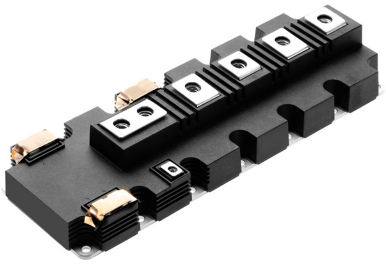
Half Bridge IGBT Module

RoHS Compliant



Features

- Trench Gate, Generation 5, TMOS IGBT
- Cu Base with Al_2O_3 Substrates
- 10µs Short Circuit Withstand

Key Parameters

V_{CES} : 1700 V
$V_{CE(sat)}$ * (typ) : 1.85 A
I_C (max) : 1000 A
$I_{C(PK)}$ (max) : 2000 V/µs

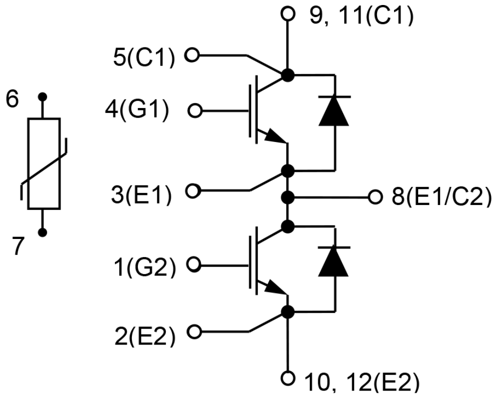
* Measured at the auxiliary terminals

Applications

- Motor Drives
- High Power Converters
- Renewable Energy Power Conversion
- High Reliability Inverters

The MP005812 is a Half Bridge 1700V, trench gate, insulated gate bipolar transistor (IGBT) module with enhanced field stop and implantation technology. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 10µs short circuit withstand. This device is optimised for traction drives and other applications requiring high thermal cycling capability.

The module incorporates an electrically isolated base plate and low inductance construction enabling circuit designers to optimise circuit layouts and utilise grounded heat sinks for safety.



Circuit configuration

Absolute Maximum Ratings

Stresses above those listed under 'Absolute Maximum Ratings' may cause permanent damage to the device. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture of the package. Appropriate safety precautions should always be followed. Exposure to Absolute Maximum Ratings may affect device reliability.

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	VGE = 0V, TC = 25°C	1700	V
V_{GES}	Gate-emitter voltage	TC = 25°C	±20	
I_C	Continuous collector current	TC = 104°C	1000	A
$I_{C(PK)}$	Peak collector current	tP = 1ms TC = 135°C	2000	
P_{max}	Max. transistor power dissipation	TC = 25°C, Tvj = 150°C	6.25	kW
I^2t	Diode I2t value	VR = 0, tp = 10ms, Tvj = 150°C	145	kA^2s
V_{isol}	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	4000	V

Thermal And Mechanical Ratings

Internal insulation material:	Al_2O_3
Baseplate material:	Cu
Creepage distance:	33mm
Clearance:	19mm
CTI (Comparative Tracking Index):	>400

Symbol	Parameter	Test Conditions	Min.	Max.	Units
$R_{th(j-c)}$	Thermal resistance – transistor	Continuous dissipation - junction to case	-	20	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode			36	
$R_{th(c-h)}$ IGBT	Thermal resistance – case to heatsink (IGBT)	Mounting torque 5Nm (with mounting grease: 1W/mK)	-	12	
$R_{th(c-h)}$ Diode	Thermal resistance – case to heatsink (Diode)				
T_j	Junction temperature	Transistor	-40	150	°C
		Diode			
F_{stg}	Storage temperature range	-			
	Screw torque	Mounting – M5	3	6	Nm
		Electrical connections – M8	8	10	

T_{case} = 25°C unless stated otherwise.

Symbol	Parameter	Test Conditions	Min.	Typ	Max.	Units
I_{CES}	Collector cut-off current	V_{GE} = 0V, V_{CE} = V_{CES}			1	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 125°C			20	
		V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 150°C			30	
I_{GES}	Gate leakage current	V_{GE} = ± 20V, V_{CE} = 0V			0.5	μA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 30mA, V_{GE} = V_{CE}	5.2	5.8	6.4	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 1000A		1.85	2.25	
		V_{GE} = 15V, I_C = 1000A, T_j = 125°C		2.2	2.6	
		V_{GE} = 15V, I_C = 1000A, T_j = 150°C		2.3	2.7	
V_F	Diode forward current	DC		1000		A
V_{IFM}	Diode maximum forward current	t_p = 1ms		2000		
V_F	Diode forward voltage	I_F = 1000A		1.8	2.2	V
		I_F = 1000A, T_j = 125°C		1.9	2.3	
		I_F = 1000A, T_j = 150°C				
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		147		nF
Q_g	Gate charge	±15V		11.4		μC
Q_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		1.5		nF
I_M	Module inductance			10		nH
R_{INT}	Internal transistor resistance			0.2		mΩ
SC_{Data}	Short circuit current, I_{SC}	T_j = 150°C, V_{CC} = 1000V t_p ≤ 10μs, V_{GE} ≤ 15V $V_{CE\ (max)}$ = V_{CES} – L* x dI/dt IEC 60747-9		4400		A

Note:
* L is the circuit inductance + L_M

NTC-Thermistor Data

Symbol	Parameter	Test Conditions	Min.	Typ	Max.	Units
R_{25}	Rated Resistance	T_C = 25°C		5		kΩ
ΔR/R	Deviation of R100	T_C = 100°C, R_{100} = 493Ω	-5		5	%
P_{25}	Power Dissipation	T_C = 25°C			20	m/W
$B_{25/50}$	B-value	$R_2 = R_{25}\exp\,[B_{25/50}(1/T2 – 1/(298.15K))]$		3375		K
$B_{25/80}$		$R_2 = R_{25}\exp\,[B_{25/80}(1/T2 – 1/(298.15K))]$		3411		
$B_{25/100}$		$R_2 = R_{25}\exp\,[B_{25/100}(1/T2 – 1/(298.15K))]$		3433		

Electrical Characteristics

T_{case} = 25°C unless stated otherwise.

Symbol	Parameter	Test Conditions		Min.	Typ	Max.	Units
$t_{d(off)}$	Turn-off delay time	I_C = 1000A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 1.8Ω $R_{G(ON)}$ = 1.2Ω L_S ~ 20nH	dv/dt = 3000V/µs		1320		ns
t_f	Fall time				340		
E_{OFF}	Turn-off energy loss				280		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 7200A/µs		500		ns
t_r	Rise time				145		
E_{ON}	Turn-on energy loss				340		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 1000A V_{CE} = 900V di/dt = 7200A/µs			285		µC
I_{rr}	Diode reverse recovery current				520		A
E_{rec}	Diode reverse recovery energy				110		mJ

T_{case} = 125°C unless stated otherwise.

Symbol	Parameter	Test Conditions		Min.	Typ	Max.	Units
$t_{d(off)}$	Turn-off delay time	I_C = 1000A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 1.8Ω $R_{G(ON)}$ = 1.2Ω L_S ~ 20nH	dv/dt = 3000V/µs		1410		ns
t_f	Fall time				440		
E_{OFF}	Turn-off energy loss				350		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 7200A/µs		470		ns
t_r	Rise time				145		
E_{ON}	Turn-on energy loss				370		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 1000A V_{CE} = 900V di/dt = 7200A/µs			315		µC
I_{rr}	Diode reverse recovery current				620		A
E_{rec}	Diode reverse recovery energy				210		mJ

T_{case} = 125°C unless stated otherwise.

Symbol	Parameter	Test Conditions		Min.	Typ	Max.	Units
$t_{d(off)}$	Turn-off delay time	I_C = 1000A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 1.8Ω $R_{G(ON)}$ = 1.2Ω L_S ~ 20nH	dv/dt = 3000V/µs		1440		ns
t_f	Fall time				570		
E_{OFF}	Turn-off energy loss				360		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 7200A/µs		460		ns
t_r	Rise time				140		
E_{ON}	Turn-on energy loss				385		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 1000A V_{CE} = 900V di/dt = 7200A/µs			340		µC
I_{rr}	Diode reverse recovery current				655		A
E_{rec}	Diode reverse recovery energy				235		mJ

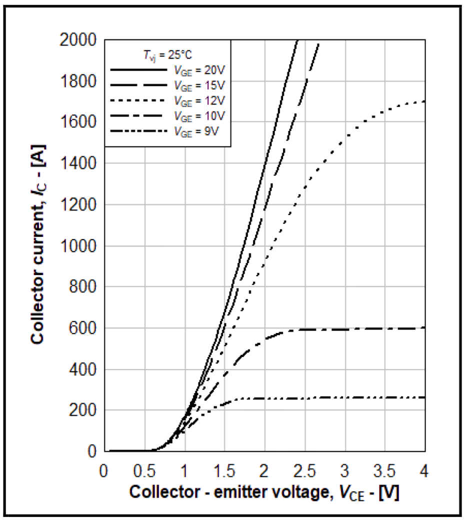


Fig. 3 Typical IGBT output characteristics, I_C = f(V_{CE})

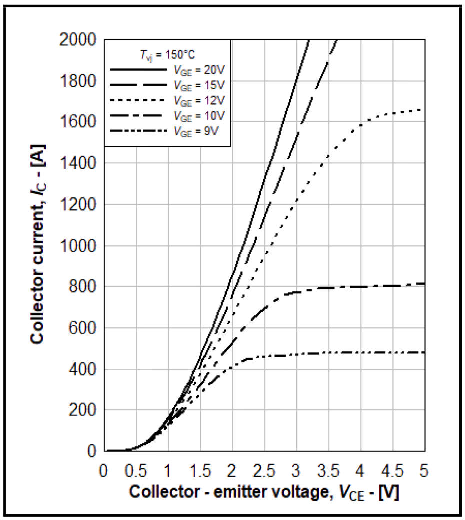


Fig. 4 Typical IGBT output characteristics, I_C = f(V_{CE})

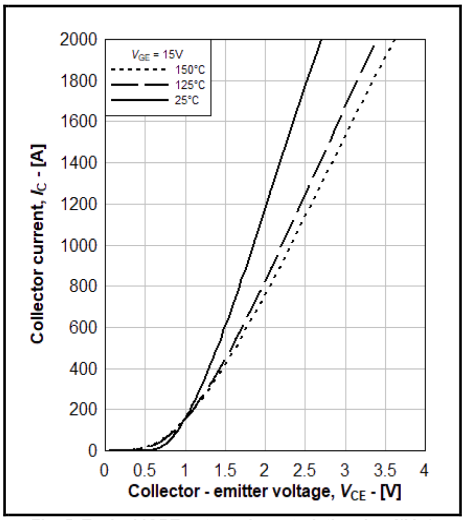


Fig. 5 Typical IGBT output characteristics, I_C = f(V_{CE})

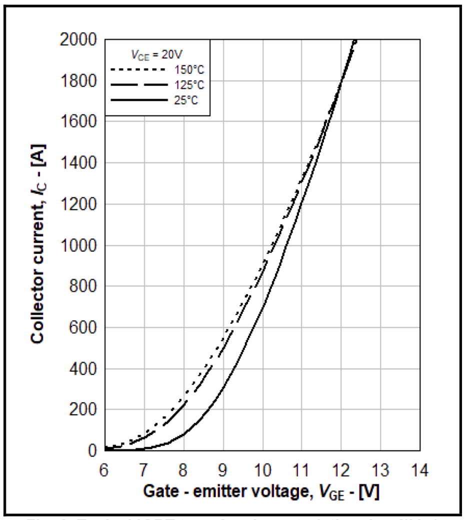


Fig. 6 Typical IGBT transfer characteristics, I_C = f(V_{GE})

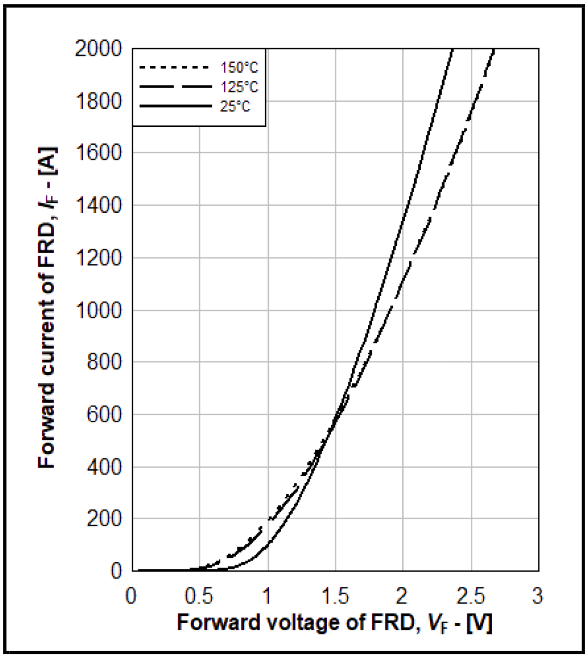


Fig. 7 Diode typical forward characteristics, $I_F = f(V_F)$

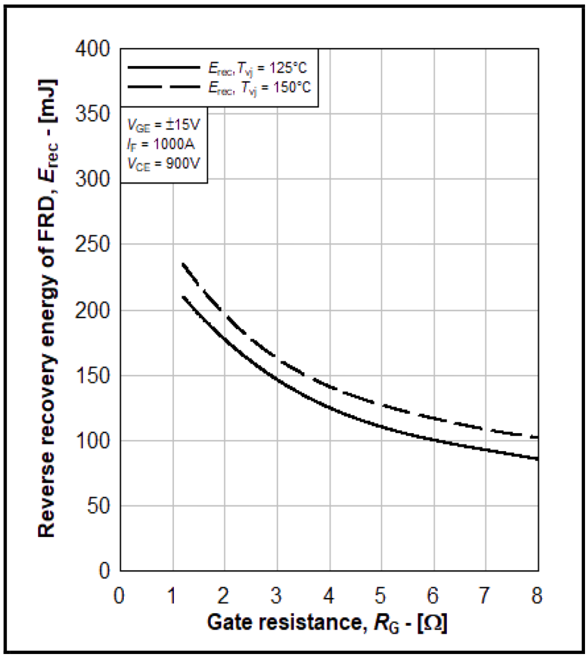


Fig. 8 Typical FRD E_{rec}, $E_{rec} = f(R_G)$

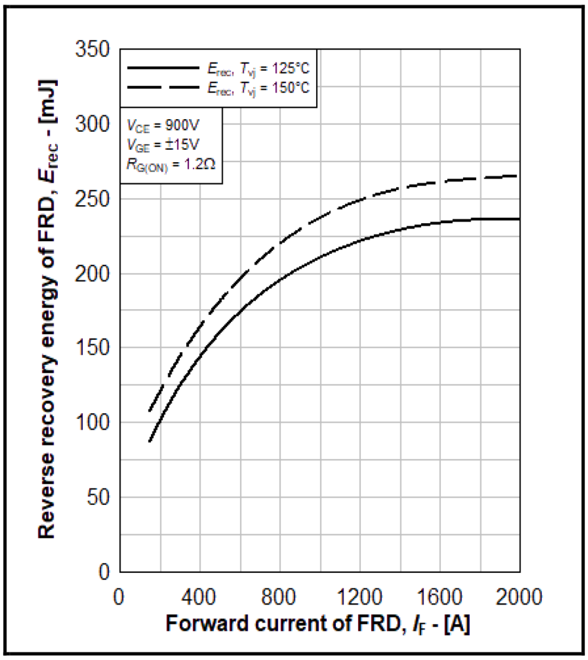


Fig. 9 Typical FRD E_{rec}, $E_{rec} = f(I_F)$

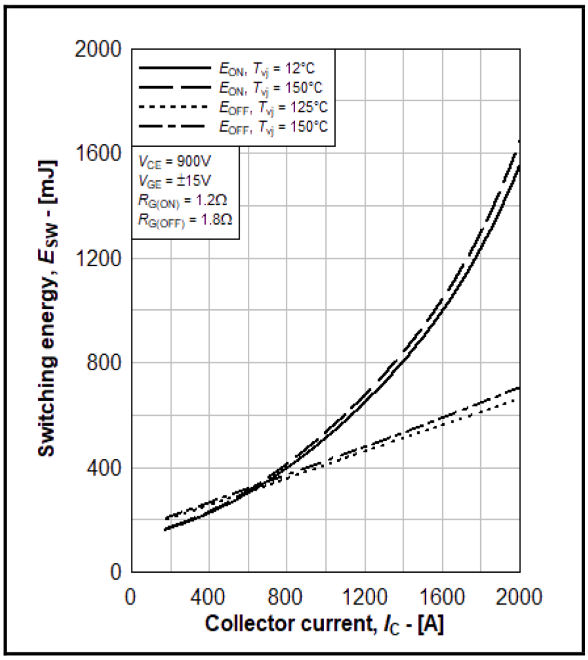


Fig. 10 Typical IGBT switching energy,
$E_{ON} = f(I_C)$, $E_{OFF} = f(I_C)$

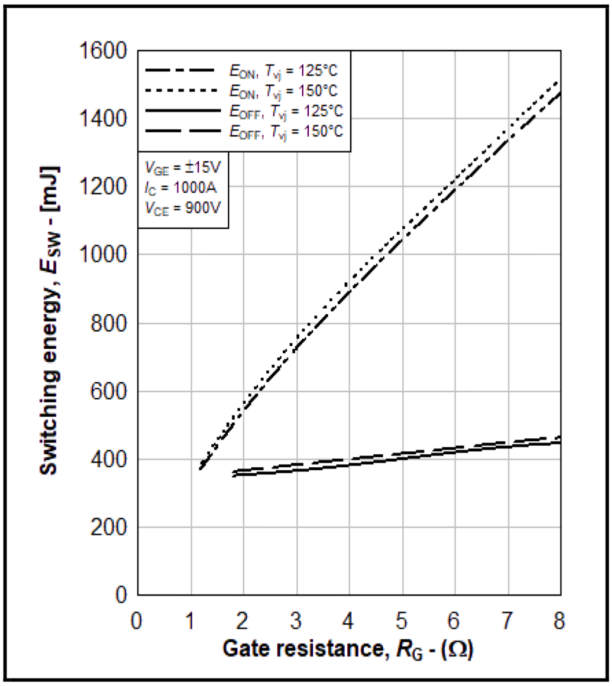


Fig. 11 Typical IGBT switching energy E_{ON} = f(R_G), E_{OFF} = fR_G)

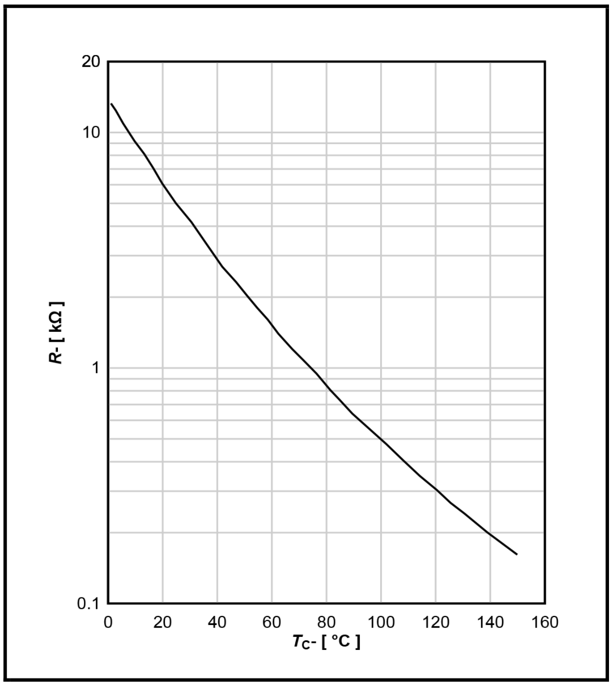


Fig. 12 Typical NTC thermistor characteristic, R = f(T_C)

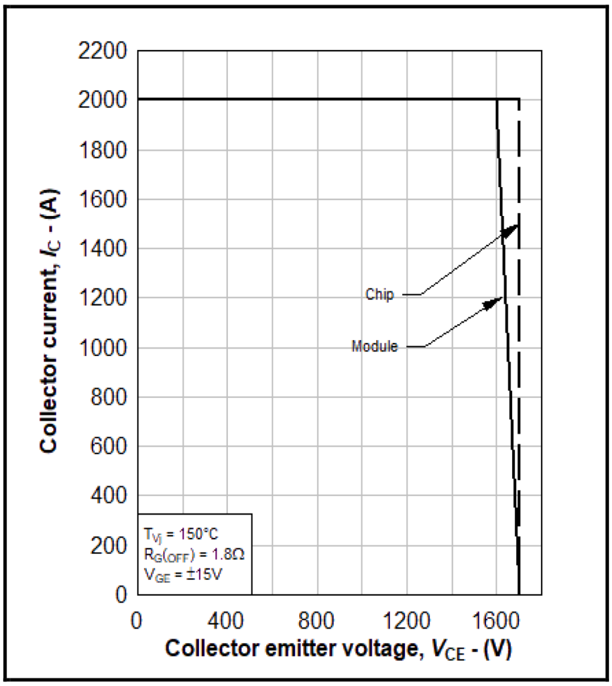


Fig. 13 Reverse bias safe operating area of IGBT, I_C = f(V_{CE})

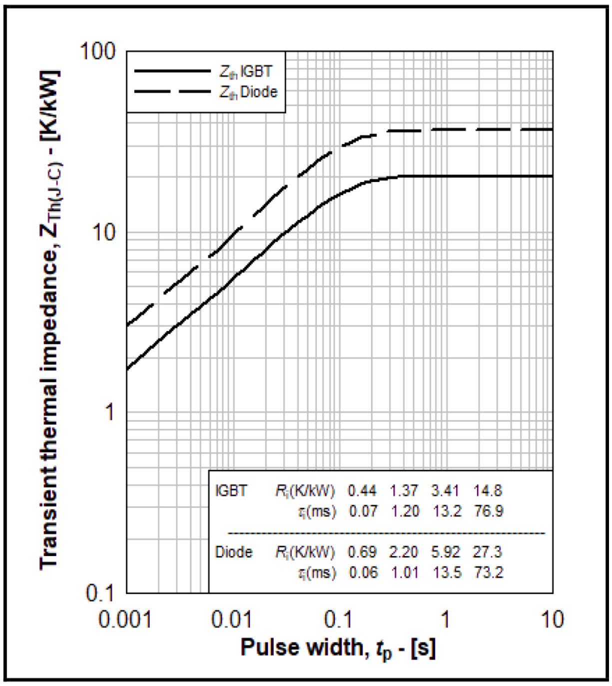
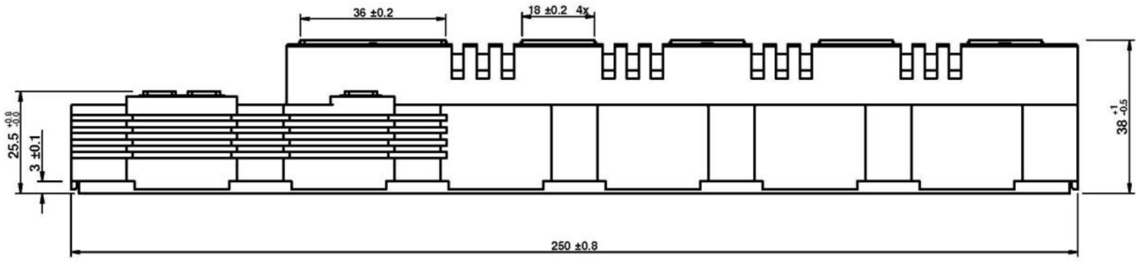
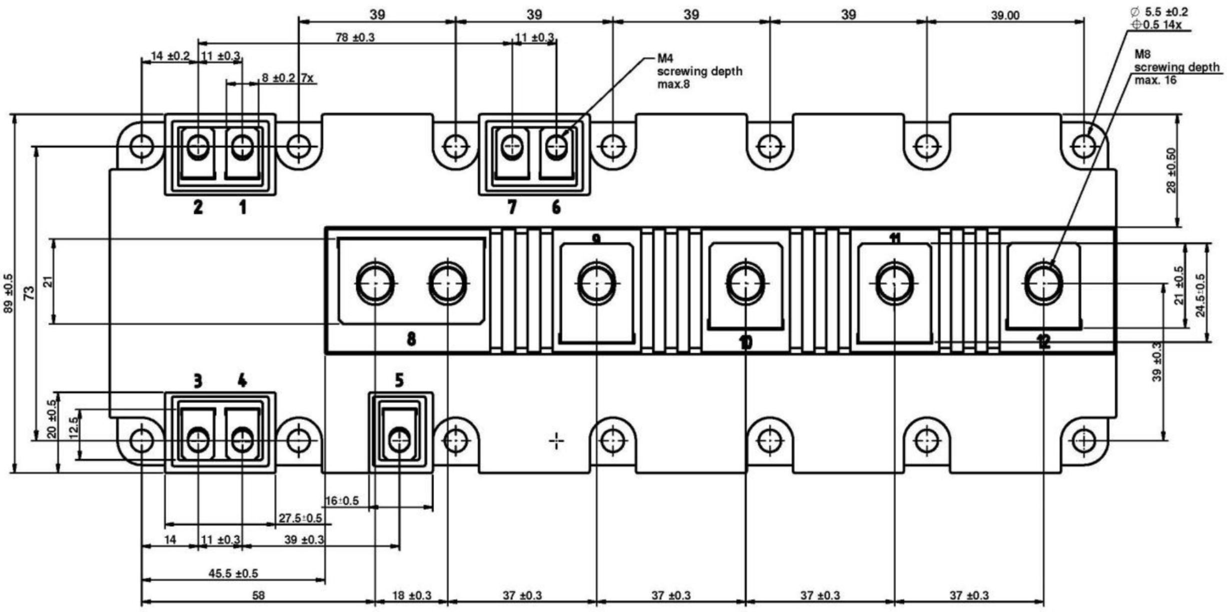


Fig. 14 Transient thermal impedance, $Z_{th(J-C)}$ = f(t)





Nominal Weight: 1200g

Part Number Table

Description	Part Number
Half Bridge IGBT Module, 1700V, 1000A, H1 Case Code	MPIM1000H117TG5

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