STARPOWER

SEMICONDUCTOR **IGBT**

GD400HFX120C2S

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 general inverters and UPS.

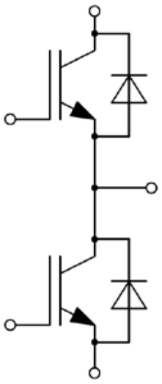
Features

- 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

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°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=25°C @ T_C=90°C	595 400	A
I_{CM}	Pulsed Collector Current t_p=1ms	800	A
P_D	Maximum Power Dissipation @ T_j=175°C	1875	W

Diode

Symbol	Description	Value	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	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=400A,V_{GE}=15V, T_j=25°C		1.75	2.20	V
		I_C=400A,V_{GE}=15V, T_j=125°C		2.00		
		I_C=400A,V_{GE}=15V, T_j=150°C		2.05		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=10.0mA,V_{CE}=V_{GE}, T_j=25°C	5.2	6.0	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			0.5		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		37.3		nF
C_{res}	Reverse Transfer Capacitance			1.04		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		2.80		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=2.0Ω,V_{GE}=±15V, T_j=25°C		205		ns
t_r	Rise Time			77		ns
$t_{d(off)}$	Turn-Off Delay Time			597		ns
t_f	Fall Time			98		ns
E_{on}	Turn-On Switching Loss			18.8		mJ
E_{off}	Turn-Off Switching Loss			32.3		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=2.0Ω,V_{GE}=±15V, T_j=125°C		214		ns
t_r	Rise Time			86		ns
$t_{d(off)}$	Turn-Off Delay Time			626		ns
t_f	Fall Time			137		ns
E_{on}	Turn-On Switching Loss			28.4		mJ
E_{off}	Turn-Off Switching Loss			48.9		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=2.0Ω,V_{GE}=±15V, T_j=150°C		198		ns
t_r	Rise Time			94		ns
$t_{d(off)}$	Turn-Off Delay Time			646		ns
t_f	Fall Time			147		ns
E_{on}	Turn-On Switching Loss			30.8		mJ
E_{off}	Turn-Off Switching Loss			53.8		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		1440		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=400A,V_{GE}=0V,T_j=25°C		1.75	2.15	V
		I_F=400A,V_{GE}=0V,T_j=125°C		1.65		
		I_F=400A,V_{GE}=0V,T_j=150°C		1.65		
Q_r	Recovered Charge	V_R=600V,I_F=400A, -di/dt=5000A/μs,V_{GE}=-15V T_j=25°C		40		μC
I_{RM}	Peak Reverse Recovery Current			299		A
E_{rec}	Reverse Recovery Energy			20.0		mJ
Q_r	Recovered Charge	V_R=600V,I_F=400A, -di/dt=5000A/μs,V_{GE}=-15V T_j=125°C		70		μC
I_{RM}	Peak Reverse Recovery Current			399		A
E_{rec}	Reverse Recovery Energy			38.4		mJ
Q_r	Recovered Charge	V_R=600V,I_F=400A, -di/dt=5000A/μs,V_{GE}=-15V T_j=150°C		80		μC
I_{RM}	Peak Reverse Recovery Current			419		A
E_{rec}	Reverse Recovery Energy			43.9		mJ

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		15		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.25		mΩ
R_{thJC}	Junction-to-Case (per IGBT) Junction-to-Case (per Diode)			0.080 0.095	K/W
R_{thCH}	Case-to-Heatsink (per IGBT) Case-to-Heatsink (per Diode) Case-to-Heatsink (per Module)		0.037 0.044 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

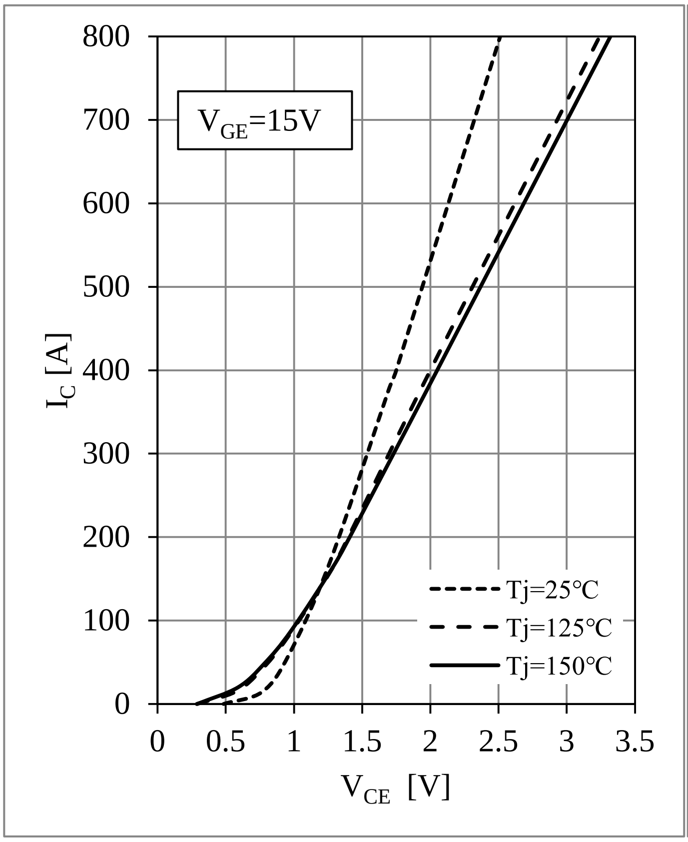


Fig 1. IGBT Output Characteristics

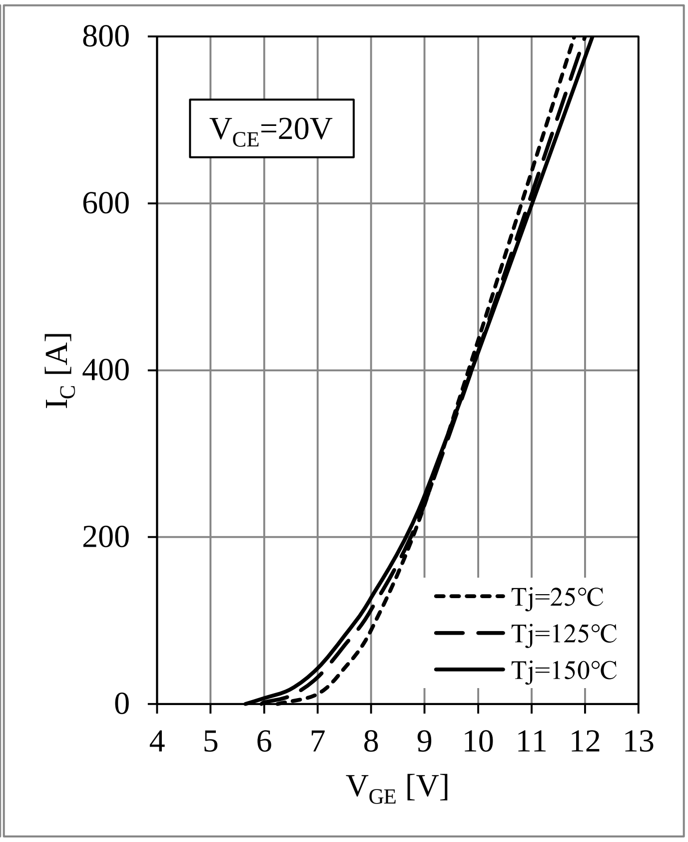


Fig 2. IGBT Transfer Characteristics

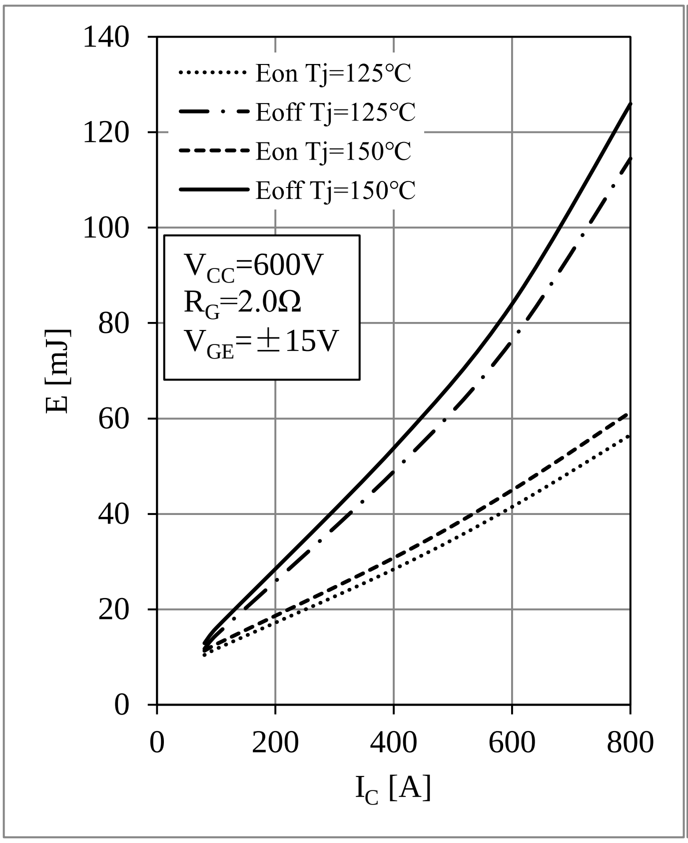


Fig 3. IGBT Switching Loss vs. I_C

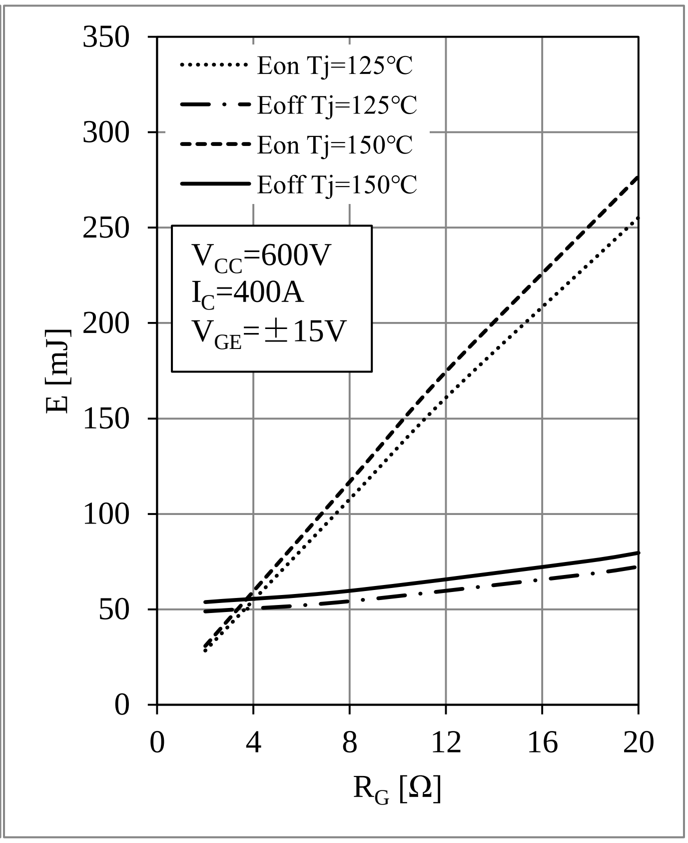


Fig 4. IGBT Switching Loss vs. R_G

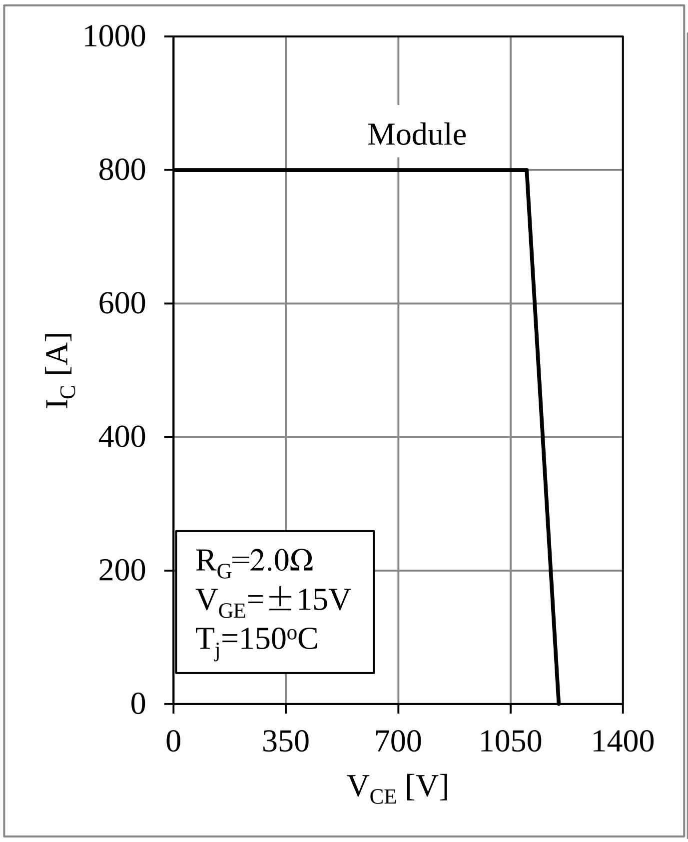


Fig 5. RBSOA

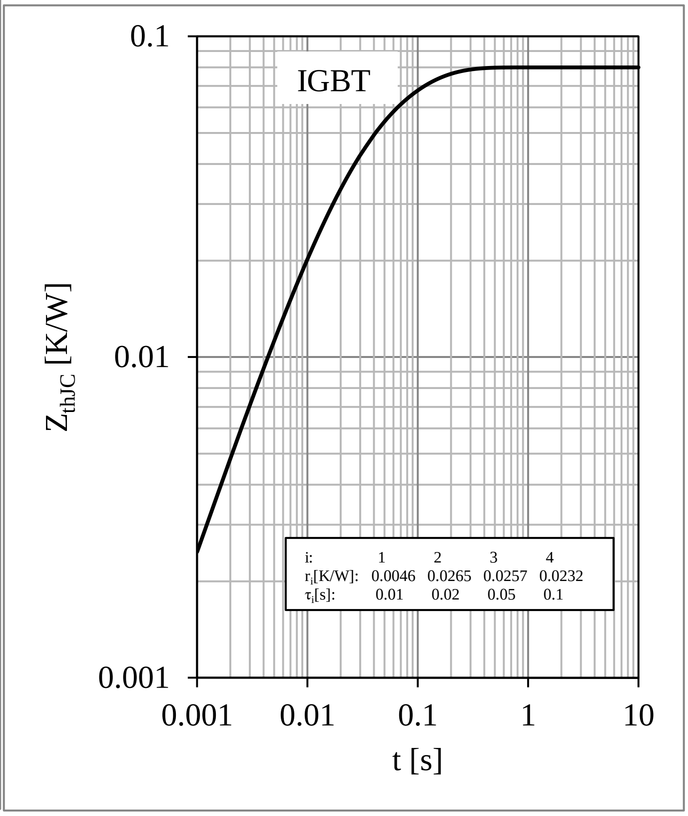


Fig 6. IGBT Transient Thermal Impedance

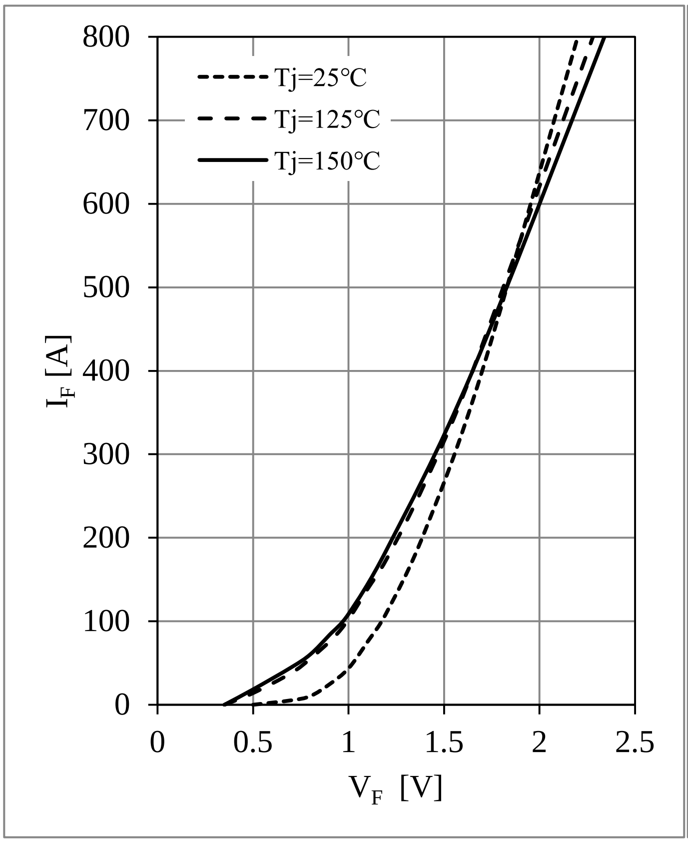


Fig 7. Diode Forward Characteristics

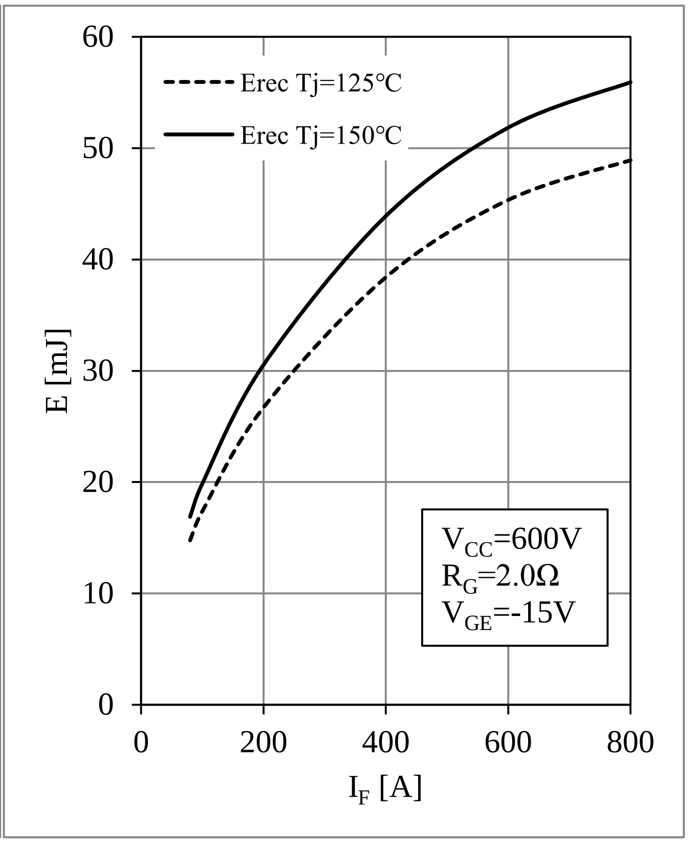


Fig 8. Diode Switching Loss vs. I_F

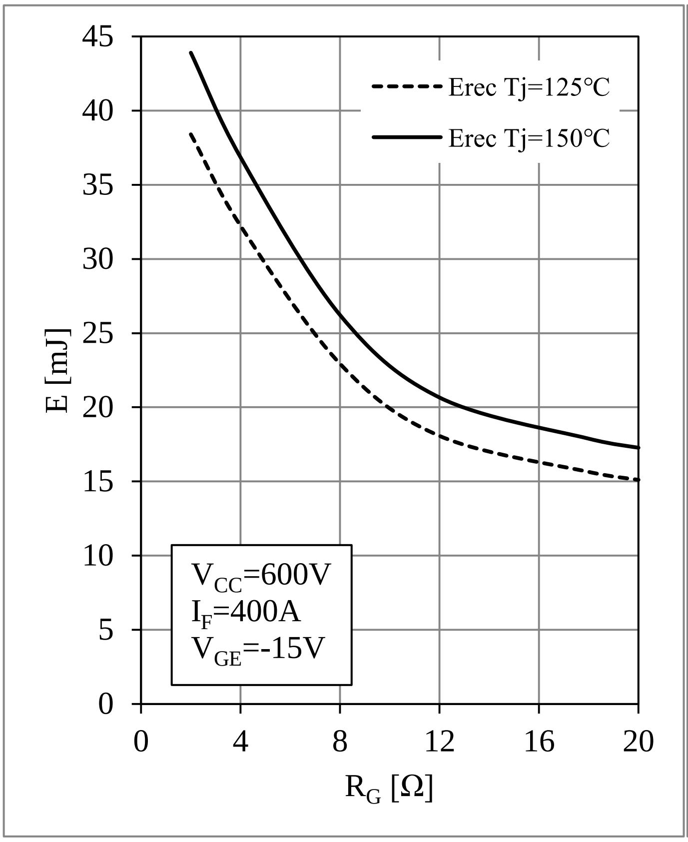


Fig 9. Diode Switching Loss vs. R_G

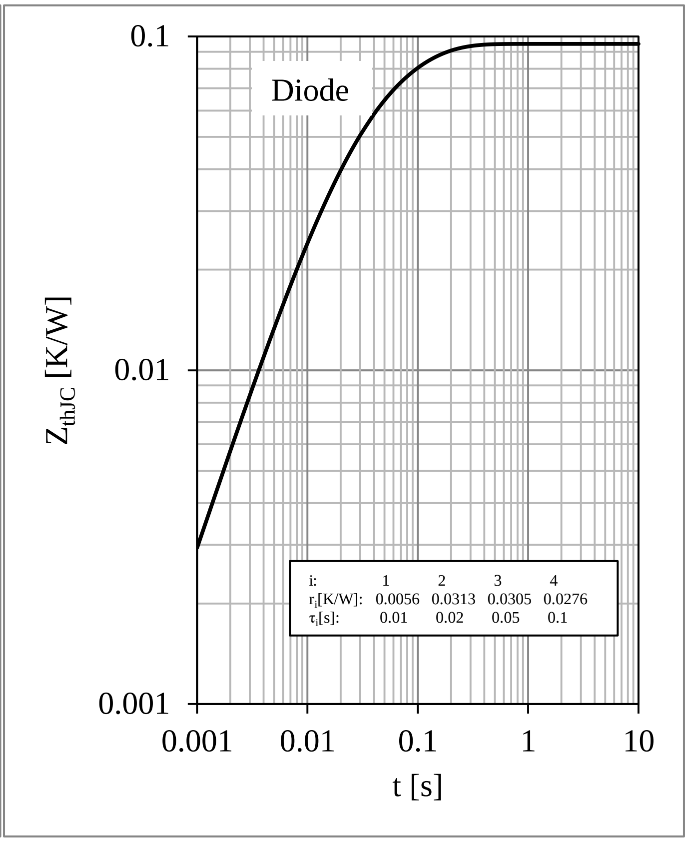
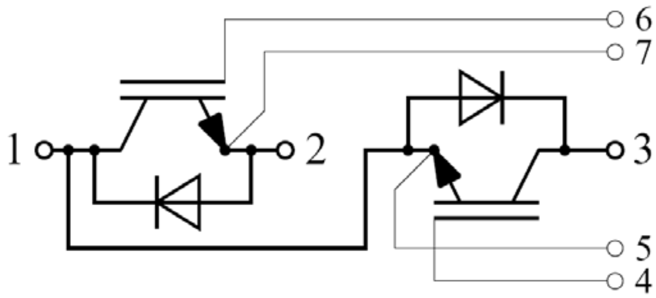


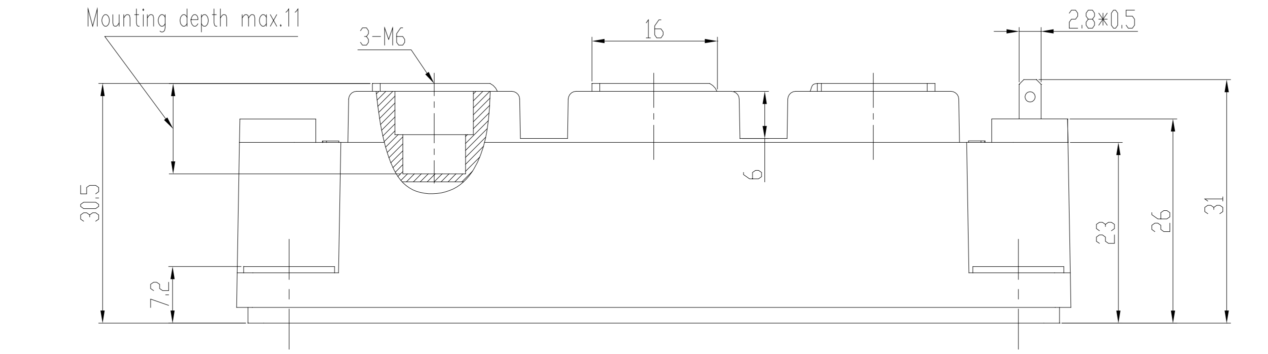
Fig 10. Diode Transient Thermal Impedance

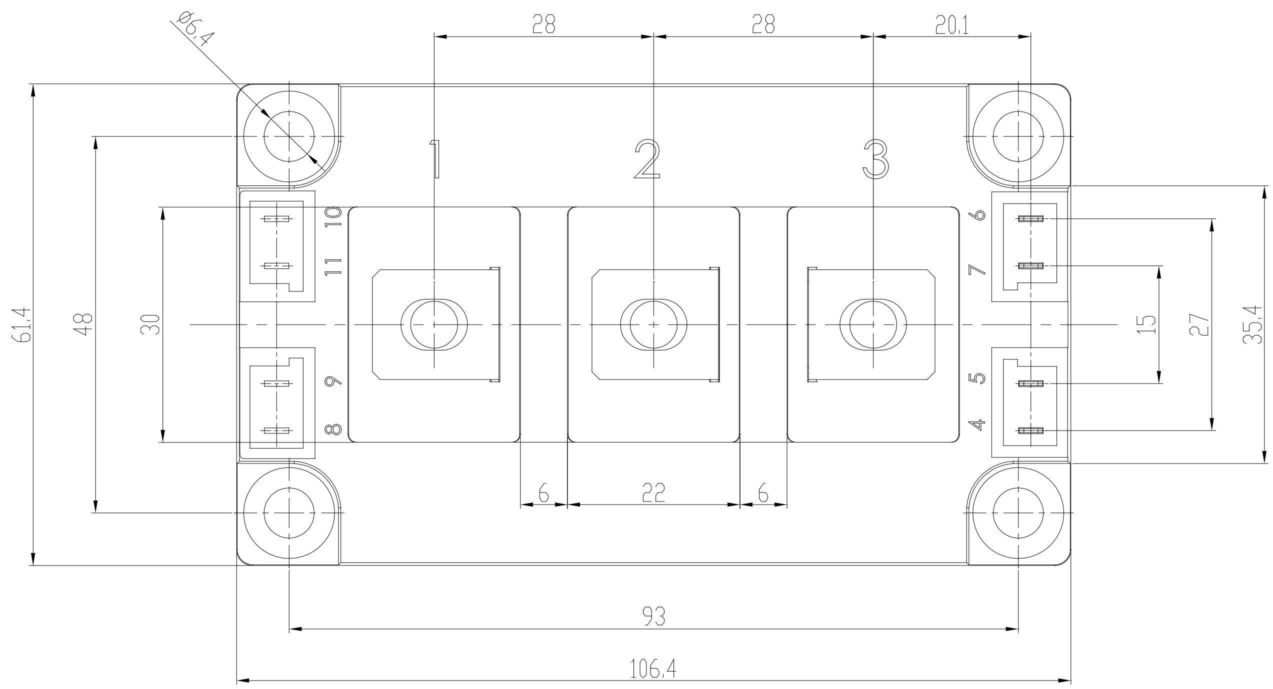
Circuit Schematic



Package Dimensions

Dimensions in Millimeters





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