

BUK9506-55B

N-channel TrenchMOS FET

Rev. 04 — 23 July 2009

Product data sheet

1. Product profile

1.1 General description

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 and 24 V loads
- Automotive systems
- 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	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	55	V
I_D	drain current	$V_{GS} = 5\text{ V}; T_{mb} = 25\text{ °C};$ see Figure 1 and 3	[1]	-	75	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C};$ see Figure 2	-	-	258	W
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}; V_{sup} \leq 55\text{ V};$ $R_{GS} = 50\ \Omega; V_{GS} = 5\text{ V};$ $T_{j(init)} = 25\text{ °C};$ unclamped	-	-	679	mJ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 5\text{ V}; I_D = 25\text{ A};$ $V_{DS} = 44\text{ V}; T_j = 25\text{ °C};$ see Figure 14 and 15	-	22	-	nC

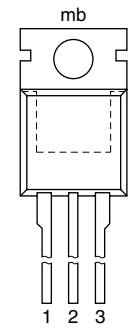
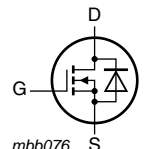
Table 1. Quick reference ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ }^\circ\text{C};$ see Figure 11 and 12	-	4.8	5.4	$m\Omega$
		$V_{GS} = 5\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ }^\circ\text{C};$ see Figure 11 and 12	-	5.1	6	$m\Omega$

[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)

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
BUK9506-55B	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

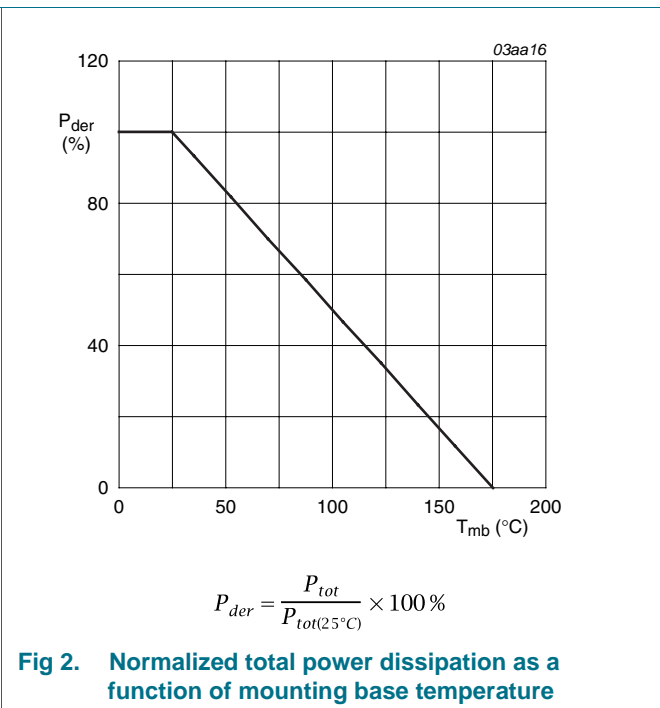
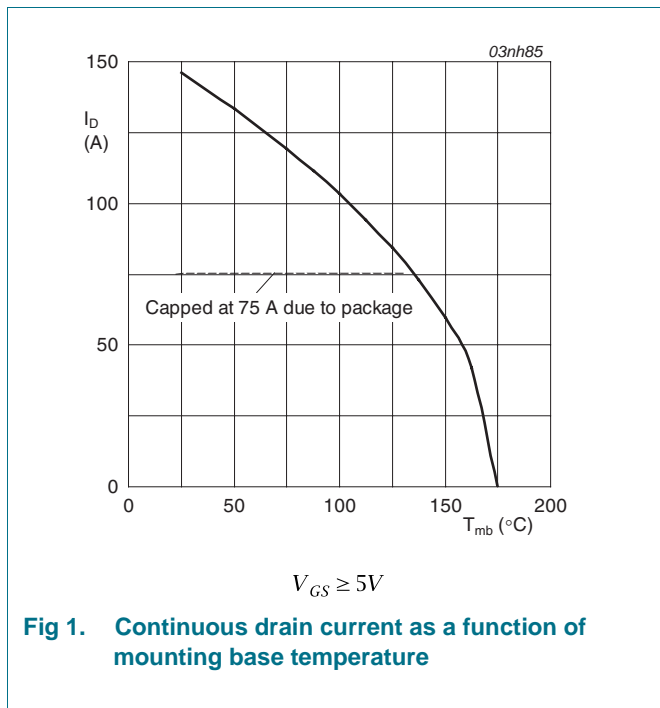
4. Limiting values

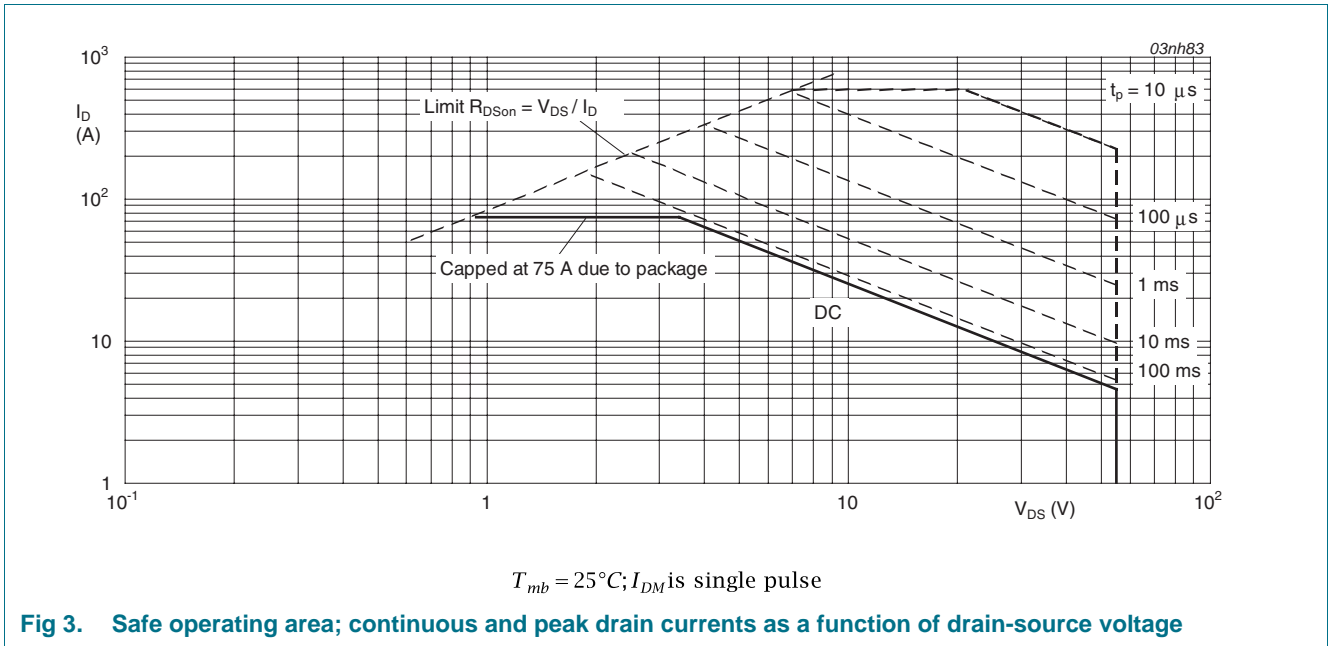
Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit	
V_{DS}	drain-source voltage	$T_j \geq 25\text{ }^\circ\text{C}$; $T_j \leq 175\text{ }^\circ\text{C}$	-	55	V	
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	55	V	
V_{GS}	gate-source voltage		-15	15	V	
I_D	drain current	$T_{mb} = 25\text{ }^\circ\text{C}$; $V_{GS} = 5\text{ V}$; see Figure 1 and 3	[1]	-	146	A
			[2]	-	75	A
		$T_{mb} = 100\text{ }^\circ\text{C}$; $V_{GS} = 5\text{ V}$; see Figure 1	[2]	-	75	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ }^\circ\text{C}$; $t_p \leq 10\text{ }\mu\text{s}$; pulsed; see Figure 3	-	587	A	
P_{tot}	total power dissipation	$T_{mb} = 25\text{ }^\circ\text{C}$; see Figure 2	-	258	W	
T_{stg}	storage temperature		-55	175	$^\circ\text{C}$	
T_j	junction temperature		-55	175	$^\circ\text{C}$	
Source-drain diode						
I_S	source current	$T_{mb} = 25\text{ }^\circ\text{C}$;	[1]	-	146	A
			[2]	-	75	A
I_{SM}	peak source current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ }^\circ\text{C}$	-	587	A	
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}$; $V_{sup} \leq 55\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $T_{j(init)} = 25\text{ }^\circ\text{C}$; unclamped	-	679	mJ	

- [1] Current is limited by power dissipation chip rating.
- [2] Continuous current is limited by package.





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	-	-	0.58	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient		-	60	-	K/W

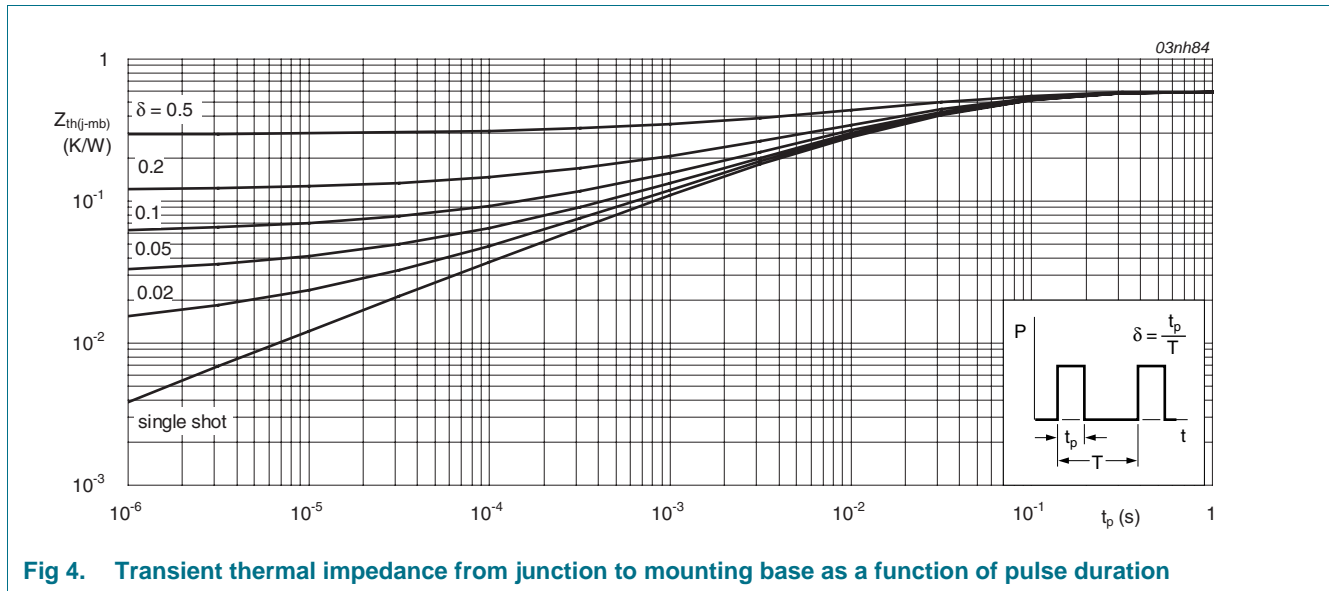


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	50	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	55	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C$; see Figure 9 and 10	-	-	2.3	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$; see Figure 9 and 10	1.1	1.5	2	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C$; see Figure 9 and 10	0.5	-	-	V
I_{DSS}	drain leakage current	$V_{DS} = 55 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	-	0.02	1	μA
		$V_{DS} = 55 V; V_{GS} = 0 V; T_j = 175 \text{ }^\circ C$	-	-	500	μA
I_{GSS}	gate leakage current	$V_{DS} = 0 V; V_{GS} = 15 V; T_j = 25 \text{ }^\circ C$	-	2	100	nA
		$V_{DS} = 0 V; V_{GS} = -15 V; T_j = 25 \text{ }^\circ C$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 V; I_D = 25 A; T_j = 25 \text{ }^\circ C$; see Figure 11 and 12	-	-	6.4	m Ω
		$V_{GS} = 10 V; I_D = 25 A; T_j = 25 \text{ }^\circ C$; see Figure 11 and 12	-	4.8	5.4	m Ω
		$V_{GS} = 5 V; I_D = 25 A; T_j = 175 \text{ }^\circ C$; see Figure 11 and 12	-	-	12	m Ω
		$V_{GS} = 5 V; I_D = 25 A; T_j = 25 \text{ }^\circ C$; see Figure 11 and 12	-	5.1	6	m Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25 A; V_{DS} = 44 V; V_{GS} = 5 V; T_j = 25 \text{ }^\circ C$; see Figure 14 and 15	-	60	-	nC
Q_{GS}	gate-source charge		-	11	-	nC
Q_{GD}	gate-drain charge		-	22	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25 A; V_{DS} = 44 V; T_j = 25 \text{ }^\circ C$; see Figure 14 and 15	-	2.4	-	V
C_{iss}	input capacitance	$V_{GS} = 0 V; V_{DS} = 25 V; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C$; see Figure 16	-	5674	7565	pF
C_{oss}	output capacitance		-	755	906	pF
C_{rss}	reverse transfer capacitance		-	255	350	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 V; R_L = 1.2 \Omega; V_{GS} = 5 V; R_{G(ext)} = 10 \Omega; T_j = 25 \text{ }^\circ C$	-	37	-	ns
t_r	rise time		-	95	-	ns
$t_{d(off)}$	turn-off delay time		-	117	-	ns
t_f	fall time		-	106	-	ns
L_D	internal drain inductance	from drain lead 6 mm from package to center of die; $T_j = 25 \text{ }^\circ C$	-	4.5	-	nH
		from contact screw on mounting base to center of die; $T_j = 25 \text{ }^\circ C$	-	3.5	-	nH
L_S	internal source inductance	from source lead to source bonding pad; $T_j = 25 \text{ }^\circ C$	-	7.5	-	nH

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; see Figure 13	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$;	-	64	-	ns
Q_r	recovered charge	$V_{DS} = 30\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$	-	79	-	nC

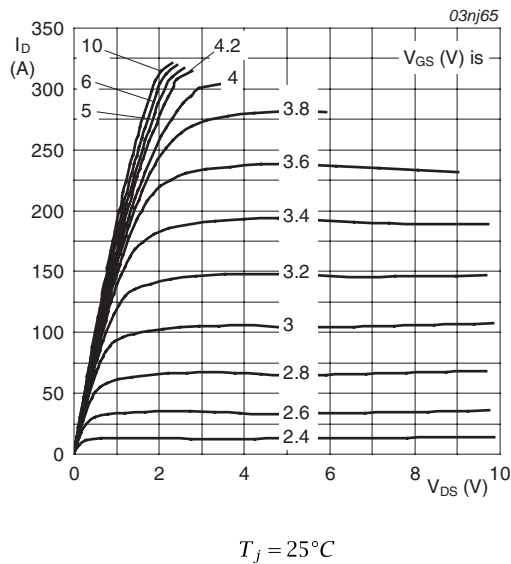


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

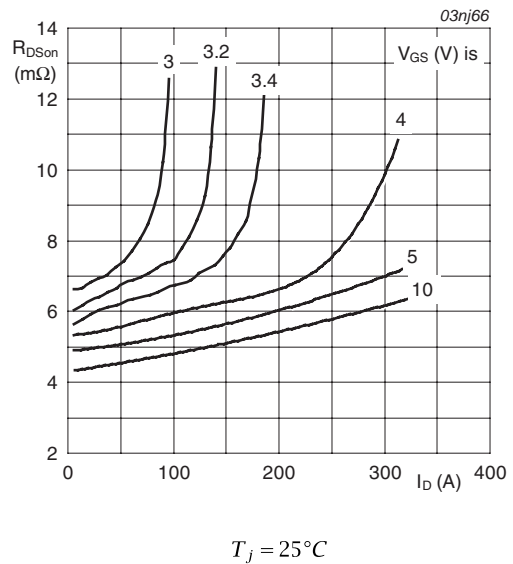


Fig 6. Drain-source on-state resistance as a function of drain current; typical values

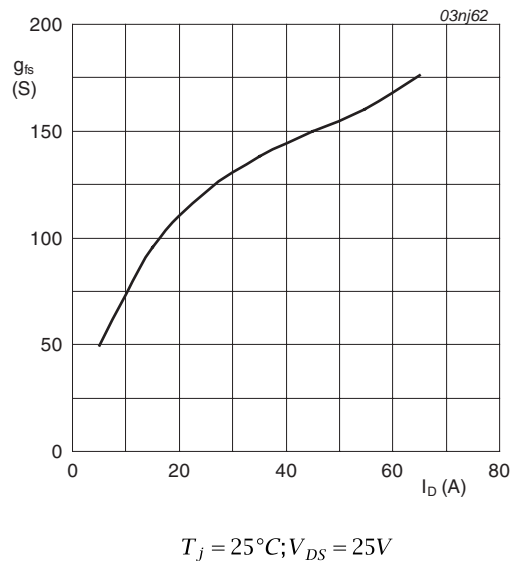


Fig 7. Forward transconductance as a function of drain current; typical values

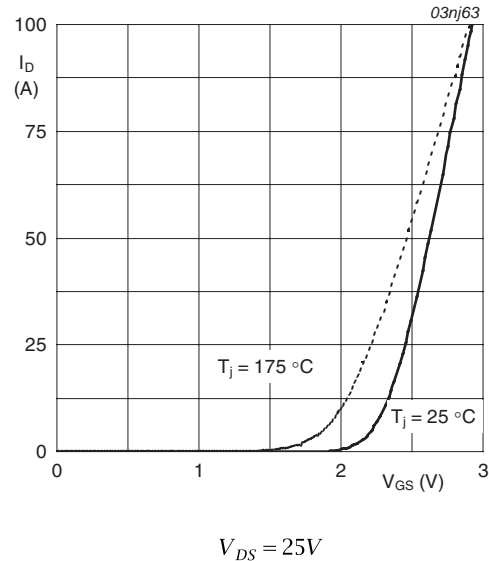
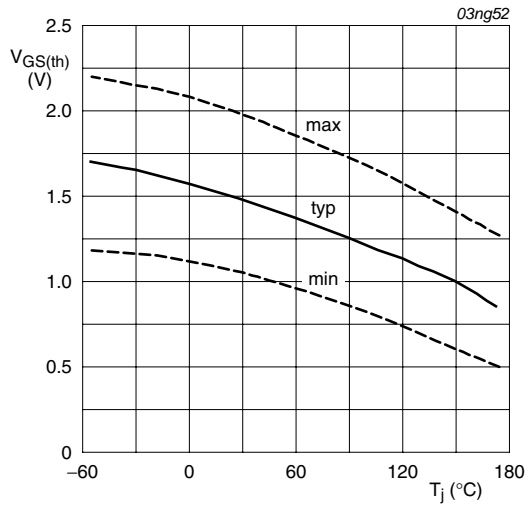
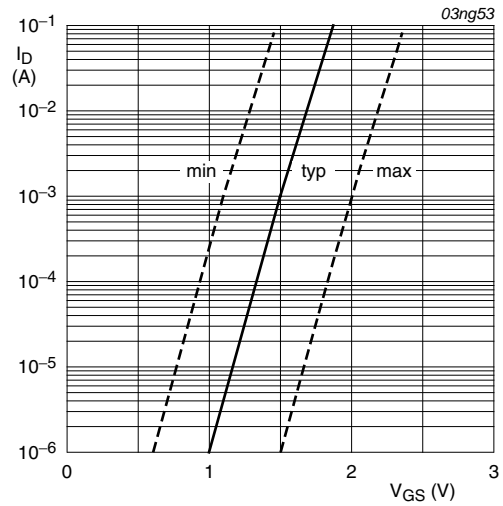


Fig 8. Transfer characteristics: drain current as a function of gate-source voltage; typical values



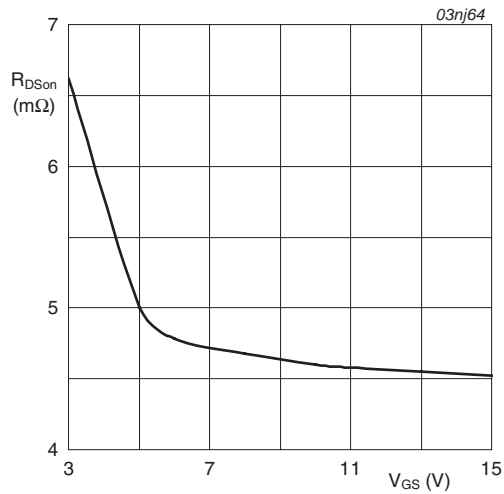
$$I_D = 1\text{ mA}; V_{DS} = V_{GS}$$

Fig 9. Gate-source threshold voltage as a function of junction temperature



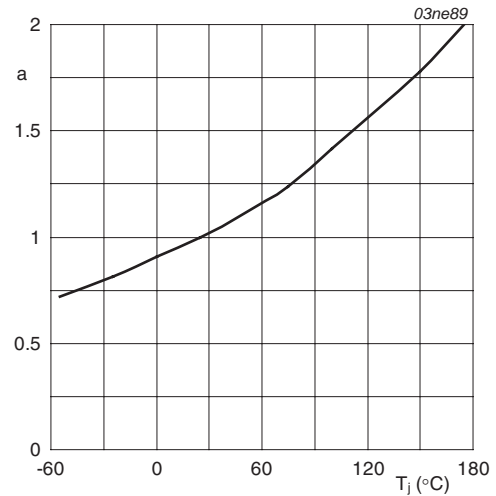
$$T_j = 25\text{ }^\circ\text{C}; V_{DS} = V_{GS}$$

Fig 10. Sub-threshold drain current as a function of gate-source voltage



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

Fig 11. 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 12. Normalized drain-source on-state resistance factor as a function of junction temperature

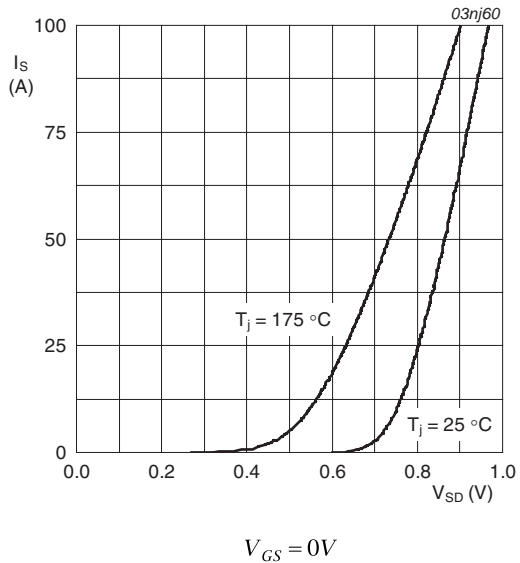


Fig 13. Source current as a function of source-drain voltage; typical values

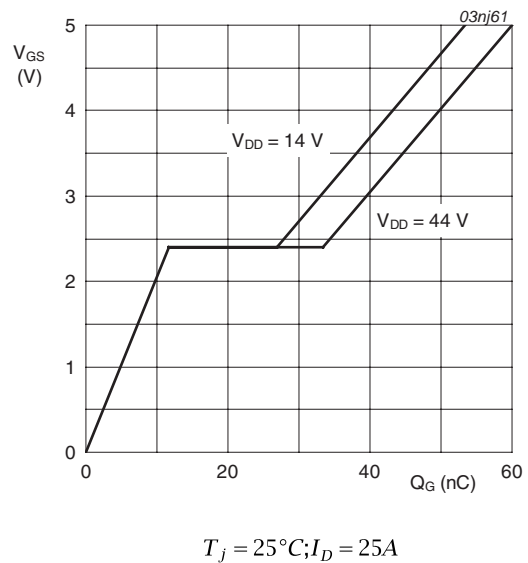


Fig 14. Gate-source voltage as a function of gate charge; typical values

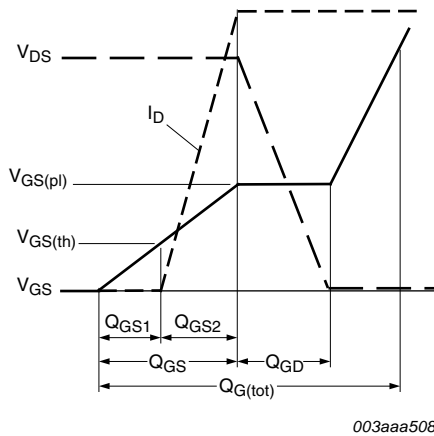


Fig 15. Gate charge waveform definitions

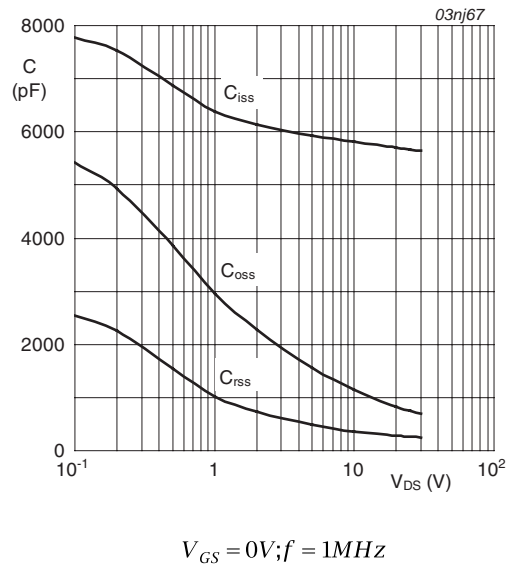


Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

7. Package outline

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

SOT78

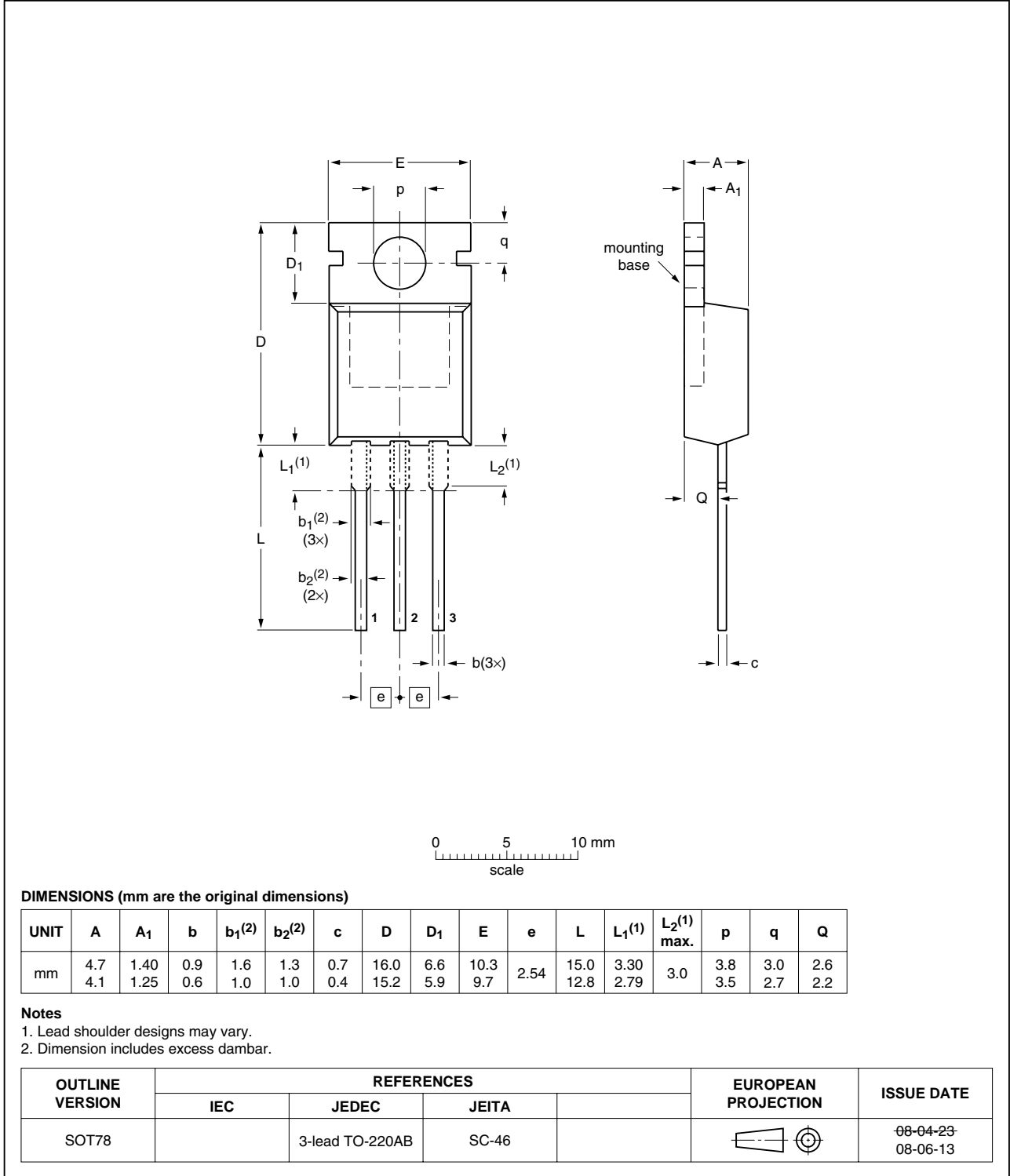


Fig 17. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9506-55B_4	20090723	Product data sheet	-	BUK95_96_9E06_55B_3
Modifications:		<ul style="list-style-type: none"> • 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 BUK9506-55B separated from data sheet BUK95_96_9E06_55B_3. 		
BUK95_96_9E06_55B_3 (9397 750 13519)	20041130	Product data sheet	-	BUK95_96_9E06_55B-02
BUK95_96_9E06_55B-02 (9397 750 10474)	20021010	Product data	-	BUK95_96_9E06_55B-01
BUK95_96_9E06_55B-01 (9397 750 09946)	20020813	Product data	-	-

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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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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