

# BUK7Y20-30B

## N-channel TrenchMOS standard level FET

Rev. 04 — 7 April 2010

Product data sheet

## 1. Product profile

### 1.1 General description

Standard level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using NXP High-Performance Automotive (HPA) 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

- Q101 compliant
- Suitable for standard level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

### 1.3 Applications

- 12 V Loads
- Automotive systems
- General purpose power switch
- Motors, lamps and solenoids

### 1.4 Quick reference data

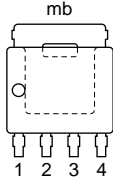
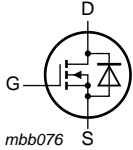
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	-	30	V
$I_D$	drain current	$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 4</a>	-	-	39.5	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	59	W
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 20\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	16	20	mΩ
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 39.5\text{ A}$ ; $V_{sup} \leq 30\text{ V}$ ; $R_{GS} = 50\text{ Ω}$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; unclamped	-	-	45	mJ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$I_D = 20\text{ A}$ ; $V_{DS} = 24\text{ V}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 14</a>	-	3.84	-	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)	

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
BUK7Y20-30B	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	$T_j \geq 25\text{ }^{\circ}\text{C}$ ; $T_j \leq 175\text{ }^{\circ}\text{C}$	-	-	30	V
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	-	30	V
$V_{GS}$	gate-source voltage		-20	-	20	V
$I_D$	drain current	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 4</a>	-	-	39.5	A
		$T_{mb} = 100\text{ }^{\circ}\text{C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a>	-	-	28	A
$I_{DM}$	peak drain current	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ; $t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; see <a href="#">Figure 4</a>	-	-	158	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 2</a>	-	-	59	W
$T_{stg}$	storage temperature		-55	-	175	$^{\circ}\text{C}$
$T_j$	junction temperature		-55	-	175	$^{\circ}\text{C}$
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25\text{ }^{\circ}\text{C}$	-	-	39.5	A
$I_{SM}$	peak source current	$t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ }^{\circ}\text{C}$	-	-	158	A
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 39.5\text{ A}$ ; $V_{sup} \leq 30\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; unclamped	-	-	45	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  $^{\circ}\text{C}$ .

[2] Repetitive avalanche rating limited by an average junction temperature of 170  $^{\circ}\text{C}$ .

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

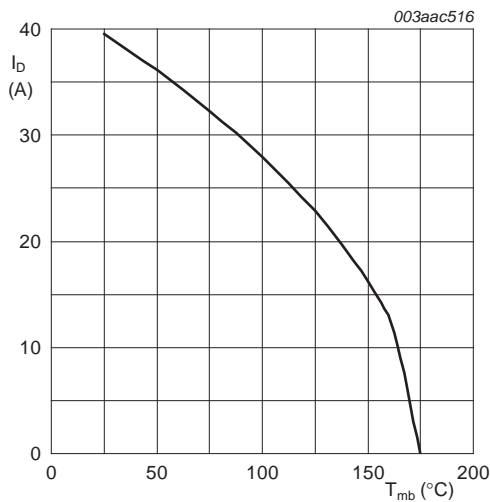
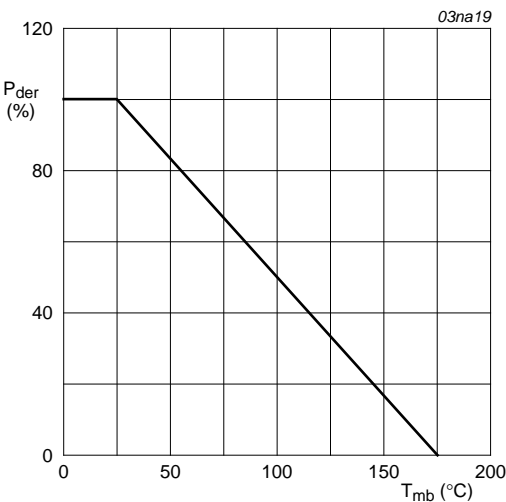


Fig 1. Continuous drain current as a function of mounting base temperature



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

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

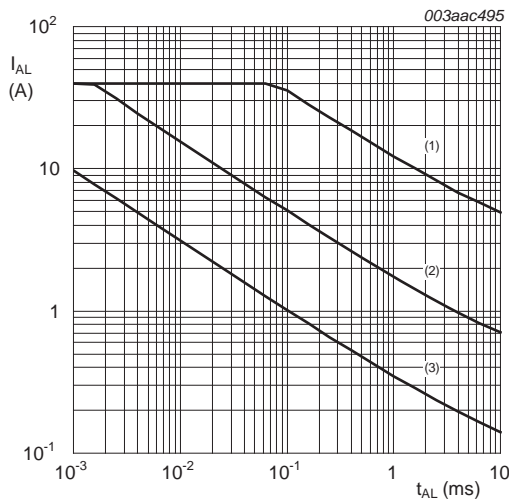
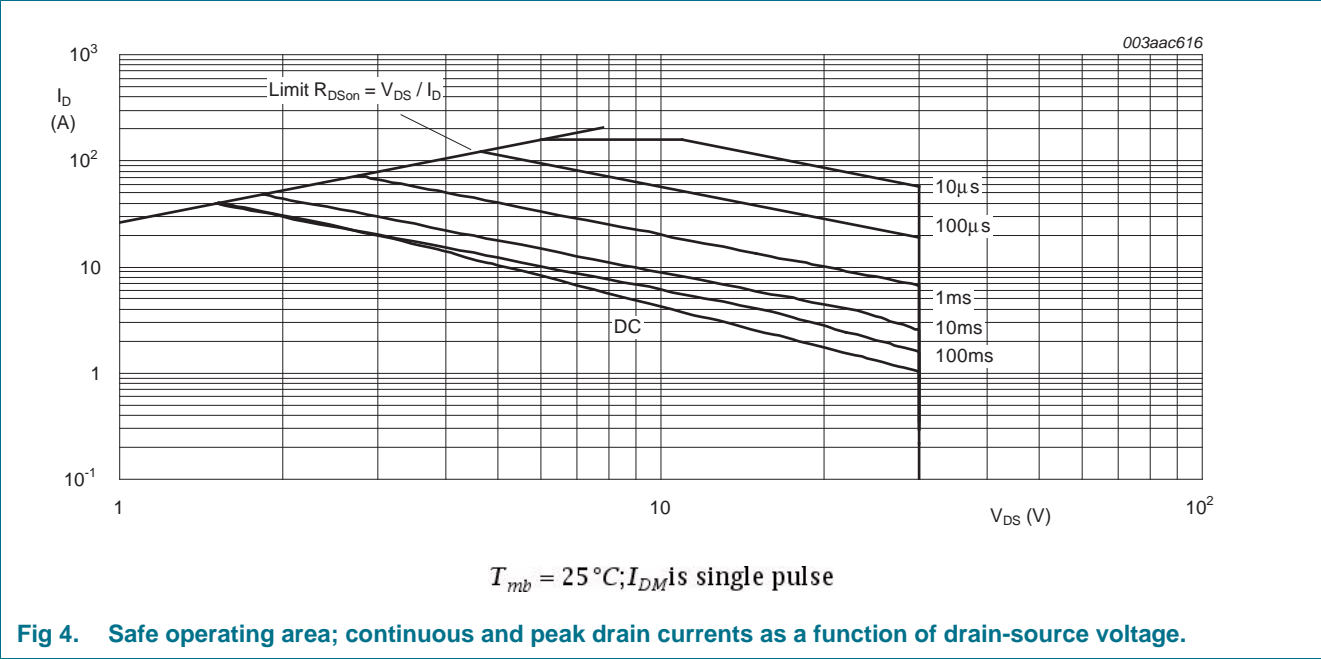


Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time



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>	-	-	2.53	K/W

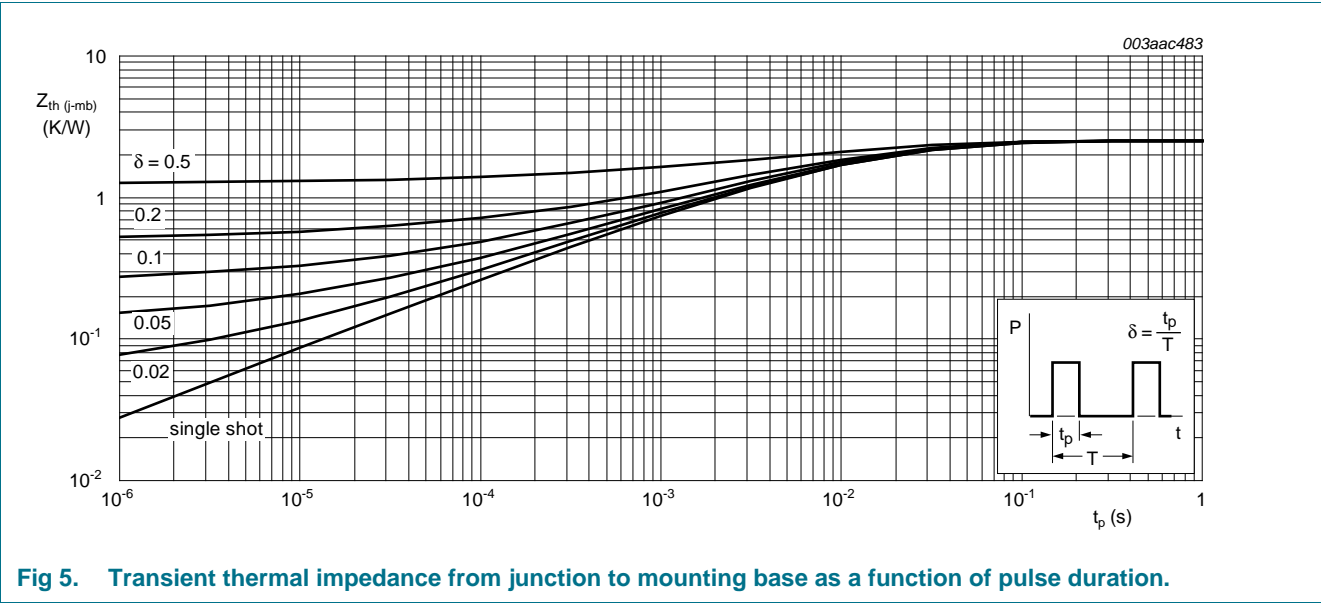


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration.

## 6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V <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	30	-	-	V
		I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = -55 °C	27	-	-	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; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	2	3	4	V
		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>	-	-	4.4	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>	1	-	-	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 30 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	0.02	1	μA
		V <sub>DS</sub> = 30 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 175 °C	-	-	500	μA
I <sub>GSS</sub>	gate leakage current	V <sub>DS</sub> = 0 V; V <sub>GS</sub> = 20 V; T <sub>j</sub> = 25 °C	-	2	100	nA
		V <sub>DS</sub> = 0 V; V <sub>GS</sub> = -20 V; T <sub>j</sub> = 25 °C	-	2	100	nA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 10 V; I <sub>D</sub> = 20 A; T <sub>j</sub> = 175 °C; see <a href="#">Figure 12</a>	-	-	38	mΩ
		V <sub>GS</sub> = 10 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>	-	16	20	mΩ
Dynamic characteristics						
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 20 A; V <sub>DS</sub> = 24 V; V <sub>GS</sub> = 10 V; see <a href="#">Figure 14</a>	-	11.2	-	nC
Q <sub>GS</sub>	gate-source charge		-	3.75	-	nC
Q <sub>GD</sub>	gate-drain charge		-	3.84	-	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>	-	516	688	pF
C <sub>oss</sub>	output capacitance		-	188	226	pF
C <sub>rss</sub>	reverse transfer capacitance		-	94	129	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 25 V; R <sub>L</sub> = 1.25 Ω; V <sub>GS</sub> = 10 V; R <sub>G(ext)</sub> = 10 Ω	-	9.5	-	ns
t <sub>r</sub>	rise time		-	18	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	20.5	-	ns
t <sub>f</sub>	fall time		-	10	-	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> = 0 V; V <sub>DS</sub> = 25 V	-	28	-	ns
Q <sub>r</sub>	recovered charge		-	27.4	-	nC

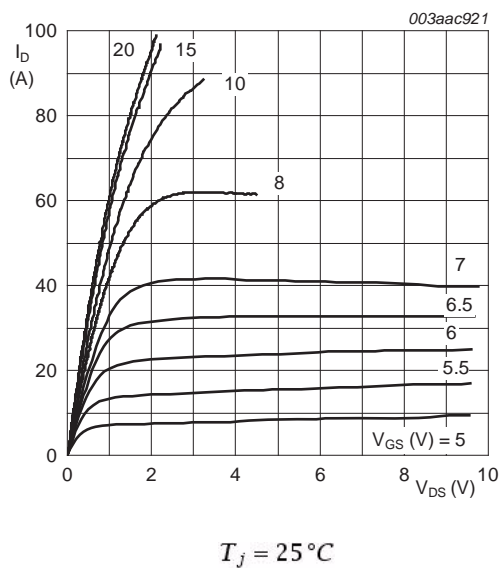


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values.

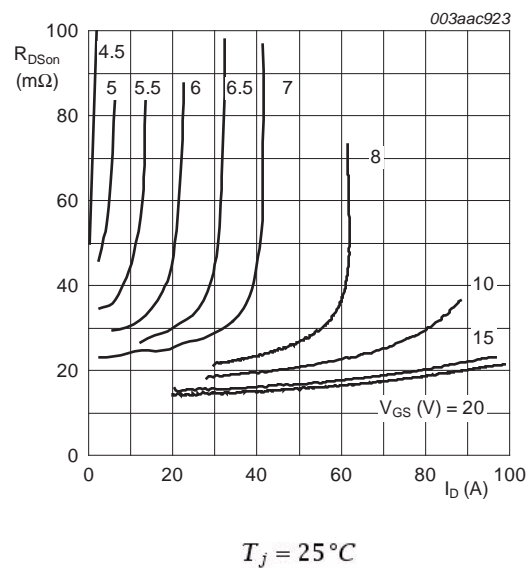


Fig 7. Drain-source on-state resistance as a function of drain current; typical values.

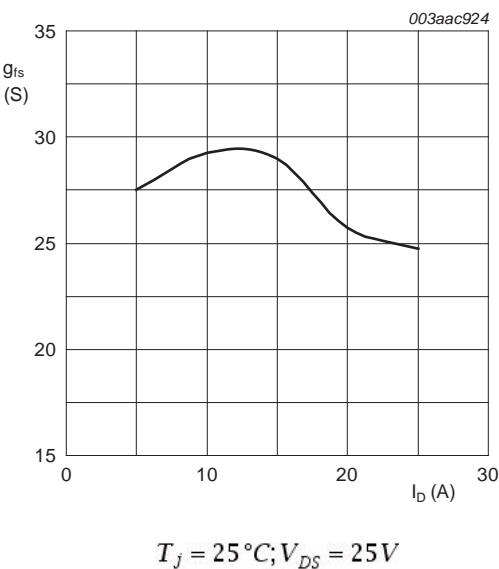


Fig 8. Forward transconductance as a function of drain current; typical values.

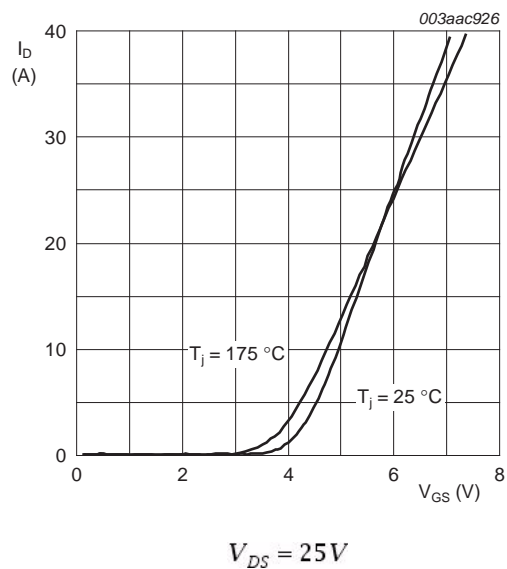


Fig 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values.

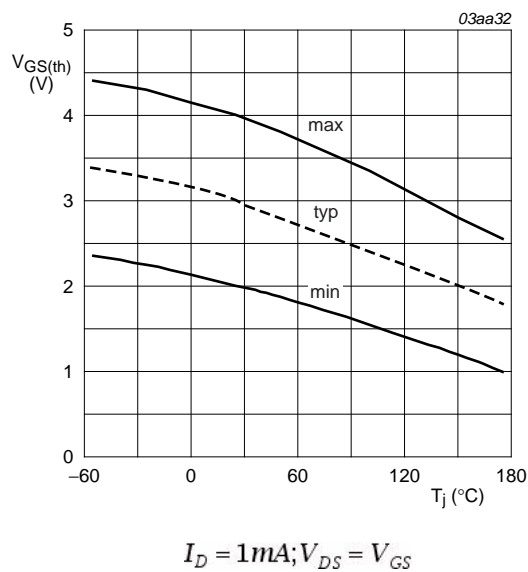


Fig 10. Gate-source threshold voltage as a function of junction temperature

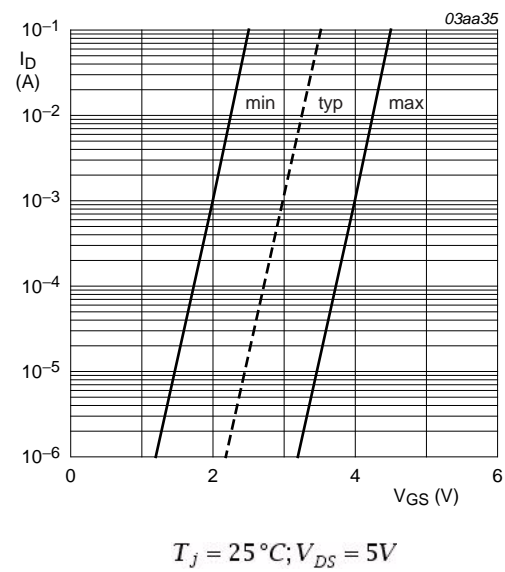


Fig 11. Sub-threshold drain current as a function of gate-source voltage

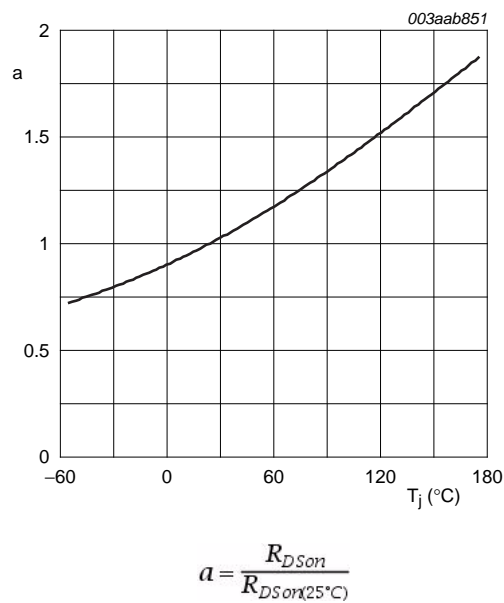


Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature

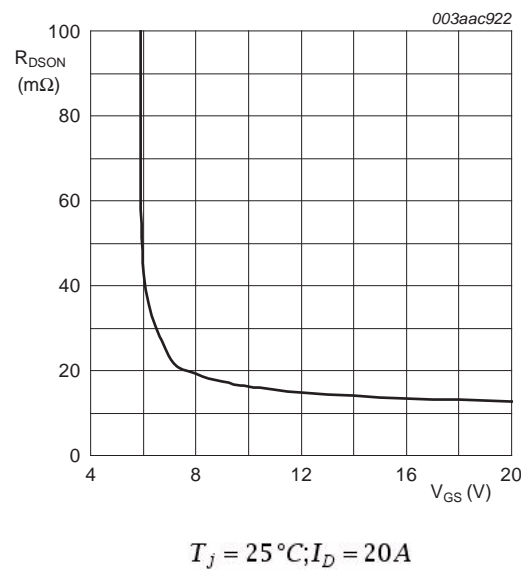
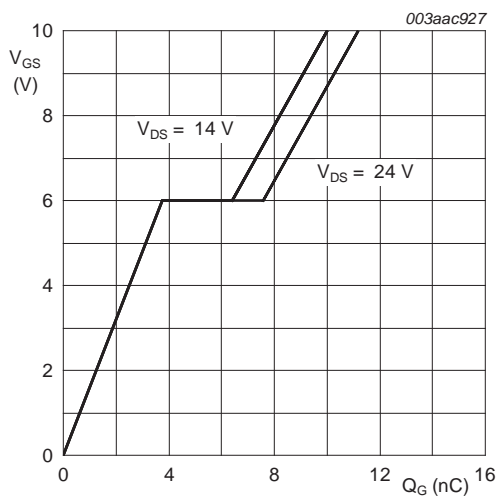


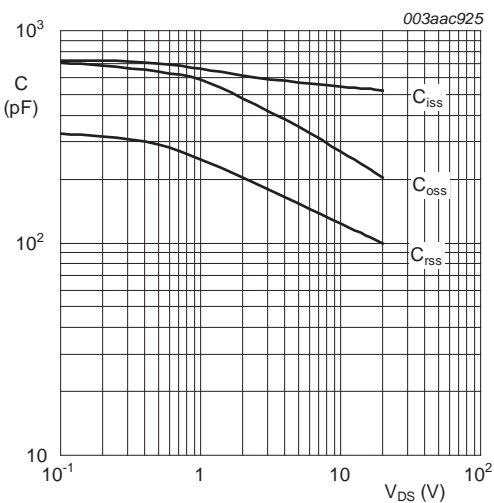
Fig 13. Drain-source on-state resistance as a function of gate-source voltage; typical values.





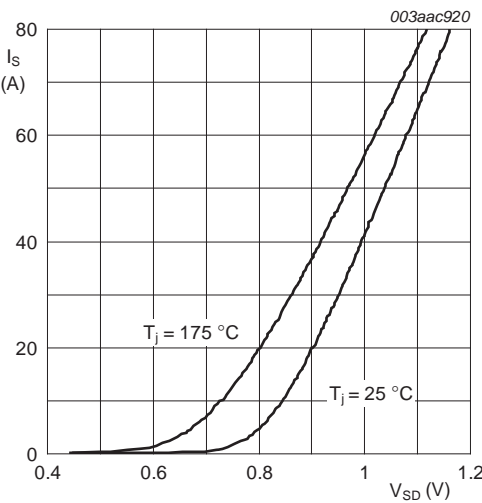
$T_j = 25^\circ\text{C}; I_D = 20\text{ A}$

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



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

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



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

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

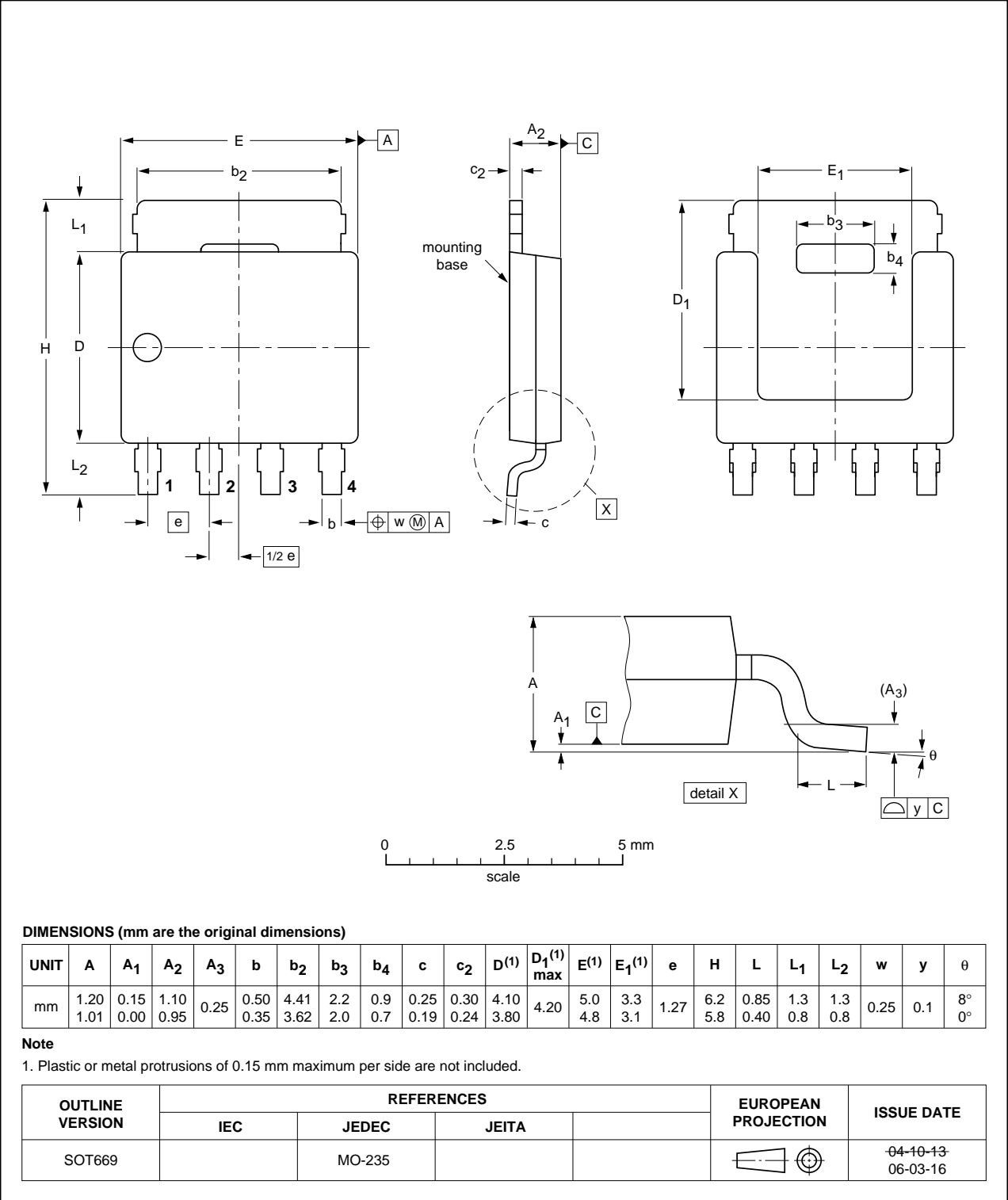


Fig 17. Package outline SOT669 (LFPAK)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK7Y20-30B_4	20100407	Product data sheet	-	BUK7Y20-30B_3
Modifications:	• Status changed from objective to product			
BUK7Y20-30B_3	20100217	Objective data sheet	-	BUK7Y20-30B_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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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