

BUK754R0-40C

N-channel TrenchMOS standard level FET

Rev. 02 — 20 July 2010

Product data sheet

1. Product profile

1.1 General description

Standard level gate drive N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using advanced TrenchMOS technology. This product has been designed and qualified to the appropriate AEC standard for use in high performance automotive applications.

1.2 Features and benefits

- AEC Q101 compliant
- Avalanche robust
- Suitable for standard level gate drive
- Suitable for thermally demanding environment up to 175°C rating

1.3 Applications

- 12V Motor, lamp and solenoid loads
- High performance automotive power systems
- High performance Pulse Width Modulation (PWM) applications

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25^\circ\text{C}; T_j \leq 175^\circ\text{C}$	-	-	40	V
I_D	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 25^\circ\text{C}$; see Figure 1 ; see Figure 3	[1]	-	100	A
P_{tot}	total power dissipation	$T_{mb} = 25^\circ\text{C}$; see Figure 2	-	-	203	W
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25^\circ\text{C}$; see Figure 11 ; see Figure 12	-	3.4	4	$\text{m}\Omega$



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	$I_D = 100 \text{ A}$; $V_{sup} \leq 40 \text{ V}$; $R_{GS} = 50 \Omega$; $V_{GS} = 10 \text{ V}$; $T_{j(init)} = 25 \text{ }^\circ\text{C}$; unclamped	-	-	292	mJ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10 \text{ V}$; $I_D = 25 \text{ A}$; $V_{DS} = 32 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$; see Figure 14 ; see Figure 13	-	35	-	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		
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
BUK754R0-40C	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

4. Limiting values

Table 4. Limiting values

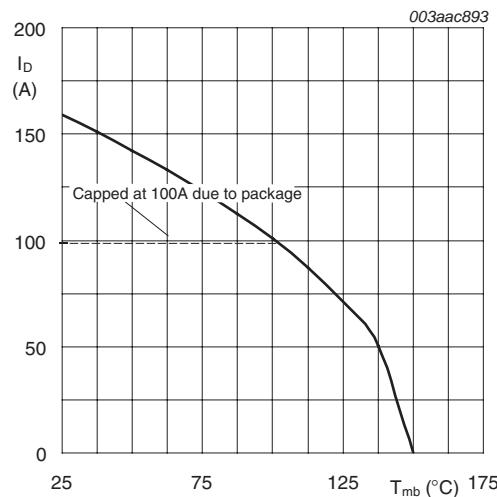
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit	
V_{DS}	drain-source voltage	$T_j \geq 25^\circ\text{C}; T_j \leq 175^\circ\text{C}$	-	40	V	
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	40	V	
V_{GS}	gate-source voltage		[1]	-20	20	V
I_D	drain current	$T_{mb} = 25^\circ\text{C}; V_{GS} = 10\text{ V};$ see Figure 1 ; see Figure 3	[2]	-	159	A
		$T_{mb} = 100^\circ\text{C}; V_{GS} = 10\text{ V};$ see Figure 1	[3]	-	100	A
		$T_{mb} = 25^\circ\text{C}; V_{GS} = 10\text{ V};$ see Figure 1 ; see Figure 3	[3]	-	100	A
I_{DM}	peak drain current	$T_{mb} = 25^\circ\text{C}; t_p \leq 10\text{ }\mu\text{s};$ pulsed; see Figure 3	-	636	A	
P_{tot}	total power dissipation	$T_{mb} = 25^\circ\text{C};$ 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	$T_{mb} = 25^\circ\text{C}$	[3]	-	100	A
			[2]	-	159	A
I_{SM}	peak source current	$t_p \leq 10\text{ }\mu\text{s};$ pulsed; $T_{mb} = 25^\circ\text{C}$	-	636	A	
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 100\text{ A}; V_{sup} \leq 40\text{ V}; R_{GS} = 50\text{ }\Omega;$ $V_{GS} = 10\text{ V}; T_{j(init)} = 25^\circ\text{C};$ unclamped	-	292	mJ	

[1] -20V accumulated duration not to exceed 168 hrs

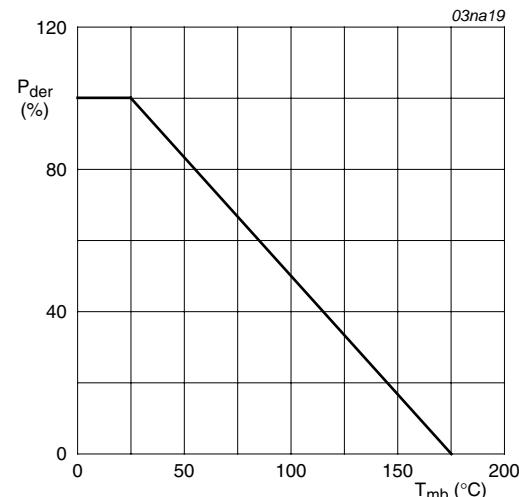
[2] Current is limited by power dissipation chip rating.

[3] Continuous current is limited by package.



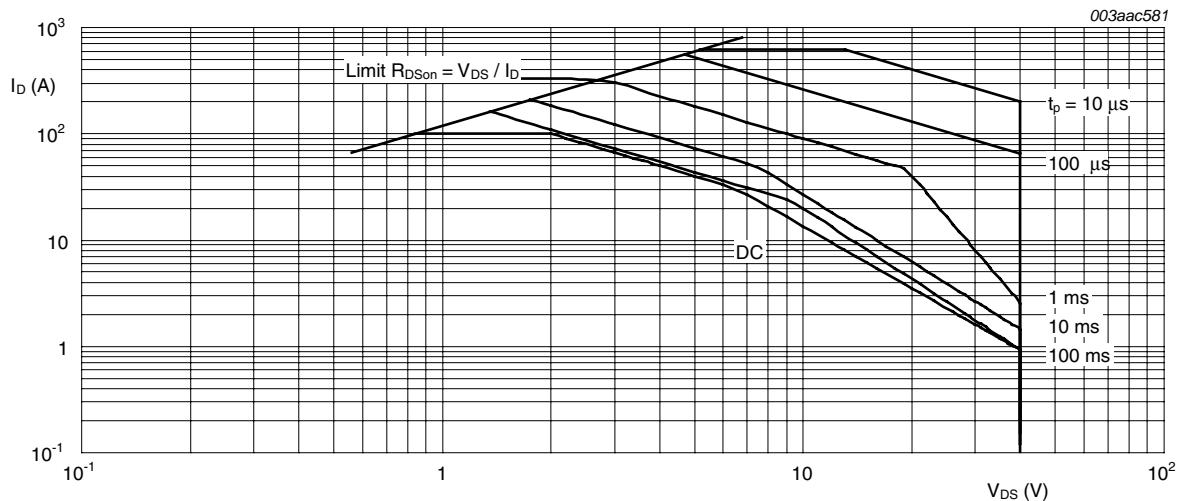
$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

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



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

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



$T_{mb} = 25^\circ\text{C}$; 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
$R_{th(j\text{-mb})}$	thermal resistance from junction to mounting base	see Figure 4	-	-	0.74	K/W
$R_{th(j\text{-a})}$	thermal resistance from junction to ambient	vertical in still air	-	-	60	K/W

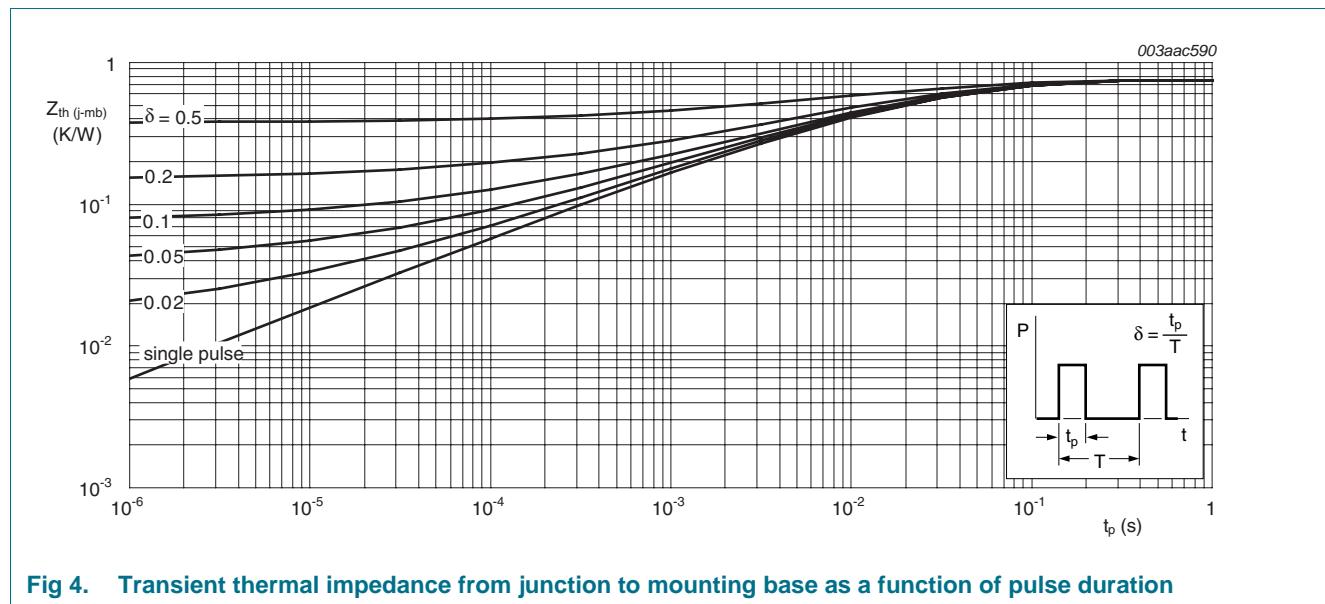
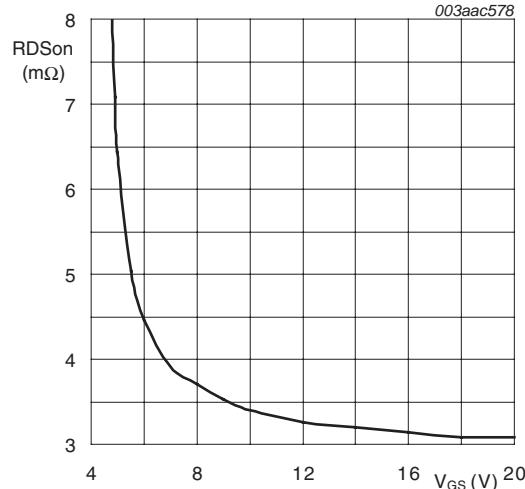


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

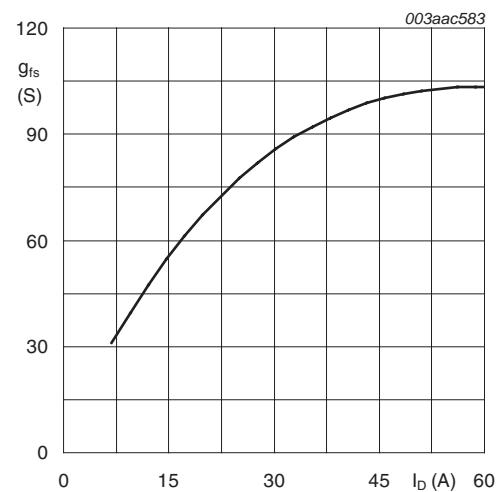
Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	40	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 10 $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 10 $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 10	2	3	4	V
I_{DSS}	drain leakage current	$V_{DS} = 40 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$ $V_{DS} = 40 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	500	μA
I_{GSS}	gate leakage current	$V_{DS} = 0 \text{ V}; V_{GS} = 20 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ $V_{DS} = 0 \text{ V}; V_{GS} = -20 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 11 $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 11 ; see Figure 12	-	-	8	$\text{m}\Omega$
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 32 \text{ V}; V_{GS} = 10 \text{ V};$	-	97	-	nC
Q_{GS}	gate-source charge	$T_j = 25 \text{ }^\circ\text{C};$ see Figure 13 ; see Figure 14	-	21	-	nC
Q_{GD}	gate-drain charge	$I_D = 25 \text{ A}; V_{DS} = 32 \text{ V}; V_{GS} = 10 \text{ V};$ $T_j = 25 \text{ }^\circ\text{C};$ see Figure 14 ; see Figure 13	-	35	-	nC
C_{iss}	input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; f = 1 \text{ MHz};$	-	4391	5708	pF
C_{oss}	output capacitance	$T_j = 25 \text{ }^\circ\text{C};$ see Figure 15	-	800	1040	pF
C_{rss}	reverse transfer capacitance		-	535	696	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 \text{ V}; R_L = 1.2 \text{ } \Omega; V_{GS} = 10 \text{ V};$	-	40	-	ns
t_r	rise time	$R_{G(ext)} = 10 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$	-	95	-	ns
$t_{d(off)}$	turn-off delay time		-	129	-	ns
t_f	fall time		-	92	-	ns
L_D	internal drain inductance	from drain lead 6 mm from package to centre of die ; $T_j = 25 \text{ }^\circ\text{C}$ from contact screw on mounting base to centre of die ; $T_j = 25 \text{ }^\circ\text{C}$	-	4.5	-	nH
L_S	internal source inductance	from source lead to source bond pad ; $T_j = 25 \text{ }^\circ\text{C}$	-	7.5	-	nH
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 16	-	0.83	1.2	V
t_{rr}	reverse recovery time	$I_S = 20 \text{ A}; dI_S/dt = -100 \text{ A}/\mu\text{s};$ $V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	44	-	ns
Q_r	recovered charge		-	57	-	nC



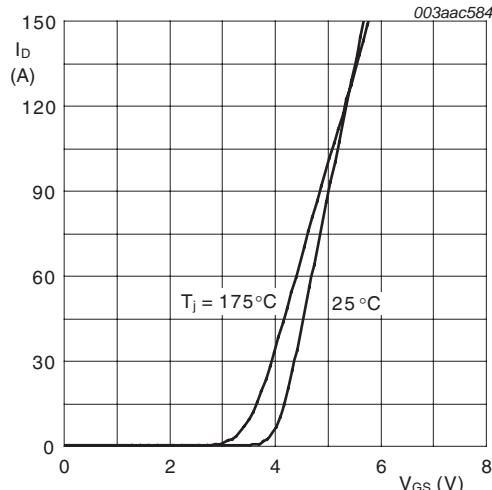
$T_j = 25^\circ\text{C}; I_D = 25\text{A}$

Fig 5. Drain-source on-state resistance as a function of gate voltage; typical values



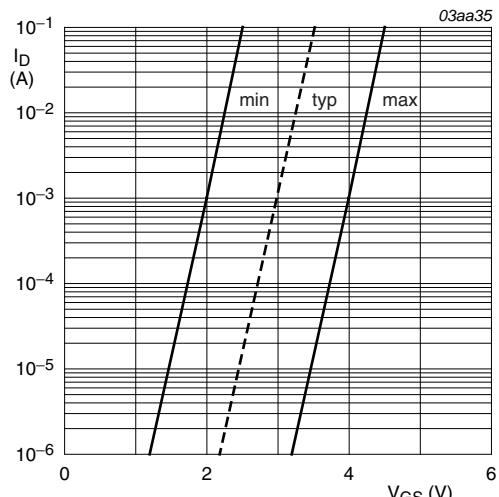
$T_j = 25^\circ\text{C}; V_{DS} = 25\text{V}$

Fig 6. Forward transconductance as a function of drain current; typical values



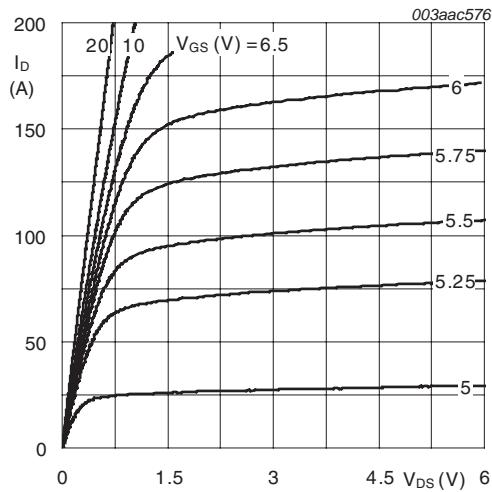
$V_{DS} = 25\text{V}$

Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values



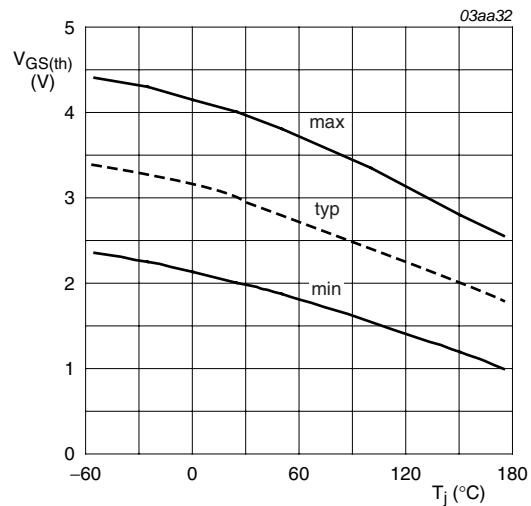
$T_j = 25^\circ\text{C}, V_{DS} = 5\text{V}$

Fig 8. Sub-threshold drain current as a function of gate-source voltage



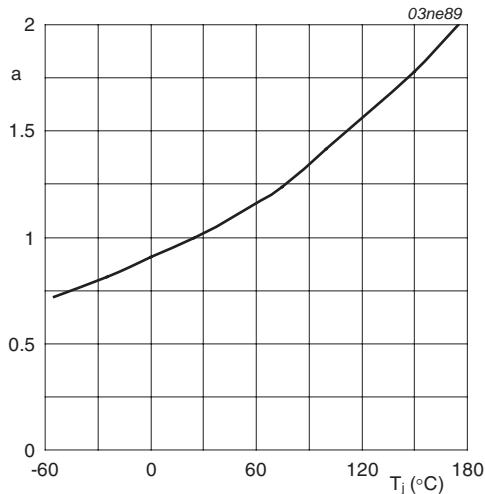
$T_j = 25^\circ\text{C}$

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



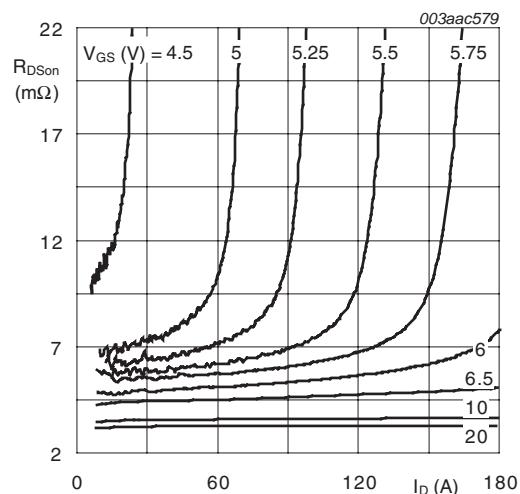
$I_D = 1\text{mA}; V_{DS} = V_{GS}$

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



$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

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



$T_j = 25^\circ\text{C}$

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

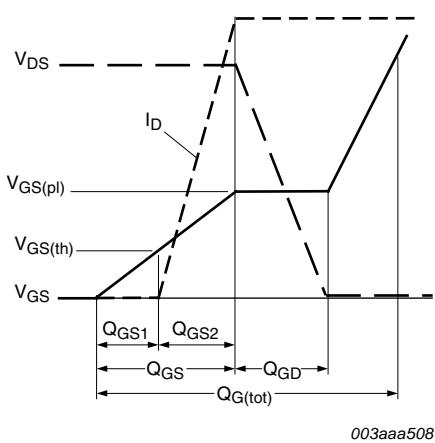


Fig 13. Gate charge waveform definitions

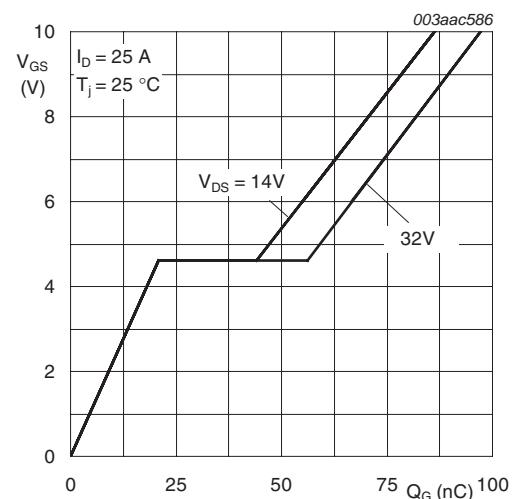


Fig 14. Gate-source voltage as a function of gate charge; typical values

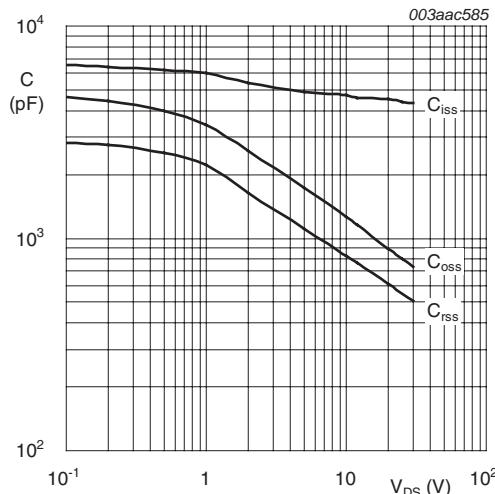


Fig 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

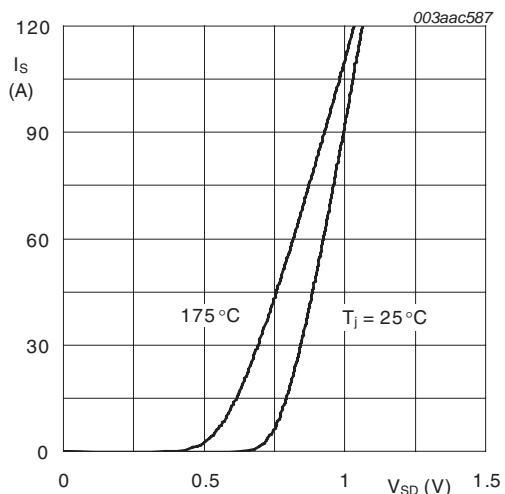


Fig 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78

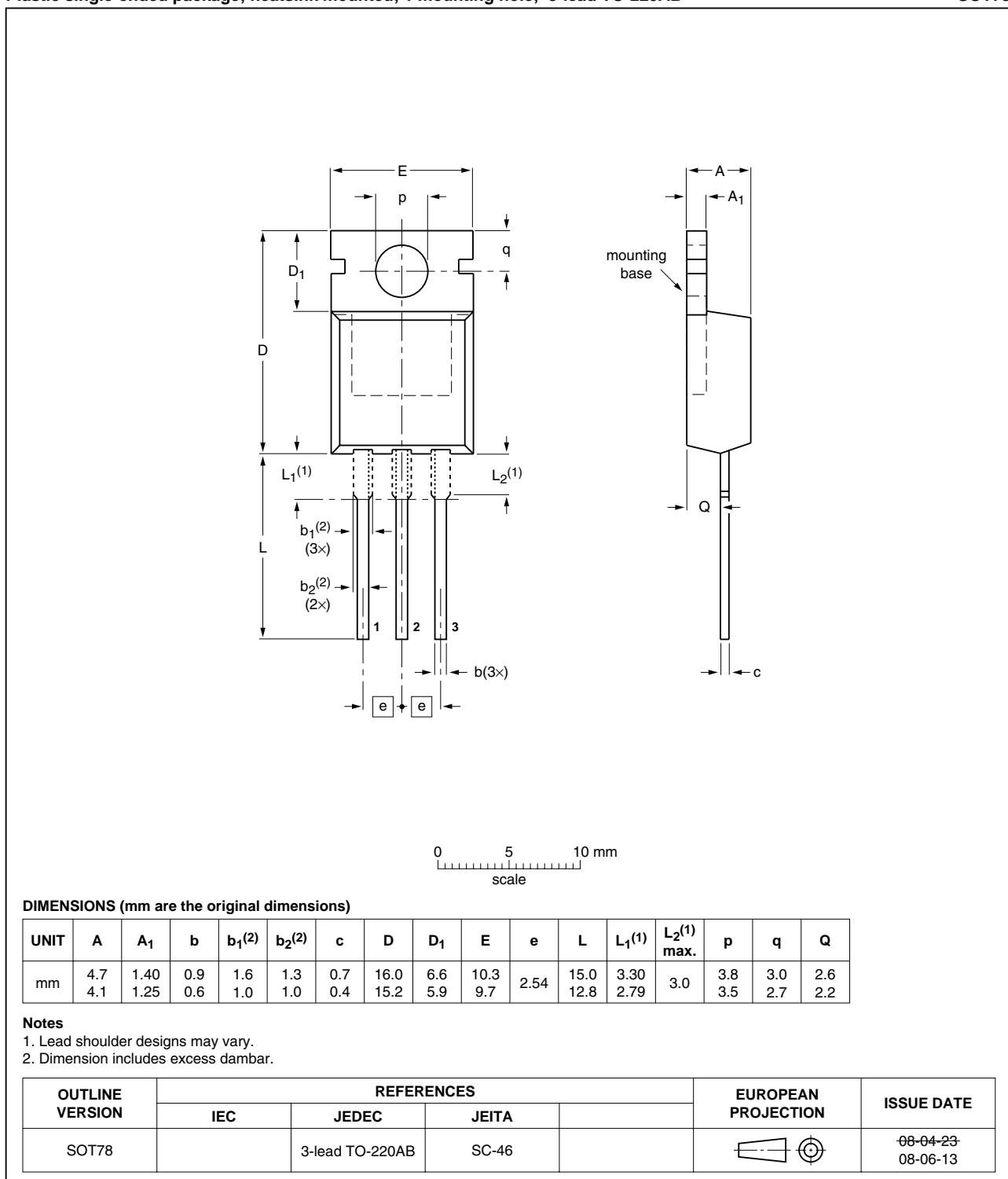


Fig 17. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK754R0-40C v.2	20100720	Product data sheet	-	BUK754R0-40C v.1
Modifications:		<ul style="list-style-type: none">• Status changed from preliminary to product.• Various changes to content.		
BUK754R0-40C v.1	20090114	Preliminary 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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