



# BUK764R0-55B

N-channel TrenchMOS standard level FET

Rev. 5 — 22 April 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 Nexperia High-Performance Automotive (HPA) 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 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             | $T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$                                                                                 | -                     | -   | 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 4</a>                     | <a href="#">[1]</a> - | -   | 75  | A    |
| $P_{tot}$                     | total power dissipation          | $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>                                                                             | -                     | -   | 300 | W    |
| <b>Static characteristics</b> |                                  |                                                                                                                                    |                       |     |     |      |
| $R_{DS(on)}$                  | drain-source on-state resistance | $V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 7</a> ; see <a href="#">Figure 12</a> | -                     | 3.4 | 4   | mΩ   |

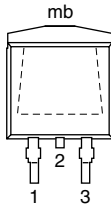
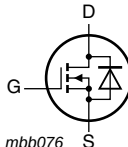
Table 1. Quick reference data ...continued

| Symbol                  | Parameter                                    | Conditions                                                                                                                                                     | Min | Typ | Max | Unit |
|-------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| Avalanche ruggedness    |                                              |                                                                                                                                                                |     |     |     |      |
| $E_{DS(AL)S}$           | non-repetitive drain-source avalanche energy | $I_D = 75\text{ A}$ ; $V_{sup} \leq 55\text{ V}$ ;<br>$R_{GS} = 50\ \Omega$ ; $V_{GS} = 10\text{ V}$ ;<br>$T_{j(init)} = 25\text{ }^\circ\text{C}$ ; unclamped | -   | -   | 1.2 | J    |
| Dynamic characteristics |                                              |                                                                                                                                                                |     |     |     |      |
| $Q_{GD}$                | gate-drain charge                            | $V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ;<br>$V_{DS} = 44\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ;<br>see <a href="#">Figure 13</a>                 | -   | 25  | -   | nC   |

[1] Continuous current is limited by package.

2. Pinning information

Table 2. Pinning information

| Pin            | Symbol | Description                          | Simplified outline                                                                 | Graphic symbol                                                                       |
|----------------|--------|--------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1              | G      | gate                                 |  |  |
| 2              | D      | drain <sup>[1]</sup>                 |                                                                                    |                                                                                      |
| 3              | S      | source                               |                                                                                    |                                                                                      |
| mb             | D      | mounting base;<br>connected to drain |                                                                                    |                                                                                      |
| SOT404 (D2PAK) |        |                                      |                                                                                    |                                                                                      |

[1] It is not possible to make a connection to pin 2.

3. Ordering information

Table 3. Ordering information

| Type number  | Package |                                                                                  | Version |
|--------------|---------|----------------------------------------------------------------------------------|---------|
|              | Name    | Description                                                                      |         |
| BUK764R0-55B | 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> ;<br>see <a href="#">Figure 4</a>                                     | <a href="#">[1]</a> -          | 75  | A    |
|                             |                                              |                                                                                                                                                       | <a href="#">[2][3]</a> -       | 193 | A    |
|                             |                                              | $T_{mb} = 100\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a>                                                                      | <a href="#">[1]</a> -          | 75  | A    |
| $I_{DM}$                    | peak drain current                           | $T_{mb} = 25\text{ °C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ;<br>see <a href="#">Figure 4</a>                                                  | -                              | 774 | A    |
| $P_{tot}$                   | total power dissipation                      | $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>                                                                                                | -                              | 300 | W    |
| $T_{stg}$                   | storage temperature                          |                                                                                                                                                       | -55                            | 175 | °C   |
| $T_j$                       | junction temperature                         |                                                                                                                                                       | -55                            | 175 | °C   |
| <b>Source-drain diode</b>   |                                              |                                                                                                                                                       |                                |     |      |
| $I_S$                       | source current                               | $T_{mb} = 25\text{ °C}$                                                                                                                               | <a href="#">[2][1]</a> -       | 193 | A    |
|                             |                                              |                                                                                                                                                       | <a href="#">[1]</a> -          | 75  | A    |
| $I_{SM}$                    | peak source current                          | pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$                                                                                    | -                              | 774 | A    |
| <b>Avalanche ruggedness</b> |                                              |                                                                                                                                                       |                                |     |      |
| $E_{DS(AL)S}$               | non-repetitive drain-source avalanche energy | $I_D = 75\text{ A}$ ; $V_{sup} \leq 55\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ;<br>$V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; unclamped | -                              | 1.2 | J    |
| $E_{DS(AL)R}$               | repetitive drain-source avalanche energy     | see <a href="#">Figure 3</a>                                                                                                                          | <a href="#">[4][5][6][7]</a> - | -   | J    |

[1] Continuous current is limited by package.

[2] Current is limited by power dissipation chip rating.

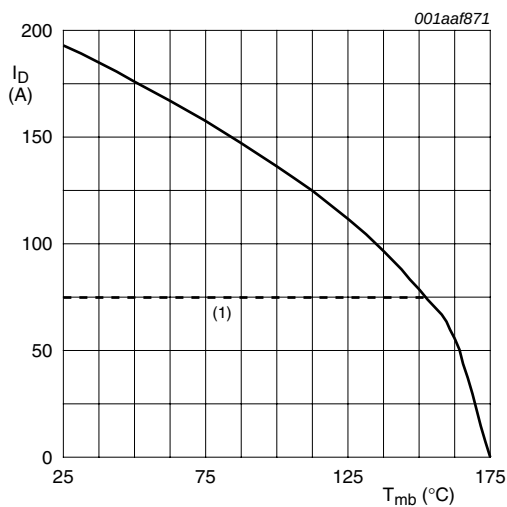
[3] Refer to document 9397 750 12572 for further information.

[4] Maximum value not quoted. Repetitive rating defined in avalanche rating figure.

[5] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

[6] Repetitive avalanche rating limited by an average junction temperature of 170 °C.

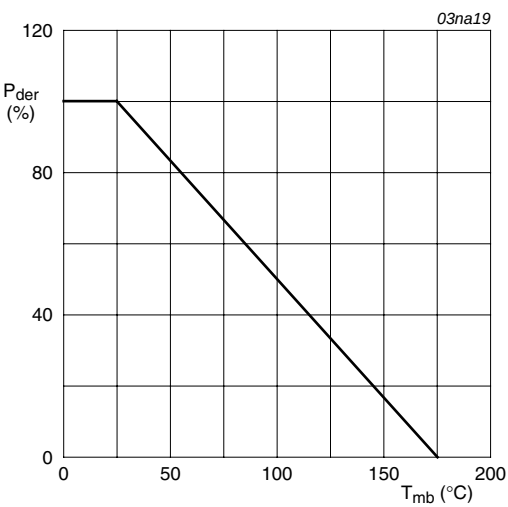
[7] Refer to application note AN10273 for further information.



$V_{GS} \geq 10\text{ V}$

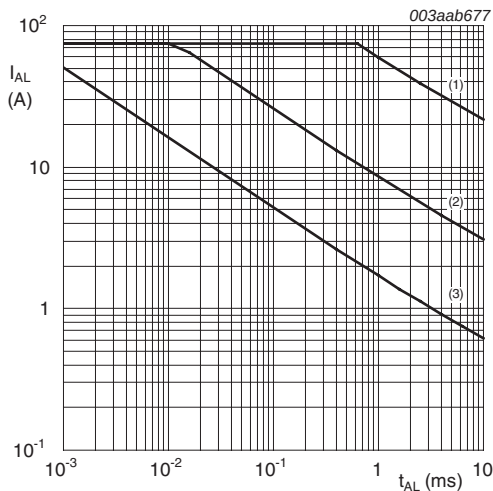
(1) Capped at 75 A due to package.

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



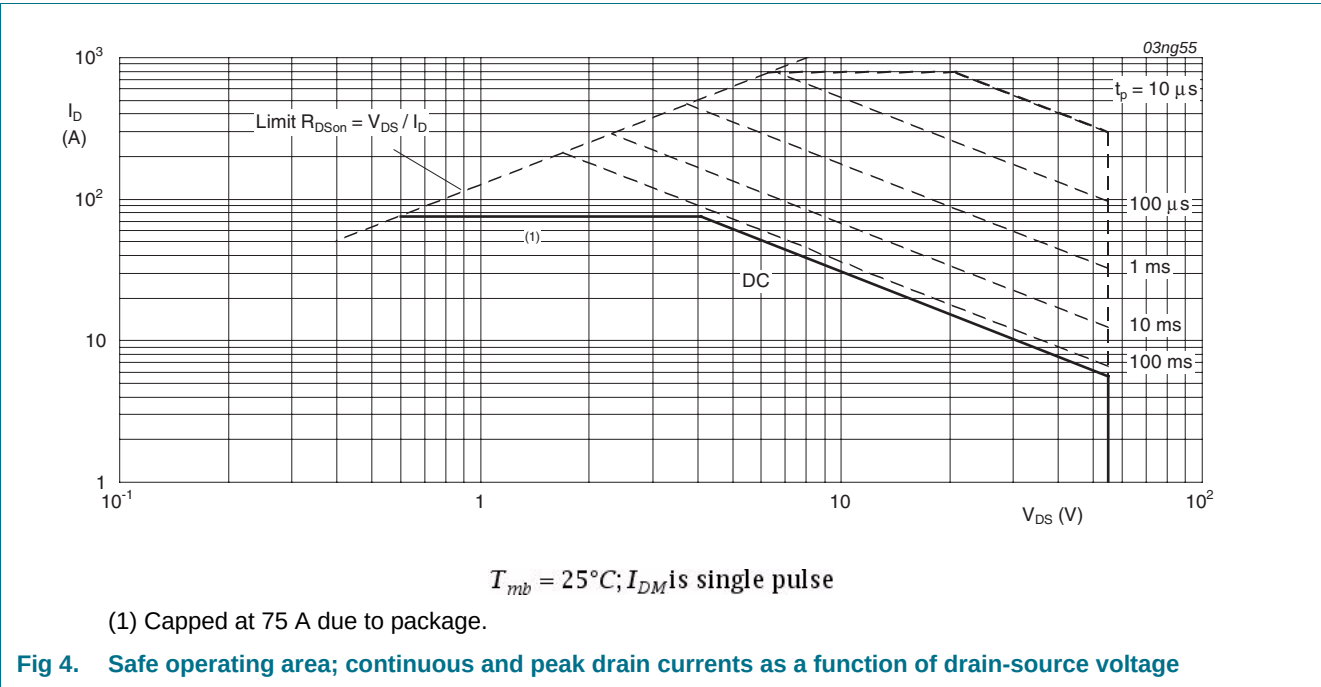
$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ\text{C})}} \times 100\%$$

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



- (1) Single-pulse;  $T_j = 25^\circ\text{C}$ .
- (2) Single-pulse;  $T_j = 150^\circ\text{C}$ .
- (3) Repetitive

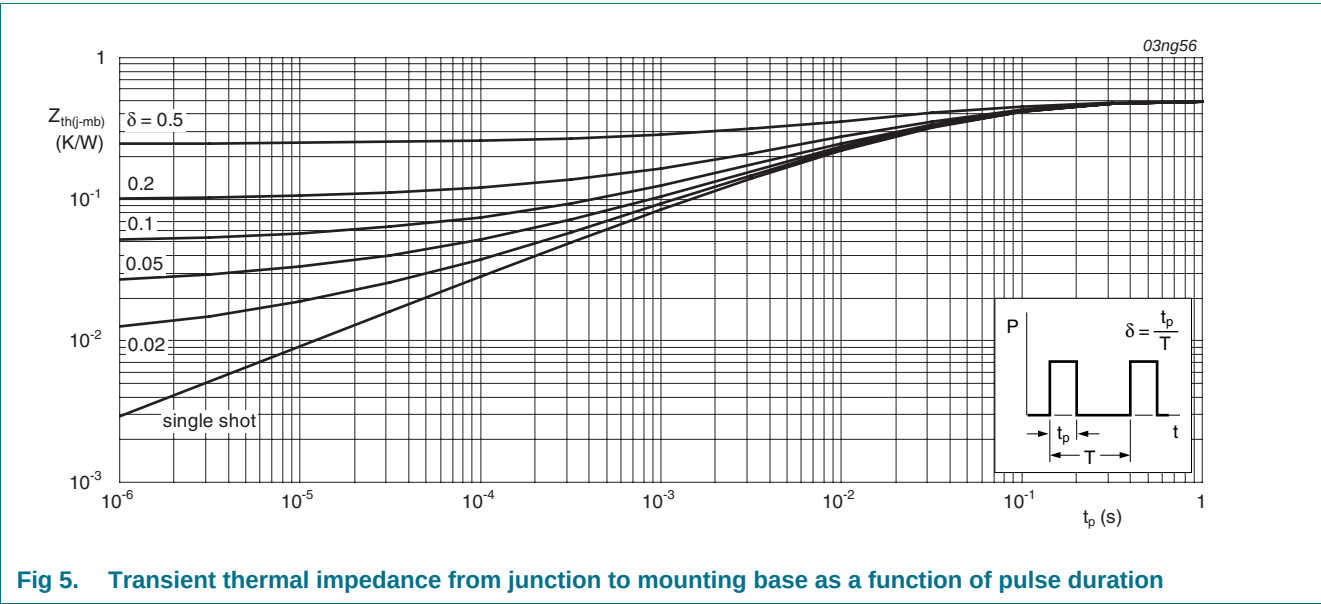
Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time.



5. Thermal characteristics

Table 5. Thermal characteristics

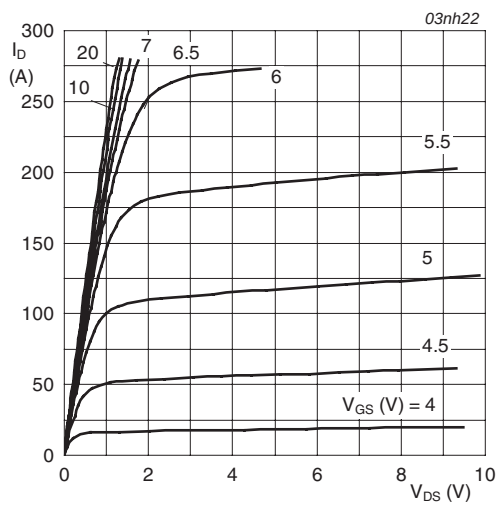
| Symbol         | Parameter                                         | Conditions                                            | Min | Typ | Max | Unit |
|----------------|---------------------------------------------------|-------------------------------------------------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | see <a href="#">Figure 5</a>                          | -   | -   | 0.5 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | mounted on a printed-circuit board; minimum footprint | -   | 50  | -   | K/W  |



## 6. Characteristics

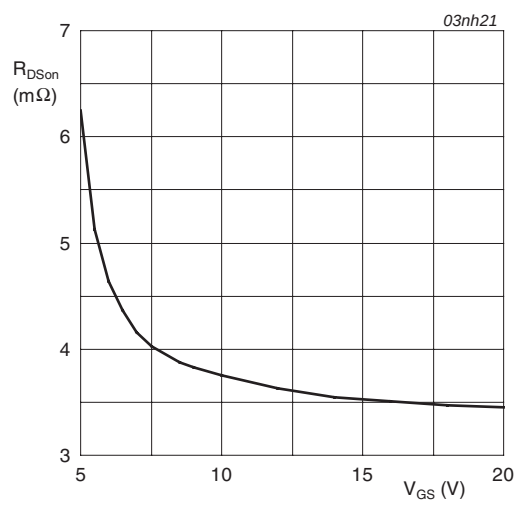
Table 6. Characteristics

| 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> = 25 °C; see <a href="#">Figure 11</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 11</a>                    | -   | -    | 4.4  | V    |
|                         |                                  | I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = 175 °C; see <a href="#">Figure 11</a>                    | 1   | -    | -    | 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                                                                | -   | 0.02 | 1    | 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> = 25 A; T <sub>J</sub> = 175 °C; see <a href="#">Figure 7</a> ; see <a href="#">Figure 12</a> | -   | -    | 8    | mΩ   |
|                         |                                  | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>J</sub> = 25 °C; see <a href="#">Figure 7</a> ; see <a href="#">Figure 12</a>  | -   | 3.4  | 4    | mΩ   |
| Dynamic characteristics |                                  |                                                                                                                                      |     |      |      |      |
| Q <sub>G(tot)</sub>     | total gate charge                | I <sub>D</sub> = 25 A; V <sub>DS</sub> = 44 V; V <sub>GS</sub> = 10 V; T <sub>J</sub> = 25 °C; see <a href="#">Figure 13</a>         | -   | 86   | -    | nC   |
| Q <sub>GS</sub>         | gate-source charge               |                                                                                                                                      | -   | 18   | -    | nC   |
| Q <sub>GD</sub>         | gate-drain charge                |                                                                                                                                      | -   | 25   | -    | nC   |
| C <sub>iss</sub>        | input capacitance                | V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 25 V; f = 1 MHz; T <sub>J</sub> = 25 °C; see <a href="#">Figure 14</a>                      | -   | 5082 | 6776 | pF   |
| C <sub>oss</sub>        | output capacitance               |                                                                                                                                      | -   | 1054 | 1265 | pF   |
| C <sub>rss</sub>        | reverse transfer capacitance     |                                                                                                                                      | -   | 450  | 617  | 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           | -   | 23   | -    | ns   |
| t <sub>r</sub>          | rise time                        |                                                                                                                                      | -   | 51   | -    | ns   |
| t <sub>d(off)</sub>     | turn-off delay time              |                                                                                                                                      | -   | 71   | -    | ns   |
| t <sub>f</sub>          | fall time                        |                                                                                                                                      | -   | 41   | -    | 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> = 40 A; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C; see <a href="#">Figure 15</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      | -   | 95   | -    | ns   |
| Q <sub>r</sub>          | recovered charge                 |                                                                                                                                      | -   | 251  | -    | nC   |



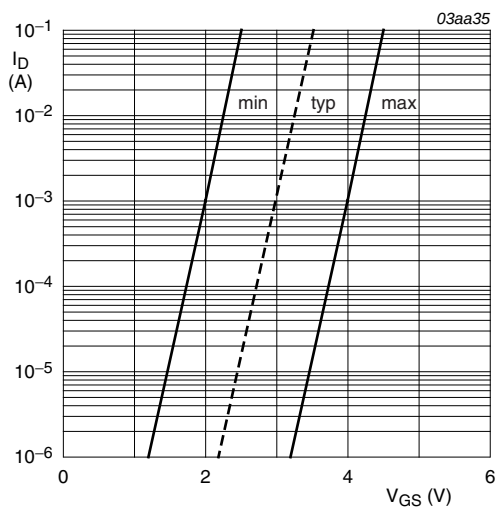
$T_j = 25^{\circ}\text{C}; t_p = 300\mu\text{s}$

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



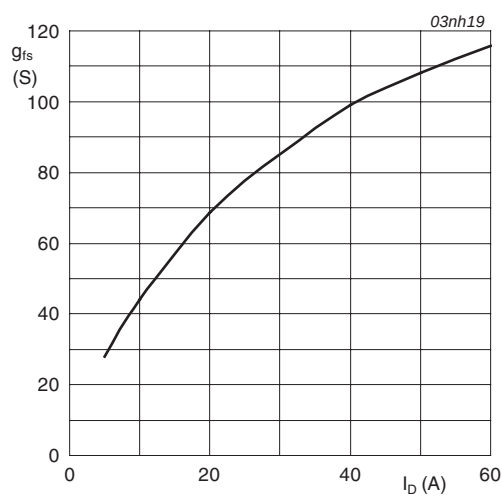
$T_j = 25^{\circ}\text{C}; I_D = 25\text{A}$

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



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

Fig 8. Sub-threshold drain current as a function of gate-source voltage



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

Fig 9. Forward transconductance as a function of drain current; typical values

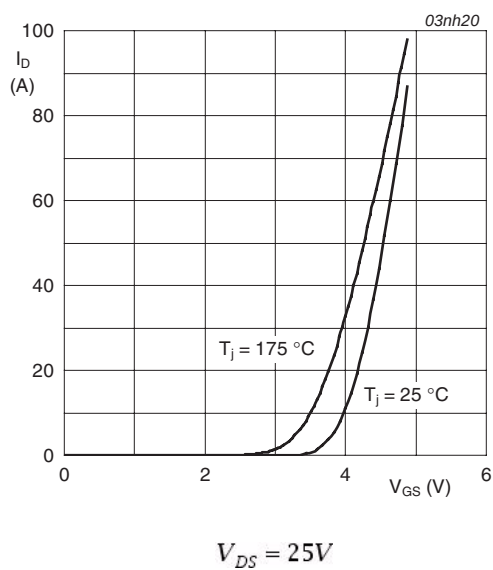


Fig 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

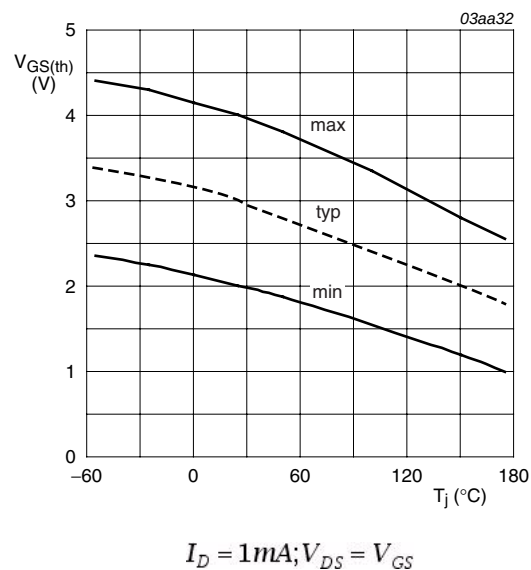


Fig 11. Gate-source threshold voltage as a function of junction temperature

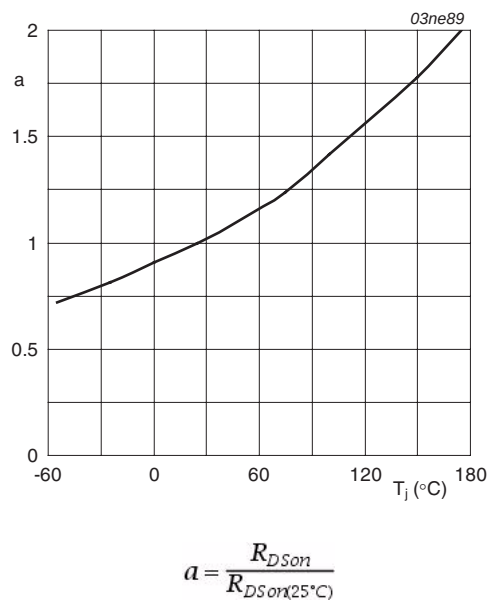


Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature

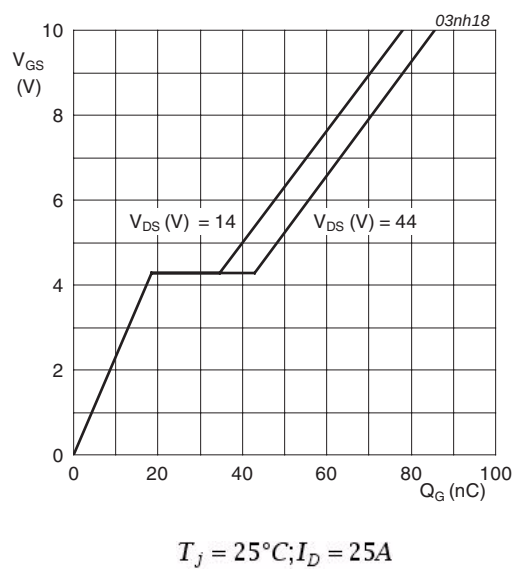
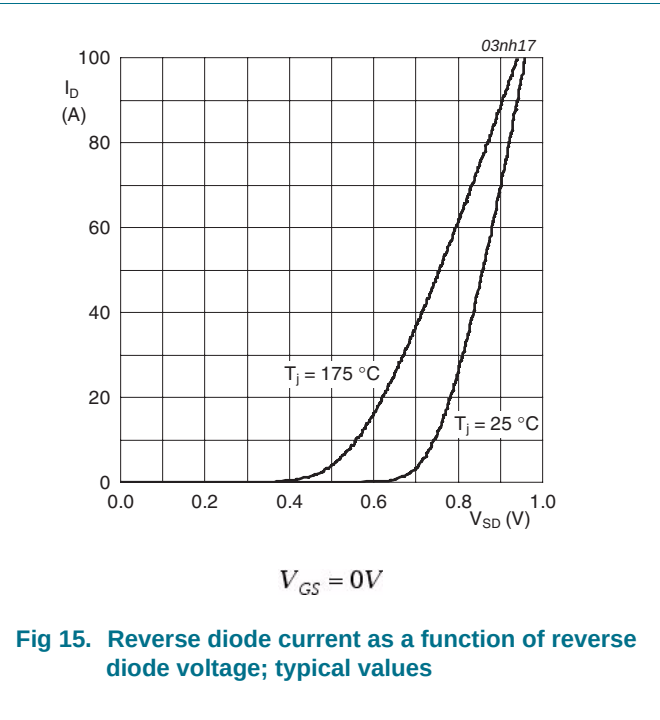
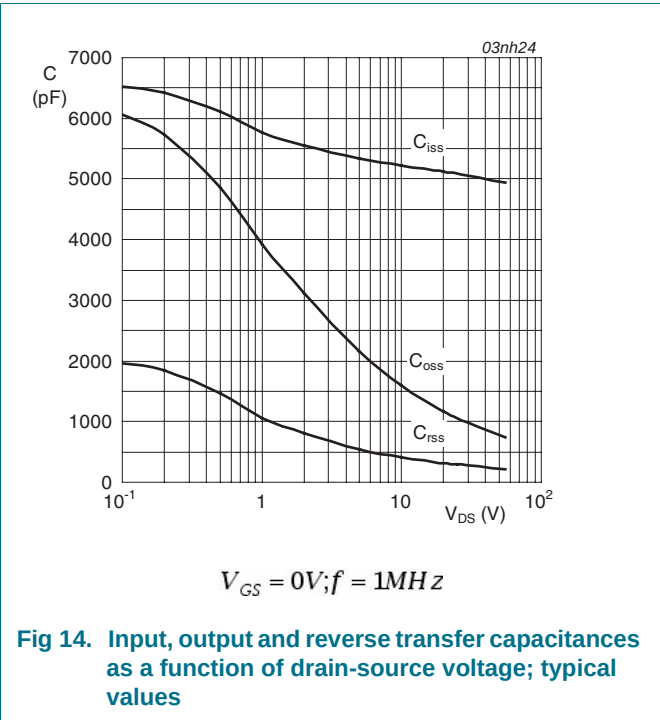


Fig 13. Gate-source voltage as a function of turn-on gate charge; typical values

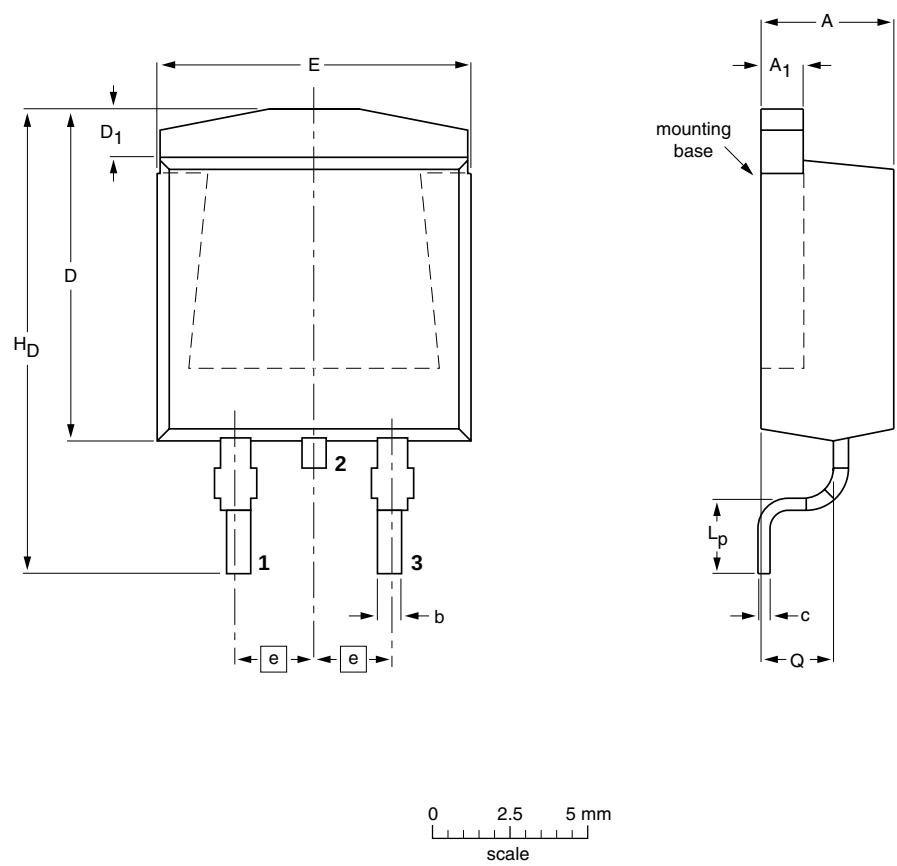




7. Package outline

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

SOT404



DIMENSIONS (mm are the original dimensions)

| UNIT | A            | A <sub>1</sub> | b            | c            | D <sub>max.</sub> | D <sub>1</sub> | E             | e    | L <sub>p</sub> | H <sub>D</sub> | Q            |
|------|--------------|----------------|--------------|--------------|-------------------|----------------|---------------|------|----------------|----------------|--------------|
| mm   | 4.50<br>4.10 | 1.40<br>1.27   | 0.85<br>0.60 | 0.64<br>0.46 | 11                | 1.60<br>1.20   | 10.30<br>9.70 | 2.54 | 2.90<br>2.10   | 15.80<br>14.80 | 2.60<br>2.20 |

| OUTLINE<br>VERSION | REFERENCES |       |       |  | EUROPEAN<br>PROJECTION | ISSUE DATE           |
|--------------------|------------|-------|-------|--|------------------------|----------------------|
|                    | IEC        | JEDEC | JEITA |  |                        |                      |
| SOT404             |            |       |       |  |                        | 05-02-11<br>06-03-16 |

Fig 16. Package outline SOT404 (D2PAK)

## 8. Revision history

Table 7. Revision history

| Document ID       | Release date                                                                                                                                                                                                                                                                                                                             | Data sheet status  | Change notice | Supersedes        |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|-------------------|
| BUK764R0-55B v.5  | 20110422                                                                                                                                                                                                                                                                                                                                 | Product data sheet | -             | BUK75_764R0-55B_4 |
| 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 BUK764R0-55B separated from data sheet BUK75_764R0-55B_4.</li></ul> |                    |               |                   |
| BUK75_764R0-55B_4 | 20071004                                                                                                                                                                                                                                                                                                                                 | Product data sheet | -             | BUK75_764R0-55B_3 |

## 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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## 10. Contact information

For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)

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