
# BUK7K5R6-30E

## Dual N-channel 30 V, 5.6 mΩ standard level MOSFET

6 November 2013 Product data sheet

## 1. General description

Dual standard level N-channel MOSFET in an LFPAK56D (Dual Power-SO8) package using TrenchMOS technology. This product has been designed and qualified to AEC Q101 standard for use in high performance automotive applications.

## 2. Features and benefits

- Dual MOSFET
- Q101 compliant
- Repetitive avalanche rated
- Suitable for thermally demanding environments due to 175 °C rating
- True standard level gate with $V_{GS(th)}$ of greater than 1 V at 175 °C

## 3. Applications

- 12 V Automotive systems
- Motors, lamps and solenoid control
- Transmission control
- Ultra high performance power switching

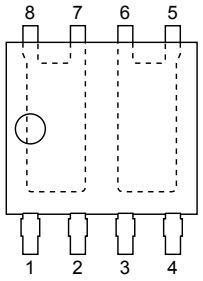
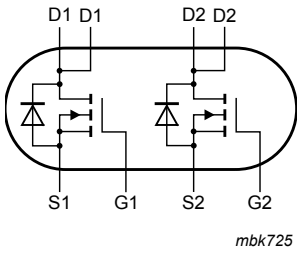
## 4. Quick reference data

**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; Fig. 1 | | - | - | 40 | A |
| **Static characteristics FET1 and FET2** | | | | | | | |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 20 A; $T_j$ = 25 °C; Fig. 12 | | - | 4.76 | 5.6 | mΩ |
| **Dynamic characteristics FET1 and FET2** | | | | | | | |
| $Q_{GD}$ | gate-drain charge | $I_D$ = 10 A; $V_{DS}$ = 24 V; $V_{GS}$ = 10 V; $T_j$ = 25 °C; Fig. 14; Fig. 15 | | - | 9.5 | - | nC |

## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | S1 | source1 |   LFPAK56D (SOT1205) |   |
| 2 | G1 | gate1 | | |
| 3 | S2 | source2 | | |
| 4 | G2 | gate2 | | |
| 5 | D2 | drain2 | | |
| 6 | D2 | drain2 | | |
| 7 | D1 | drain1 | | |
| 8 | D1 | drain1 | | |

## 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BUK7K5R6-30E | LFPAK56D | Plastic single ended surface mounted package (LFPAK56D); 8 leads | SOT1205 |

## 7. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| BUK7K5R6-30E | 75E630 |

## 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 | | - | 30 | V |
| $V_{DGR}$ | drain-gate voltage | $R_{GS} = 20$ kΩ; $T_j \geq 25$ °C; $T_j \leq 175$ °C | | - | 30 | V |
| $V_{GS}$ | gate-source voltage | $T_j \leq 175$ °C; DC | | -20 | 20 | V |
| $I_D$ | drain current | $T_{mb} = 25$ °C; $V_{GS} = 10$ V; Fig. 1 | | - | 40 | A |
| | | $T_{mb} = 100$ °C; $V_{GS} = 10$ V; Fig. 1 | | - | 40 | A |
| $I_{DM}$ | peak drain current | $T_{mb} = 25$ °C; pulsed; $t_p \leq 10$ µs; Fig. 4 | | - | 314 | A |
| $P_{tot}$ | total power dissipation | $T_{mb} = 25$ °C; Fig. 2 | | - | 64 | W |

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $T_{stg}$ | storage temperature | | | -55 | 175 | °C |
| $T_j$ | junction temperature | | | -55 | 175 | °C |
| $T_{sld(M)}$ | peak soldering temperature | | | - | 260 | °C |
| **Source-drain diode FET1 and FET2** | | | | | | |
| $I_S$ | source current | $T_{mb}$ = 25 °C | | - | 40 | A |
| $I_{SM}$ | peak source current | pulsed; $t_p \leq 10$ µs; $T_{mb}$ = 25 °C | | - | 314 | A |
| **Avalanche Ruggedness FET1 and FET2** | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D$ = 40 A; $V_{sup} \leq 30$ V; $V_{GS}$ = 10 V; $T_{j(init)}$ = 25 °C; Fig. 3 | [1][2] | - | 228 | mJ |

[1] Refer to application note AN10273 for further information
[2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C

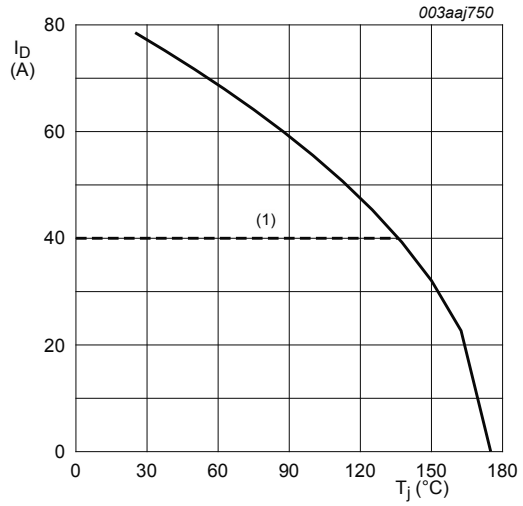



**Fig. 1. Continuous drain current as a function of mounting base temperature**

$V_{GS} \geq 10$ V; (1) capped at 40 A due to package.

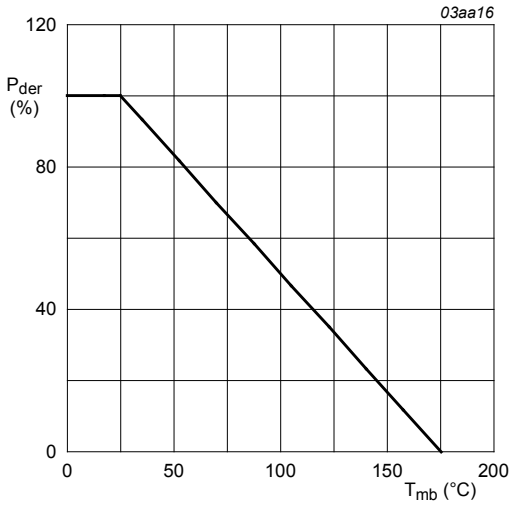



**Fig. 2. Normalized total power dissipation as a function of mounting base temperature**

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

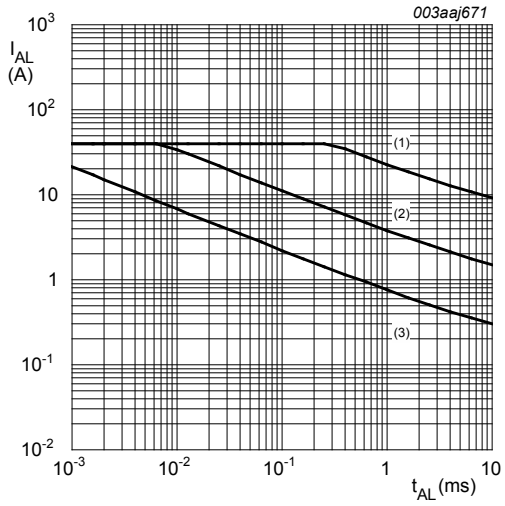



**Fig. 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time, FET1 and FET2**

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

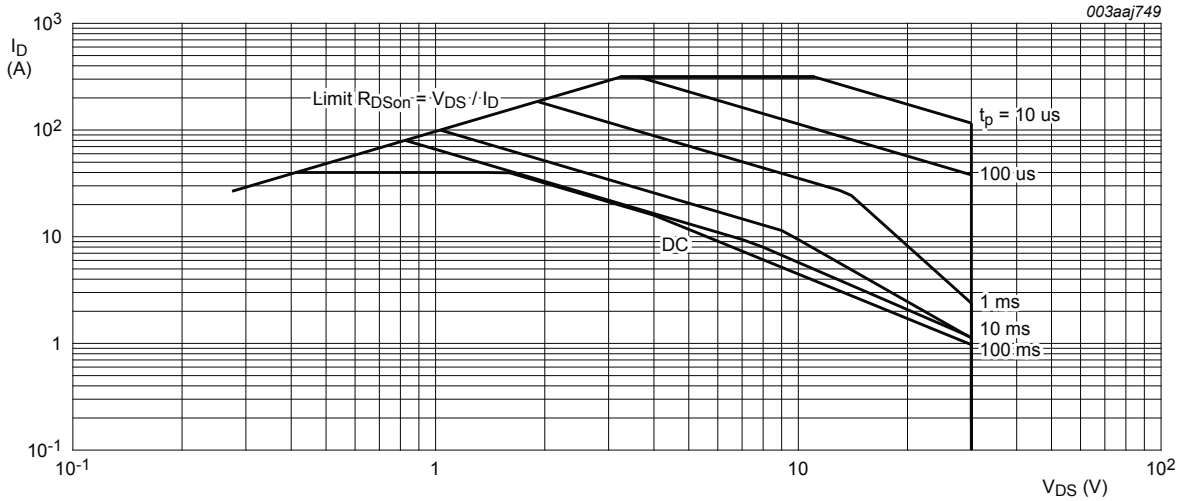



**Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage**

$T_{mb} = 25$ °C; $I_{DM}$ is a single pulse; (1) Capped at 40 A due to package

# 9. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j\text{-}mb)}$ | thermal resistance from junction to mounting base | Fig. 5 | | - | - | 2.36 | K/W |

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | Minimum footprint; mounted on a printed circuit board | | - | 95 | - | K/W |

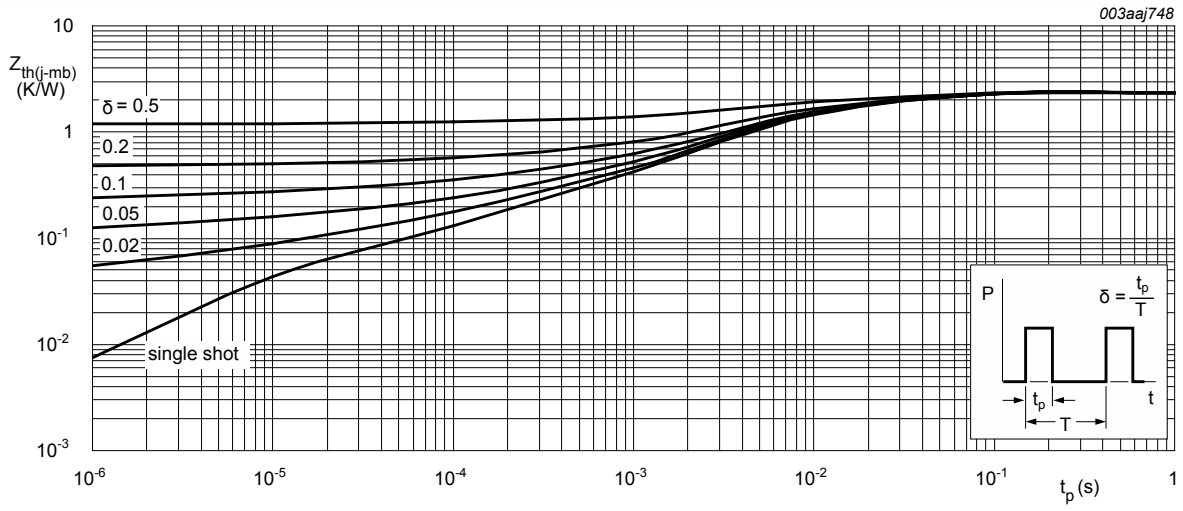



**Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration**

## 10. Characteristics

**Table 7. Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics FET1 and FET2** | | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D$ = 250 µA; $V_{GS}$ = 0 V; $T_j$ = -55 °C | | 27 | - | - | V |
| | | $I_D$ = 250 µA; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | 30 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 25 °C; Fig. 10; Fig. 11 | | 2.4 | 3 | 4 | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 175 °C; Fig. 10; Fig. 11 | | 1 | - | - | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = -55 °C; Fig. 10; Fig. 11 | | - | - | 4.5 | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 30 V; $V_{GS}$ = 0 V; $T_j$ = 175 °C | | - | - | 500 | µA |
| | | $V_{DS}$ = 30 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | 0.02 | 1 | 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 | $V_{GS}$ = 10 V; $I_D$ = 20 A; $T_j$ = 25 °C; Fig. 12 | | - | 4.76 | 5.6 | mΩ |
| | | $V_{GS}$ = 10 V; $I_D$ = 20 A; $T_j$ = 175 °C; Fig. 12; Fig. 13 | | - | 8.3 | 10.3 | mΩ |

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Dynamic characteristics FET1 and FET2** | | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 10 A; $V_{DS}$ = 24 V; $V_{GS}$ = 10 V; $T_j$ = 25 °C; Fig. 14; Fig. 15 | | - | 29.7 | - | nC |
| $Q_{GS}$ | gate-source charge | | | - | 7.6 | - | nC |
| $Q_{GD}$ | gate-drain charge | | | - | 9.5 | - | nC |
| $C_{iss}$ | input capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 25 V; f = 1 MHz; $T_j$ = 25 °C; Fig. 16 | | - | 1477 | 1969 | pF |
| $C_{oss}$ | output capacitance | | | - | 380 | 456 | pF |
| $C_{rss}$ | reverse transfer capacitance | | | - | 226 | 310 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 24 V; $R_L$ = 2.4 Ω; $V_{GS}$ = 10 V; $R_{G(ext)}$ = 5 Ω; $T_j$ = 25 °C; $I_D$ = 10 A | | - | 9.2 | - | ns |
| $t_r$ | rise time | | | - | 10 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | | - | 17.9 | - | ns |
| $t_f$ | fall time | | | - | 12.9 | - | ns |
| **Source-drain diode FET1 and FET2** | | | | | | | |
| $V_{SD}$ | source-drain voltage | $I_S$ = 10 A; $V_{GS}$ = 0 V; $T_j$ = 25 °C; Fig. 17 | | - | 0.78 | 1.2 | V |
| $t_{rr}$ | reverse recovery time | $I_S$ = 10 A; $dI_S/dt$ = -100 A/µs; $V_{GS}$ = 0 V; $V_{DS}$ = 15 V; $T_j$ = 25 °C | | - | 27.4 | - | ns |
| $Q_r$ | recovered charge | | | - | 20.7 | - | nC |

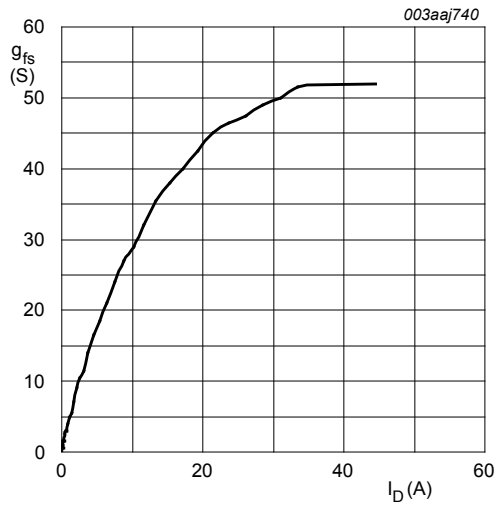



**Fig. 6. Forward transconductance as a function of drain current; typical values**

$T_j = 25\,°C; V_{DS} = 15\,V$

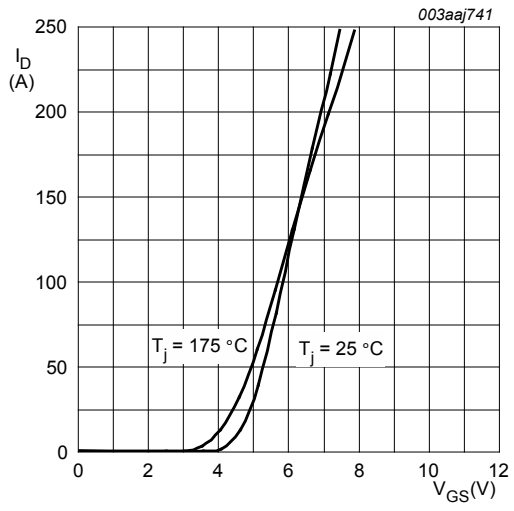



**Fig. 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values**

$V_{DS} = 10V$

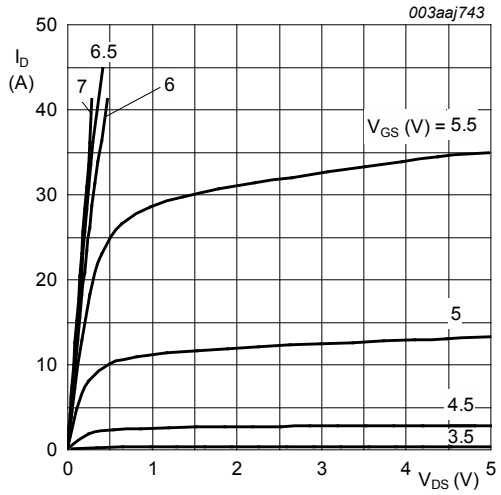



**Fig. 8. Output characteristics: drain current as a function of drain-source voltage; typical values**

$T_j = 25\,°C$

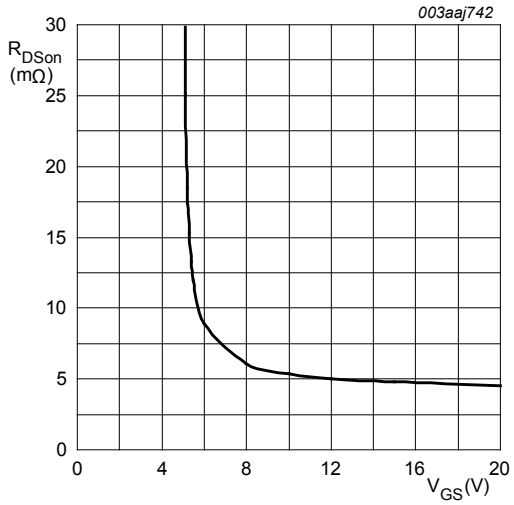



**Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values**

$T_j = 25\,°C;\ I_D = 20\,A$

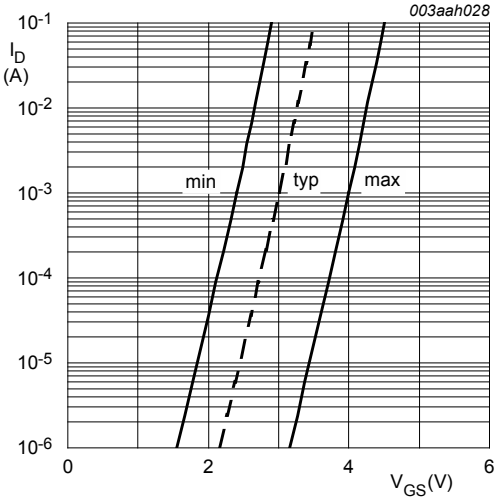



**Fig. 10. Sub-threshold drain current as a function of gate-source voltage**

$T_j = 25\,°C;\ V_{DS} = 5\,V$

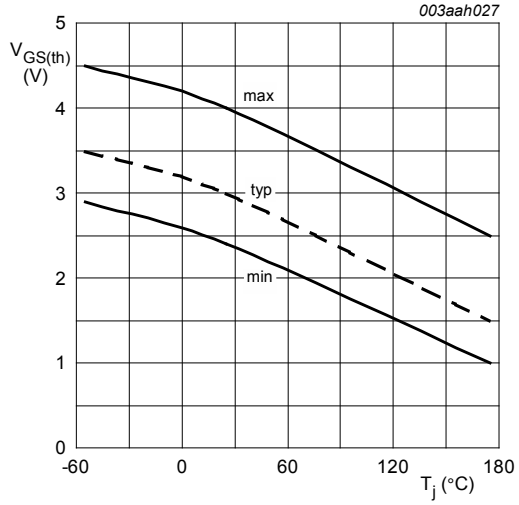



**Fig. 11. Gate-source threshold voltage as a function of junction temperature**

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

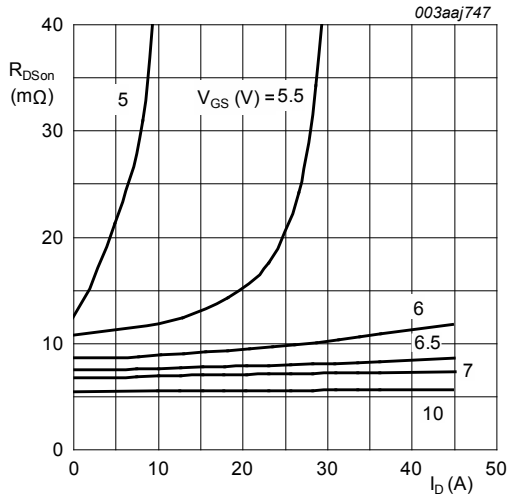



**Fig. 12. Drain-source on-state resistance as a function of drain current; typical values**

$T_j = 25\,°C$

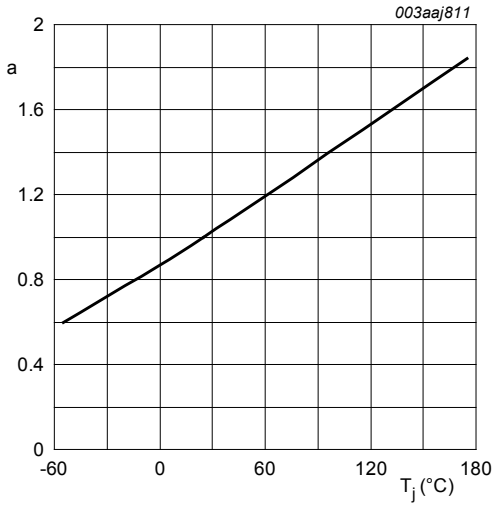



**Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature**

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

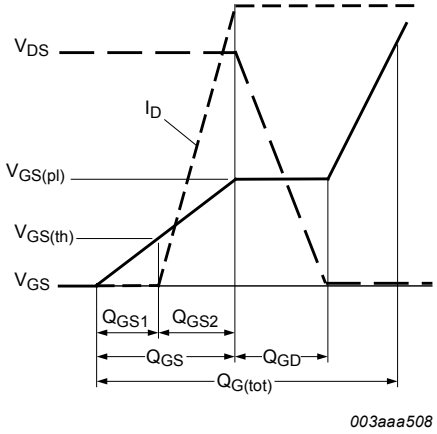



**Fig. 14. Gate charge waveform definitions**

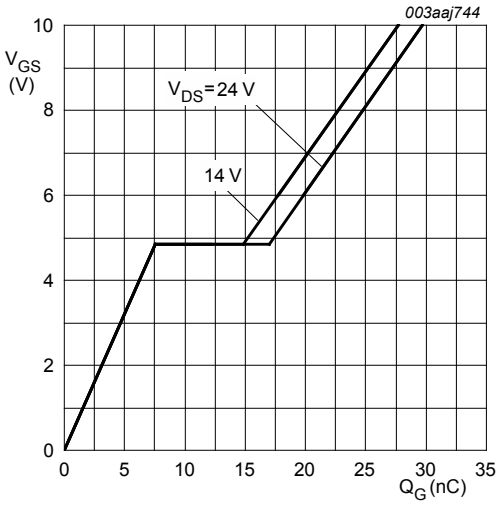



**Fig. 15. Gate-source voltage as a function of gate charge; typical values**

$T_j = 25\,°C; I_D = 10\,A$

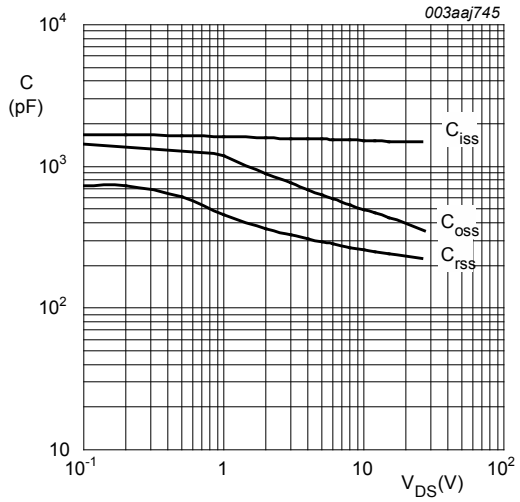



**Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**

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

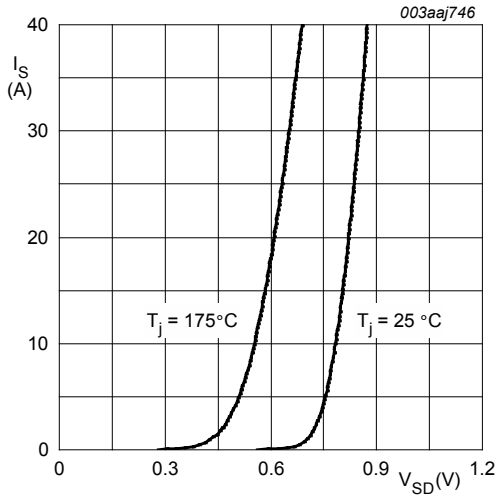
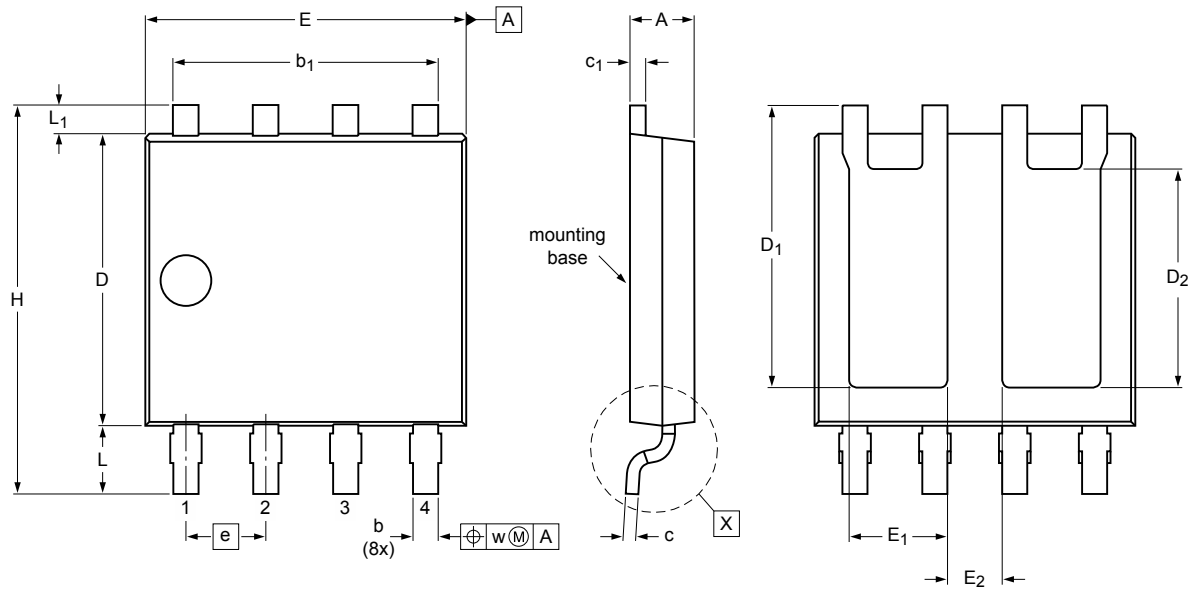


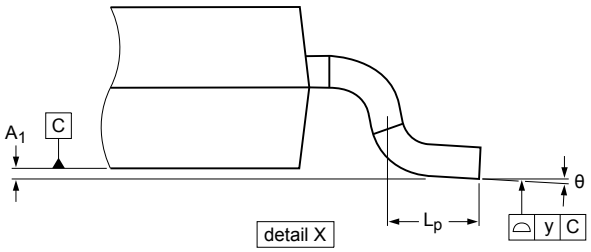

**Fig. 17. Source current as a function of source-drain voltage; typical values**

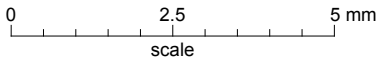
$V_{GS} = 0\ V$

# 11. Package outline

**Plastic single ended surface mounted package (LFPAK56D); 8 leads** **SOT1205**




Dimensions

| Unit | | A | $A_1$ | b | $b_1$ | c | $c_1$ | $D^{(1)}$ | $D_1{}^{(1)}$ | $D_2$ (ref) | $E^{(1)}$ | $E_1{}^{(1)}$ | $E_2$ | e | H | L | $L_1$ | $L_p$ | w | y | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 1.05 | 0.1 | 0.50 | 4.4 | 0.25 | 0.30 | 4.70 | 4.8 | | 5.30 | 1.8 | 0.85 | | 6.2 | 1.3 | 0.55 | 0.85 | | | 8° |
| | nom | | | | | | | | | 3.5 | | | | 1.27 | | | | | 0.25 | 0.1 | |
| | min | | 0.0 | 0.35 | 4.1 | 0.19 | 0.24 | 4.45 | | | 4.95 | 1.6 | | | 5.9 | 0.8 | 0.30 | 0.40 | | | 0° |

Note
1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

*sot1205_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1205 | | | | | | ~~13-02-19~~ 13-02-21 |

**Fig. 18. Package outline LFPAK56D (SOT1205)**

# 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".
[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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For more information, please visit: http://www.nexperia.com
For sales office addresses, please send an email to: salesaddresses@nexperia.com
**Date of release: 06 November 2013**