

BUK754R3-75C; BUK7E4R3-75C

N-channel TrenchMOS standard level FET

Rev. 01 — 10 August 2006

Product data sheet

1. Product profile

1.1 General description

N-channel enhancement mode power Field-Effect Transistor (FET) in a plastic package, using Philips Ultra High-Performance (UHP) automotive TrenchMOS technology.

1.2 Features

- TrenchMOS technology
- 175 °C rated
- Q101 compliant
- Standard level compatible

1.3 Applications

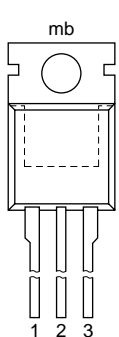
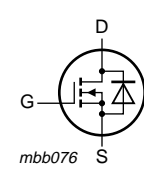
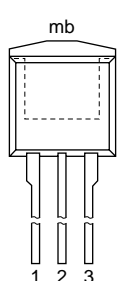
- Automotive systems
- Motors, lamps and solenoids
- General purpose power switching
- 12 V, 24 V and 42 V loads

1.4 Quick reference data

- $E_{DS(AL)S} \leq 630$ mJ
- $I_D \leq 100$ A
- $R_{DS(on)} = 3.7$ m Ω (typ)
- $P_{tot} \leq 333$ W

2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Symbol
1	gate (G)		
2	drain (D)		
3	source (S)		
mb	mounting base; connected to drain		<i>mbb076</i>
		SOT78 (TO-220AB)	SOT226 (I2PAK)

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3. Ordering information

Table 2. Ordering information

Type number	Package		Version
	Name	Description	
BUK754R3-75C	SC-46	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78
BUK7E4R3-75C	I2PAK	plastic single-ended package (I2PAK); low-profile 3-lead TO-220AB	SOT226

4. Limiting values

Table 3. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit	
V_{DS}	drain-source voltage		-	75	V	
V_{DGR}	drain-gate voltage (DC)	$R_{GS} = 20 \text{ k}\Omega$	-	75	V	
V_{GS}	gate-source voltage		-	± 20	V	
I_D	drain current	$V_{GS} = 10 \text{ V}$; see Figure 2 and 3	[1]			
		limited by power dissipation at $T_{mb} = 25 \text{ }^\circ\text{C}$	[2]	-	192	A
		limited by package at $T_{mb} = 25 \text{ }^\circ\text{C}$	[3]	-	100	A
		limited by package at $T_{mb} = 100 \text{ }^\circ\text{C}$	[3]	-	100	A
I_{DM}	peak drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$; pulsed; $t_p \leq 10 \text{ }\mu\text{s}$; see Figure 3	-	769	A	
P_{tot}	total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$; see Figure 1	-	333	W	
T_{stg}	storage temperature		-55	+175	$^\circ\text{C}$	
T_j	junction temperature		-55	+175	$^\circ\text{C}$	

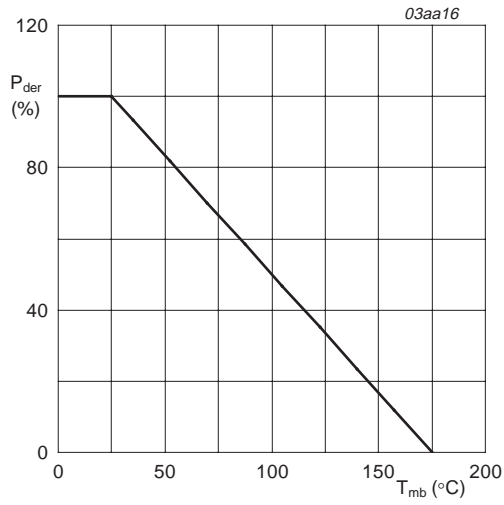
Source-drain diode

I_{DR}	reverse drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$	[1]			
		limited by power dissipation	[2]	-	192	A
		limited by package	[3]	-	100	A
I_{DRM}	peak reverse drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$; pulsed; $t_p \leq 10 \text{ }\mu\text{s}$	-	769	A	

Avalanche ruggedness

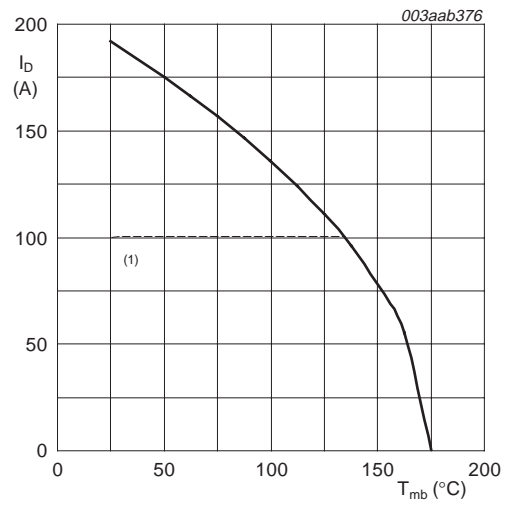
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; $I_D = 100 \text{ A}$; $V_{DS} \leq 75 \text{ V}$; $R_{GS} = 50 \text{ }\Omega$; $V_{GS} = 10 \text{ V}$; starting at $T_j = 25 \text{ }^\circ\text{C}$	-	630	mJ
$E_{DS(AL)R}$	repetitive drain-source avalanche energy		[4]	-	mJ

- [1] Refer to document *9397 750 12572* for further information.
- [2] Current is limited by chip power dissipation rating.
- [3] Continuous current is limited by package.
- [4] Conditions:
- Maximum value not quoted. Repetitive rating defined in [Figure 16](#).
 - Single-pulse avalanche rating limited by $T_{j(max)}$ of $175 \text{ }^\circ\text{C}$.
 - Repetitive avalanche rating limited by an average junction temperature of $170 \text{ }^\circ\text{C}$.
 - Refer to application note *AN10273* for further information.



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

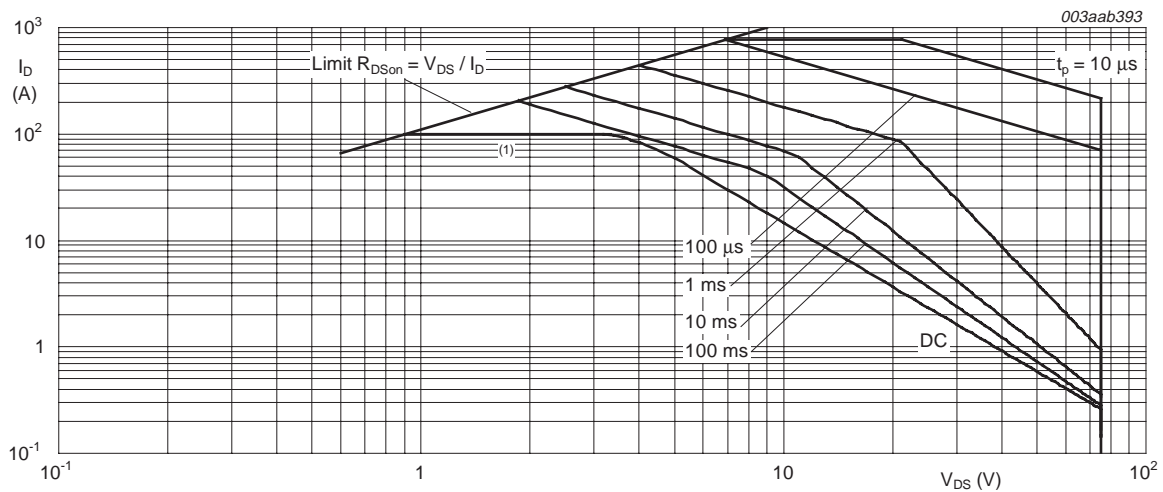
Fig 1. Normalized total power dissipation as a function of mounting base temperature



V_{GS} ≥ 10 V

(1) Capped at 100 A due to package.

Fig 2. Continuous drain current as a function of mounting base temperature



T_{mb} = 25 °C; I_{DM} is single pulse.

(1) Capped at 100 A due to package.

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

5. Thermal characteristics

Table 4. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base		-	-	0.45	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient					
	SOT78	vertical in free air	-	60	-	K/W
	SOT226	vertical in free air	-	50	-	K/W

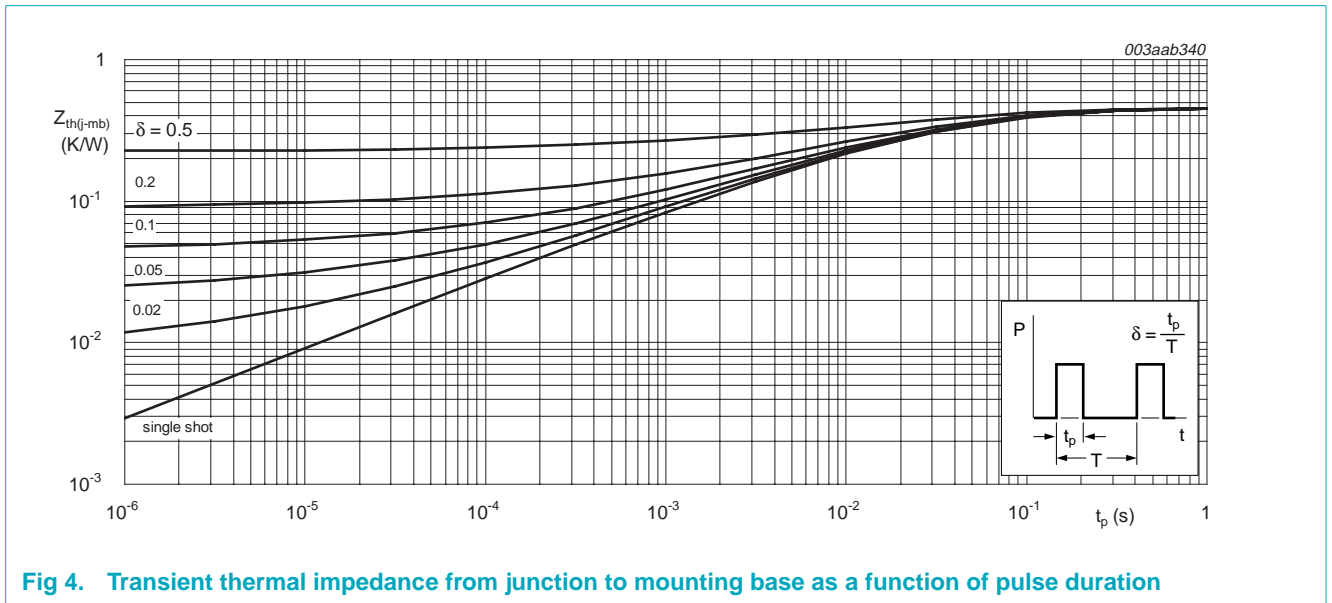


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

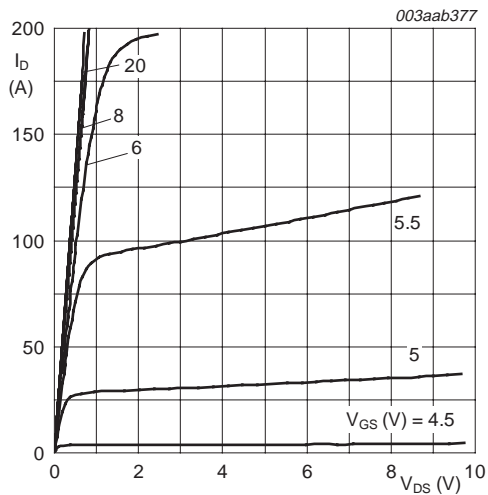
Table 5. Characteristics

$T_j = 25\text{ °C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$ $T_j = 25\text{ °C}$	75	-	-	V
			70	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; see Figure 9 and 10	2	3	4	V
			1	-	-	V
			-	-	4.4	V
			$T_j = -55\text{ °C}$			
I_{DSS}	drain leakage current	$V_{DS} = 75\ \text{V}$; $V_{GS} = 0\ \text{V}$ $T_j = 25\text{ °C}$	-	0.02	1	μA
			-	-	500	μA
I_{GSS}	gate leakage current	$V_{GS} = \pm 20\ \text{V}$; $V_{DS} = 0\ \text{V}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; see Figure 6 and 8	-	3.7	4.3	m Ω
			-	-	9	m Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25\ \text{A}$; $V_{DD} = 60\ \text{V}$; $V_{GS} = 10\ \text{V}$; see Figure 14	-	142	-	nC
Q_{GS}	gate-source charge		-	36	-	nC
Q_{GD}	gate-drain charge		-	67	-	nC
$V_{GS(pl)}$	gate-source plateau voltage		-	5	-	V
C_{iss}	input capacitance	$V_{GS} = 0\ \text{V}$; $V_{DS} = 25\ \text{V}$; $f = 1\ \text{MHz}$; see Figure 12	-	8744	11659	pF
C_{oss}	output capacitance		-	923	1108	pF
C_{rss}	reverse transfer capacitance		-	579	793	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30\ \text{V}$; $R_L = 1.2\ \Omega$; $V_{GS} = 10\ \text{V}$; $R_G = 10\ \Omega$	-	61	-	ns
t_r	rise time		-	100	-	ns
$t_{d(off)}$	turn-off delay time		-	194	-	ns
t_f	fall time		-	90	-	ns
L_D	internal drain inductance	from drain lead 6 mm from package to center of die	-	4.5	-	nH
		from contact screw on mounting base to center of die	-	3.5	-	nH
		from upper edge of drain mounting base to center of die SOT226	-	2.5	-	nH
L_S	internal source inductance	from source lead to source bonding pad	-	7.5	-	nH

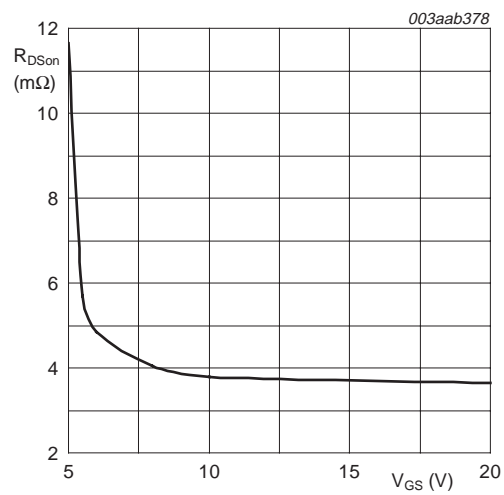
Table 5. Characteristics ...continued
 $T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; see Figure 15	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$;	-	83	-	ns
Q_r	recovered charge	$V_{GS} = 0\text{ V}$; $V_R = 25\text{ V}$	-	155	-	nC



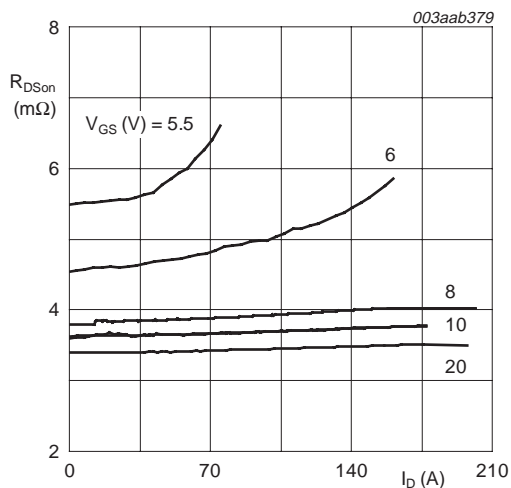
$T_j = 25\text{ }^\circ\text{C}$

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



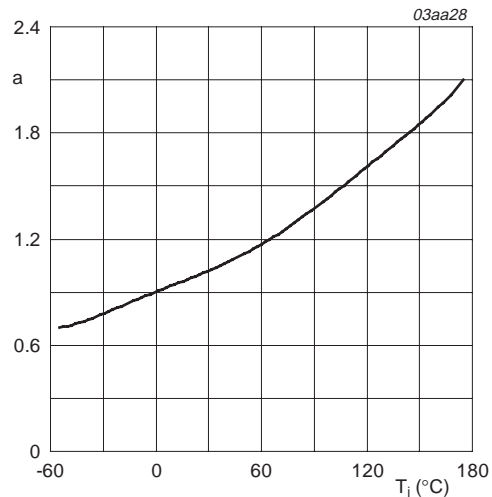
$T_j = 25\text{ }^\circ\text{C}$; $I_D = 25\text{ A}$

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



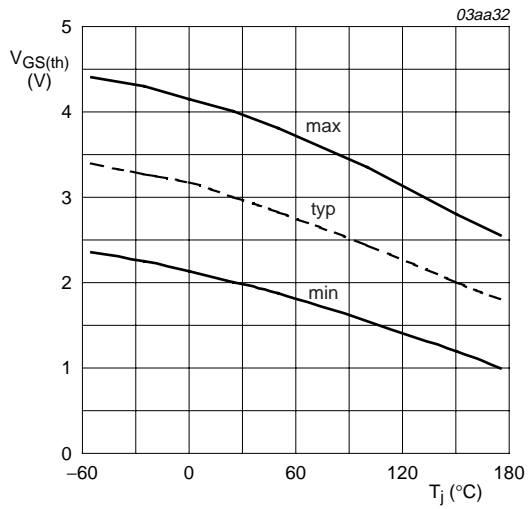
$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$

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



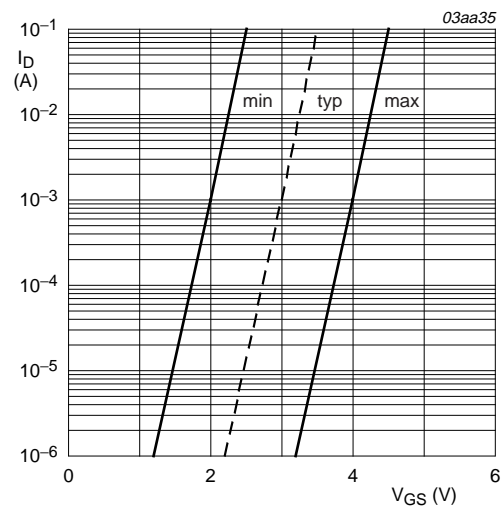
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^\circ\text{C})}}$$

Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature



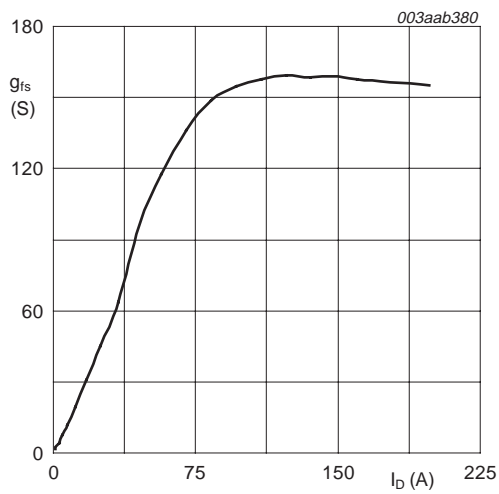
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



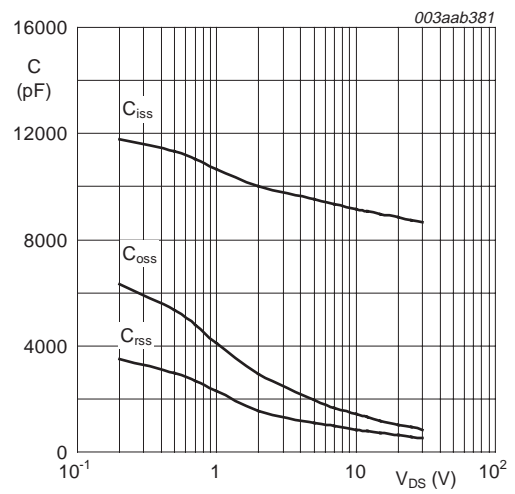
$T_j = 25 \text{ °C}; V_{DS} = V_{GS}$

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



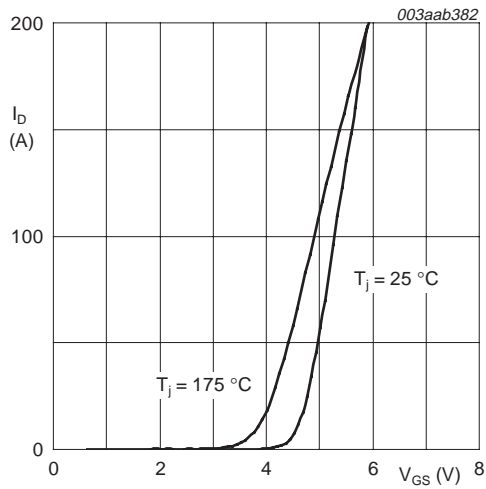
$T_j = 25 \text{ °C}; V_{DS} = 25 \text{ V}$

Fig 11. Forward transconductance as a function of drain current; typical values



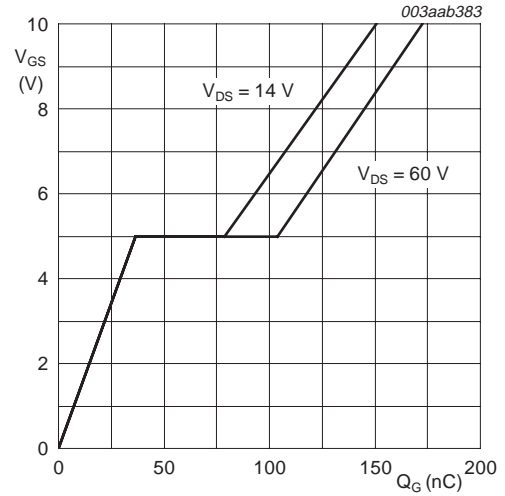
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



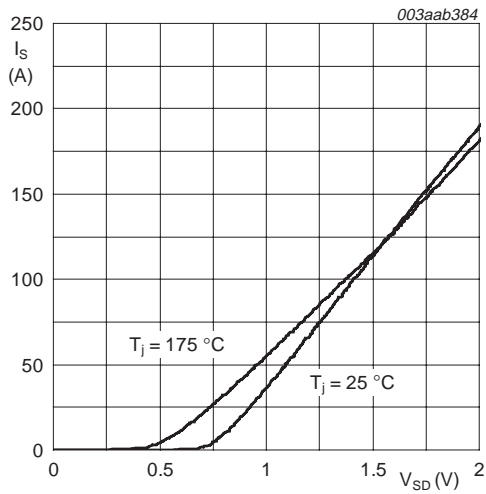
$V_{DS} = 25\text{ V}$

Fig 13. Transfer characteristics: drain current as a function of gate-source voltage; typical values



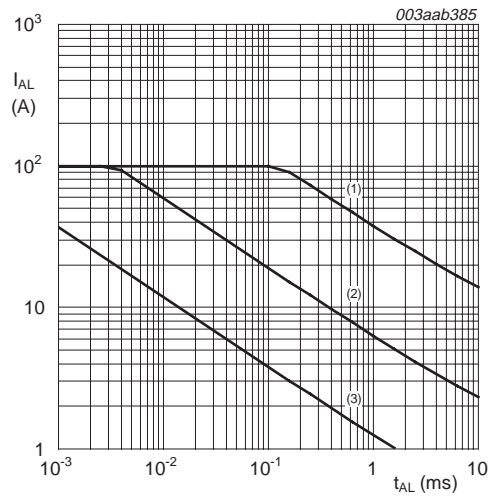
$T_j = 25\text{ }^\circ\text{C}; I_D = 25\text{ A}$

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



$V_{GS} = 0\text{ V}$

Fig 15. Source current as a function of source-drain voltage; typical values



See [Table note 4](#) of [Table 3 "Limiting values"](#).

- (1) Single-pulse; $T_j = 25\text{ }^\circ\text{C}$.
- (2) Single-pulse; $T_j = 150\text{ }^\circ\text{C}$.
- (3) Repetitive.

Fig 16. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time

7. Package outline

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

SOT78

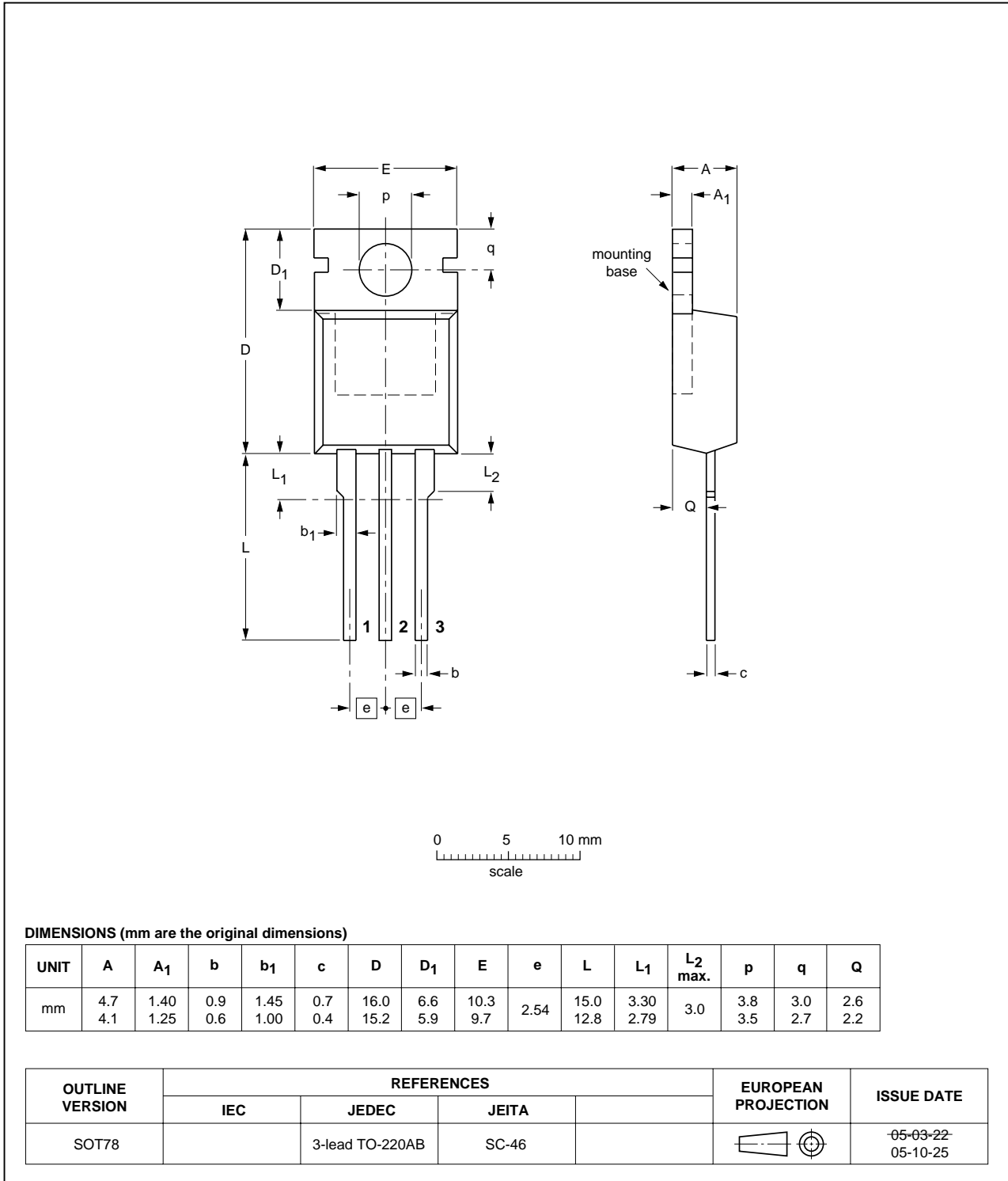


Fig 17. Package outline SOT78 (TO-220AB)

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

SOT226

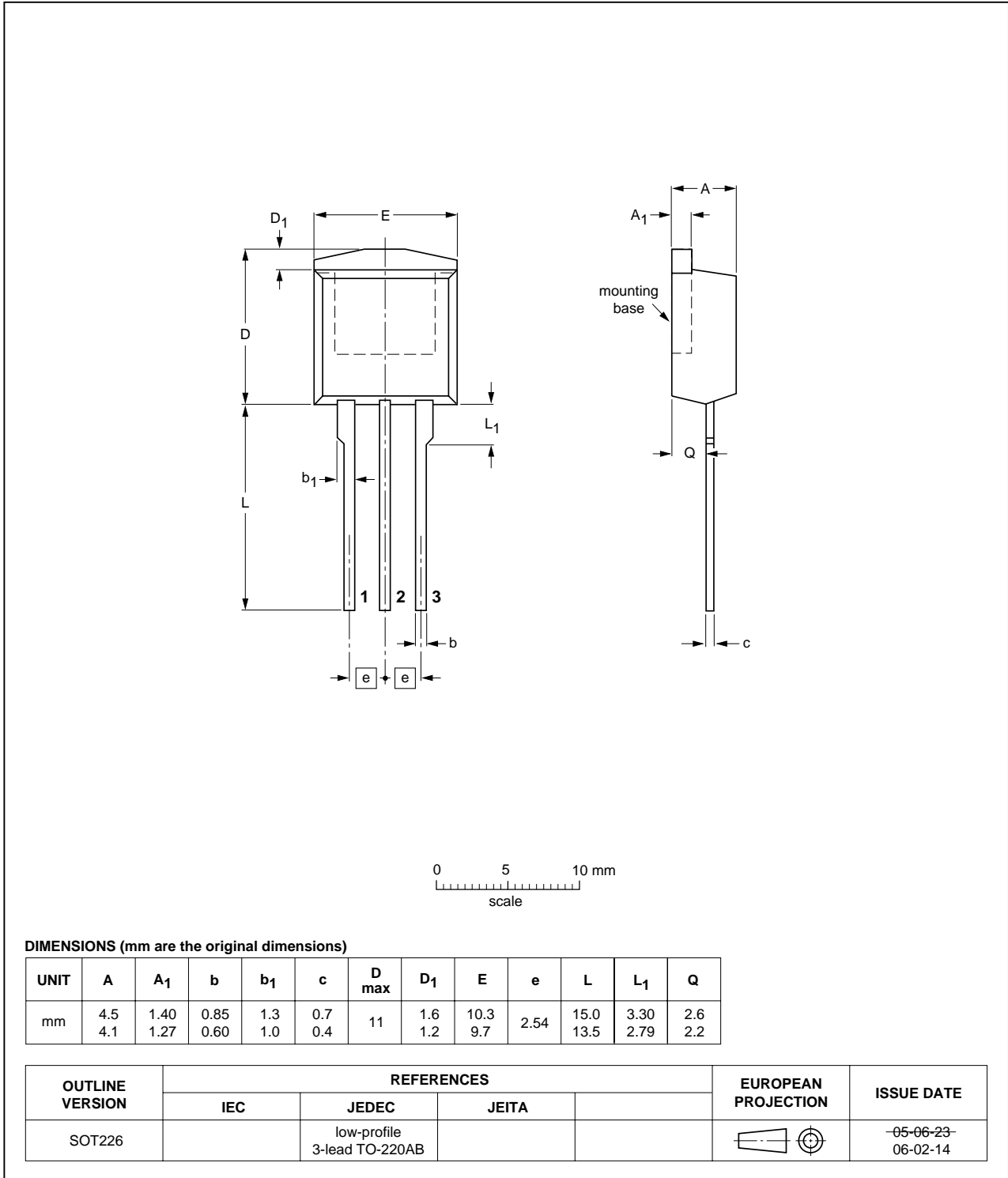


Fig 18. Package outline SOT226 (I2PAK)

8. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK75_7E4R3-75C_1	20060810	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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