

STARPOWER

SEMICONDUCTOR

IGBT

GD1400HFX170P2S

1700V/1400A 2 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 wind and solar power.

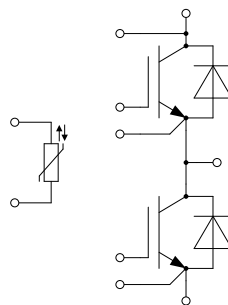
Features

- 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
- Enlarged Diode for regenerative operation
- Isolated copper baseplate using DBC technology
- High power and thermal cycling capability

Typical Applications

- Auxiliary Inverters
- High Power Converters
- Wind Power
- Traction Drives

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 @ $T_C=25^{\circ}\text{C}$	2342	A
	@ $T_C=100^{\circ}\text{C}$	1400	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	2800	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	9.37	kW

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1700	V
I_F	Diode Continuous Forward Current	1400	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	2800	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 +150	$^{\circ}\text{C}$
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	$I_C=1400\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.95	2.40	V	
		$I_C=1400\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.40			
		$I_C=1400\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.50			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=56.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	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			1.6		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		169		nF	
C_{res}	Reverse Transfer Capacitance			4.09		nF	
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		13.2		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=1400\text{A}, R_G=0.47\Omega, R_{Goff}=0.68\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		714		ns	
t_r	Rise Time			99		ns	
$t_{d(off)}$	Turn-Off Delay Time			929		ns	
t_f	Fall Time			250		ns	
E_{on}	Turn-On Switching Loss			281		mJ	
E_{off}	Turn-Off Switching Loss			264		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=900\text{V}, I_C=1400\text{A}, R_G=0.47\Omega, R_{Goff}=0.68\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		748		ns
t_r	Rise Time				109		ns
$t_{d(off)}$	Turn-Off Delay Time			1037		ns	
t_f	Fall Time			353		ns	
E_{on}	Turn-On Switching Loss			443		mJ	
E_{off}	Turn-Off Switching Loss			462		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=1400\text{A}, R_G=0.47\Omega, R_{Goff}=0.68\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			757		ns
t_r	Rise Time				112		ns
$t_{d(off)}$	Turn-Off Delay Time			1064		ns	
t_f	Fall Time			379		ns	
E_{on}	Turn-On Switching Loss			483		mJ	
E_{off}	Turn-Off Switching Loss			512		mJ	
I_{SC}	SC Data		$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=1000\text{V}, V_{CEM} \leq 1700\text{V}$		5600		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	$I_F=1400\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.80	2.25	V	
		$I_F=1400\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.90			
		$I_F=1400\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.95			
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=1400\text{A},$ $-di/dt=11500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		380		μC	
I_{RM}	Peak Reverse Recovery Current			1650		A	
E_{rec}	Reverse Recovery Energy			224		mJ	
Q_r	Recovered Charge			644		μC	
I_{RM}	Peak Reverse Recovery Current		$V_R=900\text{V}, I_F=1400\text{A},$ $-di/dt=11500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		1650		A
E_{rec}	Reverse Recovery Energy			405		mJ	
Q_r	Recovered Charge			715		μC	
I_{RM}	Peak Reverse Recovery Current		$V_R=900\text{V}, I_F=1400\text{A},$ $-di/dt=11500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		1700		A
E_{rec}	Reverse Recovery Energy			462		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		10		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.20		m Ω
R_{thJC}	Junction-to-Case (per IGBT)			16.0	K/kW
	Junction-to-Case (per Diode)			35.7	
R_{thCH}	Case-to-Heatsink (per IGBT)		8.7		K/kW
	Case-to-Heatsink (per Diode)		19.4		
	Case-to-Heatsink (per Module)		3.0		
M	Terminal Connection Torque, Screw M4	1.8		2.1	N.m
	Terminal Connection Torque, Screw M8	8.0		10.0	
	Mounting Torque, Screw M5	3.0		6.0	
G	Weight of Module		1200		g

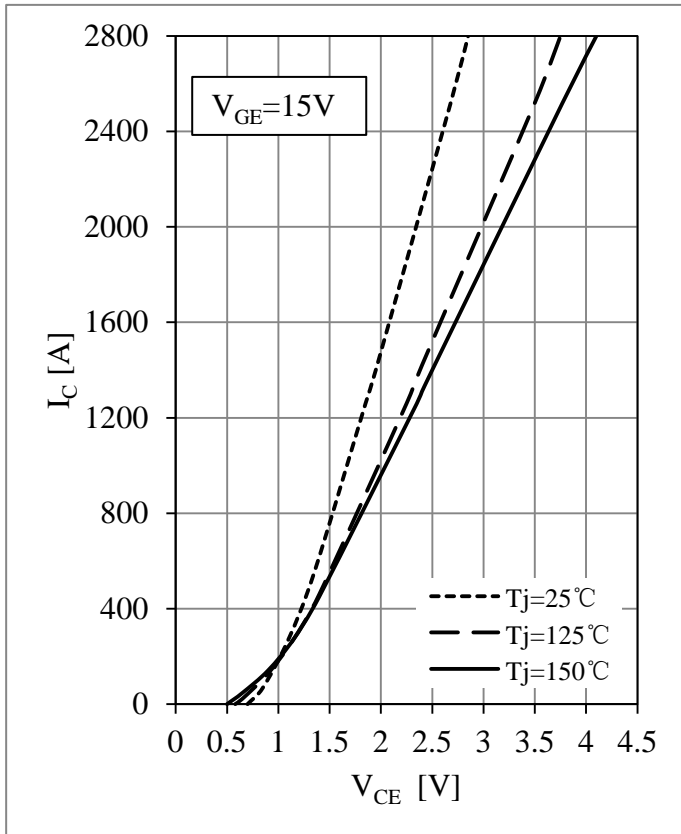


Fig 1. IGBT Output Characteristics

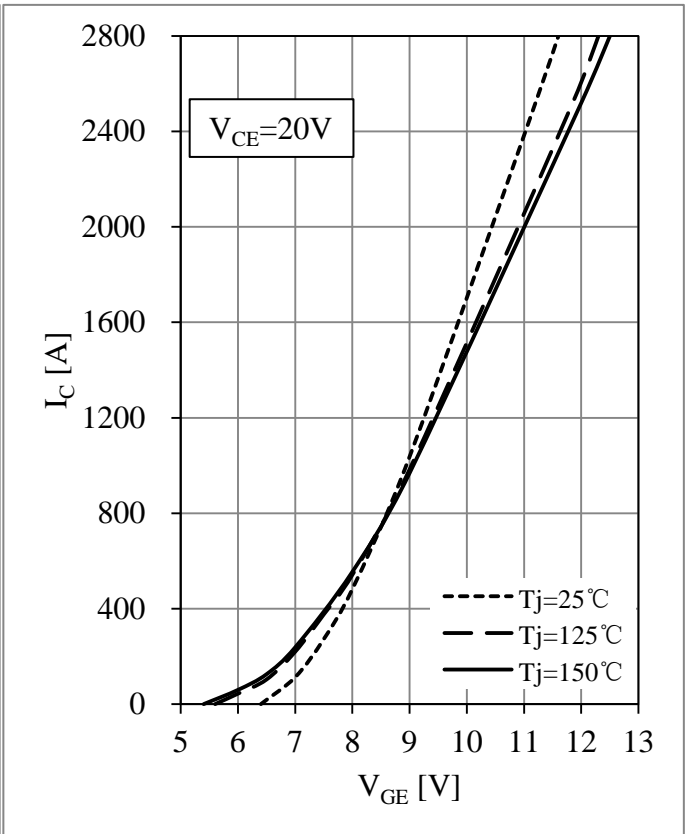


Fig 2. IGBT Transfer Characteristics

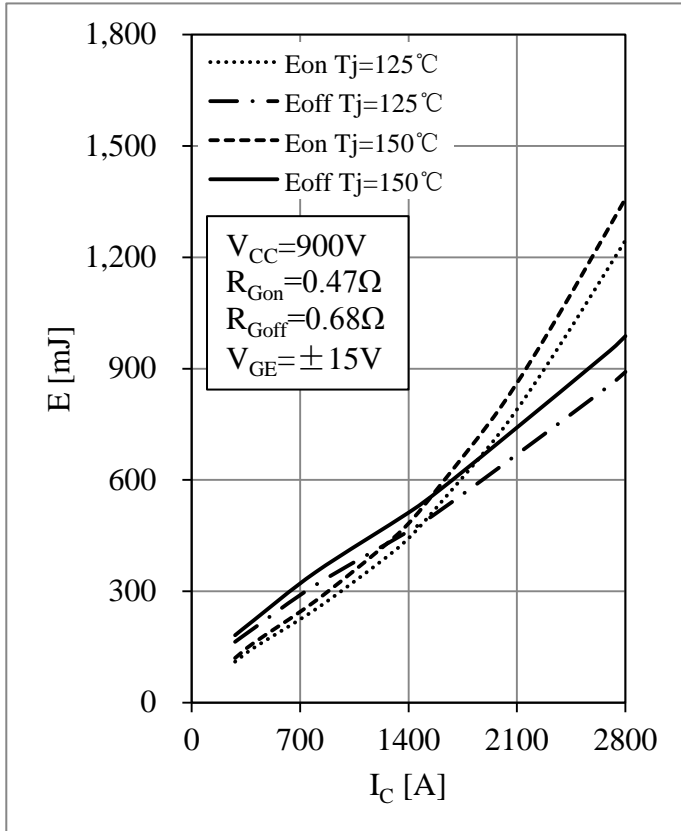


Fig 3. IGBT Switching Loss vs. I_C

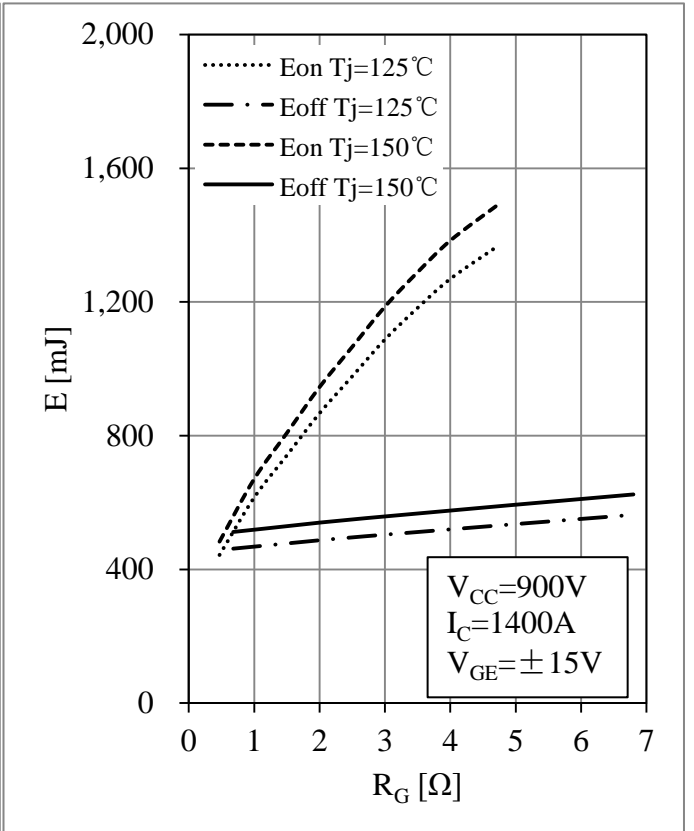


Fig 4. IGBT Switching Loss vs. R_G

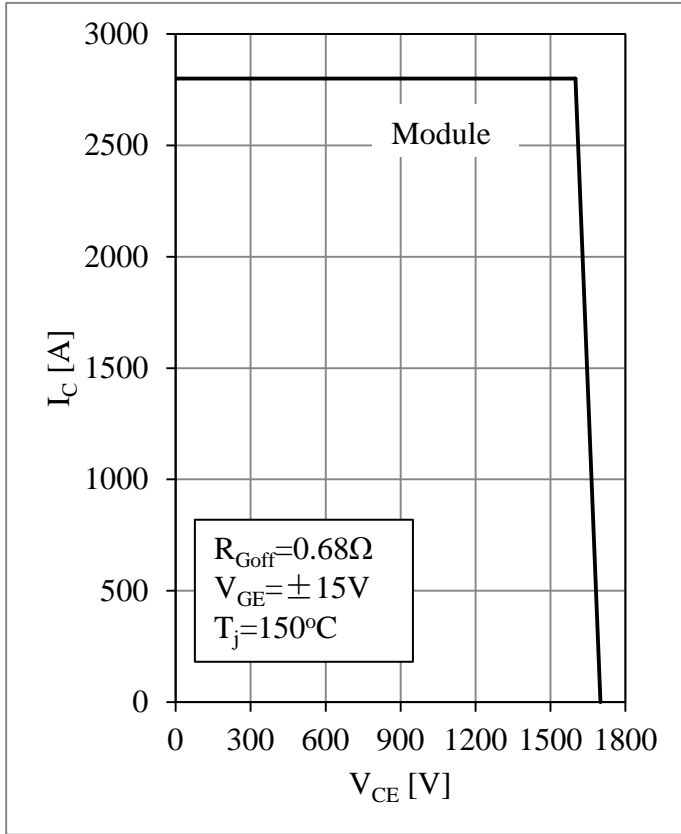


Fig 5. RBSOA

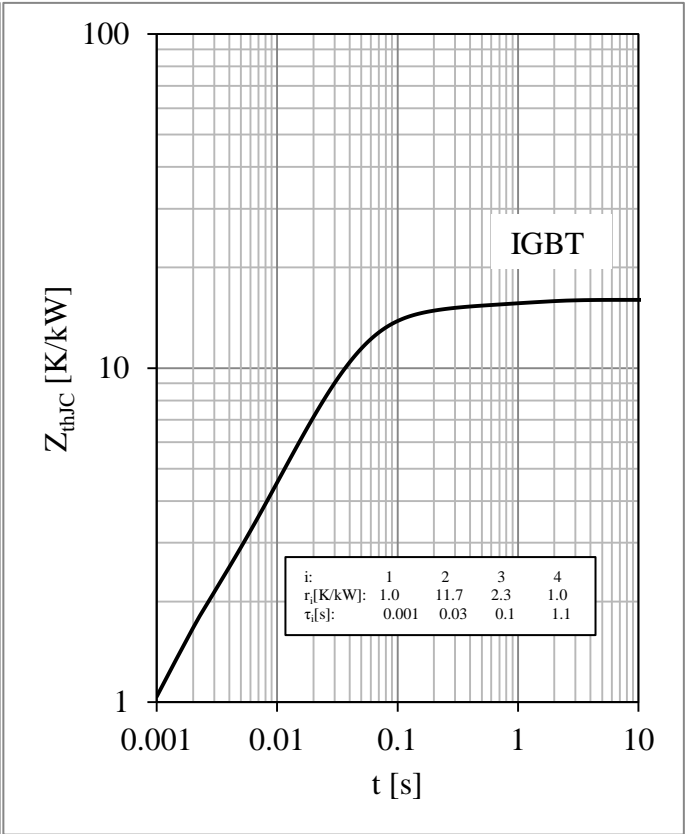


Fig 6. IGBT Transient Thermal Impedance

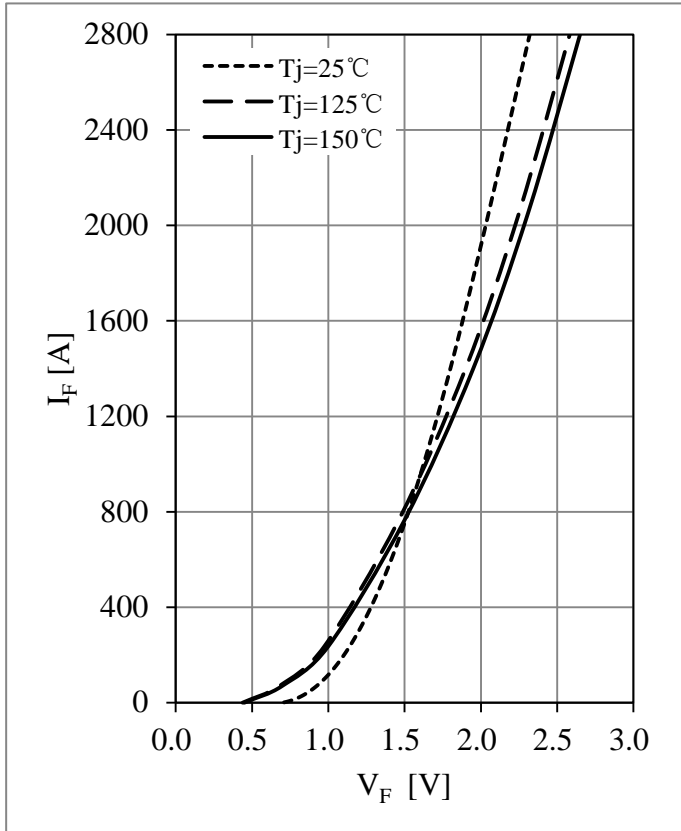


Fig 7. Diode Forward Characteristics

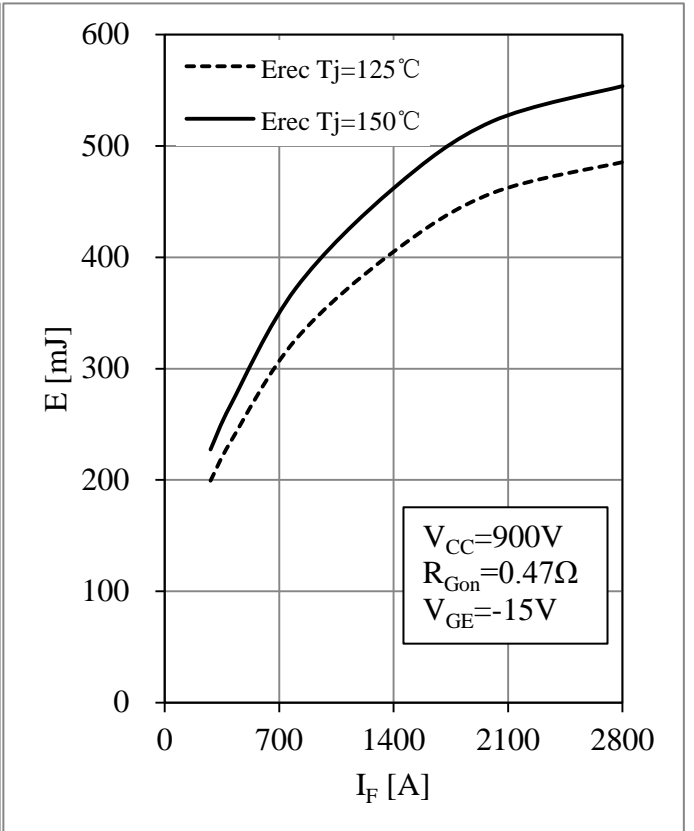


Fig 8. Diode Switching Loss vs. I_F

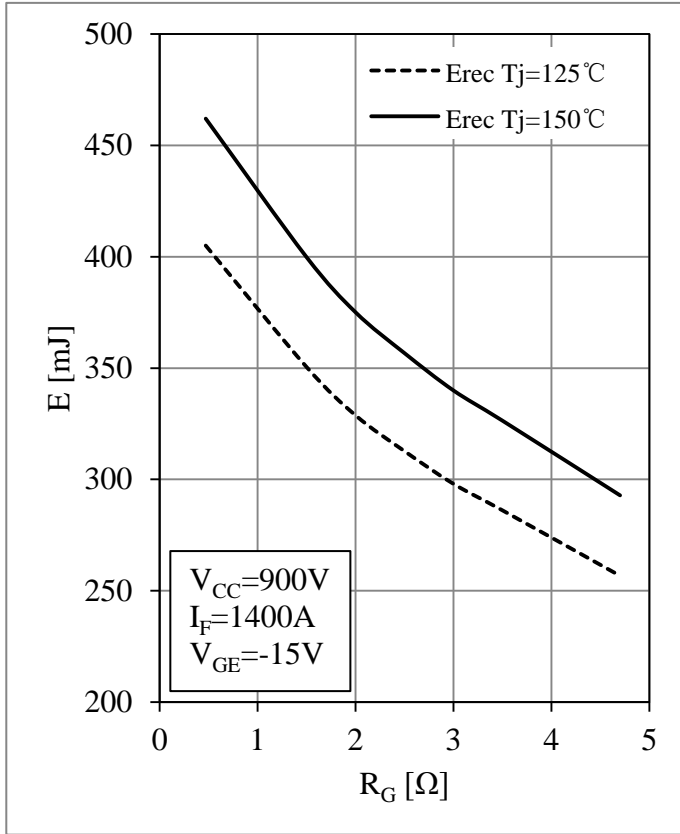


Fig 9. Diode Switching Loss vs. R_G

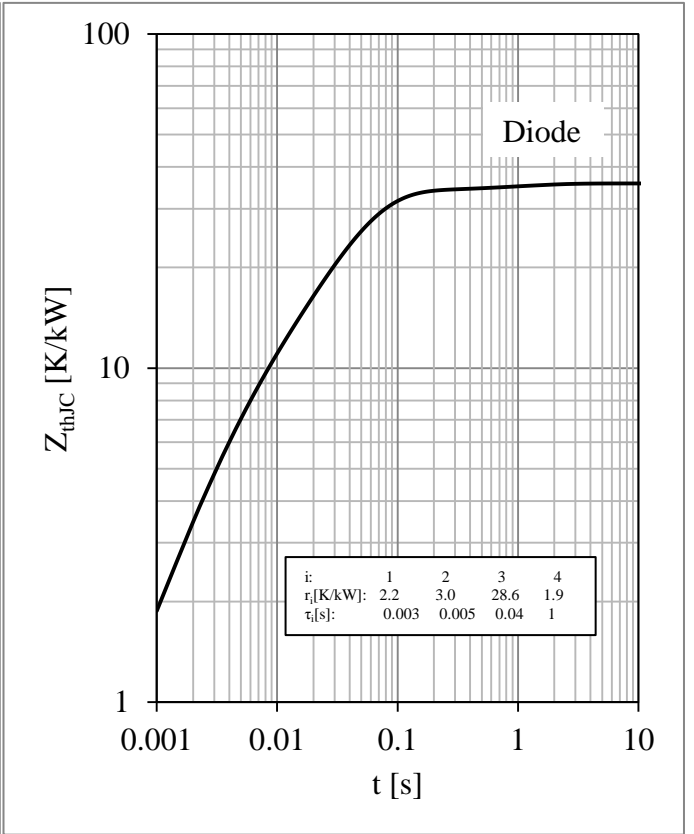


Fig 10. Diode Transient Thermal Impedance

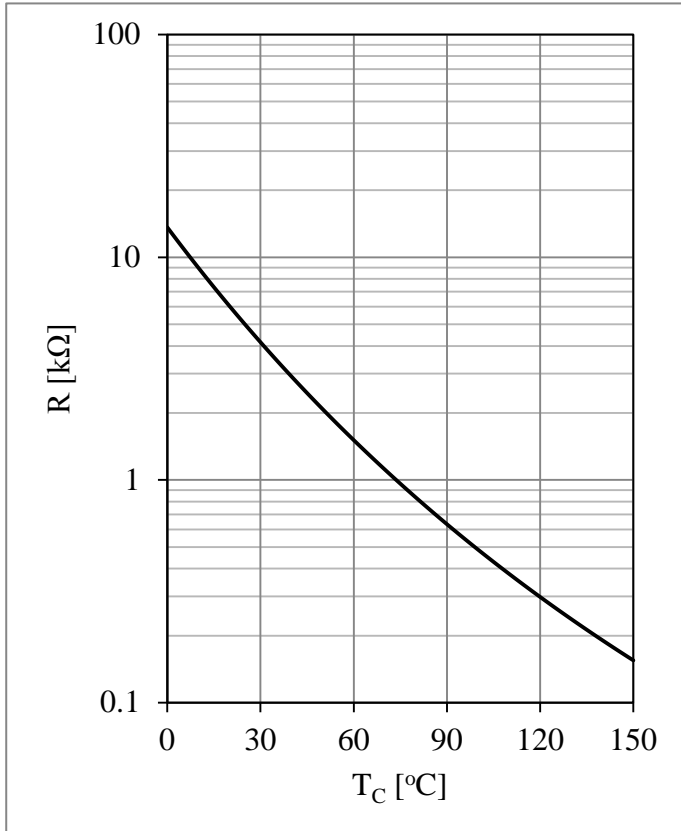
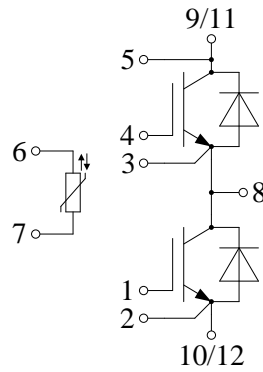


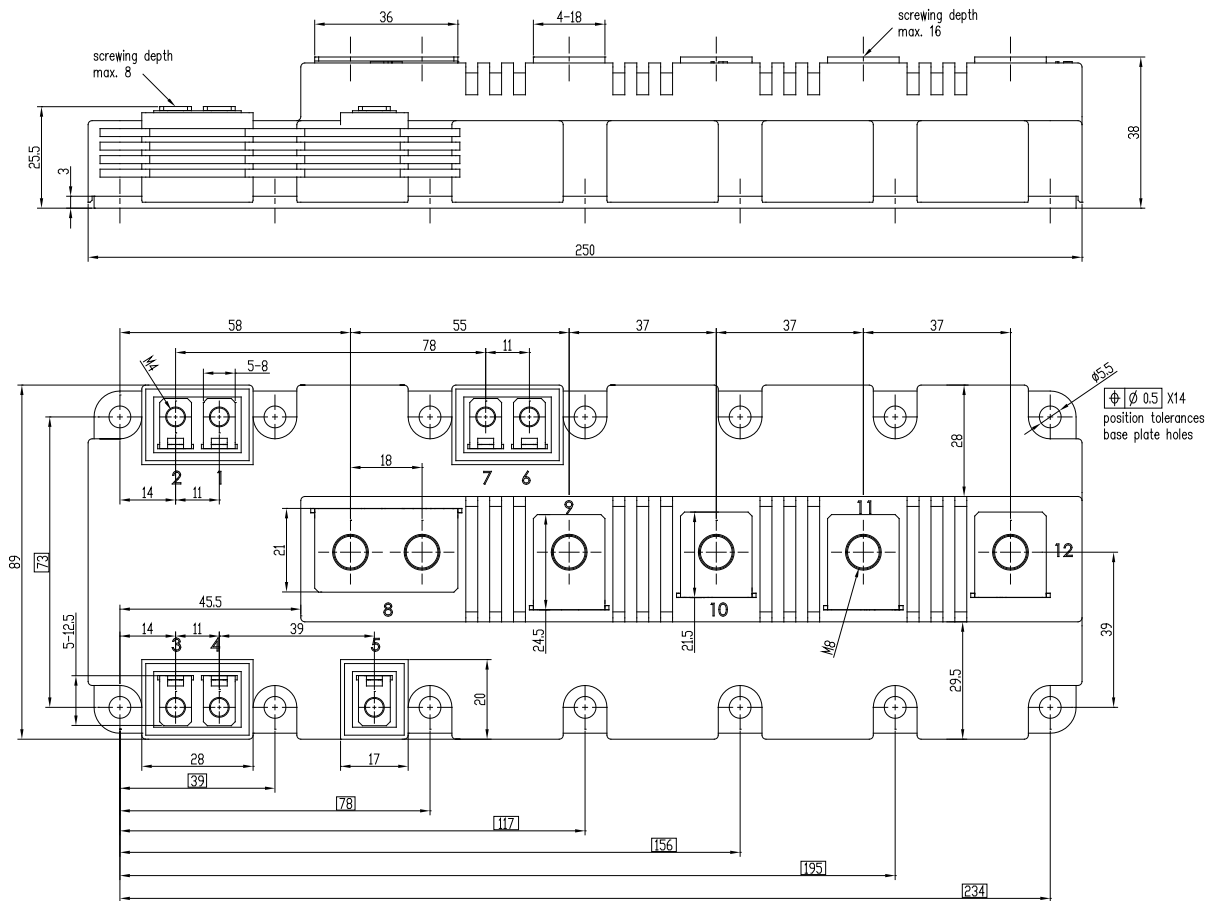
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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