



# BUK9Y14-80E

N-channel 80 V, 15 mΩ logic level MOSFET in LFPAK56

11 November 2014

Product data sheet

## 1. General description

Logic level N-channel MOSFET in an LFPAK56 (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 logic level gate with  $V_{GS(th)}$  rating of greater than 0.5 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

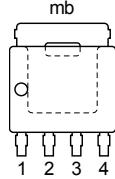
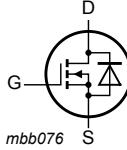
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25^\circ\text{C}$ ; $T_j \leq 175^\circ\text{C}$		-	-	80	V
$I_D$	drain current	$V_{GS} = 5\text{ V}$ ; $T_{mb} = 25^\circ\text{C}$ ; <a href="#">Fig. 1</a>		-	-	62	A
$P_{tot}$	total power dissipation	$T_{mb} = 25^\circ\text{C}$ ; <a href="#">Fig. 2</a>		-	-	147	W
<b>Static characteristics</b>							
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 5\text{ V}$ ; $I_D = 15\text{ A}$ ; $T_j = 25^\circ\text{C}$ ; <a href="#">Fig. 11</a>		-	12.2	15	$\text{m}\Omega$
<b>Dynamic characteristics</b>							
$Q_{GD}$	gate-drain charge	$V_{GS} = 5\text{ V}$ ; $I_D = 15\text{ A}$ ; $V_{DS} = 64\text{ V}$ ; $T_j = 25^\circ\text{C}$ ; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>		-	8.7	-	nC

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## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source		
2	S	source		
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain	 <b>LFPAK56; Power-SO8 (SOT669)</b>	

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK9Y14-80E	LFPAK56; Power-SO8	Plastic single-ended surface-mounted package (LFPAK56; Power-SO8); 4 leads	SOT669

## 7. Marking

Table 4. Marking codes

Type number	Marking code
BUK9Y14-80E	91480E

## 8. Limiting values

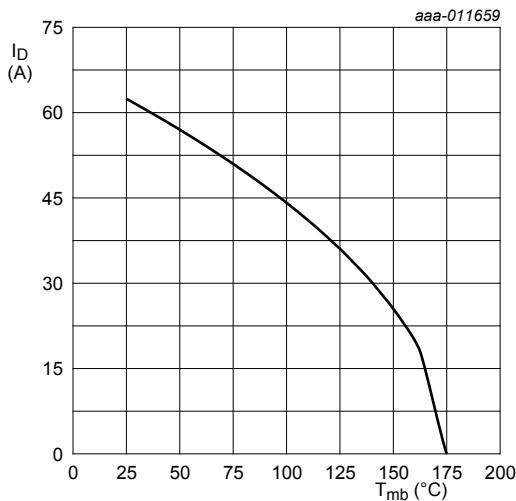
Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25^\circ\text{C}$ ; $T_j \leq 175^\circ\text{C}$	-	80	V
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	80	V
$V_{GS}$	gate-source voltage	$T_j \leq 175^\circ\text{C}$ ; DC	-10	10	V
		$T_j \leq 175^\circ\text{C}$ ; Pulsed	[1][2]	-15	V
$P_{tot}$	total power dissipation	$T_{mb} = 25^\circ\text{C}$ ; <a href="#">Fig. 2</a>	-	147	W
$I_D$	drain current	$T_{mb} = 25^\circ\text{C}$ ; $V_{GS} = 5\text{ V}$ ; <a href="#">Fig. 1</a>	-	62	A
		$T_{mb} = 100^\circ\text{C}$ ; $V_{GS} = 5\text{ V}$ ; <a href="#">Fig. 1</a>	-	44	A
$I_{DM}$	peak drain current	$T_{mb} = 25^\circ\text{C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; <a href="#">Fig. 4</a>	-	250	A

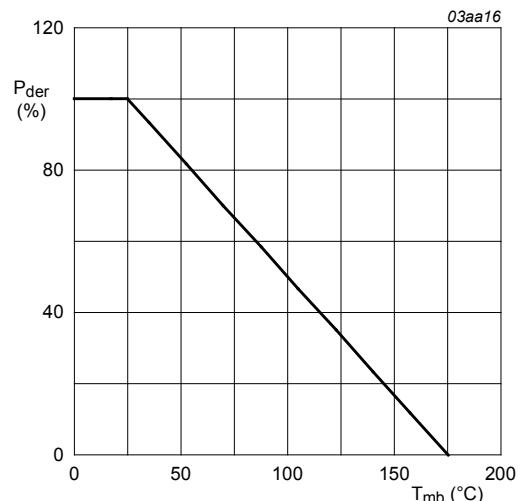
Symbol	Parameter	Conditions		Min	Max	Unit
T <sub>stg</sub>	storage temperature			-55	175	°C
T <sub>j</sub>	junction temperature			-55	175	°C
<b>Source-drain diode</b>						
I <sub>S</sub>	source current	T <sub>mb</sub> = 25 °C		-	62	A
I <sub>SM</sub>	peak source current	pulsed; t <sub>p</sub> ≤ 10 µs; T <sub>mb</sub> = 25 °C		-	250	A
<b>Avalanche ruggedness</b>						
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	I <sub>D</sub> = 62 A; V <sub>sup</sub> ≤ 80 V; R <sub>GS</sub> = 50 Ω; V <sub>GS</sub> = 5 V; T <sub>j(init)</sub> = 25 °C; unclamped; <a href="#">Fig. 3</a>	[3][4]	-	79.6	mJ

- [1] Accumulated pulse duration up to 50 hours delivers zero defect ppm
- [2] Significantly longer life times are achieved by lowering T<sub>j</sub> and or V<sub>GS</sub>
- [3] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
- [4] Refer to application note AN10273 for further information.



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

$$V_{GS} \geq 5V$$



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

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

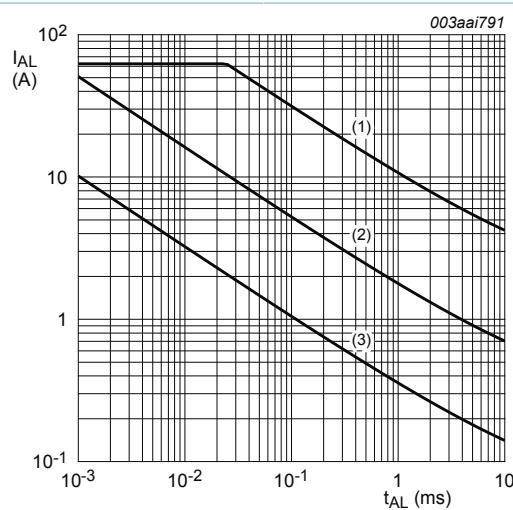


Fig. 3. Avalanche rating; avalanche current as a function of avalanche time

(1)  $T_j (init) = 25^\circ C$ ; (2)  $T_j (init) = 150^\circ C$ ; (3) Repetitive Avalanche

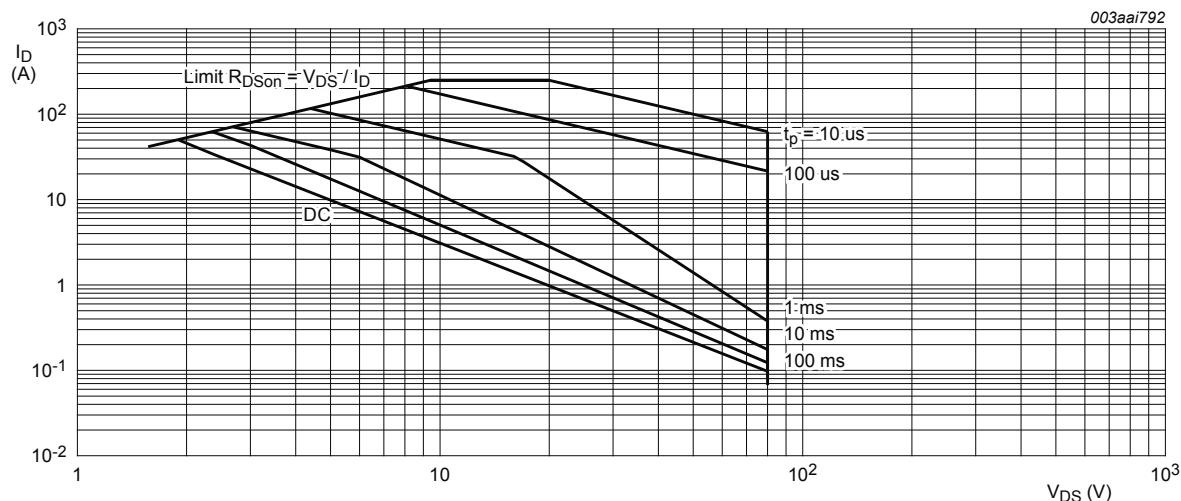


Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25^\circ C$ ;  $I_{DM}$  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	<a href="#">Fig. 5</a>		-	-	1.02	K/W

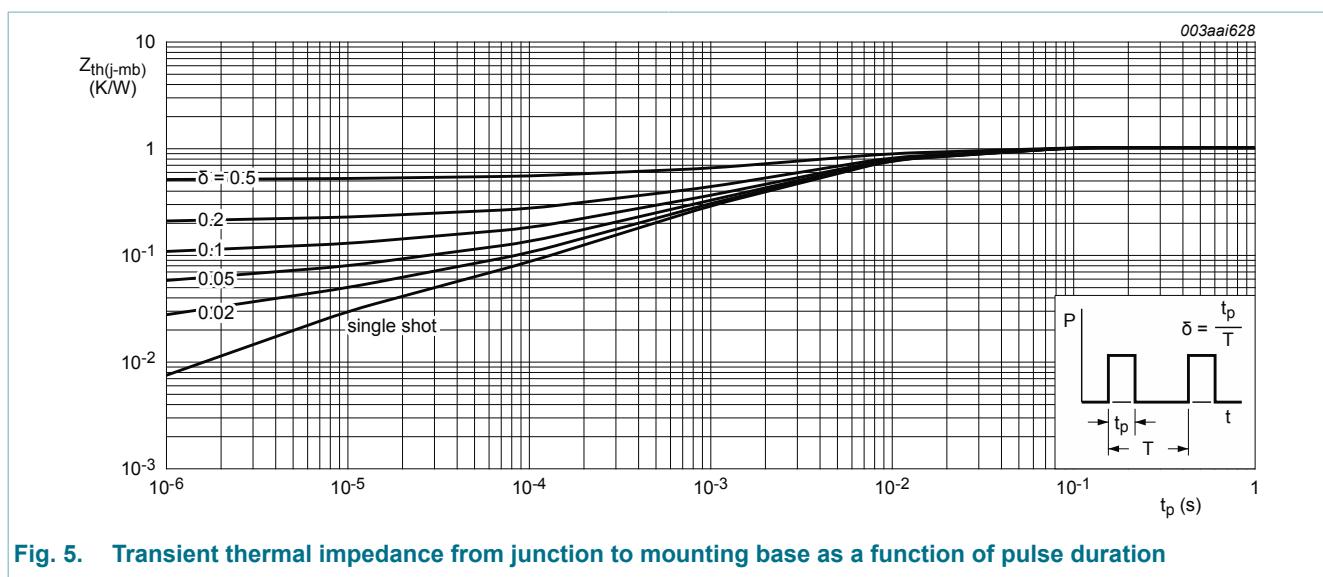


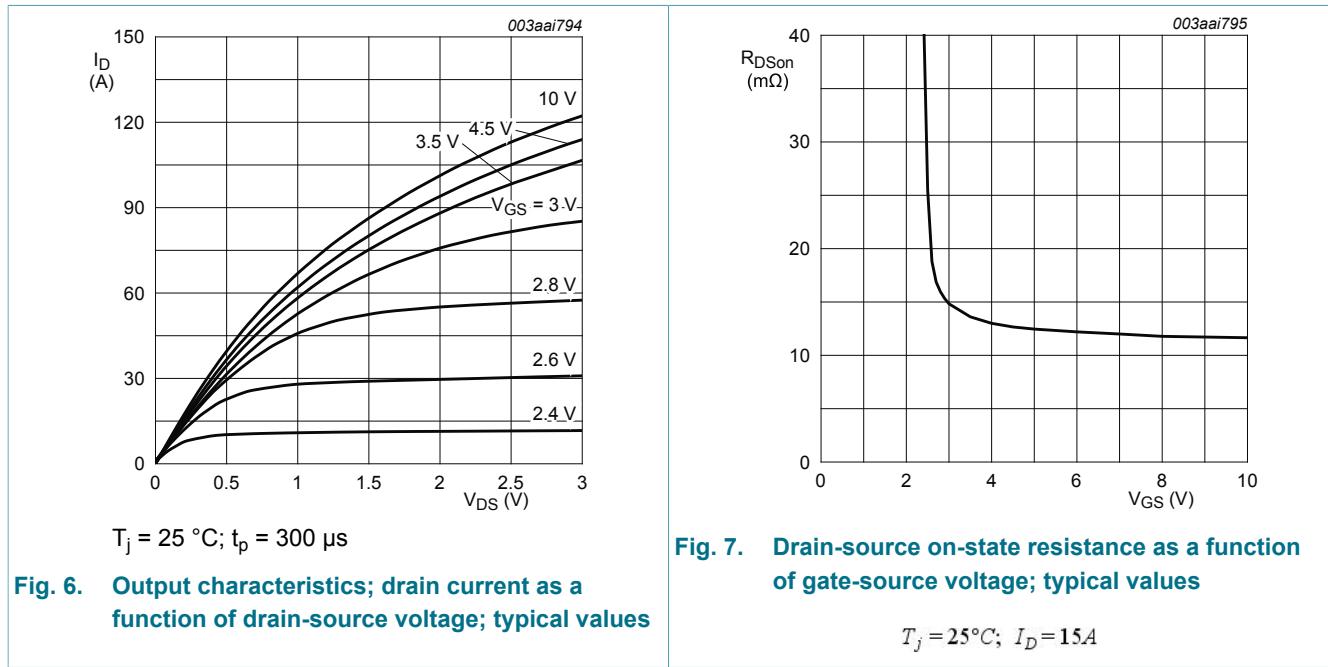
Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Static characteristics</b>							
V <sub>(BR)DSS</sub>	drain-source breakdown voltage	I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C		80	-	-	V
		I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = -55 °C		72	-	-	V
V <sub>GS(th)</sub>	gate-source threshold voltage	I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 25 °C; <a href="#">Fig. 9</a> ; <a href="#">Fig. 10</a>		1.4	1.7	2.1	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = -55 °C; <a href="#">Fig. 9</a>		-	-	2.45	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 175 °C; <a href="#">Fig. 9</a>		0.5	-	-	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 80 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	0.25	10	μA
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 80 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 175 °C		-	-	500	μA
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 10 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	2	100	nA
		V <sub>GS</sub> = -10 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	2	100	nA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 5 V; I <sub>D</sub> = 15 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 11</a>		-	12.2	15	mΩ
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 10 V; I <sub>D</sub> = 15 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 11</a>		-	11.3	14	mΩ
		V <sub>GS</sub> = 5 V; I <sub>D</sub> = 15 A; T <sub>j</sub> = 175 °C; <a href="#">Fig. 11</a> ; <a href="#">Fig. 12</a>		-	-	37.65	mΩ

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Dynamic characteristics</b>							
$Q_{G(\text{tot})}$	total gate charge	$I_D = 15 \text{ A}$ ; $V_{DS} = 64 \text{ V}$ ; $V_{GS} = 5 \text{ V}$ ; $T_j = 25^\circ\text{C}$ ; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>		-	28.9	-	nC
$Q_{GS}$	gate-source charge			-	8.1	-	nC
$Q_{GD}$	gate-drain charge			-	8.7	-	nC
$C_{iss}$	input capacitance	$V_{GS} = 0 \text{ V}$ ; $V_{DS} = 25 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $T_j = 25^\circ\text{C}$ ; <a href="#">Fig. 15</a>		-	3479	4640	pF
$C_{oss}$	output capacitance			-	236	283	pF
$C_{rss}$	reverse transfer capacitance			-	114	156	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 60 \text{ V}$ ; $R_L = 4 \Omega$ ; $V_{GS} = 5 \text{ V}$ ; $R_{G(\text{ext})} = 5 \Omega$ ; $T_j = 25^\circ\text{C}$		-	15.3	-	ns
$t_r$	rise time			-	24.6	-	ns
$t_{d(off)}$	turn-off delay time			-	45.3	-	ns
$t_f$	fall time			-	24.7	-	ns
<b>Source-drain diode</b>							
$V_{SD}$	source-drain voltage	$I_S = 15 \text{ A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25^\circ\text{C}$ ; <a href="#">Fig. 16</a>		-	0.8	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20 \text{ A}$ ; $dI_S/dt = -100 \text{ A}/\mu\text{s}$ ; $V_{GS} = 0 \text{ V}$ ; $V_{DS} = 25 \text{ V}$ ; $T_j = 25^\circ\text{C}$		-	25.8	-	ns
$Q_r$	recovered charge			-	29.3	-	nC



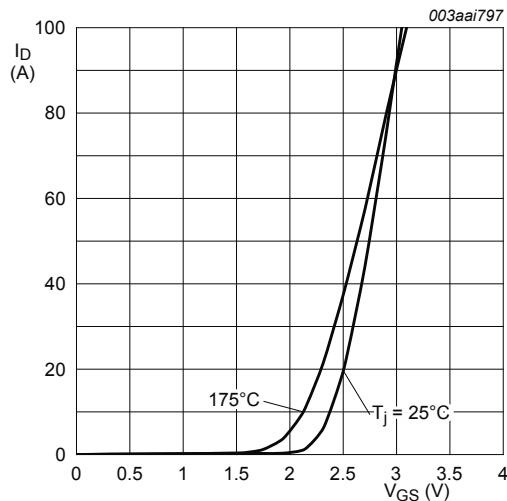


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$$V_{DS} = 10V$$

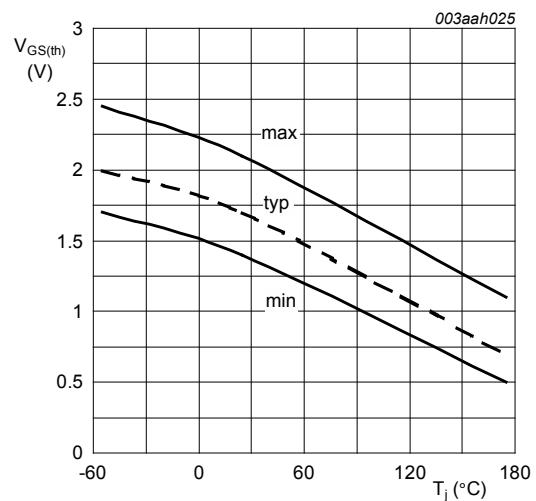


Fig. 9. Gate-source threshold voltage as a function of junction temperature

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

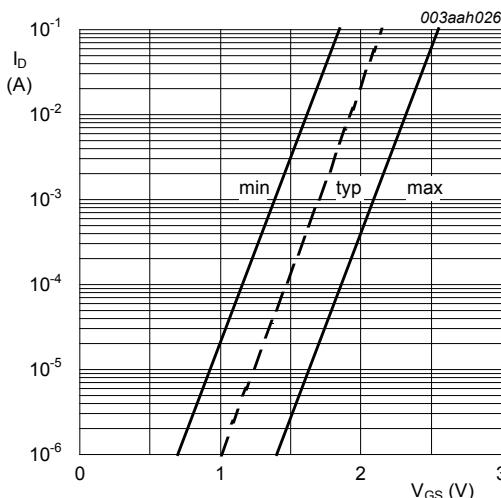
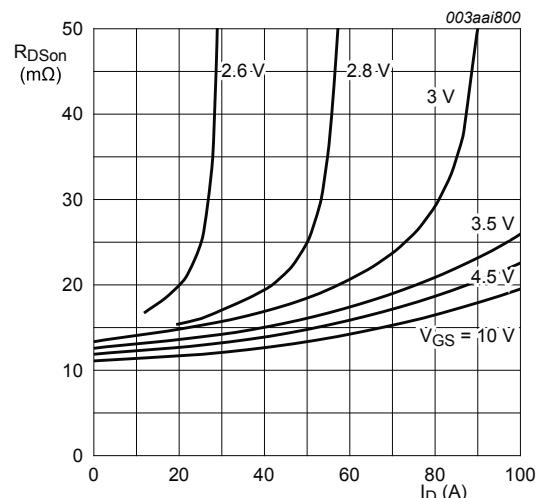


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

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



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

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

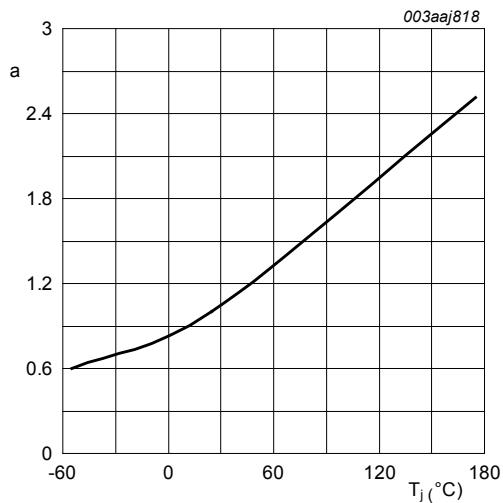


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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

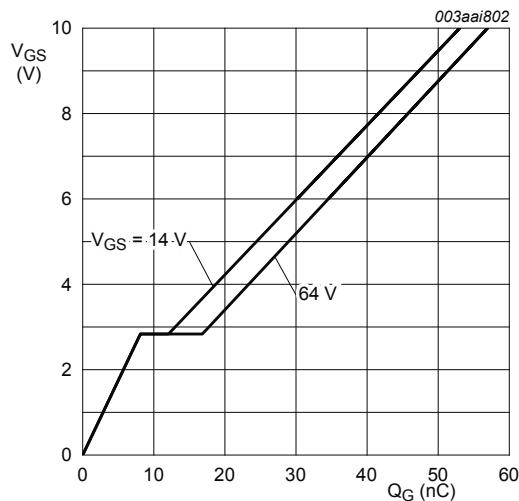


Fig. 14. Gate-source voltage as a function of gate charge; typical values

$T_j = 25^\circ\text{C}; I_D = 15\text{A}$

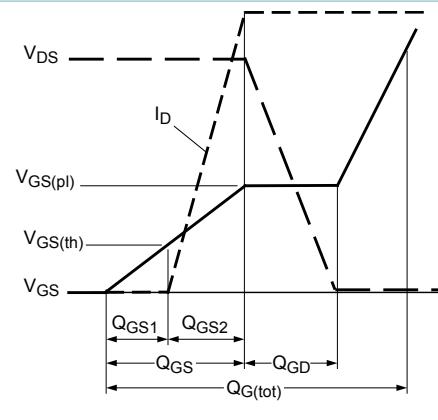


Fig. 13. Gate charge waveform definitions

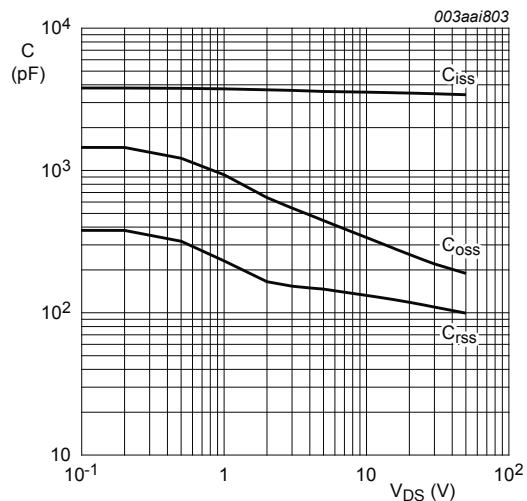


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

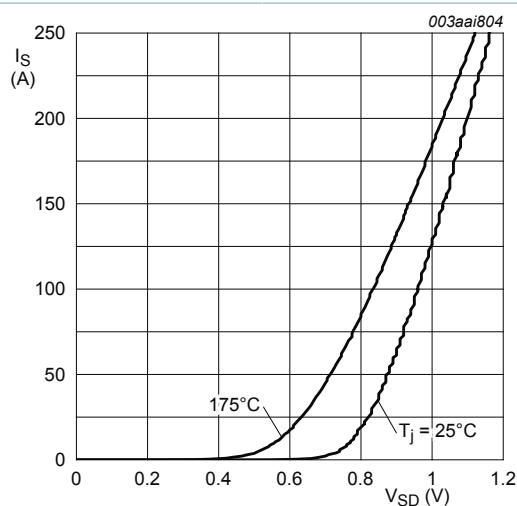


Fig. 16. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$$V_{GS} = 0\text{ V}$$

## 11. Package outline

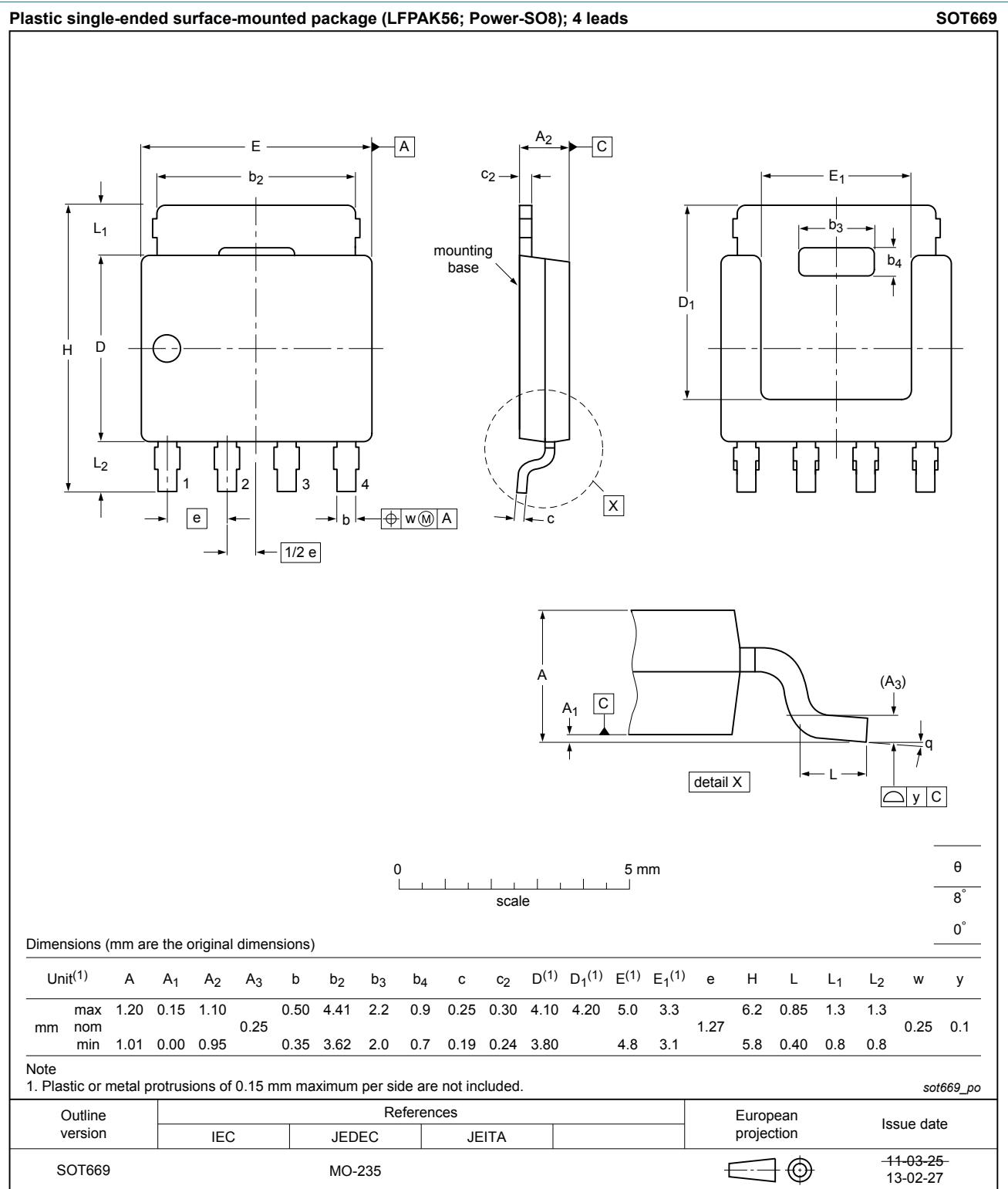


Fig. 17. Package outline LFPAK56; Power-SO8 (SOT669)

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### 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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