BUK7510-55AL

N-channel TrenchMOS standard level FET

Rev. 02 — 3 January 2008 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 General-Purpose Automotive (GPA) TrenchMOS technology specifically optimized for linear operation. This product has been designed and qualified to the appropriate AEC standard for use in automotive critical applications.

1.2 Features

- 175 °C rated
- Stable operation in linear mode
- Q101 compliant
- TrenchMOS technology

1.3 Applications

- 12 V and 24 V loads
- DC linear motor control
- Automotive systems
- Repetitive clamped inductive switching

1.4 Quick reference data

Table 1. Quick reference

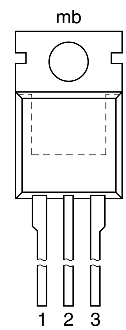
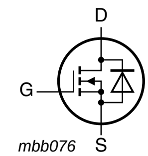
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_D	drain current	V_{GS} = 10 V; T_{mb} = 25 °C; see Figure 1 and 4	[1]	-	-	75	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; see Figure 2		-	-	300	W
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 75 A; V_{sup} ≤ 55 V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped inductive load		-	-	1.1	J
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 12 and 13		-	8.5	10	mΩ

[1] Continuous current is limited by package.

founded by Philips

2. Pinning information

Table 2. Pinning

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain	SOT78 (TO-220AB)	

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK7510-55AL	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

4. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	55	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20$ kΩ		-	55	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	$T_{mb} = 25$ °C; $V_{GS} = 10$ V; see Figure 1 and 4	[1][2]	-	122	A
		$T_{mb} = 25$ °C; $V_{GS} = 10$ V; see Figure 1 and 4	[3]	-	75	A
		$T_{mb} = 100$ °C; $V_{GS} = 10$ V; see Figure 1	[3]	-	75	A
I_{DM}	peak drain current	$T_{mb} = 25$ °C; $t_p \leq 10$ µs; pulsed; see Figure 4		-	490	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2		-	300	W
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75$ A; $V_{sup} \leq 55$ V; $R_{GS} = 50$ Ω; $V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; unclamped inductive load		-	1.1	J
$E_{DS(AL)R}$	repetitive drain-source avalanche energy	see Figure 3	[4][5] [6]	-	-	J

Table 4. Limiting values *...continued*

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

Symbol	Parameter	Conditions		Min	Max	Unit
Source-drain diode						
I_S	source current	T_{mb} = 25 °C	[1][2]	-	122	A
		T_{mb} = 25 °C	[3]	-	75	A
I_{SM}	peak source current	$t_p \leq 10$ µs; pulsed; T_{mb} = 25 °C		-	490	A

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

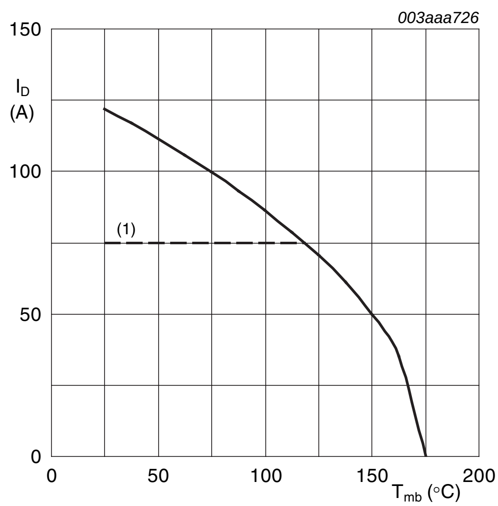
[2] Refer to document 9397 750 12572 for further information.

[3] Continuous current is limited by package.

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

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

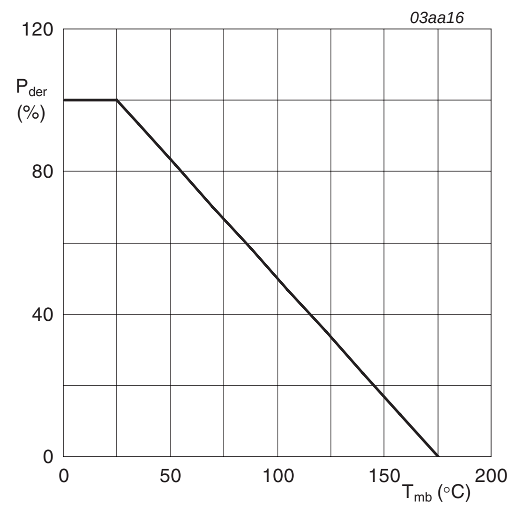
[6] Refer to AN10273 for further information.



$V_{GS} \geq 10\,V$

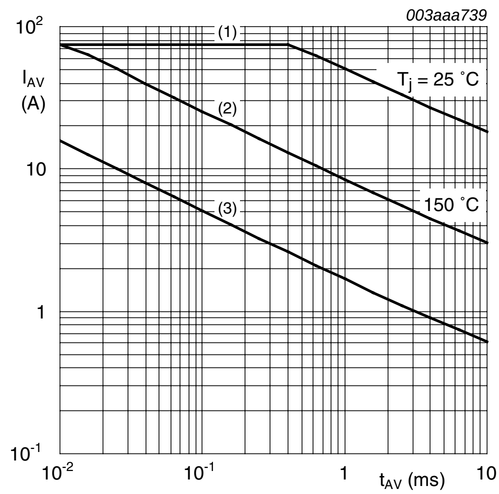
(1) Capped at 75 A due to package.

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



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

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

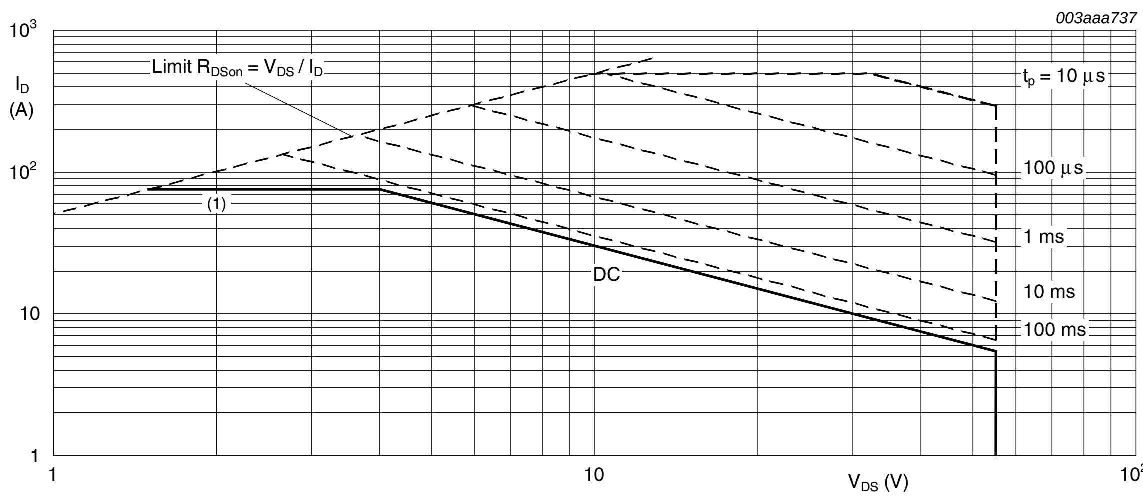


(1) Single−shot.

(2) Single−shot.

(3) Repetitive.

Fig 3. Single-shot and repetitive avalanche rating; avalanche current as a function of avalanche period



T_{mb} = 25 °C; I_{DM} is single pulse

(1) Capped at 75 A due to package.

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
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in still air	-	60	-	K/W
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 5	-	0.25	0.5	K/W

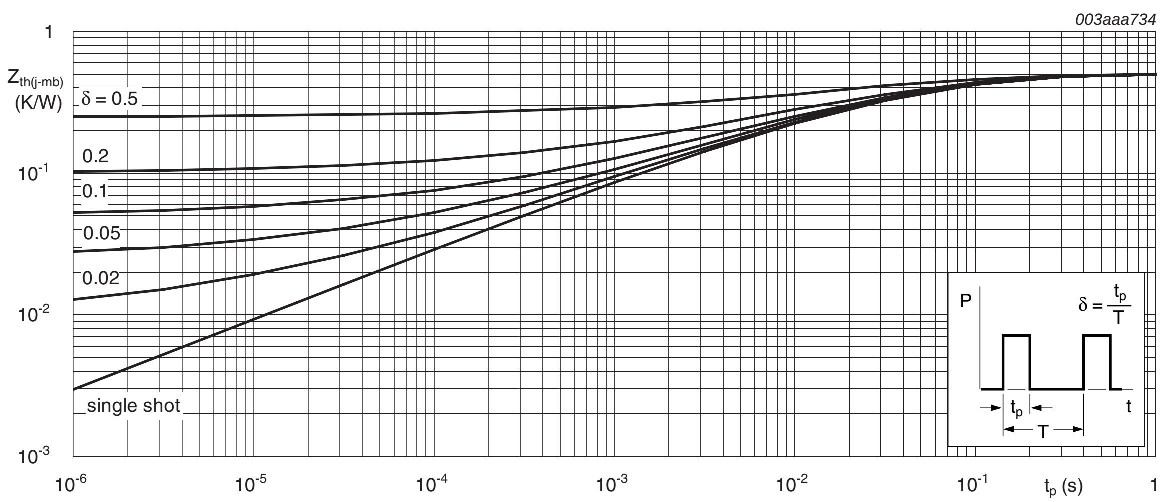


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C	50	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C	55	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 10 and 11	2	3	4	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 10 and 11	-	-	4.4	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; see Figure 10 and 11	1	-	-	V

Table 6. Characteristics *…continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{DSS}	drain leakage current	V_{DS} = 55 V; V_{GS} = 0 V; T_j = 175 °C	-	-	500	µA
		V_{DS} = 55 V; V_{GS} = 0 V; T_j = 25 °C	-	0.05	10	µA
I_{GSS}	gate leakage current	V_{DS} = 0 V; V_{GS} = +20 V; T_j = 25 °C	-	2	100	nA
		V_{DS} = 0 V; V_{GS} = -20 V; T_j = 25 °C	-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 175 °C; see Figure 12 and 13	-	-	20	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 12 and 13	-	8.5	10	mΩ
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; see Figure 16	-	0.85	1.2	V
t_{rr}	reverse recovery time	I_S = 20 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 30 V; T_j = 25 °C	-	73	-	ns
Q_r	recovered charge	I_S = 20 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 30 V; T_j = 25 °C	-	430	-	nC
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 44 V; V_{GS} = 10 V; T_j = 25 °C; see Figure 14	-	124	-	nC
Q_{GS}	gate-source charge	I_D = 25 A; V_{DS} = 44 V; V_{GS} = 10 V; T_j = 25 °C; see Figure 14	-	22	-	nC
Q_{GD}	gate-drain charge	I_D = 25 A; V_{DS} = 44 V; V_{GS} = 10 V; T_j = 25 °C; see Figure 14	-	50	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	I_D = 25 A; V_{DS} = 44 V; T_j = 25 °C; see Figure 14	-	5	-	V
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; T_j = 25 °C; see Figure 15	-	4710	6280	pF
C_{oss}	output capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; T_j = 25 °C; see Figure 15	-	980	1180	pF
C_{rss}	reverse transfer capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; T_j = 25 °C; see Figure 15	-	560	770	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 30 V; R_L = 1.2 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 10 Ω; T_j = 25 °C	-	33	-	ns
t_r	rise time	V_{DS} = 30 V; R_L = 1.2 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 10 Ω; T_j = 25 °C	-	117	-	ns

Table 6. Characteristics *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{d(off)}$	turn-off delay time	V_{DS} = 30 V; R_L = 1.2 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 10 Ω; T_j = 25 °C	-	132	-	ns
t_f	fall time	V_{DS} = 30 V; R_L = 1.2 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 10 Ω; T_j = 25 °C	-	95	-	ns
L_D	internal drain inductance	from contact screw on package to center of die; T_j = 25 °C	-	3.5	-	nH
		from drain lead 6 mm from package to center of die; T_j = 25 °C	-	4.5	-	nH
L_S	internal source inductance	from source lead to source bond pad; T_j = 25 °C	-	7.5	-	nH

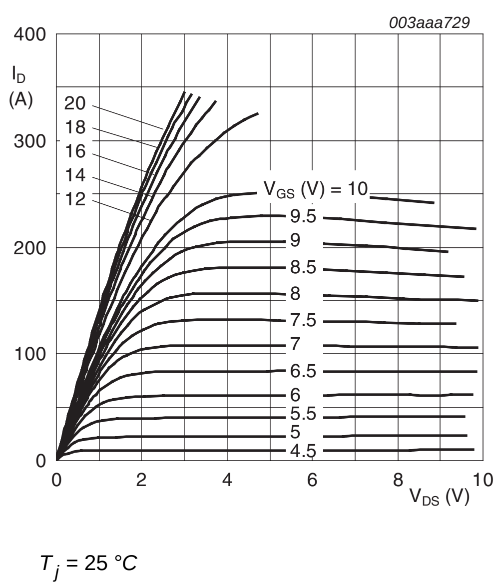


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

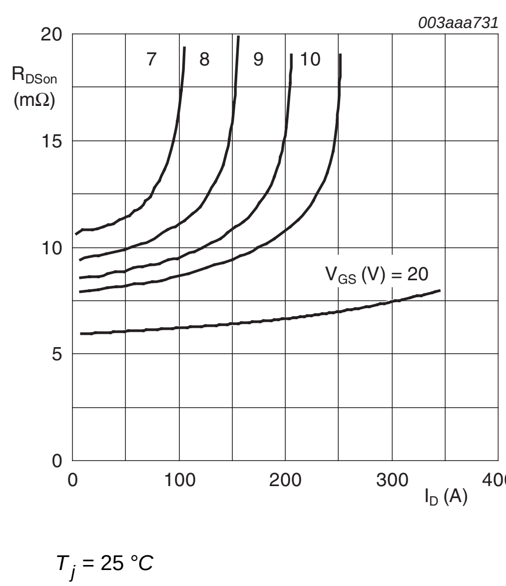
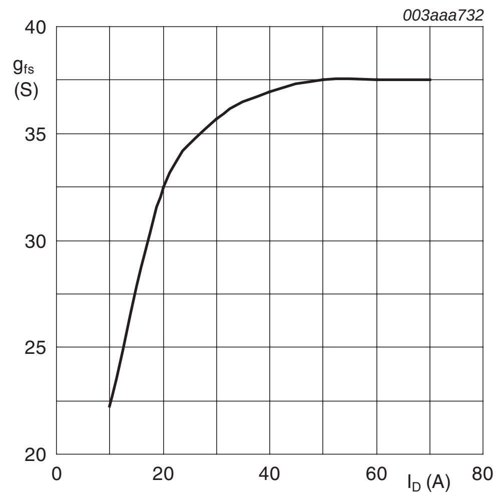
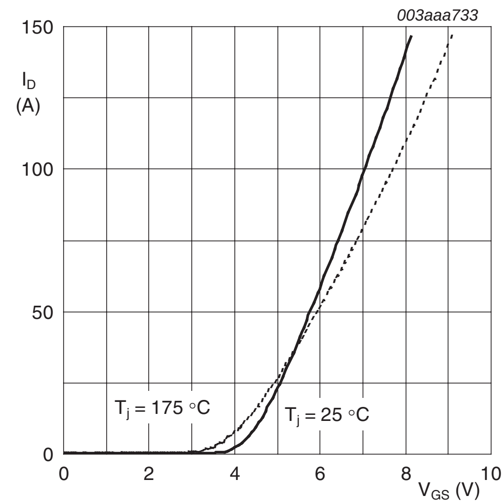


Fig 7. Drain-source on-state resistance as a function of drain current; typical values



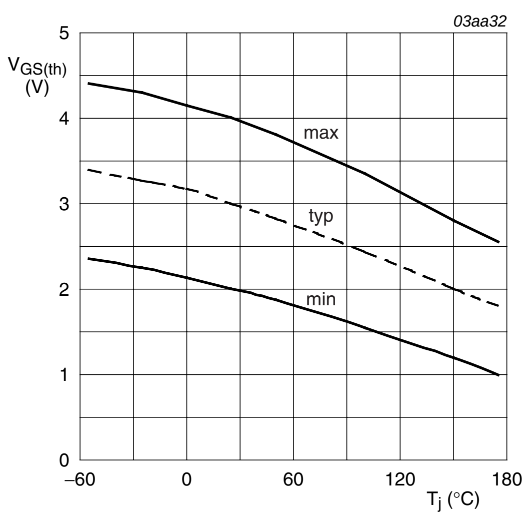
T_j = 25 °C; V_{DS} = 25 V

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



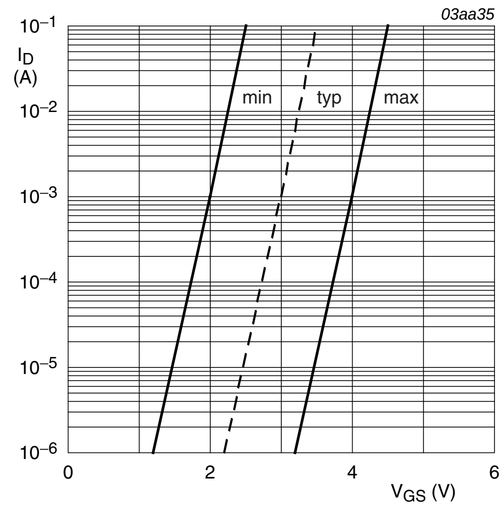
V_{DS} = 25 V

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



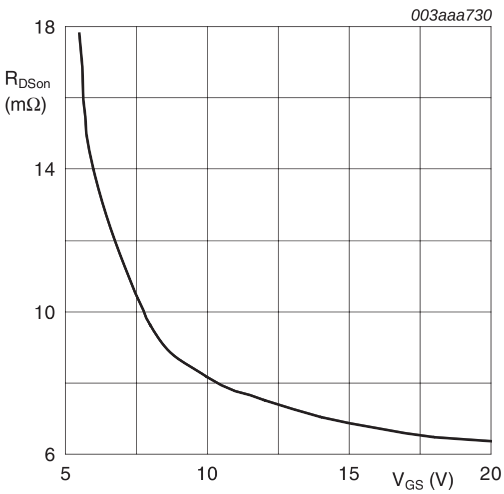
I_D = 1 mA; V_{DS} = V_{GS}

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



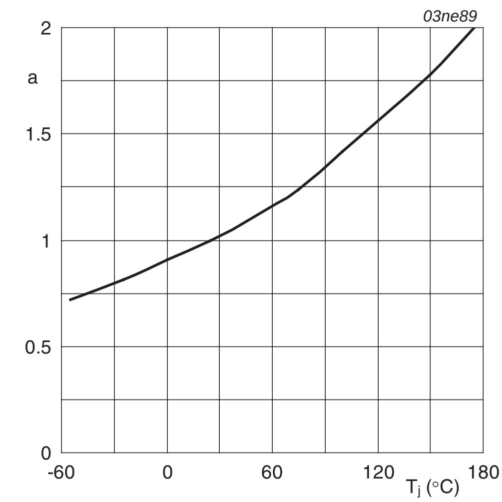
T_j = 25 °C; V_{DS} = V_{GS}

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



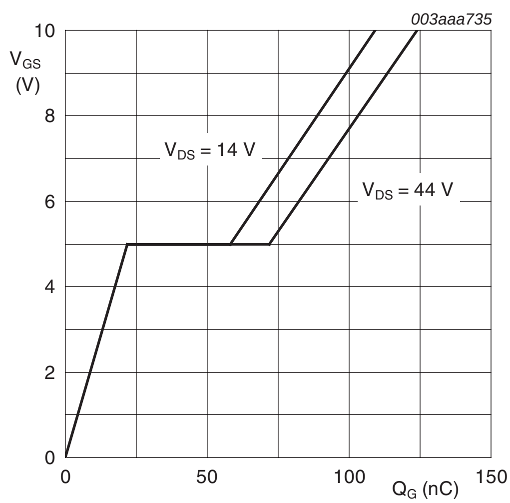
$T_j = 25\ °C$; $I_D = 25\ A$

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



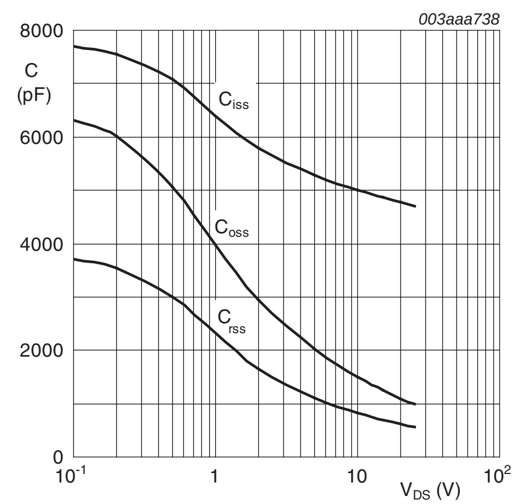
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



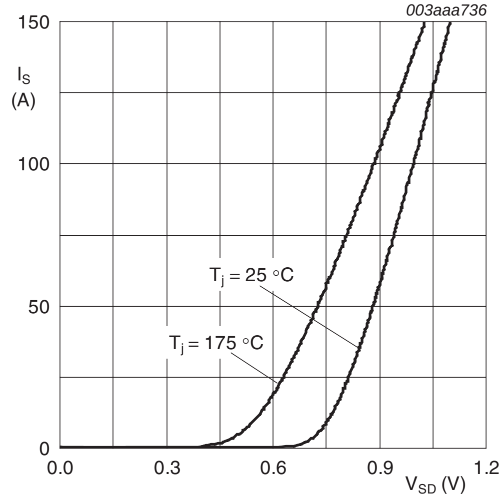
$T_j = 25\ °C$; $I_D = 25\ A$

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



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

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

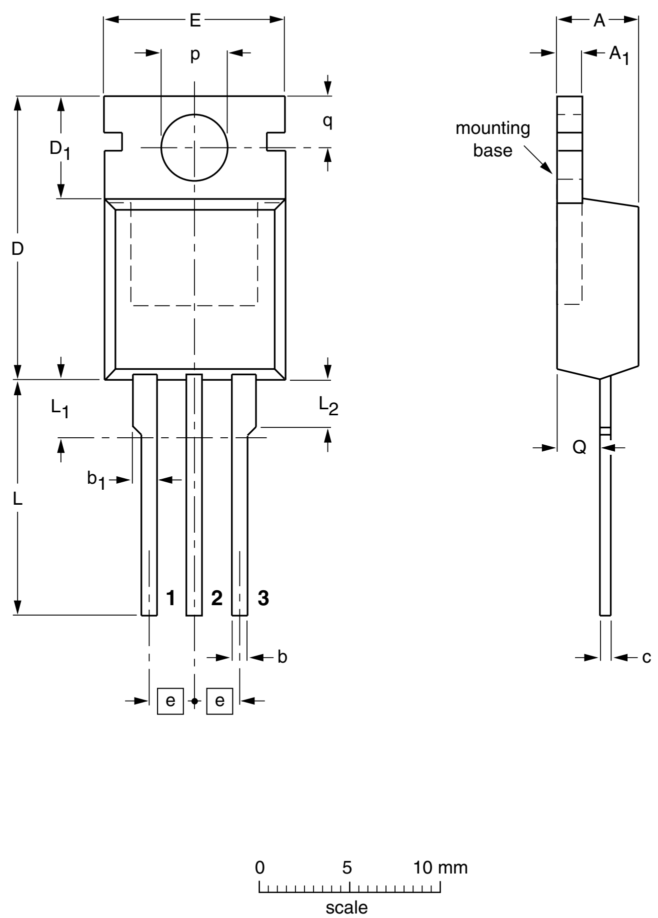


V_{GS} = 0 V

Fig 16. Source current as a function of source-drain voltage; typical values

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB **SOT78**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	c	D	D_1	E	e	L	L_1	L_2 max.	p	q	Q
mm	4.7 4.1	1.40 1.25	0.9 0.6	1.45 1.00	0.7 0.4	16.0 15.2	6.6 5.9	10.3 9.7	2.54	15.0 12.8	3.30 2.79	3.0	3.8 3.5	3.0 2.7	2.6 2.2

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			~~05-03-22~~ 05-10-25

Fig 17. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK7510_55AL_2	20080103	Product data sheet	-	BUK75_7610_55AL_1
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Typical thermal resistance from junction to mounting base figure added in Table 5.			
BUK75_7610_55AL_1	20050331	Product data sheet	-	-

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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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11. Contents

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