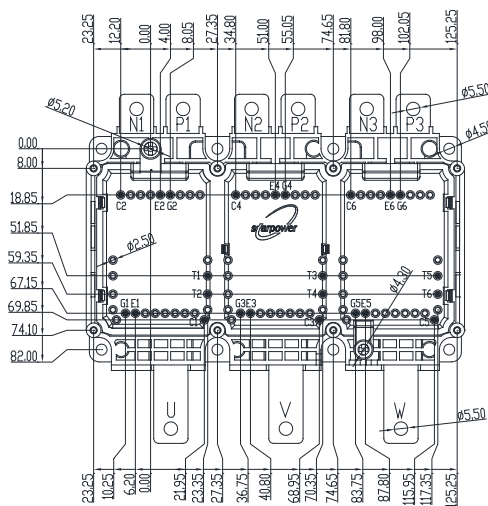
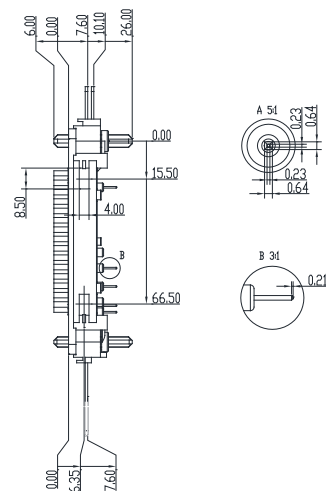
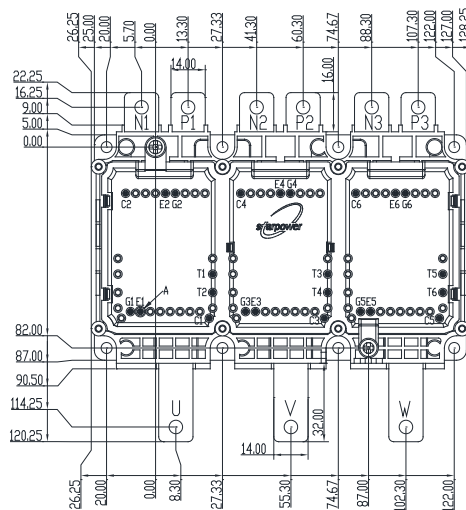
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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