

STARPOWER

SEMICONDUCTOR

IGBT

GD225HFX170C6S

1700V/225A 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 general inverters and UPS.

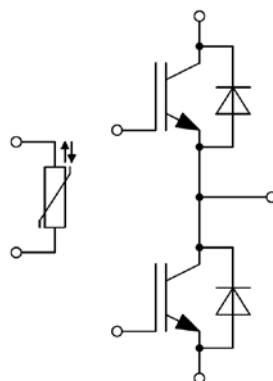
Features

- 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	1700	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	396	A
	@ $T_C=100^{\circ}\text{C}$	225	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	450	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	1530	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1700	V
I_F	Diode Continuous Forward Current	225	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	450	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	$I_C=225\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.85	2.20	V
		$I_C=225\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.25		
		$I_C=225\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.35		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=9.0\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	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			2.8		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		27.1		nF
C_{res}	Reverse Transfer Capacitance			0.66		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		2.12		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=225\text{A}, R_{Gon}=3.3\Omega, R_{Goff}=6.2\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		187		ns
t_r	Rise Time			76		ns
$t_{d(off)}$	Turn-Off Delay Time			587		ns
t_f	Fall Time			350		ns
E_{on}	Turn-On Switching Loss			56.1		mJ
E_{off}	Turn-Off Switching Loss			52.3		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=225\text{A}, R_{Gon}=3.3\Omega, R_{Goff}=6.2\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		200		ns
t_r	Rise Time			85		ns
$t_{d(off)}$	Turn-Off Delay Time			693		ns
t_f	Fall Time			662		ns
E_{on}	Turn-On Switching Loss			75.9		mJ
E_{off}	Turn-Off Switching Loss			80.9		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=225\text{A}, R_{Gon}=3.3\Omega, R_{Goff}=6.2\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		208		ns
t_r	Rise Time			90		ns
$t_{d(off)}$	Turn-Off Delay Time			704		ns
t_f	Fall Time			744		ns
E_{on}	Turn-On Switching Loss			82.8		mJ
E_{off}	Turn-Off Switching Loss			87.7		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=1000\text{V}, V_{CEM} \leq 1700\text{V}$		900		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	$I_F=225\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.80	2.25	V
		$I_F=225\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.90		
		$I_F=225\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.95		
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=225\text{A},$ $-di/dt=3565\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		63.0		μC
I_{RM}	Peak Reverse Recovery Current			352		A
E_{rec}	Reverse Recovery Energy			37.4		mJ
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=225\text{A},$ $-di/dt=3565\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		107		μC
I_{RM}	Peak Reverse Recovery Current			394		A
E_{rec}	Reverse Recovery Energy			71.0		mJ
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=225\text{A},$ $-di/dt=3565\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		121		μC
I_{RM}	Peak Reverse Recovery Current			385		A
E_{rec}	Reverse Recovery Energy			82.8		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		k Ω
$\Delta R/R$	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		20		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		1.10		m Ω
R_{thJC}	Junction-to-Case (per IGBT)			0.098	K/W
	Junction-to-Case (per Diode)			0.158	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.029		K/W
	Case-to-Heatsink (per Diode)		0.047		
	Case-to-Heatsink (per Module)		0.009		
M	Terminal Connection Torque, Screw M6	3.0		6.0	N.m
	Mounting Torque, Screw M5	3.0		6.0	
G	Weight of Module		350		g

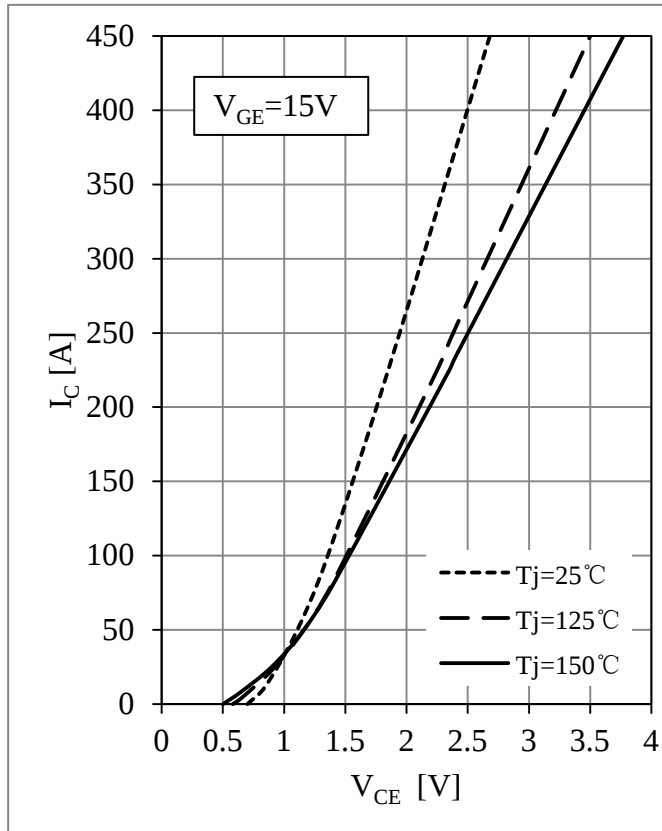


Fig 1. IGBT Output Characteristics

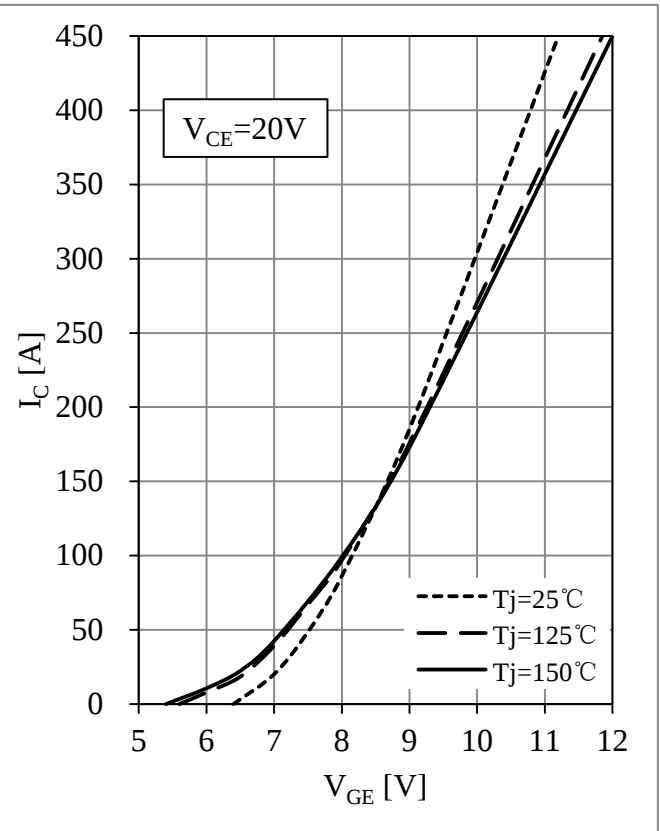
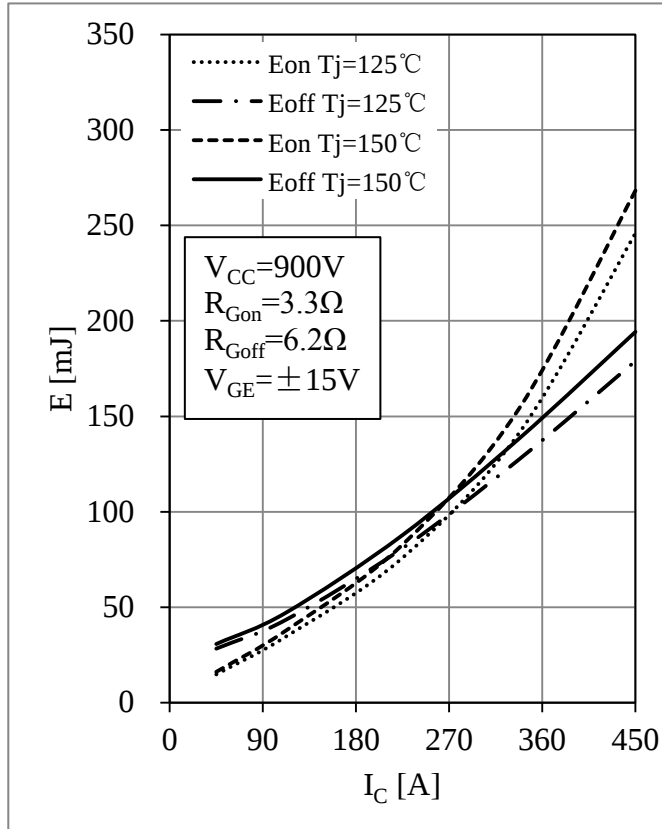
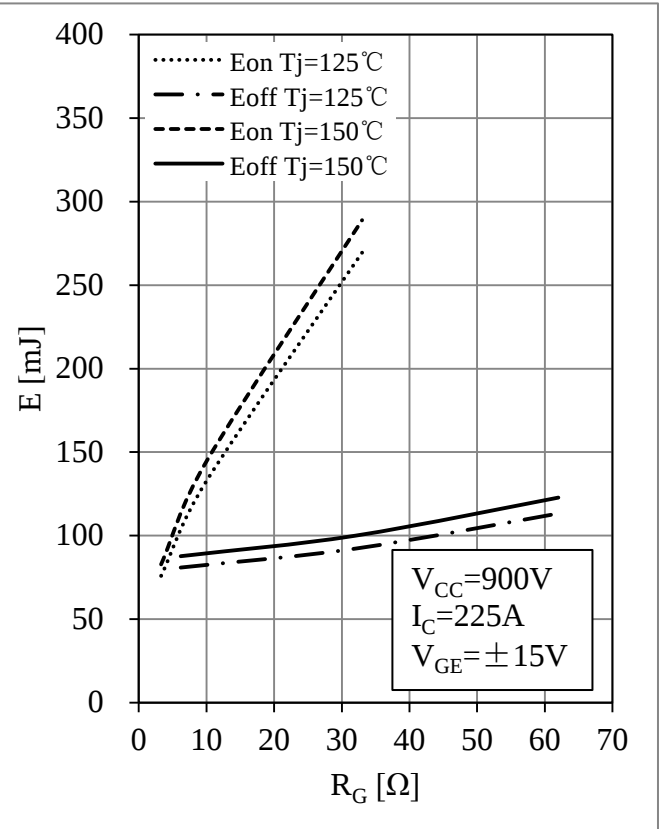


Fig 2. IGBT Transfer Characteristics

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

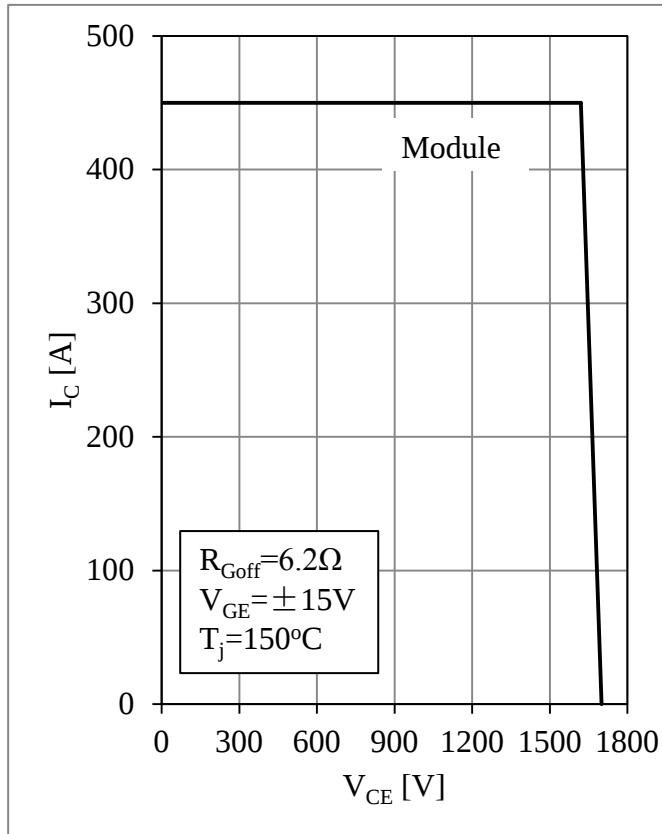


Fig 5. RBSOA

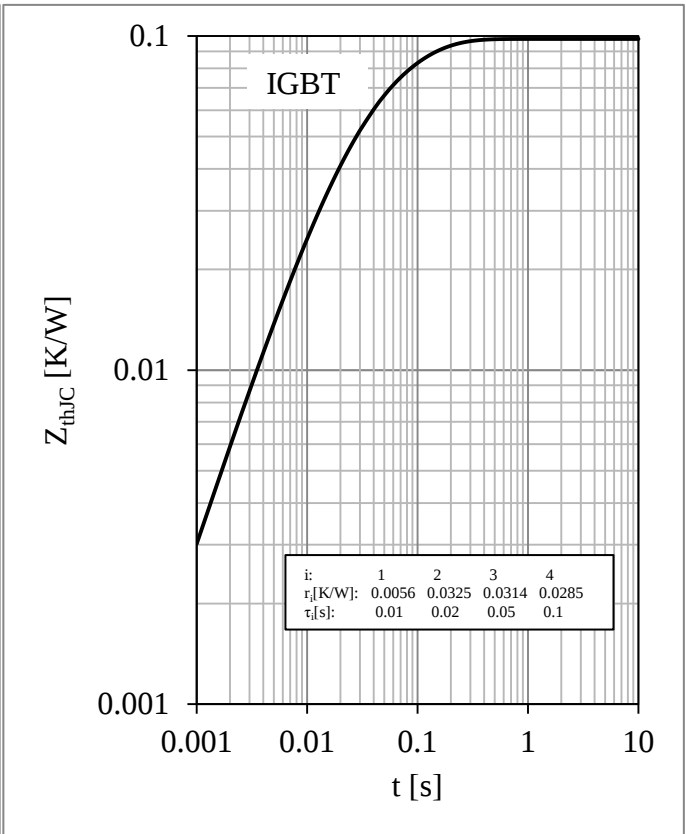


Fig 6. IGBT Transient Thermal Impedance

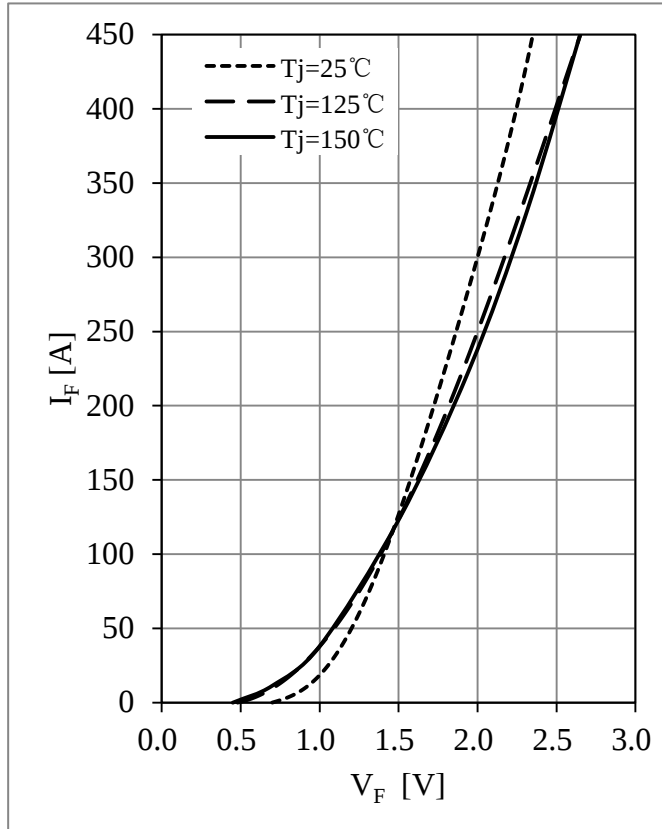
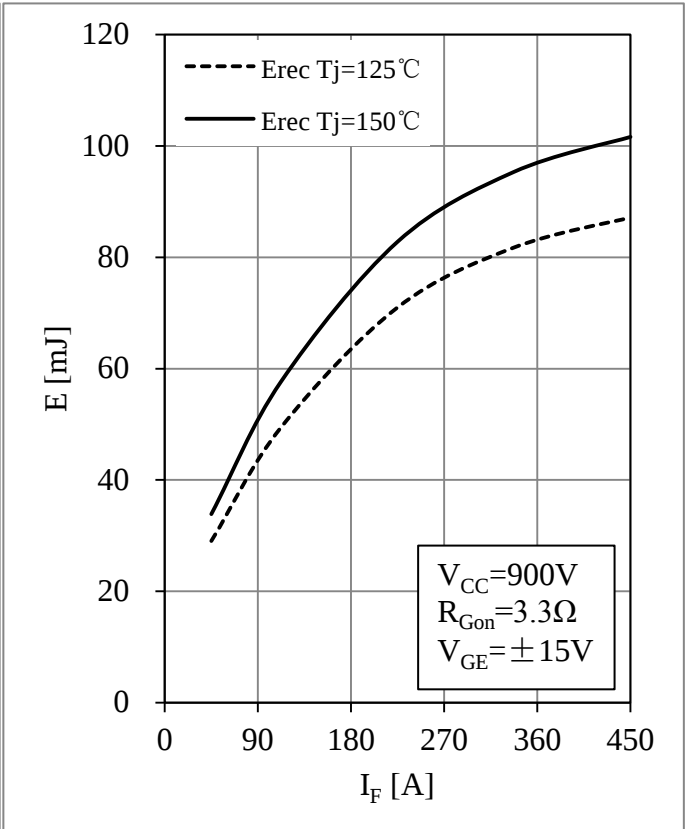


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

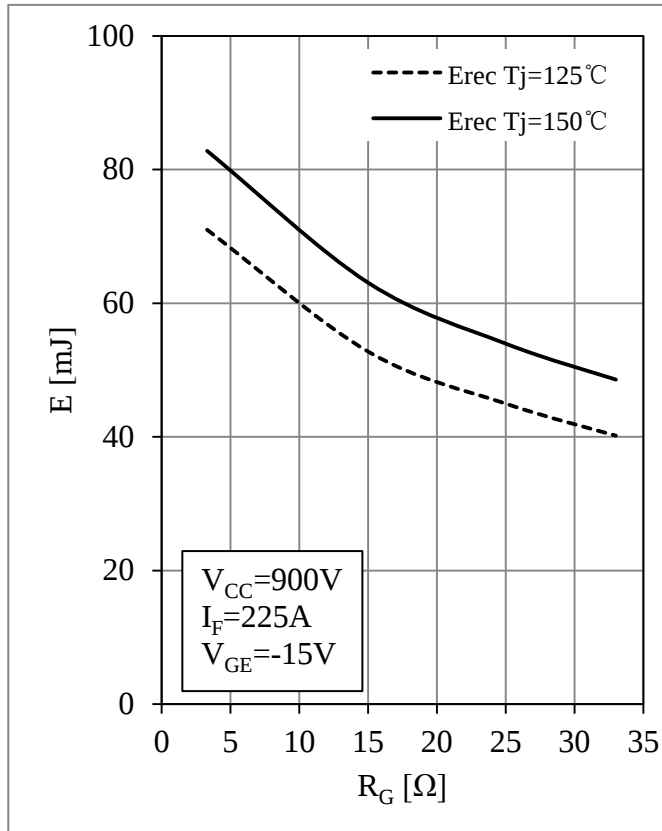
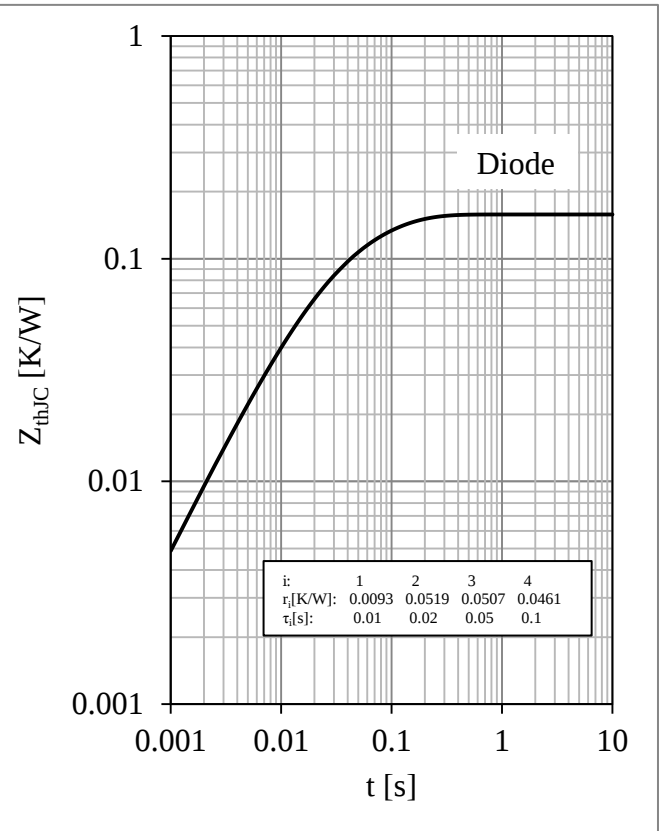
Fig 9. Diode Switching Loss vs. R_G 

Fig 10. Diode Transient Thermal Impedance

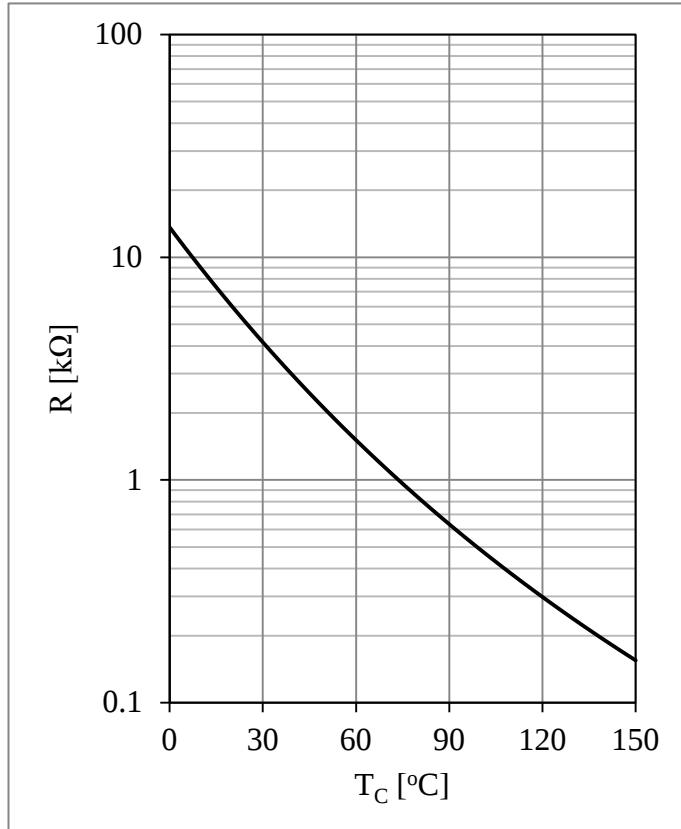
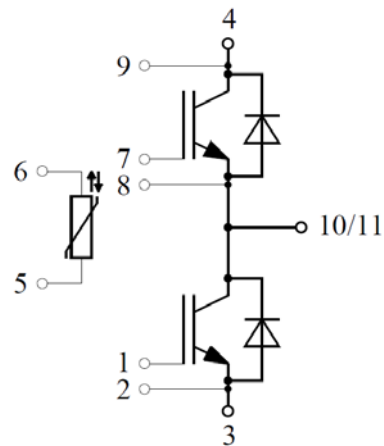


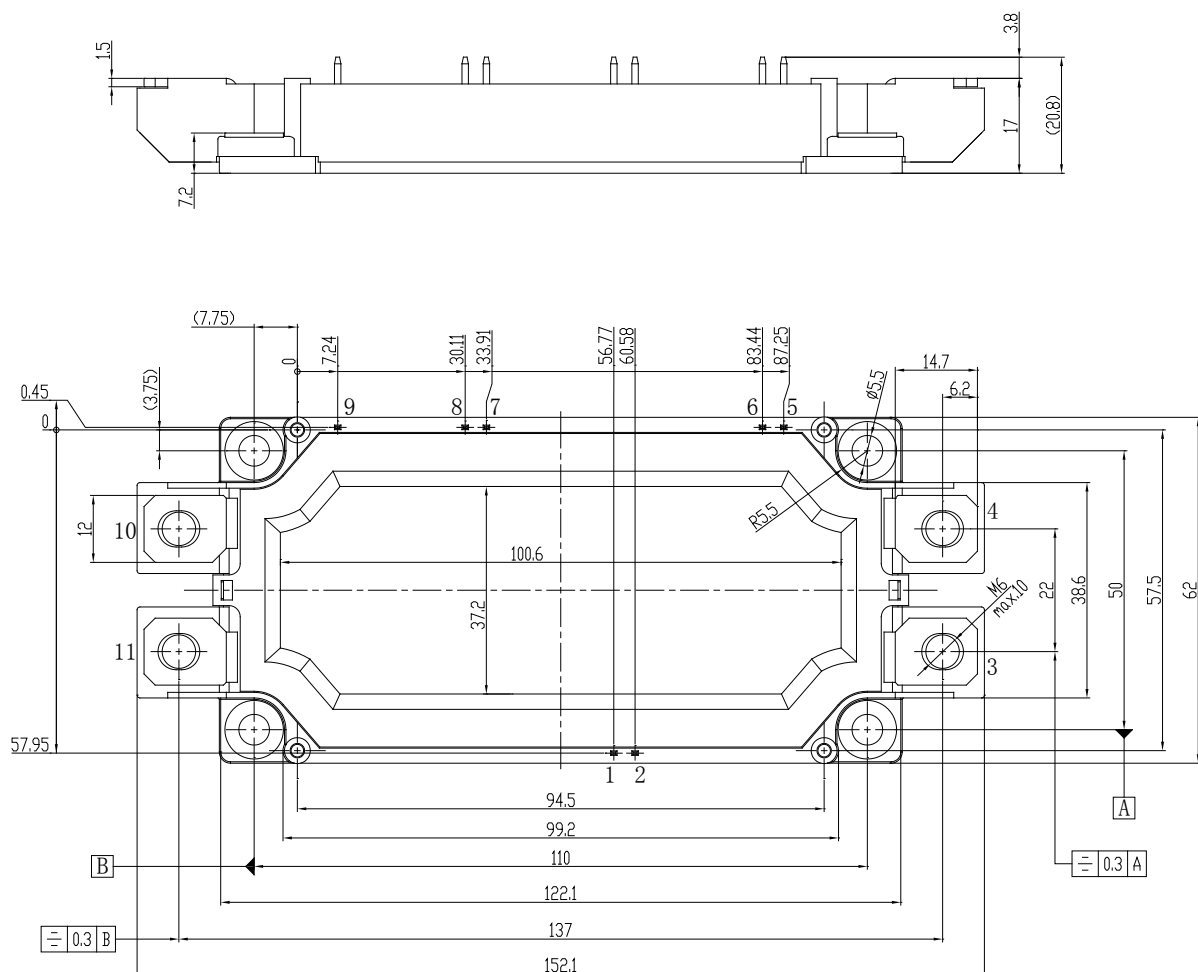
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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