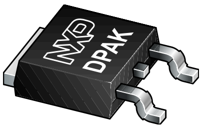



# BUK9277-55A

## N-channel TrenchMOS logic level FET

12 June 2014 Product data sheet

## 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.

## 2. Features and benefits

- Q101 compliant
- Suitable for logic level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

## 3. Applications

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

## 4. Quick reference data

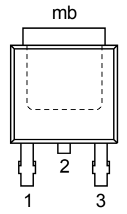
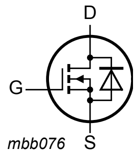
**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j \geq 25$ °C; $T_j \leq 175$ °C | | - | - | 55 | V |
| $I_D$ | drain current | $V_{GS} = 5$ V; $T_{mb} = 25$ °C; Fig. 2; Fig. 3 | | - | - | 18 | A |
| $P_{tot}$ | total power dissipation | $T_{mb} = 25$ °C; Fig. 1 | | - | - | 51 | W |
| **Static characteristics** | | | | | | | |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS} = 10$ V; $I_D = 10$ A; $T_j = 25$ °C | | - | 59 | 69 | mΩ |
| | | $V_{GS} = 4.5$ V; $I_D = 10$ A; $T_j = 25$ °C | | - | - | 86 | mΩ |
| | | $V_{GS} = 5$ V; $I_D = 10$ A; $T_j = 25$ °C; Fig. 13 | | - | 65 | 77 | mΩ |
| **Avalanche ruggedness** | | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 18$ A; $V_{sup} \leq 55$ V; $R_{GS} = 50$ Ω; $V_{GS} = 5$ V; $T_{j(init)} = 25$ °C; unclamped | | - | - | 33 | mJ |

Scan or click this QR code to view the latest information for this product

## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | G | gate |  DPAK (SOT428) |  |
| 2 | D | drain | | |
| 3 | S | source | | |
| mb | D | mounting base; connected to drain | | |

## 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BUK9277-55A | DPAK | plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped) | SOT428 |
| BUK9277-55A/CD | DPAK | plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped) | SOT428 |

## 7. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| BUK9277-55A | BUK9277-55A |
| BUK9277-55A/CD | |

## 8. Limiting values

**Table 5. 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 | | - | 55 | V |
| $V_{DGR}$ | drain-gate voltage | $R_{GS}$ = 20 kΩ | | - | 55 | V |
| $V_{GS}$ | gate-source voltage | | | -15 | 15 | V |
| $P_{tot}$ | total power dissipation | $T_{mb}$ = 25 °C; Fig. 1 | | - | 51 | W |
| $I_D$ | drain current | $T_{mb}$ = 25 °C; $V_{GS}$ = 5 V; Fig. 2; Fig. 3 | | - | 18 | A |
| | | $T_{mb}$ = 100 °C; $V_{GS}$ = 5 V; Fig. 2 | | - | 13 | A |

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{DM}$ | peak drain current | $T_{mb}$ = 25 °C; pulsed; $t_p$ ≤ 10 µs; Fig. 3 | | - | 73 | A |
| $T_{stg}$ | storage temperature | | | -55 | 175 | °C |
| $T_j$ | junction temperature | | | -55 | 175 | °C |
| **Source-drain diode** | | | | | | |
| $I_S$ | source current | $T_{mb}$ = 25 °C | | - | 18 | A |
| $I_{SM}$ | peak source current | pulsed; $t_p$ ≤ 10 µs; $T_{mb}$ = 25 °C | | - | 73 | A |
| **Avalanche ruggedness** | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D$ = 18 A; $V_{sup}$ ≤ 55 V; $R_{GS}$ = 50 Ω; $V_{GS}$ = 5 V; $T_{j(init)}$ = 25 °C; unclamped | | - | 33 | mJ |
| $E_{DS(AL)R}$ | repetitive drain-source avalanche energy | Fig. 4 | [1][2][3][4] | | - | J |

[1] Maximum value not quoted. Repetitive rating defined in avalanche rating figure.
[2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
[3] Repetitive avalanche rating limited by an average junction temperature of 170 °C.
[4] Refer to application note AN10273 for further information.

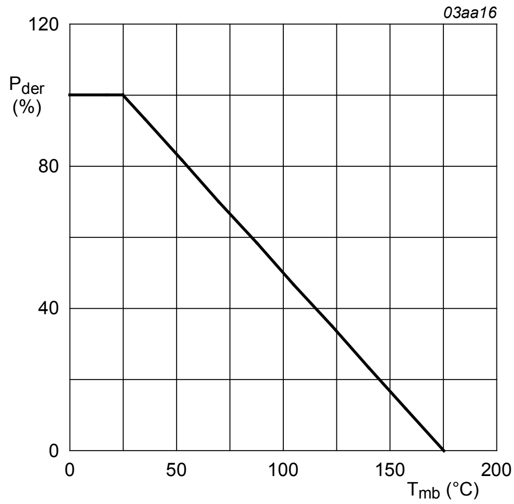



**Fig. 1. Normalized total power dissipation as a function of mounting base temperature**

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

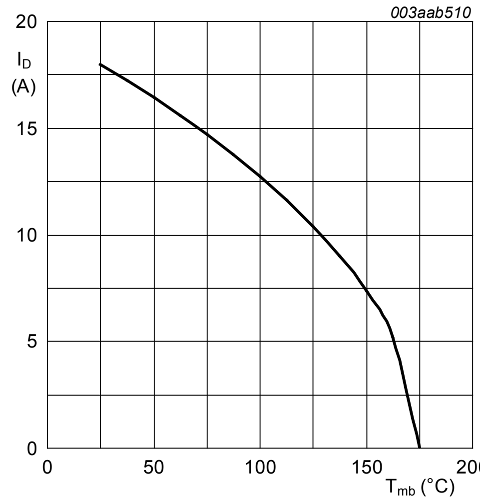



**Fig. 2. Continuous drain current as a function of mounting base temperature**

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

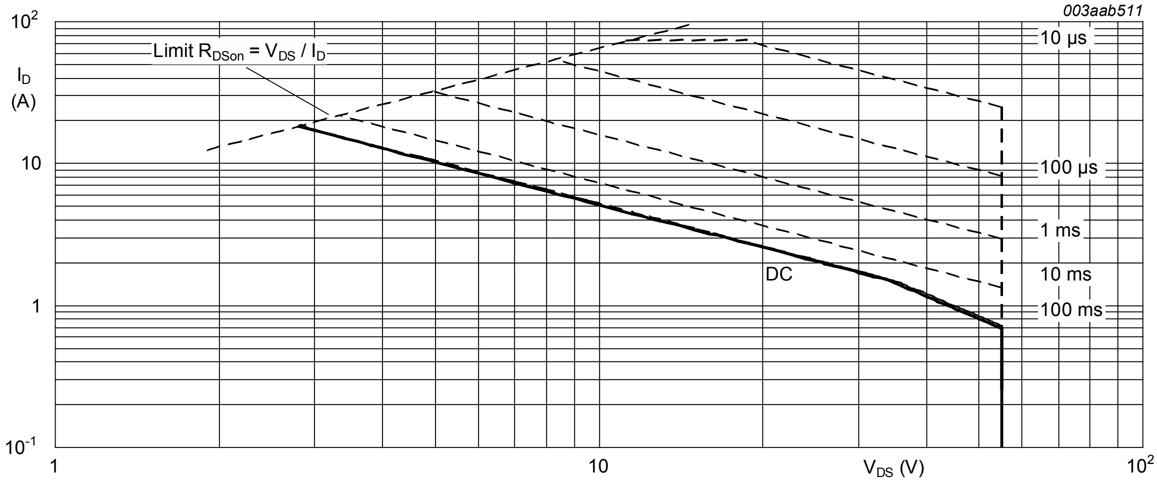



**Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage**

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

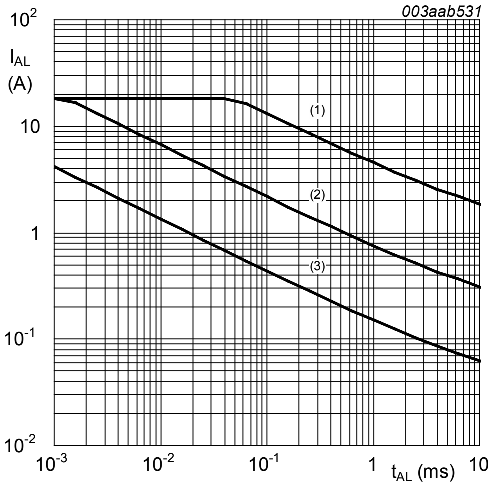



**Fig. 4. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time**

(1) Single-pulse; $T_j = 25\,°C$.
(2) Single-pulse; $T_j = 150\,°C$.
(3) Repetitive.

## 9. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | | | - | - | 2.93 | K/W |

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | Fig. 5 | | - | 71.4 | - | K/W |

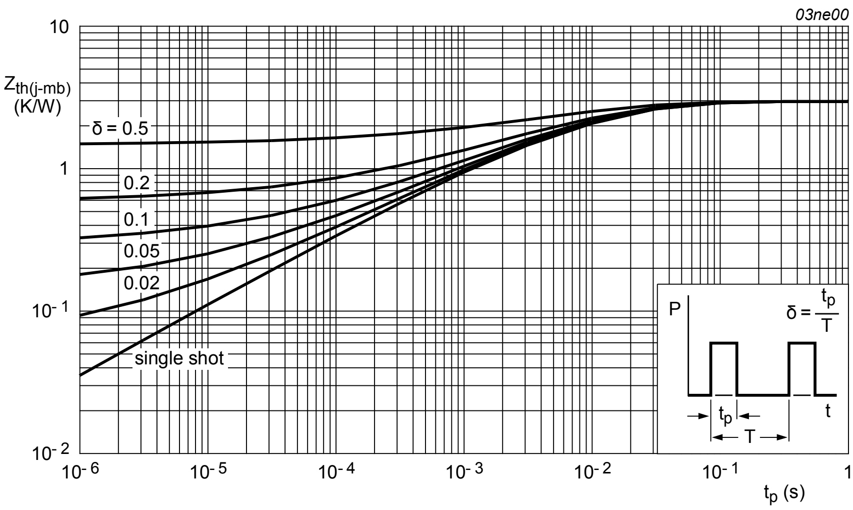



**Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration**

## 10. Characteristics

**Table 7. 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 | | 55 | - | - | V |
| | | $I_D$ = 0.25 mA; $V_{GS}$ = 0 V; $T_j$ = -55 °C | | 50 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = -55 °C; Fig. 12 | | - | - | 2.3 | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 25 °C; Fig. 12 | | 1 | 1.5 | 2 | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 175 °C; Fig. 12 | | 0.5 | - | - | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 55 V; $V_{GS}$ = 0 V; $T_j$ = 175 °C | | - | - | 500 | µA |
| | | $V_{DS}$ = 55 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | 0.05 | 10 | µA |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = 15 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | 2 | 100 | nA |
| | | $V_{GS}$ = -15 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | 2 | 100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 10 A; $T_j$ = 25 °C | | - | 59 | 69 | mΩ |
| | | $V_{GS}$ = 4.5 V; $I_D$ = 10 A; $T_j$ = 25 °C | | - | - | 86 | mΩ |
| | | $V_{GS}$ = 5 V; $I_D$ = 10 A; $T_j$ = 175 °C; Fig. 13 | | - | - | 154 | mΩ |

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{GS}$ = 5 V; $I_D$ = 10 A; $T_j$ = 25 °C; Fig. 13 | | - | 65 | 77 | mΩ |
| **Dynamic characteristics** | | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 10 A; $V_{DS}$ = 44 V; $V_{GS}$ = 5 V; Fig. 14 | | - | 11 | - | nC |
| $Q_{GS}$ | gate-source charge | | | - | 1.6 | - | nC |
| $Q_{GD}$ | gate-drain charge | | | - | 5 | - | nC |
| $C_{iss}$ | input capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 25 V; f = 1 MHz; $T_j$ = 25 °C; Fig. 15 | | - | 440 | 643 | pF |
| $C_{oss}$ | output capacitance | | | - | 90 | 110 | pF |
| $C_{rss}$ | reverse transfer capacitance | | | - | 60 | 93 | 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 | | - | 10 | - | ns |
| $t_r$ | rise time | | | - | 47 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | | - | 28 | - | ns |
| $t_f$ | fall time | | | - | 33 | - | ns |
| $L_D$ | internal drain inductance | meausured from drain lead from package to centre of die; $T_j$ = 25 °C | | - | 2.5 | - | nH |
| $L_S$ | internal source inductance | measured from source lead from package to source bond pad; $T_j$ = 25 °C | | - | 7.5 | - | nH |
| **Source-drain diode** | | | | | | | |
| $V_{SD}$ | source-drain voltage | $I_S$ = 15 A; $V_{GS}$ = 0 V; $T_j$ = 25 °C; Fig. 16 | | - | 0.85 | 1.2 | V |
| $t_{rr}$ | reverse recovery time | $I_S$ = 20 A; $dI_S/dt$ = -100 A/µs; $V_{GS}$ = -10 V; $V_{DS}$ = 30 V; $T_j$ = 25 °C | | - | 33 | - | ns |
| $Q_r$ | recovered charge | | | - | 60 | - | nC |

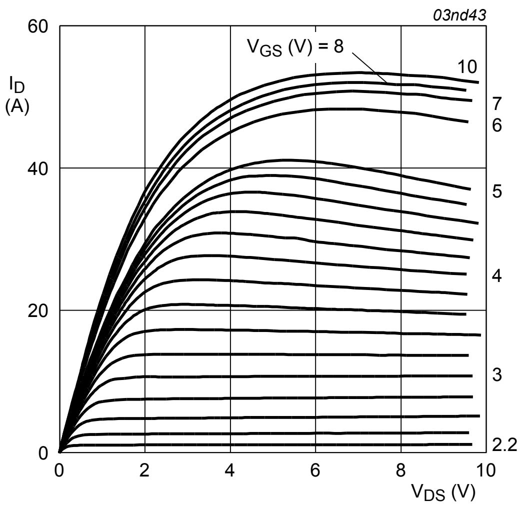



**Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values**

$T_j = 25°C; t_p = 300\mu s$

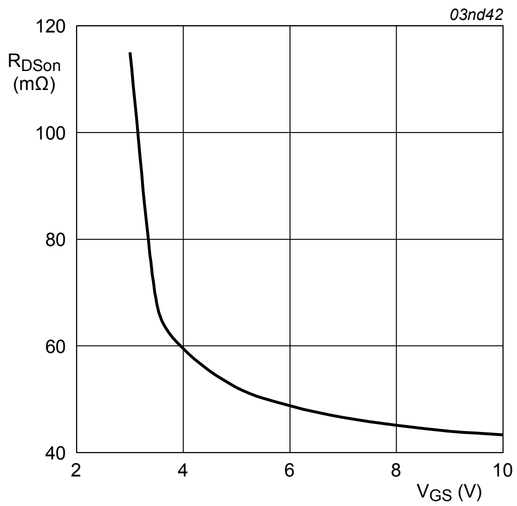



**Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values**

$T_j = 25°C; I_D = 10A$

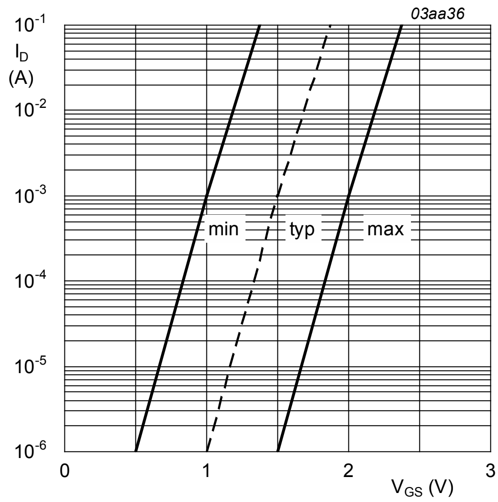



**Fig. 8. Sub-threshold drain current as a function of gate-source voltage**

$T_j = 25\,°C; V_{DS} = V_{GS}$

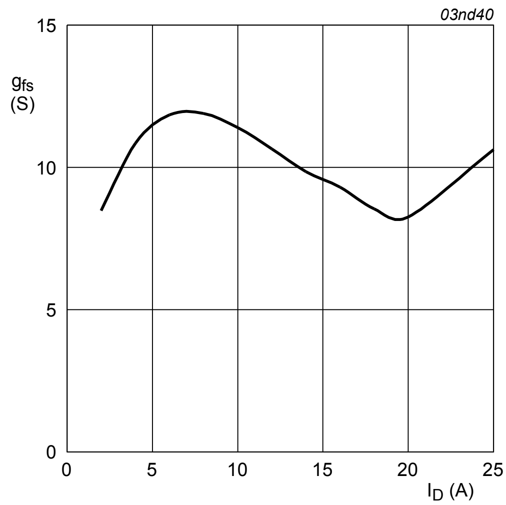



**Fig. 9. Forward transconductance as a function of drain current; typical values**

$T_j = 25°C; V_{DS} = 25V$

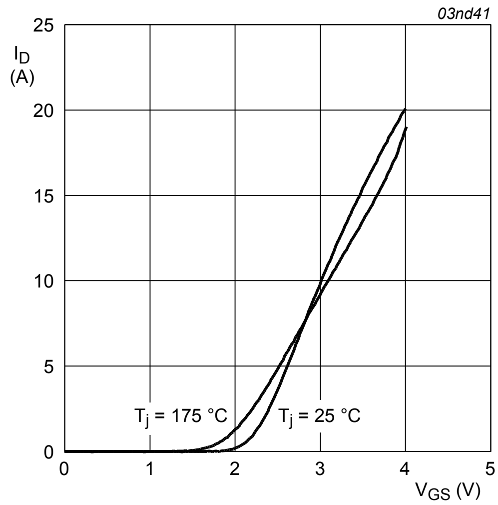



**Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values**

$V_{DS} = 25V$

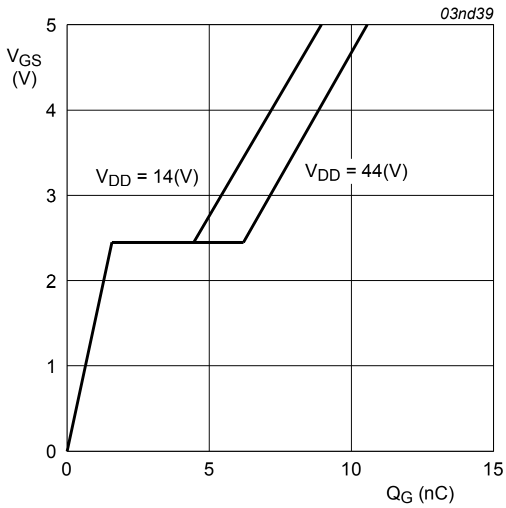



**Fig. 11. Gate-source voltage as a function of turn-on gate charge; typical values**

$T_j = 25°C; I_D = 10A$

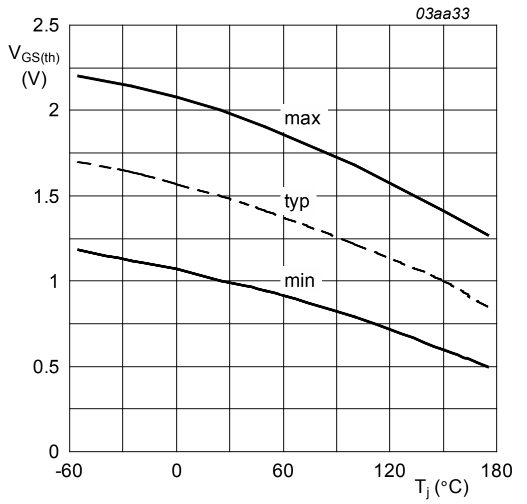



**Fig. 12. Gate-source threshold voltage as a function of junction temperature**

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

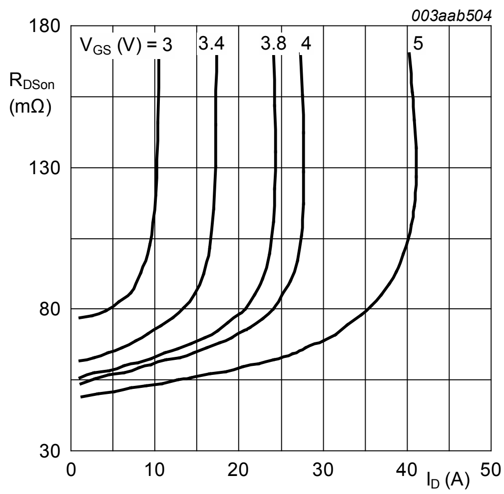



**Fig. 13. Drain-source on-state resistance as a function of drain current; typical values**

$$T_j = 25 °C$$

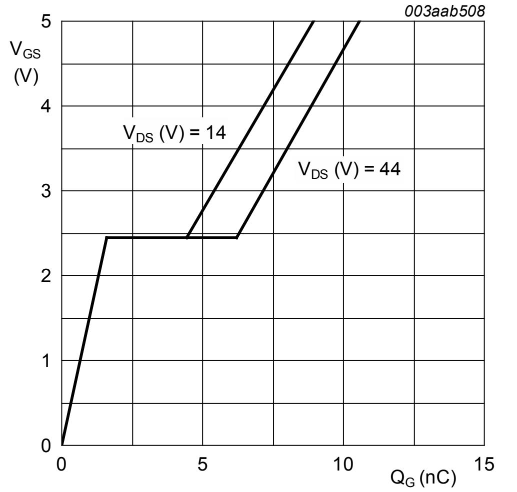



**Fig. 14. Gate-source voltage as a function of gate charge; typical values**

$$T_j = 25 °C; I_D = 10A$$

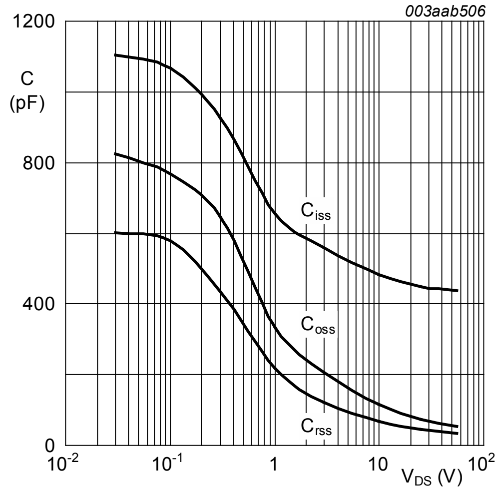



**Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**

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

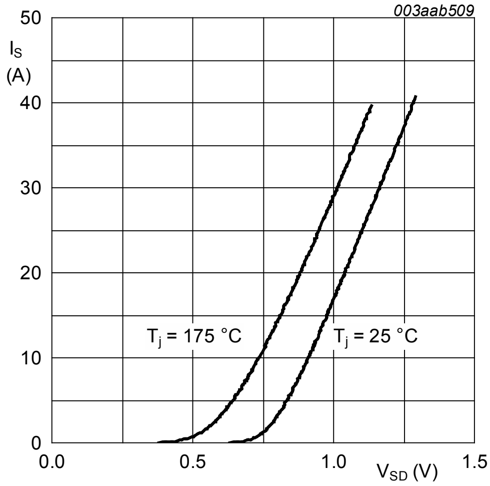
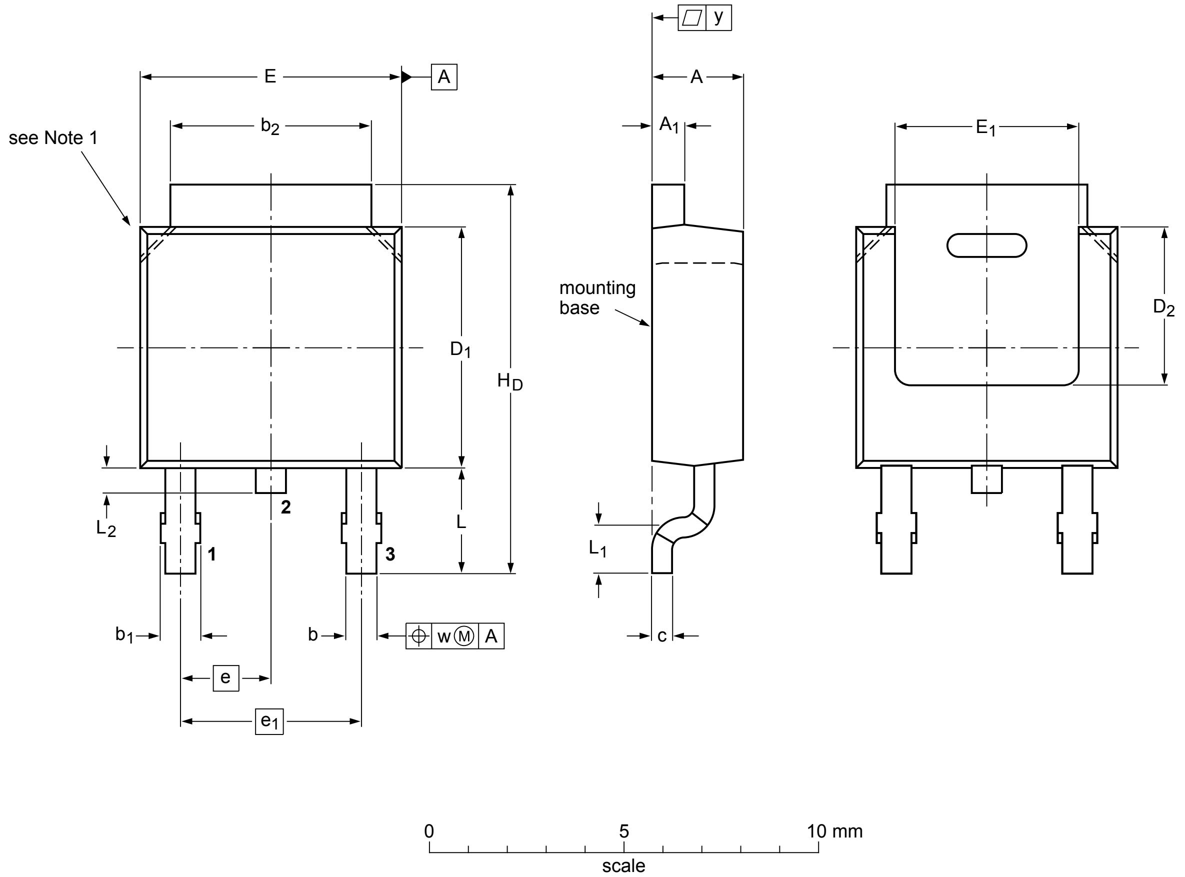



**Fig. 16. Source current as a function of source-drain voltage; typical values**

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

# 11. Package outline

**Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)** | **SOT428**




Dimensions (mm are the original dimensions)

| Unit | | A | $A_1$ | b | $b_1$ | $b_2$ | c | $D_1$ | $D_2$ | E | $E_1$ | e | $e_1$ | $H_D$ | L | $L_1$ | $L_2$ | w | y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 2.38 | 0.93 | 0.89 | 1.1 | 5.46 | 0.56 | 6.22 | | 6.73 | | | | 10.4 | 2.95 | | 0.9 | | 0.2 |
| | nom | | | | | | | | | | | 2.285 | 4.57 | | | | | 0.2 | |
| | min | 2.22 | 0.46 | 0.71 | 0.9 | 5.00 | 0.20 | 5.98 | 4.0 | 6.47 | 4.45 | | | 9.6 | 2.55 | 0.5 | 0.5 | | |

Note
1. Plastic body may have 45° chamfer.

*sot428_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT428 | | TO-252 | SC-63 | | | ~~06-03-16~~<br>14-06-10 |

**Fig. 17. Package outline DPAK (SOT428)**

# 12. Legal information

## 12.1 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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