



THE DATASHEET OF BUK78150-55A/CUX





BUK78150-55A

N-channel TrenchMOS standard level FET

Rev. 02 — 16 June 2010

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

- Low conduction losses due to low on-state resistance
- Suitable for standard level gate drive sources
- Q101 compliant

1.3 Applications

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

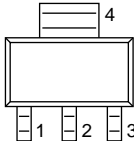
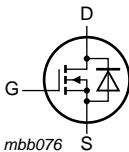
1.4 Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|--|---|-----|-----|-----|------------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 150\text{ °C}$ | - | - | 55 | V |
| I_D | drain current | $V_{GS} = 10\text{ V}$; $T_{sp} = 25\text{ °C}$; see Figure 1 ; see Figure 3 | - | - | 5.5 | A |
| P_{tot} | total power dissipation | $T_{sp} = 25\text{ °C}$; see Figure 2 | - | - | 8 | W |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10\text{ V}$; $I_D = 5\text{ A}$; $T_j = 150\text{ °C}$; see Figure 12 ; see Figure 13 | - | - | 278 | m Ω |
| | | $V_{GS} = 10\text{ V}$; $I_D = 5\text{ A}$; $T_j = 25\text{ °C}$; see Figure 12 ; see Figure 13 | - | 128 | 150 | m Ω |
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 5\text{ A}$; $V_{sup} \leq 55\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; unclamped | - | - | 25 | mJ |

2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|---|---|
| 1 | G | gate |  <p>SOT223 (SC-73)</p> |  <p>mbb076</p> |
| 2 | D | drain | | |
| 3 | S | source | | |
| 4 | D | drain | | |

3. Ordering information

Table 3. Ordering information

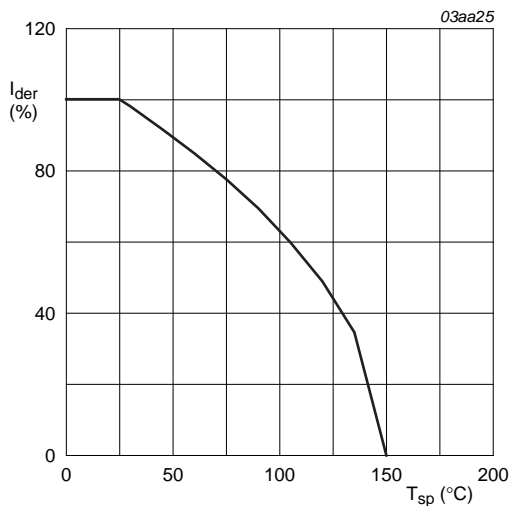
| Type number | Package | | |
|--------------|---------|--|---------|
| | Name | Description | Version |
| BUK78150-55A | SC-73 | plastic surface-mounted package with increased heatsink; 4 leads | SOT223 |

4. Limiting values

Table 4. Limiting values

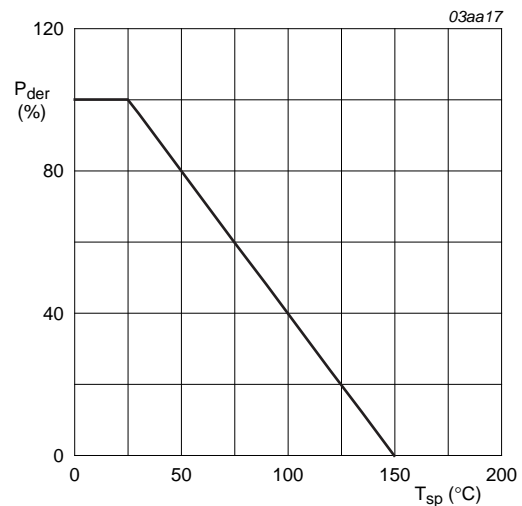
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------------|--|---|-----|-----|-----|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 150\text{ °C}$ | - | - | 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 | $T_{sp} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 1 ; see Figure 3 | - | - | 5.5 | A |
| | | $T_{sp} = 100\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 1 | - | - | 3.8 | A |
| I_{DM} | peak drain current | $T_{sp} = 25\text{ °C}$; $t_p \leq 10\text{ }\mu\text{s}$; pulsed; see Figure 3 | - | - | 22 | A |
| P_{tot} | total power dissipation | $T_{sp} = 25\text{ °C}$; see Figure 2 | - | - | 8 | W |
| T_{stg} | storage temperature | | -55 | - | 150 | °C |
| T_j | junction temperature | | -55 | - | 150 | °C |
| Source-drain diode | | | | | | |
| I_S | source current | $T_{sp} = 25\text{ °C}$ | - | - | 5.5 | A |
| I_{SM} | peak source current | $t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{sp} = 25\text{ °C}$ | - | - | 22 | A |
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 5\text{ A}$; $V_{sup} \leq 55\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; unclamped | - | - | 25 | mJ |



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

Fig 1. Normalized continuous drain current as a function of solder point temperature



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

Fig 2. Normalized total power dissipation as a function of solder point temperature

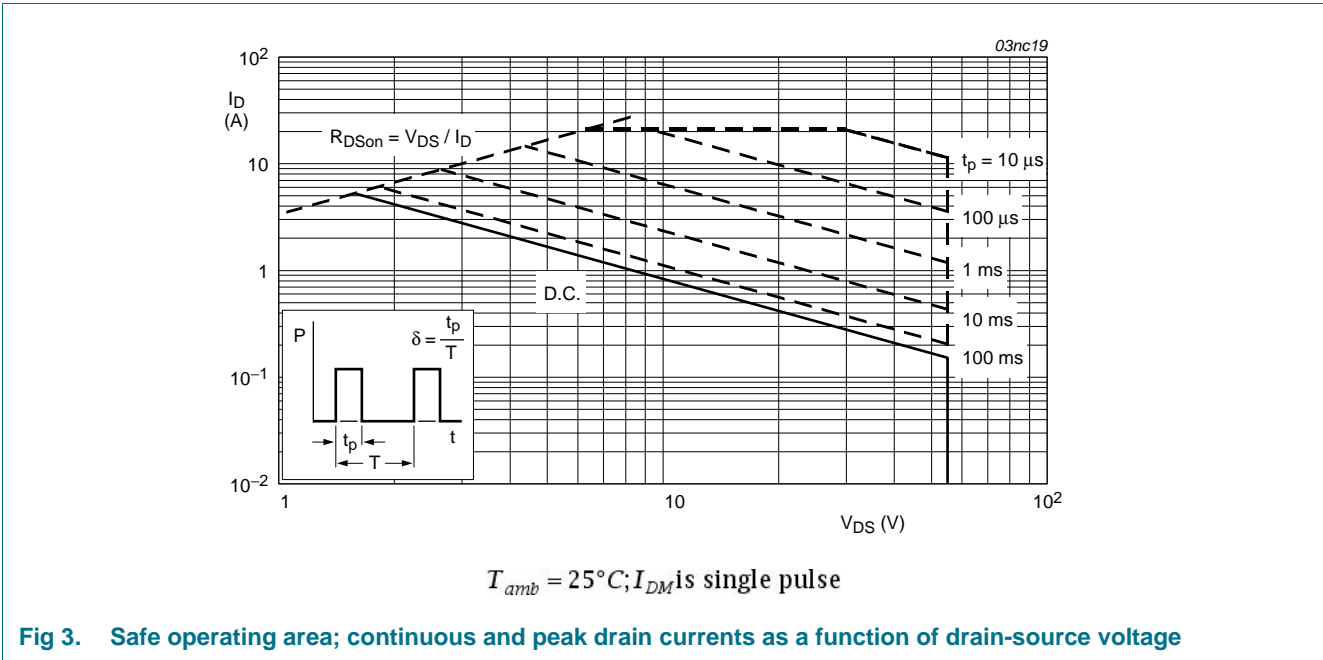


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|--|------------------------------|-----|-----|-----|------|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | - | - | 15 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | see Figure 4 | - | 70 | - | K/W |

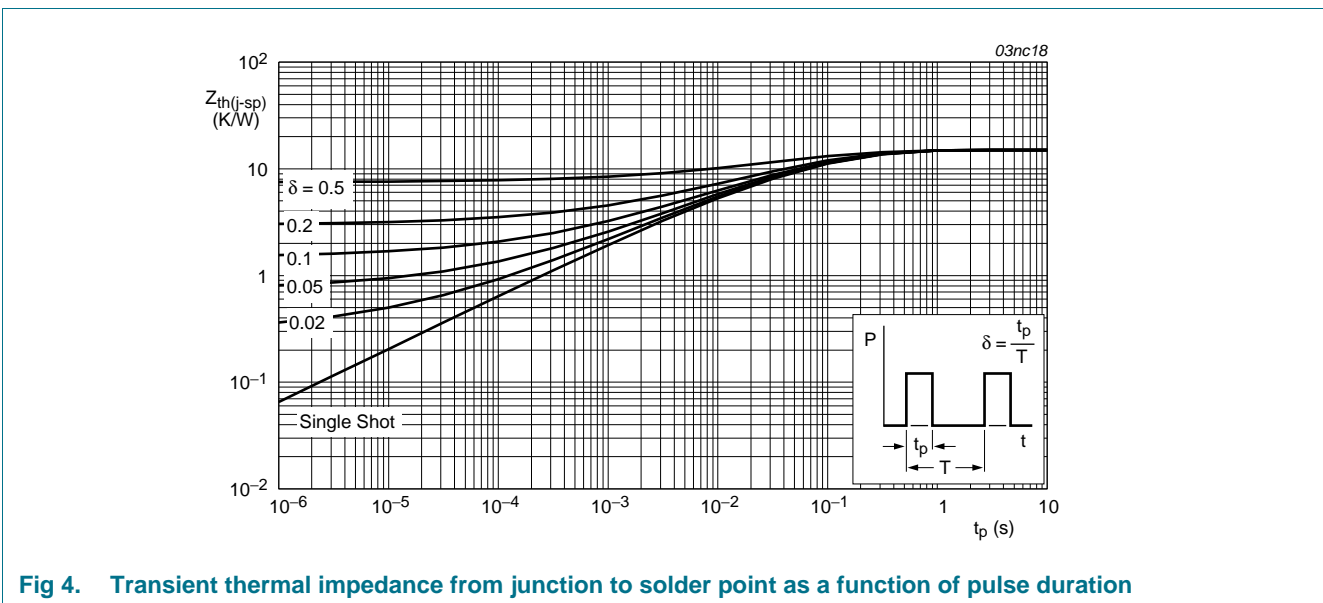


Fig 4. Transient thermal impedance from junction to solder point as a function of pulse duration

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 | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 11 | 2 | 3 | 4 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 150 \text{ }^\circ\text{C};$ see Figure 11 | 1 | - | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 11 | - | - | 4.4 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 150 \text{ }^\circ\text{C}$ | - | - | 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 | $V_{DS} = 0 \text{ V}; V_{GS} = 20 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| | | $V_{DS} = 0 \text{ V}; V_{GS} = -20 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10 \text{ V}; I_D = 5 \text{ A}; T_j = 150 \text{ }^\circ\text{C};$ see Figure 12 ; see Figure 13 | - | - | 278 | $\text{m}\Omega$ |
| | | $V_{GS} = 10 \text{ V}; I_D = 5 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 12 ; see Figure 13 | - | 128 | 150 | $\text{m}\Omega$ |
| 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 14 | - | 170 | 230 | pF |
| C_{oss} | output capacitance | | - | 54 | 65 | pF |
| C_{rss} | reverse transfer capacitance | | - | 37 | 52 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 30 \text{ V}; R_L = 2.7 \text{ } \Omega; V_{GS} = 10 \text{ V};$ $R_{G(ext)} = 5.6 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$ | - | 3 | - | ns |
| t_r | rise time | | - | 26 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 8 | - | ns |
| t_f | fall time | | - | 10 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 5 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 15 | - | 0.85 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 10 \text{ A}; dI_S/dt = -100 \text{ A}/\mu\text{s};$ $V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 32 | - | ns |
| Q_r | recovered charge | | - | 50 | - | nC |

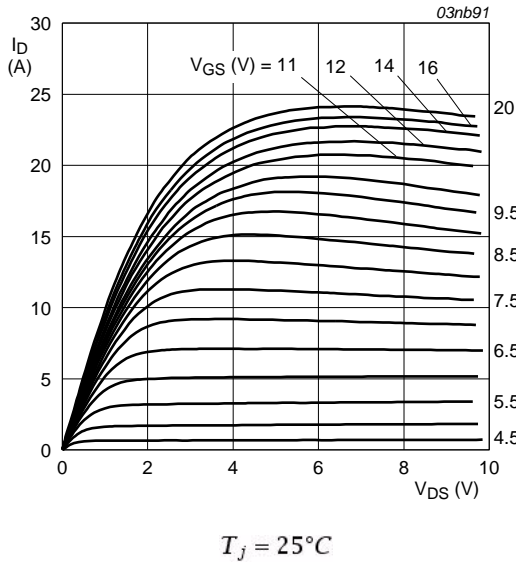


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

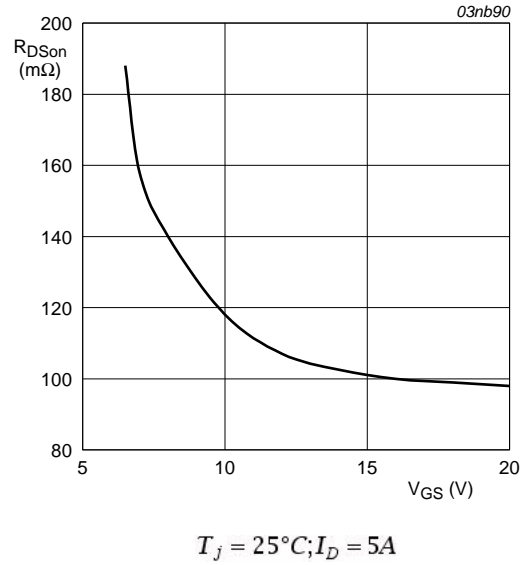


Fig 6. Drain-source on-state resistance as a function of gate-source voltage; typical values

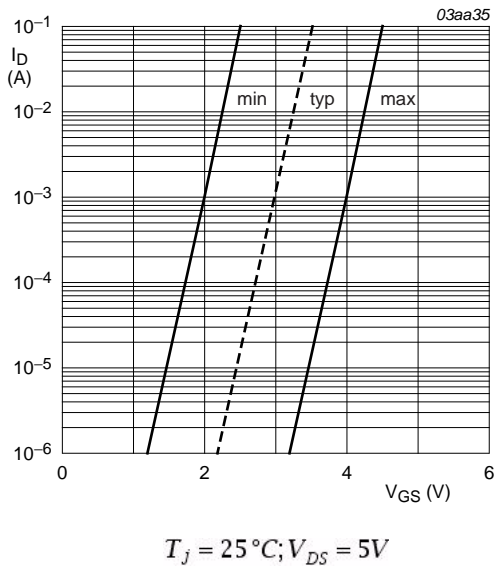


Fig 7. Sub-threshold drain current as a function of gate-source voltage

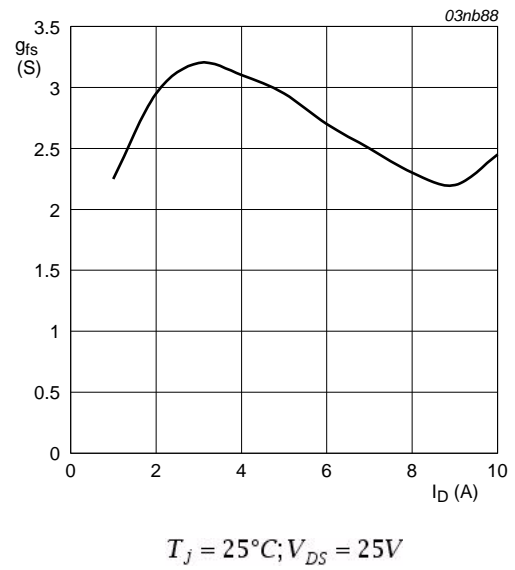


Fig 8. Forward transconductance as a function of drain current; typical values

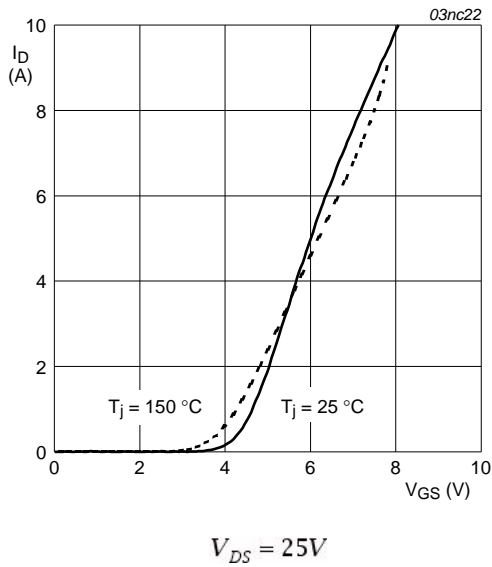


Fig 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

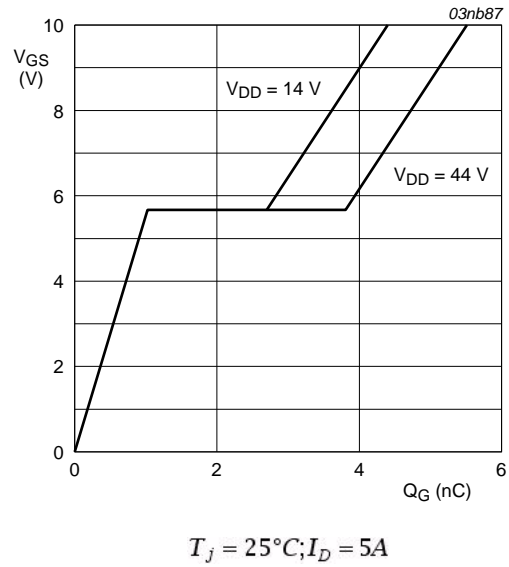


Fig 10. Gate-source voltage as a function of turn-on gate charge; typical values

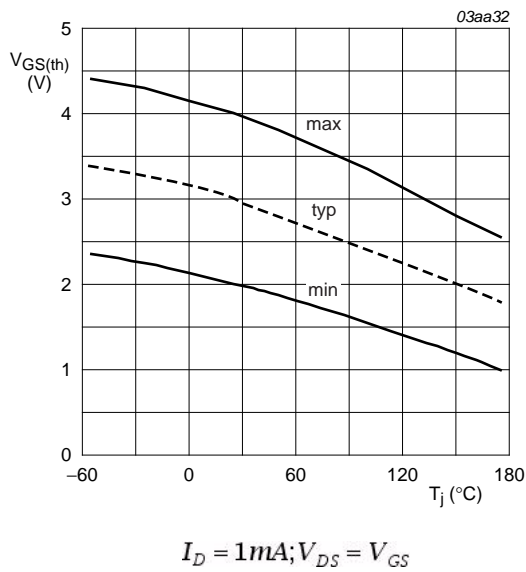


Fig 11. Gate-source threshold voltage as a function of junction temperature

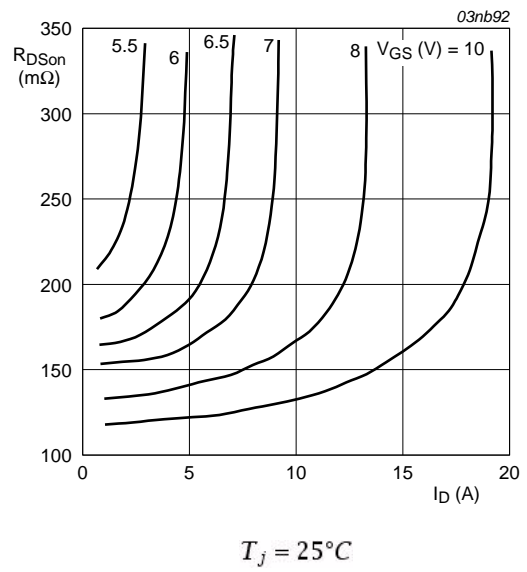
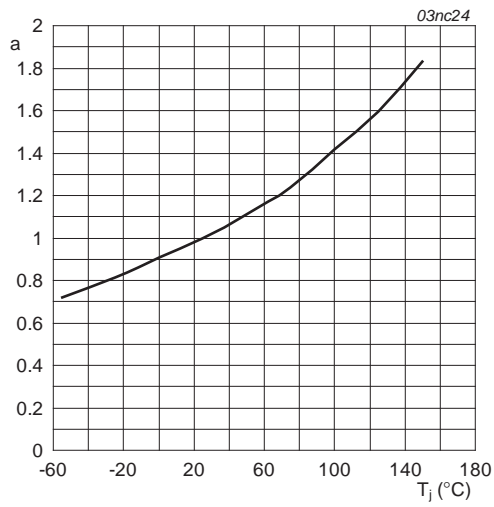
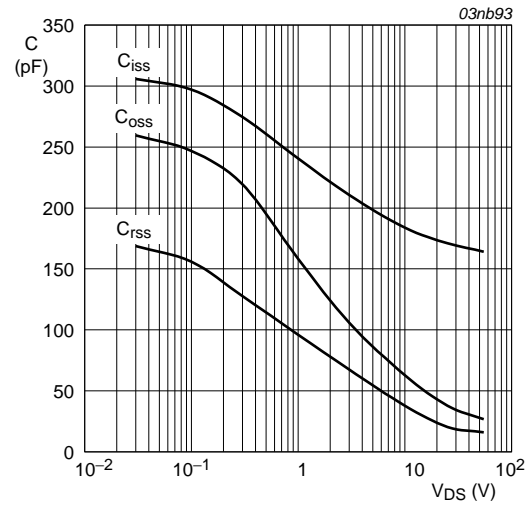


Fig 12. Drain-source on-state resistance as a function of drain current; typical values



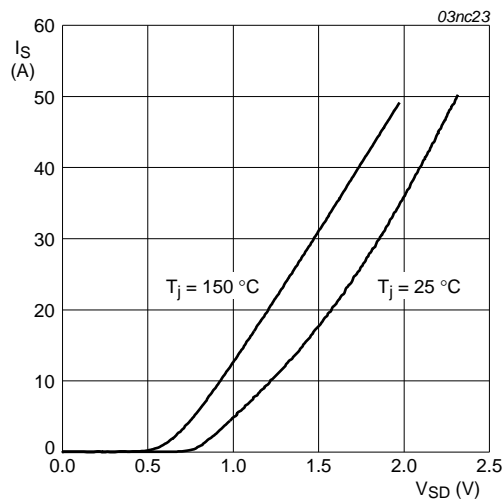
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}\text{C})}}$$

Fig 13. Normalized drain source on-state resistance factor as a function of junction temperature



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

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



$$V_{GS} = 0V$$

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

7. Package outline

Plastic surface-mounted package with increased heatsink; 4 leads

SOT223

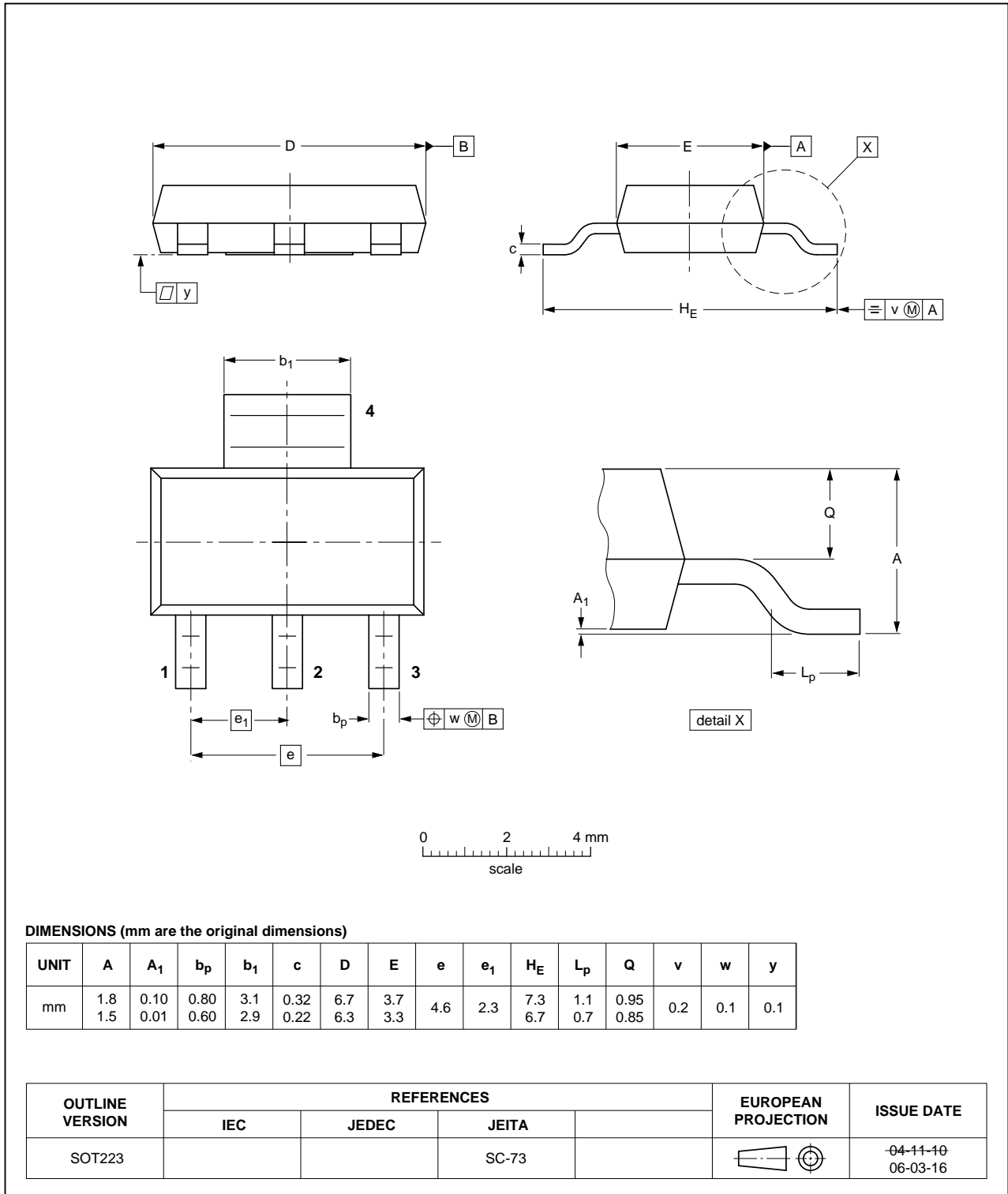


Fig 16. Package outline SOT223 (SC-73)

8. Revision history

Table 7. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|--------------------------------------|---|-----------------------|---------------|------------------|
| BUK78150-55A v.2 | 20100616 | Product data sheet | - | BUK78150-55A 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. | | | |
| BUK78150-55A v.1 (9397 750 07738) | 20010130 | Product Specification | - | - |

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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