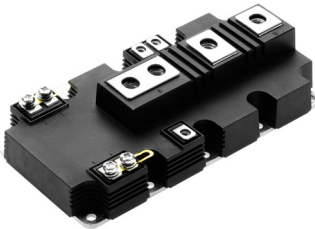


# Half Bridge IGBT Module multicomp<sup>PRO</sup>

RoHS  
Compliant



## Features

- Trench Gate, Generation 5, TMOS IGBT
- Cu Base with Al<sub>2</sub>O<sub>3</sub> Substrates
- High Thermal Cycling Capability
- 10µs Short Circuit Withstand
- High Current Density

## Key Parameters

V <sub>CES</sub>	: 1700 V
V <sub>CE(sat)</sub> * (typ)	: 1.85
I <sub>C</sub> (max)	: 650 A
I <sub>C(PK)</sub> (max)	: 1300 A

\* Measured at the auxiliary terminals

## Applications

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

The MP005810 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.

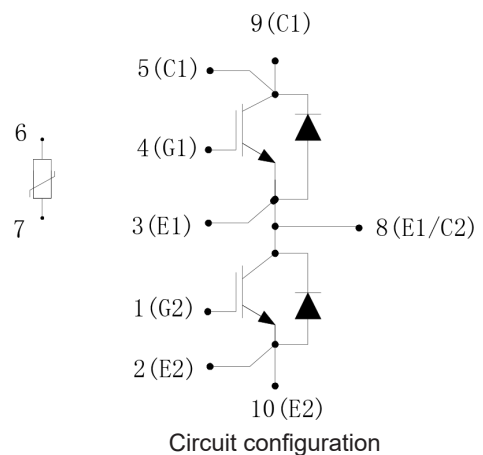
The module incorporates an electrically isolated base plate and low inductance construction enabling circuit designers to optimise circuit layouts and utilise grounded heat sinks for safety.

## 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.

T<sub>case</sub> = 25°C unless stated otherwise.

Symbol	Parameter	Test Conditions	Max.	Units
V <sub>CES</sub>	Collector-emitter voltage	V <sub>GE</sub> = 0V, T <sub>C</sub> = 25°C	1700	V
V <sub>GES</sub>	Gate-emitter voltage	T <sub>C</sub> = 25°C	±20	
I <sub>C</sub>	Continuous collector current	T <sub>C</sub> = 105°C	650	A
I <sub>C(PK)</sub>	Peak collector current	t <sub>P</sub> = 1ms	1300	
P <sub>max</sub>	Max. transistor power dissipation	T <sub>C</sub> = 25°C, T <sub>vj</sub> = 150°C	4.16	kW
I <sup>2</sup> t	Diode I <sup>2</sup> t value	V <sub>R</sub> = 0, t <sub>p</sub> = 10ms, T <sub>vj</sub> = 150°C	64	kA <sup>2</sup> s
V <sub>isol</sub>	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	4000	V



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## Thermal and Mechanical Ratings

Internal insulation material	: Al <sub>2</sub> O <sub>3</sub>
Baseplate material	: Cu
Creepage distance – Terminal to heatsink	: 33mm
Creepage distance – Terminal to terminal	: 33mm
Clearance – Terminal to heatsink	: 19mm
Clearance – Terminal to terminal	: 19mm
CTI (Comparative Tracking Index)	: >400

Symbol	Parameter	Test Conditions	Min.	Max.	Units
R <sub>th(j-c)</sub>	Thermal resistance– IGBT	Continuous dissipation - junction to case	-	30	°C/kW
R <sub>th(j-c)</sub>	Thermal resistance – diode			54	
R <sub>th(c-h)</sub>	Thermal resistance – case to heatsink (IGBT)	Mounting torque 5Nm (with mounting grease 1W/m °C)	-	19.5	
R <sub>th(c-h)</sub>	Thermal resistance – case to heatsink (Diode)			35	
T <sub>j</sub>	Junction temperature	IGBT	-40	150	°C
		Diode			
F <sub>stg</sub>	Storage temperature range	-			
	Screw torque	Mounting – M5	3	6	Nm
		Electrical connections – M8	8	10	

## Electrical Characteristics

T<sub>case</sub> = 25°C unless stated otherwise.

Symbol	Parameter	Test Conditions	Min.	Typ	Max.	Units
I <sub>CES</sub>	Collector cut-off current	V <sub>GE</sub> = 0V, V <sub>CE</sub> = V <sub>CES</sub>			1	mA
		V <sub>GE</sub> = 0V, V <sub>CE</sub> = V <sub>CES</sub> , T <sub>C</sub> = 125°C			20	
		V <sub>GE</sub> = 0V, V <sub>CE</sub> = V <sub>CES</sub> , T <sub>C</sub> = 150°C			30	
I <sub>GES</sub>	Gate leakage current	V <sub>GE</sub> = ± 20V, V <sub>CE</sub> = 0V			0.5	µA
V <sub>GE(TH)</sub>	Gate threshold voltage	I <sub>C</sub> = 40mA, V <sub>GE</sub> = V <sub>CE</sub>	5.2	5.8	6.4	V
V <sub>CE(sat)</sub>	Collector-emitter saturation voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 650A		1.85	2.25	
		V <sub>GE</sub> = 15V, I <sub>C</sub> = 650A, T <sub>J</sub> = 125°C		2.2	2.6	
		V <sub>GE</sub> = 15V, I <sub>C</sub> = 650A, T <sub>J</sub> = 150°C		2.3	2.7	
I <sub>F</sub>	Diode forward current	DC		650		A
I <sub>FM</sub>	Diode maximum forward current	t <sub>p</sub> = 1ms		1300		
V <sub>F</sub>	Diode forward voltage	I <sub>F</sub> = 650A		1.8	2.2	V
		I <sub>F</sub> = 650A, T <sub>J</sub> = 125°C		1.9	2.3	
		I <sub>F</sub> = 650A, T <sub>J</sub> = 150°C				
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 100kHz		83		nF
Q <sub>g</sub>	Gate charge	±15V		7.7		µC
C <sub>res</sub>	Reverse transfer capacitance	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 100kHz		1		nF
L <sub>M</sub>	Module inductance			18		nH
R <sub>INT</sub>	Internal transistor resistance			0.3		mΩ
SC <sub>Data</sub>	Short circuit current, I <sub>sc</sub>	T <sub>J</sub> = 150°C, V <sub>CC</sub> = 1000V t <sub>p</sub> ≤ 10µs, V <sub>GE</sub> ≤ 15V V <sub>CE(max)</sub> = V <sub>CES</sub> – L* x di/dt IEC 60747-9		3300		A

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**Note:**

\* L is the circuit inductance + L<sub>M</sub>

## NTC-Thermistor Data

Symbol	Parameter	Test Conditions	Min.	Typ	Max.	Units
R <sub>25</sub>	Rated Resistance	T <sub>C</sub> = 25°C		5		kΩ
ΔR/R	Deviation of R <sub>100</sub>	T <sub>C</sub> = 100°C, R <sub>100</sub> = 493Ω	-5		5	%
P <sub>25</sub>	Power Dissipation	T <sub>C</sub> = 25°C			20	m/W
B <sub>25/50</sub>	B-value	R <sub>2</sub> = R <sub>25</sub> exp [B <sub>25/50</sub> (1/T <sub>2</sub> – 1/(298.15K))]		3375		K
B <sub>25/80</sub>		R <sub>2</sub> = R <sub>25</sub> exp [B <sub>25/80</sub> (1/T <sub>2</sub> – 1/(298.15K))]		3411		
B <sub>25/100</sub>		R <sub>2</sub> = R <sub>25</sub> exp [B <sub>25/100</sub> (1/T <sub>2</sub> – 1/(298.15K))]		3433		

## Electrical Characteristics

T<sub>case</sub> = 25°C unless stated otherwise.

Symbol	Parameter	Test Conditions	Min.	Typ	Max.	Units
t <sub>d(off)</sub>	Turn-off delay time	I <sub>C</sub> = 650A V <sub>CE</sub> = 900V V <sub>GE</sub> = ±15V R <sub>G(OFF)</sub> = 2.7Ω R <sub>G(ON)</sub> = 1.8Ω L <sub>S</sub> ~ 70nH		dv/dt = 4500V/μs		ns
t <sub>f</sub>	Fall time					
E <sub>OFF</sub>	Turn-off energy loss					
t <sub>d(on)</sub>	Turn-on delay time	I <sub>F</sub> = 650A V <sub>CE</sub> = 900V di/dt = 4200A/μs		di/dt = 4200A/μs		ns
t <sub>r</sub>	Rise time					
E <sub>ON</sub>	Turn-on energy loss					
Q <sub>rr</sub>	Diode reverse recovery charge	I <sub>F</sub> = 650A V <sub>CE</sub> = 900V di/dt = 4200A/μs				μC
I <sub>rr</sub>	Diode reverse recovery current					
E <sub>rec</sub>	Diode reverse recovery energy					

T<sub>case</sub> = 125°C unless stated otherwise.

Symbol	Parameter	Test Conditions	Min.	Typ	Max.	Units
t <sub>d(off)</sub>	Turn-off delay time	I <sub>C</sub> = 650A V <sub>CE</sub> = 900V V <sub>GE</sub> = ±15V R <sub>G(OFF)</sub> = 2.7Ω R <sub>G(ON)</sub> = 1.8Ω L <sub>S</sub> ~ 70nH		dv/dt = 4500V/μs		ns
t <sub>f</sub>	Fall time					
E <sub>OFF</sub>	Turn-off energy loss					
t <sub>d(on)</sub>	Turn-on delay time	I <sub>F</sub> = 650A V <sub>CE</sub> = 900V di/dt = 4200A/μs		di/dt = 4200A/μs		ns
t <sub>r</sub>	Rise time					
E <sub>ON</sub>	Turn-on energy loss					
Q <sub>rr</sub>	Diode reverse recovery charge	I <sub>F</sub> = 650A V <sub>CE</sub> = 900V di/dt = 4200A/μs				μC
I <sub>rr</sub>	Diode reverse recovery current					
E <sub>rec</sub>	Diode reverse recovery energy					

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T<sub>case</sub> = 150°C unless stated otherwise.

Symbol	Parameter	Test Conditions	Min.	Typ	Max.	Units	
t <sub>d(off)</sub>	Turn-off delay time	I <sub>C</sub> = 650A V <sub>CE</sub> = 900V V <sub>GE</sub> = ±15V R <sub>G(OFF)</sub> = 2.7Ω R <sub>G(ON)</sub> = 1.8Ω L <sub>S</sub> ~ 70nH		1170		ns	
t <sub>f</sub>	Fall time				550		
E <sub>OFF</sub>	Turn-off energy loss				210		
t <sub>d(on)</sub>	Turn-on delay time		dv/dt = 4500V/μs  di/dt = 4200A/μs		480		ns
t <sub>r</sub>	Rise time				160		
E <sub>ON</sub>	Turn-on energy loss				210		
Q <sub>rr</sub>	Diode reverse recovery charge	I <sub>F</sub> = 650A V <sub>CE</sub> = 900V di/dt = 4200A/μs		280		μC	
I <sub>rr</sub>	Diode reverse recovery current			780		A	
E <sub>rec</sub>	Diode reverse recovery energy			190		mJ	

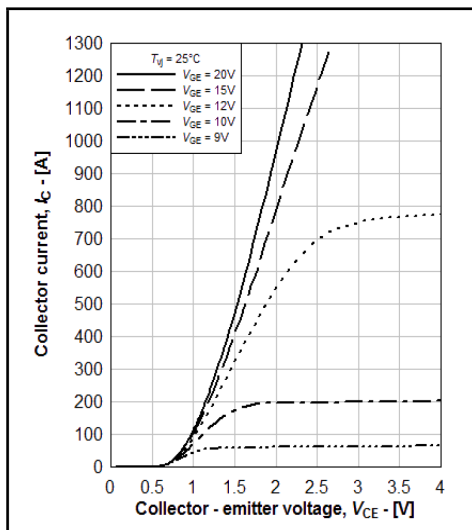


Fig. 3 Typical output characteristics

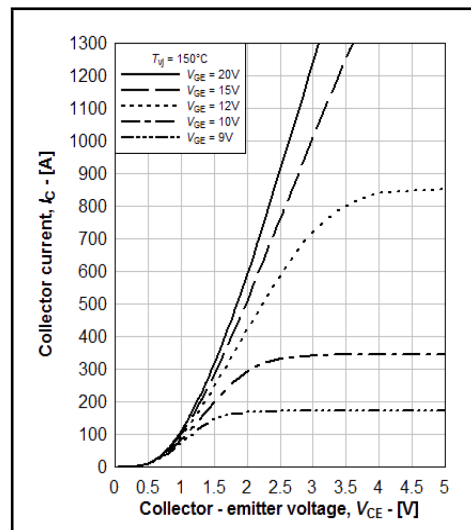


Fig. 4 Typical output characteristics

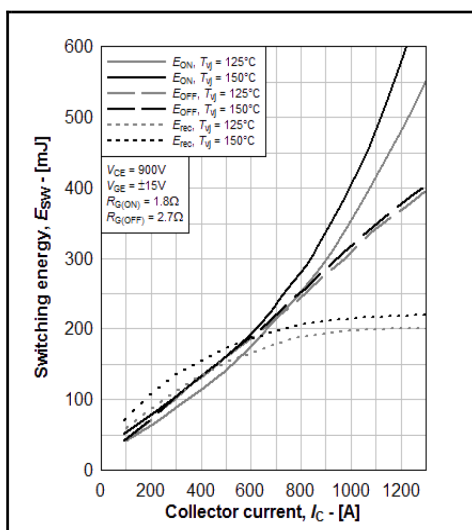


Fig. 5 Typical switching energy vs collector current

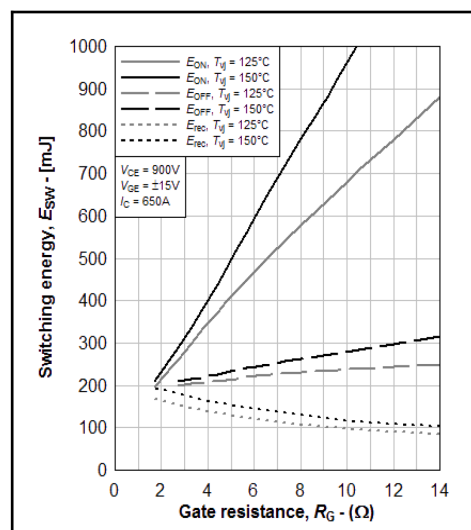


Fig. 6 Typical switching energy vs gate resistance

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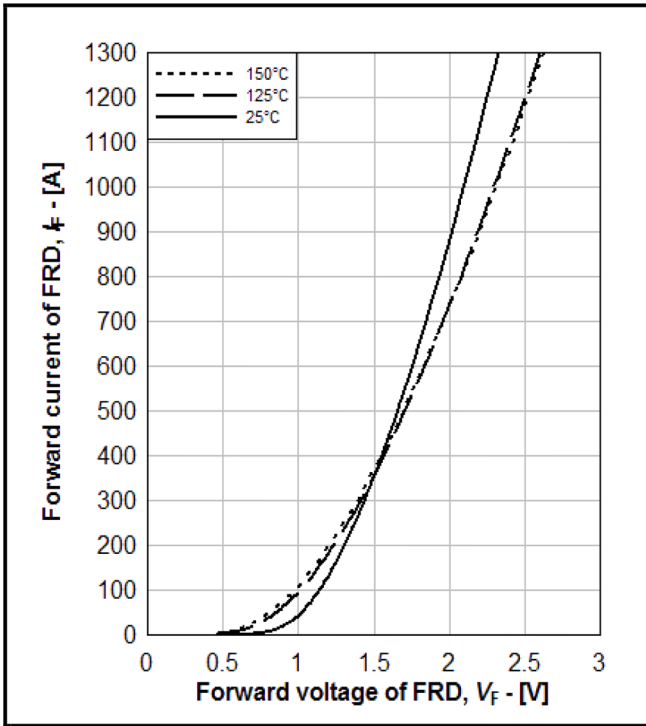


Fig. 7 Diode typical forward characteristics

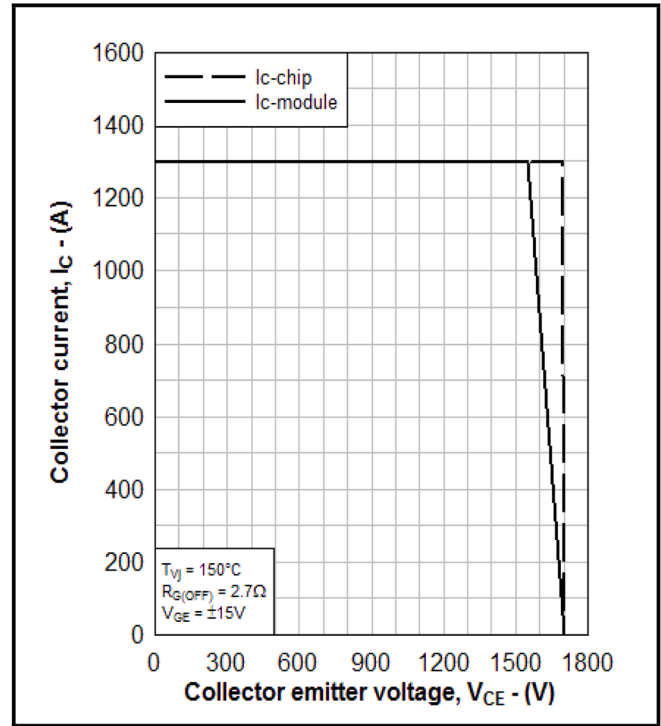


Fig. 8 Reverse bias safe operating area

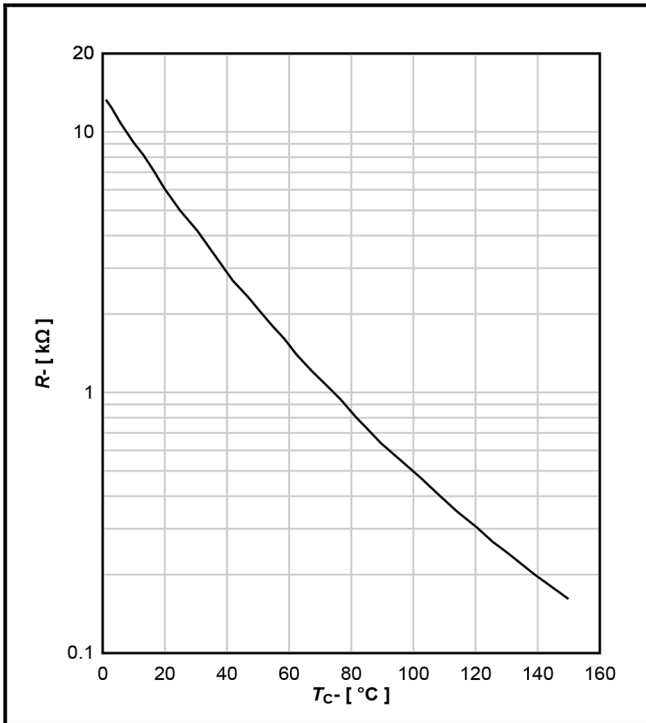


Fig. 9 Typical NTC thermistor characteristics

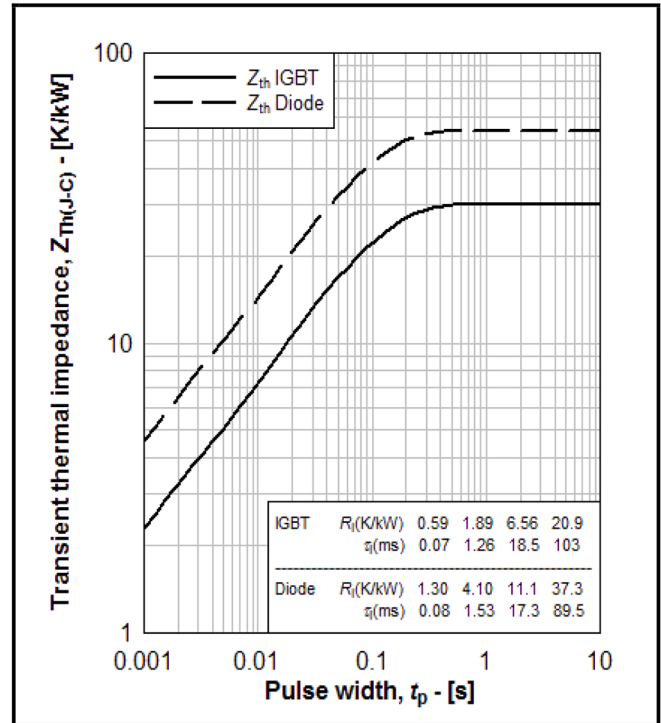
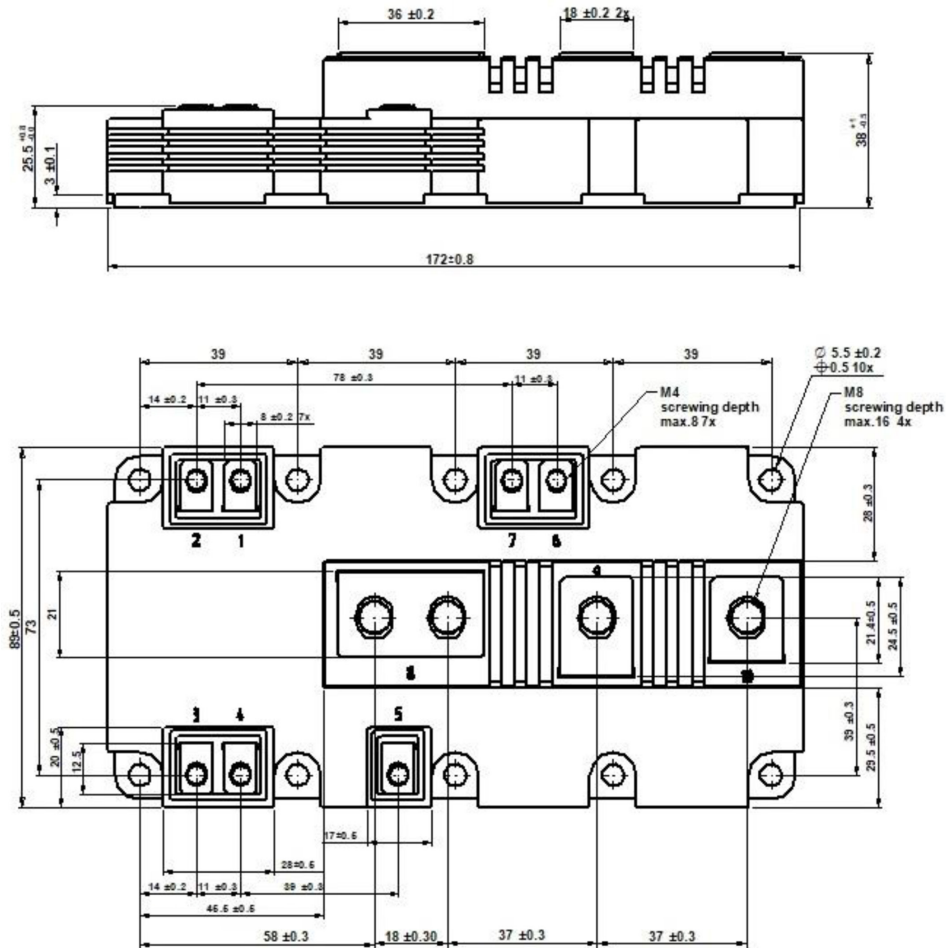


Fig. 10 Transient thermal impedance

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Nominal Weight: 900g

## Part Number Table

Description	Part Number
Half Bridge IGBT Module, 1700V, 650A, H2 Case Code	MPIM650H217TG5

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