



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
- Power management
- Synchronized rectification

1.4 Quick reference data

Table 1. Quick reference data

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

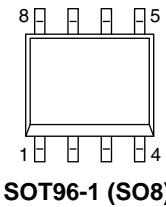
[1] Maximum permissible dissipation per MOS transistor. Both devices may be loaded up to 2 W at the same time.

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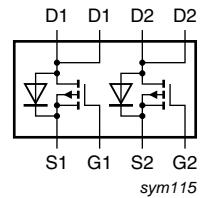
2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|--------------------|----------------|
| 1 | S1 | source1 | | |
| 2 | G1 | gate1 | | |
| 3 | S2 | source2 | | |
| 4 | G2 | gate2 | | |
| 5 | D2 | drain2 | | |
| 6 | D2 | drain2 | | |
| 7 | D1 | drain1 | | |
| 8 | D1 | drain1 | | |



SOT96-1 (SO8)



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

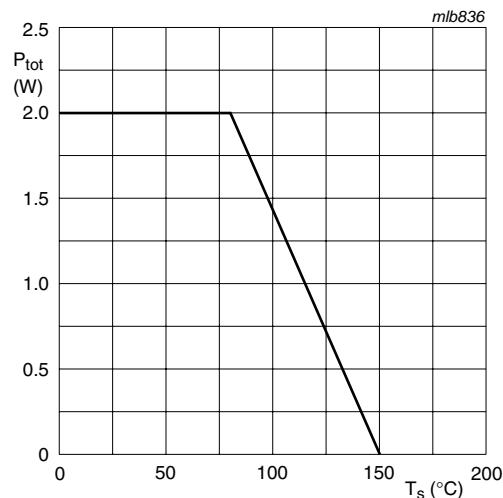


Fig 1. Power derating curve

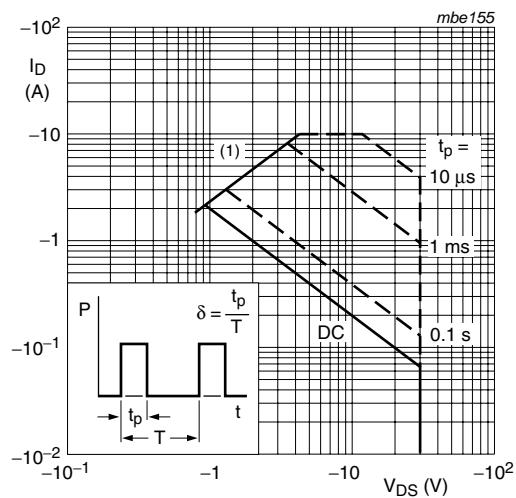


Fig 2. SOAR; P-channel

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 Figure 3 | - | - | 35 | K/W |

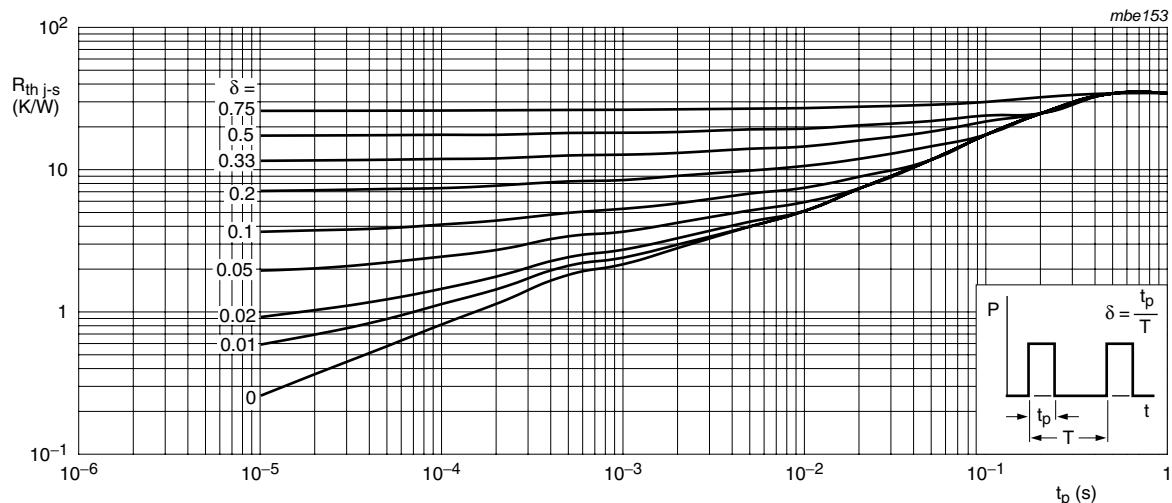
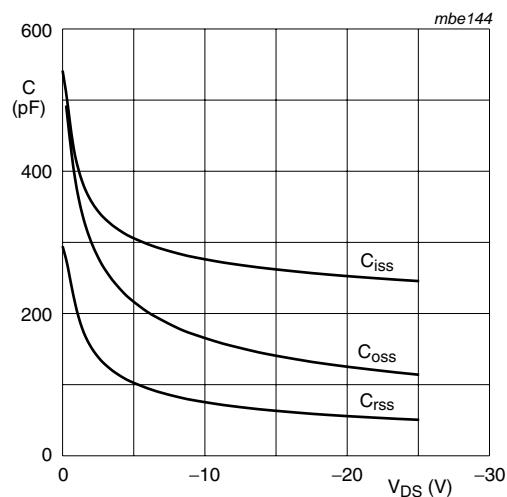


Fig 3. Transient thermal resistance from junction to soldering point as a function of pulse time; typical values.

6. Characteristics

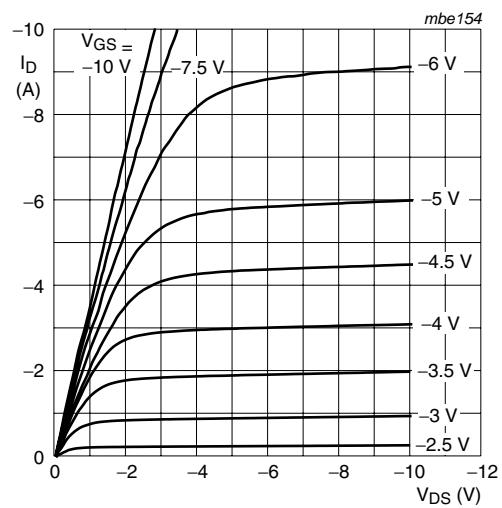
Table 6. Characteristics

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



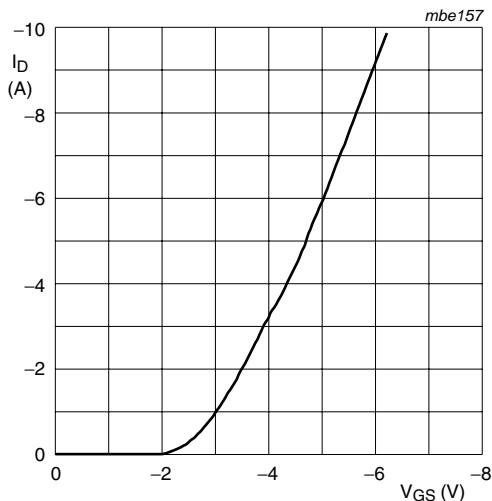
$T_j = 25^\circ C; V_{GS} = 0V$

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



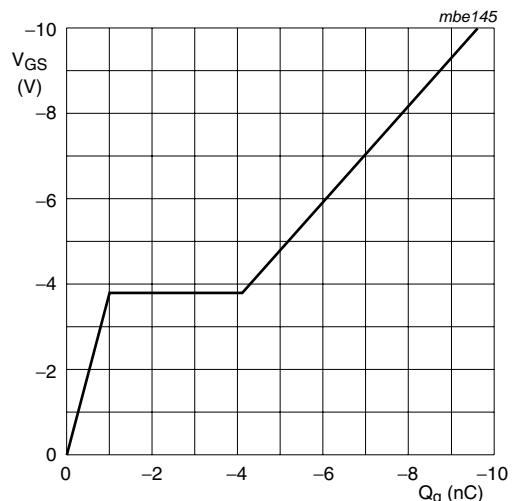
$T_j = 25^\circ C$

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



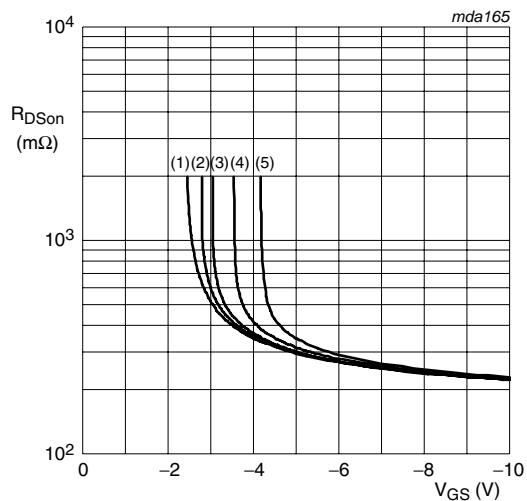
$T_j = 25^\circ C; V_{DS} = -10V$

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



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

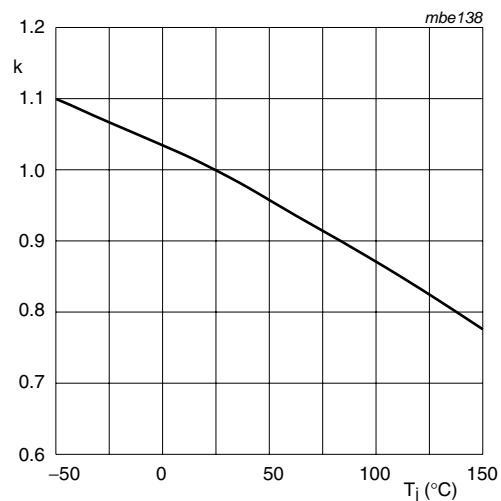
Fig 7. Gate-source voltage as a function of gate charge; P-channel; typical values



$-V_{DS} \geq -I_D \times R_{DSon}; T_j = 25^\circ C.$

- (1) $I_D = -0.1 A.$
- (2) $I_D = -0.5 A.$
- (3) $I_D = -1 A.$
- (4) $I_D = -2.3 A.$
- (5) $I_D = -4.5 A.$

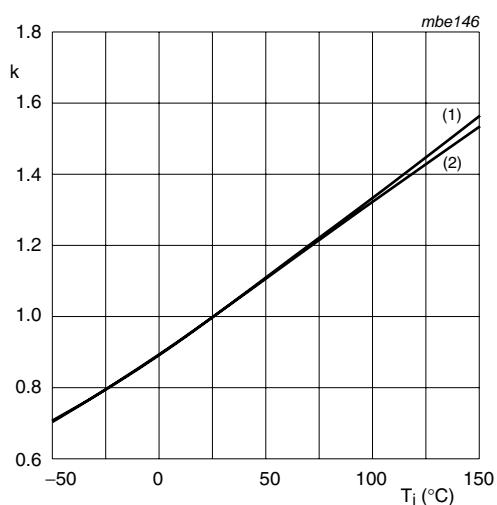
Fig 8. Drain-source on-state resistance as a function of drain current; typical values



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

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

Fig 9. Temperature coefficient of gate-source threshold voltage

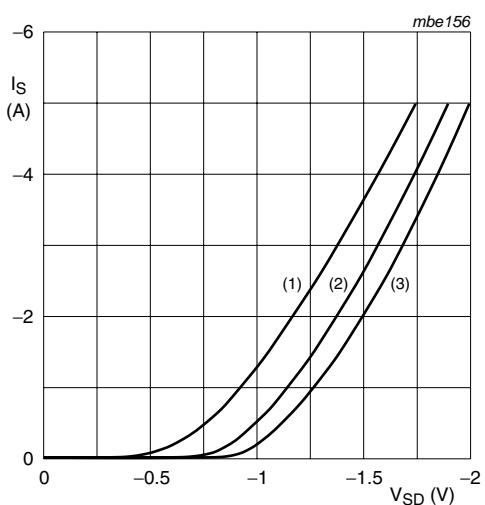


$$k = \frac{R_{DSon} \text{ at } T_j}{R_{DSon} \text{ at } 25^\circ C}$$

Typical R_{DSon} at:

- (1) $I_D = -1 A; V_{GS} = -10 V.$
- (2) $I_D = -0.5 A; V_{GS} = -4.5 V.$

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



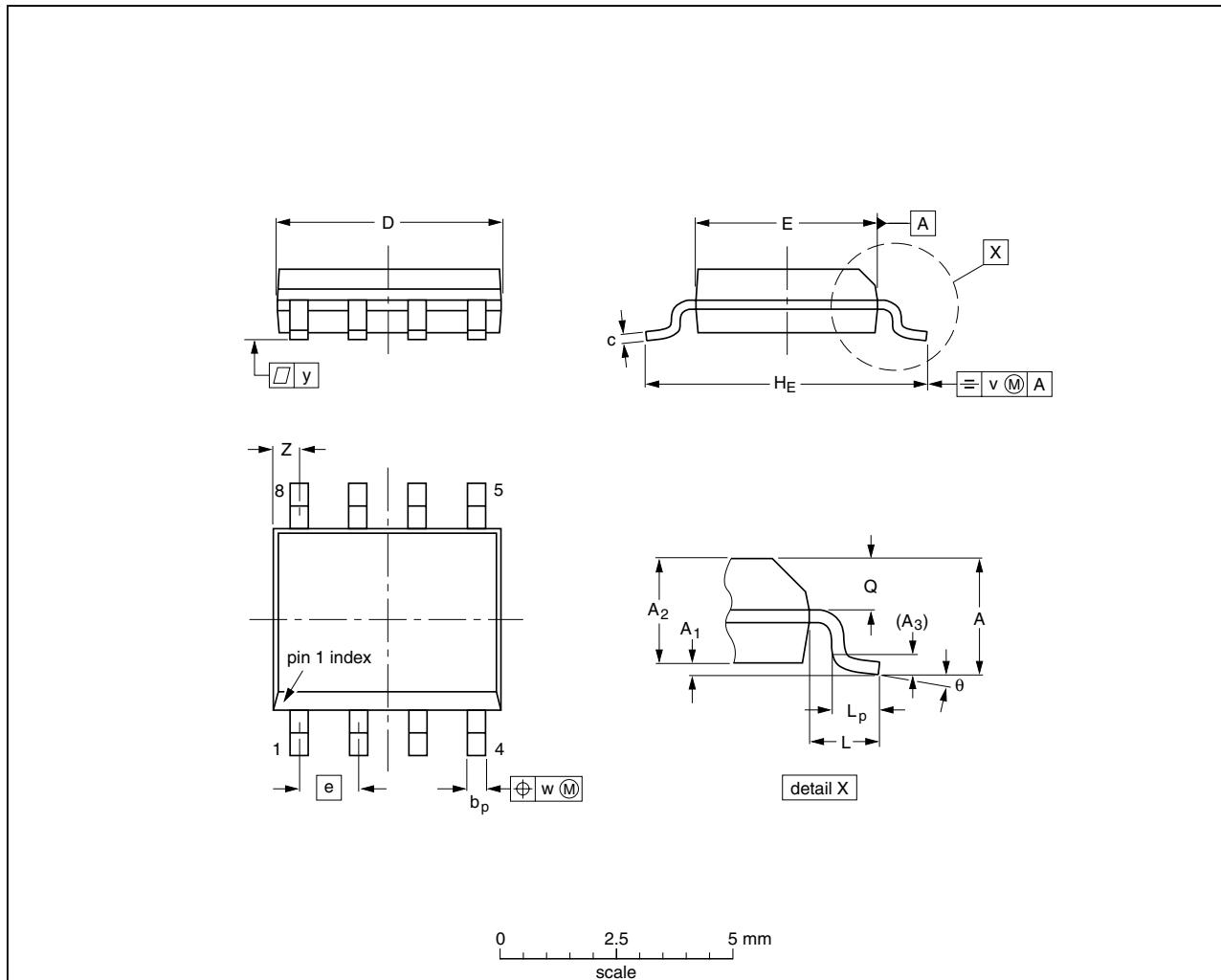
$$V_{GD} = 0V (1) T_j = 150^\circ C (2) T_j = 25^\circ C (3) T_j = -55^\circ C$$

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



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽²⁾ | e | H _E | L | L _p | Q | v | w | y | Z ⁽¹⁾ | θ |
|--------|----------------|----------------|----------------|----------------|-----------------|------------------|------------------|------------------|------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm | 1.75 0.10 | 0.25 1.25 | 1.45 0.19 | 0.25 | 0.49 0.36 | 0.25 0.19 | 5.0 4.8 | 4.0 3.8 | 1.27 | 6.2 5.8 | 1.05 | 1.0 0.4 | 0.7 0.6 | 0.25 | 0.25 | 0.1 | 0.7 0.3 | 8° 0° |
| inches | 0.069 0.004 | 0.010 0.049 | 0.057 0.014 | 0.01 | 0.019 0.0100 | 0.0100 0.0075 | 0.20 | 0.16 0.15 | 0.05 | 0.244 0.228 | 0.041 | 0.039 0.016 | 0.028 0.024 | 0.01 | 0.01 | 0.004 | 0.028 0.012 | |

Notes

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|--------------------|------------|--------|-------|------------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT96-1 | 076E03 | MS-012 | | | 99-12-27 03-02-18 |

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 |

9. Legal information

9.1 Data sheet status

| Document status [1] [2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
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| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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