BUK75/7608-40B

N-channel TrenchMOS standard level FET

Rev. 02 — 16 November 2007 Product data sheet

1. Product profile

1.1 General description

N-channel enhancement mode field-effect power transistor in a plastic package using NXP High-Performance Automotive (HPA) TrenchMOS technology.

1.2 Features

- Very low on-state resistance
- 175 °C rated
- Q101 compliant
- Standard level compatible

1.3 Applications

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

1.4 Quick reference data

- $E_{DS(AL)S} \leq 241$ mJ
- $I_D \leq 75$ A
- $R_{DSon} = 6.6$ mΩ (typ)
- $P_{tot} \leq 157$ W

2. Pinning information

Table 1. Pinning - SOT78 and SOT404, simplified outlines and symbol

Pin	Description	Simplified outline		Symbol
1	Gate (G)	SOT78 (TO-220AB)	SOT404 (D2PAK)	mbb076
2	Drain (D) [1]			
3	Source (S)			
mb	mounting base, connected to drain (D)			

[1] It is not possible to make connection to pin 2 of the SOT404 package.

3. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
BUK7508-40B	TO-220AB	plastic single-ended package; heat sink mounted; 1 mounting hole; 3-leads	SOT78A
BUK7608-40B	D2PAK	plastic single-ended surface mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

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			-	40	V
V_{DGR}	drain-gate voltage (DC)	R_{GS} = 20 kΩ		-	40	V
V_{GS}	gate-source voltage			-	±20	V
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 10 V; see Figure 2 and 3	[1]	-	101	A
			[2]	-	75	A
		T_{mb} = 100 °C; V_{GS} = 10 V; see Figure 2	[1]	-	71	A
I_{DM}	peak drain current	T_{mb} = 25 °C; pulsed; $t_p \leq$ 10 µs; see Figure 3		-	407	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; see Figure 1		-	157	W
T_{stg}	storage temperature			–55	+175	°C
T_j	junction temperature			–55	+175	°C
Source-drain diode						
I_{DR}	reverse drain current	T_{mb} = 25 °C	[1]	-	101	A
			[2]	-	75	A
I_{DRM}	peak reverse drain current	T_{mb} = 25 °C; pulsed; $t_p \leq$ 10 µs		-	407	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; I_D = 75 A; $V_{DS} \leq$ 40 V; V_{GS} = 10 V; R_{GS} = 50 Ω; starting at T_{mb} = 25 °C		-	241	mJ

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

[2] Continuous current is limited by package.

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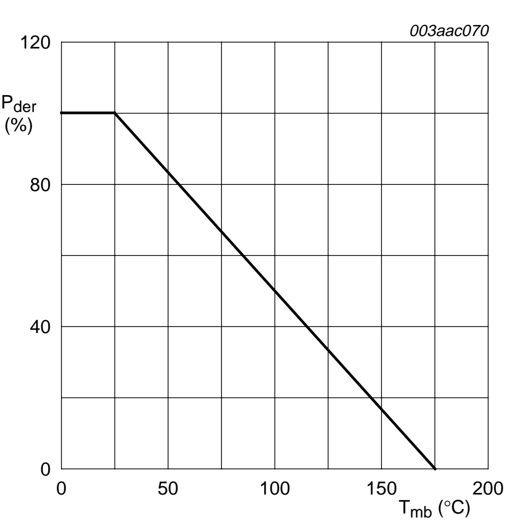
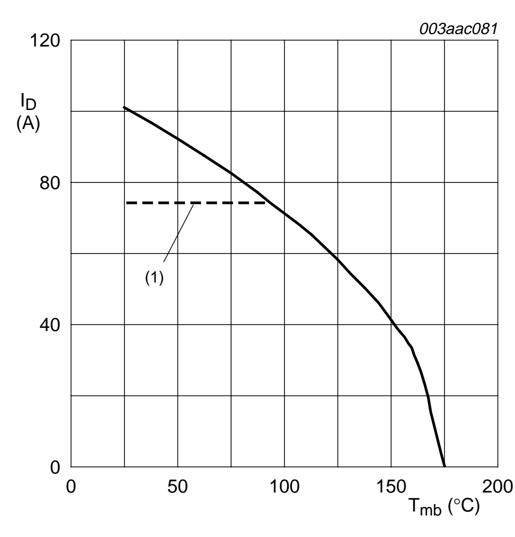


$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\ \%$$

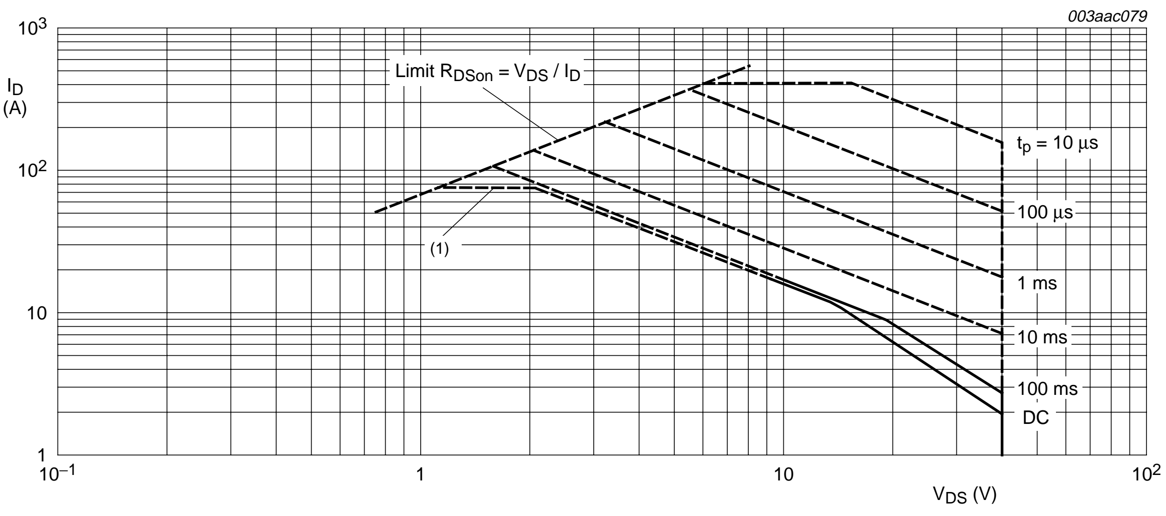
Fig 1. Normalized total power dissipation as a function of solder point temperature



$V_{GS} \geq 10$ V

[1] Capped at 75 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 75 A due to package.

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

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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	see Figure 4		-	-	0.95	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient		[1]	-	60	-	K/W
			[2]	-	50	-	K/W

[1] Vertical in still air; SOT78 package.

[2] mounted on a printed circuit board; minimum footprint; SOT404 package

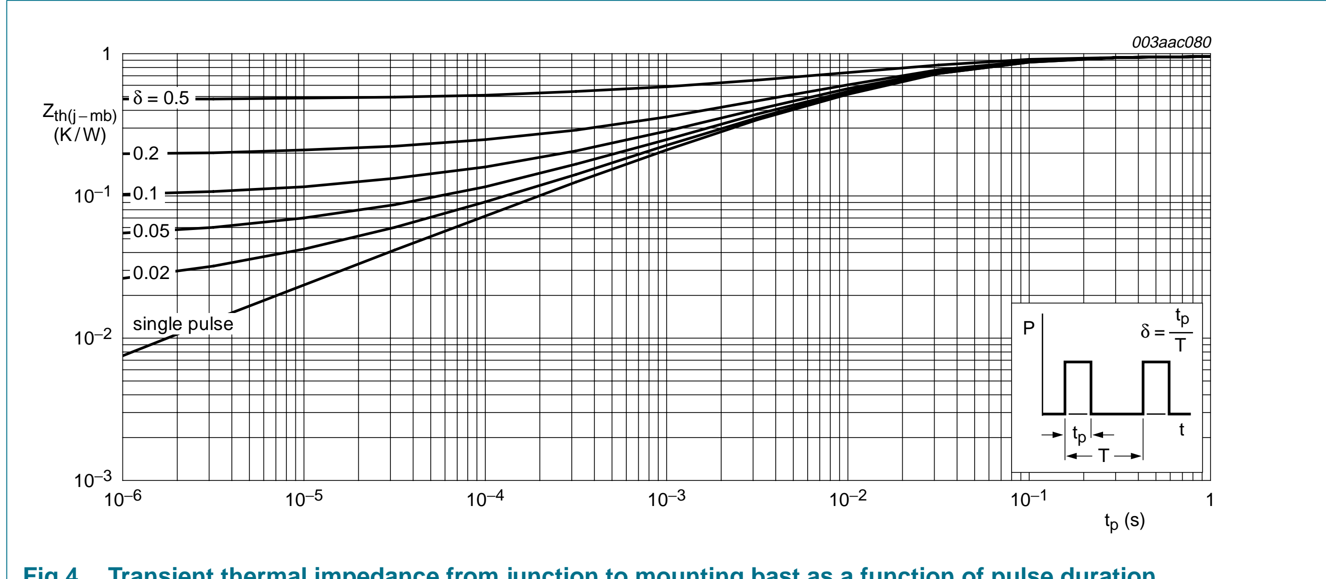

Fig 4. Transient thermal impedance from junction to mounting bast as a function of pulse duration

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6. Characteristics

Table 5. Characteristics
T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V				
		T_j = 25 °C	40	-	-	V
		T_j = −55 °C	36	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; see Figure 9 and 10				
		T_j = 25 °C	2	3	4	V
		T_j = 175 °C	1	-	-	V
		T_j = −55 °C	-	-	4.4	V
I_{DSS}	drain leakage current	V_{DS} = 40 V; V_{GS} = 0 V				
		T_j = 25 °C	-	0.02	1	µA
		T_j = 175 °C	-	-	500	µA
I_{GSS}	gate leakage current	V_{GS} = ±20 V; V_{DS} = 0 V	-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D =25 A; see Figure 6 and 8				
		T_j = 25 °C	-	6.6	8	mΩ
		T_j = 175 °C	-	-	15.2	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DD} = 32 V; V_{GS} = 10 V; see Figure 14	-	36	-	nC
Q_{GS}	gate-source charge		-	9	-	nC
Q_{GD}	gate-drain charge		-	12	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; see Figure 12	-	2017	2689	pF
C_{oss}	output capacitance		-	486	583	pF
C_{rss}	reverse transfer capacitance		-	213	291	pF
$t_{d(on)}$	turn-on delay time	V_{DD} = 30 V; R_L = 1.2 Ω; V_{GS} = 10 V; R_G = 10 Ω	-	20	-	ns
t_r	rise time		-	51	-	ns
$t_{d(off)}$	turn-off delay time		-	20	-	ns
t_f	fall time		-	33	-	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 SOT78	-	3.5		nH
		from upper edge of drain mounting base to center of die SOT404	-	2.5	-	nH
L_S	internal source inductance	from source lead 6 mm from package to source bond pad	-	7.5	-	nH
Source-drain diode						

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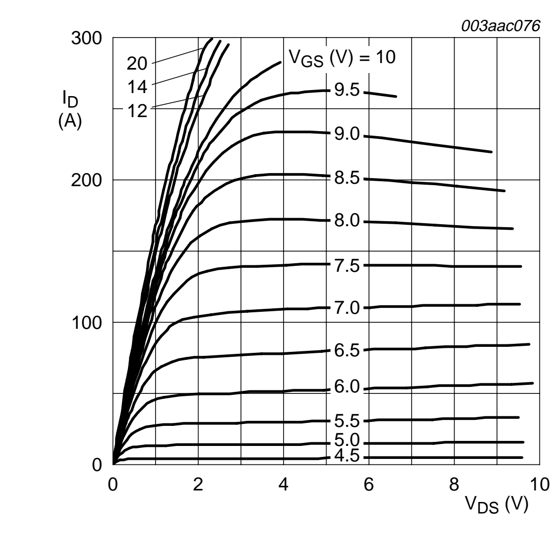
Table 5. Characteristics *...continued*

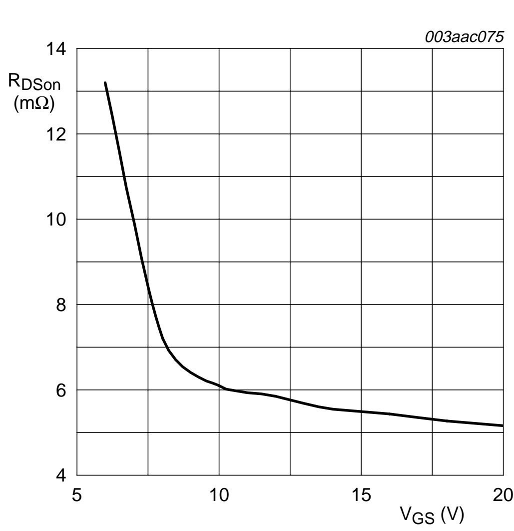
T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; 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} = 20 V	-	53	-	ns
Q_r	recovered charge		-	44	-	nC



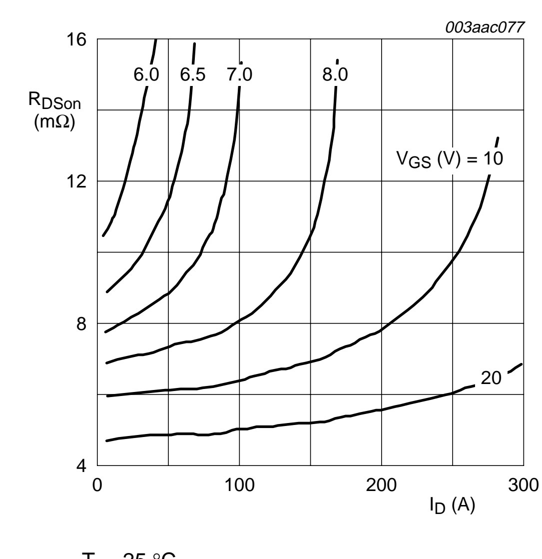
T_j = 25 °C; t_p = 300 µs

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



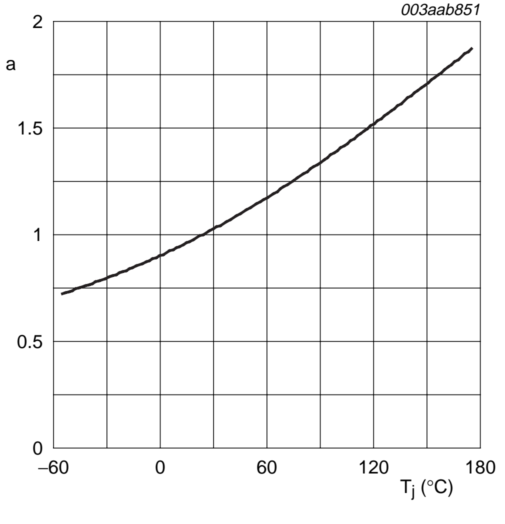
T_j = 25 °C; I_D = 25 A

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



T_j = 25 °C

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



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

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

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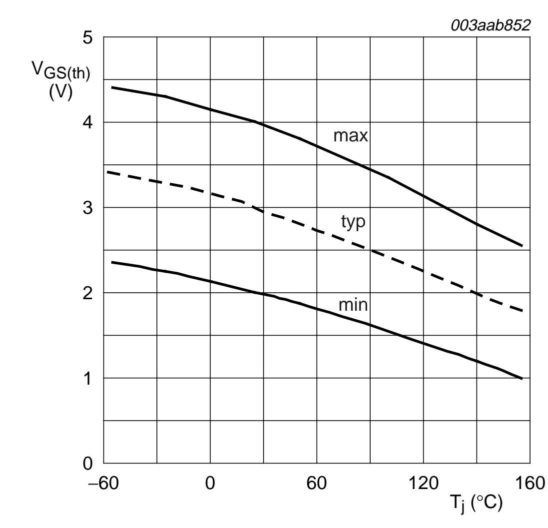
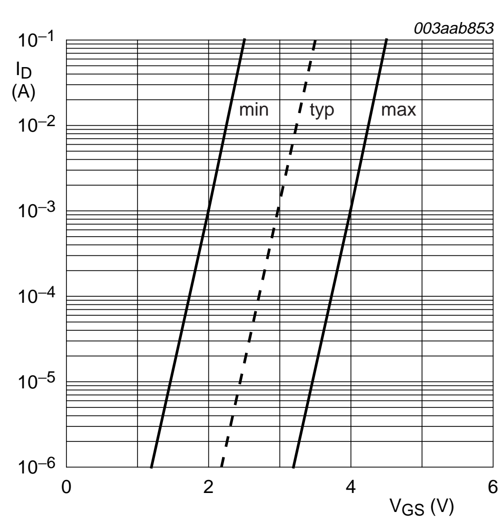


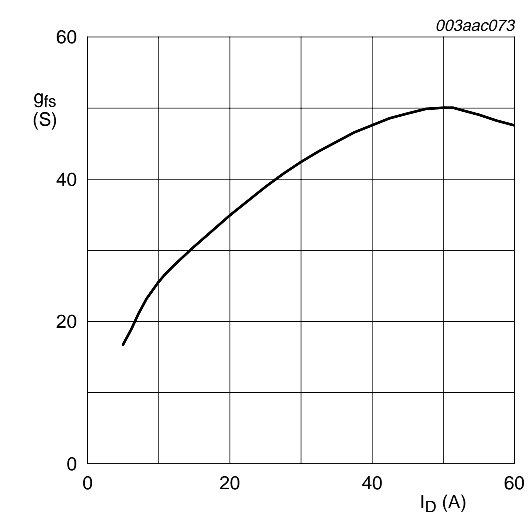
I_D = 1 mA; $V_{DS} = V_{GS}$

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



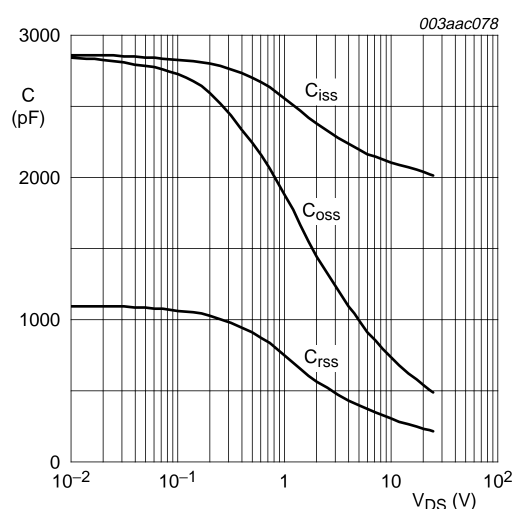
T_j = 25 °C; $V_{DS} = V_{GS}$

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



T_j = 25 °C; V_{DS} = 25 V

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



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

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

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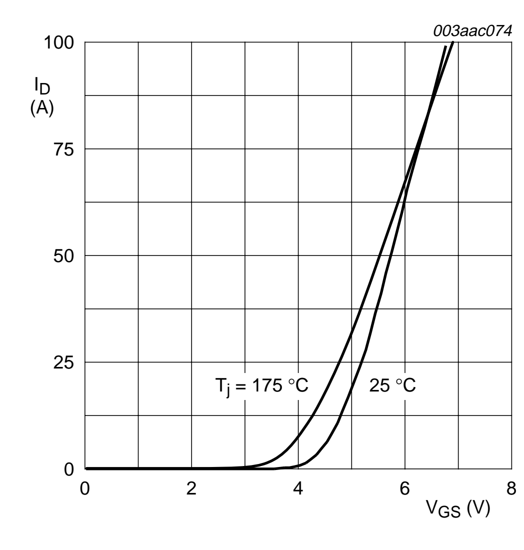
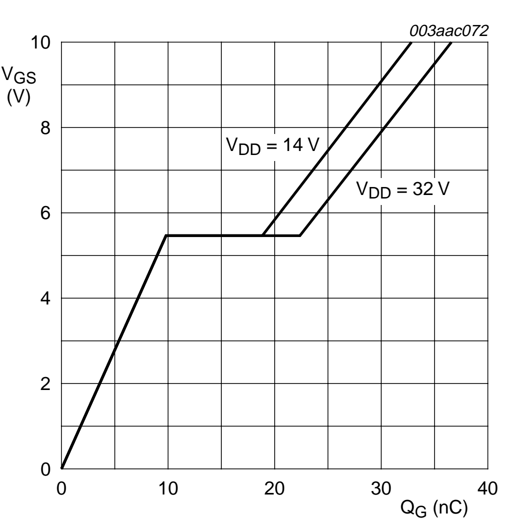


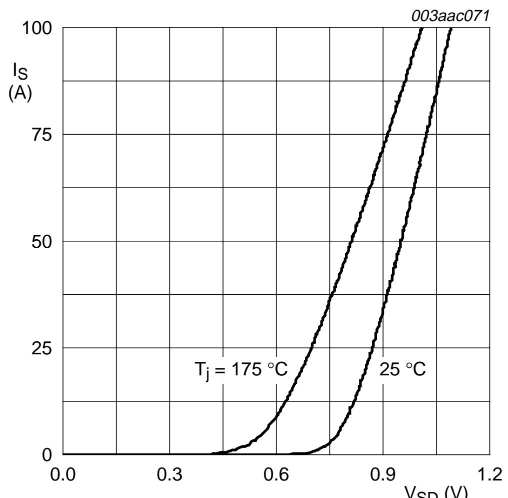
V_{DS} = 25 V

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



T_j = 25 °C; I_D = 25 A

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



V_{GS} = 0 V

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

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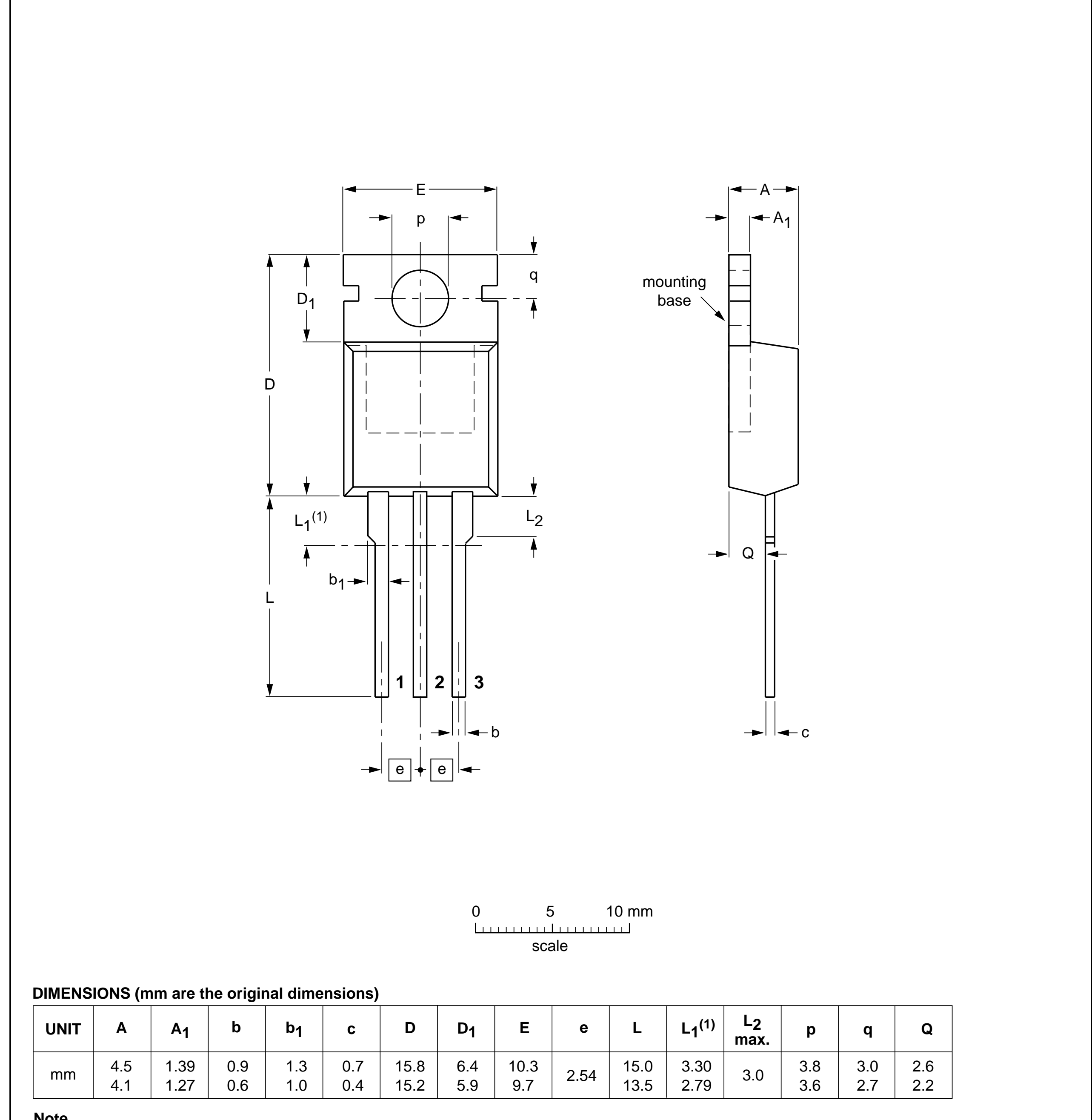
7. Package outline

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 16. Package outline SOT78A (TO-220AB)

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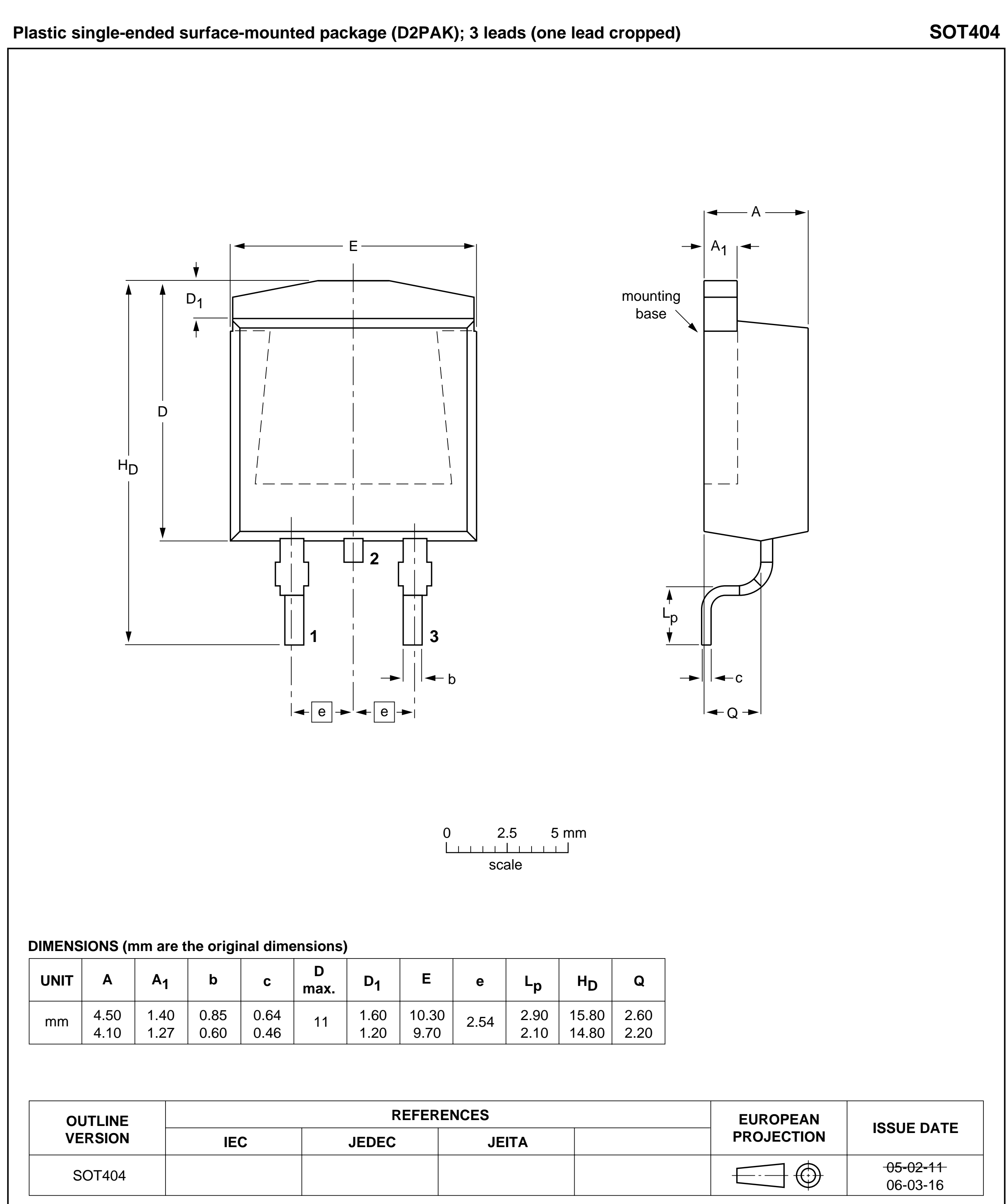
Plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped) **SOT404**



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 17. Package outline SOT404 (D2PAK)

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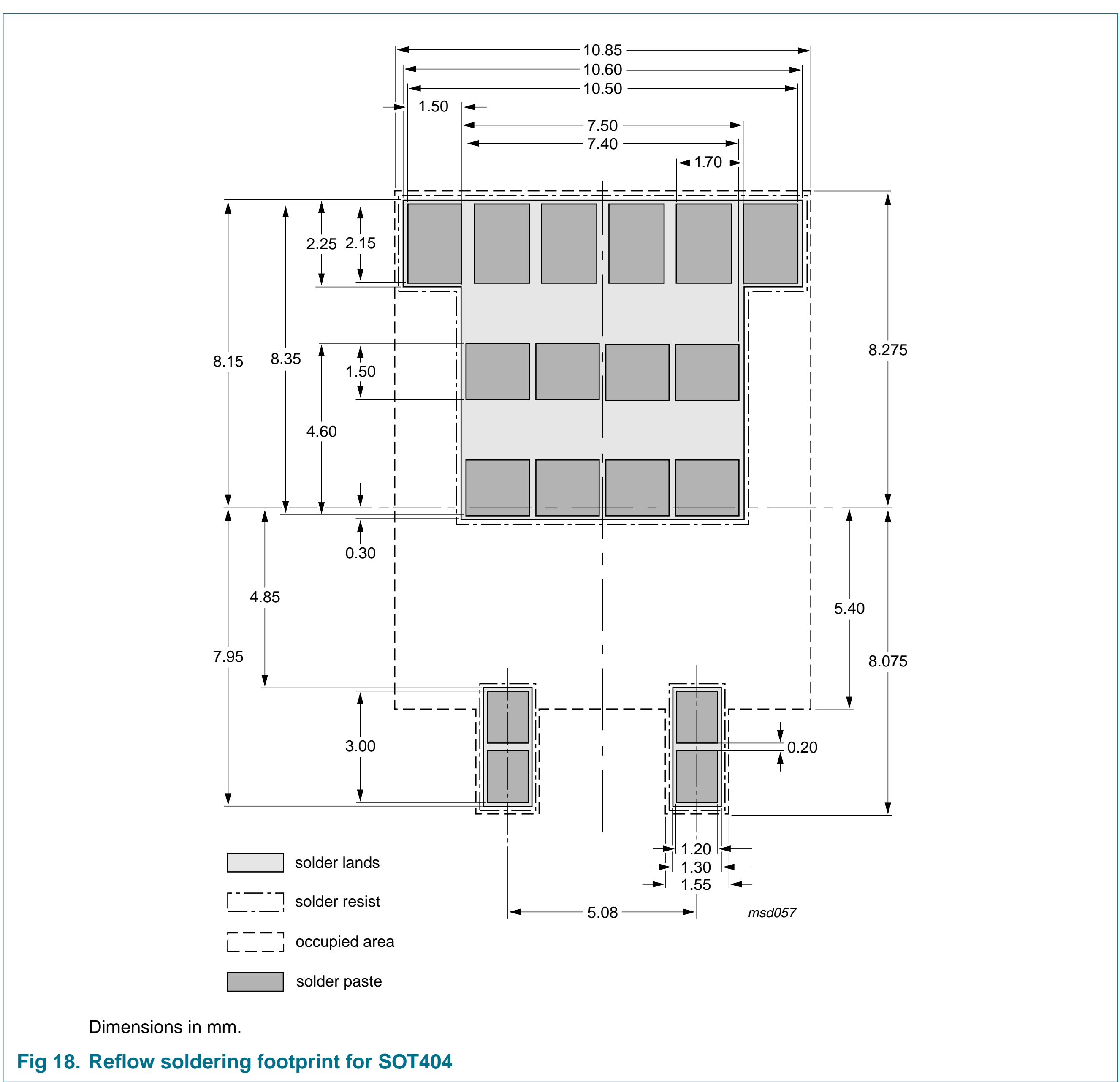
8. Soldering



Dimensions in mm.

Fig 18. Reflow soldering footprint for SOT404

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9. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK75_7608-40B_2	20071116	Product data sheet	-	BUK75_7608_40B-01
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.			
BUK75_7608_40B-01	20030319	Product data sheet	-	-

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10.1 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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