# THE DATASHEET OF

# BUK6213-30A,118


# BUK6213-30A

## N-channel TrenchMOS intermediate level FET

Rev. 03 — 2 February 2011 Product data sheet

## 1. Product profile

### 1.1 General description

Intermediate 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
- Suitable for logic or standard level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

### 1.3 Applications

- 12 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 | $T_j \geq 25$ °C; $T_j \leq 175$ °C | | - | - | 30 | V |
| $I_D$ | drain current | $V_{GS}$ = 10 V; $T_{mb}$ = 25 °C; see Figure 1; see Figure 3 | [1] | - | - | 55 | A |
| $P_{tot}$ | total power dissipation | $T_{mb}$ = 25 °C; see Figure 2 | | - | - | 102 | W |
| **Static characteristics** | | | | | | | |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 10 A; $T_j$ = 25 °C; see Figure 4; see Figure 5 | | - | 10 | 13 | mΩ |
| **Avalanche ruggedness** | | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D$ = 55 A; $V_{sup} \leq 30$ V; $R_{GS}$ = 50 Ω; $V_{GS}$ = 10 V; $T_{j(init)}$ = 25 °C; unclamped | | - | - | 267 | mJ |
| **Dynamic characteristics** | | | | | | | |
| $Q_{GD}$ | gate-drain charge | $V_{GS}$ = 5 V; $I_D$ = 25 A; $V_{DS}$ = 24 V | | - | 14 | - | nC |

[1] Continuous current is limited by bondwires.

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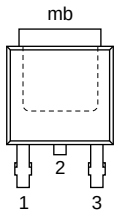
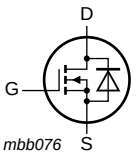
## 2. Pinning information

**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 | | |
|---|---|---|---|
| | Name | Description | Version |
| BUK6213-30A | 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 | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j \geq 25$ °C; $T_j \leq 175$ °C | | - | 30 | V |
| $V_{DGR}$ | drain-gate voltage | $R_{GS}$ = 20 kΩ | | - | 30 | V |
| $V_{GS}$ | gate-source voltage | | | -20 | 20 | V |
| $I_D$ | drain current | $T_{mb}$ = 100 °C; $V_{GS}$ = 10 V; see Figure 1 | [1] | - | 45 | A |
| | | $T_{mb}$ = 25 °C; $V_{GS}$ = 10 V; see Figure 1; see Figure 3 | [2] | - | 55 | A |
| | | | [1] | - | 64 | A |
| $I_{DM}$ | peak drain current | $T_{mb}$ = 25 °C; pulsed; $t_p \leq 10$ µs; see Figure 3 | | - | 257 | A |
| $P_{tot}$ | total power dissipation | $T_{mb}$ = 25 °C; see Figure 2 | | - | 102 | 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 | [1] | - | 64 | A |
| | | | [2] | - | 55 | A |
| $I_{SM}$ | peak source current | pulsed; $t_p \leq 10$ µs; $T_{mb}$ = 25 °C | | - | 257 | A |
| **Avalanche ruggedness** | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D$ = 55 A; $V_{sup} \leq 30$ V; $R_{GS}$ = 50 Ω; $V_{GS}$ = 10 V; $T_{j(init)}$ = 25 °C; unclamped | | - | 267 | mJ |

[1] Current is limited by power dissipation chip rating.

[2] Continuous current is limited by bondwires.

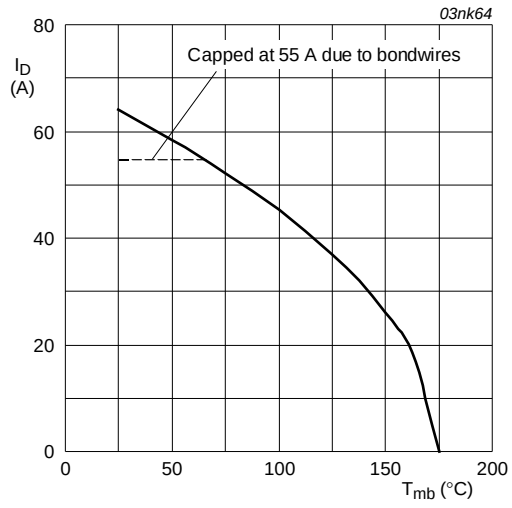
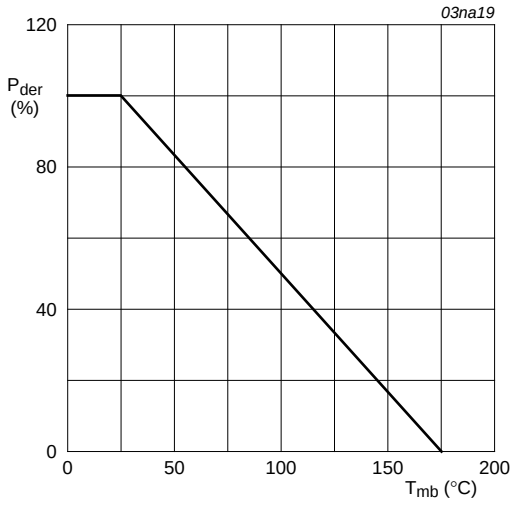
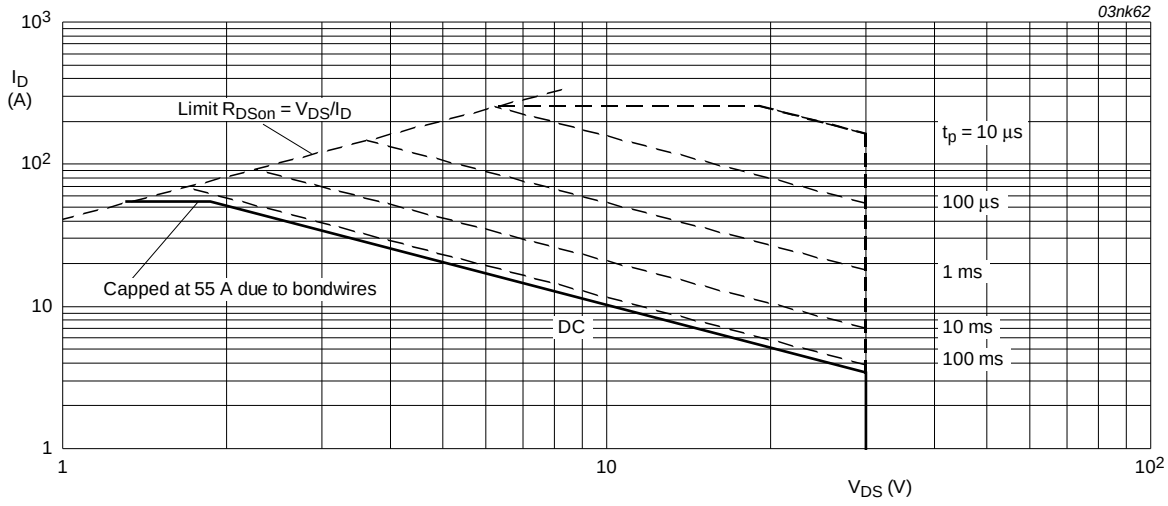



**Fig 1. Continuous drain current as a function of mounting base temperature.**




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

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




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

**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 |
|---|---|---|---|---|---|---|
| $R_{th(j\text{-}mb)}$ | thermal resistance from junction to mounting base | | - | - | 1.4 | K/W |
| $R_{th(j\text{-}a)}$ | thermal resistance from junction to ambient | | - | 71.4 | - | K/W |

## 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 | 30 | - | - | V |
| | | $I_D$ = 0.25 mA; $V_{GS}$ = 0 V; $T_j$ = -55 °C | 27 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 25 °C | 1 | 1.8 | 3 | V |
| $V_{GSth}$ | gate-source threshold voltage | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = -55 °C | - | - | 3.5 | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 175 °C | 0.5 | - | - | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 30 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | - | 0.05 | 10 | µA |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = 20 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | - | 2 | 100 | nA |
| | | $V_{GS}$ = -20 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | - | 2 | 100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 4.5 V; $I_D$ = 10 A | - | 15 | 20 | mΩ |
| | | $V_{GS}$ = 10 V; $I_D$ = 10 A; $T_j$ = 175 °C | - | - | 25 | mΩ |
| | | $V_{GS}$ = 10 V; $I_D$ = 10 A; $T_j$ = 25 °C; see Figure 4; see Figure 5 | - | 10 | 13 | mΩ |

**Table 6. Characteristics** *...continued*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 30 V; $V_{GS}$ = 0 V; $T_j$ = 175 °C; see Figure 4; see Figure 5 | - | - | 500 | µA |
| **Dynamic characteristics** | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 25 A; $V_{DS}$ = 24 V; $V_{GS}$ = 10 V | - | 44 | - | nC |
| | | $I_D$ = 25 A; $V_{DS}$ = 24 V; $V_{GS}$ = 5 V | - | 26 | - | nC |
| $Q_{GS}$ | gate-source charge | | - | 7 | - | nC |
| $Q_{GD}$ | gate-drain charge | | - | 14 | - | nC |
| $C_{iss}$ | input capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 25 V; f = 1 MHz; $T_j$ = 25 °C | - | 1490 | 1986 | pF |
| $C_{oss}$ | output capacitance | | - | 505 | 606 | pF |
| $C_{rss}$ | reverse transfer capacitance | | - | 325 | 445 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 25 V; $R_L$ = 1.2 Ω; $V_{GS}$ = 10 V; $R_{G(ext)}$ = 10 Ω | - | 12 | - | ns |
| $t_r$ | rise time | | - | 95 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 75 | - | ns |
| $t_f$ | fall time | | - | 105 | - | ns |
| $L_D$ | internal drain inductance | measured from drain to center 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 | $I_S$ = 15 A; $V_{GS}$ = 0 V; $T_j$ = 25 °C | - | 0.85 | 1.2 | V |
| $t_{rr}$ | reverse recovery time | $I_S$ = 20 A; $dI_S/dt$ = -100 A/µs; $V_{GS}$ = -10 V; $V_{DS}$ = 25 V | - | 49 | - | ns |
| $Q_r$ | recovered charge | | - | 27 | - | nC |

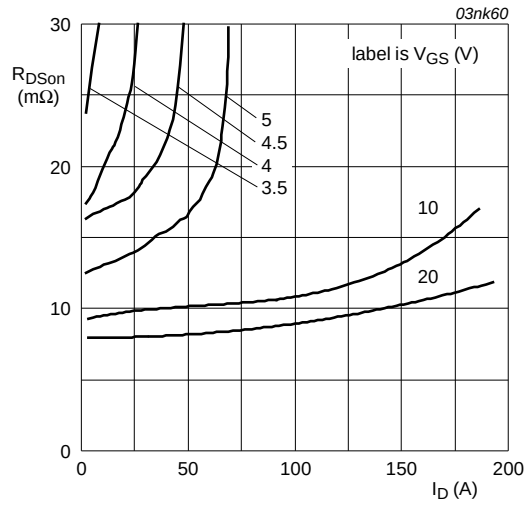
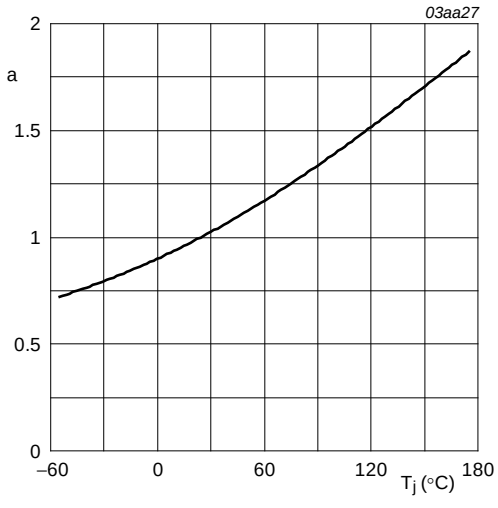



**Fig 4. Drain-source on-state resistance as a function of drain current; typical values.**

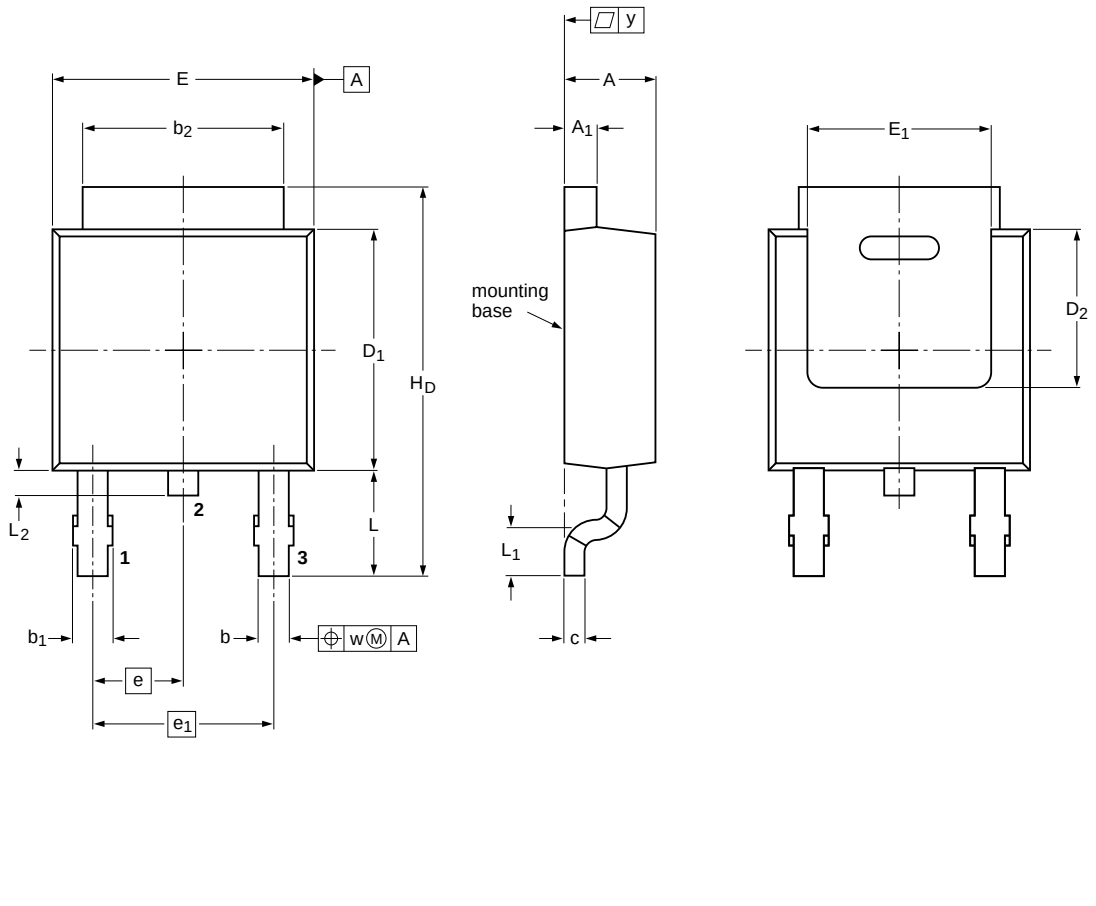



$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

**Fig 5. Normalized drain-source on-state resistance factor as a function of junction temperature**

# 7. 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 | $D_1$ | $D_2$ min | E | $E_1$ min | e | $e_1$ | $H_D$ | L | $L_1$ min | $L_2$ | w | y max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2.38<br>2.22 | 0.93<br>0.46 | 0.89<br>0.71 | 1.1<br>0.9 | 5.46<br>5.00 | 0.56<br>0.20 | 6.22<br>5.98 | 4.0 | 6.73<br>6.47 | 4.45 | 2.285 | 4.57 | 10.4<br>9.6 | 2.95<br>2.55 | 0.5 | 0.9<br>0.5 | 0.2 | 0.2 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT428 | | TO-252 | SC-63 | | | ~~06-02-14~~<br>06-03-16 |

**Fig 6. Package outline SOT428 (DPAK)**

# 8. Revision history

**Table 7. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BUK6213-30A v.3 | 20110202 | Product data sheet | - | BUK6213-30A v.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>• Various changes to content. | | | |
| BUK6213-30A v.2 (9397 750 12028) | 20030922 | Product data sheet | - | - |

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| 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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