

### FEATURES

- 10 $\mu$ s Short Circuit Withstand
- High Thermal Cycling Capability
- Non Punch Through Silicon
- Isolated AISiC Base with AlN Substrates
- Lead Free construction

### APPLICATIONS

- High Reliability Inverters
- Motor Controllers
- Traction Drives

The Powerline range of high power modules includes half bridge, chopper, dual, single and bi-directional switch configurations covering voltages from 1200V to 6500V and currents up to 2400A.

The DIM1600FSM12-A000 is a single switch 1200V, n-channel enhancement mode, insulated gate bipolar transistor (IGBT) module. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 10 $\mu$ s 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.

### ORDERING INFORMATION

Order As:

#### DIM1600FSM12-A000

Note: When ordering, please use the complete part number

### KEY PARAMETERS

$V_{CES}$	<b>1200V</b>
$V_{CE(sat)}$ * (typ)	<b>2.2V</b>
$I_C$ (max)	<b>1600A</b>
$I_{C(PK)}$ (max)	<b>3200A</b>

\* Measured at the power busbars, not the auxiliary terminals

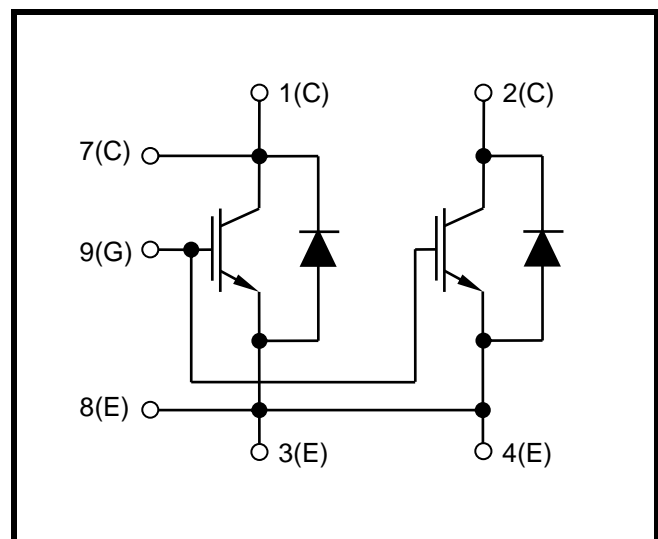


Fig. 1 Circuit configuration



Outline type code: F

(See Fig. 11 for further information)

Fig. 2 Package

## 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.

$T_{case} = 25^{\circ}\text{C}$  unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
$V_{CES}$	Collector-emitter voltage	$V_{GE} = 0\text{V}$	1200	V
$V_{GES}$	Gate-emitter voltage		$\pm 20$	V
$I_C$	Continuous collector current	$T_{case} = 85^{\circ}\text{C}$	1600	A
$I_{C(PK)}$	Peak collector current	1ms, $T_{case} = 115^{\circ}\text{C}$	3200	A
$P_{max}$	Max. transistor power dissipation	$T_{case} = 25^{\circ}\text{C}$ , $T_j = 150^{\circ}\text{C}$	13890	W
$I^2t$	Diode $I^2t$ value	$V_R = 0$ , $t_p = 10\text{ms}$ , $T_j = 125^{\circ}\text{C}$	400	$\text{kA}^2\text{s}$
$V_{isol}$	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	2500	V
$Q_{PD}$	Partial discharge – per module	IEC1287, $V_1 = 1300\text{V}$ , $V_2 = 1000\text{V}$ , 50Hz RMS	10	pC

## THERMAL AND MECHANICAL RATINGS

Internal insulation material:	AlN
Baseplate material:	AlSiC
Creepage distance:	20mm
Clearance:	10mm
CTI (Comparative Tracking Index):	>600

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$R_{th(j-c)}$	Thermal resistance – transistor	Continuous dissipation - junction to case	-	-	9	$^{\circ}\text{C}/\text{kW}$
$R_{th(j-c)}$	Thermal resistance – diode	Continuous dissipation - junction to case	-	-	20	$^{\circ}\text{C}/\text{kW}$
$R_{th(c-h)}$	Thermal resistance – case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)	-	-	8	$^{\circ}\text{C}/\text{kW}$
$T_j$	Junction temperature	Transistor	-	-	150	$^{\circ}\text{C}$
		Diode	-	-	125	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature range	-	-40	-	125	$^{\circ}\text{C}$
	Screw torque	Mounting – M6	-	-	5	Nm
		Electrical connections – M4	-	-	2	Nm
		Electrical connections – M8	-	-	10	Nm

**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>			2	mA
		V <sub>GE</sub> = 0V, V <sub>CE</sub> = V <sub>CES</sub> , T <sub>case</sub> = 125°C			50	mA
I <sub>GES</sub>	Gate leakage current	V <sub>GE</sub> = ± 20V, V <sub>CE</sub> = 0V			8	μA
V <sub>GE(TH)</sub>	Gate threshold voltage	I <sub>C</sub> = 80mA, V <sub>GE</sub> = V <sub>CE</sub>	4.5	5.5	6.5	V
V <sub>CE(sat)</sub>	Collector-emitter saturation voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 1600A		2.2	2.8	V
		V <sub>GE</sub> = 15V, I <sub>C</sub> = 1600A, T <sub>j</sub> = 125°C		2.6	3.3	V
I <sub>F</sub>	Diode forward current	DC			1600	A
I <sub>FM</sub>	Diode maximum forward current	t <sub>p</sub> = 1ms			3200	A
V <sub>F</sub>	Diode forward voltage	I <sub>F</sub> = 1600A		2.1	2.4	V
		I <sub>F</sub> = 1600A, T <sub>j</sub> = 125°C		2.1	2.4	V
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 1MHz		180		nF
Q <sub>g</sub>	Gate charge	±15V		18		μC
C <sub>res</sub>	Reverse transfer capacitance	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 1MHz				nF
L <sub>M</sub>	Module inductance			15		nH
R <sub>INT</sub>	Internal transistor resistance			140		μΩ
SC <sub>Data</sub>	Short circuit current, I <sub>SC</sub>	T <sub>j</sub> = 125°C, V <sub>CC</sub> = 900V t <sub>p</sub> ≤ 10μs, V <sub>GE</sub> ≤ 15V V <sub>CE(max)</sub> = V <sub>CES</sub> - L* x dl/dt IEC 60747-9		9000		A

**Note:**

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

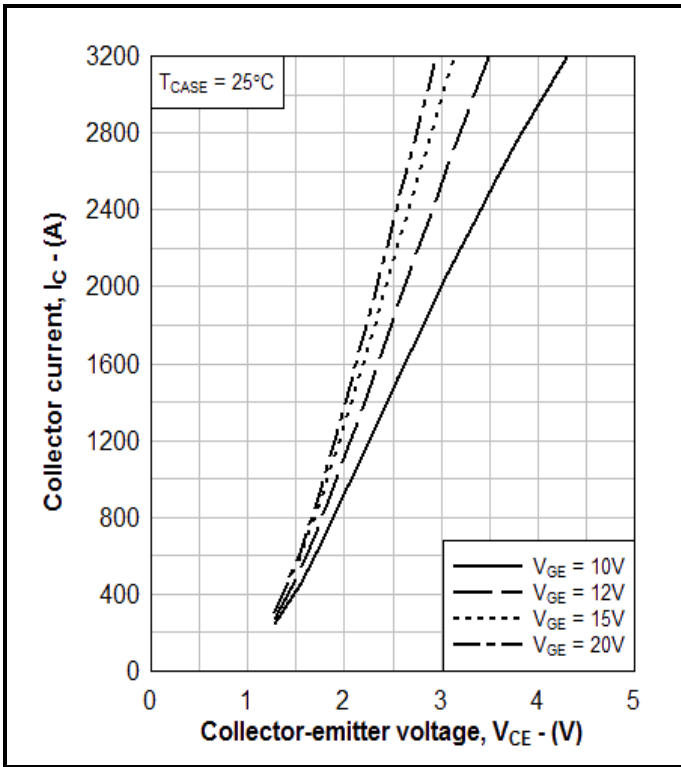
## ELECTRICAL CHARACTERISTICS

$T_{case} = 25^{\circ}\text{C}$  unless stated otherwise

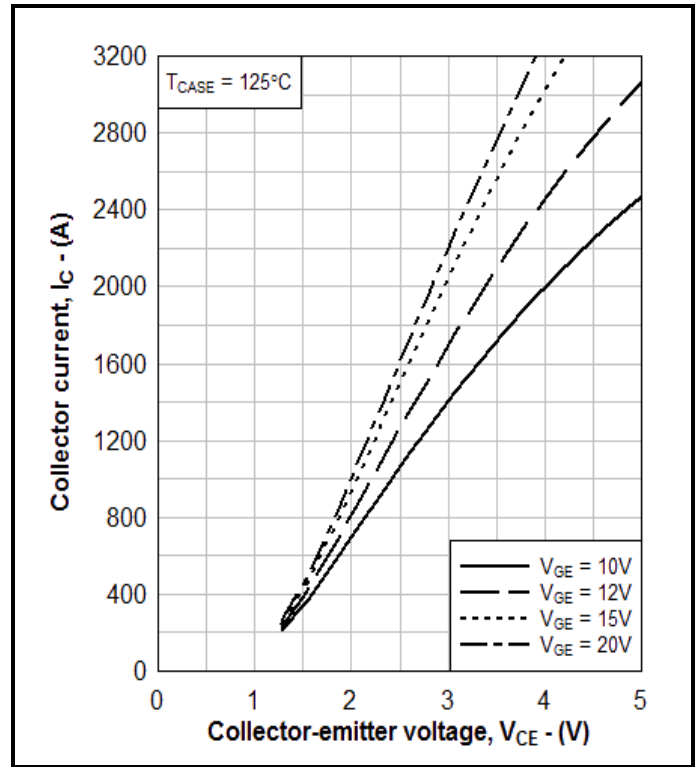
Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units	
$t_{d(off)}$	Turn-off delay time	$I_C = 1600\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 600\text{V}$ $R_{G(ON)} = 1.5\Omega$ $R_{G(OFF)} = 1.5\Omega$ $L_S \sim 100\text{nH}$		1250		ns	
$t_f$	Fall time			180		ns	
$E_{OFF}$	Turn-off energy loss				300		mJ
$t_{d(on)}$	Turn-on delay time				250		ns
$t_r$	Rise time				200		ns
$E_{ON}$	Turn-on energy loss				80		mJ
$Q_{rr}$	Diode reverse recovery charge	$I_F = 1600\text{A}$ $V_{CE} = 600\text{V}$ $di_F/dt = 8200\text{A}/\mu\text{s}$		150		$\mu\text{C}$	
$I_{rr}$	Diode reverse recovery current				750		A
$E_{rec}$	Diode reverse recovery energy				90		mJ

$T_{case} = 125^{\circ}\text{C}$  unless stated otherwise

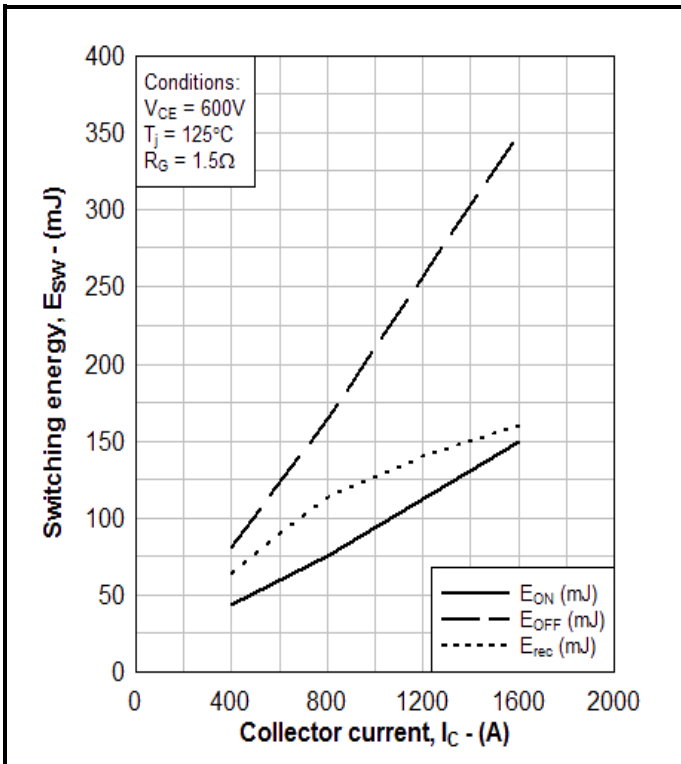
Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units	
$t_{d(off)}$	Turn-off delay time	$I_C = 1600\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 600\text{V}$ $R_{G(ON)} = 1.5\Omega$ $R_{G(OFF)} = 1.5\Omega$ $L_S \sim 100\text{nH}$		1500		ns	
$t_f$	Fall time				200		ns
$E_{OFF}$	Turn-off energy loss				350		mJ
$t_{d(on)}$	Turn-on delay time				350		ns
$t_r$	Rise time				220		ns
$E_{ON}$	Turn-on energy loss				150		mJ
$Q_{rr}$	Diode reverse recovery charge	$I_F = 1600\text{A}$ $V_{CE} = 600\text{V}$ $di_F/dt = 7500\text{A}/\mu\text{s}$		350		$\mu\text{C}$	
$I_{rr}$	Diode reverse recovery current				900		A
$E_{rec}$	Diode reverse recovery energy				160		mJ



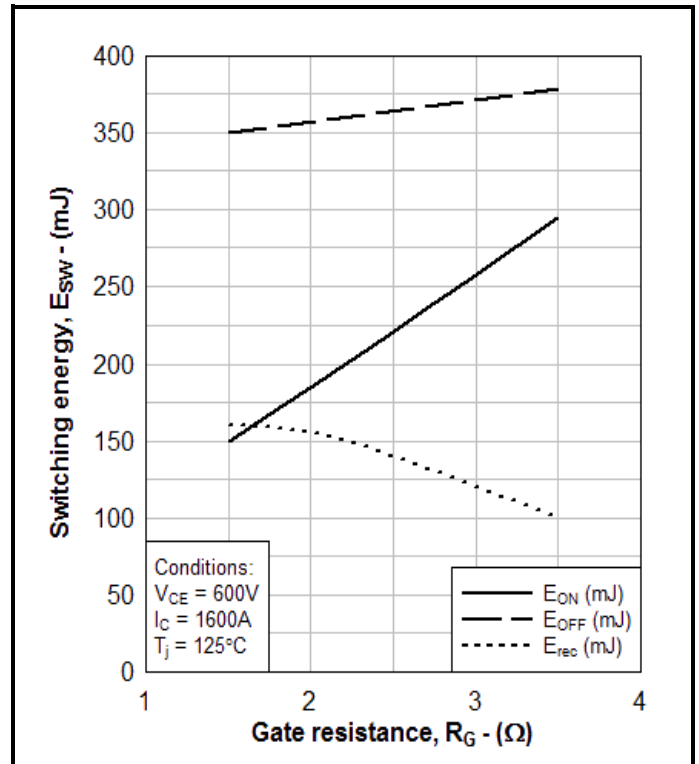
**Fig. 3 Typical output characteristics**



**Fig. 4 Typical output characteristics**



**Fig. 5 Typical switching energy vs collector current**



**Fig. 6 Typical switching energy vs gate resistance**

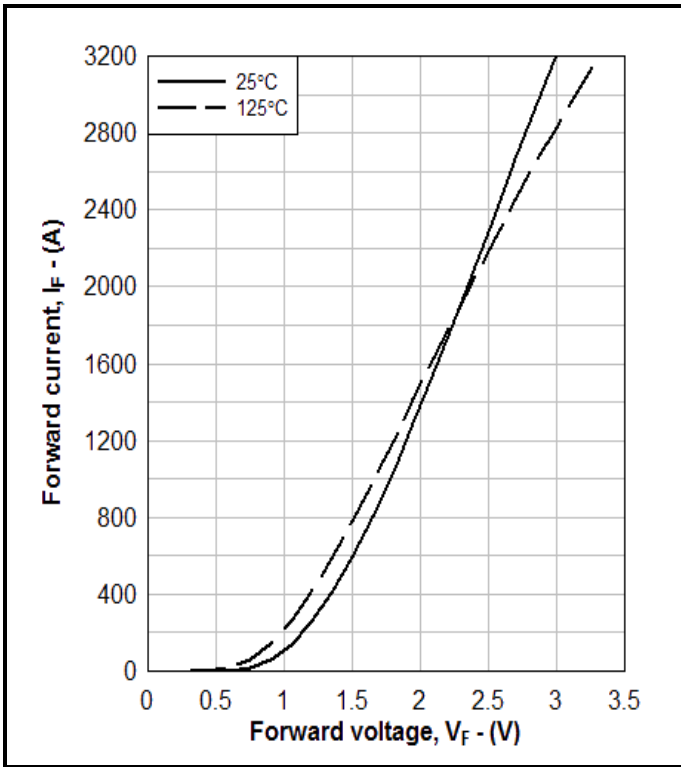


Fig. 7 Diode typical forward characteristics

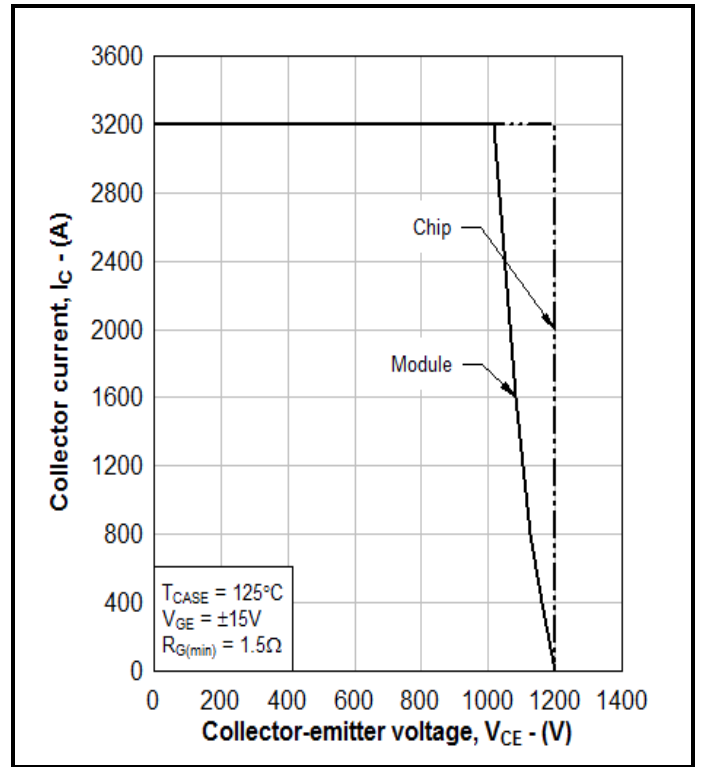


Fig. 8 Reverse bias safe operating area

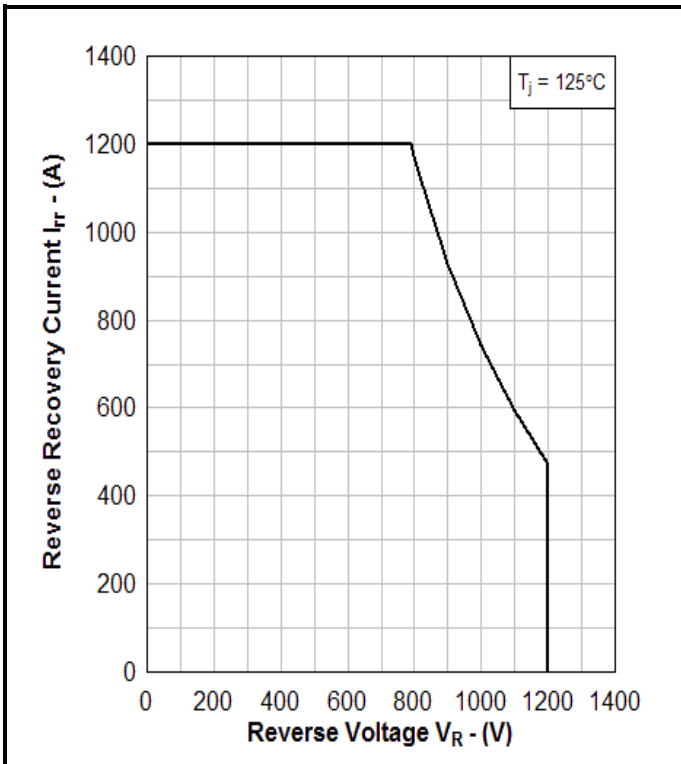


Fig. 9 Diode reverse bias safe operating area

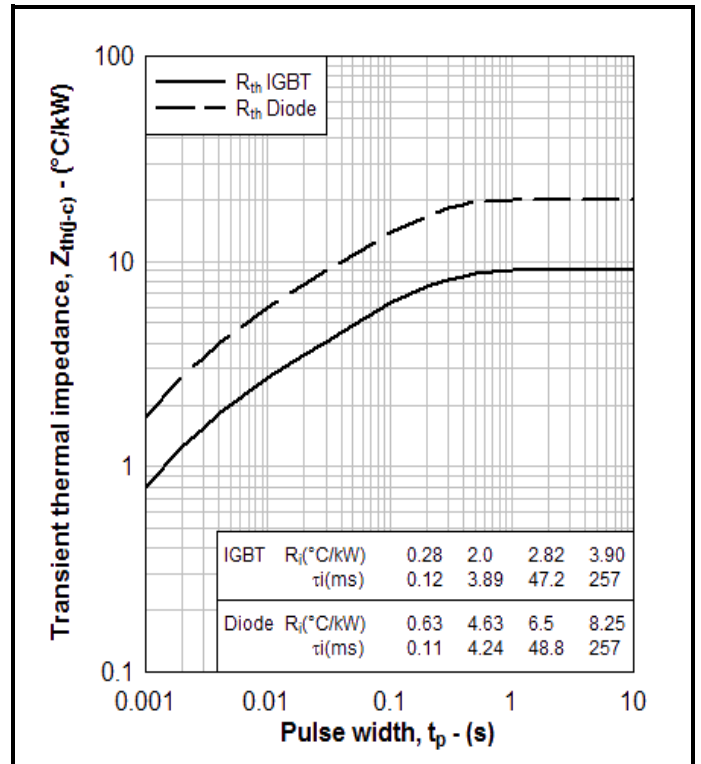
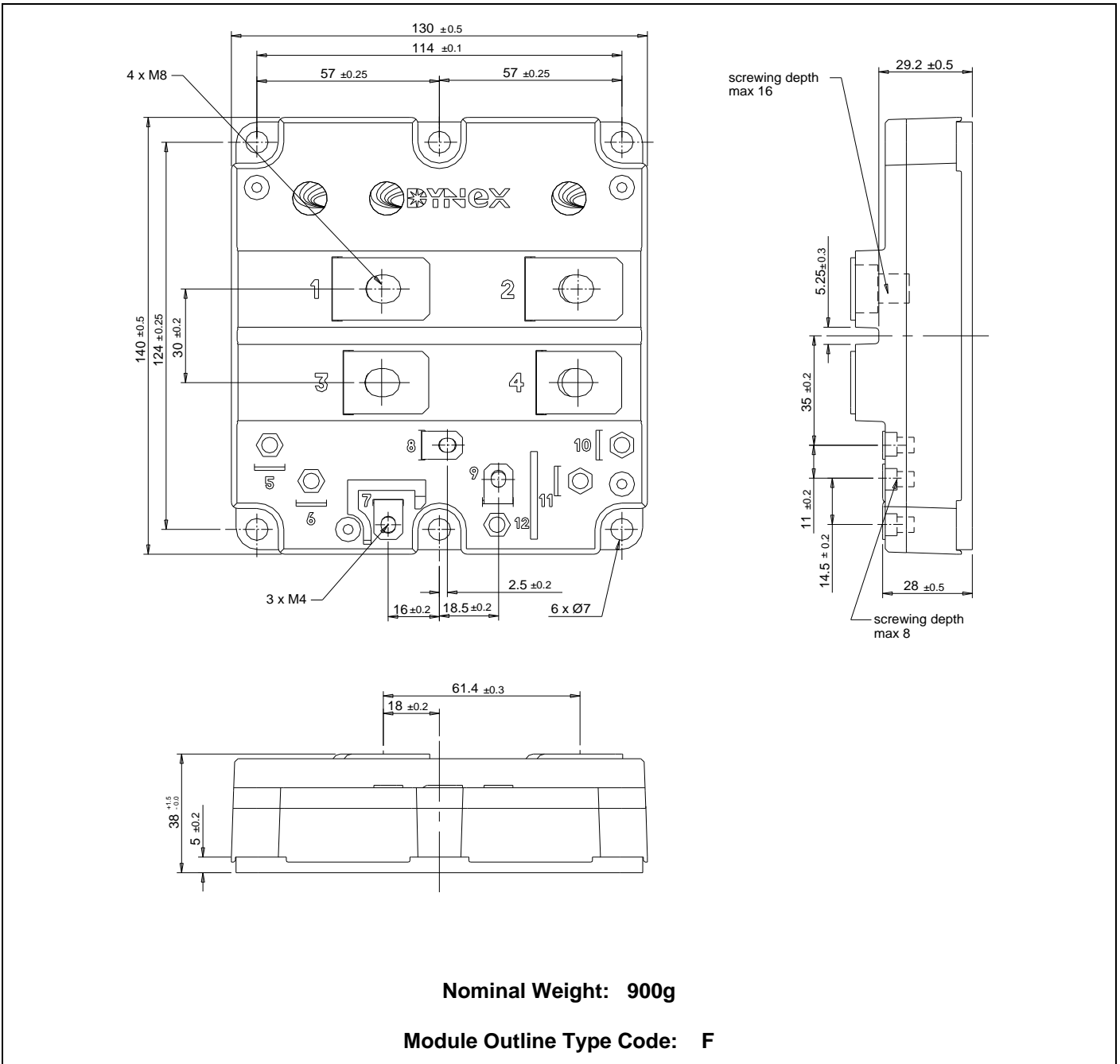


Fig. 10 Transient thermal impedance

**PACKAGE DETAILS**

For further package information, please visit our website or contact Customer Services.  
 All dimensions in mm, unless stated otherwise.  
**DO NOT SCALE.**



**Nominal Weight: 900g**

**Module Outline Type Code: F**

**Fig. 11 Module outline drawing**

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