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Kind regards,

Team Nexperia

BUK9E06-55B

N-channel TrenchMOS FET

Rev. 04 — 22 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; see Figure 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; see Figure 15		-	22	-	nC

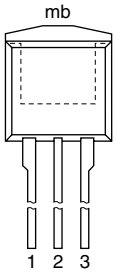
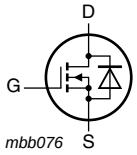
Table 1. Quick reference

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; see Figure 12	-	4.8	5.4	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 25 °C; see Figure 11; see Figure 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	 SOT226 (I2PAK)	
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK9E06-55B	I2PAK	plastic single-ended package (I2PAK); low-profile 3-lead TO-220AB	SOT226

4. Limiting values

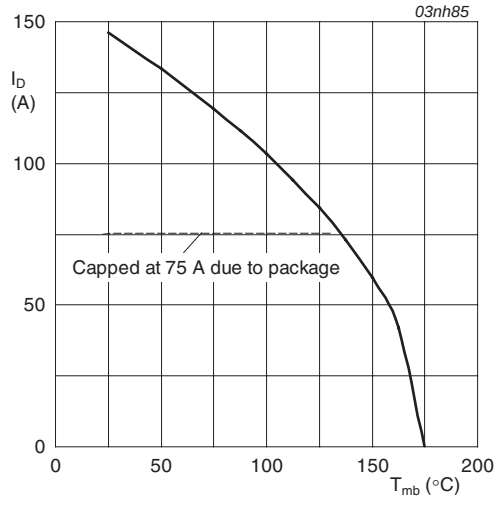
Table 4. Limiting values

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; see Figure 3	[1]	-	146	A
		T_{mb} = 25 °C; V_{GS} = 5 V; see Figure 1; see Figure 3	[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
		T_{mb} = 25 °C;	[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

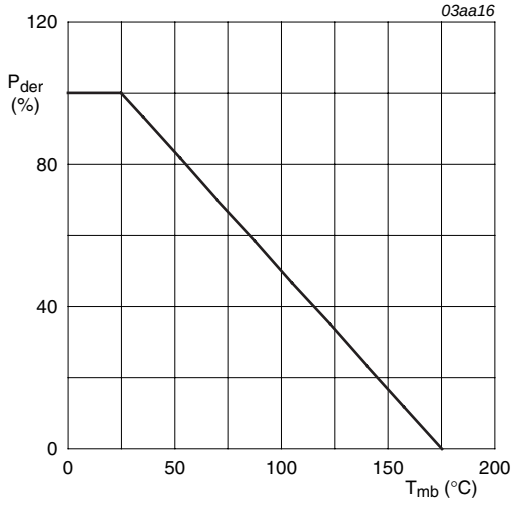
[1] Current is limited by power dissipation chip rating.

[2] Continuous current is limited by package.



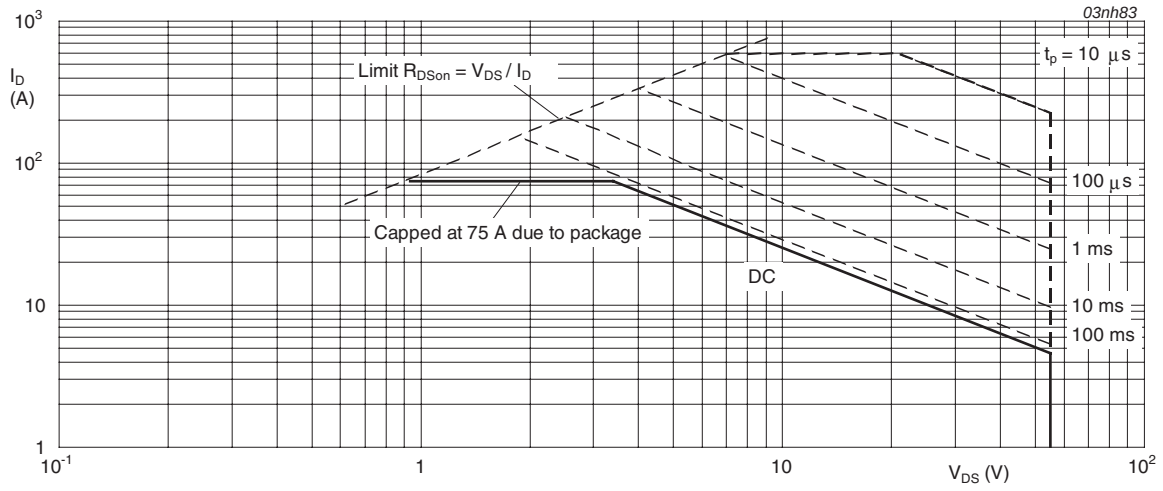
$V_{GS} \geq 5V$

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	vertical in free air	-	60	-	K/W

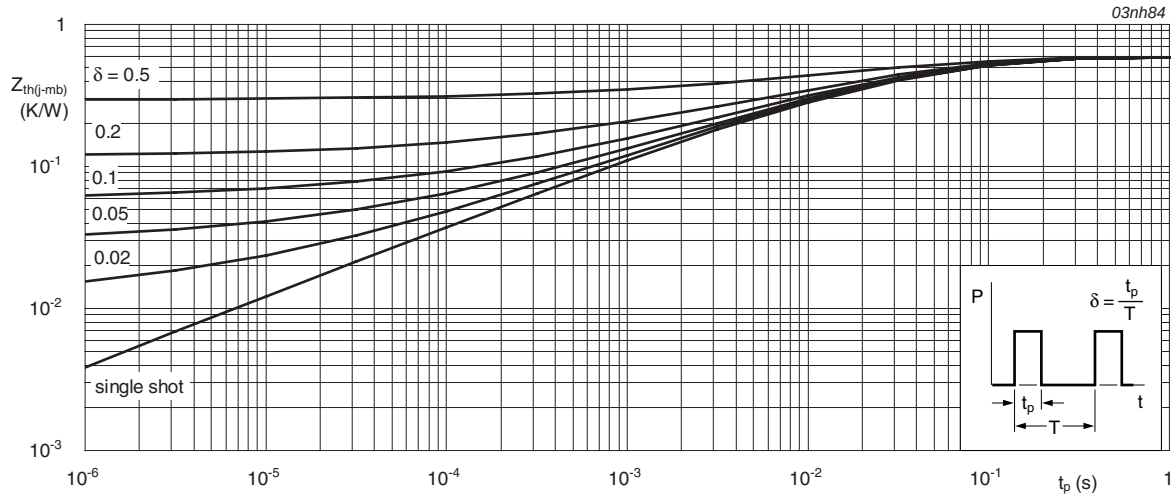


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

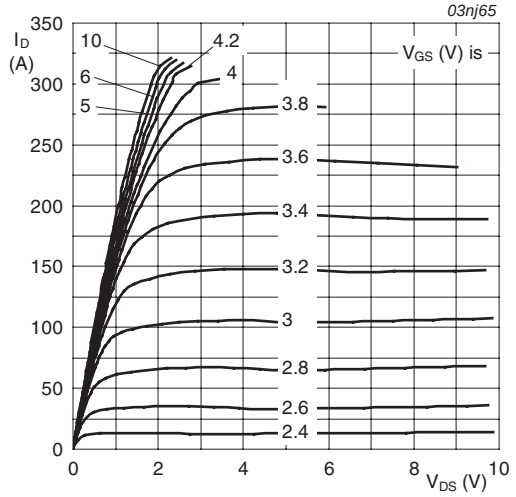
6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 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; see Figure 10	-	-	2.3	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 9; see Figure 10	1.1	1.5	2	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; see Figure 9; see Figure 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; see Figure 12	-	-	6.4	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 11; see Figure 12	-	4.8	5.4	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 175 °C; see Figure 11; see Figure 12	-	-	12	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 25 °C; see Figure 11; see Figure 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; see Figure 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; see Figure 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 upper edge of drain mounting base to center of die; T_j = 25 °C	-	2.5	-	nH
L_S	internal source inductance	from source lead to source bonding pad; T_j = 25 °C	-	7.5	-	nH

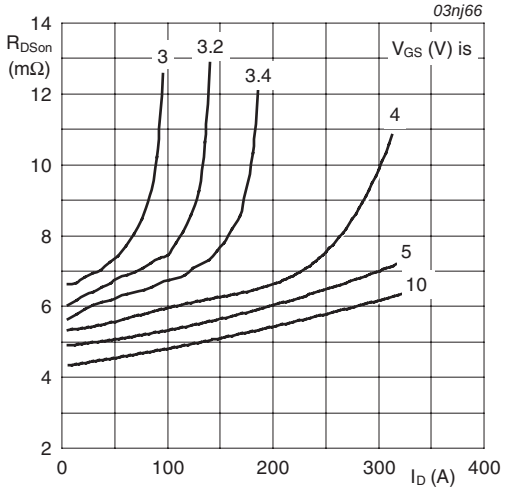
Table 6. Characteristics *...continued*

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



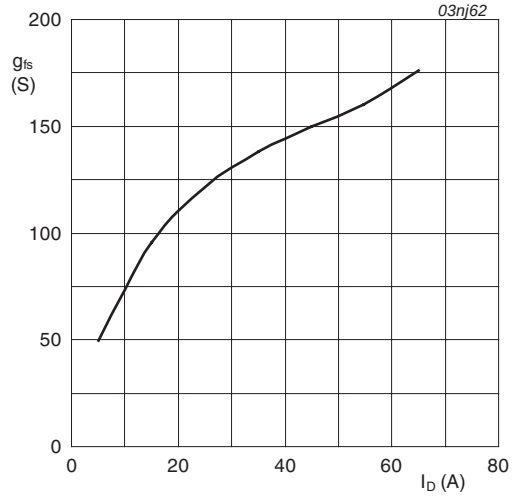
$T_j = 25°C$

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



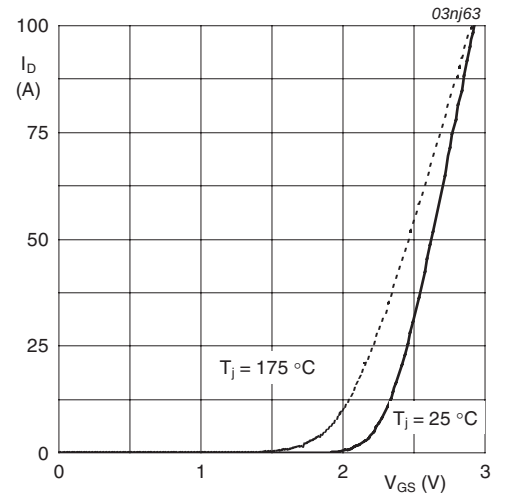
$T_j = 25°C$

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



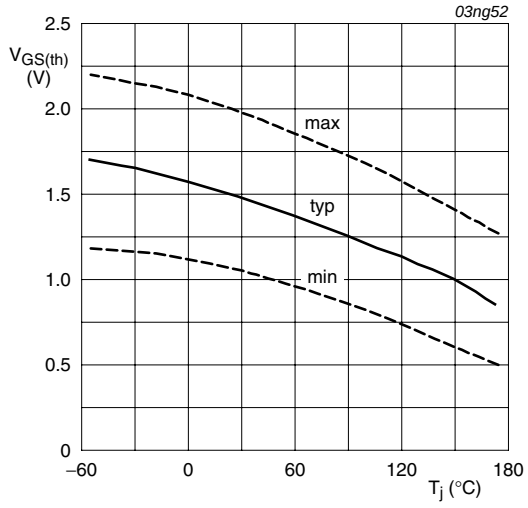
$T_j = 25°C; V_{DS} = 25V$

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



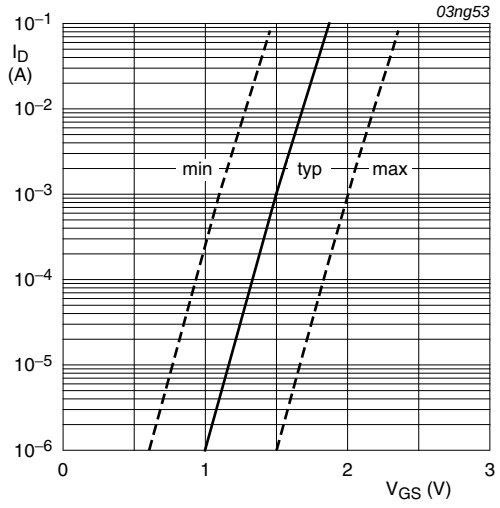
$V_{DS} = 25V$

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



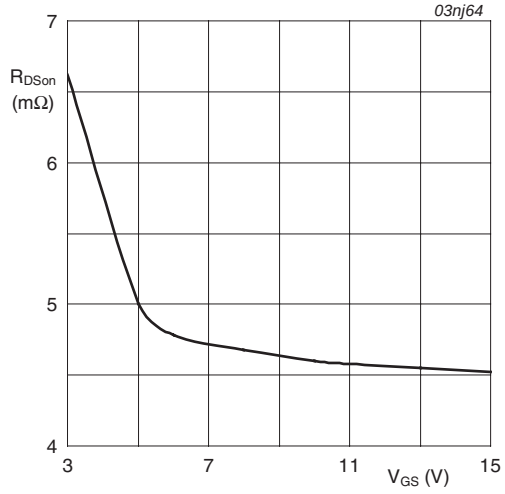
$I_D = 1mA; V_{DS} = V_{GS}$

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



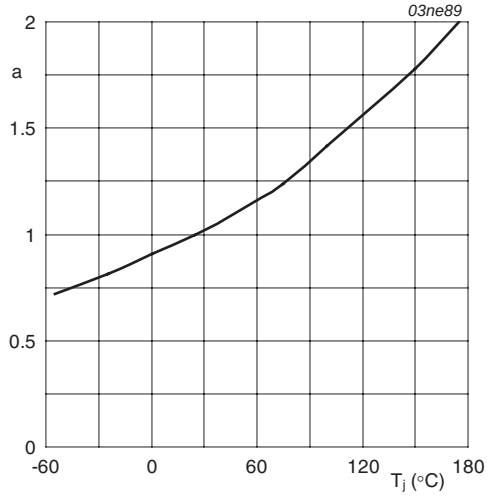
$T_j = 25\,°C; V_{DS} = V_{GS}$

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



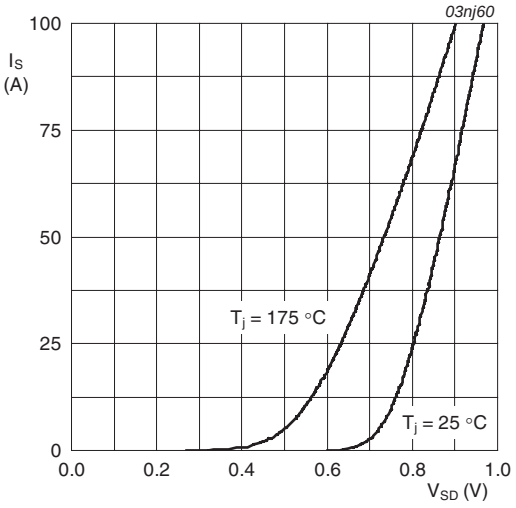
$T_j = 25°C; I_D = 25A$

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



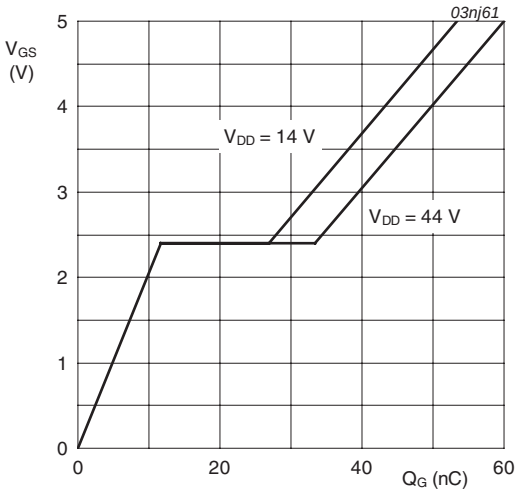
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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

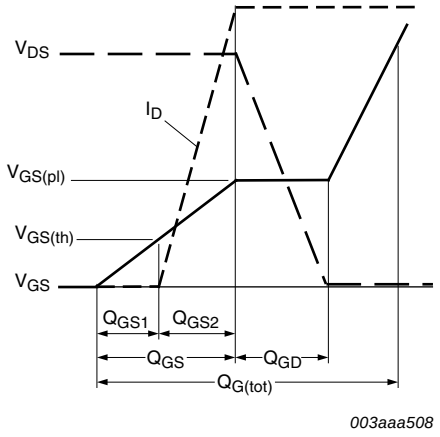
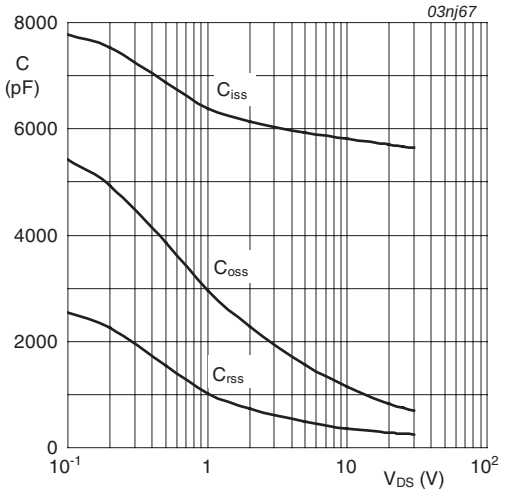


Fig 15. Gate charge waveform definitions

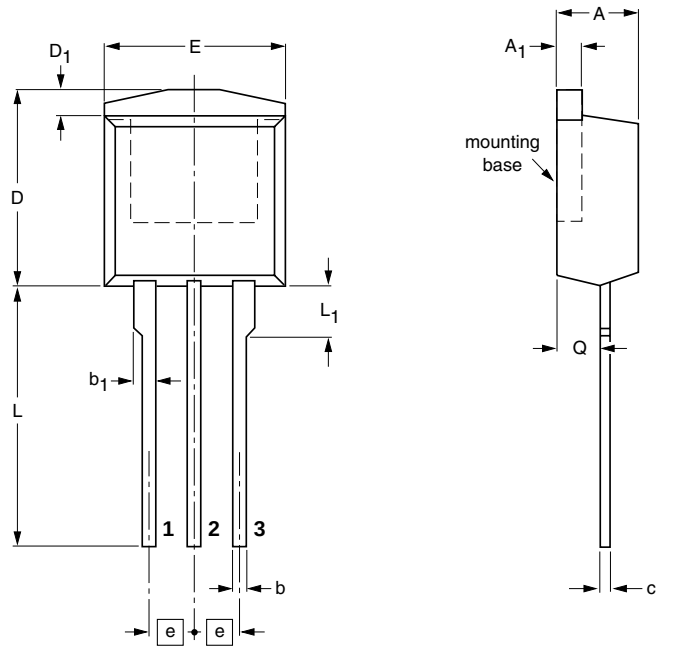


$V_{GS} = 0V; f = 1MHz$

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

7. Package outline

Plastic single-ended package (I2PAK); low-profile 3-lead TO-220AB **SOT226**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	c	D max	D_1	E	e	L	L_1	Q
mm	4.5 4.1	1.40 1.27	0.85 0.60	1.3 1.0	0.7 0.4	11	1.6 1.2	10.3 9.7	2.54	15.0 13.5	3.30 2.79	2.6 2.2

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT226		low-profile 3-lead TO-220AB				~~05-06-23~~ 06-02-14

Fig 17. Package outline SOT226 (I2PAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9E06-55B_4	20090722	Product data sheet	-	BUK9E06-55B_1
Modifications:	• Various changes to content.			
BUK9E06-55B_1	20090715	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 BUK9E06-55B 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 sheet	-	BUK95_96_9E06_55B-01
BUK95_96_9E06_55B-01 (9397 750 09946)	20020813	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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11. Contents

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