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Kind regards,

Team Nexperia

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	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	55	V
I_D	drain current	$V_{GS} = 5$ V; $T_{mb} = 25$ °C; see Figure 1 and 3	[1]	-	-	75	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2		-	-	258	W
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; $V_{GS} = 5$ V; $T_{j(init)} = 25$ °C; unclamped		-	-	679	mJ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 5$ V; $I_D = 25$ A; $V_{DS} = 44$ V; $T_j = 25$ °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 V; I_D = 25 A; T_j = 25 °C; see Figure 11 and 12	-	4.8	5.4	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 25 °C; see Figure 11 and 12	-	5.1	6	mΩ

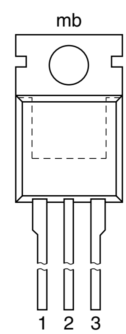
[1] Continuous current is limited by package.

2. Pinning information

Table 2. Pinning information

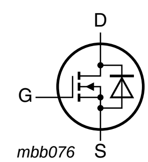
Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

Simplified outline:



SOT78 (TO-220AB)

Graphic symbol:



3. Ordering information

Table 3. Ordering information

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

4. Limiting values

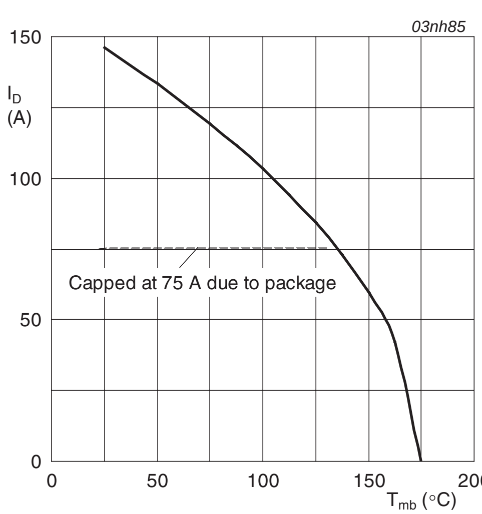
Table 4. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	55	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20$ kΩ		-	55	V
V_{GS}	gate-source voltage			-15	15	V
I_D	drain current	$T_{mb} = 25$ °C; $V_{GS} = 5$ V; see Figure 1 and 3	[1]	-	146	A
			[2]	-	75	A
		$T_{mb} = 100$ °C; $V_{GS} = 5$ V; see Figure 1	[2]	-	75	A
I_{DM}	peak drain current	$T_{mb} = 25$ °C; $t_p \leq 10$ µs; pulsed; see Figure 3		-	587	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2		-	258	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]	-	146	A
			[2]	-	75	A
I_{SM}	peak source current	$t_p \leq 10$ µs; pulsed; $T_{mb} = 25$ °C		-	587	A
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; $V_{GS} = 5$ V; $T_{j(init)} = 25$ °C; unclamped		-	679	mJ

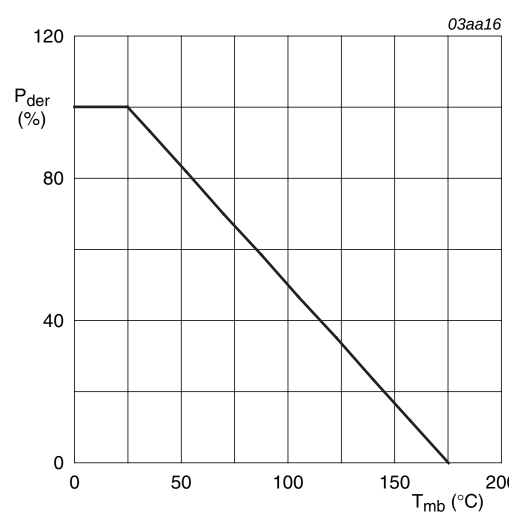
[1] Current is limited by power dissipation chip rating.

[2] Continuous current is limited by package.



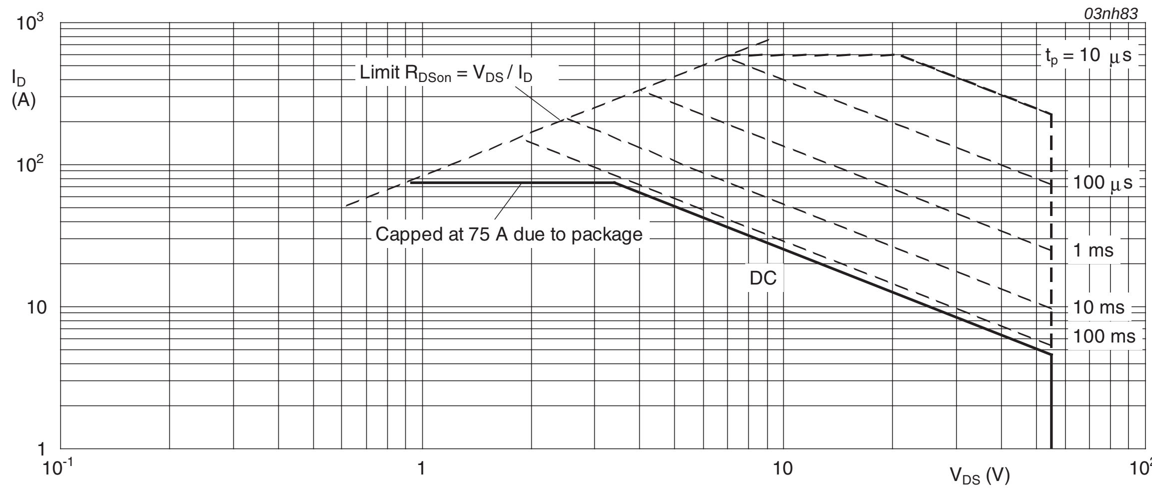
$$V_{GS} \geq 5V$$

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



$T_{mb} = 25°C; I_{DM}$ 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	-	-	0.58	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient		-	60	-	K/W

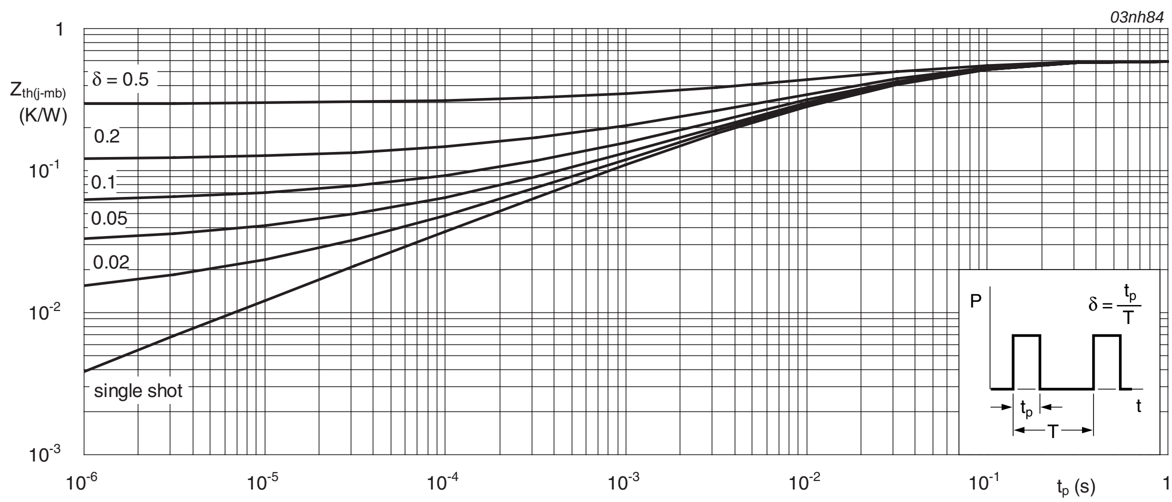


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

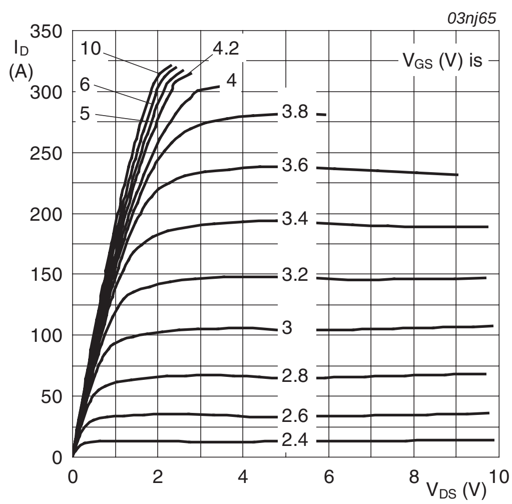
6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 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 = -55 °C; see Figure 9 and 10	-	-	2.3	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 9 and 10	1.1	1.5	2	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °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 °C	-	0.02	1	µA
		V_{DS} = 55 V; V_{GS} = 0 V; T_j = 175 °C	-	-	500	µA
I_{GSS}	gate leakage current	V_{DS} = 0 V; V_{GS} = 15 V; T_j = 25 °C	-	2	100	nA
		V_{DS} = 0 V; V_{GS} = -15 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; see Figure 11 and 12	-	-	6.4	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 11 and 12	-	4.8	5.4	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 175 °C; see Figure 11 and 12	-	-	12	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 25 °C; see Figure 11 and 12	-	5.1	6	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 44 V; V_{GS} = 5 V; T_j = 25 °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 °C; see Figure 14 and 15	-	2.4	-	V
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; T_j = 25 °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 Ω; V_{GS} = 5 V; $R_{G(ext)}$ = 10 Ω; T_j = 25 °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 °C	-	4.5	-	nH
		from contact screw on mounting base to center of die; T_j = 25 °C	-	3.5	-	nH
L_S	internal source inductance	from source lead to source bonding pad; T_j = 25 °C	-	7.5	-	nH

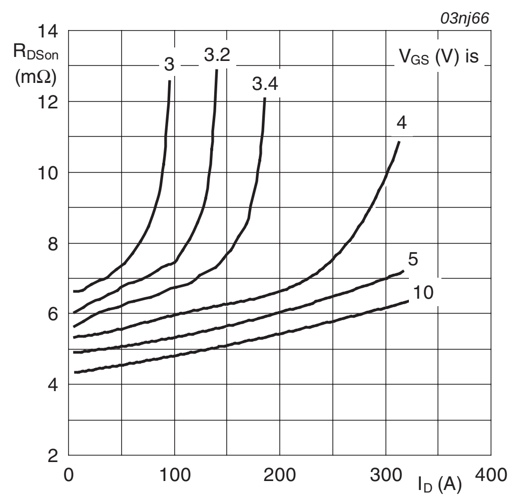
Table 6. Characteristics *…continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 25 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} = 0 V; V_{DS} = 30 V; T_j = 25 °C	-	64	-	ns
Q_r	recovered charge		-	79	-	nC



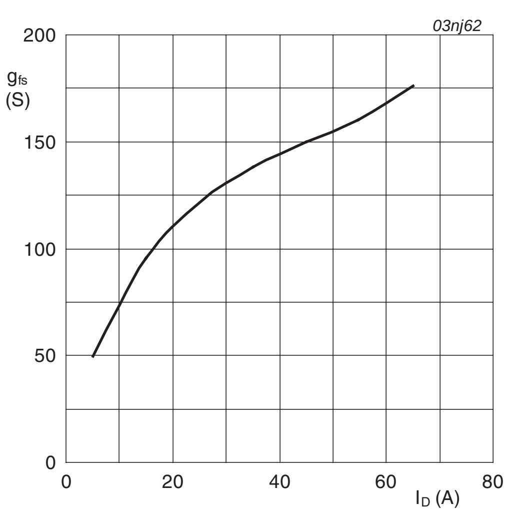
$T_j = 25°C$

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



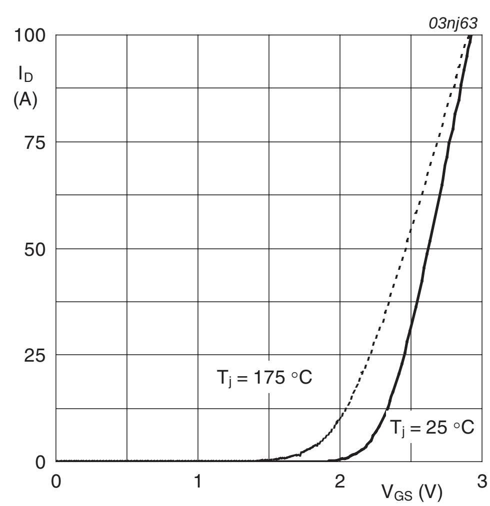
$T_j = 25°C$

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



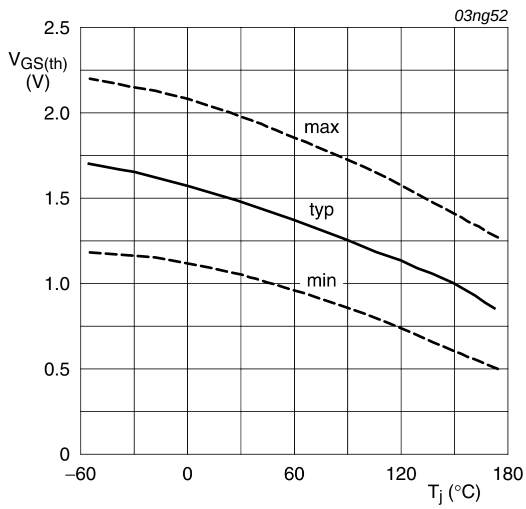
$T_j = 25°C; V_{DS} = 25V$

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



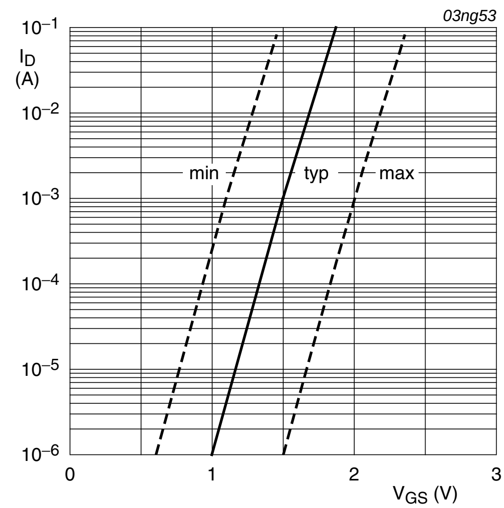
$V_{DS} = 25V$

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



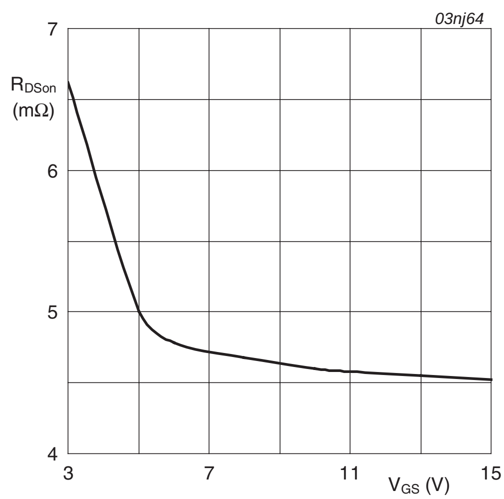
$I_D = 1 mA; V_{DS} = V_{GS}$

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



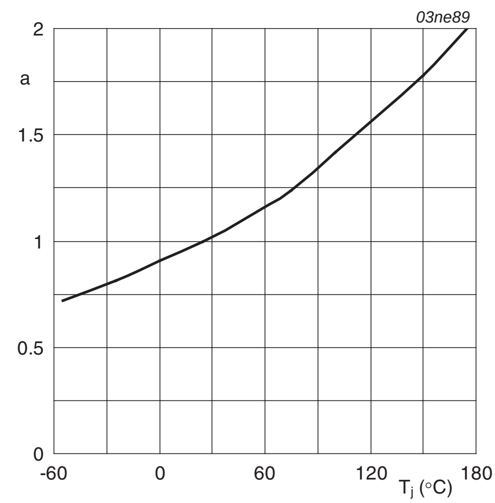
$T_j = 25\,°C; V_{DS} = V_{GS}$

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



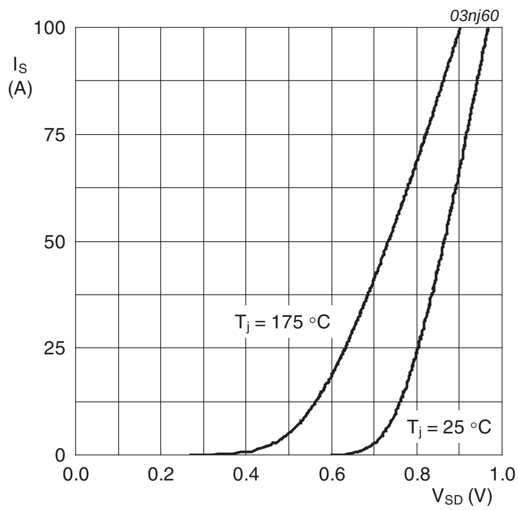
$T_j = 25°C; I_D = 25A$

Fig 11. Drain-source on-state resistance as a function of gate-source voltage; typical values



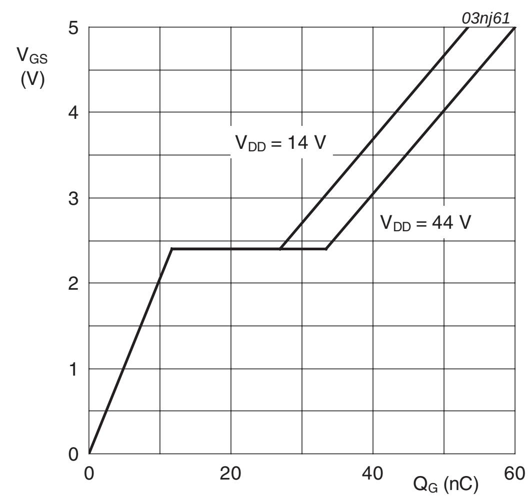
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



$$V_{GS} = 0V$$

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



$$T_j = 25°C; I_D = 25A$$

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

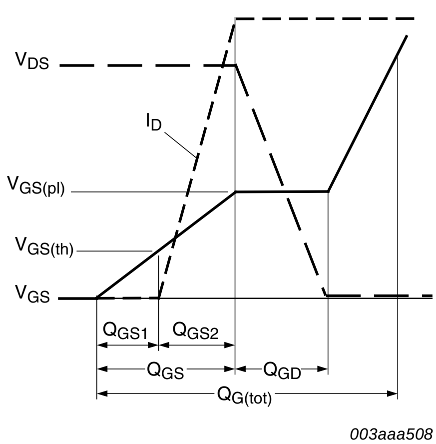
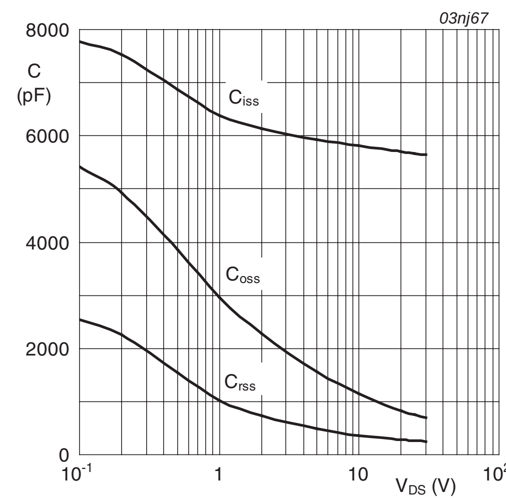


Fig 15. Gate charge waveform definitions

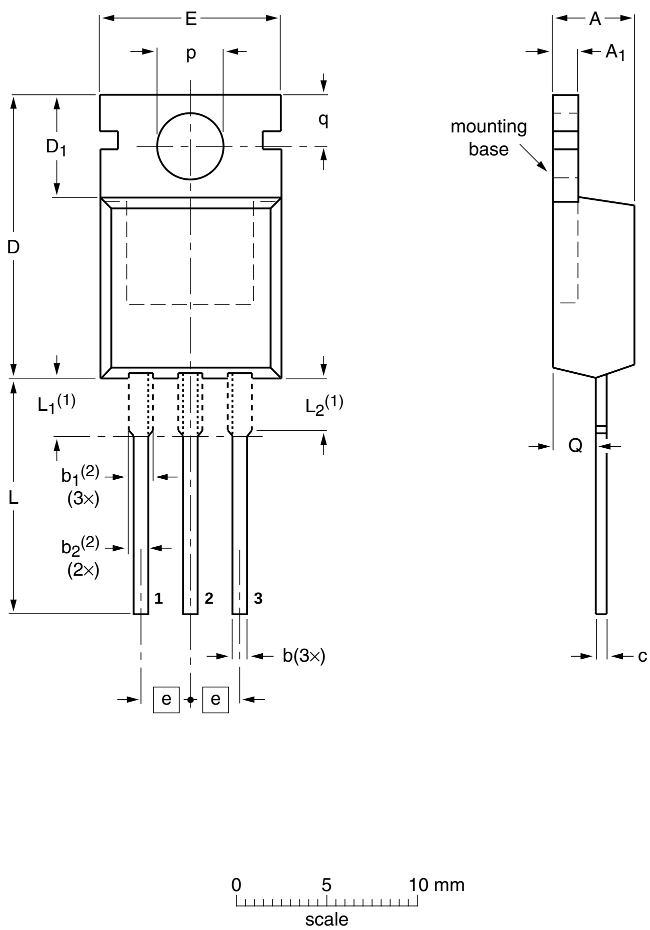


$$V_{GS} = 0V; f = 1MHz$$

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**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1(2)	b_2(2)	c	D	D_1	E	e	L	L_1(1)	L_2(1) max.	p	q	Q
mm	4.7 4.1	1.40 1.25	0.9 0.6	1.6 1.0	1.3 1.0	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

Notes

1. Lead shoulder designs may vary.
2. Dimension includes excess dambar.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			~~08-04-23~~ 08-06-13

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:	• 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	-	-

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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Document identifier: BUK9506-55B_4