STARPOWER

SEMICONDUCTOR **IGBT**

GD400HFQ120C2S

1200V/400A 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 electronic welder and inductive heating.

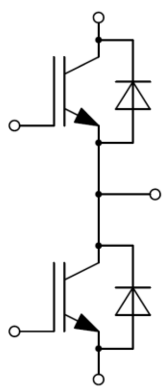
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 10μs 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

- Switching mode power supply
- Inductive heating
- Electronic welder

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°C unless otherwise noted

IGBT

Symbol	Description	Values	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=25°C @ T_C=100°C	783 400	A
I_{CM}	Pulsed Collector Current t_p=1ms	800	A
P_D	Maximum Power Dissipation @ T_j=175°C	2206	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	400	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	800	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	2500	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=400A,V_{GE}=15V, T_j=25°C		1.85	2.30	V
		I_C=400A,V_{GE}=15V, T_j=125°C		2.25		
		I_C=400A,V_{GE}=15V, T_j=150°C		2.35		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=16.00mA,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			1.0	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			0.5		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100KHz, V_{GE}=0V		43.2		nF
C_{res}	Reverse Transfer Capacitance			1.18		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		3.36		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=2Ω, V_{GE}=-4V/+15V, L_S=18nH,T_j=25°C		192		ns
t_r	Rise Time			74		ns
$t_{d(off)}$	Turn-Off Delay Time			401		ns
t_f	Fall Time			59		ns
E_{on}	Turn-On Switching Loss			32.8		mJ
E_{off}	Turn-Off Switching Loss			16.2		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=2Ω, V_{GE}=-4V/+15V, L_S=18nH,T_j=125°C		201		ns
t_r	Rise Time			87		ns
$t_{d(off)}$	Turn-Off Delay Time			443		ns
t_f	Fall Time			99		ns
E_{on}	Turn-On Switching Loss			56.6		mJ
E_{off}	Turn-Off Switching Loss			21.7		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=2Ω, V_{GE}=-4V/+15V, L_S=18nH,T_j=150°C		198		ns
t_r	Rise Time			92		ns
$t_{d(off)}$	Turn-Off Delay Time			449		ns
t_f	Fall Time			100		ns
E_{on}	Turn-On Switching Loss			64.3		mJ
E_{off}	Turn-Off Switching Loss			22.3		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=800V, V_{CEM}≤1200V		1500		A

Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=400A,V_{GE}=0V,T_j=25°C		1.90	2.35	V
		I_F=400A,V_{GE}=0V,T_j=125°C		1.90		
		I_F=400A,V_{GE}=0V,T_j=150°C		1.90		
Q_r	Recovered Charge	V_R=600V,I_F=400A, -di/dt=8820A/μs,V_{GE}=-4V L_S=18nH,T_j=25°C		10.9		μC
I_{RM}	Peak Reverse Recovery Current			346		A
E_{rec}	Reverse Recovery Energy			2.6		mJ
Q_r	Recovered Charge	V_R=600V,I_F=400A, -di/dt=7170A/μs,V_{GE}=-4V L_S=18nH,T_j=125°C		33.9		μC
I_{RM}	Peak Reverse Recovery Current			351		A
E_{rec}	Reverse Recovery Energy			14.6		mJ
Q_r	Recovered Charge	V_R=600V,I_F=400A, -di/dt=6760A/μs,V_{GE}=-4V L_S=18nH,T_j=150°C		43.1		μC
I_{RM}	Peak Reverse Recovery Current			348		A
E_{rec}	Reverse Recovery Energy			18.1		mJ

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance			20	nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.35		mΩ
R_{thJC}	Junction-to-Case (per IGBT) Junction-to-Case (per Diode)			0.068 0.097	K/W
R_{thCH}	Case-to-Heatsink (per IGBT) Case-to-Heatsink (per Diode) Case-to-Heatsink (per Module)		0.034 0.049 0.010		K/W
M	Terminal Connection Torque, Screw M6 Mounting Torque, Screw M6	2.5 3.0		5.0 5.0	N.m
G	Weight of Module		300		g

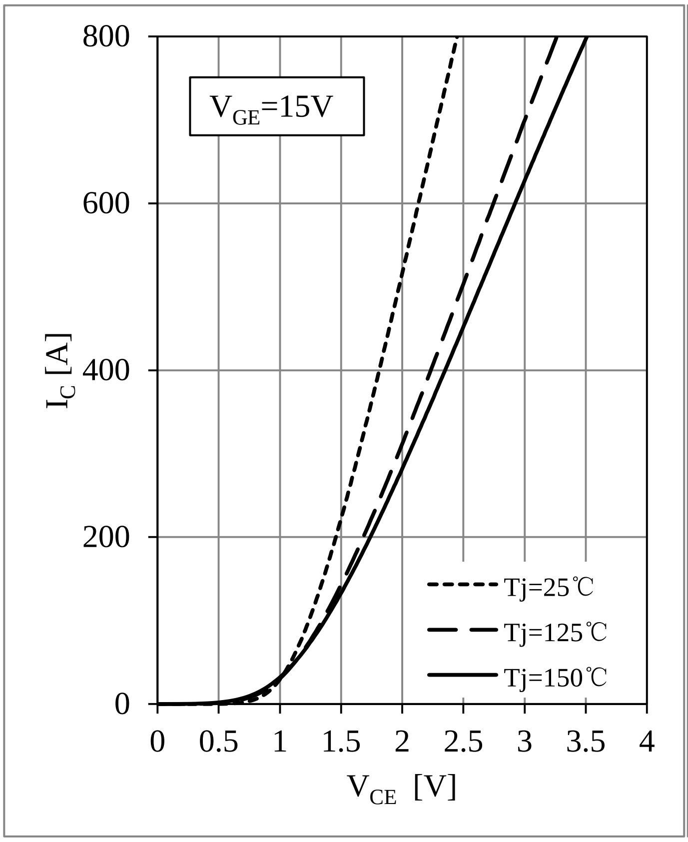


Fig 1. IGBT Output Characteristics

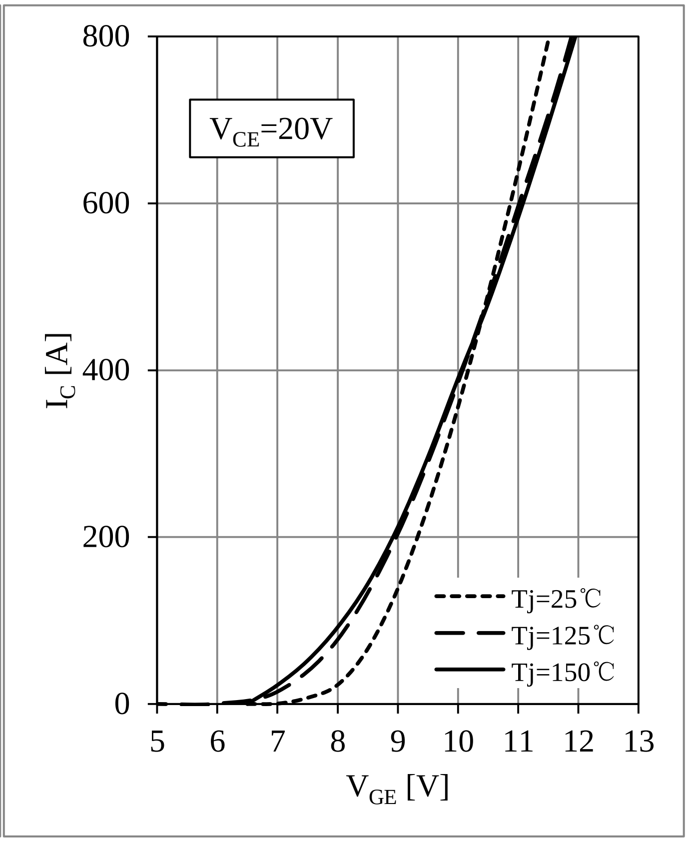


Fig 2. IGBT Transfer Characteristics

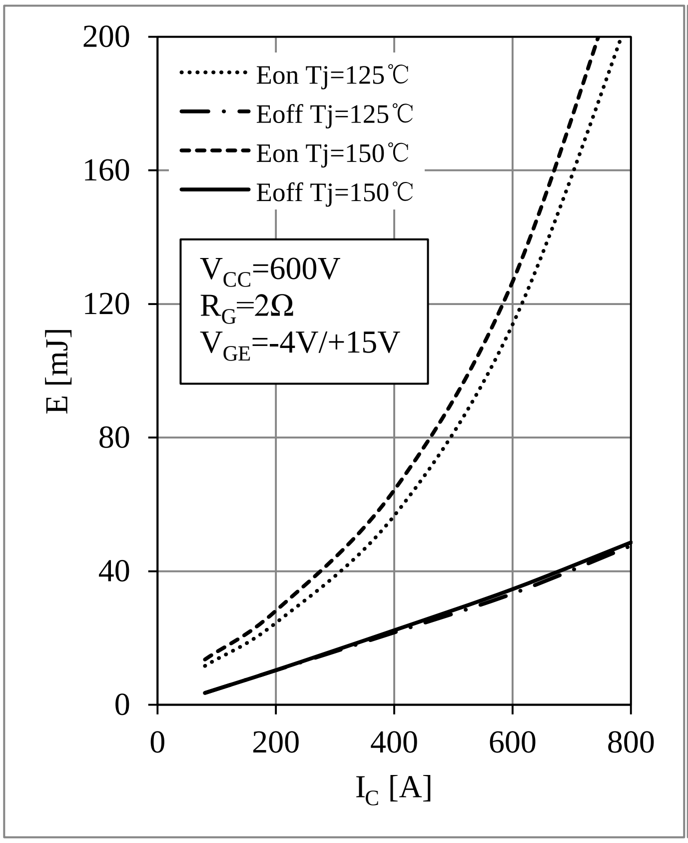


Fig 3. IGBT Switching Loss vs. IC

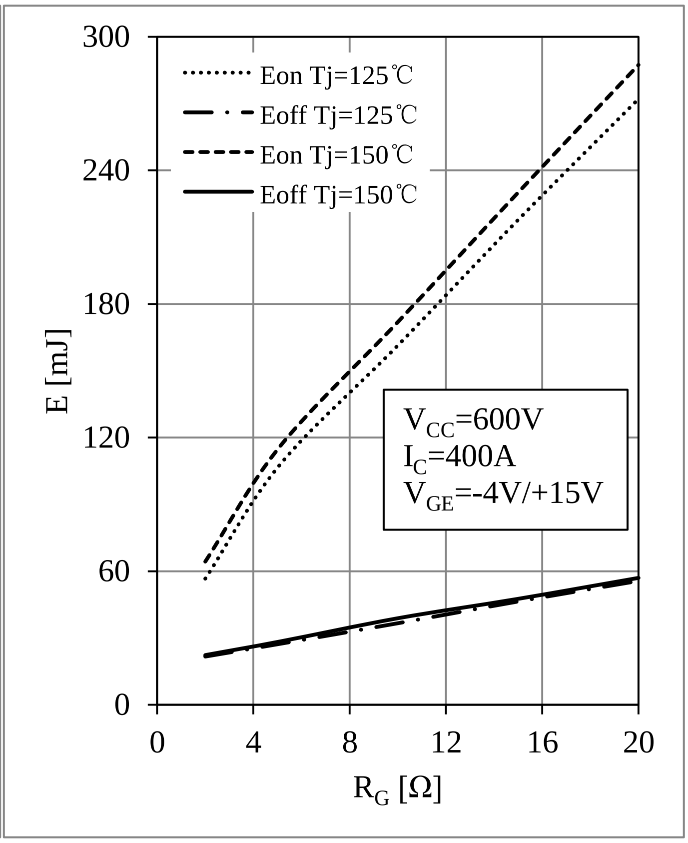


Fig 4. IGBT Switching Loss vs. RG

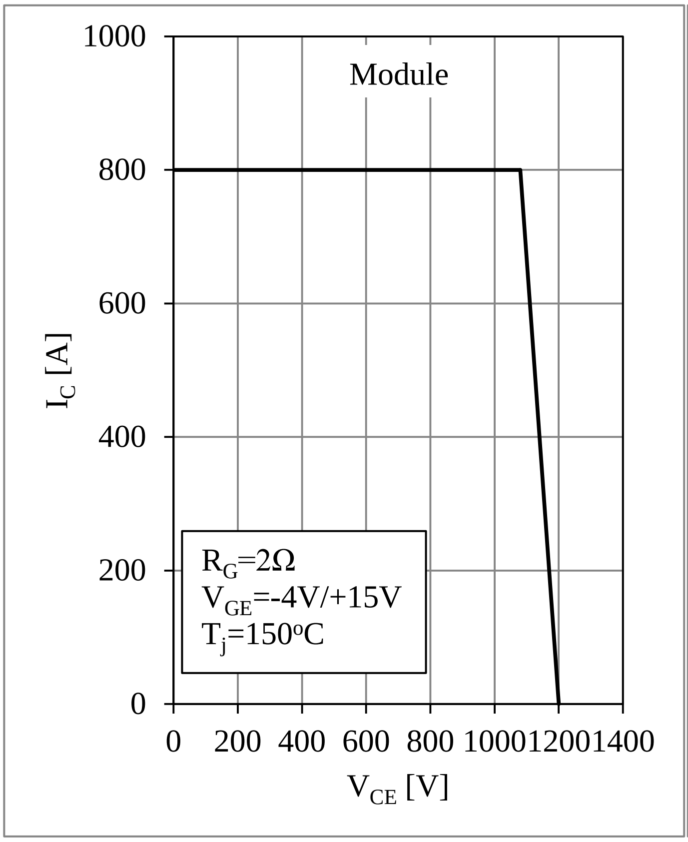


Fig 5. RBSOA

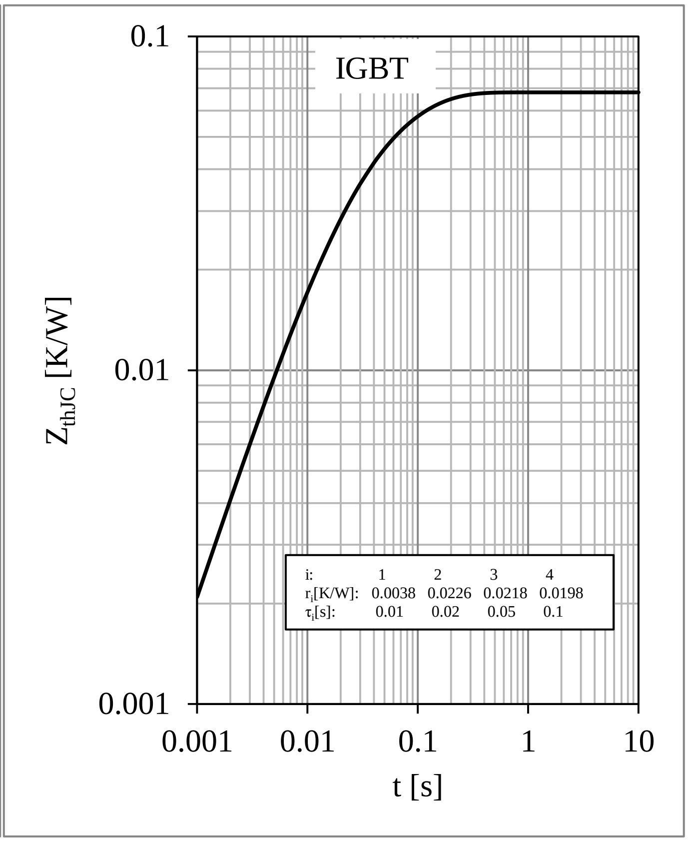


Fig 6. IGBT Transient Thermal Impedance

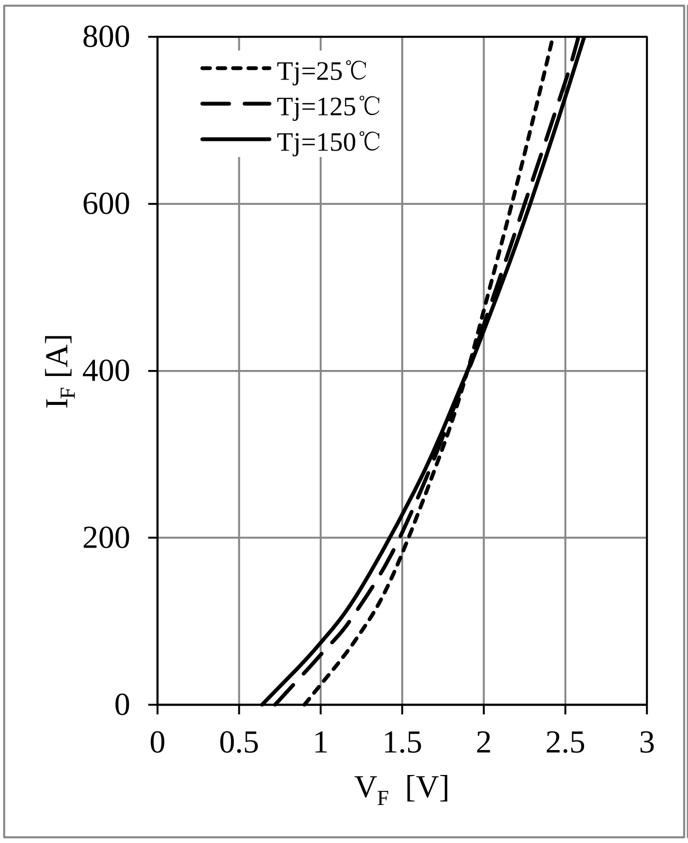


Fig 7. Diode Forward Characteristics

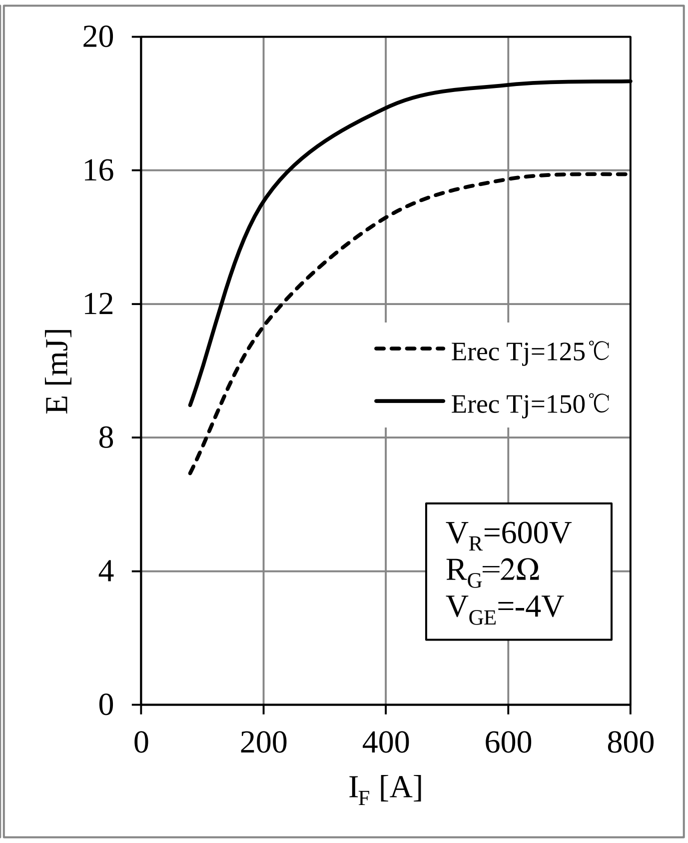


Fig 8. Diode Switching Loss vs. I_F

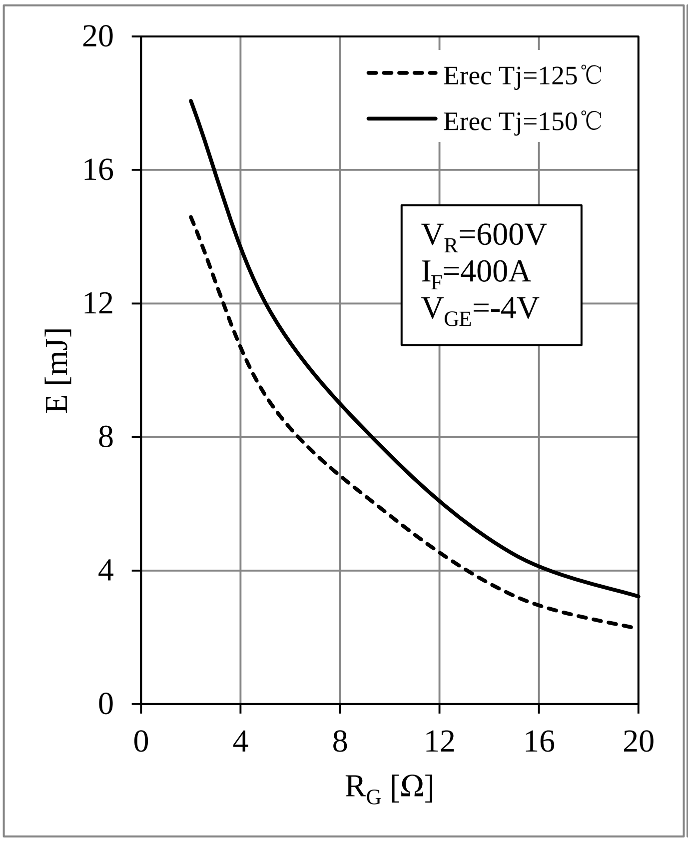


Fig 9. Diode Switching Loss vs. R_G

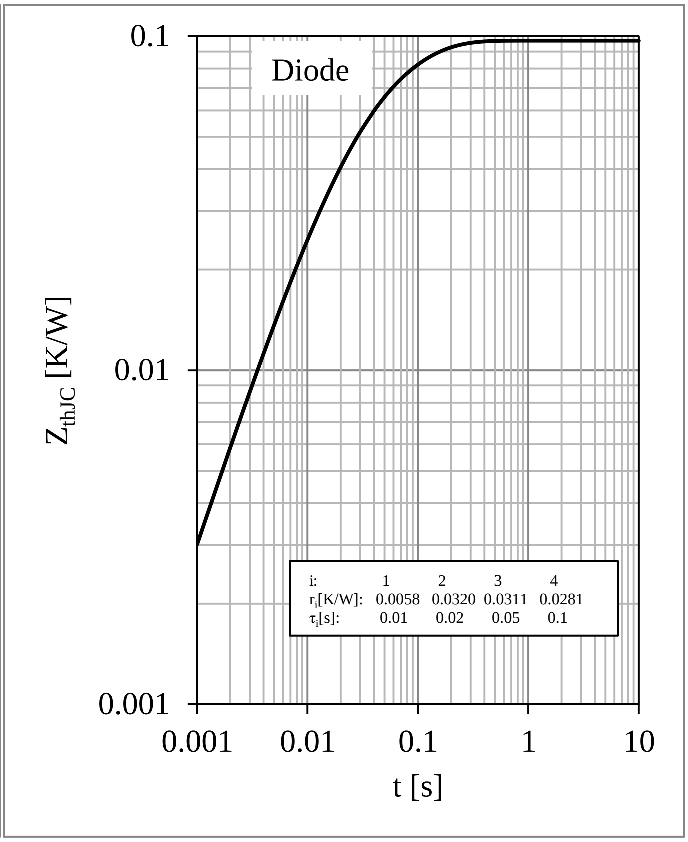
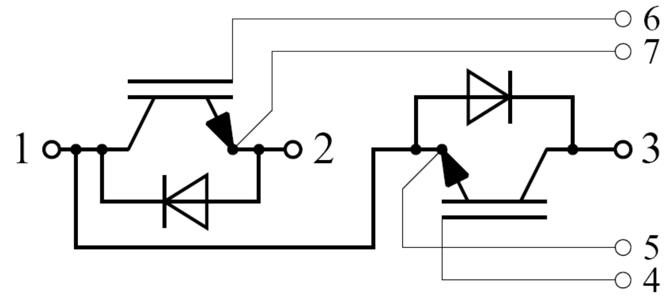


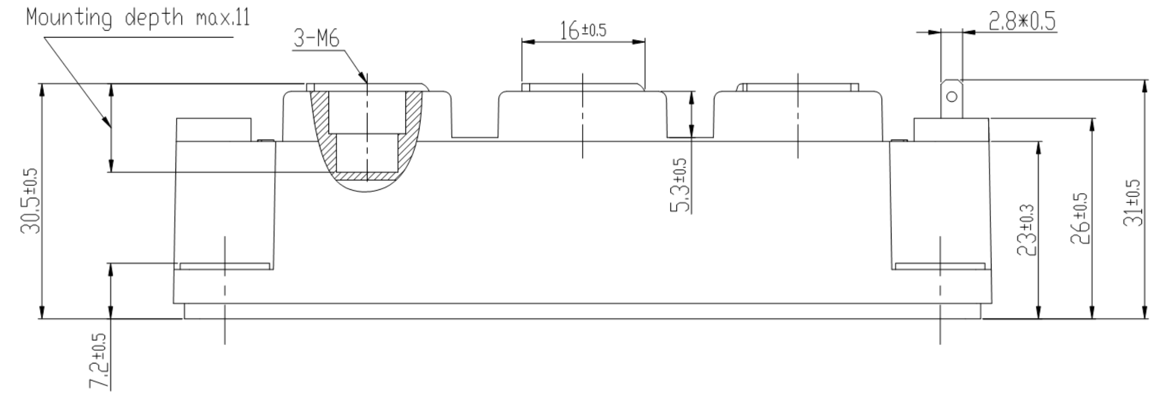
Fig 10. Diode Transient Thermal Impedance

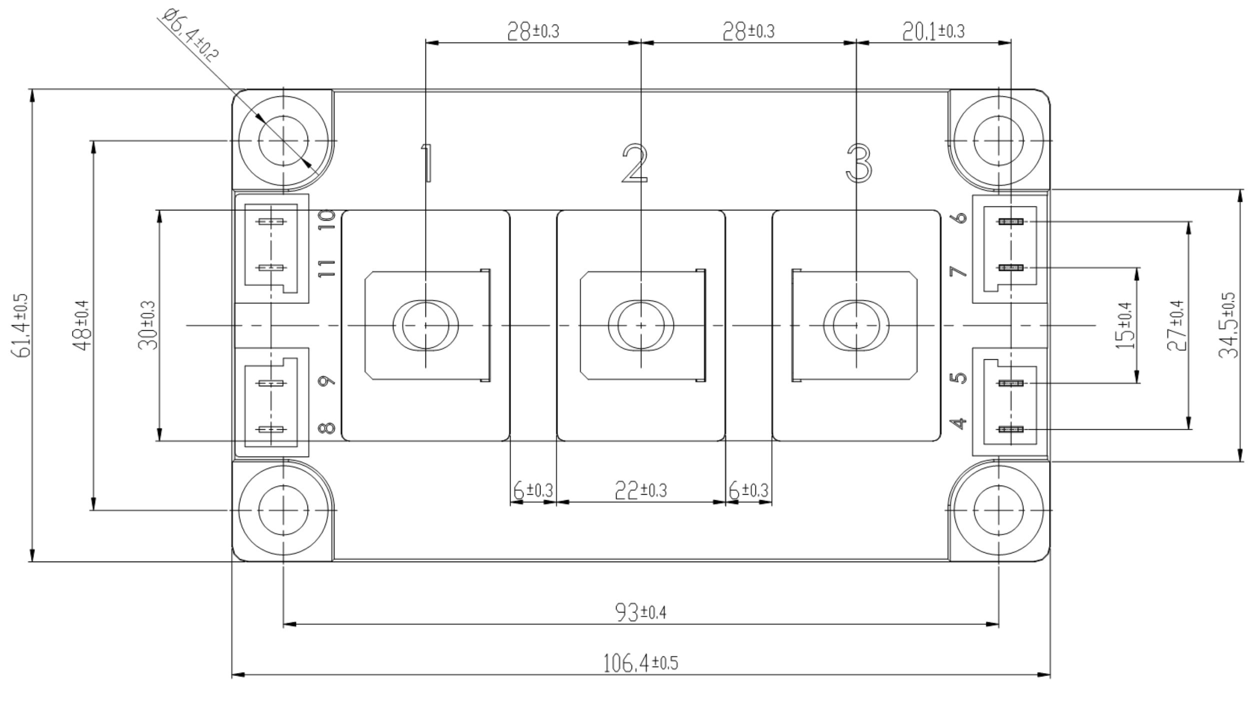
Circuit Schematic



Package Dimensions

Dimensions in Millimeters





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