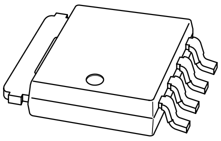


# BUK9Y11-30B

## N-channel TrenchMOS logic level FET

**Rev. 01 — 30 August 2007** **Product data sheet**

## 1. Product profile

### 1.1 General description

N-channel enhancement mode power Field-Effect Transistor (FET) in a plastic package using NXP High-Performance Automotive (HPA) TrenchMOS technology.

### 1.2 Features

- Very low on-state resistance
- 175 °C rated
- Q101 compliant
- Logic level compatible

### 1.3 Applications

- Automotive systems
- Motors, lamps and solenoids
- General purpose power switching
- 12 V loads

### 1.4 Quick reference data

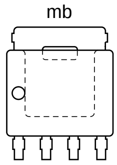
- $E_{DS(AL)S} \leq 112$ mJ
- $I_D \leq 59$ A
- $R_{DSon} = 9.3$ mΩ (typ)
- $P_{tot} \leq 75$ W

## 2. Pinning information

**Table 1. Pinning**

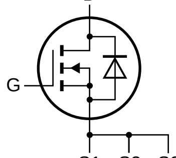
| Pin | Description |
|---|---|
| 1, 2, 3 | source (S) |
| 4 | gate (G) |
| mb | mounting base; connected to drain (D) |

**Simplified outline**




**SOT669 (LFPAK)**

**Symbol**




founded by Philips

## 3. Ordering information

**Table 2. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BUK9Y11-30B | LFPAK | plastic single-ended surface-mounted package (LFPAK); 4 leads | SOT669 |

## 4. Limiting values

**Table 3. Limiting values**

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | | - | 30 | V |
| $V_{DGR}$ | drain-gate voltage (DC) | $R_{GS}$ = 20 kΩ | - | 30 | V |
| $V_{GS}$ | gate-source voltage | | - | ±15 | V |
| $I_D$ | drain current | $T_{mb}$ = 25 °C; $V_{GS}$ = 5 V; see Figure 2 and 3 | - | 59 | A |
| | | $T_{mb}$ = 100 °C; $V_{GS}$ = 5 V; see Figure 2 | - | 42 | A |
| $I_{DM}$ | peak drain current | $T_{mb}$ = 25 °C; pulsed; $t_p$ ≤ 10 µs; see Figure 3 | - | 239 | A |
| $P_{tot}$ | total power dissipation | $T_{mb}$ = 25 °C; see Figure 1 | - | 75 | W |
| $T_{stg}$ | storage temperature | | –55 | +175 | °C |
| $T_j$ | junction temperature | | –55 | +175 | °C |
| **Source-drain diode** | | | | | |
| $I_{DR}$ | reverse drain current | $T_{mb}$ = 25 °C | - | 59 | A |
| $I_{DRM}$ | peak reverse drain current | $T_{mb}$ = 25 °C; pulsed; $t_p$ ≤ 10 µs | - | 239 | A |
| **Avalanche ruggedness** | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | unclamped inductive load; $I_D$ = 59 A; $V_{DS}$ ≤ 30 V; $V_{GS}$ = 5 V; $R_{GS}$ = 50 Ω; starting at $T_j$ = 25 °C | - | 112 | mJ |
| $E_{DS(AL)R}$ | repetitive drain-source avalanche energy | | - | [1] | - |

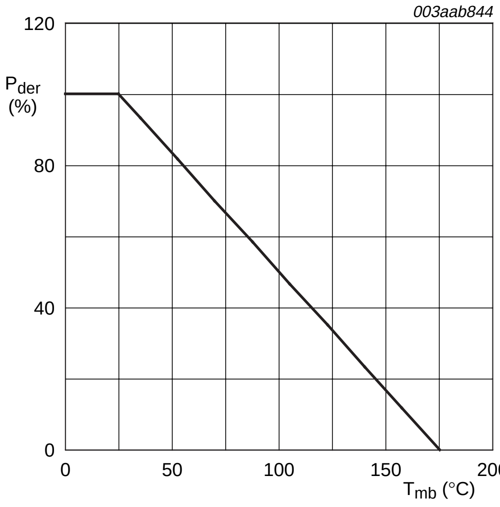
[1] Conditions:

a) Maximum value not quoted. Repetitive rating defined in Figure 16.

b) Single-pulse avalanche rating limited by $T_{j(max)}$ of 175 °C.

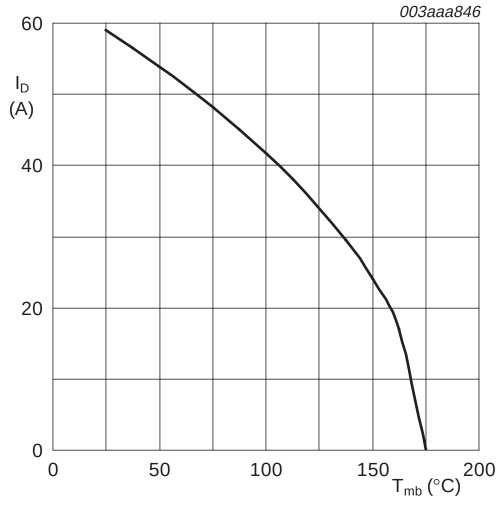
c) Repetitive avalanche rating limited by an average junction temperature of 170 °C.

d) Refer to application note *AN10273* for further information.



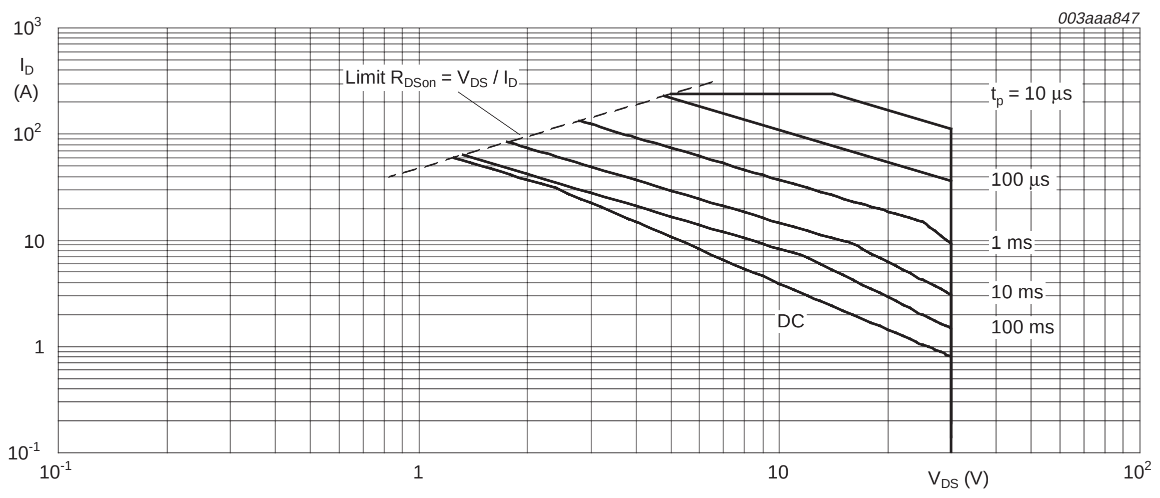

$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\ \%$$

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




$V_{GS} \geq 5$ V

**Fig 2. Continuous drain current 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 4: Thermal characteristics**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | - | - | - | 2 | K/W |

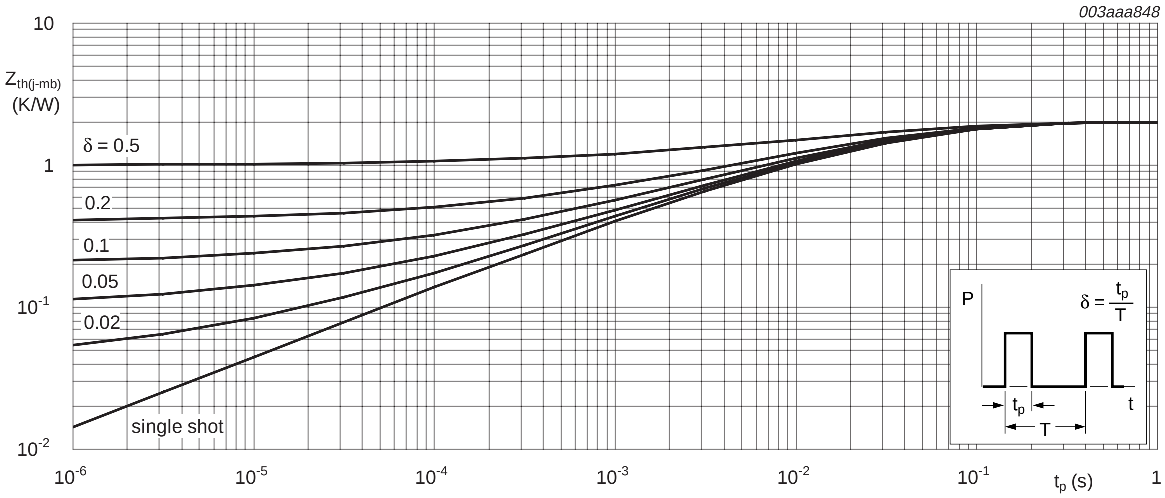


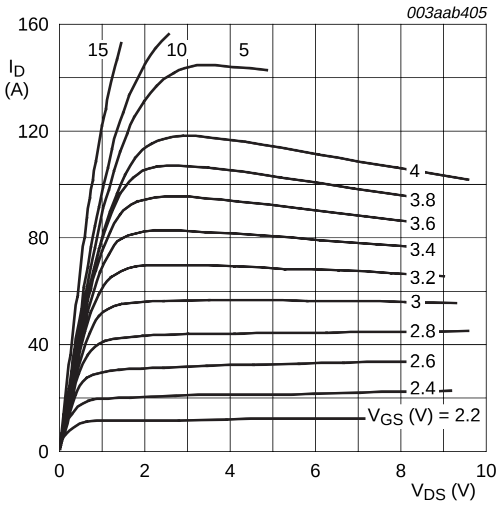

**Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration**

## 6. Characteristics

**Table 5: Characteristics**

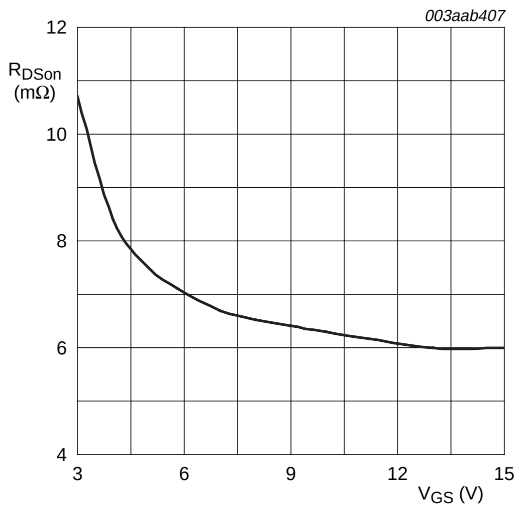
*$T_j$ = 25 °C unless otherwise specified.*

| 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 |
| | | $T_j$ = –55 °C | 27 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; see Figure 9 and 10 | | | | |
| | | $T_j$ = 25 °C | 1.1 | 1.5 | 2 | V |
| | | $T_j$ = 175 °C | 0.5 | - | - | V |
| | | $T_j$ = –55 °C | - | - | 2.3 | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 30 V; $V_{GS}$ = 0 V | | | | |
| | | $T_j$ = 25 °C | - | 0.02 | 1 | µA |
| | | $T_j$ = 175 °C | - | - | 500 | µA |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = ±15 V; $V_{DS}$ = 0 V | - | 2 | 100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 5 V; $I_D$ = 25 A; see Figure 6 and 8 | | | | |
| | | $T_j$ = 25 °C | - | 9.3 | 11 | mΩ |
| | | $T_j$ = 175 °C | - | - | 21 | mΩ |
| | | $V_{GS}$ = 4.5 V; $I_D$ = 25 A | - | - | 12 | mΩ |
| | | $V_{GS}$ = 10 V; $I_D$ = 25 A | - | 8.1 | 9 | mΩ |
| **Dynamic characteristics** | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 25 A; $V_{DS}$ = 24 V; $V_{GS}$ = 5 V; see Figure 14 | - | 16.5 | - | nC |
| $Q_{GS}$ | gate-source charge | | - | 3.3 | - | nC |
| $Q_{GD}$ | gate-drain charge | | - | 5.4 | - | nC |
| $C_{iss}$ | input capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 25 V; f = 1 MHz; see Figure 12 | - | 1211 | 1614 | pF |
| $C_{oss}$ | output capacitance | | - | 341 | 409 | pF |
| $C_{rss}$ | reverse transfer capacitance | | - | 160 | 220 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 25 V; $R_L$ = 2.5 Ω; $V_{GS}$ = 5 V; $R_G$ = 10 Ω | - | 14 | - | ns |
| $t_r$ | rise time | | - | 33 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 62 | - | ns |
| $t_f$ | fall time | | - | 42 | - | ns |
| **Source-drain diode** | | | | | | |
| $V_{SD}$ | source-drain voltage | $I_S$ = 25 A; $V_{GS}$ = 0 V; see Figure 15 | - | 0.85 | 1.2 | V |
| $t_{rr}$ | reverse recovery time | $I_S$ = 20 A; $dI_S/dt$ = –100 A/µs; $V_{GS}$ = 0 V; $V_R$ = 30 V | - | 47 | - | ns |
| $Q_r$ | recovered charge | | - | 20 | - | nC |



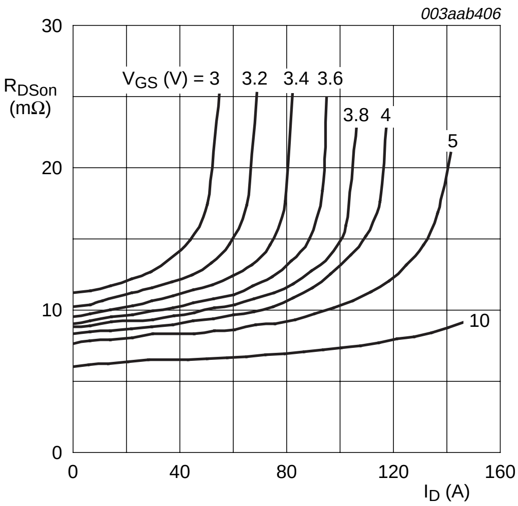

$T_j$ = 25 °C

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



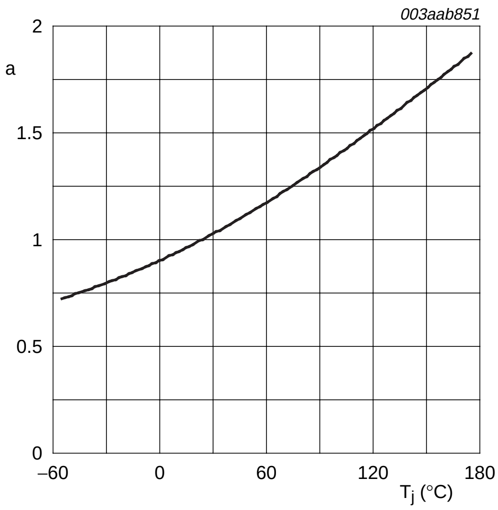

$T_j$ = 25 °C; $I_D$ = 25 A

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



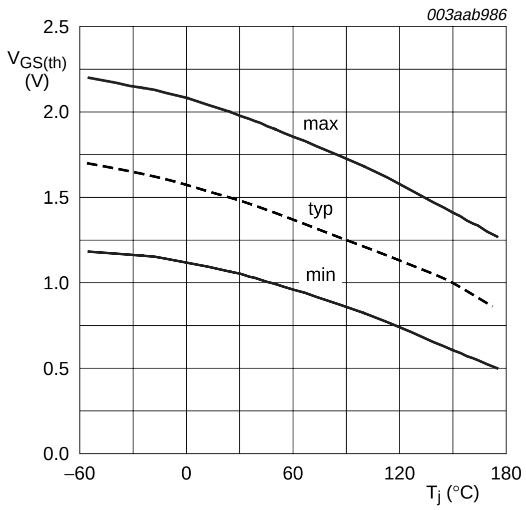

$T_j$ = 25 °C

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



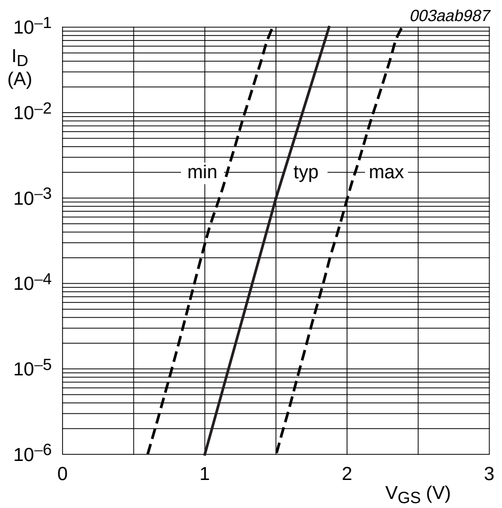

$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

**Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature**



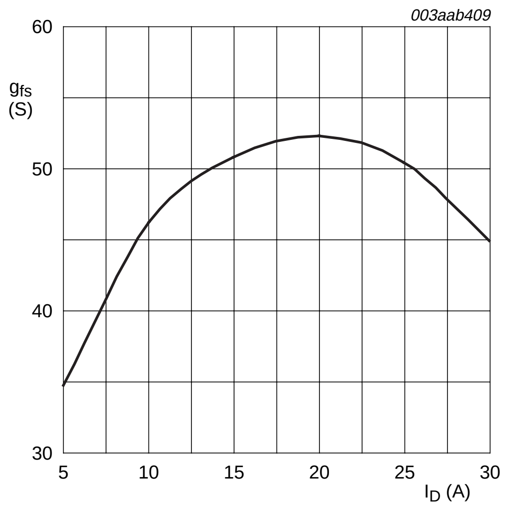

$I_D$ = 1 mA; $V_{DS} = V_{GS}$

**Fig 9. Gate-source threshold voltage as a function of junction temperature**



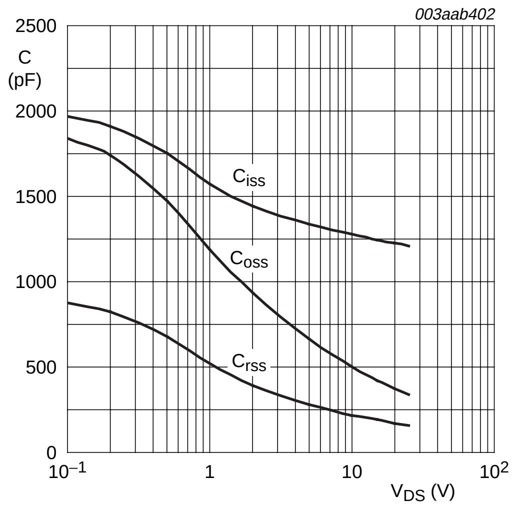

$T_j$ = 25 °C; $V_{DS} = V_{GS}$

**Fig 10. Sub-threshold drain current as a function of gate-source voltage**



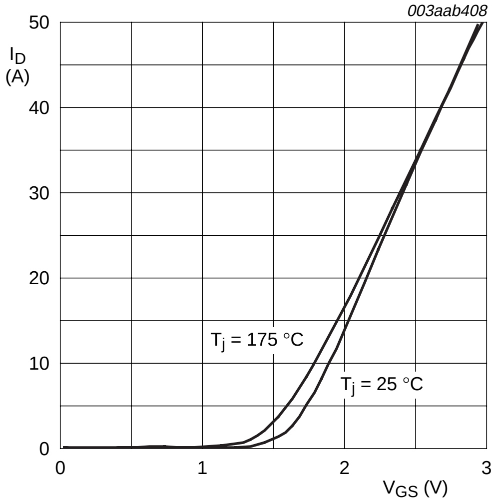

$T_j$ = 25 °C; $V_{DS}$ = 25 V

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



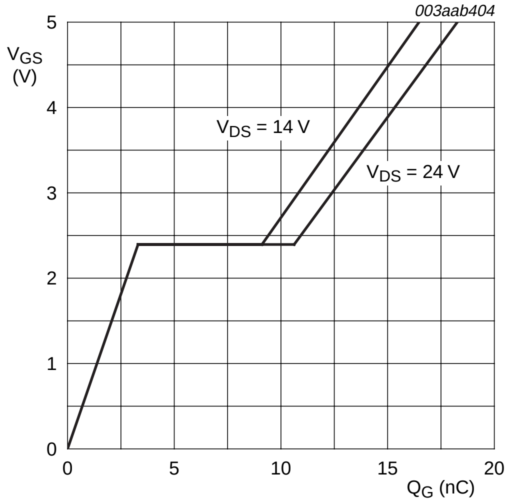

$V_{GS}$ = 0 V; f = 1 MHz

**Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



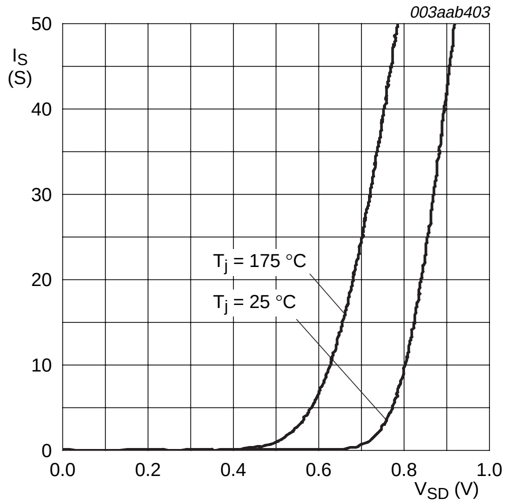

$V_{DS}$ = 25 V

**Fig 13. Transfer characteristics: drain current as a function of gate-source voltage; typical values**



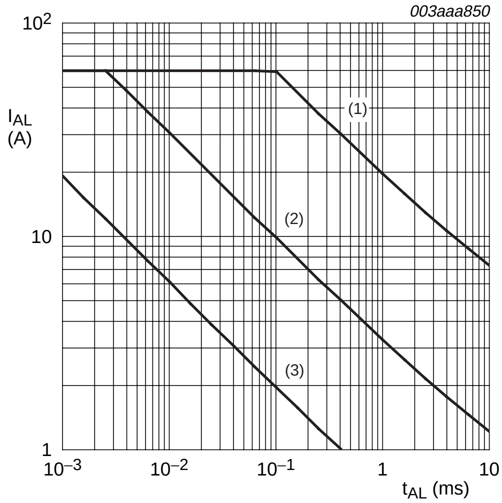

$T_j$ = 25 °C; $I_D$ = 25 A

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




$V_{GS}$ = 0 V

**Fig 15. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values**




See Table note 1 of Table 3 Limiting values.

(1) Single-pulse; $T_j$ = 25 °C.

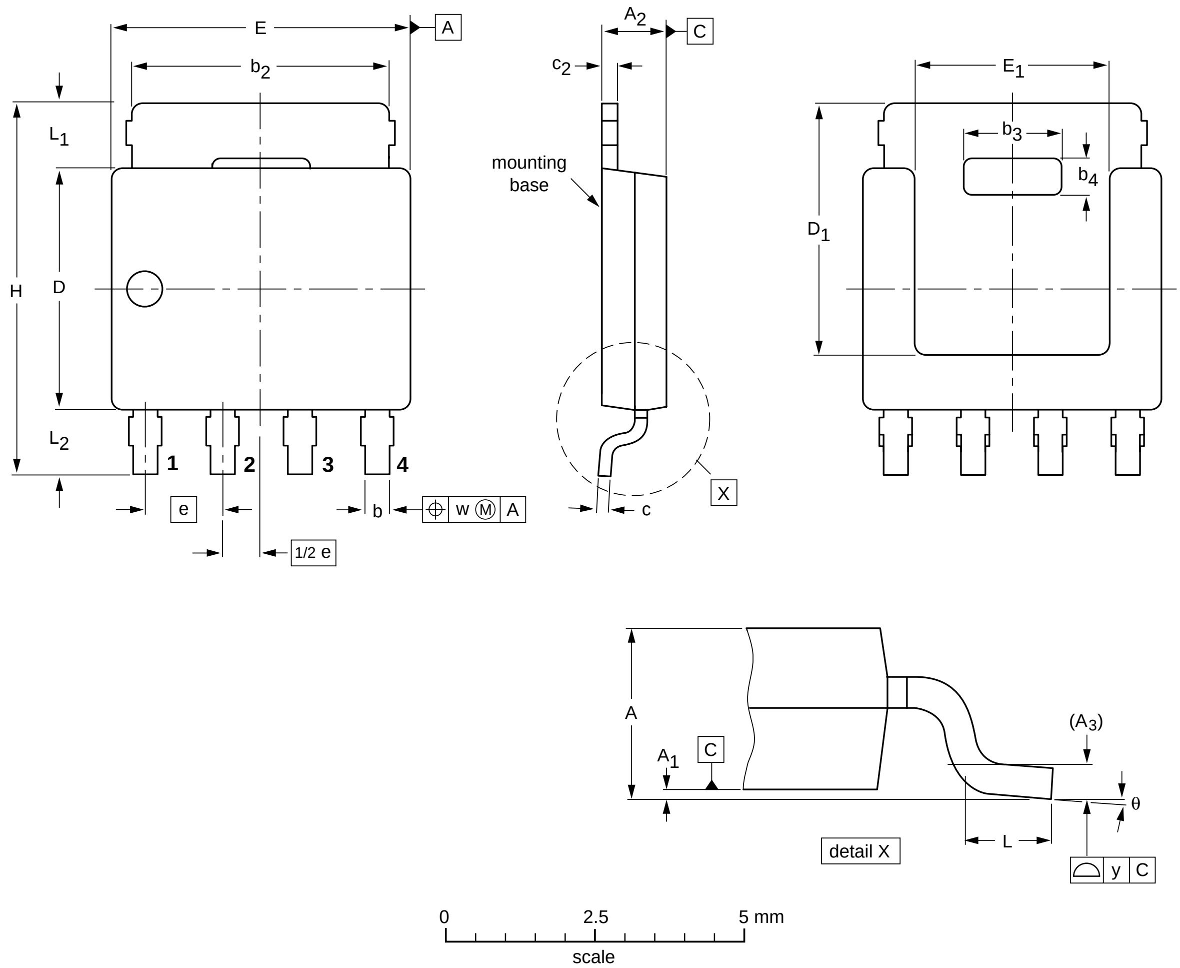
(2) Single-pulse; $T_j$ = 150 °C.

(3) Repetitive.

**Fig 16. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time**

# 7. Package outline

**Plastic single-ended surface-mounted package (LFPAK); 4 leads** **SOT669**




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

| UNIT | A | $A_1$ | $A_2$ | $A_3$ | b | $b_2$ | $b_3$ | $b_4$ | c | $c_2$ | D(1) | $D_1$(1) max | E(1) | $E_1$(1) | e | H | L | $L_1$ | $L_2$ | w | y | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.20<br>1.01 | 0.15<br>0.00 | 1.10<br>0.95 | 0.25 | 0.50<br>0.35 | 4.41<br>3.62 | 2.2<br>2.0 | 0.9<br>0.7 | 0.25<br>0.19 | 0.30<br>0.24 | 4.10<br>3.80 | 4.20 | 5.0<br>4.8 | 3.3<br>3.1 | 1.27 | 6.2<br>5.8 | 0.85<br>0.40 | 1.3<br>0.8 | 1.3<br>0.8 | 0.25 | 0.1 | 8°<br>0° |

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

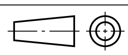
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT669 | | MO-235 | | |  | ~~04-10-13~~<br>06-03-16 |

**Fig 17. Package outline SOT669 (LFPAK)**

## 8. Revision history

**Table 6. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BUK9Y11-30B_1 | 20070830 | Product data sheet | - | - |

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

## 11. Contents





**Date of release: 30 August 2007**

**Document identifier: BUK9Y11-30B_1**