



# BUK7Y98-80E

N-channel 80 V, 98 mΩ standard level MOSFET in LPAK56

8 May 2013

Product data sheet

## 1. General description

Standard level N-channel MOSFET in an LPAK56 (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

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

## 3. Applications

- 12 V, 24 V and 48 V Automotive systems
- Motors, lamps and solenoid control
- Transmission control
- Ultra high performance power switching

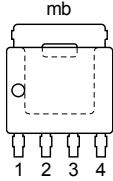
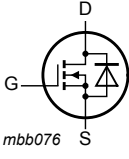
## 4. Quick reference data

Table 1. Quick reference data

| Symbol                         | Parameter                        | Conditions   | Min | Typ | Max  | Unit |
|--------------------------------|----------------------------------|--|-----|-----|------|------|
| $V_{DS}$                       | drain-source voltage             | $T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$  | -   | -   | 80   | V    |
| $I_D$                          | drain current                    | $V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}; \text{Fig. 1}$   | -   | -   | 12.3 | A    |
| $P_{tot}$                      | total power dissipation          | $T_{mb} = 25\text{ °C}; \text{Fig. 2}$   | -   | -   | 37   | W    |
| <b>Static characteristics</b>  |                                  |  |     |     |      |      |
| $R_{DSon}$                     | drain-source on-state resistance | $V_{GS} = 10\text{ V}; I_D = 5\text{ A}; T_j = 25\text{ °C}; \text{Fig. 11}$                                       | -   | 70  | 98   | mΩ   |
| <b>Dynamic characteristics</b> |                                  |  |     |     |      |      |
| $Q_{GD}$                       | gate-drain charge                | $V_{GS} = 10\text{ V}; I_D = 5\text{ A}; V_{DS} = 64\text{ V}; T_j = 25\text{ °C}; \text{Fig. 13}; \text{Fig. 14}$ | -   | 3   | -    | nC   |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                       | Simplified outline   | Graphic symbol  |
|-----|--------|-----------------------------------|--|---|
| 1   | S      | source                            |  <p><b>LPAK56; Power-SO8 (SOT669)</b></p> |  <p>mbb076</p> |
| 2   | S      | source                            |  |   |
| 3   | S      | source                            |  |   |
| 4   | G      | gate                              |  |   |
| mb  | D      | mounting base; connected to drain |  |   |

## 6. Ordering information

Table 3. Ordering information

| Type number | Package              |   |         |
|-------------|----------------------|---|---------|
|             | Name                 | Description   | Version |
| BUK7Y98-80E | LPAK56;<br>Power-SO8 | Plastic single-ended surface-mounted package (LPAK56; Power-SO8); 4 leads | SOT669  |

## 7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| BUK7Y98-80E | 79880E       |

## 8. Limiting values

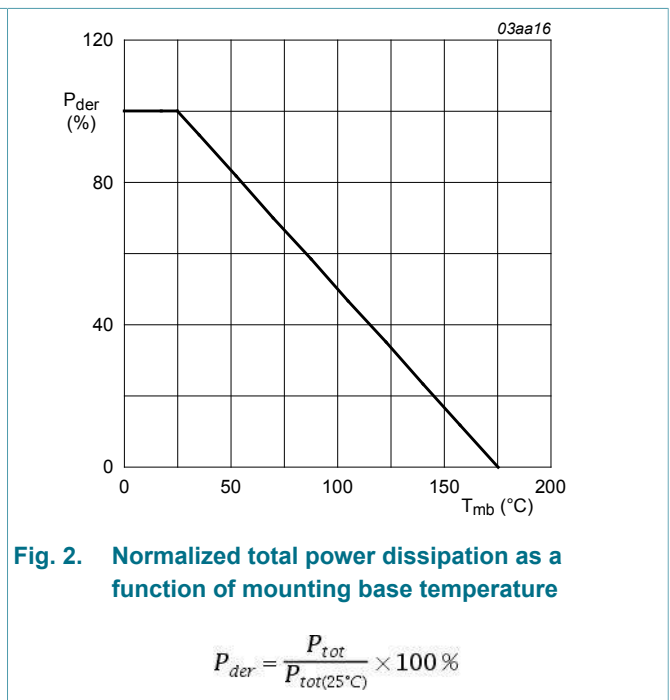
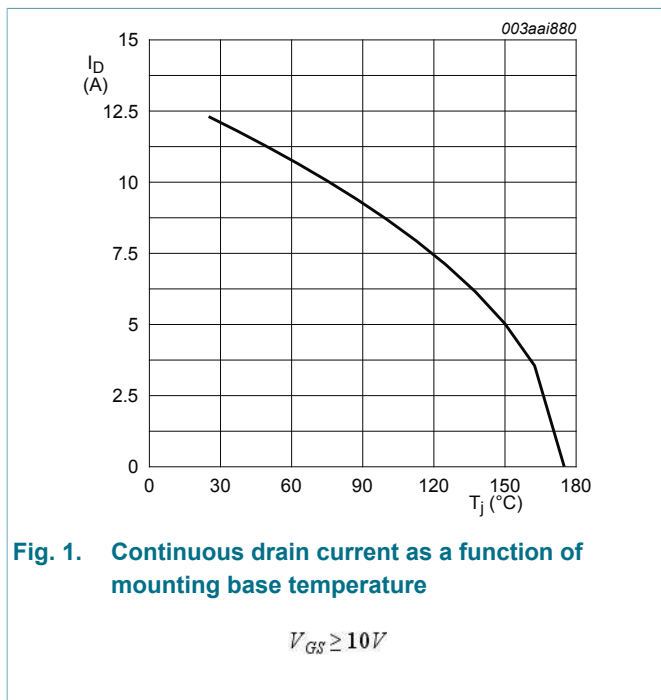
Table 5. Limiting values

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

| Symbol    | Parameter               | Conditions  | Min | Max  | Unit |
|-----------|-------------------------|---|-----|------|------|
| $V_{DS}$  | drain-source voltage    | $T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$  | -   | 80   | V    |
| $V_{DGR}$ | drain-gate voltage      | $R_{GS} = 20\text{ k}\Omega$  | -   | 80   | V    |
| $V_{GS}$  | gate-source voltage     | $T_j \leq 175\text{ °C}$ ; DC   | -20 | 20   | V    |
| $I_D$     | drain current           | $T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; <a href="#">Fig. 1</a>                   | -   | 12.3 | A    |
|           |                         | $T_{mb} = 100\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; <a href="#">Fig. 1</a>                  | -   | 8.7  | A    |
| $I_{DM}$  | peak drain current      | $T_{mb} = 25\text{ °C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; <a href="#">Fig. 4</a> | -   | 49   | A    |
| $P_{tot}$ | total power dissipation | $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 2</a>  | -   | 37   | W    |
| $T_{stg}$ | storage temperature     |   | -55 | 175  | °C   |

| Symbol                      | Parameter                                    | Conditions  | Min    | Max  | Unit    |
|-----------------------------|--|---|--------|------|---------|
| T <sub>j</sub>              | junction temperature                         |   | -55    | 175  | °C      |
| <b>Source-drain diode</b>   |  |   |        |      |         |
| I <sub>S</sub>              | source current                               | T <sub>mb</sub> = 25 °C   | -      | 12.3 | A       |
| I <sub>SM</sub>             | peak source current                          | pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C   | -      | 49   | A       |
| <b>Avalanche ruggedness</b> |  |   |        |      |         |
| E <sub>DS(AL)S</sub>        | non-repetitive drain-source avalanche energy | I <sub>D</sub> = 12.3 A; V <sub>sup</sub> ≤ 80 V; R <sub>GS</sub> = 50 Ω; V <sub>GS</sub> = 10 V; T <sub>j(init)</sub> = 25 °C; unclamped; <a href="#">Fig. 3</a> | [1][2] | -    | 9.02 mJ |

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



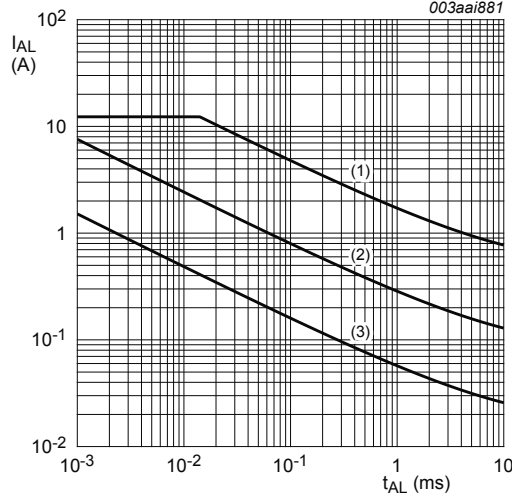


Fig. 3. Avalanche rating; avalanche current as a function of avalanche time

(1)  $T_{j (init)} = 25^\circ C$ ; (2)  $T_{j (init)} = 150^\circ C$ ; (3) Repetitive Avalanche

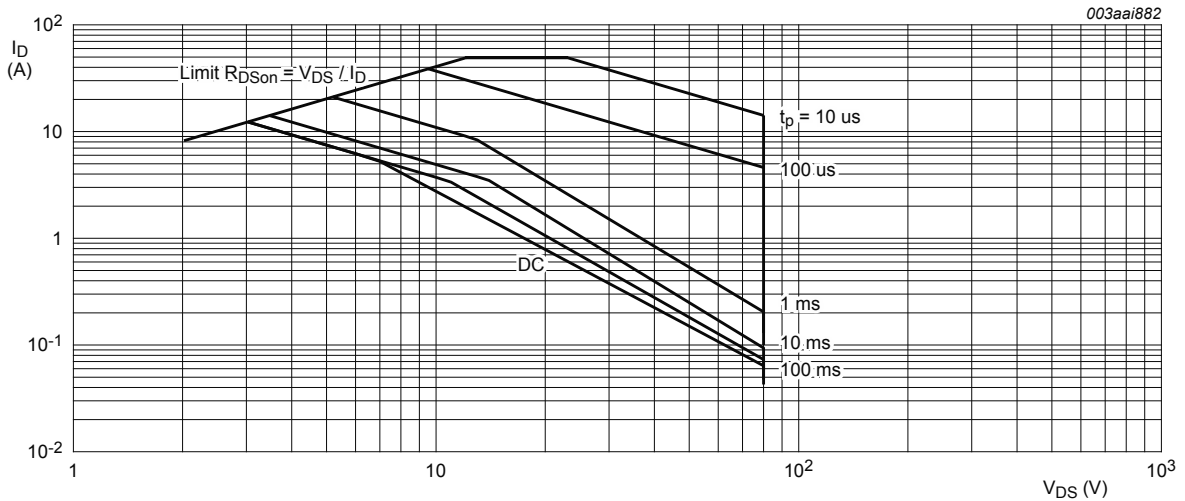


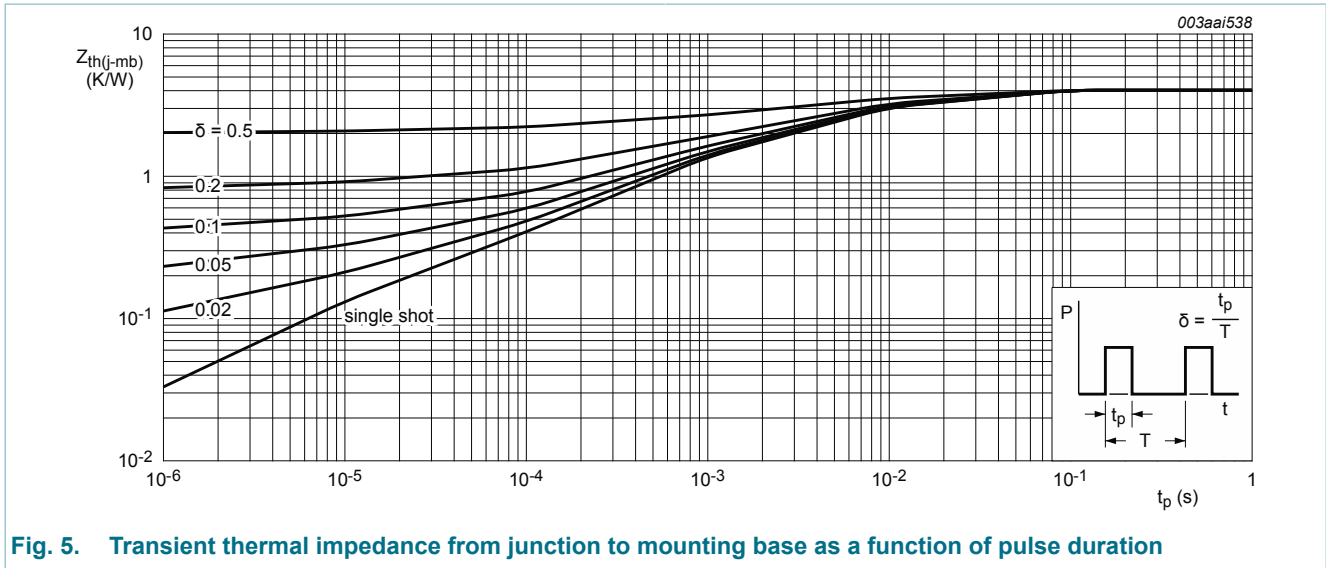
Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25^\circ C$ ;  $I_{DM}$  is a single pulse

## 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 | Fig. 5     | -   | -   | 4.03 | K/W  |

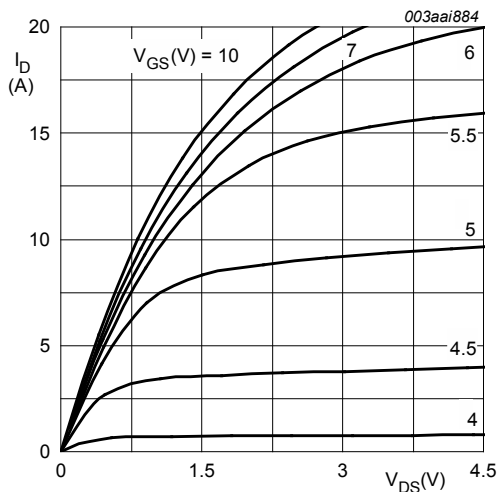


## 10. Characteristics

Table 7. Characteristics

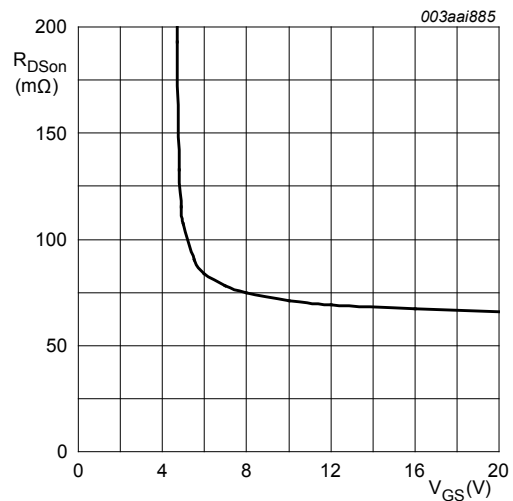
| Symbol                         | Parameter                        | Conditions  | Min | Typ  | Max | Unit    |
|--------------------------------|----------------------------------|---|-----|------|-----|---------|
| <b>Static characteristics</b>  |                                  |   |     |      |     |         |
| $V_{(BR)DSS}$                  | drain-source breakdown voltage   | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$  | 80  | -    | -   | V       |
|                                |                                  | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$   | 72  | -    | -   | V       |
| $V_{GS(th)}$                   | gate-source threshold voltage    | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C;$<br><a href="#">Fig. 9; Fig. 10</a>        | 2.4 | 3    | 4   | V       |
|                                |                                  | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C;$<br><a href="#">Fig. 9</a>                | -   | -    | 4.5 | V       |
|                                |                                  | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C;$<br><a href="#">Fig. 9</a>                | 1   | -    | -   | V       |
| $I_{DSS}$                      | drain leakage current            | $V_{DS} = 80 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$  | -   | 0.01 | 1   | $\mu A$ |
|                                |                                  | $V_{DS} = 80 V; V_{GS} = 0 V; T_j = 175 \text{ }^\circ C$   | -   | -    | 500 | $\mu A$ |
| $I_{GSS}$                      | gate leakage current             | $V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$  | -   | 2    | 100 | nA      |
|                                |                                  | $V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$   | -   | 2    | 100 | nA      |
| $R_{DSon}$                     | drain-source on-state resistance | $V_{GS} = 10 V; I_D = 5 A; T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 11</a>                              | -   | 70   | 98  | mΩ      |
|                                |                                  | $V_{GS} = 10 V; I_D = 5 A; T_j = 175 \text{ }^\circ C;$<br><a href="#">Fig. 11; Fig. 12</a>                 | -   | -    | 246 | mΩ      |
| <b>Dynamic characteristics</b> |                                  |   |     |      |     |         |
| $Q_{G(tot)}$                   | total gate charge                | $I_D = 5 A; V_{DS} = 64 V; V_{GS} = 10 V;$<br>$T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 13; Fig. 14</a> | -   | 8.5  | -   | nC      |
| $Q_{GS}$                       | gate-source charge               |   | -   | 1.6  | -   | nC      |
| $Q_{GD}$                       | gate-drain charge                |   | -   | 3    | -   | nC      |

| Symbol                    | Parameter                    | Conditions   | Min | Typ  | Max | Unit |
|---------------------------|------------------------------|--|-----|------|-----|------|
| $C_{iss}$                 | input capacitance            | $V_{GS} = 0\text{ V}; V_{DS} = 25\text{ V}; f = 1\text{ MHz};$                       | -   | 374  | 498 | pF   |
| $C_{oss}$                 | output capacitance           | $T_j = 25\text{ °C};$ <a href="#">Fig. 15</a>  | -   | 56   | 67  | pF   |
| $C_{rss}$                 | reverse transfer capacitance |  | -   | 45   | 62  | pF   |
| $t_{d(on)}$               | turn-on delay time           | $V_{DS} = 60\text{ V}; R_L = 10\text{ }\Omega; V_{GS} = 10\text{ V};$                | -   | 3.9  | -   | ns   |
| $t_r$                     | rise time                    | $R_{G(ext)} = 5\text{ }\Omega; T_j = 25\text{ °C}$                                   | -   | 3.5  | -   | ns   |
| $t_{d(off)}$              | turn-off delay time          |  | -   | 7.3  | -   | ns   |
| $t_f$                     | fall time                    |  | -   | 3.7  | -   | ns   |
| <b>Source-drain diode</b> |                              |  |     |      |     |      |
| $V_{SD}$                  | source-drain voltage         | $I_S = 5\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ °C};$ <a href="#">Fig. 16</a> | -   | 0.85 | 1.2 | V    |
| $t_{rr}$                  | reverse recovery time        | $I_S = 5\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V};$        | -   | 18.1 | -   | ns   |
| $Q_r$                     | recovered charge             | $V_{DS} = 25\text{ V}; T_j = 25\text{ °C}$   | -   | 15.8 | -   | nC   |



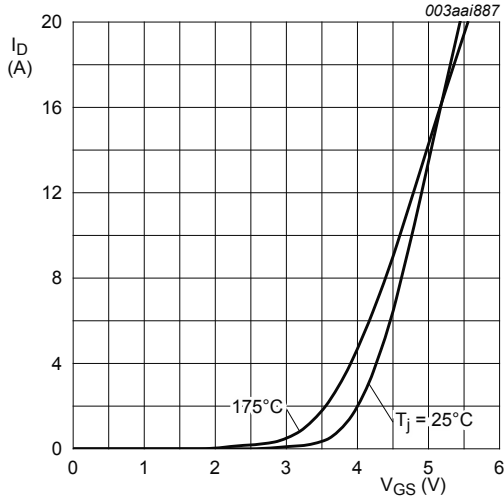
$T_j = 25\text{ °C}; t_p = 300\text{ }\mu\text{s}$

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



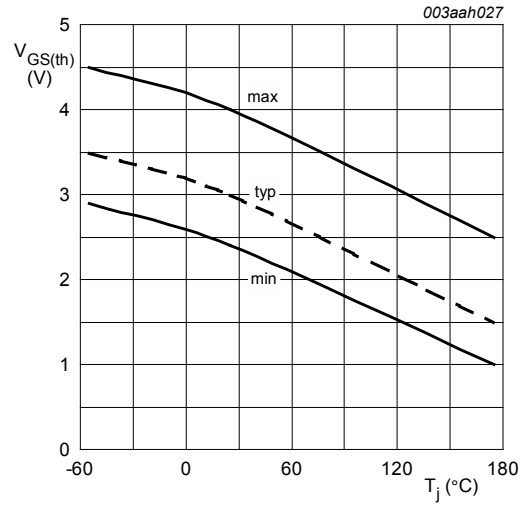
**Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values**

$T_j = 25\text{ °C}; I_D = 5\text{ A}$



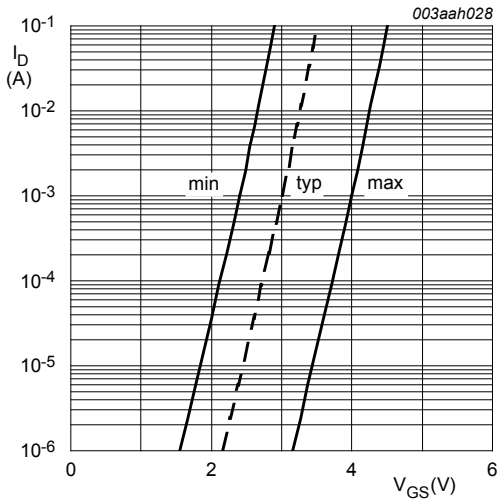
**Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values**

$$V_{DS} = 10V$$



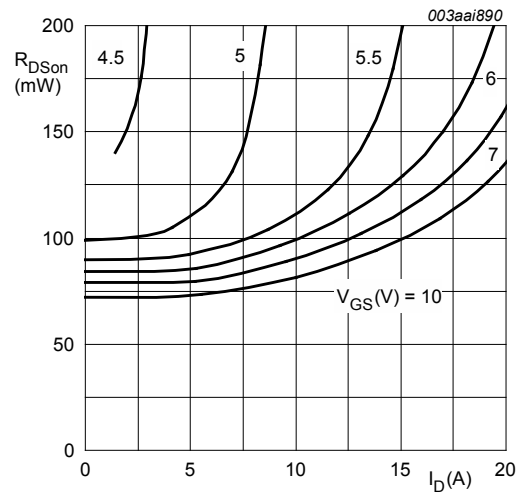
**Fig. 9. Gate-source threshold voltage as a function of junction temperature**

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



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

$$T_j = 25^\circ\text{C}; V_{DS} = 5V$$



$$T_j = 25^\circ\text{C}; t_p = 300 \mu\text{s}$$

**Fig. 11. Drain-source on-state resistance as a function of drain current; typical values**

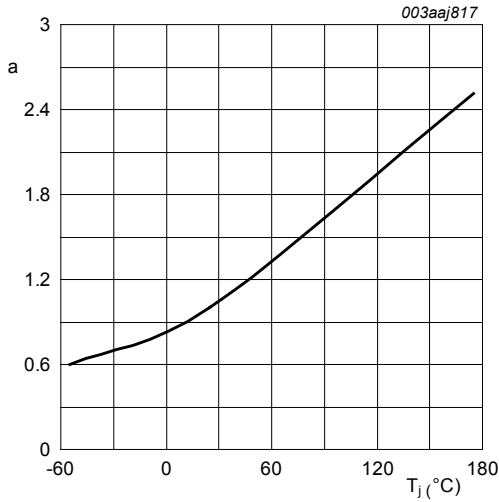


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^\circ\text{C})}}$$

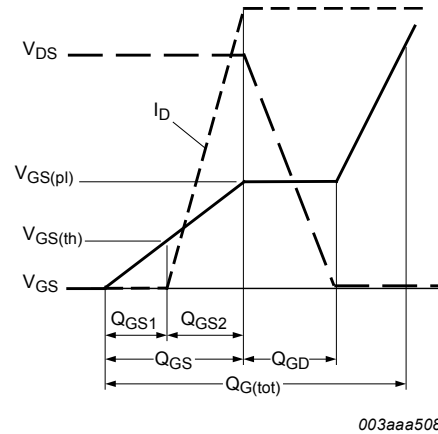


Fig. 13. Gate charge waveform definitions

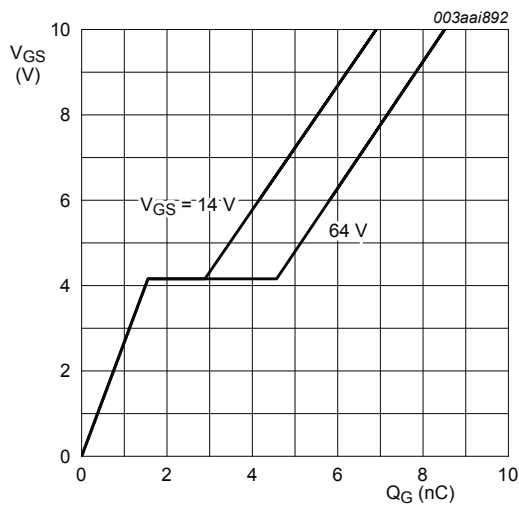


Fig. 14. Gate-source voltage as a function of gate charge; typical values

$$T_j = 25^\circ\text{C}; I_D = 5\text{A}$$

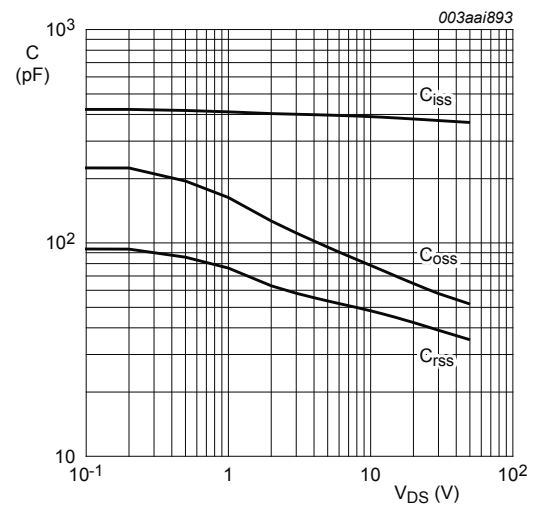
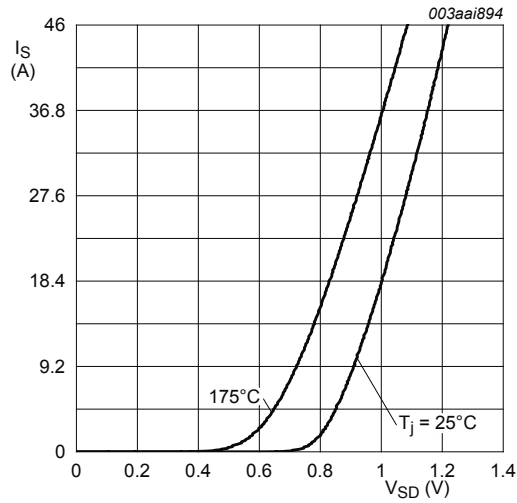


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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





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

$$V_{GS} = 0V$$

### 11. Package outline

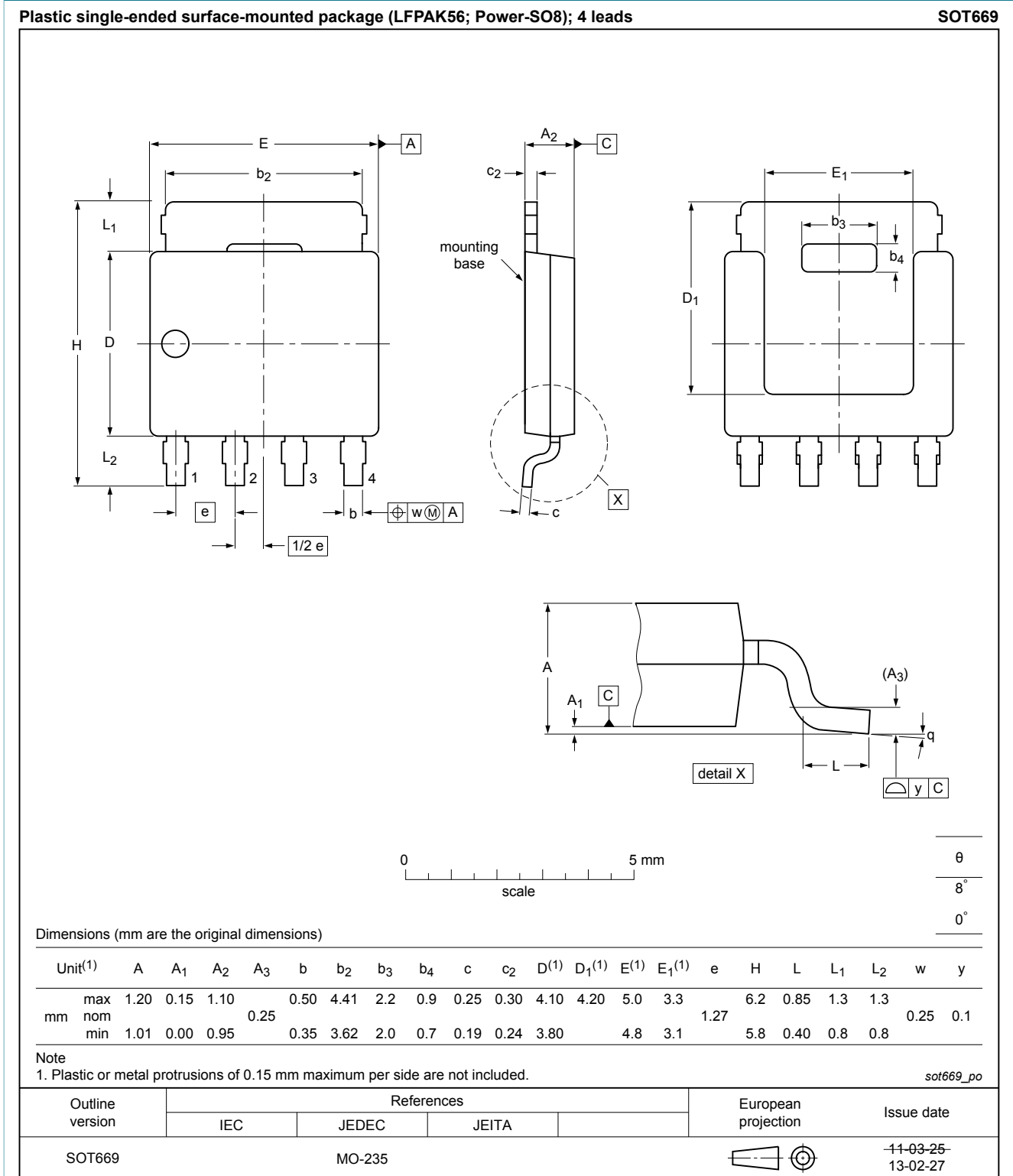


Fig. 17. Package outline LPAK56; Power-SO8 (SOT669)

## 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. |
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