

STARPOWER

SEMICONDUCTOR

IGBT

GD20FSX65L2S

650V/20A 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.

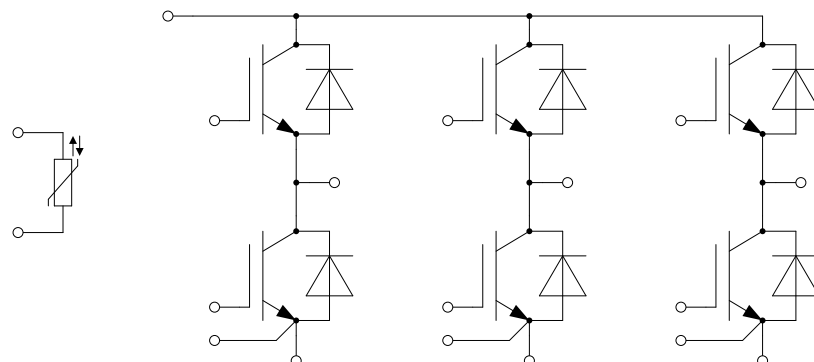
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 6 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**

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	40	A
	@ $T_C=100^{\circ}\text{C}$	20	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	40	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	129	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	20	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	40	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, $f=50\text{Hz}$, $t=1\text{min}$	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	$I_C=20\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.45	1.90	V	
		$I_C=20\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.60			
		$I_C=20\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		1.70			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.32\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.1	5.8	6.5	V	
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			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	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		2.32		nF	
C_{res}	Reverse Transfer Capacitance				0.05		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.14		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=20\text{A}, R_G=18\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		15		ns	
t_r	Rise Time			13		ns	
$t_{d(off)}$	Turn-Off Delay Time			96		ns	
t_f	Fall Time			56		ns	
E_{on}	Turn-On Switching Loss			0.32		mJ	
E_{off}	Turn-Off Switching Loss			0.35		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=300\text{V}, I_C=20\text{A}, R_G=18\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		15		ns
t_r	Rise Time				16		ns
$t_{d(off)}$	Turn-Off Delay Time			112		ns	
t_f	Fall Time			76		ns	
E_{on}	Turn-On Switching Loss			0.44		mJ	
E_{off}	Turn-Off Switching Loss			0.45		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=20\text{A}, R_G=18\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			15		ns
t_r	Rise Time				17		ns
$t_{d(off)}$	Turn-Off Delay Time			120		ns	
t_f	Fall Time			80		ns	
E_{on}	Turn-On Switching Loss			0.49		mJ	
E_{off}	Turn-Off Switching Loss			0.47		mJ	
I_{SC}	SC Data		$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		100		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	$I_C=20\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.60	2.05	V
		$I_C=20\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.55		
		$I_C=20\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.50		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=20\text{A},$ $-di/dt=1800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		1.00		μC
I_{RM}	Peak Reverse Recovery Current			30.0		A
E_{rec}	Reverse Recovery Energy			0.21		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=20\text{A},$ $-di/dt=1800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		1.75		μC
I_{RM}	Peak Reverse Recovery Current			32.0		A
E_{rec}	Reverse Recovery Energy			0.37		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=20\text{A},$ $-di/dt=1800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		2.20		μC
I_{RM}	Peak Reverse Recovery Current			34.0		A
E_{rec}	Reverse Recovery Energy			0.47		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		25		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		4.50		m Ω
R_{thJC}	Junction-to-Case (per IGBT-inverter)		1.055	1.160	K/W
	Junction-to-Case (per Diode-inverter)		1.687	1.856	
R_{thCH}	Case-to-Sink (per IGBT-inverter)		0.566		K/W
	Case-to-Sink (per Diode-inverter)		0.905		
	Case-to-Sink (per Module)		0.058		
F	Mounting Force Per Clamp	20		50	N
G	Weight of Module		24		g

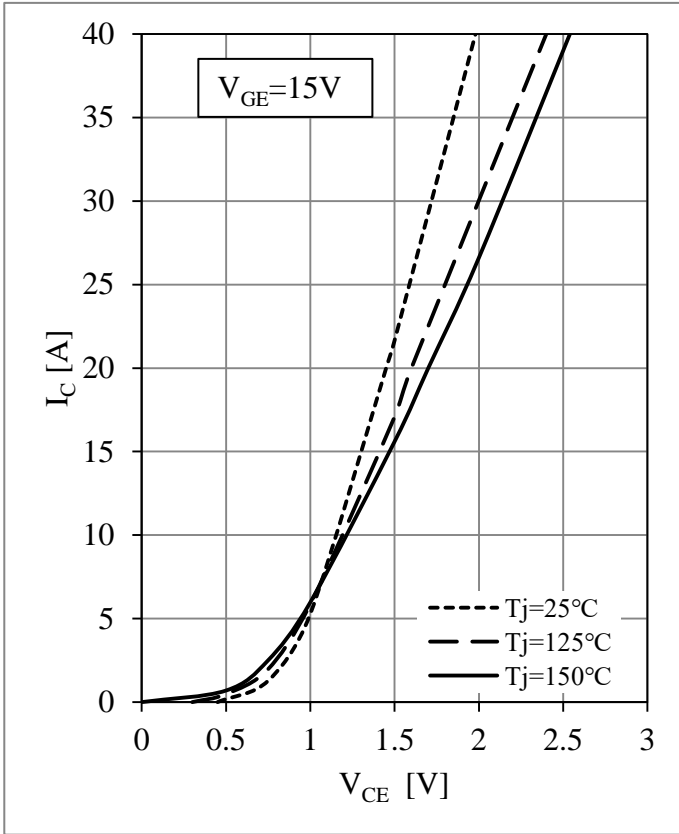


Fig 1. IGBT Output Characteristics

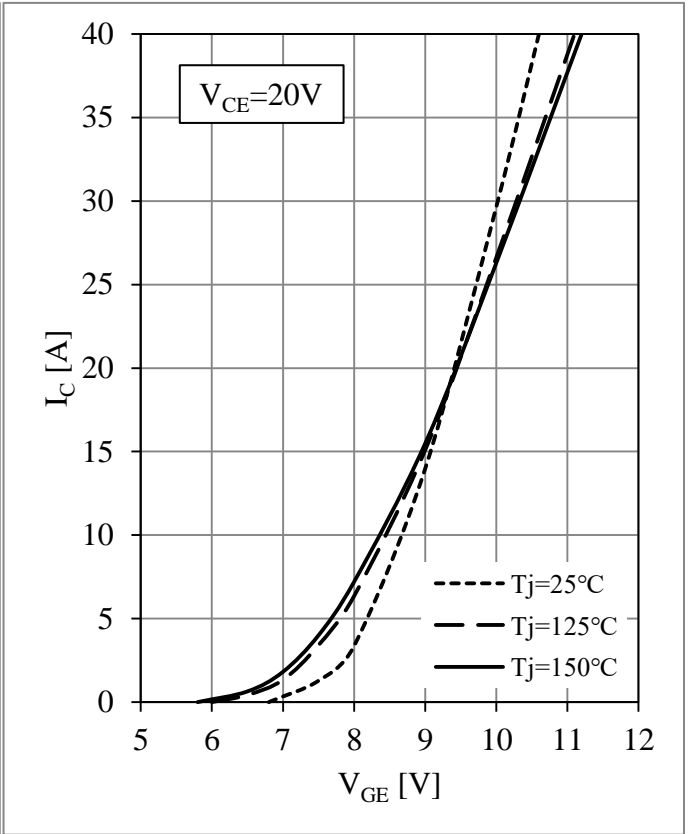


Fig 2. IGBT Transfer Characteristics

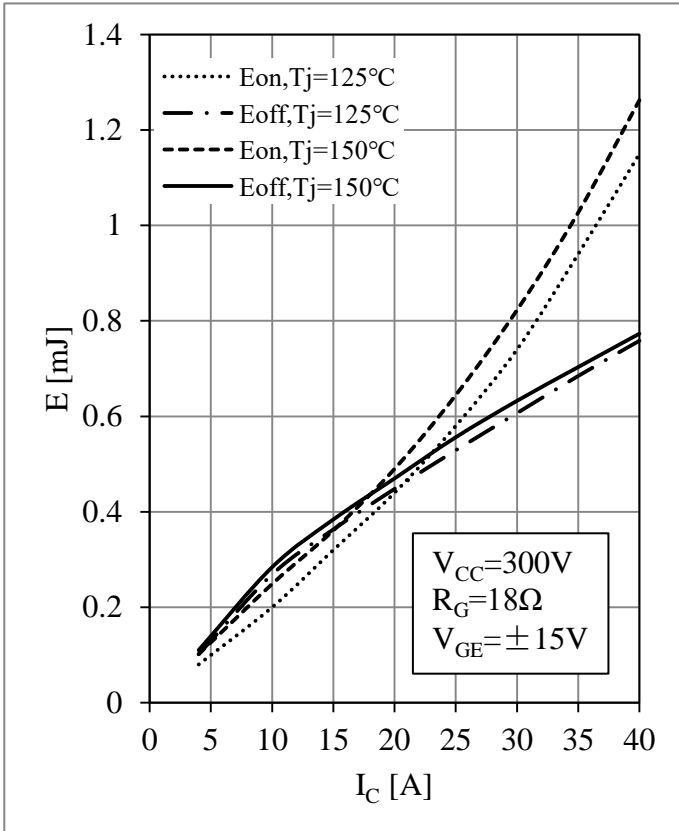


Fig 3. IGBT Switching Loss vs. I_c

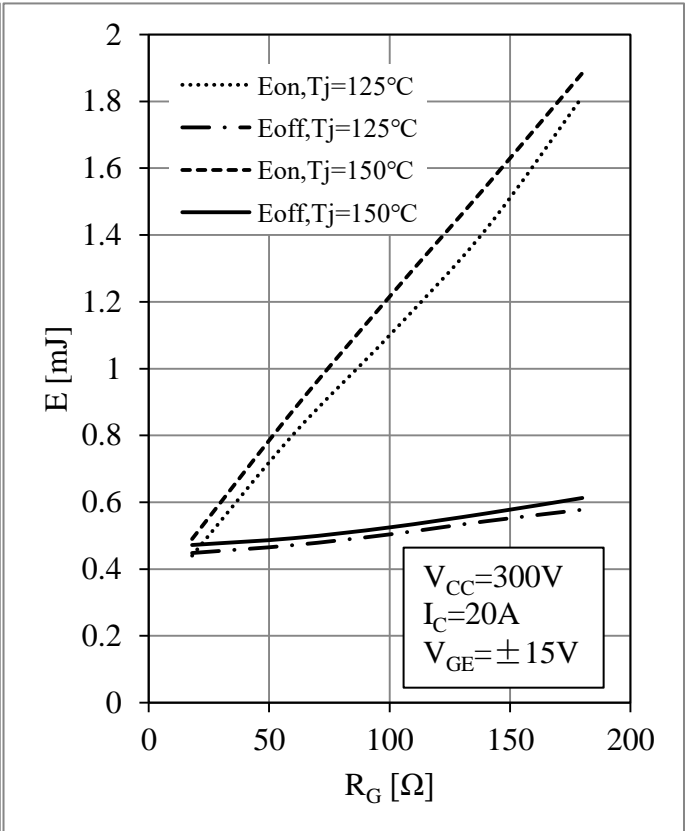


Fig 4. IGBT Switching Loss vs. R_g

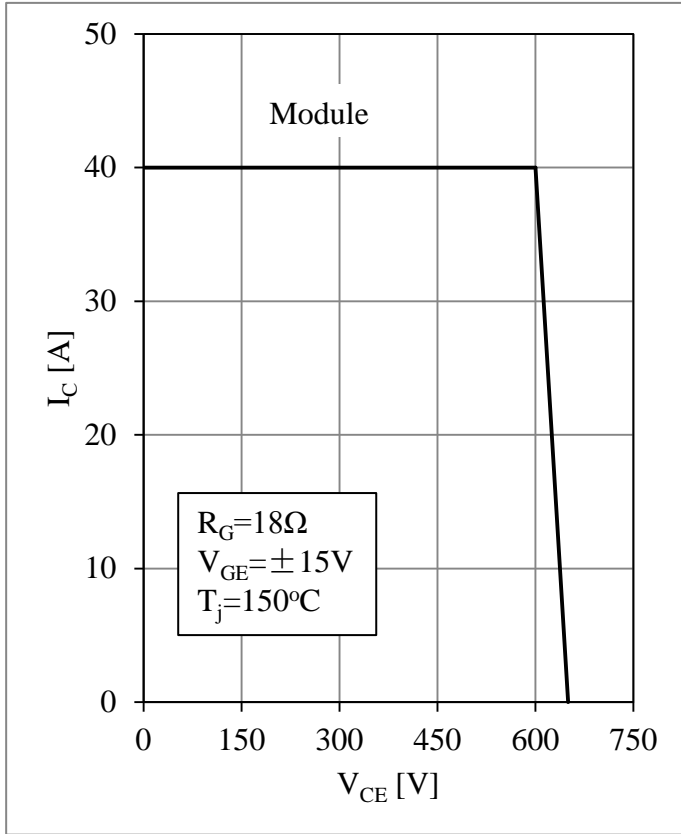


Fig 5. RBSOA

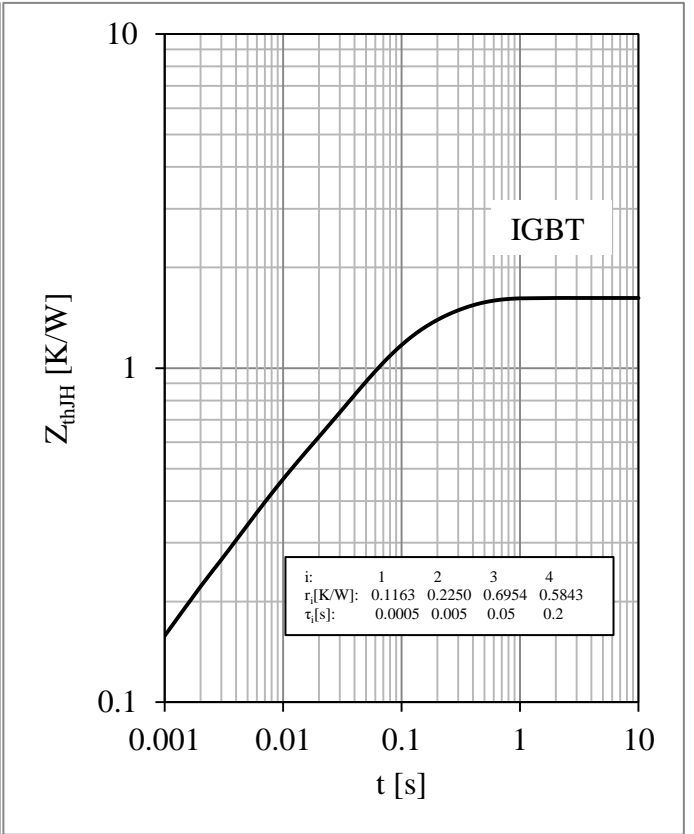


Fig 6. IGBT Transient Thermal Impedance

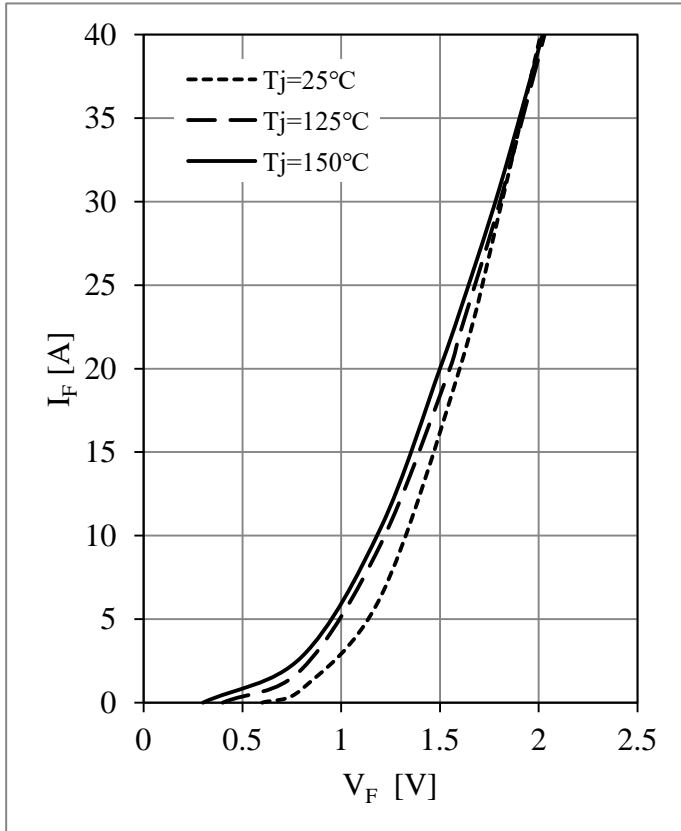


Fig 7. Diode Forward Characteristics

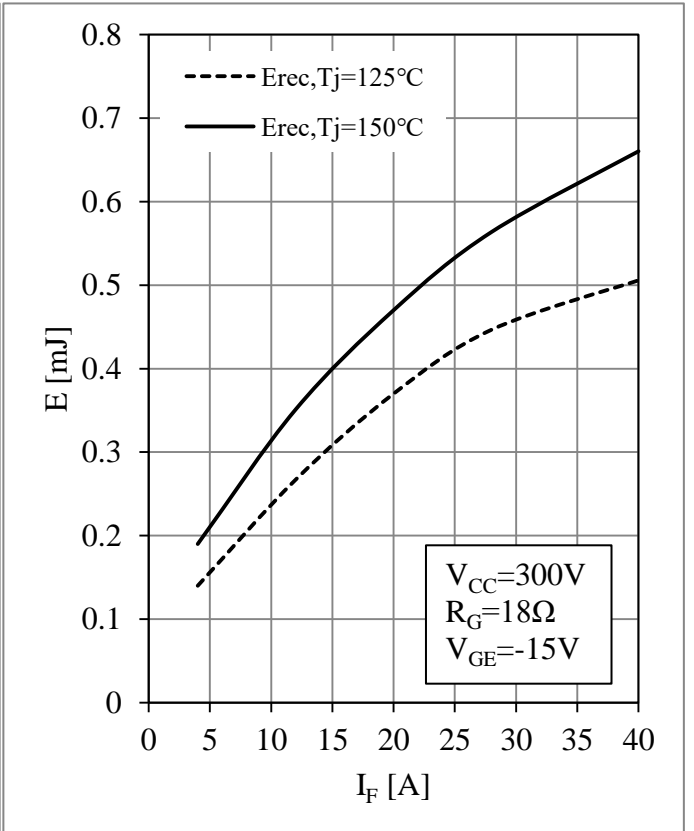


Fig 8. Diode Switching Loss vs. I_F

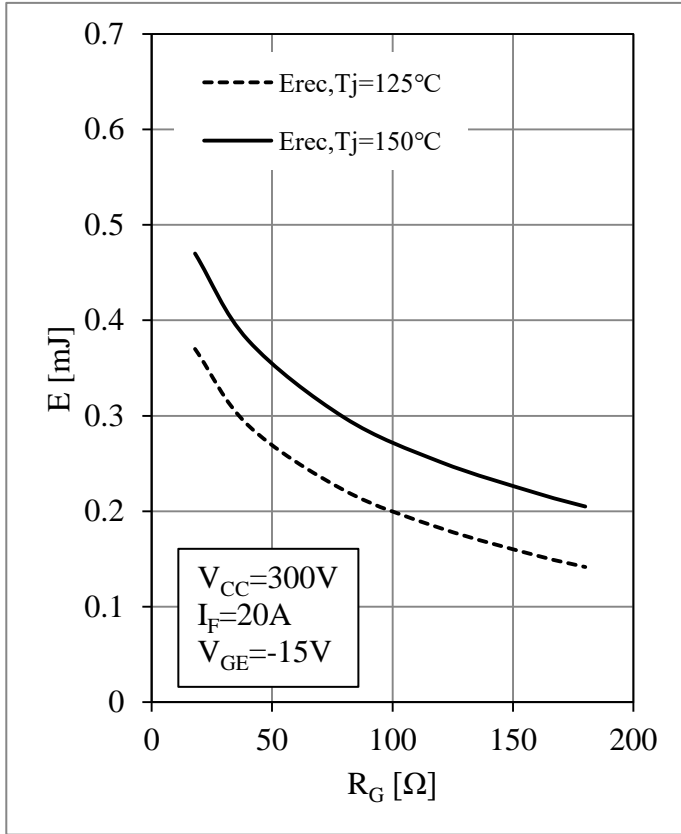


Fig 9. Diode Switching Loss vs. R_G

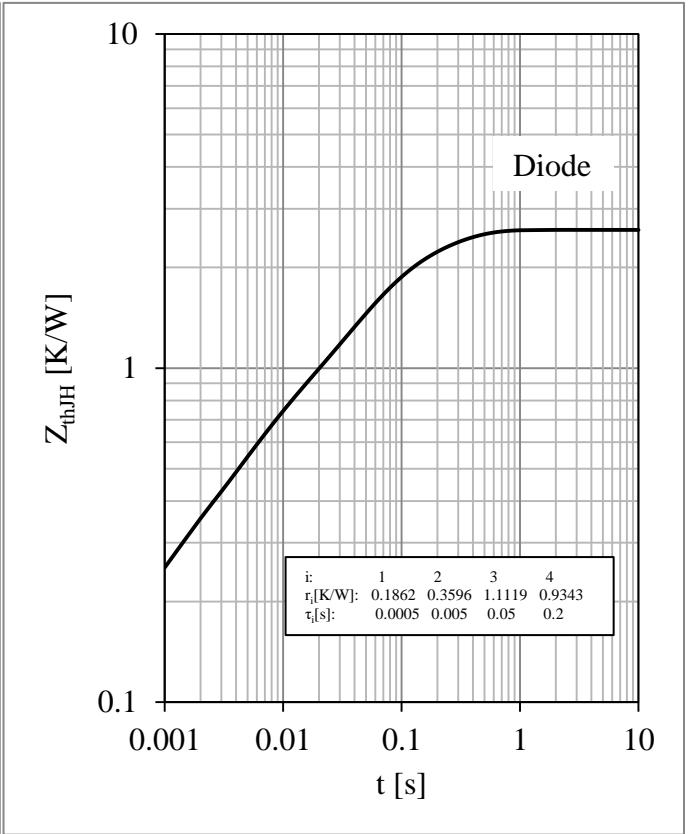


Fig 10. Diode Transient Thermal Impedance

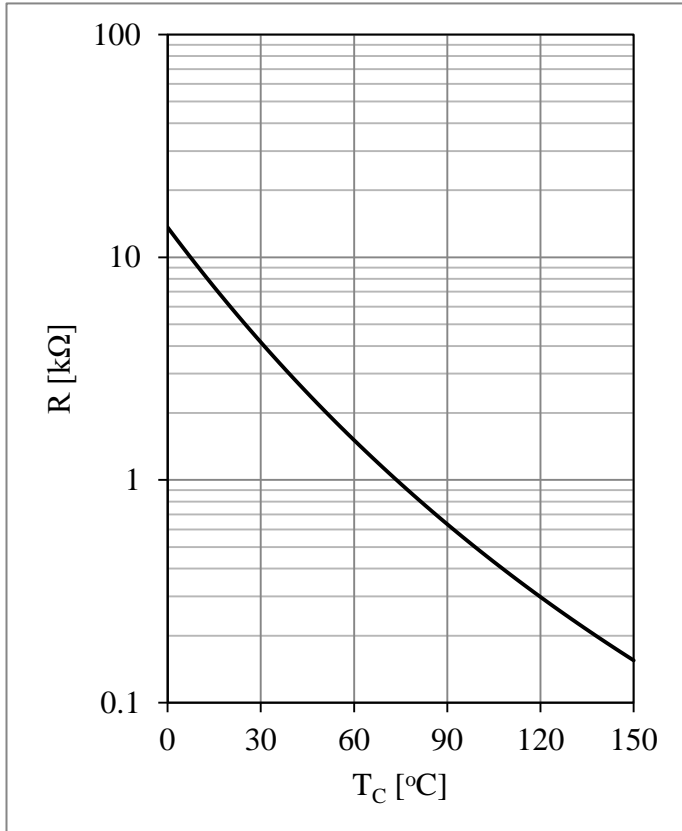
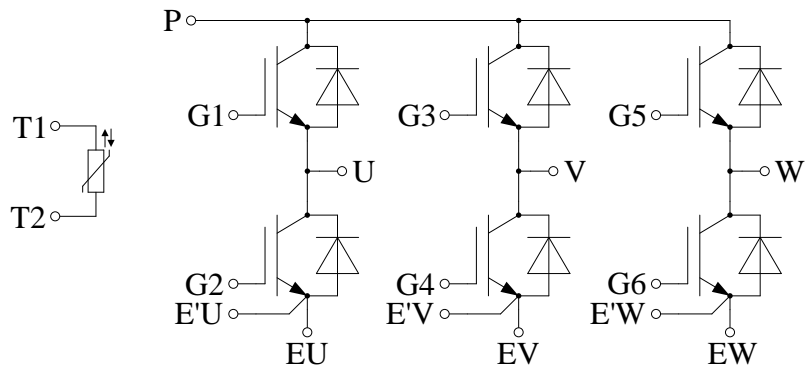


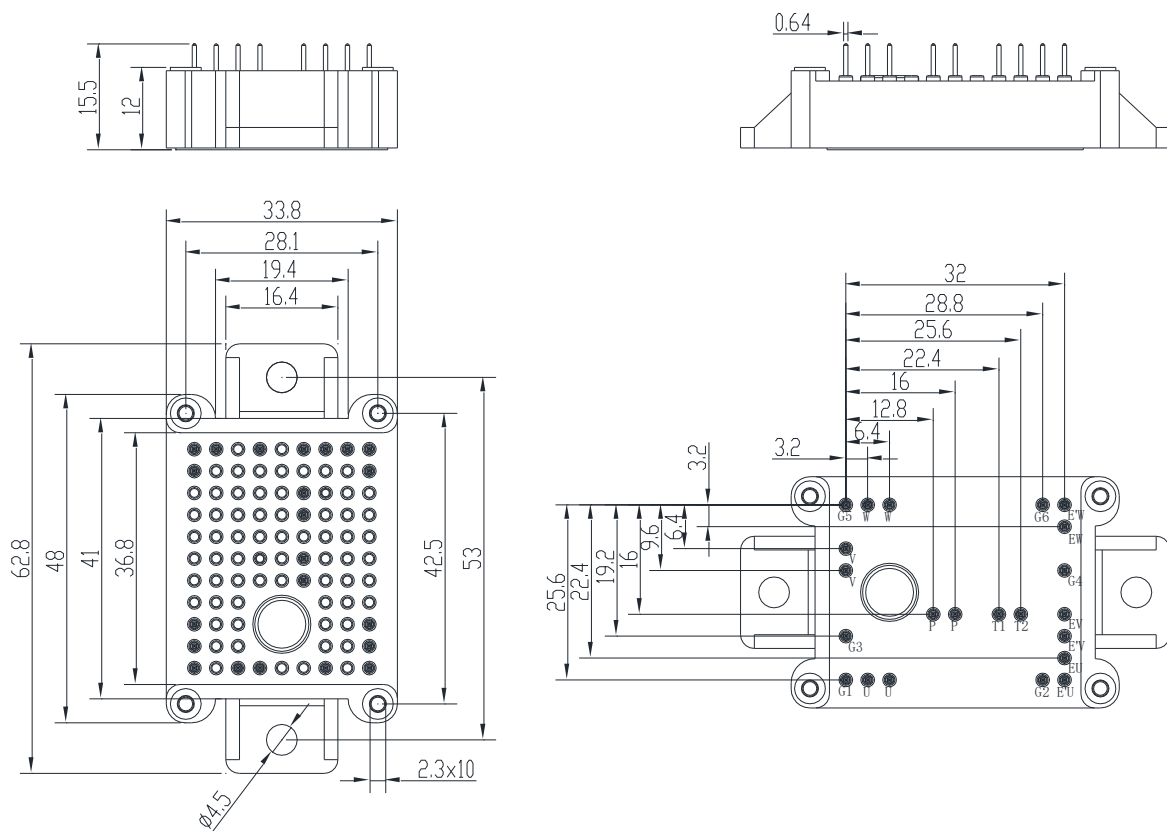
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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