

STARPOWER

SEMICONDUCTOR

IGBT

GD100PFX170C6SG

1700V/100A 4 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.

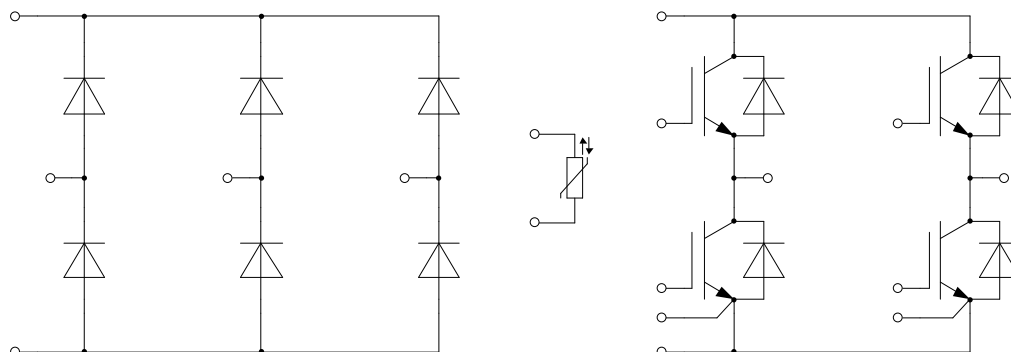
Features

- 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-inverter**

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1700	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	161	A
	@ $T_C=100^{\circ}\text{C}$	100	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	200	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	592	W

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1700	V
I_F	Diode Continuous Forward Current	100	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	200	A

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1800	V
I_O	Average Output Current 50Hz/60Hz,sine wave	100	A
I_{FSM}	Surge Forward Current $t_p=10\text{ms}$ @ $T_j=25^{\circ}\text{C}$	1600	A
	@ $T_j=150^{\circ}\text{C}$	1400	
I^2t	I^2t -value, $t_p=10\text{ms}$ @ $T_j=25^{\circ}\text{C}$	13000	A^2s
	@ $T_j=150^{\circ}\text{C}$	9800	

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature(inverter)	175	$^{\circ}\text{C}$
	Maximum Junction Temperature (rectifier)	150	
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-inverter 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	$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.85	2.20	V
		$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.25		
		$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.35		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=4.0\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	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			7.5		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		12.0		nF
C_{res}	Reverse Transfer Capacitance			0.29		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.94		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=100\text{A}, R_G=4.7\Omega, V_{GE}=\pm 15\text{V}, L_S=46\text{nH}, T_j=25^{\circ}\text{C}$		257		ns
t_r	Rise Time			47		ns
$t_{d(off)}$	Turn-Off Delay Time			377		ns
t_f	Fall Time			382		ns
E_{on}	Turn-On Switching Loss			24.6		mJ
E_{off}	Turn-Off Switching Loss			16.7		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=100\text{A}, R_G=4.7\Omega, V_{GE}=\pm 15\text{V}, L_S=46\text{nH}, T_j=125^{\circ}\text{C}$		284		ns
t_r	Rise Time			56		ns
$t_{d(off)}$	Turn-Off Delay Time			444		ns
t_f	Fall Time			555		ns
E_{on}	Turn-On Switching Loss			34.9		mJ
E_{off}	Turn-Off Switching Loss			23.1		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=100\text{A}, R_G=4.7\Omega, V_{GE}=\pm 15\text{V}, L_S=46\text{nH}, T_j=150^{\circ}\text{C}$		286		ns
t_r	Rise Time			60		ns
$t_{d(off)}$	Turn-Off Delay Time			465		ns
t_f	Fall Time			636		ns
E_{on}	Turn-On Switching Loss			38.0		mJ
E_{off}	Turn-Off Switching Loss			26.1		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=1000\text{V}, V_{CEM} \leq 1700\text{V}$		400		A

Diode-inverter Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=100\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.80	2.25	V
		$I_F=100\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.90		
		$I_F=100\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.95		
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=100\text{A},$ $-di/dt=1590\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_S=46\text{nH}, T_j=25^{\circ}\text{C}$		13.3		μC
I_{RM}	Peak Reverse Recovery Current			107		A
E_{rec}	Reverse Recovery Energy			8.79		mJ
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=100\text{A},$ $-di/dt=1300\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_S=46\text{nH}, T_j=125^{\circ}\text{C}$		25.0		μC
I_{RM}	Peak Reverse Recovery Current			111		A
E_{rec}	Reverse Recovery Energy			18.6		mJ
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=100\text{A},$ $-di/dt=1230\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_S=46\text{nH}, T_j=150^{\circ}\text{C}$		28.0		μC
I_{RM}	Peak Reverse Recovery Current			112		A
E_{rec}	Reverse Recovery Energy			20.4		mJ

Diode-rectifier Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_C=100\text{A}, T_j=150^{\circ}\text{C}$		0.85		V
I_R	Reverse Current	$T_j=150^{\circ}\text{C}, V_R=1800\text{V}$			3.0	mA

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
R_{thJC}	Junction-to-Case (per IGBT-inverter)			0.253	K/W
	Junction-to-Case (per Diode-inverter)			0.424	
	Junction-to-Case (per Diode-rectifier)			0.289	
R_{thCH}	Case-to-Heatsink (per IGBT-inverter)		0.105		K/W
	Case-to-Heatsink (per Diode-inverter)		0.176		
	Case-to-Heatsink (per Diode-rectifier)		0.120		
	Case-to-Heatsink (per Module)		0.009		
M	Mounting Torque, Screw:M5	3.0		6.0	N.m
G	Weight of Module		300		g

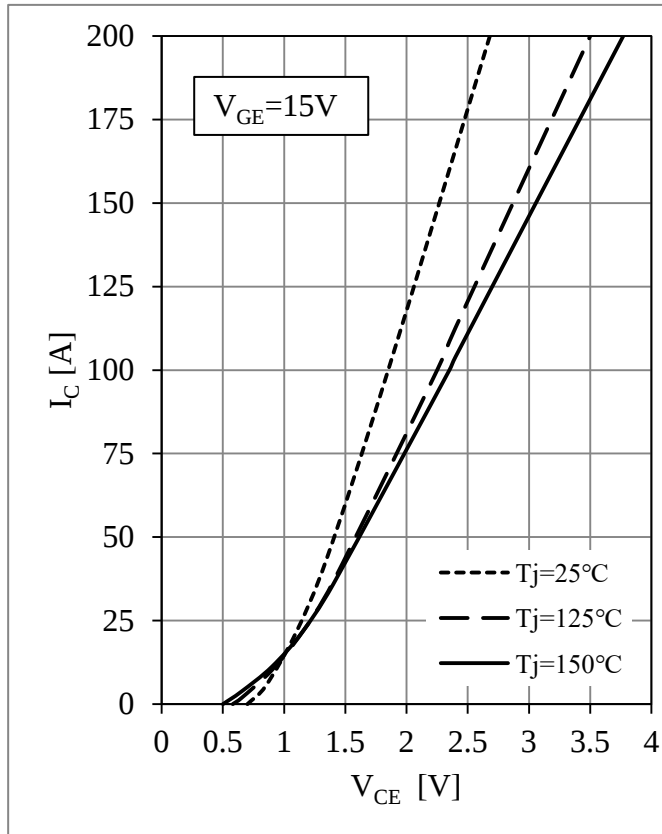


Fig 1. IGBT-inverter Output Characteristics

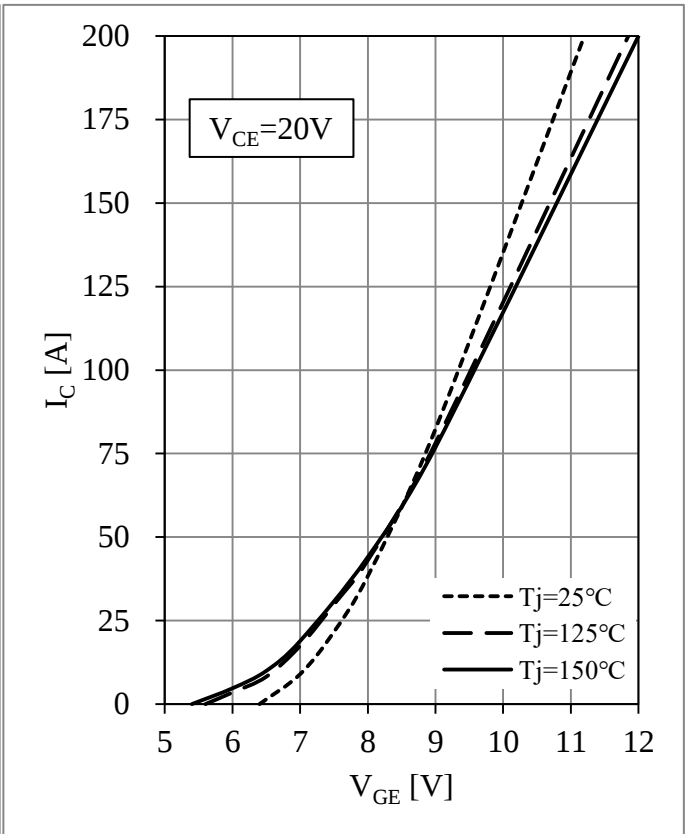
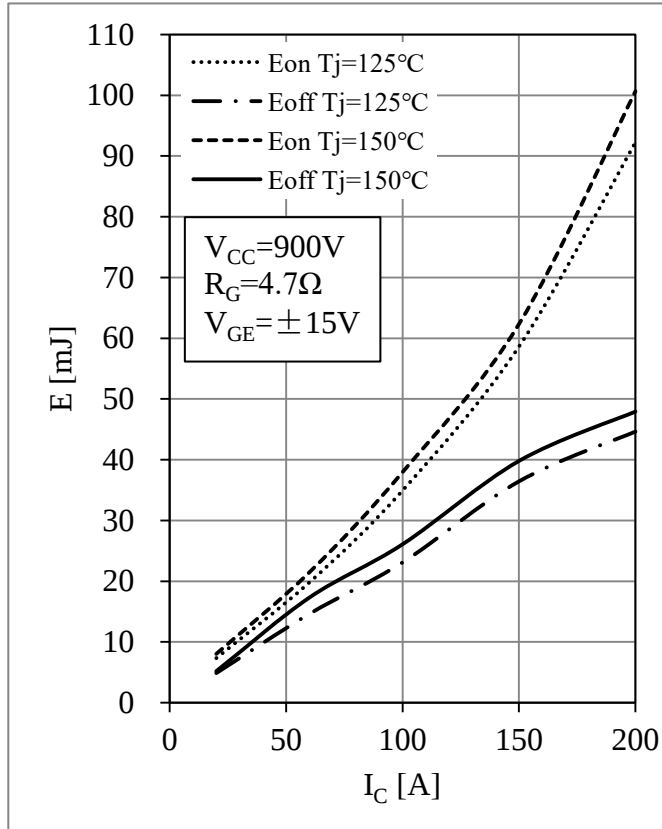
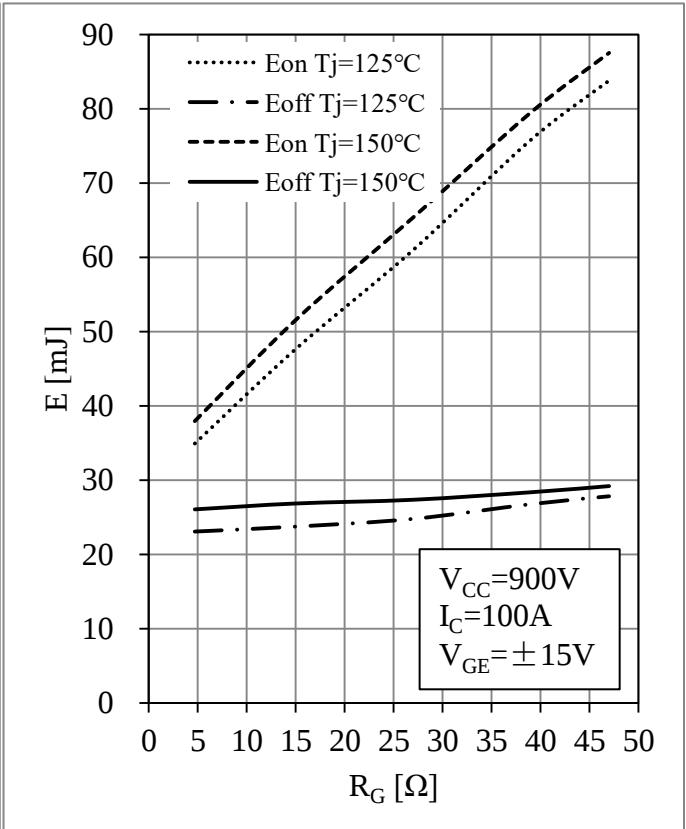


Fig 2. IGBT-inverter Transfer Characteristics

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

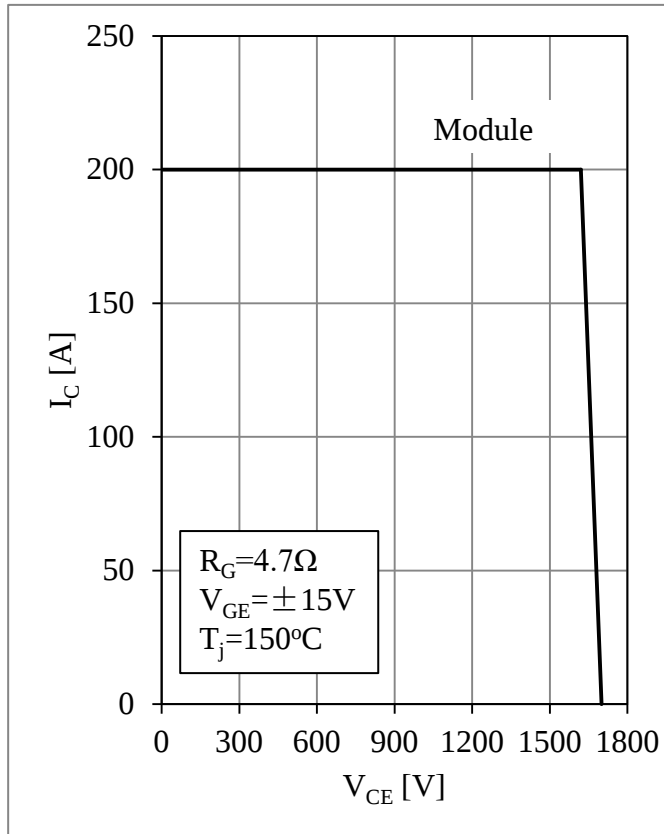


Fig 5. IGBT-inverter RBSOA

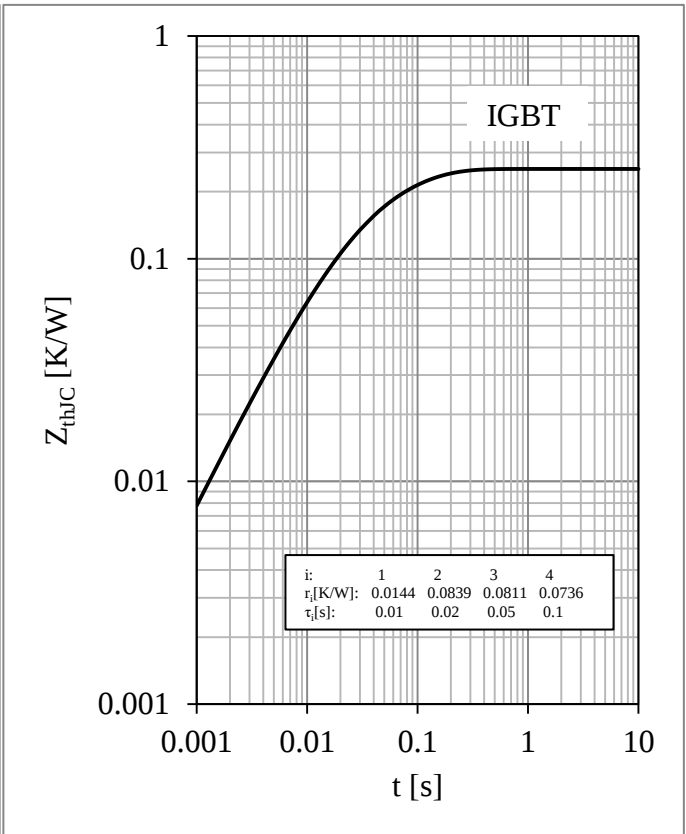


Fig 6. IGBT-inverter Transient Thermal Impedance

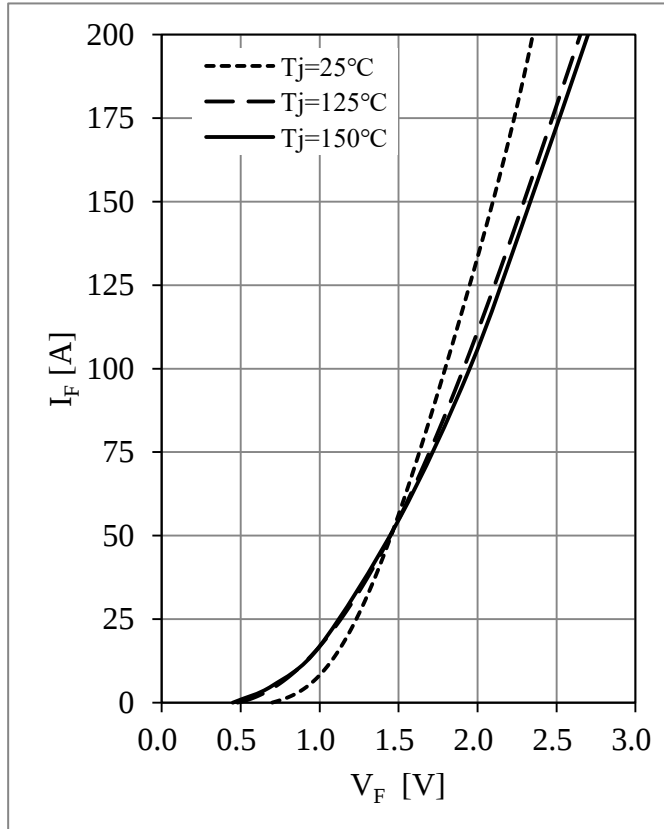
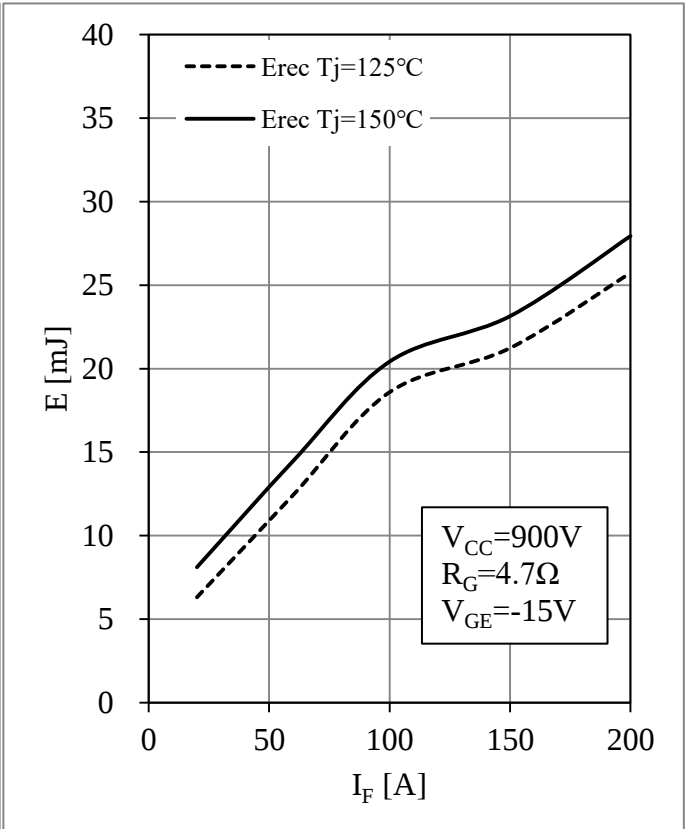
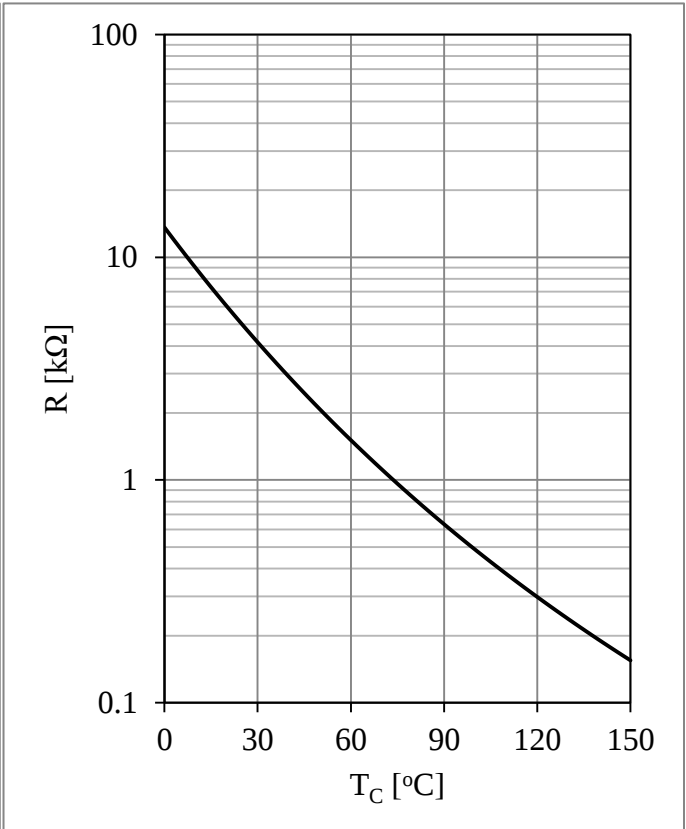
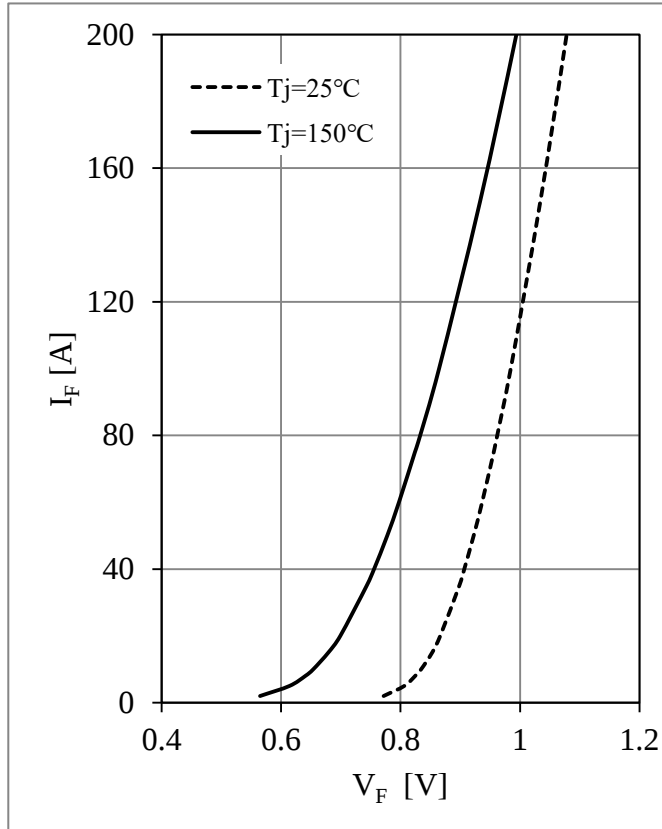
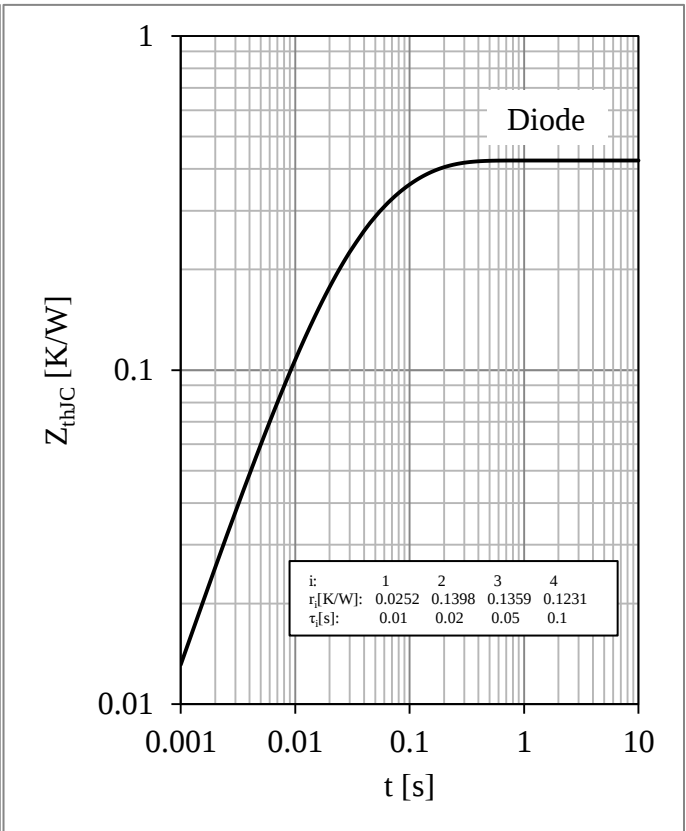
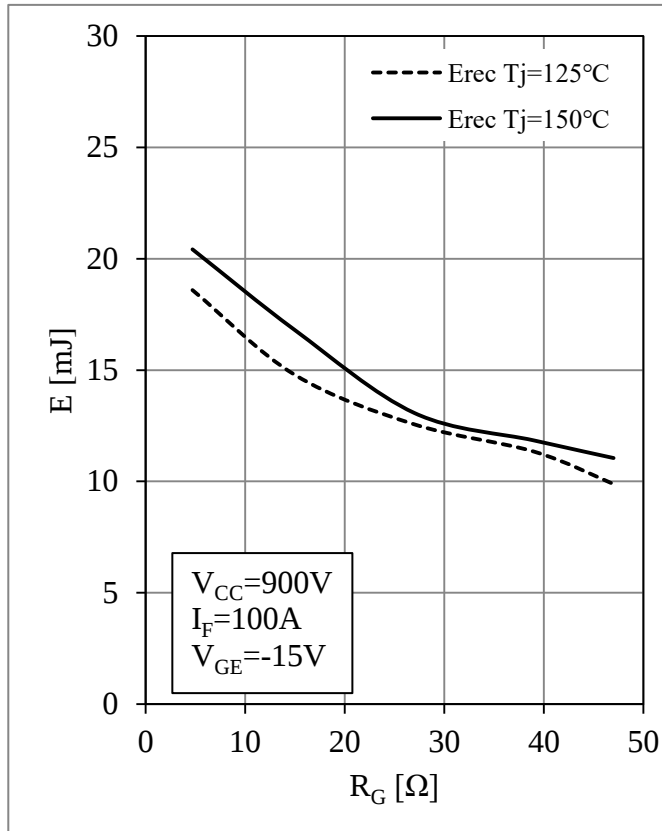
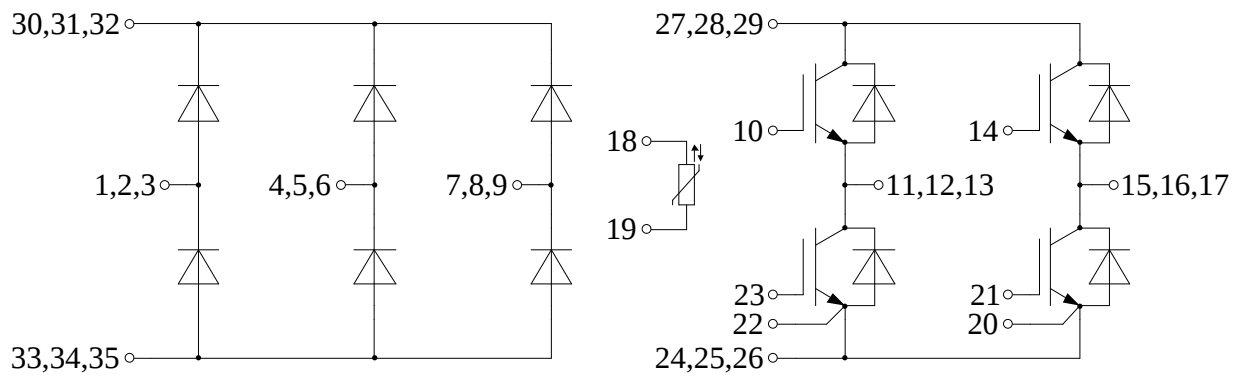


Fig 7. Diode-inverter Forward Characteristics

Fig 8. Diode-inverter Switching Loss vs. I_F

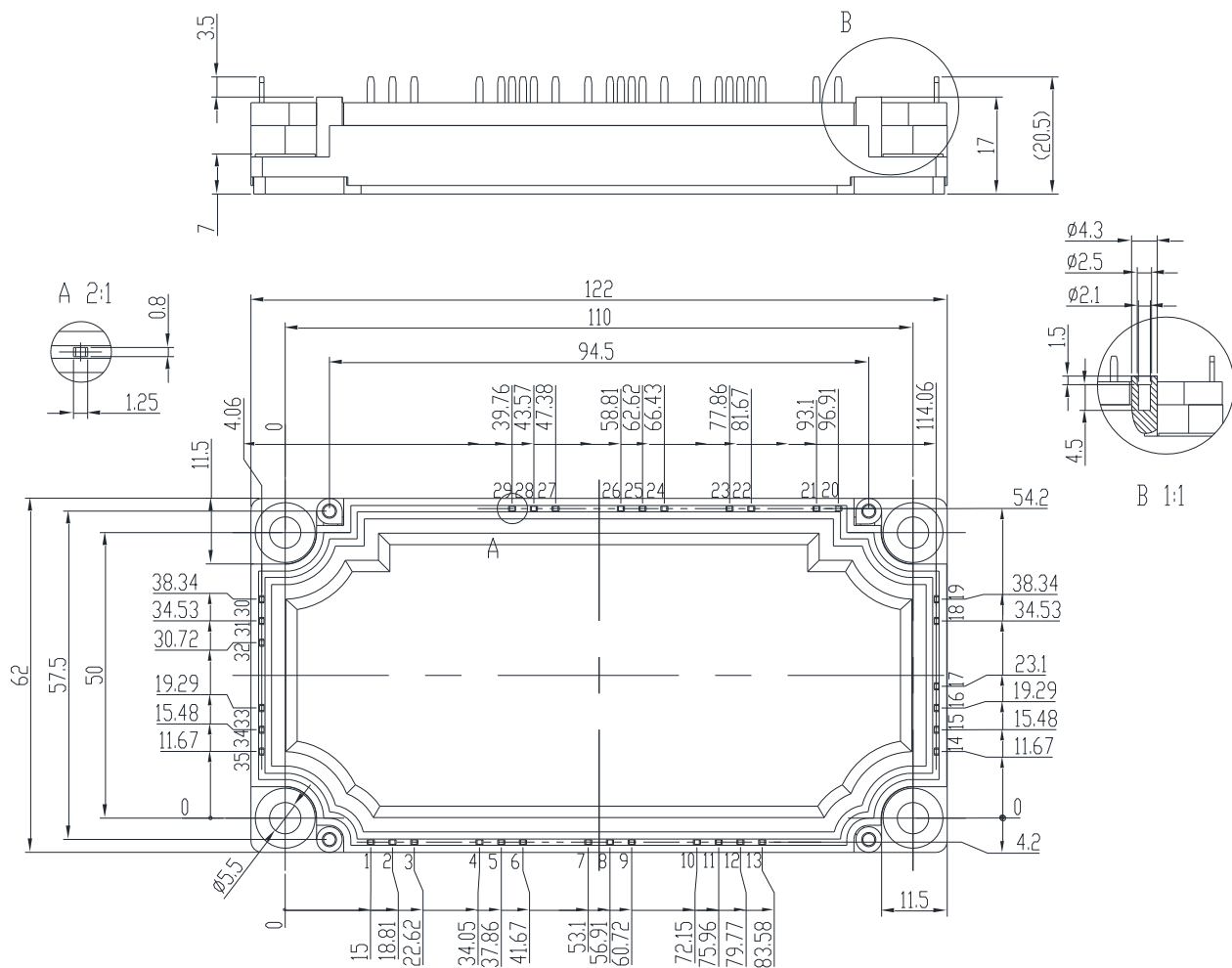


Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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