

STARPOWER

SEMICONDUCTOR

IGBT

GD300FFX65P3S

650V/300A 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.

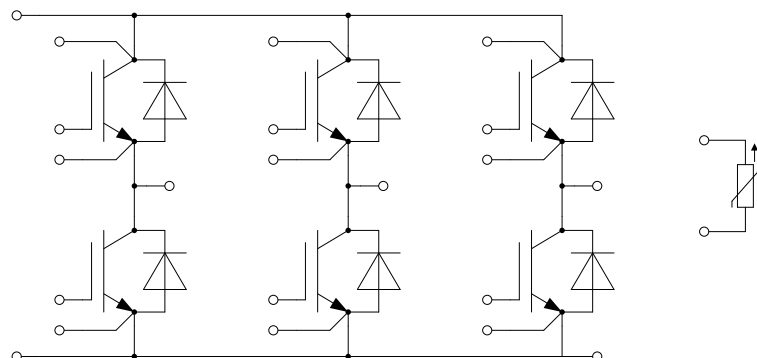
Features

- 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

- Automotive application
- Hybrid and electric vehicle
- Inverter for motor drive

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	650	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=60^{\circ}\text{C}$	365 300	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	600	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	892	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	300	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	600	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, $f=50\text{Hz}$, $t=1\text{min}$	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	$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.45	1.90	V
		$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		1.60		
		$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=4.80\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.1	5.8	6.5	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			1.0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		34.8		nF
C_{res}	Reverse Transfer Capacitance			0.69		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		2.08		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=300\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		96		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			249		ns
t_f	Fall Time			74		ns
E_{on}	Turn-On Switching Loss			0.55		mJ
E_{off}	Turn-Off Switching Loss			7.23		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=300\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		106		ns
t_r	Rise Time			55		ns
$t_{d(off)}$	Turn-Off Delay Time			272		ns
t_f	Fall Time			109		ns
E_{on}	Turn-On Switching Loss			1.12		mJ
E_{off}	Turn-Off Switching Loss			9.12		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=300\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		112		ns
t_r	Rise Time			55		ns
$t_{d(off)}$	Turn-Off Delay Time			279		ns
t_f	Fall Time			129		ns
E_{on}	Turn-On Switching Loss			1.30		mJ
E_{off}	Turn-Off Switching Loss			9.70		mJ
I_{SC}	SC Data	$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		1500		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	$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.55	2.00	V
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.50		
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.45		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=300\text{A},$ $-di/dt=5230\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		6.64		μC
I_{RM}	Peak Reverse Recovery Current			192		A
E_{rec}	Reverse Recovery Energy			2.52		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=300\text{A},$ $-di/dt=5200\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		11.9		μC
I_{RM}	Peak Reverse Recovery Current			240		A
E_{rec}	Reverse Recovery Energy			4.76		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=300\text{A},$ $-di/dt=5190\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		14.5		μC
I_{RM}	Peak Reverse Recovery Current			256		A
E_{rec}	Reverse Recovery Energy			5.37		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		1.00		m Ω
R_{thJC}	Junction-to-Case (per IGBT)			0.168	K/W
	Junction-to-Case (per Diode)			0.287	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.095		K/W
	Case-to-Heatsink (per Diode)		0.163		
	Case-to-Heatsink (per Module)		0.010		
M	Terminal Connection Torque, Screw M6	3.0		6.0	N.m
	Mounting Torque, Screw M5	3.0		6.0	
G	Weight of Module		485		g

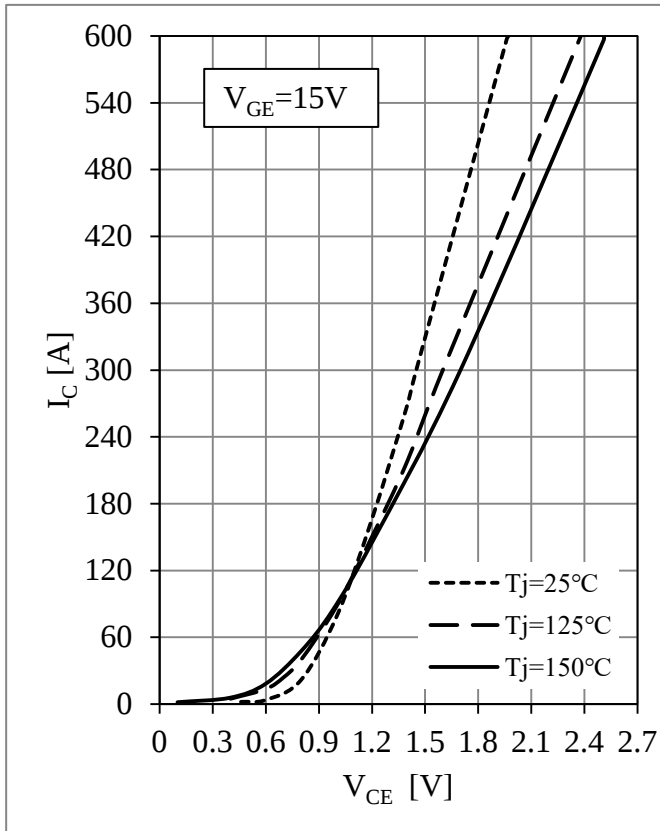


Fig 1. IGBT Output Characteristics

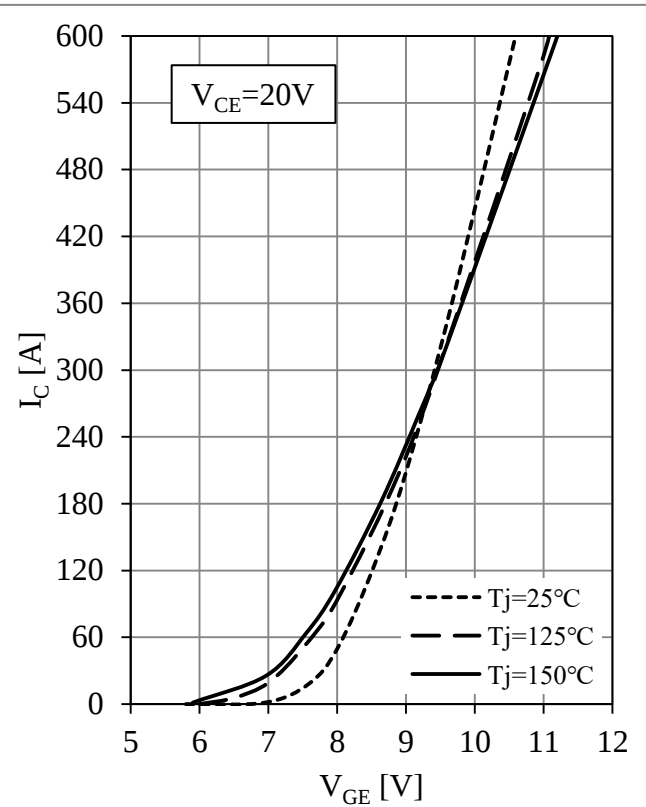
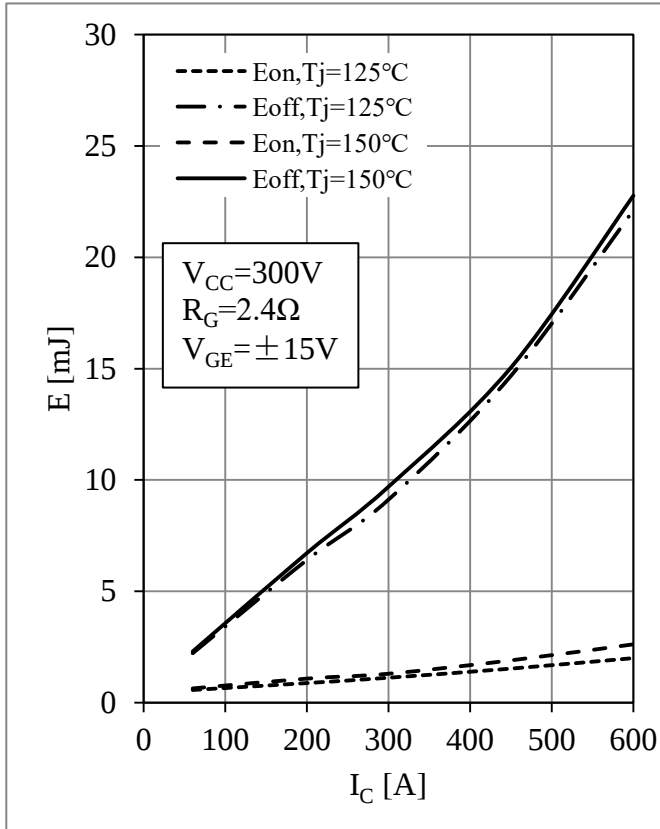
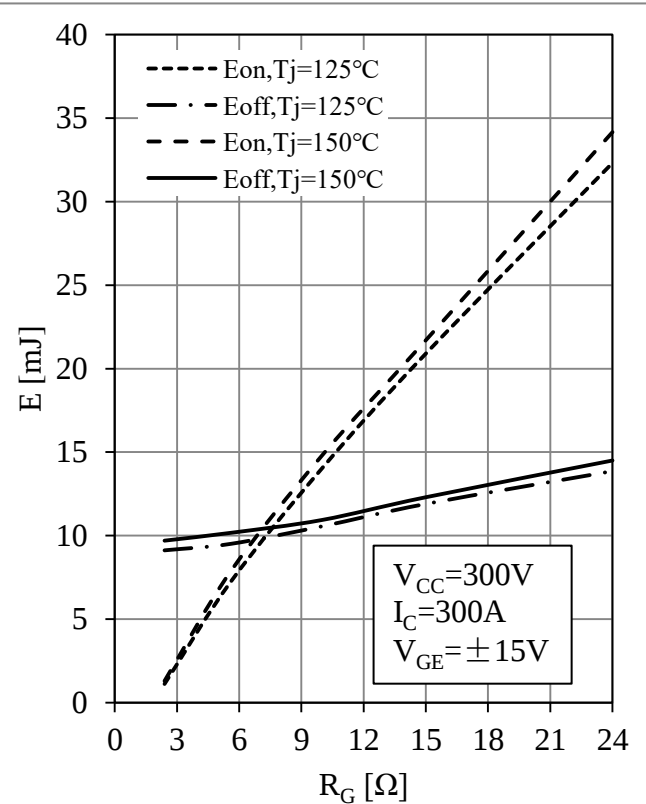


Fig 2. IGBT Transfer Characteristics

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

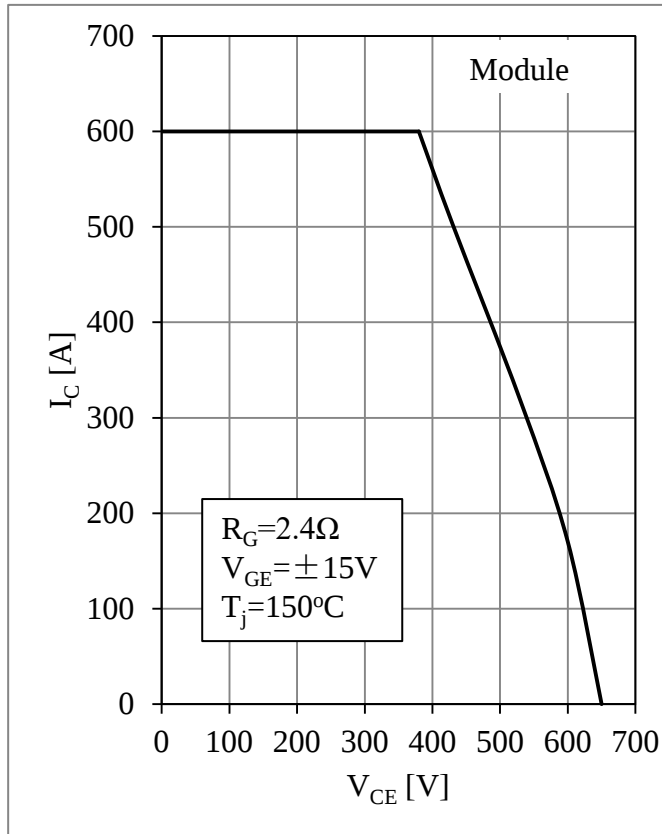


Fig 5. RBSOA

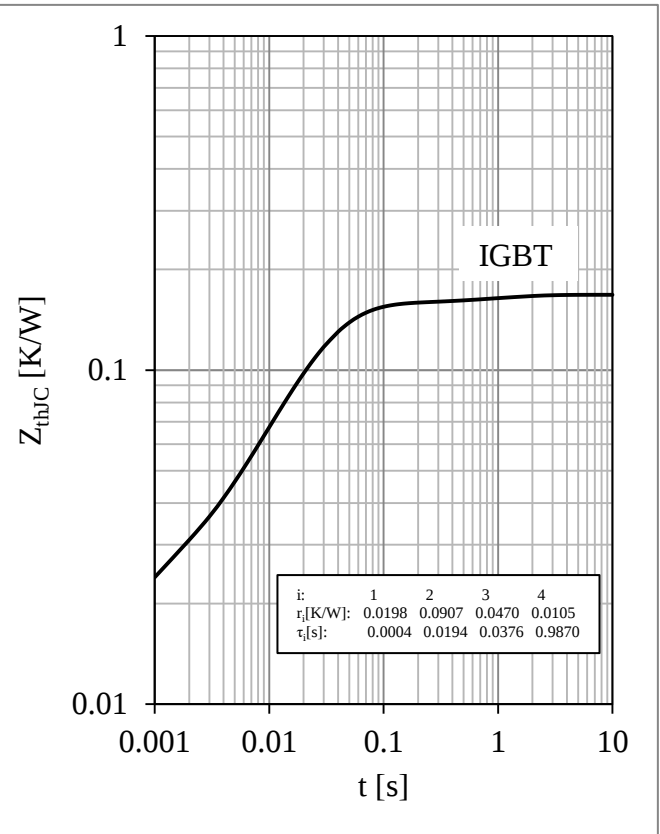


Fig 6. IGBT Transient Thermal Impedance

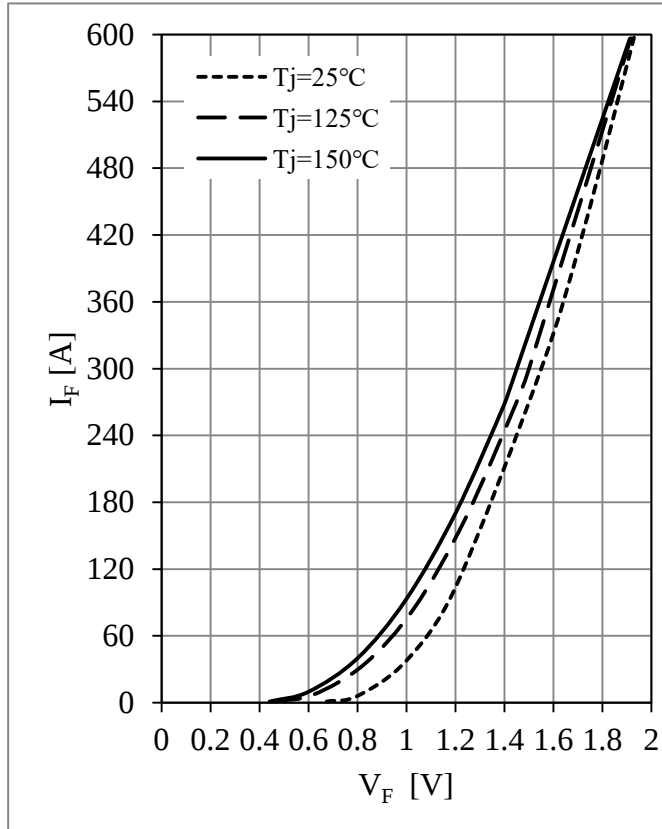
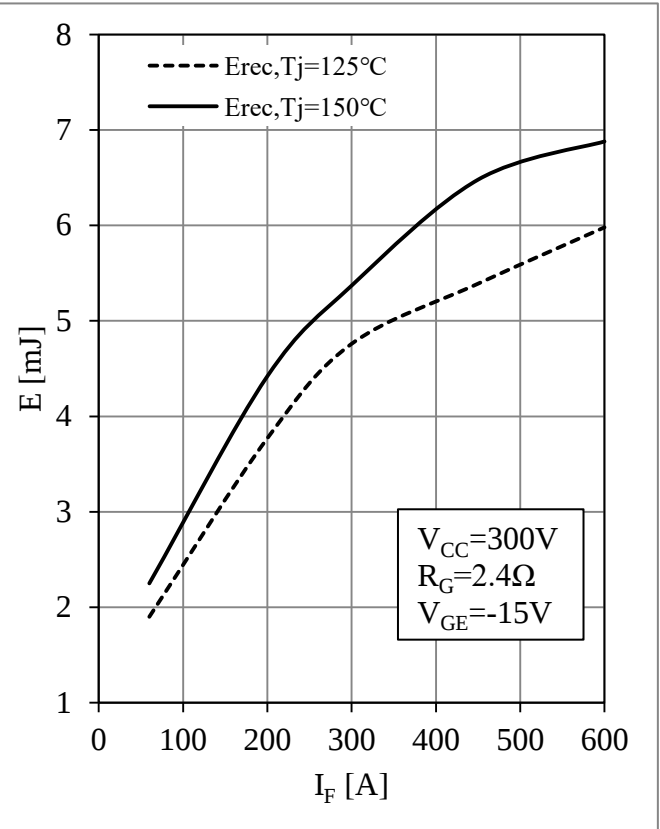


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

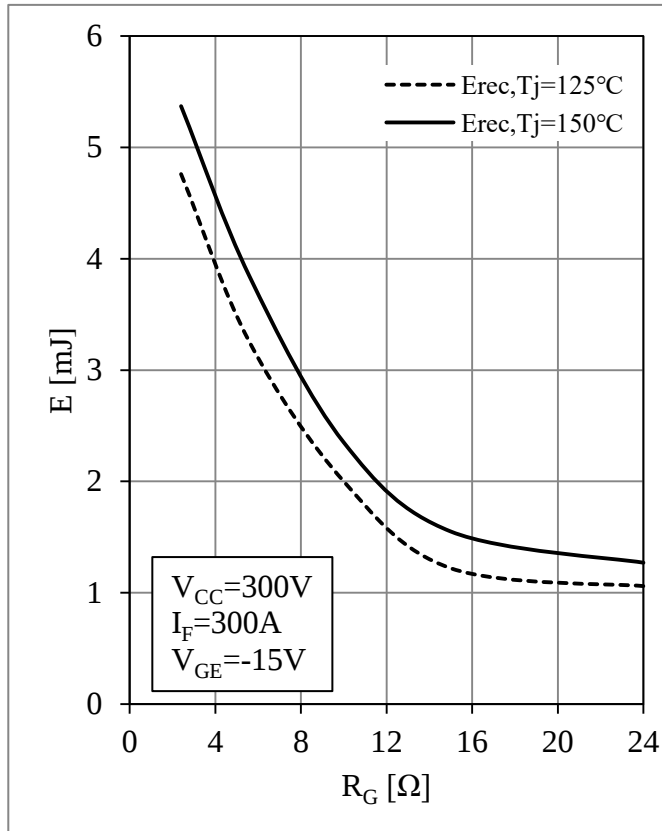
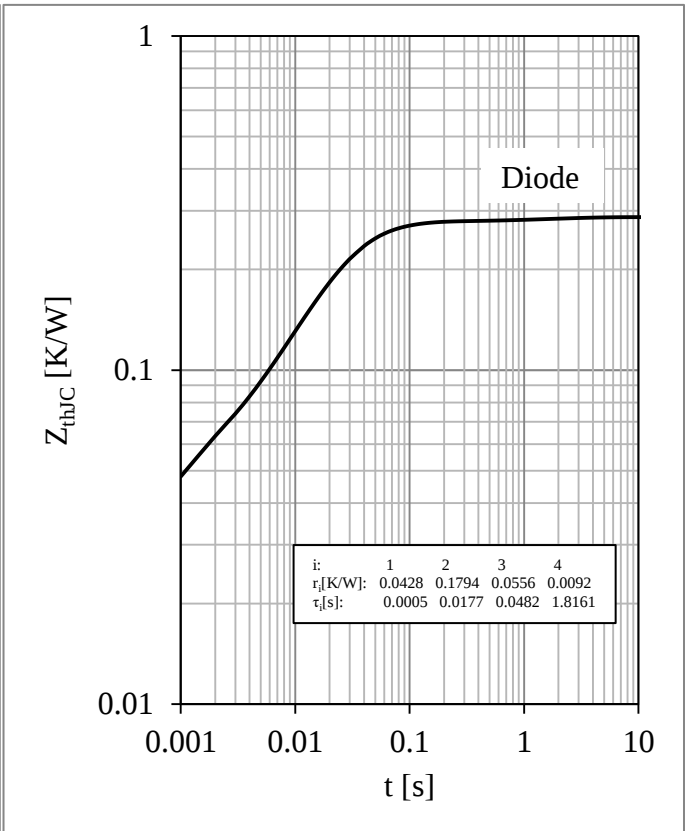
Fig 9. Diode Switching Loss vs. R_G 

Fig 10. Diode Transient Thermal Impedance

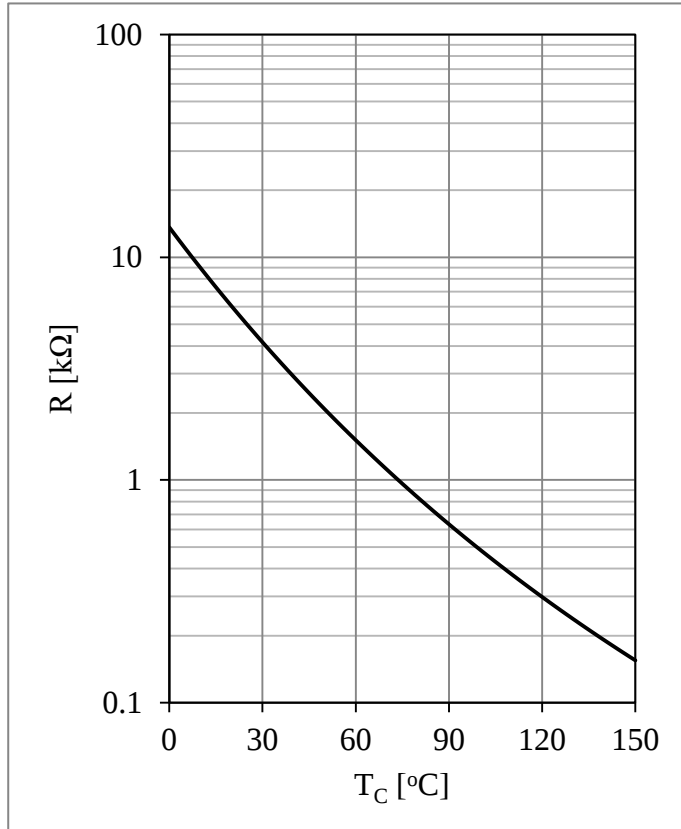
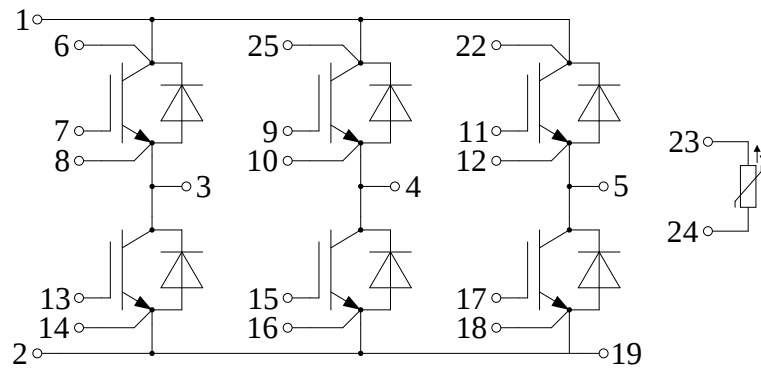


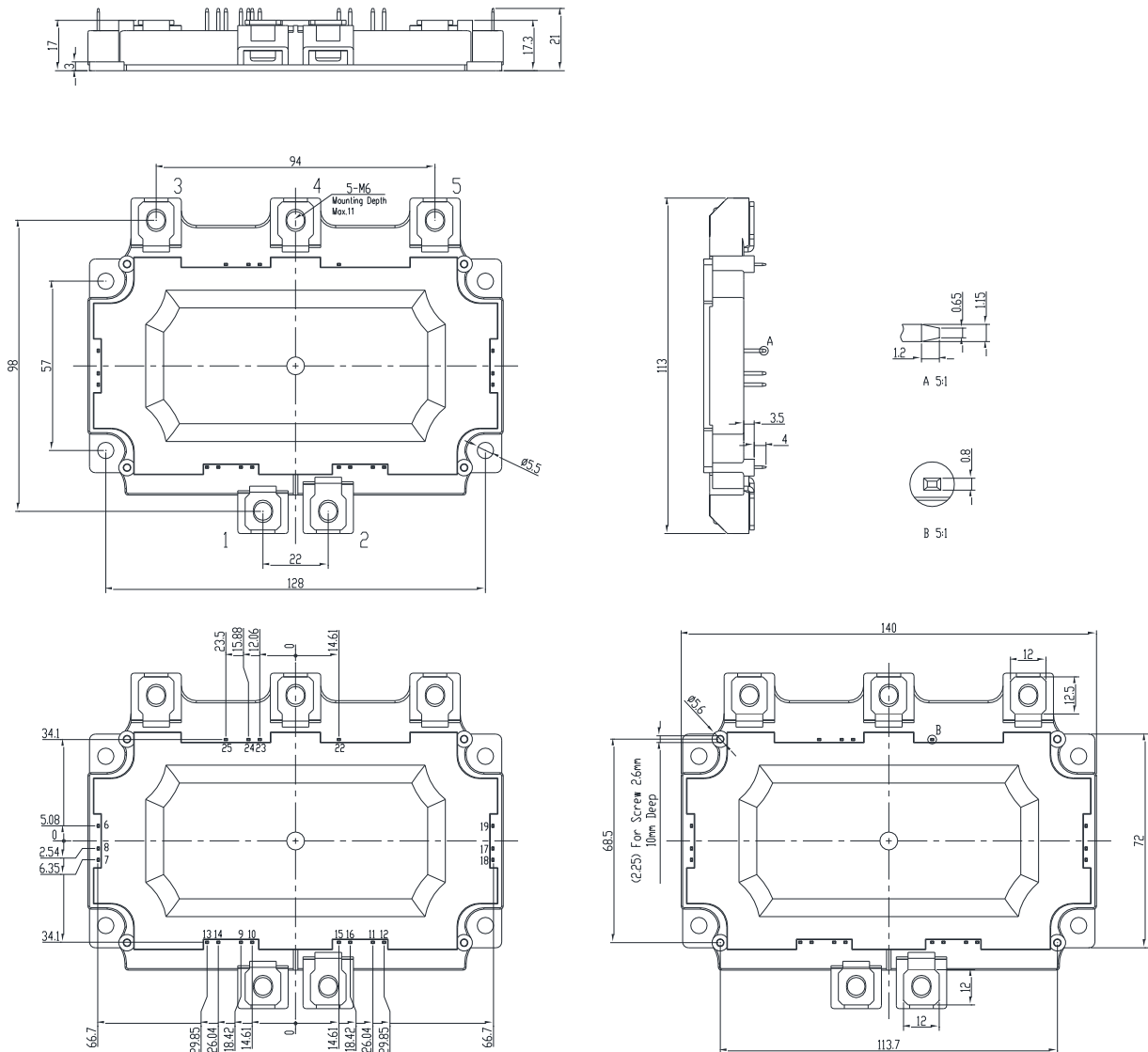
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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