



BUK9516-75B

N-channel TrenchMOS logic level FET

Rev. 02 — 17 February 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

- AEC Q101 compliant
- Low conduction losses due to low on-state resistance
- 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 systems
- General purpose power switching
- Motors, lamps and solenoids

1.4 Quick reference data

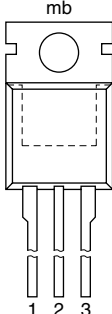
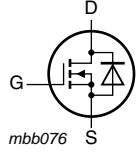
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--|--|-----|-----|------|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$ | - | - | 75 | V |
| I_D | drain current | $V_{GS} = 5\text{ V}; T_{mb} = 25\text{ °C};$ see Figure 1 ; see Figure 3 | - | - | 67 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C};$ see Figure 2 | - | - | 157 | W |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C}$ | - | 12 | 14 | mΩ |
| | | $V_{GS} = 5\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C};$ see Figure 10 ; see Figure 11 | - | 14 | 16.4 | mΩ |
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 67\text{ A}; V_{sup} \leq 75\text{ V};$ $R_{GS} = 50\text{ }\Omega; V_{GS} = 5\text{ V};$ $T_{j(init)} = 25\text{ °C};$ unclamped | - | - | 140 | mJ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 5\text{ V}; I_D = 25\text{ A}; V_{DS} = 60\text{ V};$ $T_j = 25\text{ °C};$ see Figure 12 | - | 14 | - | nC |



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 | | |

SOT78A (TO-220AB)

3. Ordering information

Table 3. Ordering information

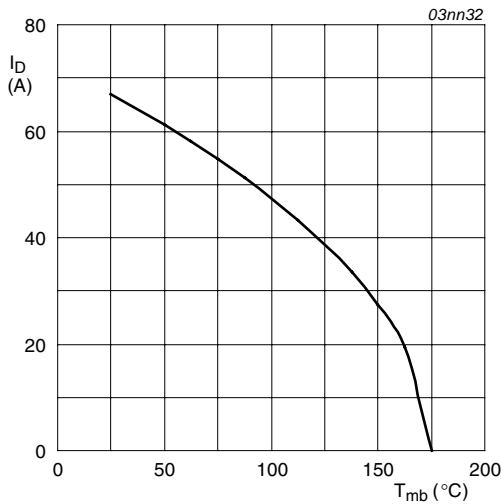
| Type number | Package | | |
|-------------|----------|--|---------|
| | Name | Description | Version |
| BUK9516-75B | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78A |

4. Limiting values

Table 4. Limiting values

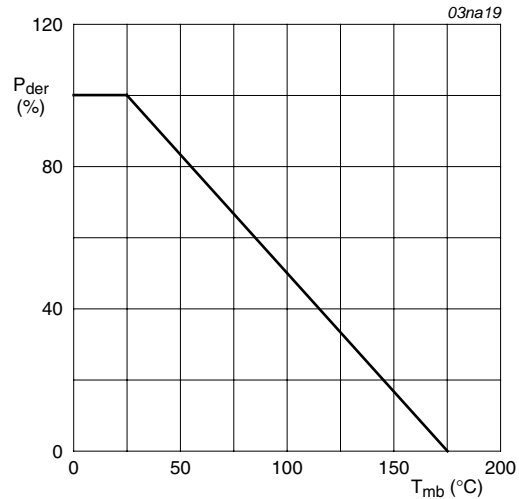
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|--|---|-----|-----|------------------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ }^\circ\text{C}$; $T_j \leq 175\text{ }^\circ\text{C}$ | - | 75 | V |
| V_{DGR} | drain-gate voltage | $R_{GS} = 20\text{ k}\Omega$ | - | 75 | V |
| V_{GS} | gate-source voltage | | -15 | 15 | V |
| I_D | drain current | $T_{mb} = 25\text{ }^\circ\text{C}$; $V_{GS} = 5\text{ V}$; see Figure 1 ; see Figure 3 | - | 67 | A |
| | | $T_{mb} = 100\text{ }^\circ\text{C}$; $V_{GS} = 5\text{ V}$; see Figure 1 | - | 47 | A |
| I_{DM} | peak drain current | $T_{mb} = 25\text{ }^\circ\text{C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; see Figure 3 | - | 270 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ }^\circ\text{C}$; see Figure 2 | - | 157 | W |
| T_{stg} | storage temperature | | -55 | 175 | $^\circ\text{C}$ |
| T_j | junction temperature | | -55 | 175 | $^\circ\text{C}$ |
| Source-drain diode | | | | | |
| I_S | source current | $T_{mb} = 25\text{ }^\circ\text{C}$ | - | 67 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ }^\circ\text{C}$ | - | 270 | A |
| Avalanche ruggedness | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 67\text{ A}$; $V_{sup} \leq 75\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$; unclamped | - | 140 | mJ |



$$V_{GS} \geq 5V$$

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

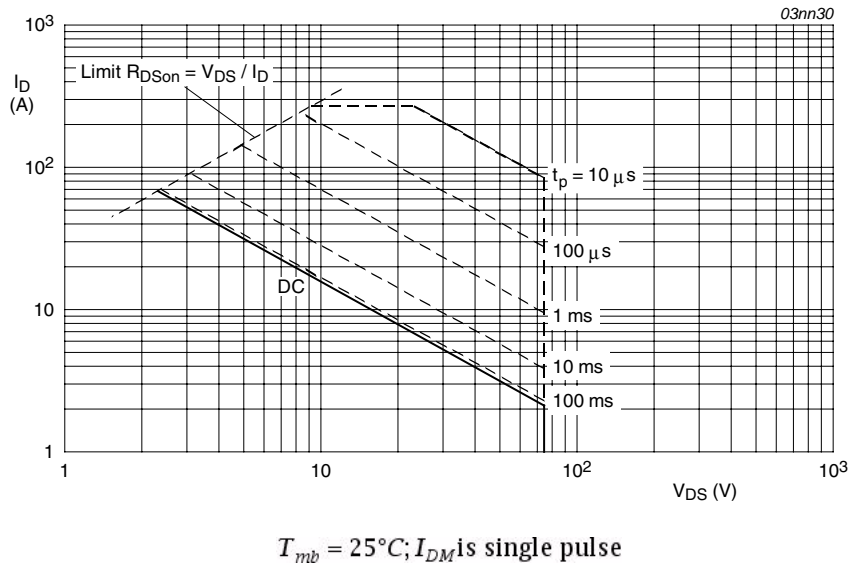


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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 | - | - | 0.95 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | vertical in still air | - | 60 | - | K/W |

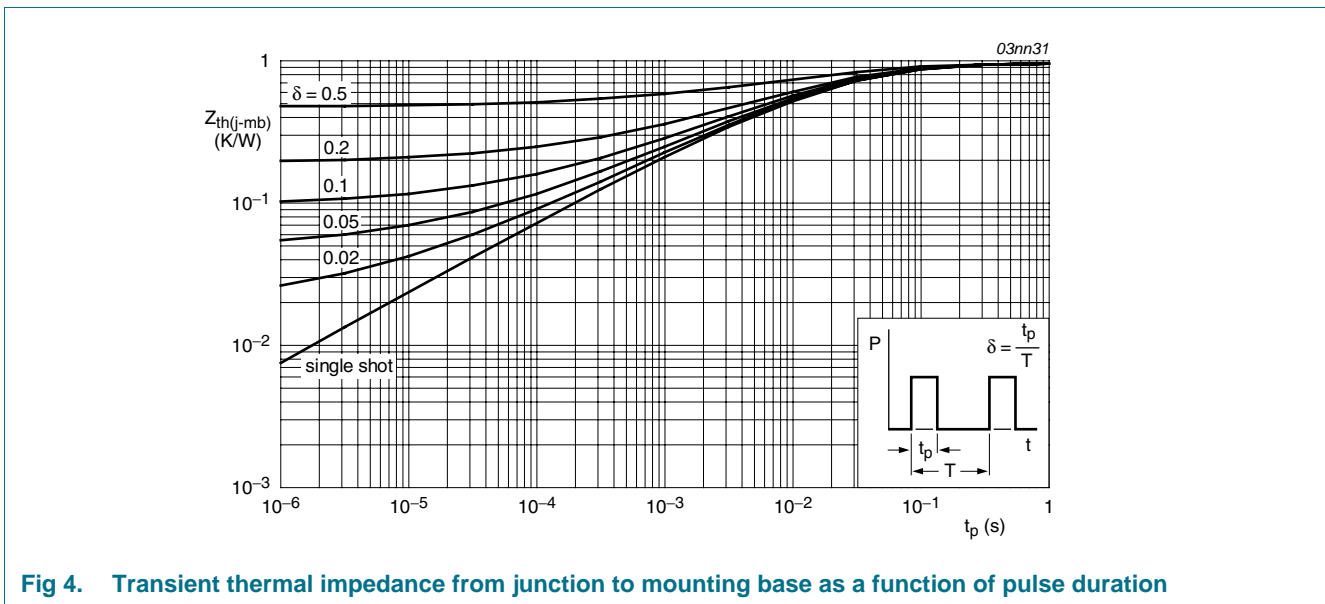
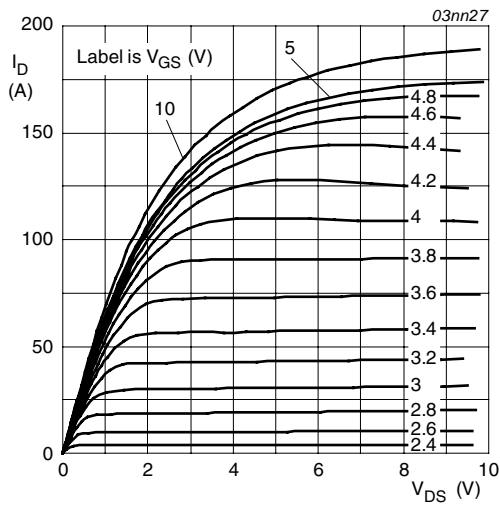


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

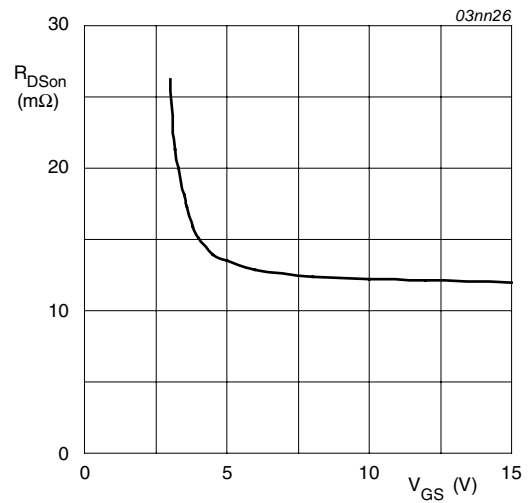
Table 6. Characteristics

| 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 | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 9 | - | - | 2.3 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 9 | 1.1 | 1.5 | 2 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 9 | 0.5 | - | - | V |
| I_{DSS} | drain leakage current | $V_{DS} = 75 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 0.02 | 1 | μA |
| | | $V_{DS} = 75 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$ | - | - | 500 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 15 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| | | $V_{GS} = -15 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | 12 | 14 | m Ω |
| | | $V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | 18 | m Ω |
| | | $V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 10 ; see Figure 11 | - | - | 34 | m Ω |
| | | $V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 10 ; see Figure 11 | - | 14 | 16.4 | m Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 25 \text{ A}; V_{DS} = 60 \text{ V}; V_{GS} = 5 \text{ V};$ $T_j = 25 \text{ }^\circ\text{C};$ see Figure 12 | - | 35 | - | nC |
| Q_{GS} | gate-source charge | | - | 6 | - | nC |
| Q_{GD} | gate-drain charge | | - | 14 | - | nC |
| C_{iss} | input capacitance | $V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ see Figure 13 | - | 3026 | 4034 | pF |
| C_{oss} | output capacitance | | - | 301 | 361 | pF |
| C_{riss} | reverse transfer capacitance | | - | 140 | 191 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 30 \text{ V}; R_L = 1.2 \text{ } \Omega; V_{GS} = 5 \text{ V};$ $R_{G(ext)} = 10 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$ | - | 30 | - | ns |
| t_r | rise time | | - | 102 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 101 | - | ns |
| t_f | fall time | | - | 57 | - | ns |
| L_D | internal drain inductance | from drain lead 6 mm from package to centre of die ; $T_j = 25 \text{ }^\circ\text{C}$ | - | 4.5 | - | nH |
| | | from contact screw on mounting base to centre of die ; $T_j = 25 \text{ }^\circ\text{C}$ | - | 3.5 | - | nH |
| L_S | internal source inductance | from source lead 6 mm from package 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 14 | - | 0.85 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 20 \text{ A}; di_S/dt = -100 \text{ A}/\mu\text{s};$ $V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 96 | - | ns |
| Q_r | recovered charge | | - | 138 | - | nC |



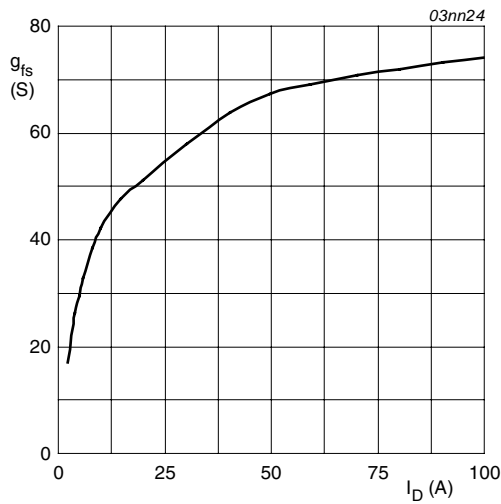
$T_j = 25^\circ\text{C}; t_p = 300\mu\text{s}$

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



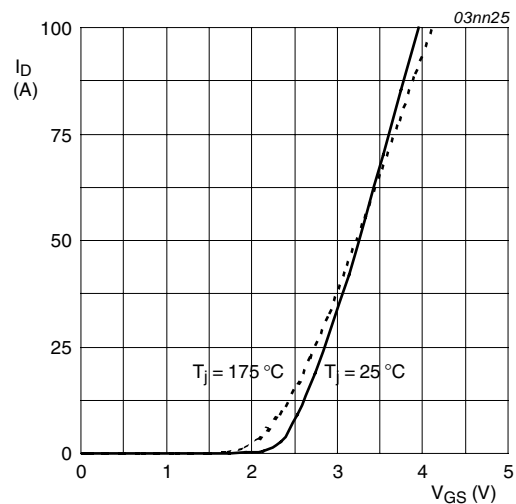
$T_j = 25^\circ\text{C}; I_D = 25\text{A}$

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



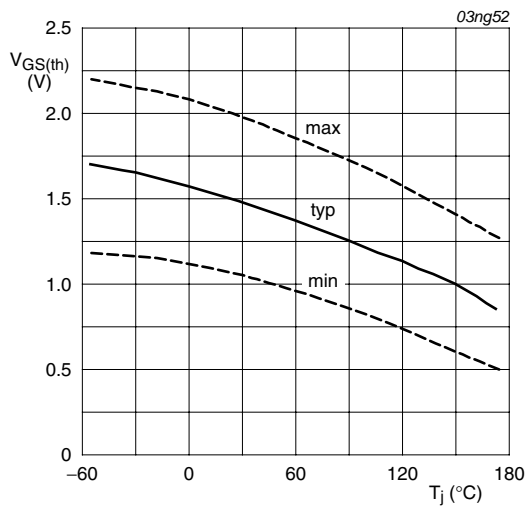
$T_j = 25^\circ\text{C}; V_{DS} = 25\text{V}$

Fig 7. Forward transconductance as a function of drain current; typical values



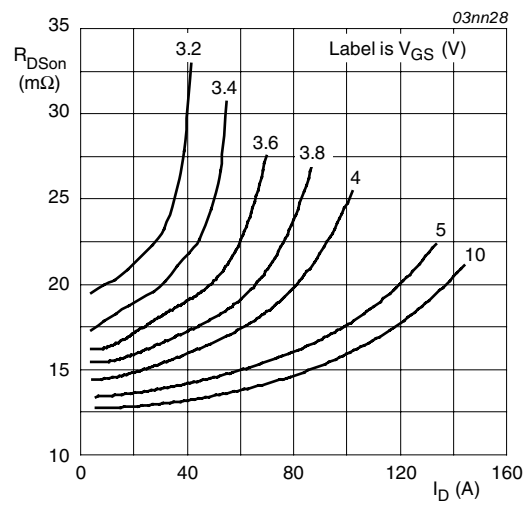
$V_{DS} = 25\text{V}$

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



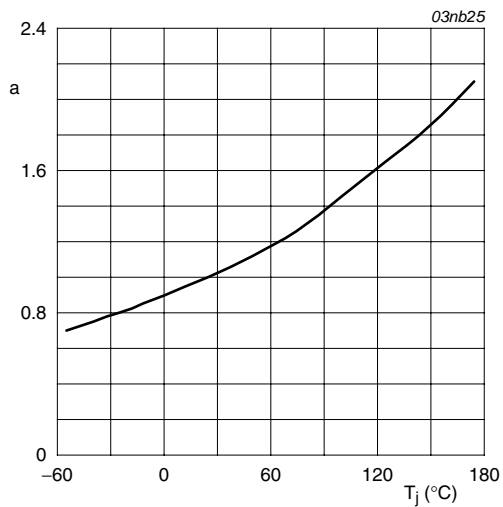
$$I_D = 1\text{mA}; V_{DS} = V_{GS}$$

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



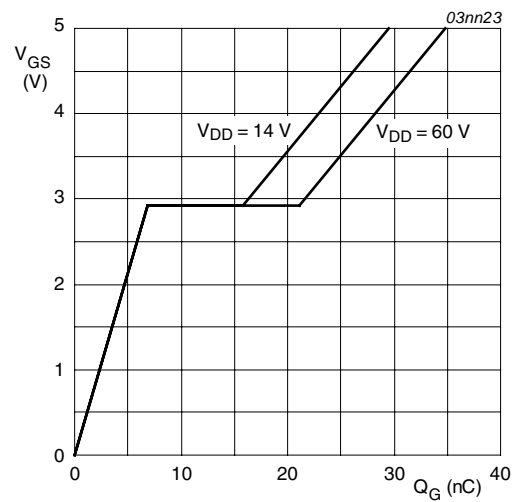
$$T_j = 25^\circ\text{C}$$

Fig 10. Drain-source on-state resistance as a function of drain current; typical values



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

Fig 11. Normalized drain-source on-state resistance factor as a function of junction temperature



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

Fig 12. Gate-source voltage as a function of gate charge; typical values

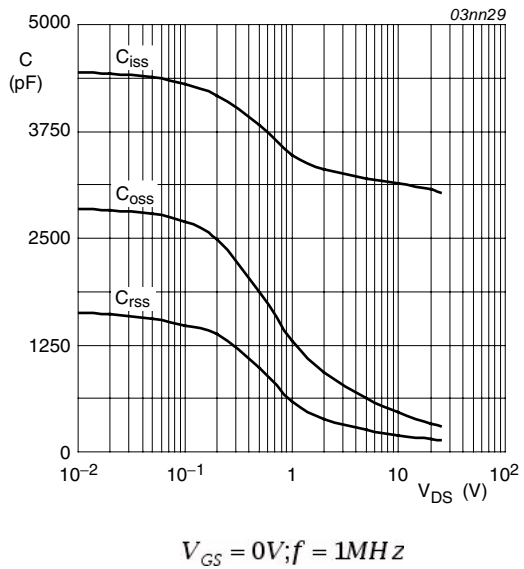


Fig 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

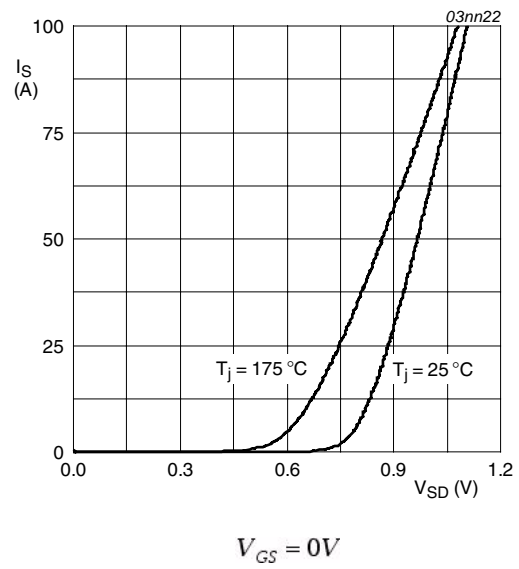


Fig 14. Source current as a function of source-drain voltage; typical values

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78A

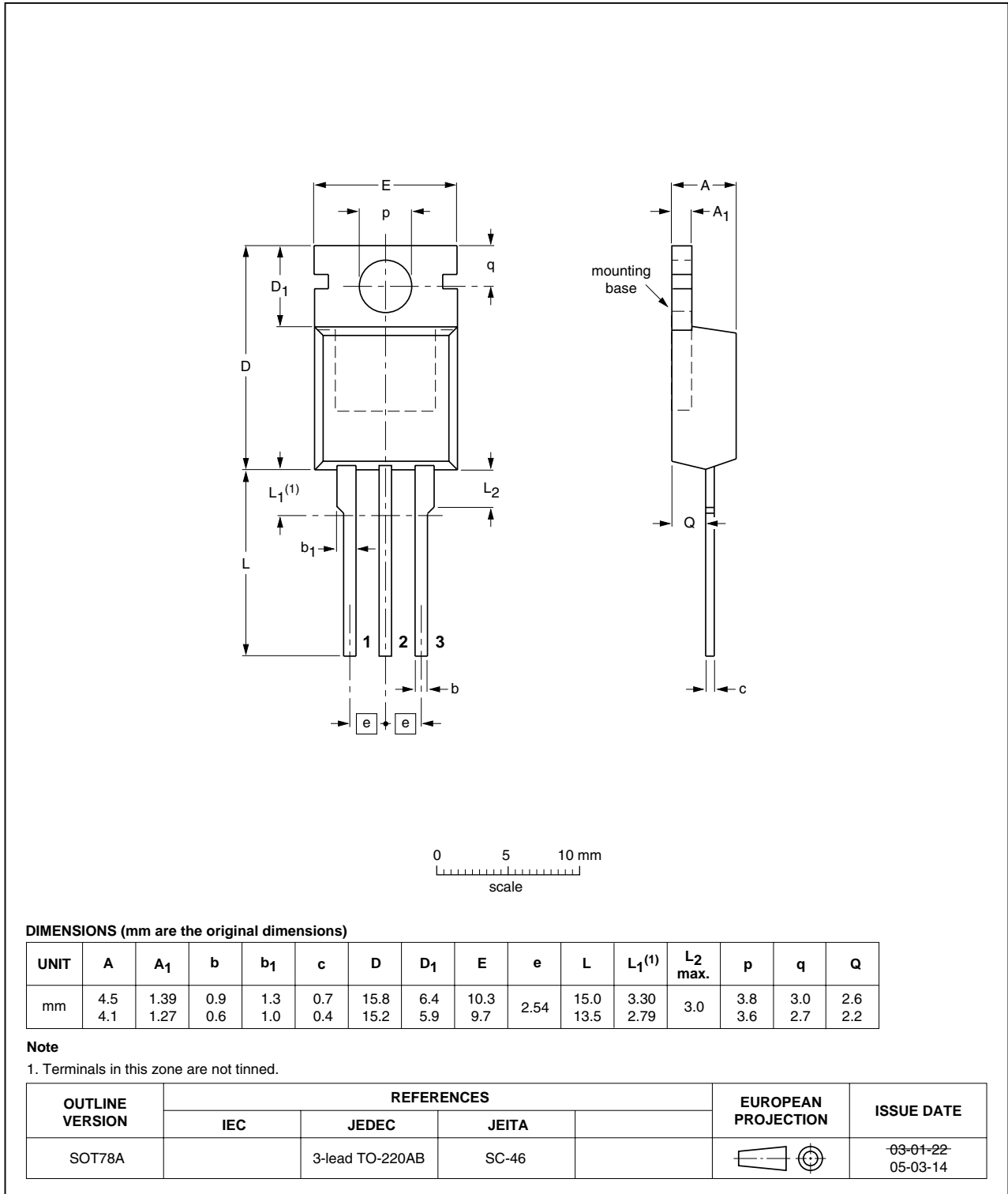


Fig 15. Package outline SOT78A (TO-220AB)

8. Revision history

Table 7. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|--------------------|--|--------------------|---------------|--------------------|
| BUK9516-75B v.2 | 20110217 | Product data sheet | - | BUK95_9616_75B v.1 |
| Modifications: | <ul style="list-style-type: none">• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.• Legal texts have been adapted to the new company name where appropriate.• Type number BUK9516-75B separated from data sheet BUK95_9616_75B v.1. | | | |
| BUK95_9616_75B v.1 | 20030423 | Product data | - | - |

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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. |
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