

STARPOWER

SEMICONDUCTOR™

IGBT

GD450HFT120C6S

Molding Type Module**1200V/450A 2 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 general inverters and UPS.

Features

- Low $V_{CE(sat)}$ trench IGBT technology
- Low switching losses
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology

Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

IGBT-inverter $T_C=25^{\circ}\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD450HFT120C6S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^{\circ}\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage @ $T_j=25^{\circ}\text{C}$	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=80^{\circ}\text{C}$	750 450	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	900	A
P_{tot}	Total Power Dissipation @ $T_j=175^{\circ}\text{C}$	2381	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^{\circ}\text{C}$	1200			V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V},$ $T_j=25^{\circ}\text{C}$			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V},$ $T_j=25^{\circ}\text{C}$			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=18.0\text{mA}, V_{CE}=V_{GE},$ $T_j=25^{\circ}\text{C}$	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=450\text{A}, V_{GE}=15\text{V},$ $T_j=25^{\circ}\text{C}$		1.70	2.15	V
		$I_C=450\text{A}, V_{GE}=15\text{V},$ $T_j=125^{\circ}\text{C}$		2.00		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=450A,$ $R_G=1.6\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		251		ns
t_r	Rise Time			89		ns
$t_{d(off)}$	Turn-Off Delay Time			545		ns
t_f	Fall Time			135		ns
E_{on}	Turn-On Switching Loss			21.9		mJ
E_{off}	Turn-Off Switching Loss			43.2		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=450A,$ $R_G=1.6\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		299		ns
t_r	Rise Time			101		ns
$t_{d(off)}$	Turn-Off Delay Time			655		ns
t_f	Fall Time			158		ns
E_{on}	Turn-On Switching Loss			33.1		mJ
E_{off}	Turn-Off Switching Loss			64.9		mJ
C_{ies}	Input Capacitance	$V_{CE}=25V, f=1Mhz,$ $V_{GE}=0V$		32.3		nF
C_{oes}	Output Capacitance			1.69		nF
C_{res}	Reverse Transfer Capacitance			1.46		nF
Q_G	Gate Charge	$V_{CC}=600V, I_C=450A,$ $V_{GE}=15V$		4.30		μC
R_{Gint}	Internal Gate Resister			1.7		Ω
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		1800		A

DIODE-inverter $T_C=25^{\circ}\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD450HFT120C6S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_J=25^{\circ}\text{C}$	1200	V
I_F	DC Forward Current	450	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	900	A

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=450\text{A}$, $V_{GE}=0\text{V}$		1.65	2.15	V
		$T_J=25^{\circ}\text{C}$		1.65		
		$T_J=125^{\circ}\text{C}$				
Q_r	Recovered Charge	$I_F=450\text{A}$, $V_R=600\text{V}$, $R_G=1.6\Omega$, $V_{GE}=-15\text{V}$		46		μC
		$T_J=25^{\circ}\text{C}$		86		
		$T_J=125^{\circ}\text{C}$				
I_{RM}	Peak Reverse Recovery Current	$T_J=25^{\circ}\text{C}$		313		A
		$T_J=125^{\circ}\text{C}$		406		
E_{rec}	Reverse Recovery Energy	$T_J=25^{\circ}\text{C}$		21.2		mJ
		$T_J=125^{\circ}\text{C}$		38.9		

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated Resistance			5.0		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$R_{100}=493.3\Omega$	-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

IGBT Module

Symbol	Parameter	Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500			V
L_{CE}	Stray Inductance		20		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip @ $T_C=25^{\circ}\text{C}$		1.10		$\text{m}\Omega$
$R_{\theta JC}$	Junction-to-Case (per IGBT) Junction-to-Case (per DIODE)			0.063 0.110	K/W
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)		0.009		K/W
T_J	Maximum Junction Temperature			175	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40		125	$^{\circ}\text{C}$
Mounting Torque	Power Terminal Screw:M5 Mounting Screw:M6	3.0 3.0		6.0 6.0	N.m
Weight	Weight of Module		350		g

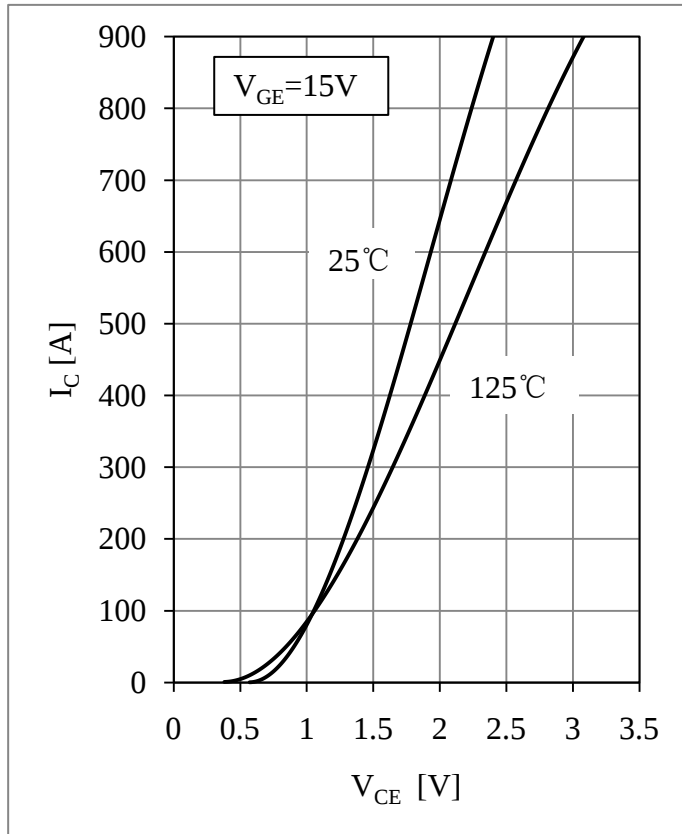


Fig 1. IGBT Output Characteristics

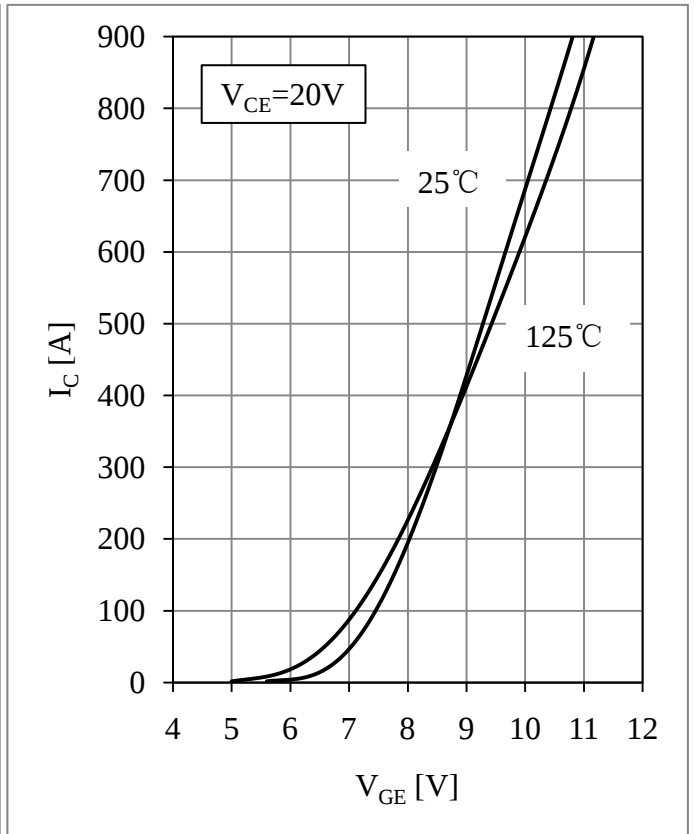
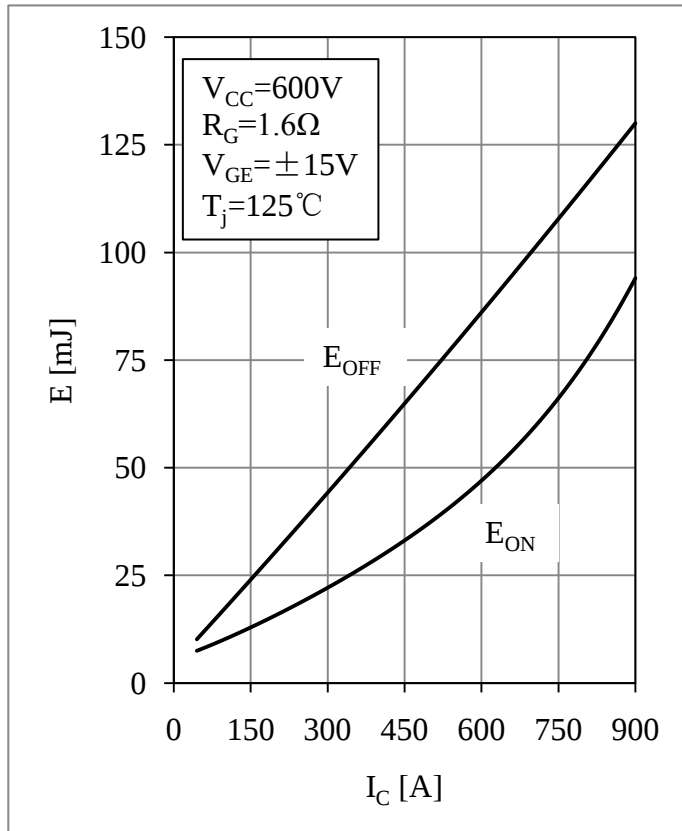
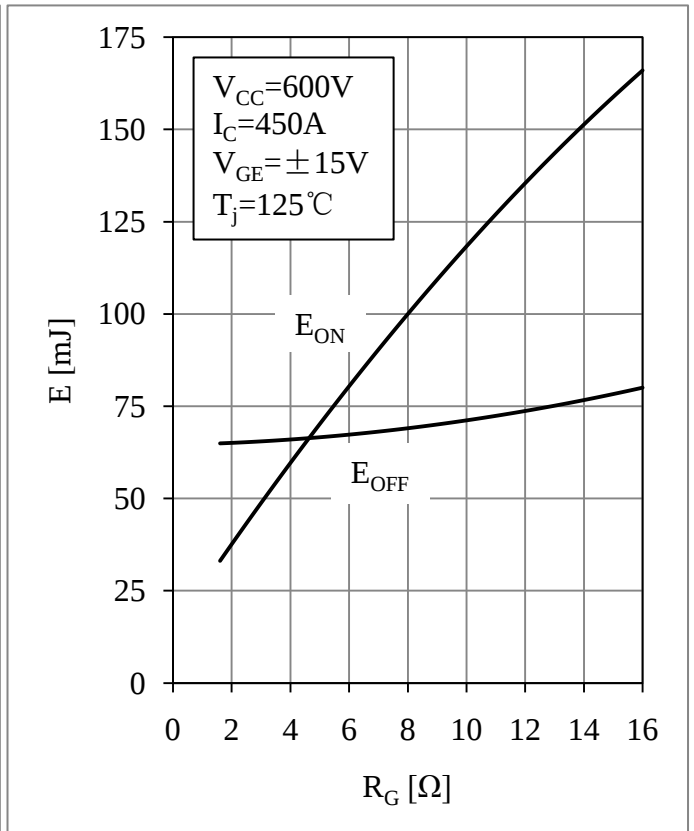


Fig 2. IGBT Transfer Characteristics

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

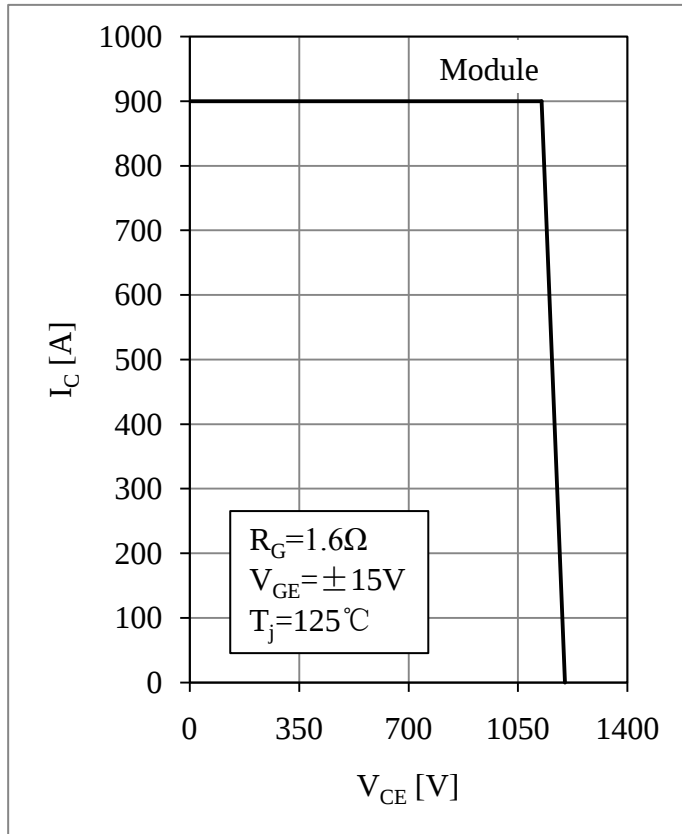


Fig 5. RBSOA

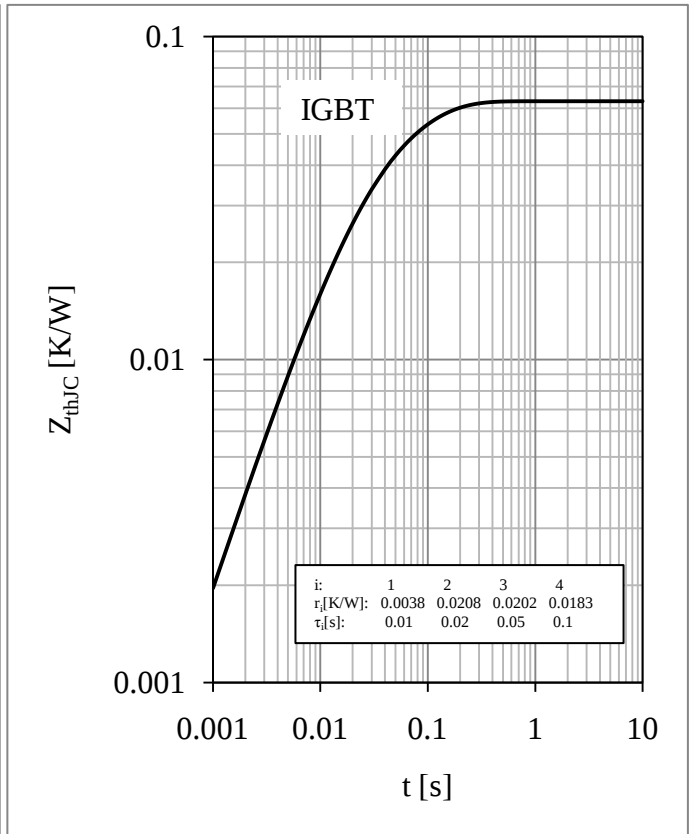


Fig 6. IGBT Transient Thermal Impedance

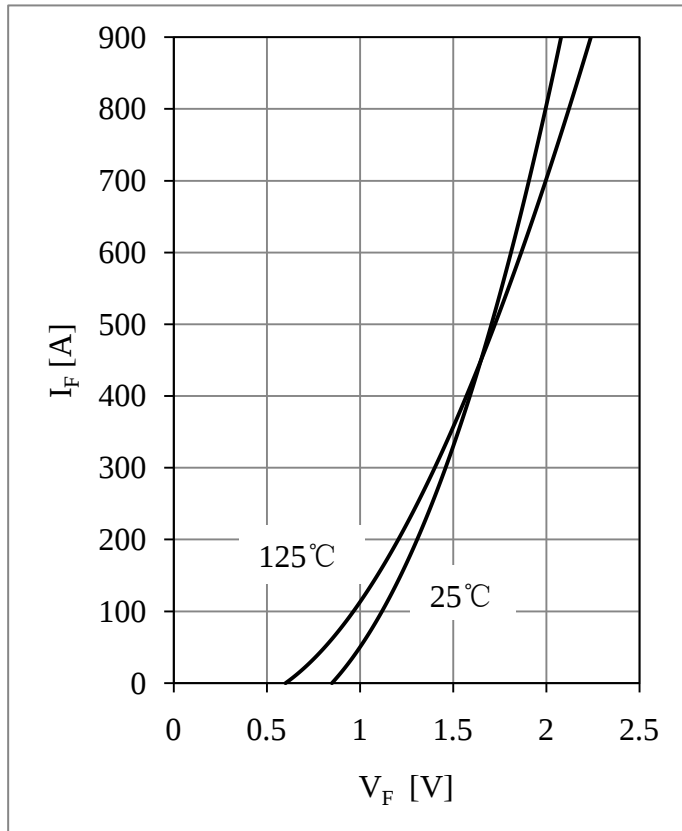
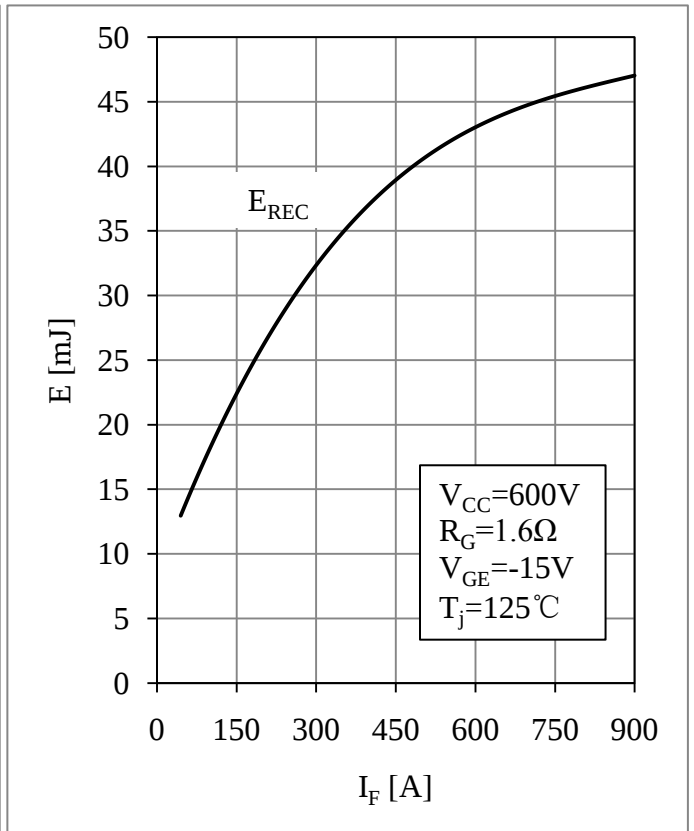


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

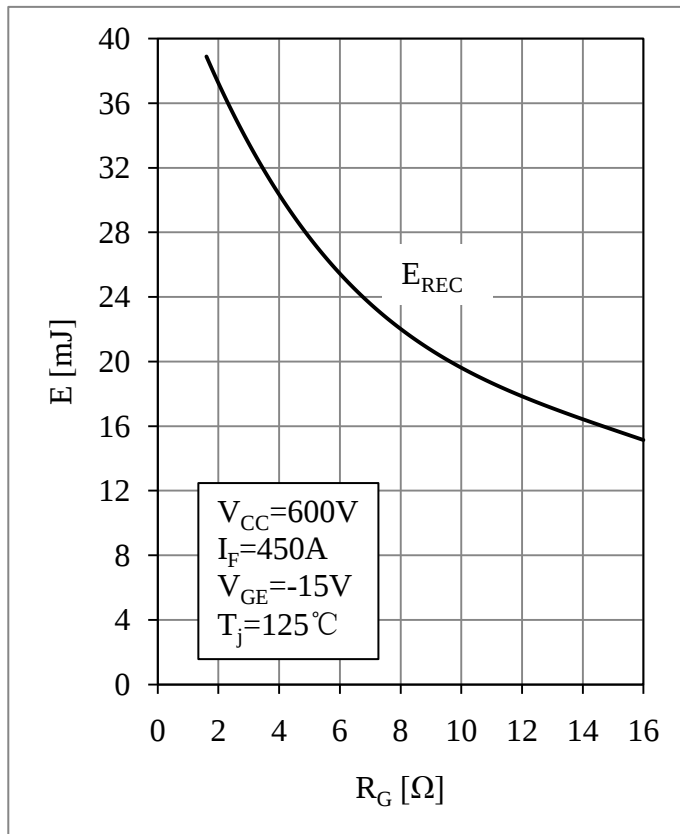
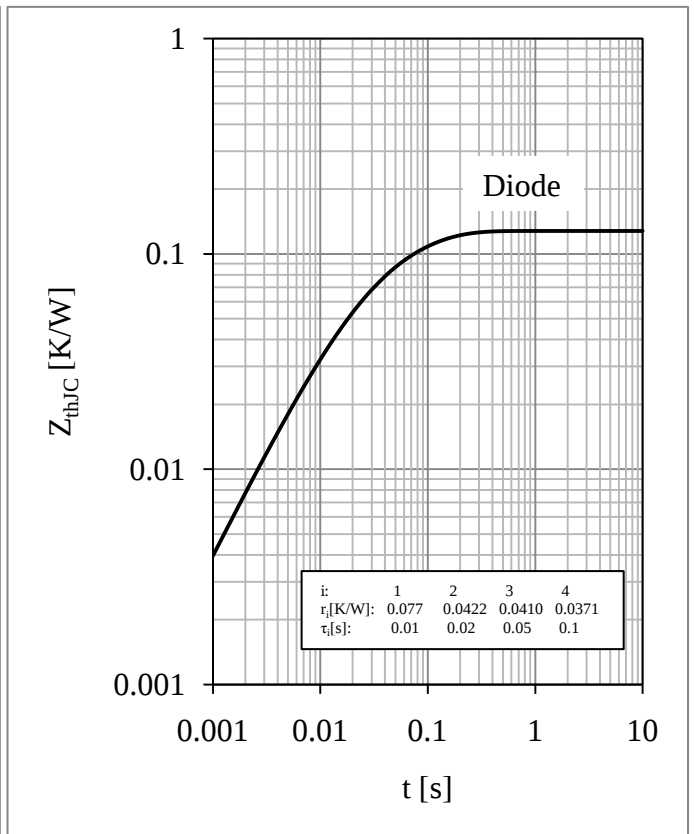
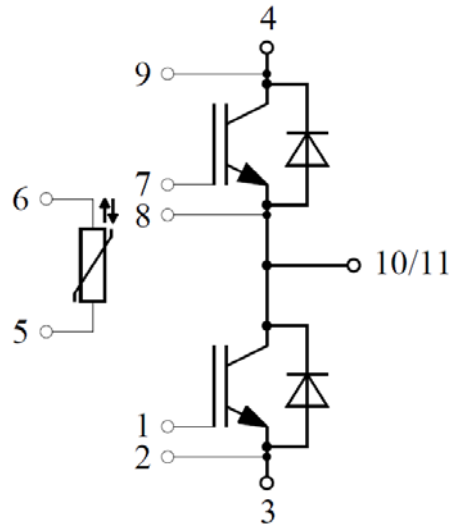
Fig 9. Diode Switching Loss vs. R_G 

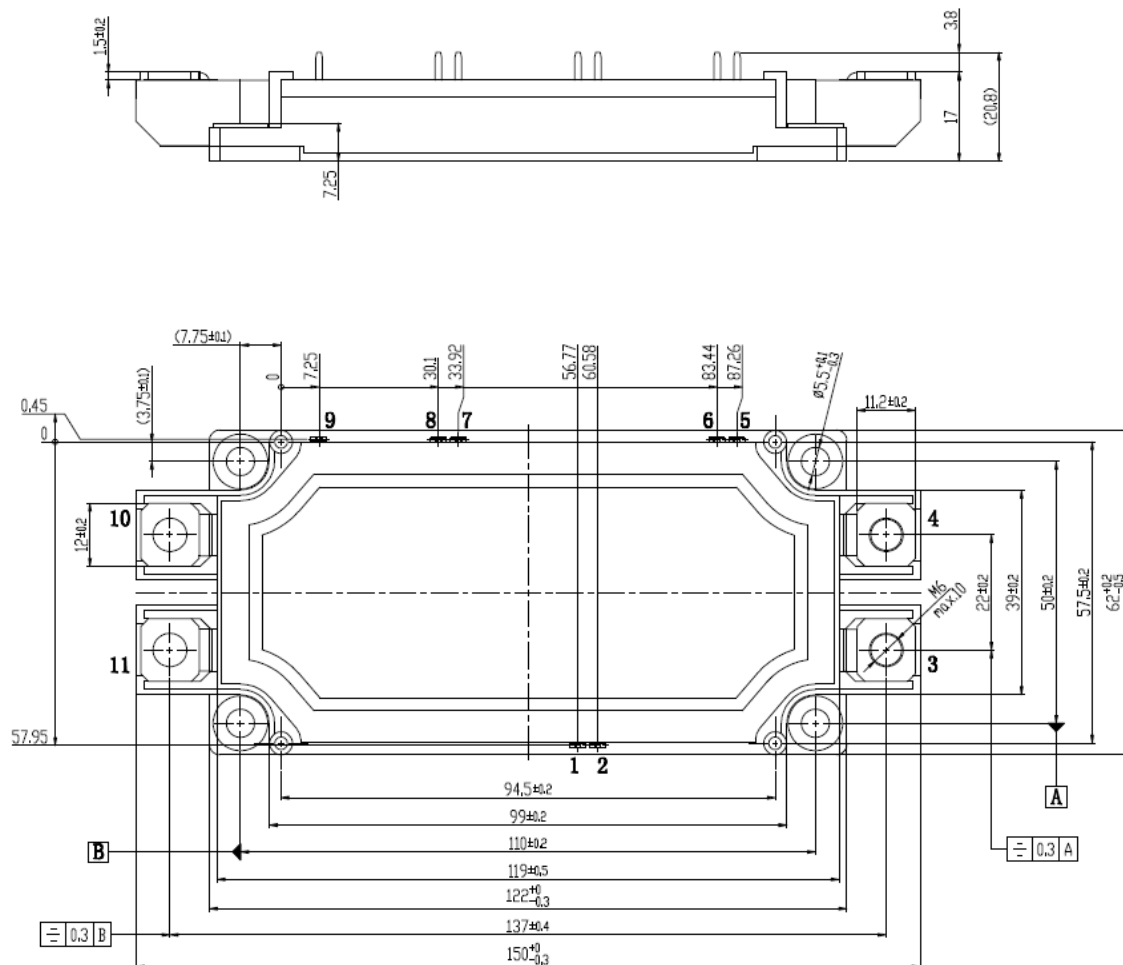
Fig 10. Diode Transient Thermal Impedance

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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