STARPOWER

SEMICONDUCTOR **IGBT**

GD600HFX65C2S

650V/600A 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.

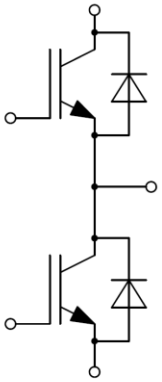
Features

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

- Automotive application
- Hybrid and electric vehicle
- Inverter for motor drive

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°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°C @ T_C=70°C	882 600	A
I_{CM}	Pulsed Collector Current t_p=1ms	1200	A
P_D	Maximum Power Dissipation @ T_{vj}=175°C	1898	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	600	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	1200	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	°C
T_{vjop}	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=600A,V_{GE}=15V, T_{vj}=25°C		1.45	1.90	V
		I_C=600A,V_{GE}=15V, T_{vj}=125°C		1.60		
		I_C=600A,V_{GE}=15V, T_{vj}=150°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=9.60mA,V_{CE}=V_{GE}, T_{vj}=25°C	5.1	5.8	6.5	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_{vj}=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_{vj}=25°C			400	nA
R_{Gint}	Internal Gate Resistance			0.5		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		73.7		nF
C_{res}	Reverse Transfer Capacitance			1.68		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		4.32		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=600A, R_G=2.4Ω, Ls=45nH, V_{GE}=±15V,T_{vj}=25°C		402		ns
t_r	Rise Time			137		ns
$t_{d(off)}$	Turn-Off Delay Time			346		ns
t_f	Fall Time			79		ns
E_{on}	Turn-On Switching Loss			12.9		mJ
E_{off}	Turn-Off Switching Loss			20.2		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=600A, R_G=2.4Ω, Ls=45nH, V_{GE}=±15V,T_{vj}=125°C		408		ns
t_r	Rise Time			146		ns
$t_{d(off)}$	Turn-Off Delay Time			363		ns
t_f	Fall Time			86		ns
E_{on}	Turn-On Switching Loss			18.5		mJ
E_{off}	Turn-Off Switching Loss			21.2		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=600A, R_G=2.4Ω, Ls=45nH, V_{GE}=±15V,T_{vj}=150°C		412		ns
t_r	Rise Time			154		ns
$t_{d(off)}$	Turn-Off Delay Time			366		ns
t_f	Fall Time			86		ns
E_{on}	Turn-On Switching Loss			20.9		mJ
E_{off}	Turn-Off Switching Loss			21.6		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_{vj}=150°C,V_{CC}=360V, V_{CEM}≤650V		3000		A

Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_C=600A,V_{GE}=0V,T_{vj}=25°C		1.55	2.00	V
		I_C=600A,V_{GE}=0V,T_{vj}=125°C		1.60		
		I_C=600A,V_{GE}=0V,T_{vj}=150°C		1.60		
Q_r	Recovered Charge	V_R=300V,I_F=600A, -di/dt=3900A/μs, Ls=45nH, V_{GE}=-15V,T_{vj}=25°C		16.2		μC
I_{RM}	Peak Reverse Recovery Current			215		A
E_{rec}	Reverse Recovery Energy			2.77		mJ
Q_r	Recovered Charge	V_R=300V,I_F=600A, -di/dt=3500A/μs, Ls=45nH, V_{GE}=-15V,T_{vj}=125°C		28.6		μC
I_{RM}	Peak Reverse Recovery Current			251		A
E_{rec}	Reverse Recovery Energy			4.80		mJ
Q_r	Recovered Charge	V_R=300V,I_F=600A, -di/dt=3400A/μs, Ls=45nH, V_{GE}=-15V,T_{vj}=150°C		32.5		μC
I_{RM}	Peak Reverse Recovery Current			256		A
E_{rec}	Reverse Recovery Energy			5.30		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)			0.079 0.131	K/W
R_{thCH}	Case-to-Heatsink (per IGBT) Case-to-Heatsink (per Diode) Case-to-Heatsink (per Module)		0.032 0.053 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

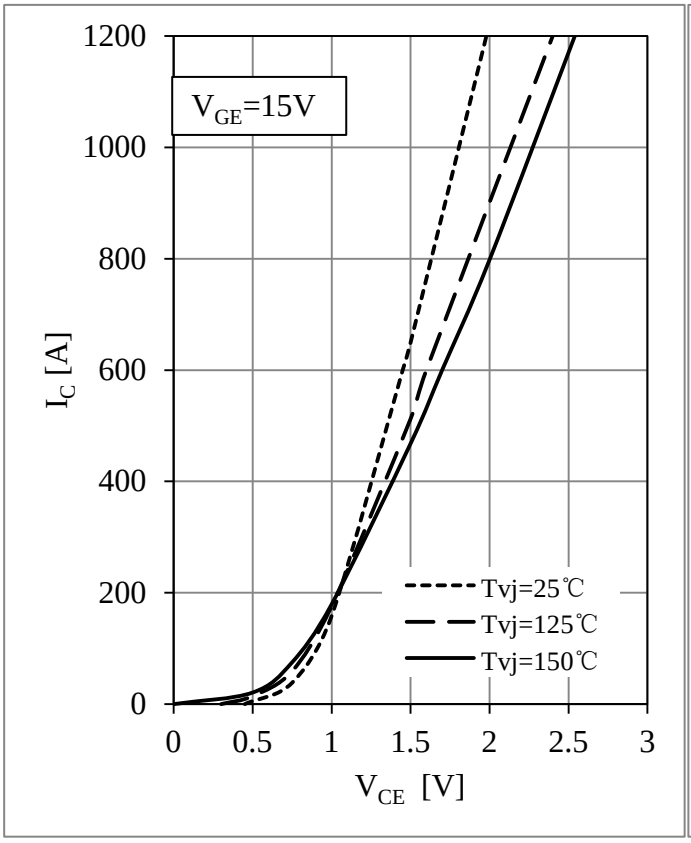


Fig 1. IGBT Output Characteristics

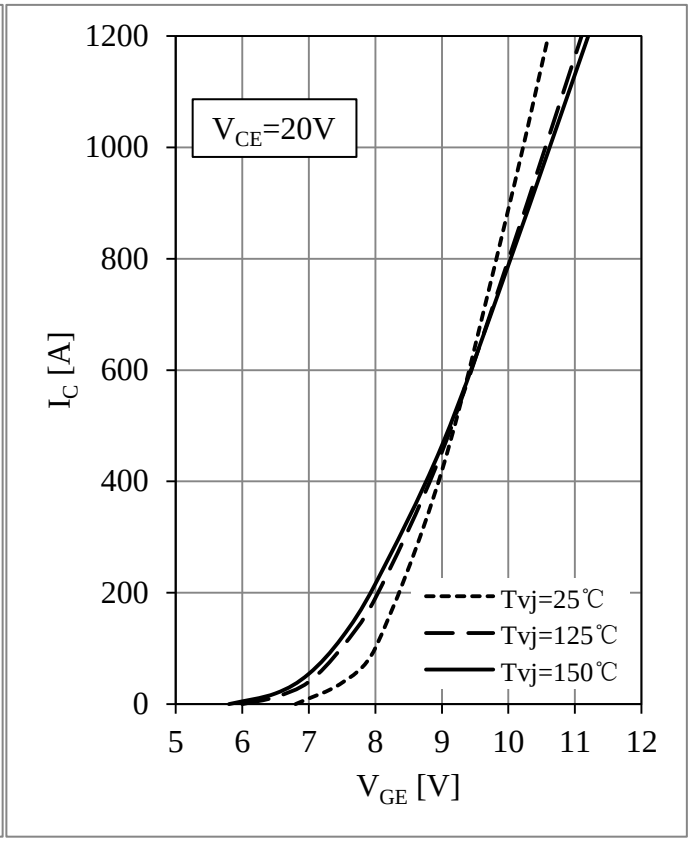


Fig 2. IGBT Transfer Characteristics

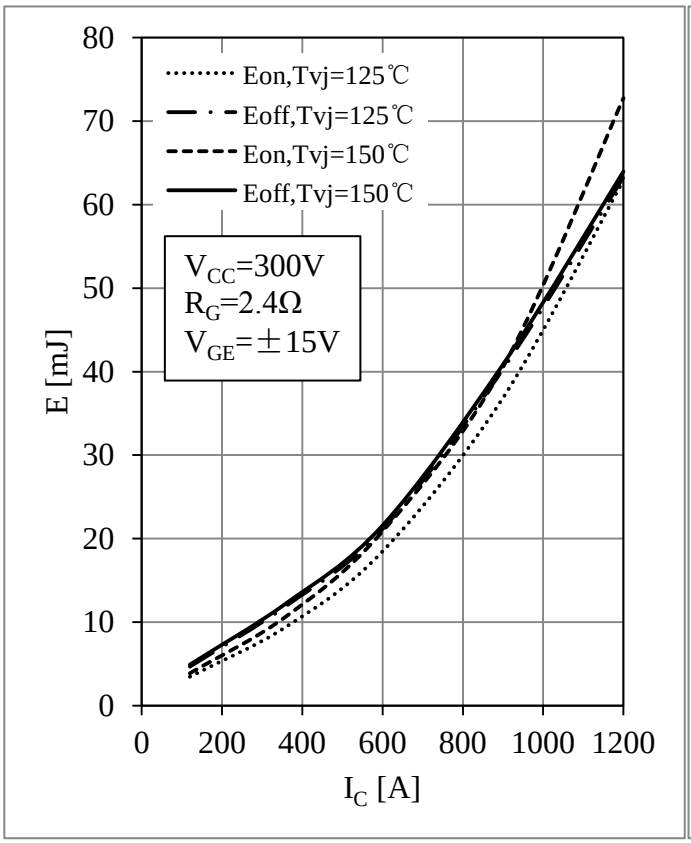


Fig 3. IGBT Switching Loss vs. I_C

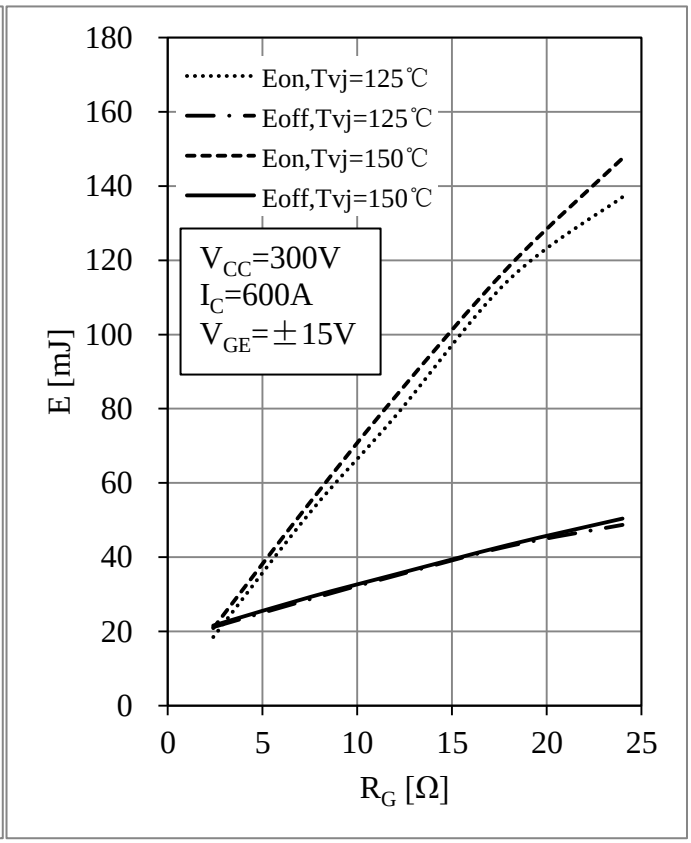


Fig 4. IGBT Switching Loss vs. R_G

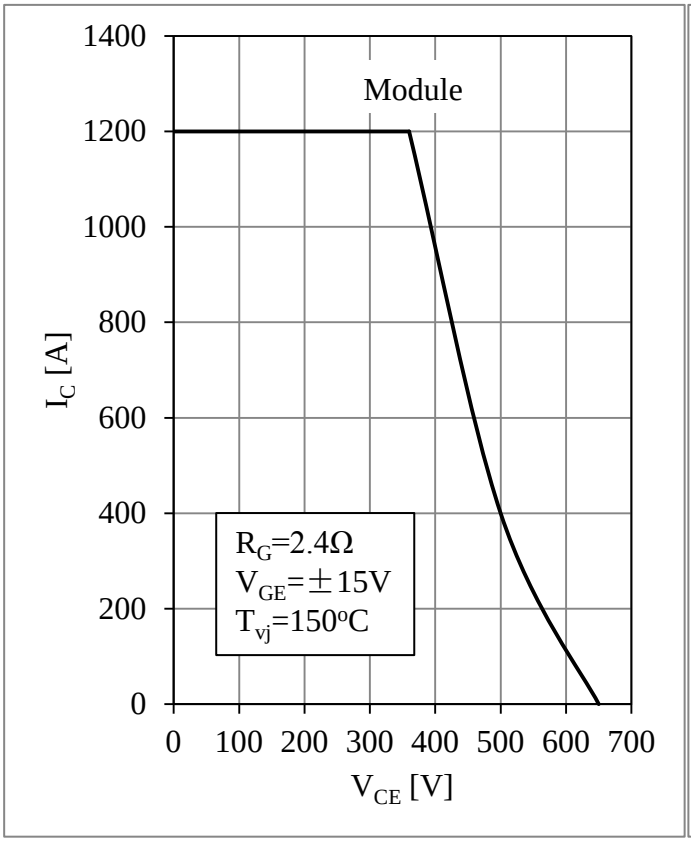


Fig 5. RBSOA

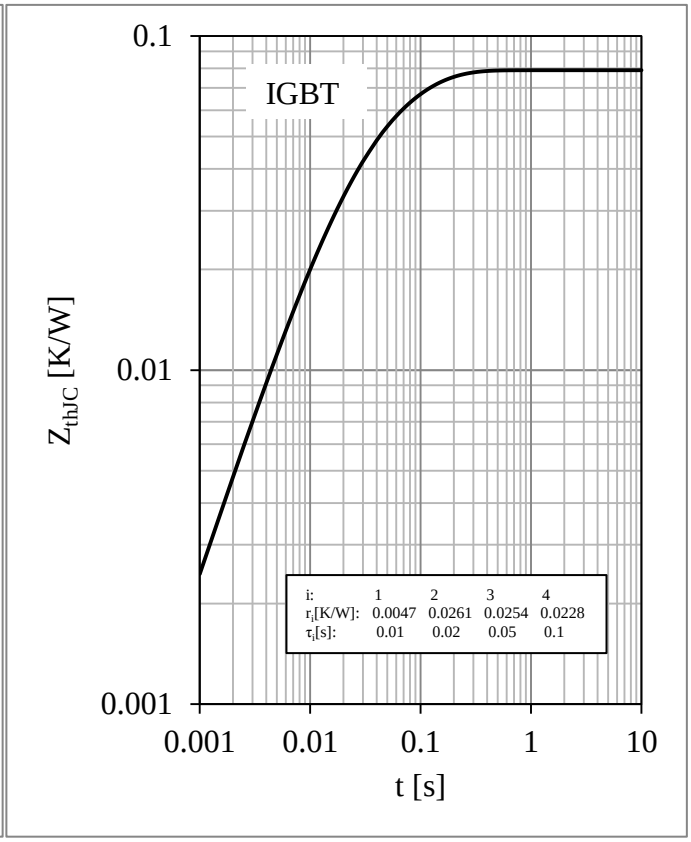


Fig 6. IGBT Transient Thermal Impedance

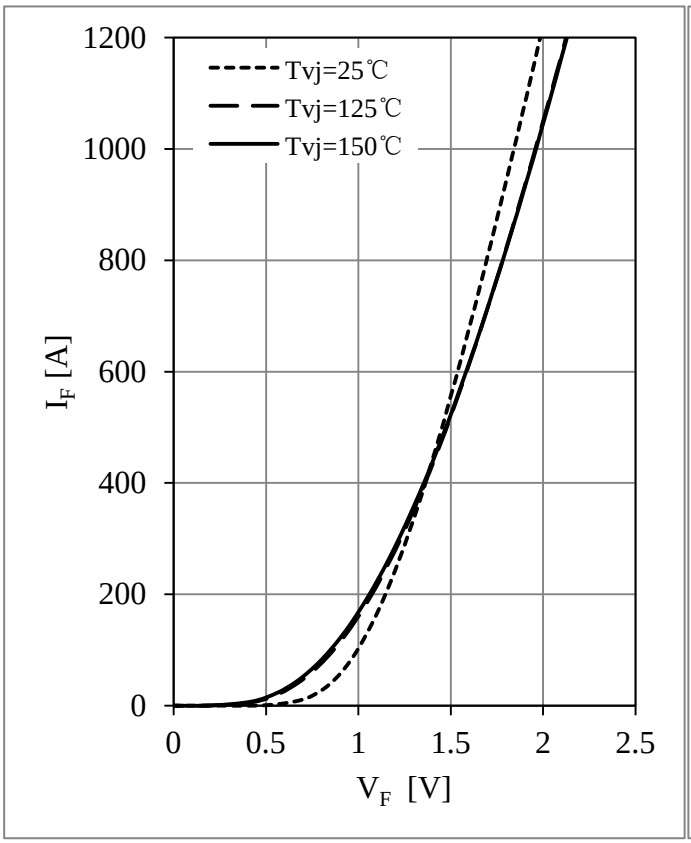


Fig 7. Diode Forward Characteristics

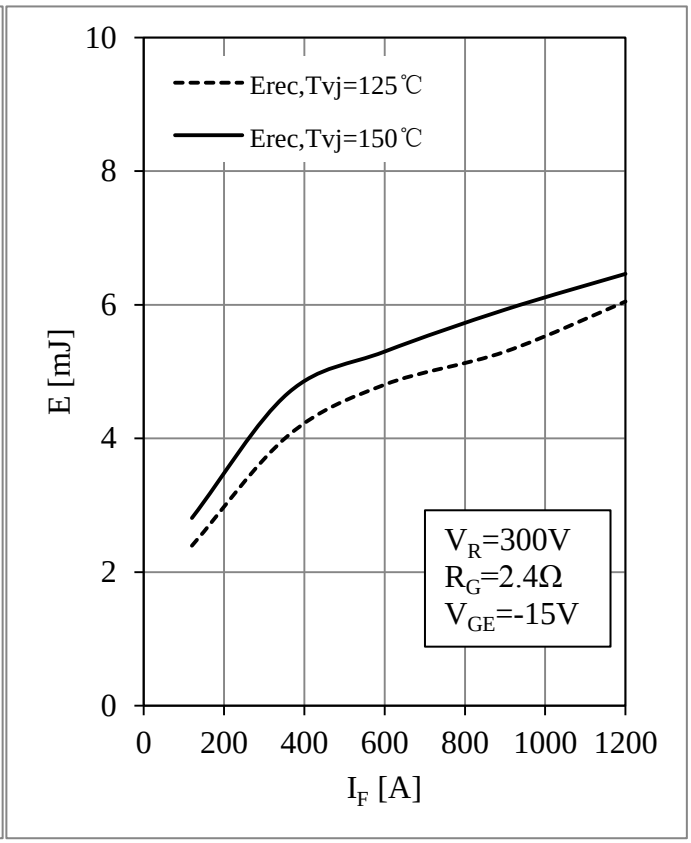


Fig 8. Diode Switching Loss vs. I_F

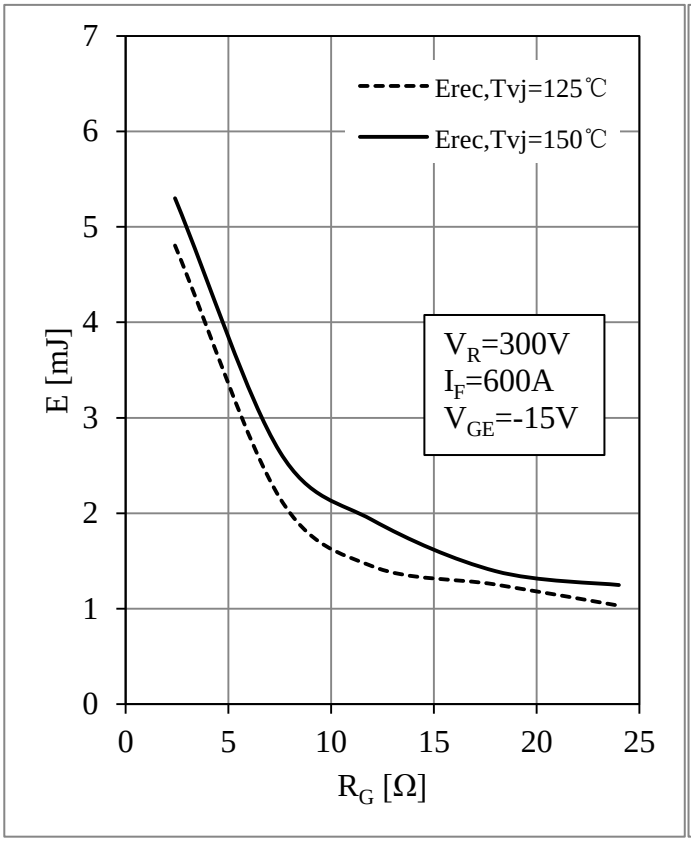


Fig 9. Diode Switching Loss vs. R_G

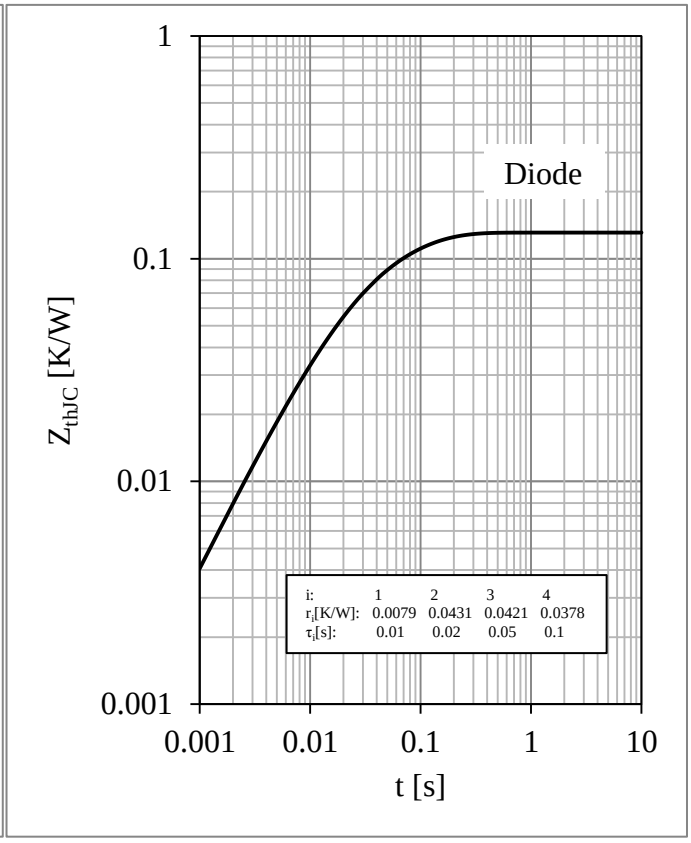
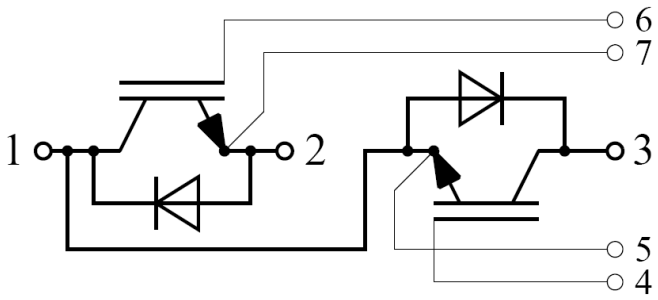


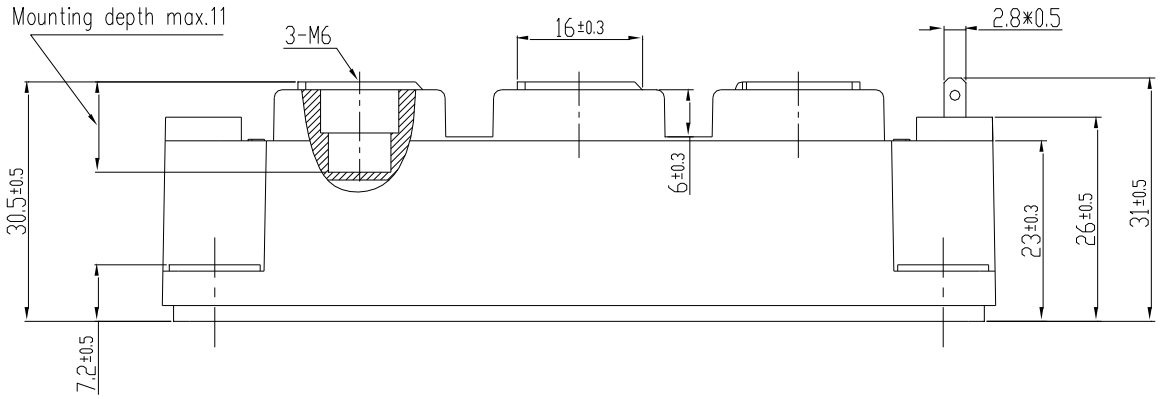
Fig 10. Diode Transient Thermal Impedance

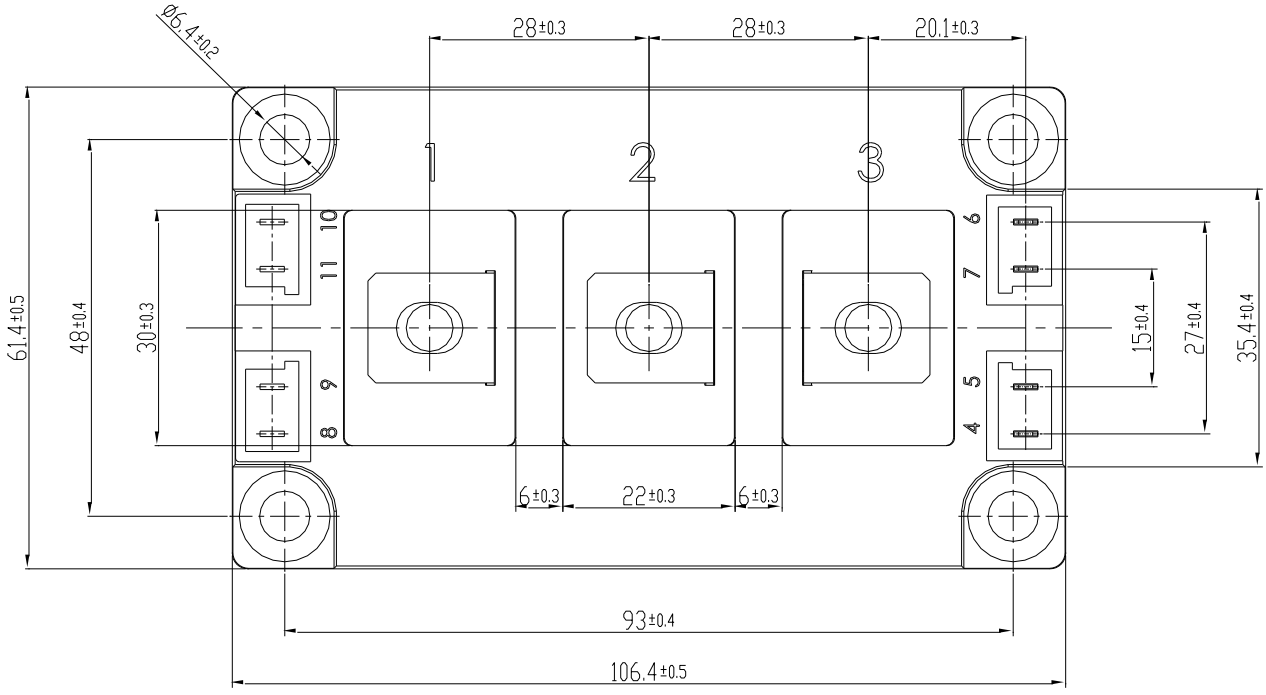
Circuit Schematic



Package Dimensions

Dimensions in Millimeters





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