

STARPOWER

SEMICONDUCTOR

IGBT

GD35PHY120F5S

1200V/35A PIM 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.

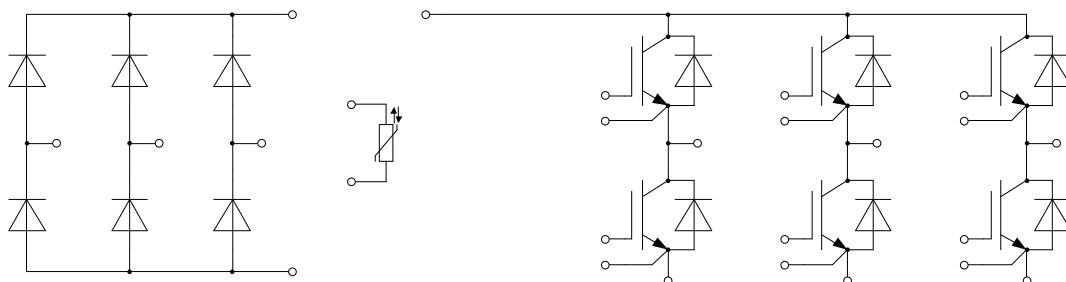
Features

- 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 heatsink 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	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	65	A
	@ $T_C=100^{\circ}\text{C}$	35	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	70	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	237	W

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	35	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	70	A

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_O	Average Output Current 50Hz/60Hz,sine wave	35	A
I_{FSM}	Surge Forward Current $t_p=10\text{ms}$ @ $T_j=25^{\circ}\text{C}$	450	A
	@ $T_j=150^{\circ}\text{C}$	370	
I^2t	I^2t -value, $t_p=10\text{ms}$ @ $T_j=25^{\circ}\text{C}$ @ $T_j=150^{\circ}\text{C}$	1000 685	A^2s

Module

Symbol	Description	Value	Unit
$T_{j\text{max}}$	Maximum Junction Temperature(inverter)	175	$^{\circ}\text{C}$
	Maximum Junction Temperature(rectifier)	150	
$T_{j\text{op}}$	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-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	$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.70	2.15	V
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.95		
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.40\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.6	6.2	6.8	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			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			0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		3.62		nF
C_{res}	Reverse Transfer Capacitance				0.10	
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.27		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		27		ns
t_r	Rise Time			14		ns
$t_{d(off)}$	Turn-Off Delay Time			247		ns
t_f	Fall Time			118		ns
E_{on}	Turn-On Switching Loss			2.03		mJ
E_{off}	Turn-Off Switching Loss			2.06		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		27		ns
t_r	Rise Time			17		ns
$t_{d(off)}$	Turn-Off Delay Time			304		ns
t_f	Fall Time			175		ns
E_{on}	Turn-On Switching Loss			3.10		mJ
E_{off}	Turn-Off Switching Loss			2.99		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$		27		ns
t_r	Rise Time			19		ns
$t_{d(off)}$	Turn-Off Delay Time			319		ns
t_f	Fall Time			206		ns
E_{on}	Turn-On Switching Loss			3.37		mJ
E_{off}	Turn-Off Switching Loss			3.30		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		140		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	$I_F=35\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.85	2.30	V
		$I_F=35\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.90		
		$I_F=35\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.95		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=2500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		4.5		μC
I_{RM}	Peak Reverse Recovery Current			93		A
E_{rec}	Reverse Recovery Energy			1.47		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=2500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		7.8		μC
I_{RM}	Peak Reverse Recovery Current			98		A
E_{rec}	Reverse Recovery Energy			2.65		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=2500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		8.6		μC
I_{RM}	Peak Reverse Recovery Current			101		A
E_{rec}	Reverse Recovery Energy			2.89		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	$I_F=35\text{A}, T_j=150^\circ\text{C}$		0.90		V
I_R	Reverse Current	$T_j=150^\circ\text{C}, V_R=1600\text{V}$			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			22		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_C=100^\circ\text{C}, R_{100}=1486.1\Omega$	-5		5	%
P_{25}	Power Dissipation				200	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		4000		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)		0.575	0.633	K/W
	Junction-to-Case (per Diode-inverter)		0.865	0.951	
	Junction-to-Case (per Diode-rectifier)		1.005	1.106	
R_{thCH}	Case-to-Heatsink (per IGBT-inverter)		0.403		K/W
	Case-to-Heatsink (per Diode-inverter)		0.605		
	Case-to-Heatsink (per Diode-rectifier)		0.704		
	Case-to-Heatsink (per Module)		0.030		
M	Mounting Torque, Screw M4	2.0		2.2	N.m
G	Weight of Module		42		g

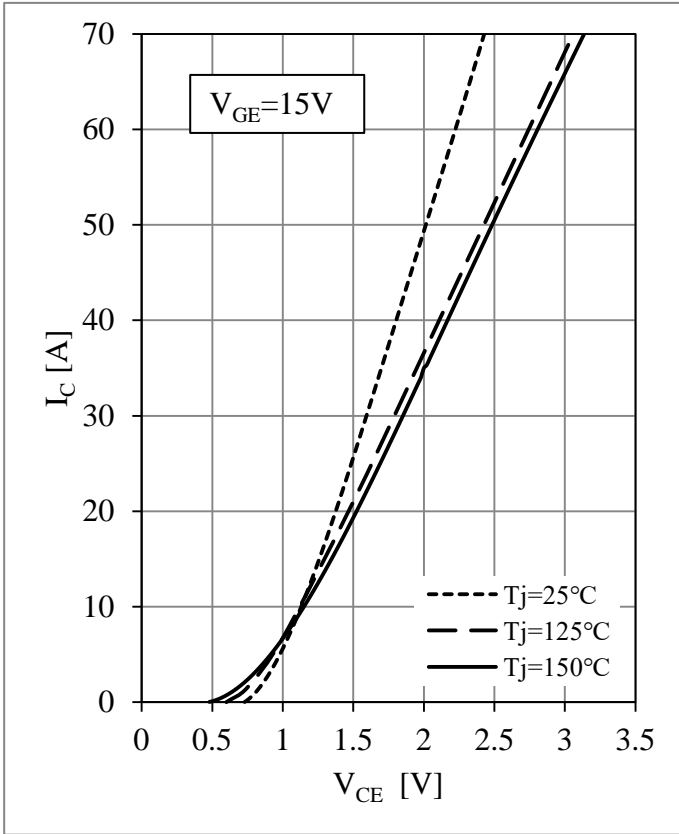


Fig 1. IGBT-inverter Output Characteristics

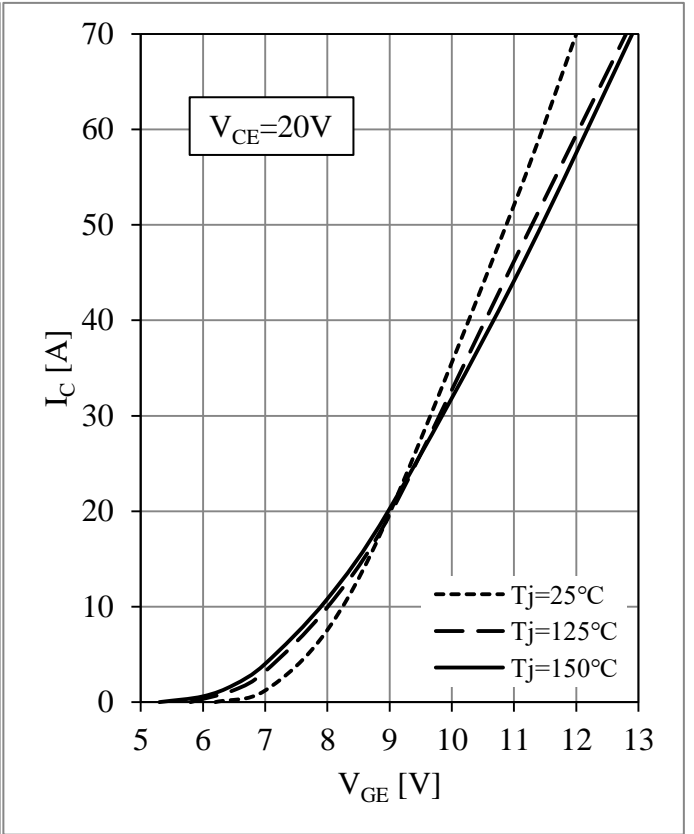


Fig 2. IGBT-inverter Transfer Characteristics

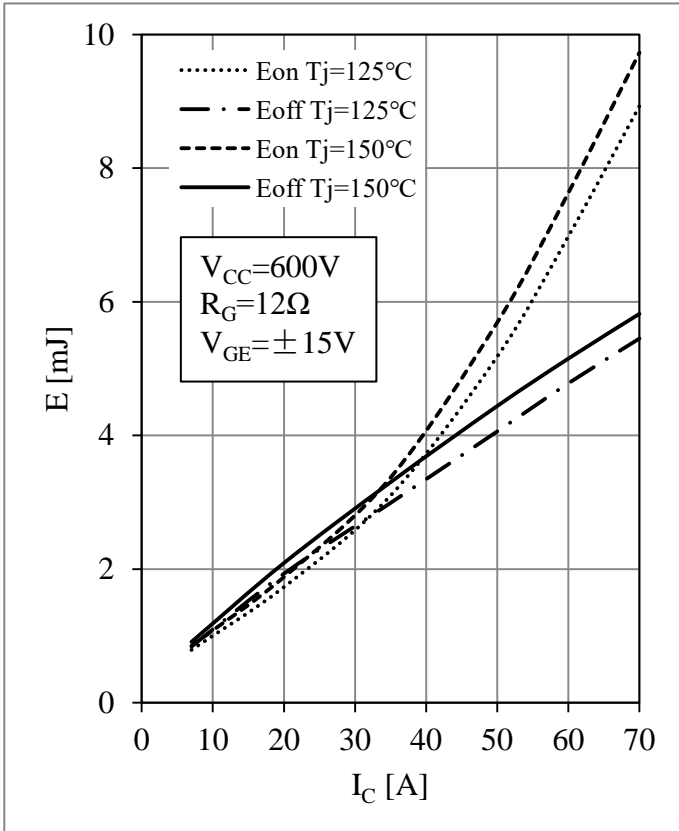


Fig 3. IGBT-inverter Switching Loss vs. I_C

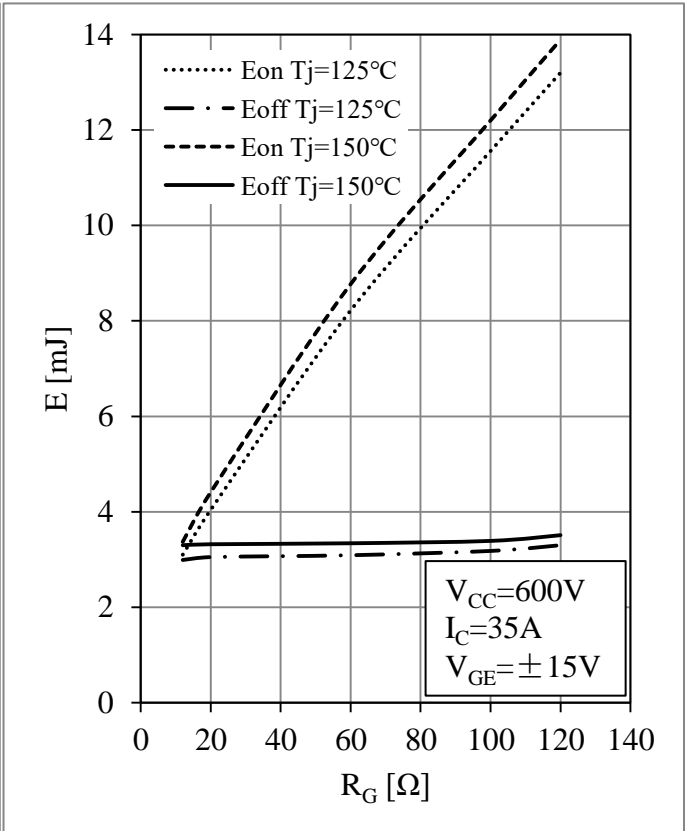


Fig 4. IGBT-inverter Switching Loss vs. R_G

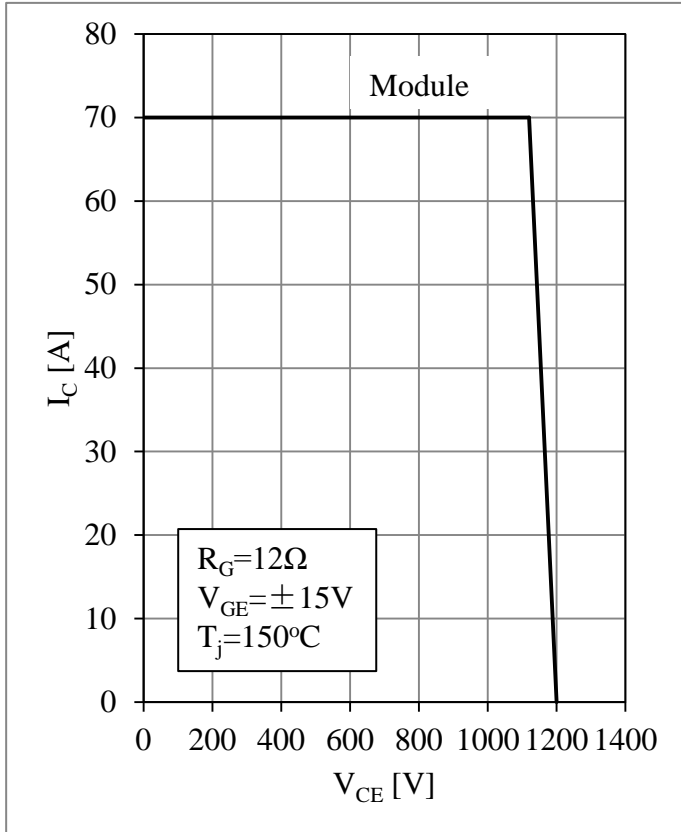


Fig 5. IGBT-inverter RBSOA

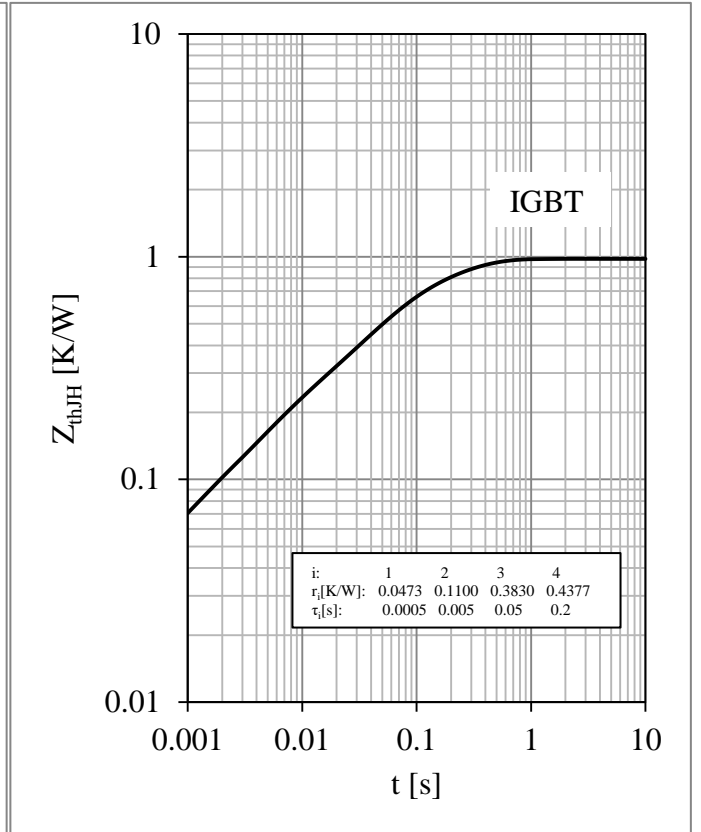


Fig 6. IGBT-inverter Transient Thermal Impedance

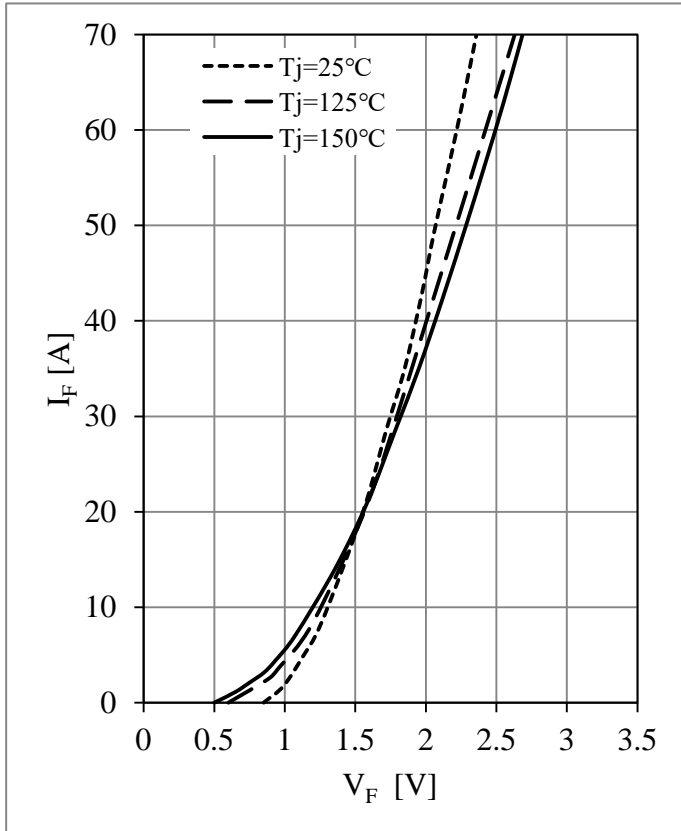


Fig 7. Diode-inverter Forward Characteristics

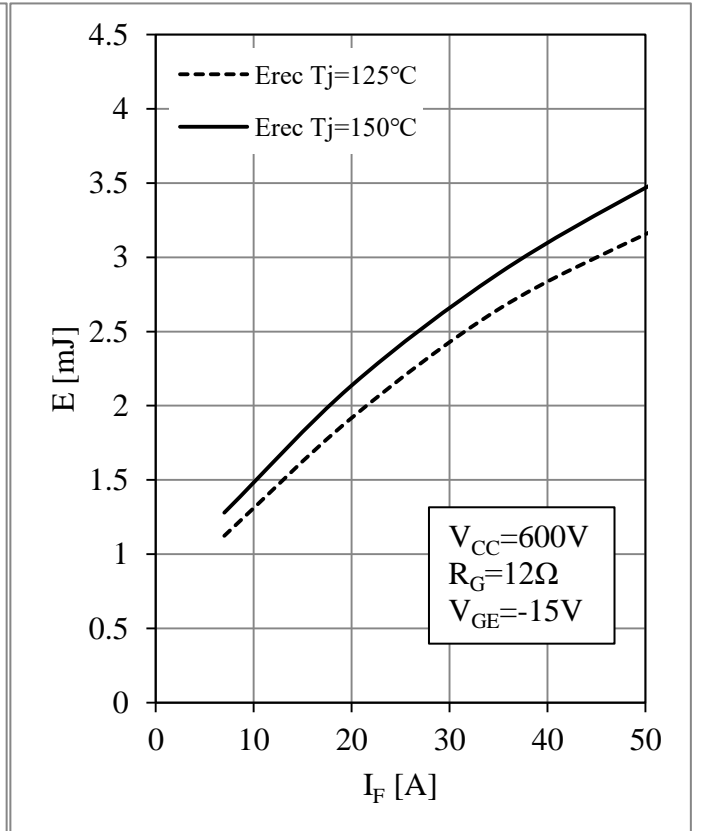


Fig 8. Diode-inverter Switching Loss vs. I_F

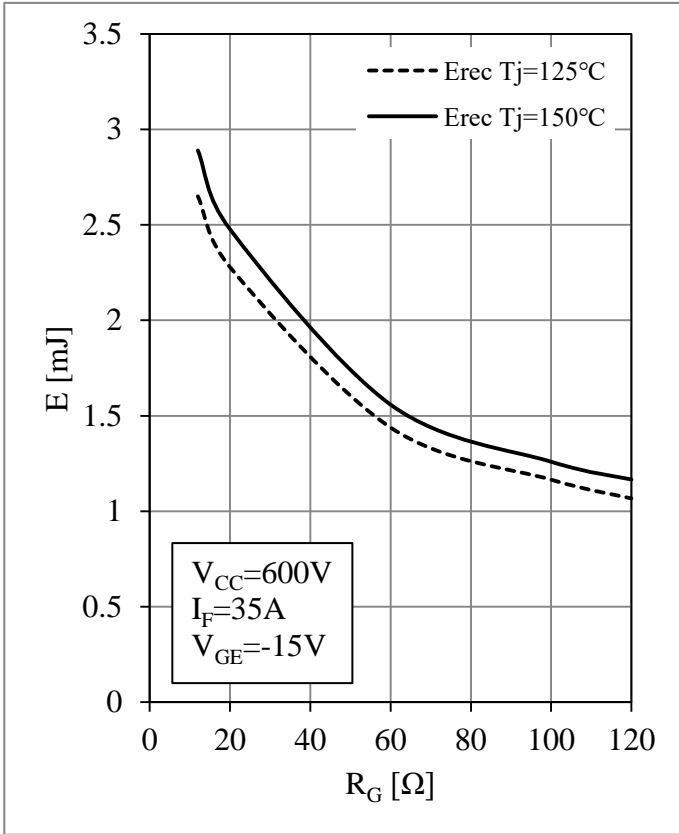


Fig 9. Diode-inverter Switching Loss vs. R_G

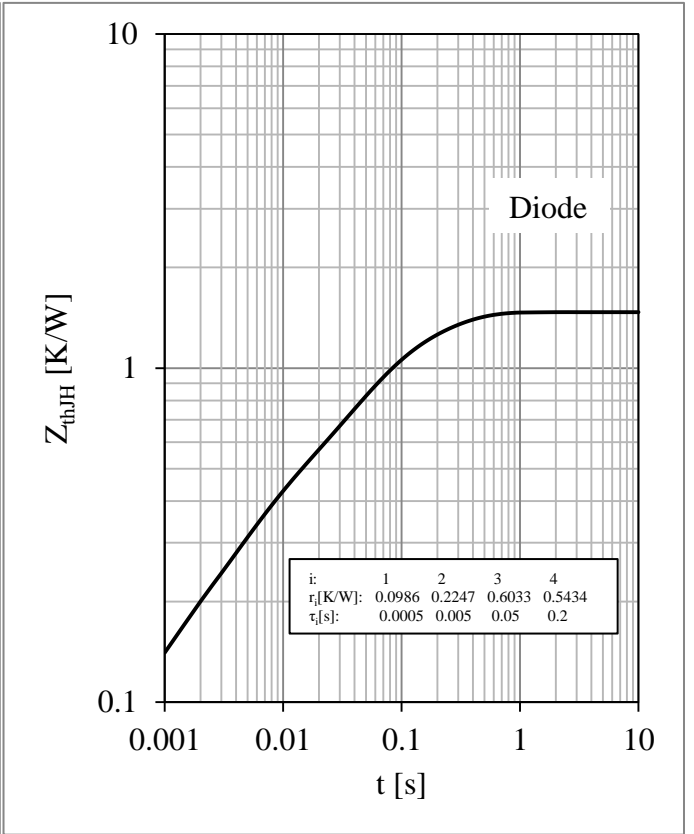


Fig 10. Diode-inverter Transient Thermal Impedance

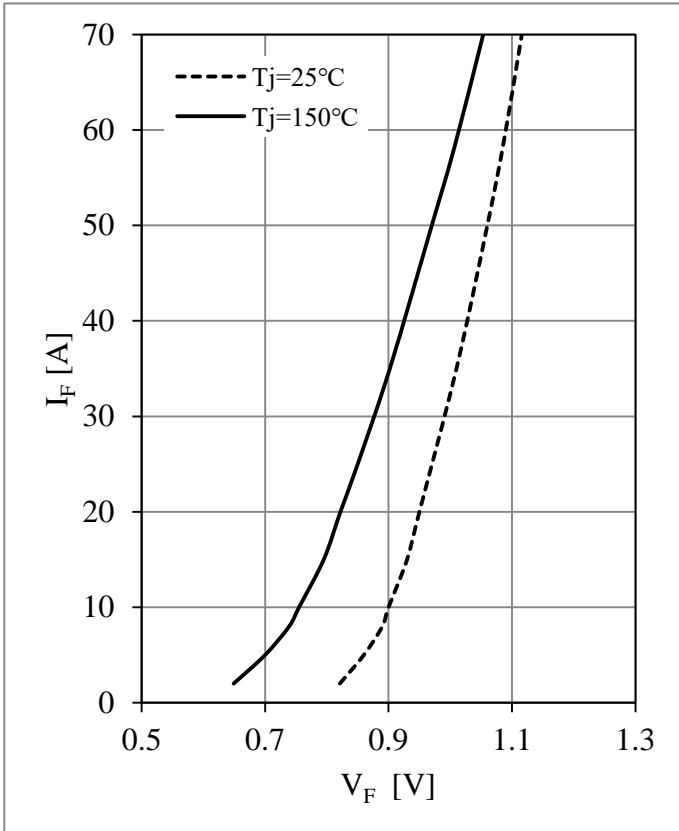


Fig 11. Diode-rectifier Forward Characteristics

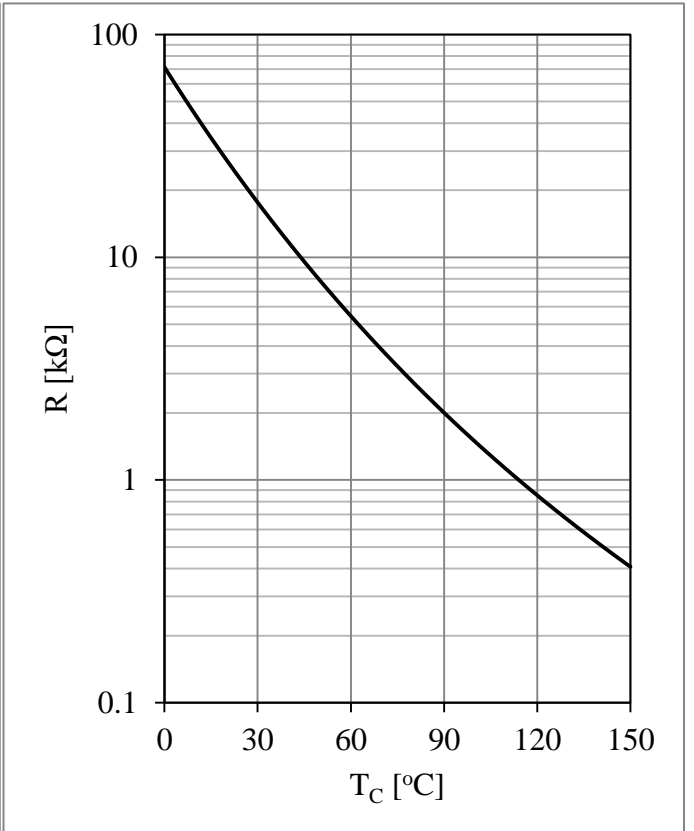
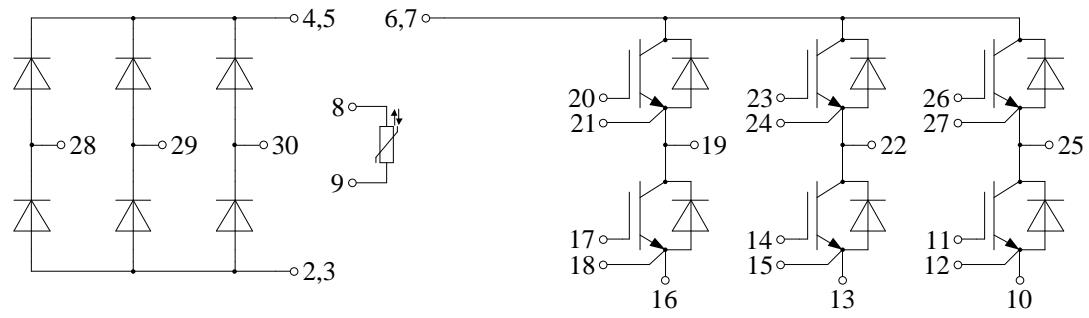


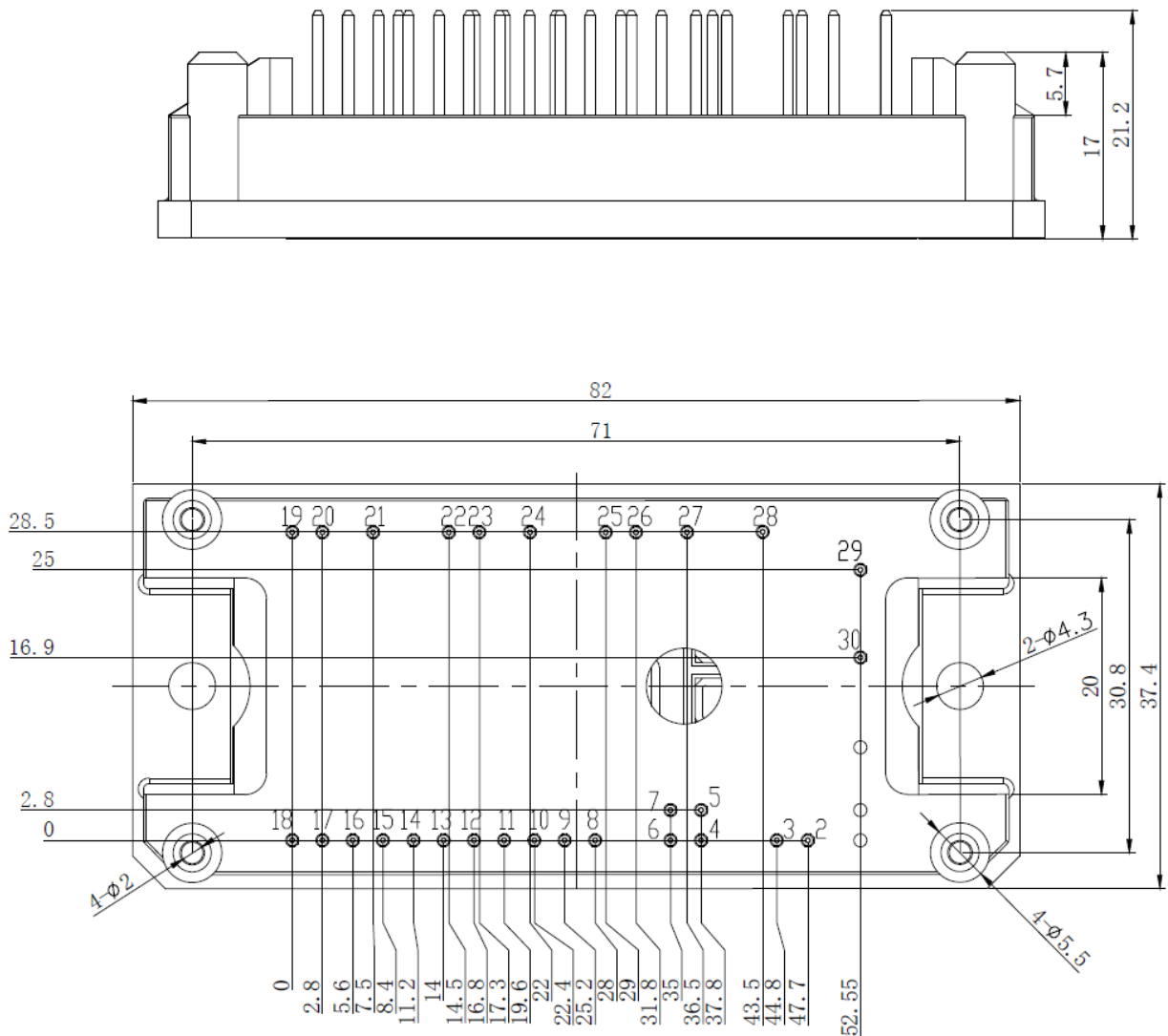
Fig 12. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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