

STARPOWER

SEMICONDUCTOR

IGBT

GD75FFX170C6S

1700V/75A 6 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 UPS.

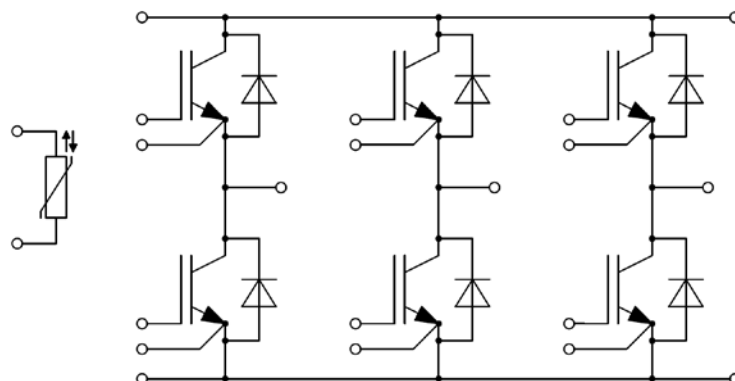
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 10 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 baseplate using DBC technology

Typical Applications

- Uninterruptible 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	1700	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	139	A
	@ $T_C=100^{\circ}\text{C}$	75	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	150	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	559	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1700	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	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, $f=50\text{Hz}$, $t=1\text{min}$	4000	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	$I_C=75\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.85	2.20	V	
		$I_C=75\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.25			
		$I_C=75\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.35			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=3.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.6	6.2	6.8	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			8.5		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		9.03		nF	
C_{res}	Reverse Transfer Capacitance			0.22		nF	
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.71		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=75\text{A}, R_G=6.8\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		215		ns	
t_r	Rise Time			38		ns	
$t_{d(off)}$	Turn-Off Delay Time			391		ns	
t_f	Fall Time			100		ns	
E_{on}	Turn-On Switching Loss			15.7		mJ	
E_{off}	Turn-Off Switching Loss			16.7		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=900\text{V}, I_C=75\text{A}, R_G=6.8\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		220		ns
t_r	Rise Time				44		ns
$t_{d(off)}$	Turn-Off Delay Time			495		ns	
t_f	Fall Time			184		ns	
E_{on}	Turn-On Switching Loss			23.5		mJ	
E_{off}	Turn-Off Switching Loss			27.5		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=75\text{A}, R_G=6.8\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			229		ns
t_r	Rise Time				50		ns
$t_{d(off)}$	Turn-Off Delay Time			512		ns	
t_f	Fall Time			192		ns	
E_{on}	Turn-On Switching Loss			25.6		mJ	
E_{off}	Turn-Off Switching Loss			29.9		mJ	
I_{SC}	SC Data		$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=1000\text{V}, V_{CEM} \leq 1700\text{V}$		300		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
		$I_F=75\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.90		
		$I_F=75\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.95		
Q_r	Recovered Charge			14.4		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=900\text{V}, I_F=75\text{A},$ $-di/dt=2290\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		112		A
E_{rec}	Reverse Recovery Energy			9.65		mJ
Q_r	Recovered Charge			27.2		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=900\text{V}, I_F=75\text{A},$ $-di/dt=2290\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		127		A
E_{rec}	Reverse Recovery Energy			19.4		mJ
Q_r	Recovered Charge			31.5		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=900\text{V}, I_F=75\text{A},$ $-di/dt=2290\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		126		A
E_{rec}	Reverse Recovery Energy			23.4		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
$B_{25/80}$	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		21		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		1.80		m Ω
R_{thJC}	Junction-to-Case (per IGBT)			0.268	K/W
	Junction-to-Case (per Diode)			0.481	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.084		K/W
	Case-to-Heatsink (per Diode)		0.151		
	Case-to-Heatsink (per Module)		0.009		
M	Mounting Screw:M5	3.0		6.0	N.m
G	Weight of Module		300		g

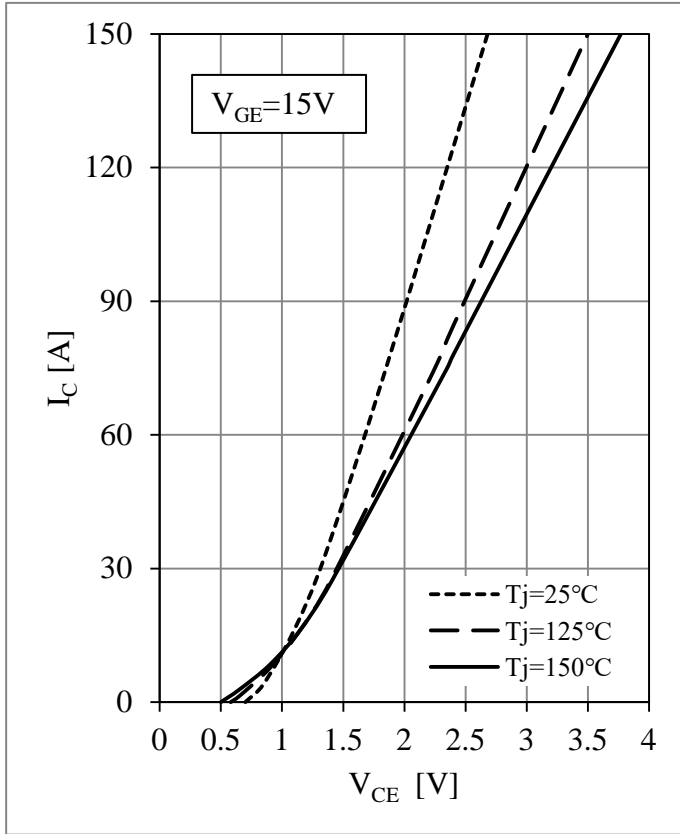


Fig 1. IGBT Output Characteristics

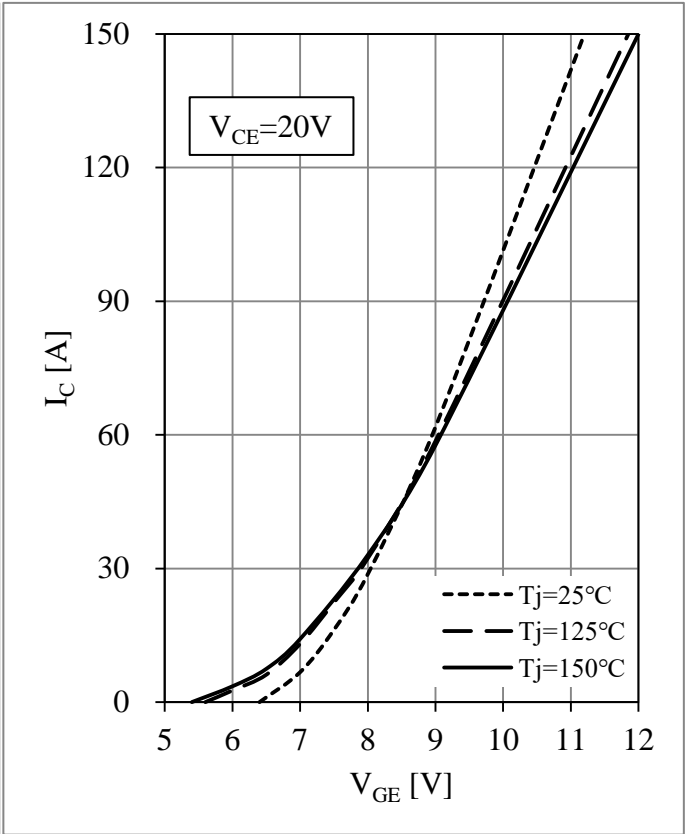


Fig 2. IGBT Transfer Characteristics

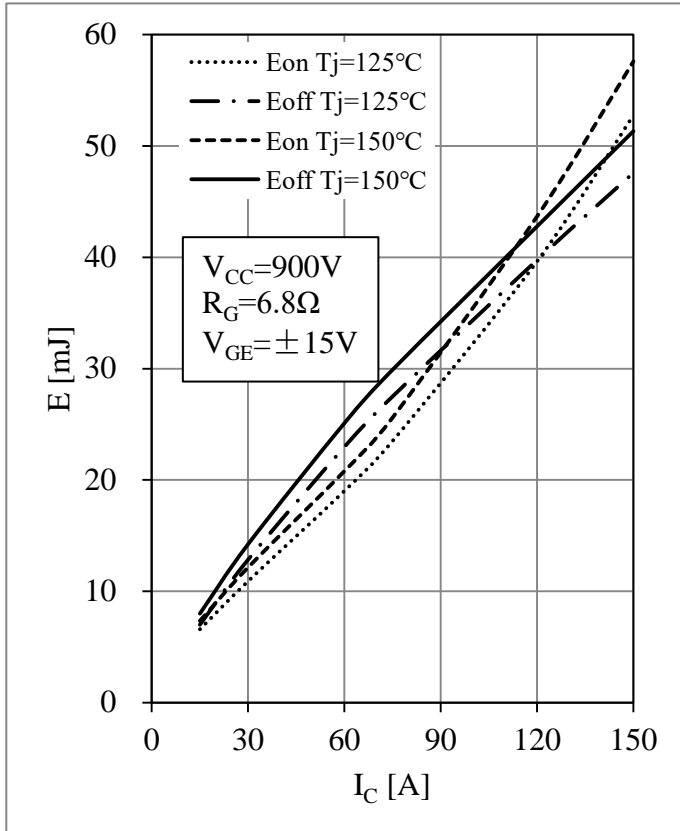


Fig 3. IGBT Switching Loss vs. I_C

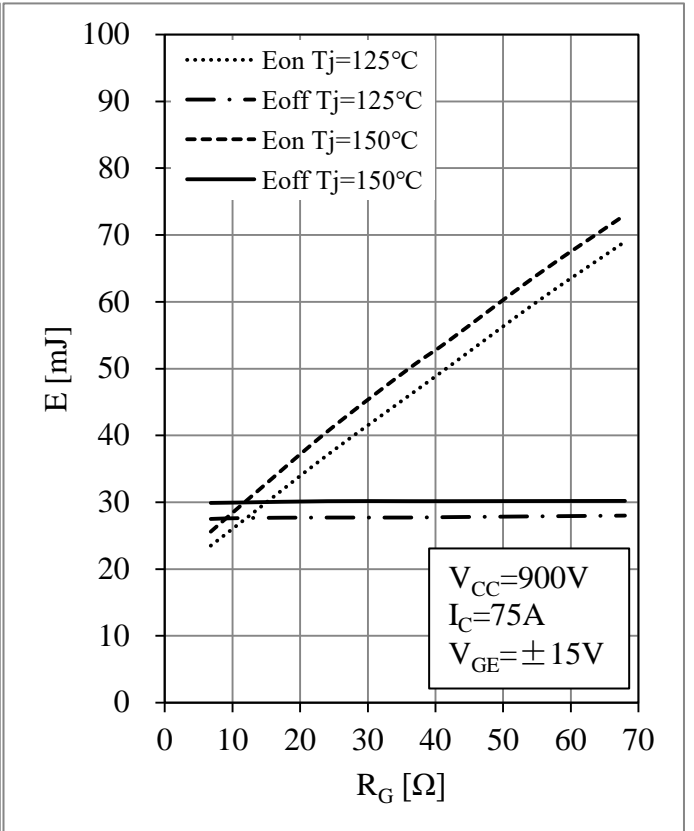


Fig 4. IGBT Switching Loss vs. R_G

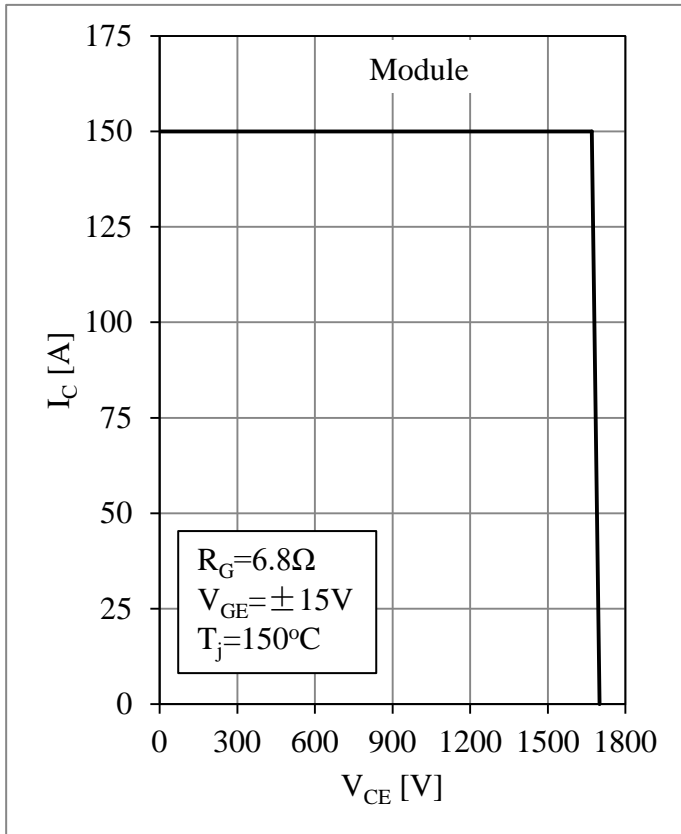


Fig 5. IGBT RBSOA

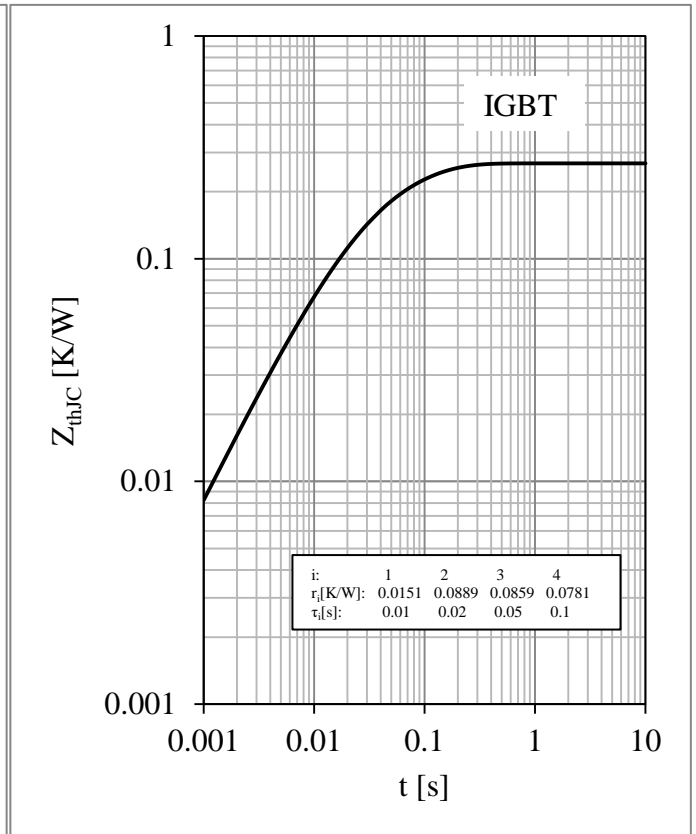


Fig 6. IGBT Transient Thermal Impedance

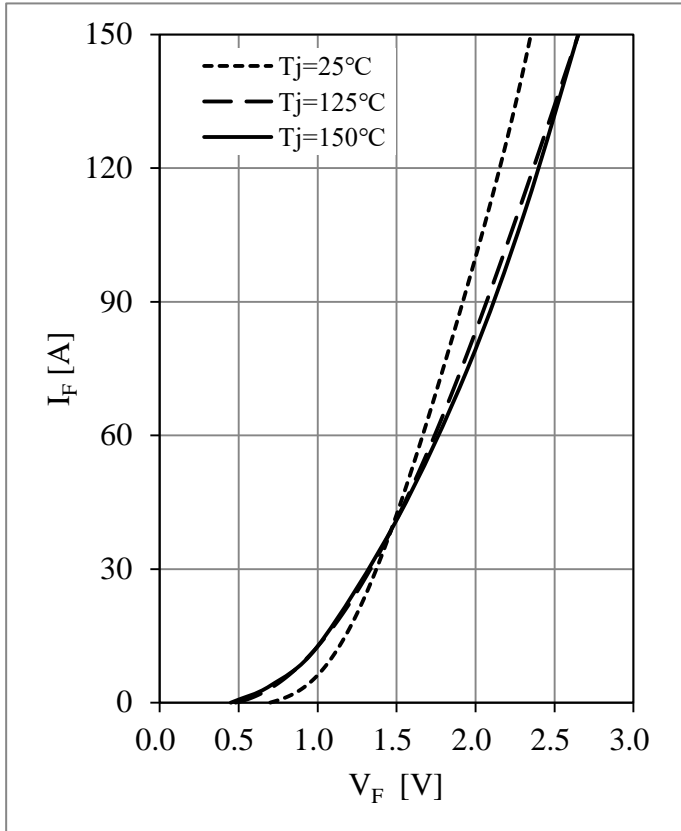


Fig 7. Diode Forward Characteristics

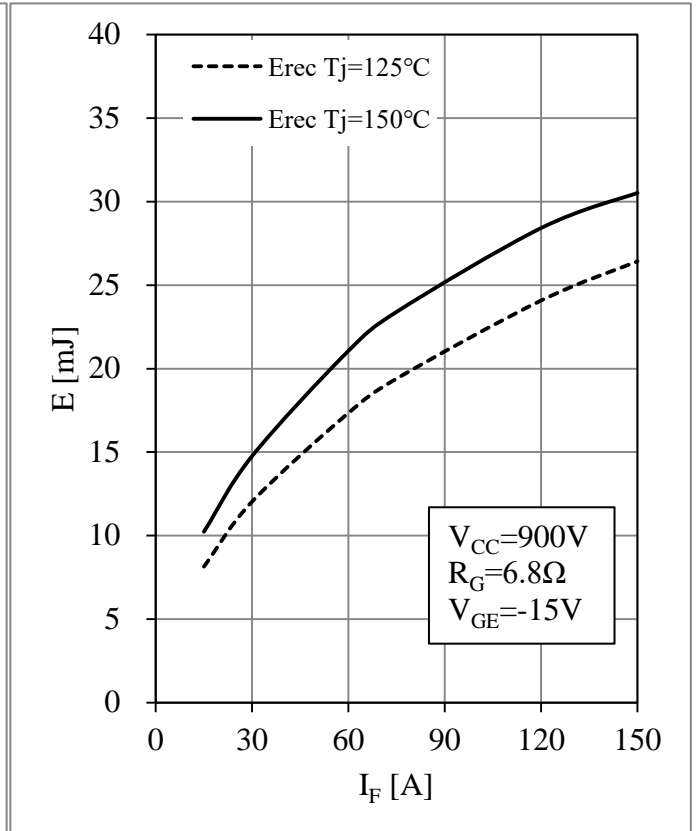


Fig 8. Diode Switching Loss vs. I_F

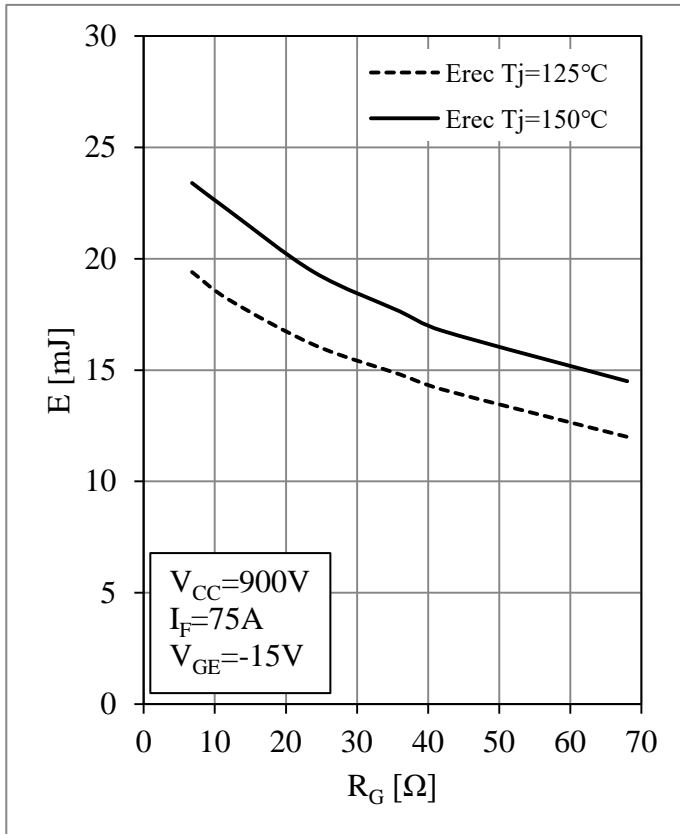


Fig 9. Diode Switching Loss vs. R_G

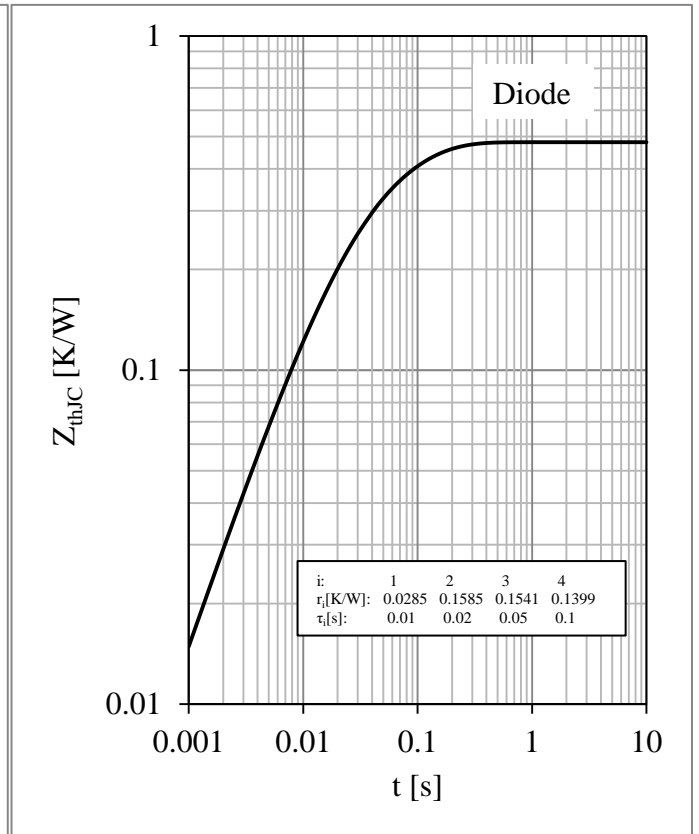


Fig 10. Diode Transient Thermal Impedance

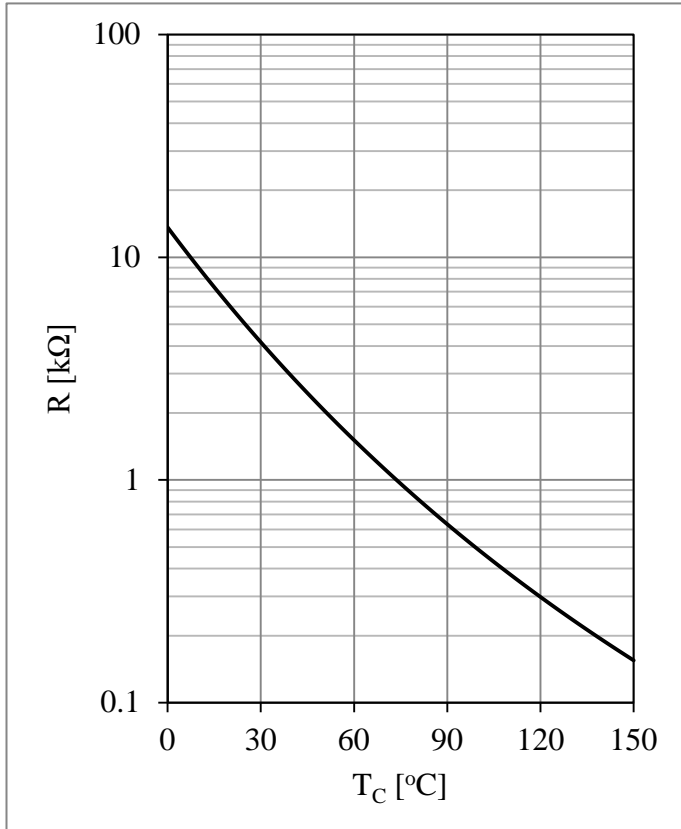
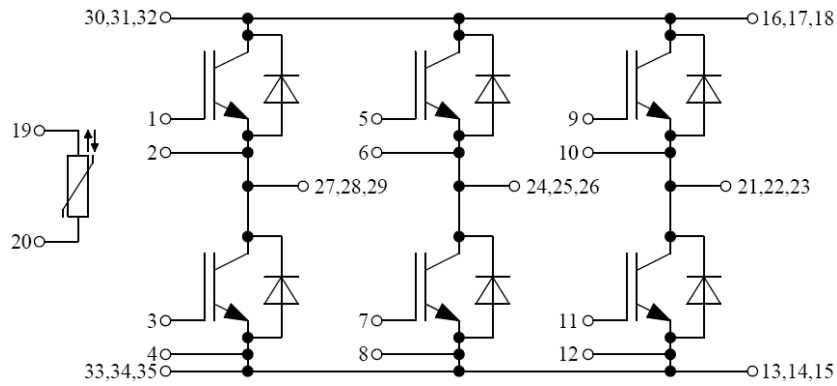


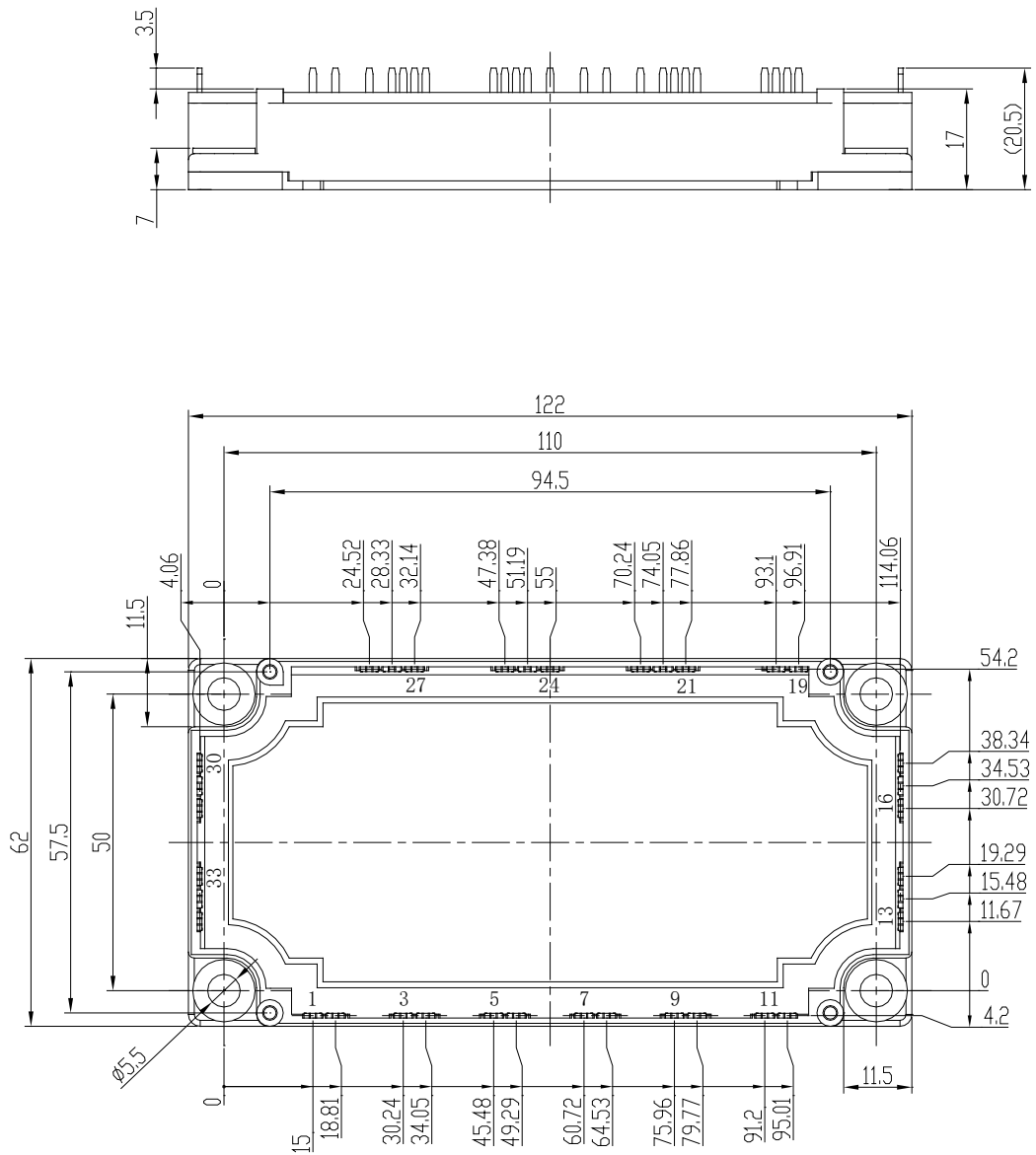
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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