



BUK9609-75A

N-channel TrenchMOS logic level FET

Rev. 4 — 30 August 2011

Product data sheet

1. Product profile

1.1 General description

Logic 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

- Low conduction losses due to low on-state resistance
- Q101 compliant
- Suitable for logic level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

1.3 Applications

- 12 V, 24 V and 42 V loads
- Automotive and general purpose power switching
- Motors, lamps and solenoids

1.4 Quick reference data

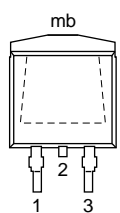
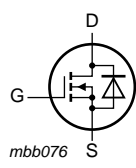
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|--|--|-----|------|------|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$ | - | - | 75 | V |
| I_D | drain current | $V_{GS} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 3 ; see Figure 1 | [1] | - | 75 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; see Figure 2 | - | - | 230 | W |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$ | - | - | 9.95 | mΩ |
| | | $V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$ | - | 7.23 | 8.5 | mΩ |
| | | $V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 13 ; see Figure 14 | - | 7.6 | 9 | mΩ |
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 75\text{ A}$; $V_{sup} \leq 75\text{ V}$; $R_{GS} = 50\text{ Ω}$; $V_{GS} = 5\text{ V}$; $T_{j(init)} = 25\text{ °C}$; unclamped | - | - | 562 | mJ |

[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 | | |
| 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 | |
| BUK9609-75A | D2PAK | plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped) | SOT404 |

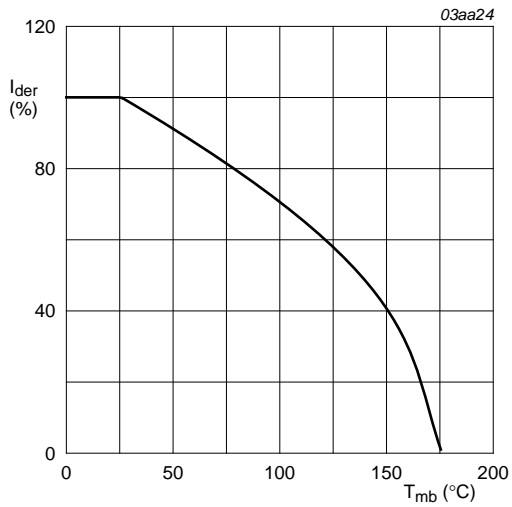
4. Limiting values

Table 4. Limiting values

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

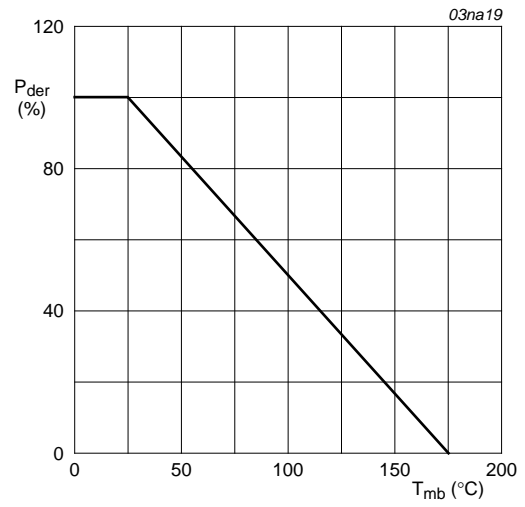
| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|--|---|-----|-----|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$ | - | 75 | V |
| V_{DGR} | drain-gate voltage | $R_{GS} = 20\text{ k}\Omega$ | - | 75 | V |
| V_{GS} | gate-source voltage | | -10 | 10 | V |
| I_D | drain current | $T_{mb} = 100\text{ °C}$; $V_{GS} = 5\text{ V}$; see Figure 1 | [1] | 75 | A |
| | | $T_{mb} = 25\text{ °C}$; $V_{GS} = 5\text{ V}$; see Figure 3 ; see Figure 1 | [1] | 75 | A |
| I_{DM} | peak drain current | $T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; see Figure 3 | - | 440 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; see Figure 2 | - | 230 | W |
| T_{stg} | storage temperature | | -55 | 175 | °C |
| T_j | junction temperature | | -55 | 175 | °C |
| V_{GSM} | peak gate-source voltage | pulsed; $t_p \leq 50\text{ }\mu\text{s}$ | -15 | 15 | V |
| Source-drain diode | | | | | |
| I_S | source current | $T_{mb} = 25\text{ °C}$ | [1] | 75 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$ | - | 440 | A |
| Avalanche ruggedness | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 75\text{ A}$; $V_{sup} \leq 75\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $T_{j(init)} = 25\text{ °C}$; unclamped | - | 562 | mJ |

[1] Continuous current is limited by package.



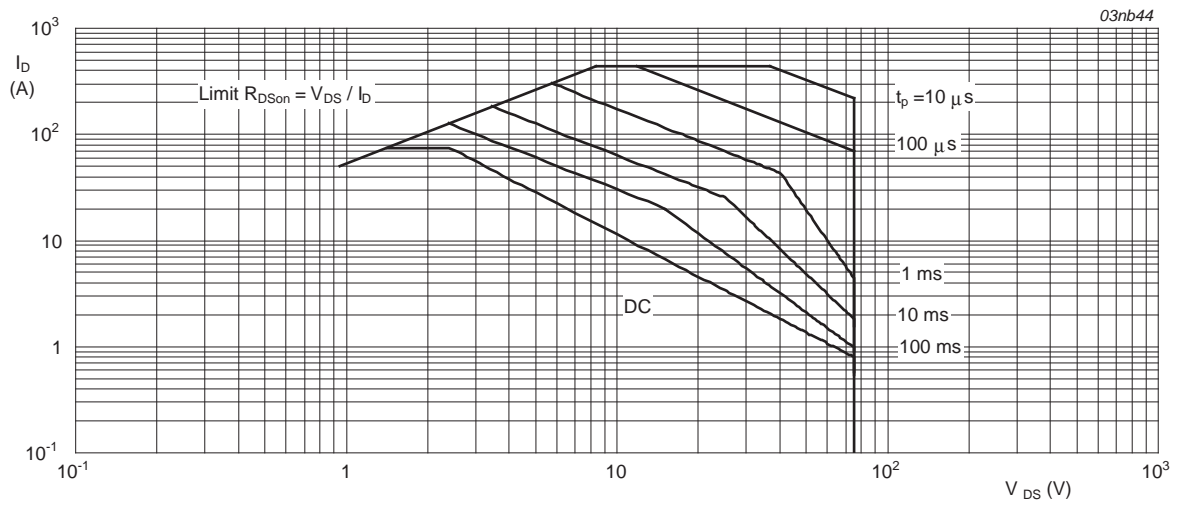
$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

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 Figure 4 | - | - | 0.65 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | minimum footprint ; mounted on a printed-circuit board | - | 50 | - | K/W |

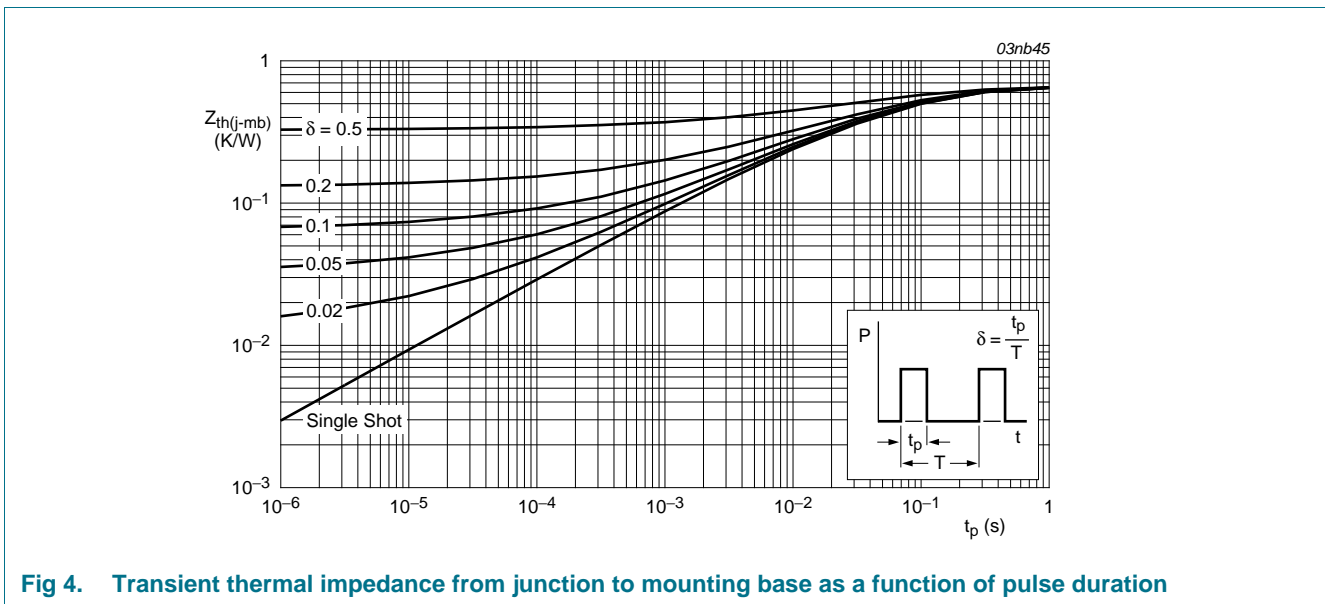
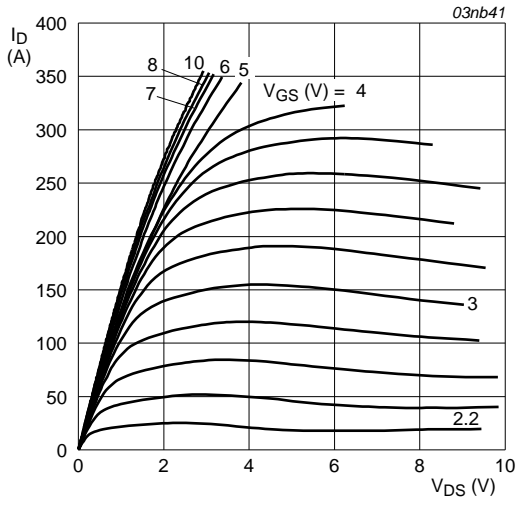


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

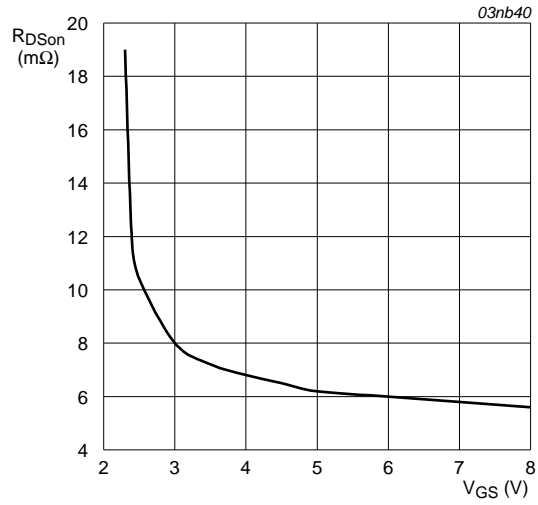
Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|---|-----|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | 75 | - | - | V |
| | | $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$ | 70 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 12 | 1 | 1.5 | 2 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 12 | 0.5 | - | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 12 | - | - | 2.3 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 75 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$ | - | - | 500 | μA |
| | | $V_{DS} = 75 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 0.05 | 10 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| | | $V_{GS} = -10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | 9.95 | m Ω |
| | | $V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 13 ; see Figure 14 | - | - | 18.9 | m Ω |
| | | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | 7.23 | 8.5 | m Ω |
| | | $V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 13 ; see Figure 14 | - | 7.6 | 9 | m Ω |
| Dynamic characteristics | | | | | | |
| C_{iss} | input capacitance | $V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ see Figure 8 | - | 6631 | 8840 | pF |
| C_{oss} | output capacitance | | - | 905 | 1090 | pF |
| C_{rss} | reverse transfer capacitance | | - | 610 | 840 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 30 \text{ V}; R_L = 1.2 \text{ } \Omega; V_{GS} = 5 \text{ V};$ $R_{G(ext)} = 10 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$ | - | 47 | - | ns |
| t_r | rise time | | - | 185 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 424 | - | ns |
| t_f | fall time | | - | 226 | - | ns |
| L_D | internal drain inductance | from upper edge of drain mounting base to centre of die ; $T_j = 25 \text{ }^\circ\text{C}$ | - | 2.5 | - | nH |
| | | from drain lead 6 mm from package to centre of die ; $T_j = 25 \text{ }^\circ\text{C}$ | - | 4.5 | - | nH |
| L_S | internal source inductance | from source lead to source bond pad ; $T_j = 25 \text{ }^\circ\text{C}$ | - | 7.5 | - | nH |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 15 | - | 0.85 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 20 \text{ A}; di_S/dt = -100 \text{ A}/\mu\text{s};$ $V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 70.3 | - | ns |
| Q_r | recovered charge | | - | 213 | - | nC |



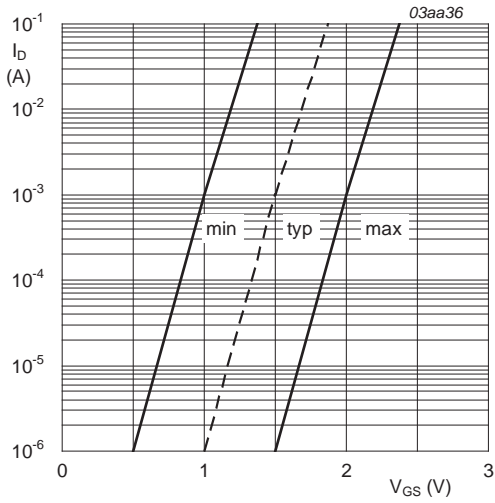
$T_j = 25^\circ\text{C}; t_p = 300\mu\text{s}$

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



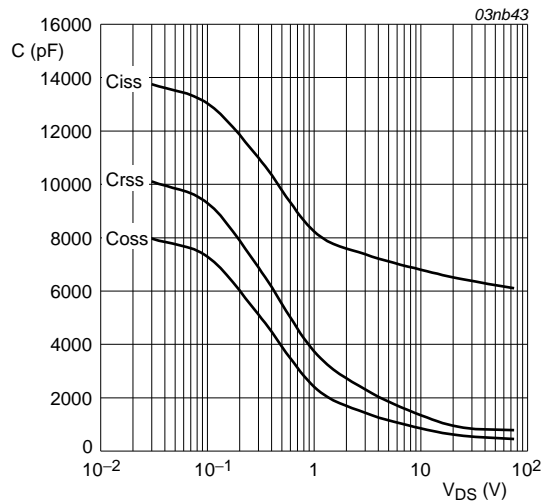
$T_j = 25^\circ\text{C}; I_D = 25\text{A}$

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



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

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



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

Fig 8. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

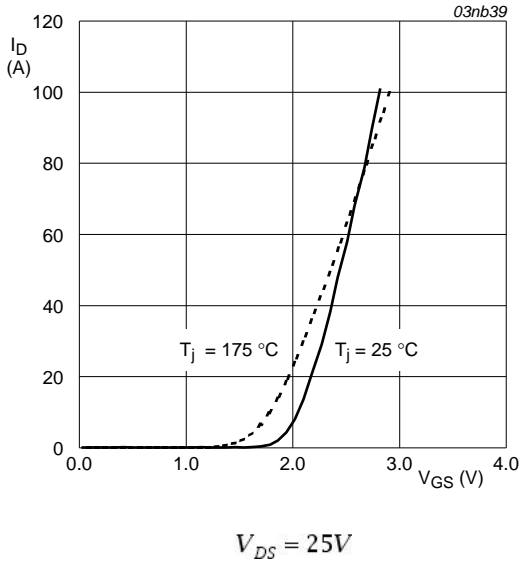


Fig 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

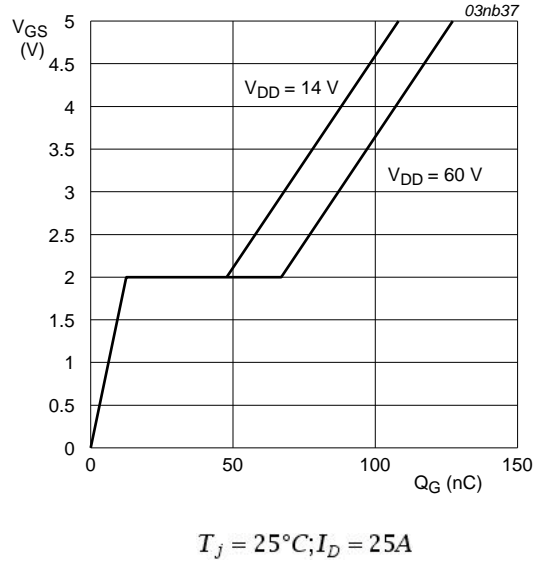


Fig 10. Gate-source voltage as a function of gate charge; typical values

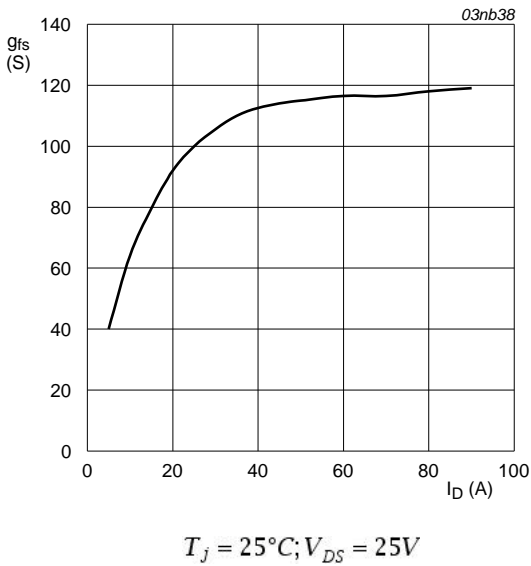


Fig 11. Forward transconductance as a function of drain current; typical values

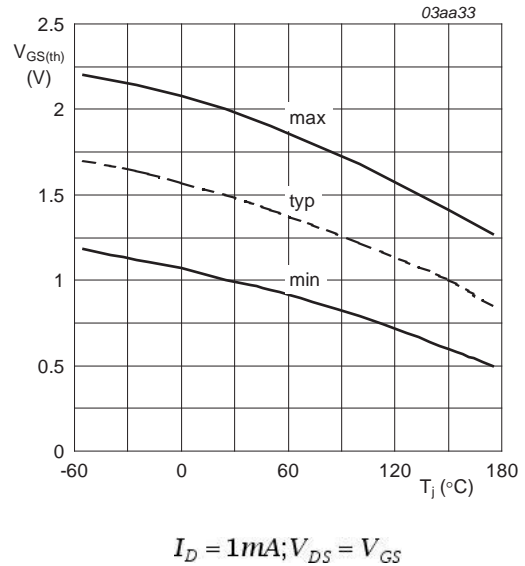


Fig 12. Gate-source threshold voltage as a function of junction temperature

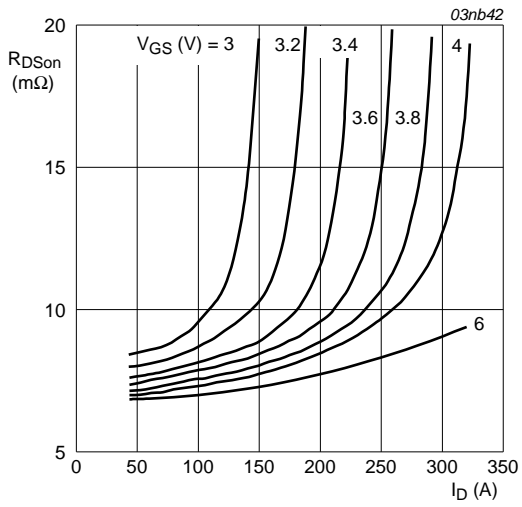
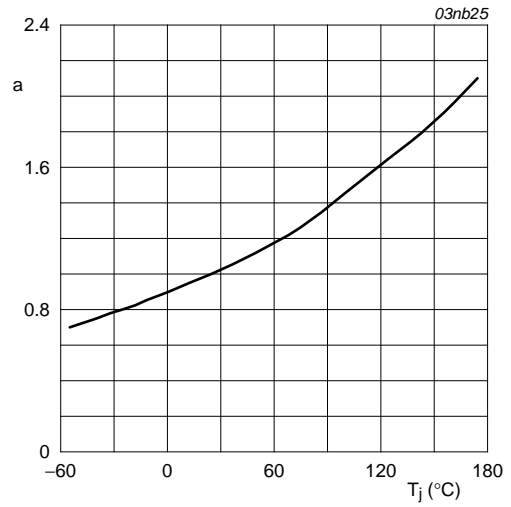


Fig 13. Drain-source on-state resistance as a function of drain current; typical values



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

Fig 14. Normalized drain-source on-state resistance factor as a function of junction temperature

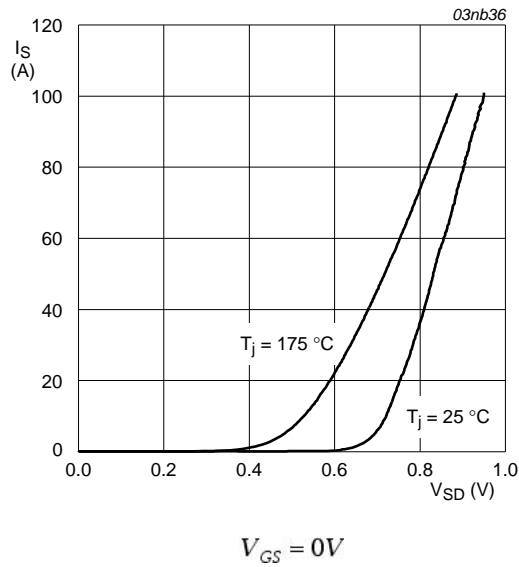


Fig 15. Reverse diode current as a function of reverse diode voltage; typical values

7. Package outline

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

SOT404



Fig 16. Package outline SOT404 (D2PAK)

8. Revision history

Table 7. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|-------------------------------|--------------------|---------------|----------------------|
| BUK9609-75A v.4 | 20110830 | Product data sheet | - | BUK9609-75A v.3 |
| Modifications: | • Various changes to content. | | | |
| BUK9609-75A v.3 | 20080922 | Product data sheet | - | BUK9509_9609_75A 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. |
| 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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