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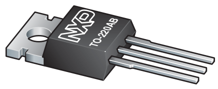



# BUK9515-100A

## N-channel TrenchMOS logic level FET

Rev. 3 — 19 April 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

### 1.3 Applications

- Automotive and general purpose power switching

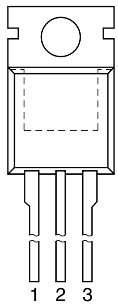
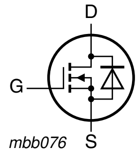
### 1.4 Quick reference data

**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j \geq 25$ °C; $T_j \leq 175$ °C | - | - | 100 | V |
| $I_D$ | drain current | $T_{mb} = 25$ °C | - | - | 75 | A |
| $P_{tot}$ | total power dissipation | | - | - | 230 | W |
| $T_j$ | junction temperature | | -55 | - | 175 | °C |
| **Static characteristics** | | | | | | |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS} = 10$ V; $I_D = 25$ A; $T_j = 25$ °C | - | 11.5 | 14.4 | mΩ |
| | | $V_{GS} = 5$ V; $I_D = 25$ A; $T_j = 25$ °C | - | 12 | 15 | mΩ |
| **Avalanche ruggedness** | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 35$ A; $V_{sup} \leq 25$ V; $R_{GS} = 50$ Ω; $V_{GS} = 5$ V; $T_{j(init)} = 25$ °C; unclamped | - | - | 120 | mJ |

## 2. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | G | gate |   SOT78A (TO-220AB) |   |
| 2 | D | drain | | |
| 3 | S | source | | |
| mb | D | mounting base; connected to drain | | |

## 3. Ordering information

**Table 3. Ordering information**

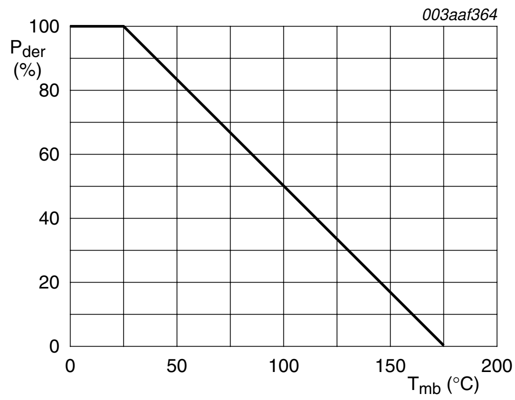
| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BUK9515-100A | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78A |

## 4. Limiting values

**Table 4. Limiting values**

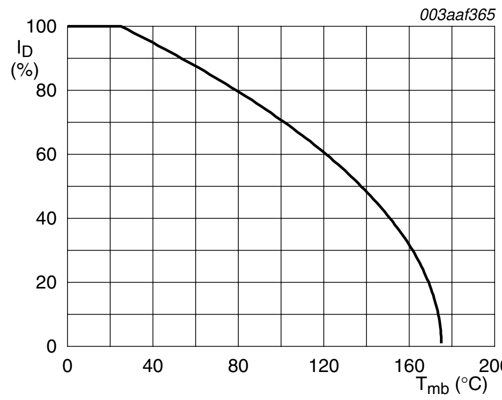
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j \geq 25$ °C; $T_j \leq 175$ °C | - | 100 | V |
| $V_{DGR}$ | drain-gate voltage | $R_{GS} = 20$ kΩ | - | 100 | V |
| $V_{GS}$ | gate-source voltage | | -10 | 10 | V |
| $I_D$ | drain current | $T_{mb} = 25$ °C | - | 75 | A |
| | | $T_{mb} = 100$ °C | - | 53 | A |
| $I_{DM}$ | peak drain current | $T_{mb} = 25$ °C; pulsed | - | 313 | A |
| $P_{tot}$ | total power dissipation | $T_{mb} = 25$ °C | - | 230 | W |
| $T_{stg}$ | storage temperature | | -55 | 175 | °C |
| $T_j$ | junction temperature | | -55 | 175 | °C |
| $V_{GSM}$ | peak gate-source voltage | pulsed; $t_p \leq 50$ µs | -15 | 15 | V |
| **Source-drain diode** | | | | | |
| $I_S$ | source current | $T_{mb} = 25$ °C | - | 75 | A |
| $I_{SM}$ | peak source current | pulsed; $T_{mb} = 25$ °C | - | 313 | A |
| **Avalanche ruggedness** | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 35$ A; $V_{sup} \leq 25$ V; $R_{GS} = 50$ Ω; $V_{GS} = 5$ V; $T_{j(init)} = 25$ °C; unclamped | - | 120 | mJ |




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

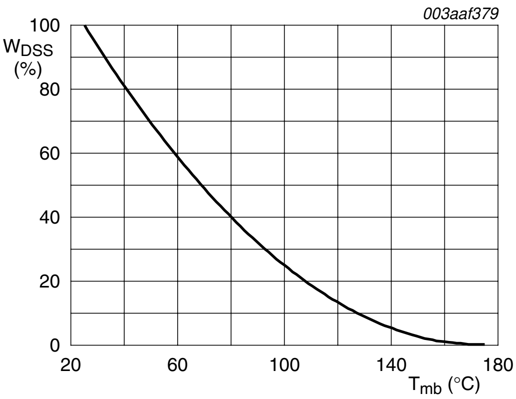
**Fig 1. Normalized total power dissipation as a function of mounting base temperature**




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

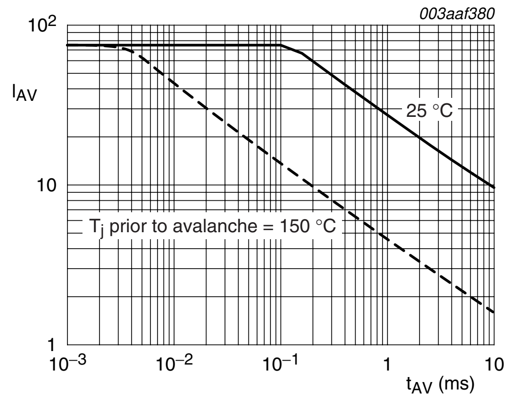
$V_{GS} \geq 5$ V

**Fig 2. Normalized continuous drain current as a function of mounting base temperature**



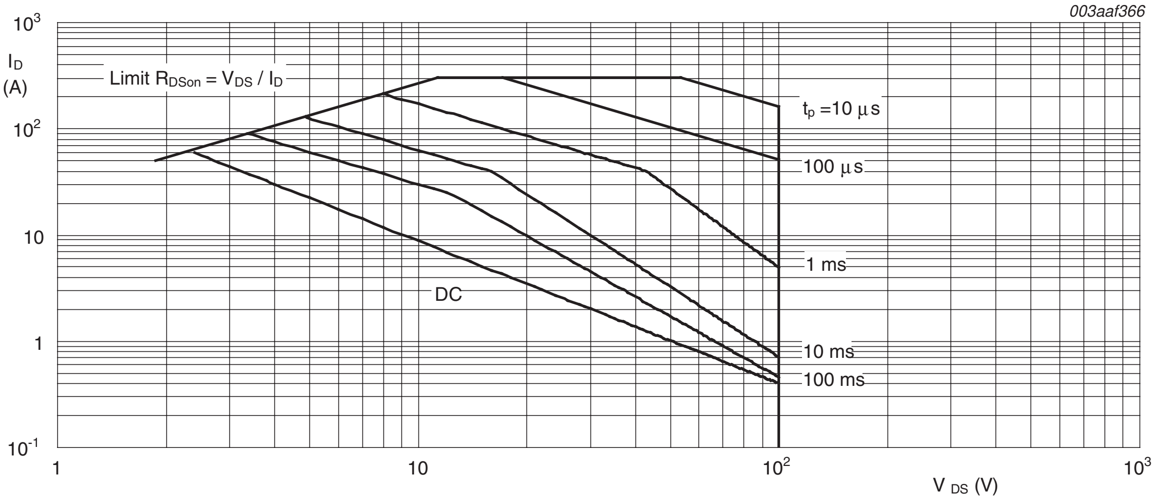

$I_D = 75$ A

**Fig 3. Normalised drain-source non-repetitive avalanche energy as a function of mounting-base temperature**




unclamped inductive load

**Fig 4. Single-shot avalanche rating; avalanche current as a function of avalanche period**




$T_{mb}$ = 25 °C; $I_{DM}$ is single pulse

**Fig 5. 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 | | - | - | 0.65 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | - | 60 | - | K/W |

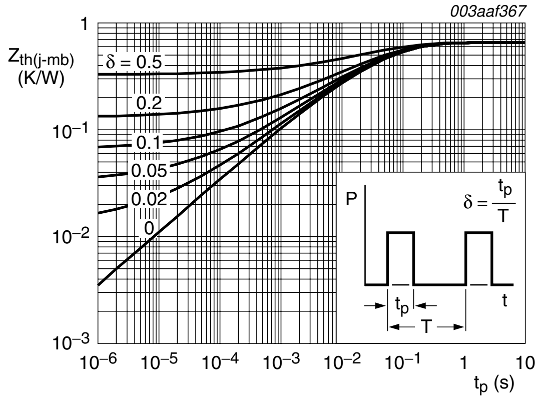
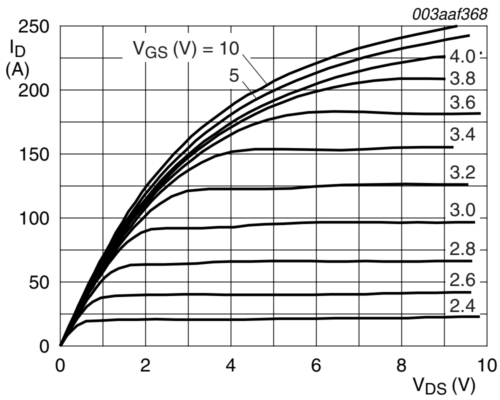



**Fig 6. Transient thermal impedance from junction to mounting base as a function of pulse duration**

## 6. Characteristics

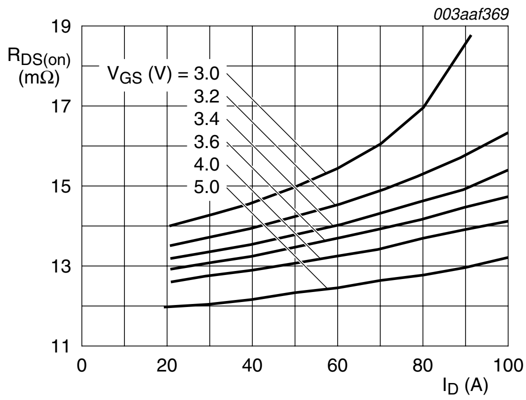
**Table 6. Characteristics**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D$ = 0.25 mA; $V_{GS}$ = 0 V; $T_j$ = 25 °C | 100 | - | - | V |
| | | $I_D$ = 0.25 mA; $V_{GS}$ = 0 V; $T_j$ = -55 °C | 89 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 25 °C | 1 | 1.5 | 2 | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = -55 °C | - | - | 2.3 | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 175 °C | 0.5 | - | - | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 100 V; $V_{GS}$ = 0 V; $T_j$ = 175 °C | - | - | 500 | µA |
| | | $V_{DS}$ = 100 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | - | 0.05 | 10 | µA |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = 10 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | - | 2 | 100 | nA |
| | | $V_{GS}$ = -10 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | - | 2 | 100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 4.5 V; $I_D$ = 25 A; $T_j$ = 25 °C | - | - | 16 | mΩ |
| | | $V_{GS}$ = 5 V; $I_D$ = 25 A; $T_j$ = 175 °C | - | - | 40.5 | mΩ |
| | | $V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 25 °C | - | 11.5 | 14.4 | mΩ |
| | | $V_{GS}$ = 5 V; $I_D$ = 25 A; $T_j$ = 25 °C | - | 12 | 15 | mΩ |
| **Dynamic characteristics** | | | | | | |
| $C_{iss}$ | input capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 25 V; f = 1 MHz; $T_j$ = 25 °C | - | 6500 | 8600 | pF |
| $C_{oss}$ | output capacitance | | - | 550 | 660 | pF |
| $C_{rss}$ | reverse transfer capacitance | | - | 325 | 400 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 30 V; $R_L$ = 1.2 Ω; $V_{GS}$ = 5 V; $R_{G(ext)}$ = 10 Ω; $T_j$ = 25 °C | - | 45 | 65 | ns |
| $t_r$ | rise time | | - | 130 | 195 | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 400 | 560 | ns |
| $t_f$ | fall time | | - | 130 | 190 | ns |
| $L_D$ | internal drain inductance | measured from contact screw on mounting base to centre of die; $T_j$ = 25 °C | - | 3.5 | - | nH |
| | | measured from drain lead 6 mm from package to centre of die; $T_j$ = 25 °C | - | 4.5 | - | nH |
| $L_S$ | internal source inductance | measured from source lead to source bond pad; $T_j$ = 25 °C | - | 7.5 | - | nH |
| **Source-drain diode** | | | | | | |
| $V_{SD}$ | source-drain voltage | $I_S$ = 75 A; $V_{GS}$ = 0 V; $T_j$ = 25 °C | - | 1.1 | - | V |
| | | $I_S$ = 25 A; $V_{GS}$ = 0 V; $T_j$ = 25 °C | - | 0.85 | 1.2 | V |
| $t_{rr}$ | reverse recovery time | $I_S$ = 75 A; $dI_S/dt$ = -100 A/µs; $V_{GS}$ = -10 V; $V_{DS}$ = 30 V; $T_j$ = 25 °C | - | 60 | - | ns |
| $Q_r$ | recovered charge | | - | 0.24 | - | µC |



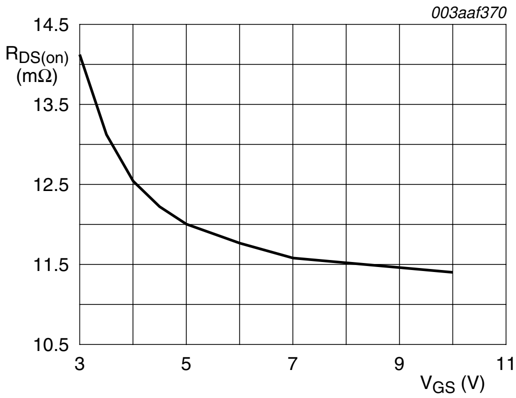

$T_j$ = 25 °C

**Fig 7. Output characteristics: drain current as a function of drain-source voltage; typical values**



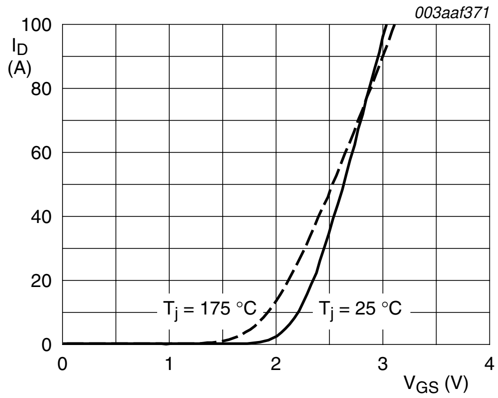

$T_j$ = 25 °C

**Fig 8. Drain-source on-state resistance as a function of drain current; typical values**



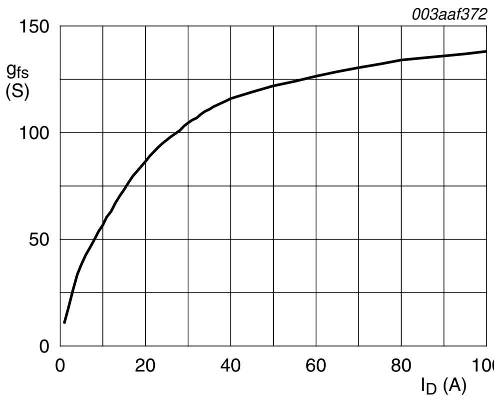

$T_j$ = 25 °C

**Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values**



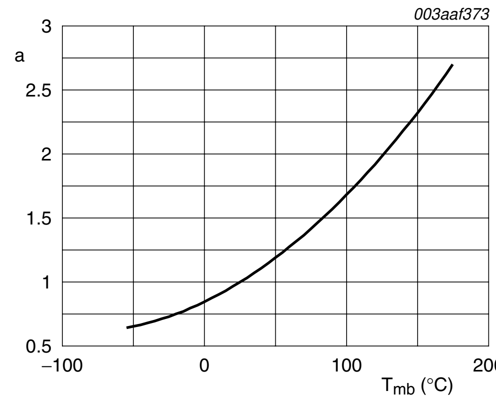

$V_{DS} > I_D \times R_{DSon}$

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




$V_{DS} > I_D \times R_{DSon}$

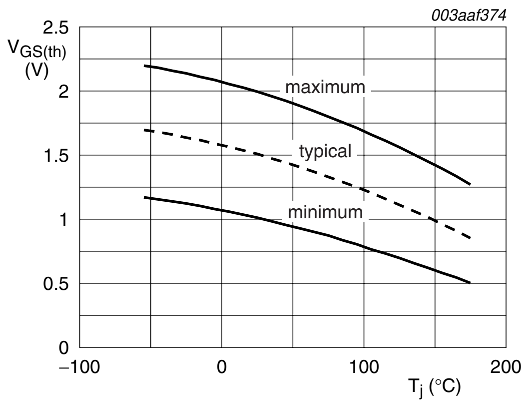
**Fig 11. Forward transconductance as a function of drain current; typical values**




$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

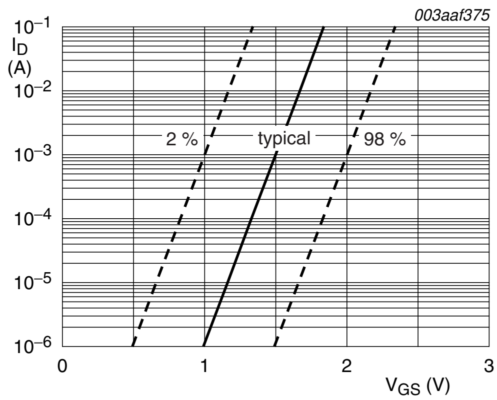
$I_D = 25$ A; $V_{GS} = 5$ V

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



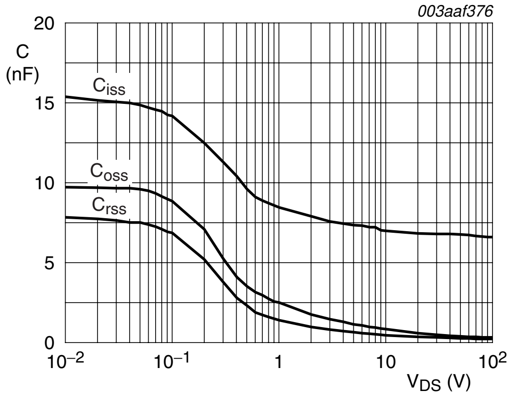

$I_D = 1$ mA; $V_{DS} = V_{GS}$

**Fig 13. Gate-source threshold voltage as a function of junction temperature**



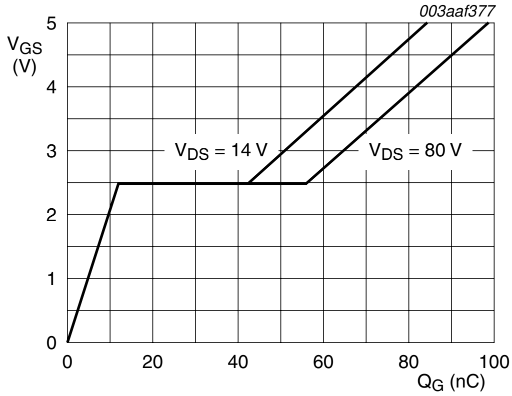

$T_j = 25$ °C; $V_{DS} = V_{GS}$

**Fig 14. Sub-threshold drain current as a function of gate-source voltage**



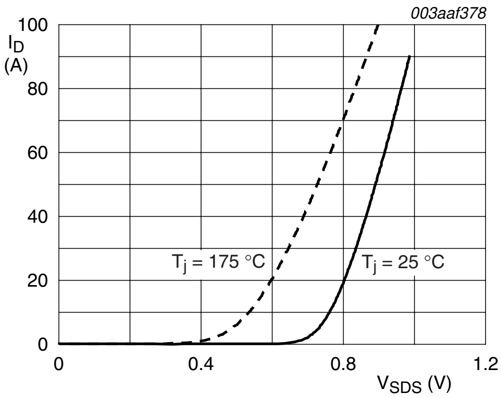

$V_{GS}$ = 0 V; f = 1 MHz

**Fig 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**




$T_j$ = 25 °C; $I_D$ = 25 A

**Fig 16. Gate-source voltage as a function of gate charge; typical values**

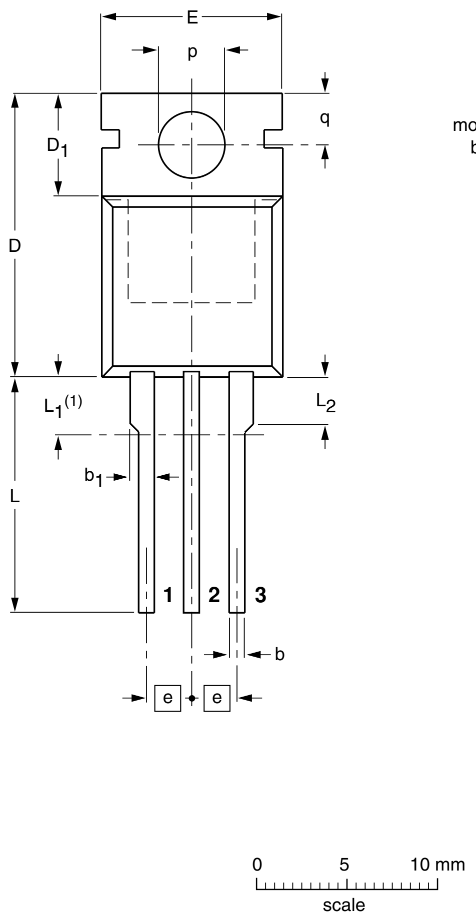



$V_{GS}$ = 0 V

**Fig 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values**

# 7. Package outline

**Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB** **SOT78A**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | $A_1$ | b | $b_1$ | c | D | $D_1$ | E | e | L | $L_1^{(1)}$ | $L_2$ max. | p | q | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.5<br>4.1 | 1.39<br>1.27 | 0.9<br>0.6 | 1.3<br>1.0 | 0.7<br>0.4 | 15.8<br>15.2 | 6.4<br>5.9 | 10.3<br>9.7 | 2.54 | 15.0<br>13.5 | 3.30<br>2.79 | 3.0 | 3.8<br>3.6 | 3.0<br>2.7 | 2.6<br>2.2 |

**Note**

1. Terminals in this zone are not tinned.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT78A | | 3-lead TO-220AB | SC-46 | | | ~~03-01-22~~<br>05-03-14 |

**Fig 18. Package outline SOT78A (TO-220AB)**

## 8. Revision history

**Table 7. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BUK9515-100A v.3 | 20110419 | Product data sheet | - | BUK9515_9615-100A_2 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Type number BUK9515-100A separated from data sheet BUK9515_9615-100A_2. | | | |
| BUK9515_9615-100A_2 | 19991101 | 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".

[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.nxp.com.

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## 10. Contact information

For more information, please visit: http://www.nxp.com

For sales office addresses, please send an email to: salesaddresses@nxp.com

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