STARPOWER

SEMICONDUCTOR **IGBT**

GD650HFX170P1S_B28

1700V/650A 2 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 wind and solar power.

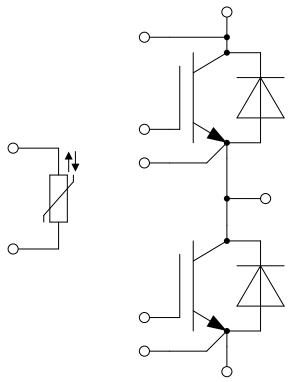
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 10μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Enlarged Diode for regenerative operation
- Isolated copper baseplate using DBC technology
- High power and thermal cycling capability

Typical Applications

- High Power Converter
- Wind and Solar Power
- Traction Drive

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°C unless otherwise noted

IGBT

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°C @ T_C=100°C	1073 650	A
I_{CM}	Pulsed Collector Current t_p=1ms	1300	A
P_D	Maximum Power Dissipation @ T_j=175°C	4.2	kW

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1700	V
I_F	Diode Continuous Forward Current	650	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	1300	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	°C
T_{jop}	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature Range	-40 to +125	°C
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	4000	V

IGBT Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=650A,V_{GE}=15V, T_j=25°C		1.95	2.40	V
		I_C=650A,V_{GE}=15V, T_j=125°C		2.35		
		I_C=650A,V_{GE}=15V, T_j=150°C		2.50		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=26.0mA,V_{CE}=V_{GE}, T_j=25°C	5.6	6.2	6.8	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			400	nA
R_{Gint}	Internal Gate Resistance			1.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		74.0		nF
C_{res}	Reverse Transfer Capacitance			1.79		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		5.92		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=900V,I_C=650A, R_{Gon}=1.5Ω,R_{Goff}=2.7Ω, V_{GE}=±15V, L_S=26nH, T_j=25°C		362		ns
t_r	Rise Time			104		ns
$t_{d(off)}$	Turn-Off Delay Time			611		ns
t_f	Fall Time			284		ns
E_{on}	Turn-On Switching Loss			212		mJ
E_{off}	Turn-Off Switching Loss			108		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=900V,I_C=650A, R_{Gon}=1.5Ω,R_{Goff}=2.7Ω, V_{GE}=±15V, L_S=26nH, T_j=125°C		437		ns
t_r	Rise Time			126		ns
$t_{d(off)}$	Turn-Off Delay Time			737		ns
t_f	Fall Time			471		ns
E_{on}	Turn-On Switching Loss			310		mJ
E_{off}	Turn-Off Switching Loss			152		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=900V,I_C=650A, R_{Gon}=1.5Ω,R_{Goff}=2.7Ω, V_{GE}=±15V, L_S=26nH, T_j=150°C		457		ns
t_r	Rise Time			133		ns
$t_{d(off)}$	Turn-Off Delay Time			768		ns
t_f	Fall Time			490		ns
E_{on}	Turn-On Switching Loss			341		mJ
E_{off}	Turn-Off Switching Loss			160		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=1000V, V_{CEM}≤1700V		2400		A

Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=650A,V_{GE}=0V,T_i=25°C		1.85	2.30	V
		I_F=650A,V_{GE}=0V,T_j=125°C		2.00		
		I_F=650A,V_{GE}=0V,T_j=150°C		2.00		
Q_r	Recovered Charge	V_R=900V,I_F=650A, -di/dt=4900A/μs,V_{GE}=-15V, L_S=26nH,T_j=25°C		89.1		μC
I_{RM}	Peak Reverse Recovery Current			403		A
E_{rec}	Reverse Recovery Energy			62.7		mJ
Q_r	Recovered Charge	V_R=900V,I_F=650A, -di/dt=3970A/μs,V_{GE}=-15V L_S=26nH,T_j=125°C		177		μC
I_{RM}	Peak Reverse Recovery Current			420		A
E_{rec}	Reverse Recovery Energy			115		mJ
Q_r	Recovered Charge	V_R=900V,I_F=650A, -di/dt=3780A/μs,V_{GE}=-15V L_S=26nH,T_j=150°C		192		μC
I_{RM}	Peak Reverse Recovery Current			419		A
E_{rec}	Reverse Recovery Energy			117		mJ

NTC Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		kΩ
ΔR/R	Deviation of R_{100}	T_C=100 °C,R_{100}=493.3Ω	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$		3433		K

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		18		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.30		mΩ
R_{thJC}	Junction-to-Case (per IGBT) Junction-to-Case (per Diode)			35.8 71.3	K/kW
R_{thCH}	Case-to-Heatsink (per IGBT) Case-to-Heatsink (per Diode) Case-to-Heatsink (per Module)		13.5 26.9 4.5		K/kW
M	Terminal Connection Torque, Screw M4 Terminal Connection Torque, Screw M8 Mounting Torque, Screw M5	1.8 8.0 3.0		2.1 10.0 6.0	N.m
G	Weight of Module		810		g

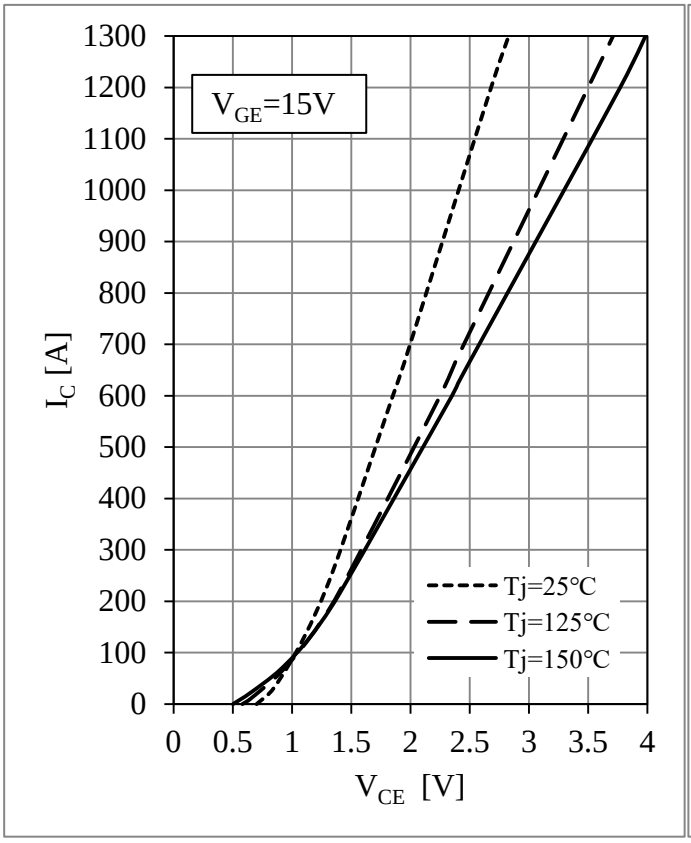


Fig 1. IGBT Output Characteristics

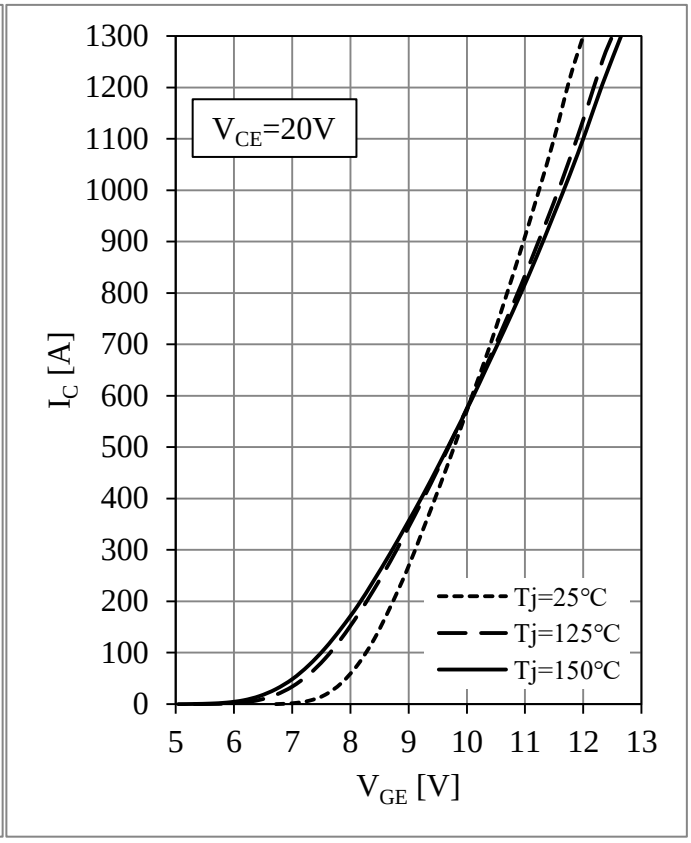


Fig 2. IGBT Transfer Characteristics

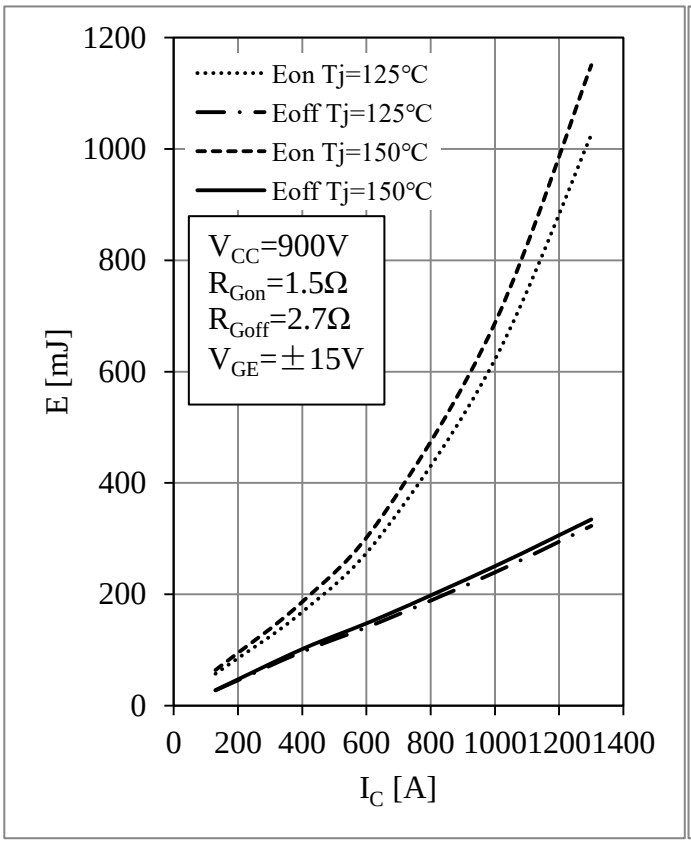


Fig 3. IGBT Switching Loss vs. I_C

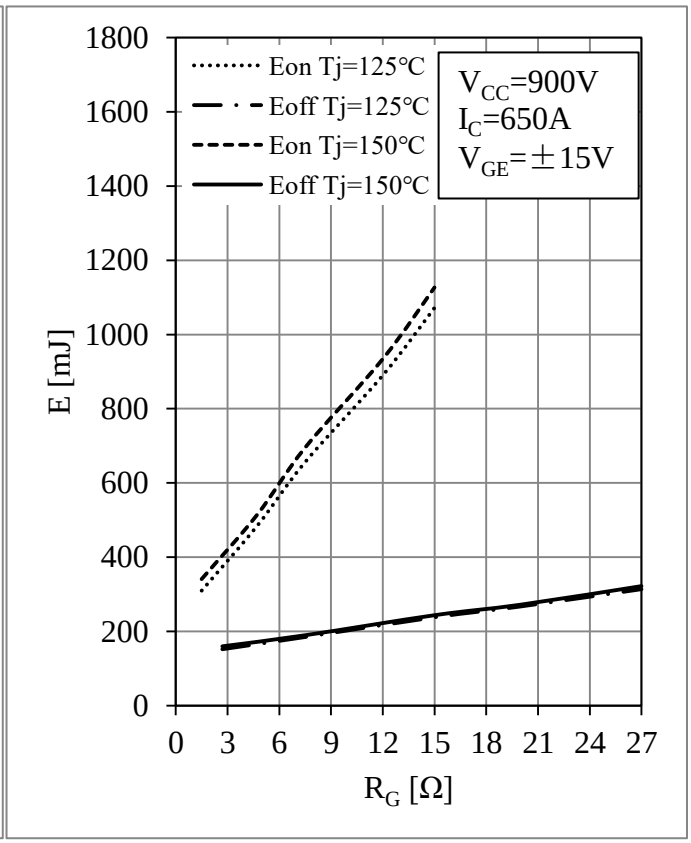


Fig 4. IGBT Switching Loss vs. R_G

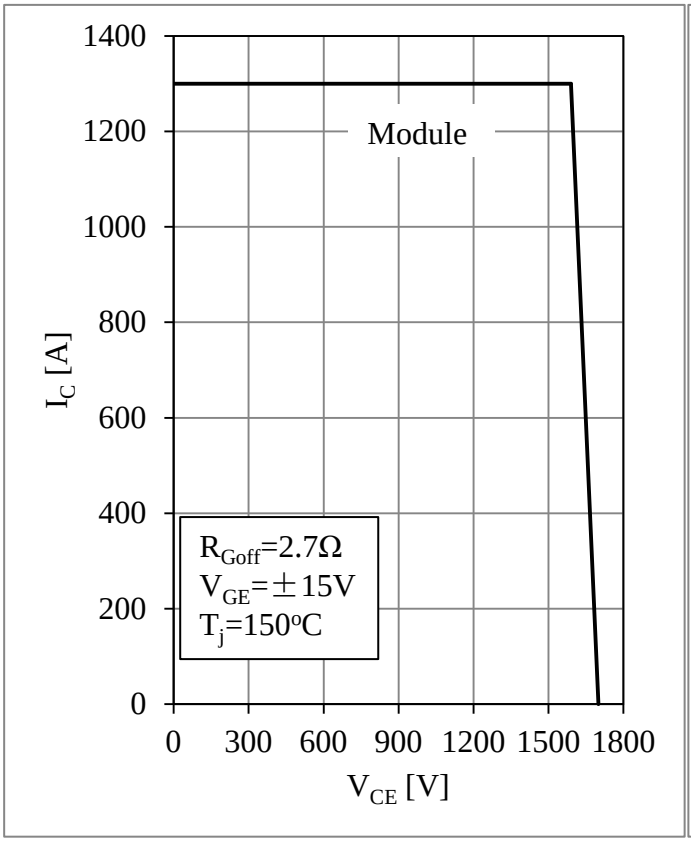


Fig 5. RBSOA

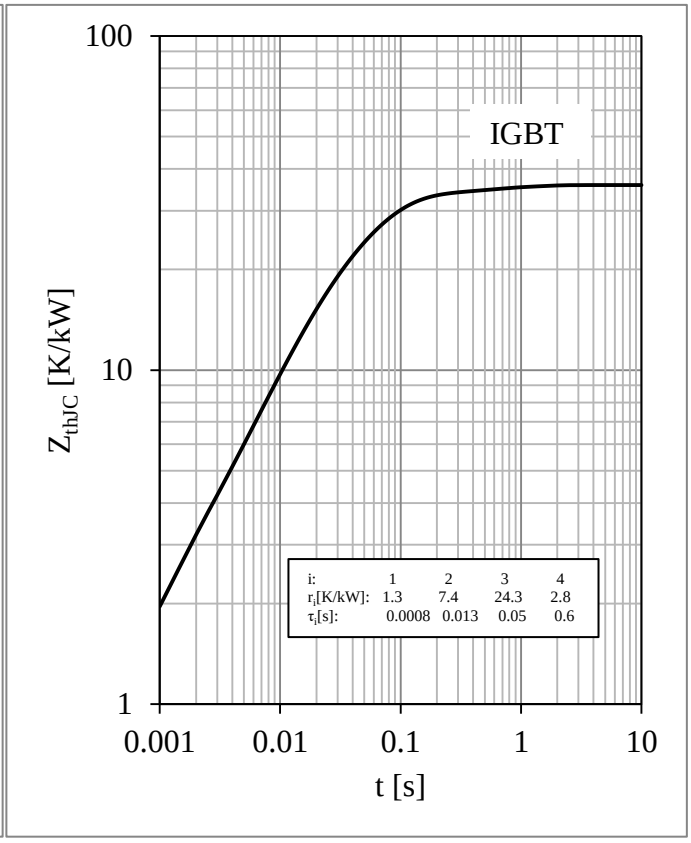


Fig 6. IGBT Transient Thermal Impedance

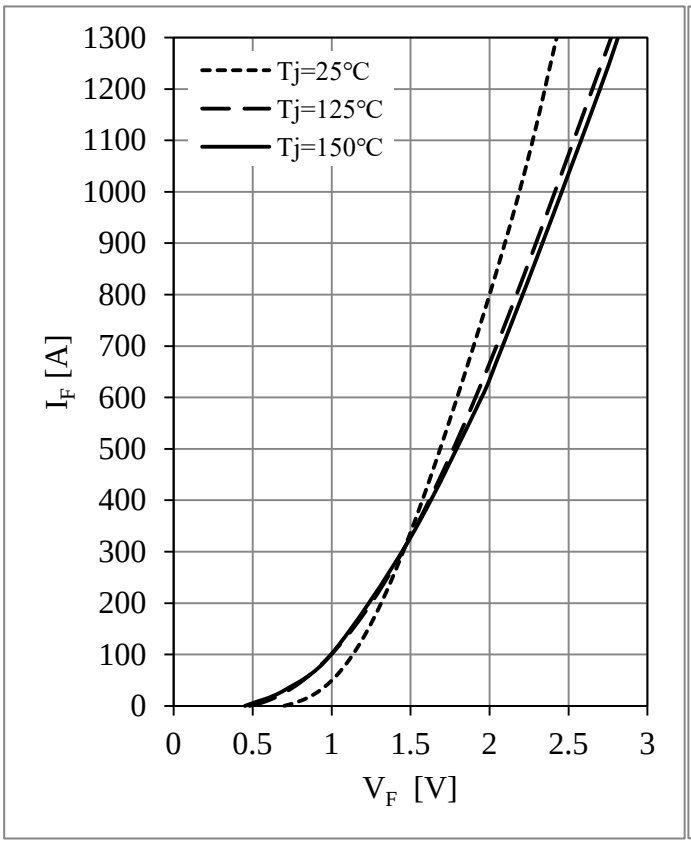


Fig 7. Diode Forward Characteristics

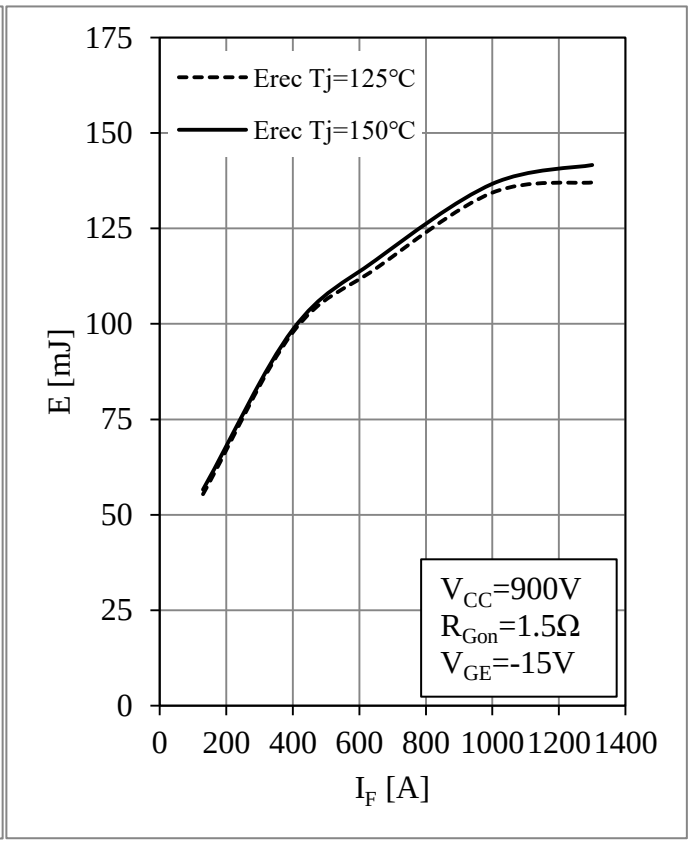


Fig 8. Diode Switching Loss vs. I_F

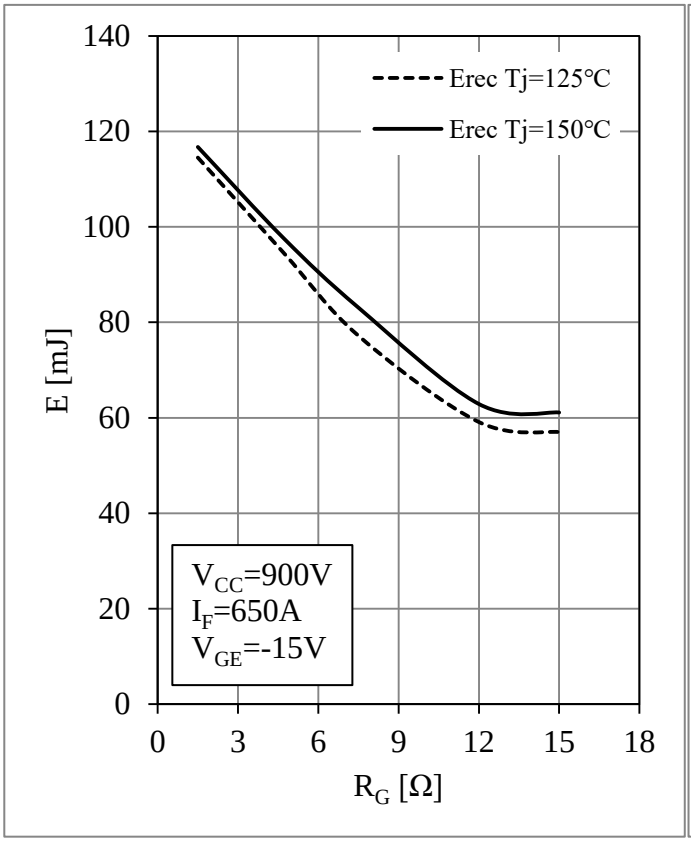


Fig 9. Diode Switching Loss vs. R_G

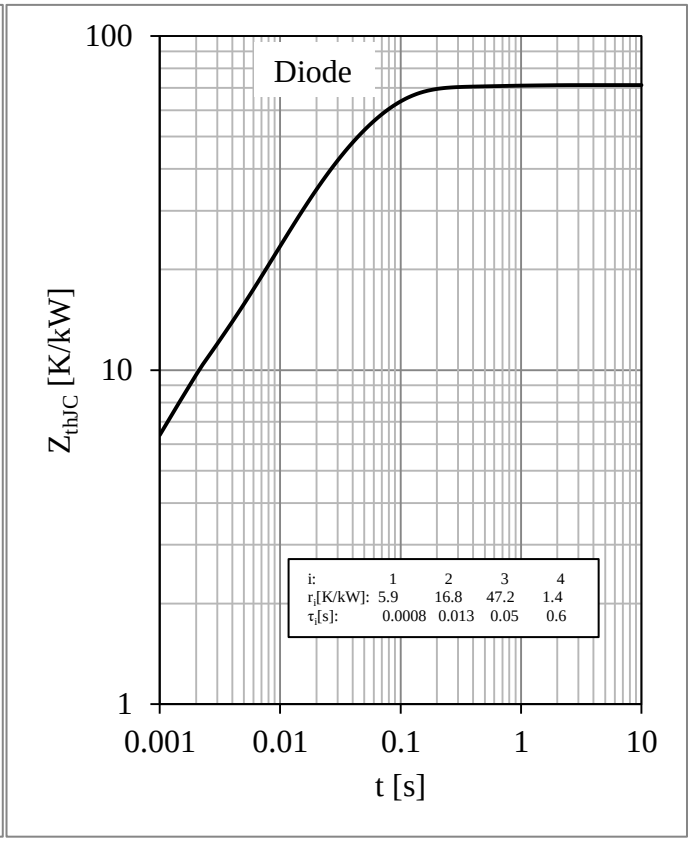


Fig 10. Diode Transient Thermal Impedance

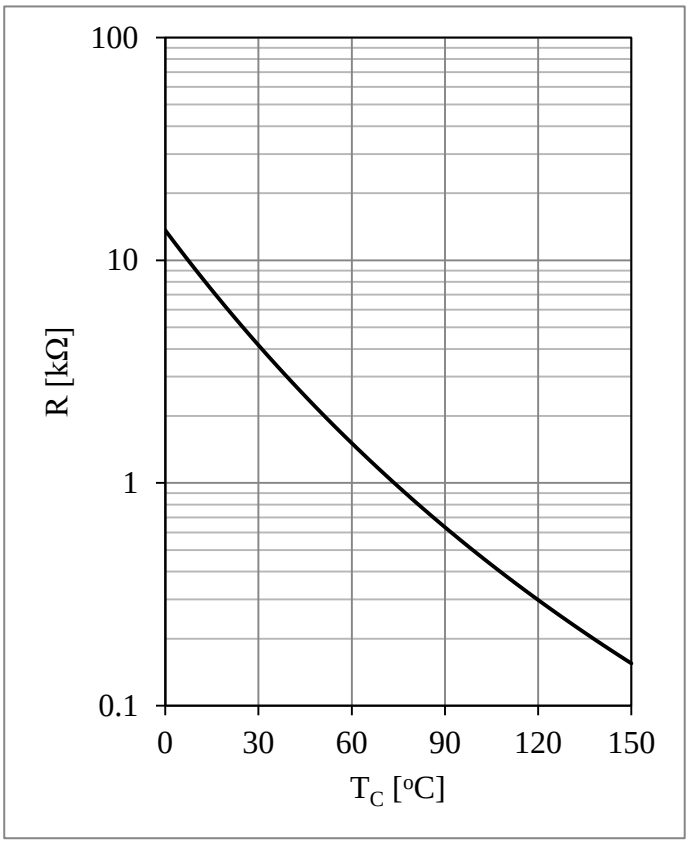
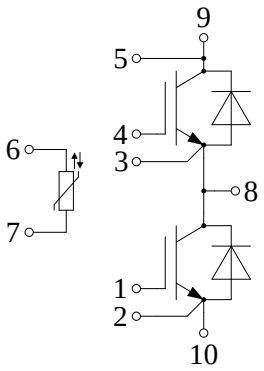


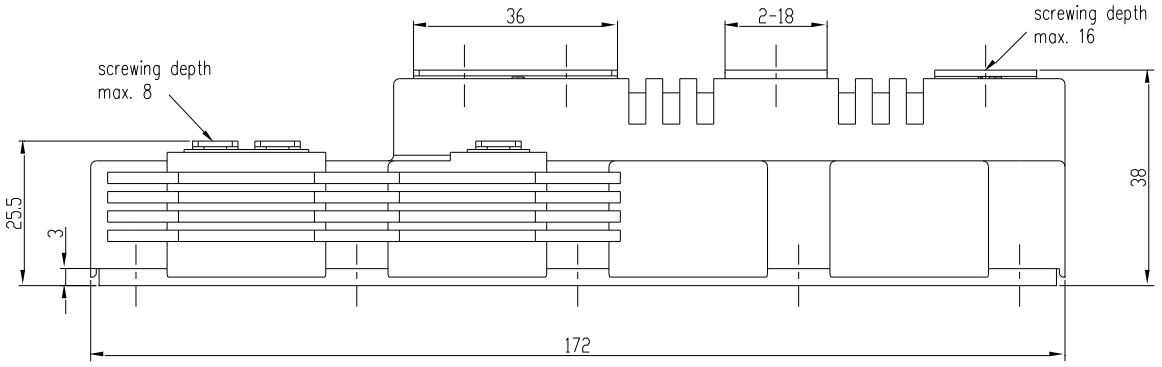
Fig 11. NTC Temperature Characteristic

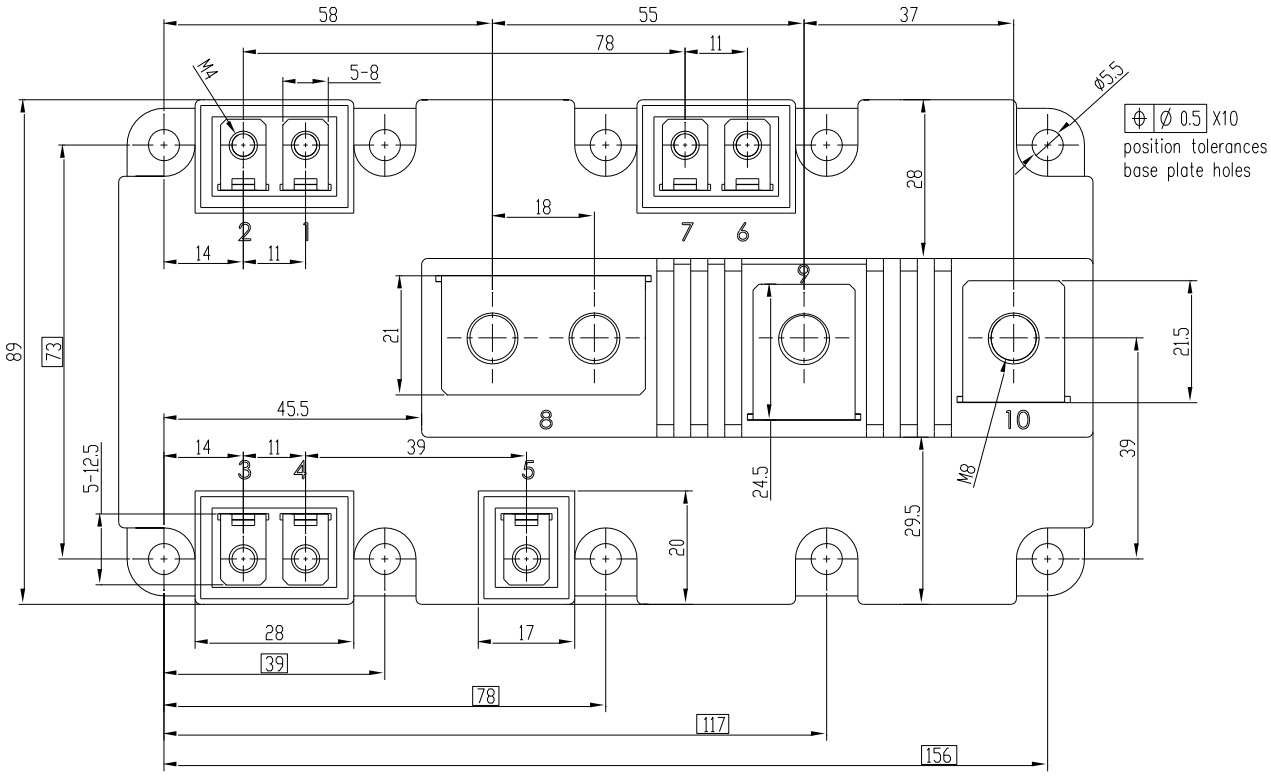
Circuit Schematic



Package Dimensions

Dimensions in Millimeters





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