



# PHP225

## Dual P-channel intermediate level FET

Rev. 04 — 17 March 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Dual intermediate level P-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using vertical D-MOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

### 1.2 Features and benefits

- Low conduction losses due to low on-state resistance
- Suitable for high frequency applications due to fast switching characteristics

### 1.3 Applications

- Motor and actuator drivers
- Synchronized rectification
- Power management

### 1.4 Quick reference data

Table 1. Quick reference data

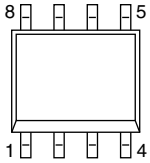
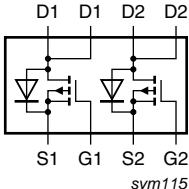
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 150\text{ °C}$	-	-	-30	V
$I_D$	drain current	$T_{sp} \leq 80\text{ °C}$	-	-	-2.3	A
$P_{tot}$	total power dissipation	$T_{sp} = 80\text{ °C}$	[1]	-	2	W
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = -10\text{ V}; I_D = -1\text{ A}; T_j = 25\text{ °C}$	-	0.22	0.25	$\Omega$
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = -10\text{ V}; I_D = -2.3\text{ A}; V_{DS} = -15\text{ V}; T_j = 25\text{ °C}$	-	3	-	nC

[1] Maximum permissible dissipation per MOS transistor. Both devices may be loaded up to 2 W at the same time.



## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source1	 <p>SOT96-1 (SO8)</p>	 <p>sym115</p>
2	G1	gate1		
3	S2	source2		
4	G2	gate2		
5	D2	drain2		
6	D2	drain2		
7	D1	drain1		
8	D1	drain1		

## 3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PHP225	SO8	plastic small outline package; 8 leads; body width 3.9 mm	SOT96-1

## 4. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 150\text{ °C}$	-	-30	V
$V_{GS}$	gate-source voltage		-	-	V
$V_{GSO}$	gate-source voltage	open drain	-20	20	V
$I_D$	drain current	$T_{sp} \leq 80\text{ °C}$	-	-2.3	A
$I_{DM}$	peak drain current	$T_{sp} = 25\text{ °C};$ pulsed	[1]	-10	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ °C}$	[2]	1	W
		$T_{sp} = 80\text{ °C}$	[3]	2	W
		$T_{amb} = 25\text{ °C}$	[4]	1.3	W
			[5]	2	W
$T_{stg}$	storage temperature		-65	150	°C
$T_j$	junction temperature		-	150	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{sp} \leq 80\text{ °C}$	-	-1.25	A
$I_{SM}$	peak source current	$T_{sp} = 25\text{ °C};$ pulsed	[1]	-5	A

- [1] Pulse width and duty cycle limited by maximum junction temperature.
- [2] Maximum permissible dissipation per MOS transistor. Device mounted on printed-circuit board with a thermal resistance from ambient to tie-point of 90 K/W.
- [3] Maximum permissible dissipation per MOS transistor. Both devices may be loaded up to 2 W at the same time.
- [4] Maximum permissible dissipation if only one MOS transistor dissipates. Device mounted on printed-circuit board with a thermal resistance from ambient to tie-point of 90 K/W.
- [5] Maximum permissible dissipation per MOS transistor. Device mounted on printed-circuit board with a thermal resistance from ambient to tie-point of 27.5 K/W.

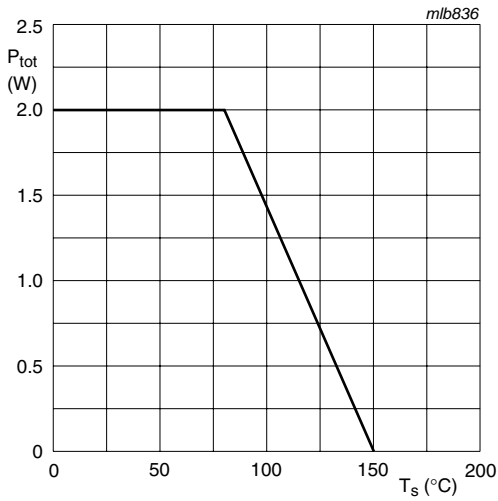
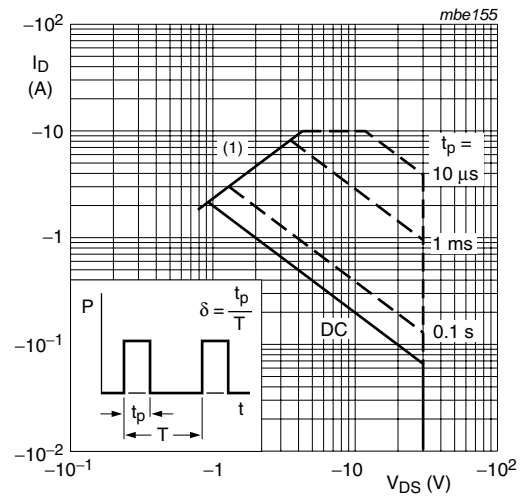


Fig 1. Power derating curve



$\delta = 0.01$   
 $T_s = 80 \text{ }^\circ\text{C}$ .  
 (1)  $R_{DSon}$  limitation.

Fig 2. SOAR; P-channel

### 5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	see <a href="#">Figure 3</a>	-	-	35	K/W

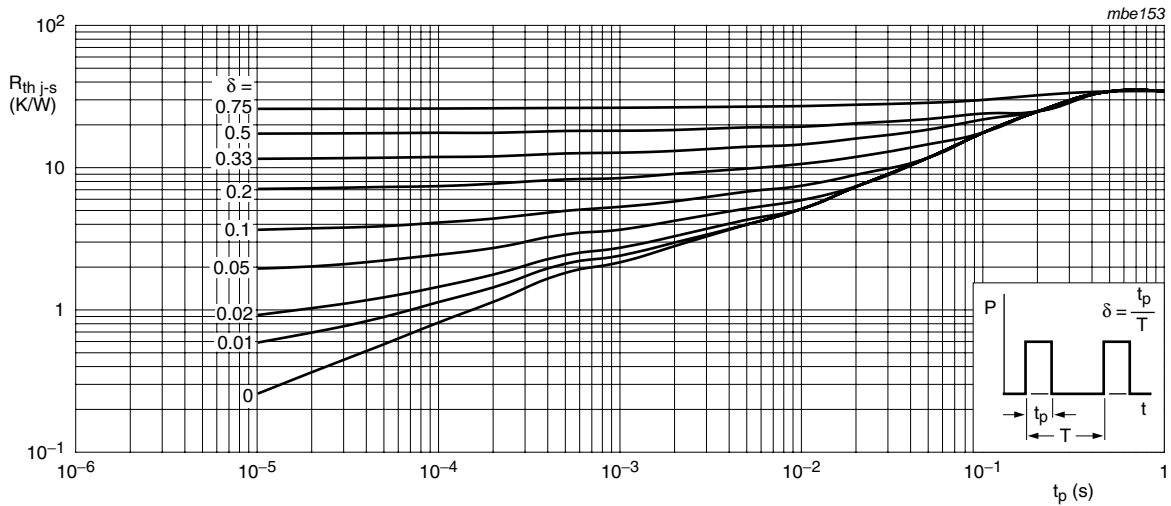
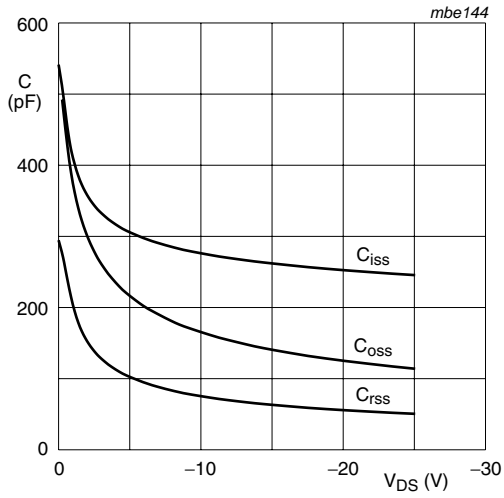


Fig 3. Transient thermal resistance from junction to soldering point as a function of pulse time; typical values.

## 6. Characteristics

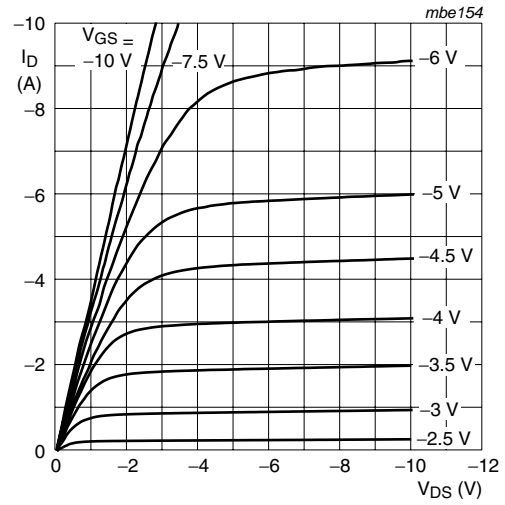
**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = -10 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-30	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = -1 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ C$	-1	-	-2.8	V
$I_{DSS}$	drain leakage current	$V_{DS} = -24 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-100	nA
$I_{GSS}$	gate leakage current	$V_{GS} = 20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	100	nA
		$V_{GS} = -20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = -10 V$ ; $I_D = -1 A$ ; $T_j = 25 \text{ }^\circ C$	-	0.22	0.25	$\Omega$
		$V_{GS} = -4.5 V$ ; $I_D = -0.5 A$ ; $T_j = 25 \text{ }^\circ C$	-	0.33	0.4	$\Omega$
$I_{Dson}$	on-state drain current	$V_{DS} = -1 V$ ; $V_{GS} = -10 V$	-2.3	-	-	A
		$V_{DS} = -5 V$ ; $V_{GS} = -4.5 V$	-1	-	-	A
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = -2.3 A$ ; $V_{DS} = -15 V$ ; $V_{GS} = -10 V$ ; $T_j = 25 \text{ }^\circ C$	-	10	25	nC
$Q_{GS}$	gate-source charge		-	1	-	nC
$Q_{GD}$	gate-drain charge		-	3	-	nC
$C_{iss}$	input capacitance	$V_{DS} = -20 V$ ; $V_{GS} = 0 V$ ; $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ C$	-	250	-	pF
$C_{oss}$	output capacitance		-	140	-	pF
$C_{rss}$	reverse transfer capacitance		-	50	-	pF
$g_{fs}$	transfer conductance	$V_{DS} = -20 V$ ; $I_D = -1 A$ ; $T_j = 25 \text{ }^\circ C$	1	2	-	S
$t_{off}$	turn-off time	$V_{DS} = -20 V$ ; $V_{GS} = -10 V$ ; $R_{G(ext)} = 4.7 \text{ } \Omega$ ; $R_L = 20 \text{ } \Omega$ ; $T_j = 25 \text{ }^\circ C$ ; $I_D = -1 A$	-	50	140	ns
$t_{on}$	turn-on time		-	20	80	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = -1.25 A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-1.6	V
$t_{rr}$	reverse recovery time	$I_S = -1.25 A$ ; $di_S/dt = 100 \text{ A}/\mu s$ ; $V_{GS} = 0 V$ ; $V_{DS} = 25 V$ ; $T_j = 25 \text{ }^\circ C$	-	150	200	ns



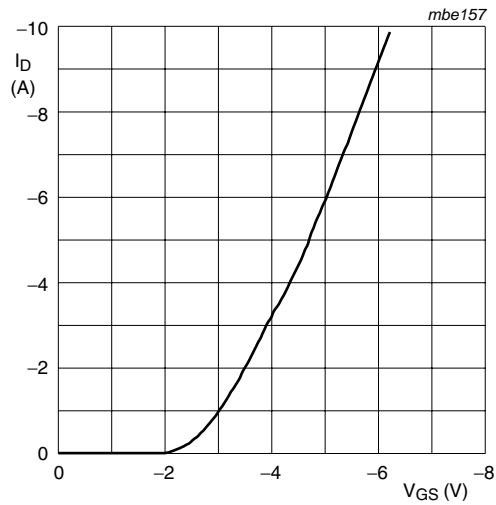
$T_j = 25^\circ\text{C}; V_{GS} = 0\text{V}$

Fig 4. Capacitance as a function of drain-source voltage; P-channel; typical values



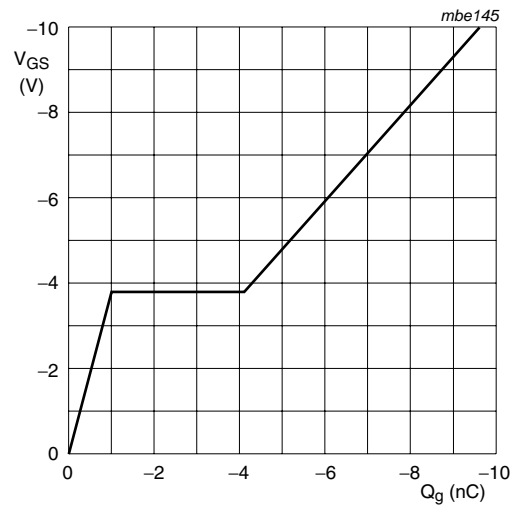
$T_j = 25^\circ\text{C}$

Fig 5. Output characteristics: drain current as a function of drain-source voltage; P-channel; typical values



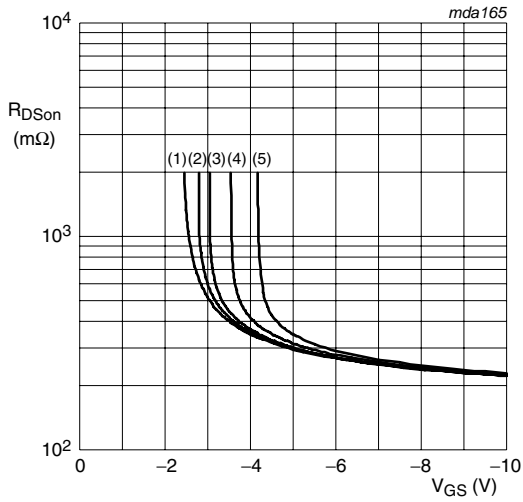
$T_j = 25^\circ\text{C}; V_{DS} = -10\text{V}$

Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; P-channel; typical values



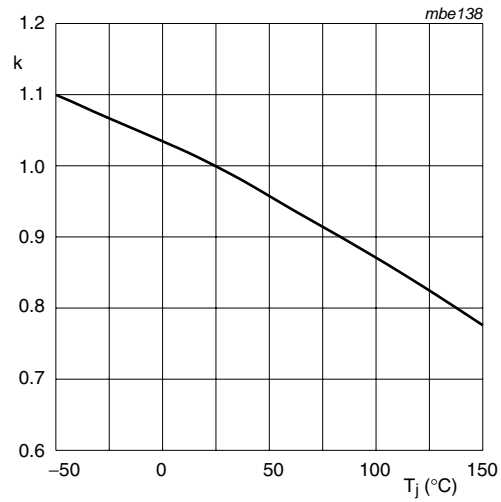
$I_D = -2.3\text{A}; V_{DS} = -15\text{V}$

Fig 7. Gate-source voltage as a function of gate charge; P-channel; typical values



$-V_{DS} \geq -I_D \times R_{DS(on)}$ ;  $T_j = 25^\circ\text{C}$ .  
 (1)  $I_D = -0.1\text{ A}$ .  
 (2)  $I_D = -0.5\text{ A}$ .  
 (3)  $I_D = -1\text{ A}$ .  
 (4)  $I_D = -2.3\text{ A}$ .  
 (5)  $I_D = -4.5\text{ A}$ .

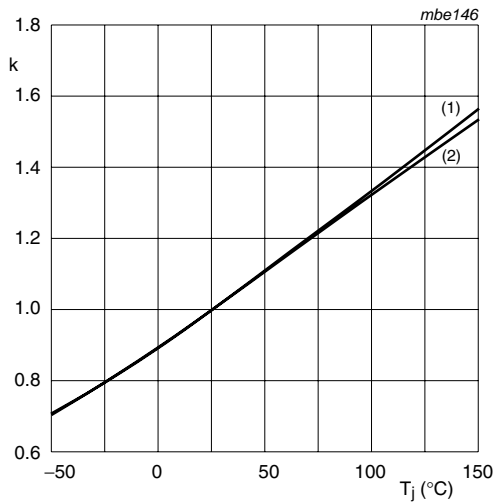
Fig 8. Drain-source on-state resistance as a function of drain current; typical values



$$k = \frac{V_{GSth} \text{ at } T_j}{V_{GSth} \text{ at } 25^\circ\text{C}}$$

Typical  $V_{GSth}$  at  $I_D = 1\text{ mA}$ ;  $V_{DS} = V_{GS} = V_{GSth}$ .

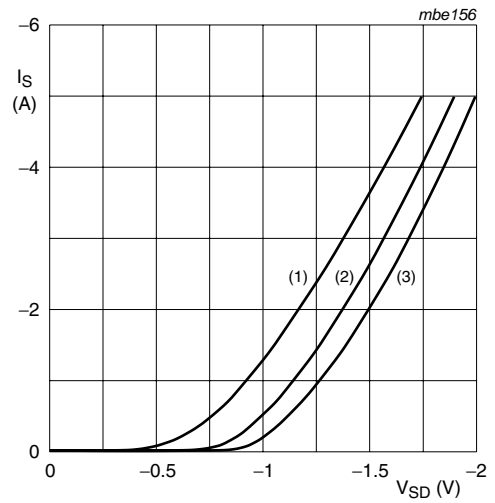
Fig 9. Temperature coefficient of gate-source threshold voltage



$$k = \frac{R_{DS(on)} \text{ at } T_j}{R_{DS(on)} \text{ at } 25^\circ\text{C}}$$

Typical  $R_{DS(on)}$  at:  
 (1)  $I_D = -1\text{ A}$ ;  $V_{GS} = -10\text{ V}$ .  
 (2)  $I_D = -0.5\text{ A}$ ;  $V_{GS} = -4.5\text{ V}$ .

Fig 10. Temperature coefficient of drain-source on-state resistance; P-channel



$V_{GD} = 0\text{V}$ (1)  $T_j = 150^\circ\text{C}$ (2)  $T_j = 25^\circ\text{C}$ (3)  $T_j = -55^\circ\text{C}$

Fig 11. Source current as a function of source-drain voltage

7. Package outline

SO8: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1

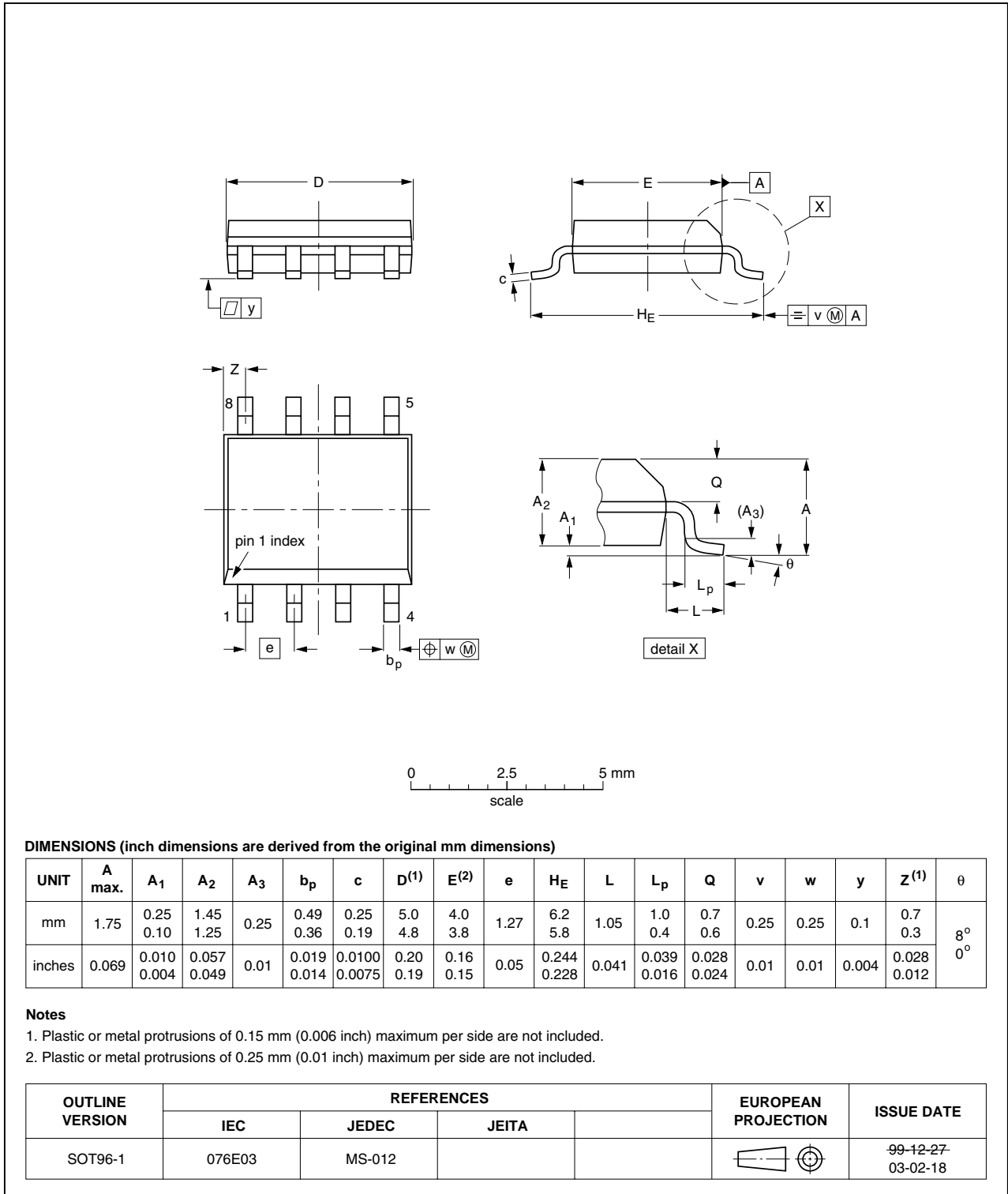


Fig 12. Package outline SOT96-1 (SO8)



## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHP225 v.4	20110317	Product data sheet	-	PHP225 v.3
Modifications:	• Various changes to content.			
PHP225 v.3	20110104	Product data sheet	-	PHP225 v.2

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### 9.1 Data sheet status

Document status <sup>[1]</sup> <sup>[2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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## 11. Contents

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<b>1</b>	<b>Product profile</b> . . . . .	<b>1</b>
1.1	General description . . . . .	1
1.2	Features and benefits . . . . .	1
1.3	Applications . . . . .	1
1.4	Quick reference data . . . . .	1
<b>2</b>	<b>Pinning information</b> . . . . .	<b>2</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>4</b>	<b>Limiting values</b> . . . . .	<b>3</b>
<b>5</b>	<b>Thermal characteristics</b> . . . . .	<b>4</b>
<b>6</b>	<b>Characteristics</b> . . . . .	<b>5</b>
<b>7</b>	<b>Package outline</b> . . . . .	<b>8</b>
<b>8</b>	<b>Revision history</b> . . . . .	<b>9</b>
<b>9</b>	<b>Legal information</b> . . . . .	<b>10</b>
9.1	Data sheet status . . . . .	10
9.2	Definitions . . . . .	10
9.3	Disclaimers . . . . .	10
9.4	Trademarks . . . . .	11
<b>10</b>	<b>Contact information</b> . . . . .	<b>11</b>

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