

STARPOWER

SEMICONDUCTOR

IGBT

GD1400HFY120P2S

1200V/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 electric vehicle and solar power.

Features

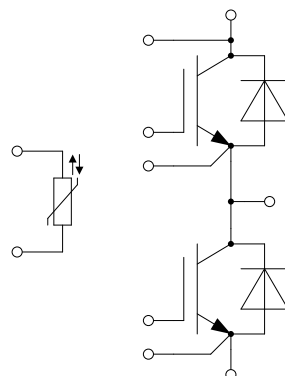
- Low $V_{CE(sat)}$ Trench IGBT technology
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Isolated copper baseplate using DBC technology
- High power and thermal cycling capability



Typical Applications

- High Power Converter
- Solar Power
- Hybrid and Electric Vehicle

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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	2315 1400	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	2800	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	7.94	kW

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	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	$I_C=1400\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.70	2.15	V
		$I_C=1400\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		1.95		
		$I_C=1400\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=35.0\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.2	6.0	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			0.8		Ω
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=1400\text{A}, R_G=1.0\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		214		ns
t_r	Rise Time			128		ns
$t_{d(off)}$	Turn-Off Delay Time			896		ns
t_f	Fall Time			206		ns
E_{on}	Turn-On Switching Loss			70		mJ
E_{off}	Turn-Off Switching Loss			221		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=1400\text{A}, R_G=1.0\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		225		ns
t_r	Rise Time			139		ns
$t_{d(off)}$	Turn-Off Delay Time			979		ns
t_f	Fall Time			237		ns
E_{on}	Turn-On Switching Loss			86		mJ
E_{off}	Turn-Off Switching Loss			288		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=1400\text{A}, R_G=1.0\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		225		ns
t_r	Rise Time			139		ns
$t_{d(off)}$	Turn-Off Delay Time			999		ns
t_f	Fall Time			237		ns
E_{on}	Turn-On Switching Loss			102		mJ
E_{off}	Turn-Off Switching Loss			314		mJ
I_{SC}	SC Data	$t_P \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=800\text{V}, V_{CEM} \leq 1200\text{V}$		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	$I_F=1400\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.90	2.25	V
		$I_F=1400\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.85		
		$I_F=1400\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.80		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=1400\text{A},$ $-di/dt=8600\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		127		μC
I_{RM}	Peak Reverse Recovery Current			740		A
E_{rec}	Reverse Recovery Energy			66.6		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=1400\text{A},$ $-di/dt=8600\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		224		μC
I_{RM}	Peak Reverse Recovery Current			950		A
E_{rec}	Reverse Recovery Energy			104		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=1400\text{A},$ $-di/dt=8600\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		257		μC
I_{RM}	Peak Reverse Recovery Current			997		A
E_{rec}	Reverse Recovery Energy			124		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)			18.9	K/kW
	Junction-to-Case (per Diode)			34.9	
R_{thCH}	Case-to-Heatsink (per IGBT)		9.25		K/kW
	Case-to-Heatsink (per Diode)		17.1		
	Case-to-Heatsink (per Module)		3.00		
M	Terminal Connection Torque, Screw M4	1.8		2.1	N.m
	Terminal Connection Torque, Screw M8	8.0		10	
	Mounting Torque, Screw M5	3.0		6.0	
G	Weight of Module		1210		g

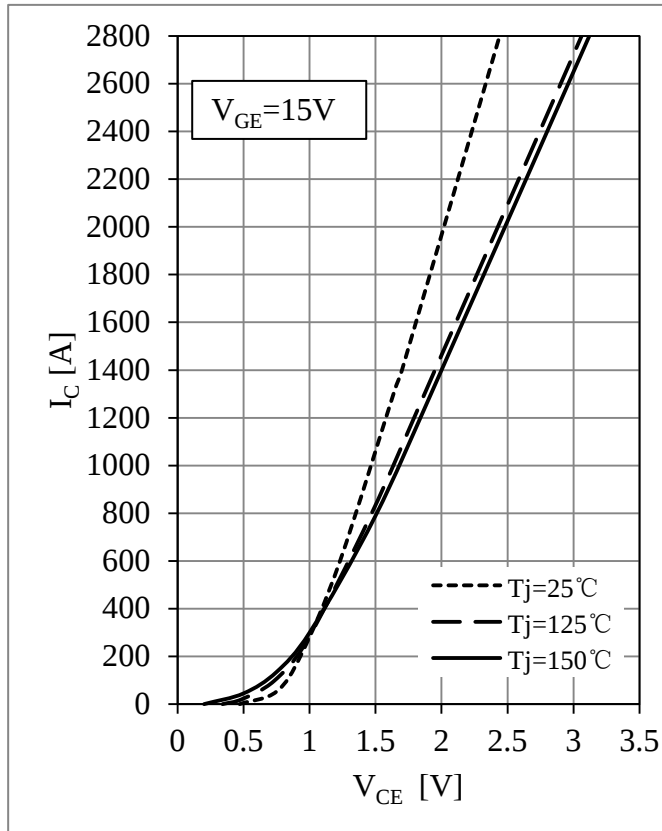


Fig 1. IGBT Output Characteristics

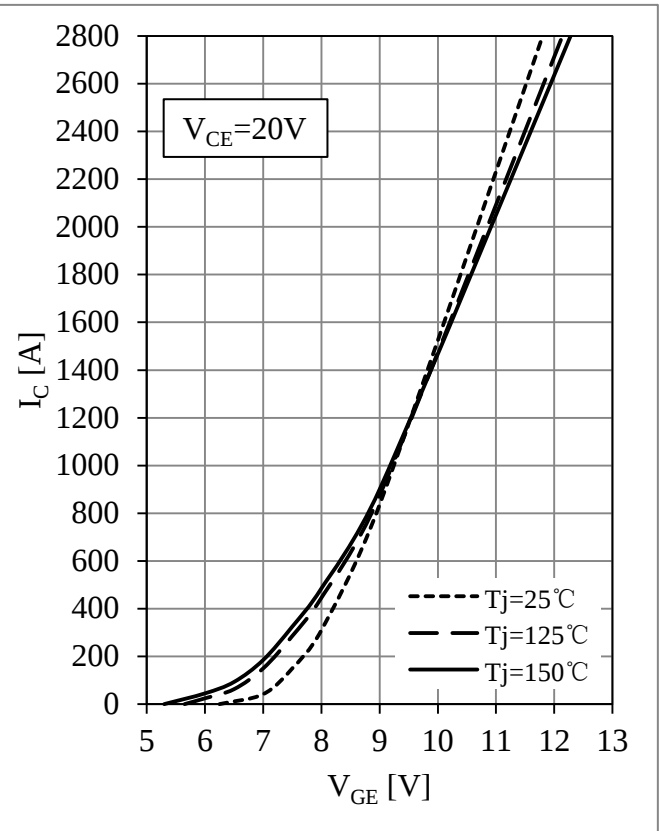
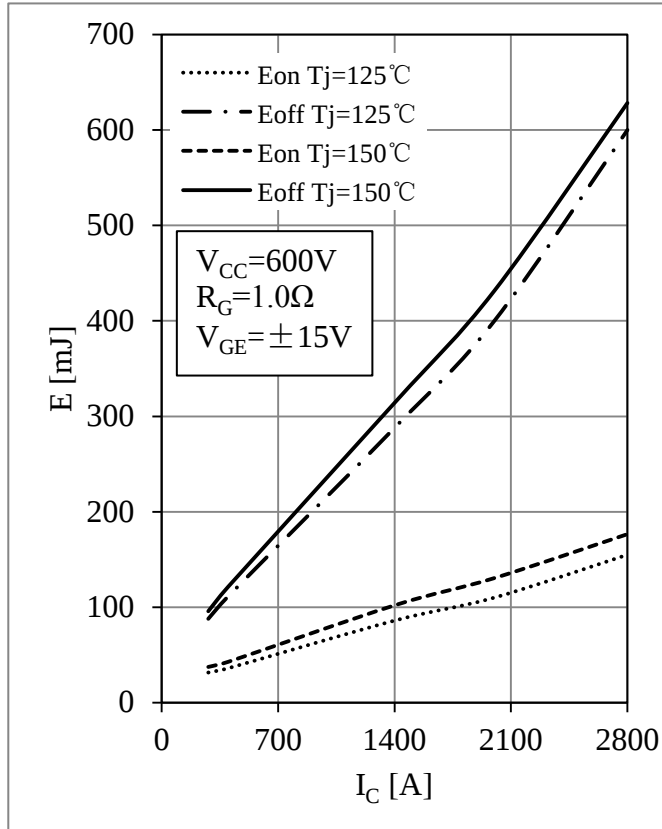
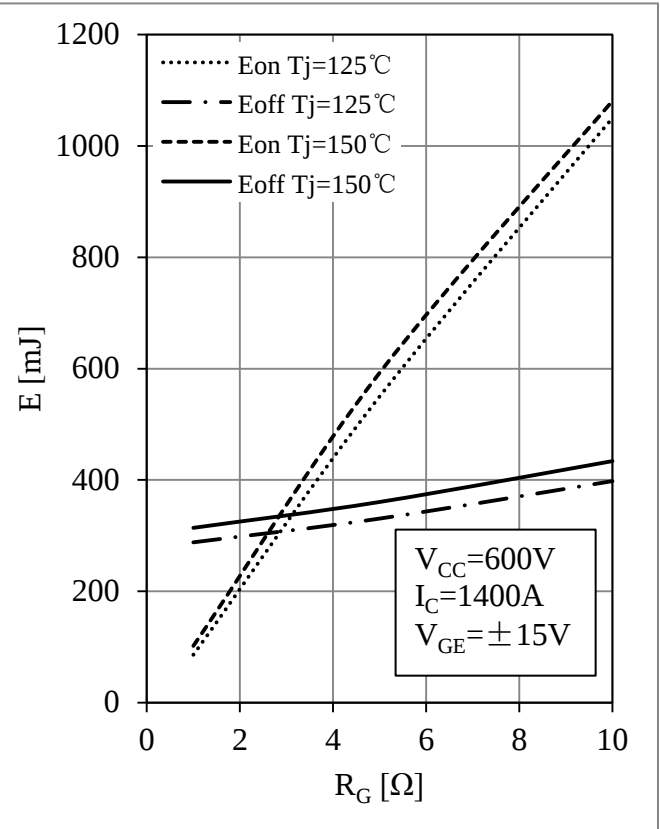


Fig 2. IGBT Transfer Characteristics

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

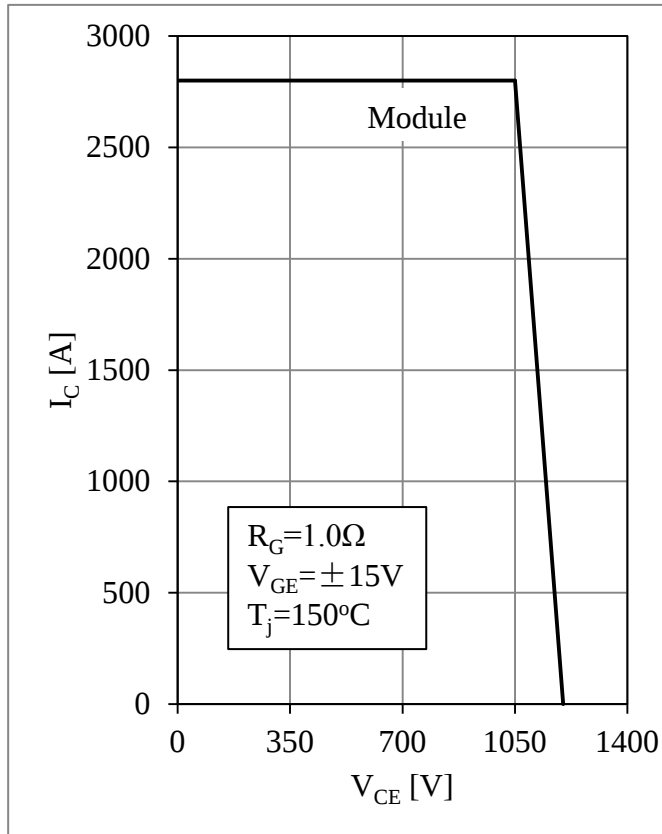


Fig 5. RBSOA

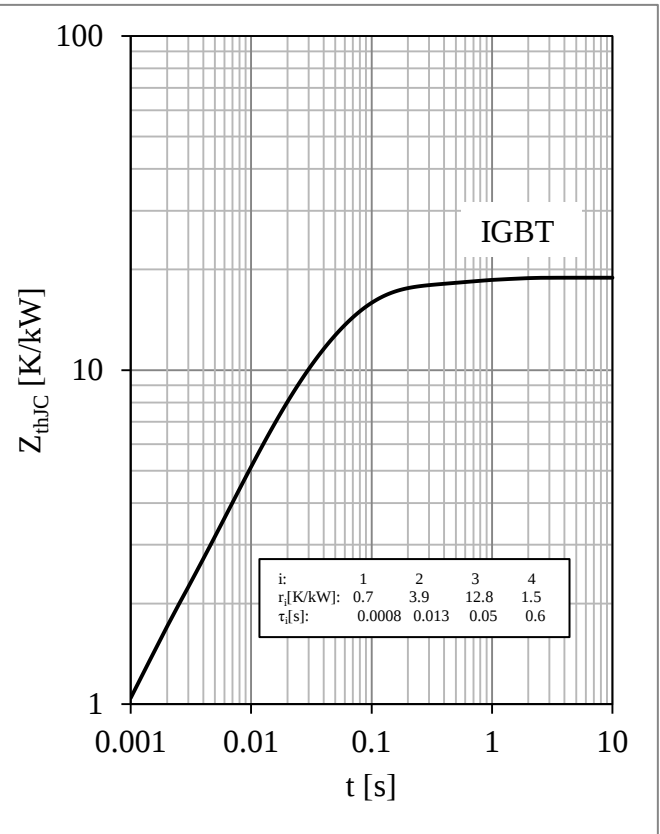


Fig 6. IGBT Transient Thermal Impedance

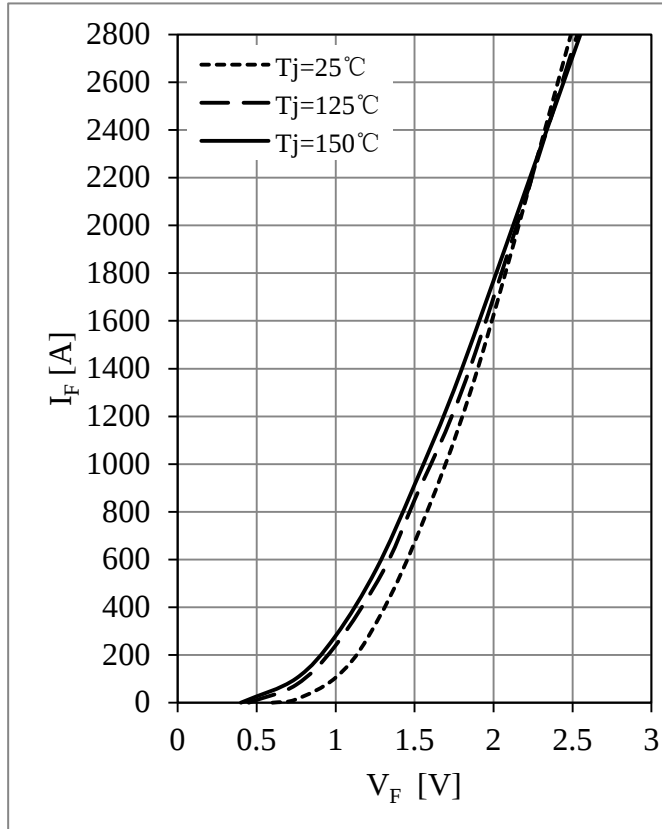
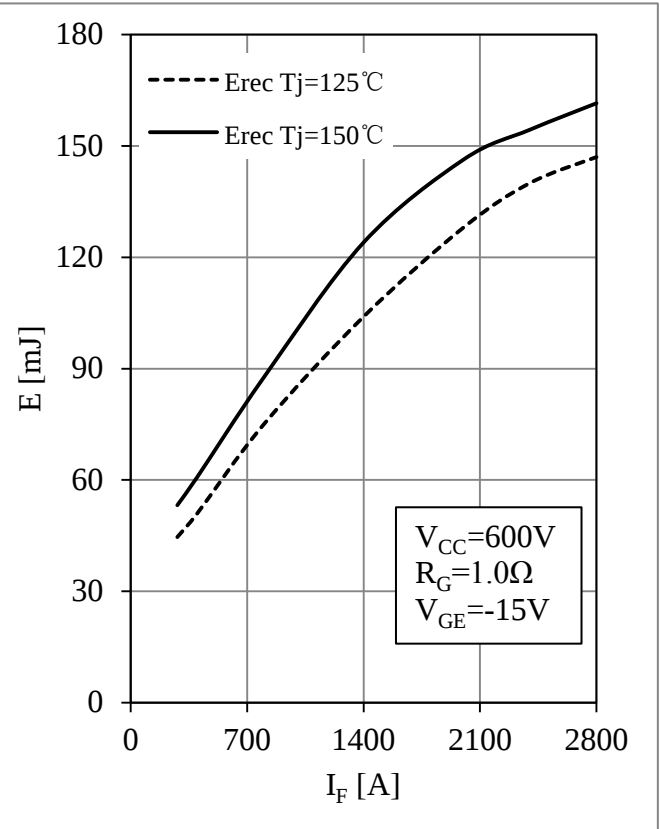


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

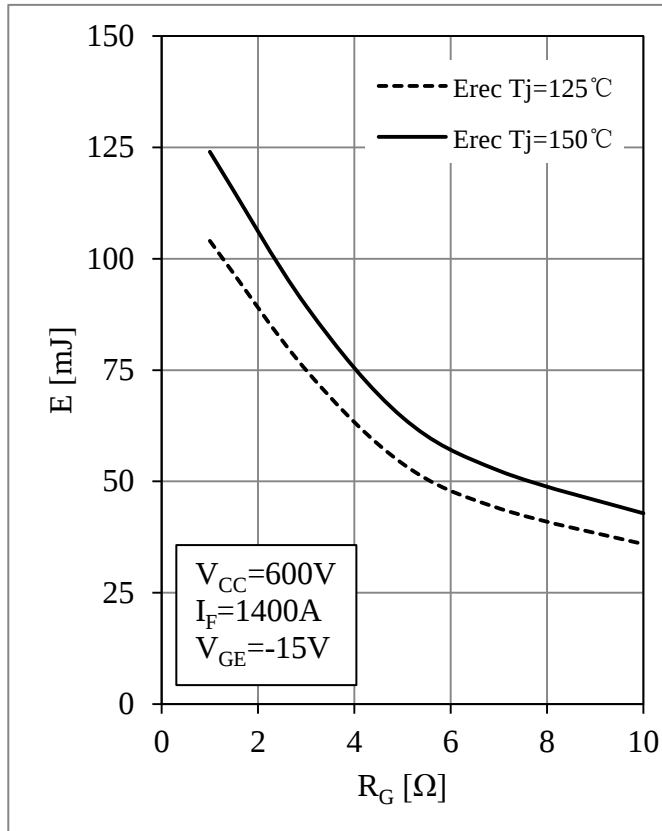
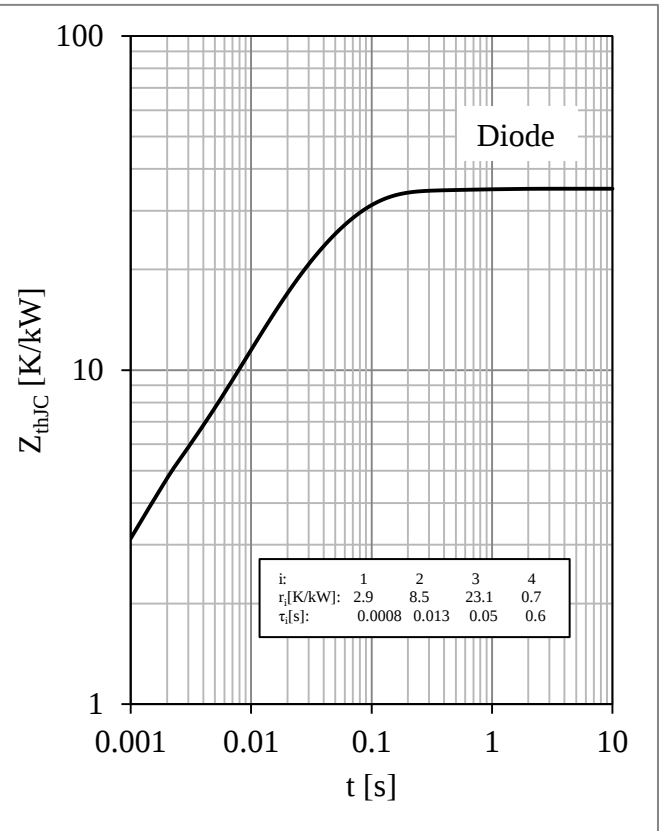
Fig 9. Diode Switching Loss vs. R_G 

Fig 10. Diode Transient Thermal Impedance

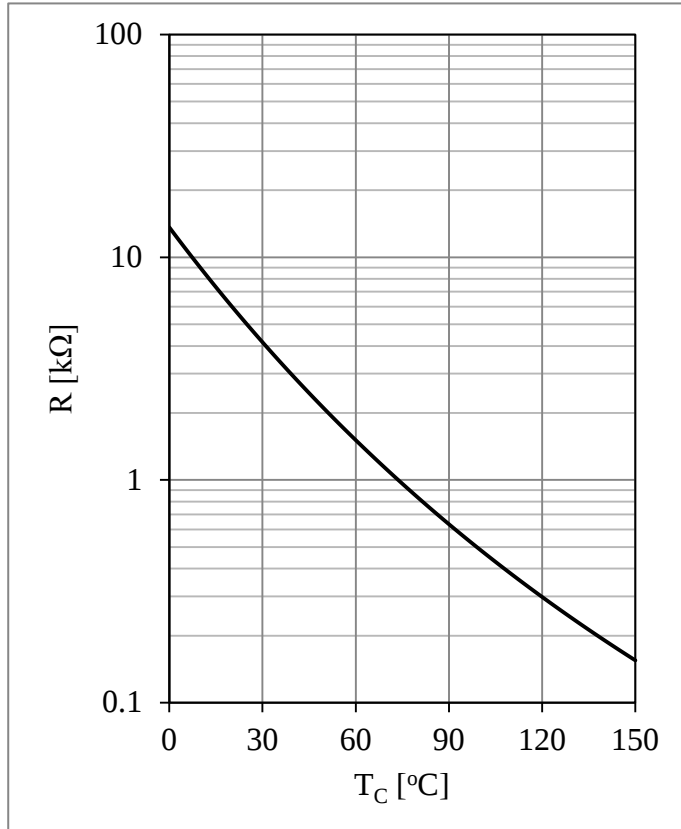
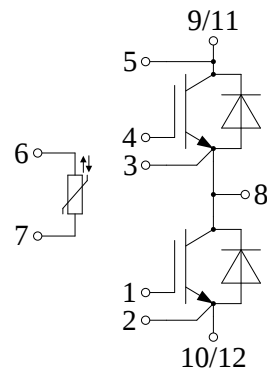


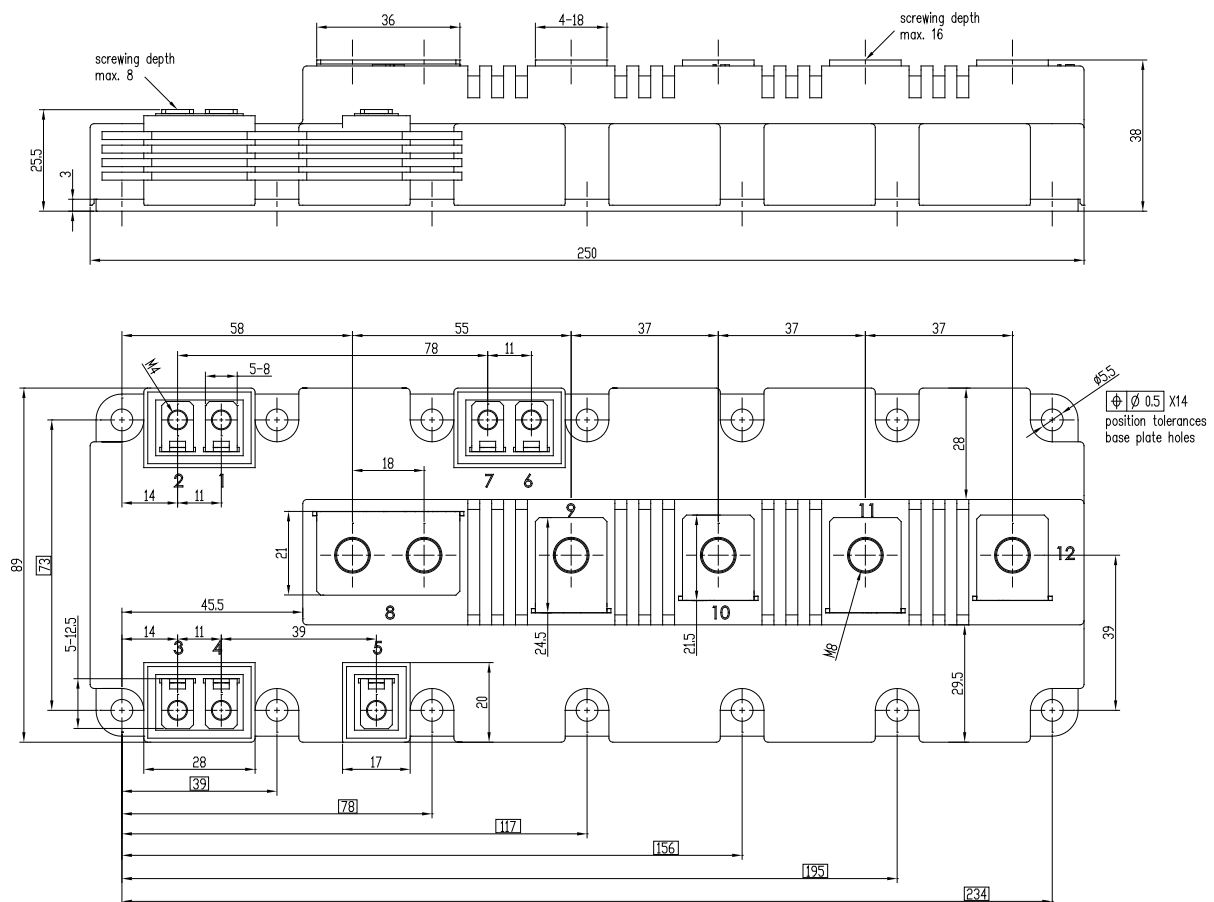
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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