



# 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

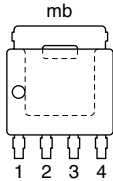
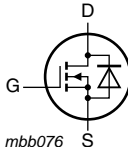
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	-	55	V
$I_D$	drain current	$V_{GS} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 4</a>	-	-	61.8	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	106	W
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 20\text{ A}$ ; $T_j = 25\text{ °C}$	-	8.1	11	mΩ
		$V_{GS} = 5\text{ V}$ ; $I_D = 20\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	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	$I_D = 61.8\text{ A}$ ; $V_{sup} \leq 55\text{ V}$ ; $R_{GS} = 50\ \Omega$ ; $V_{GS} = 5\text{ V}$ ; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; unclamped	-	-	129	mJ
Dynamic characteristics						
$Q_{GD}$	gate-drain charge	$V_{GS} = 5\text{ V}$ ; $I_D = 20\text{ A}$ ; $V_{DS} = 44\text{ V}$ ; $T_j = 25\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 14</a>	-	13	-	nC

2. 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		
SOT669 (LFAK)				<i>mbb076</i>

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK9Y12-55B	LFAK	plastic single-ended surface-mounted package (LFAK); 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	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	-	55	V
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	-	55	V
$V_{GS}$	gate-source voltage		-15	-	15	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 5\text{ V}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 4</a>	-	-	61.8	A
		$T_{mb} = 100\text{ °C}$ ; $V_{GS} = 5\text{ V}$ ; see <a href="#">Figure 1</a>	-	-	43.8	A
$I_{DM}$	peak drain current	$T_{mb} = 25\text{ °C}$ ; $t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; see <a href="#">Figure 4</a>	-	-	247	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	106	W
$T_{stg}$	storage temperature		-55	-	175	°C
$T_j$	junction temperature		-55	-	175	°C
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	-	61.8	A
$I_{SM}$	peak source current	$t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ °C}$	-	-	247	A
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 61.8\text{ A}$ ; $V_{sup} \leq 55\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; $V_{GS} = 5\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; unclamped	-	-	129	mJ
$E_{DS(AL)R}$	repetitive drain-source avalanche energy	see <a href="#">Figure 3</a>	<a href="#">[1]</a> <a href="#">[2]</a> <a href="#">[3]</a>	-	-	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.

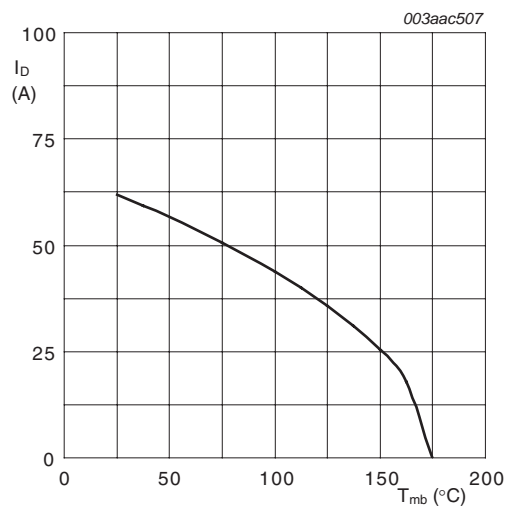
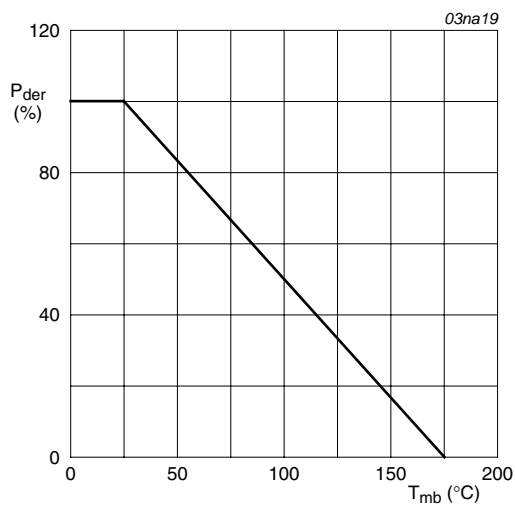


Fig 1. Continuous drain current as a function of mounting base temperature



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

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

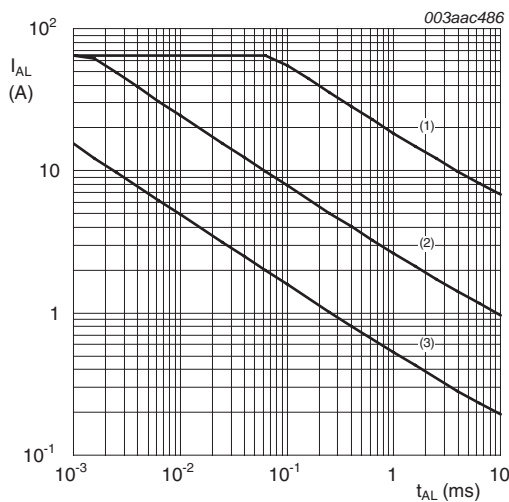
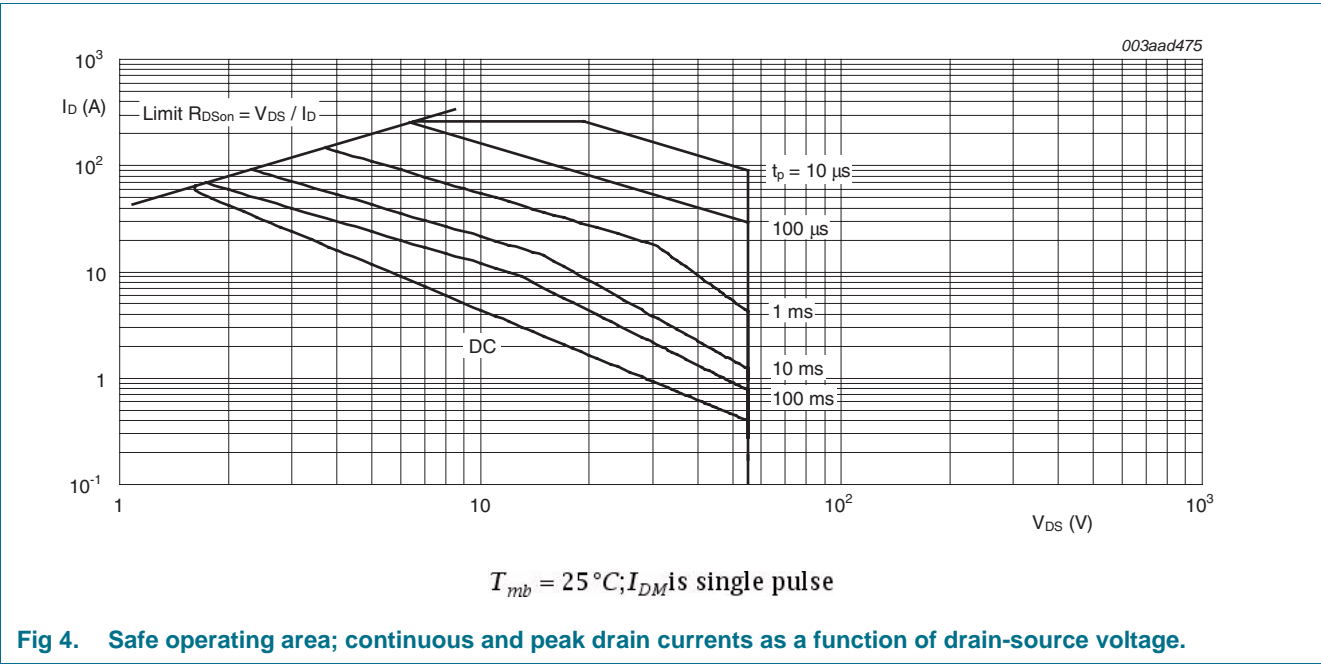


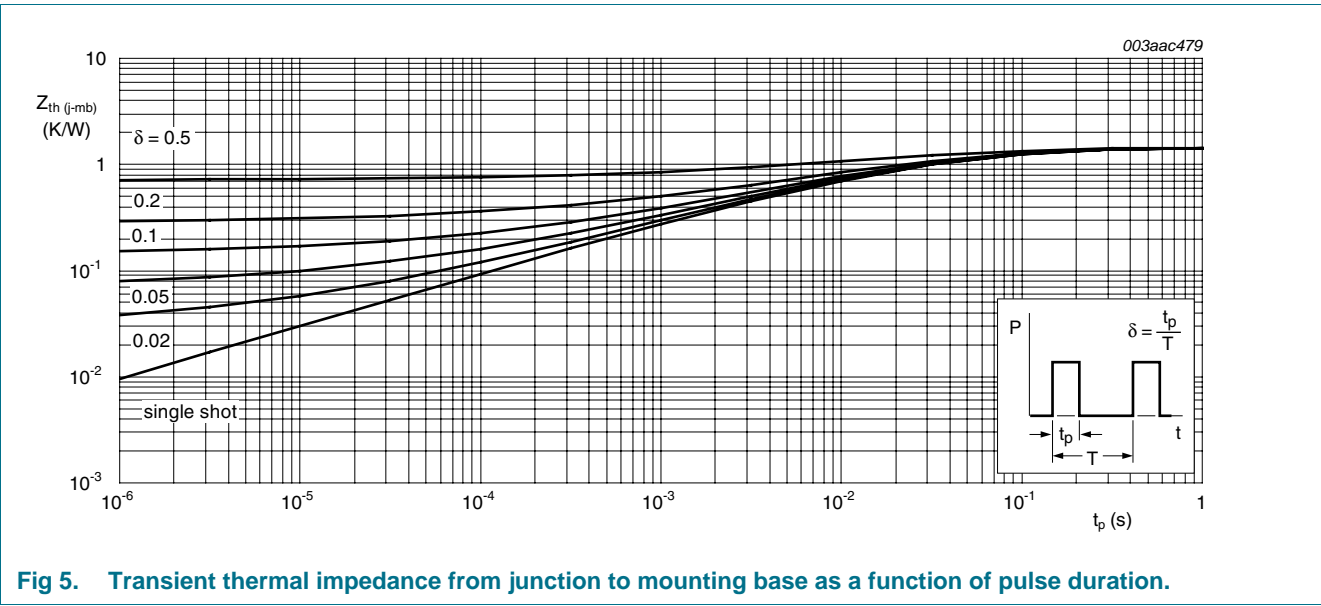
Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time



5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 5</a>	-	-	1.42	K/W



## 6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V <sub>(BR)DSS</sub>	drain-source breakdown voltage	I <sub>D</sub> = 0.25 mA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	55	-	-	V
		I <sub>D</sub> = 0.25 mA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = -55 °C	50	-	-	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> = -55 °C; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	-	-	2.45	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 25 °C; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	1.25	1.65	2.15	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 175 °C; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	0.5	-	-	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 55 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 175 °C	-	-	500	μA
		V <sub>DS</sub> = 55 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	0.02	1	μA
I <sub>GSS</sub>	gate leakage current	V <sub>DS</sub> = 0 V; V <sub>GS</sub> = 15 V; T <sub>j</sub> = 25 °C	-	2	100	nA
		V <sub>DS</sub> = 0 V; V <sub>GS</sub> = -15 V; T <sub>j</sub> = 25 °C	-	2	100	nA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 20 A; T <sub>j</sub> = 25 °C	-	-	13	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 20 A; T <sub>j</sub> = 25 °C	-	8.1	11	mΩ
		V <sub>GS</sub> = 5 V; I <sub>D</sub> = 20 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	9.1	12	mΩ
		V <sub>GS</sub> = 5 V; I <sub>D</sub> = 20 A; T <sub>j</sub> = 175 °C; see <a href="#">Figure 13</a>	-	-	27.6	mΩ
Dynamic characteristics						
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 20 A; V <sub>DS</sub> = 44 V; V <sub>GS</sub> = 5 V; T <sub>j</sub> = 25 °C; see <a href="#">Figure 14</a>	-	32	-	nC
Q <sub>GS</sub>	gate-source charge		-	6	-	nC
Q <sub>GD</sub>	gate-drain charge		-	13	-	nC
C <sub>iss</sub>	input capacitance	V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 25 V; f = 1 MHz; T <sub>j</sub> = 25 °C; see <a href="#">Figure 15</a>	-	2160	2880	pF
C <sub>oss</sub>	output capacitance		-	315	378	pF
C <sub>rss</sub>	reverse transfer capacitance		-	175	240	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 30 V; R <sub>L</sub> = 1.5 Ω; V <sub>GS</sub> = 5 V; R <sub>G(ext)</sub> = 10 Ω; T <sub>j</sub> = 25 °C	-	29	-	ns
t <sub>r</sub>	rise time		-	78	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	100	-	ns
t <sub>f</sub>	fall time		-	63	-	ns
Source-drain diode						
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 20 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C; see <a href="#">Figure 16</a>	-	0.85	1.2	V
t <sub>rr</sub>	reverse recovery time	I <sub>S</sub> = 20 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = -10 V; V <sub>DS</sub> = 30 V; T <sub>j</sub> = 25 °C	-	44	-	ns
Q <sub>r</sub>	recovered charge		-	83	-	nC

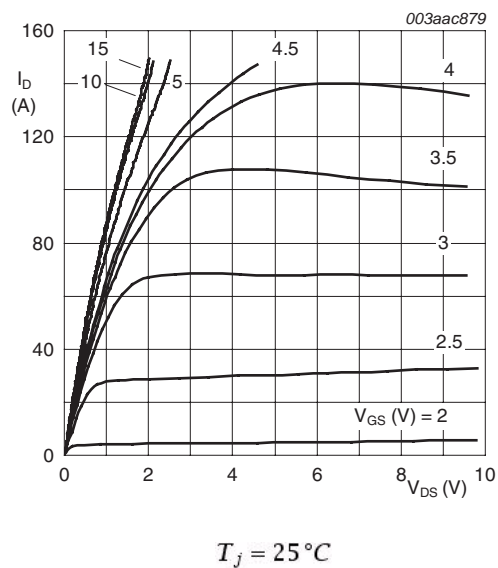


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values.

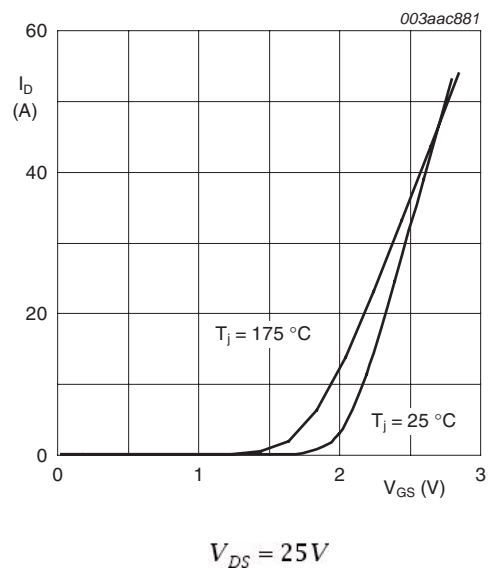


Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values.

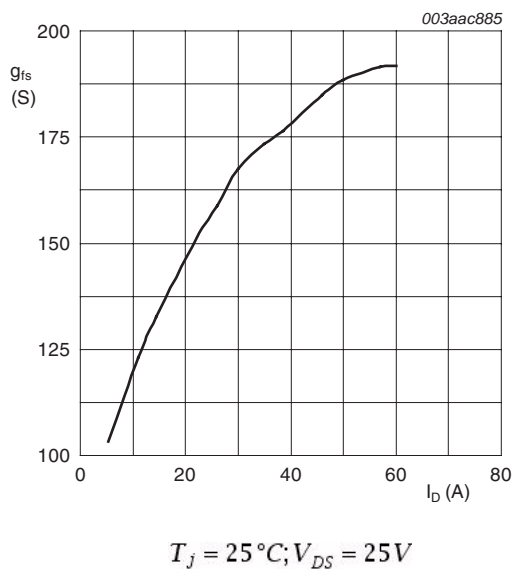


Fig 8. Forward transconductance as a function of drain current; typical values.

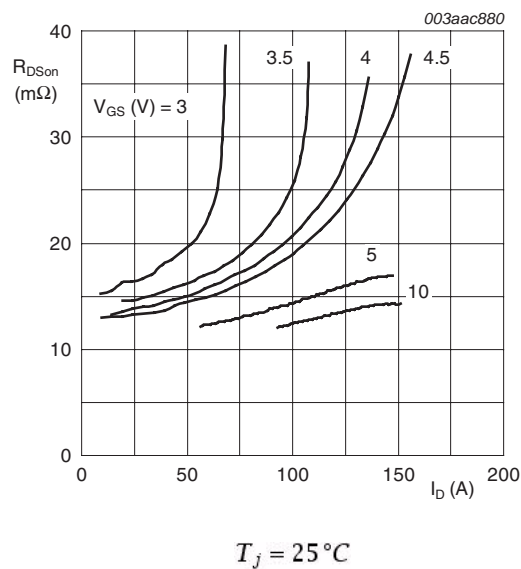
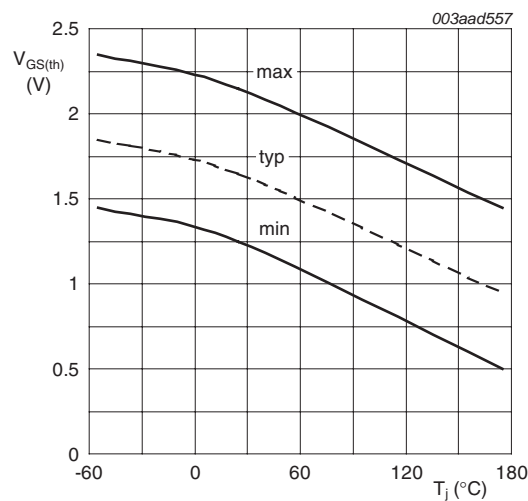
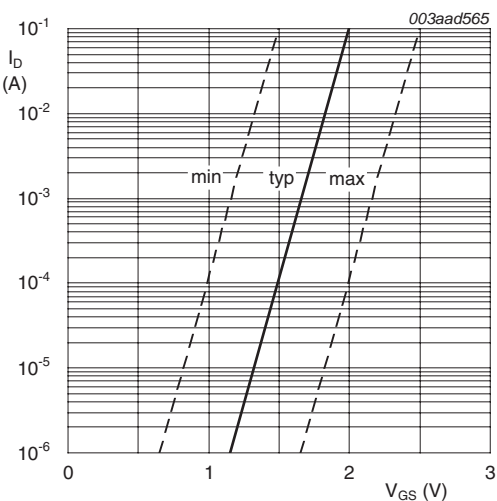


Fig 9. Drain-source on-state resistance as a function of drain current; typical values.



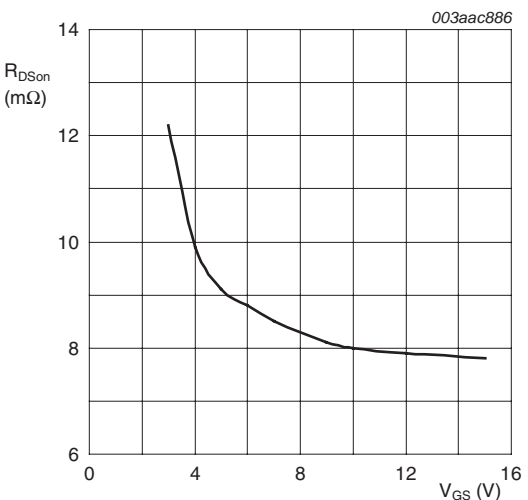
$I_D = 1\text{mA}; V_{DS} = V_{GS}$

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



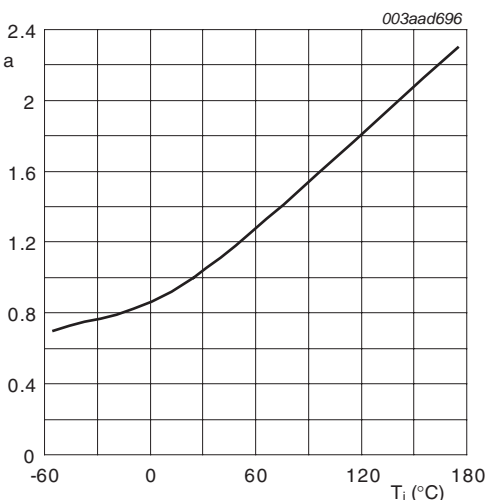
$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = V_{GS}$

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



$T_j = 25\text{ }^{\circ}\text{C}; I_D = 20\text{A}$

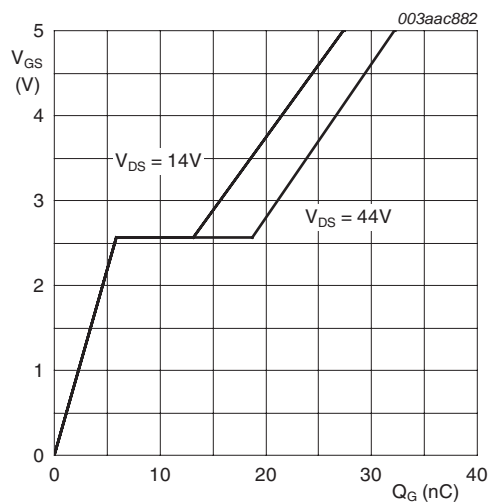
Fig 12. Drain-source on-state resistance as a function of gate-source voltage; typical values.



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

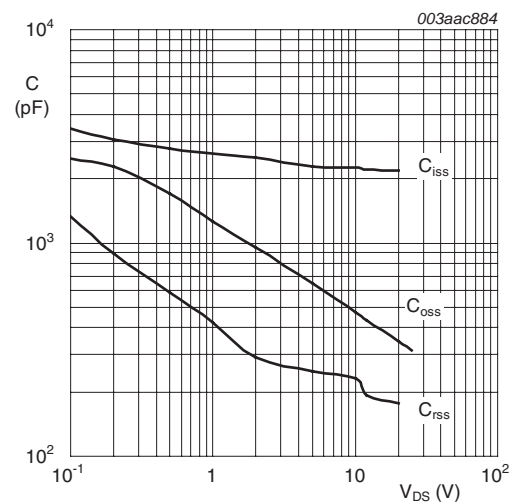
Fig 13. Normalized drain-source on-state resistance factor as a function of junction temperature.





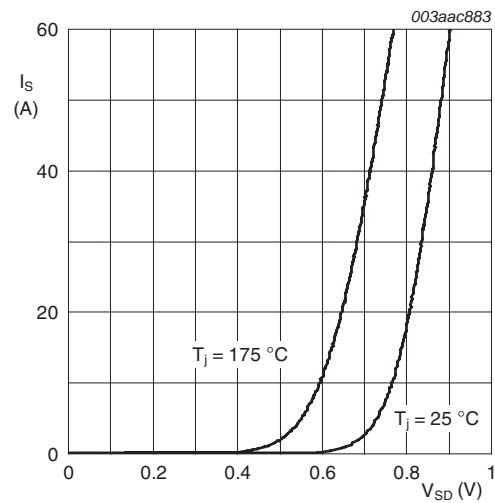
$T_j = 25^\circ C; I_D = 20A$

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 (LFAK); 4 leads

SOT669

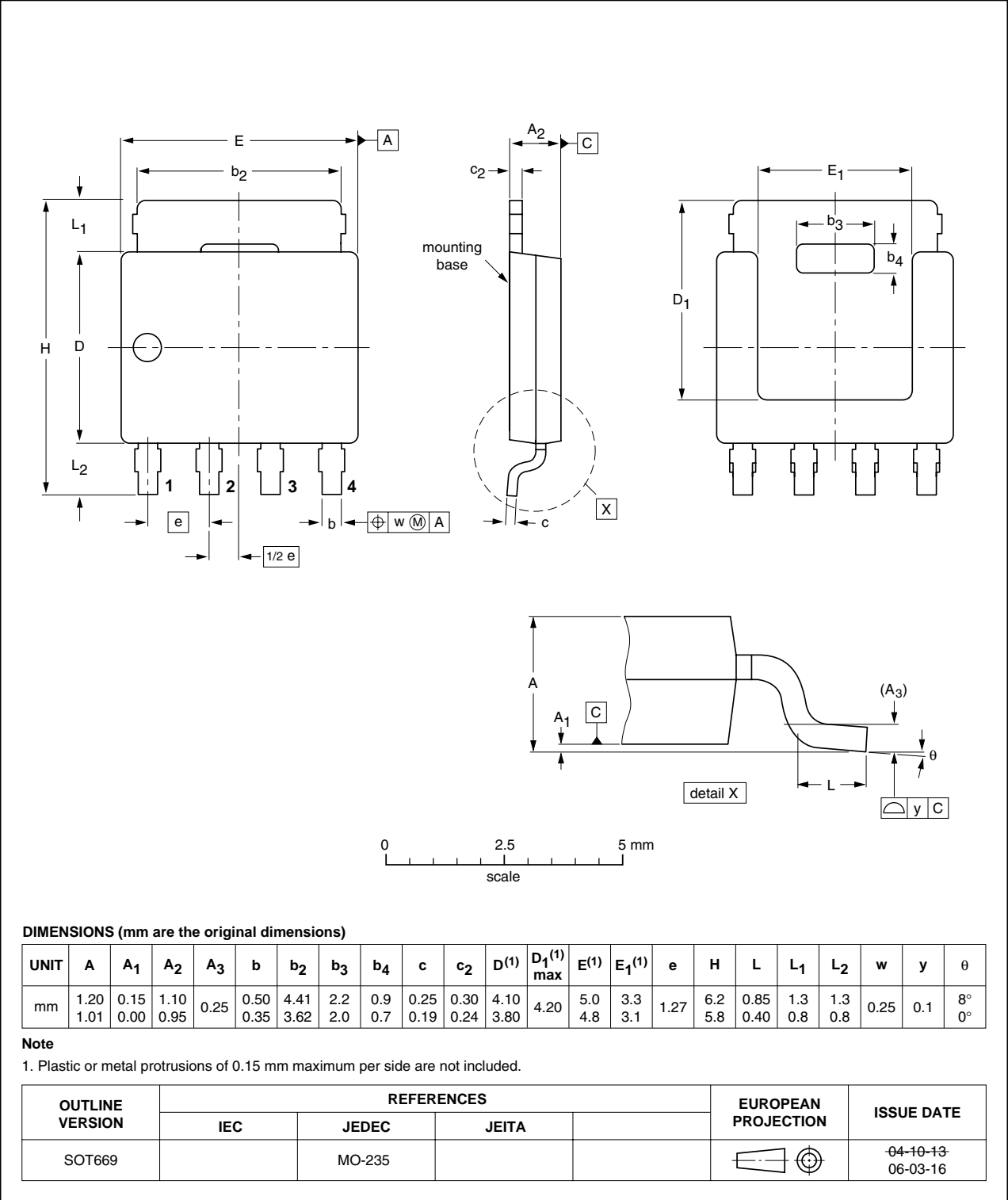


Fig 17. Package outline SOT669 (LFAK)

## 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 <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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".

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## 11. Contents

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<b>1</b>	<b>Product profile</b> . . . . .	<b>1</b>
1.1	General description . . . . .	1
1.2	Features and benefits . . . . .	1
1.3	Applications . . . . .	1
1.4	Quick reference data . . . . .	1
<b>2</b>	<b>Pinning information</b> . . . . .	<b>2</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>4</b>	<b>Limiting values</b> . . . . .	<b>3</b>
<b>5</b>	<b>Thermal characteristics</b> . . . . .	<b>5</b>
<b>6</b>	<b>Characteristics</b> . . . . .	<b>6</b>
<b>7</b>	<b>Package outline</b> . . . . .	<b>10</b>
<b>8</b>	<b>Revision history</b> . . . . .	<b>11</b>
<b>9</b>	<b>Legal information</b> . . . . .	<b>12</b>
9.1	Data sheet status . . . . .	12
9.2	Definitions . . . . .	12
9.3	Disclaimers . . . . .	12
9.4	Trademarks . . . . .	13
<b>10</b>	<b>Contact information</b> . . . . .	<b>13</b>

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