

BUK7510-55AL

N-channel TrenchMOS standard level FET

Rev. 03 — 4 August 2009

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 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 thermally demanding environments due to 175 °C rating
- Suitable for use in control systems due to stable operation in linear mode

1.3 Applications

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

1.4 Quick reference data

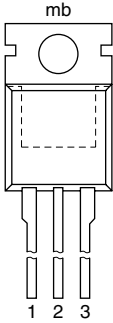
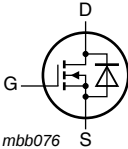
Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	-	55	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1 ; see Figure 3	[1]	-	75	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	300	W
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}$; $V_{sup} \leq 55\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; unclamped	-	-	1.1	J
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 44\text{ V}$; $T_j = 25\text{ °C}$; see Figure 15	-	50	-	nC
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 12 ; see Figure 13	-	8.5	10	m Ω

[1] Continuous current is limited by package.

2. Pinning information

Table 2. Pinning information

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; SC-46)	

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
BUK7510-55AL	TO-220AB; SC-46	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 ≥ 25 °C; T _j ≤ 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 ; see Figure 3	[1] [2]	-	122	A
		T _{mb} = 25 °C; V _{GS} = 10 V; see Figure 1 ; see Figure 3	[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 ≤ 10 μs; pulsed; see Figure 3	-	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	
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 ≤ 10 μs; pulsed; T _{mb} = 25 °C	-	490	A	
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	-	1.1	J	
E _{DS(AL)R}	repetitive drain-source avalanche energy	see Figure 4	[4] [5] [6]	-	-	J

[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 $^{\circ}\text{C}$.

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

[6] Refer to AN10273 for further information.

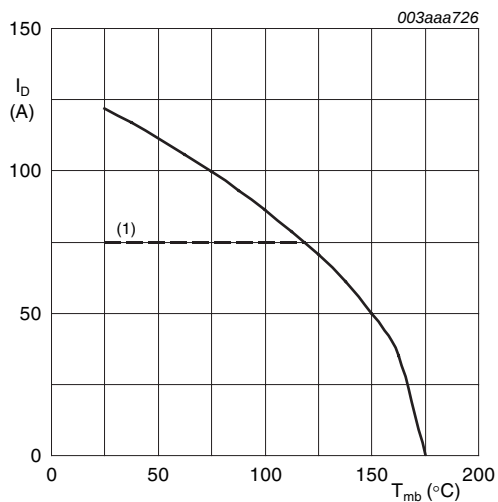
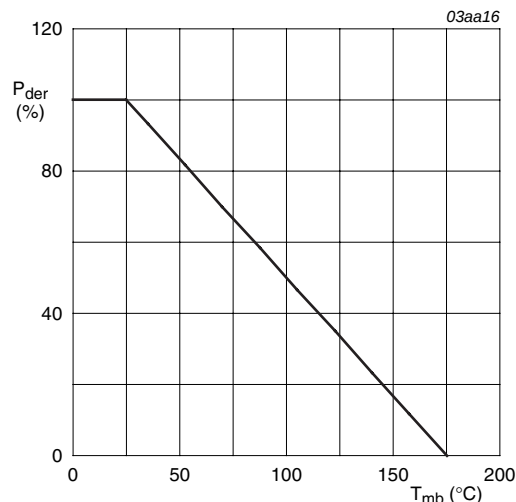
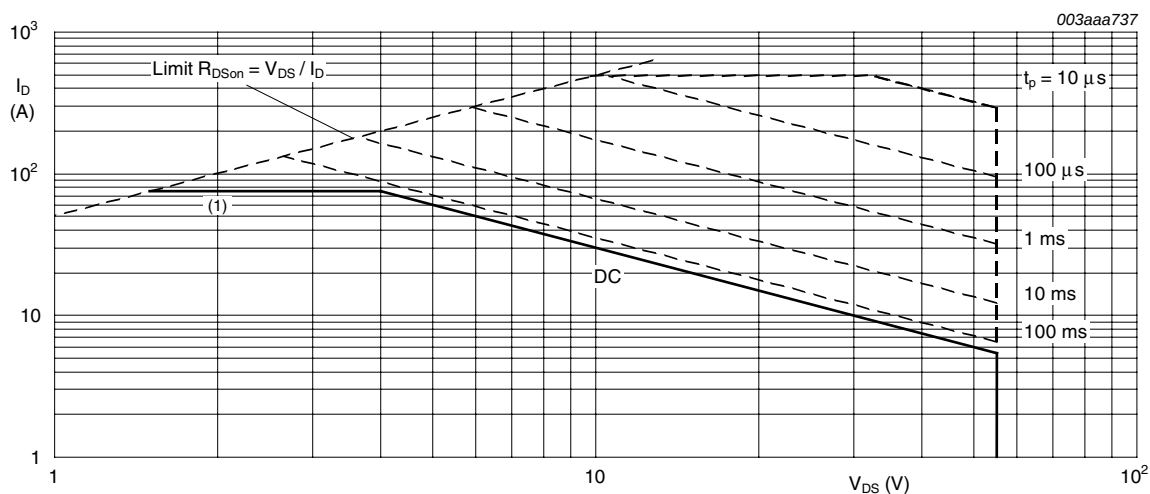


Fig 1. Continuous drain current as a function of mounting base temperature



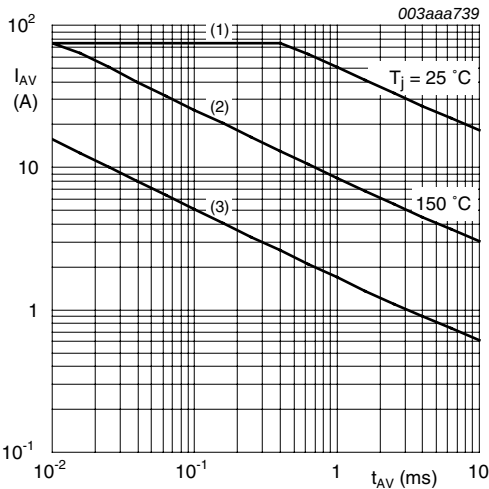
$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ C)}} \times 100\%$$

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



$T_{mb} = 25^\circ C$; I_{DM} is single pulse
(1) Capped at 75 A due to package.

Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage



- (1) Single-shot.
- (2) Single-shot.
- (3) Repetitive.

Fig 4. Single-shot and repetitive avalanche rating; avalanche current as a function of avalanche period

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

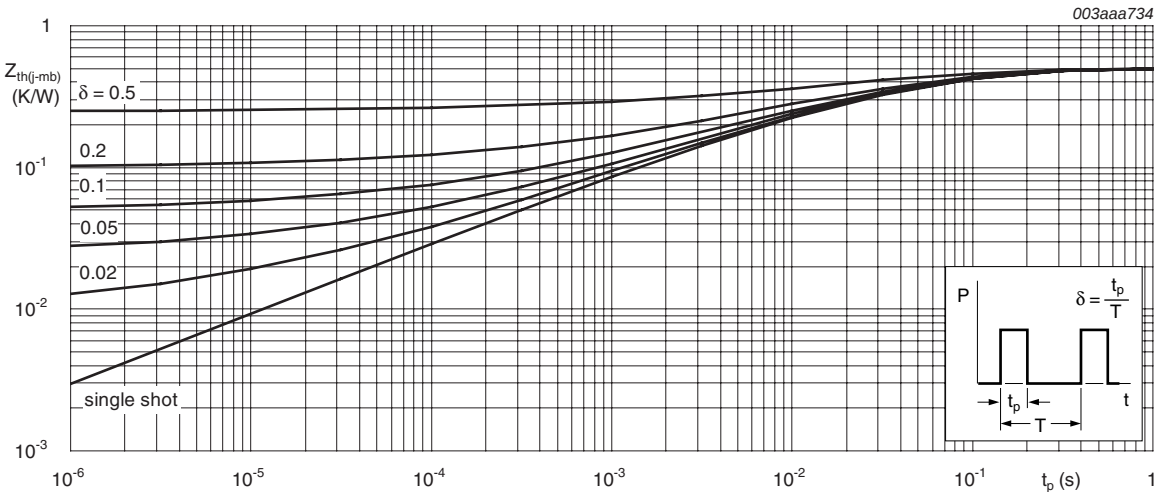
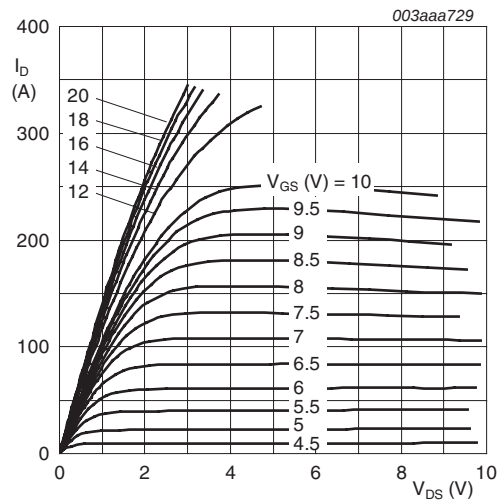


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

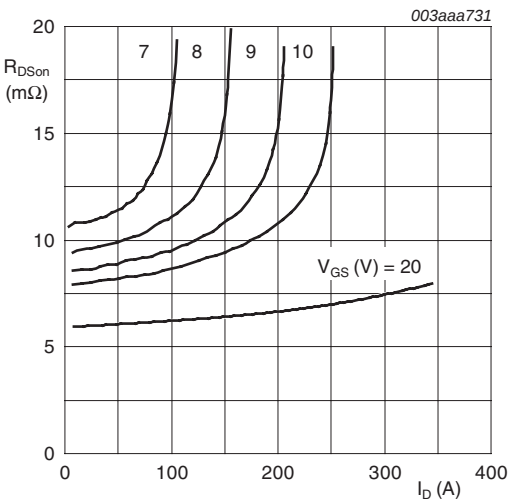
Table 6. Characteristics

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 ; see Figure 11	2	3	4	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _j = -55 °C; see Figure 10 ; see Figure 11	-	-	4.4	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _j = 175 °C; see Figure 10 ; see Figure 11	1	-	-	V
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 ; see Figure 13	-	-	20	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C; see Figure 12 ; see Figure 13	-	8.5	10	mΩ
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 15	-	124	-	nC
Q _{GS}	gate-source charge		-	22	-	nC
Q _{GD}	gate-drain charge		-	50	-	nC
V _{GS(pl)}	gate-source plateau voltage	I _D = 25 A; V _{DS} = 44 V; T _j = 25 °C; see Figure 15	-	5	-	V
C _{iss}	input capacitance	V _{GS} = 0 V; V _{DS} = 25 V; f = 1 MHz; T _j = 25 °C; see Figure 16	-	4710	6280	pF
C _{oss}	output capacitance		-	980	1180	pF
C _{rss}	reverse transfer capacitance		-	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		-	117	-	ns
t _{d(off)}	turn-off delay time		-	132	-	ns
t _f	fall time		-	95	-	ns
L _D	internal drain inductance	from contact screw on package to centre of die; T _j = 25 °C	-	3.5	-	nH
		from drain lead 6mm from package to centre of die; T _j = 25 °C	-	4.5	-	H
L _S	internal source inductance	from source lead to source bond pad; T _j = 25 °C	-	7.5	-	nH
Source-drain diode						
V _{SD}	source-drain voltage	I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; see Figure 14	-	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		-	430	-	nC



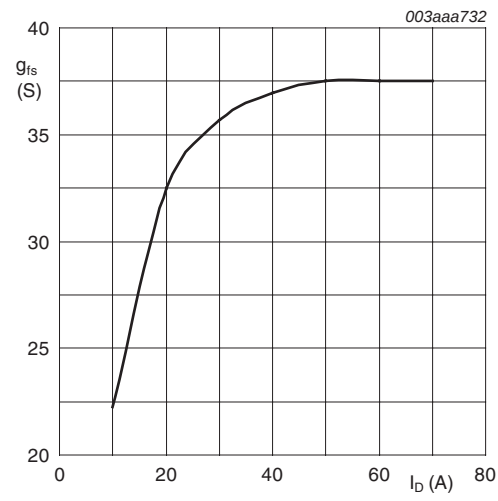
$T_j = 25\text{ }^{\circ}\text{C}$

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



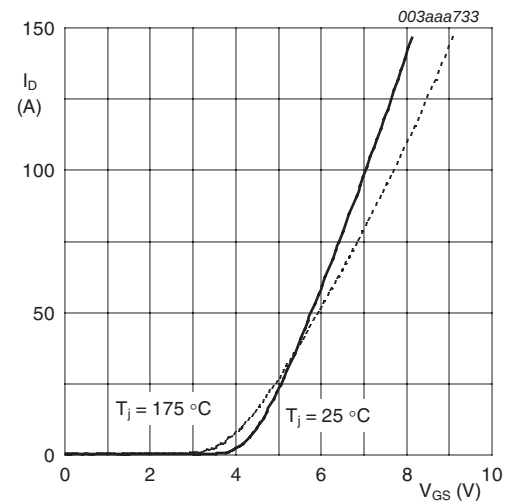
$T_j = 25\text{ }^{\circ}\text{C}$

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



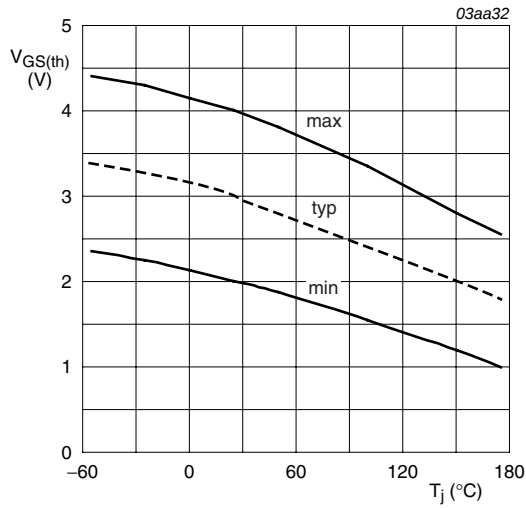
$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = 25\text{ V}$

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



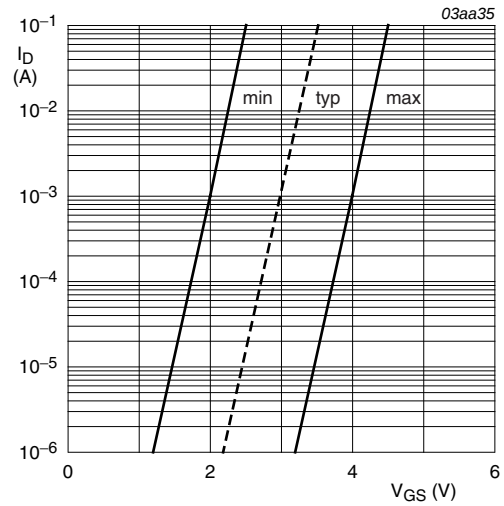
$V_{DS} = 25\text{ V}$

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



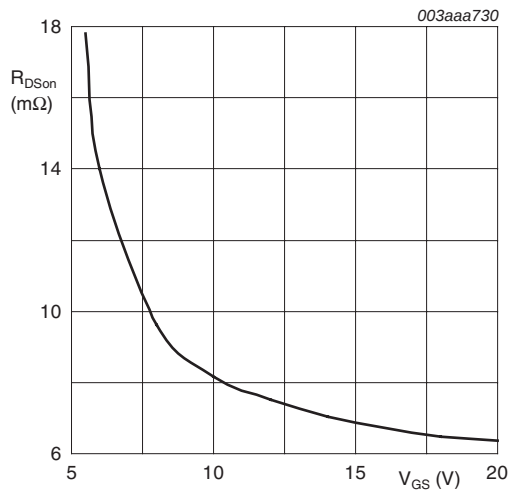
$$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$$

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



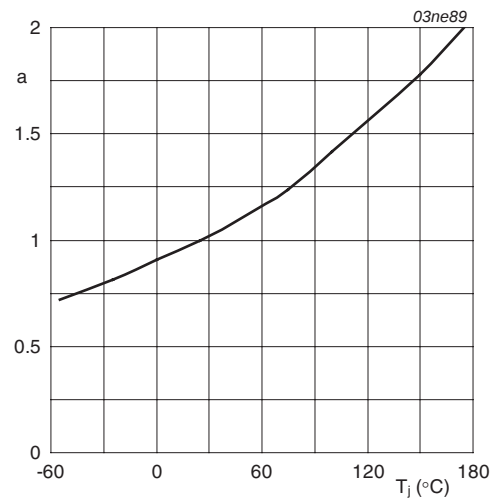
$$T_j = 25^\circ\text{C}; V_{DS} = 5 \text{ V}$$

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



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

Fig 12. 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 13. Normalized drain-source on-state resistance factor as a function of junction temperature

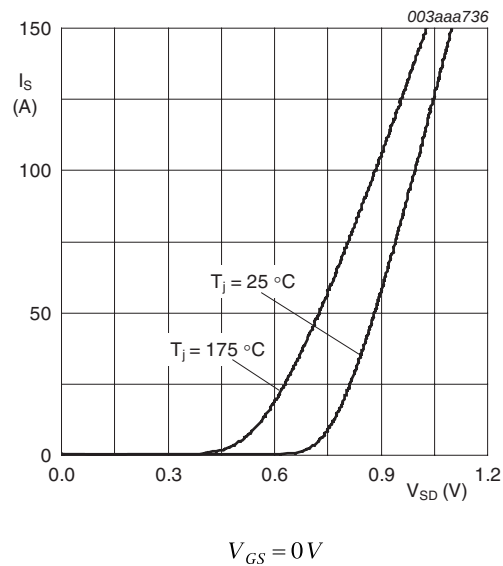


Fig 14. Source current as a function of source-drain voltage; typical values

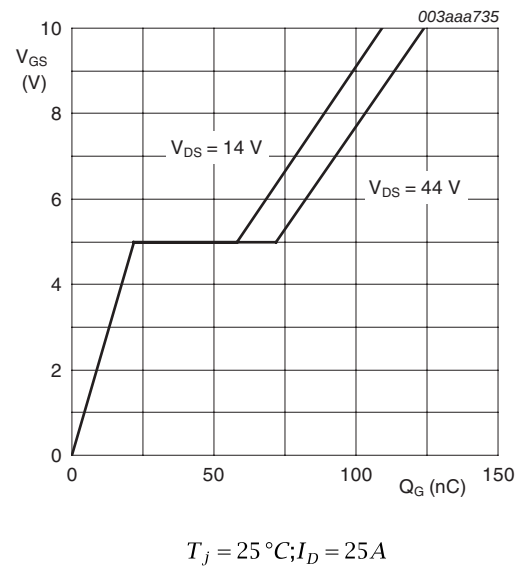


Fig 15. Gate-source voltage as a function of gate charge; typical values

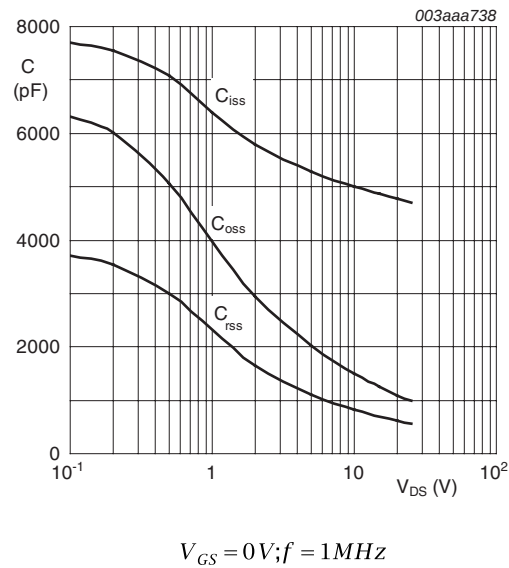


Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

7. Package outline

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

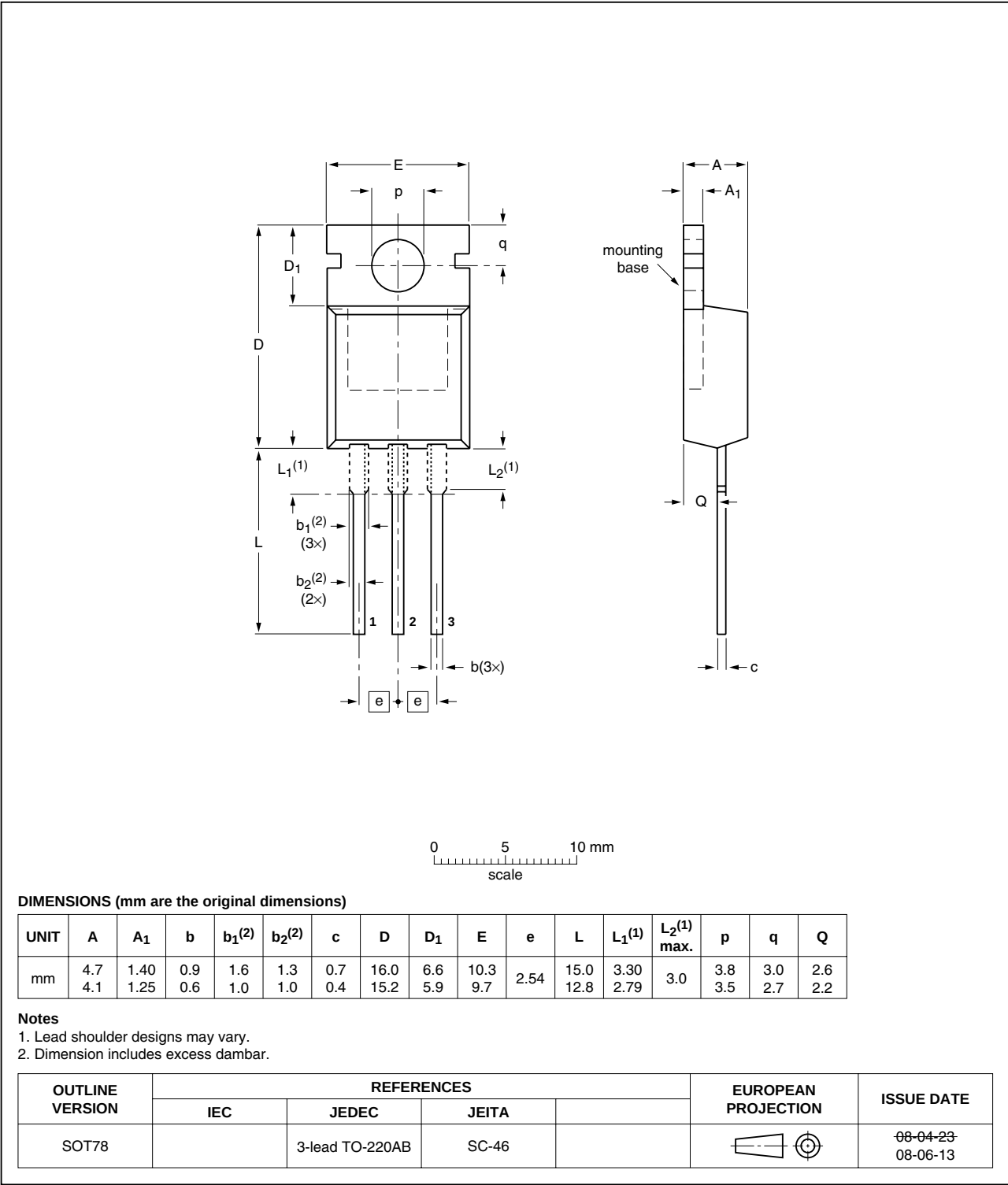


Fig 17. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK7510-55AL_3	20090804	Product data sheet	-	BUK7510-55AL_2
Modifications:	• Package outline updated.			
BUK7510-55AL_2	20080103	Product data sheet	-	BUK75_7610_55AL_1
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.
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[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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11. Contents

1 Product profile1

1.1 General description1

1.2 Features and benefits1

1.3 Applications1

1.4 Quick reference data1

2 Pinning information2

3 Ordering information2

4 Limiting values3

5 Thermal characteristics5

6 Characteristics6

7 Package outline10

8 Revision history11

9 Legal information12

9.1 Data sheet status12

9.2 Definitions12

9.3 Disclaimers12

9.4 Trademarks12

10 Contact information12



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