

STARPOWER

SEMICONDUCTOR

IGBT

GD150FFT60C6S

600V/150A 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 general inverters and UPS.

Features

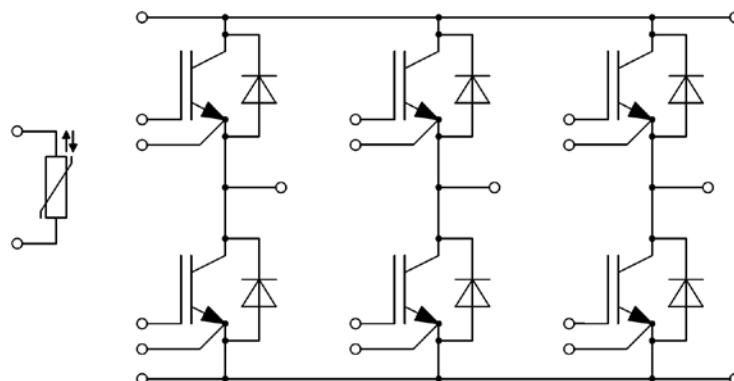
- Low $V_{CE(sat)}$ Trench IGBT technology
- 6 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Typical Applications

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

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	600	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	180	A
	@ $T_C=60^{\circ}\text{C}$	150	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	300	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	445	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	600	V
I_F	Diode Continuous Forward Current	150	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	300	A

Module

Symbol	Description	Values	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	$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.45	1.90	V
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.60		
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=2.4\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.1	5.8	6.4	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			2.0		Ω
C_{ies}	Input Capacitance	$V_{CE}=30\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		9.24		nF
C_{res}	Reverse Transfer Capacitance			0.27		nF
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		1.60		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=150\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		118		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			345		ns
t_f	Fall Time			62		ns
E_{on}	Turn-On Switching Loss			0.84		mJ
E_{off}	Turn-Off Switching Loss			4.10		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=150\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		140		ns
t_r	Rise Time			39		ns
$t_{d(off)}$	Turn-Off Delay Time			370		ns
t_f	Fall Time			69		ns
E_{on}	Turn-On Switching Loss			1.35		mJ
E_{off}	Turn-Off Switching Loss			5.32		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=150\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$		142		ns
t_r	Rise Time			40		ns
$t_{d(off)}$	Turn-Off Delay Time			382		ns
t_f	Fall Time			70		ns
E_{on}	Turn-On Switching Loss			1.52		mJ
E_{off}	Turn-Off Switching Loss			5.58		mJ
I_{SC}	SC Data	$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 600\text{V}$		750		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.55	2.00	V
		$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.50		
		$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.45		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=150\text{A},$ $-di/dt=5400\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		7.1		μC
I_{RM}	Peak Reverse Recovery Current			152		A
E_{rec}	Reverse Recovery Energy			1.94		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=150\text{A},$ $-di/dt=5400\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		13.0		μC
I_{RM}	Peak Reverse Recovery Current			180		A
E_{rec}	Reverse Recovery Energy			3.50		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=150\text{A},$ $-di/dt=5400\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		14.8		μC
I_{RM}	Peak Reverse Recovery Current			186		A
E_{rec}	Reverse Recovery Energy			3.94		mJ

NTC Characteristics $T_C=25^\circ\text{C}$ 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}	$T_C=100^\circ\text{C}, R_{100}=493.3\Omega$	-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		21		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		1.80		$\text{m}\Omega$
R_{thJC}	Junction-to-Case (per IGBT)			0.337	K/W
	Junction-to-Case (per Diode)			0.554	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.087		K/W
	Case-to-Heatsink (per Diode)		0.143		
	Case-to-Heatsink (per Module)		0.009		
M	Mounting Torque, Screw M6	3.0		6.0	N.m
G	Weight of Module		300		g

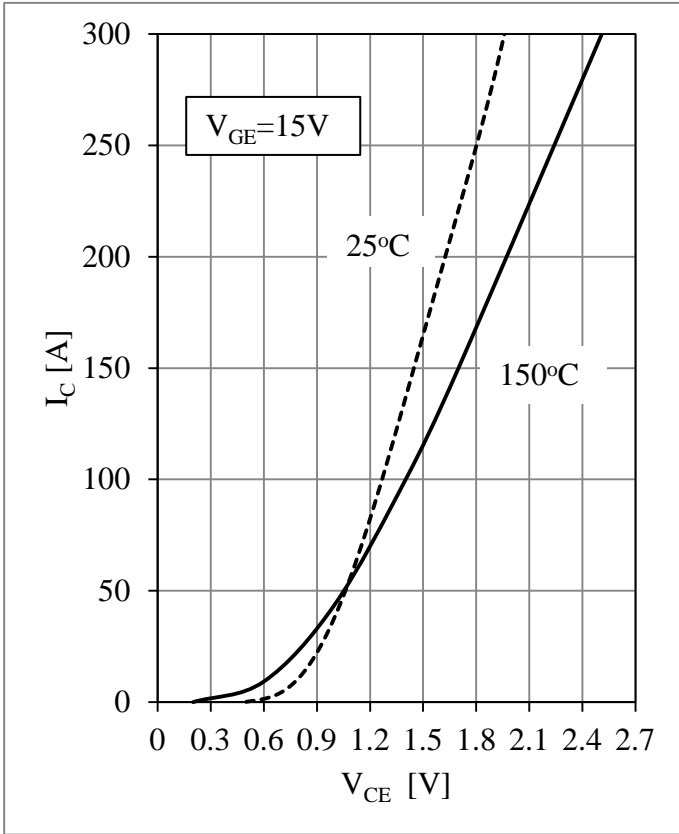


Fig 1. IGBT Output Characteristics

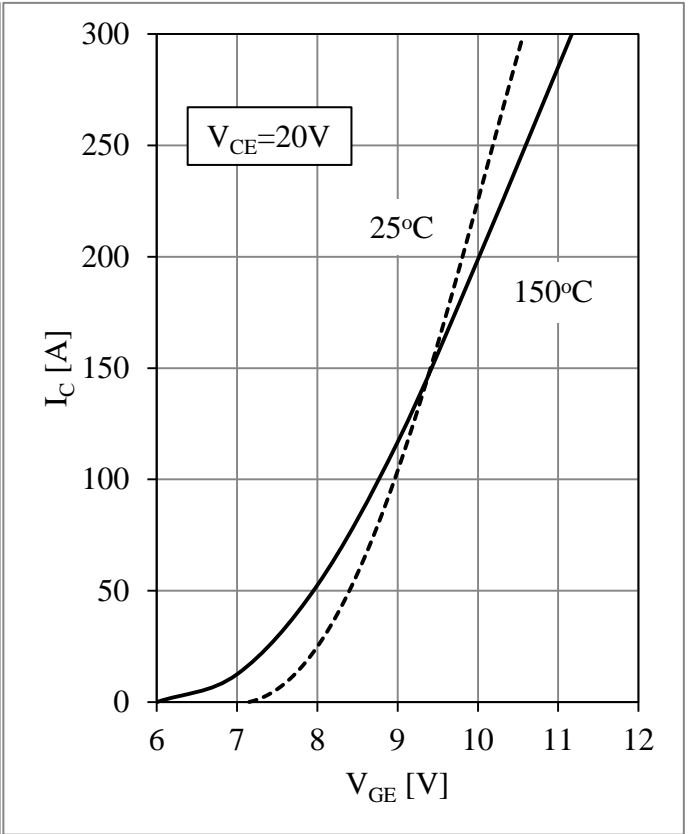


Fig 2. IGBT Transfer Characteristics

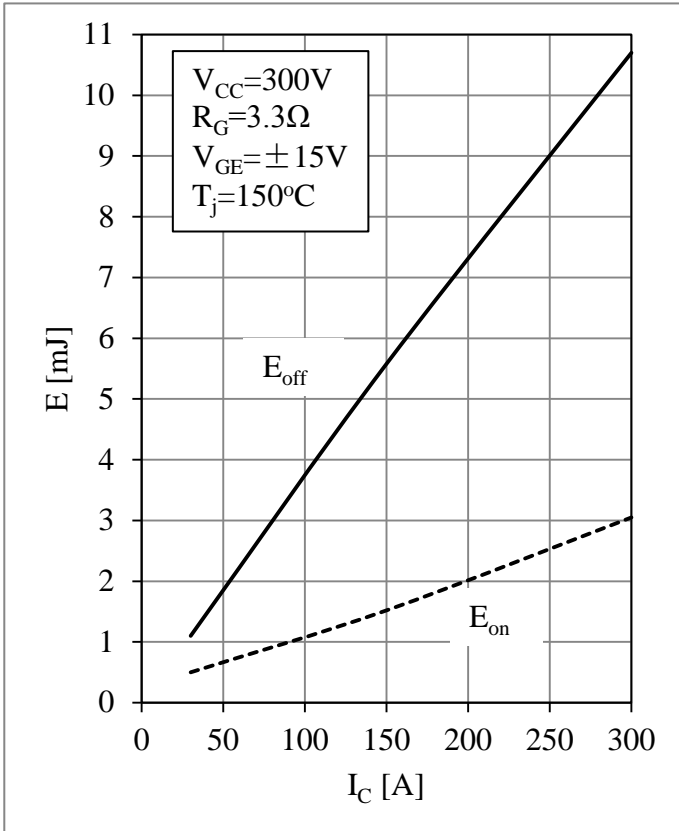


Fig 3. IGBT Switching Loss vs. I_C

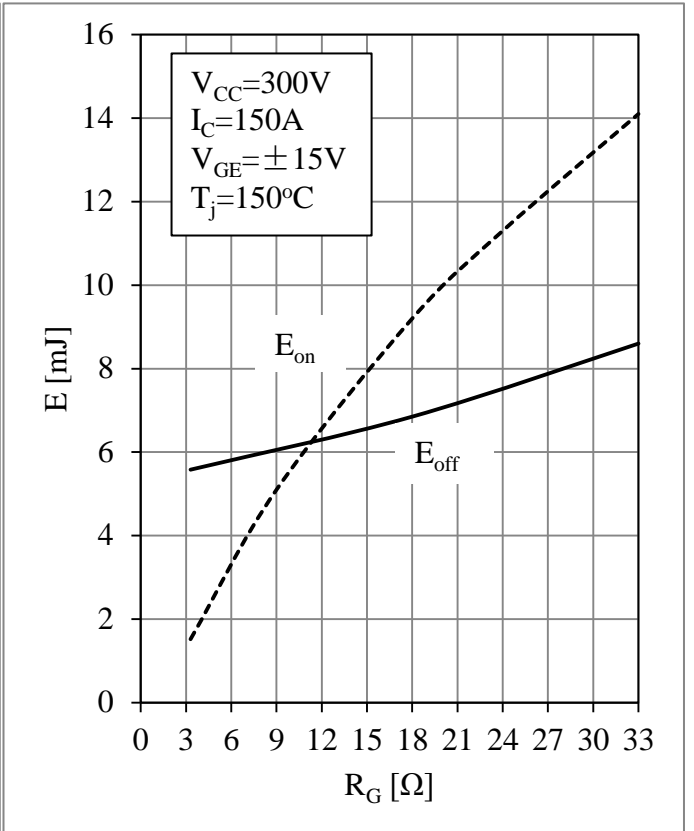


Fig 4. IGBT Switching Loss vs. R_G

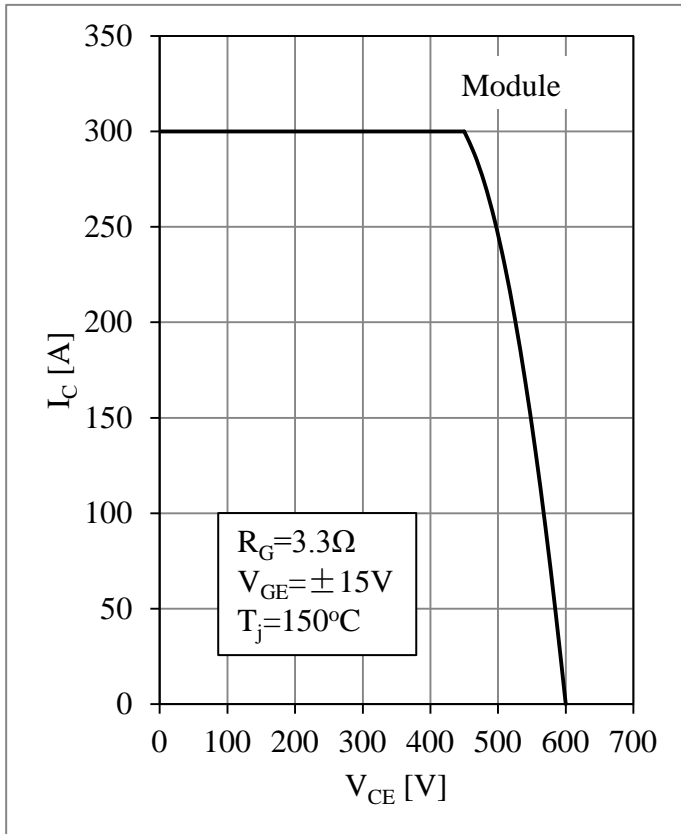


Fig 5. RBSOA

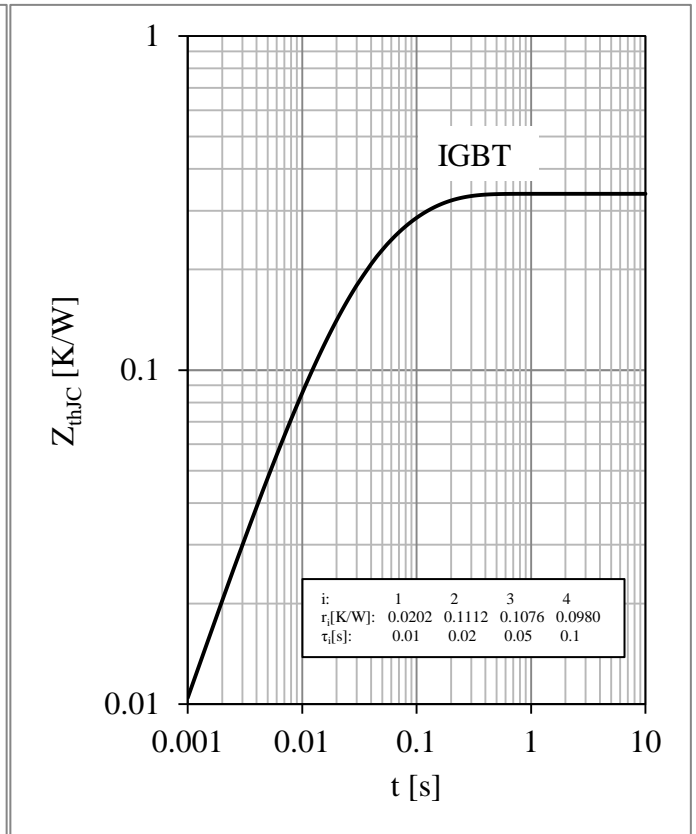


Fig 6. IGBT Transient Thermal Impedance

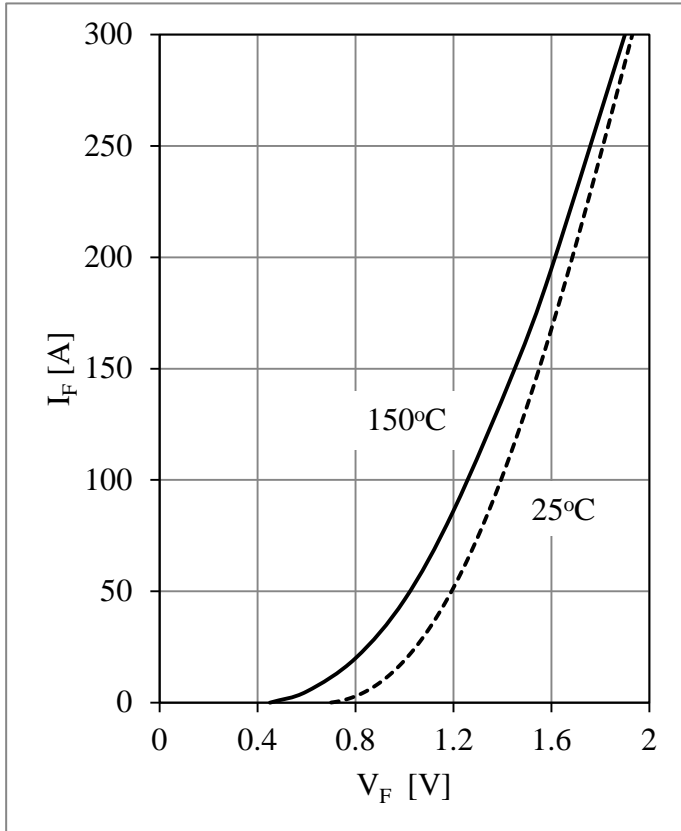


Fig 7. Diode Forward Characteristics

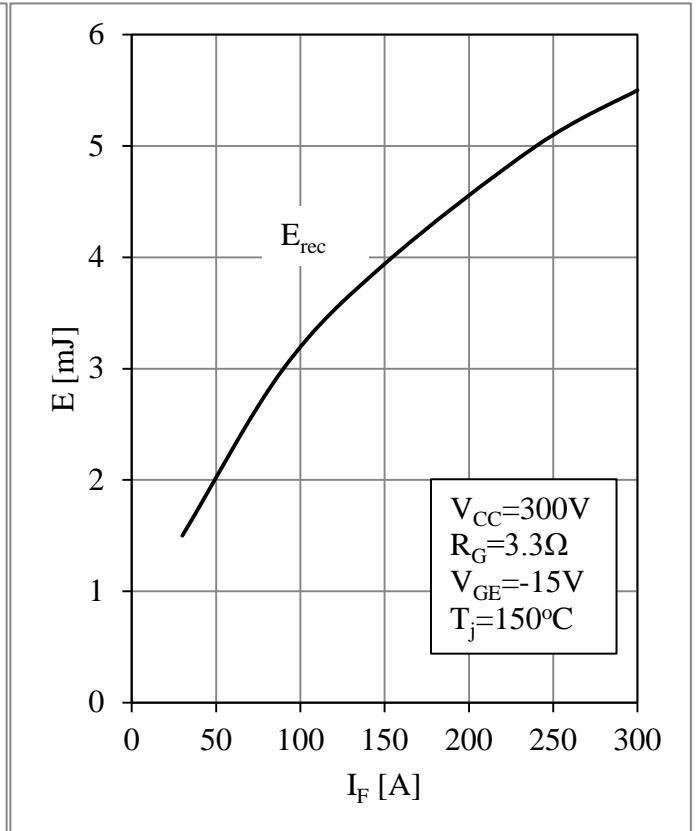


Fig 8. Diode Switching Loss vs. I_F

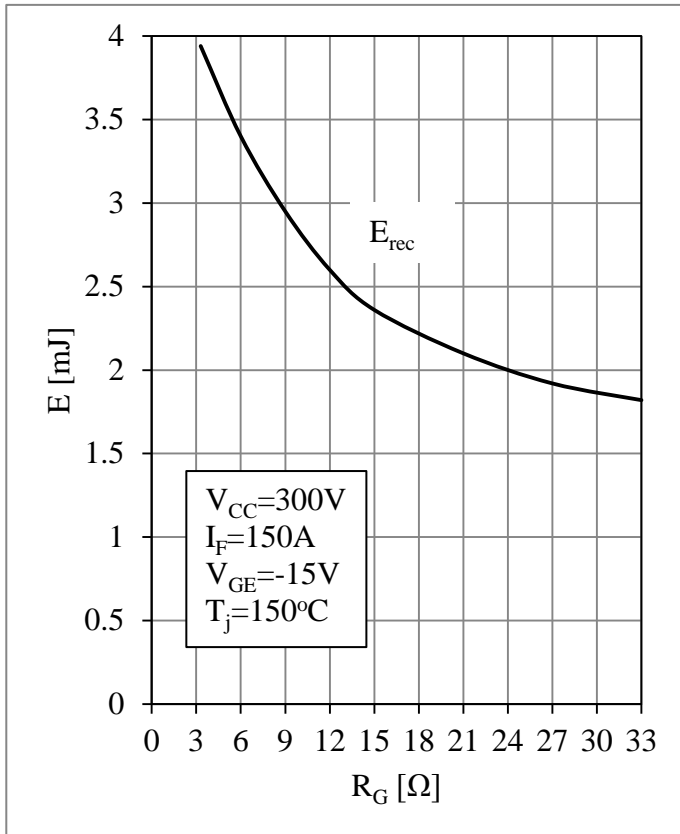


Fig 9. Diode Switching Loss vs. R_G

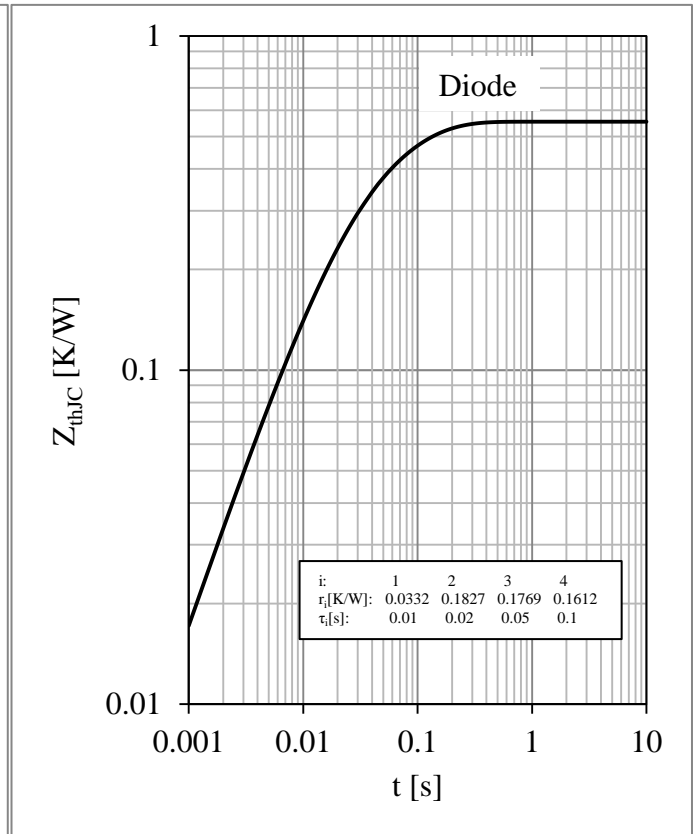
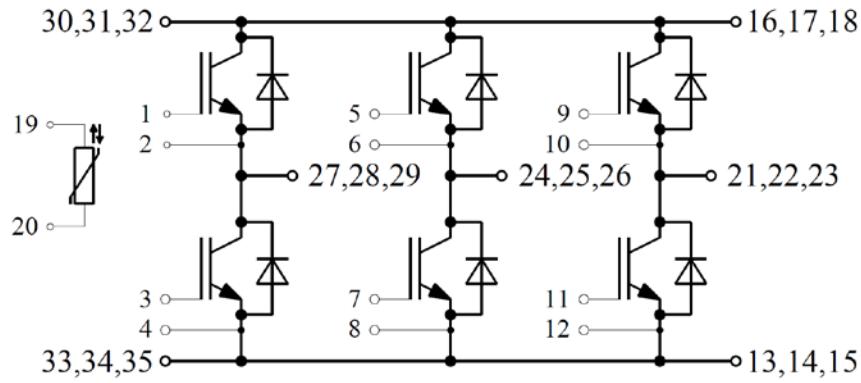


Fig 10. Diode Transient Thermal Impedance



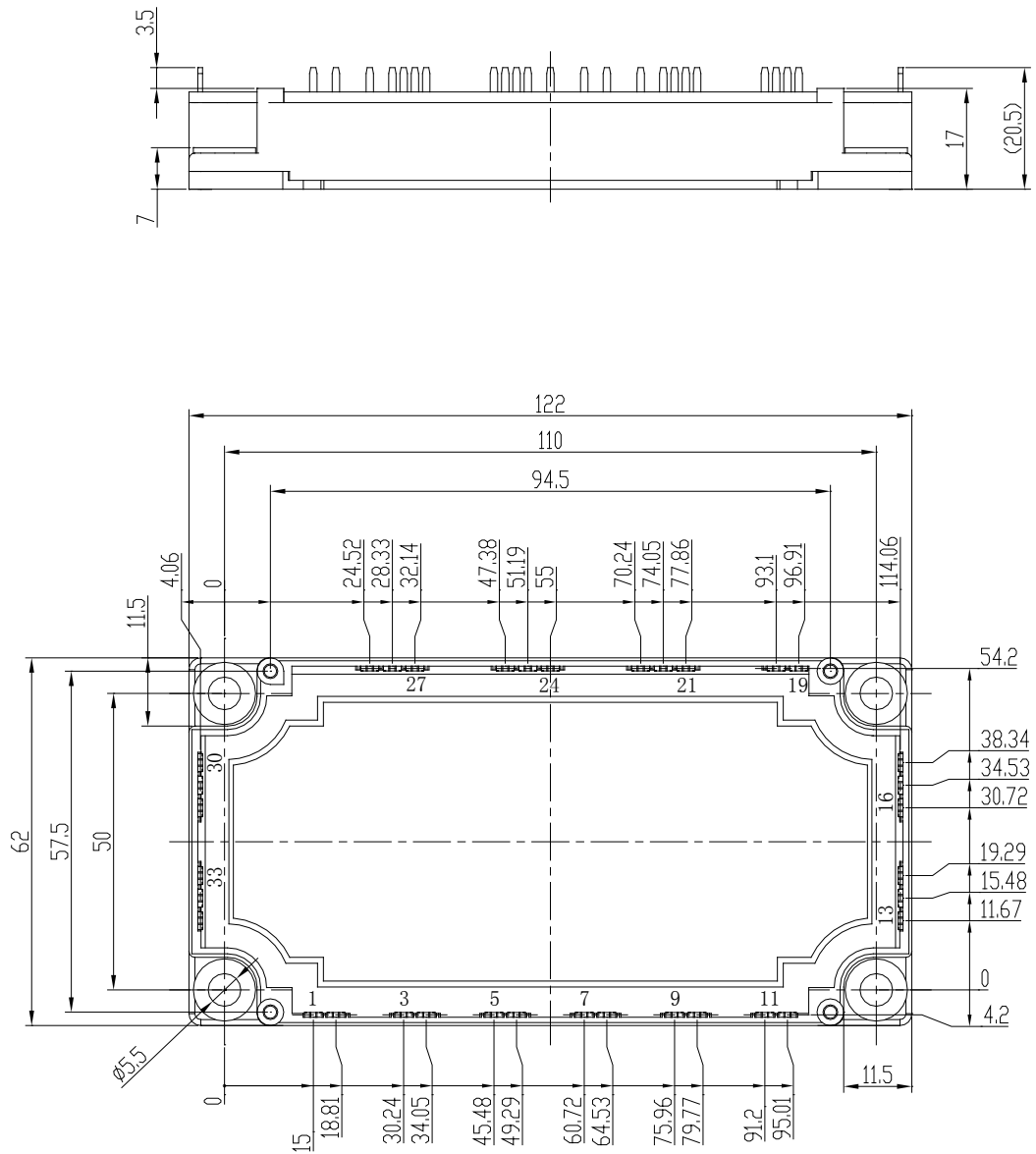
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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