

BUK9245-55A

N-channel TrenchMOS logic level FET

Rev. 02 — 31 May 2010

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 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 | $V_{GS} = 5\text{ V}; T_{mb} = 25\text{ °C};$ see Figure 1 ; see Figure 3 | - | - | 28 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C};$ see Figure 2 | - | - | 70 | W |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10\text{ V}; I_D = 5\text{ A};$ $T_j = 25\text{ °C}$ | - | 27 | 40 | mΩ |
| | | $V_{GS} = 4.5\text{ V}; I_D = 5\text{ A};$ $T_j = 25\text{ °C}$ | - | - | 50 | mΩ |
| | | $V_{GS} = 5\text{ V}; I_D = 5\text{ A};$ $T_j = 25\text{ °C};$ see Figure 11 ; see Figure 12 | - | 31 | 45 | mΩ |

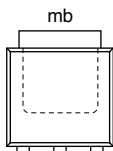
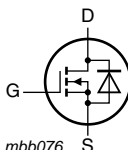


Table 1. Quick reference data ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--|---|-----|-----|-----|------|
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 28\text{ A}$; $V_{sup} \leq 55\text{ V}$; $R_{GS} = 50\ \Omega$; $V_{GS} = 5\text{ V}$; $T_{j(init)} = 25\text{ }^\circ\text{C}$; unclamped | - | - | 62 | mJ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 5\text{ V}$; $I_D = 5\text{ A}$; $V_{DS} = 44\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; see Figure 13 | - | 6.3 | - | 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 | | |

SOT428 (DPAK)

3. Ordering information

Table 3. Ordering information

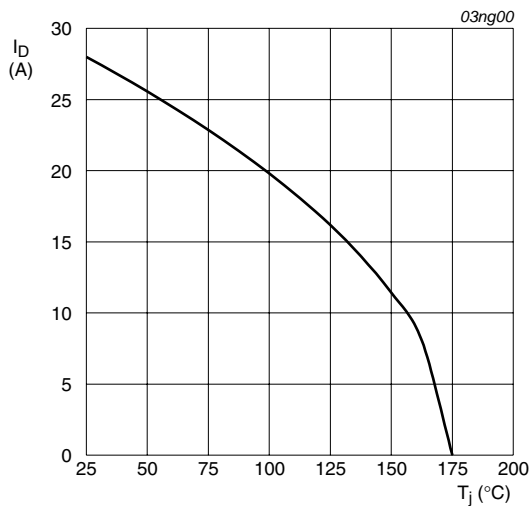
| Type number | Package | | Version |
|-------------|---------|---|---------|
| | Name | Description | |
| BUK9245-55A | DPAK | plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped) | SOT428 |

4. Limiting values

Table 4. Limiting values

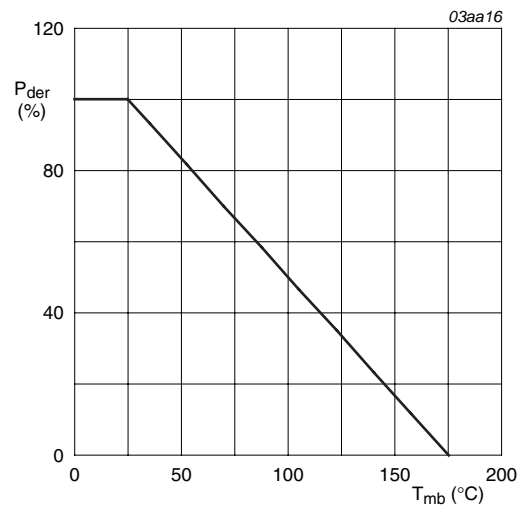
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------------|--|---|-----|-----|-----|------|
| V _{DS} | drain-source voltage | T _j ≥ 25 °C; T _j ≤ 175 °C | - | - | 55 | V |
| V _{DGR} | drain-gate voltage | R _{GS} = 20 kΩ | - | - | 55 | V |
| V _{GS} | gate-source voltage | | -15 | - | 15 | V |
| I _D | drain current | T _{mb} = 25 °C; V _{GS} = 5 V; see Figure 1 ; see Figure 3 | - | - | 28 | A |
| | | T _{mb} = 100 °C; V _{GS} = 5 V; see Figure 1 | - | - | 20 | A |
| I _{DM} | peak drain current | T _{mb} = 25 °C; t _p ≤ 10 μs; pulsed; see Figure 3 | - | - | 112 | A |
| P _{tot} | total power dissipation | T _{mb} = 25 °C; see Figure 2 | - | - | 70 | W |
| T _{stg} | storage temperature | | -55 | - | 175 | °C |
| T _j | junction temperature | | -55 | - | 175 | °C |
| Source-drain diode | | | | | | |
| I _S | source current | T _{mb} = 25 °C | - | - | 28 | A |
| I _{SM} | peak source current | t _p ≤ 10 μs; pulsed; T _{mb} = 25 °C | - | - | 112 | A |
| Avalanche ruggedness | | | | | | |
| E _{DS(AL)S} | non-repetitive drain-source avalanche energy | I _D = 28 A; V _{sup} ≤ 55 V; R _{GS} = 50 Ω; V _{GS} = 5 V; T _{j(init)} = 25 °C; unclamped | - | - | 62 | mJ |



$$V_{GS} \geq 4.5V I_{der} = \frac{I_D}{I_{D(25^\circ C)}} \times 100\%$$

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



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

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

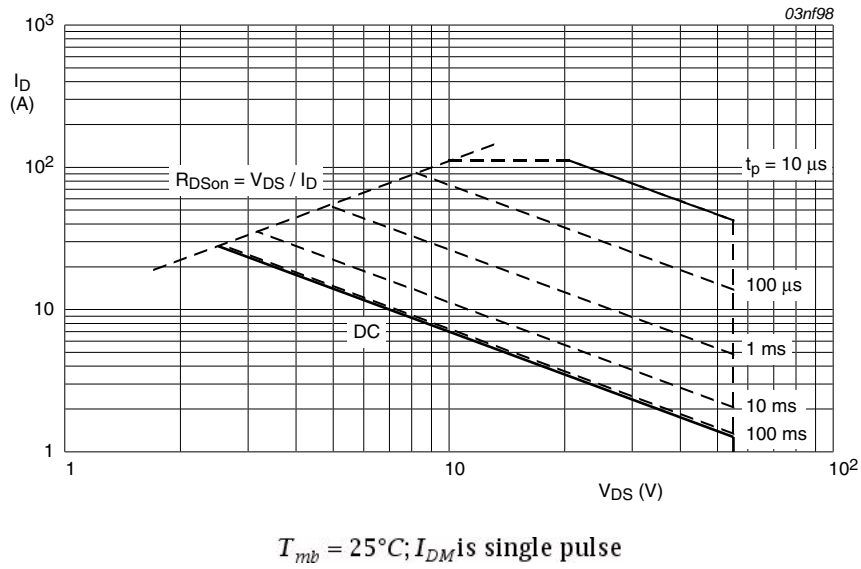


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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 | - | - | 2.1 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | | - | 71.4 | - | K/W |

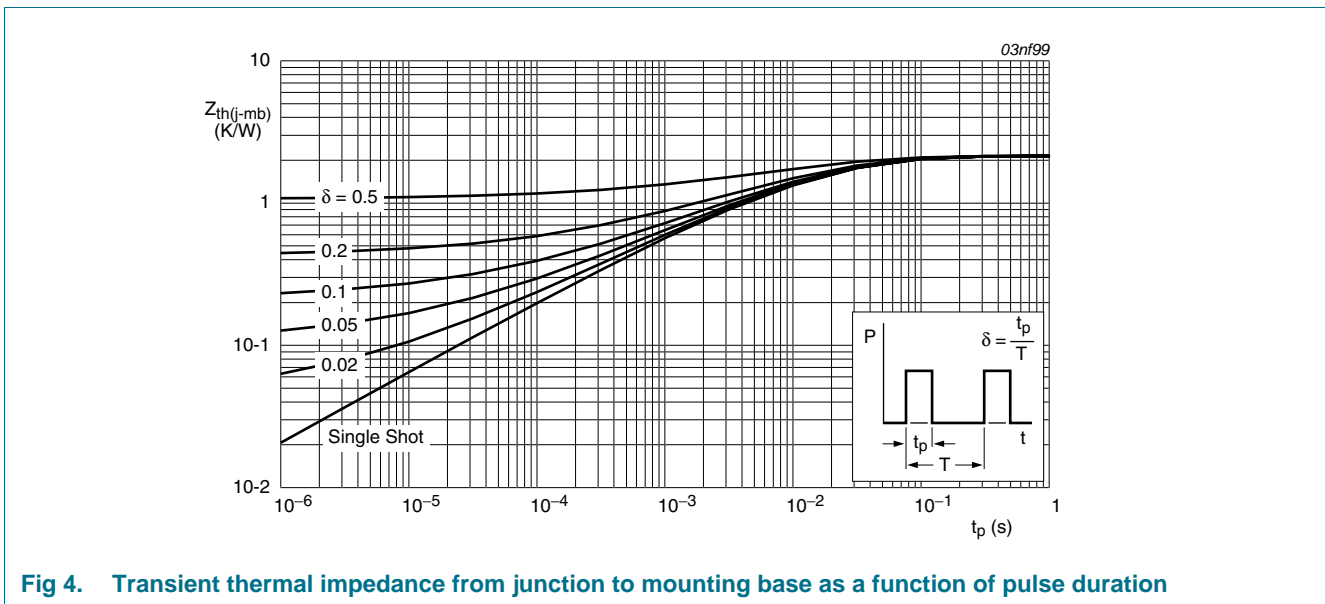
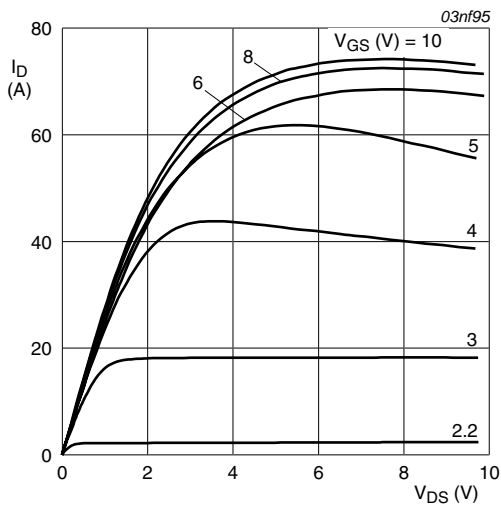


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

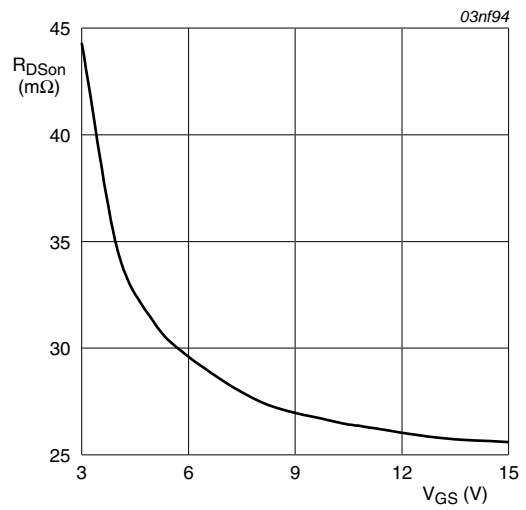
Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|---|-----|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | 55 | - | - | V |
| | | $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$ | 50 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 10 | 0.5 | - | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 10 | 1 | 1.5 | 2 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 10 | - | - | 2.3 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$ | - | - | 500 | μA |
| | | $V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 0.05 | 10 | μA |
| I_{GSS} | gate leakage current | $V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| | | $V_{DS} = 0 \text{ V}; V_{GS} = -10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10 \text{ V}; I_D = 5 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | 27 | 40 | m Ω |
| | | $V_{GS} = 5 \text{ V}; I_D = 5 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 11 ; see Figure 12 | - | - | 90 | m Ω |
| | | $V_{GS} = 4.5 \text{ V}; I_D = 5 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | 50 | m Ω |
| | | $V_{GS} = 5 \text{ V}; I_D = 5 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 11 ; see Figure 12 | - | 31 | 45 | m Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 5 \text{ A}; V_{DS} = 44 \text{ V}; V_{GS} = 5 \text{ V};$ $T_j = 25 \text{ }^\circ\text{C};$ see Figure 13 | - | 14 | - | nC |
| Q_{GS} | gate-source charge | | - | 1.6 | - | nC |
| Q_{GD} | gate-drain charge | | - | 6.3 | - | 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 14 | - | 750 | 1006 | pF |
| C_{oss} | output capacitance | | - | 140 | 166 | pF |
| C_{rss} | reverse transfer capacitance | | - | 97 | 132 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 30 \text{ V}; R_L = 1.2 \text{ } \Omega; V_{GS} = 5 \text{ V};$ $R_{G(ext)} = 10 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$ | - | 10 | - | ns |
| t_r | rise time | | - | 132 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 38 | - | ns |
| t_f | fall time | | - | 112 | - | ns |
| L_D | internal drain inductance | measured from drain to centre of die | - | 2.5 | - | nH |
| L_S | internal source inductance | measured from source lead to source bond pad | - | 7.5 | - | nH |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 8 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 15 | - | 0.85 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 20 \text{ A}; di_S/dt = -100 \text{ A}/\mu\text{s};$ | - | 50 | - | ns |
| Q_r | recovered charge | $V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 53 | - | nC |



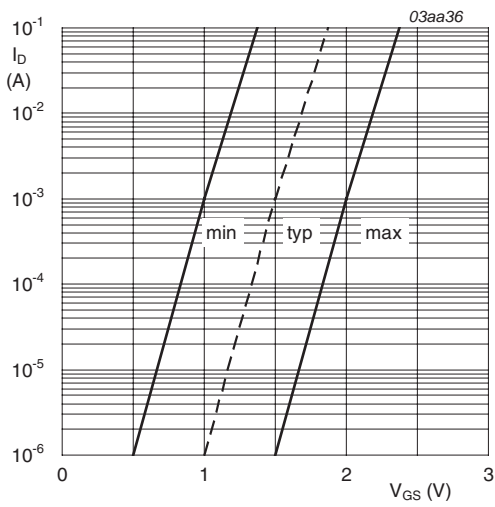
$T_j = 25^\circ\text{C}$

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



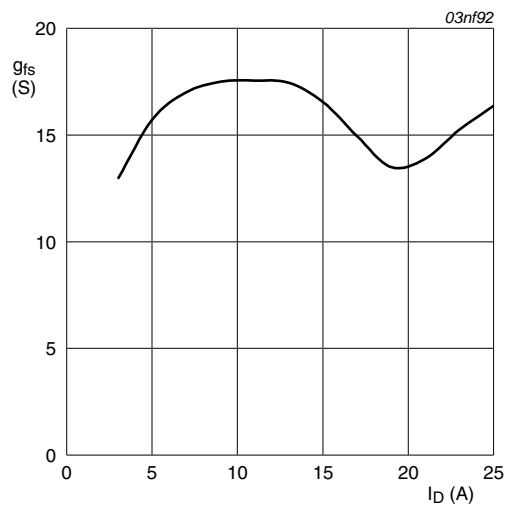
$T_j = 25^\circ\text{C}; I_D = 5\text{A}$

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



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

Fig 8. Forward transconductance as a function of drain current; typical values

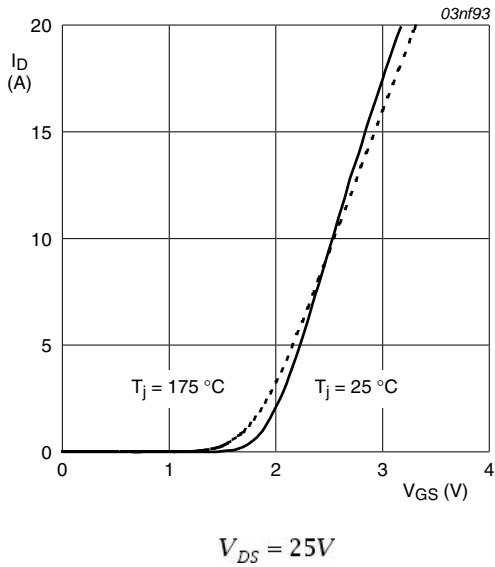


Fig 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

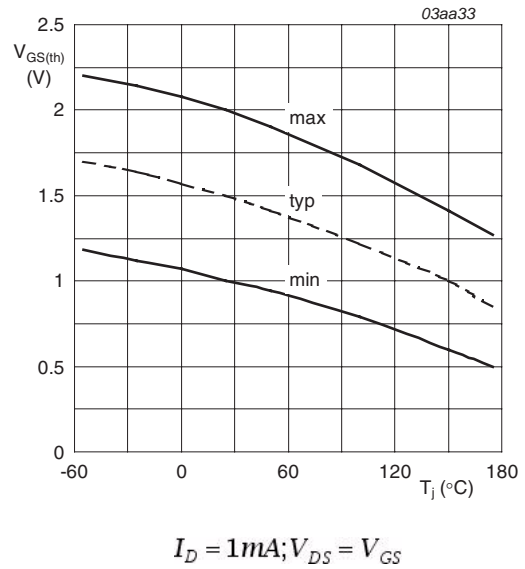


Fig 10. Gate-source threshold voltage as a function of junction temperature

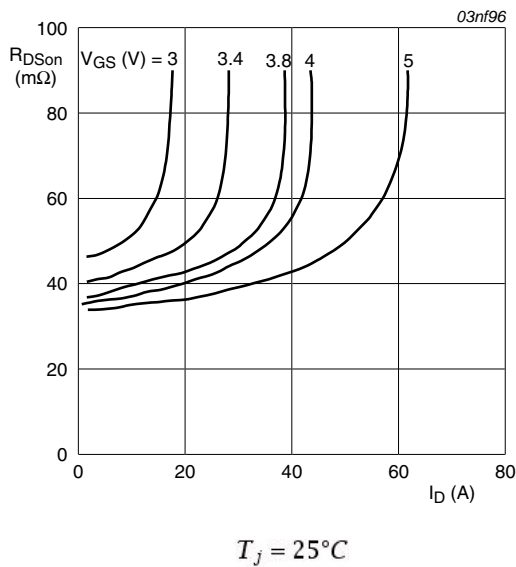


Fig 11. Drain-source on-state resistance as a function of drain current; typical values

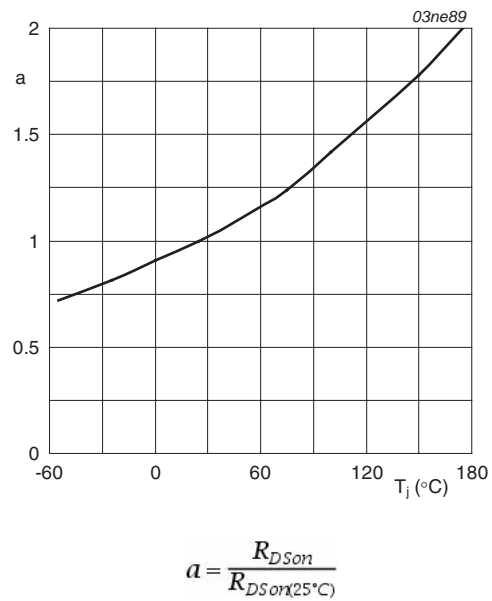
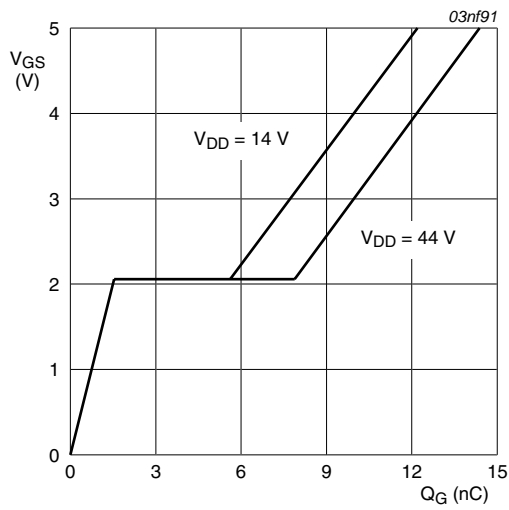
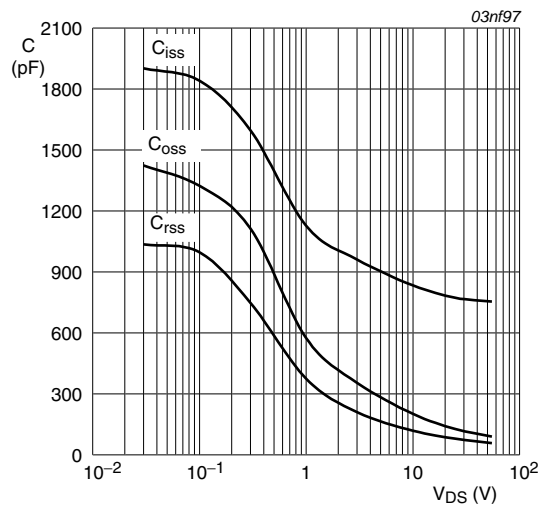


Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature



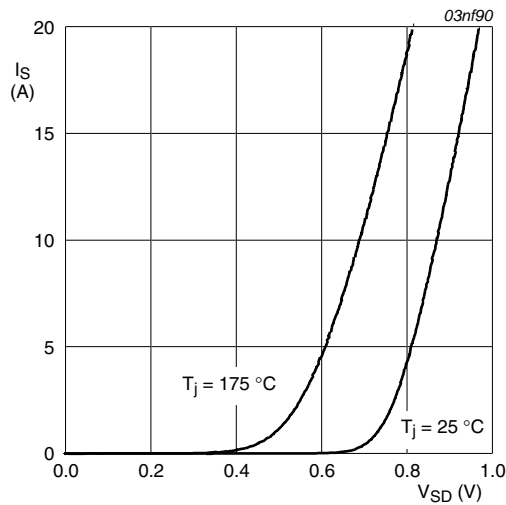
$T_j = 25^\circ\text{C}; I_D = 5\text{ A}$

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



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

Fig 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$V_{GS} = 0\text{ V}$

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

7. Package outline

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

SOT428

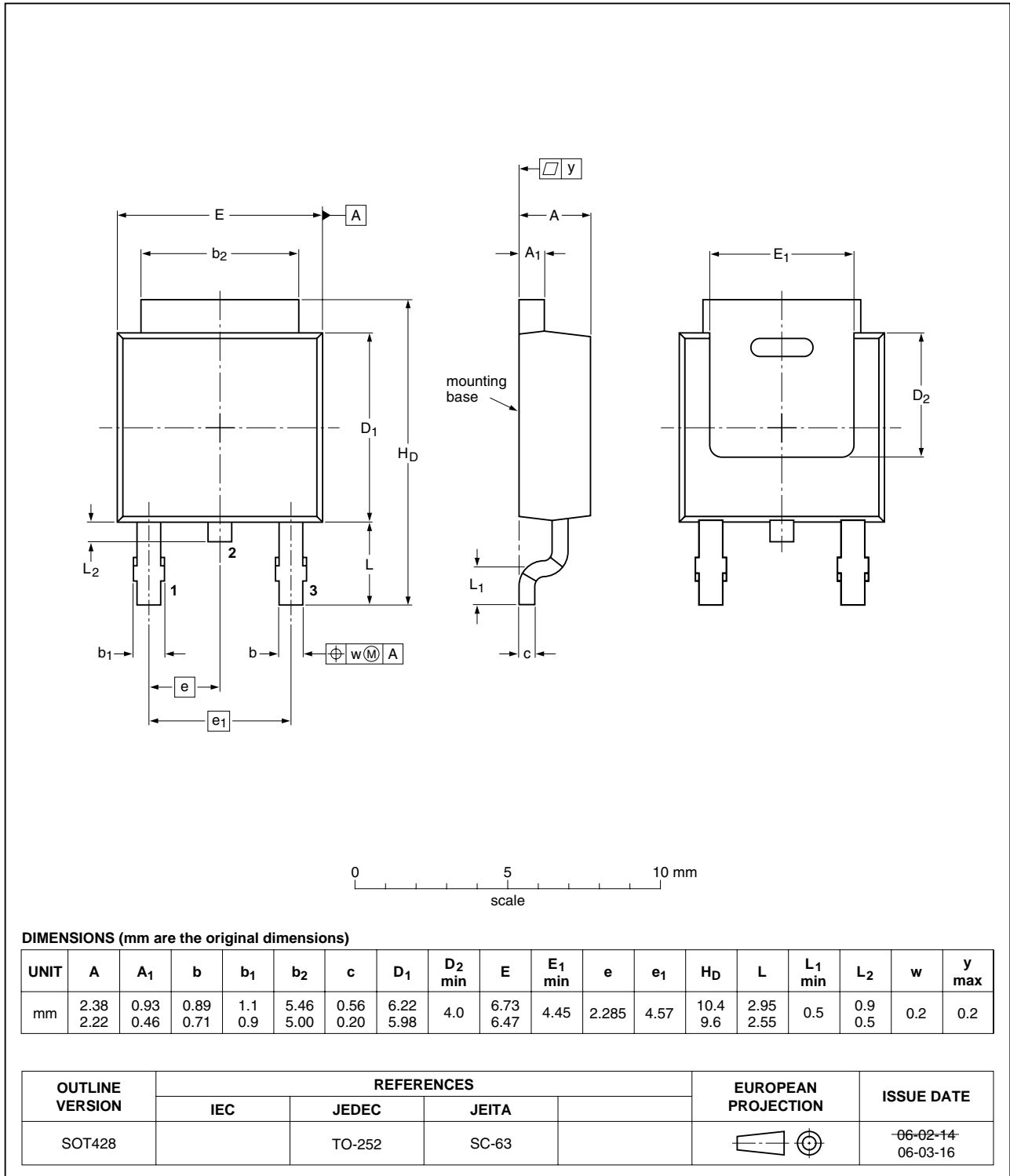


Fig 16. Package outline SOT428 (DPAK)

8. Revision history

Table 7. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|-------------------------------|--------------------|---------------|---------------|
| BUK9245-55A v.2 | 20100531 | Product data sheet | - | BUK9245_55A_1 |
| Modifications: | • Various changes to content. | | | |
| BUK9245_55A_1 | 20011011 | Product data | - | - |

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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11. Contents

| | | |
|-----------|--|-----------|
| 1 | Product profile | 1 |
| 1.1 | General description | 1 |
| 1.2 | Features and benefits | 1 |
| 1.3 | Applications | 1 |
| 1.4 | Quick reference data | 1 |
| 2 | Pinning information | 2 |
| 3 | Ordering information | 2 |
| 4 | Limiting values | 3 |
| 5 | Thermal characteristics | 5 |
| 6 | Characteristics | 6 |
| 7 | Package outline | 10 |
| 8 | Revision history | 11 |
| 9 | Legal information | 12 |
| 9.1 | Data sheet status | 12 |
| 9.2 | Definitions | 12 |
| 9.3 | Disclaimers | 12 |
| 9.4 | Trademarks | 13 |
| 10 | Contact information | 13 |

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