BUK9520-100B

N-channel TrenchMOS logic level FET

Rev. 01 — 6 May 2009 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

- AEC-Q101 compliant
- Low conduction losses due to low on-state resistance
- Suitable for logic level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

1.3 Applications

- 12 V, 24 V and 42 V loads
- Automotive and 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	-	-	100	V
I_D	drain current	$V_{GS} = 5$ V; $T_{mb} = 25$ °C; see Figure 1; see Figure 3	-	-	63	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2	-	-	203	W
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 63$ A; $V_{sup} \leq 100$ V; $R_{GS} = 50\ \Omega$; $V_{GS} = 5$ V; $T_{j(init)} = 25$ °C; unclamped	-	-	222	mJ
Static characteristics						
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	-	16.4	22.3	mΩ
		$V_{GS} = 5$ V; $I_D = 25$ A; $T_j = 25$ °C; see Figure 12; see Figure 11	-	16.2	20	mΩ

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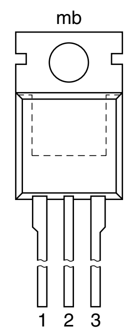
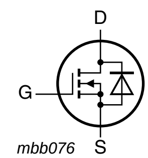
2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 **SOT78A (3-lead TO-220AB; SC-46; SFM3)**	
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

3. Ordering information

Table 3. Ordering information

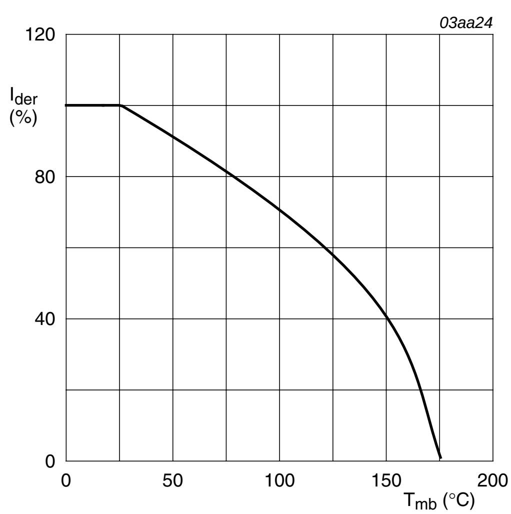
Type number	Package		
	Name	Description	Version
BUK9520-100B	3-lead TO-220AB; SC-46; SFM3	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78A

4. Limiting values

Table 4. Limiting values

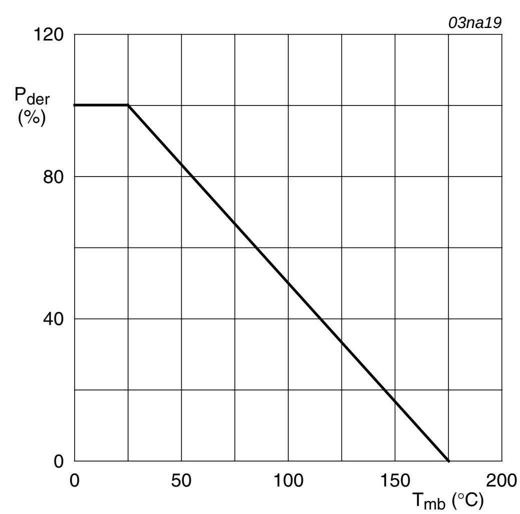
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C	-	100	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20$ kΩ	-	100	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	-	63	A
		$T_{mb} = 100$ °C; $V_{GS} = 5$ V; see Figure 1	-	45	A
I_{DM}	peak drain current	$T_{mb} = 25$ °C; $t_p \leq 10$ µs; pulsed; see Figure 3	-	253	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2	-	203	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	-	63	A
I_{SM}	peak source current	$t_p \leq 10$ µs; pulsed; $T_{mb} = 25$ °C	-	253	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 63$ A; $V_{sup} \leq 100$ V; $R_{GS} = 50$ Ω; $V_{GS} = 5$ V; $T_{j(init)} = 25$ °C; unclamped	-	222	mJ



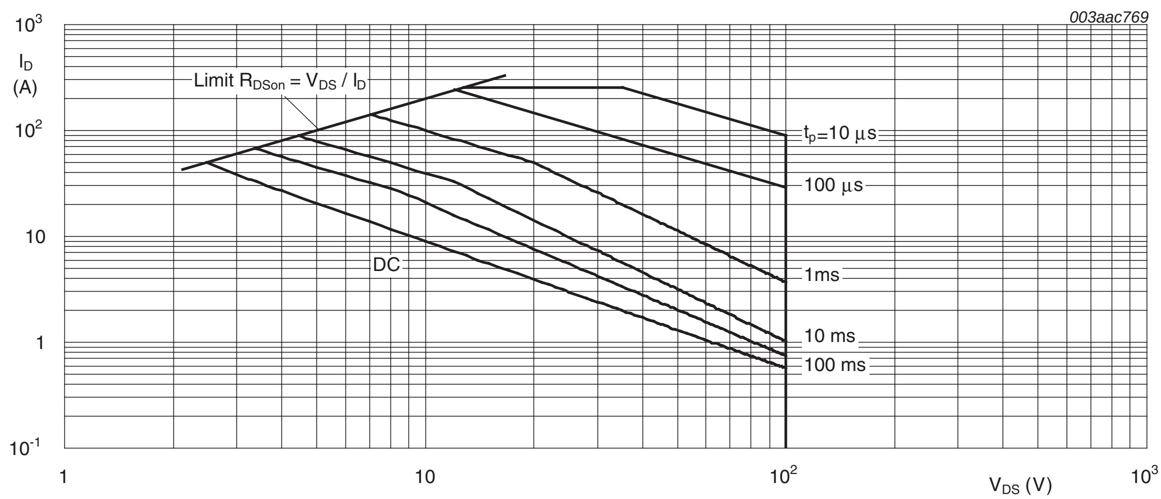
$$I_{der} = \frac{I_D}{I_{D(25°C)}} \times 100\,\%$$

Fig 1. Normalized 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	-	-	0.75	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in still air; SOT78 package	-	60	-	K/W

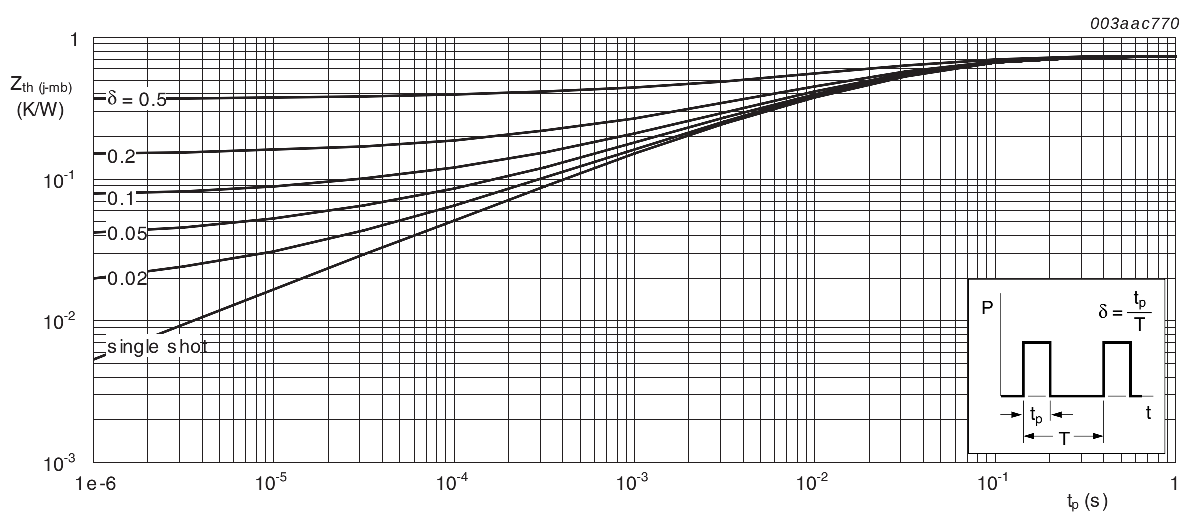


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

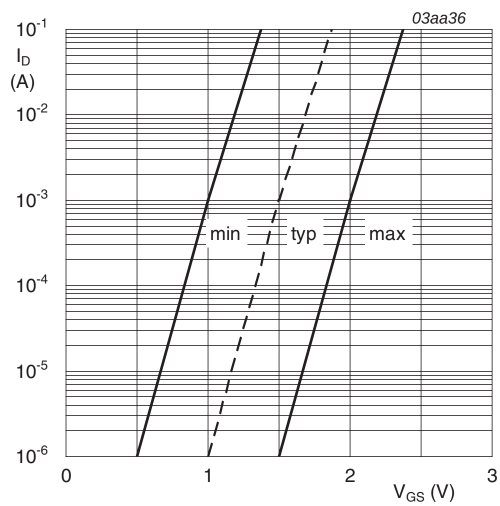
6. Characteristics

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 = 25 °C	100	-	-	V
		I_D = 0.25 mA; V_{GS} = 0 V; T_j = -55 °C	90	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 10	1	1.58	2	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; see Figure 10	0.5	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 10	-	-	2.3	V
I_{DSS}	drain leakage current	V_{DS} = 100 V; V_{GS} = 0 V; T_j = 175 °C	-	-	500	µA
		V_{DS} = 100 V; V_{GS} = 0 V; T_j = 25 °C	-	0.05	1	µA
I_{GSS}	gate leakage current	V_{DS} = 0 V; V_{GS} = -10 V; T_j = 25 °C	-	2	100	nA
		V_{DS} = 0 V; V_{GS} = 10 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	-	16.4	22.3	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 11; see Figure 12	-	15.6	18.5	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 175 °C; see Figure 12; see Figure 11	-	-	50	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 25 °C; see Figure 12; see Figure 11	-	16.2	20	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 80 V; V_{GS} = 5 V; T_j = 25 °C; see Figure 14; see Figure 15	-	53.4	-	nC
Q_{GS}	gate-source charge		-	9.5	-	nC
Q_{GD}	gate-drain charge		-	21.2	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; T_j = 25 °C; see Figure 16	-	4300	5657	pF
C_{oss}	output capacitance		-	340	411	pF
C_{rss}	reverse transfer capacitance		-	150	201	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	-	45	-	ns
t_r	rise time		-	116	-	ns
$t_{d(off)}$	turn-off delay time		-	173	-	ns
t_f	fall time		-	77	-	ns
L_D	internal drain inductance	from drain lead 6 mm from package to centre of die; T_j = 25 °C	-	4.5	-	nH
		from upper edge of drain mounting base to centre of die; T_j = 25 °C	-	2.5	-	nH
L_S	internal source inductance	from source lead to source bond pad; T_j = 25 °C	-	7.5	-	nH

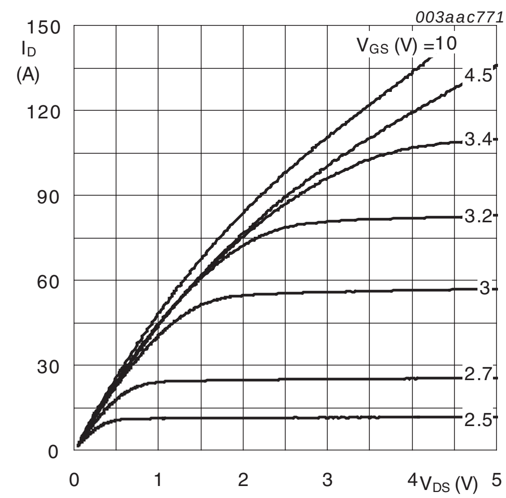
Table 6. Characteristics *...continued*

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	-	0.86	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	-	80	-	ns
Q_r	recovered charge		-	272	-	nC



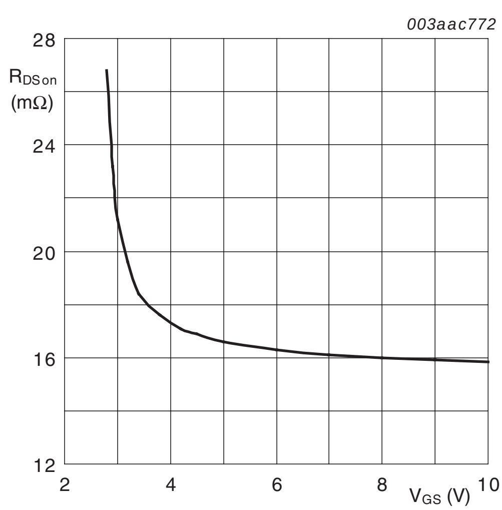
$T_j = 25\,°C; V_{DS} = V_{GS}$

Fig 5. Sub-threshold drain current as a function of gate-source voltage



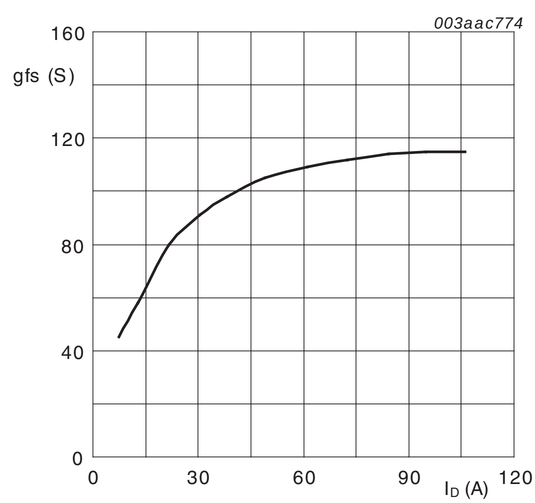
$T_j = 25\,°C; t_p = 300\,\mu s$

Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values



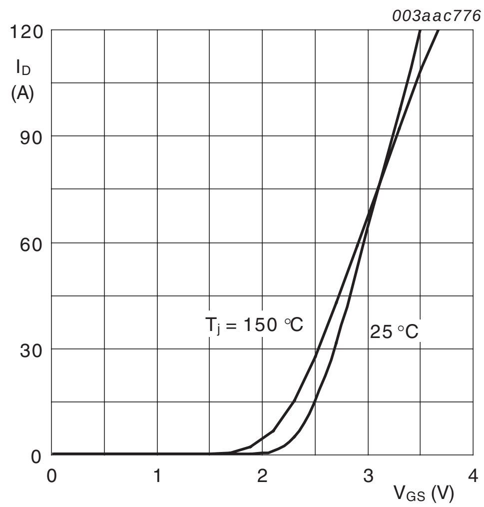
$T_j = 25\,°C; I_D = 25\,A$

Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values.



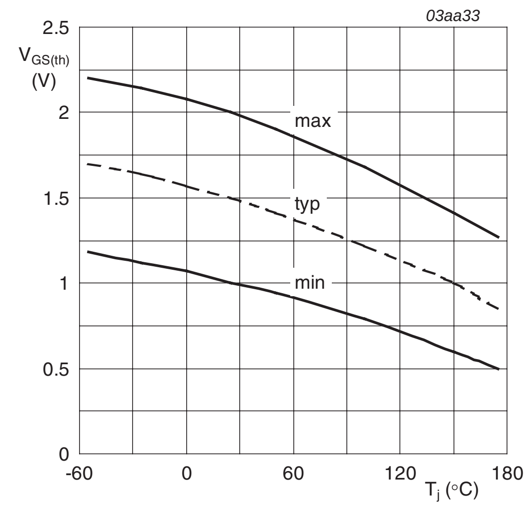
$T_j = 25\,°C; V_{DS} = 25\,V$

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



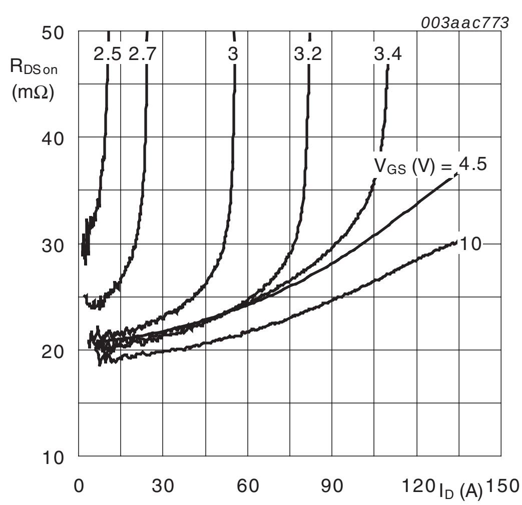
$V_{DS} = 25V$

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



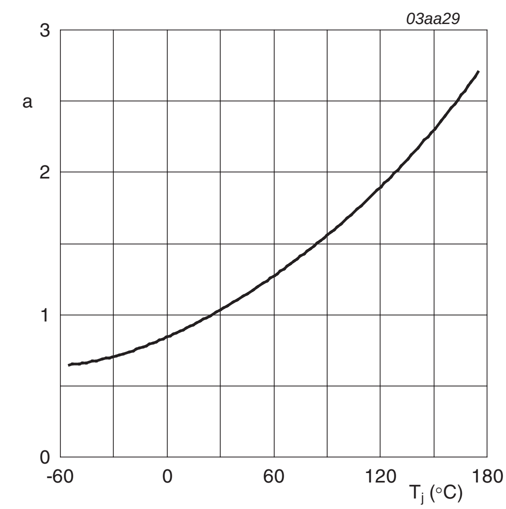
$I_D = 1mA; V_{DS} = V_{GS}$

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



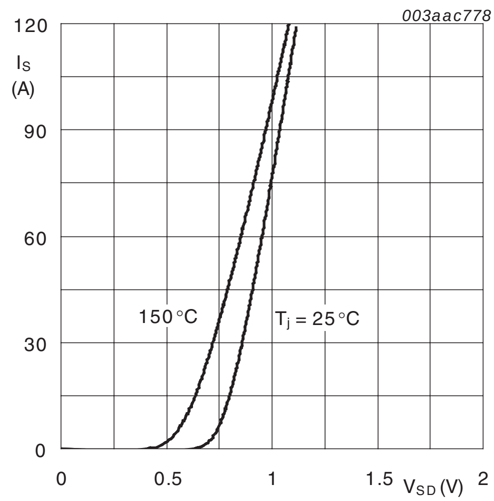
$T_j = 25°C$

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



$V_{GS} = 0V$

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

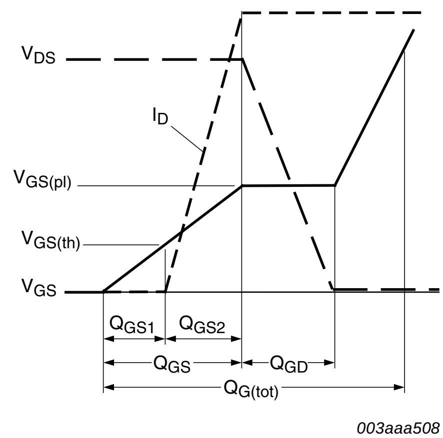
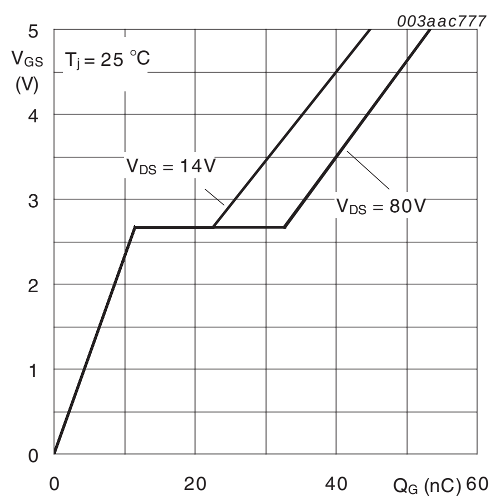
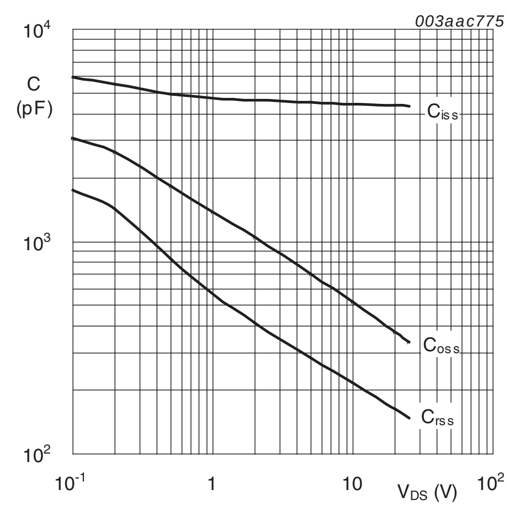


Fig 14. Gate charge waveform definitions



$T_j = 25°C; I_D = 25A$

Fig 15. Gate-source voltage as a function of turn-on gate charge; typical values.

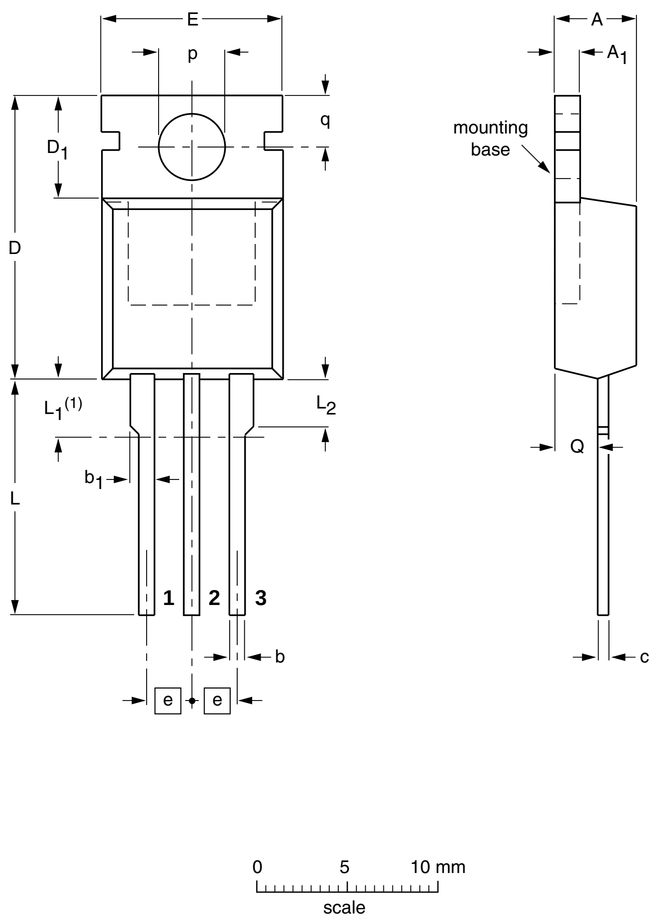


$V_{GS} = 0V; f = 1MHz$

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 **SOT78A**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	c	D	D_1	E	e	L	L_1(1)	L_2 max.	p	q	Q
mm	4.5 4.1	1.39 1.27	0.9 0.6	1.3 1.0	0.7 0.4	15.8 15.2	6.4 5.9	10.3 9.7	2.54	15.0 13.5	3.30 2.79	3.0	3.8 3.6	3.0 2.7	2.6 2.2

Note

1. Terminals in this zone are not tinned.

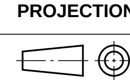
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78A		3-lead TO-220AB	SC-46			~~03-01-22~~ 05-03-14

Fig 17. Package outline SOT78A (3-lead TO-220AB; SC-46; SFM3)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9520-100B_1	20090506	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".

[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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