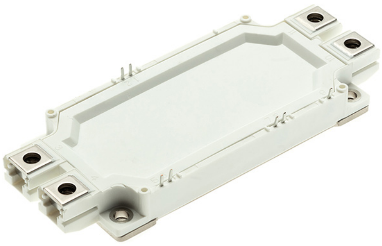
RoHS Compliant



Features

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

Key Parameters

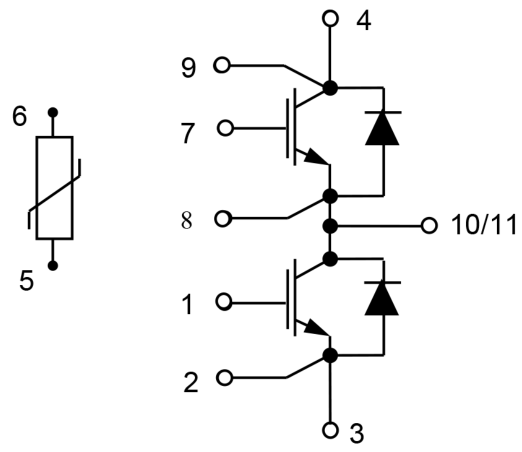
V_{CES} : 1200 V
$V_{CE(sat)}$ * (typ) : 1.7
I_C (max) : 600 A
$I_{C(PK)}$ (max) : 1200 A
* Measured at the auxiliary terminals

Applications

- Motor Drives
- Power Charging Equipment
- Renewable Energy Power Conversion
- High Reliability Inverters

The MP005808 is a half bridge 1200V, 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.

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

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	VGE = 0V, TC = 25°C	1200	V
V_{GES}	Gate-emitter voltage	TC = 25°C	±20	
I_C	Continuous collector current	TC = 88°C	600	A
$I_{C(PK)}$	Peak collector current	tP = 1ms, TC = 133°C	1200	
P_{max}	Max. transistor power dissipation	TC = 25°C, Tvj = 175°C	3	kW
I^2t	Diode I^2t value	VR = 0, tp = 10ms, Tvj = 150°C	28.8	kA^2s
V_{isol}	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	2500	V

Half Bridge IGBT Module

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	-	49	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode			77	
$R_{th(c-h)}$	Thermal resistance – case to heatsink (IGBT)	Mounting torque 5Nm (with mounting grease: 1W/m °C)	-	34	
$R_{th(c-h)}$	Thermal resistance – case to heatsink (Diode)			40	
T_j	Junction temperature – under switching conditions	IGBT	-40	150	°C
		Diode			
F_{stg}	Storage temperature range	-			
	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			10	
		V_{GE} = 0V, V_{CE} = V_{CES}, T_C = 150°C			20	
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	7	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 600A		1.7		
		V_{GE} = 15V, I_C = 600A, T_j = 125°C		2		
		V_{GE} = 15V, I_C = 600A, T_j = 150°C		2.1		
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		1.9		V
		I_F = 600A, T_j = 125°C		2.1		
		I_F = 600A, T_j = 150°C				
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		57		nF
Q_g	Gate charge	±15V		6.1		μC
Q_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		1.8		nF
L_M	Module inductance			22		nH
R_{INT}	Internal transistor resistance			1		mΩ
SC_{Data}	Short circuit current, I_{SC}	T_j = 150°C, V_{CC} = 800V t_p ≤ 10μs, V_{GE} ≤ 15V $V_{CE\ (max)}$ = V_{CES} – L* x dI/dt IEC 60747-9		2800		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} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 0.5Ω $R_{G(ON)}$ = 0.5Ω L_S ~ 40nH	dv/dt = 3500V/µs		710		ns
t_f	Fall time				280		
E_{OFF}	Turn-off energy loss				90		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 6000A/µs		185		ns
t_r	Rise time				92		
E_{ON}	Turn-on energy loss				22		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 600V di/dt = 7000A/µs			52		µC
I_{rr}	Diode reverse recovery current				365		A
E_{rec}	Diode reverse recovery energy				29		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} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 0.5Ω $R_{G(ON)}$ = 0.5Ω L_S ~ 40nH	dv/dt = 3500V/µs		780		ns
t_f	Fall time				400		
E_{OFF}	Turn-off energy loss				102		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 6000A/µs		180		ns
t_r	Rise time				98		
E_{ON}	Turn-on energy loss				32		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 600V di/dt = 6000A/µs			78		µC
I_{rr}	Diode reverse recovery current				420		A
E_{rec}	Diode reverse recovery energy				43		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} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 0.5Ω $R_{G(ON)}$ = 0.5Ω L_S ~ 40nH	dv/dt = 3500V/μs		800		ns
t_f	Fall time				430		
E_{OFF}	Turn-off energy loss				105		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 6000A/μs		180		ns
t_r	Rise time				100		
E_{ON}	Turn-on energy loss				34		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 600A V_{CE} = 600V di/dt = 6000A/μs			100		μC
I_{rr}	Diode reverse recovery current				450		A
E_{rec}	Diode reverse recovery energy				55		mJ

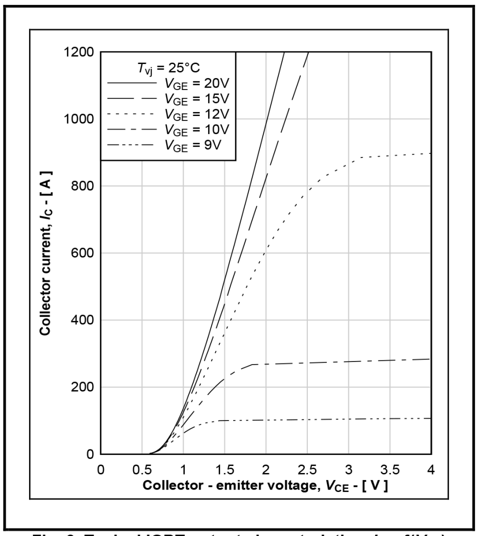


Fig. 3 Typical IGBT output characteristics, I_C = f(V_{CE})

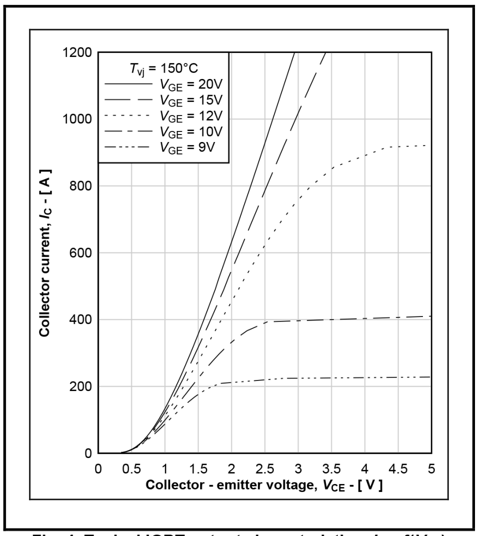


Fig. 4 Typical IGBT output characteristics, I_C = f(V_{CE})

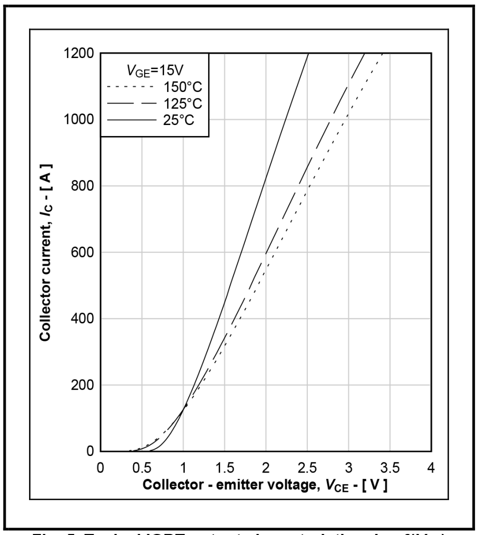


Fig. 5 Typical IGBT output characteristics, I_C = f(V_{CE})

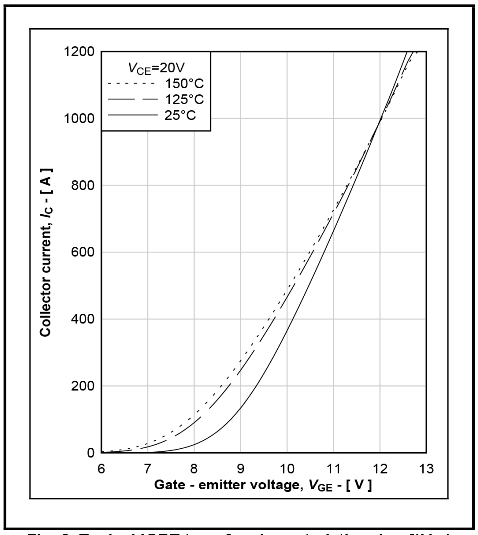


Fig. 6 Typical IGBT transfer characteristics, I_C = f(V_{GE})

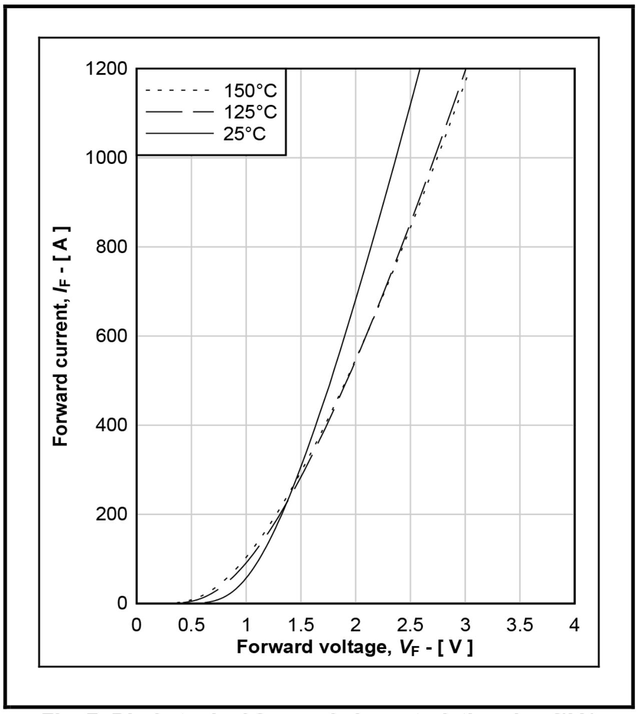


Fig. 7 Diode typical forward characteristics, $I_F = f(V_F)$

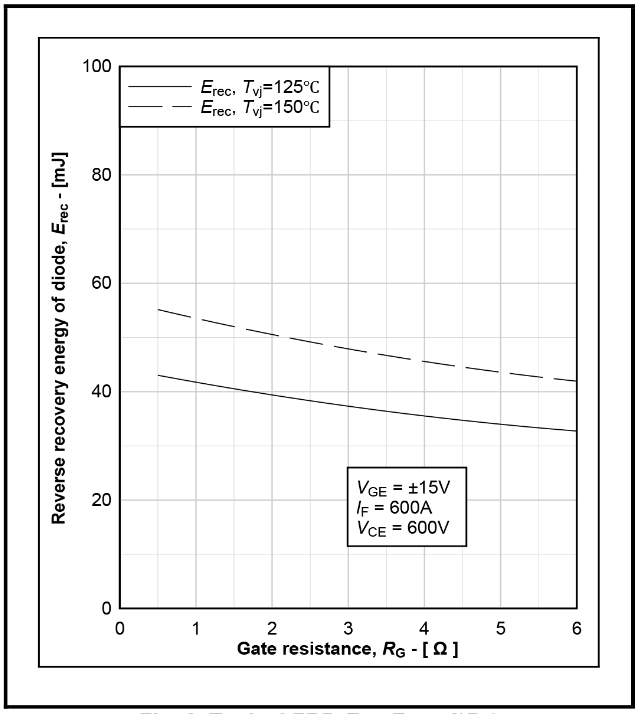


Fig. 8 Typical FRD E_{rec}, $E_{rec} = f(R_G)$

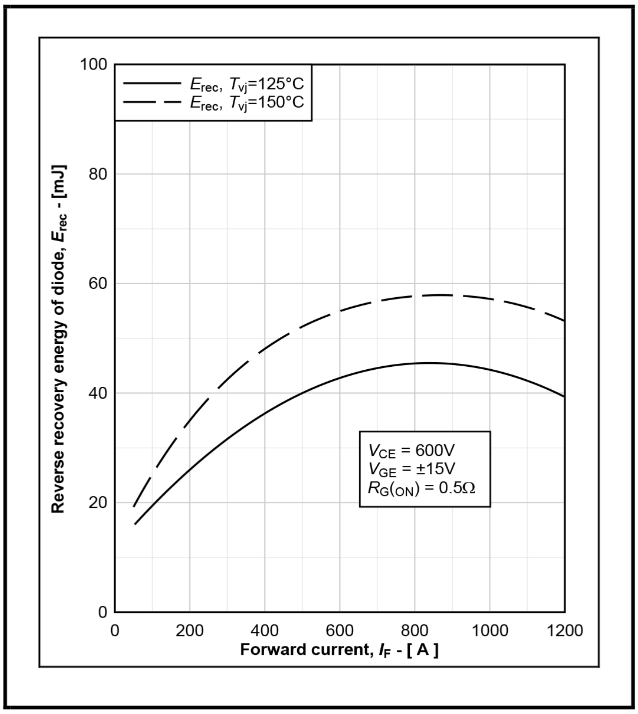


Fig. 9 Typical FRD E_{rec}, $E_{rec} = f(I_F)$

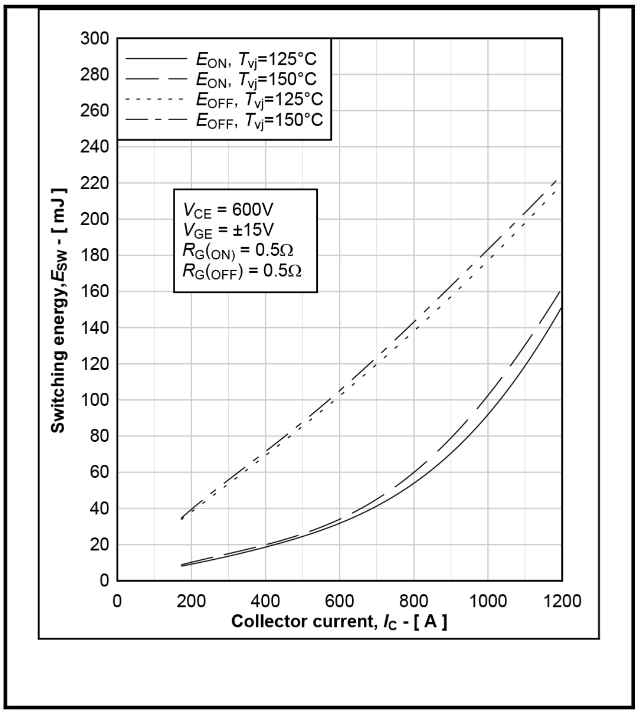


Fig. 10 Typical IGBT switching energy,
$E_{ON} = f(I_C)$, $E_{OFF} = f(I_C)$

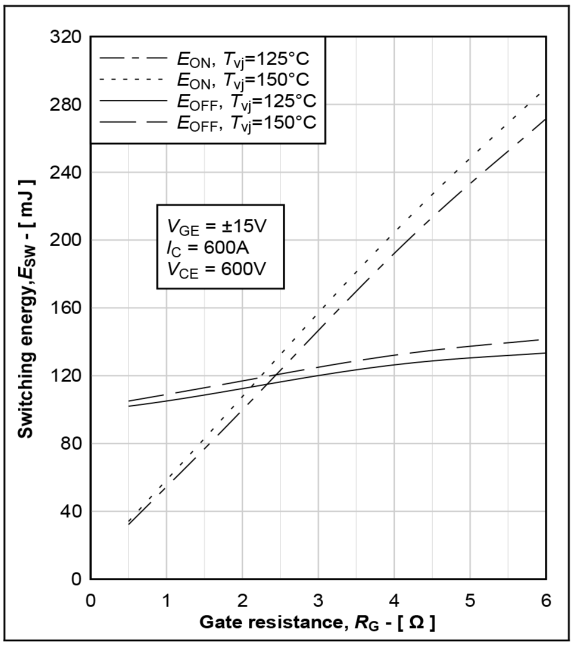


Fig. 11 Typical IGBT switching energy E_{ON} = f(R_G), E_{OFF} = fR_G)

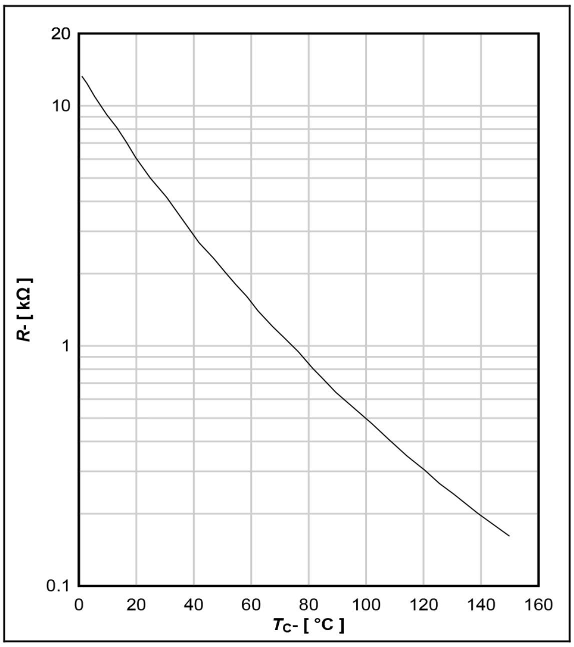


Fig. 12 Typical NTC thermistor characteristic, R = f(T_C)

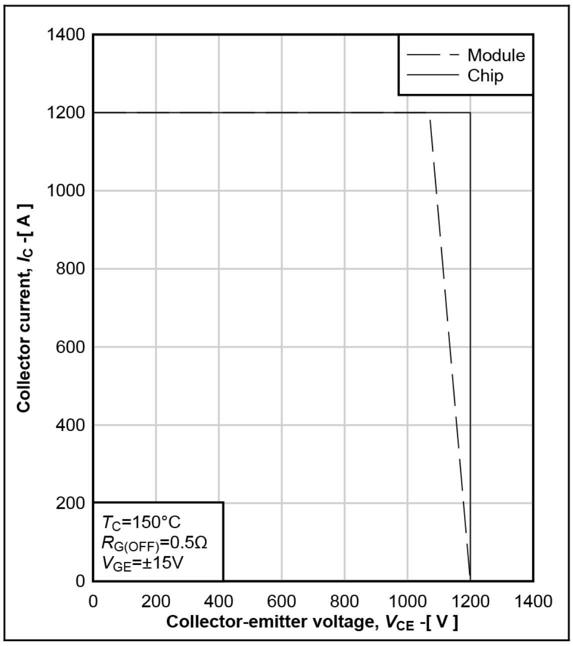


Fig. 13 Reverse bias safe operating area of IGBT, I_C = f(V_{CE})

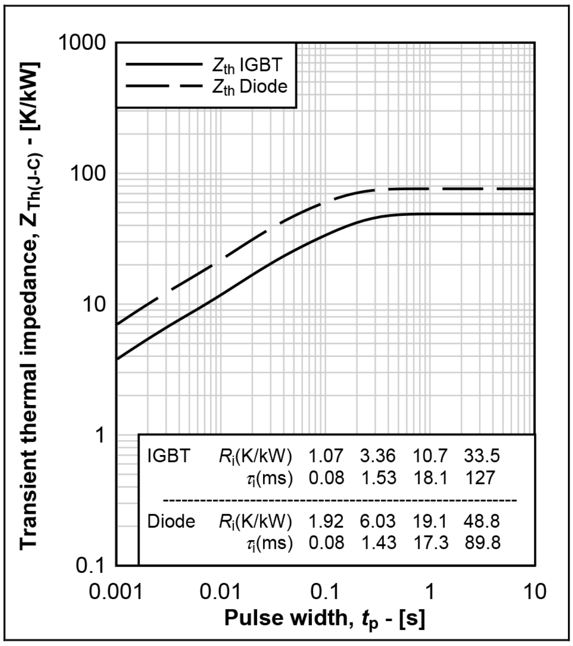
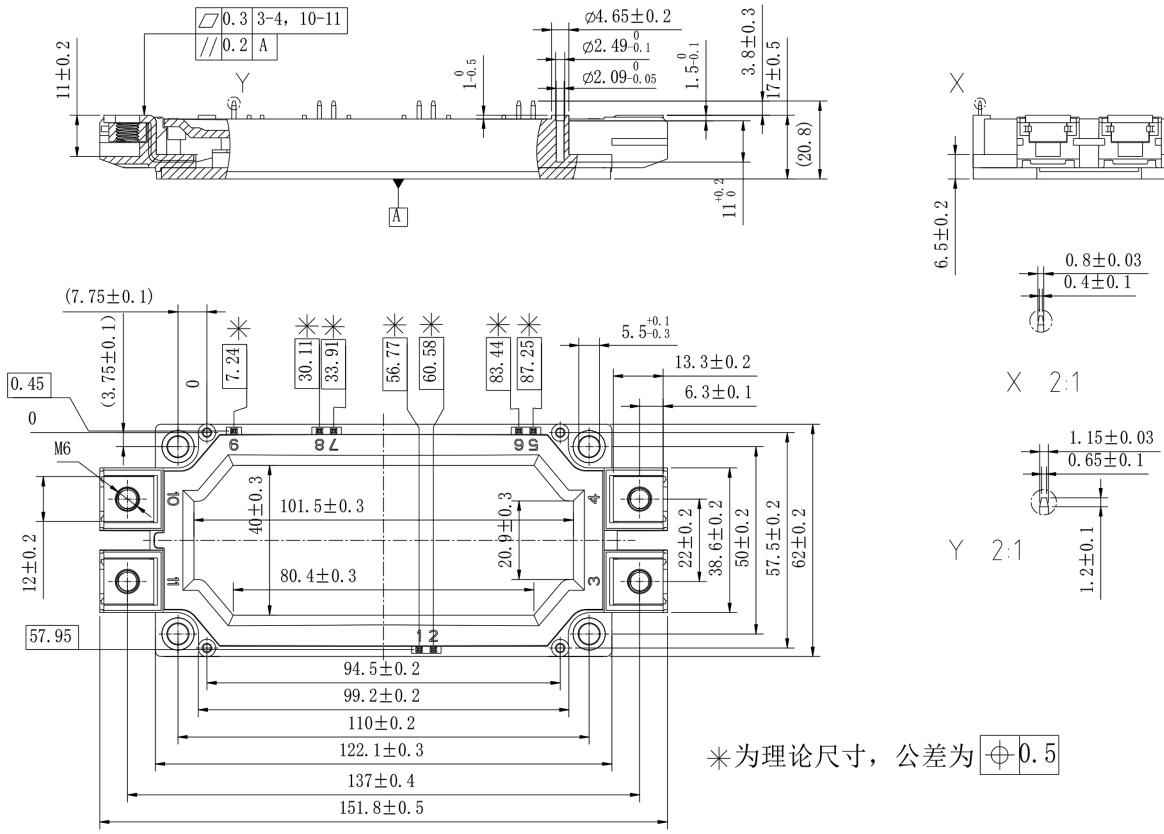


Fig. 14 Transient thermal impedance, $Z_{th(J\text{-}C)}$ = f(t)



Nominal Weight: 345g

Part Number Table

Description	Part Number
Half Bridge IGBT Module, 1200V, 600A, M1 Case Code	MPIM600M112TG5