

STARPOWER

SEMICONDUCTOR

IGBT

GD10FSX65L4SN

650V/10A 6 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.

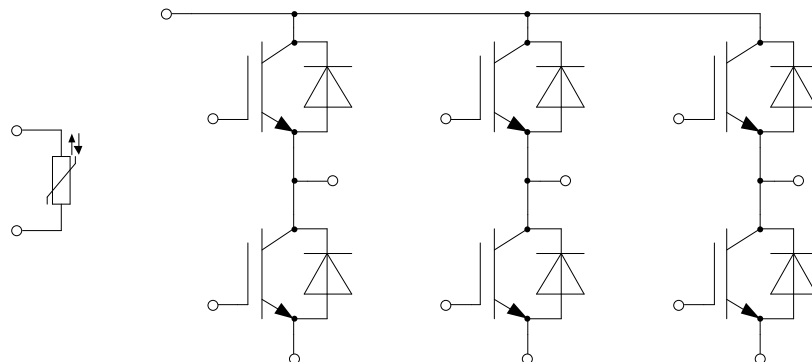
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- Low switching loss
- 6 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- 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	650	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	20	A
	@ $T_C=100^{\circ}\text{C}$	10	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	20	A
P_D	Maximum Power Dissipation @ $T_{vj}=175^{\circ}\text{C}$	87	W

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	10	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	20	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{vjop}	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	$I_C=10\text{A}, V_{GE}=15\text{V}, T_{vj}=25^\circ\text{C}$		1.45	1.90	V	
		$I_C=10\text{A}, V_{GE}=15\text{V}, T_{vj}=125^\circ\text{C}$		1.60			
		$I_C=10\text{A}, V_{GE}=15\text{V}, T_{vj}=150^\circ\text{C}$		1.70			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.16\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^\circ\text{C}$	5.1	5.8	6.5	V	
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^\circ\text{C}$			1.0	mA	
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^\circ\text{C}$			400	nA	
R_{Gint}	Internal Gate Resistance			0		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		1.16		nF	
C_{res}	Reverse Transfer Capacitance				0.02		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.07		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=10\text{A}, R_G=27\Omega, V_{GE}=\pm 15\text{V}, L_S=48\text{nH}, T_{vj}=25^\circ\text{C}$		16		ns	
t_r	Rise Time			13		ns	
$t_{d(off)}$	Turn-Off Delay Time			68		ns	
t_f	Fall Time			139		ns	
E_{on}	Turn-On Switching Loss			0.16		mJ	
E_{off}	Turn-Off Switching Loss			0.16		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=300\text{V}, I_C=10\text{A}, R_G=27\Omega, V_{GE}=\pm 15\text{V}, L_S=48\text{nH}, T_{vj}=125^\circ\text{C}$		14		ns
t_r	Rise Time				15		ns
$t_{d(off)}$	Turn-Off Delay Time			76		ns	
t_f	Fall Time			150		ns	
E_{on}	Turn-On Switching Loss			0.20		mJ	
E_{off}	Turn-Off Switching Loss			0.21		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=10\text{A}, R_G=27\Omega, V_{GE}=\pm 15\text{V}, L_S=48\text{nH}, T_{vj}=150^\circ\text{C}$			14		ns
t_r	Rise Time				15		ns
$t_{d(off)}$	Turn-Off Delay Time			78		ns	
t_f	Fall Time			156		ns	
E_{on}	Turn-On Switching Loss			0.21		mJ	
E_{off}	Turn-Off Switching Loss			0.22		mJ	
I_{SC}	SC Data		$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^\circ\text{C}, V_{CC}=300\text{V}, V_{CEM} \leq 650\text{V}$		60		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_C=10\text{A}, V_{GE}=0\text{V}, T_{vj}=25^\circ\text{C}$		1.60	2.05	V
		$I_C=10\text{A}, V_{GE}=0\text{V}, T_{vj}=125^\circ\text{C}$		1.65		
		$I_C=10\text{A}, V_{GE}=0\text{V}, T_{vj}=150^\circ\text{C}$		1.65		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=10\text{A},$ $-di/dt=825\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_S=48\text{nH}, T_{vj}=25^\circ\text{C}$		0.31		μC
I_{RM}	Peak Reverse Recovery Current			9		A
E_{rec}	Reverse Recovery Energy			0.05		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=10\text{A},$ $-di/dt=694\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_S=48\text{nH}, T_{vj}=125^\circ\text{C}$		0.55		μC
I_{RM}	Peak Reverse Recovery Current			9		A
E_{rec}	Reverse Recovery Energy			0.10		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=10\text{A},$ $-di/dt=682\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_S=48\text{nH}, T_{vj}=150^\circ\text{C}$		0.59		μC
I_{RM}	Peak Reverse Recovery Current			9		A
E_{rec}	Reverse Recovery Energy			0.11		mJ

NTC Characteristics $T_f=25^\circ\text{C}$ 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}	$T_{vj}=100^\circ\text{C}, R_{100}=493.3\Omega$	-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		25		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		9.50		m Ω
R_{thJC}	Junction-to-Case (per IGBT-inverter)		1.555	1.710	K/W
	Junction-to-Case (per Diode-inverter)		2.294	2.523	
R_{thCH}	Case-to-Heatsink (per IGBT-inverter)		0.775		K/W
	Case-to-Heatsink (per Diode-inverter)		1.144		
	Case-to-Heatsink (per Module)		0.077		
F	Mounting Force Per Clamp	30		50	N
G	Weight of Module		10		g

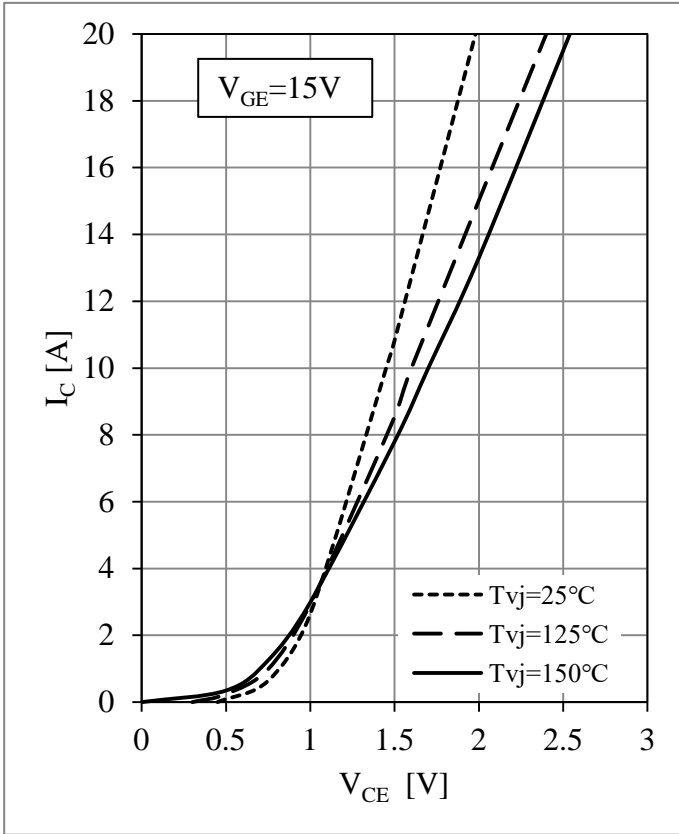


Fig 1. IGBT-inverter Output Characteristics

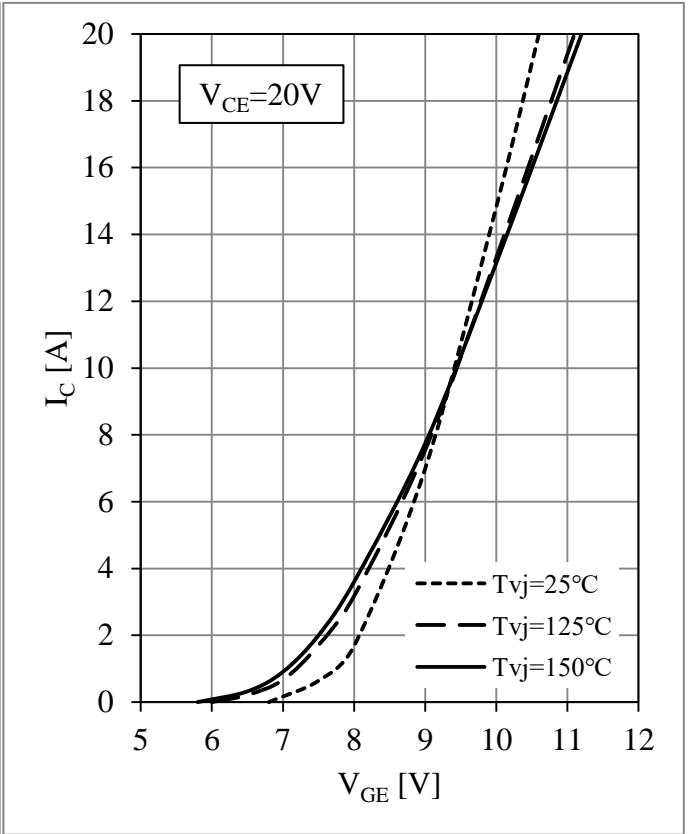


Fig 2. IGBT-inverter Transfer Characteristics

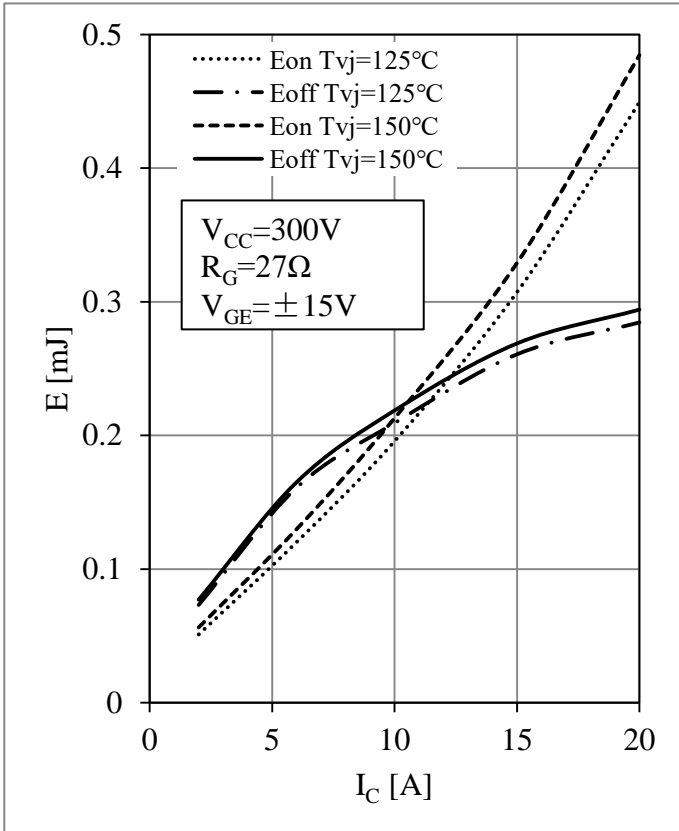


Fig 3. IGBT-inverter Switching Loss vs. I_C

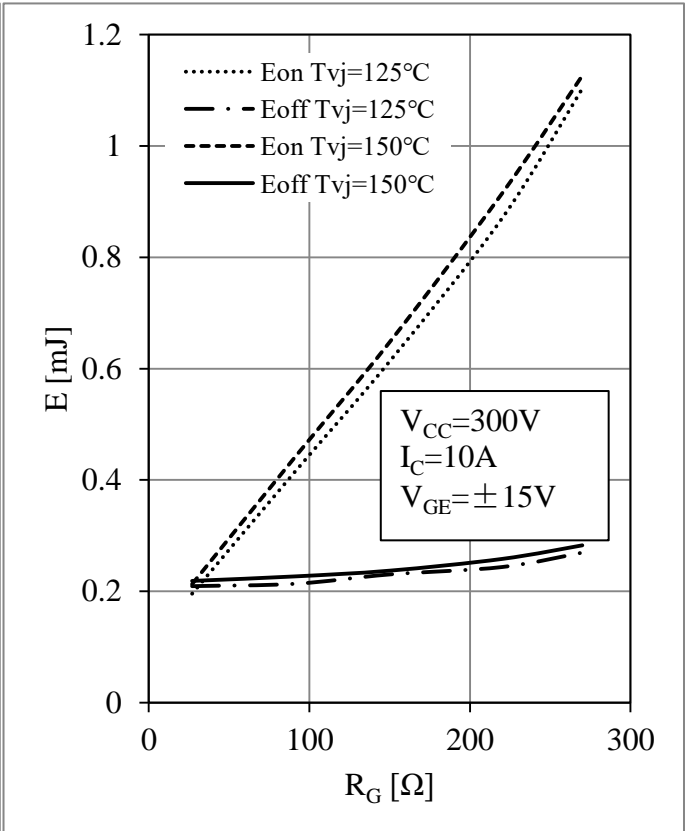


Fig 4. IGBT-inverter Switching Loss vs. R_G

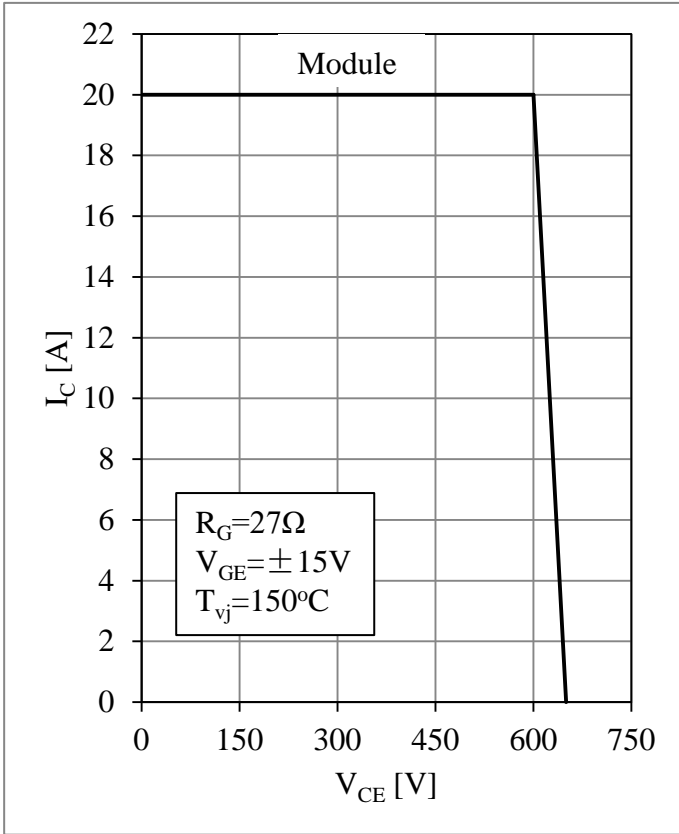


Fig 5. IGBT-inverter RBSOA

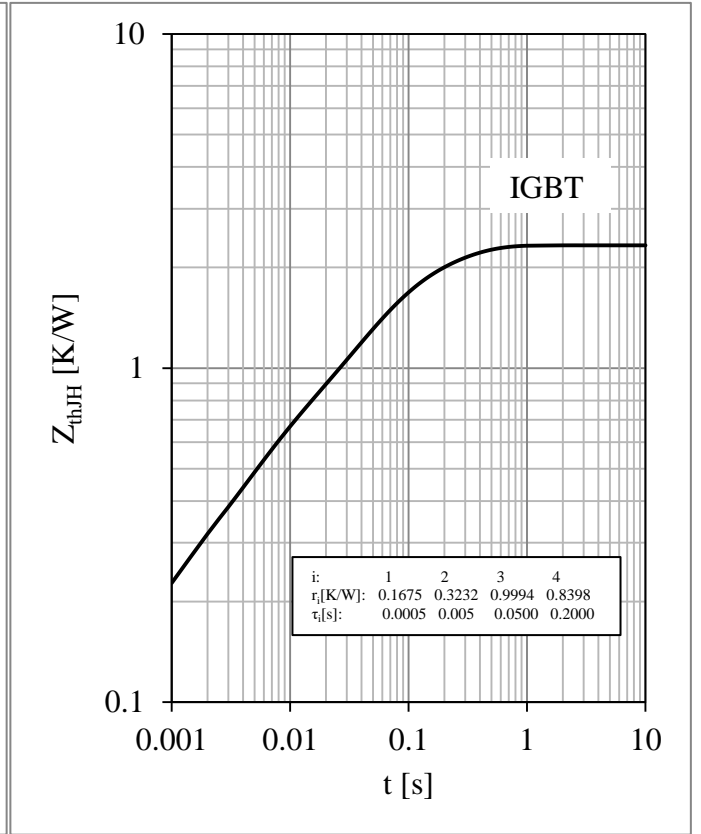


Fig 6. IGBT-inverter Transient Thermal Impedance

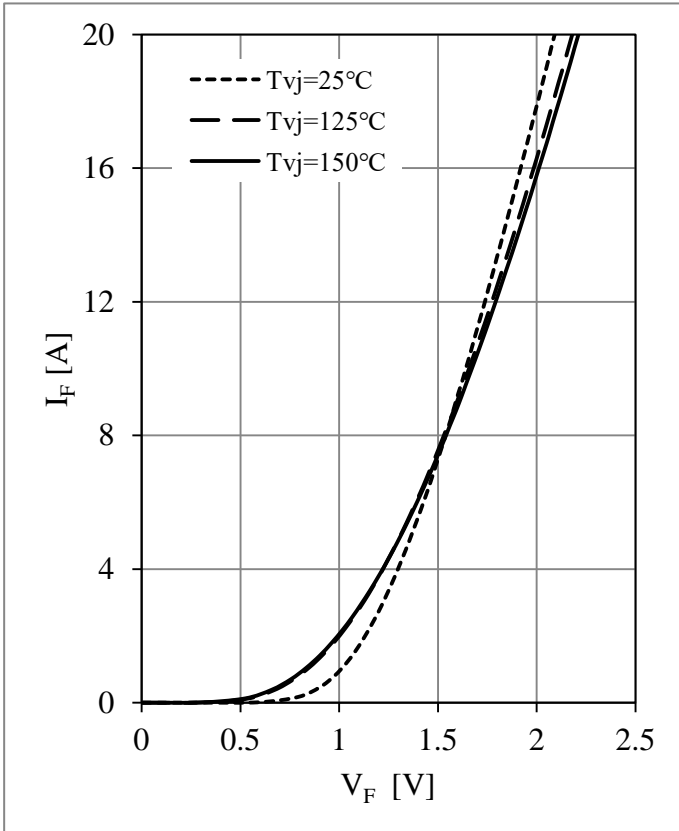


Fig 7. Diode-inverter Forward Characteristics

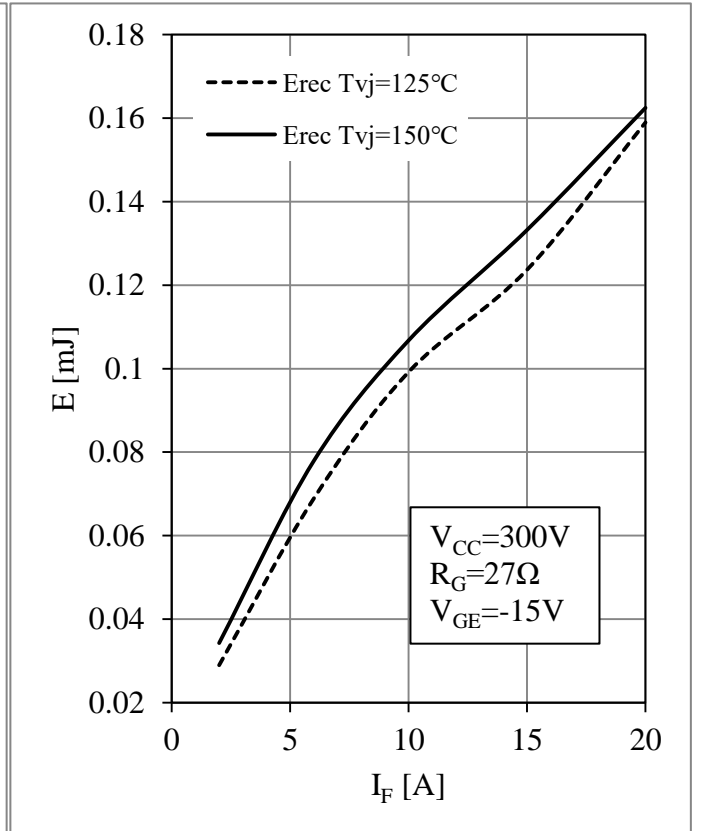


Fig 8. Diode-inverter Switching Loss vs. I_F

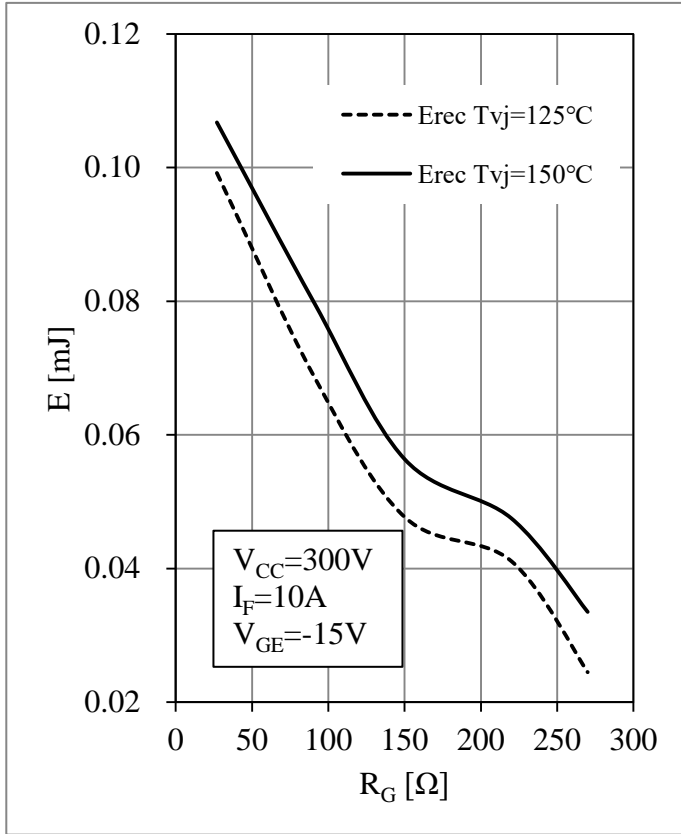


Fig 9. Diode-inverter Switching Loss vs. R_G

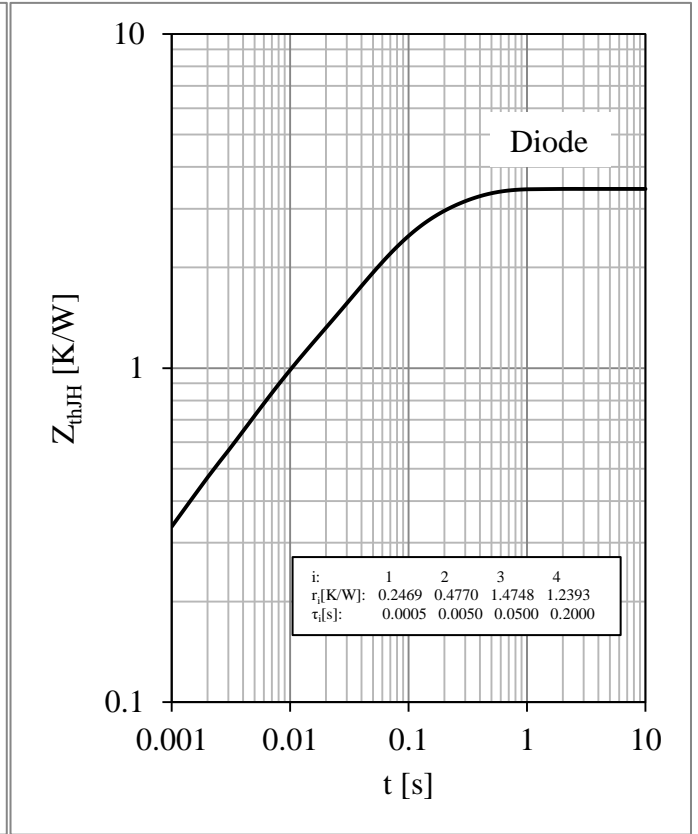


Fig 10. Diode-inverter Transient Thermal Impedance

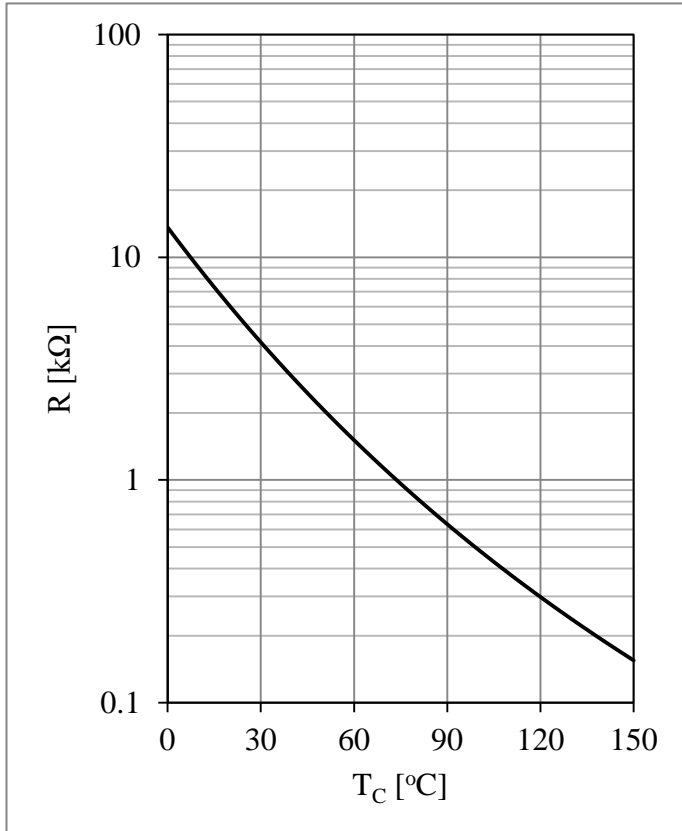
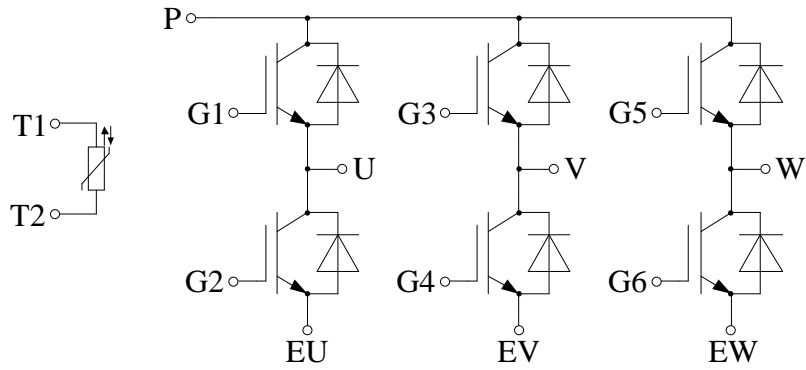


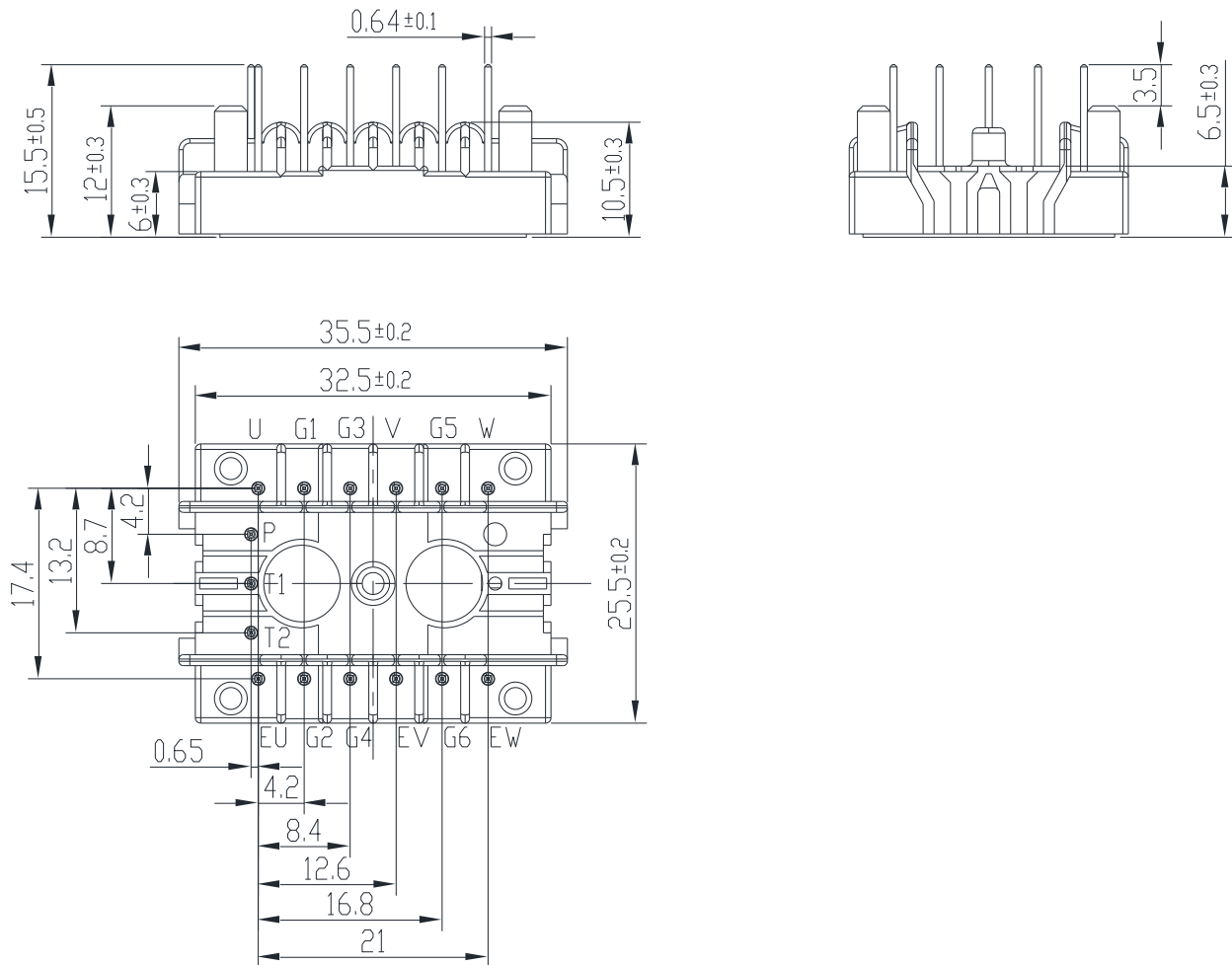
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



Pinpositions with tolerance $\text{⌀} \text{⌀}0.8$

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