



# BUK7675-55A

N-channel TrenchMOS standard level FET

Rev. 02 — 3 February 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Standard 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
- Low conduction losses due to low on-state resistance
- Suitable for standard level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

### 1.3 Applications

- 12 V and 24 V loads
- Automotive and general purpose power switching
- Motors, lamps and solenoids

### 1.4 Quick reference data

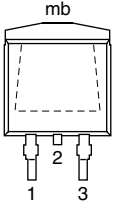
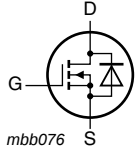
Table 1. Quick reference data

| Symbol                        | Parameter                                    | Conditions                                                                                                                                    | Min | Typ | Max  | Unit |
|-------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|------|------|
| $V_{DS}$                      | drain-source voltage                         | $T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$                                                                                            | -   | -   | 55   | 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>                                | -   | -   | 20.3 | A    |
| $P_{tot}$                     | total power dissipation                      | $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>                                                                                        | -   | -   | 62   | W    |
| <b>Static characteristics</b> |                                              |                                                                                                                                               |     |     |      |      |
| $R_{DS(on)}$                  | drain-source on-state resistance             | $V_{GS} = 10\text{ V}$ ; $I_D = 10\text{ A}$ ; $T_j = 175\text{ °C}$ ; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>          | -   | -   | 150  | mΩ   |
|                               |                                              | $V_{GS} = 10\text{ V}$ ; $I_D = 10\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>           | -   | 64  | 75   | mΩ   |
| <b>Avalanche ruggedness</b>   |                                              |                                                                                                                                               |     |     |      |      |
| $E_{DS(AL)S}$                 | non-repetitive drain-source avalanche energy | $I_D = 11\text{ A}$ ; $V_{sup} \leq 55\text{ V}$ ; $R_{GS} = 50\text{ Ω}$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; unclamped | -   | -   | 30.3 | mJ   |



## 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 |                                                                                   |                                                                                     |

**SOT404 (D2PAK)**

## 3. Ordering information

Table 3. Ordering information

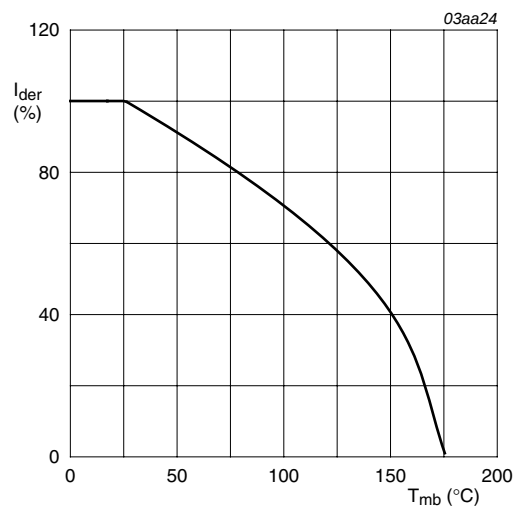
| Type number | Package |                                                                                  | Version |
|-------------|---------|----------------------------------------------------------------------------------|---------|
|             | Name    | Description                                                                      |         |
| BUK7675-55A | D2PAK   | plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped) | SOT404  |

## 4. Limiting values

Table 4. Limiting values

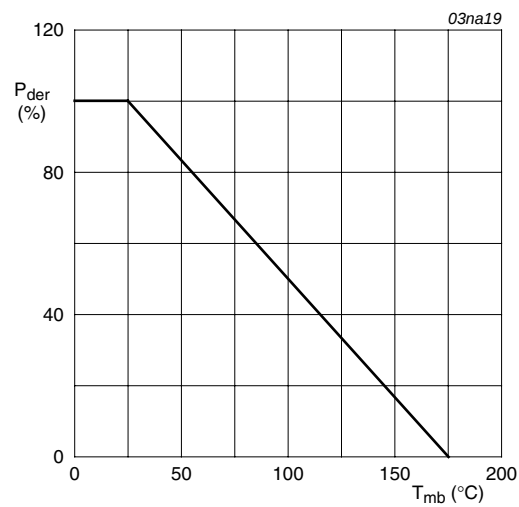
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol                      | Parameter                                    | Conditions                                                                                                                                         | Min | Max  | Unit |
|-----------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|------|
| $V_{DS}$                    | drain-source voltage                         | $T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$                                                                                                 | -   | 55   | V    |
| $V_{DGR}$                   | drain-gate voltage                           | $R_{GS} = 20\text{ k}\Omega$                                                                                                                       | -   | 55   | V    |
| $V_{GS}$                    | gate-source voltage                          |                                                                                                                                                    | -20 | 20   | V    |
| $I_D$                       | drain current                                | $T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>                                     | -   | 20.3 | A    |
|                             |                                              | $T_{mb} = 100\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a>                                                                   | -   | 14.3 | A    |
| $I_{DM}$                    | peak drain current                           | $T_{mb} = 25\text{ °C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; see <a href="#">Figure 3</a>                                                  | -   | 81   | A    |
| $P_{tot}$                   | total power dissipation                      | $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>                                                                                             | -   | 62   | W    |
| $T_{stg}$                   | storage temperature                          |                                                                                                                                                    | -55 | 175  | °C   |
| $T_j$                       | junction temperature                         |                                                                                                                                                    | -55 | 175  | °C   |
| <b>Source-drain diode</b>   |                                              |                                                                                                                                                    |     |      |      |
| $I_S$                       | source current                               | $T_{mb} = 25\text{ °C}$                                                                                                                            | -   | 20.3 | A    |
| $I_{SM}$                    | peak source current                          | pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$                                                                                 | -   | 81   | A    |
| <b>Avalanche ruggedness</b> |                                              |                                                                                                                                                    |     |      |      |
| $E_{DS(AL)S}$               | non-repetitive drain-source avalanche energy | $I_D = 11\text{ A}$ ; $V_{sup} \leq 55\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; unclamped | -   | 30.3 | mJ   |



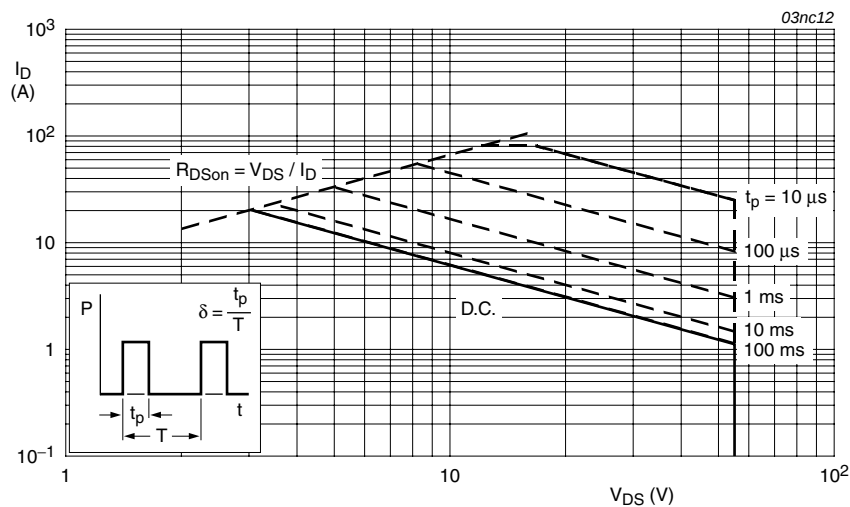
$$I_{der} = \frac{I_D}{I_{D(25^{\circ}\text{C})}} \times 100\%$$

Fig 1. Normalized continuous drain current as a function of mounting base temperature



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

Fig 2. Normalized total power dissipation as a function of mounting base temperature



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

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

5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol         | Parameter                                         | Conditions                                           | Min | Typ | Max | Unit |
|----------------|---------------------------------------------------|------------------------------------------------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | see <a href="#">Figure 4</a>                         | -   | -   | 2.4 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | mounted on printed-circuit board ; minimum footprint | -   | 50  | -   | K/W  |

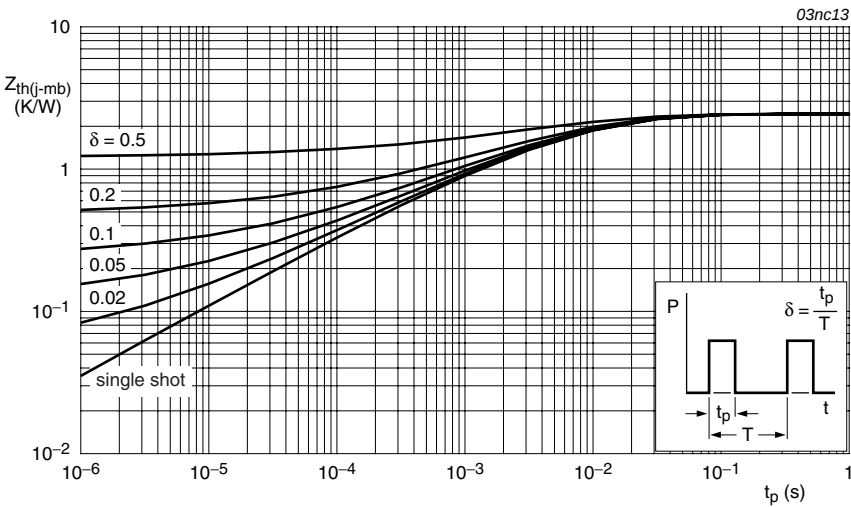


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

Table 6. Characteristics

| Symbol                  | Parameter                        | Conditions                                                                                                                            | Min | Typ  | Max | Unit |
|-------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| Static characteristics  |                                  |                                                                                                                                       |     |      |     |      |
| V <sub>(BR)DSS</sub>    | drain-source breakdown voltage   | I <sub>D</sub> = 0.25 mA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C                                                               | 55  | -    | -   | V    |
|                         |                                  | I <sub>D</sub> = 0.25 mA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = -55 °C                                                              | 50  | -    | -   | V    |
| V <sub>GS(th)</sub>     | gate-source threshold voltage    | I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = 175 °C; see <a href="#">Figure 10</a>                     | 1   | -    | -   | V    |
|                         |                                  | I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = 25 °C; see <a href="#">Figure 10</a>                      | 2   | 3    | 4   | V    |
|                         |                                  | I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = -55 °C; see <a href="#">Figure 10</a>                     | -   | -    | 4.4 | V    |
| I <sub>DSS</sub>        | drain leakage current            | V <sub>DS</sub> = 55 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 175 °C                                                                | -   | -    | 500 | μA   |
|                         |                                  | V <sub>DS</sub> = 55 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C                                                                 | -   | 0.05 | 10  | μA   |
| I <sub>GSS</sub>        | gate leakage current             | V <sub>GS</sub> = 20 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C                                                                 | -   | 2    | 100 | nA   |
|                         |                                  | V <sub>GS</sub> = -20 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C                                                                | -   | 2    | 100 | nA   |
| R <sub>DSon</sub>       | drain-source on-state resistance | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 10 A; T <sub>J</sub> = 175 °C; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a> | -   | -    | 150 | mΩ   |
|                         |                                  | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 10 A; T <sub>J</sub> = 25 °C; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>  | -   | 64   | 75  | mΩ   |
| Dynamic characteristics |                                  |                                                                                                                                       |     |      |     |      |
| C <sub>iss</sub>        | input capacitance                | V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 25 V; f = 1 MHz;                                                                             | -   | 320  | 483 | pF   |
| C <sub>oss</sub>        | output capacitance               | T <sub>J</sub> = 25 °C; see <a href="#">Figure 13</a>                                                                                 | -   | 92   | 113 | pF   |
| C <sub>rss</sub>        | reverse transfer capacitance     |                                                                                                                                       | -   | 64   | 90  | pF   |
| t <sub>d(on)</sub>      | turn-on delay time               | V <sub>DS</sub> = 30 V; R <sub>L</sub> = 1.2 Ω; V <sub>GS</sub> = 10 V; R <sub>G(ext)</sub> = 10 Ω; T <sub>J</sub> = 25 °C            | -   | 10   | -   | ns   |
| t <sub>r</sub>          | rise time                        |                                                                                                                                       | -   | 50   | -   | ns   |
| t <sub>d(off)</sub>     | turn-off delay time              |                                                                                                                                       | -   | 70   | -   | ns   |
| t <sub>f</sub>          | fall time                        |                                                                                                                                       | -   | 40   | -   | ns   |
| L <sub>D</sub>          | internal drain inductance        | from upper edge of drain mounting base to centre of die ; T <sub>J</sub> = 25 °C                                                      | -   | 2.5  | -   | nH   |
|                         |                                  | from drain lead 6 mm from package to centre of die ; T <sub>J</sub> = 25 °C                                                           | -   | 4.5  | -   | nH   |
| L <sub>S</sub>          | internal source inductance       | from source lead to source bond pad ; T <sub>J</sub> = 25 °C                                                                          | -   | 7.5  | -   | nH   |
| Source-drain diode      |                                  |                                                                                                                                       |     |      |     |      |
| V <sub>SD</sub>         | source-drain voltage             | I <sub>S</sub> = 25 A; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C; see <a href="#">Figure 14</a>                                   | -   | 0.85 | 1.2 | V    |
| t <sub>rr</sub>         | reverse recovery time            | I <sub>S</sub> = 20 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = -10 V; V <sub>DS</sub> = 30 V; T <sub>J</sub> = 25 °C       | -   | 32   | -   | ns   |
| Q <sub>r</sub>          | recovered charge                 |                                                                                                                                       | -   | 120  | -   | nC   |

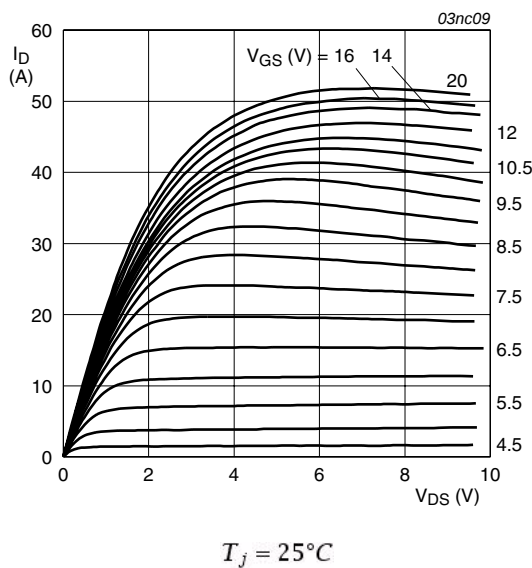


Fig 5. Output characteristics; drain current as a function of drain-source voltage; typical values

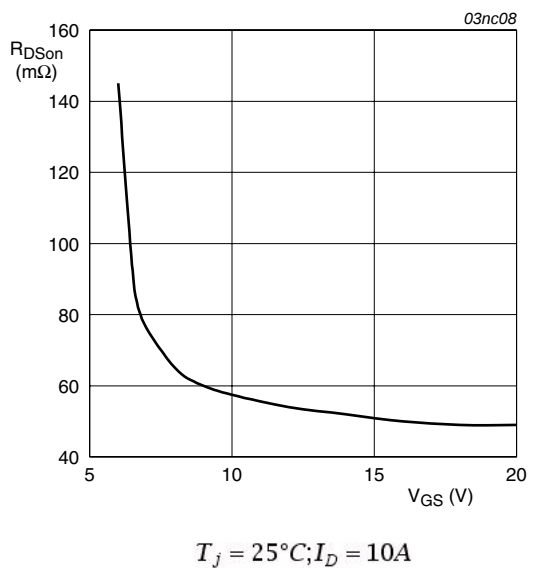


Fig 6. Drain-source on-state resistance as a function of gate-source voltage; typical values

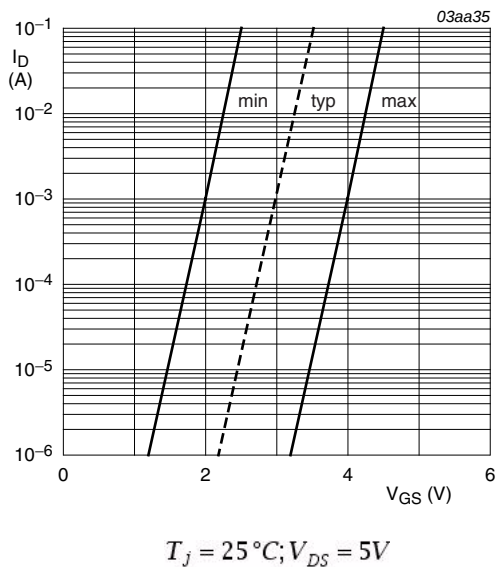


Fig 7. Sub-threshold drain current as a function of gate-source voltage

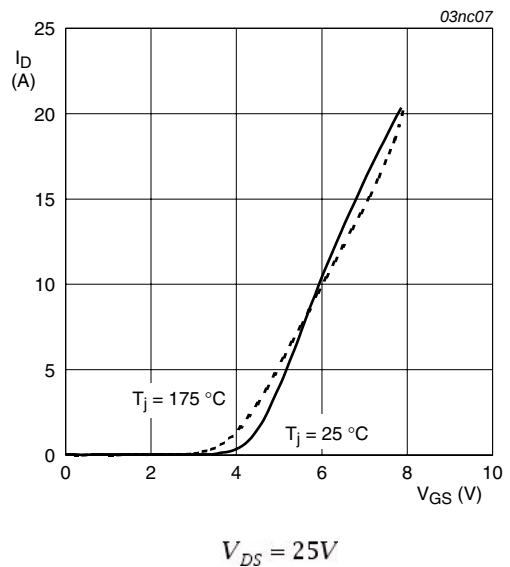


Fig 8. Transfer characteristics: drain current as a function of gate-source voltage; typical values

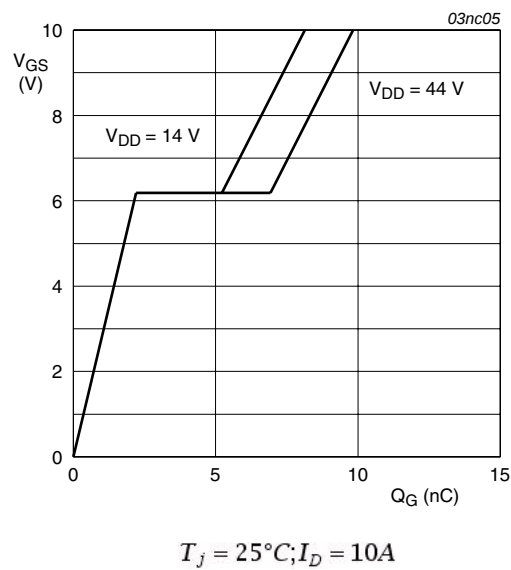


Fig 9. Gate-source voltage as a function of gate charge; typical values

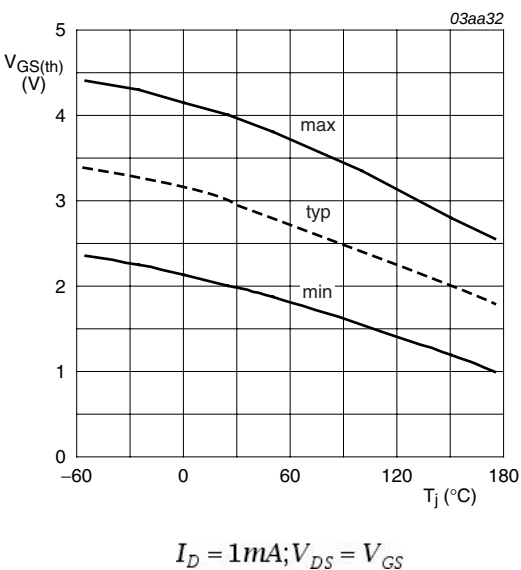


Fig 10. Gate-source threshold voltage as a function of junction temperature

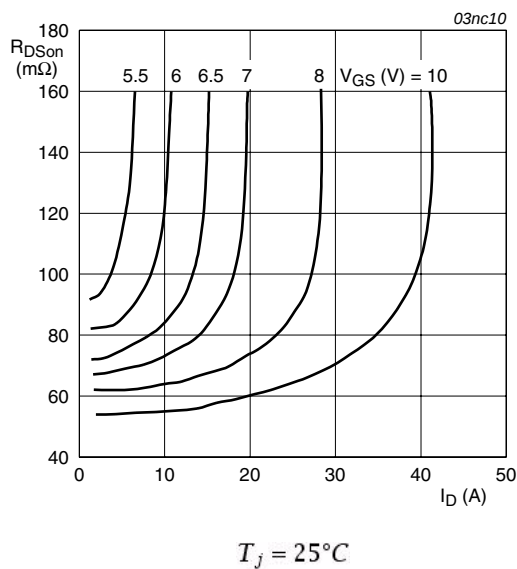


Fig 11. Drain-source on-state resistance as a function of drain current; typical values

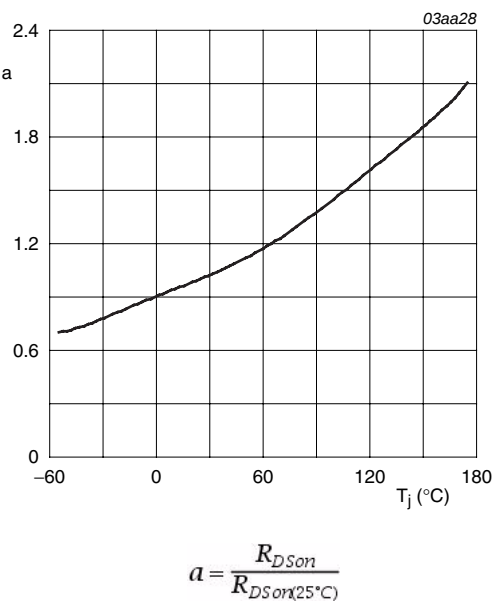


Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature

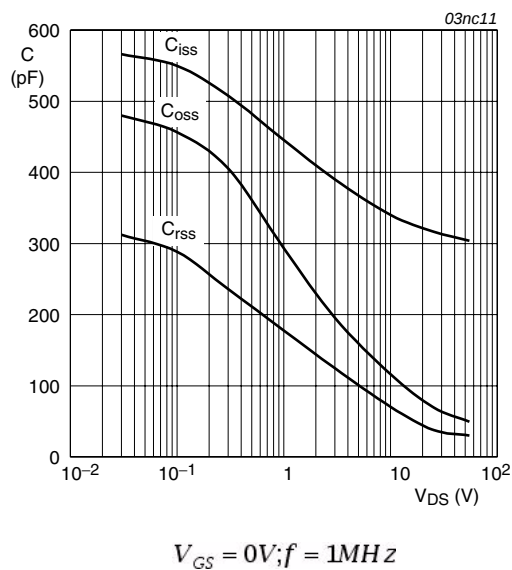


Fig 13. Input, output and reverse capacitances as a function of drain-source voltage; typical values

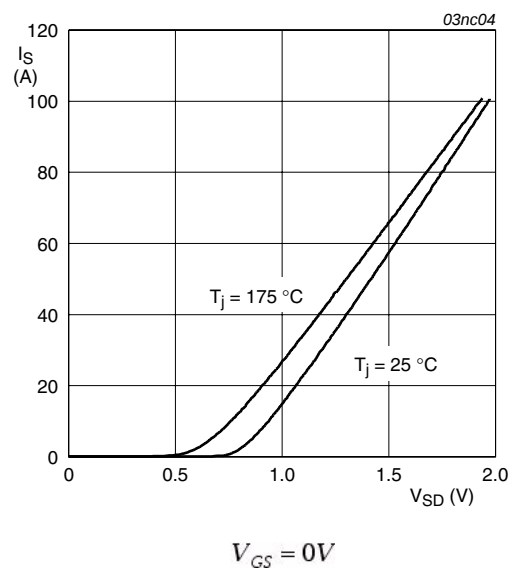


Fig 14. Reverse diode current as a function of reverse diode voltage; typical values

7. Package outline

Plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)

SOT404

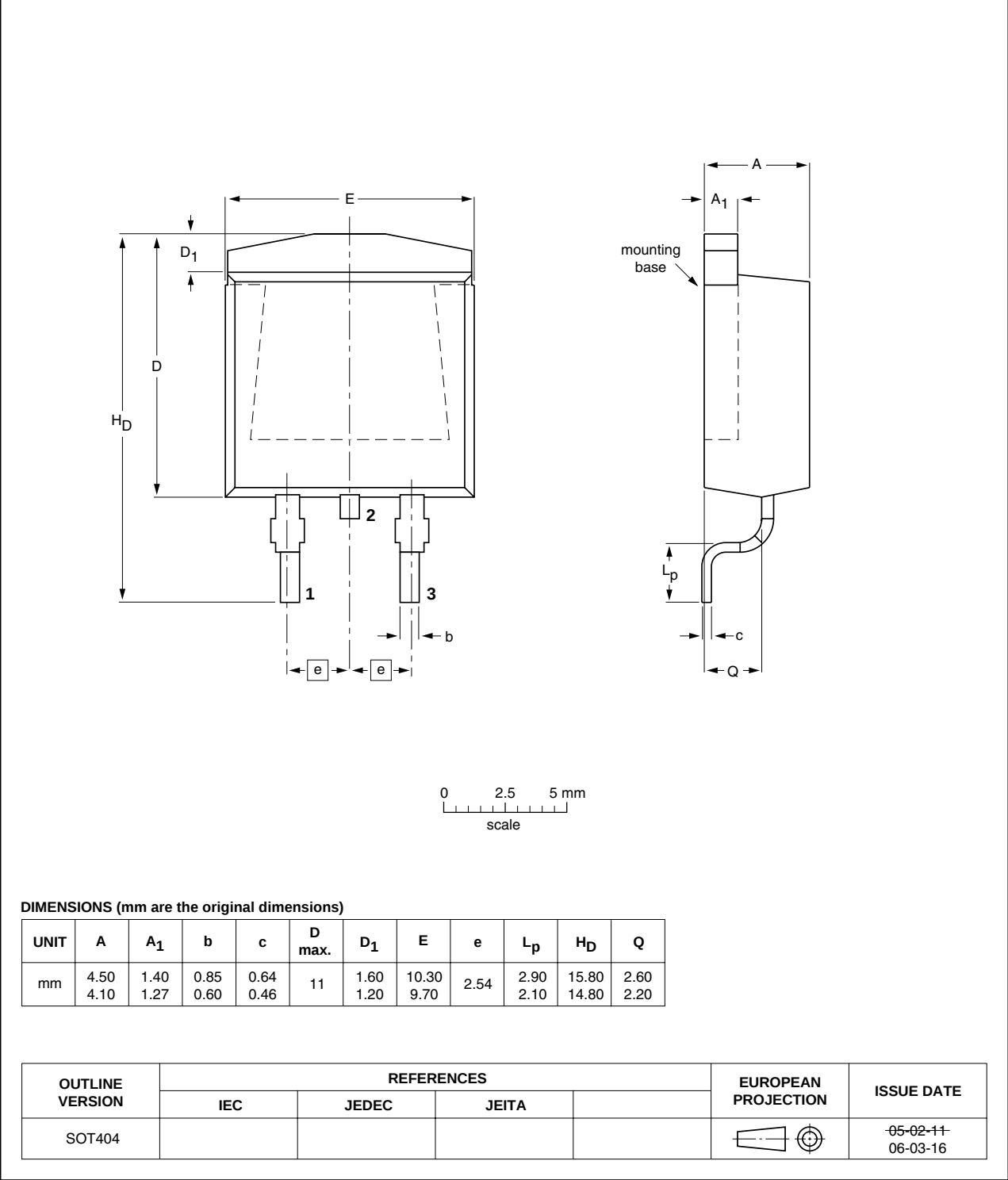


Fig 15. Package outline SOT404 (D2PAK)

## 8. Revision history

Table 7. Revision history

| Document ID          | Release date                                                                                                                                                                                                                                                                                                                               | Data sheet status     | Change notice | Supersedes           |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|----------------------|
| BUK7675-55A v.2      | 20110203                                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | BUK7575_7675_55A v.1 |
| 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>• Type number BUK7675-55A separated from data sheet BUK7575_7675_55A v.1.</li></ul> |                       |               |                      |
| BUK7575_7675_55A v.1 | 20001208                                                                                                                                                                                                                                                                                                                                   | Product specification | -             | -                    |

## 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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