

STARPOWER

SEMICONDUCTOR

IGBT

GD50HHU120C5S

1200V/50A 4 in one-package

General Description

STARPOWER IGBT Power Module provides ultrafast switching speed as well as short circuit ruggedness. It's designed for the applications such as welding machine and inductive heating.



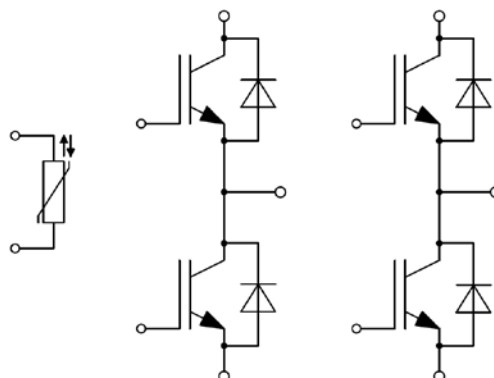
Features

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

Typical Applications

- Switching mode power supply
- Inductive heating
- Welding machine

Equivalent Circuit Schematic



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

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	77	A
	@ $T_C=80^{\circ}\text{C}$	50	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	100	A
P_D	Maximum Power Dissipation @ $T_j=150^{\circ}\text{C}$	396	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	50	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	100	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	150	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40 to +125	$^{\circ}\text{C}$
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 $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=50\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		2.90	3.35	V
		$I_C=50\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		3.60		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.0\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.0	6.1	7.0	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
R_{Gint}	Internal Gate Resistance			/		Ω
C_{ies}	Input Capacitance	$V_{CE}=30\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		3.41		nF
C_{res}	Reverse Transfer Capacitance			0.20		nF
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		0.61		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=50\text{A}, R_G=13\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		203		ns
t_r	Rise Time			49		ns
$t_{d(off)}$	Turn-Off Delay Time			261		ns
t_f	Fall Time			136		ns
E_{on}	Turn-On Switching Loss			4.20		mJ
E_{off}	Turn-Off Switching Loss			1.64		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=50\text{A}, R_G=13\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		203		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			271		ns
t_f	Fall Time			172		ns
E_{on}	Turn-On Switching Loss			5.50		mJ
E_{off}	Turn-Off Switching Loss			2.41		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		450		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=50\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.82	2.27	V
		$I_F=50\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.95		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=50\text{A},$ $-di/dt=1200\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		3.5		μC
I_{RM}	Peak Reverse Recovery Current			41		A
E_{rec}	Reverse Recovery Energy			1.38		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=50\text{A},$ $-di/dt=1200\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		6.7		μC
I_{RM}	Peak Reverse Recovery Current			56		A
E_{rec}	Reverse Recovery Energy			3.16		mJ

NTC Characteristics $T_C=25^{\circ}\text{C}$ 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

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		30		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		2.20		m Ω
$R_{\theta JC}$	Junction-to-Case (per IGBT)			0.316	K/W
	Junction-to-Case (per Diode)			0.545	
$R_{\theta CS}$	Case-to-Sink (per IGBT)		0.126		K/W
	Case-to-Sink (per Diode)		0.218		
$R_{\theta CS}$	Case-to-Sink		0.02		K/W
M	Mounting Screw:M5	3.0		6.0	N.m
G	Weight of Module		200		g

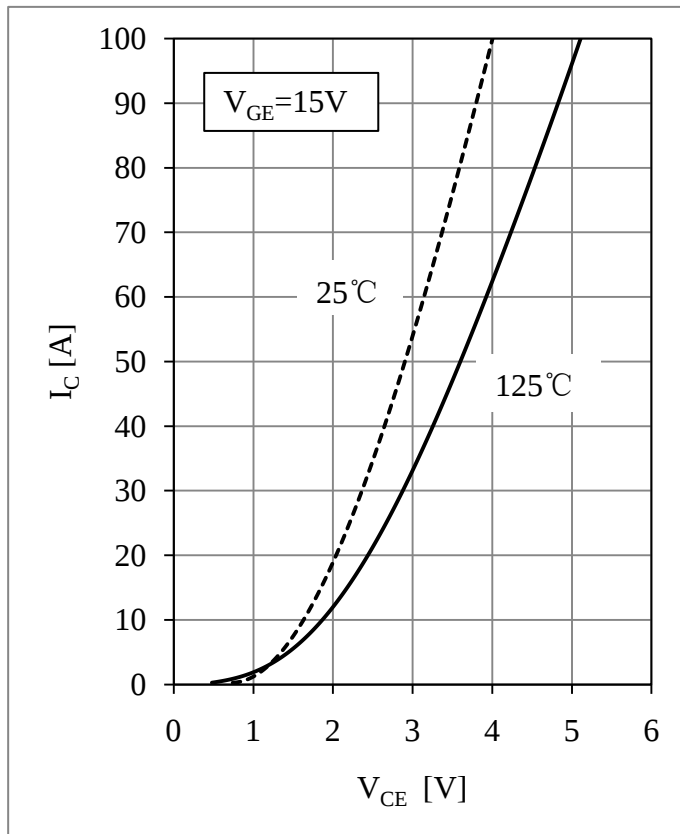


Fig 1. IGBT Output Characteristics

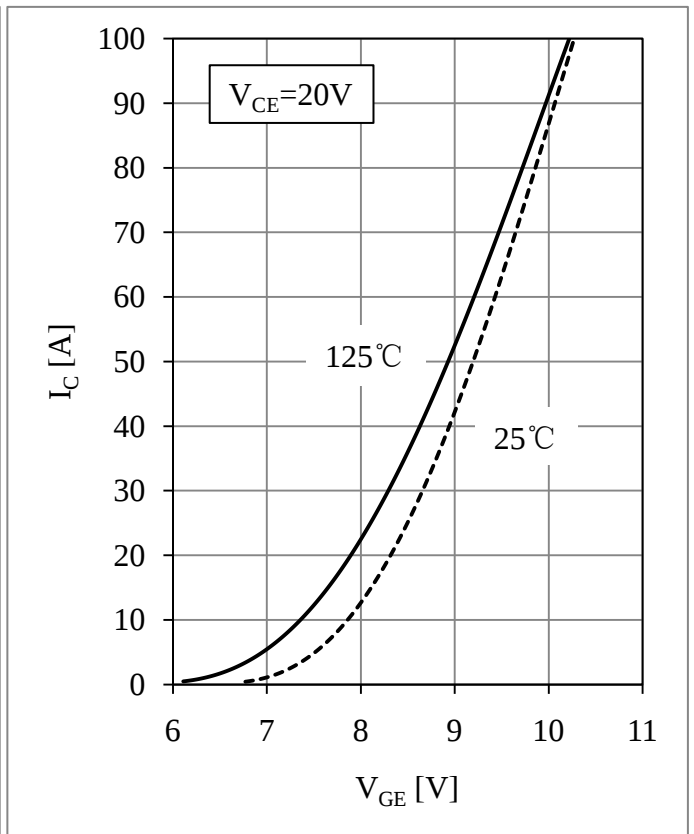
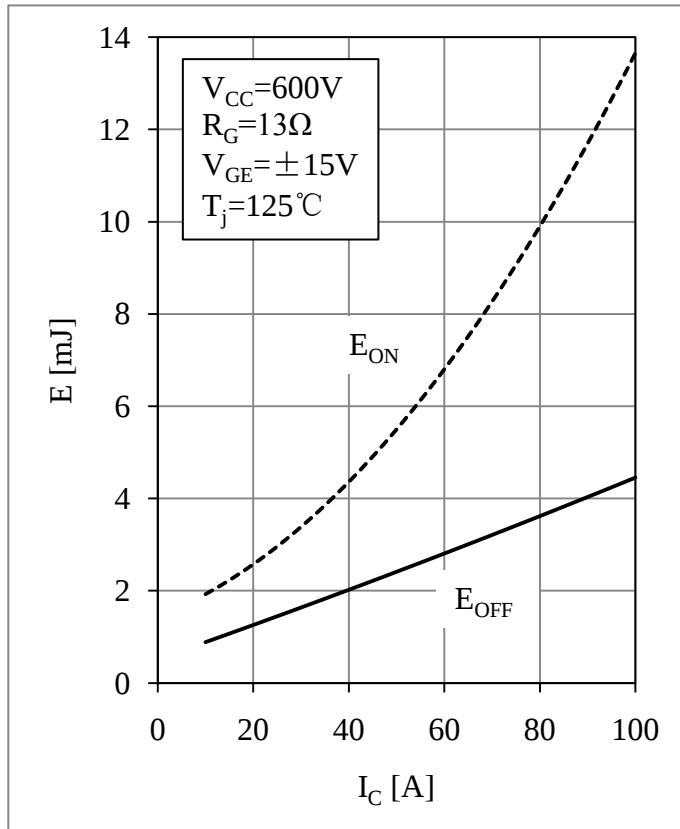
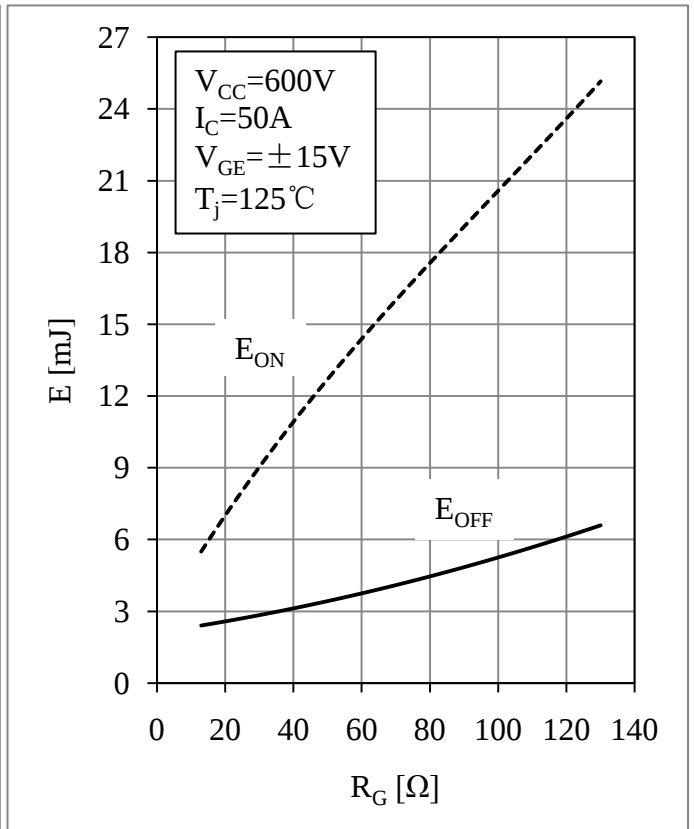


Fig 2. IGBT Transfer Characteristics

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

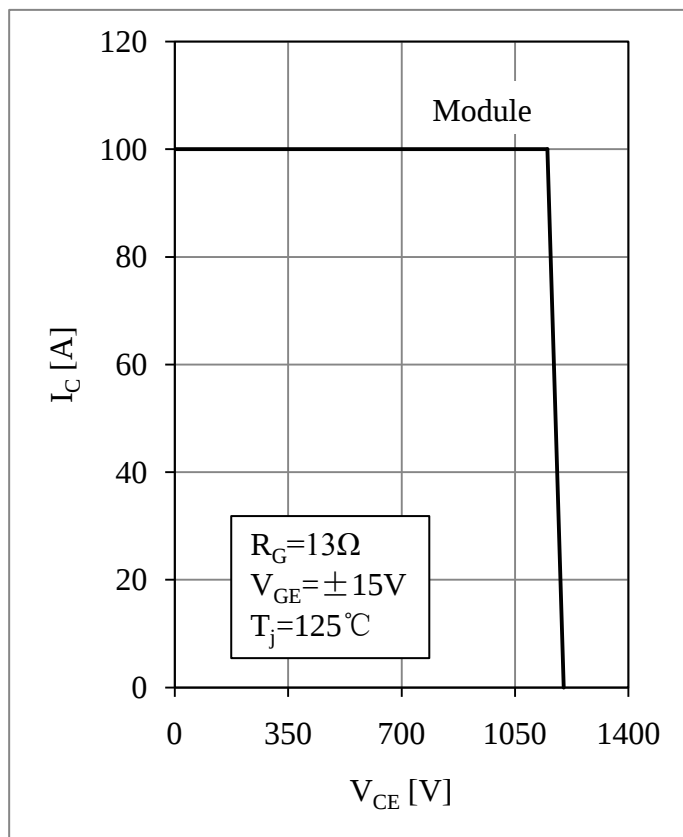


Fig 5. IGBT RBSOA

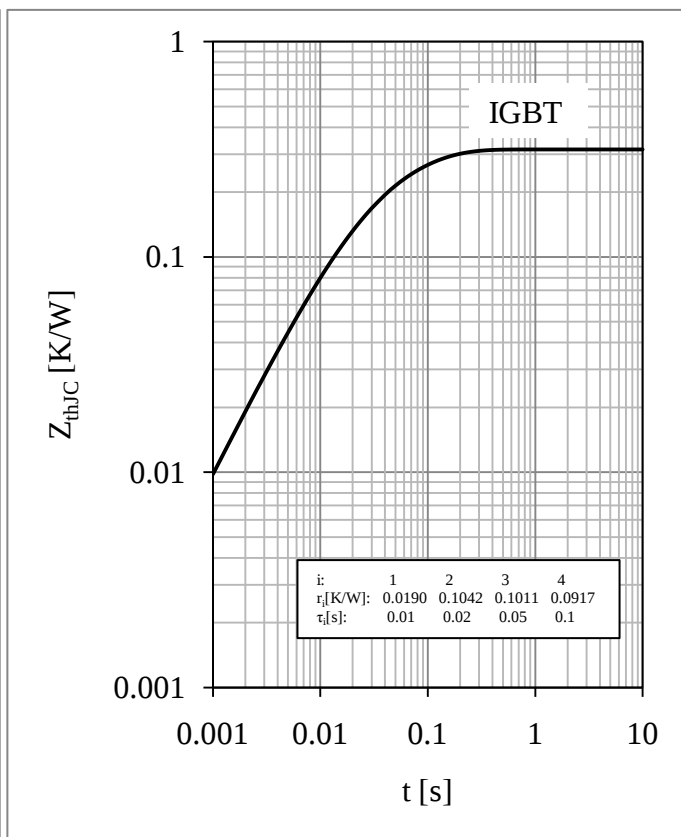


Fig 6. IGBT Transient Thermal Impedance

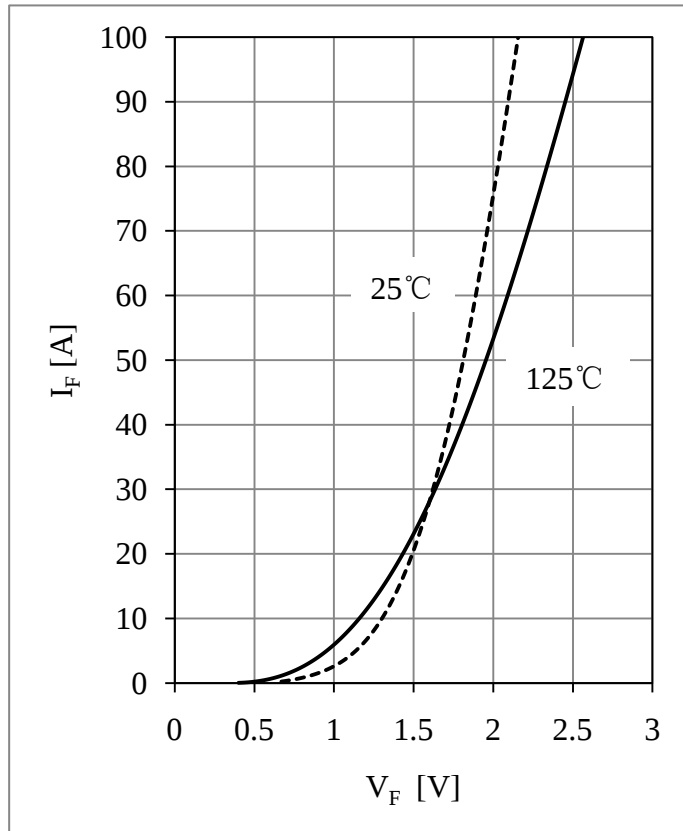
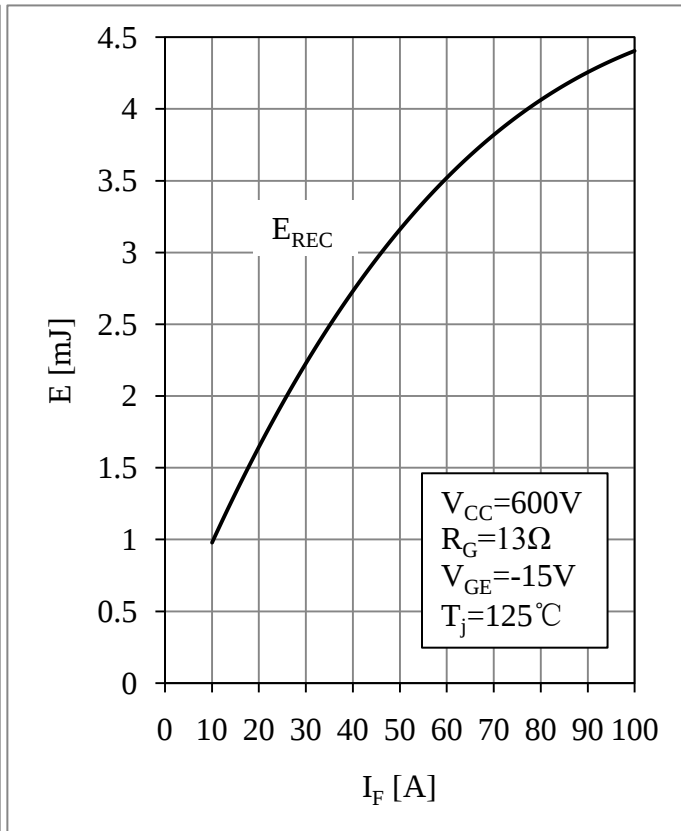


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

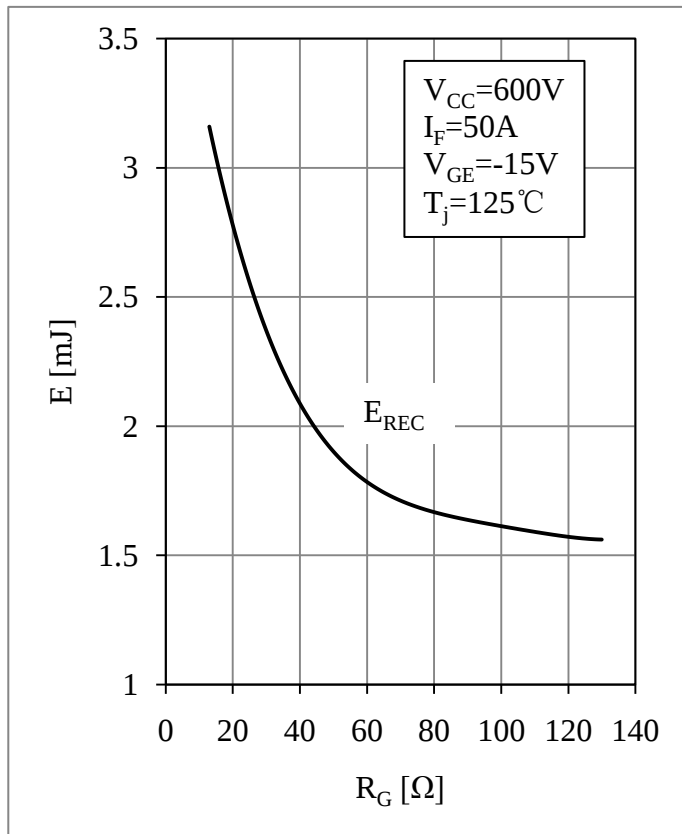
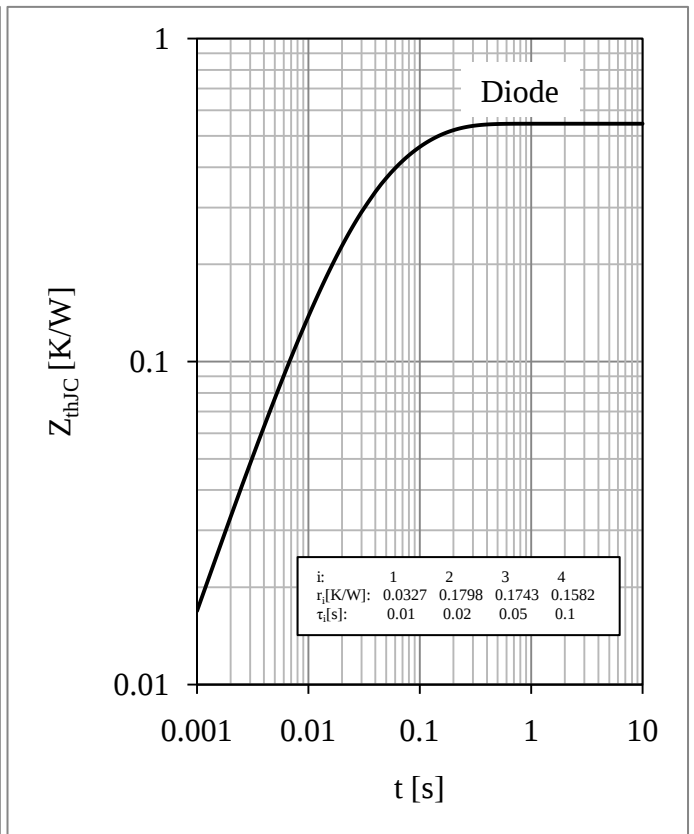
Fig 9. Diode Switching Loss vs. R_G 

Fig 10. Diode Transient Thermal Impedance

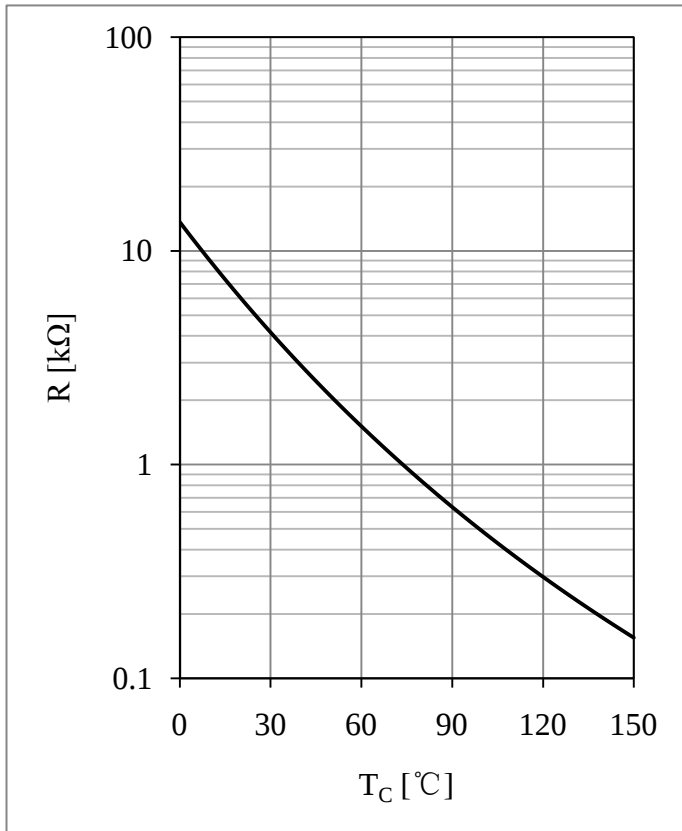
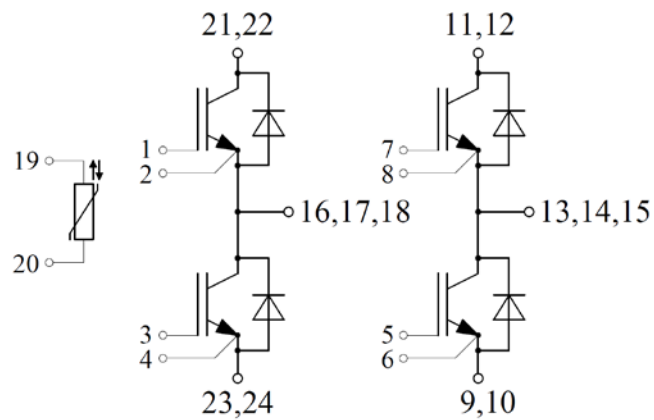


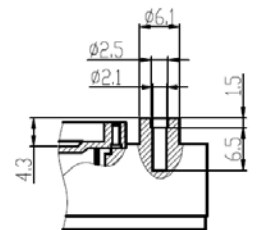
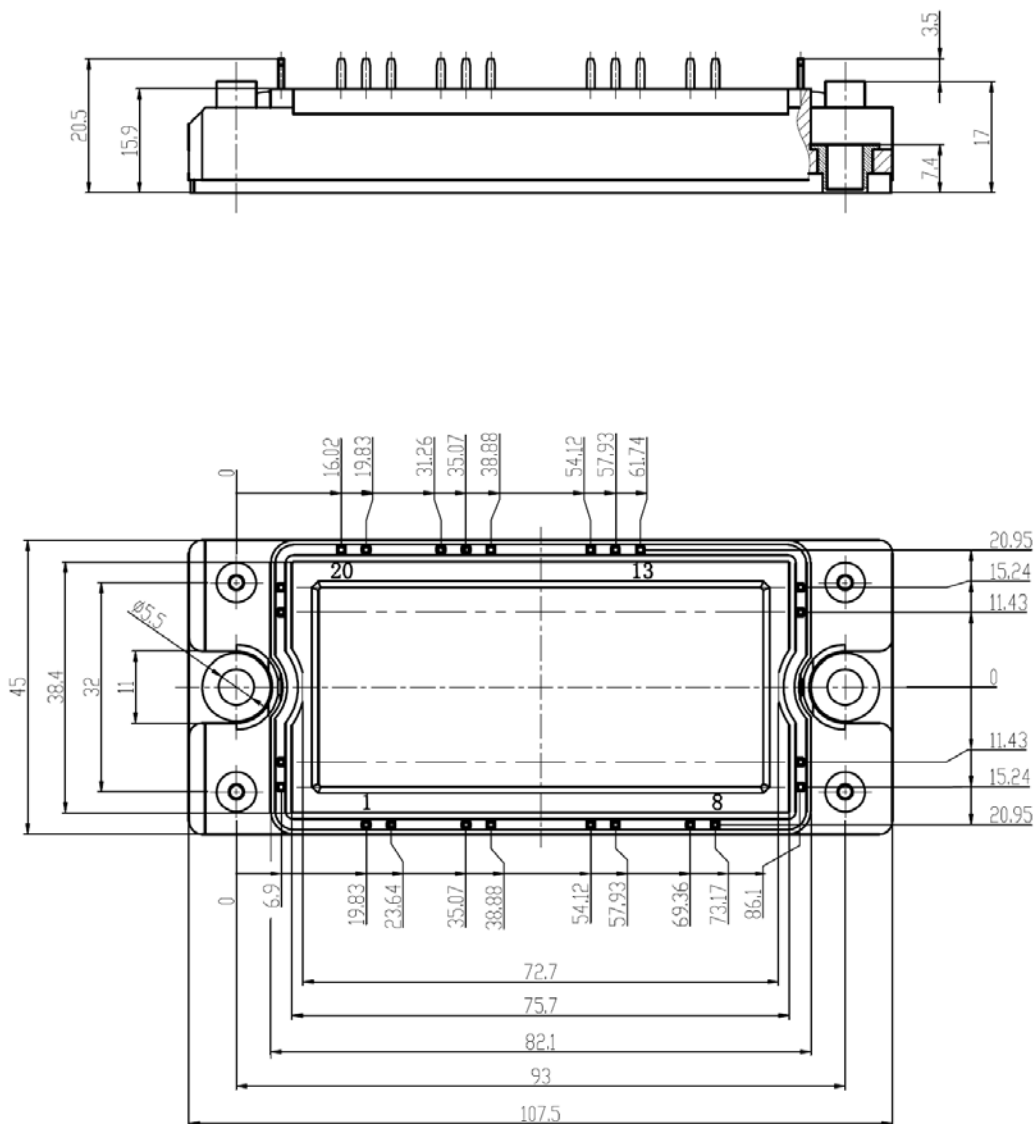
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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