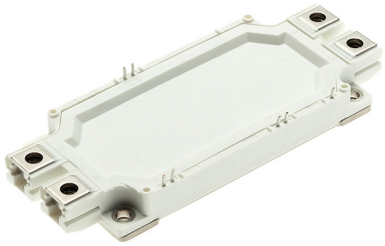
Half Bridge IGBT Module

multicomp PRO

RoHS Compliant



Features

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

Key Parameters

V_{CES}	: 1200 V
$V_{CE(sat)}$ * (typ)	: 1.65
I_C (max)	: 450 A
$I_{C(PK)}$ (max)	: 900 A

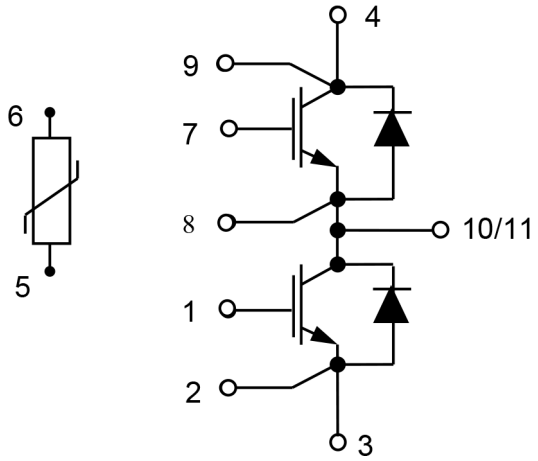
* Measured at the auxiliary terminals

Applications

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

The MP005806 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.

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 = 100°C	450	A
$I_{C(PK)}$	Peak collector current	tP = 1ms,	900	
P_{max}	Max. transistor power dissipation	TC = 25°C, Tvj = 175°C	2.8	kW
I^2t	Diode I^2t value	VR = 0, tp = 10ms, Tvj = 150°C	27.2	kA^2s
V_{isol}	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	2500	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 : 13.0mm
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 – transistor	Continuous dissipation - junction to case	-	52	°C/kW
$R_{th(j-c)}$	Thermal resistance – diode			86	
$R_{th(c-h)}$ IGBT	Thermal resistance – case to heatsink (IGBT)	Mounting torque 3Nm (with mounting grease 1W/m °C)	-	30	
$R_{th(c-h)}$ Diode	Thermal resistance – case to heatsink (Diode)			45	
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	

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	6.4	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 450A		1.65	2.25	
		V_{GE} = 15V, I_C = 450A, T_j = 125°C		1.95	2.6	
		V_{GE} = 15V, I_C = 450A, T_j = 150°C		2	2.7	
V_F	Diode forward current	DC		450		A
V_{IFM}	Diode maximum forward current	t_p = 1ms		900		
V_F	Diode forward voltage	I_F = 450A		1.65	2.2	V
		I_F = 450A, T_j = 125°C		1.75	2.3	
		I_F = 450A, T_j = 150°C				
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		62		nF
Q_g	Gate charge	±15V		4.6		µC
Q_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		0.82		nF
I_M	Module inductance			20		nH
R_{INT}	Internal transistor resistance			1.1		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		1900		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 = 450A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 1Ω $R_{G(ON)}$ = 1Ω L_S ~ 50nH	dv/dt = 4500V/µs		560		ns
t_f	Fall time				260		
E_{OFF}	Turn-off energy loss				52		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 7000A/µs		220		ns
t_r	Rise time				70		
E_{ON}	Turn-on energy loss				8.3		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 450A V_{CE} = 600V di/dt = 7000A/µs			34		µC
I_{rr}	Diode reverse recovery current				415		A
E_{rec}	Diode reverse recovery energy				24		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 = 450A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 1Ω $R_{G(ON)}$ = 1Ω L_S ~ 50nH	dv/dt = 4500V/µs		490		ns
t_f	Fall time				320		
E_{OFF}	Turn-off energy loss				62		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 7000A/µs		224		ns
t_r	Rise time				74		
E_{ON}	Turn-on energy loss				12		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 450A V_{CE} = 600V di/dt = 7000A/µs			77		µC
I_{rr}	Diode reverse recovery current				475		A
E_{rec}	Diode reverse recovery energy				48		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 = 450A V_{CE} = 600V V_{GE} = ±15V $R_{G(OFF)}$ = 1Ω $R_{G(ON)}$ = 1Ω L_S ~ 50nH	dv/dt = 4500V/µs		600		ns
t_f	Fall time				330		
E_{OFF}	Turn-off energy loss				65		mJ
$t_{d(on)}$	Turn-on delay time		di/dt = 7000A/µs		226		ns
t_r	Rise time				76		
E_{ON}	Turn-on energy loss				13		mJ
Q_{rr}	Diode reverse recovery charge	I_F = 450A V_{CE} = 600V di/dt = 7000A/µs			90		µC
I_{rr}	Diode reverse recovery current				500		A
E_{rec}	Diode reverse recovery energy				55		mJ

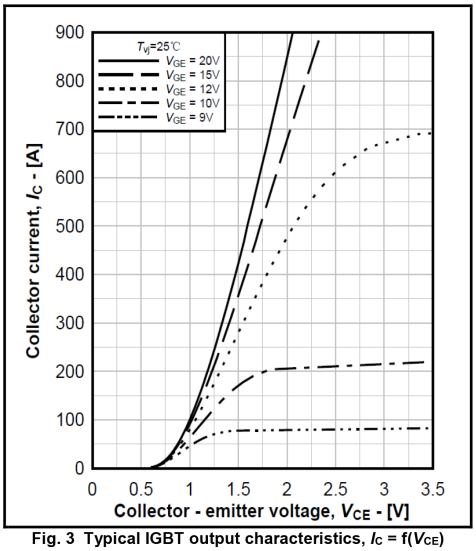


Fig. 3 Typical IGBT output characteristics, $I_C = f(V_{CE})$

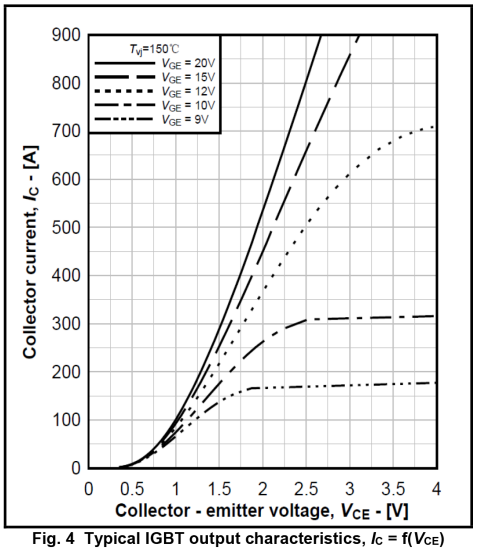


Fig. 4 Typical IGBT output characteristics, $I_C = f(V_{CE})$

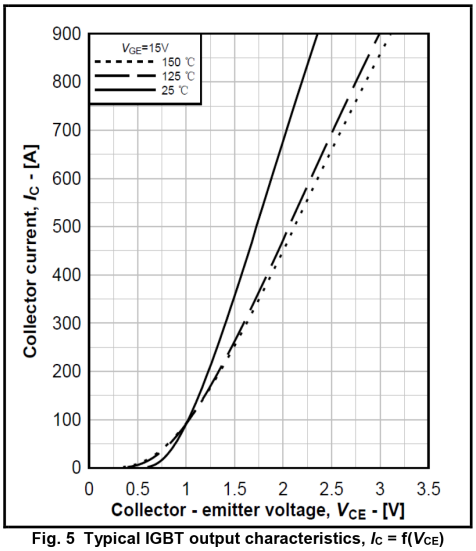


Fig. 5 Typical IGBT output characteristics, $I_C = f(V_{CE})$

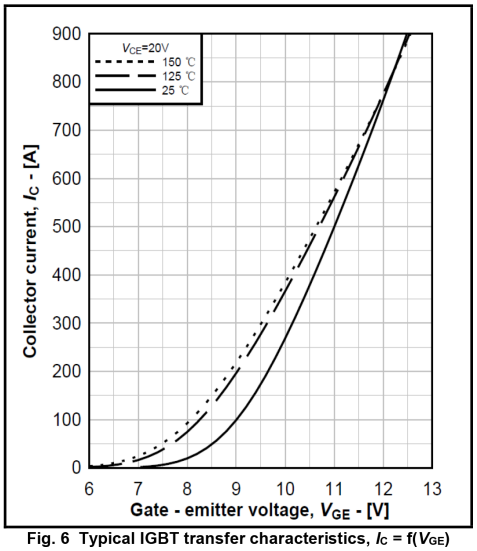


Fig. 6 Typical IGBT transfer characteristics, $I_C = f(V_{GE})$

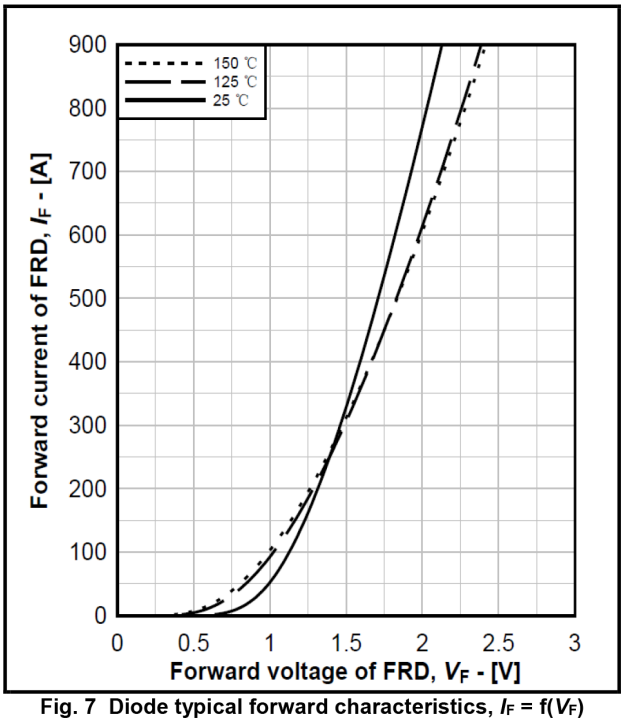


Fig. 7 Diode typical forward characteristics, $I_F = f(V_F)$

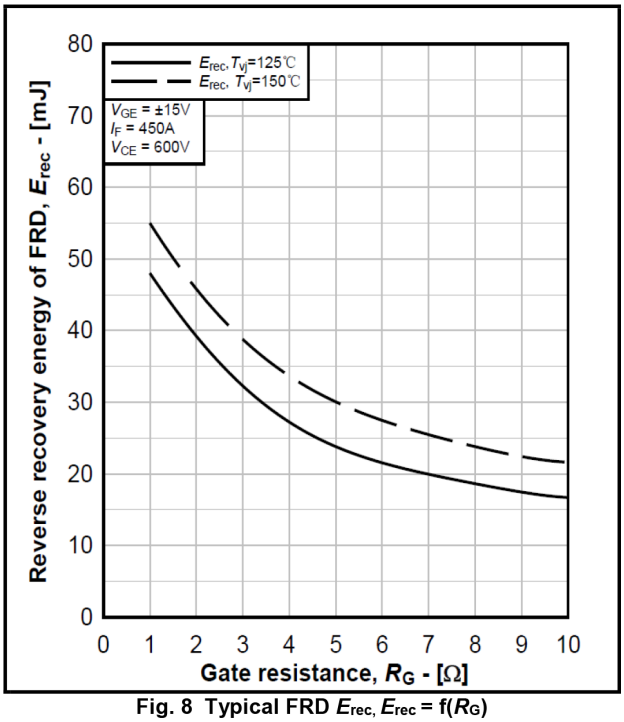


Fig. 8 Typical FRD E_{rec}, $E_{rec} = f(R_G)$

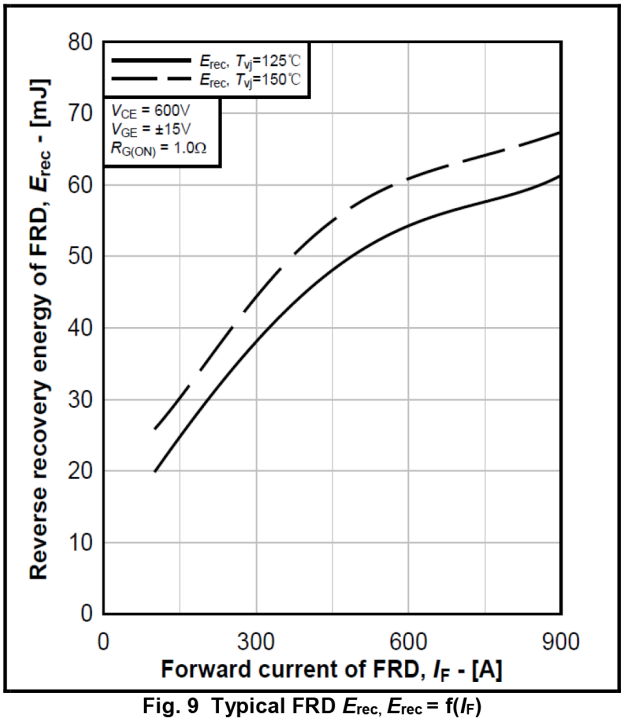


Fig. 9 Typical FRD E_{rec}, $E_{rec} = f(I_F)$

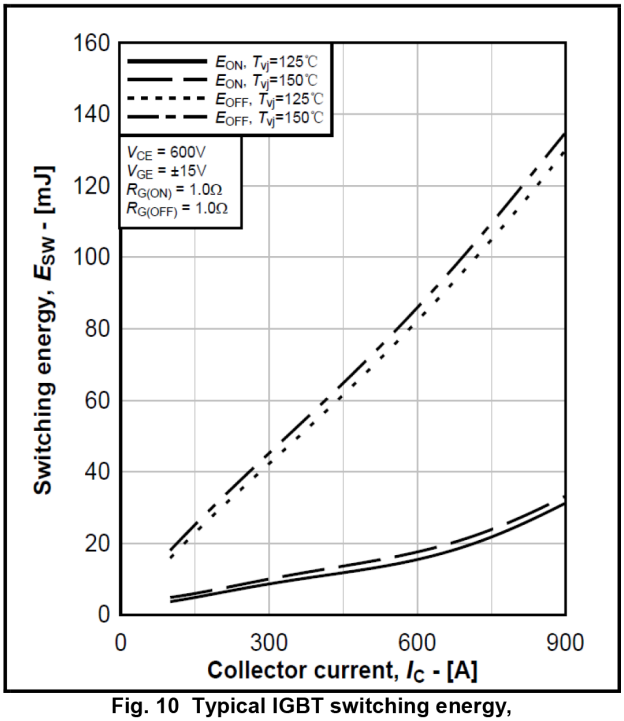


Fig. 10 Typical IGBT switching energy, $E_{ON} = f(I_C)$, $E_{OFF} = f(I_C)$

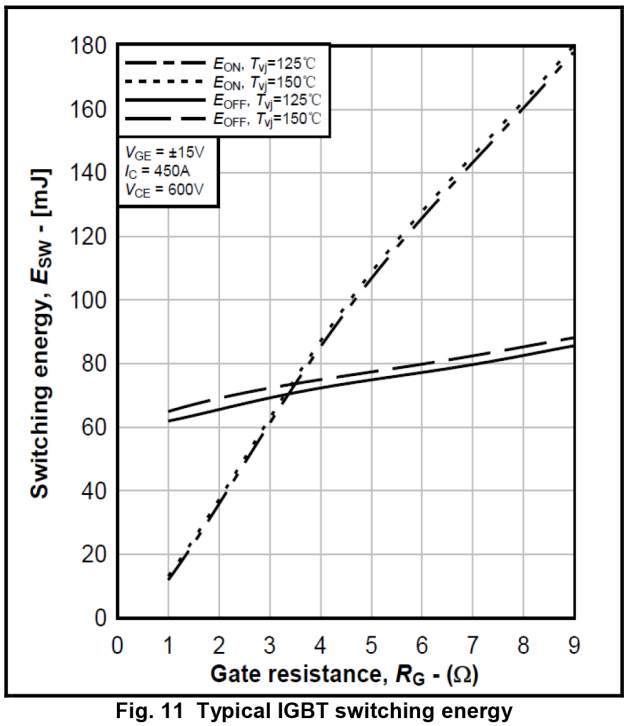


Fig. 11 Typical IGBT switching energy
$E_{ON} = f(R_G)$, $E_{OFF} = fR_G)$

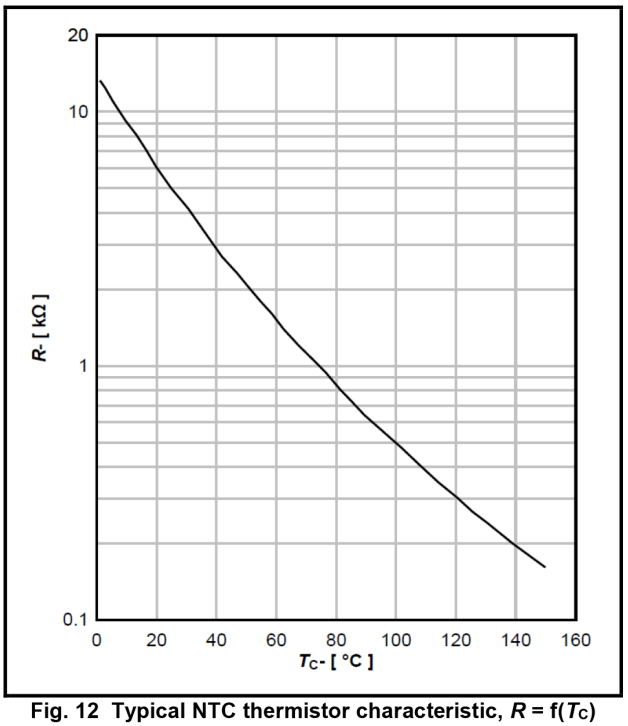


Fig. 12 Typical NTC thermistor characteristic, $R = f(T_C)$

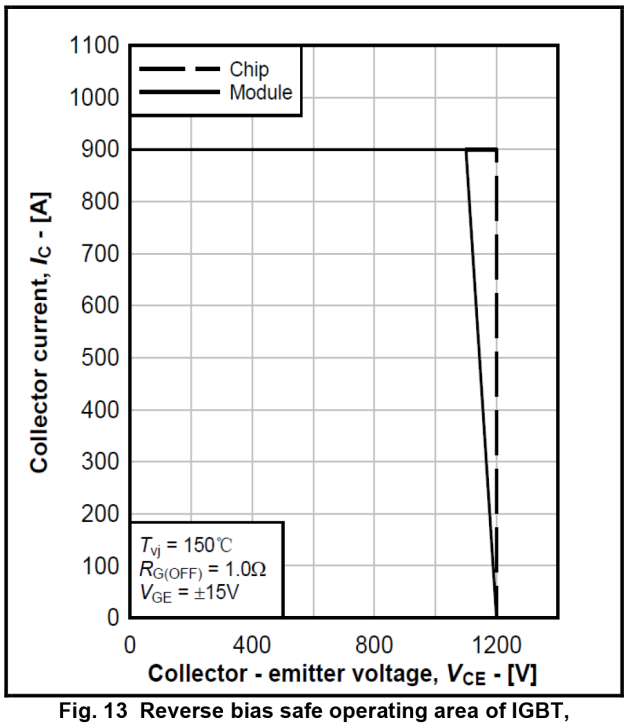


Fig. 13 Reverse bias safe operating area of IGBT,
$I_C = f(V_{CE})$

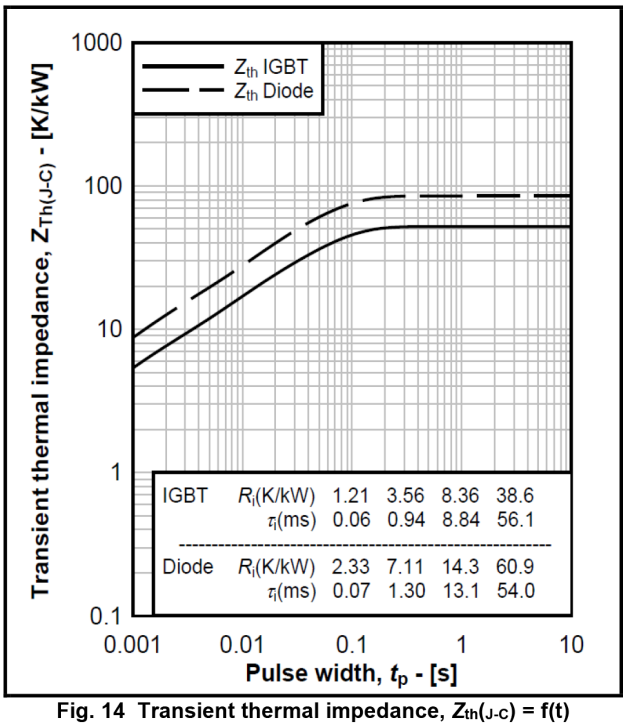
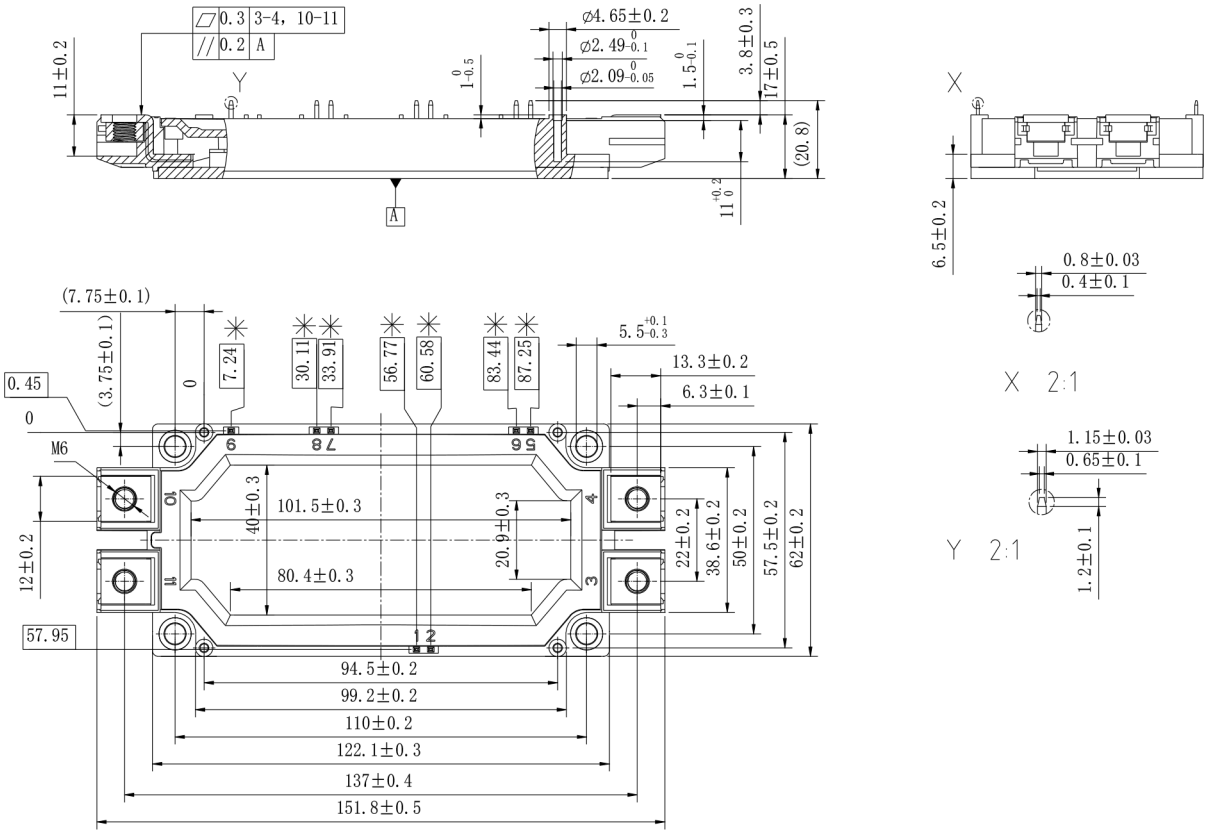


Fig. 14 Transient thermal impedance, $Z_{th(J-C)} = f(t)$



Nominal Weight: 345g

Part Number Table

Description	Part Number
Half Bridge IGBT Module, 1200V, 450A, M1 Case Code	MPIM450M112TG5