

STARPOWER

SEMICONDUCTOR

IGBT

GD150FFT120C6S_T4

1200V/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

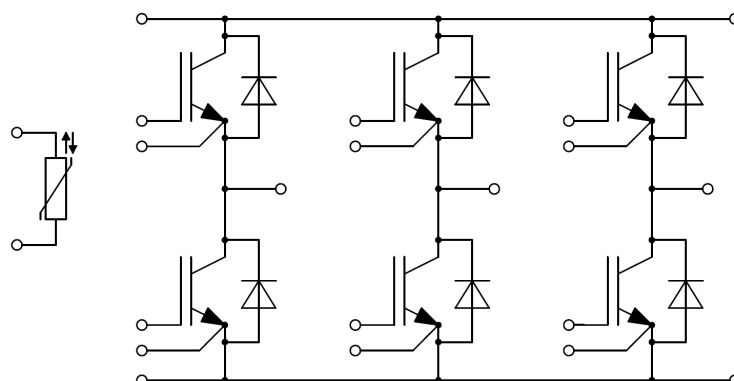
- Low $V_{CE(sat)}$ Trench IGBT technology
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Typical Applications

- 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	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=95^{\circ}\text{C}$	220 150	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	300	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	798	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	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	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	$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.85	2.30	V
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.15		
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.25		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=5.2\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.3	5.8	6.3	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	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^{\circ}\text{C}$			100	nA
R_{Gint}	Internal Gate Resistance			5		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		8.60		nF
C_{res}	Reverse Transfer Capacitance			0.32		nF
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		1.14		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=150\text{A}, R_G=2.6\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		231		ns
t_r	Rise Time			57		ns
$t_{d(off)}$	Turn-Off Delay Time			268		ns
t_f	Fall Time			195		ns
E_{on}	Turn-On Switching Loss			9.90		mJ
E_{off}	Turn-Off Switching Loss			8.38		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=150\text{A}, R_G=2.6\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		240		ns
t_r	Rise Time			60		ns
$t_{d(off)}$	Turn-Off Delay Time			396		ns
t_f	Fall Time			343		ns
E_{on}	Turn-On Switching Loss			14.0		mJ
E_{off}	Turn-Off Switching Loss			13.8		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=150\text{A}, R_G=2.6\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		252		ns
t_r	Rise Time			63		ns
$t_{d(off)}$	Turn-Off Delay Time			510		ns
t_f	Fall Time			398		ns
E_{on}	Turn-On Switching Loss			16.3		mJ
E_{off}	Turn-Off Switching Loss			15.5		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		540		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	$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.65	2.10	V
		$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.65		
		$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.65		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A},$ $-di/dt=3700\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		16.2		μC
I_{RM}	Peak Reverse Recovery Current			180		A
E_{rec}	Reverse Recovery Energy			6.65		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A},$ $-di/dt=3700\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		28.5		μC
I_{RM}	Peak Reverse Recovery Current			200		A
E_{rec}	Reverse Recovery Energy			12.5		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A},$ $-di/dt=3700\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		30.2		μC
I_{RM}	Peak Reverse Recovery Current			210		A
E_{rec}	Reverse Recovery Energy			13.8		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

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		$\text{m}\Omega$
$R_{\theta JC}$	Junction-to-Case (per IGBT) Junction-to-Case (per Diode)			0.188 0.328	K/W
$R_{\theta CS}$	Case-to-Sink (per IGBT) Case-to-Sink (per Diode)		0.085 0.148		K/W
$R_{\theta CS}$	Case-to-Sink		0.009		K/W
M	Mounting Torque, Screw M6	3.0		6.0	N.m
G	Weight of Module		300		g

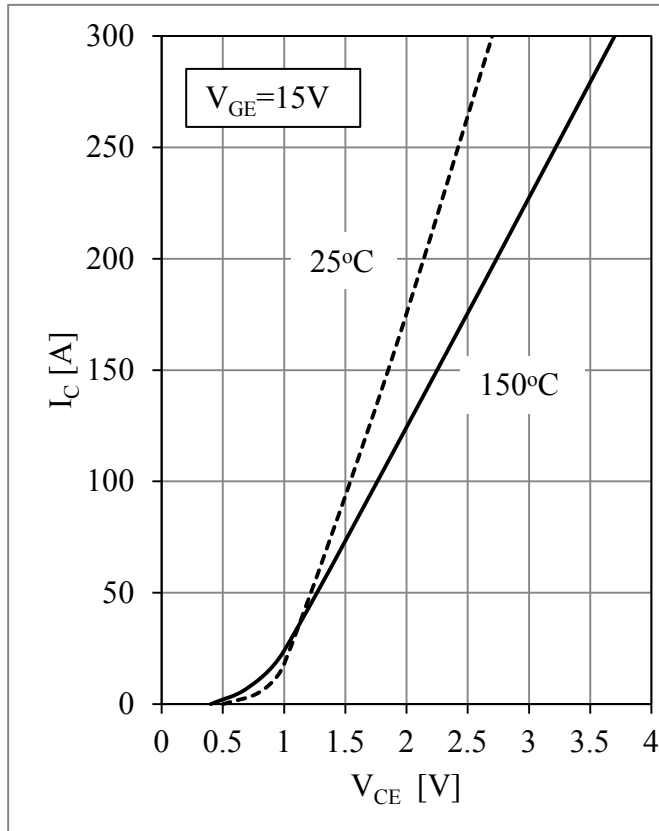


Fig 1. IGBT Output Characteristics

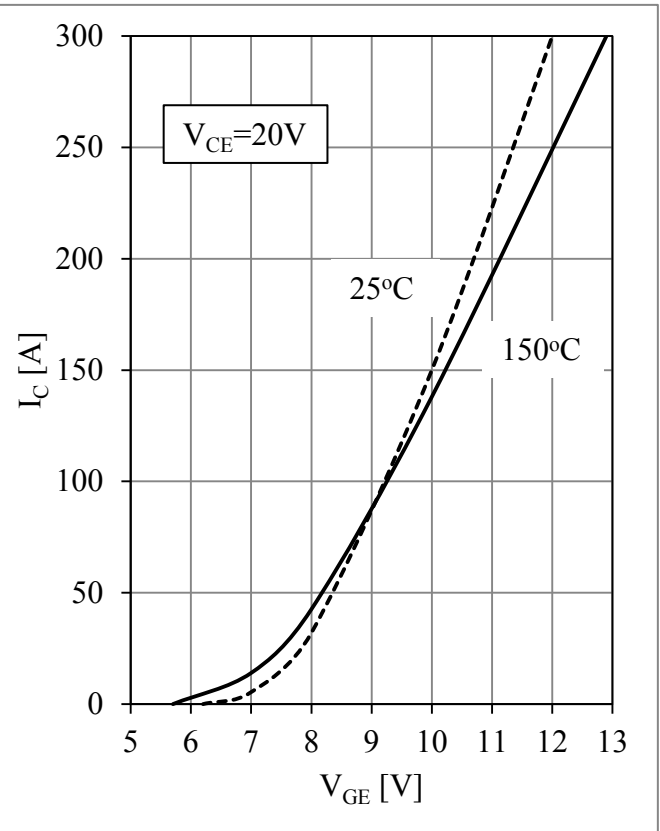
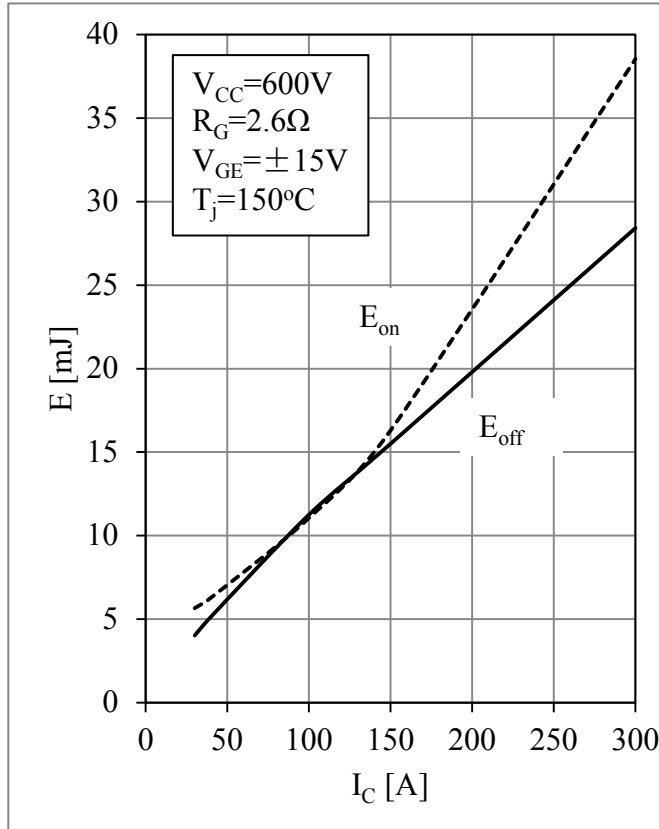
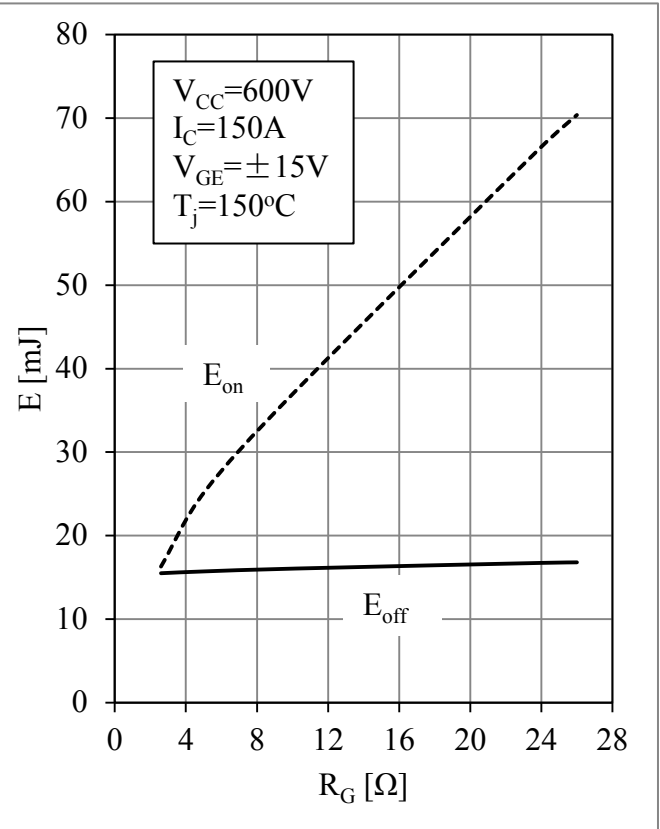


Fig 2. IGBT Transfer Characteristics

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

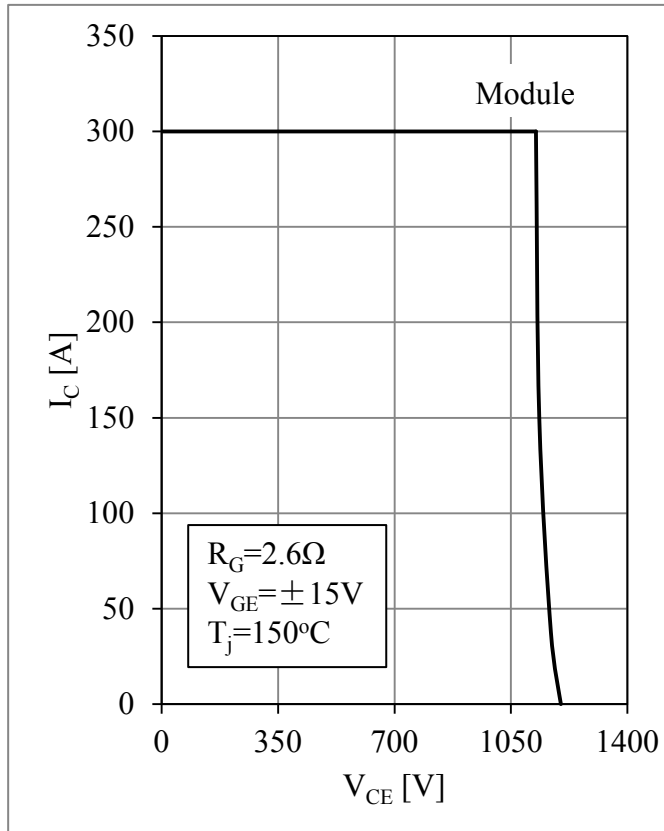


Fig 5. RBSOA

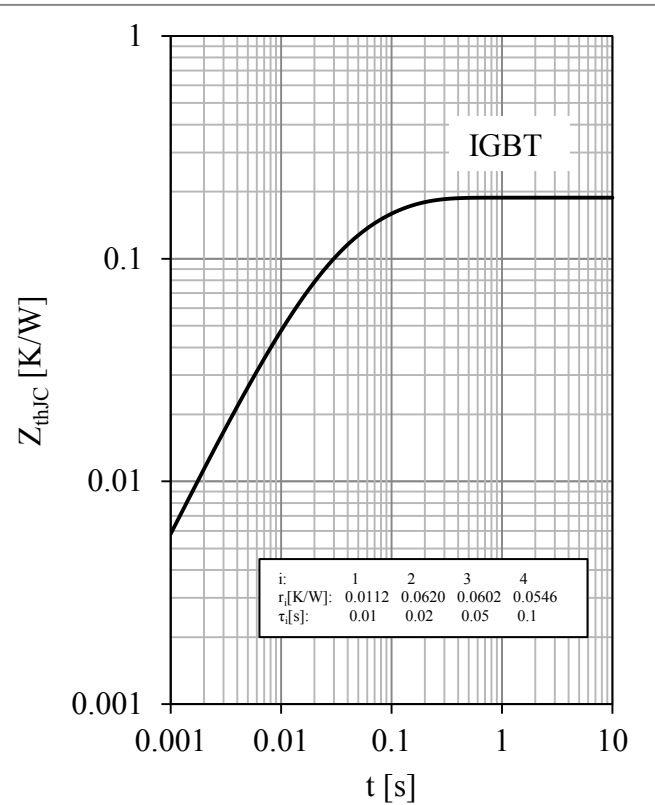


Fig 6. IGBT Transient Thermal Impedance

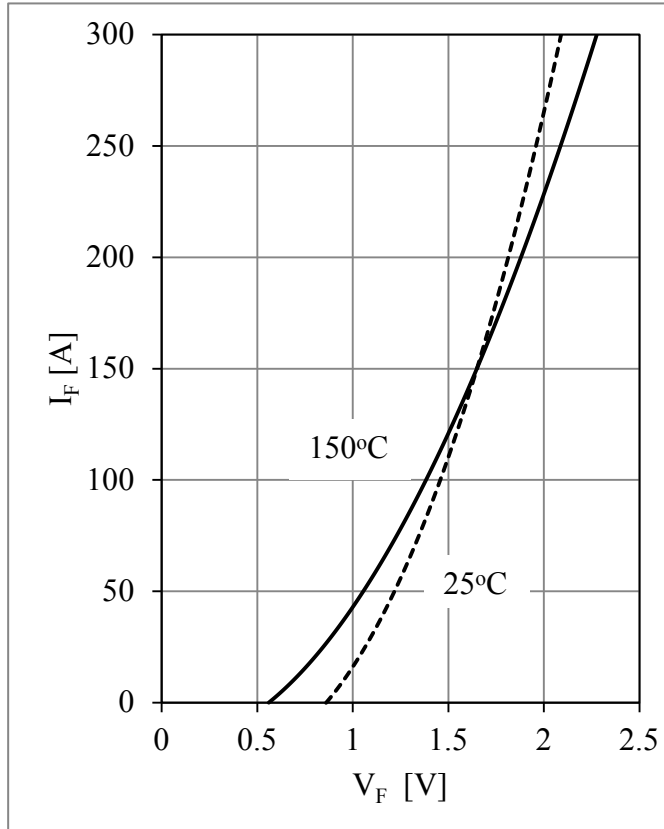
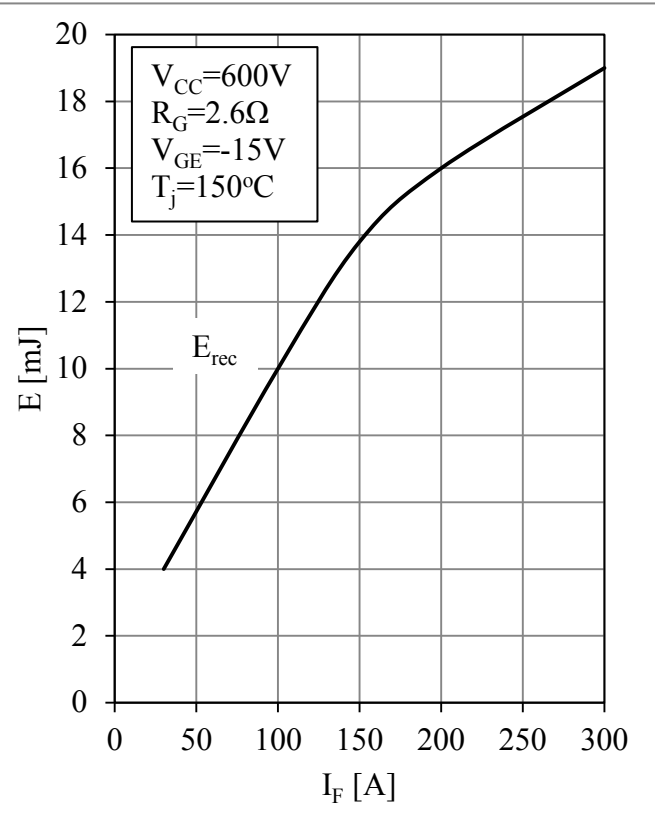


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

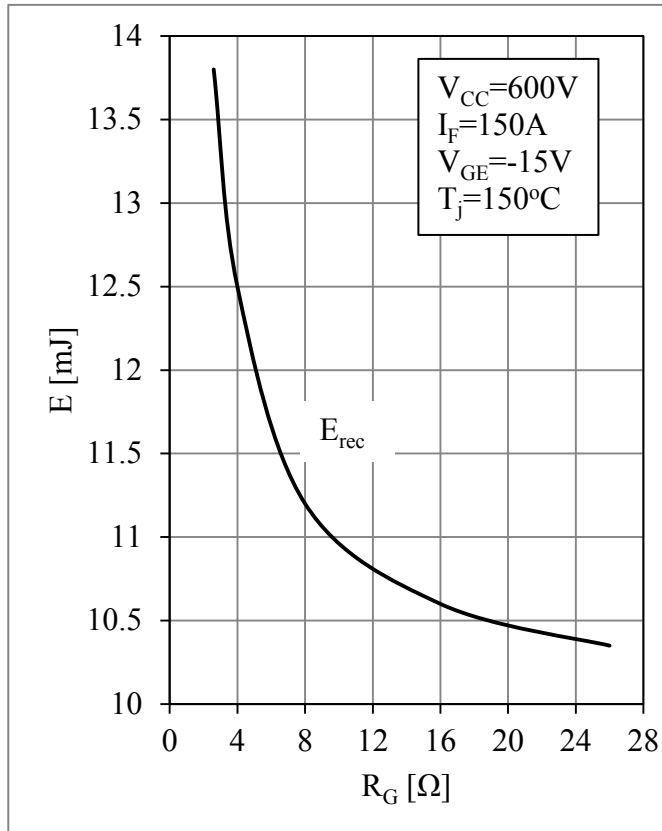
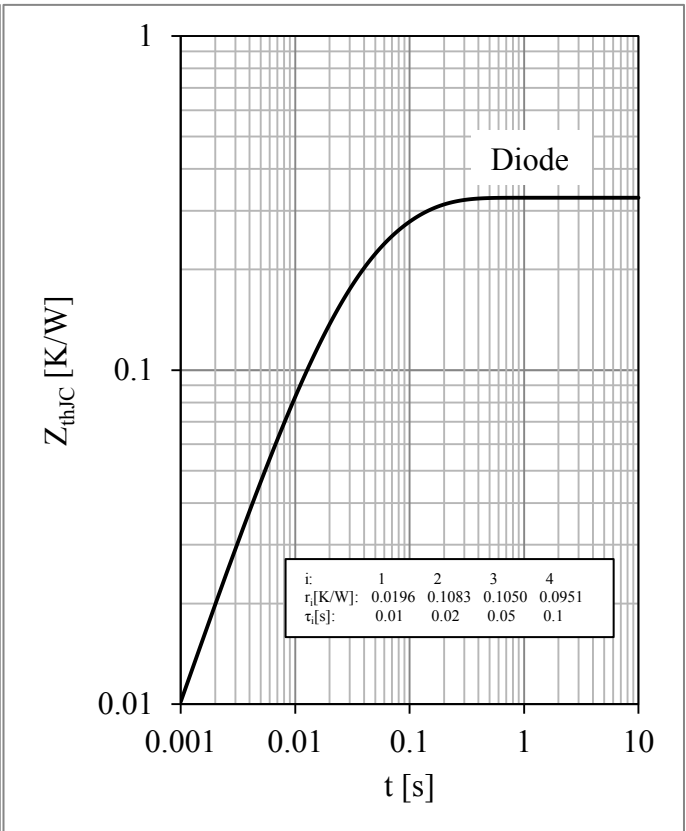
Fig 9. Diode Switching Loss vs. R_G 

Fig 10. Diode Transient Thermal Impedance

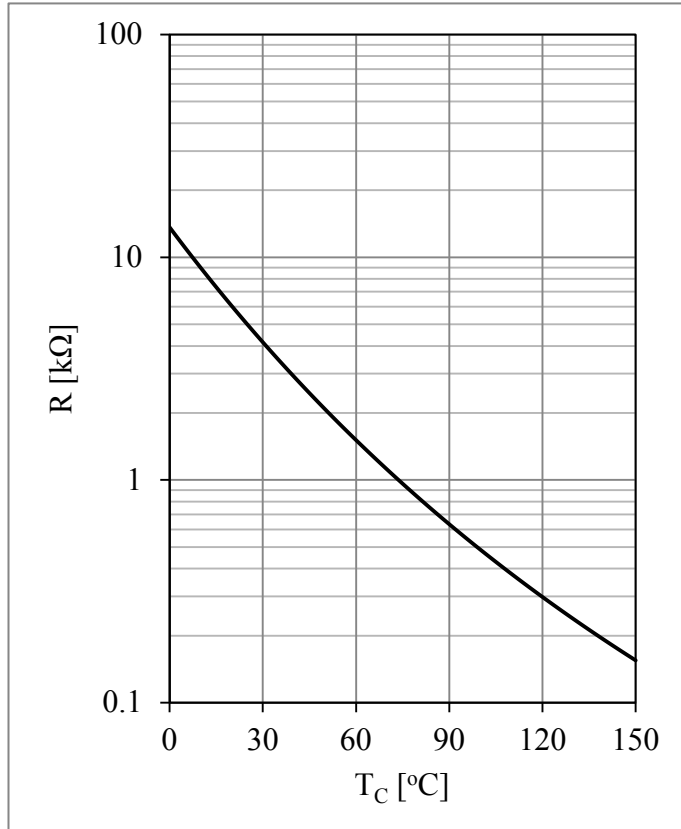


Fig 11. NTC Temperature Characteristic

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