STARPOWER

SEMICONDUCTOR™

IGBT

GD400HFT60C2S

Molding Type Module

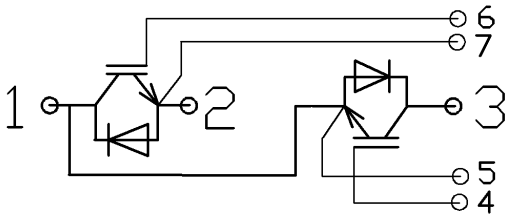
600V/400A 2 in one-package

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 UPS and SMPS.

Features

- Low $V_{CE(sat)}$ trench IGBT technology
- Low switching losses
- 5μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175℃
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Equivalent Circuit Schematic

Typical Applications

- UPS
- Switching mode power supplies
- Electronic welders

Absolute Maximum Ratings T_C=25℃ unless otherwise noted

Symbol	Description	GD400HFT60C2S	Units
V_{CES}	Collector-Emitter Voltage	600	V

Symbol	Description	GD400HFT60C2S	Units
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=25℃	530	A
	@ T_C=80℃	400	
$I_{CM(1)}$	Pulsed Collector Current t_p=1ms	800	A
I_F	Diode Continuous Forward Current	400	A
I_{FM}	Diode Maximum Forward Current	800	A
P_D	Maximum Power Dissipation @ T_j=175℃	1600	W
T_{SC}	Short Circuit Withstand Time @ T_j=125℃	5	μs
T_j	Maximum Junction Temperature	175	℃
T_{STG}	Storage Temperature Range	-40 to +125	℃
I^2t-value,Diode	V_R=0V,t=10ms,T_j=125℃	10900	A^2s
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	2500	V
Mounting Torque	Power Terminal Screw:M6	2.5 to 5.0	N.m
	Mounting Screw:M6	3.0 to 5.0	N.m

Notes:

(1) Repetitive rating: Pulse width limited by max. junction temperature

Electrical Characteristics of IGBT T_C=25℃ unless otherwise noted

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	V_{GE}=0V, I_C=2.0mA, T_j=25℃	600			V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25℃			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25℃			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=4.0mA,V_{CE}=V_{GE}, T_j=25℃	4.0		6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=400A,V_{GE}=15V, T_j=25℃		1.60	2.05	V
		I_C=400A,V_{GE}=15V, T_j=175℃		2.00		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=400A,		35		ns
t_r	Rise Time	R_G=1.3Ω,V_{GE}=±15V,		70		ns
$t_{d(off)}$	Turn-Off Delay Time	T_j=25℃		180		ns

t_f	Fall Time	V_{CC}=400V,I_C=400A, R_G=1.3Ω,V_{GE}=±15V, T_j=25℃		75		ns
E_{on}	Turn-On Switching Loss			14.1		mJ
E_{off}	Turn-Off Switching Loss			10.0		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=400A, R_G=1.3Ω,V_{GE}=±15V, T_j=175℃		37		ns
t_r	Rise Time			72		ns
$t_{d(off)}$	Turn-Off Delay Time			220		ns
t_f	Fall Time			84		ns
E_{on}	Turn-On Switching Loss			23.2		mJ
E_{off}	Turn-Off Switching Loss			16.8		mJ
C_{ies}	Input Capacitance	V_{CE}=30V,f=1MHz, V_{GE}=0V		30.8		nF
C_{oes}	Output Capacitance			2.12		nF
C_{res}	Reverse Transfer Capacitance			0.92		nF
I_{SC}	SC Data	t_{SC}≤5μs,V_{GE}=15V, T_j=125℃,V_{CC}=360V, V_{CEM}≤600V		TBD		A
R_{Gint}	Internal Gate Resistance			1.3		Ω
L_{CE}	Stray Inductance				20	nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip	T_C=25℃		0.35		mΩ

Electrical Characteristics of DIODE T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=400A	T_j=25℃		1.38	1.80	V
			T_j=125℃		1.41		
Q_r	Diode Reverse Recovery Charge	I_F=400A, V_R=300V, di/dt=-7000A/μs, V_{GE}=-15V	T_j=25℃		15.5		μC
			T_j=125℃		28.5		
I_{RM}	Diode Peak Reverse Recovery Current		T_j=25℃		265		A
			T_j=125℃		335		
E_{rec}	Reverse Recovery Energy		T_j=25℃		3.5		mJ
			T_j=125℃		7.5		

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case (IGBT Part, per 1/2 Module)		0.094	K/W
$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/2 Module)		0.158	K/W
$R_{\theta JC}$	Case-to-Sink (Conductive grease applied)	0.035		K/W
Weight	Weight of Module	300		g

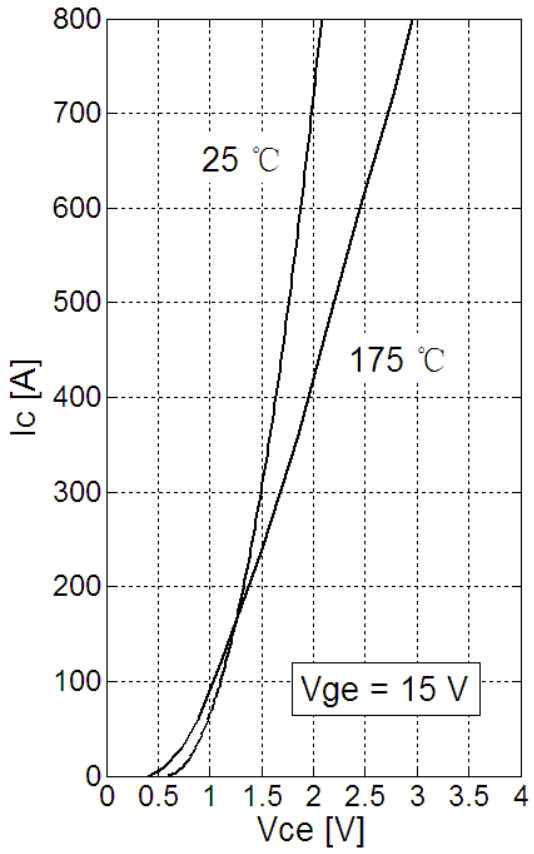


Fig 1. IGBT Typical Output Characteristics

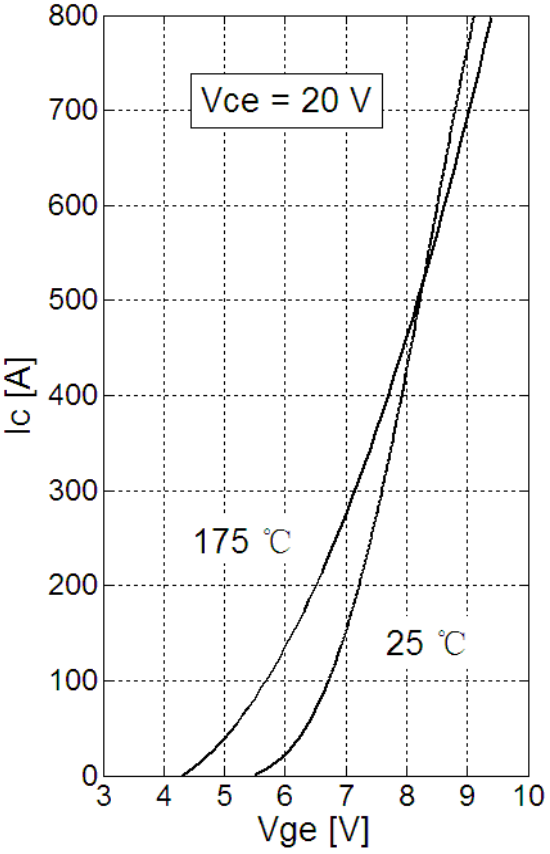


Fig 2. IGBT Typical Transfer Characteristics

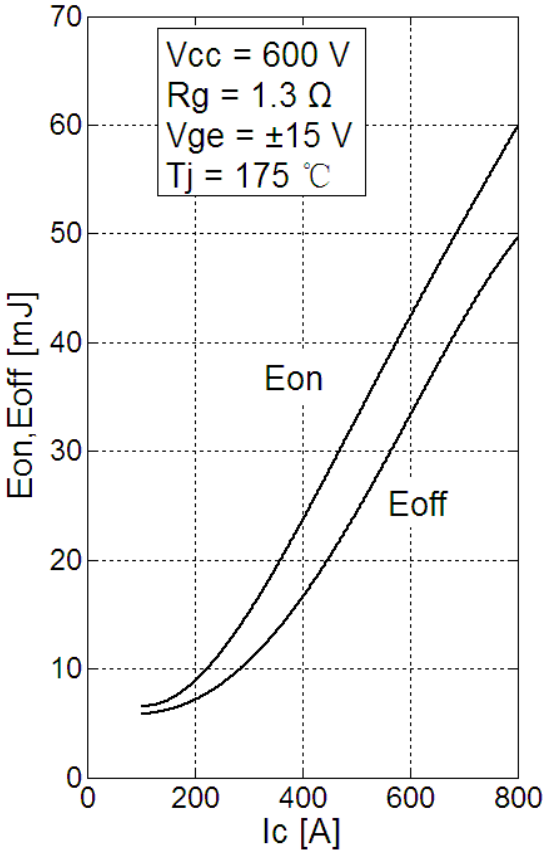


Fig 3. IGBT Switching Loss vs. I_C

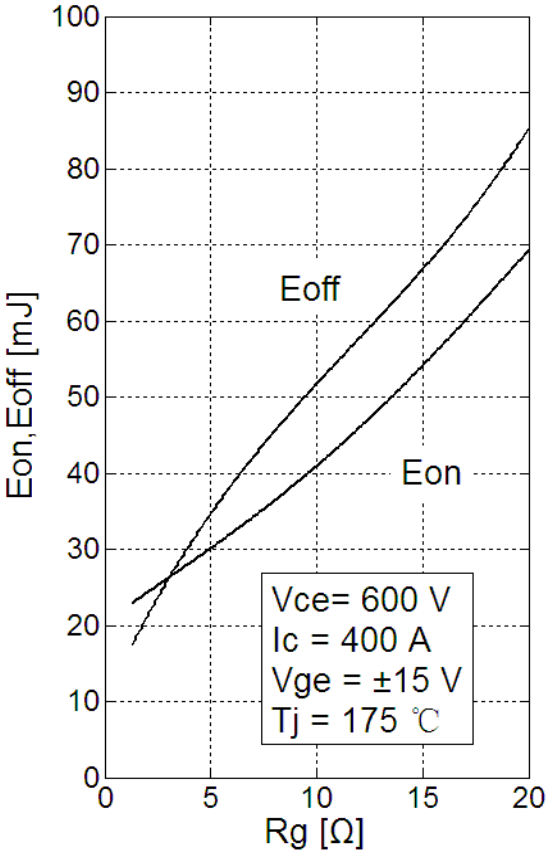


Fig 4. IGBT Switching Loss vs. R_G

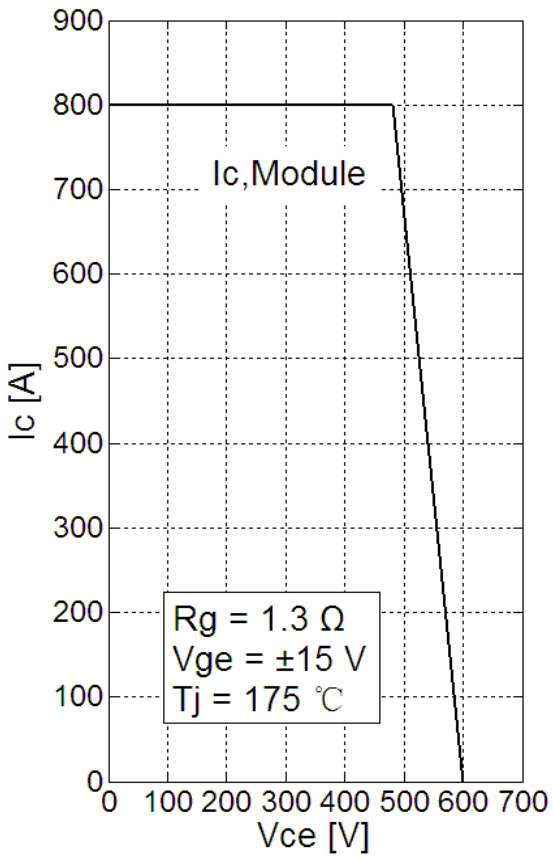


Fig 5. RBSOA

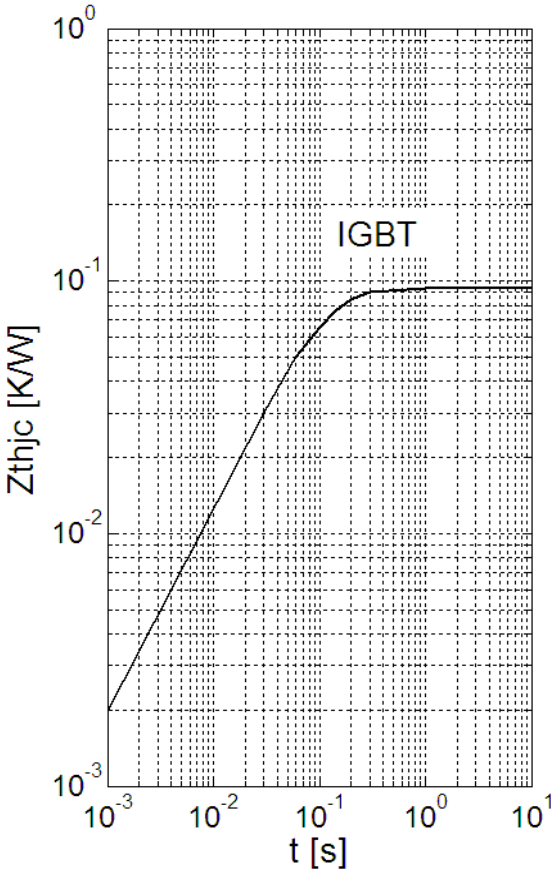


Fig 6. IGBT Transient Thermal Impedance

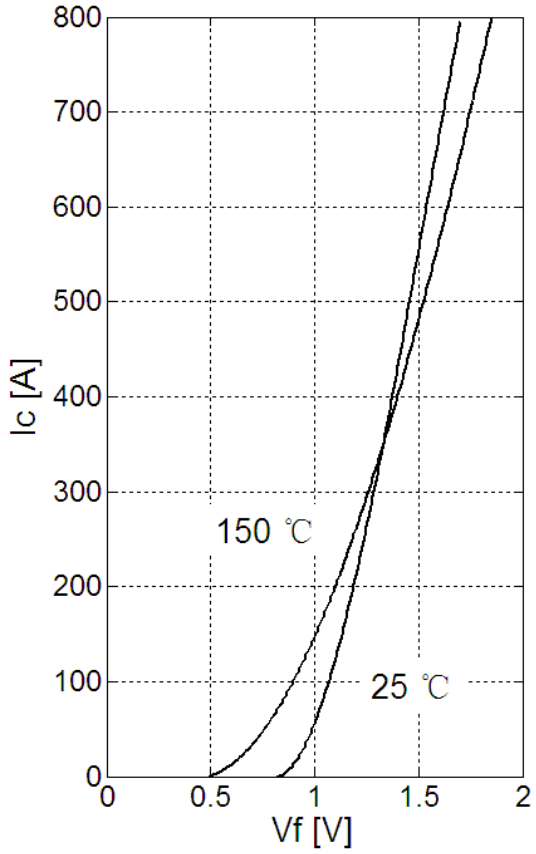


Fig 7. Forward Characteristics of Diode

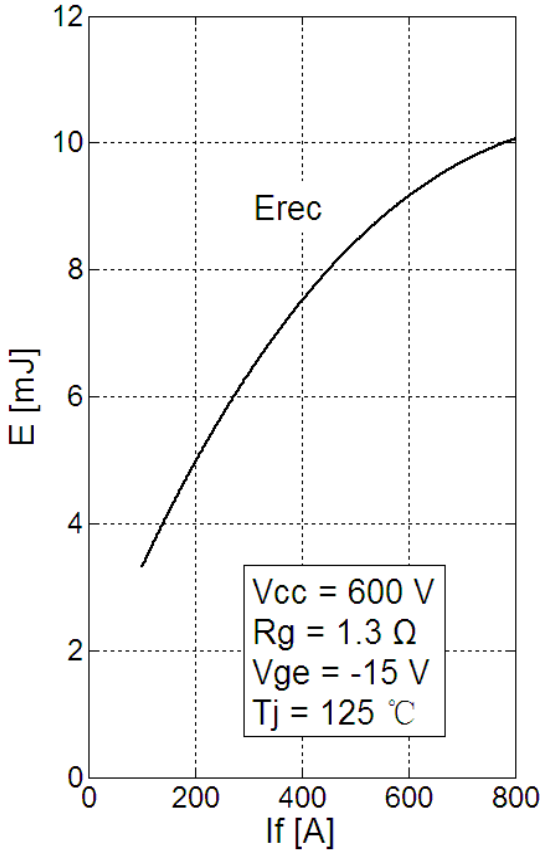


Fig 8. Diode Switching Loss vs. I_f

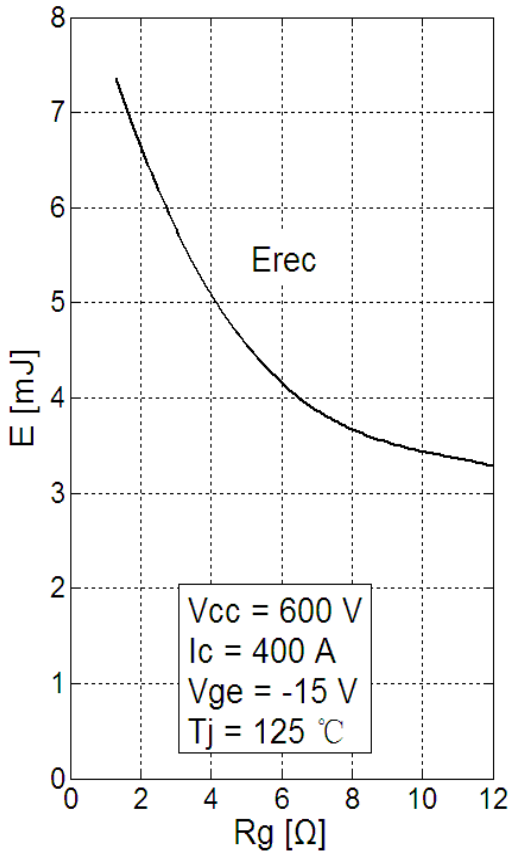


Fig 9. Diode Switching Loss vs. R_G

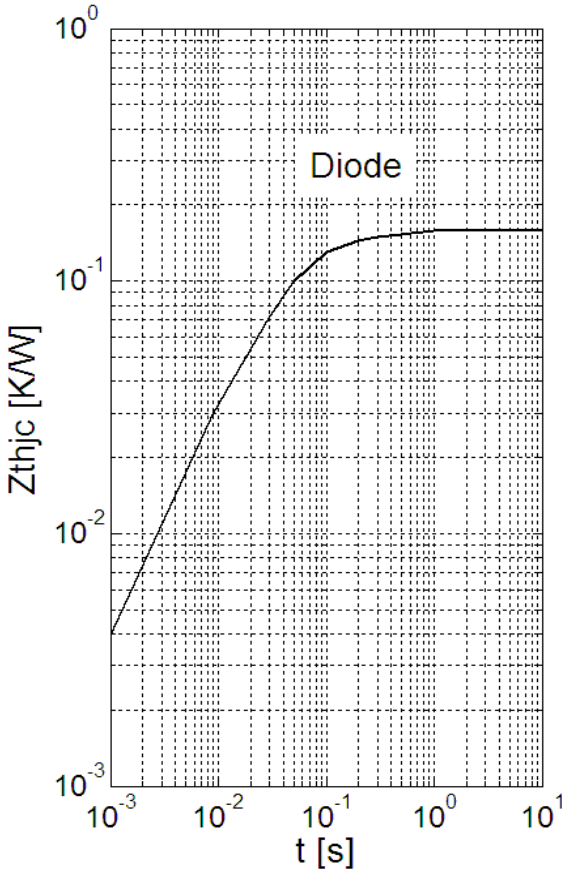
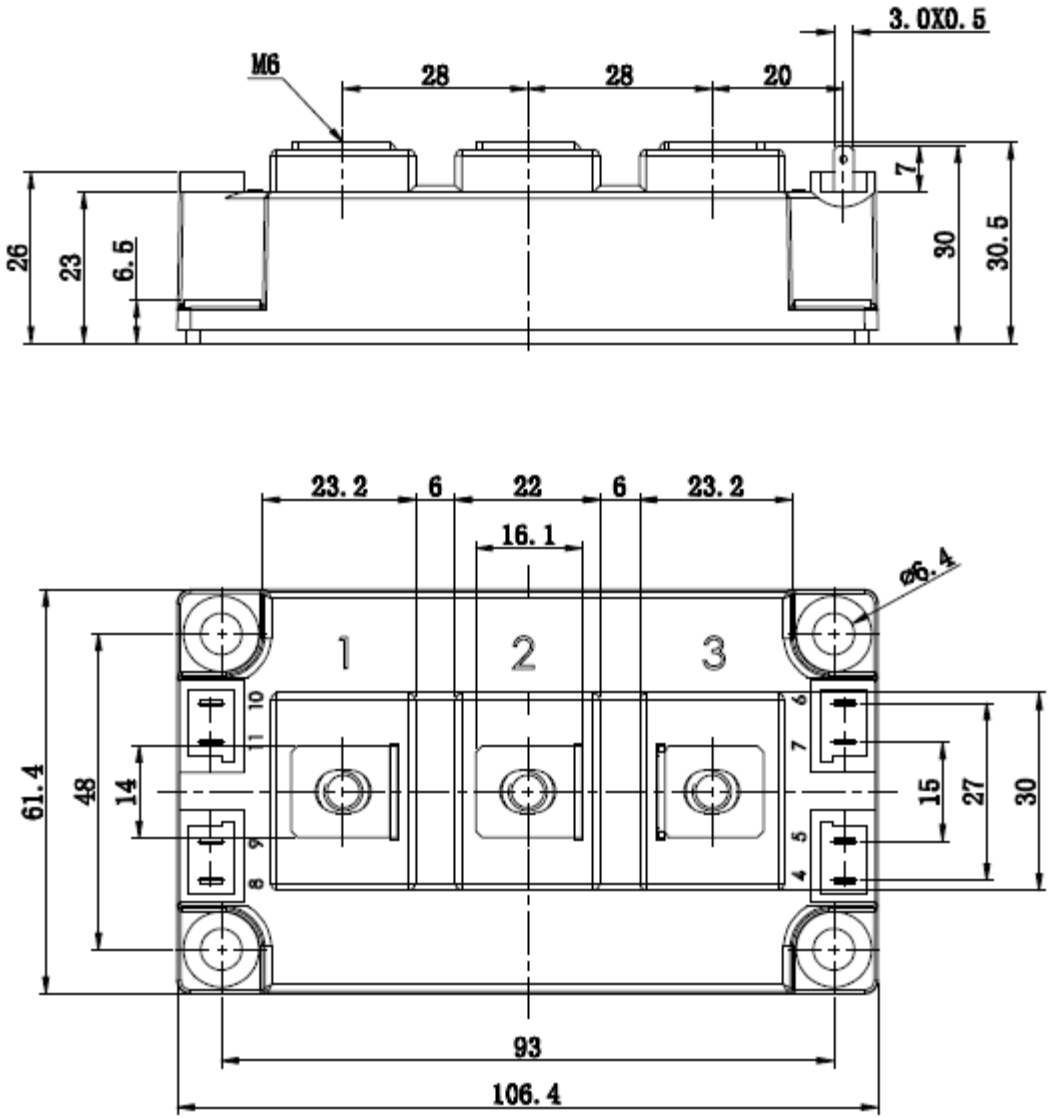


Fig 10. Diode Transient Thermal Impedance

Package Dimension

Dimensions in Millimeters



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