BUK954R2-55B

N-channel TrenchMOS logic level FET

Rev. 03 — 8 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 ℃ 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	$T_j \geq 25$ ℃; $T_j \leq 175$ °C		-	-	55	V
I_D	drain current	$V_{GS} = 5$ V; $T_{mb} = 25$ ℃; see Figure 1; see Figure 3	[1]	-	-	75	A
P_{tot}	total power dissipation	$T_{mb} = 25$ ℃; see Figure 2		-	-	300	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 5$ V; $I_D = 25$ A; $T_j = 25$ ℃; see Figure 11; see Figure 12		-	3.5	4.2	mΩ
		$V_{GS} = 10$ V; $I_D = 25$ A; $T_j = 25$ ℃		-	3.1	3.7	mΩ

Table 1. Quick reference data *...continued*

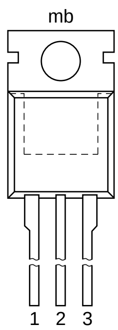
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 75 A; V_{sup} ≤ 55 V; R_{GS} = 50 Ω; V_{GS} = 5 V; $T_{j(init)}$ = 25 °C; unclamped	-	-	1.2	J
Dynamic characteristics						
Q_{GD}	gate-drain charge	V_{GS} = 5 V; I_D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

[1] Continuous current is limited by package.

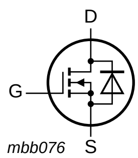
2. Pinning information

Table 2. Pinning information

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



SOT78 (TO-220AB)



3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK954R2-55B	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

4. Limiting values

Table 4. Limiting values

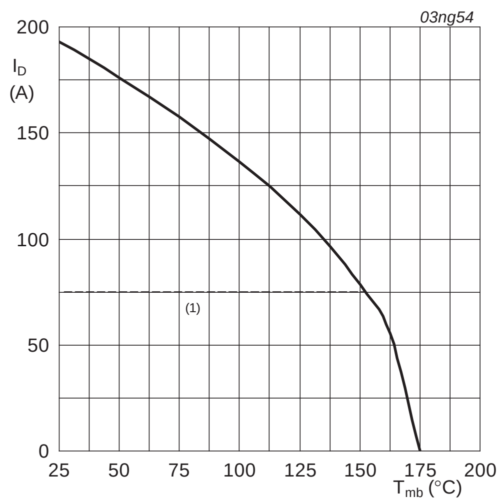
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Typ	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 3; see Figure 1	[1]	-	-	191	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		-	-	765	A
P_{tot}	total power dissipation	T_{mb} = 25 °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 °C	[2]	-	-	75	A
			[3]	-	-	191	A
I_{SM}	peak source current	$t_p \leq 10$ µs; pulsed; T_{mb} = 25 °C		-	-	765	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		-	-	1.2	J

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

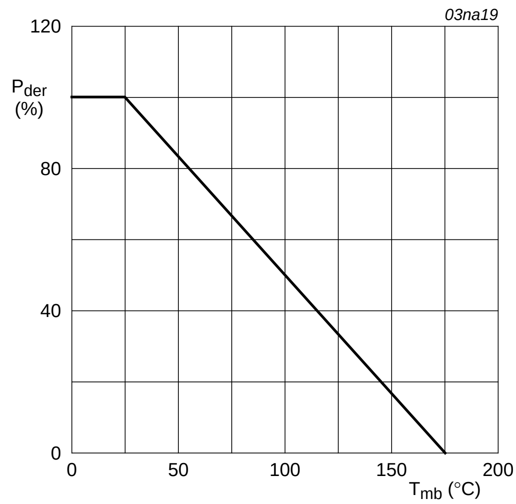
[2] Continuous current is limited by package.

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



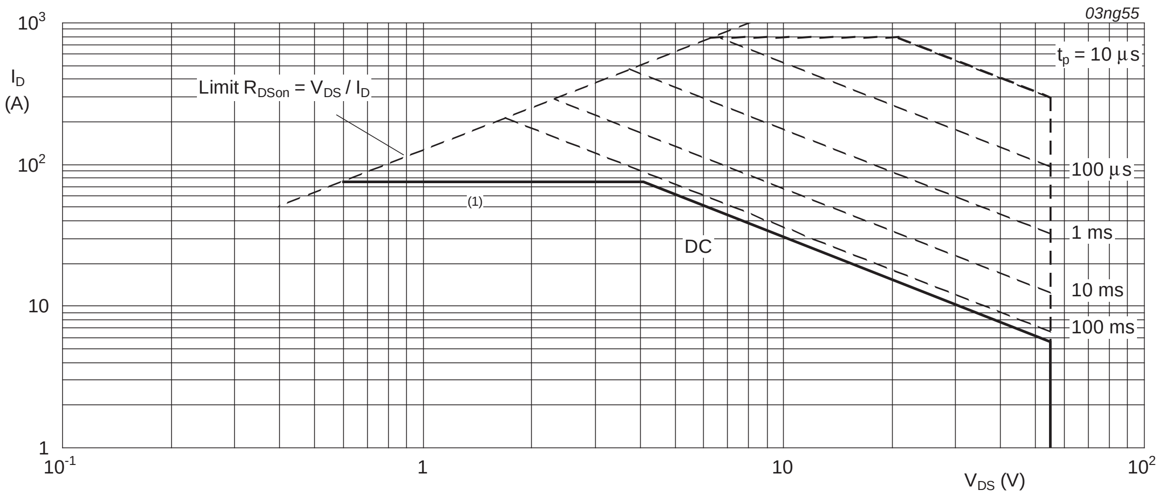
$$V_{GS} \geq 5V$$

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



$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ C)}} \times 100\,\%$$

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



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

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

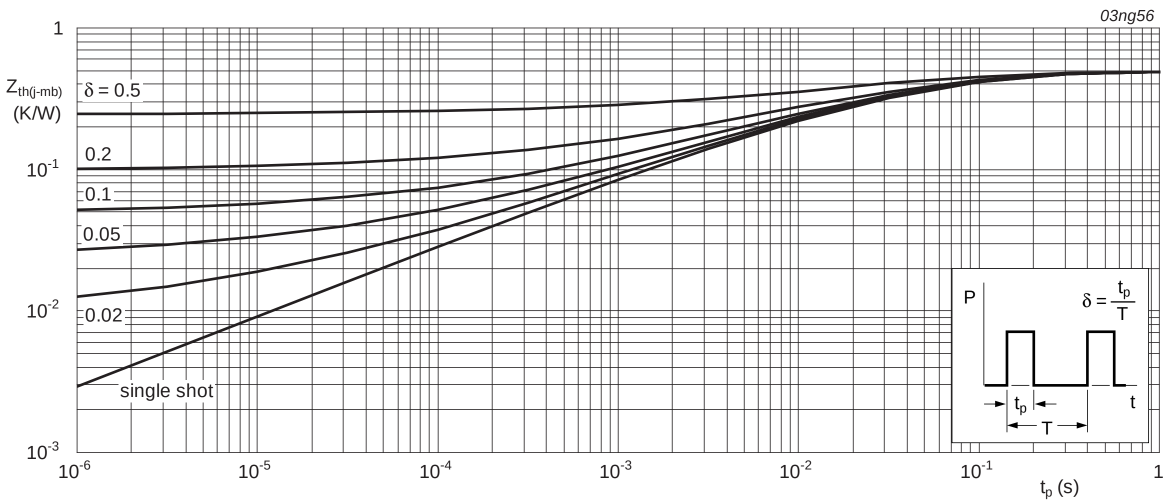


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

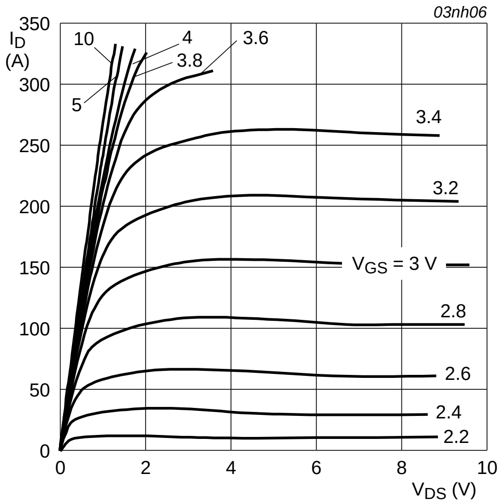
6. Characteristics

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 = -55 ℃	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 ℃; see Figure 10	1.1	1.5	2	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 ℃; see Figure 10	-	-	2.3	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 ℃; see Figure 10	0.5	-	-	V
I_{DSS}	drain leakage current	V_{DS} = 55 V; V_{GS} = 0 V; T_j = 25 ℃	-	0.02	1	µA
		V_{DS} = 55 V; V_{GS} = 0 V; T_j = 175 ℃	-	-	500	µA
I_{GSS}	gate leakage current	V_{DS} = 0 V; V_{GS} = 15 V; T_j = 25 ℃	-	2	100	nA
		V_{DS} = 0 V; V_{GS} = -15 V; T_j = 25 ℃	-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 5 V; I_D = 25 A; T_j = 25 ℃; 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 ℃; see Figure 11; see Figure 12	-	-	8.4	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 ℃	-	3.1	3.7	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 ℃; 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 ℃; 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 ℃	-	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 contact screw on mounting base to centre of die ; T_j = 25 ℃	-	3.5	-	nH
		from drain lead 6 mm from package to centre of die ; T_j = 25 ℃	-	4.5	-	nH
L_S	internal source inductance	from source lead to source bond pad ; T_j = 25 ℃	-	7.5	-	nH
Source-drain diode						

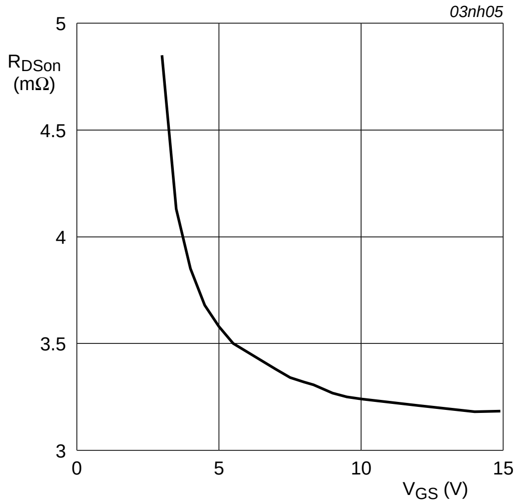
Table 6. Characteristics *...continued*

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



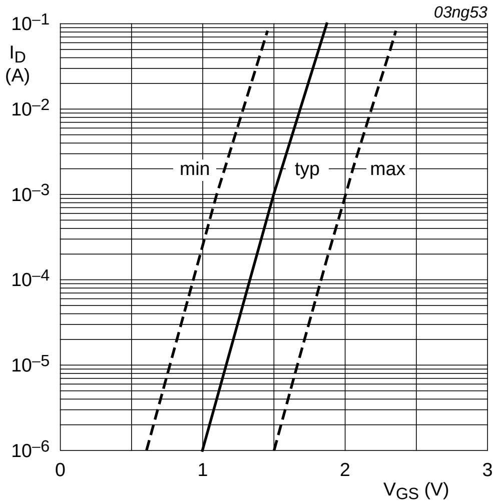
$T_j = 25°C; t_p = 300 \mu s$

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



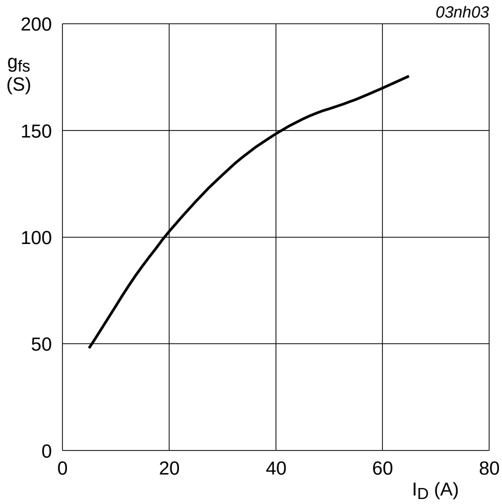
$T_j = 25°C; I_D = 25A$

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



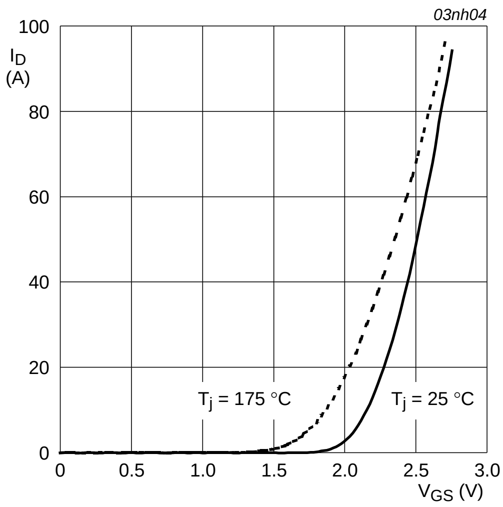
$T_j = 25°C; V_{DS} = V_{GS}$

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



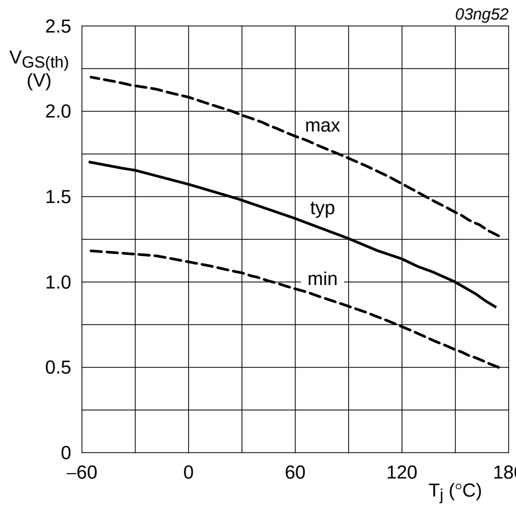
$T_j = 25°C; V_{DS} = 25V$

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



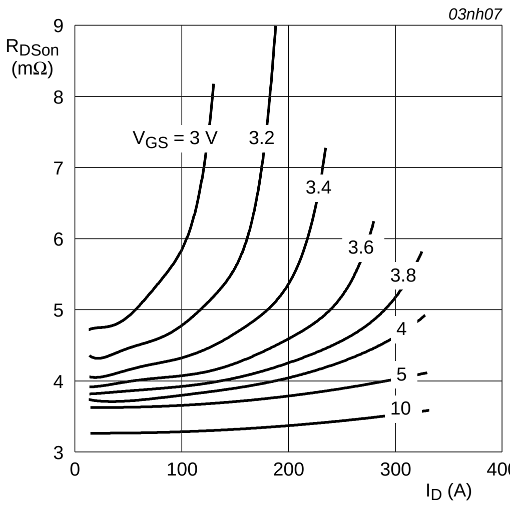
$V_{DS} = 25V$

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



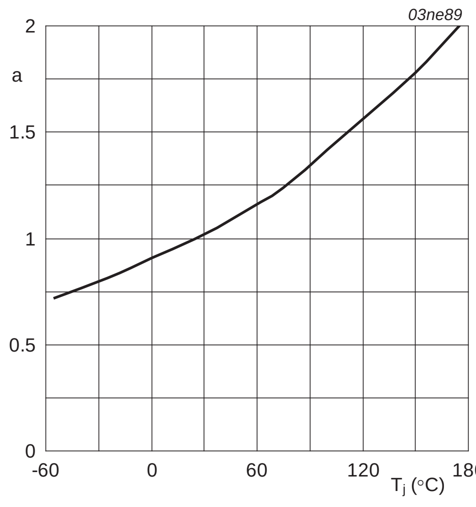
$I_D = 1mA; V_{DS} = V_{GS}$

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



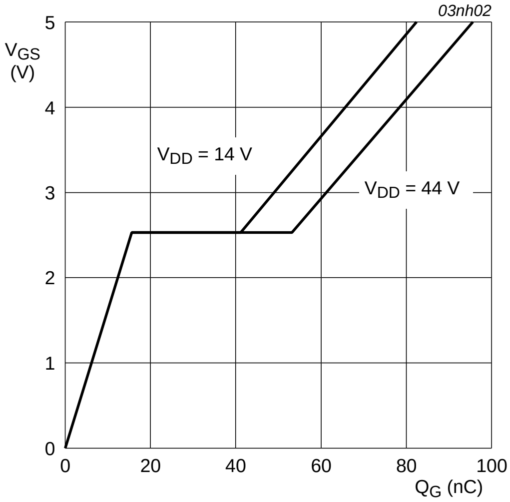
$T_j = 25°C$

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



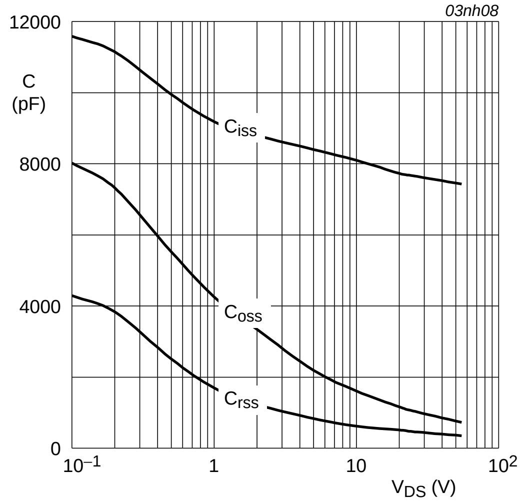
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



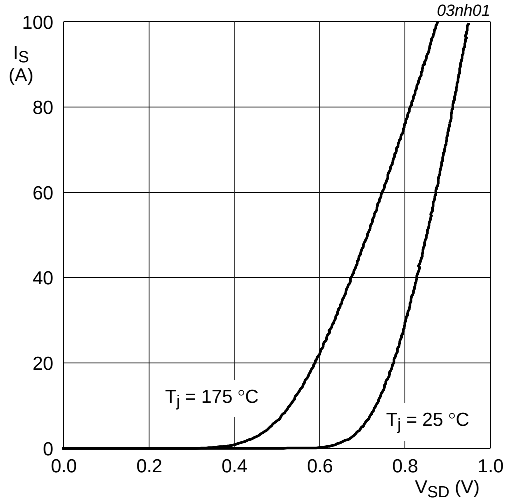
$$T_j = 25°C; I_D = 25A$$

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



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

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

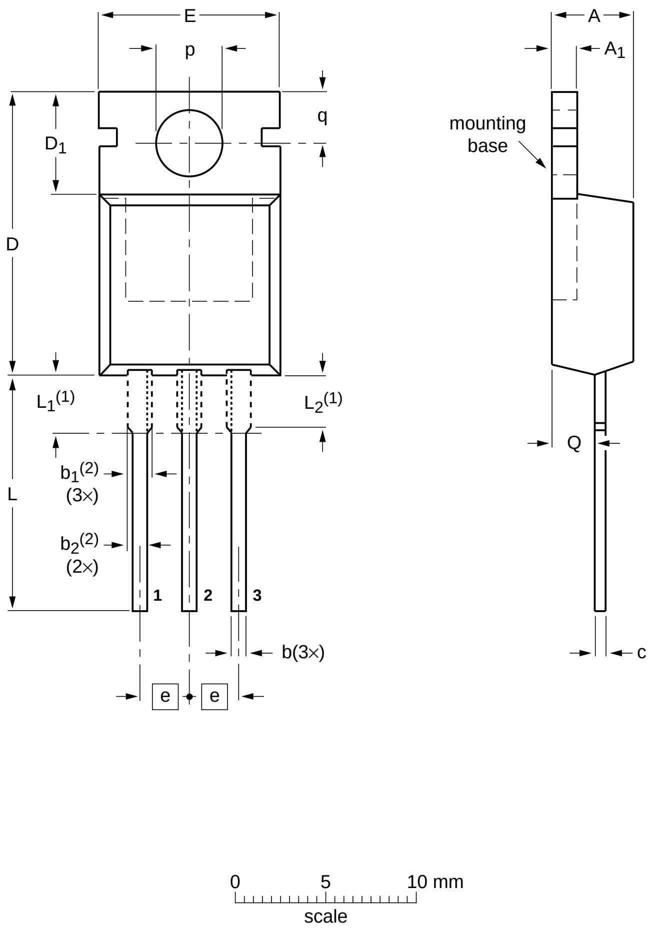


$$V_{GS} = 0V$$

Fig 15. Reverse diode current as a function of reverse diode 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.

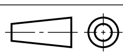
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			~~08-04-23~~ 08-06-13

Fig 16. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK954R2-55B v.3	20100608	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 BUK954R2-55B 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".

[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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