

BUK9509-75A

N-channel TrenchMOS logic level FET

Rev. 03 — 22 September 2008

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, 24 V and 42 V loads
- Automotive and general purpose power switching
- Motors, lamps and solenoids

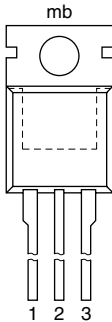
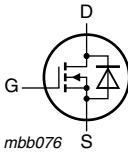
1.4 Quick reference data

Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	-	75	V
I_D	drain current	$V_{GS} = 5\text{ V}$; $T_j = 25\text{ °C}$; see Figure 3 ; see Figure 1	-	-	75	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	230	W
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}$; $V_{sup} \leq 75\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $T_{j(init)} = 25\text{ °C}$; unclamped	-	-	562	mJ
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$	-	-	9.95	m Ω
		$V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 12 ; see Figure 15	-	7.6	9	m Ω

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		
			SOT78A (TO-220AB; SC-46)	

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
BUK9509-75A	TO-220AB; SC-46	Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78A

4. Limiting values

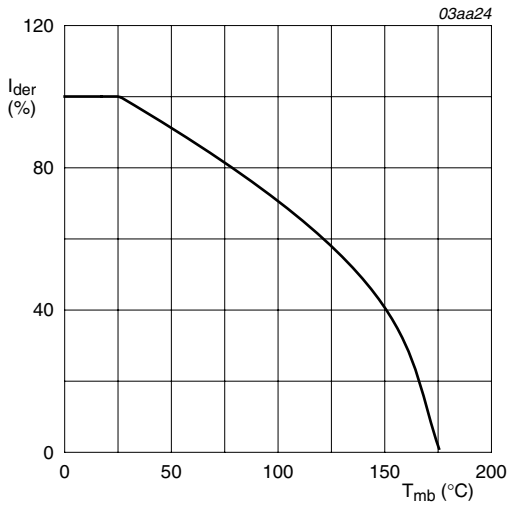
Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	75	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	75	V
V_{GS}	gate-source voltage		-10	10	V
I_D	drain current	$V_{GS} = 5\text{ V}$; $T_j = 100\text{ °C}$; see Figure 1	-	65	A
		$V_{GS} = 5\text{ V}$; $T_j = 25\text{ °C}$; see Figure 3 ; see Figure 1	-	75	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ °C}$; $t_p \leq 10\text{ }\mu\text{s}$; pulsed; see Figure 3	-	440	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	230	W
T_{stg}	storage temperature		-55	175	°C
T_j	junction temperature		-55	175	°C
V_{GSM}	peak gate-source voltage	pulsed; $t_p \leq 50\text{ }\mu\text{s}$	-15	15	V
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; $T_{mb} = 25\text{ °C}$	-	440	A

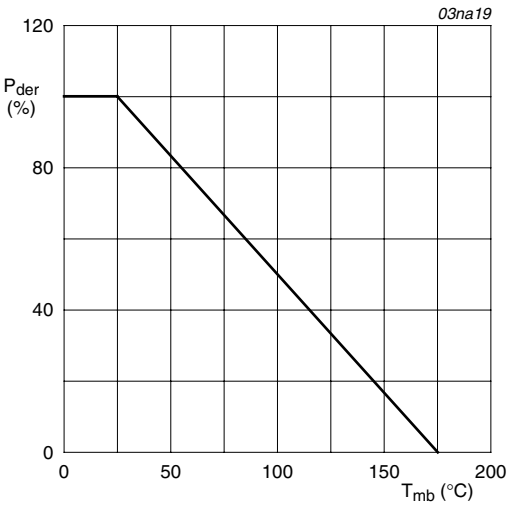
Table 4. Limiting values ...continued
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}$; $V_{sup} \leq 75\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $T_{J(\text{init})} = 25\text{ }^\circ\text{C}$; unclamped	-	562	mJ



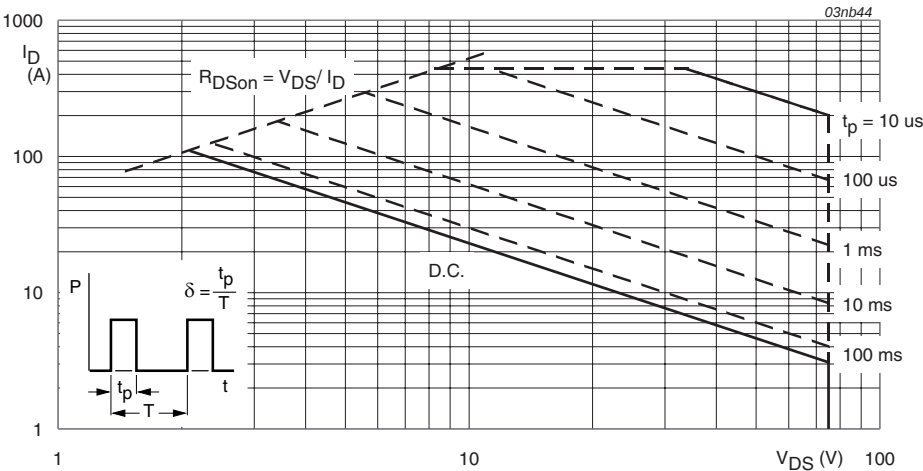
$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

Fig 1. Normalized 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



$T_{mb} = 25^\circ\text{C}$; I_{DM} is single pulse

Fig 3. 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 4	-	-	0.65	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in still air	-	60	-	K/W

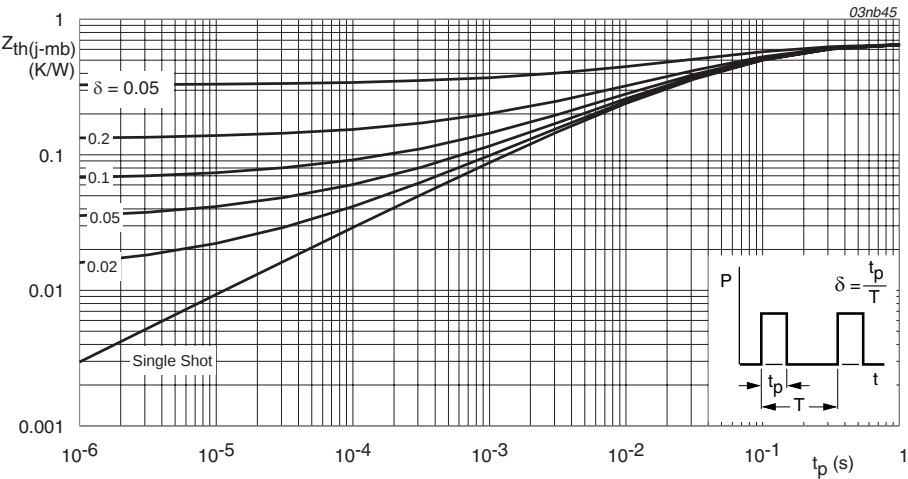
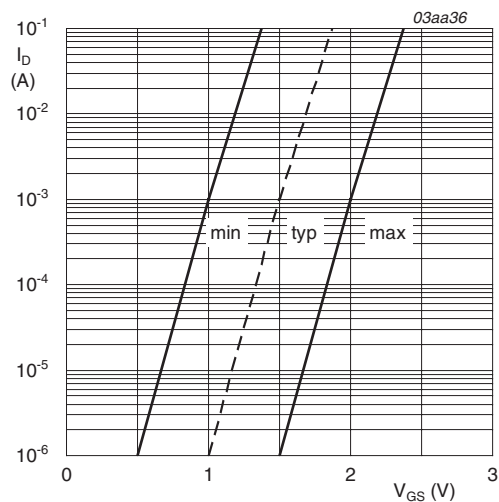


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

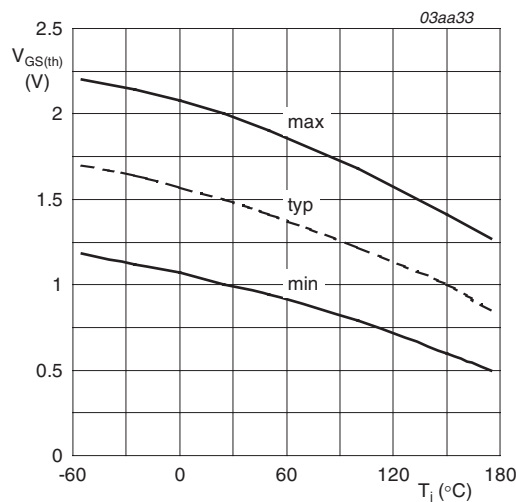
Table 6. Characteristics

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 = 25 °C	75	-	-	V
		I _D = 0.25 mA; V _{GS} = 0 V; T _j = -55 °C	70	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; T _j = 25 °C; see Figure 6	1	1.5	2	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _j = 175 °C; see Figure 6	0.5	-	-	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _j = -55 °C; see Figure 6	-	-	2.3	V
I _{DSS}	drain leakage current	V _{DS} = 75 V; V _{GS} = 0 V; T _j = 175 °C	-	-	500	μA
		V _{DS} = 75 V; V _{GS} = 0 V; T _j = 25 °C	-	0.05	10	μA
I _{GSS}	gate leakage current	V _{DS} = 0 V; V _{GS} = 10 V; T _j = 25 °C	-	2	100	nA
		V _{DS} = 0 V; V _{GS} = -10 V; T _j = 25 °C	-	2	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 4.5 V; I _D = 25 A; T _j = 25 °C	-	-	9.95	mΩ
		V _{GS} = 5 V; I _D = 25 A; T _j = 175 °C; see Figure 12 ; see Figure 15	-	-	18.9	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C	-	7.23	8.5	mΩ
		V _{GS} = 5 V; I _D = 25 A; T _j = 25 °C; see Figure 12 ; see Figure 15	-	7.6	9	mΩ
Dynamic characteristics						
C _{iss}	input capacitance	V _{GS} = 0 V; V _{DS} = 25 V; f = 1 MHz;	-	6631	8840	pF
C _{oss}	output capacitance	T _j = 25 °C; see Figure 14	-	905	1090	pF
C _{rss}	reverse transfer capacitance		-	610	840	pF
t _{d(on)}	turn-on delay time	V _{DS} = 30 V; R _L = 1.2 Ω; V _{GS} = 5 V;	-	47	-	ns
t _r	rise time	R _{G(ext)} = 10 Ω; T _j = 25 °C	-	185	-	ns
t _{d(off)}	turn-off delay time		-	424	-	ns
t _f	fall time		-	226	-	ns
L _D	internal drain inductance	from contact screw on mounting base to centre of die; T _j = 25 °C	-	3.5	-	nH
		from drain lead 6 mm from package to centre 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
Source-drain diode						
V _{SD}	source-drain voltage	I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; see Figure 13	-	0.85	1.2	V
t _{rr}	reverse recovery time	I _S = 20 A; dI _S /dt = -100 A/μs; V _{GS} = -10 V;	-	70.3	-	ns
Q _r	recovered charge	V _{DS} = 30 V; T _j = 25 °C	-	213	-	nC



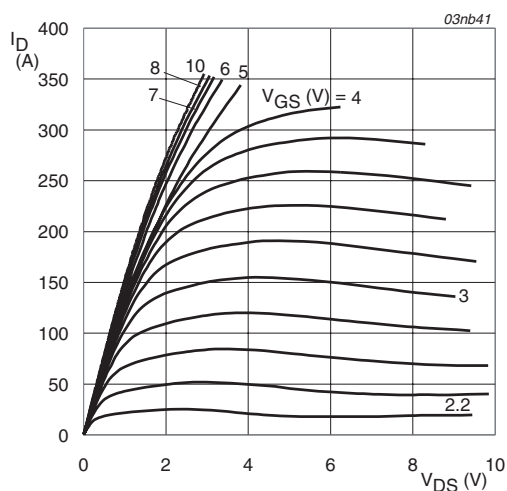
$$T_j = 25^\circ\text{C}; V_{DS} = V_{GS}$$

Fig 5. Sub-threshold drain current as a function of gate-source voltage



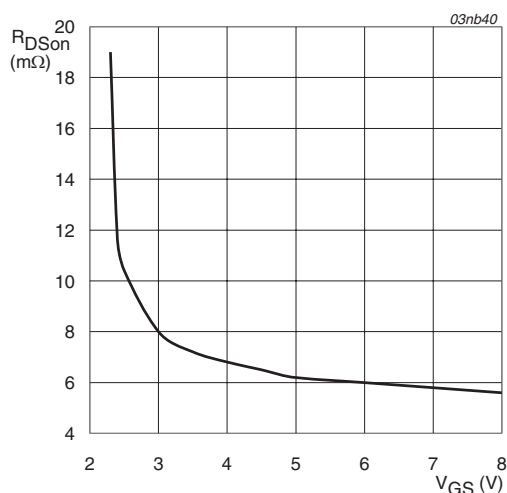
$$I_D = 1\text{ mA}; V_{DS} = V_{GS}$$

Fig 6. Gate-source threshold voltage as a function of junction temperature



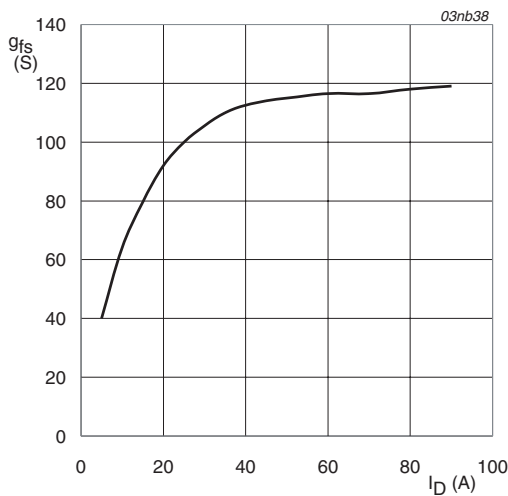
$$T_j = 25^\circ\text{C}; t_p = 300\mu\text{s}$$

Fig 7. Output characteristics: drain current as a function of drain-source voltage; typical values



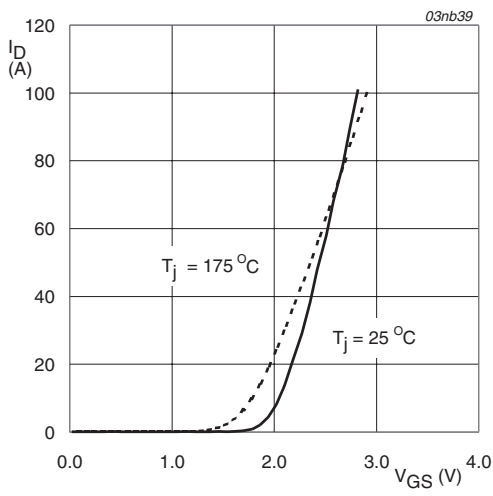
$$T_j = 25^\circ\text{C}; I_D = 25\text{ A}$$

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



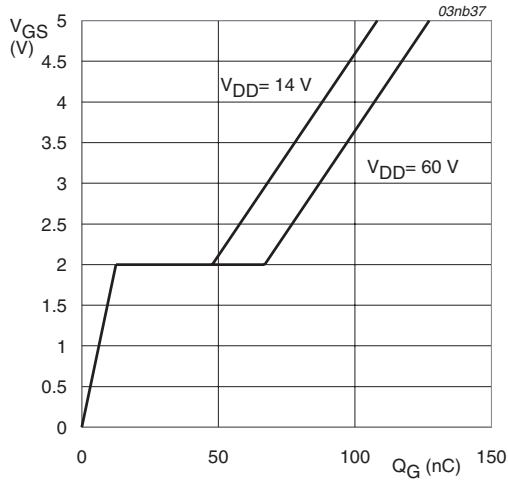
$T_j = 25^\circ\text{C}; V_{DS} = 25\text{V}$

Fig 9. Forward transconductance as a function of drain current; typical values



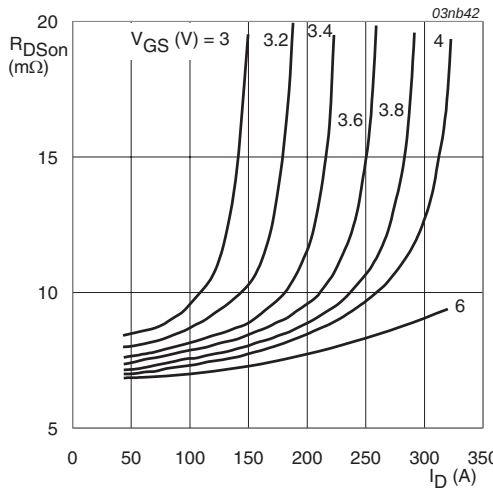
$V_{DS} = 25\text{V}$

Fig 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values



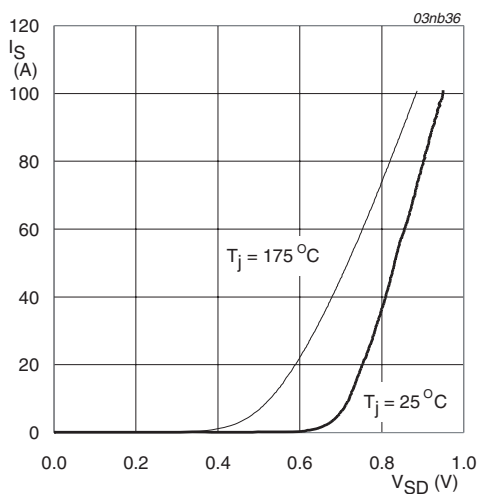
$T_j = 25^\circ\text{C}; I_D = 25\text{A}$

Fig 11. Gate-source voltage as a function of gate charge; typical values



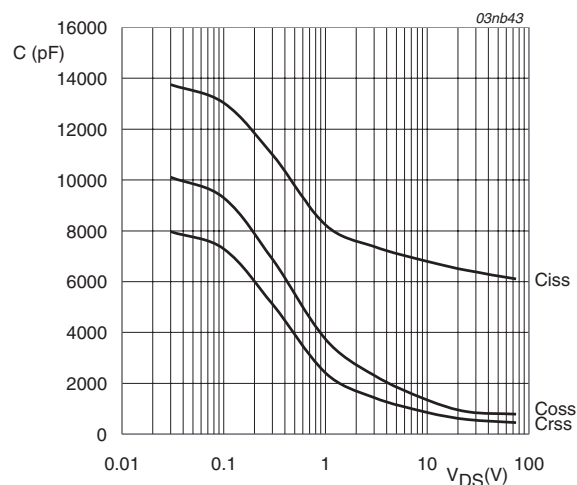
$T_j = 25^\circ\text{C}$

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



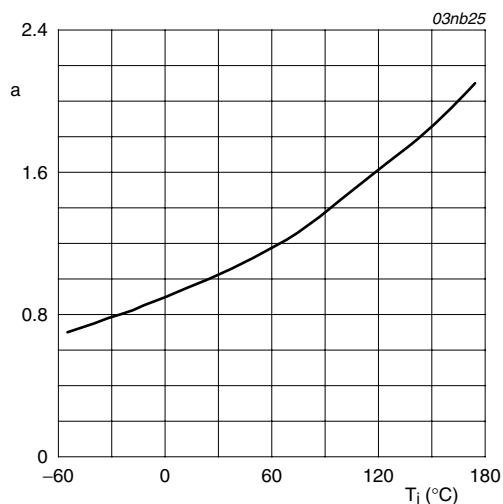
$$V_{GS} = 0V$$

Fig 13. Reverse diode current as a function of reverse diode voltage; typical values



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

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



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

Fig 15. Normalized drain-source on-state resistance factor as a function of junction temperature

7. Package outline

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

SOT78A

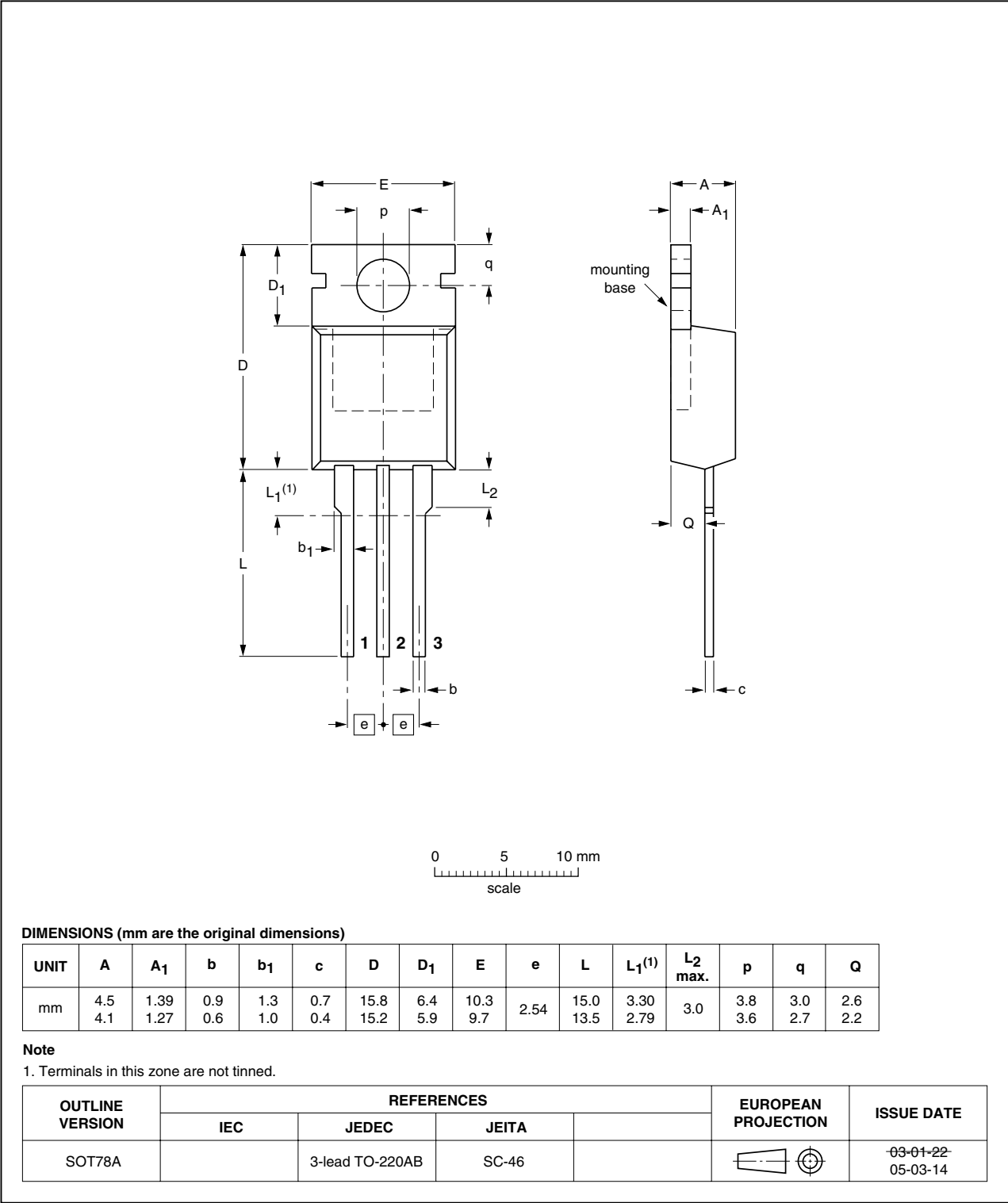


Fig 16. Package outline SOT78A (TO-220AB; SC-46)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9509-75A_3	20080922	Product data sheet	-	BUK9509_9609_75A-02
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. • Type number BUK9509-75A separated from data sheet BUK9509_9609_75A-02. • Package outline updated, see Figure 16.			
BUK9509_9609_75A-02	20001106	Product data sheet	-	BUK9509_9609_75A-01
BUK9509_9609_75A-01	20001010	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".

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