
# BUK9Y12-55B

## N-channel TrenchMOS logic level FET

**Rev. 04 — 7 April 2010** **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

- Low conduction losses due to low on-state resistance
- Q101 compliant
- Suitable for logic level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

### 1.3 Applications

- 12 V and 24 V loads
- Advanced braking systems (ABS)
- Automotive systems
- General purpose power switching
- Motors, lamps and solenoids

### 1.4 Quick reference data

**Table 1. Quick reference data**

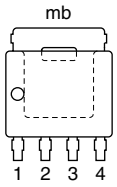
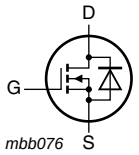
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j \geq 25$ °C; $T_j \leq 175$ °C | - | - | 55 | V |
| $I_D$ | drain current | $V_{GS}$ = 5 V; $T_{mb}$ = 25 °C; see Figure 1; see Figure 4 | - | - | 61.8 | A |
| $P_{tot}$ | total power dissipation | $T_{mb}$ = 25 °C; see Figure 2 | - | - | 106 | W |
| **Static characteristics** | | | | | | |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 20 A; $T_j$ = 25 °C | - | 8.1 | 11 | mΩ |
| | | $V_{GS}$ = 5 V; $I_D$ = 20 A; $T_j$ = 25 °C; see Figure 12; see Figure 13 | - | 9.1 | 12 | mΩ |

**Table 1. Quick reference data** *...continued*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Avalanche ruggedness** | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D$ = 61.8 A; $V_{sup} \leq$ 55 V; $R_{GS}$ = 50 Ω; $V_{GS}$ = 5 V; $T_{j(init)}$ = 25 °C; unclamped | - | - | 129 | mJ |
| **Dynamic characteristics** | | | | | | |
| $Q_{GD}$ | gate-drain charge | $V_{GS}$ = 5 V; $I_D$ = 20 A; $V_{DS}$ = 44 V; $T_j$ = 25 °C; see Figure 14 | - | 13 | - | nC |

## 2. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | S | source |   SOT669 (LFPAK) |   |
| 2 | S | source | | |
| 3 | S | source | | |
| 4 | G | gate | | |
| mb | D | mounting base; connected to drain | | |

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BUK9Y12-55B | LFPAK | plastic single-ended surface-mounted package (LFPAK); 4 leads | SOT669 |

# 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 | $T_j \geq 25$ °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 |
| $I_D$ | drain current | $T_{mb} = 25$ °C; $V_{GS} = 5$ V; see Figure 1; see Figure 4 | | - | - | 61.8 | A |
| | | $T_{mb} = 100$ °C; $V_{GS} = 5$ V; see Figure 1 | | - | - | 43.8 | A |
| $I_{DM}$ | peak drain current | $T_{mb} = 25$ °C; $t_p \leq 10$ µs; pulsed; see Figure 4 | | - | - | 247 | A |
| $P_{tot}$ | total power dissipation | $T_{mb} = 25$ °C; see Figure 2 | | - | - | 106 | 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 | | - | - | 61.8 | A |
| $I_{SM}$ | peak source current | $t_p \leq 10$ µs; pulsed; $T_{mb} = 25$ °C | | - | - | 247 | A |
| **Avalanche ruggedness** | | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 61.8$ A; $V_{sup} \leq 55$ V; $R_{GS} = 50$ Ω; $V_{GS} = 5$ V; $T_{j(init)} = 25$ °C; unclamped | | - | - | 129 | mJ |
| $E_{DS(AL)R}$ | repetitive drain-source avalanche energy | see Figure 3 | [1][2][3] | - | - | - | J |

[1] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

[2] Repetitive avalanche rating limited by average junction temperature of 170 °C.

[3] Refer to application note AN10273 for further information.

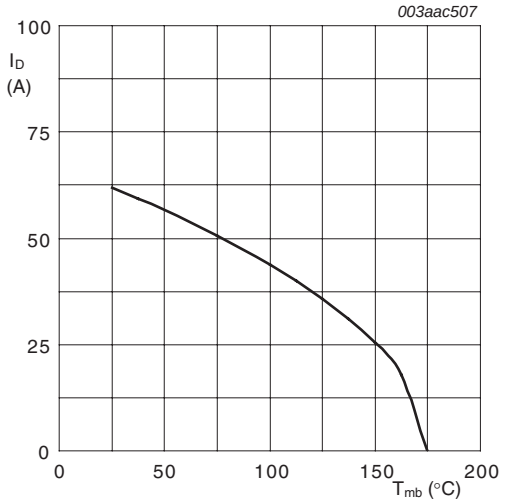
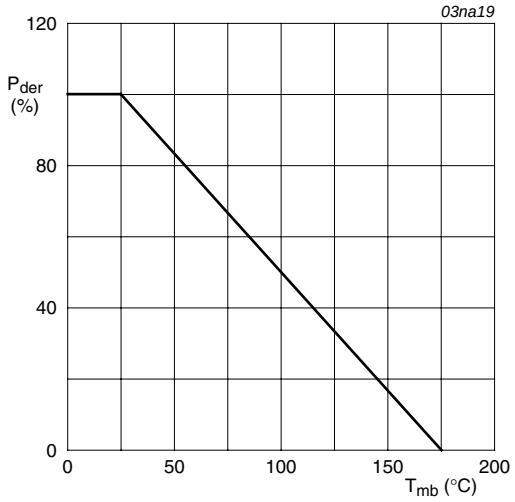



**Fig 1. Continuous drain current as a function of mounting base temperature**




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

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

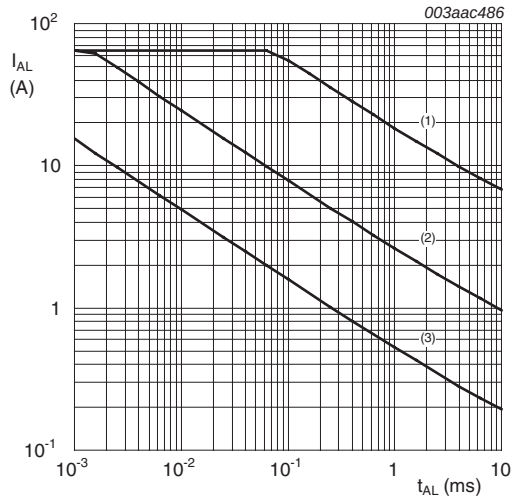
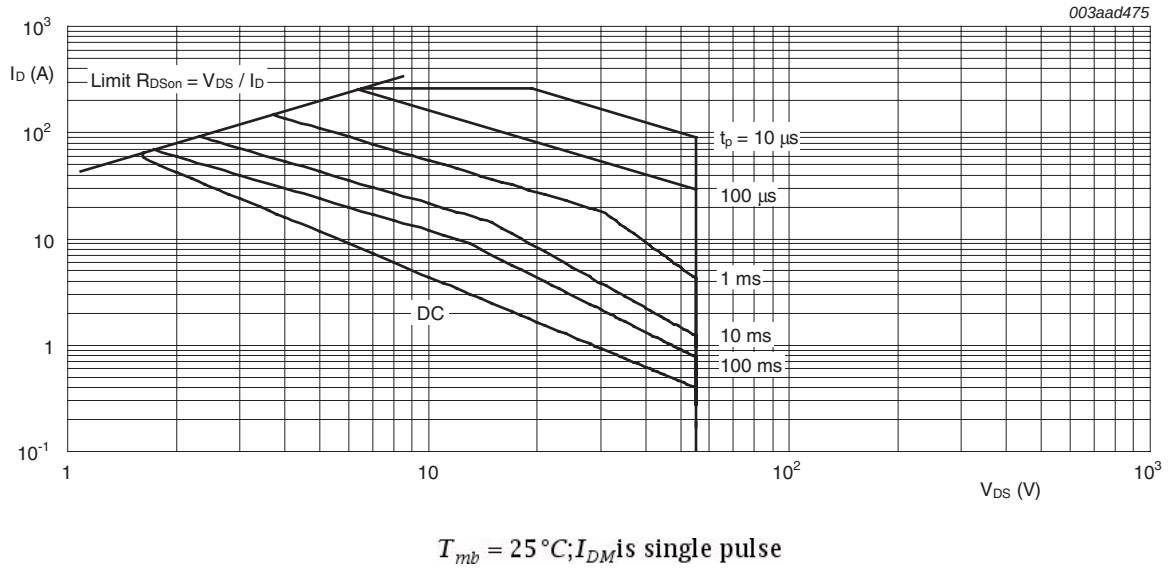



**Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time**




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

**Fig 4. 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 | see Figure 5 | - | - | 1.42 | K/W |

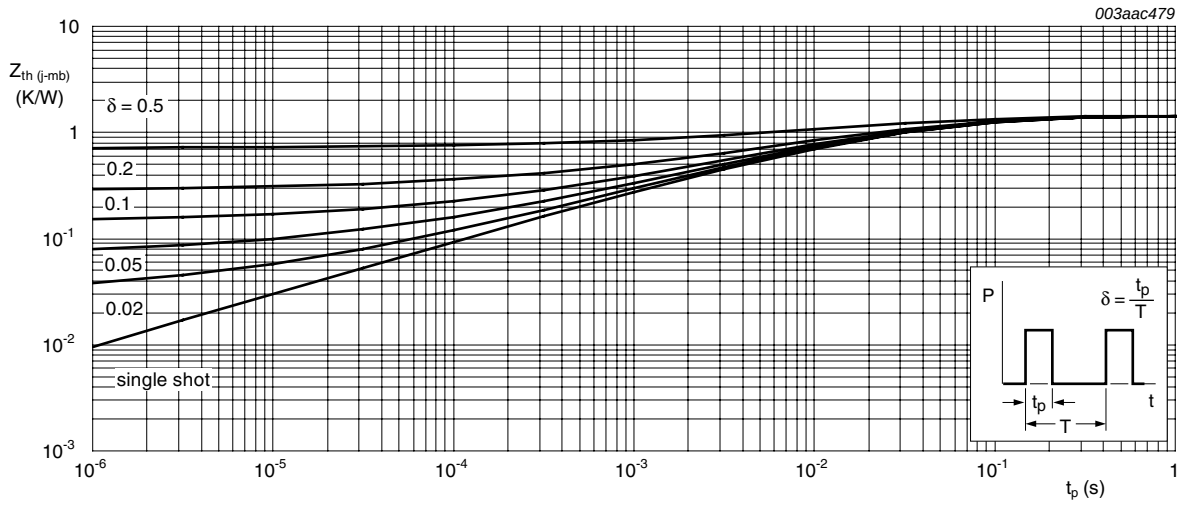
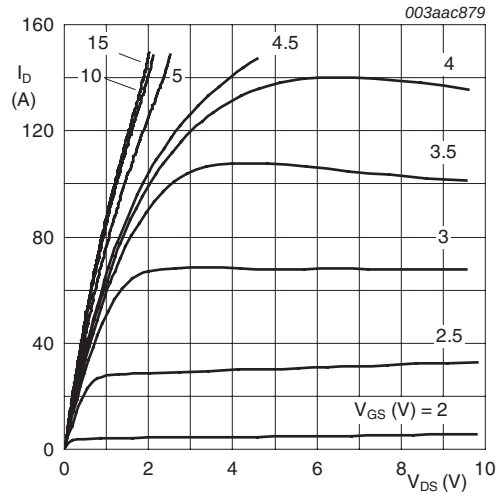



**Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration.**

# 6. Characteristics

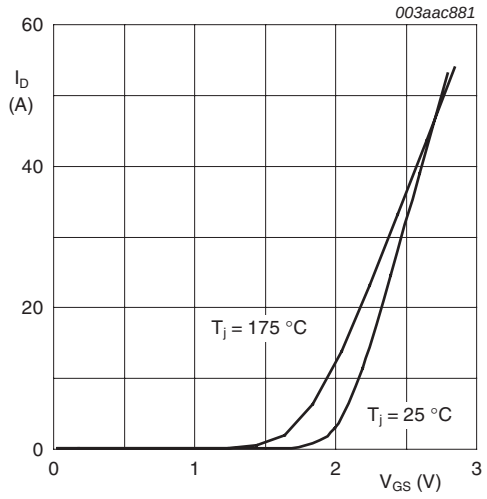
**Table 6. Characteristics**

| 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 | 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; see Figure 10; see Figure 11 | - | - | 2.45 | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 25 °C; see Figure 10; see Figure 11 | 1.25 | 1.65 | 2.15 | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 175 °C; see Figure 10; see Figure 11 | 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 | - | 0.02 | 1 | µA |
| $I_{GSS}$ | gate leakage current | $V_{DS}$ = 0 V; $V_{GS}$ = 15 V; $T_j$ = 25 °C | - | 2 | 100 | nA |
| | | $V_{DS}$ = 0 V; $V_{GS}$ = -15 V; $T_j$ = 25 °C | - | 2 | 100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 4.5 V; $I_D$ = 20 A; $T_j$ = 25 °C | - | - | 13 | mΩ |
| | | $V_{GS}$ = 10 V; $I_D$ = 20 A; $T_j$ = 25 °C | - | 8.1 | 11 | mΩ |
| | | $V_{GS}$ = 5 V; $I_D$ = 20 A; $T_j$ = 25 °C; see Figure 12; see Figure 13 | - | 9.1 | 12 | mΩ |
| | | $V_{GS}$ = 5 V; $I_D$ = 20 A; $T_j$ = 175 °C; see Figure 13 | - | - | 27.6 | mΩ |
| **Dynamic characteristics** | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 20 A; $V_{DS}$ = 44 V; $V_{GS}$ = 5 V; $T_j$ = 25 °C; see Figure 14 | - | 32 | - | nC |
| $Q_{GS}$ | gate-source charge | | - | 6 | - | nC |
| $Q_{GD}$ | gate-drain charge | | - | 13 | - | nC |
| $C_{iss}$ | input capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 25 V; f = 1 MHz; $T_j$ = 25 °C; see Figure 15 | - | 2160 | 2880 | pF |
| $C_{oss}$ | output capacitance | | - | 315 | 378 | pF |
| $C_{rss}$ | reverse transfer capacitance | | - | 175 | 240 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 30 V; $R_L$ = 1.5 Ω; $V_{GS}$ = 5 V; $R_{G(ext)}$ = 10 Ω; $T_j$ = 25 °C | - | 29 | - | ns |
| $t_r$ | rise time | | - | 78 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 100 | - | ns |
| $t_f$ | fall time | | - | 63 | - | ns |
| **Source-drain diode** | | | | | | |
| $V_{SD}$ | source-drain voltage | $I_S$ = 20 A; $V_{GS}$ = 0 V; $T_j$ = 25 °C; see Figure 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 | - | 44 | - | ns |
| $Q_r$ | recovered charge | | - | 83 | - | nC |



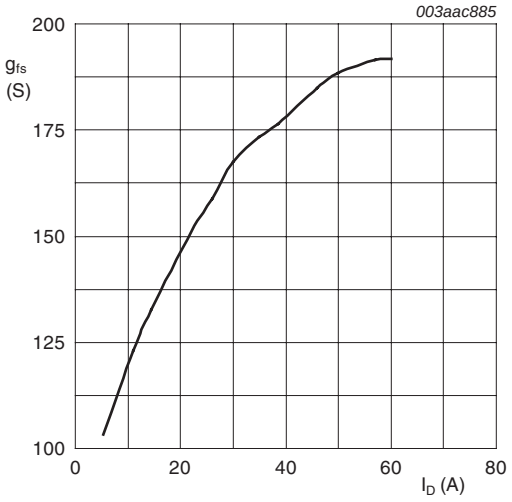

$T_j = 25\,°C$

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



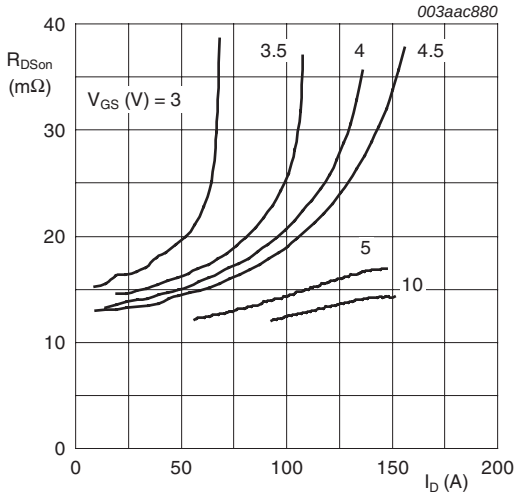

$V_{DS} = 25V$

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



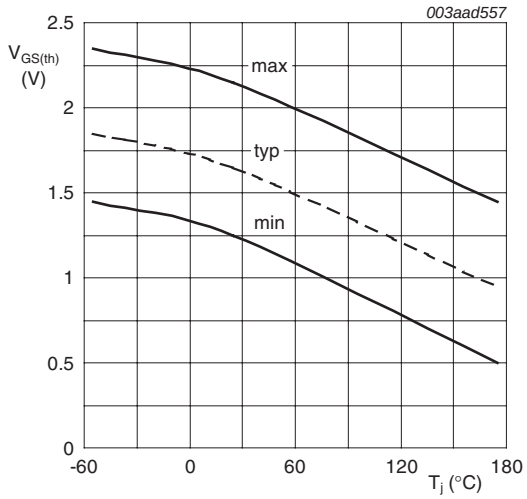

$T_j = 25\,°C; V_{DS} = 25V$

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



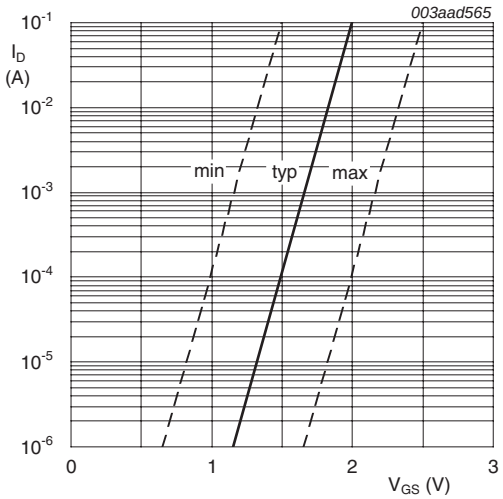

$T_j = 25\,°C$

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



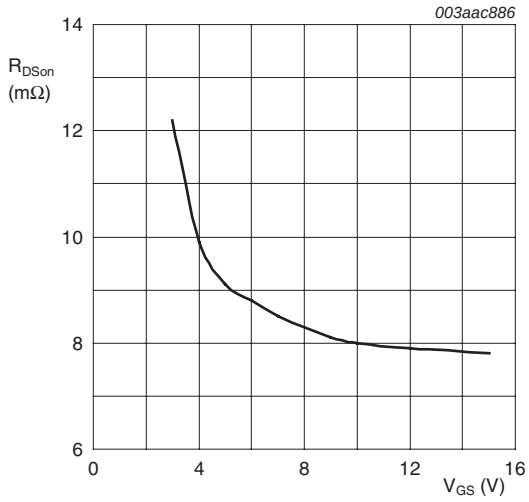

$I_D = 1mA; V_{DS} = V_{GS}$

**Fig 10. Gate-source threshold voltage as a function of junction temperature**



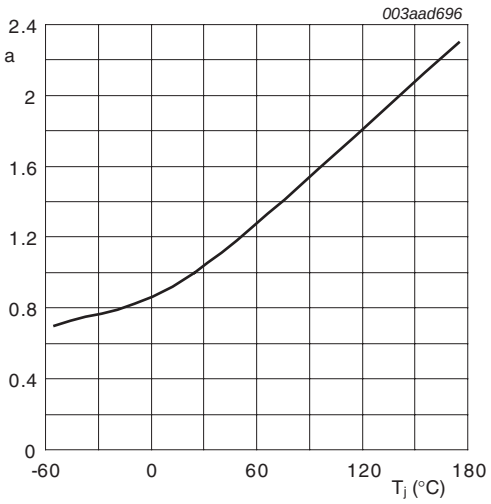

$T_j = 25°C; V_{DS} = V_{GS}$

**Fig 11. Sub-threshold drain current as a function of gate-source voltage**



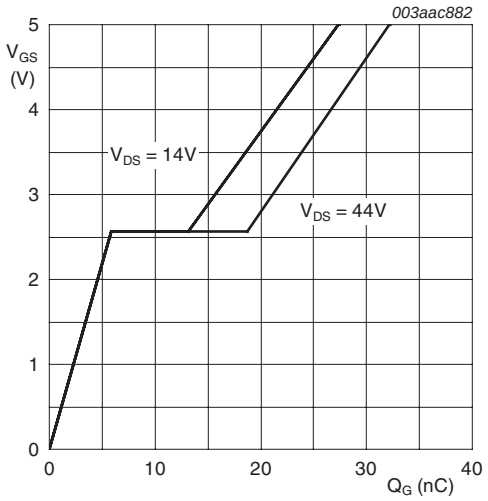

$T_j = 25°C; I_D = 20A$

**Fig 12. Drain-source on-state resistance as a function of gate-source voltage; typical values.**



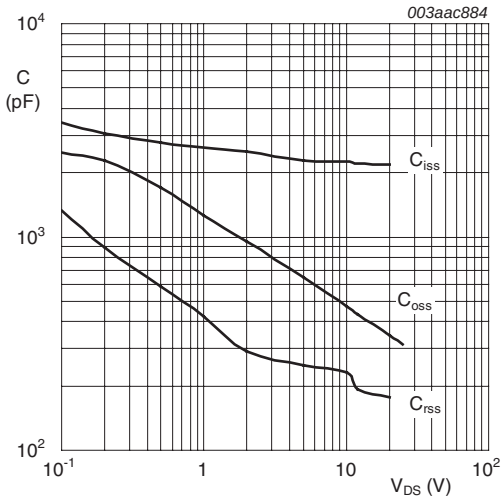

$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



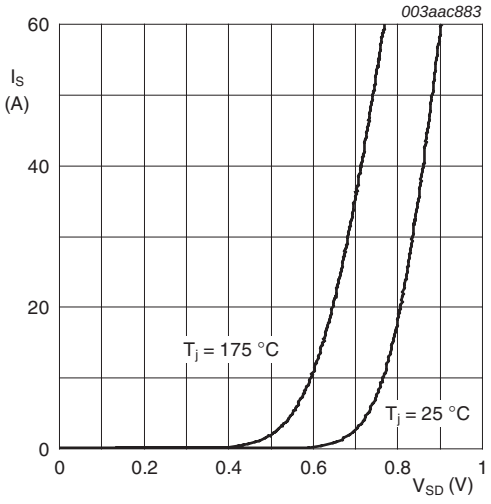

$T_j = 25\,°C; I_D = 20A$

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




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

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

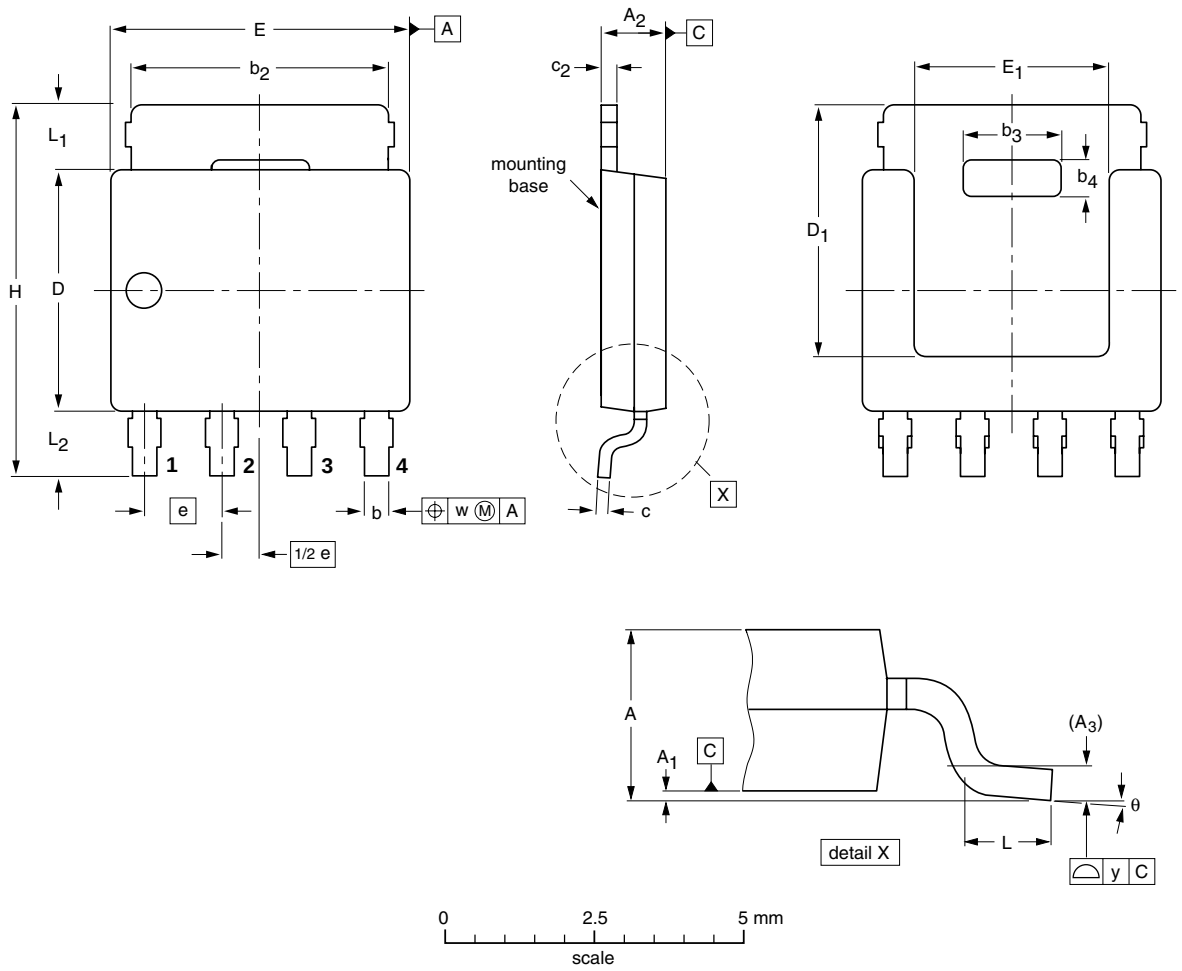



$V_{GS} = 0V$

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

# 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 7. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BUK9Y12-55B_4 | 20100407 | Product data sheet | - | BUK9Y12-55B_3 |
| Modifications: | • Status changed from objective to product. | | | |
| BUK9Y12-55B_3 | 20100216 | Objective data sheet | - | BUK9Y12-55B_2 |

# 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.nexperia.com.

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## 11. Contents





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**Date of release: 07 April 2010**

# OCEAN CHIPS
## Океан Электроники
## Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».

AVIC JONHON

**«JONHON»** (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

**«FORSTAR»** (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

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