

BUK964R2-55B

N-channel TrenchMOS logic level FET

Rev. 03 — 4 June 2010

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 and 24 V loads
- Automotive systems
- General purpose power switching
- Motors, lamps and solenoids

1.4 Quick reference data

Table 1. Quick reference data

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 3 ; see Figure 1	1	-	75	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	300	W
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 11 ; see Figure 12	-	3.5	4.2	mΩ
		$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$	-	3.1	3.7	mΩ

Avalanche ruggedness



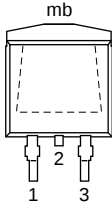
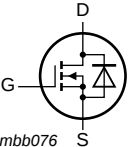
Table 1. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}$; $V_{sup} \leq 55\text{ V}$; $R_{GS} = 50\ \Omega$; $V_{GS} = 5\text{ V}$; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$; unclamped	-	-	1.2	J
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 44\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; see Figure 13	-	37	-	nC

[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 ^[1]		
3	S	source		
mb	D	mounting base; connected to drain		

SOT404 (D2PAK)

[1] It is not possible to make a connection to pin 2.

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
BUK964R2-55B	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

4. Limiting values

Table 4. Limiting values

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

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
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	$T_{mb} = 25\text{ °C}; V_{GS} = 5\text{ V}$; see Figure 3 ; see Figure 1	[1]	-	75	A
		$T_{mb} = 100\text{ °C}; V_{GS} = 5\text{ V}$; see Figure 1	[1]	-	75	A
		$T_{mb} = 25\text{ °C}; V_{GS} = 5\text{ V}$; see Figure 1 ; see Figure 3	[2]	-	191	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ °C}; t_p \leq 10\text{ }\mu\text{s}$; pulsed; see Figure 3	-	-	765	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; 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	$T_{mb} = 25\text{ °C}$	[1]	-	75	A
			[3]	-	191	A
I_{SM}	peak source current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$	-	-	765	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}; V_{sup} \leq 55\text{ V}; R_{GS} = 50\text{ }\Omega$; $V_{GS} = 5\text{ V}; T_{j(init)} = 25\text{ °C}$; unclamped	-	-	1.2	J

[1] Continuous current is limited by package.

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

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

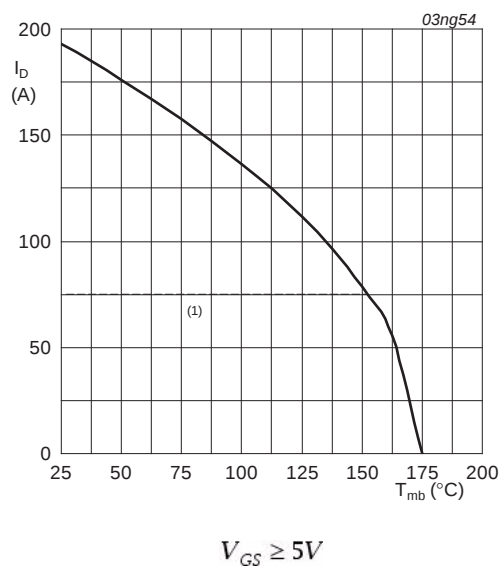


Fig. 1. Continuous drain current as a function of mounting base temperature

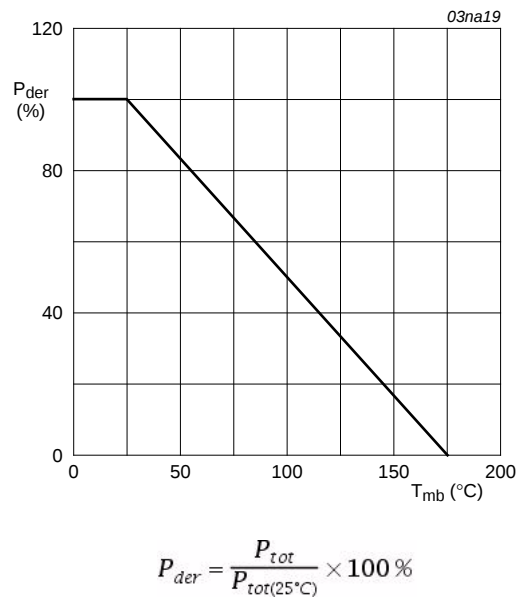


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

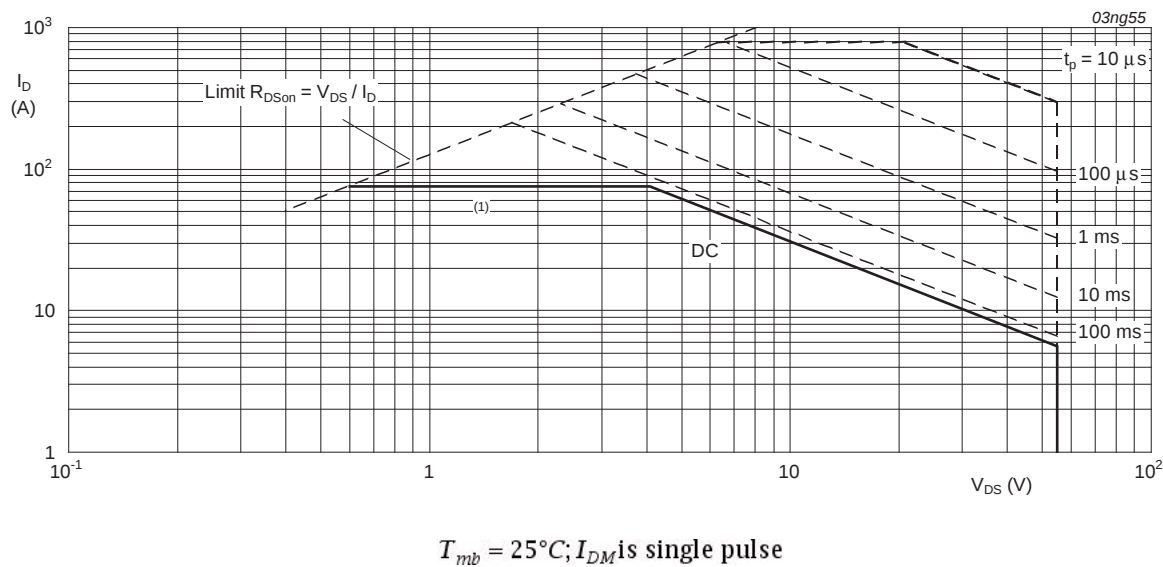


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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	-	-	0.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	minimum footprint ; mounted on a printed circuit-board	-	50	-	K/W

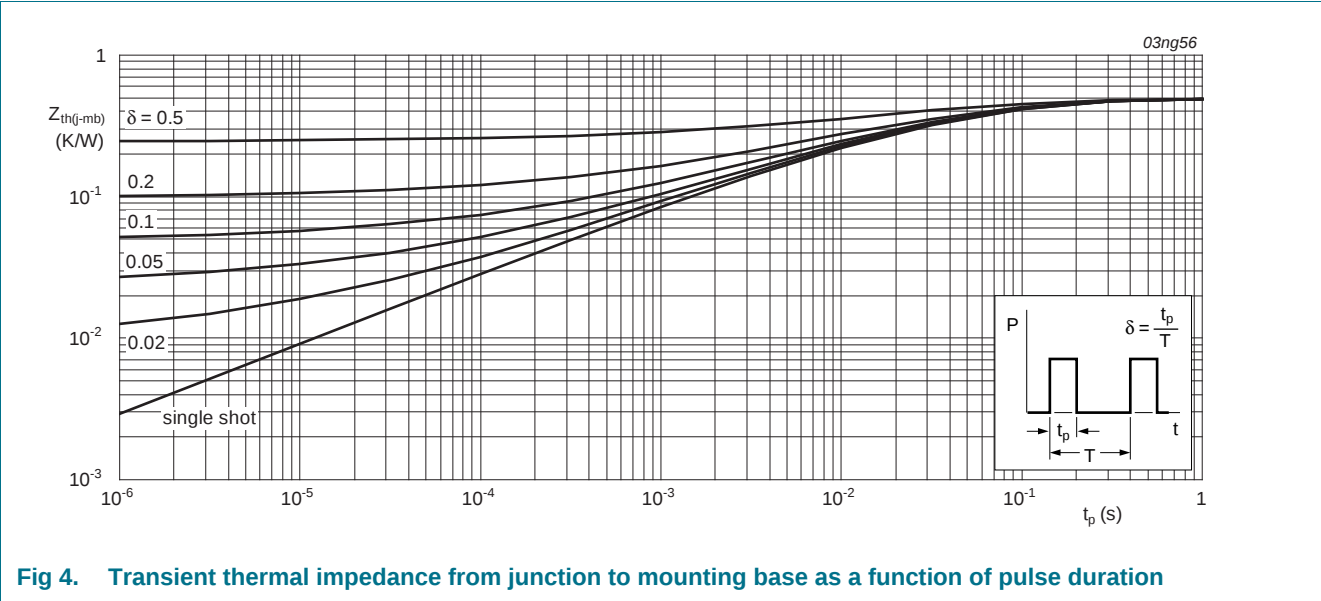


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

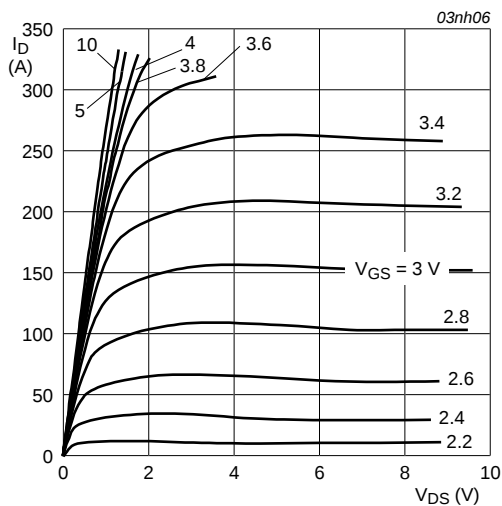
Table 6. Characteristics

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 = -55 °C	50	-	-	V
		I _D = 0.25 mA; 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	1.1	1.5	2	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _J = -55 °C; see Figure 10	-	-	2.3	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _J = 175 °C; 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} = 5 V; I _D = 25 A; T _J = 25 °C; see Figure 11 ; see Figure 12	-	3.5	4.2	mΩ
		V _{GS} = 4.5 V; I _D = 25 A; T _J = 25 °C	-	-	4.4	mΩ
		V _{GS} = 5 V; I _D = 25 A; T _J = 175 °C; see Figure 11 ; see Figure 12	-	-	8.4	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _J = 25 °C	-	3.1	3.7	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 13	-	95	-	nC
Q _{GS}	gate-source charge		-	17	-	nC
Q _{GD}	gate-drain charge		-	37	-	nC
C _{iss}	input capacitance	V _{GS} = 0 V; V _{DS} = 25 V; f = 1 MHz; T _J = 25 °C; see Figure 14	-	7665	10220	pF
C _{oss}	output capacitance		-	1044	1253	pF
C _{rss}	reverse transfer capacitance		-	466	638	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	-	63	-	ns
t _r	rise time		-	232	-	ns
t _{d(off)}	turn-off delay time		-	273	-	ns
t _f	fall time		-	178	-	ns
L _D	internal drain inductance	from upper edge of drain mounting base to centre of die SOT404 ; T _J = 25 °C	-	2.5	-	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

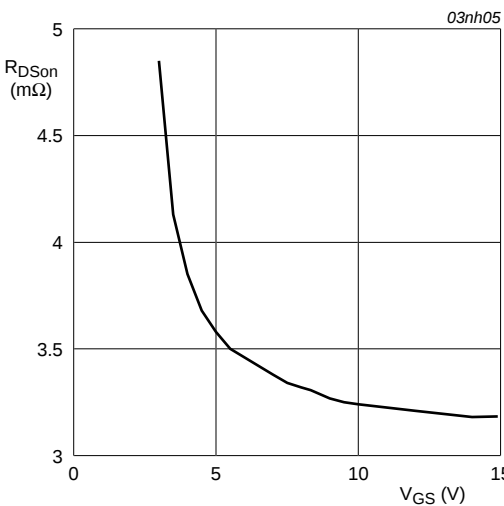
Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{SD}	source-drain voltage	$I_S = 40\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$; see Figure 15	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$;	-	78	-	ns
Q_r	recovered charge	$V_{GS} = -10\text{ V}$; $V_{DS} = 30\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$	-	171	-	nC



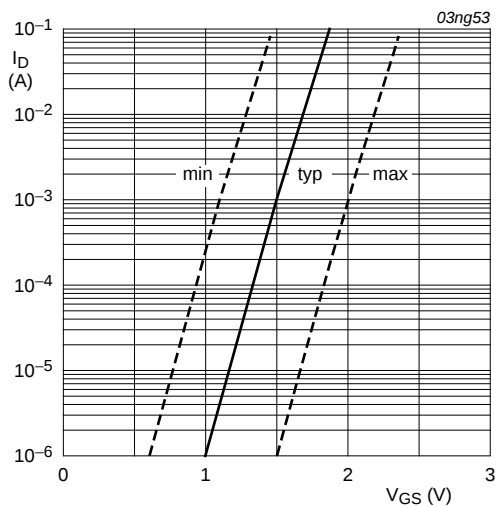
$T_j = 25\text{ }^{\circ}\text{C}$; $t_p = 300\mu\text{s}$

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



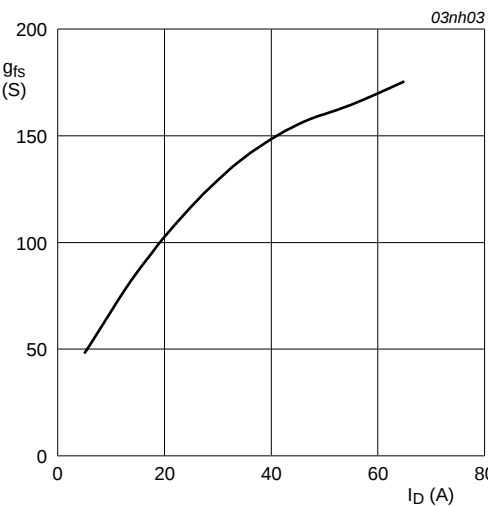
$T_j = 25\text{ }^{\circ}\text{C}$; $I_D = 25\text{ A}$

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



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

Fig 7. Sub-threshold drain current as a function of gate-source voltage



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

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

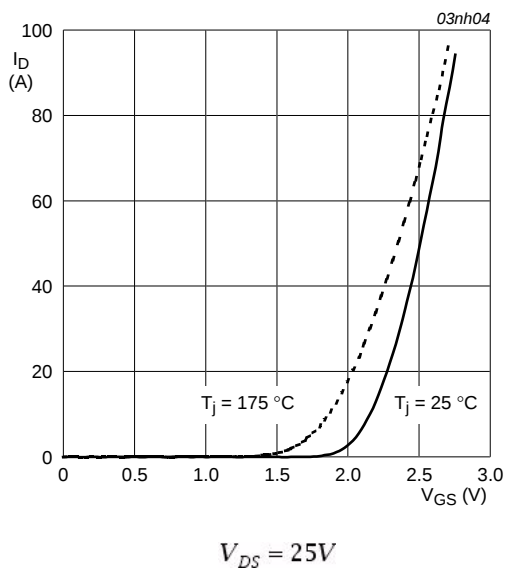


Fig 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

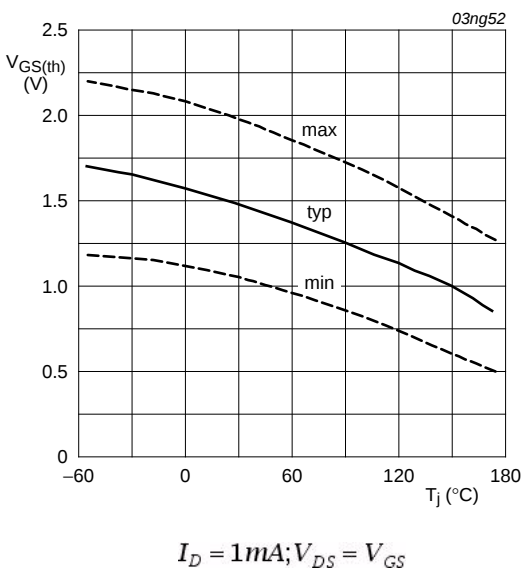


Fig 10. Gate-source threshold voltage as a function of junction temperature

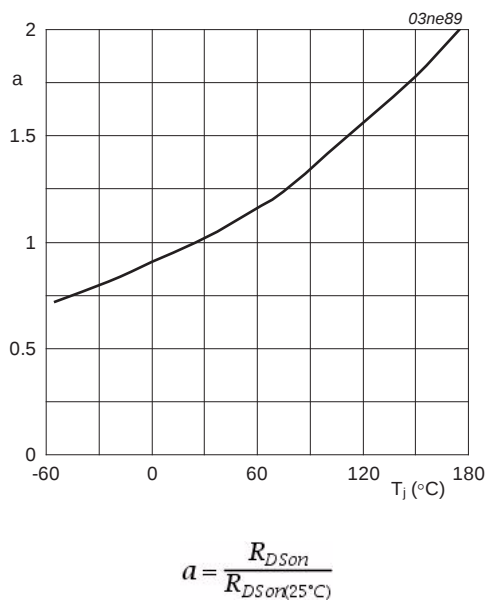


Fig 11. Normalized drain-source on-state resistance factor as a function of junction temperature

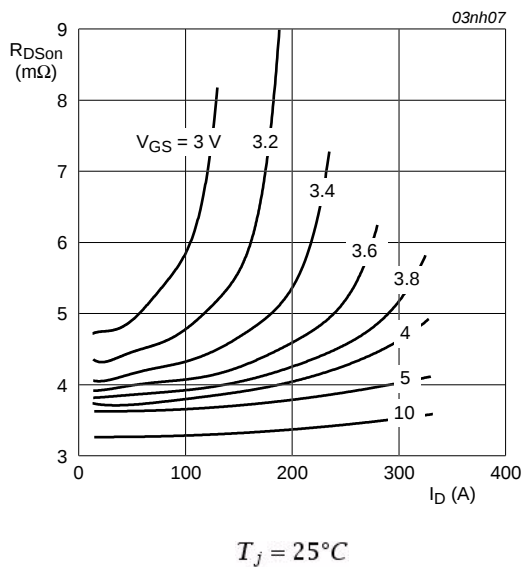


Fig 12. Drain-source on-state resistance as a function of drain current; typical values

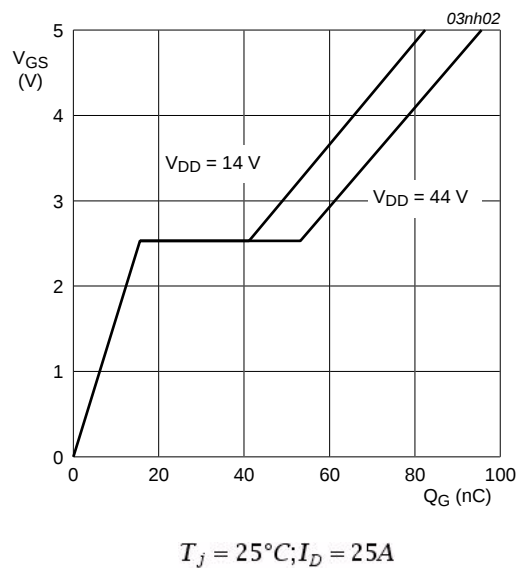


Fig 13. Gate-source threshold voltage as a function of junction temperature

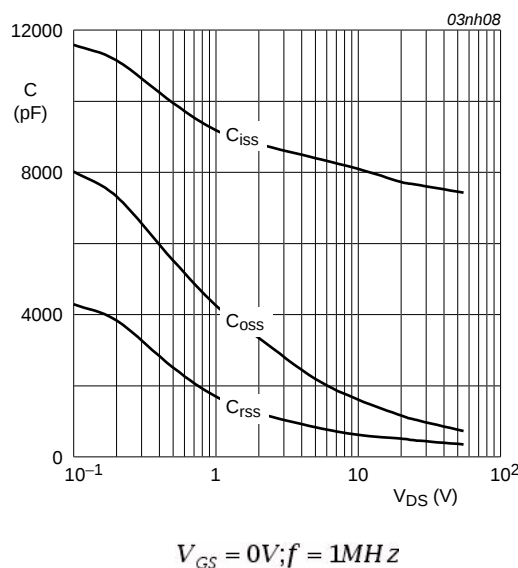


Fig 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

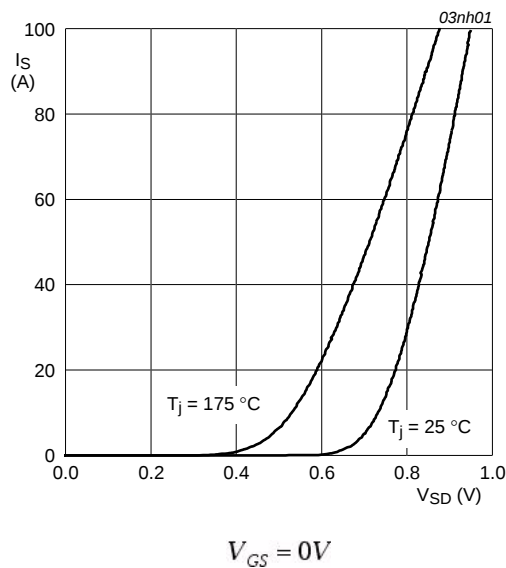
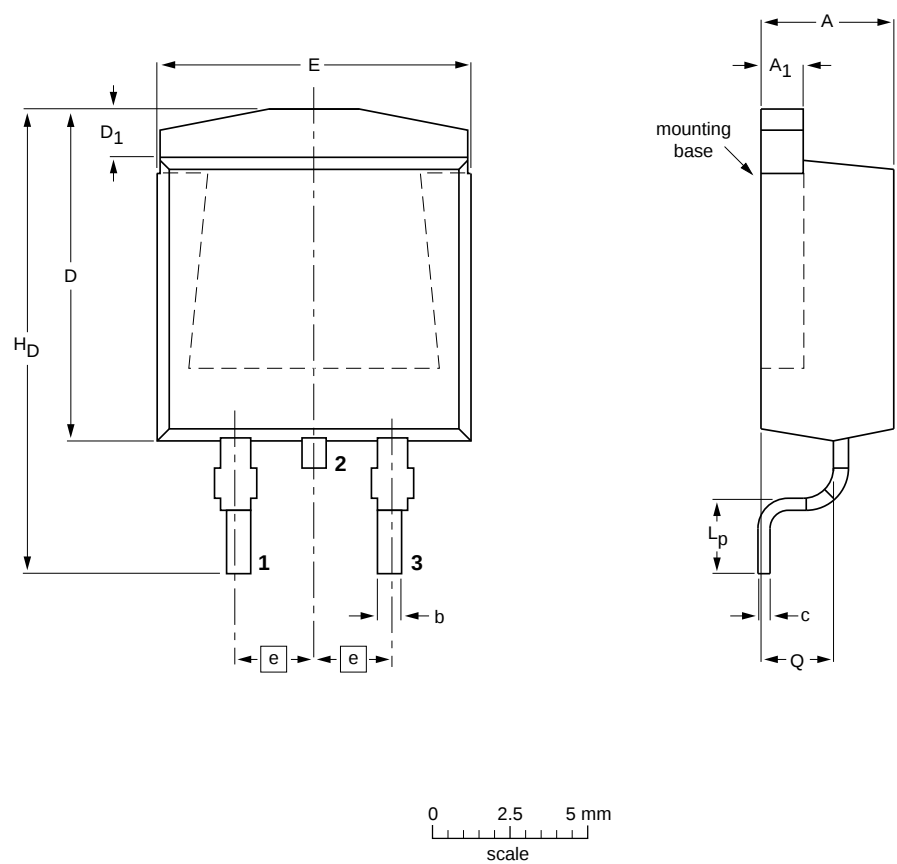


Fig 15. Reverse diode current as a function of reverse diode voltage; typical values

7. Package outline

Plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)

SOT404



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁	b	c	D _{max.}	D ₁	E	e	L _p	H _D	Q
mm	4.50 4.10	1.40 1.27	0.85 0.60	0.64 0.46	11	1.60 1.20	10.30 9.70	2.54	2.90 2.10	15.80 14.80	2.60 2.20

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT404						05-02-11 06-03-16

Fig 16. Package outline SOT404 (D2PAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK964R2-55B v.3	20100604	Product data sheet	-	BUK95_964R2_55B-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 BUK964R2-55B separated from data sheet BUK95_964R2_55B-02.			
BUK95_964R2_55B-02 (9397 750 10277)	20021008	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".

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11. Contents

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