



# BUK6213-30A

N-channel TrenchMOS intermediate level FET

Rev. 03 — 2 February 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Intermediate level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product has been designed and qualified to the appropriate AEC standard for use in automotive critical applications.

### 1.2 Features and benefits

- AEC Q101 compliant
- Suitable for logic or standard level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

### 1.3 Applications

- 12 V loads
- Automotive systems
- General purpose power switching
- Motors, lamps and solenoids

### 1.4 Quick reference data

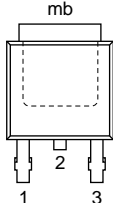
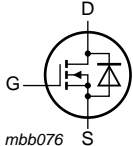
Table 1. Quick reference data

| Symbol                         | Parameter                                    | Conditions  | Min | Typ | Max | Unit |
|--------------------------------|--|---|-----|-----|-----|------|
| $V_{DS}$                       | drain-source voltage                         | $T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$  | -   | -   | 30  | V    |
| $I_D$                          | drain current                                | $V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>                                | [1] | -   | 55  | A    |
| $P_{tot}$                      | total power dissipation                      | $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>  | -   | -   | 102 | W    |
| <b>Static characteristics</b>  |  |   |     |     |     |      |
| $R_{DS(on)}$                   | drain-source on-state resistance             | $V_{GS} = 10\text{ V}$ ; $I_D = 10\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a>             | -   | 10  | 13  | mΩ   |
| <b>Avalanche ruggedness</b>    |  |   |     |     |     |      |
| $E_{DS(AL)S}$                  | non-repetitive drain-source avalanche energy | $I_D = 55\text{ A}$ ; $V_{sup} \leq 30\text{ V}$ ; $R_{GS} = 50\text{ Ω}$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; unclamped | -   | -   | 267 | mJ   |
| <b>Dynamic characteristics</b> |  |   |     |     |     |      |
| $Q_{GD}$                       | gate-drain charge                            | $V_{GS} = 5\text{ V}$ ; $I_D = 25\text{ A}$ ; $V_{DS} = 24\text{ V}$  | -   | 14  | -   | nC   |

[1] Continuous current is limited by bondwires.

2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                       | Simplified outline  | Graphic symbol  |
|-----|--------|-----------------------------------|---|---|
| 1   | G      | gate                              |  |  |
| 2   | D      | drain                             |   |   |
| 3   | S      | source                            |   |   |
| mb  | D      | mounting base; connected to drain |   |   |

SOT428 (DPAK)

3. Ordering information

Table 3. Ordering information

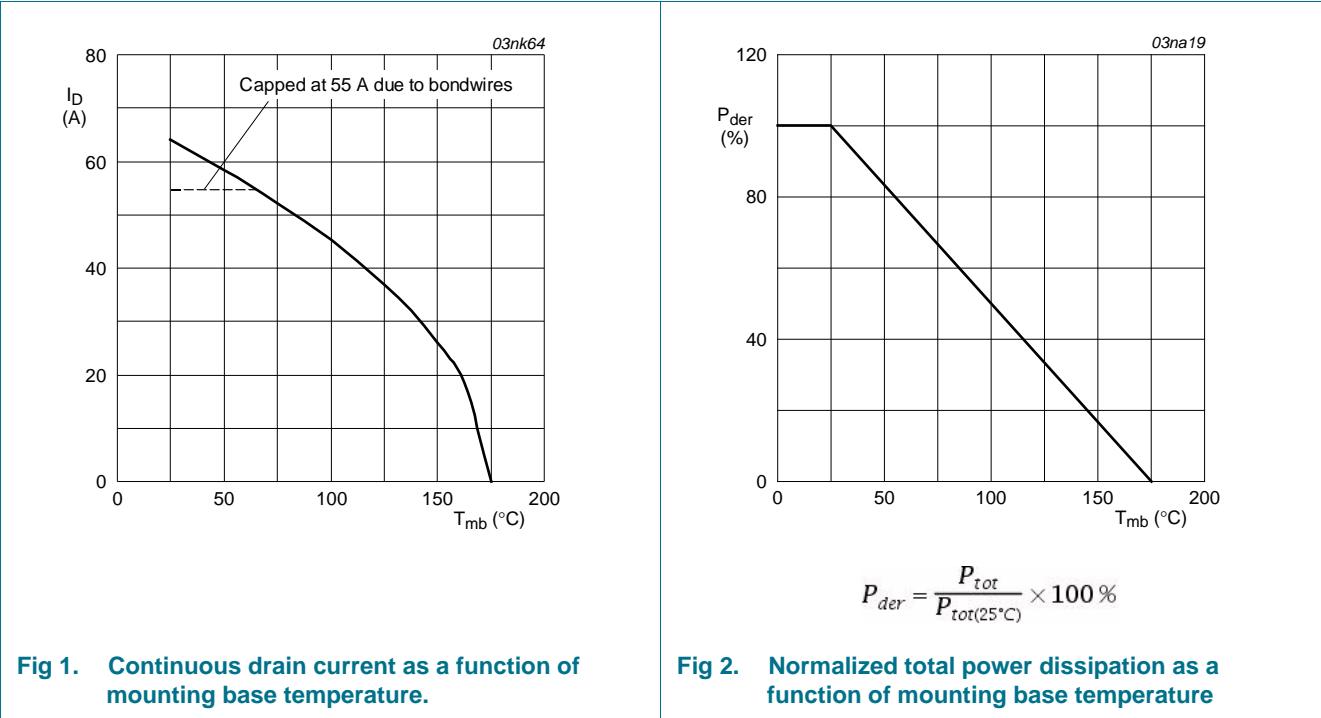
| Type number | Package |   | Version |
|-------------|---------|---|---------|
|             | Name    | Description   |         |
| BUK6213-30A | DPAK    | plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped) | SOT428  |

4. Limiting values

Table 4. Limiting values  
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol               | Parameter                                    | Conditions  | Min                 | Max | Unit |   |
|----------------------|--|---|---------------------|-----|------|---|
| V <sub>DS</sub>      | drain-source voltage                         | T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C   | -                   | 30  | V    |   |
| V <sub>DGR</sub>     | drain-gate voltage                           | R <sub>GS</sub> = 20 kΩ   | -                   | 30  | V    |   |
| V <sub>GS</sub>      | gate-source voltage                          |   | -20                 | 20  | V    |   |
| I <sub>D</sub>       | drain current                                | T <sub>mb</sub> = 100 °C; V <sub>GS</sub> = 10 V; see <a href="#">Figure 1</a> <a href="#">[1]</a>                                      | -                   | 45  | A    |   |
|                      |  | T <sub>mb</sub> = 25 °C; V <sub>GS</sub> = 10 V; see <a href="#">Figure 1</a> ; <a href="#">[2]</a>                                     | -                   | 55  | A    |   |
|                      |  | see <a href="#">Figure 3</a> <a href="#">[1]</a>  | -                   | 64  | A    |   |
| I <sub>DM</sub>      | peak drain current                           | T <sub>mb</sub> = 25 °C; pulsed; t <sub>p</sub> ≤ 10 μs; see <a href="#">Figure 3</a>   | -                   | 257 | A    |   |
| P <sub>tot</sub>     | total power dissipation                      | T <sub>mb</sub> = 25 °C; see <a href="#">Figure 2</a>   | -                   | 102 | W    |   |
| T <sub>stg</sub>     | storage temperature                          |   | -55                 | 175 | °C   |   |
| T <sub>j</sub>       | junction temperature                         |   | -55                 | 175 | °C   |   |
| Source-drain diode   |  |   |                     |     |      |   |
| I <sub>S</sub>       | source current                               | T <sub>mb</sub> = 25 °C   | <a href="#">[1]</a> | -   | 64   | A |
|                      |  |   | <a href="#">[2]</a> | -   | 55   | A |
| I <sub>SM</sub>      | peak source current                          | pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C   | -                   | 257 | A    |   |
| Avalanche ruggedness |  |   |                     |     |      |   |
| E <sub>DS(AL)S</sub> | non-repetitive drain-source avalanche energy | I <sub>D</sub> = 55 A; V <sub>sup</sub> ≤ 30 V; R <sub>GS</sub> = 50 Ω; V <sub>GS</sub> = 10 V; T <sub>j(init)</sub> = 25 °C; unclamped | -                   | 267 | mJ   |   |

- [1] Current is limited by power dissipation chip rating.  
[2] Continuous current is limited by bondwires.



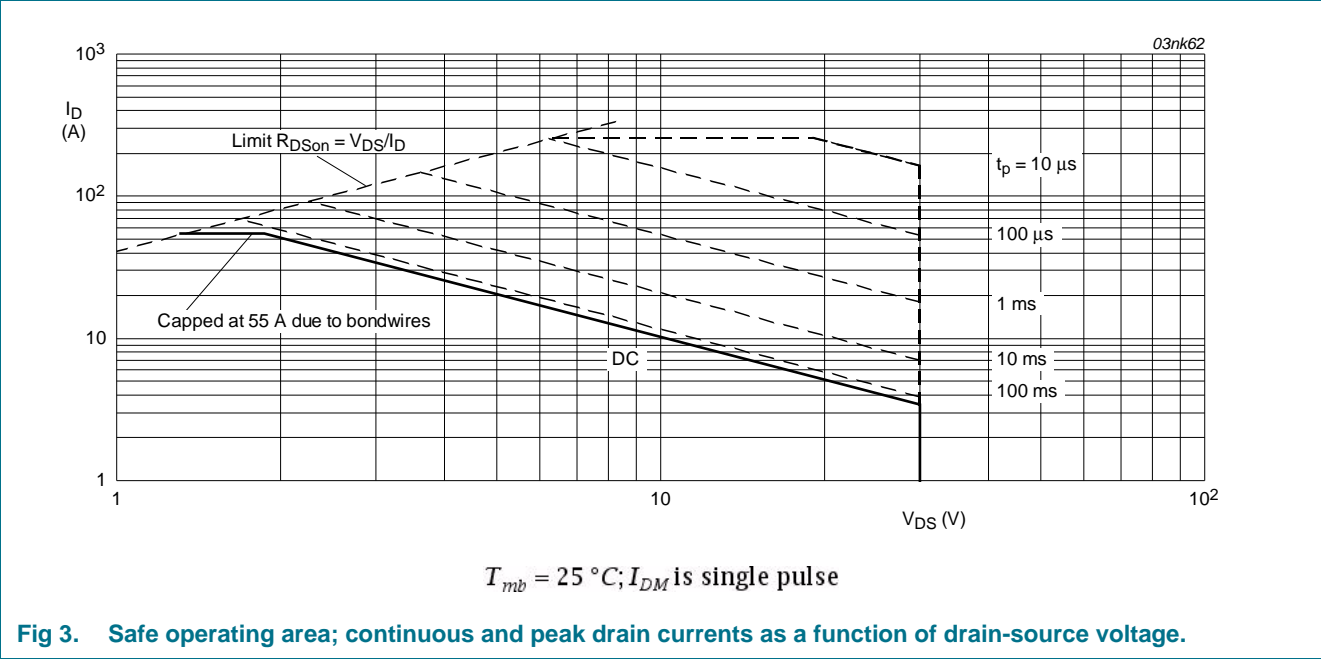


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.

5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol         | Parameter   | Conditions | Min | Typ  | Max | Unit |
|----------------|---|------------|-----|------|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base |            | -   | -    | 1.4 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       |            | -   | 71.4 | -   | K/W  |

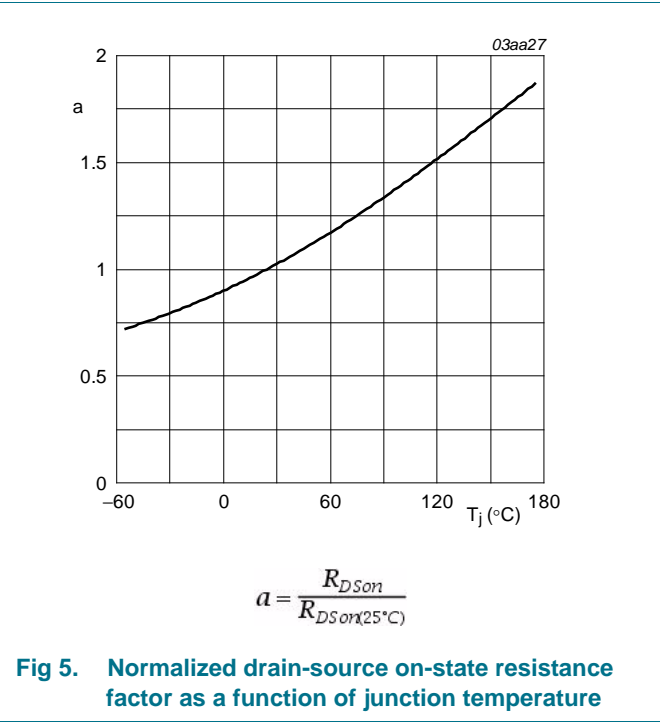
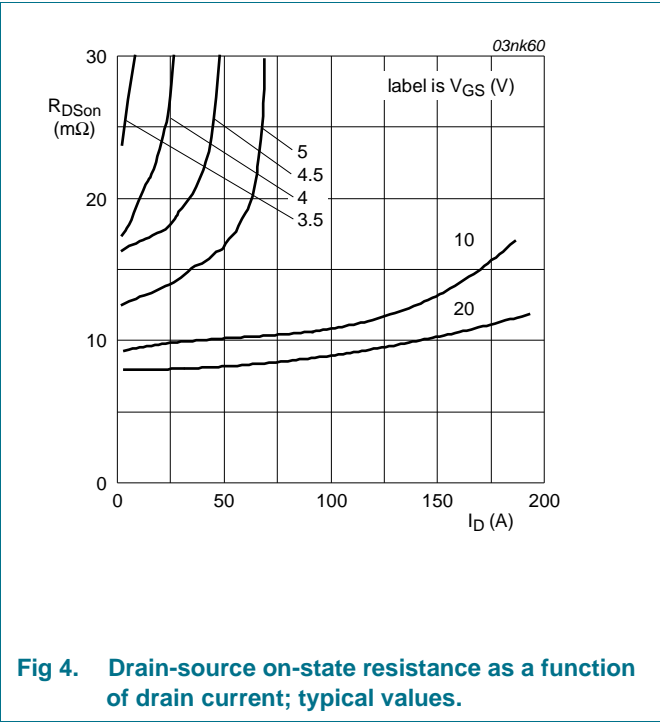
6. Characteristics

Table 6. Characteristics

| Symbol                 | Parameter                        | Conditions  | Min | Typ  | Max | Unit       |
|------------------------|----------------------------------|---|-----|------|-----|------------|
| Static characteristics |                                  |   |     |      |     |            |
| $V_{(BR)DSS}$          | drain-source breakdown voltage   | $I_D = 0.25\text{ mA}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ }^{\circ}\text{C}$   | 30  | -    | -   | V          |
|                        |                                  | $I_D = 0.25\text{ mA}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = -55\text{ }^{\circ}\text{C}$  | 27  | -    | -   | V          |
| $V_{GS(th)}$           | gate-source threshold voltage    | $I_D = 1\text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25\text{ }^{\circ}\text{C}$  | 1   | 1.8  | 3   | V          |
| $V_{GSth}$             | gate-source threshold voltage    | $I_D = 1\text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = -55\text{ }^{\circ}\text{C}$   | -   | -    | 3.5 | V          |
|                        |                                  | $I_D = 1\text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 175\text{ }^{\circ}\text{C}$   | 0.5 | -    | -   | V          |
| $I_{DSS}$              | drain leakage current            | $V_{DS} = 30\text{ V}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ }^{\circ}\text{C}$   | -   | 0.05 | 10  | $\mu$ A    |
| $I_{GSS}$              | gate leakage current             | $V_{GS} = 20\text{ V}$ ; $V_{DS} = 0\text{ V}$ ; $T_j = 25\text{ }^{\circ}\text{C}$   | -   | 2    | 100 | nA         |
|                        |                                  | $V_{GS} = -20\text{ V}$ ; $V_{DS} = 0\text{ V}$ ; $T_j = 25\text{ }^{\circ}\text{C}$  | -   | 2    | 100 | nA         |
| $R_{DSon}$             | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}$ ; $I_D = 10\text{ A}$   | -   | 15   | 20  | m $\Omega$ |
|                        |                                  | $V_{GS} = 10\text{ V}$ ; $I_D = 10\text{ A}$ ; $T_j = 175\text{ }^{\circ}\text{C}$  | -   | -    | 25  | m $\Omega$ |
|                        |                                  | $V_{GS} = 10\text{ V}$ ; $I_D = 10\text{ A}$ ; $T_j = 25\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a> | -   | 10   | 13  | m $\Omega$ |

Table 6. Characteristics ...continued

| Symbol                         | Parameter                    | Conditions  | Min | Typ  | Max  | Unit          |
|--------------------------------|------------------------------|---|-----|------|------|---------------|
| $I_{DSS}$                      | drain leakage current        | $V_{DS} = 30\text{ V}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 175\text{ }^{\circ}\text{C}$ ;<br>see <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a> | -   | -    | 500  | $\mu\text{A}$ |
| <b>Dynamic characteristics</b> |                              |   |     |      |      |               |
| $Q_{G(tot)}$                   | total gate charge            | $I_D = 25\text{ A}$ ; $V_{DS} = 24\text{ V}$ ; $V_{GS} = 10\text{ V}$   | -   | 44   | -    | nC            |
|                                |                              | $I_D = 25\text{ A}$ ; $V_{DS} = 24\text{ V}$ ; $V_{GS} = 5\text{ V}$  | -   | 26   | -    | nC            |
| $Q_{GS}$                       | gate-source charge           |   | -   | 7    | -    | nC            |
| $Q_{GD}$                       | gate-drain charge            |   | -   | 14   | -    | nC            |
| $C_{iss}$                      | input capacitance            | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 25\text{ V}$ ; $f = 1\text{ MHz}$ ;<br>$T_j = 25\text{ }^{\circ}\text{C}$   | -   | 1490 | 1986 | pF            |
| $C_{oss}$                      | output capacitance           |   | -   | 505  | 606  | pF            |
| $C_{rss}$                      | reverse transfer capacitance |   | -   | 325  | 445  | pF            |
| $t_{d(on)}$                    | turn-on delay time           | $V_{DS} = 25\text{ V}$ ; $R_L = 1.2\text{ }\Omega$ ; $V_{GS} = 10\text{ V}$ ;<br>$R_{G(ext)} = 10\text{ }\Omega$                                      | -   | 12   | -    | ns            |
| $t_r$                          | rise time                    |   | -   | 95   | -    | ns            |
| $t_{d(off)}$                   | turn-off delay time          |   | -   | 75   | -    | ns            |
| $t_f$                          | fall time                    |   | -   | 105  | -    | ns            |
| $L_D$                          | internal drain inductance    | measured from drain to center of die  | -   | 2.5  | -    | nH            |
| $L_S$                          | internal source inductance   | measured from source lead to source bond pad  | -   | 7.5  | -    | nH            |
| <b>Source-drain diode</b>      |                              |   |     |      |      |               |
| $V_{SD}$                       | source-drain voltage         | $I_S = 15\text{ A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ }^{\circ}\text{C}$  | -   | 0.85 | 1.2  | V             |
| $t_{rr}$                       | reverse recovery time        | $I_S = 20\text{ A}$ ; $dI_S/dt = -100\text{ A}/\mu\text{s}$ ;<br>$V_{GS} = -10\text{ V}$ ; $V_{DS} = 25\text{ V}$                                     | -   | 49   | -    | ns            |
| $Q_r$                          | recovered charge             |   | -   | 27   | -    | nC            |



7. Package outline

Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)

SOT428

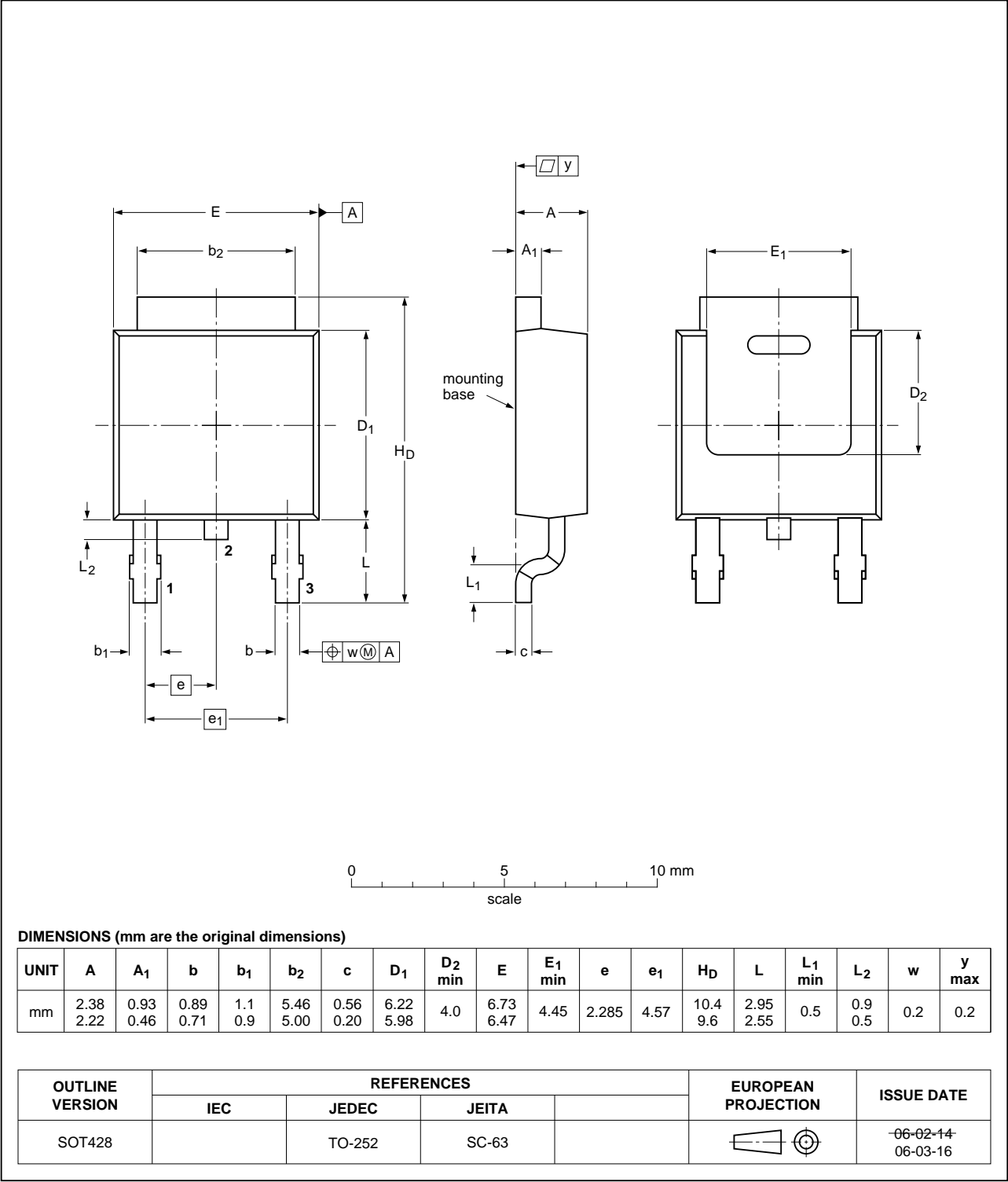


Fig 6. Package outline SOT428 (DPAK)

## 8. Revision history

**Table 7.** Revision history

| Document ID                         | Release date   | Data sheet status  | Change notice | Supersedes      |
|-------------------------------------|--|--------------------|---------------|-----------------|
| BUK6213-30A v.3                     | 20110202   | Product data sheet | -             | BUK6213-30A v.2 |
| Modifications:                      | <ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• Various changes to content.</li></ul> |                    |               |                 |
| BUK6213-30A v.2<br>(9397 750 12028) | 20030922   | Product data sheet | -             | -               |

## 9. Legal information

### 9.1 Data sheet status

| Document status <sup>[1][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.                                     |

[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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