



PH4530L

N-channel TrenchMOS™ logic level FET

Rev. 02 — 26 January 2005

Product data sheet

1. Product profile

1.1 General description

Logic level N-channel enhancement mode field effect transistor in a plastic package using TrenchMOS™ technology.

1.2 Features

- Low thermal resistance
- Logic level gate drive
- SO8 equivalent area footprint
- Low on-state resistance.

1.3 Applications

- DC-to-DC converters
- Portable appliances
- Switched-mode power supplies
- Notebook computers.

1.4 Quick reference data

- $V_{DS} \leq 30$ V
- $I_D \leq 80$ A
- $P_{tot} \leq 62.5$ W
- $R_{DSon} \leq 5.7$ m Ω .

2. Pinning information

Table 1: Discrete pinning

| Pin | Description | Simplified outline | Symbol |
|-------|--------------------------------------|--------------------------------------|---------------|
| 1,2,3 | source | <p>Top view</p> <p>SOT669 (LFAK)</p> | <p>mbb076</p> |
| 4 | gate | | |
| mb | mounting base; connected to drain | | |

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3. Ordering information

Table 2: Ordering information

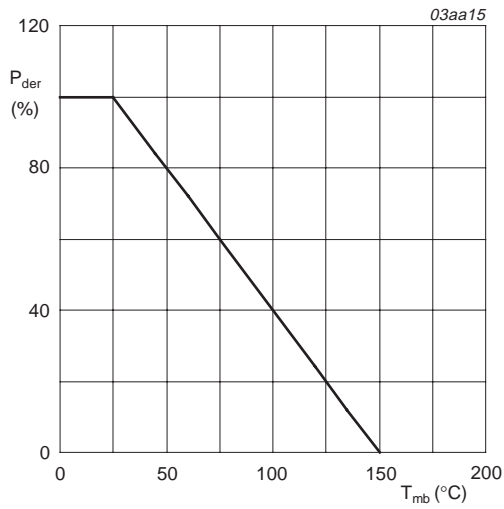
| Type number | Package | | Version |
|-------------|---------|---|---------|
| | Name | Description | |
| PH4530L | LFPAK | plastic single-ended surface mounted package (LFPAK); 4 leads | SOT669 |

4. Limiting values

Table 3: Limiting values

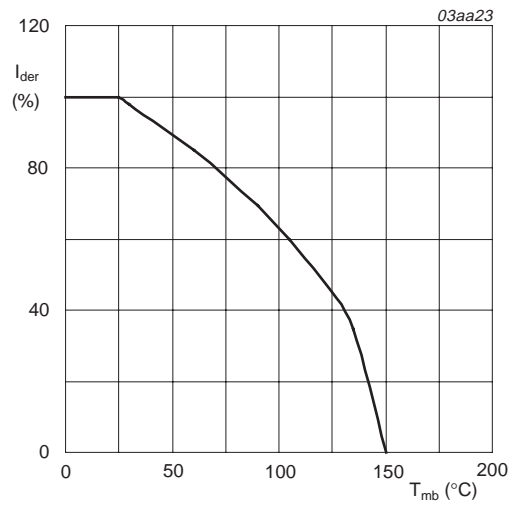
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|--|---|-----|----------|------|
| V_{DS} | drain-source voltage (DC) | $25\text{ °C} \leq T_j \leq 150\text{ °C}$ | - | 30 | V |
| V_{GS} | gate-source voltage (DC) | | - | ± 20 | V |
| I_D | drain current (DC) | $T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ Figure 2 and 3 | - | 80 | A |
| | | $T_{mb} = 100\text{ °C}; V_{GS} = 10\text{ V};$ Figure 2 | - | 240 | A |
| I_{DM} | peak drain current | $T_{mb} = 25\text{ °C};$ pulsed; $t_p \leq 10\text{ }\mu\text{s};$ Figure 3 | - | 50.7 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C};$ Figure 1 | - | 62.5 | W |
| T_{stg} | storage temperature | | -55 | +150 | °C |
| T_j | junction temperature | | -55 | +150 | °C |
| Source-drain diode | | | | | |
| I_S | source (diode forward) current (DC) | $T_{mb} = 25\text{ °C}$ | - | 52 | A |
| I_{SM} | peak source (diode forward) current | $T_{mb} = 25\text{ °C};$ pulsed; $t_p \leq 10\text{ }\mu\text{s}$ | - | 150 | A |
| Avalanche ruggedness | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | unclamped inductive load; $I_D = 36.2\text{ A};$ $t_p = 0.24\text{ ms}; V_{DD} \leq 30\text{ V}; V_{GS} = 10\text{ V};$ starting $T_j = 25\text{ °C}$ | - | 130 | mJ |



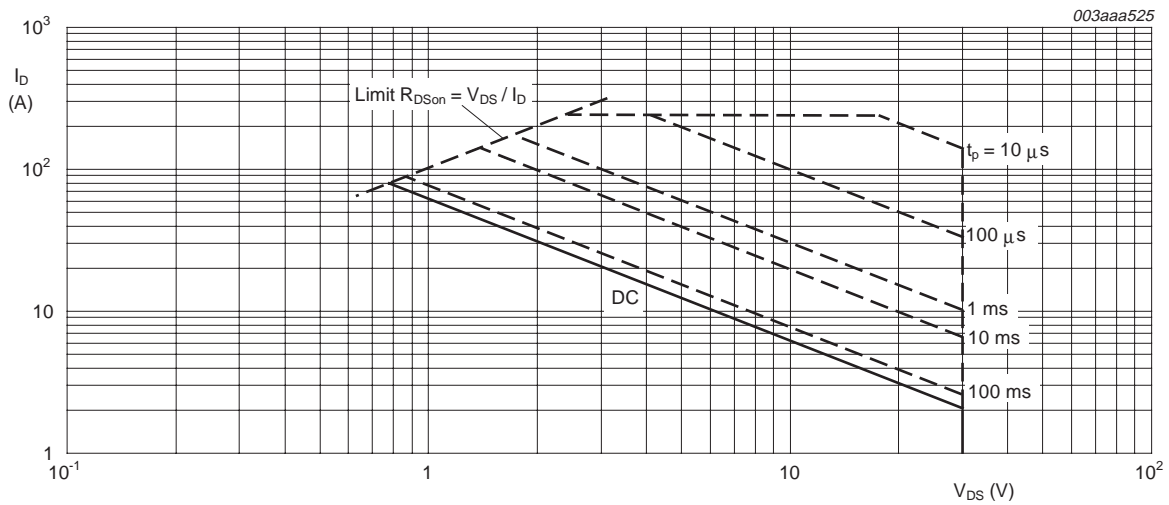
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

Fig 1. Normalized total power dissipation as a function of mounting base temperature.



$$I_{der} = \frac{I_D}{I_{D(25^{\circ}C)}} \times 100\%$$

Fig 2. Normalized continuous drain current as a function of mounting base temperature.



$T_{mb} = 25^{\circ}C$; I_{DM} is single pulse

Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.

5. Thermal characteristics

Table 4: Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|---|------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | Figure 4 | - | - | 2 | K/W |

5.1 Transient thermal impedance

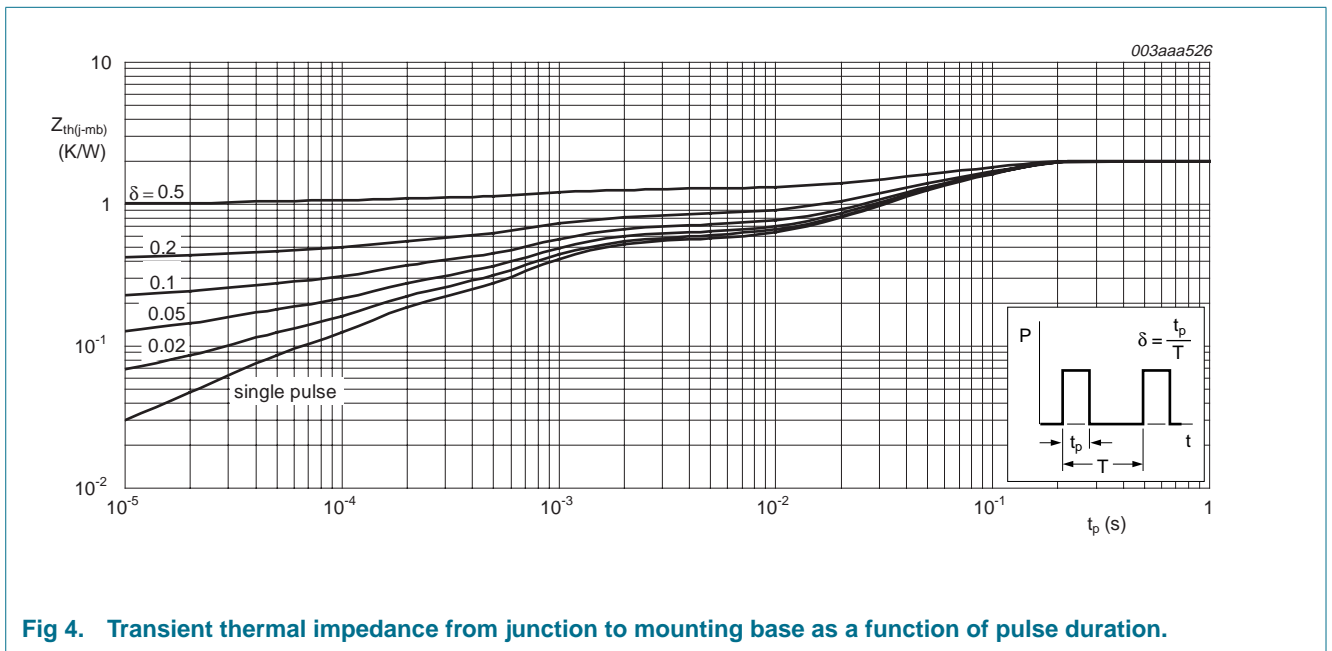


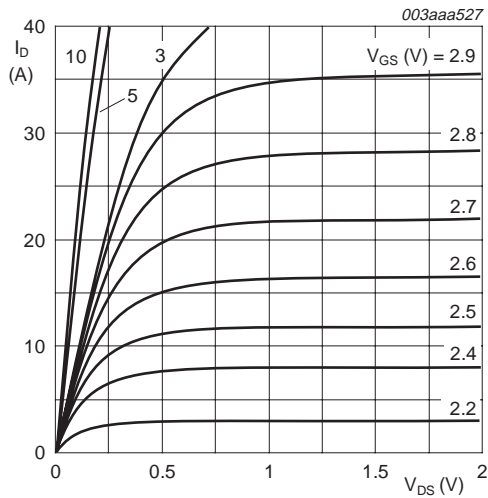
Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.

6. Characteristics

Table 5: Characteristics

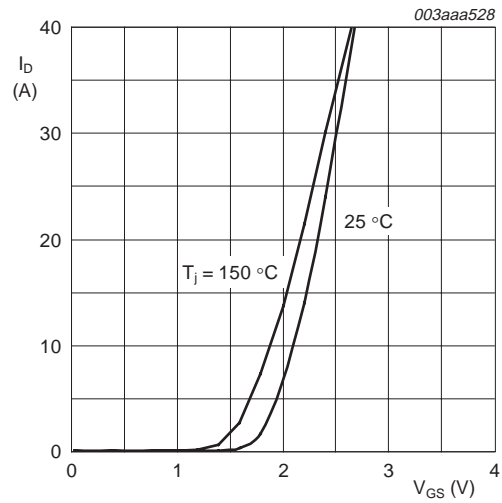
$T_j = 25\text{ °C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--------------------------------------|--|-----|------|-----|------------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$ | 30 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; Figure 9 | 1 | 1.5 | 2 | V |
| I_{DSS} | drain-source leakage current | $V_{DS} = 30\ \text{V}$; $V_{GS} = 0\ \text{V}$ | | | | |
| | | $T_j = 25\text{ °C}$ | - | 0.06 | 1 | μA |
| | | $T_j = 150\text{ °C}$ | - | - | 500 | μA |
| I_{GSS} | gate-source leakage current | $V_{GS} = \pm 15\ \text{V}$; $V_{DS} = 0\ \text{V}$ | - | 2 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10\ \text{V}$; $I_D = 15\ \text{A}$; Figure 7 and 8 | | | | |
| | | $T_j = 25\text{ °C}$ | - | 4.8 | 5.7 | $\text{m}\Omega$ |
| | | $T_j = 150\text{ °C}$ | - | 8.2 | 9.7 | $\text{m}\Omega$ |
| | | $V_{GS} = 5\ \text{V}$; $I_D = 15\ \text{A}$; Figure 7 and 8 | - | 5.8 | 7.2 | $\text{m}\Omega$ |
| Dynamic characteristics | | | | | | |
| $Q_{g(tot)}$ | total gate charge | $I_D = 25\ \text{A}$; $V_{DS} = 10\ \text{V}$; $V_{GS} = 5\ \text{V}$; Figure 13 | - | 23.5 | - | nC |
| Q_{gs} | gate-source charge | | - | 5.8 | - | nC |
| Q_{gd} | gate-drain (Miller) charge | | - | 6.5 | - | nC |
| C_{iss} | input capacitance | $V_{GS} = 0\ \text{V}$; $V_{DS} = 10\ \text{V}$; $f = 1\ \text{MHz}$; Figure 11 | - | 1972 | - | pF |
| C_{oss} | output capacitance | | - | 769 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 304 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; | - | 22 | - | ns |
| t_r | rise time | $V_{GS} = 5\ \text{V}$; $R_G = 4.7\ \Omega$ | - | 40 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 48 | - | ns |
| t_f | fall time | | - | 18 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain (diode forward) voltage | $I_S = 15\ \text{A}$; $V_{GS} = 0\ \text{V}$; Figure 12 | - | 0.85 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 20\ \text{A}$; $di_S/dt = -100\ \text{A}/\mu\text{s}$; $V_{GS} = 0\ \text{V}$ | - | 38 | - | ns |



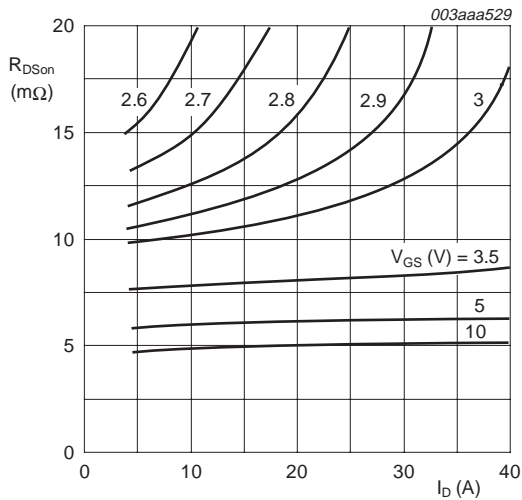
$T_j = 25\text{ °C}$

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



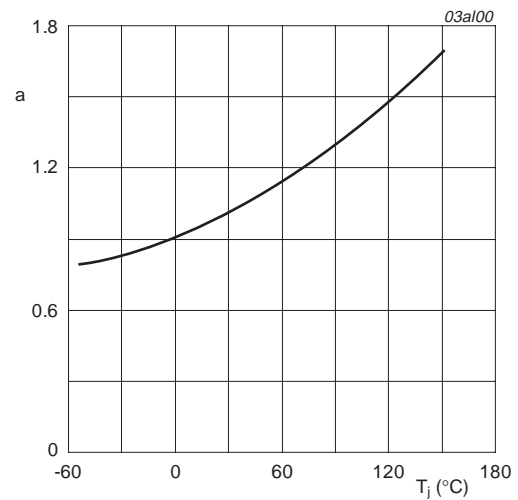
$T_j = 25\text{ °C}$ and 150 °C ; $V_{DS} > I_D \times R_{DSon}$

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



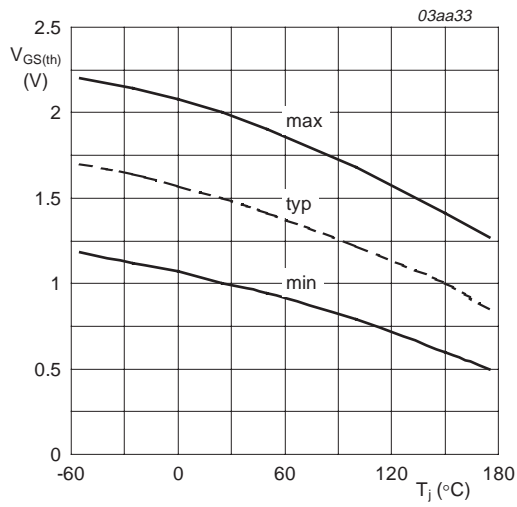
$T_j = 25\text{ °C}$

Fig 7. Drain-source on-state resistance as a function of drain current; typical values.



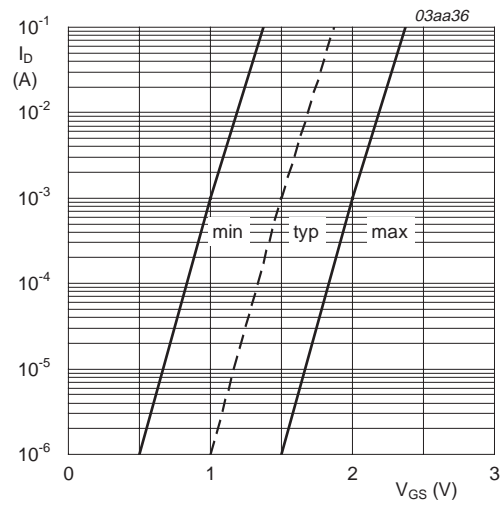
$$a = \frac{R_{DSon}}{R_{DSon}(25\text{ °C})}$$

Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature.



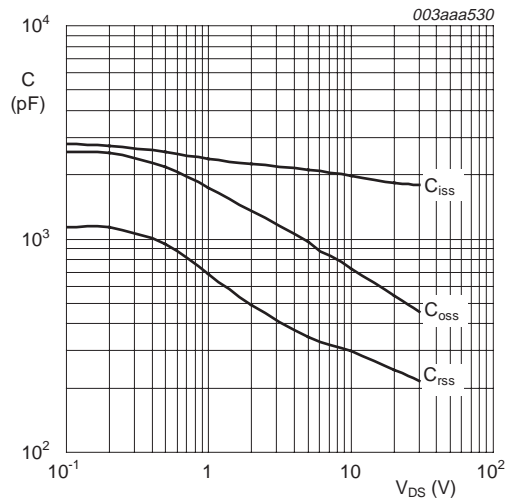
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

Fig 9. Gate-source threshold voltage as a function of junction temperature.



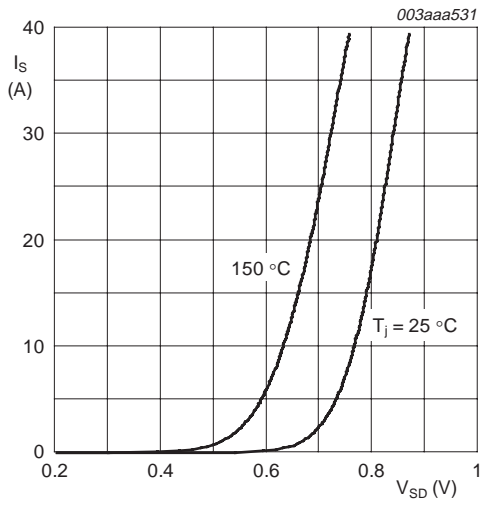
$T_j = 25 \text{ °C}; V_{DS} = 5 \text{ V}$

Fig 10. Sub-threshold drain current as a function of gate-source voltage.



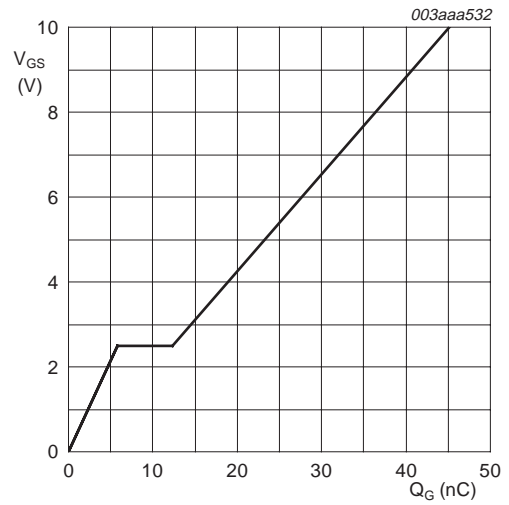
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

Fig 11. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.



$T_j = 25\text{ °C}$ and 150 °C ; $V_{GS} = 0\text{ V}$

Fig 12. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values.



$I_D = 25\text{ A}$; $V_{DD} = 10\text{ V}$

Fig 13. Gate-source voltage as a function of gate charge; typical values.

7. Package outline

Plastic single-ended surface mounted package (LFAK); 4 leads

SOT669

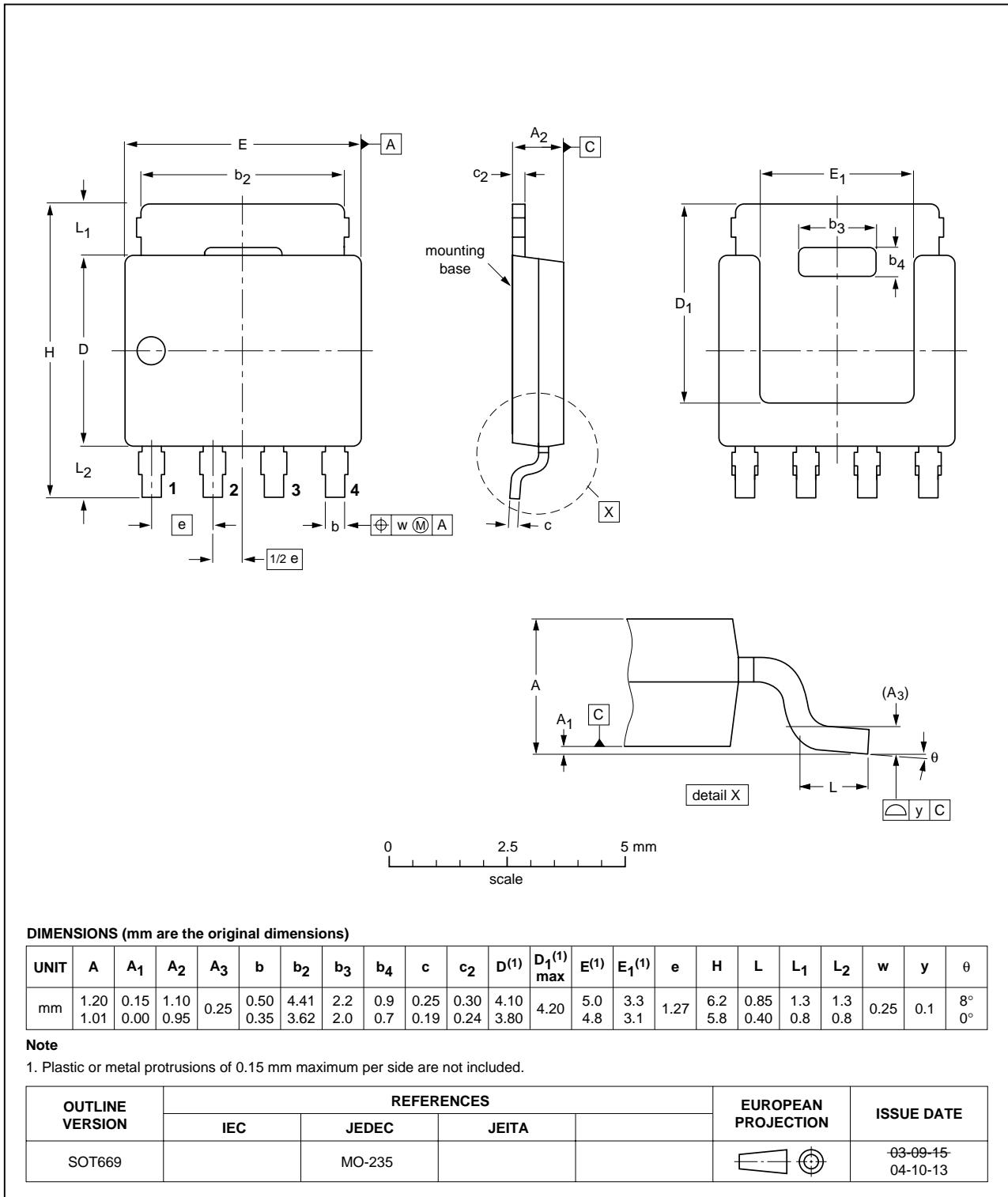


Fig 14. SOT669 (LFAK) package outline.

8. Revision history

Table 6: Revision history

| Document ID | Release date | Data sheet status | Change notice | Doc. number | Supersedes |
|----------------|--------------|------------------------|---------------|----------------|---|
| PH4530L_2 | 20050126 | Product data sheet | - | 9397 750 14031 | PH4530L_1 |
| Modifications: | | | | | <ul style="list-style-type: none"> • Section 1.4 "Quick reference data" I_D and R_{DSon} values updated • Table 3 "Limiting values" I_D and I_{DM} values updated • Figure 3, Figure 6, Figure 11 and Figure 13 updated • Table 5 "Characteristics" R_{DSon}, $Q_{g(tot)}$, Q_{gs}, Q_{gd}, C_{iss}, C_{oss} and C_{rss} values updated. |
| PH4530L_1 | 20040304 | Preliminary data sheet | - | 9397 750 12813 | - |

9. Data sheet status

| Level | Data sheet status ^[1] | Product status ^{[2] [3]} | Definition |
|-------|----------------------------------|-----------------------------------|--|
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