



# DIM100PHM33-F000

## Half Bridge IGBT Module

PDS5764-1.1 April 2004

### FEATURES

- Soft Punch Through Silicon
- 10 $\mu$ s Short Circuit Withstand
- Isolated MMC Base with AlN Substrates
- High Thermal Cycling Capability

### APPLICATIONS

- High Reliability Inverters
- Motor Controllers
- Traction Auxiliaries

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

The DIM100PHM33-F000 is a half bridge 3300V soft punch through, n channel enhancement mode, insulated gate bipolar transistor (IGBT) module. The IGBT has a wide reverse bias safe operating area (RBSOA) plus full 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:

**DIM100PHM33-F000**

Note: When ordering, please use the whole part number.

### KEY PARAMETERS

$V_{CES}$		<b>3300V</b>
$V_{CE(sat)}$ *	(typ)	<b>2.8V</b>
$I_C$	(max)	<b>100A</b>
$I_{C(PK)}$	(max)	<b>200A</b>

\* Measured at auxiliary terminals.

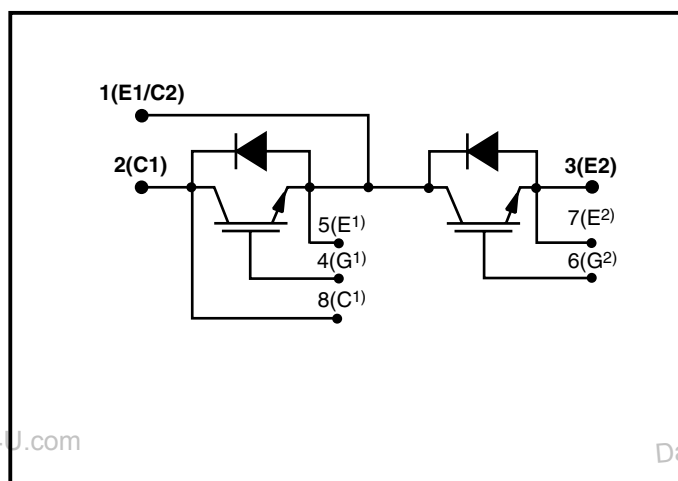


Fig. 1 Half bridge circuit diagram



Outline type code: P

(See package details for further information)

Fig. 2 Electrical connections - (not to scale)

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

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**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.

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

Symbol	Parameter	Test Conditions	Max.	Units
$V_{\text{CES}}$	Collector-emitter voltage	$V_{\text{GE}} = 0\text{V}$ , $T_{\text{j}} = -25^{\circ}\text{C}$	3300	V
$V_{\text{GES}}$	Gate-emitter voltage	-	$\pm 20$	V
$I_{\text{C}}$	Continuous collector current	$T_{\text{case}} = 90^{\circ}\text{C}$	100	A
$I_{\text{C(PK)}}$	Peak collector current	1ms, $T_{\text{case}} = 115^{\circ}\text{C}$	200	A
$P_{\text{max}}$	Max. transistor power dissipation	$T_{\text{case}} = 25^{\circ}\text{C}$ , $T_{\text{j}} = 150^{\circ}\text{C}$	1.3	kW
$I^2t$	Diode $I^2t$ value (Diode arm)	$V_{\text{R}} = 0$ , $t_{\text{p}} = 10\text{ms}$ , $T_{\text{vj}} = 125^{\circ}\text{C}$	5	$\text{kA}^2\text{s}$
$V_{\text{isol}}$	Isolation voltage - per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	6000	V
$Q_{\text{PD}}$	Partial discharge - per module	IEC1287. $V_1 = 3500\text{V}$ , $V_2 = 2600\text{V}$ , 50Hz RMS	10	pC

## THERMAL AND MECHANICAL RATINGS

Internal insulation material: AlN  
 Baseplate material: AlSiC  
 Creepage distance: 33mm  
 Clearance: 20mm  
 CTI (Critical Tracking Index): 175

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$R_{th(j-c)}$	Thermal resistance - transistor (per switch)	Continuous dissipation - junction to case	-	-	96	°C/kW
$R_{th(j-c)}$	Thermal resistance - diode (per switch)	Continuous dissipation - junction to case	-	-	192	°C/kW
$R_{th(c-h)}$	Thermal resistance - case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)	-	-	16	°C/kW
$T_j$	Junction temperature	Transistor	-	-	150	°C
		Diode	-	-	125	°C
$T_{stg}$	Storage temperature range	-	-40	-	125	°C
-	Screw torque	Mounting - M6	-	-	5	Nm
		Electrical connections - M5	-	-	4	Nm

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

## ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
$I_{\text{CES}}$	Collector cut-off current	$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}$	-	-	1	mA	
		$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}, T_{\text{case}} = 125^{\circ}\text{C}$	-	-	8	mA	
$I_{\text{GES}}$	Gate leakage current	$V_{\text{GE}} = \pm 20\text{V}, V_{\text{CE}} = 0\text{V}$	-	400	-	nA	
$V_{\text{GE(TH)}}$	Gate threshold voltage	$I_{\text{C}} = 10\text{mA}, V_{\text{GE}} = V_{\text{CE}}$	5.5	6.5	7.0	V	
$V_{\text{CE(sat)}}^{\dagger}$	Collector-emitter saturation voltage	$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 100\text{A}$	-	2.8	-	V	
		$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 100\text{A}, T_{\text{case}} = 125^{\circ}\text{C}$	-	3.6	-	V	
$I_{\text{F}}$	Diode forward current	DC	-	100	-	A	
$I_{\text{FM}}$	Diode maximum forward current	$t_{\text{p}} = 1\text{ms}$	-	200	-	A	
$V_{\text{F}}^{\dagger}$	Diode forward voltage	$I_{\text{F}} = 100\text{A}$	-	2.9	-	V	
		$I_{\text{F}} = 100\text{A}, T_{\text{case}} = 125^{\circ}\text{C}$	-	3.0	-	V	
$C_{\text{ies}}$	Input capacitance	$V_{\text{CE}} = 25\text{V}, V_{\text{GE}} = 0\text{V}, f = 1\text{MHz}$	-	18	-	nF	
$C_{\text{res}}$	Reverse transfer capacitance	$V_{\text{CE}} = 25\text{V}, V_{\text{GE}} = 0\text{V}, f = 1\text{MHz}$	-	0.28	-	nF	
$L_{\text{M}}$	Module inductance - pins 2 & 3	-	-	40	-	nH	
$R_{\text{INT}}$	Internal transistor resistance - pins 2 & 3	-	-	0.54	-	m $\Omega$	
$SC_{\text{Data}}$	Short circuit. $I_{\text{SC}}$	$T_{\text{j}} = 125^{\circ}\text{C}, V_{\text{CC}} = 2500\text{V},$	$I_1$	-	500	-	A
		$t_{\text{p}} \leq 10\mu\text{s}, V_{\text{CE(max)}} = V_{\text{CES}} - L^* \cdot di/dt$ IEC 60747-9	$I_2$	-	470	-	A

**Note:**

$\dagger$  Measured at auxiliary terminals.

$L^*$  is the circuit inductance +  $L_{\text{M}}$

## ELECTRICAL CHARACTERISTICS

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

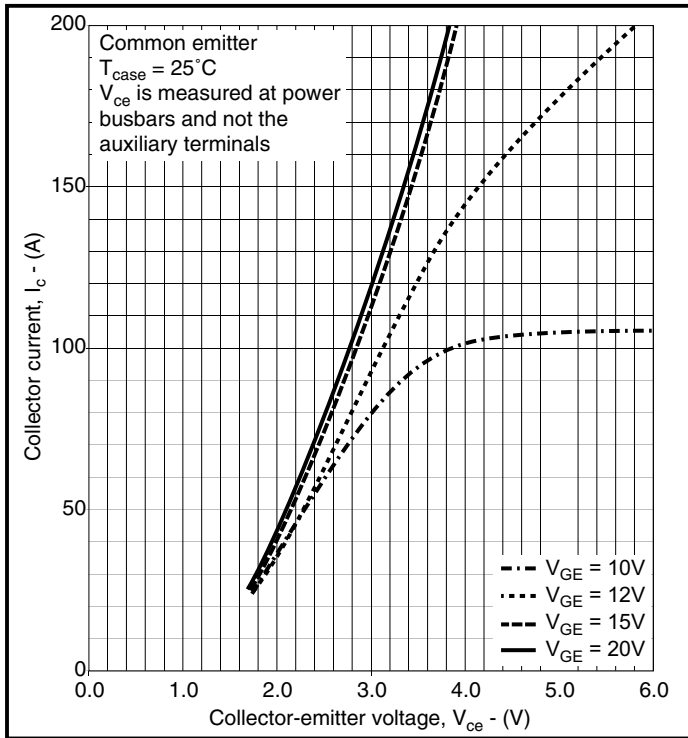
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{\text{d(off)}}$	Turn-off delay time	$I_{\text{C}} = 100\text{A}$ $V_{\text{GE}} = \pm 15\text{V}$ $V_{\text{CE}} = 1800\text{V}$ $R_{\text{G(ON)}} = R_{\text{G(OFF)}} = 33\Omega$ $C_{\text{ge}} = 33\text{nF}$ $L \sim 100\text{nH}$	-	1950	-	ns
$t_{\text{f}}$	Fall time		-	170	-	ns
$E_{\text{OFF}}$	Turn-off energy loss		-	110	-	mJ
$t_{\text{d(on)}}$	Turn-on delay time		-	1180	-	ns
$t_{\text{r}}$	Rise time		-	225	-	ns
$Q_{\text{g}}$	Gate charge		-	2.5	-	$\mu\text{C}$
$E_{\text{ON}}$	Turn-on energy loss	$I_{\text{C}} = 100\text{A}, V_{\text{GE}} = \pm 15\text{V}, V_{\text{CE}} = 1800\text{V},$ $R_{\text{G(ON)}} = 16.5\Omega, C_{\text{ge}} = 33\text{nF}, L \sim 100\text{nH}$	-	150	-	mJ
$Q_{\text{rr}}$	Diode reverse recovery charge	$I_{\text{F}} = 100\text{A}, V_{\text{R}} = 1800\text{V},$ $di_{\text{F}}/dt = 800\text{A}/\mu\text{s}$	-	40	-	$\mu\text{C}$
$I_{\text{rr}}$	Diode reverse current		-	75	-	A
$E_{\text{REC}}$	Diode reverse recovery energy		-	40	-	mJ

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

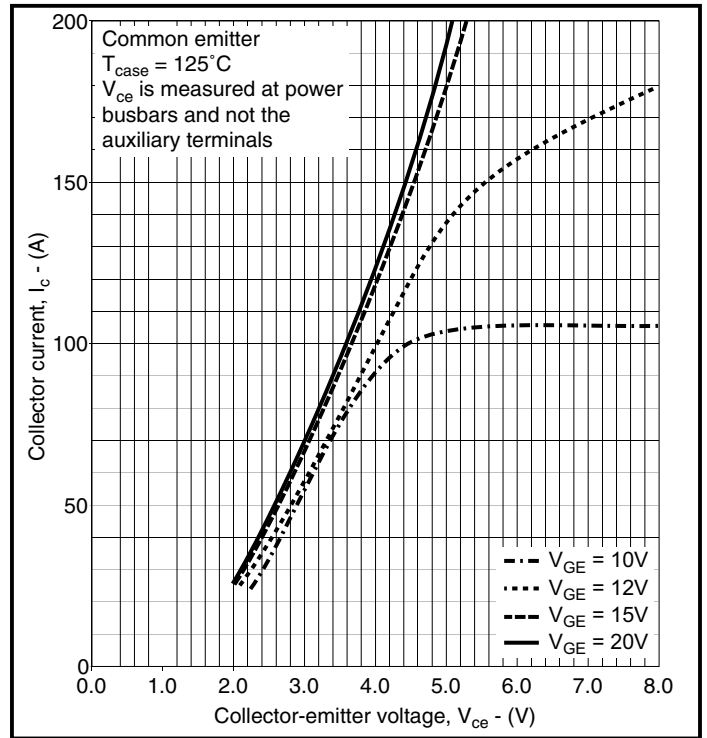
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{\text{d(off)}}$	Turn-off delay time	$I_{\text{C}} = 100\text{A}$ $V_{\text{GE}} = \pm 15\text{V}$ $V_{\text{CE}} = 1800\text{V}$ $R_{\text{G(ON)}} = R_{\text{G(OFF)}} = 33\Omega$ $C_{\text{ge}} = 33\text{nF}, L \sim 100\text{nH}$	-	2200	-	ns
$t_{\text{f}}$	Fall time		-	190	-	ns
$E_{\text{OFF}}$	Turn-off energy loss		-	135	-	mJ
$t_{\text{d(on)}}$	Turn-on delay time		-	1150	-	ns
$t_{\text{r}}$	Rise time		-	280	-	ns
$E_{\text{ON}}$	Turn-on energy loss		$I_{\text{C}} = 100\text{A}, V_{\text{GE}} = \pm 15\text{V}, V_{\text{CE}} = 1800\text{V},$ $R_{\text{G(ON)}} = 16.5\Omega, C_{\text{ge}} = 33\text{nF}, L \sim 100\text{nH}$	-	200	-
$Q_{\text{rr}}$	Diode reverse recovery charge	$I_{\text{F}} = 100\text{A}, V_{\text{R}} = 1800\text{V},$ $di_{\text{F}}/dt = 800\text{A}/\mu\text{s}$	-	65	-	$\mu\text{C}$
$I_{\text{rr}}$	Diode reverse current		-	85	-	A
$E_{\text{REC}}$	Diode reverse recovery energy		-	65	-	mJ

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

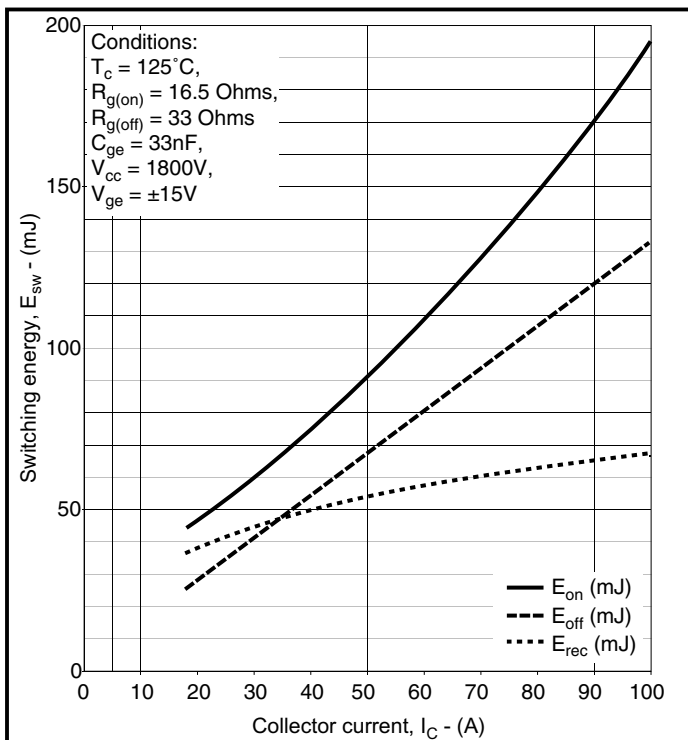
**TYPICAL CHARACTERISTICS**



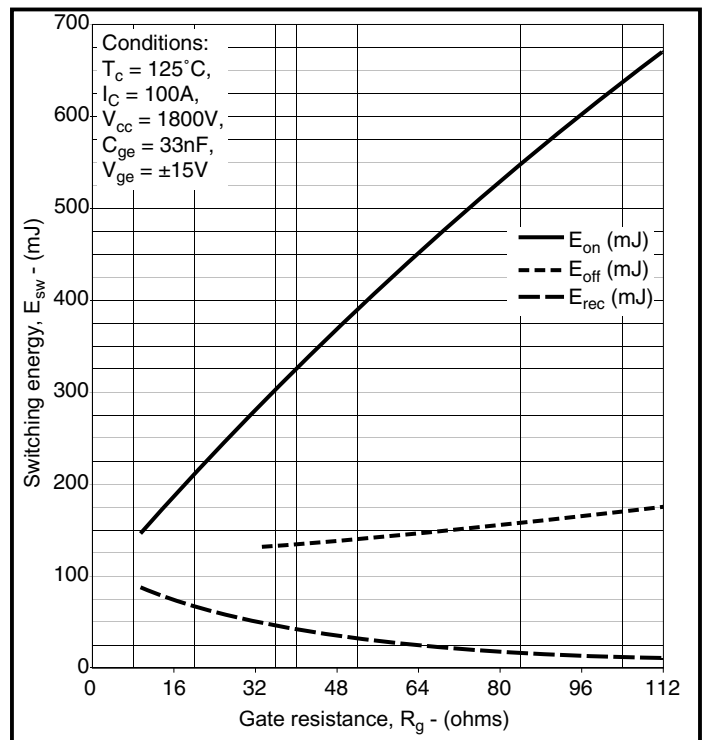
**Fig. 3 Typical output characteristics**



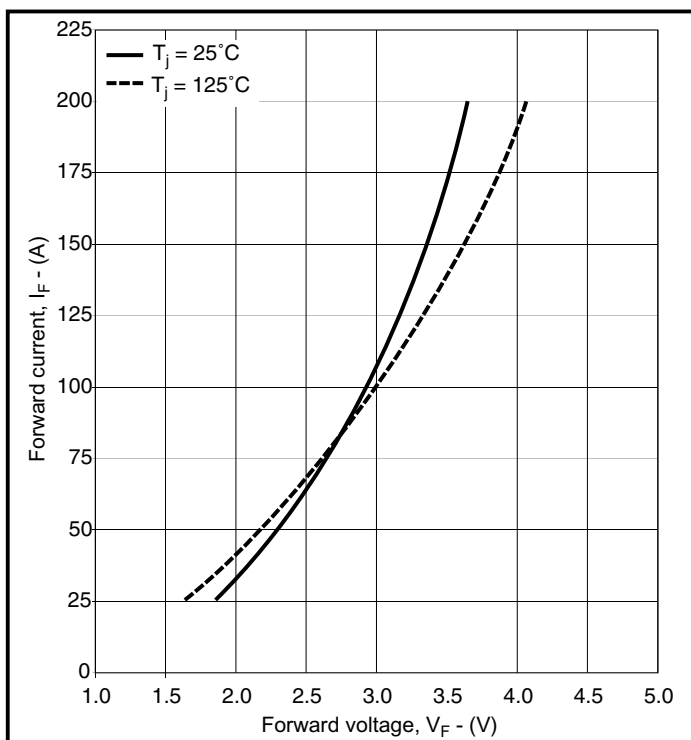
**Fig. 4 Typical output characteristics**



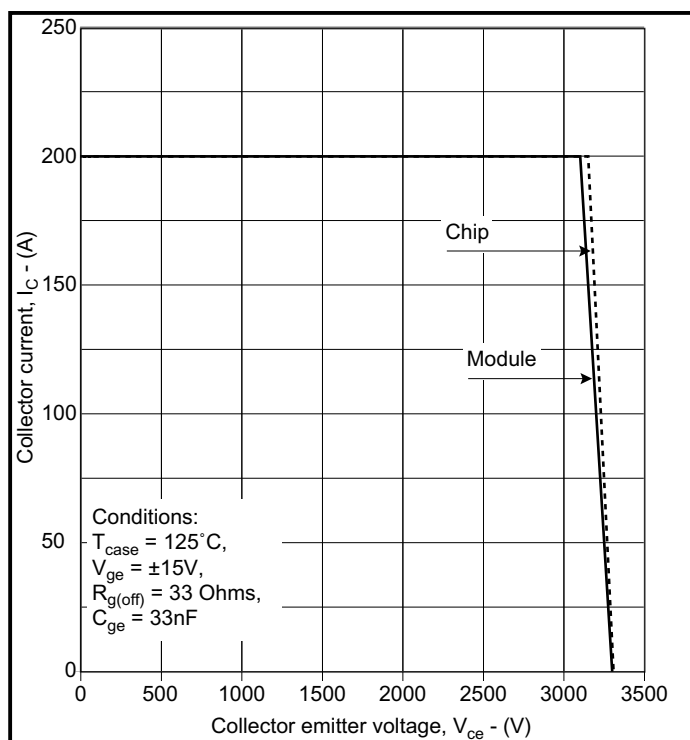
**Fig. 5 Typical switching energy vs collector current**



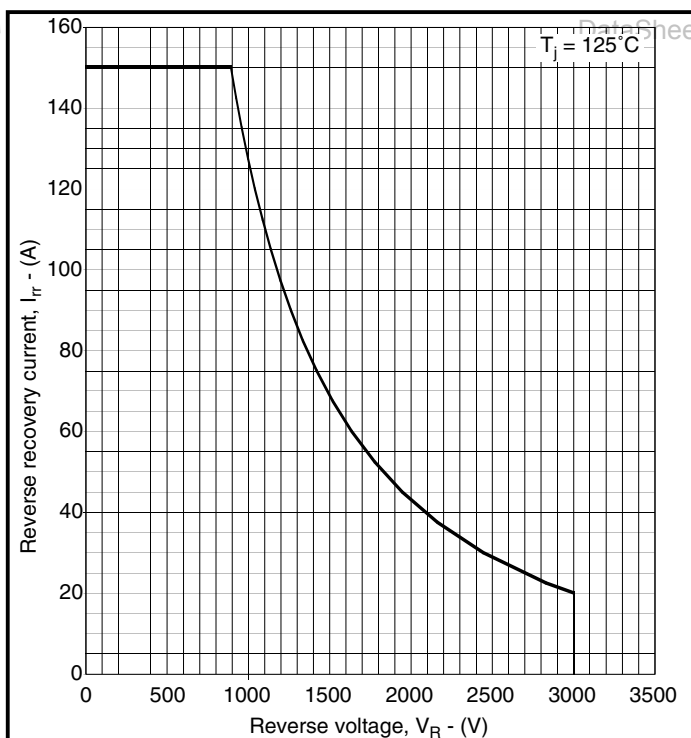
**Fig. 6 Typical switching energy vs gate resistance**



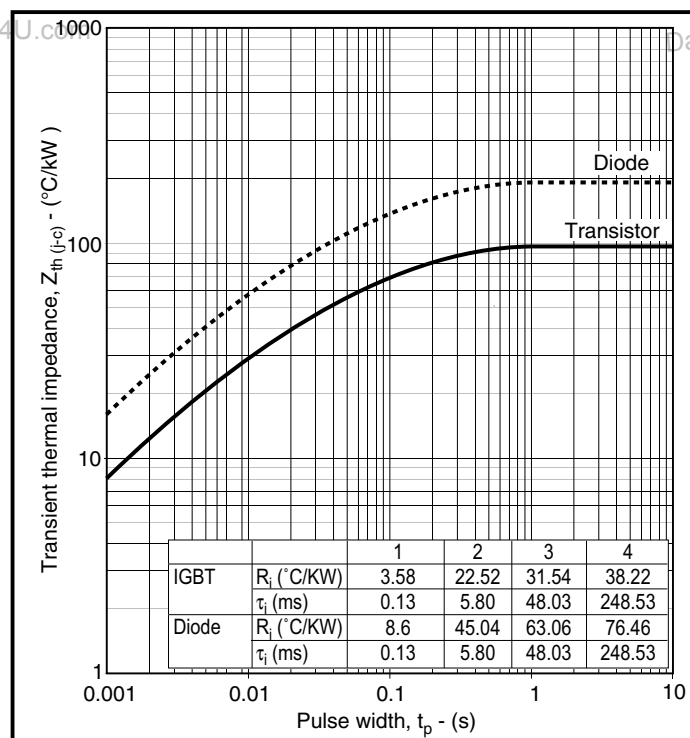
**Fig. 7 Diode typical forward characteristics**



**Fig. 8 Reverse bias safe operating area**



**Fig. 9 Diode reverse bias safe operating area**

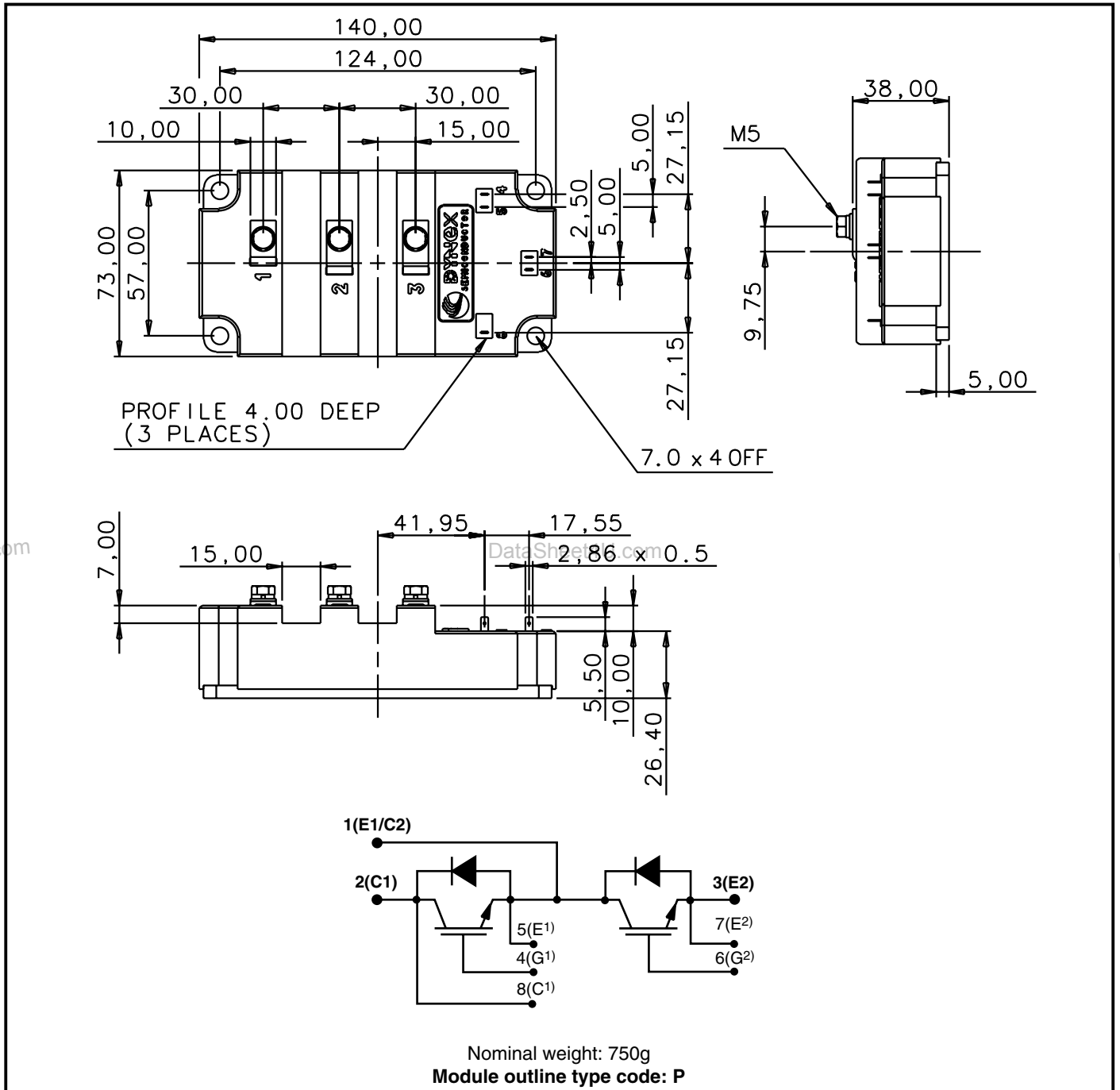


**Fig. 10 Transient thermal impedance**

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

**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: 750g  
**Module outline type code: P**

**Fig. 11 Package details**





## 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.

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