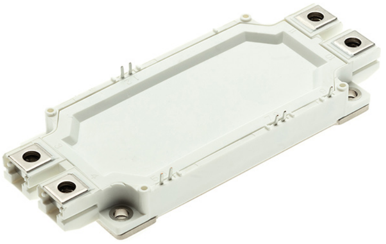
Half Bridge IGBT Module

RoHS Compliant



Features

- Trench Gate, Generation 5, TMOS IGBT
- High Thermal Cycling
- Cu Base with Enhanced Al2O3 Substrates
- 10µs Short Circuit Withstand

Key Parameters

V_{CES} : 1700 V
$V_{CE(sat)}$ * (typ) : 1.8
I_C (max) : 600 A
$I_{C(RM)}$ (max) : 1200 A
* Measured at the auxiliary terminals

Applications

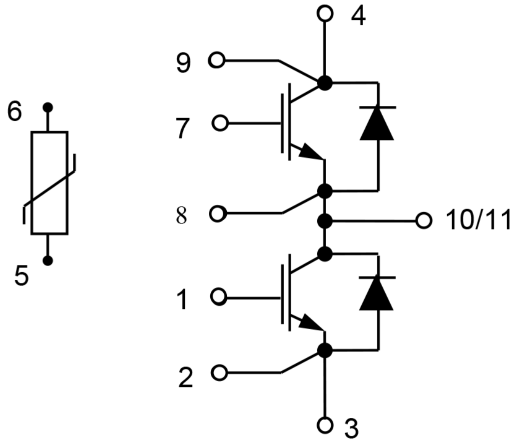
- Wind Turbines
- Power Charging Equipment
- Smart Grid
- High Reliability Inverters

The MP005809 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.

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.



Circuit configuration

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

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	VGE = 0V, TC = 25°C	1700	V
V_{GES}	Gate-emitter voltage	T_C = 25°C	±20	
I_C	Continuous collector current	T_C = 100°C, T_{vj}max = 175°C	600	A
$I_{C(PK)}$	Peak collector current	t_P = 1ms	1200	
P_{max}	Max. transistor power dissipation	TC = 25°C, T_{vj} = 175°C	3.26	kW
I^2t	Diode I^2t value	VR = 0, tp = 10ms, Tvj = 150°C	41.5	kA^2s
V_{isol}	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	3400	V

Thermal and Mechanical Ratings

Internal insulation material	: Al_2O_3
Baseplate material	: Cu
Creepage distance – Terminal to heatsink	: 14.5mm
Creepage distance – Terminal to terminal	: 13mm
Clearance – Terminal to heatsink	: 12.5mm
Clearance – Terminal to terminal	: 10mm
CTI (Comparative Tracking Index)	: >200

Symbol	Parameter	Test Conditions	Min.	Max.	Units
$R_{th(j-c)}$	Thermal resistance– IGBT	Continuous dissipation - junction to case	-	46	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode			80	
$R_{th(c-h)}$	Thermal resistance – case to heatsink (IGBT)	Mounting torque 5Nm (with mounting grease 1W/m °C)	-	-	
$R_{th(c-h)}$	Thermal resistance – case to heatsink (Diode)			-	
T_j	Junction temperature	IGBT	-40	150	°C
		Diode			
F_{stg}	Storage temperature range	-		125	
	Screw torque	Mounting – M5	3	6	Nm
		Electrical connections – M6	3	6	

Electrical Characteristics

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 = 15mA, V_{GE} = V_{CE}	5.6	6.2	6.4	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 600A		1.8	2.25	
		V_{GE} = 15V, I_C = 600A, T_j = 125°C		2.2	2.6	
		V_{GE} = 15V, I_C = 600A, T_j = 150°C		2.3	2.7	
I_F	Diode forward current	DC		600		A
I_{FM}	Diode maximum forward current	t_p = 1ms		1200		
V_F	Diode forward voltage	I_F = 600A		1.85	2.2	V
		I_F = 600A, T_j = 125°C		2.1	2.3	
		I_F = 600A, T_j = 150°C				
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		96		nF
Q_g	Gate charge	±15V		6.1		µC
Q_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		0.7		nF
L_M	Module inductance			20		nH
R_{INT}	Internal transistor resistance			1		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		2400		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 = 600A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 1Ω $R_{G(ON)}$ = 1Ω L_S ~ 60nH	dv/dt = 5000V/μs		760		ns
t_f	Fall time				360		
E_{OFF}	Turn-off energy loss				135		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 7700A/μs		285		ns
t_r	Rise time				81		
E_{ON}	Turn-on energy loss				45		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 900V di/dt = 7700A/μs			155		μC
I_{rr}	Diode reverse recovery current				720		A
E_{rec}	Diode reverse recovery energy				123		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 = 600A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 1Ω $R_{G(ON)}$ = 1Ω L_S ~ 60nH	dv/dt = 5000V/μs		860		ns
t_f	Fall time				500		
E_{OFF}	Turn-off energy loss				183		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 7700A/μs		295		ns
t_r	Rise time				85		
E_{ON}	Turn-on energy loss				61		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 900V di/dt = 7700A/μs			250		μC
I_{rr}	Diode reverse recovery current				810		A
E_{rec}	Diode reverse recovery energy				192		mJ

T_{case} = 150°C unless stated otherwise.

Symbol	Parameter	Test Conditions		Min.	Typ	Max.	Units
$t_{d(off)}$	Turn-off delay time	I_C = 600A V_{CE} = 900V V_{GE} = ±15V $R_{G(OFF)}$ = 1Ω $R_{G(ON)}$ = 1Ω L_S ~ 60nH	dv/dt = 5000V/µs		870		ns
t_f	Fall time				535		
E_{OFF}	Turn-off energy loss				194		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 7700A/µs		300		ns
t_r	Rise time				86		
E_{ON}	Turn-on energy loss				67		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 900V di/dt = 7700A/µs			270		µC
I_{rr}	Diode reverse recovery current				830		A
E_{rec}	Diode reverse recovery energy				209		mJ

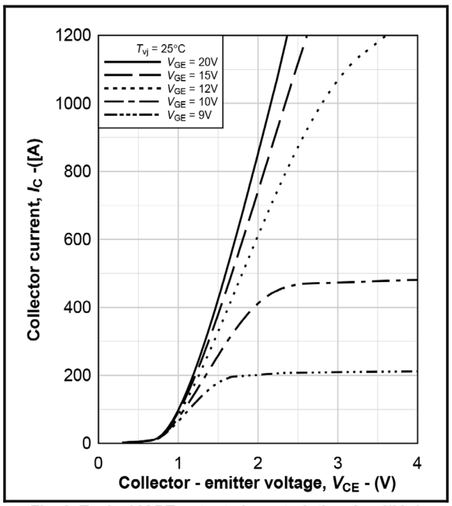


Fig. 3 Typical IGBT output characteristics, $I_C = f(V_{CE})$

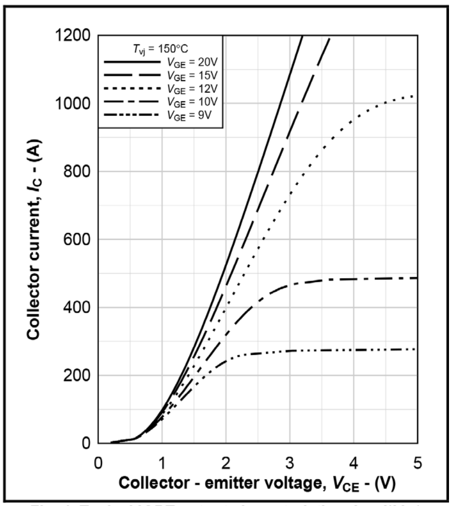


Fig. 4 Typical IGBT output characteristics, $I_C = f(V_{CE})$

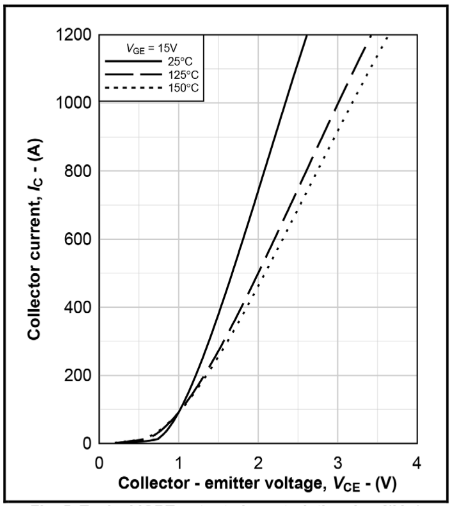


Fig. 5 Typical IGBT output characteristics, $I_C = f(V_{CE})$

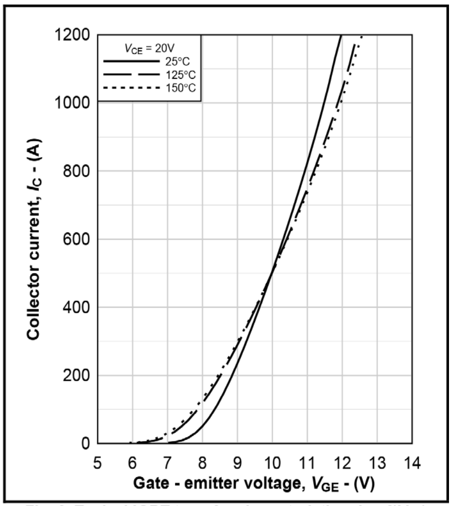


Fig. 6 Typical IGBT transfer characteristics, $I_C = f(V_{GE})$

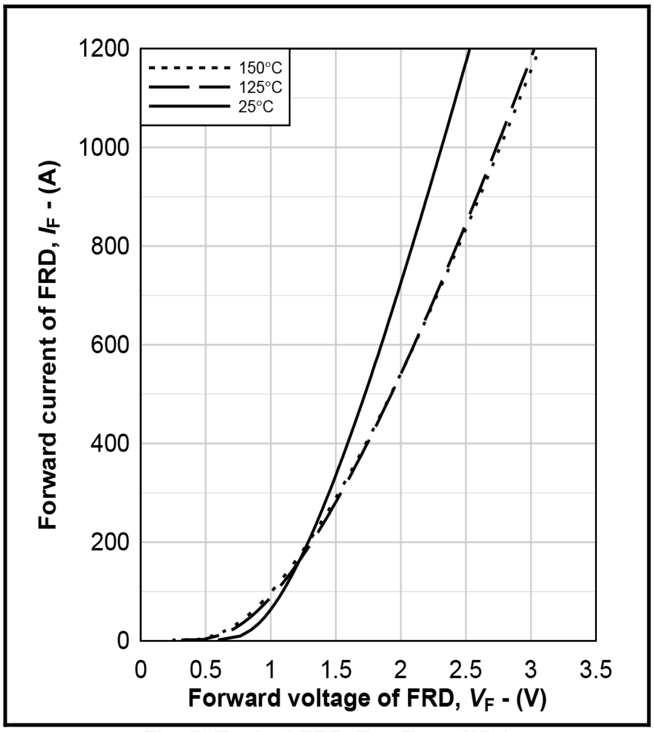


Fig. 7 Typical FRD E_{rec}, $E_{rec} = f(R_G)$

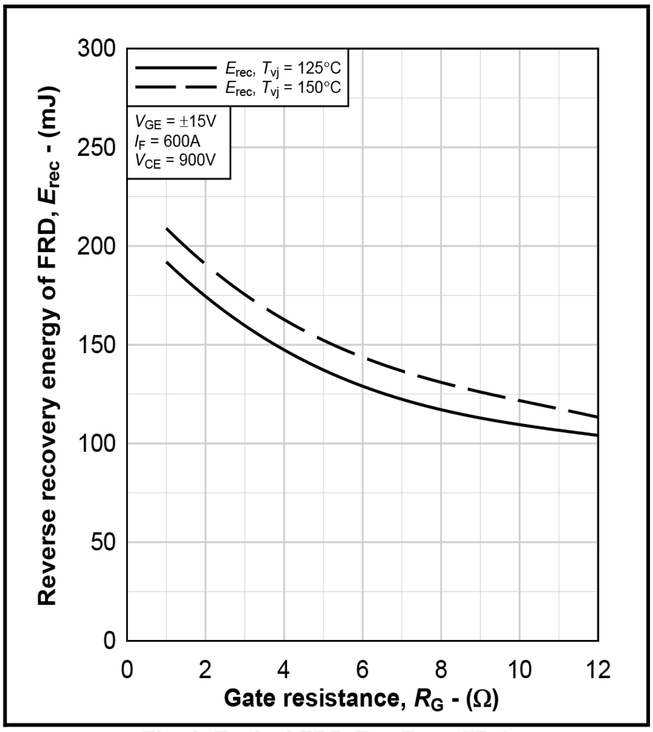


Fig. 8 Typical FRD E_{rec}, $E_{rec} = f(R_G)$

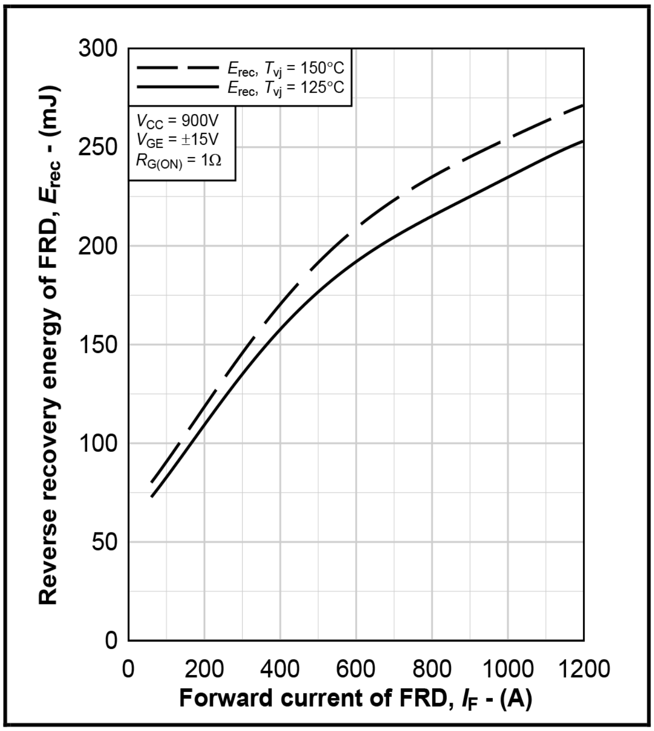


Fig. 9 Typical FRD E_{rec}, $E_{rec} = f(I_F)$

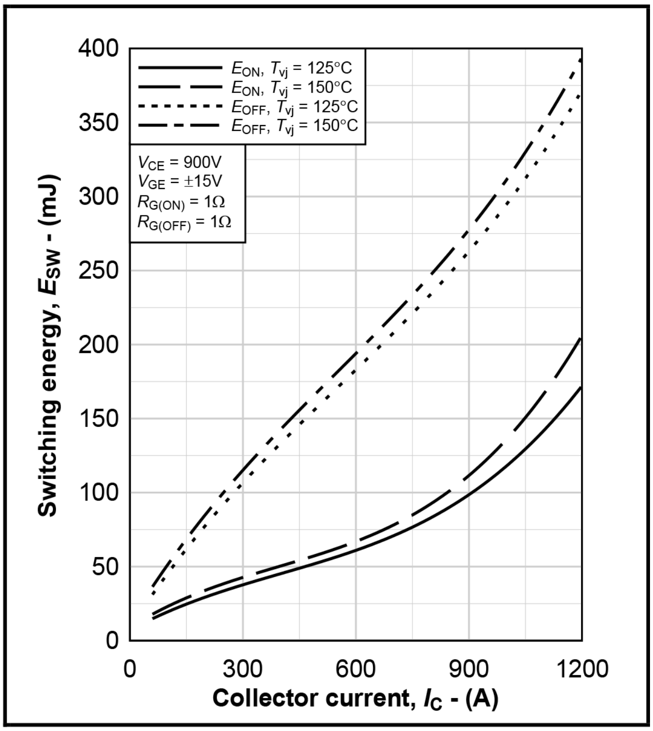


Fig. 10 Typical IGBT switching energy,
$E_{ON} = f(I_C)$, $E_{OFF} = f(I_C)$

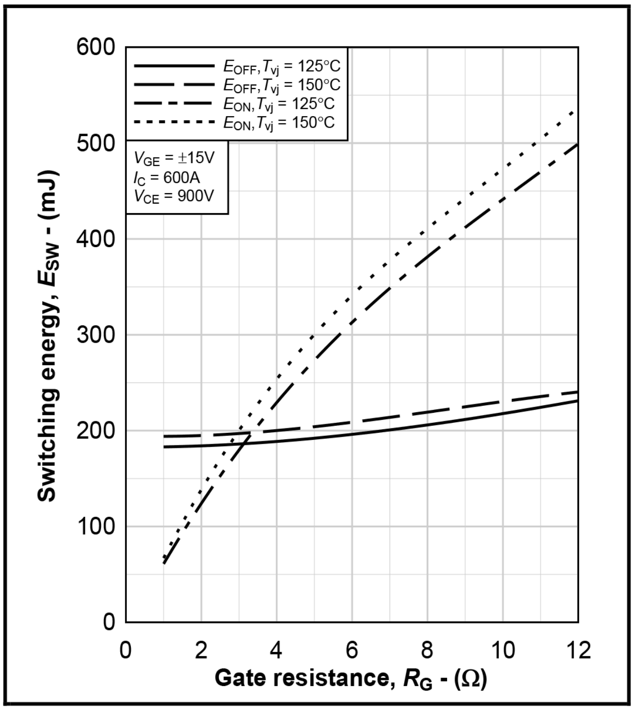


Fig. 11 Typical IGBT switching energy $E_{ON} = f(R_G)$, $E_{OFF} = fR_G)$

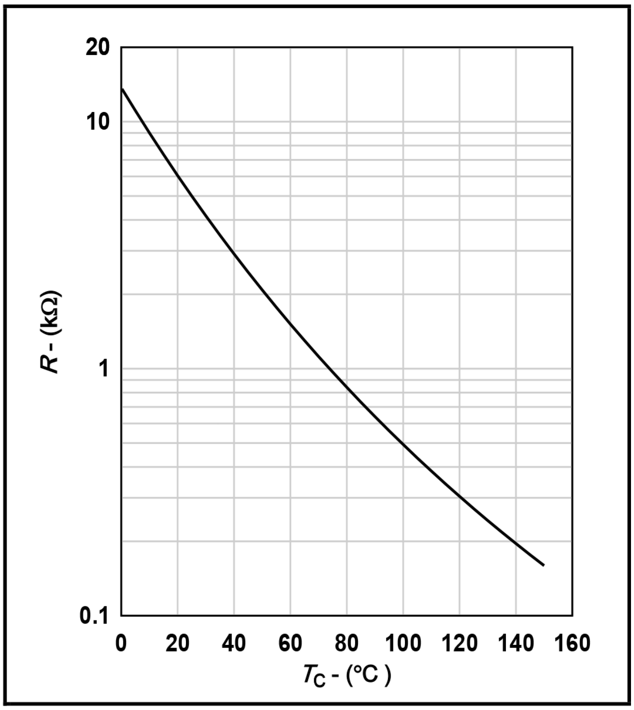


Fig. 12 Typical NTC thermistor characteristic, $R = f(T_C)$

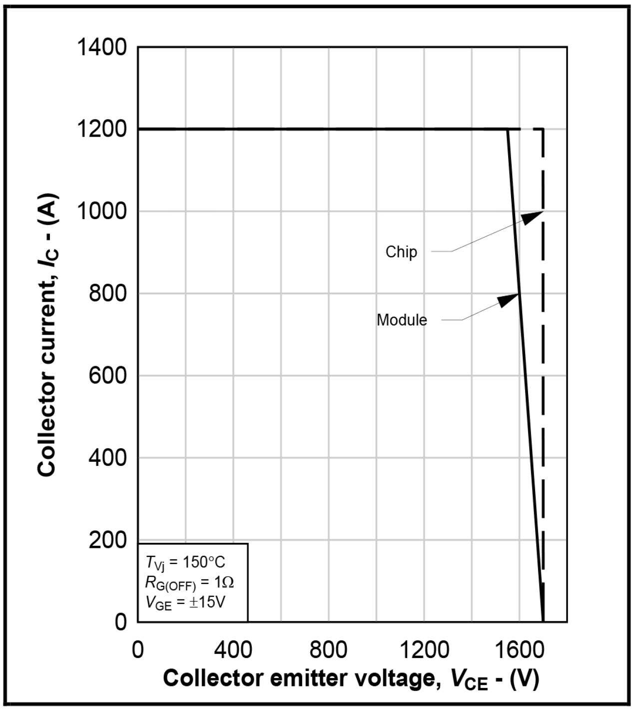


Fig. 13 Reverse bias safe operating area of IGBT, $I_C = f(V_{CE})$

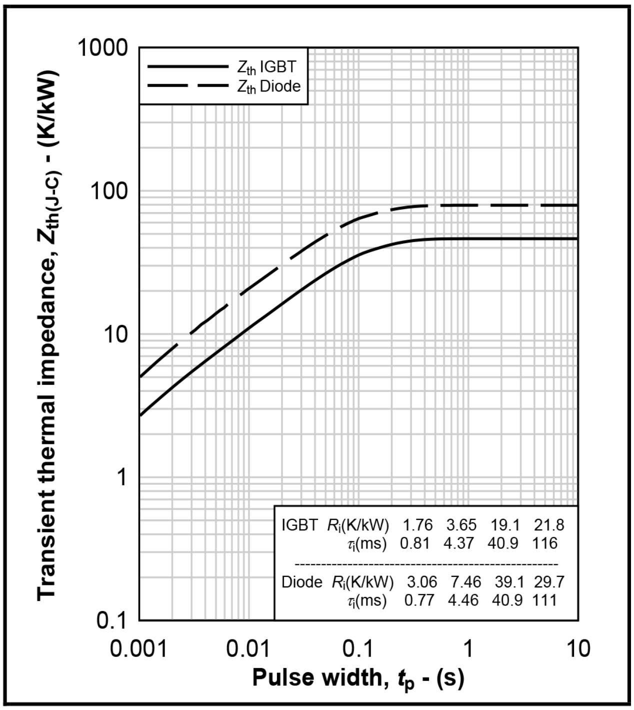
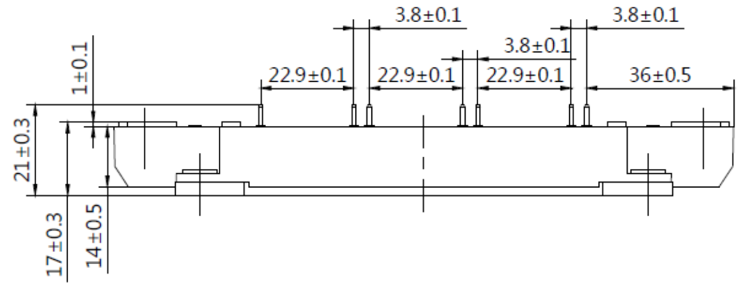
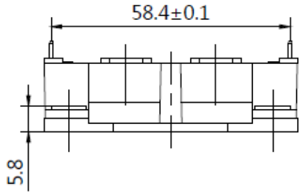
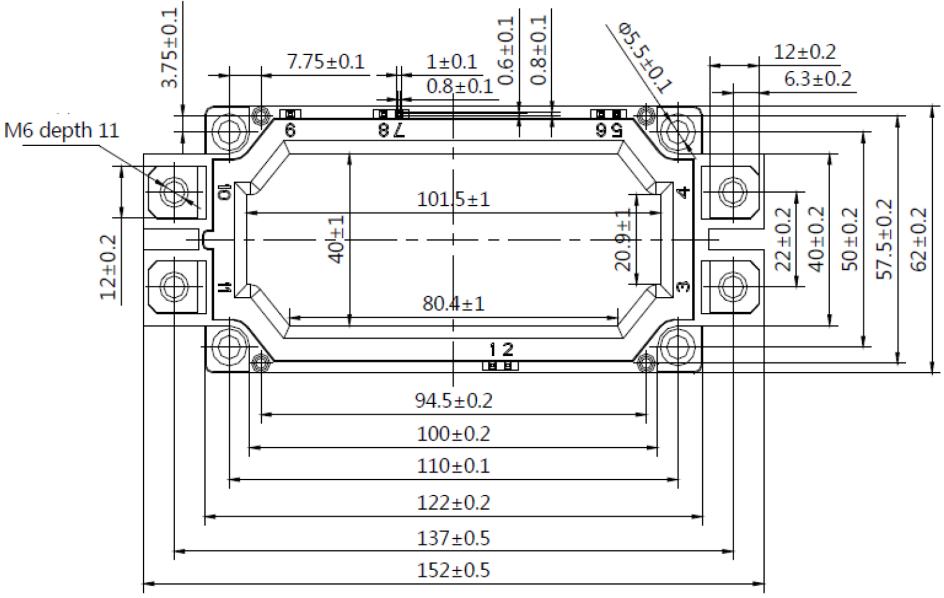


Fig. 14 Transient thermal impedance, $Z_{th(J-C)} = f(t)$







Nominal Weight: 345g

Part Number Table

Description	Part Number
Half Bridge IGBT Module, 1700V, 600A, M1 Case Code	MPIM600M117TG5

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