

STARPOWER

SEMICONDUCTOR™

IGBT

GD1000HFT170P2S

Preliminary

Molding Type Module**1700V/1000A 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
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- High power and thermal cycling capability

Typical Applications

- Auxiliary Inverters
- High Power Converters
- UPS
- Wind and Solar Power
- Traction Drivers

Absolute Maximum Ratings $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Description	GD1000HFT170P2S	Units
V_{CES}	Collector-Emitter Voltage	1700	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	1500	A
		1000	A
$I_{CM(1)}$	Pulsed Collector Current $t_p=1\text{ms}$	2000	A
I_F	Diode Continuous Forward Current	1000	A
I_{FM}	Diode Maximum Forward Current	2000	A
P_D	Maximum power Dissipation @ $T_j=175^{\circ}\text{C}$	7500	W
T_{jmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	4000	V
Mounting Torque	Power Terminal Screw:M4	1.8 to 2.1	N.m
	Power Terminal Screw:M8	8.0 to 10	
	Mounting Screw:M5	3.0 to 5.0	N.m

Notes:

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

Electrical Characteristics of IGBT $T_C=25^{\circ}\text{C}$ unless otherwise noted**Off Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^{\circ}\text{C}$	1700			V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}$, $V_{GE}=0\text{V}$, $T_j=25^{\circ}\text{C}$			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}$, $V_{CE}=0\text{V}$, $T_j=25^{\circ}\text{C}$			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=40\text{mA}$, $V_{CE}=V_{GE}$, $T_j=25^{\circ}\text{C}$	5.0	5.8	6.4	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=1000\text{A}$, $V_{GE}=15\text{V}$, $T_j=25^{\circ}\text{C}$		2.00	2.45	V
		$I_C=1000\text{A}$, $V_{GE}=15\text{V}$, $T_j=125^{\circ}\text{C}$		2.40		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=1000A,$ $R_{Gon}=1.4\Omega, R_{Goff}=1.8\Omega,$ $V_{GE}=\pm 15V, T_j=25^\circ C$		648		ns
t_r	Rise Time			162		ns
$t_{d(off)}$	Turn-Off Delay Time			1290		ns
t_f	Fall Time			178		ns
E_{on}	Turn-On Switching Loss			206		mJ
E_{off}	Turn-Off Switching Loss			300		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=1000A,$ $R_{Gon}=1.4\Omega, R_{Goff}=1.8\Omega,$ $V_{GE}=\pm 15V, T_j=125^\circ C$		701		ns
t_r	Rise Time			198		ns
$t_{d(off)}$	Turn-Off Delay Time			1610		ns
t_f	Fall Time			302		ns
E_{on}	Turn-On Switching Loss			306		mJ
E_{off}	Turn-Off Switching Loss			369		mJ
C_{ies}	Input Capacitance	$V_{CE}=25V, f=1MHz,$ $V_{GE}=0V$		88.2		nF
C_{oes}	Output Capacitance			3.67		nF
C_{res}	Reverse Transfer Capacitance			2.92		nF
I_{SC}	SC Data	$t_{sc} \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=1000V,$ $V_{CEM} \leq 1700V$		4000		A
R_{Gint}	Internal Gate Resistance			0.75		Ω
L_{CE}	Stray Inductance			10		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal To Chip			0.20		m Ω

Electrical Characteristics of DIODE $T_C=25^\circ C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=1000A$	$T_j=25^\circ C$	1.80	2.40	V
			$T_j=125^\circ C$	1.85		
Q_r	Recovered charge	$I_F=1000A,$	$T_j=25^\circ C$	290		μC
			$T_j=125^\circ C$	510		
I_{RM}	Peak Reverse Recovery Current	$V_R=900V,$ $di/dt=-4750A/\mu s,$	$T_j=25^\circ C$	800		A
			$T_j=125^\circ C$	1005		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15V$	$T_j=25^\circ C$	205		mJ
			$T_j=125^\circ C$	380		

Electrical Characteristics of NTC $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated Resistance			5.0		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$R_{100}=493\Omega$	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case (per IGBT)		0.020	K/W
$R_{\theta JC}$	Junction-to-Case (per DIODE)		0.031	K/W
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)	0.003		K/W
Weight	Weight of Module	1200		g

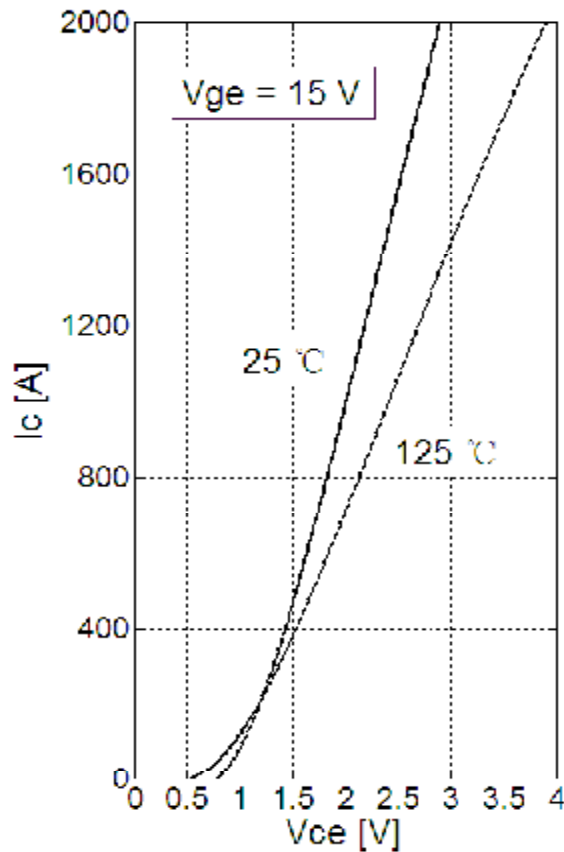


Fig 1. Typical IGBT Output Characteristics

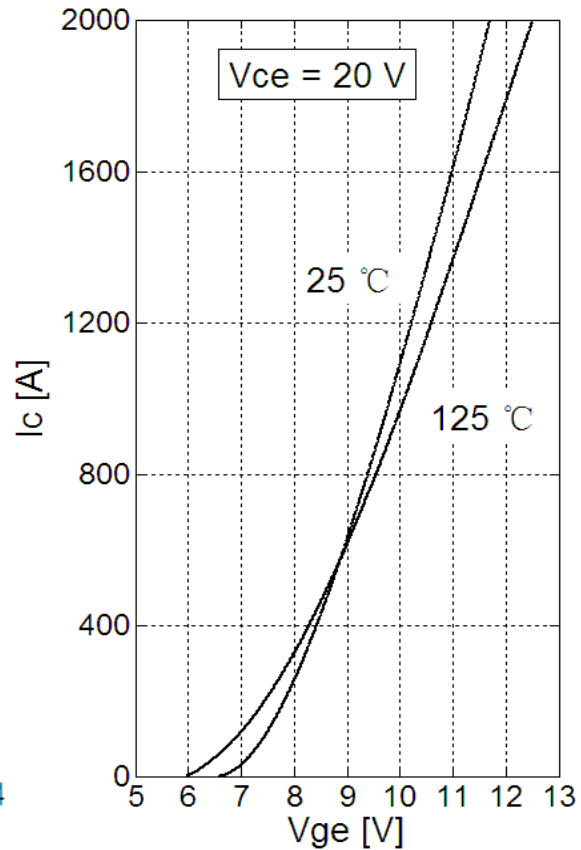
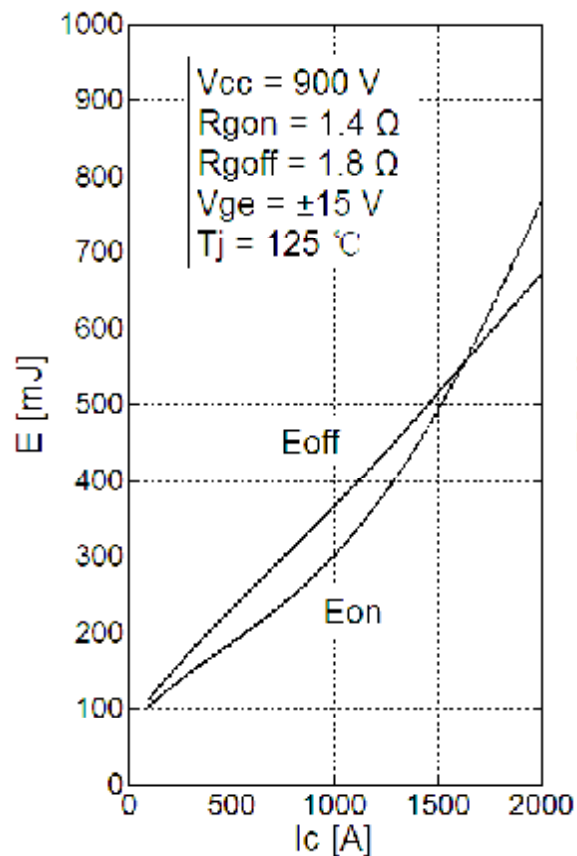
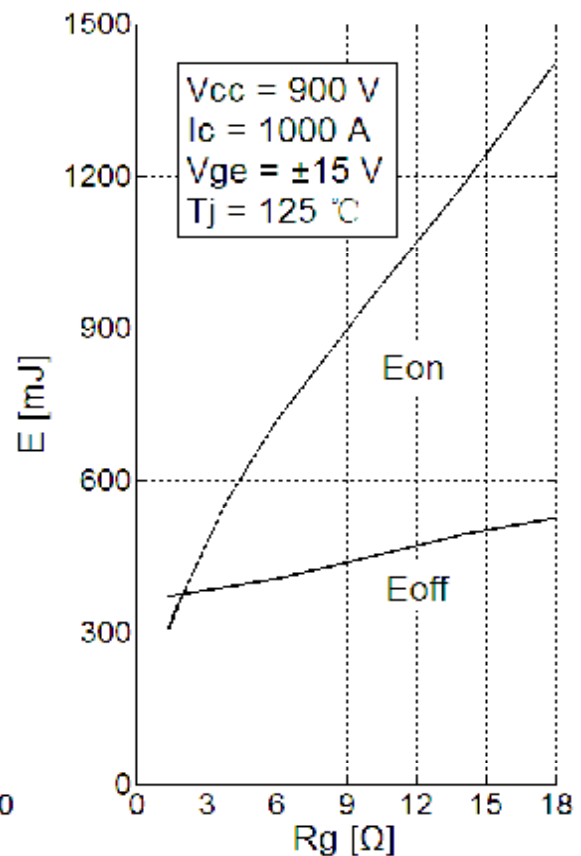


Fig 2. Typical IGBT Transfer Characteristics

Fig 3. IGBT Switching Loss vs. I_c Fig 4. IGBT Switching Loss vs. R_g

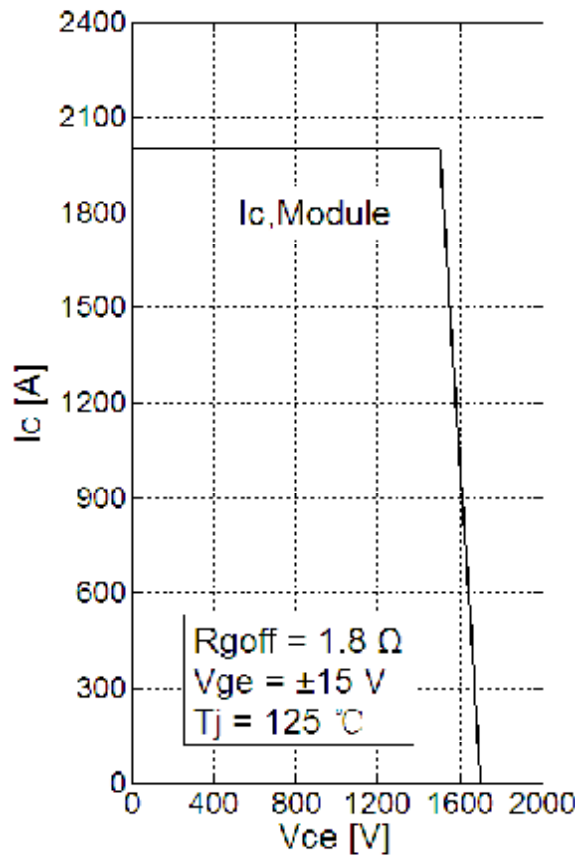


Fig 5. RBSOA

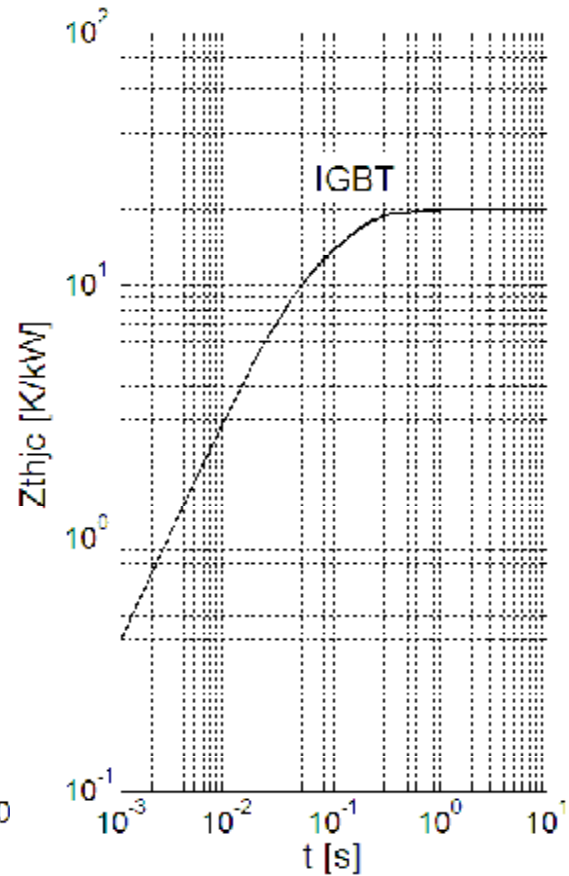


Fig 6. IGBT Transient Thermal Impedance

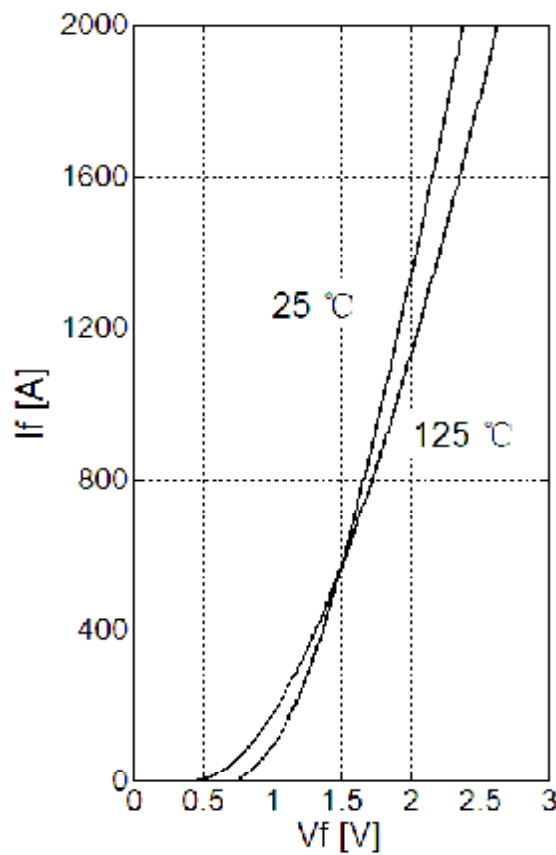
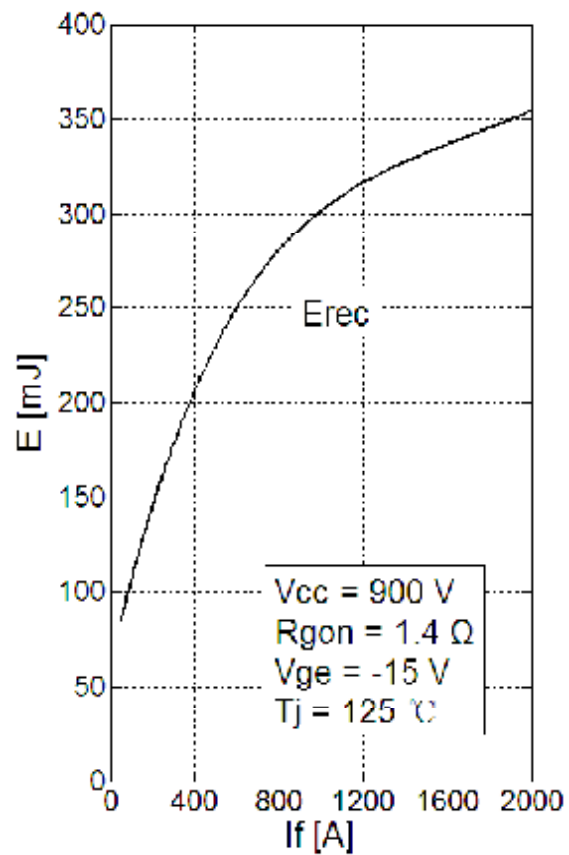


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_f

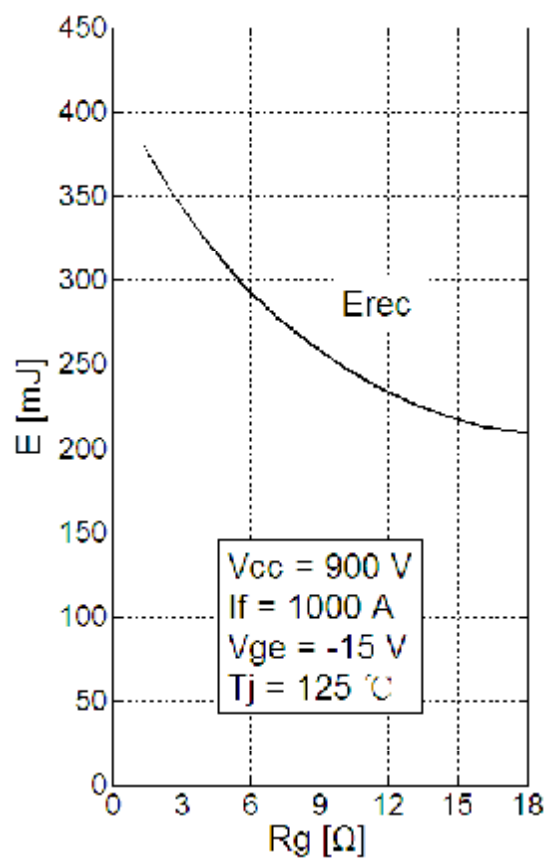
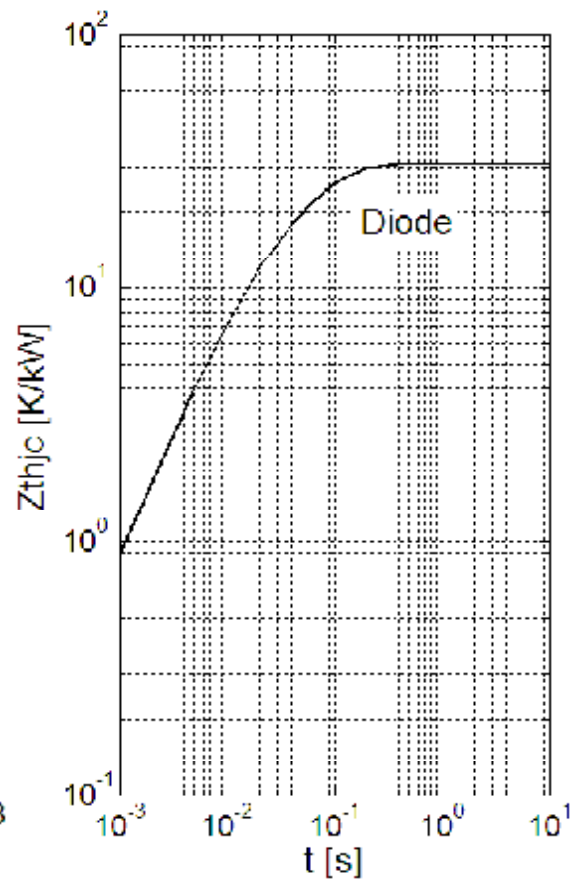
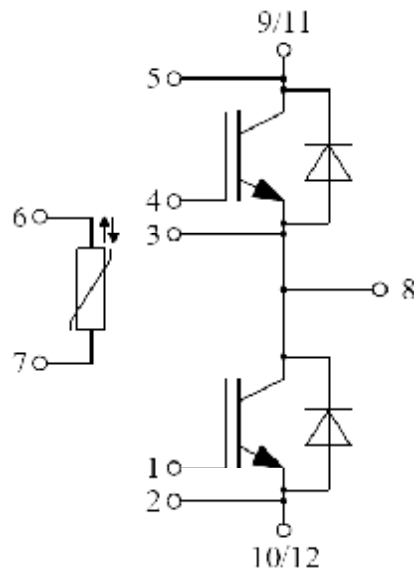
Fig 9. Diode Switching Loss vs. R_g 

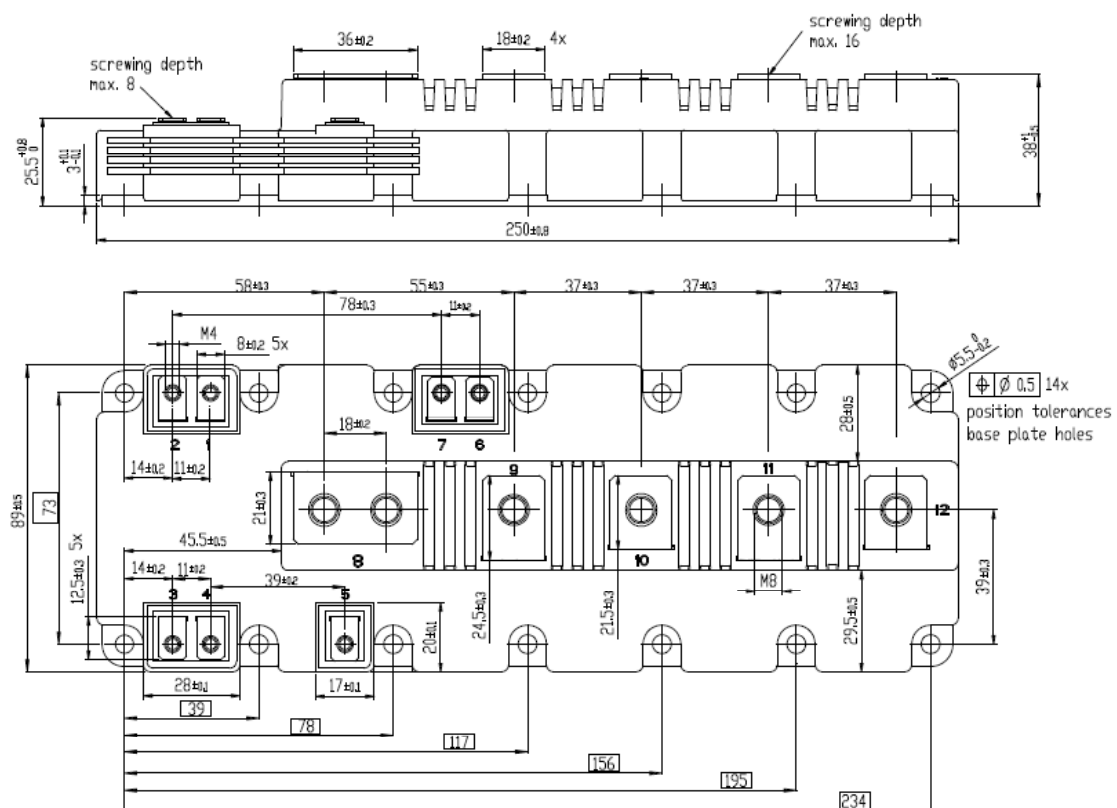
Fig 10. Diode Transient Thermal Impedance

Equivalent Circuit Schematic



Package Dimension

Dimensions in Millimeters



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