

# **BUK9Y58-75B**

# N-channel TrenchMOS logic level FET Rev. 04 — 7 April 2010

**Product data sheet** 

### **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, 24 V and 42 V loads
- Automotive systems
- DC-to-DC converters

- General purpose power switching
- solenoid drives

#### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \ge 25 \text{ °C}; T_j \le 175 \text{ °C}$	-	-	75	V
I <sub>D</sub>	drain current	V <sub>GS</sub> = 5 V; T <sub>mb</sub> = 25 °C; see <u>Figure 1</u> ; see <u>Figure 4</u>	-	-	20.7 3	Α
P <sub>tot</sub>	total power dissipation	$T_{mb} = 25  ^{\circ}\text{C}$ ; see Figure 2	-	-	60.4	W
Static chara	acteristics					
R <sub>DSon</sub>	drain-source on-state	$V_{GS} = 5 \text{ V}; I_D = 10 \text{ A};$ $T_j = 25 \text{ °C}; \text{ see } \frac{\text{Figure } 13}{}$	-	52	58	mΩ
	resistance	$V_{GS} = 10 \text{ V}; I_D = 10 \text{ A};$ $T_j = 25 \text{ °C}$	-	47	53	mΩ



Table 1. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Avalanche	ruggedness					
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	$I_D = 20.73 \text{ A; } V_{sup} \le 75 \text{ V;}$ $R_{GS} = 50 \Omega; V_{GS} = 5 \text{ V;}$ $T_{j(init)} = 25 ^{\circ}C; \text{ unclamped}$	-	-	34	mJ
Dynamic ch	naracteristics					
$Q_{GD}$	gate-drain charge	$V_{GS} = 5 \text{ V; } I_D = 10 \text{ A;}$ $V_{DS} = 60 \text{ V; } T_j = 25 \text{ °C;}$ see Figure 14	-	5	-	nC

# 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source		
2	S	source	mb	D
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain	1 2 3 4	mbb076 S
			SOT669 (LFPAK)	

### 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK9Y58-75B	LFPAK	plastic single-ended surface-mounted package (LFPAK); 4 leads	SOT669

# 4. Limiting values

Table 4. Limiting values

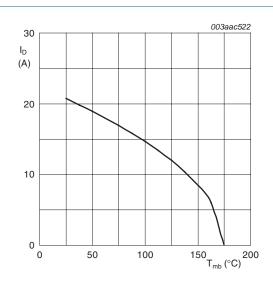
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
$V_{DS}$	drain-source voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C		-	-	75	V
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20 \text{ k}\Omega; T_{mb} \ge 25 \text{ °C};$ $T_{mb} \le 175 \text{ °C}$		-	-	75	V
$V_{GS}$	gate-source voltage			-15	-	15	V
I <sub>D</sub>	drain current	$T_{mb}$ = 25 °C; $V_{GS}$ = 5 V; see <u>Figure 1</u> ; see <u>Figure 4</u>		-	-	20.73	Α
		$T_{mb} = 100  ^{\circ}\text{C};  V_{GS} = 5  \text{V};  \text{see}  \frac{\text{Figure 1}}{}$		-	-	14.66	Α
I <sub>DM</sub>	peak drain current	$T_{mb}$ = 25 °C; $t_p$ ≤ 10 μs; pulsed; see Figure 4		-	-	82.9	Α
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; see <u>Figure 2</u>		-	-	60.4	W
T <sub>stg</sub>	storage temperature			-55	-	175	°C
Tj	junction temperature			-55	-	175	°C
Source-drain	diode						
I <sub>S</sub>	source current	T <sub>mb</sub> = 25 °C		-	-	20.73	Α
I <sub>SM</sub>	peak source current	$t_p \le 10  \mu \text{s}; \text{ pulsed}; T_{mb} = 25 ^{\circ}\text{C}$		-	-	82.9	Α
Avalanche rug	gedness						
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	$I_D$ = 20.73 A; $V_{sup}$ ≤ 75 V; $R_{GS}$ = 50 Ω; $V_{GS}$ = 5 V; $T_{j(init)}$ = 25 °C; unclamped		-	-	34	mJ
E <sub>DS(AL)R</sub>	repetitive drain-source avalanche energy	see Figure 3	[1][2][3]	-	-	-	J

<sup>[1]</sup> Single-pulse avalanche rating limited by maximum junction temperature of 175  $^{\circ}\text{C}.$ 

<sup>[2]</sup> Repetitive avalanche rating limited by average junction temperature of 170 °C.

<sup>[3]</sup> Refer to application note AN10273 for further information.



03na19 120 P<sub>der</sub> (%) 80 40 0 \_ 100 150 200 T<sub>mb</sub> (°C)

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

Continuous drain current as a function of mounting base temperature

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

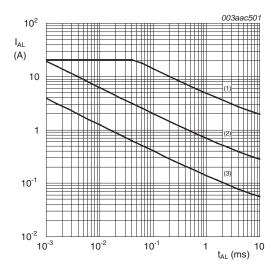
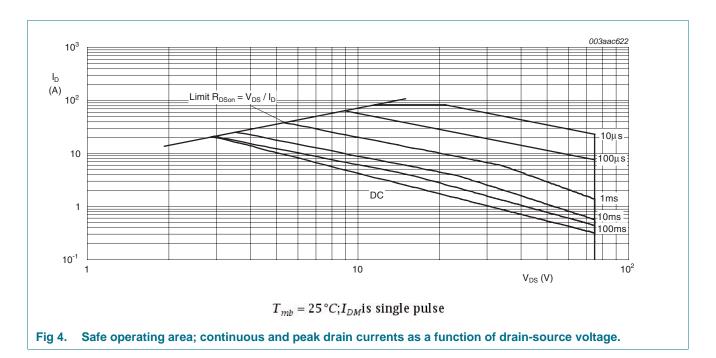


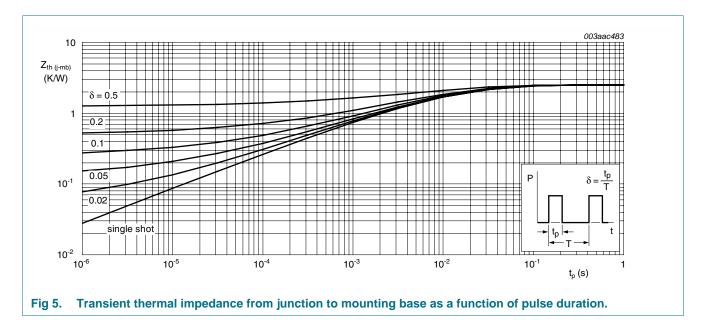
Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time



### 5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 5	-	-	2.53	K/W



### 6. Characteristics

Table 6. Characteristics

Table 6.	Characteristics					
Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Static cha	racteristics					
$V_{(BR)DSS}$	drain-source	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ °C}$	75	-	-	V
	breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ °C}$	70	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1$ mA; $V_{DS} = V_{GS}$ ; $T_j = 175$ °C; see <u>Figure 10</u> ; see <u>Figure 11</u>	0.5	-	-	V
		$I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$ ; $T_j$ = 25 °C; see <u>Figure 10</u> ; see <u>Figure 11</u>	1.25	1.65	2.15	V
		$I_D = 1$ mA; $V_{DS} = V_{GS}$ ; $T_j = -55$ °C; see <u>Figure 10</u> ; see <u>Figure 11</u>	-	-	2.45	V
I <sub>DSS</sub> drain leakage current		$V_{DS} = 75 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ °C}$	-	-	500	μΑ
		$V_{DS} = 75 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ °C}$	-	0.02	1	μΑ
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	V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 10 A; T <sub>j</sub> = 25 °C	-	-	61	mΩ
	resistance	$V_{GS} = 5 \text{ V}; I_D = 10 \text{ A}; T_j = 175 °C;$ see Figure 12	-	-	145	mΩ
		$V_{GS} = 5 \text{ V}; I_D = 10 \text{ A}; T_j = 25 ^{\circ}\text{C};$ see Figure 13	-	52	58	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 10 A; T <sub>i</sub> = 25 °C	-	47	53	mΩ
Dynamic o	characteristics	·				
Q <sub>G(tot)</sub>	total gate charge	$I_D = 10 \text{ A}; V_{DS} = 60 \text{ V}; V_{GS} = 5 \text{ V};$	-	10.7	-	nC
$Q_{GS}$	gate-source charge	T <sub>j</sub> = 25 °C; see <u>Figure 14</u>	-	2.3	-	nC
$Q_{GD}$	gate-drain charge		-	5	-	nC
C <sub>iss</sub>	input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; f = 1 \text{ MHz};$	-	853	1137	pF
C <sub>oss</sub>	output capacitance	T <sub>j</sub> = 25 °C; see <u>Figure 15</u>	-	106	127	pF
C <sub>rss</sub>	reverse transfer capacitance		-	52	71	pF
t <sub>d(on)</sub>	turn-on delay time	$V_{DS} = 30 \text{ V}; R_L = 3 \Omega; V_{GS} = 5 \text{ V};$	-	15	-	ns
t <sub>r</sub>	rise time	$R_{G(ext)} = 10 \Omega$ ; $T_j = 25 °C$	-	16	-	ns
d(off)	turn-off delay time		-	30	-	ns
t <sub>f</sub>	fall time		-	9	-	ns
Source-dr	ain diode					
V <sub>SD</sub>	source-drain voltage	$I_S = 10 \text{ A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ °C}$ ; see Figure 16	-	0.85	1.2	V
·rr	reverse recovery time	$I_S = 20 \text{ A}; dI_S/dt = -100 \text{ A/}\mu\text{s};$	-	53	-	ns
Q <sub>r</sub>	recovered charge	recovered charge $V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 ^{\circ}\text{C}$		122	-	nC

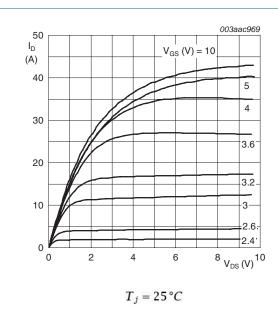


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values.

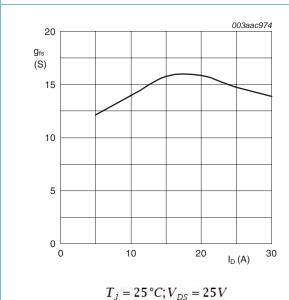


Fig 8. Forward transconductance as a function of drain current; typical values.

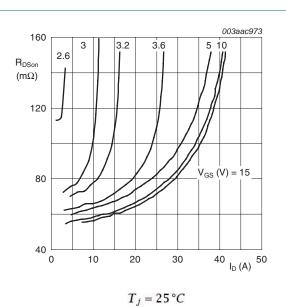


Fig 7. Drain-source on-state resistance as a function of drain current; typical values.

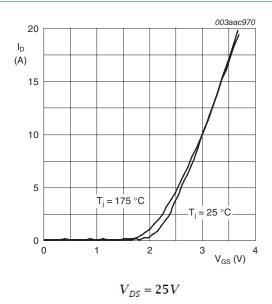


Fig 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values.

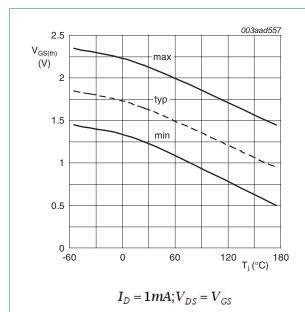


Fig 10. Gate-source threshold voltage as a function of junction temperature

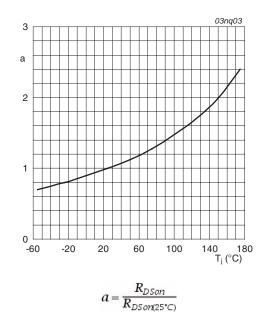
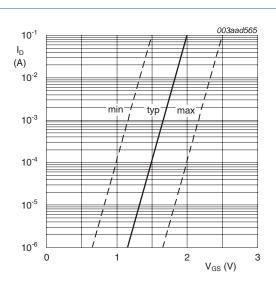
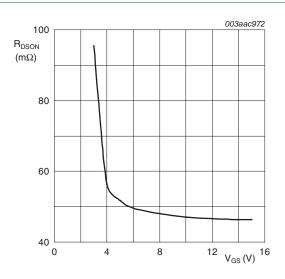


Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature



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

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



 $T_j = 25\,^{\circ}C; I_D = 10A$ 

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

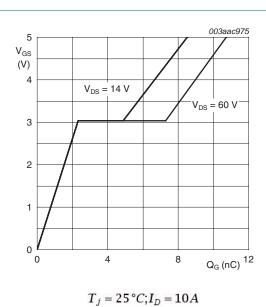
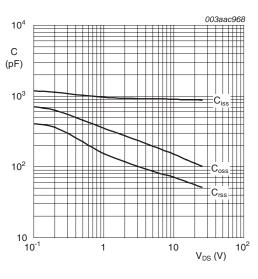
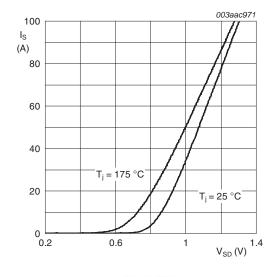


Fig 14. Gate-source voltage as a function of gate charge; typical values.



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

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 (LFPAK); 4 leads **SOT669** С c<sub>2</sub> → $E_1$ mounting b<sub>4</sub> base $D_1$ **→** w M A 1/2 e $(A_3)$ detail X

### DIMENSIONS (mm are the original dimensions)

UNIT	Α	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	С	c <sub>2</sub>	D <sup>(1)</sup>	D <sub>1</sub> <sup>(1)</sup> max	E <sup>(1)</sup>	E <sub>1</sub> <sup>(1)</sup>	е	Н	L	L <sub>1</sub>	L <sub>2</sub>	w	у	θ
mm	1.20 1.01	0.15 0.00	1.10 0.95	0.25	0.50 0.35	4.41 3.62	2.2 2.0	0.9 0.7	0.25 0.19	0.30 0.24	4.10 3.80	4.20	5.0 4.8	3.3 3.1	1.27	6.2 5.8	0.85 0.40	1.3 0.8	1.3 0.8	0.25	0.1	8° 0°

#### Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT669		MO-235			$ \  \   \bigoplus   \big($	<del>04-10-13</del> 06-03-16

Fig 17. Package outline SOT669 (LFPAK)

BUK9Y58-75B

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# 8. Revision history

### Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes				
BUK9Y58-75B_4	20100407	Product data sheet	-	BUK9Y58-75B_3				
Modifications:  • Status changed from objective to product.								
BUK9Y58-75B_3	20100216	Objective data sheet	-	BUK9Y58-75B_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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# BUK9Y58-75B

### **Nexperia**

N-channel TrenchMOS logic level FET

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### **ПОСТАВКА** ЭЛЕКТРОННЫХ КОМПОНЕНТОВ

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