

# STARPOWER

SEMICONDUCTOR™

# IGBT

## GD1200HFT120C3S

## Preliminary

**Molding Type Module****1200V/1200A 2 in one-package**

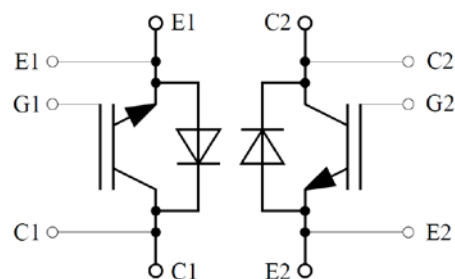
### General Description

STARPOWER IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as high power converters.



### Features

- Low  $V_{CE(sat)}$  Trench IGBT technology
- 10 $\mu$ s short circuit capability
- $V_{CE(sat)}$  with positive temperature coefficient
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Equivalent Circuit Schematic

### Typical Applications

- AC Inverter Drives
- Uninterruptible Power Supply
- Wind Turbines

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

Symbol	Description	GD1200HFT120C3S	Units
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=80^\circ\text{C}$	1800	A
		1200	
$I_{CM(1)}$	Pulsed Collector Current $t_p=1\text{ms}$	2400	A
$I_F$	Diode Continuous Forward Current	1200	A
$I_{FM}$	Diode Maximum Forward Current	2400	A
$P_D$	Maximum power Dissipation @ $T_j=150^\circ\text{C}$	5.2	kW
$T_j$	Maximum Junction Temperature	150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-40 to +125	$^\circ\text{C}$
$V_{ISO}$	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$	2500	V
Mounting Torque	Signal Terminal Screw:M4	1.8 to 2.1	N.m
	Power Terminal Screw:M8	8.0 to 10	
	Mounting Screw:M6	4.25 to 5.75	

**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	$T_j=25^\circ\text{C}$	1200			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	$I_C=48\text{mA}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=1200\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		1.70	2.15	V
		$I_C=1200\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.00	2.45	

## Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$Q_G$	Gate charge	$V_{GE}=-15\dots+15V$		11.5		$\mu C$
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=1200A,$ $R_{Gon}=2.4\Omega,$ $R_{Goff}=0.82\Omega,$ $V_{GE}=\pm 15V, T_j=25^\circ C$		600		ns
$t_r$	Rise Time			230		ns
$t_{d(off)}$	Turn-Off Delay Time			820		ns
$t_f$	Fall Time			150		ns
$E_{on}$	Turn-On Switching Loss			/		mJ
$E_{off}$	Turn-Off Switching Loss			/		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=1200A,$ $R_{Gon}=2.4\Omega,$ $R_{Goff}=0.82\Omega,$ $V_{GE}=\pm 15V, T_j=125^\circ C$		660		ns
$t_r$	Rise Time			220		ns
$t_{d(off)}$	Turn-Off Delay Time			960		ns
$t_f$	Fall Time			180		ns
$E_{on}$	Turn-On Switching Loss			246		mJ
$E_{off}$	Turn-Off Switching Loss			191		mJ
$C_{ies}$	Input Capacitance	$V_{CE}=25V, f=1MHz,$ $V_{GE}=0V$		86.1		nF
$C_{oes}$	Output Capacitance			4.50		nF
$C_{res}$	Reverse Transfer Capacitance			3.90		nF
$I_{SC}$	SC Data	$t_{sc} \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		4800		A
$L_{CE}$	Stray Inductance			20		nH
$R_{CC'+EE'}$	Module lead resistance, terminal to chip	$T_C=25^\circ C$		0.18		m $\Omega$

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	$I_F=1200A$	$T_j=25^\circ C$	1.65	2.15	V
			$T_j=125^\circ C$	1.65	2.15	
$Q_r$	Diode Reverse Recovery Charge	$I_F=1200A,$ $V_R=600V,$ $R_{Gon}=2.4\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$	69		$\mu C$
			$T_j=125^\circ C$	129		
$I_{RM}$	Diode Peak Reverse Recovery Current		$T_j=25^\circ C$	485		A
			$T_j=125^\circ C$	623		
$E_{rec}$	Reverse Recovery Energy		$T_j=25^\circ C$	32		mJ
			$T_j=125^\circ C$	60		

**Thermal Characteristics**

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case (per IGBT)		24	K/kW
$R_{\theta JC}$	Junction-to-Case (per Diode)		43	K/kW
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied, per Module)	6		K/kW
Weight	Weight of Module	1500		g

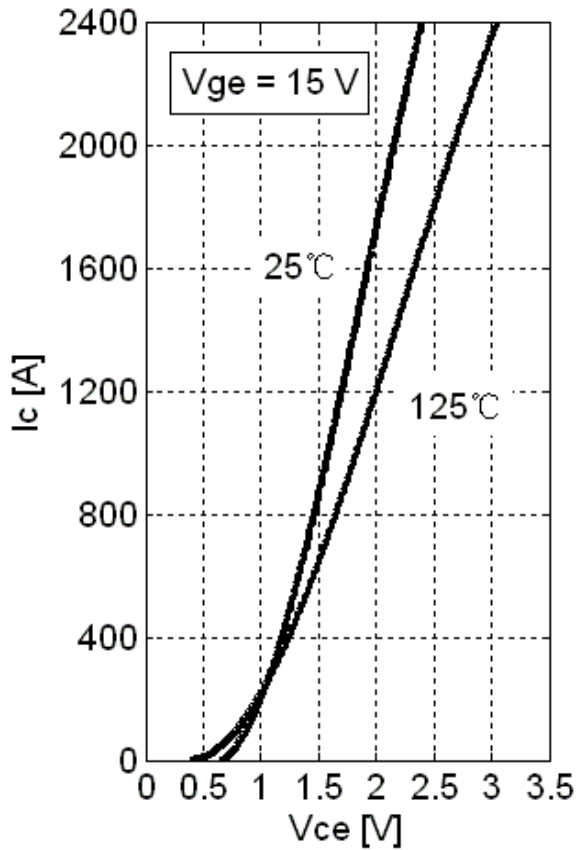


Fig 1. IGBT Output Characteristics

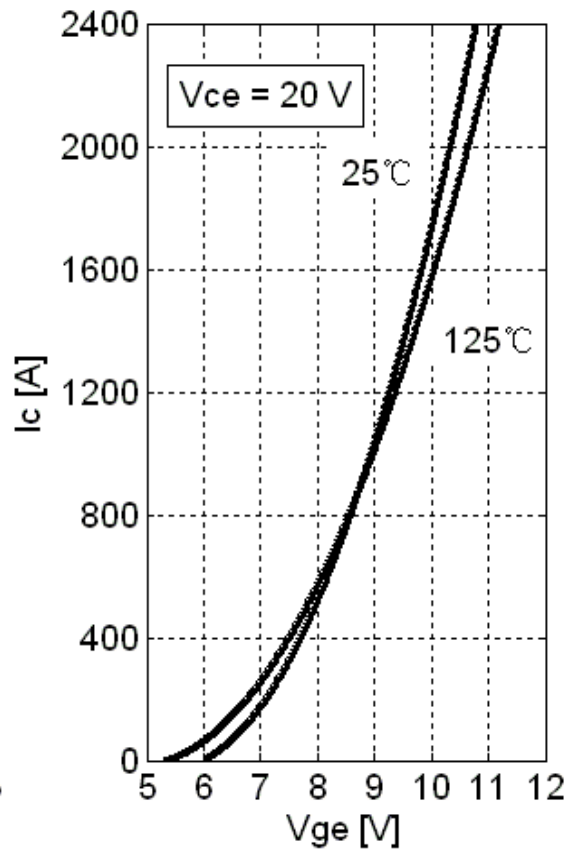


Fig 2. IGBT Transfer Characteristics

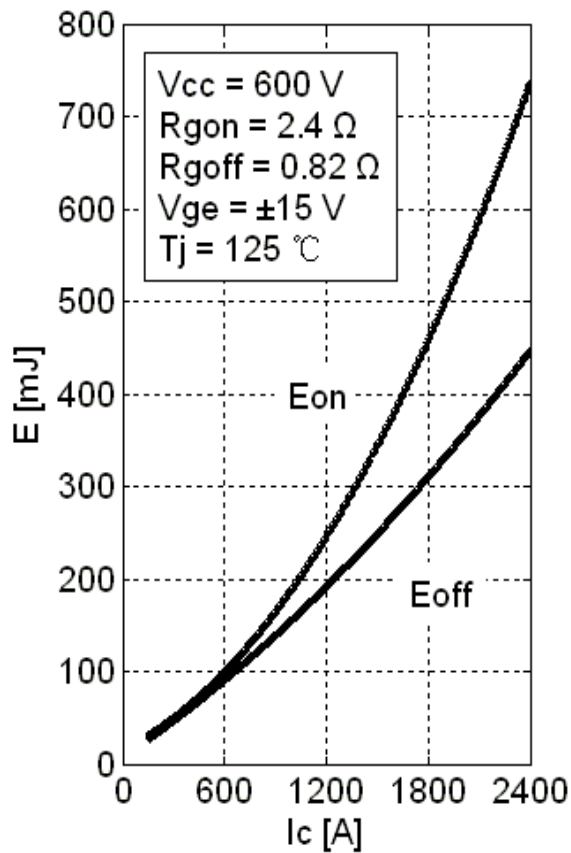


Fig 3. IGBT Switching Loss vs.  $I_c$

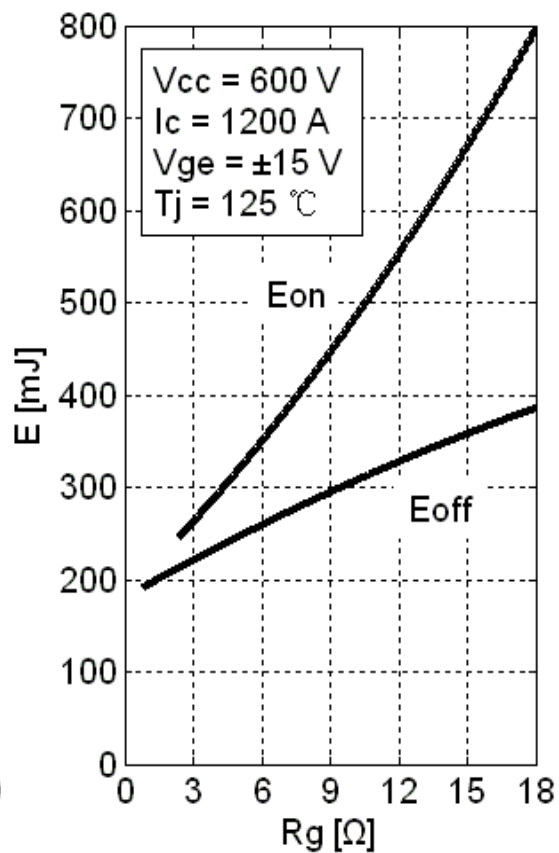


Fig 4. IGBT Switching Loss vs.  $R_G$

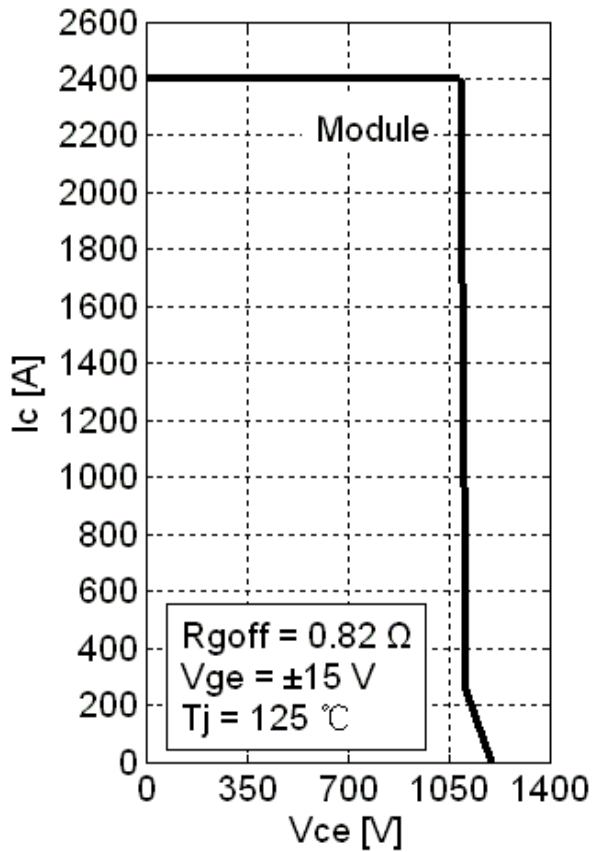


Fig 5. RBSOA

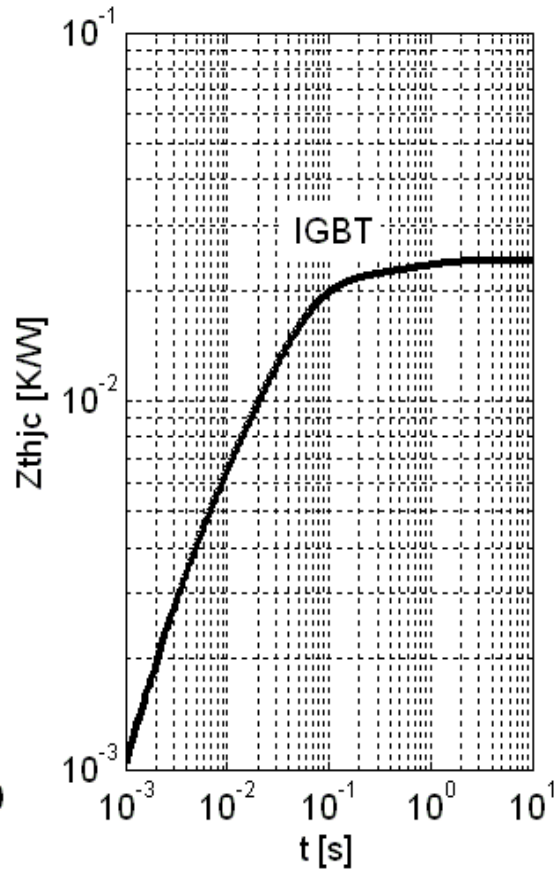


Fig 6. IGBT Transient Thermal Impedance

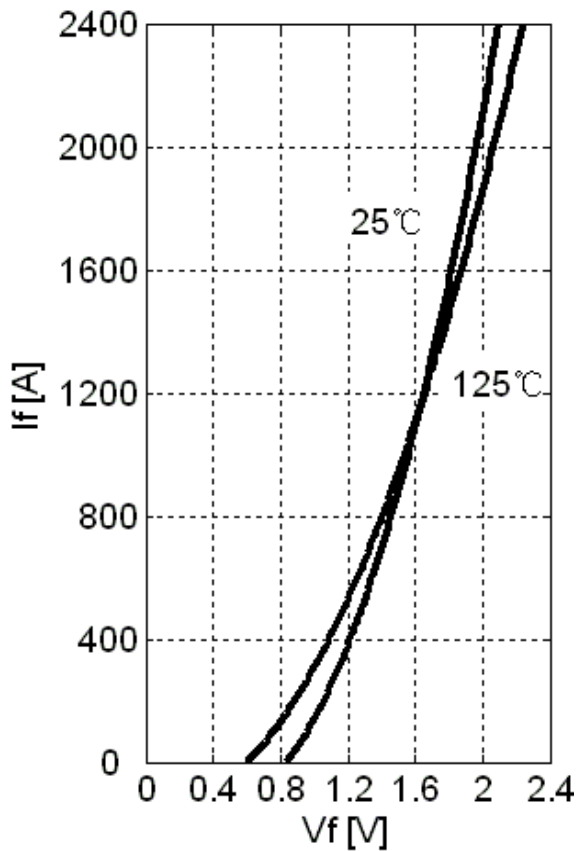


Fig 7. Diode Forward Characteristics

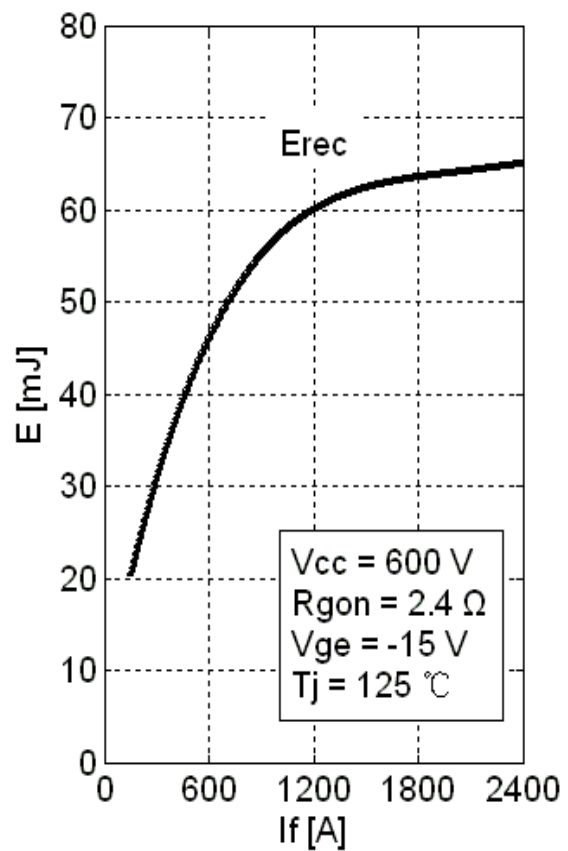


Fig 8. Diode Switching Loss vs.  $I_f$

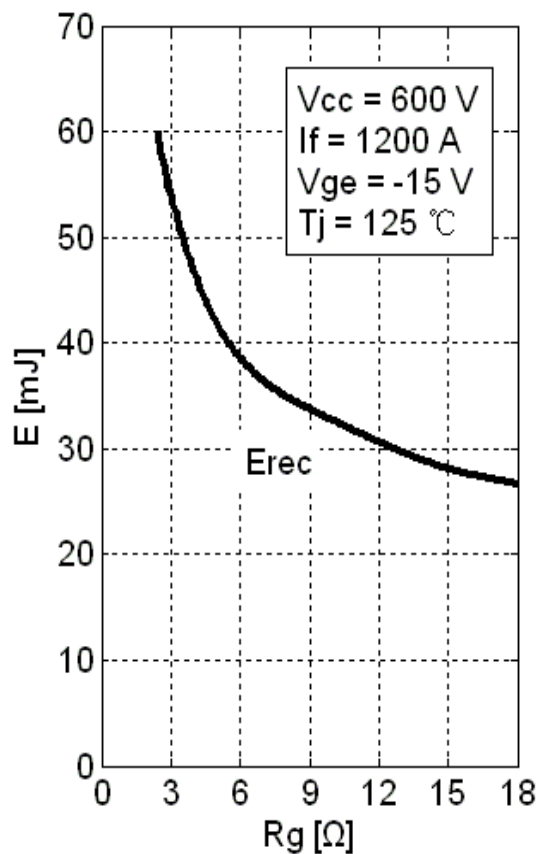


Fig 9. Diode Switching Loss vs.  $R_G$

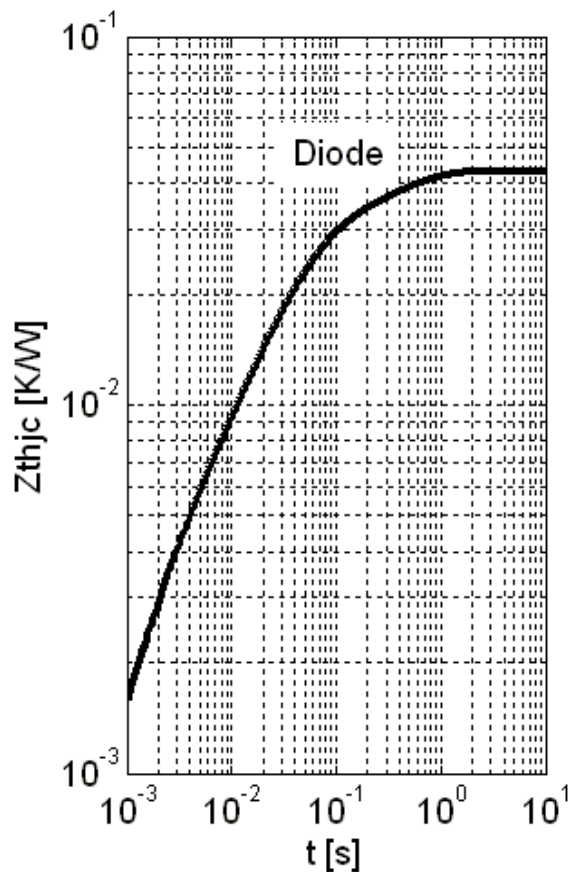
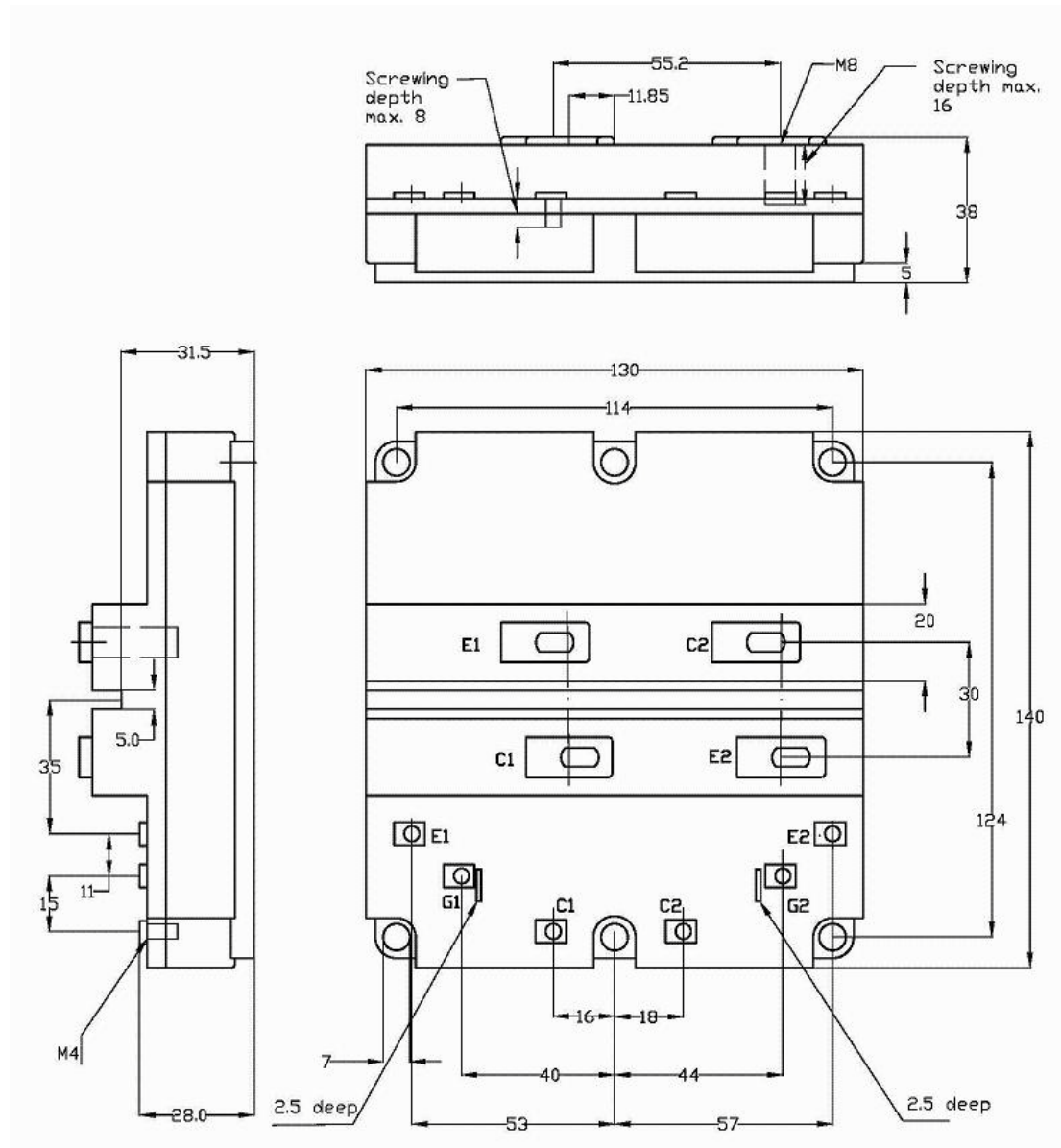


Fig 10. Diode Transient Thermal Impedance

### Package Dimension

Dimensions in Millimeters





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