

### FEATURES

- n - Channel
- High Switching Speed
- Low Forward Voltage Drop
- Isolated Base

### APPLICATIONS

- PWM Motor Control
- UPS

The Powerline range of modules includes half bridge, chopper, bi-directional, dual and single switch configurations covering voltages from 600V to 3300V and currents up to 3600A.

The DIM250WHS06-S000 is a half bridge 600V n channel enhancement mode insulated gate bipolar transistor (IGBT) module. The module is suitable for a variety of medium voltage applications in motor drives and power conversion.

The IGBT has a wide reverse bias safe operating area (RBSOA) for ultimate reliability in demanding applications.

These modules incorporate electrically isolated base plates and low inductance construction enabling circuit designers to optimise circuit layouts and utilise earthed heat sinks for safety.

Typical applications include dc motor drives, ac pwm drives and ups systems.

### ORDERING INFORMATION

Order as:

**DIM250WHS06-S000**

Note: When ordering, use complete part number.

### KEY PARAMETERS

$V_{CES}$  600V

$V_{CE(sat)}$  \* (typ) 2.1V

$I_C$  (max) 250A

$I_{C(PK)}$  (max) 500A

\*(measured at the power busbars and not the auxiliary terminals)

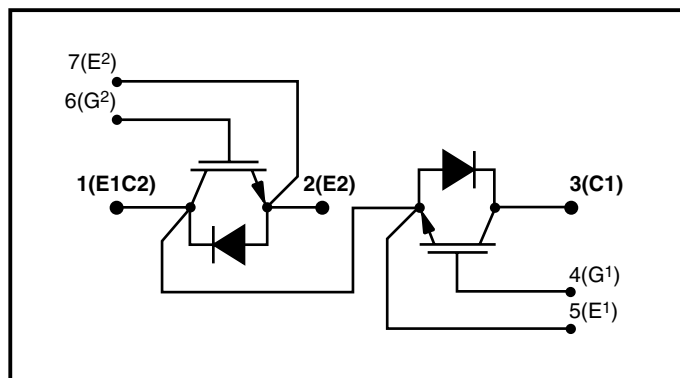


Fig. 1 Half bridge circuit diagram



Outline type code: W

(See package details for further information)

Fig. 2 Electrical connections - (not to scale)

## ABSOLUTE MAXIMUM RATINGS - PER ARM

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         | $V_{GE} = 0\text{V}$                                             | 600      | V                     |
| $V_{GES}$   | Gate-emitter voltage              | -                                                                | $\pm 20$ | V                     |
| $I_C$       | Continuous collector current      | $T_{case} = 65^{\circ}\text{C}$                                  | 250      | A                     |
| $I_{C(PK)}$ | Peak collector current            | 1ms, $T_{case} = 95^{\circ}\text{C}$                             | 500      | A                     |
| $P_{max}$   | Max. transistor power dissipation | $T_{case} = 25^{\circ}\text{C}$ , $T_j = 150^{\circ}\text{C}$    | 1157     | W                     |
| $I^2t$      | Diode $I^2t$ value                | $V_R = 0$ , $t_p = 10\text{ms}$ , $T_{vj} = 125^{\circ}\text{C}$ | TBD      | $\text{kA}^2\text{s}$ |
| $V_{isol}$  | Isolation voltage - per module    | Commoned terminals to base plate. AC RMS, 1 min, 50Hz            | 2.5      | kV                    |

## THERMAL AND MECHANICAL RATINGS

Internal insulation:  $\text{Al}_2\text{O}_3$

Clearance: 13mm

Baseplate material: Cu

CTI (Critical Tracking Index): 175

Creepage distance: 24mm

| Symbol        | Parameter                                             | Test Conditions                               | Min. | Typ. | Max. | Units                        |
|---------------|-------------------------------------------------------|-----------------------------------------------|------|------|------|------------------------------|
| $R_{th(j-c)}$ | Thermal resistance - transistor                       | Continuous dissipation -<br>junction to case  | -    | -    | 108  | $^{\circ}\text{C}/\text{kW}$ |
| $R_{th(j-c)}$ | Thermal resistance - diode                            | Continuous dissipation -<br>junction to case  | -    | -    | 203  | $^{\circ}\text{C}/\text{kW}$ |
| $R_{th(c-h)}$ | Thermal resistance - case to heatsink<br>(per module) | Mounting torque 5Nm<br>(with mounting grease) | -    | -    | 15   | $^{\circ}\text{C}/\text{kW}$ |
| $T_j$         | 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                                 | 3    | -    | 5    | Nm                           |
|               |                                                       | Electrical connections - M6                   | 2.5  | -    | 5    | Nm                           |

## ELECTRICAL CHARACTERISTICS

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

| Symbol                  | Parameter                                | Test Conditions                                                          | Min. | Typ. | Max. | Units         |
|-------------------------|------------------------------------------|--------------------------------------------------------------------------|------|------|------|---------------|
| $I_{CES}$               | Collector cut-off current                | $V_{GE} = 0\text{V}, V_{CE} = V_{CES}$                                   | -    | -    | 1    | mA            |
|                         |                                          | $V_{GE} = 0\text{V}, V_{CE} = V_{CES}, T_{case} = 125^{\circ}\text{C}$   | -    | -    | 10   | mA            |
| $I_{GES}$               | Gate leakage current                     | $V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}$                            | -    | -    | 1    | $\mu\text{A}$ |
| $V_{GE(TH)}$            | Gate threshold voltage                   | $I_C = 10\text{mA}, V_{GE} = V_{CE}$                                     | 4.5  | 5.5  | 7.5  | V             |
| $V_{CE(sat)}^{\dagger}$ | Collector-emitter saturation voltage     | $V_{GE} = 15\text{V}, I_C = 250\text{A}$                                 | -    | 2.1  | 2.6  | V             |
|                         |                                          | $V_{GE} = 15\text{V}, I_C = 250\text{A}, T_{case} = 125^{\circ}\text{C}$ | -    | 2.3  | 2.8  | V             |
| $I_F$                   | Diode forward current                    | DC                                                                       | -    | -    | 250  | A             |
| $I_{FM}$                | Diode maximum forward current            | $t_p = 1\text{ms}$                                                       | -    | -    | 500  | A             |
| $V_F^{\dagger}$         | Diode forward voltage                    | $I_F = 250\text{A}$                                                      | -    | 1.5  | 1.8  | V             |
|                         |                                          | $I_F = 250\text{A}, T_{case} = 125^{\circ}\text{C}$                      | -    | 1.5  | 1.8  | V             |
| $C_{ies}$               | Input capacitance                        | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$               | -    | 27   | -    | nF            |
| $L_M$                   | Module inductance                        | -                                                                        | -    | 20   | -    | nH            |
| $R_{INT}$               | Internal transistor resistance - per arm | -                                                                        | -    | 0.23 | -    | m $\Omega$    |

**Note:**

$^{\dagger}$  Measured at the power busbars and not the auxiliary terminals.

$L^*$  is the circuit inductance +  $L_M$

## ELECTRICAL CHARACTERISTICS

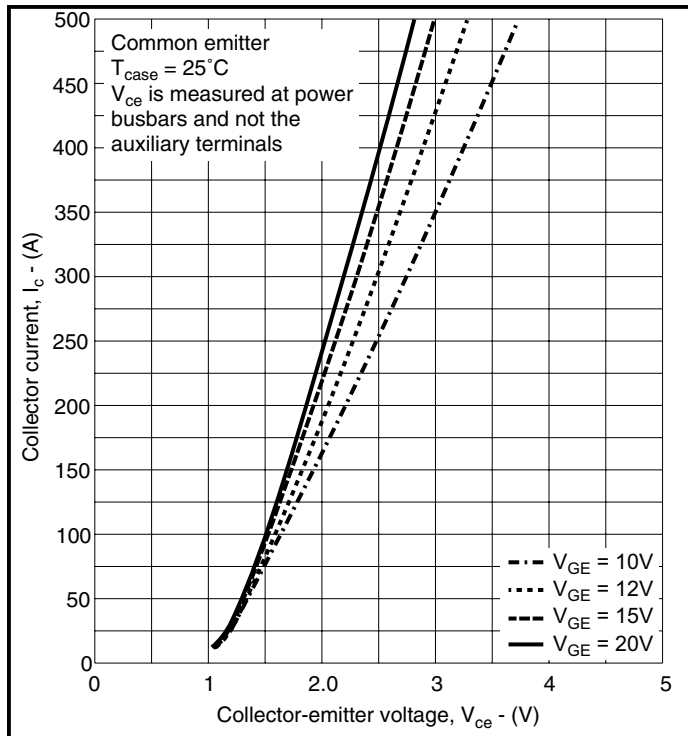
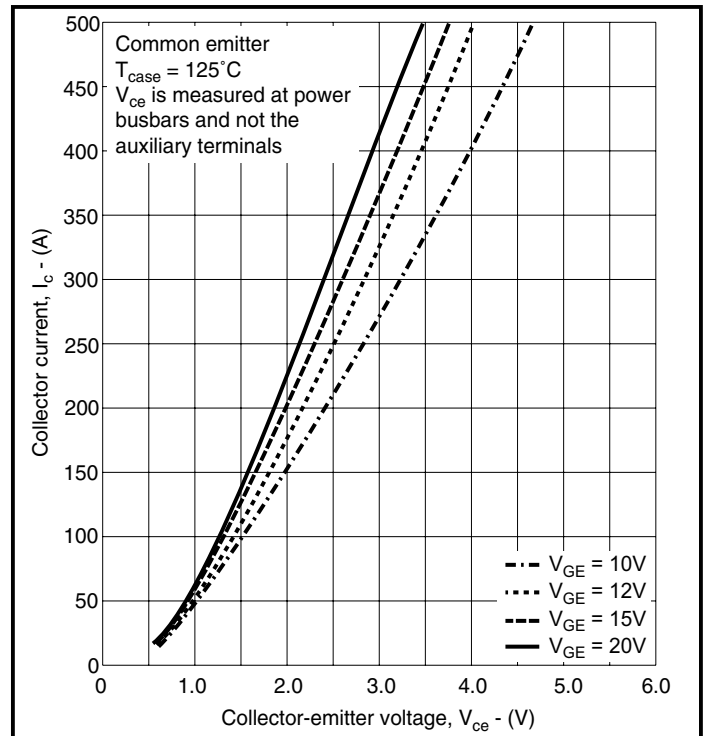
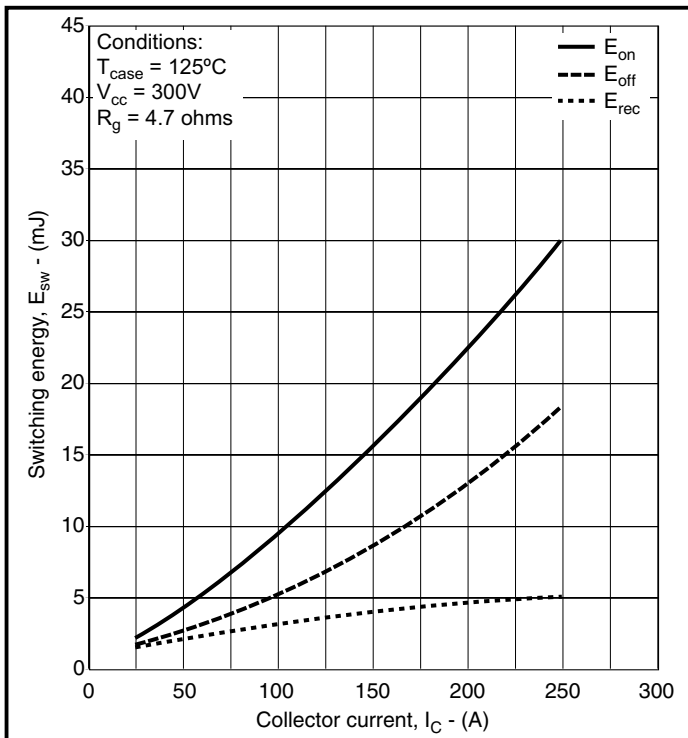
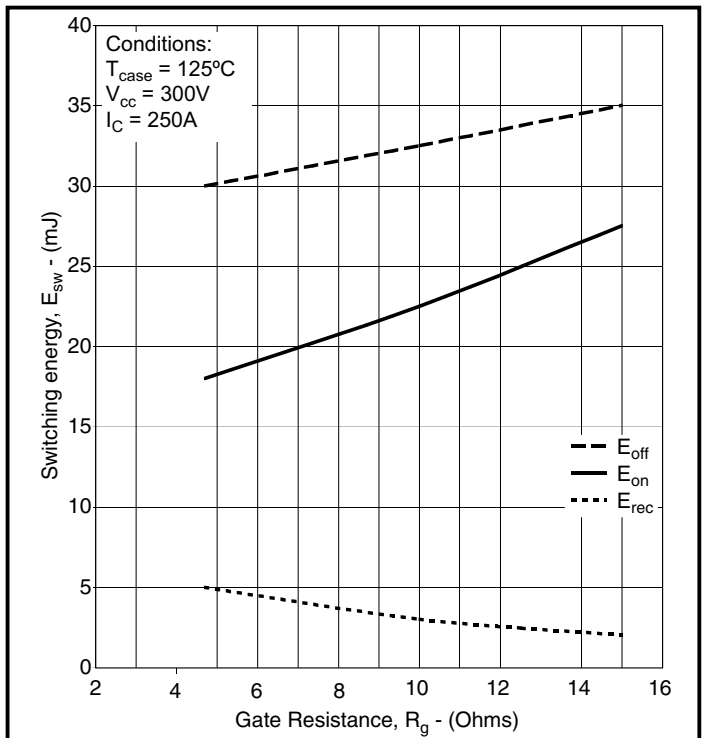
 $T_{\text{case}} = 25^{\circ}\text{C}$  unless stated otherwise

| Symbol              | Parameter                     | Test Conditions                                                                                                                                           | Min. | Typ. | Max. | Units         |
|---------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $t_{d(\text{off})}$ | Turn-off delay time           | $I_C = 250\text{A}$<br>$V_{GE} = \pm 15\text{V}$<br>$V_{CE} = 300\text{V}$<br>$R_{G(\text{ON})} = R_{G(\text{OFF})} = 4.7\Omega$<br>$L \sim 100\text{nH}$ | -    | 600  | -    | ns            |
| $t_f$               | Fall time                     |                                                                                                                                                           | -    | 250  | -    | ns            |
| $E_{\text{OFF}}$    | Turn-off energy loss          |                                                                                                                                                           | -    | 20   | -    | mJ            |
| $t_{d(\text{on})}$  | Turn-on delay time            |                                                                                                                                                           | -    | 330  | -    | ns            |
| $t_r$               | Rise time                     |                                                                                                                                                           | -    | 130  | -    | ns            |
| $E_{\text{ON}}$     | Turn-on energy loss           |                                                                                                                                                           | -    | 12   | -    | mJ            |
| $Q_g$               | Gate charge                   |                                                                                                                                                           | -    | 2    | -    | $\mu\text{C}$ |
| $Q_{rr}$            | Diode reverse recovery charge | $I_F = 250\text{A}, V_R = 300\text{V},$<br>$dI_F/dt = 3600\text{A}/\mu\text{s}$                                                                           | -    | 15   | -    | $\mu\text{C}$ |
| $I_{rr}$            | Diode reverse current         |                                                                                                                                                           | -    | 185  | -    | A             |
| $E_{\text{REC}}$    | Diode reverse recovery energy |                                                                                                                                                           | -    | 4    | -    | mJ            |

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

| Symbol              | Parameter                     | Test Conditions                                                                                                                                           | Min. | Typ. | Max. | Units         |
|---------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $t_{d(\text{off})}$ | Turn-off delay time           | $I_C = 250\text{A}$<br>$V_{GE} = \pm 15\text{V}$<br>$V_{CE} = 300\text{V}$<br>$R_{G(\text{ON})} = R_{G(\text{OFF})} = 4.7\Omega$<br>$L \sim 100\text{nH}$ | -    | 650  | -    | ns            |
| $t_f$               | Fall time                     |                                                                                                                                                           | -    | 500  | -    | ns            |
| $E_{\text{OFF}}$    | Turn-off energy loss          |                                                                                                                                                           | -    | 30   | -    | mJ            |
| $t_{d(\text{on})}$  | Turn-on delay time            |                                                                                                                                                           | -    | 400  | -    | ns            |
| $t_r$               | Rise time                     |                                                                                                                                                           | -    | 160  | -    | ns            |
| $E_{\text{ON}}$     | Turn-on energy loss           |                                                                                                                                                           | -    | 18   | -    | mJ            |
| $Q_{rr}$            | Diode reverse recovery charge | $I_F = 250\text{A}, V_R = 300\text{V},$<br>$dI_F/dt = 3600\text{A}/\mu\text{s}$                                                                           | -    | 23   | -    | $\mu\text{C}$ |
| $I_{rr}$            | Diode reverse current         |                                                                                                                                                           | -    | 200  | -    | A             |
| $E_{\text{REC}}$    | Diode reverse recovery energy |                                                                                                                                                           | -    | 5    | -    | mJ            |

## TYPICAL CHARACTERISTICS


**Fig.3 Typical output characteristics**

**Fig.4 Typical output characteristics**

**Fig.4 Typical switching energy vs collector current**

**Fig.5 Typical switching energy vs gate resistance**

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

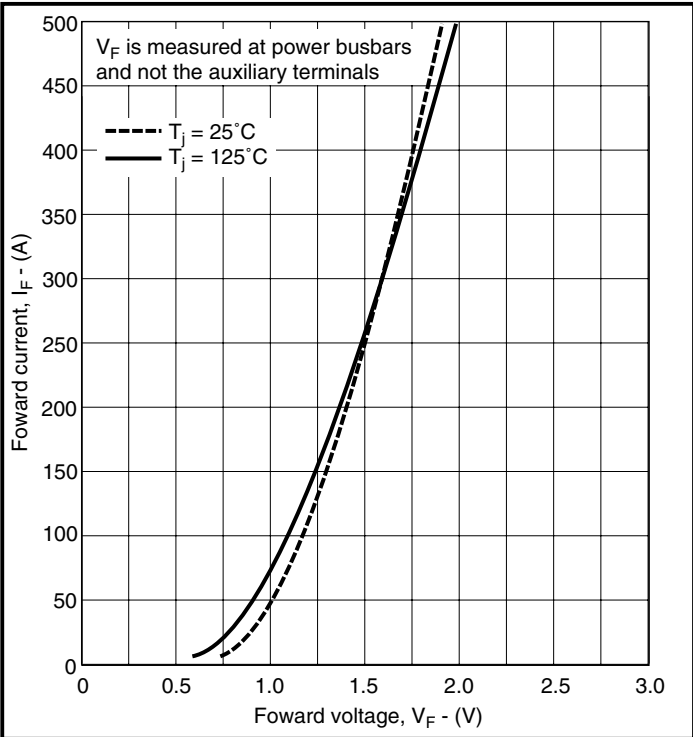


Fig.6 Diode typical forward characteristics

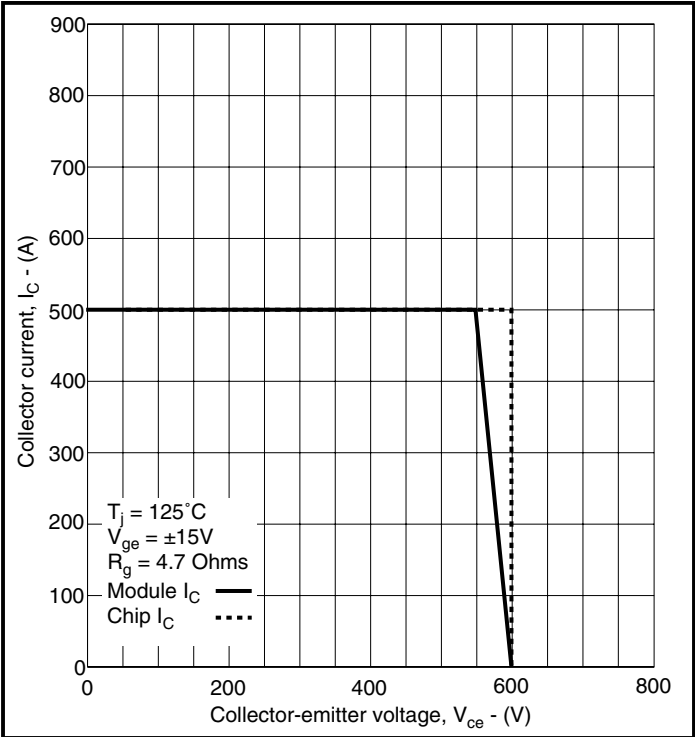


Fig.7 Reverse bias safe operating area

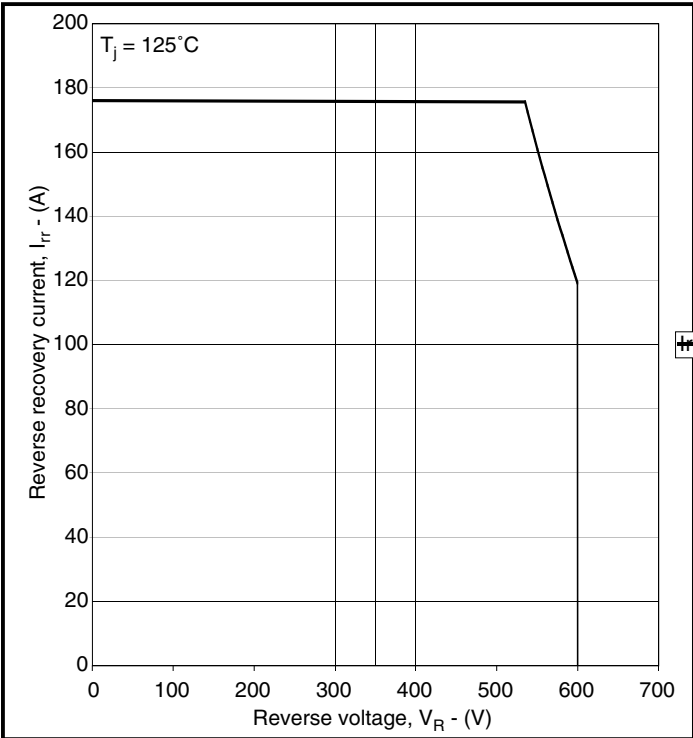


Fig.7 Diode reverse bias safe operating area

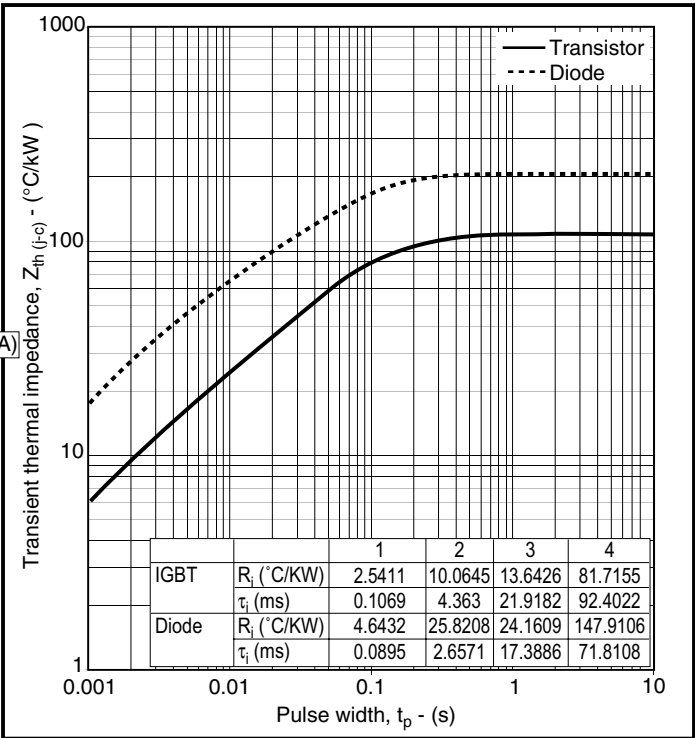
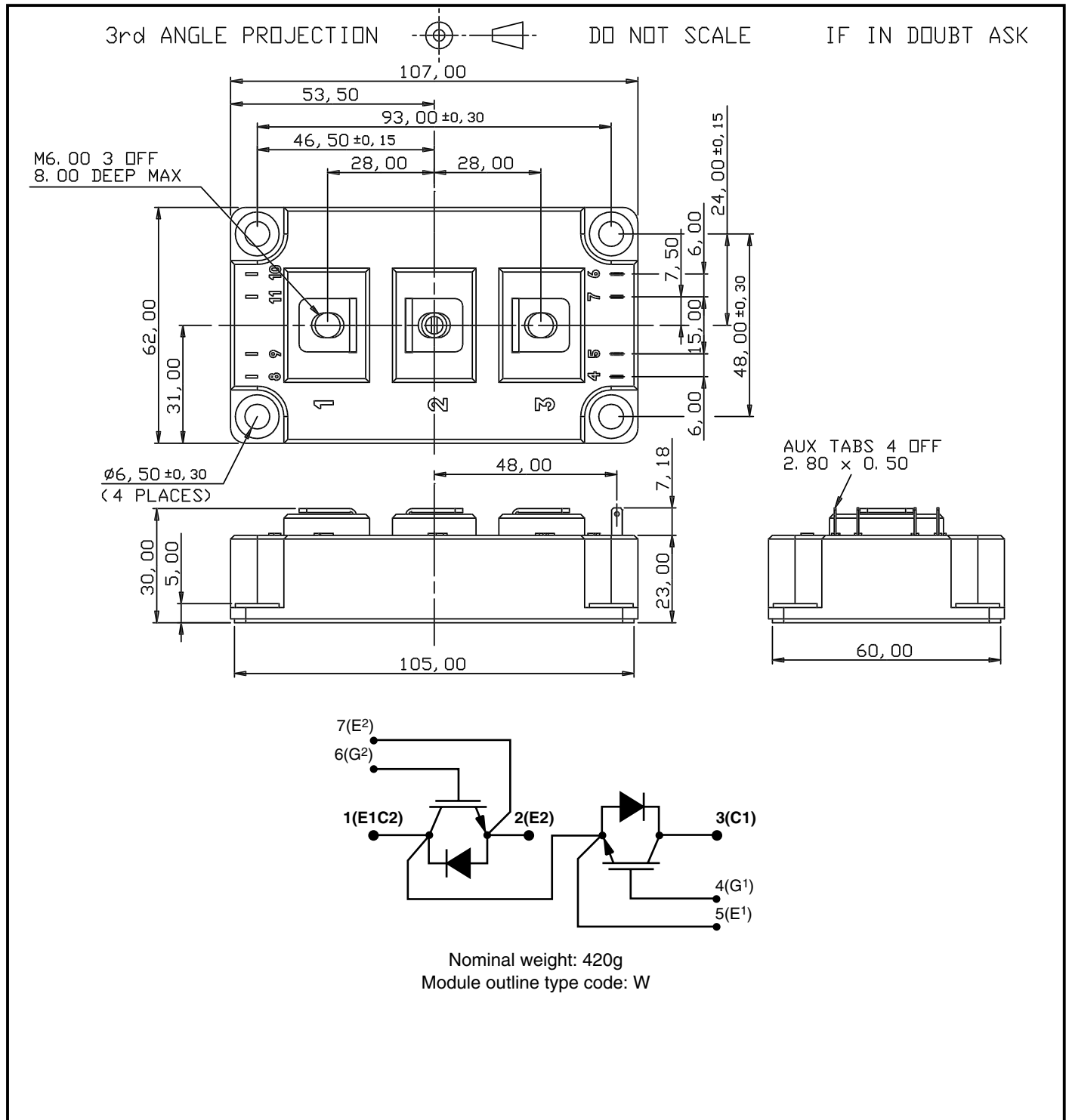


Fig.8 Transient thermal impedance

## 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. 15 Package details**

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

## POWER ASSEMBLY CAPABILITY

The Power Assembly group was set up to provide a support service for those customers requiring more than the basic semiconductor, and has developed a flexible range of heatsink and clamping systems in line with advances in device voltages and current capability of our semiconductors.

We offer an extensive range of air and liquid cooled assemblies covering the full range of circuit designs in general use today. The Assembly group offers high quality engineering support dedicated to designing new units to satisfy the growing needs of our customers.

Using the latest CAD methods our team of design and applications engineers aim to provide the Power Assembly Complete Solution (PACs).

## HEATSINKS

The Power Assembly group has its own proprietary range of extruded aluminium heatsinks which have been designed to optimise the performance of Dynex semiconductors. Data with respect to air natural, forced air and liquid cooling (with flow rates) is available on request.

For further information on device clamps, heatsinks and assemblies, please contact your nearest sales representative or Customer Services.



<http://www.dynexsemi.com>

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