



BUK9Y09-40B

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 loads
- Automotive systems
- General purpose power switching
- Motors, lamps and solenoids

1.4 Quick reference data

Table 1. Quick reference data

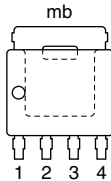
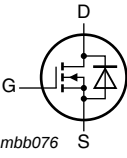
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	-	40	V
I_D	drain current	$V_{GS} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1 ; see Figure 4	-	-	75	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	105.3	W
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 11 ; see Figure 12	-	6.9	9	mΩ
		$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$	-	5.8	8	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	$I_D = 75\text{ A}$; $V_{sup} \leq 40\text{ V}$; $R_{GS} = 50\ \Omega$; $V_{GS} = 5\text{ V}$; $T_{J(init)} = 25\text{ }^{\circ}\text{C}$; unclamped	-	-	146	mJ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 32\text{ V}$; see Figure 13	-	11	-	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		
	Name	Description	Version
BUK9Y09-40B	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	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	-	40	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	-	40	V
V_{GS}	gate-source voltage		-15	-	15	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 5\text{ V}$; see Figure 1 ; see Figure 4	-	-	75	A
		$T_{mb} = 100\text{ °C}$; $V_{GS} = 5\text{ V}$; see Figure 1	-	-	53	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ °C}$; $t_p \leq 10\text{ }\mu\text{s}$; pulsed; see Figure 4	-	-	300	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	105.3	W
T_{stg}	storage temperature		-55	-	175	°C
T_j	junction temperature		-55	-	175	°C
Source-drain diode						
I_S	source current	$T_{mb} = 25\text{ °C}$	-	-	75	A
I_{SM}	peak source current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$	-	-	300	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}$; $V_{sup} \leq 40\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $T_{j(init)} = 25\text{ °C}$; unclamped	-	-	146	mJ
$E_{DS(AL)R}$	repetitive drain-source avalanche energy	see Figure 3	[1] [2] [3] [4]	-	-	J

- [1] Maximum value not quoted. Repetitive rating defined in avalanche rating figure.
 [2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
 [3] Repetitive avalanche rating limited by an average junction temperature of 170 °C.
 [4] Refer to application note AN10273 for further information.

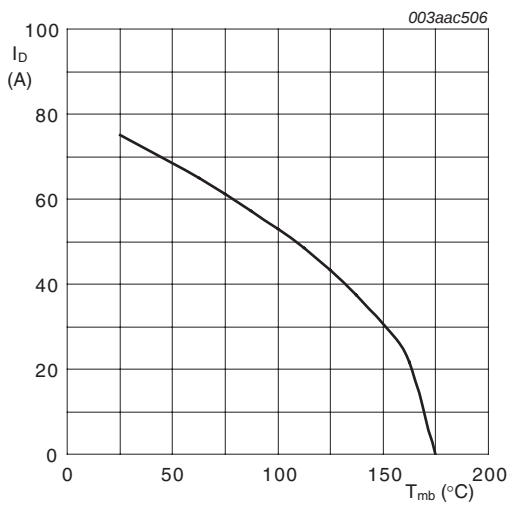
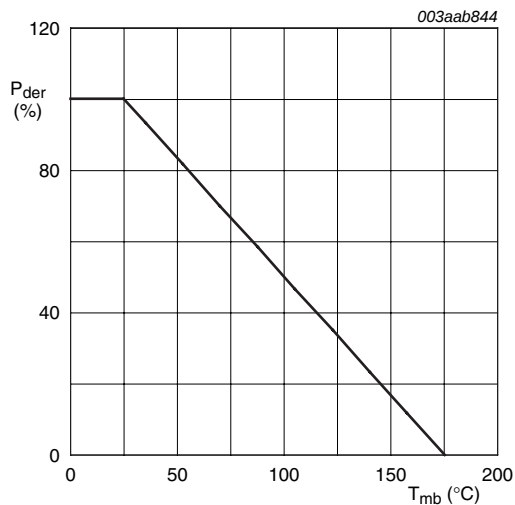


Fig 1. Continuous drain current as a function of mounting base temperature



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

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

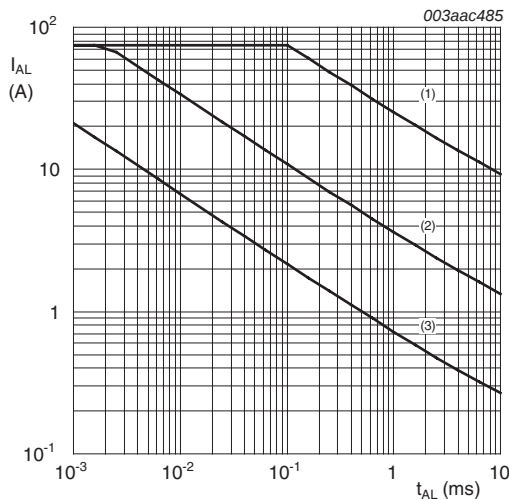


Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time

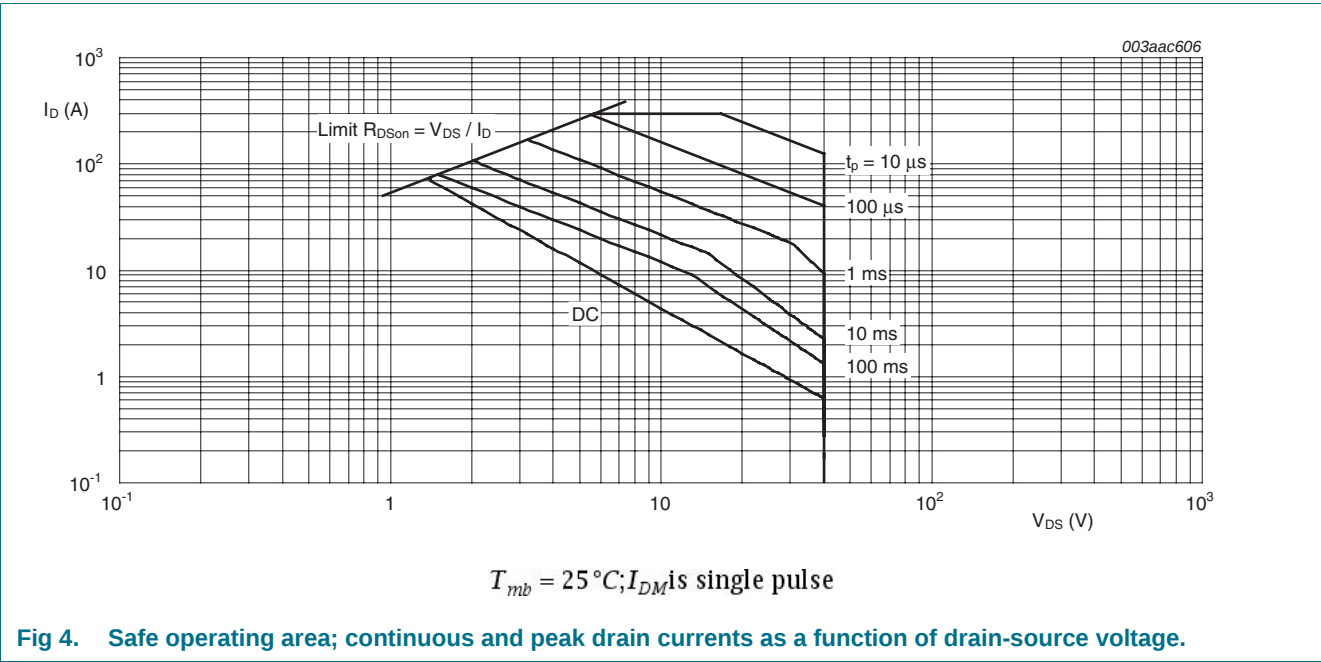


Fig 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.

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 Figure 5	-	-	1.42	K/W

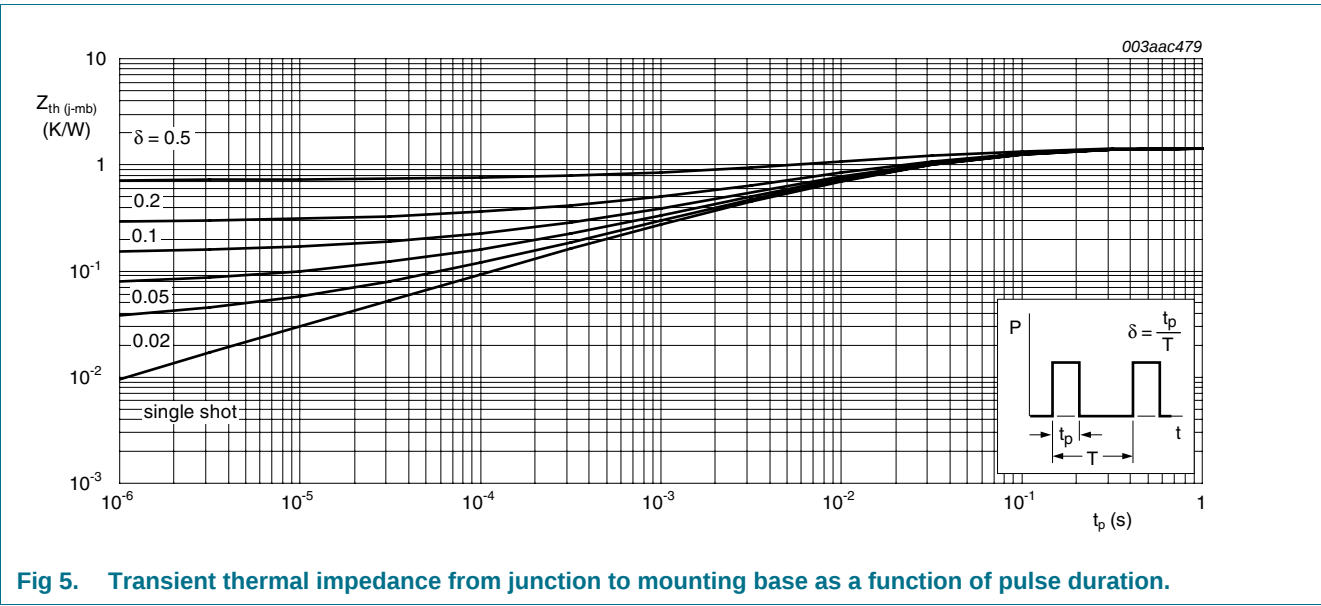


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration.

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 0.25 mA; V _{GS} = 0 V; T _j = -55 °C	36	-	-	V
		I _D = 0.25 mA; V _{GS} = 0 V; T _j = 25 °C	40	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; T _j = 25 °C; see Figure 9 ; see Figure 10	1.25	1.65	2.15	V
V _{GSth}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; T _j = 175 °C; see Figure 9 ; see Figure 10	0.5	-	-	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _j = -55 °C; see Figure 9 ; see Figure 10	-	-	2.45	V
I _{DSS}	drain leakage current	V _{DS} = 40 V; V _{GS} = 0 V; T _j = 25 °C	-	0.02	1	μA
		V _{DS} = 40 V; V _{GS} = 0 V; T _j = 175 °C	-	-	500	μA
I _{GSS}	gate leakage current	V _{DS} = 0 V; V _{GS} = 15 V; T _j = 25 °C	-	2	100	nA
		V _{DS} = 0 V; V _{GS} = -15 V; T _j = 25 °C	-	2	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 5 V; I _D = 25 A; T _j = 25 °C; see Figure 11 ; see Figure 12	-	6.9	9	mΩ
		V _{GS} = 4.5 V; I _D = 25 A; T _j = 25 °C	-	-	10	mΩ
		V _{GS} = 5 V; I _D = 25 A; T _j = 175 °C; see Figure 12	-	-	19	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C	-	5.8	8	mΩ
Dynamic characteristics						
Q _{G(tot)}	total gate charge	I _D = 25 A; V _{DS} = 32 V; V _{GS} = 5 V; see Figure 13	-	30	-	nC
Q _{GS}	gate-source charge		-	6.5	-	nC
Q _{GD}	gate-drain charge		-	11	-	nC
C _{iss}	input capacitance	V _{GS} = 0 V; V _{DS} = 25 V; f = 1 MHz; T _j = 25 °C; see Figure 14	-	2150	2866	pF
C _{oss}	output capacitance		-	378	454	pF
C _{rss}	reverse transfer capacitance		-	194	266	pF
t _{d(on)}	turn-on delay time	V _{DS} = 30 V; R _L = 1.2 Ω; V _{GS} = 5 V; R _{G(ext)} = 10 Ω	-	29	-	ns
t _r	rise time		-	92	-	ns
t _{d(off)}	turn-off delay time		-	97	-	ns
t _f	fall time		-	83	-	ns
Source-drain diode						
V _{SD}	source-drain voltage	I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; see Figure 15	-	0.85	1.2	V
t _{rr}	reverse recovery time	I _S = 20 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V;	-	40	-	ns
Q _r	recovered charge	V _{DS} = 30 V	-	66	-	nC

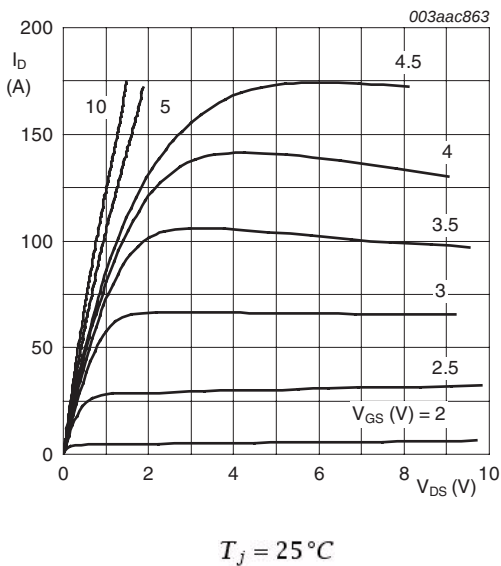


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values.

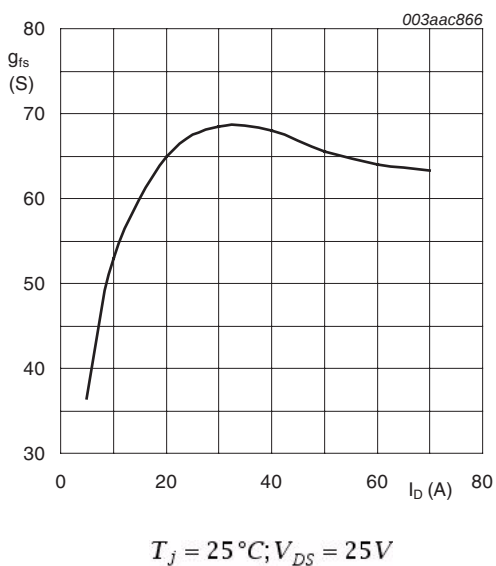


Fig 7. Forward transconductance as a function of drain current; typical values.

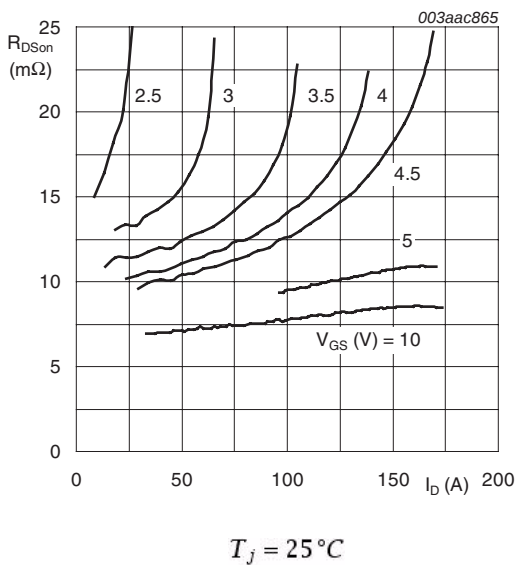


Fig 8. Drain-source on-state resistance as a function of drain current; typical values.

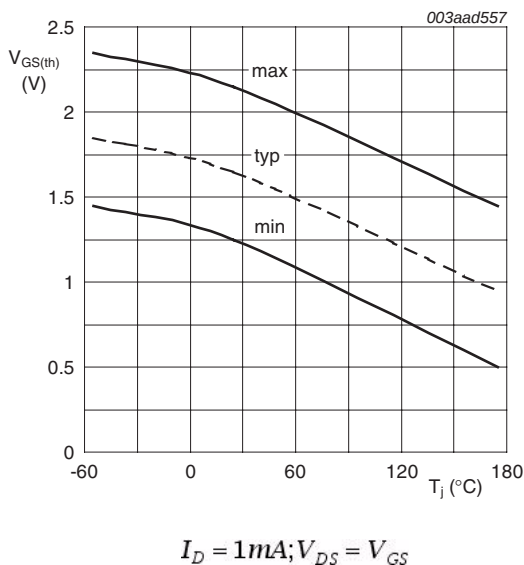
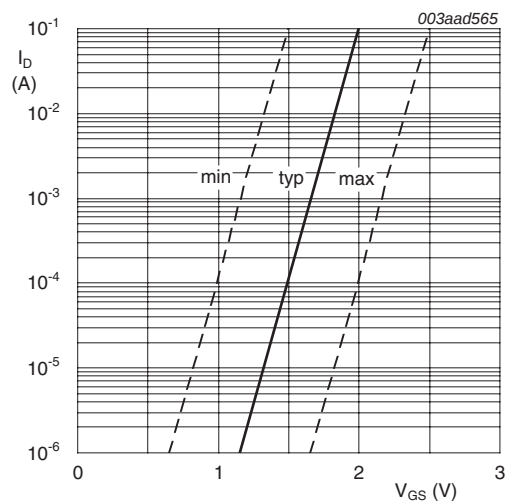
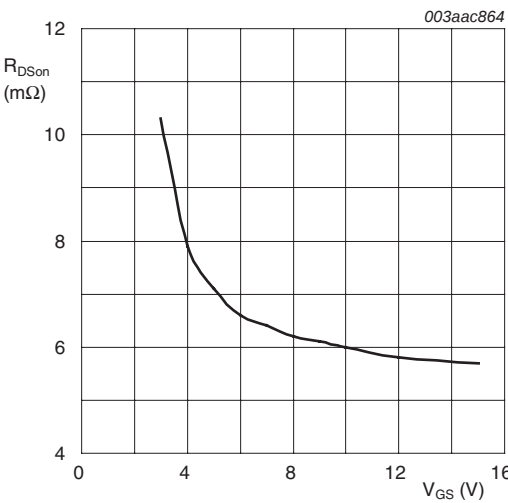


Fig 9. Gate-source threshold voltage as a function of junction temperature



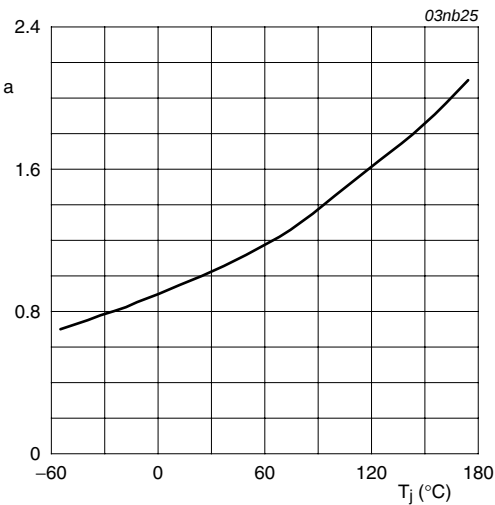
$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = V_{GS}$

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



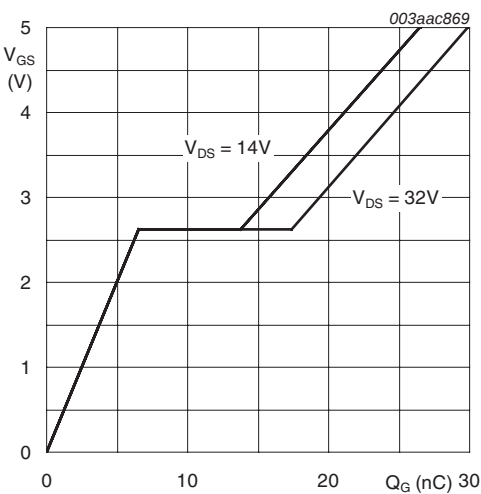
$T_j = 25\text{ }^{\circ}\text{C}; I_D = 25\text{ A}$

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



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

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



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

Fig 13. Gate-source voltage as a function of turn-on gate charge; typical values.

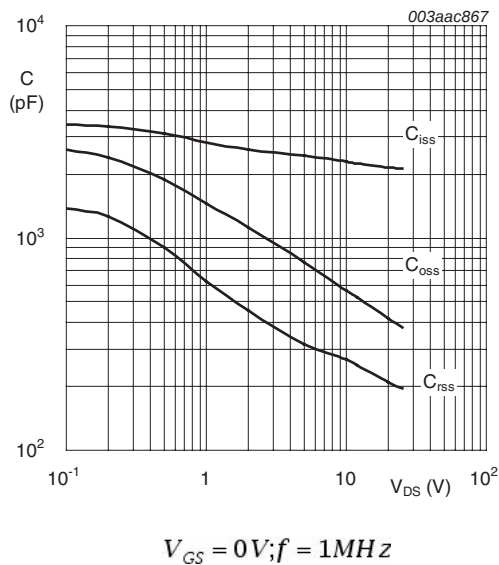


Fig 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.

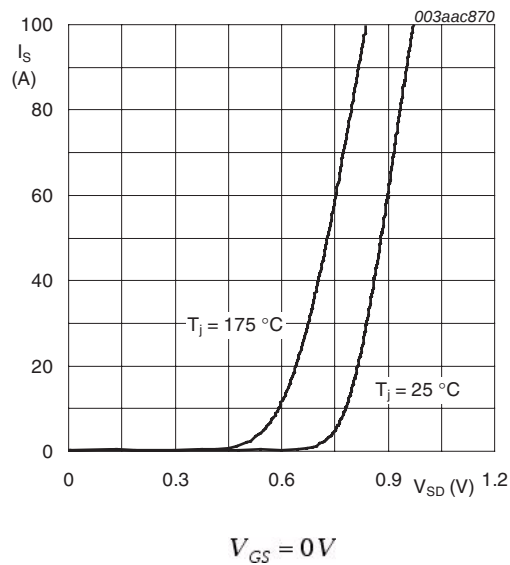


Fig 15. Reverse diode current as a function of reverse diode voltage; typical values.

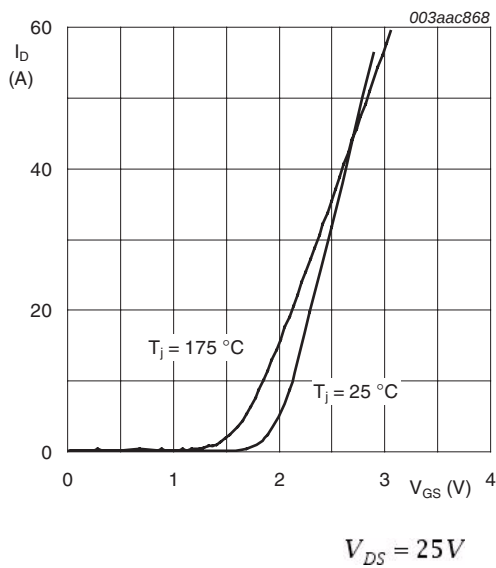


Fig 16. Transfer characteristics: drain current as a function of gate-source voltage; typical values.

7. Package outline

Plastic single-ended surface-mounted package (LPAK); 4 leads

SOT669

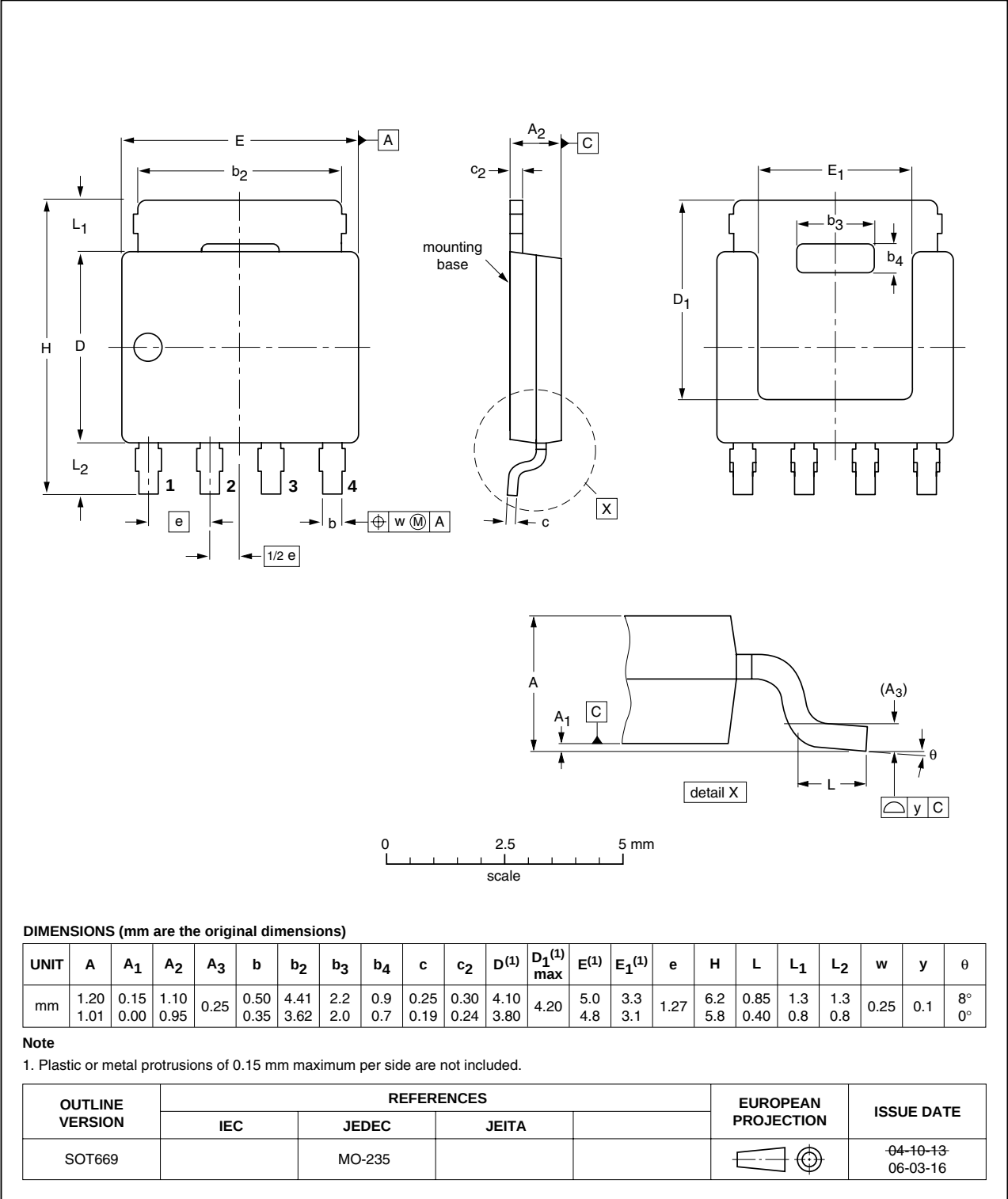


Fig 17. Package outline SOT669 (LPAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9Y09-40B_4	20100407	Product data sheet	-	BUK9Y09-40B_3
Modifications:		• Status changed from objective to product.		
BUK9Y09-40B_3	20100215	Objective data sheet	-	BUK9Y09-40B_2

9. Legal information

9.1 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".

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