

# N-channel TrenchMOS standard level FET Rev. 5 — 22 April 2011

Product data sheet

#### **Product profile** 1.

#### 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

- AEC Q101 compliant
- Low conduction losses due to low on-state resistance
- Suitable for standard level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

#### 1.3 Applications

- 12 V and 24 V loads
- Automotive systems

- General purpose power switching
- Motors, lamps and solenoids

#### 1.4 Quick reference data

Table 1.	Quick reference data	a					
Symbol	Parameter	Conditions		Min	Тур	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C		-	-	55	V
I <sub>D</sub>	drain current	$V_{GS} = 10 \text{ V}; T_{mb} = 25 \text{ °C};$ see <u>Figure 1</u> ; see <u>Figure 4</u>	<u>[1]</u>	-	-	75	A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; see <u>Figure 2</u>		-	-	300	W
Static ch	aracteristics						
R <sub>DSon</sub>	drain-source on-state resistance	$V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 25 °C; see <u>Figure 7</u> ; see Figure 12		-	3.4	4	mΩ



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Table 1.	Quick reference da	ta continued				
Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Avalanch	e ruggedness					
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	$ \begin{split} I_D &= 75 \text{ A};  \text{V}_{\text{sup}} \leq 55 \text{ V}; \\ R_{\text{GS}} &= 50  \Omega;  \text{V}_{\text{GS}} = 10  \text{V}; \\ T_{j(\text{init})} &= 25 ^{\circ}\text{C}; \text{ unclamped} \end{split} $	-	-	1.2	J
Dynamic	characteristics					
$Q_{GD}$	gate-drain charge	V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; V <sub>DS</sub> = 44 V; T <sub>j</sub> = 25 °C; see <u>Figure 13</u>	-	25	-	nC

**T**. I. I. A. 1.1.1

[1] Continuous current is limited by package.

#### **Pinning information** 2.

Table 2.	Pinning	information		
Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain	mb	
3	S	source		
mb	D	mounting base; connected to drain		mbb076 S

#### SOT78A (TO-220AB)

#### **Ordering information** 3.

#### Table 3. **Ordering information**

Type number	Package		
	Name	Description	Version
BUK754R0-55B	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78A

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### 4. Limiting values

#### Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C	-	55	V
V <sub>DGR</sub>	drain-gate voltage	$R_{GS} = 20 \text{ k}\Omega$	-	55	V
V <sub>GS</sub>	gate-source voltage		-20	20	V
I <sub>D</sub>	drain current	$T_{mb} = 25 \text{ °C}; V_{GS} = 10 \text{ V}; \text{ see } \frac{\text{Figure 1}}{\text{Figure 1}};$	<u>[1]</u> _	75	А
		see Figure 4	[2][3]	193	А
		$T_{mb}$ = 100 °C; $V_{GS}$ = 10 V; see Figure 1	<u>[1]</u> _	75	А
I <sub>DM</sub>	peak drain current	$T_{mb}$ = 25 °C; pulsed; $t_p \le 10 \ \mu s$ ; see <u>Figure 4</u>	-	774	А
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; see <u>Figure 2</u>	-	300	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	[2][1] _	193	А
			<u>[1]</u> -	75	А
I <sub>SM</sub>	peak source current	pulsed; $t_p \le 10 \ \mu s$ ; $T_{mb} = 25 \ ^{\circ}C$	-	774	А
Avalanche ru	ggedness				
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	$\label{eq:ID} \begin{array}{l} I_D = 75 \; A; \; V_sup \leq 55 \; V; \; R_GS = 50 \; \Omega; \\ V_GS = 10 \; V; \; T_j(init) = 25 \; ^\circC; \; unclamped \end{array}$	-	1.2	J
E <sub>DS(AL)R</sub>	repetitive drain-source avalanche energy	see Figure 3	<u>[4][5][6][</u>	-	J

[1] Continuous current is limited by package.

[2] Current is limited by power dissipation chip rating.

[3] Refer to document 9397 750 12572 for further information.

[4] Maximum value not quoted. Repetitive rating defined in avalanche rating figure.

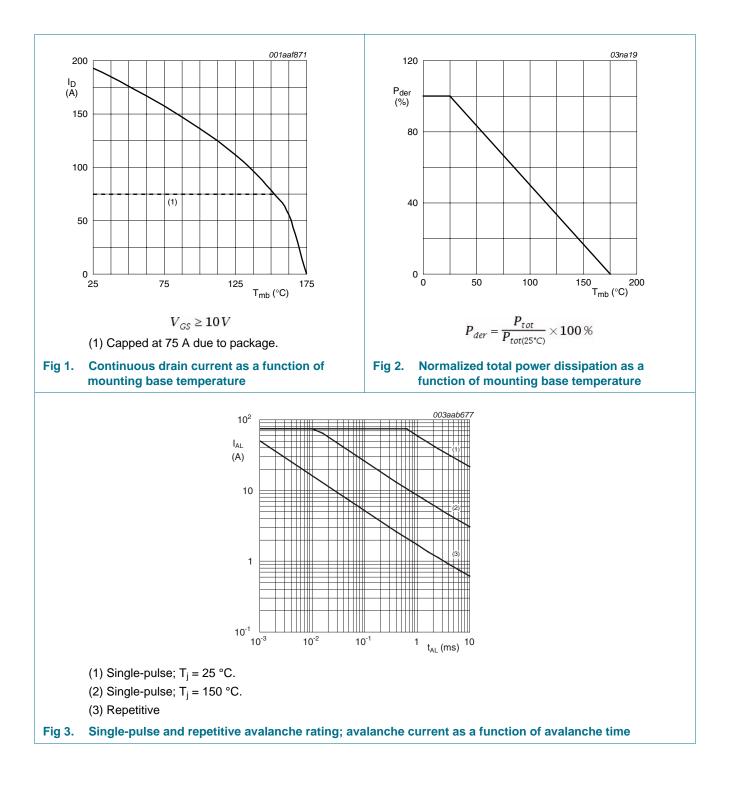
[5] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

[6] Repetitive avalanche rating limited by an average junction temperature of 170 °C.

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

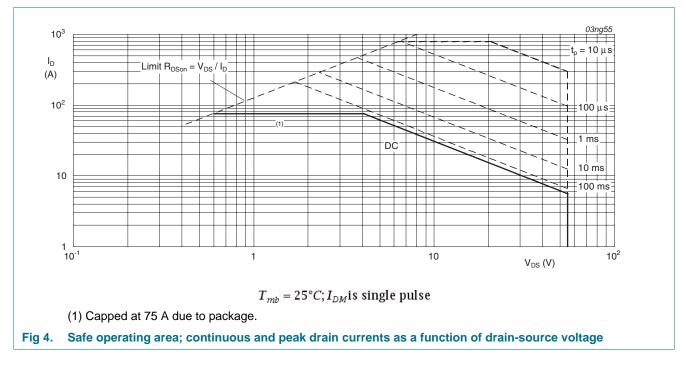
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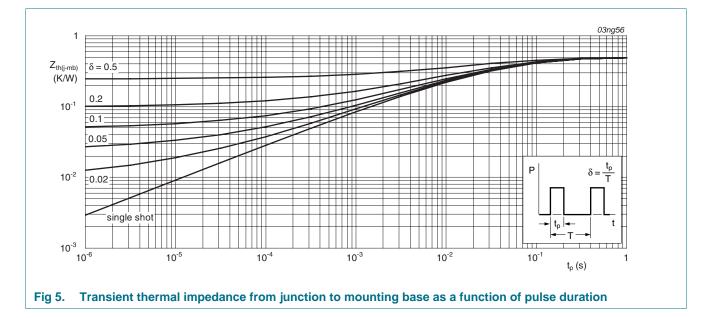
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#### **Thermal characteristics** 5.

#### Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
R <sub>th(j-mb)</sub>	thermal resistance from junction to mounting base	see <u>Figure 5</u>	-	-	0.5	K/W
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	vertical in still air	-	60	-	K/W



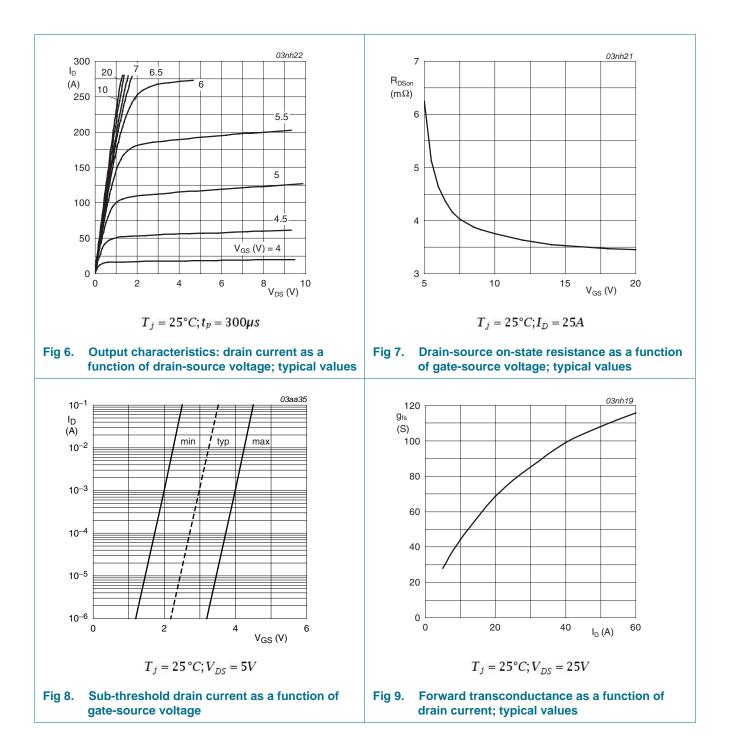
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### 6. Characteristics

Table 6.	Characteristics					
Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Static cha	aracteristics					
V <sub>(BR)DSS</sub>	drain-source	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ °C}$	55	-	-	V
	breakdown voltage	$I_D = 0.25 \text{ mA};  V_{GS} = 0  V;  T_j = -55 ^\circ\text{C}$	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> = 25 °C; see <u>Figure 11</u>	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 <u>Figure 11</u>	-	-	4.4	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 175 °C; see <u>Figure 11</u>	1	-	-	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>i</sub> = 25 °C	-	0.02	1	μA
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 20 V; V <sub>DS</sub> = 0 V; T <sub>i</sub> = 25 °C	-	2	100	nA
		V <sub>GS</sub> = -20 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	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; \text{ I}_D = 25 \text{ A}; \text{ T}_j = 175 ^{\circ}\text{C};$ see <u>Figure 7</u> ; see <u>Figure 12</u>	-	-	8	mΩ
		$V_{GS} = 10 \text{ V}; \text{ I}_D = 25 \text{ A}; \text{ T}_j = 25 \text{ °C};$ see Figure 7; see Figure 12	-	3.4	4	mΩ
Dynamic	characteristics					
Q <sub>G(tot)</sub>	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 44 \text{ V}; V_{GS} = 10 \text{ V};$	-	86	-	nC
Q <sub>GS</sub>	gate-source charge	$T_j = 25 \text{ °C}; \text{ see } Figure 13$	-	18	-	nC
Q <sub>GD</sub>	gate-drain charge		-	25	-	nC
C <sub>iss</sub>	input capacitance	V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 25 V; f = 1 MHz;	-	5082	6776	pF
C <sub>oss</sub>	output capacitance	T <sub>j</sub> = 25 °C; see <u>Figure 14</u>	-	1054	1265	pF
C <sub>rss</sub>	reverse transfer capacitance		-	450	617	pF
t <sub>d(on)</sub>	turn-on delay time	$V_{DS} = 30 \text{ V}; \text{ R}_{L} = 1.2 \Omega; \text{ V}_{GS} = 10 \text{ V};$	-	23	-	ns
t <sub>r</sub>	rise time	R <sub>G(ext)</sub> = 10 Ω; T <sub>j</sub> = 25 °C	-	51	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	71	-	ns
t <sub>f</sub>	fall time		-	41	-	ns
L <sub>D</sub>	internal drain inductance	from contact screw on mounting base to centre of die; $T_j = 25 \text{ °C}$	-	3.5	-	nH
		from drain lead 6 mm from package to centre of die; $T_j = 25 \text{ °C}$	-	4.5	-	nH
L <sub>S</sub>	internal source inductance	from source lead to source bond pad; $T_j = 25 \text{ °C}$	-	7.5	-	nH
Source-d	rain diode					
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 40 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C; see <u>Figure 15</u>	-	0.85	1.2	V
t <sub>rr</sub>	reverse recovery time	$I_{S} = 20 \text{ A}; \text{ d}I_{S}/\text{d}t = -100 \text{ A}/\mu\text{s};$	-	95	-	ns
Q <sub>r</sub>	recovered charge	$V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ °C}$	-	251	-	nC

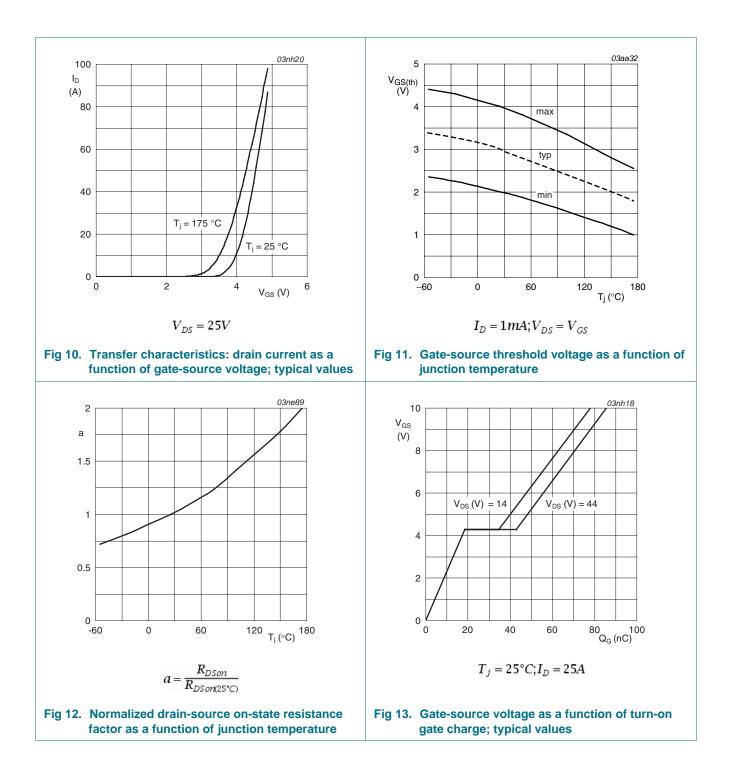
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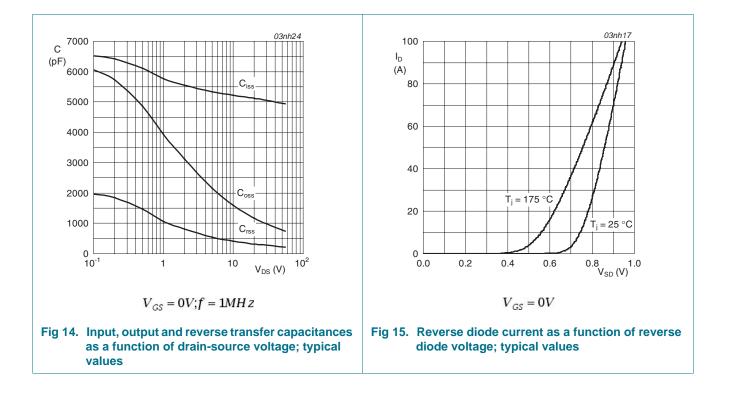
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### 7. Package outline

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#### Fig 16. Package outline SOT78A (TO-220AB)

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### 8. Revision history

Table 7. Revision hi	istory							
Document ID	Release date	Data sheet status	Change notice	Supersedes				
BUK754R0-55B v.5	20110422	Product data sheet	-	BUK75_764R0-55B_4				
Modifications:	<ul> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> </ul>							
	<ul> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>							
	<ul> <li>Type number BUK754R0-55B separated from data sheet BUK75_764R0-55B_4.</li> </ul>							
BUK75_764R0-55B_4	20071004	Product data sheet	-	BUK75_764R0-55B_3				

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### 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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