

# STARPOWER

SEMICONDUCTOR

**IGBT**

## GD75HHU120C5S

**1200V/75A 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.

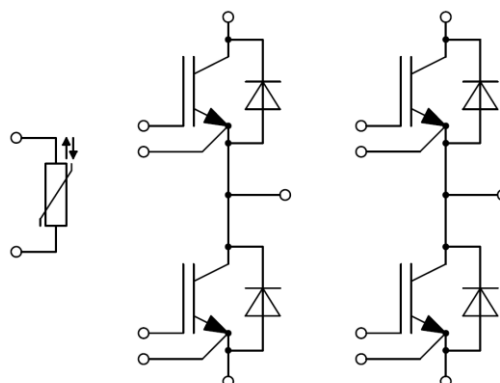
### Features

- NPT IGBT technology
- 10 $\mu$ 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	Values	Unit
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^{\circ}\text{C}$	111	A
	@ $T_C=75^{\circ}\text{C}$	75	
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	150	A
$P_D$	Maximum Power Dissipation @ $T_j=150^{\circ}\text{C}$	565	W

**Diode**

Symbol	Description	Values	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_F$	Diode Continuous Forward Current	75	A
$I_{FM}$	Diode Maximum Forward Current $t_p=1\text{ms}$	150	A

**Module**

Symbol	Description	Values	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	$I_C=75\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		2.80	3.25	V	
		$I_C=75\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		3.65			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=3.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	4.7	5.7	6.7	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			2.50		$\Omega$	
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		5.07		nF	
$C_{res}$	Reverse Transfer Capacitance				0.31		nF
$Q_G$	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.81		$\mu\text{C}$	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=75\text{A}, R_G=7.5\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		63		ns	
$t_r$	Rise Time			37		ns	
$t_{d(off)}$	Turn-Off Delay Time			278		ns	
$t_f$	Fall Time			156		ns	
$E_{on}$	Turn-On Switching Loss				5.68		mJ
$E_{off}$	Turn-Off Switching Loss				3.36		mJ
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=600\text{V}, I_C=75\text{A}, R_G=7.5\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		67		ns
$t_r$	Rise Time				39		ns
$t_{d(off)}$	Turn-Off Delay Time			297		ns	
$t_f$	Fall Time			232		ns	
$E_{on}$	Turn-On Switching Loss				7.93		mJ
$E_{off}$	Turn-Off Switching Loss				4.77		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	$I_F=75\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.80	2.25	V
		$I_F=75\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.85		
$Q_r$	Recovered Charge	$V_R=600\text{V}, I_F=75\text{A},$ $-di/dt=1700\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		4.8		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			45		A
$E_{rec}$	Reverse Recovery Energy			1.53		mJ
$Q_r$	Recovered Charge			11.6		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=75\text{A},$ $-di/dt=1600\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		74		A
$E_{rec}$	Reverse Recovery Energy			4.06		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		$\text{k}\Omega$
$\Delta R/R$	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**  $T_C=25^\circ\text{C}$  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		$\text{m}\Omega$
$R_{thJC}$	Junction-to-Case (per IGBT)			0.221	K/W
	Junction-to-Case (per Diode)			0.389	
$R_{thCH}$	Case-to-Heatsink (per IGBT)		0.125		K/W
	Case-to-Heatsink (per Diode)		0.221		
	Case-to-Heatsink (per Module)		0.020		
M	Mounting Torque, Screw M5	3.0		6.0	N.m
G	Weight of Module		200		g

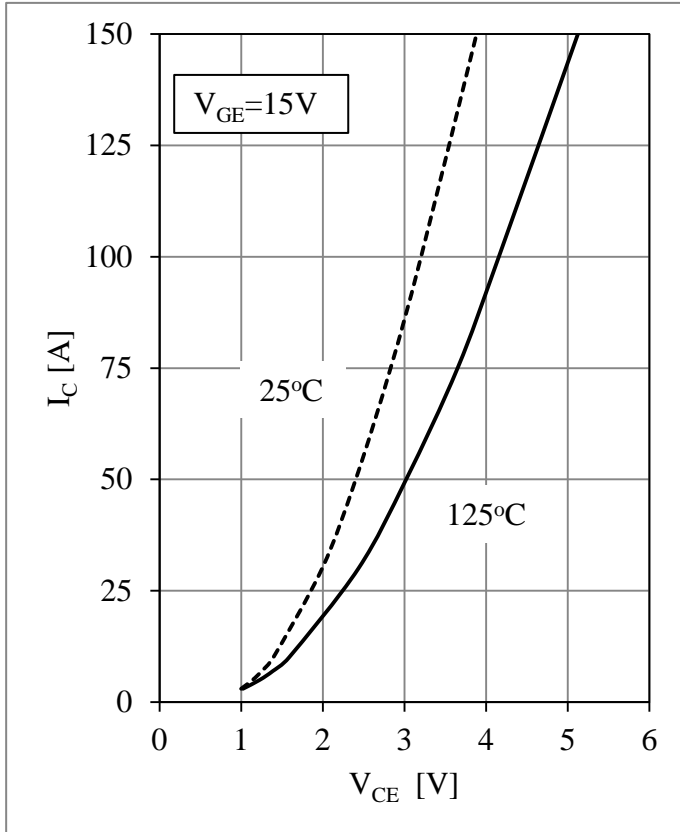


Fig 1. IGBT Output Characteristics

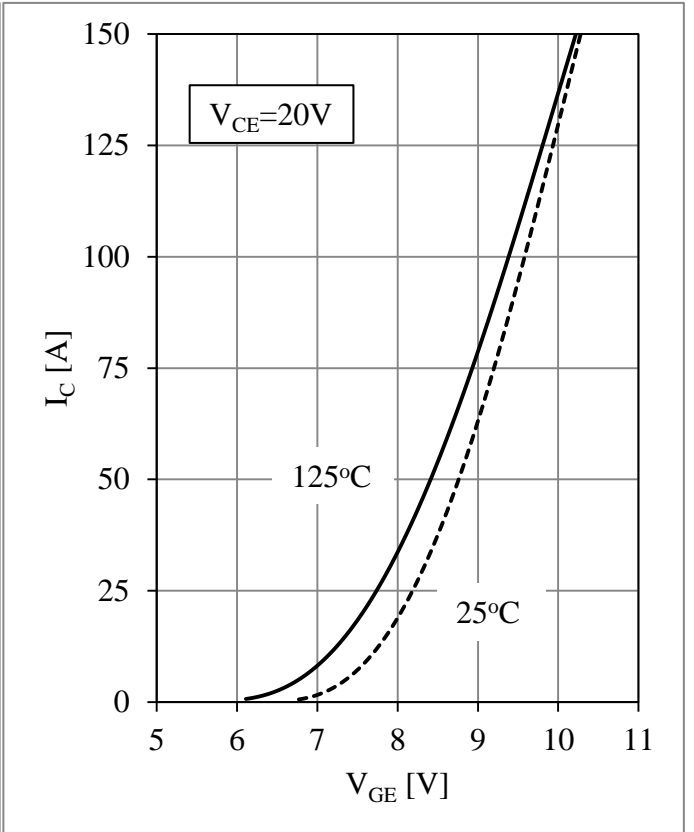


Fig 2. IGBT Transfer Characteristics

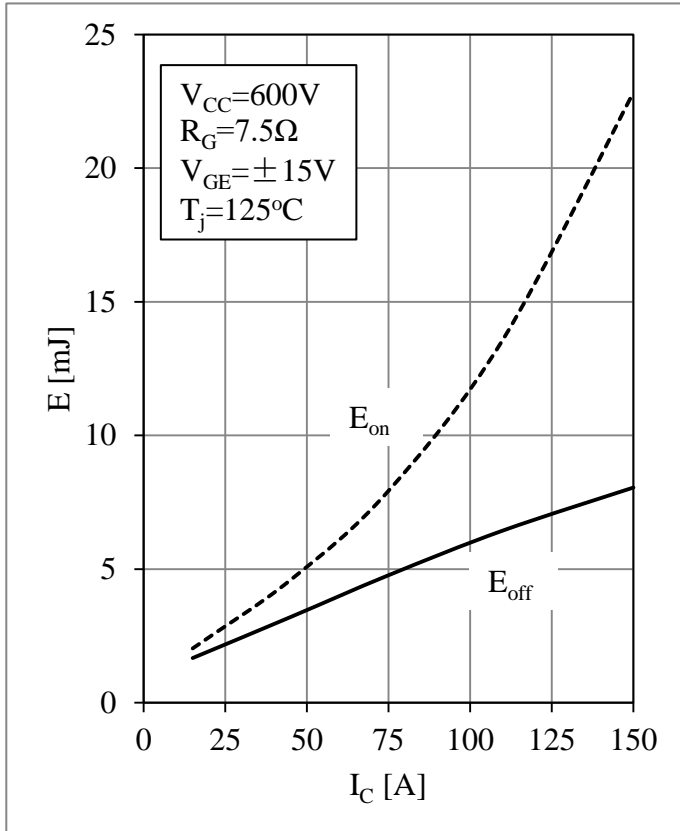


Fig 3. IGBT Switching Loss vs.  $I_C$

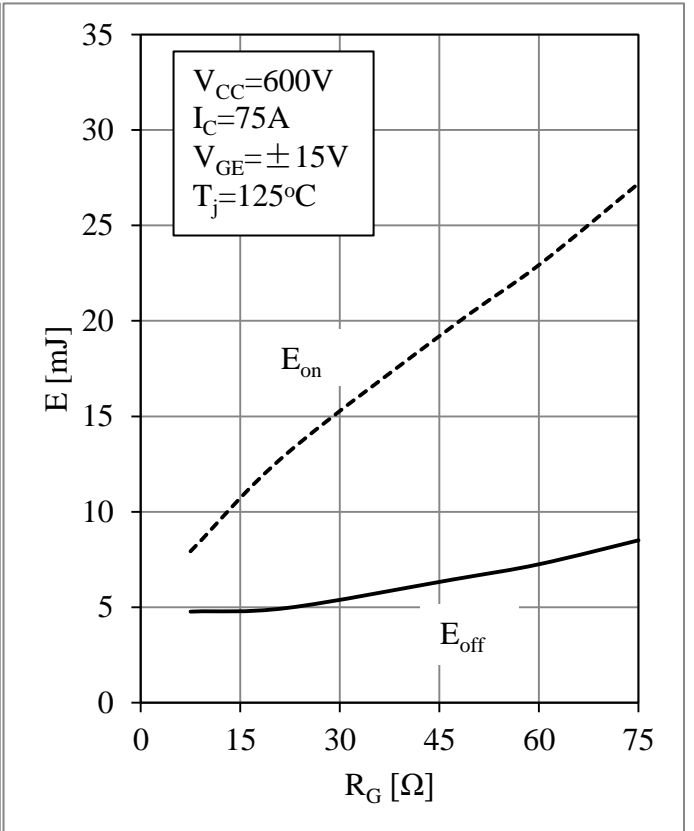


Fig 4. IGBT Switching Loss vs.  $R_G$

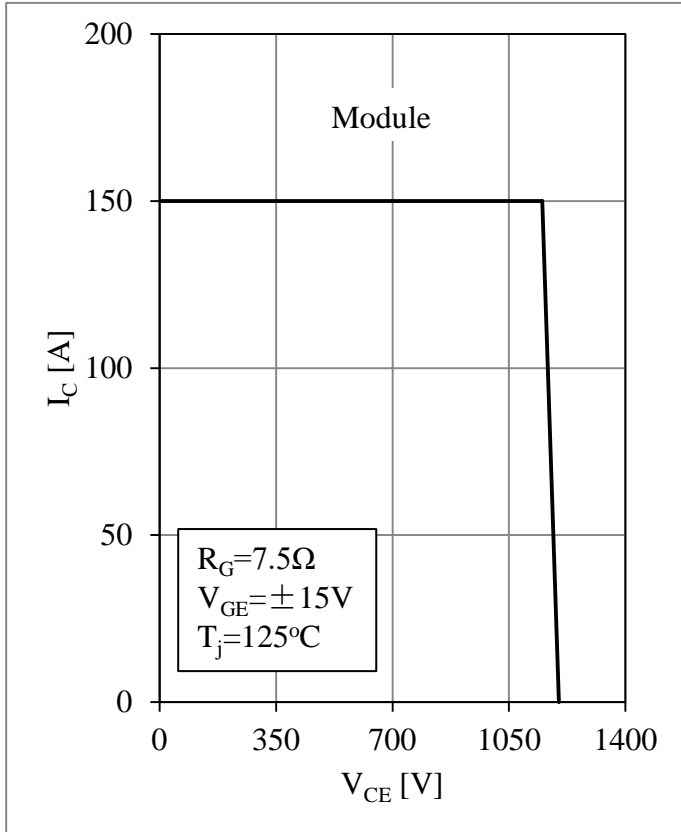


Fig 5. RBSOA

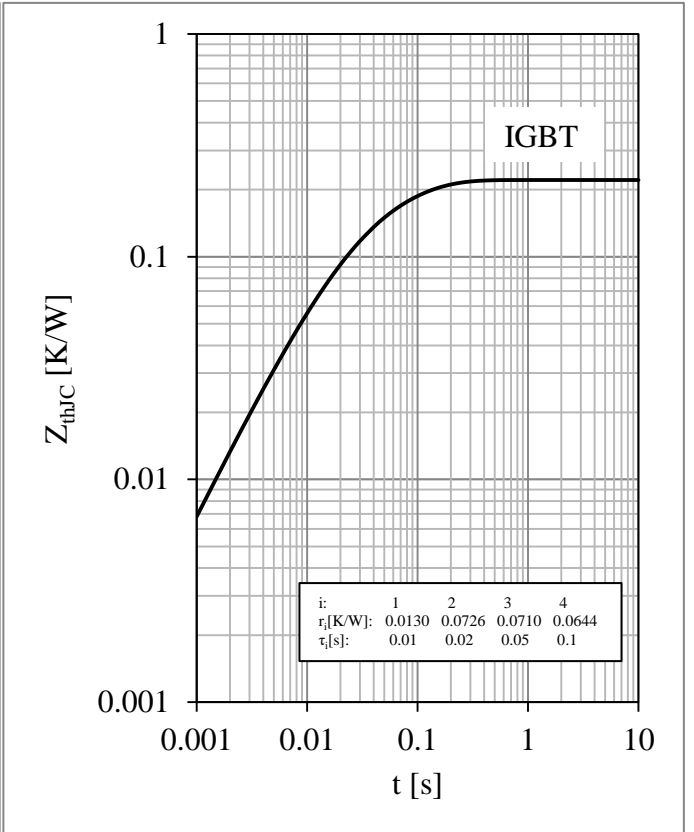


Fig 6. IGBT Transient Thermal Impedance

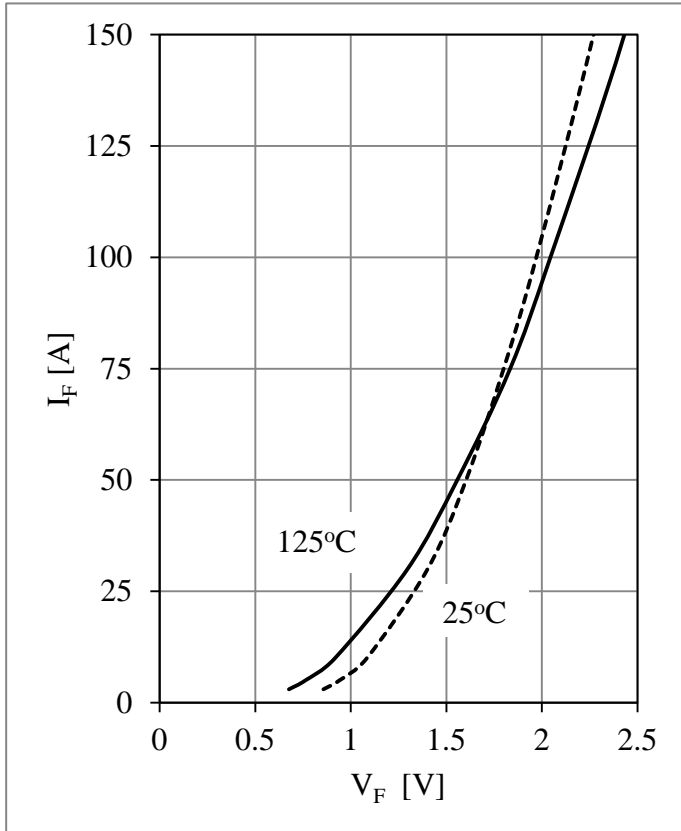


Fig 7. Diode Forward Characteristics

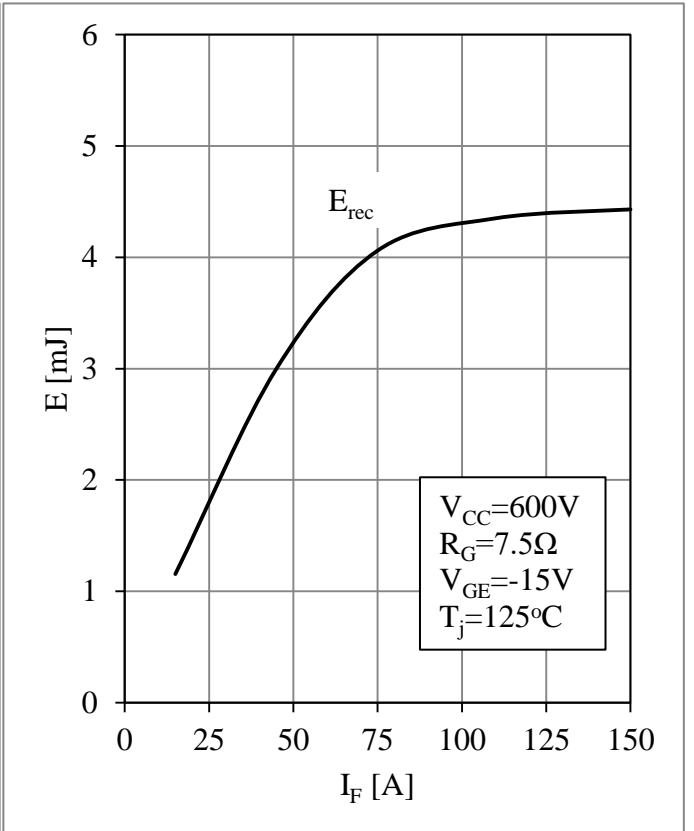


Fig 8. Diode Switching Loss vs.  $I_F$

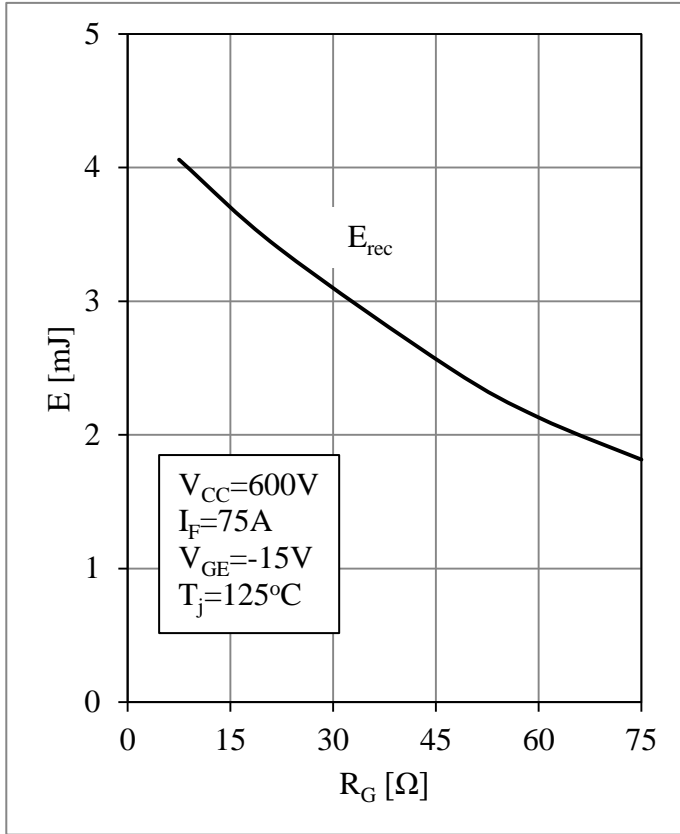


Fig 9. Diode Switching Loss vs.  $R_G$

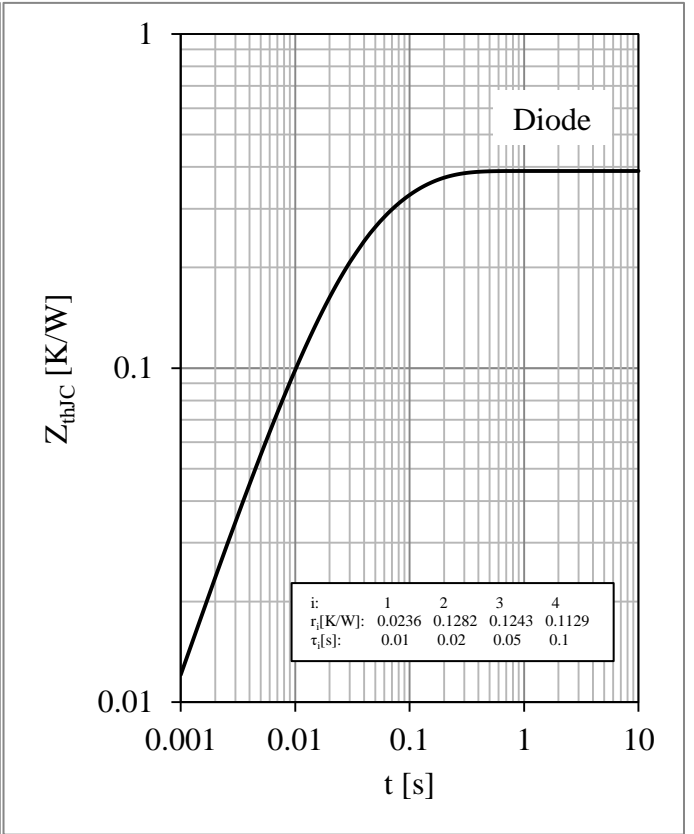


Fig 10. Diode Transient Thermal Impedance

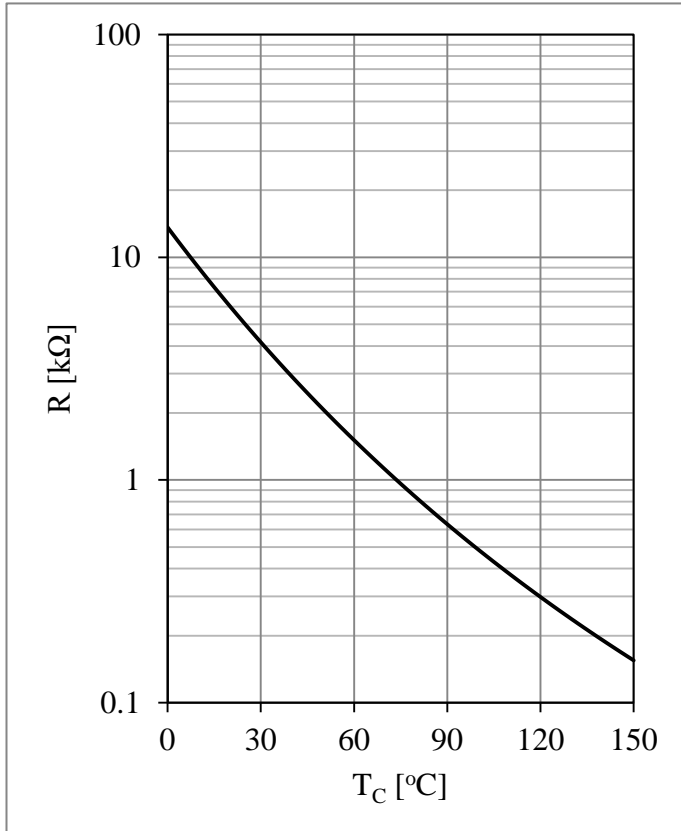
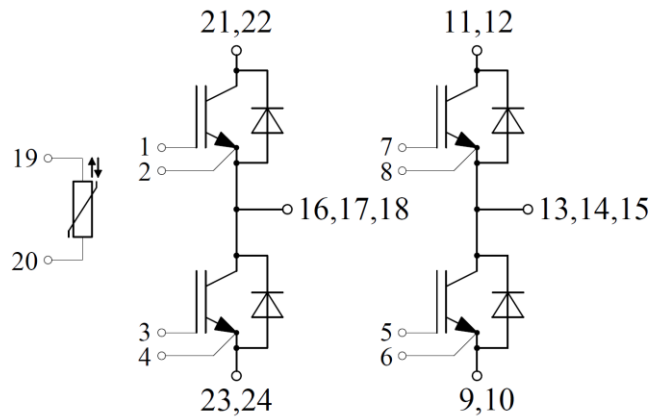


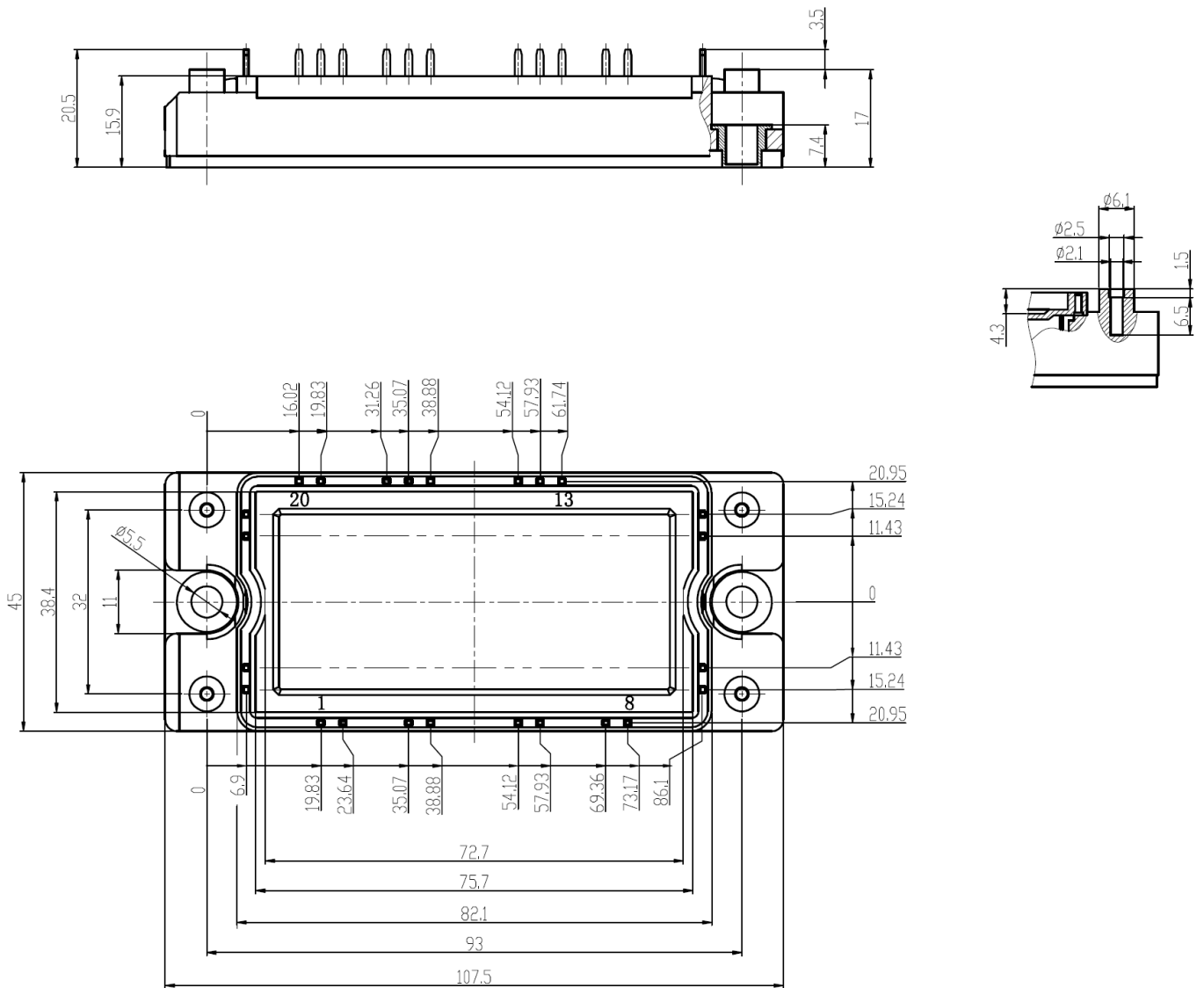
Fig 11. NTC Temperature Characteristic

**Circuit Schematic**



**Package Dimensions**

Dimensions in Millimeters





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