

STARPOWER

SEMICONDUCTOR

IGBT

GD50FFA120C5S

1200V/50A 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.

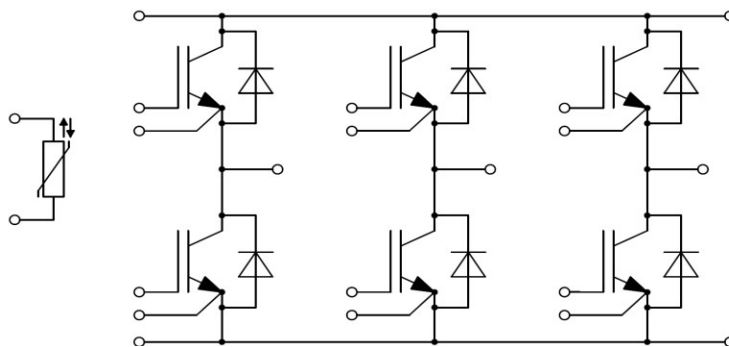
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 8 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	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=100^{\circ}\text{C}$	50	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	100	A

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	50	A
I_{FRM}	Repetitive Peak Forward Current tp limited by T_{vjop}	100	A
I_{FSM}	Surge Forward Current $t_p=10\text{ms}$ @ $T_{vj}=125^{\circ}\text{C}$ @ $T_{vj}=150^{\circ}\text{C}$	251	A
		233	
I^2t	I^2t -value, $t_p=10\text{ms}$ @ $T_{vj}=125^{\circ}\text{C}$ @ $T_{vj}=150^{\circ}\text{C}$	315	A^2s
		271	

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 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	$I_C=50\text{A}, V_{GE}=15\text{V}, T_{vj}=25^\circ\text{C}$		1.50	1.95	V
		$I_C=50\text{A}, V_{GE}=15\text{V}, T_{vj}=125^\circ\text{C}$		1.70		
		$I_C=50\text{A}, V_{GE}=15\text{V}, T_{vj}=150^\circ\text{C}$		1.80		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.00\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^\circ\text{C}$	5.3	6.2	7.0	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^\circ\text{C}$			50	μA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^\circ\text{C}$			100	nA
R_{Gint}	Internal Gate Resistance			0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		4.42		nF
C_{res}	Reverse Transfer Capacitance				0.04	
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.32		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=50\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=25^\circ\text{C}$		83		ns
t_r	Rise Time			34		ns
$t_{d(off)}$	Turn-Off Delay Time			334		ns
t_f	Fall Time			180		ns
E_{on}	Turn-On Switching Loss			4.24		mJ
E_{off}	Turn-Off Switching Loss			4.32		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=50\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=125^\circ\text{C}$		83		ns
t_r	Rise Time			40		ns
$t_{d(off)}$	Turn-Off Delay Time			402		ns
t_f	Fall Time			293		ns
E_{on}	Turn-On Switching Loss			5.34		mJ
E_{off}	Turn-Off Switching Loss			6.07		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=50\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=150^\circ\text{C}$		84		ns
t_r	Rise Time			41		ns
$t_{d(off)}$	Turn-Off Delay Time			415		ns
t_f	Fall Time			320		ns
E_{on}	Turn-On Switching Loss			5.70		mJ
E_{off}	Turn-Off Switching Loss			6.42		mJ
I_{SC}	SC Data	$t_p \leq 8\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^\circ\text{C}, V_{CC}=600\text{V}, V_{CEM} \leq 1200\text{V}$		150		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	$I_F=50\text{A}, V_{GE}=0\text{V}, T_{vj}=25^\circ\text{C}$		1.60	2.05	V
		$I_F=50\text{A}, V_{GE}=0\text{V}, T_{vj}=125^\circ\text{C}$		1.65		
		$I_F=50\text{A}, V_{GE}=0\text{V}, T_{vj}=150^\circ\text{C}$		1.65		
Q_r	Recovered Charge			5.08		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=50\text{A},$ $-di/dt=1399\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=25^\circ\text{C}$		43		A
E_{rec}	Reverse Recovery Energy			1.66		mJ
Q_r	Recovered Charge			8.35		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=50\text{A},$ $-di/dt=1283\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=125^\circ\text{C}$		47		A
E_{rec}	Reverse Recovery Energy			3.05		mJ
Q_r	Recovered Charge			9.13		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=50\text{A},$ $-di/dt=1239\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=150^\circ\text{C}$		47		A
E_{rec}	Reverse Recovery Energy			3.37		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		19		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		1.80		m Ω
R_{thJC}	Junction-to-Case (per IGBT)			0.438	K/W
	Junction-to-Case (per Diode)			0.739	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.140		K/W
	Case-to-Heatsink (per Diode)		0.162		
	Case-to-Heatsink (per Module)		0.020		
M	Mounting Torque, Screw M5	3.0		6.0	N.m
G	Weight of Module		200		g

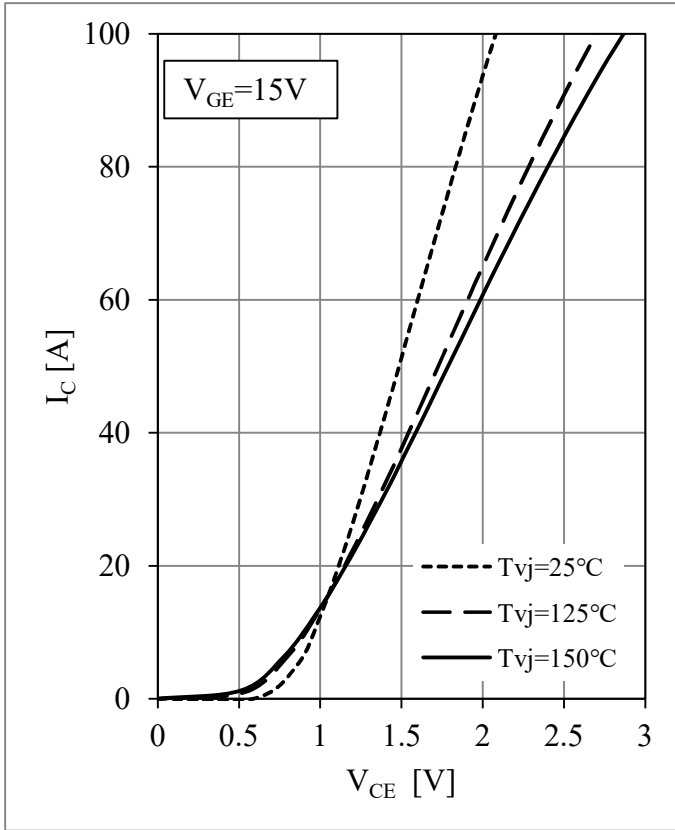


Fig 1. IGBT Output Characteristics

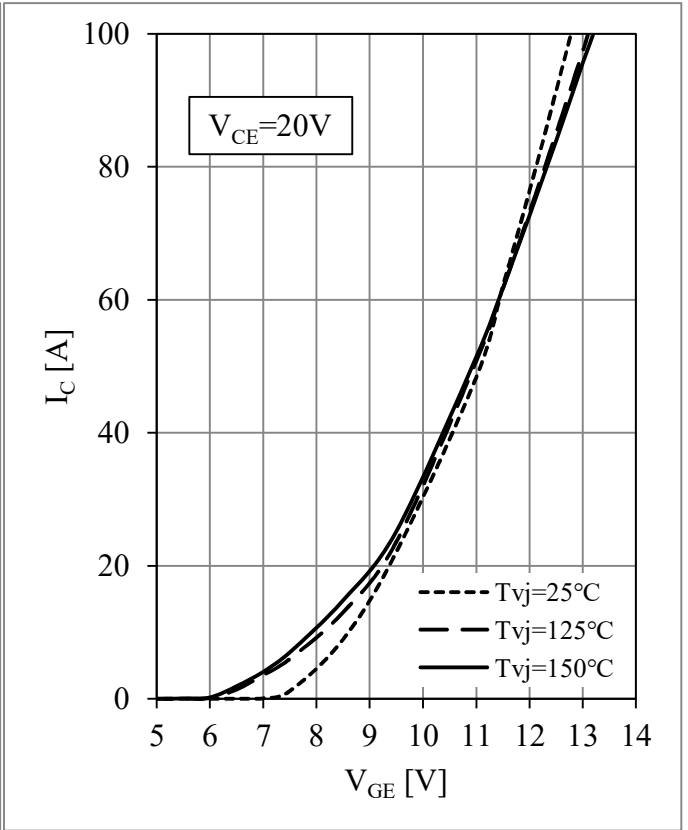


Fig 2. IGBT Transfer Characteristics

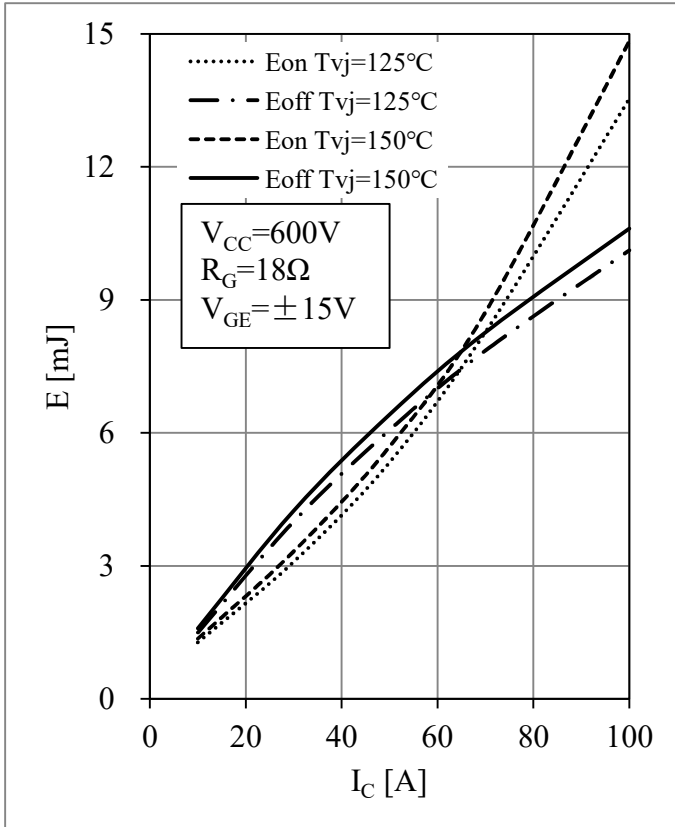


Fig 3. IGBT Switching Loss vs. I_C

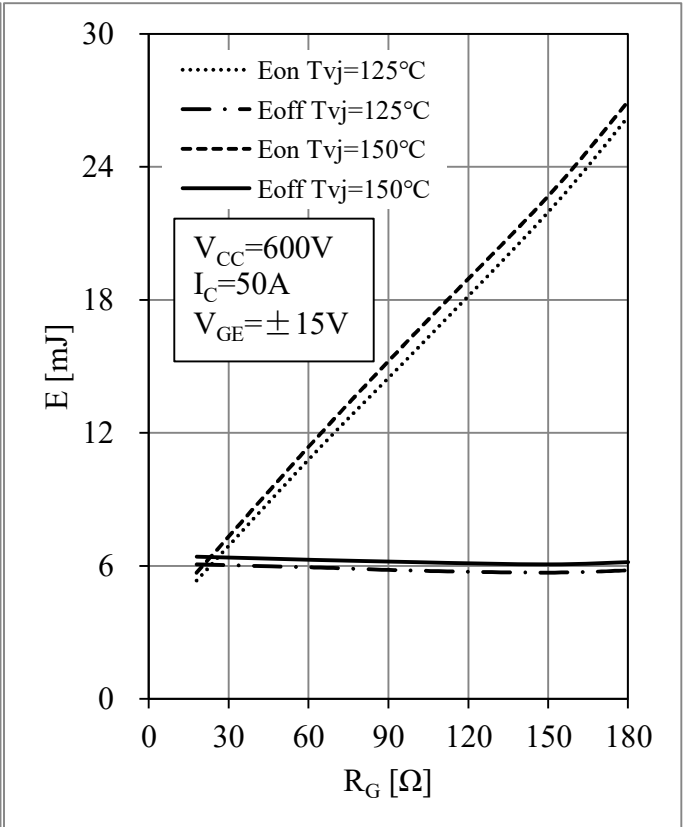


Fig 4. IGBT Switching Loss vs. R_G

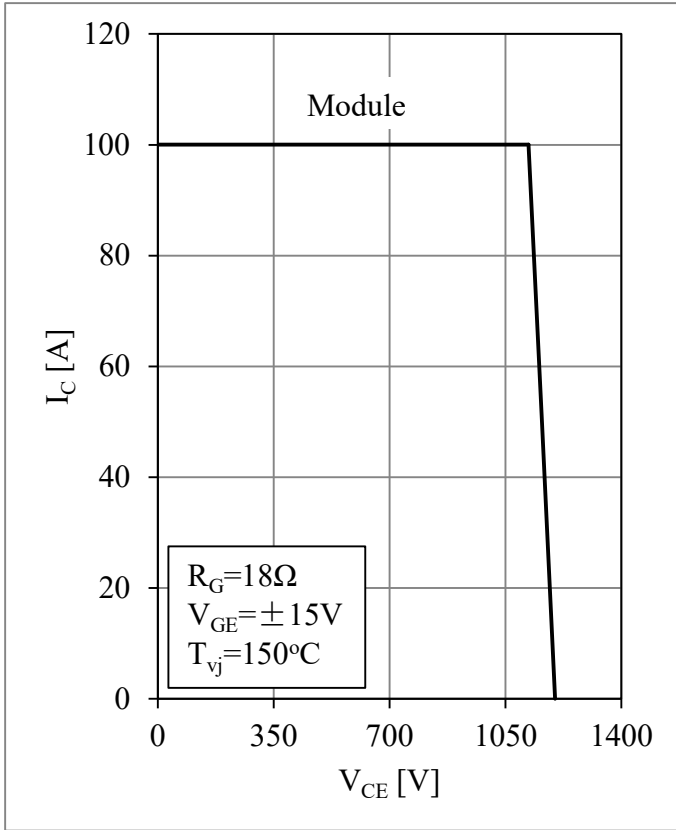


Fig 5. IGBT RBSOA

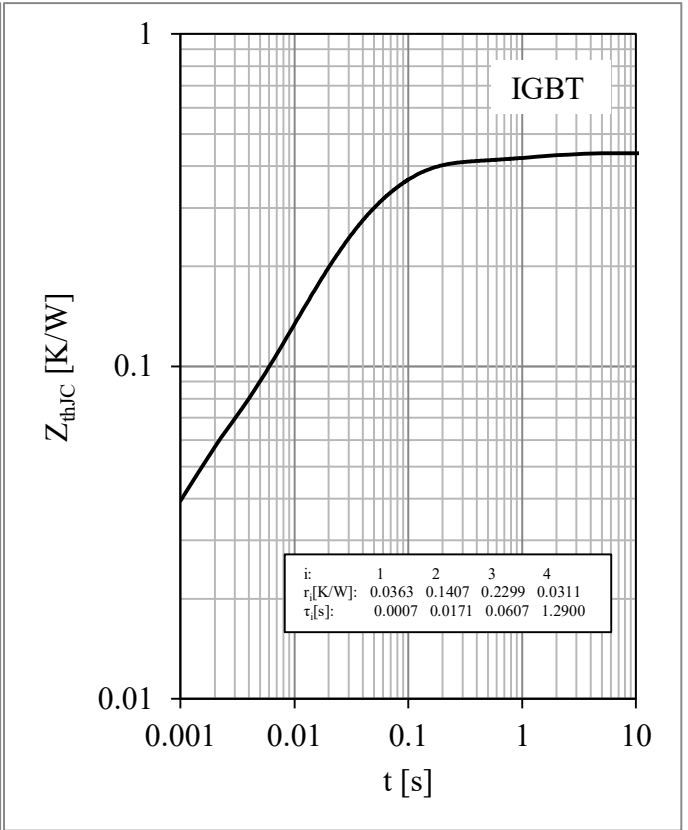


Fig 6. IGBT Transient Thermal Impedance

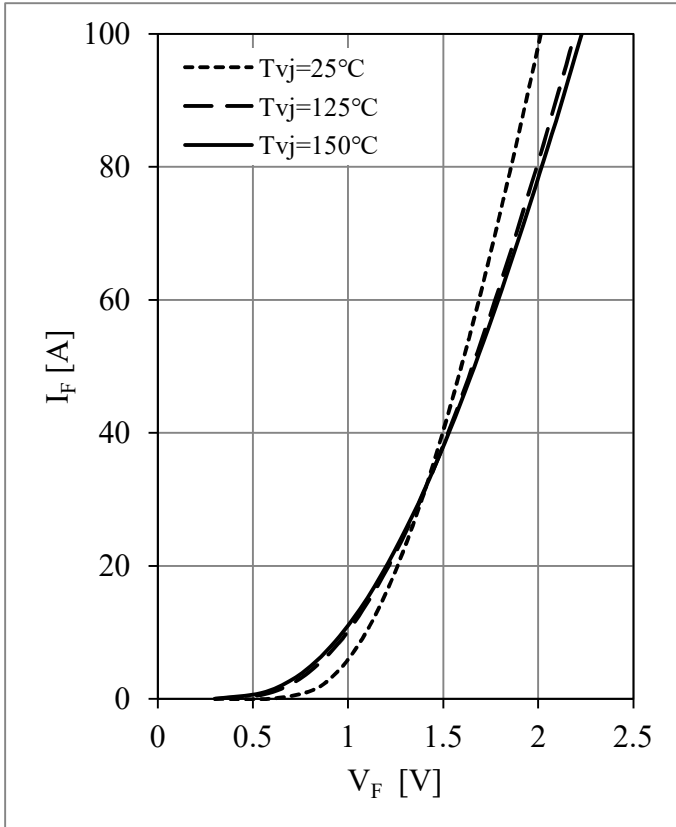


Fig 7. Diode Forward Characteristics

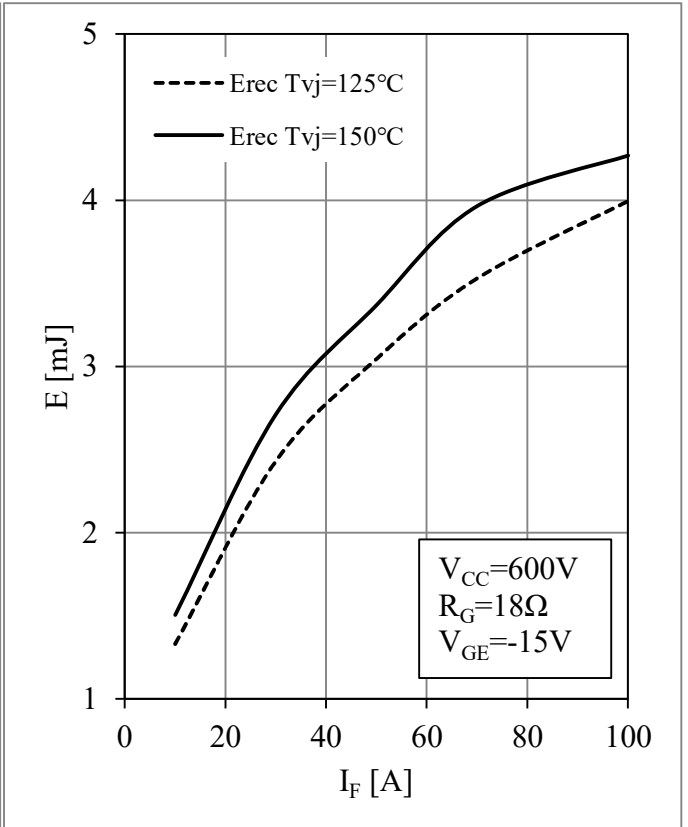


Fig 8. Diode Switching Loss vs. I_F

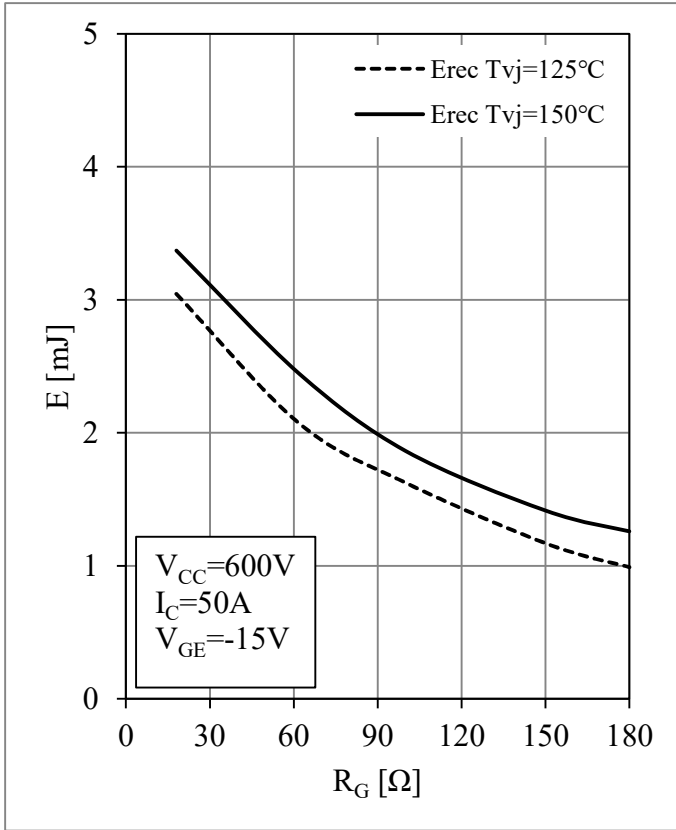


Fig 9. Diode Switching Loss vs. R_G

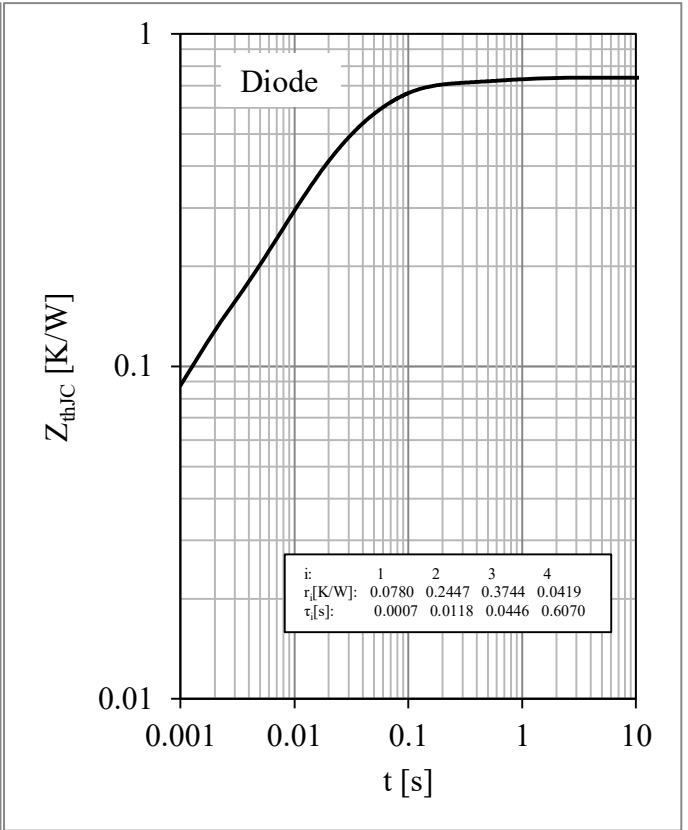


Fig 10. Diode Transient Thermal Impedance

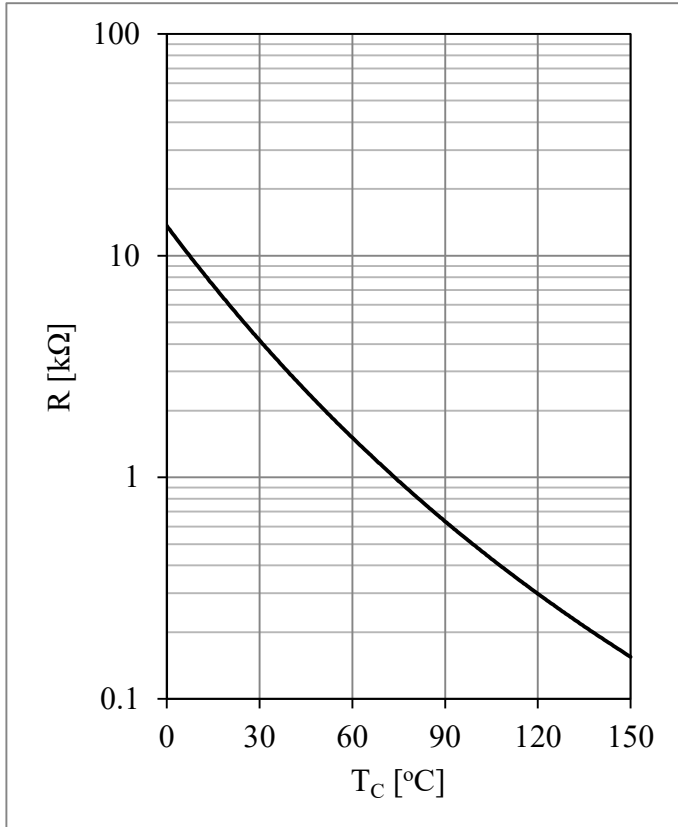
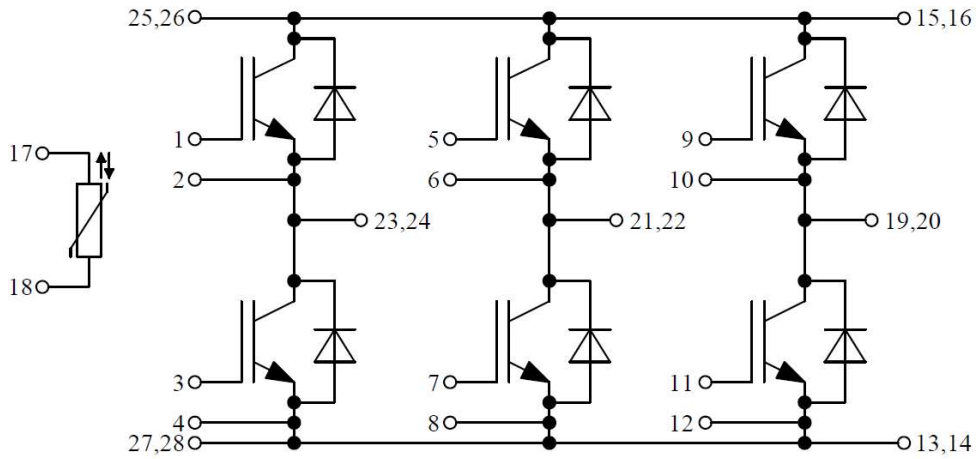


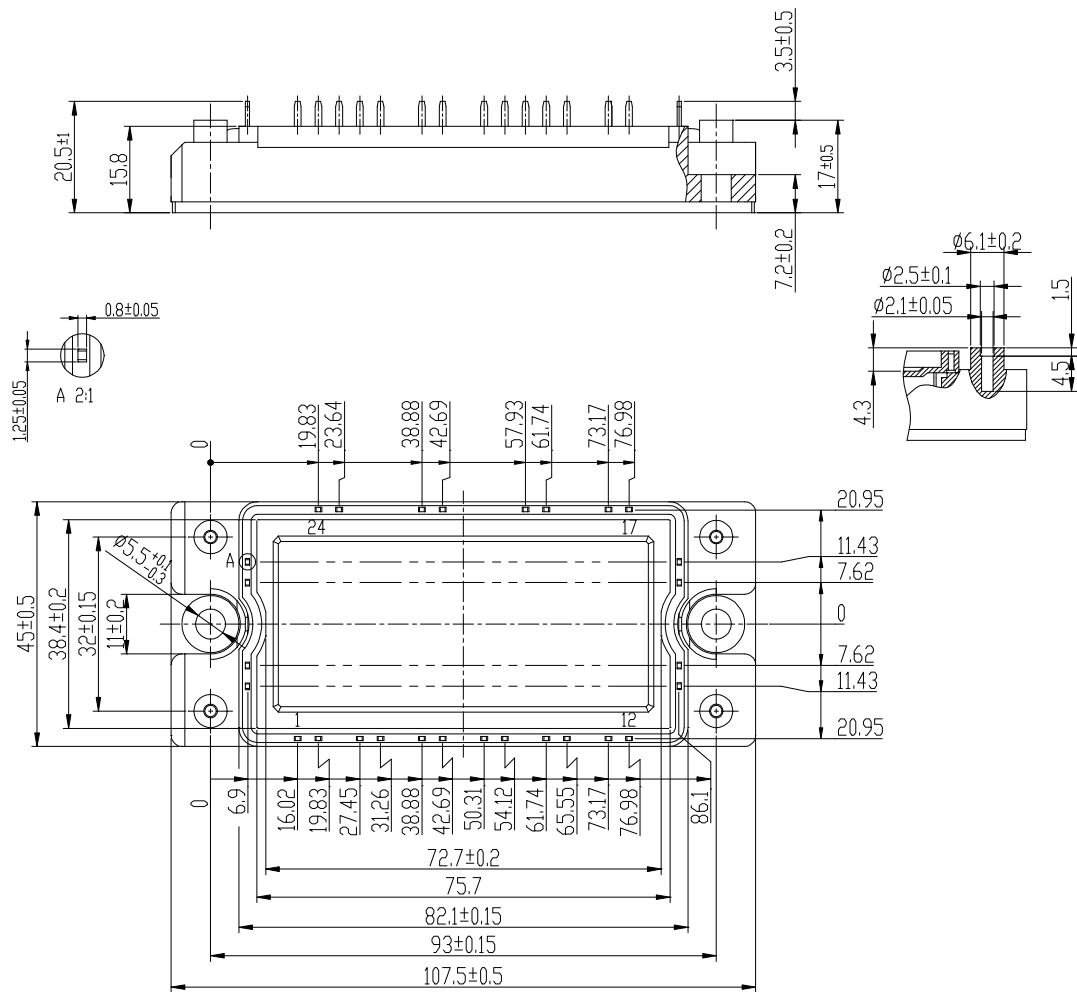
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



Pin positions with tolerance $\oplus \ominus \varnothing 0.4$

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