

### FEATURES

- 10µs 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 DIM2400ESM12-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 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.

### ORDERING INFORMATION

Order As:

#### DIM2400ESM12-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>2400A</b>
$I_{C(PK)}$ (max)	<b>4800A</b>

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

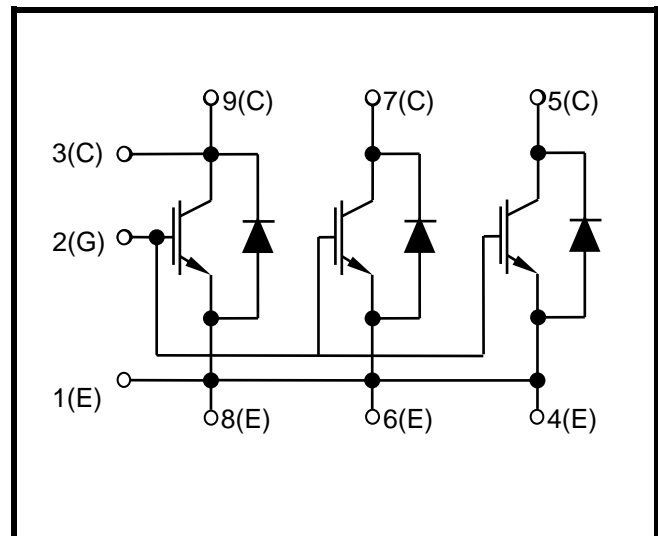


Fig. 1 Circuit configuration



Outline type code: E

(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<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	1200	V
V <sub>GES</sub>	Gate-emitter voltage		±20	V
I <sub>C</sub>	Continuous collector current	T <sub>case</sub> = 85°C	2400	A
I <sub>C(PK)</sub>	Peak collector current	1ms, T <sub>case</sub> = 115°C	4800	A
P <sub>max</sub>	Max. transistor power dissipation	T <sub>case</sub> = 25°C, T <sub>j</sub> = 150°C	20830	W
I <sup>2</sup> t	Diode I <sup>2</sup> t value	V <sub>R</sub> = 0, t <sub>p</sub> = 10ms, T <sub>j</sub> = 125°C	900	kA <sup>2</sup> s
V <sub>isol</sub>	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	2500	V
Q <sub>PD</sub>	Partial discharge – per module	IEC1287, V <sub>1</sub> = 1300V, V <sub>2</sub> = 1000V, 50Hz RMS	10	pC

**THERMAL AND MECHANICAL RATINGS**

Internal insulation material: AIN  
 Baseplate material: AISiC  
 Creepage distance: 33mm  
 Clearance: 20mm  
 CTI (Comparative Tracking Index): >600

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
R <sub>th(j-c)</sub>	Thermal resistance – transistor	Continuous dissipation - junction to case	-	-	6	°C/kW
R <sub>th(j-c)</sub>	Thermal resistance – diode	Continuous dissipation - junction to case	-	-	13	°C/kW
R <sub>th(c-h)</sub>	Thermal resistance – case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)	-	-	6	°C/kW
T <sub>j</sub>	Junction temperature	Transistor	-	-	150	°C
		Diode	-	-	125	°C
T <sub>stg</sub>	Storage temperature range	-	-40	-	125	°C
	Screw torque	Mounting – M6	-	-	5	Nm
		Electrical connections – M4	-	-	2	Nm
		Electrical connections – M8	-	-	10	Nm

**ELECTRICAL CHARACTERISTICS**

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$I_{CES}$	Collector cut-off current	$V_{GE} = 0V, V_{CE} = V_{CES}$			3	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 125^{\circ}C$			75	mA
$I_{GES}$	Gate leakage current	$V_{GE} = \pm 20V, V_{CE} = 0V$			12	$\mu A$
$V_{GE(TH)}$	Gate threshold voltage	$I_C = 120mA, V_{GE} = V_{CE}$	4.5	5.5	6.5	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 2400A$		2.2	2.8	V
		$V_{GE} = 15V, I_C = 2400A, T_j = 125^{\circ}C$		2.6	3.3	V
$I_F$	Diode forward current	DC			2400	A
$I_{FM}$	Diode maximum forward current	$t_p = 1ms$			4800	A
$V_F$	Diode forward voltage	$I_F = 2400A$		2.1	2.4	V
		$I_F = 2400A, T_j = 125^{\circ}C$		2.1	2.4	V
$C_{ies}$	Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$		270		nF
$Q_g$	Gate charge	$\pm 15V$		26		$\mu C$
$C_{res}$	Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$				nF
$L_M$	Module inductance			10		nH
$R_{INT}$	Internal transistor resistance			90		$\mu\Omega$
$SC_{Data}$	Short circuit current, $I_{SC}$	$T_j = 125^{\circ}C, V_{CC} = 900V$ $t_p \leq 10\mu s, V_{GE} \leq 15V$ $V_{CE(max)} = V_{CES} - L^* \times dl/dt$ IEC 60747-9		13500		A

**Note:**

\* L is the circuit inductance +  $L_M$

**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> = 2400A V <sub>GE</sub> = ±15V V <sub>CE</sub> = 600V R <sub>G(ON)</sub> = 1.0Ω R <sub>G(OFF)</sub> = 1.0Ω L <sub>S</sub> ~ 50nH		1370		ns	
t <sub>f</sub>	Fall time			230		ns	
E <sub>OFF</sub>	Turn-off energy loss				520		mJ
t <sub>d(on)</sub>	Turn-on delay time				250		ns
t <sub>r</sub>	Rise time				230		ns
E <sub>ON</sub>	Turn-on energy loss				180		mJ
Q <sub>rr</sub>	Diode reverse recovery charge	I <sub>F</sub> = 2400A V <sub>CE</sub> = 600V di <sub>F</sub> /dt = 9500A/μs		310		μC	
I <sub>rr</sub>	Diode reverse recovery current				1000		A
E <sub>rec</sub>	Diode reverse recovery energy				150		mJ

**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> = 2400A V <sub>GE</sub> = ±15V V <sub>CE</sub> = 600V R <sub>G(ON)</sub> = 1.0Ω R <sub>G(OFF)</sub> = 1.0Ω L <sub>S</sub> ~ 50nH		1570		ns	
t <sub>f</sub>	Fall time				230		ns
E <sub>OFF</sub>	Turn-off energy loss				600		mJ
t <sub>d(on)</sub>	Turn-on delay time				360		ns
t <sub>r</sub>	Rise time				290		ns
E <sub>ON</sub>	Turn-on energy loss				200		mJ
Q <sub>rr</sub>	Diode reverse recovery charge	I <sub>F</sub> = 2400A V <sub>CE</sub> = 600V di <sub>F</sub> /dt = 8500A/μs		540		μC	
I <sub>rr</sub>	Diode reverse recovery current				1260		A
E <sub>rec</sub>	Diode reverse recovery energy				260		mJ

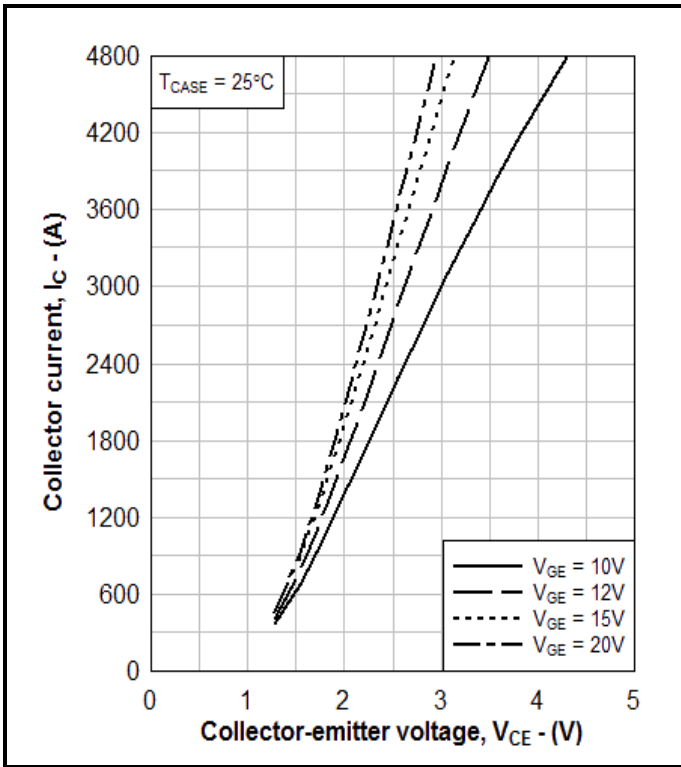


Fig. 3 Typical output characteristics

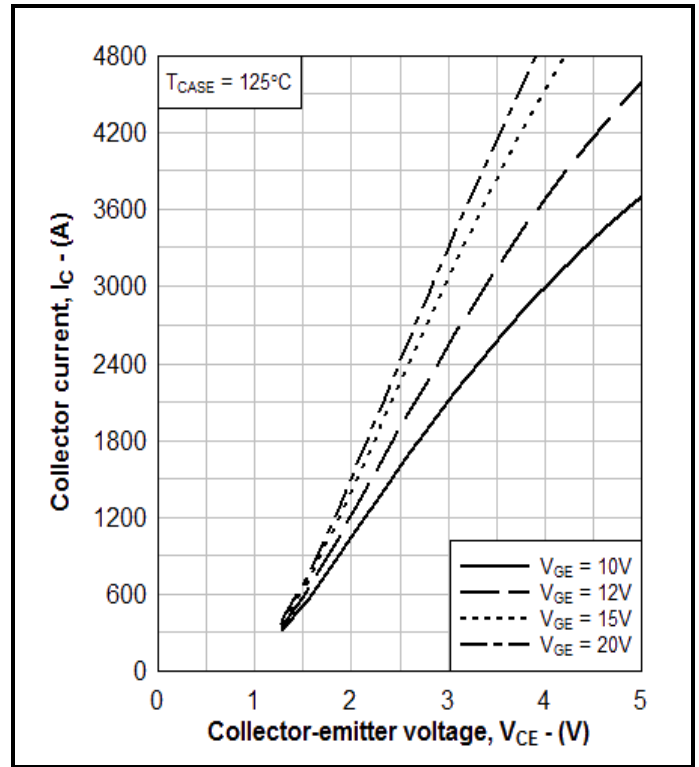


Fig. 4 Typical output characteristics

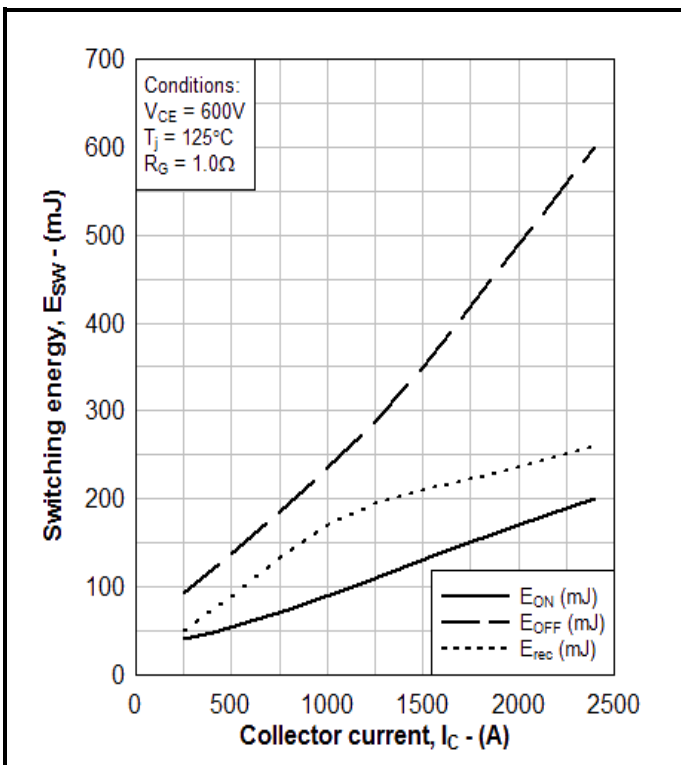


Fig. 5 Typical switching energy vs collector current

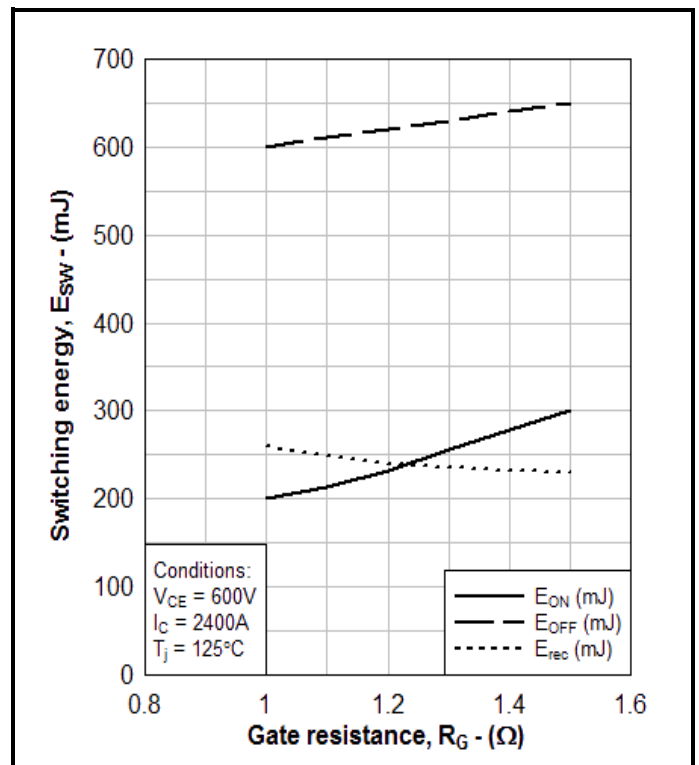


Fig. 6 Typical switching energy vs gate resistance

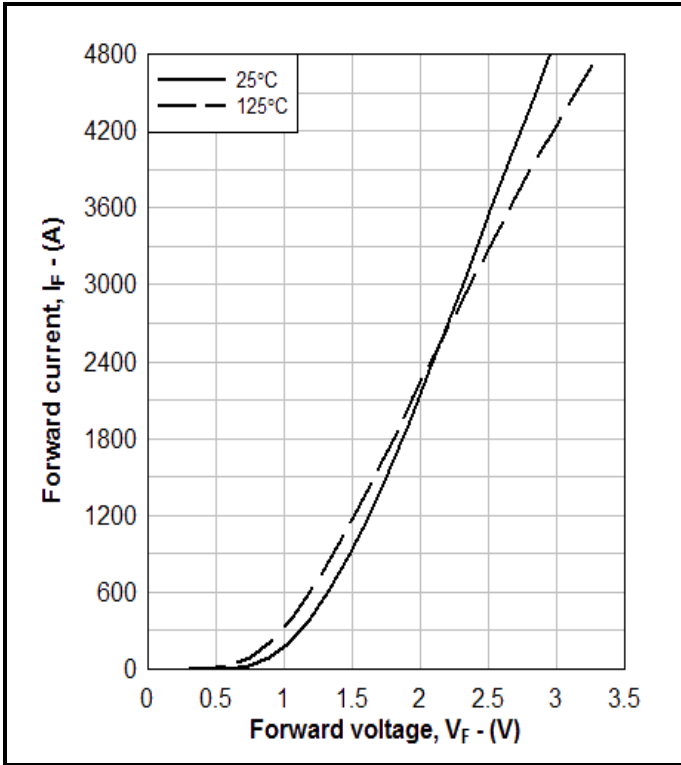


Fig. 7 Diode typical forward characteristics

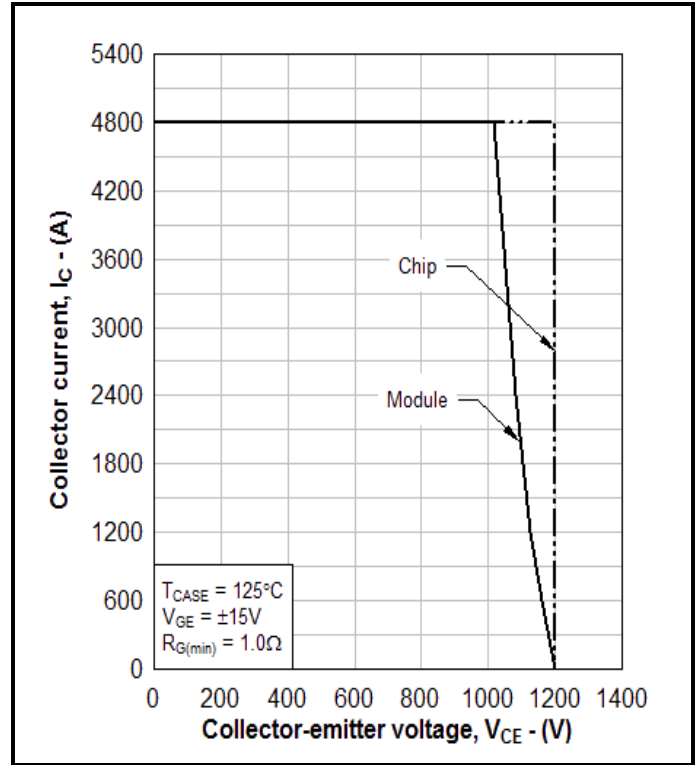


Fig. 8 Reverse bias safe operating area

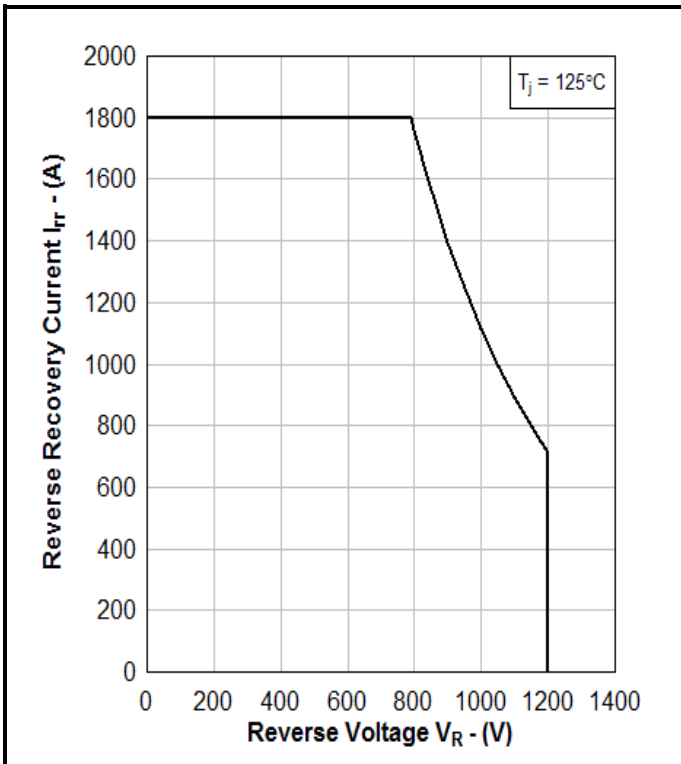


Fig. 9 Diode reverse bias safe operating area

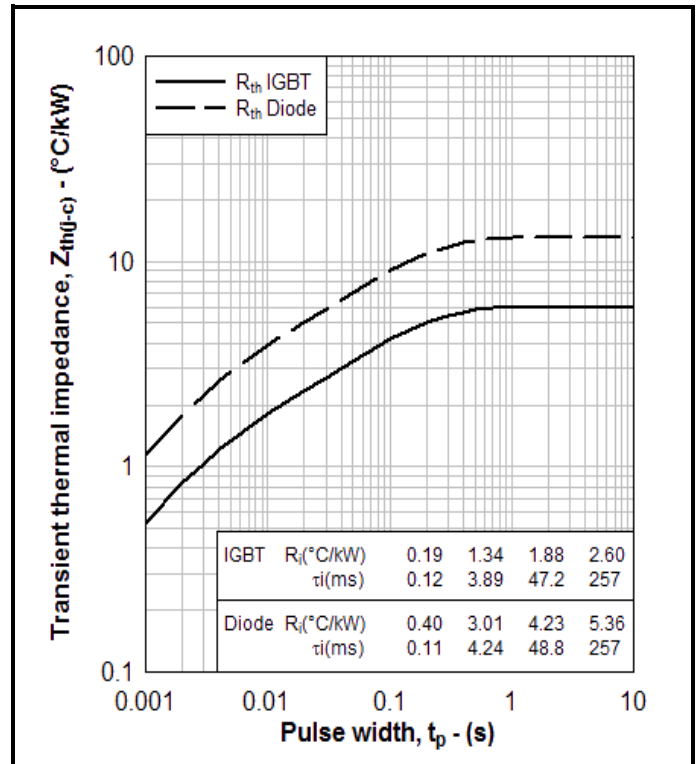
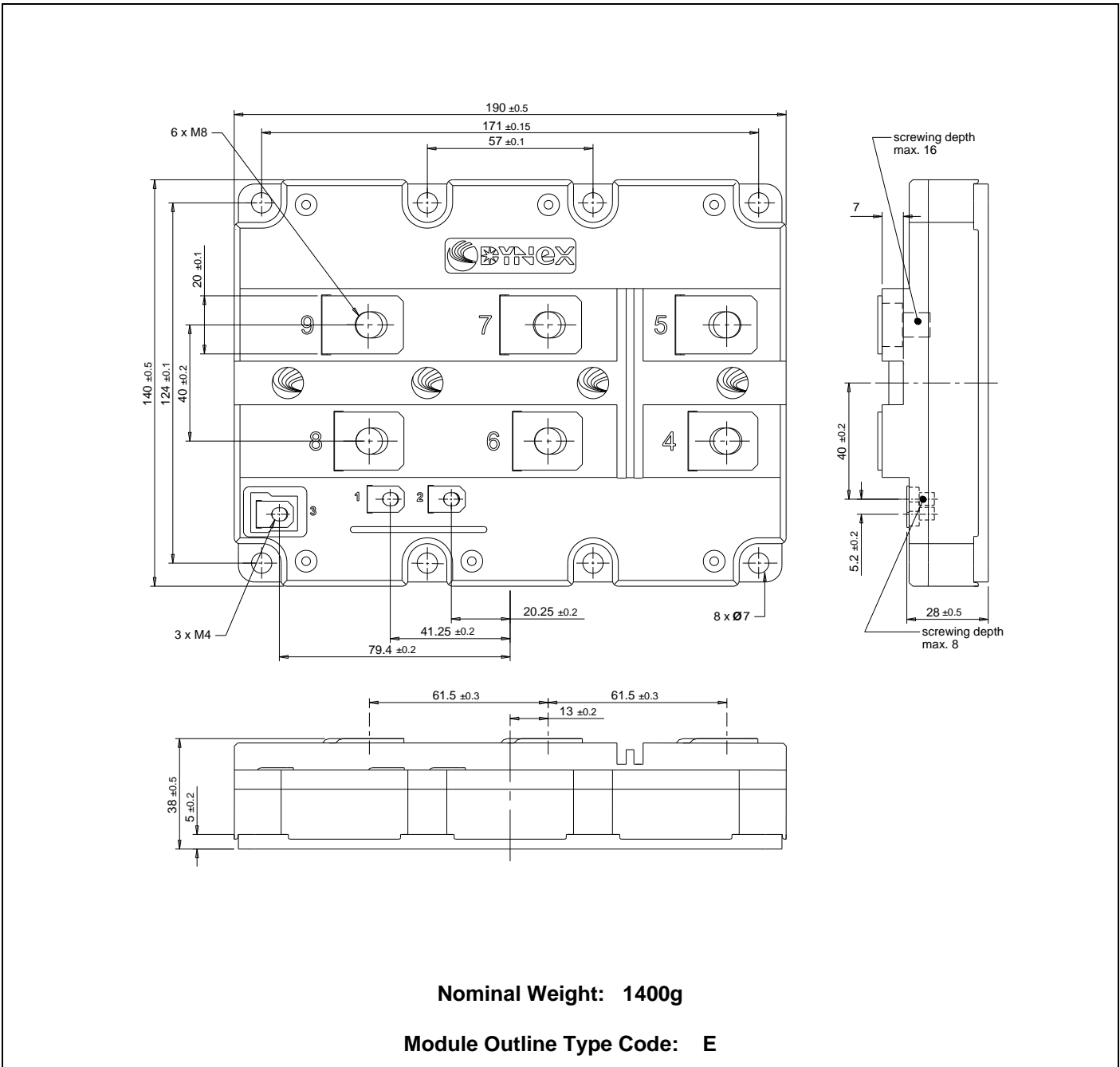


Fig. 10 Transient thermal impedance

**PACKAGE DETAILS**

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



**Fig. 11 Module outline drawing**

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