

BUK764R0-75C

N-channel TrenchMOS standard level FET

Rev. 01 — 17 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

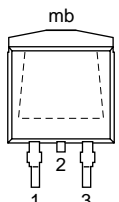
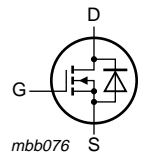
- Automotive systems
- Motors, lamps and solenoids
- General purpose power switching
- 12 V, 24 V and 42 V loads

1.4 Quick reference data

- $E_{DS(AL)S} \leq 630$ mJ
- $I_D \leq 100$ A
- $R_{DS(on)} = 3.4$ 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) [1]		
3	source (S)		
mb	mounting base; connected to drain	SOT404 (D2PAK)	<i>mbb076</i>

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

3. Ordering information

Table 2. Ordering information

Type number	Package		Version
	Name	Description	
BUK764R0-75C	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		-	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	$T_{mb} = 25 \text{ }^\circ\text{C}$; $V_{GS} = 10 \text{ V}$; see Figure 2 and 3	[1][2]	-	199	A
			[2][3]	-	100	A
		$T_{mb} = 100 \text{ }^\circ\text{C}$; $V_{GS} = 10 \text{ V}$; see Figure 2	[2][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	-	797	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][2]	-	199	A
			[1][3]	-	100	A
I_{DRM}	peak reverse drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$; pulsed; $t_p \leq 10 \text{ }\mu\text{s}$	-	797	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]	-	J	

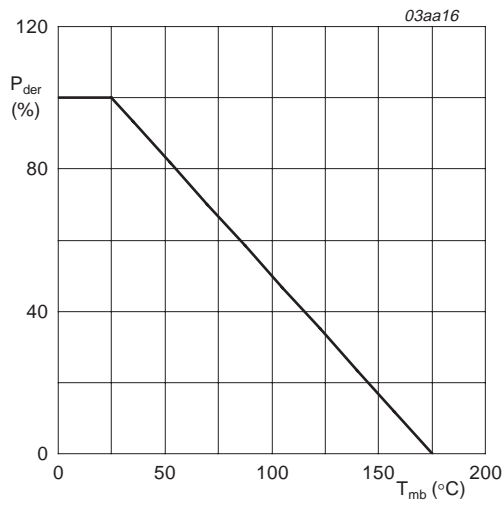
[1] Current is limited by chip power dissipation rating.

[2] Refer to document *9397 750 12572* for further information.

[3] Continuous current is limited by package.

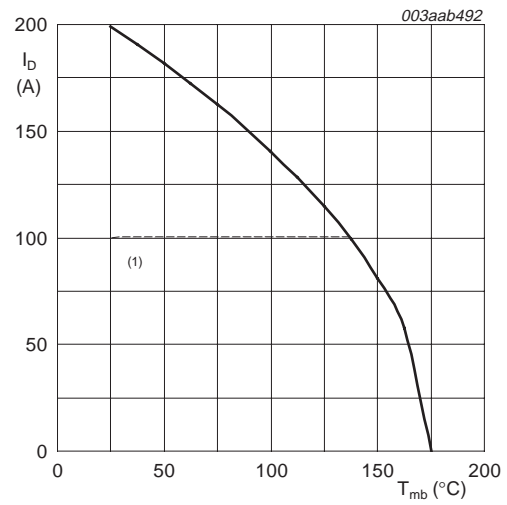
[4] Conditions:

- 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.



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

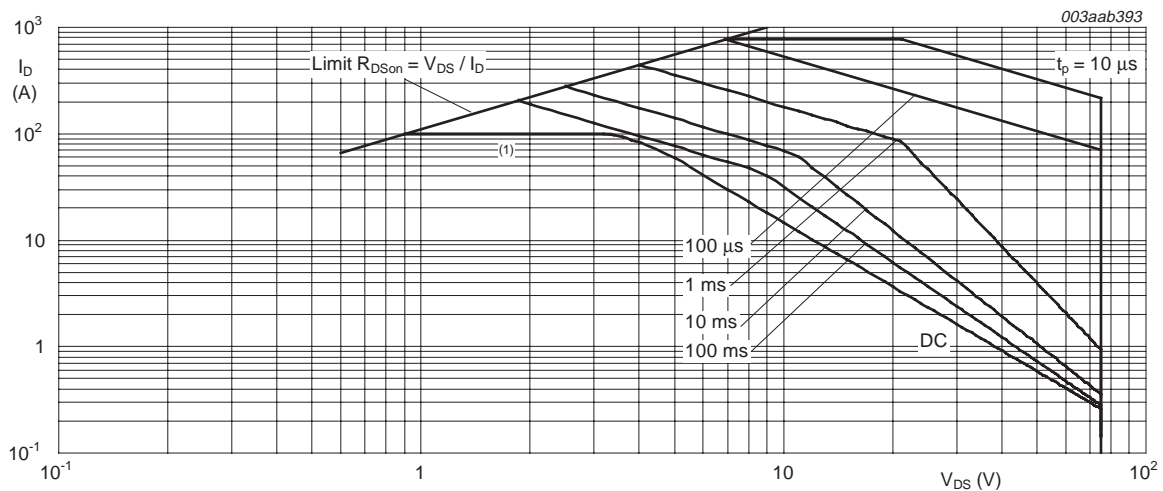
Fig 1. Normalized total power dissipation as a function of mounting base temperature



V_{GS} ≥ 10 V

(1) Capped at 100 A due to package.

Fig 2. Normalized 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	minimum footprint	[1]	-	50	-

[1] Mounted on a printed-circuit board; vertical in still air.

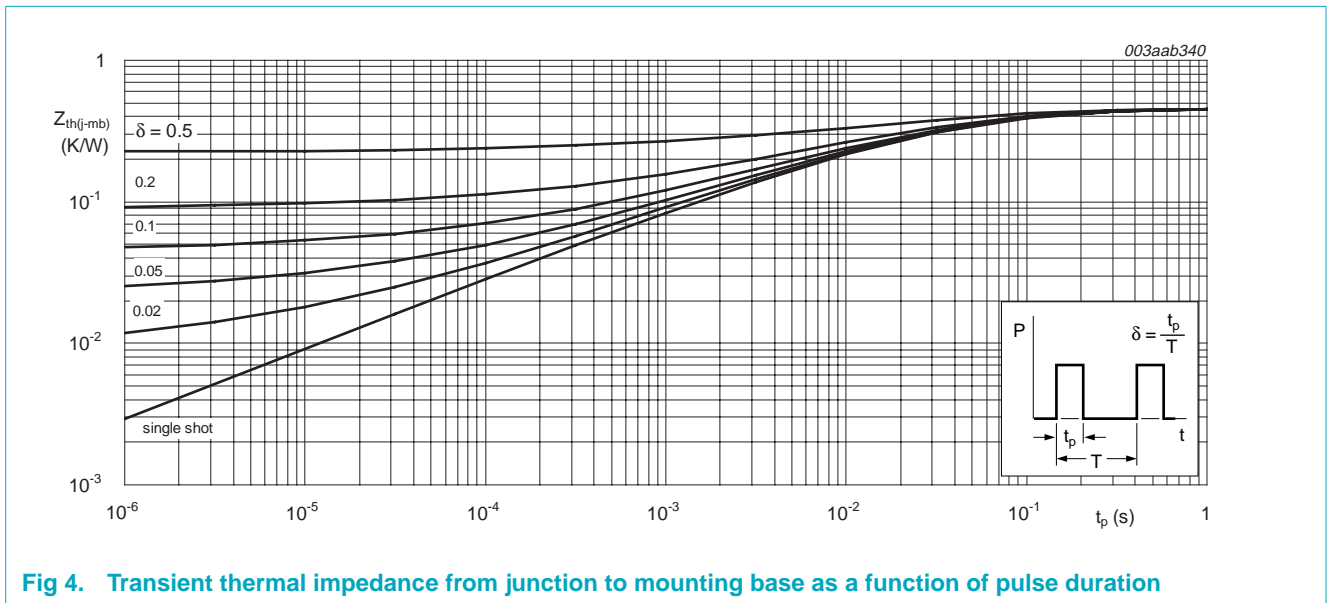


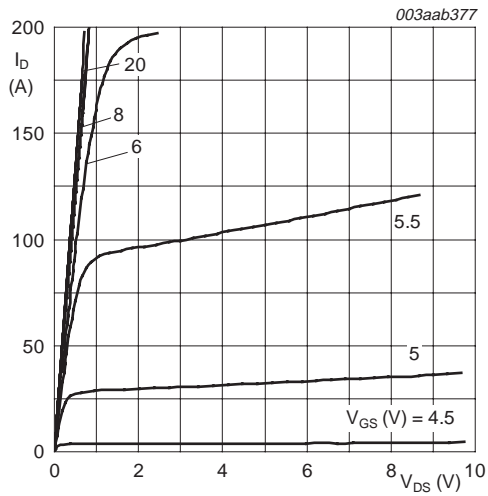
Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 5. Characteristics

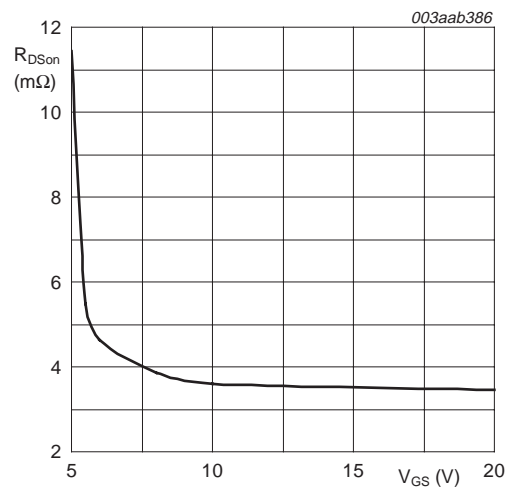
$T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\text{ }\mu\text{A}$; $V_{GS} = 0\text{ V}$ $T_j = 25\text{ }^\circ\text{C}$	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					
			$T_j = 25\text{ }^\circ\text{C}$	2	3	4	V
			$T_j = 175\text{ }^\circ\text{C}$	1	-	-	V
			$T_j = -55\text{ }^\circ\text{C}$	-	-	4.4	V
I_{DSS}	drain leakage current	$V_{DS} = 75\text{ V}$; $V_{GS} = 0\text{ V}$ $T_j = 25\text{ }^\circ\text{C}$	-	0.02	1	μA	
			$T_j = 175\text{ }^\circ\text{C}$	-	-	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					
			$T_j = 25\text{ }^\circ\text{C}$	-	3.4	4.0	m Ω
			$T_j = 175\text{ }^\circ\text{C}$	-	-	8.4	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	$V_{DS} = 30\text{ V}$; $R_L = 1.2\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $R_G = 10\text{ }\Omega$	-	65	-	ns	
t_r	rise time		-	133	-	ns	
$t_{d(off)}$	turn-off delay time		-	146	-	ns	
t_f	fall time		-	119	-	ns	
L_D	internal drain inductance	from upper edge of drain mounting base to center of die	-	2.5	-	nH	
L_S	internal source inductance	from source lead to source bonding pad	-	7.5	-	nH	
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	$I_S = 20\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; $V_R = 25\text{ V}$	-	83	-	ns	
Q_r	recovered charge		-	155	-	nC	



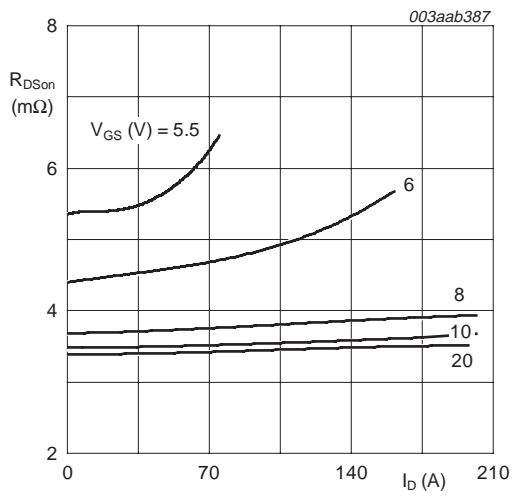
$T_j = 25\text{ }^\circ\text{C}$

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



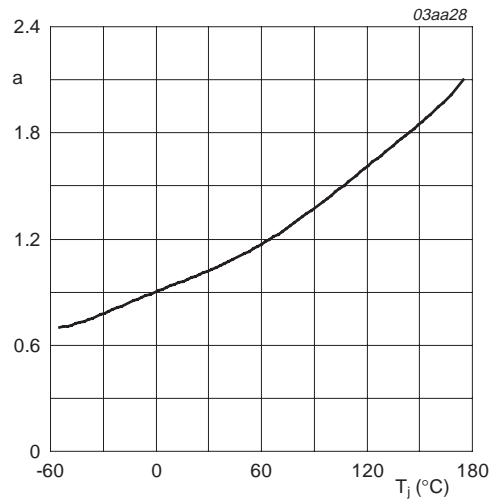
$T_j = 25\text{ }^\circ\text{C}; I_D = 25\text{ A}$

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



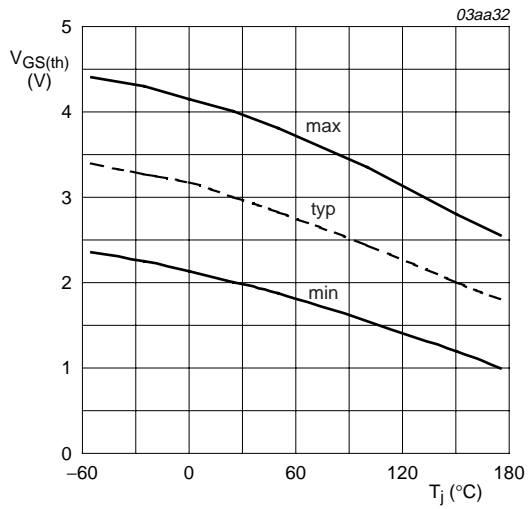
$T_j = 25\text{ }^\circ\text{C}$

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



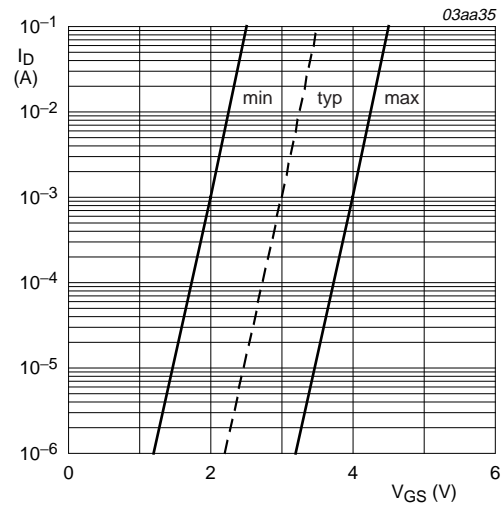
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

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



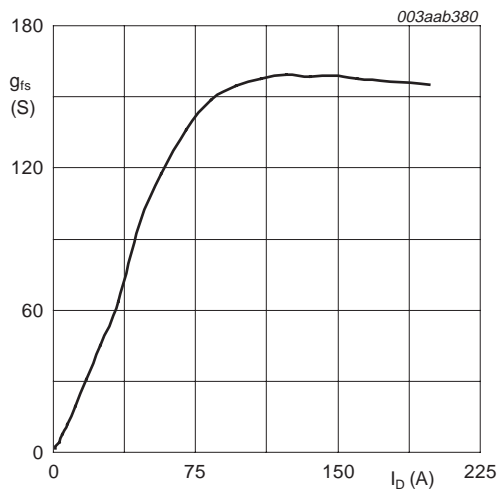
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



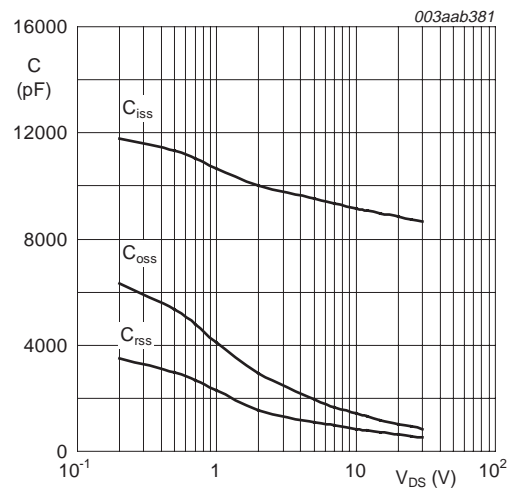
$T_j = 25 \text{ }^{\circ}C; V_{DS} = V_{GS}$

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



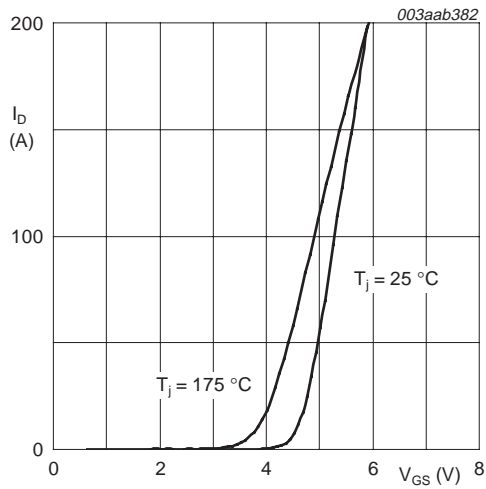
$T_j = 25 \text{ }^{\circ}C; V_{DS} = 25 \text{ V}$

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



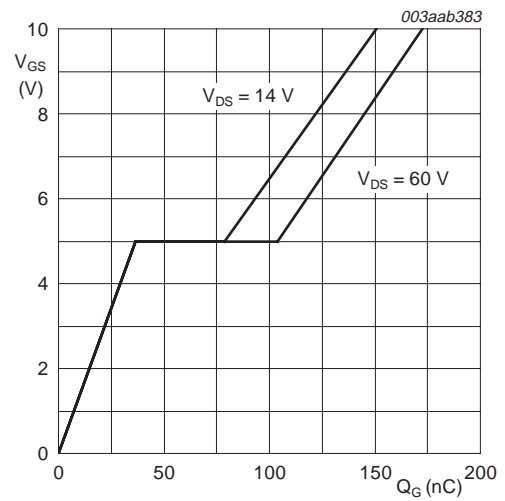
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

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



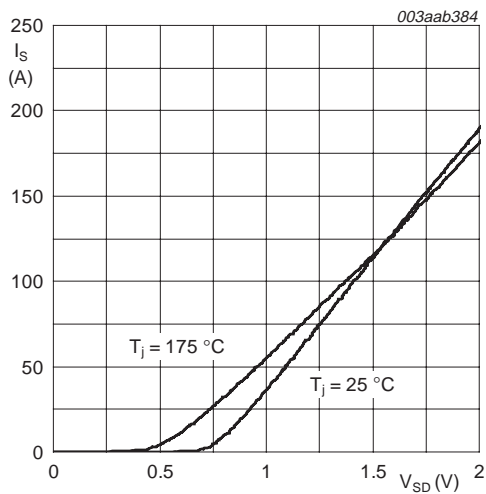
$V_{DS} = 25 \text{ V}$

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



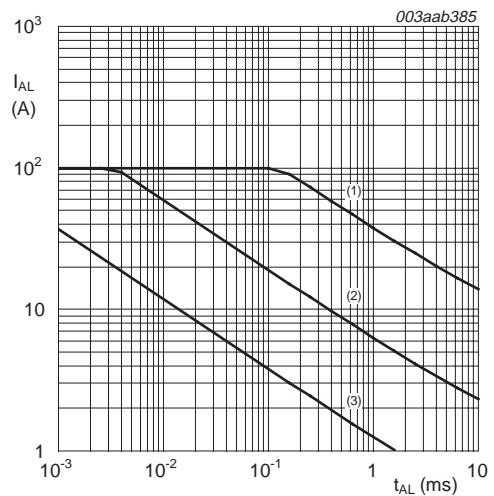
$T_j = 25 \text{ °C}; I_D = 25 \text{ A}$

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

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

7. Package outline

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

SOT404

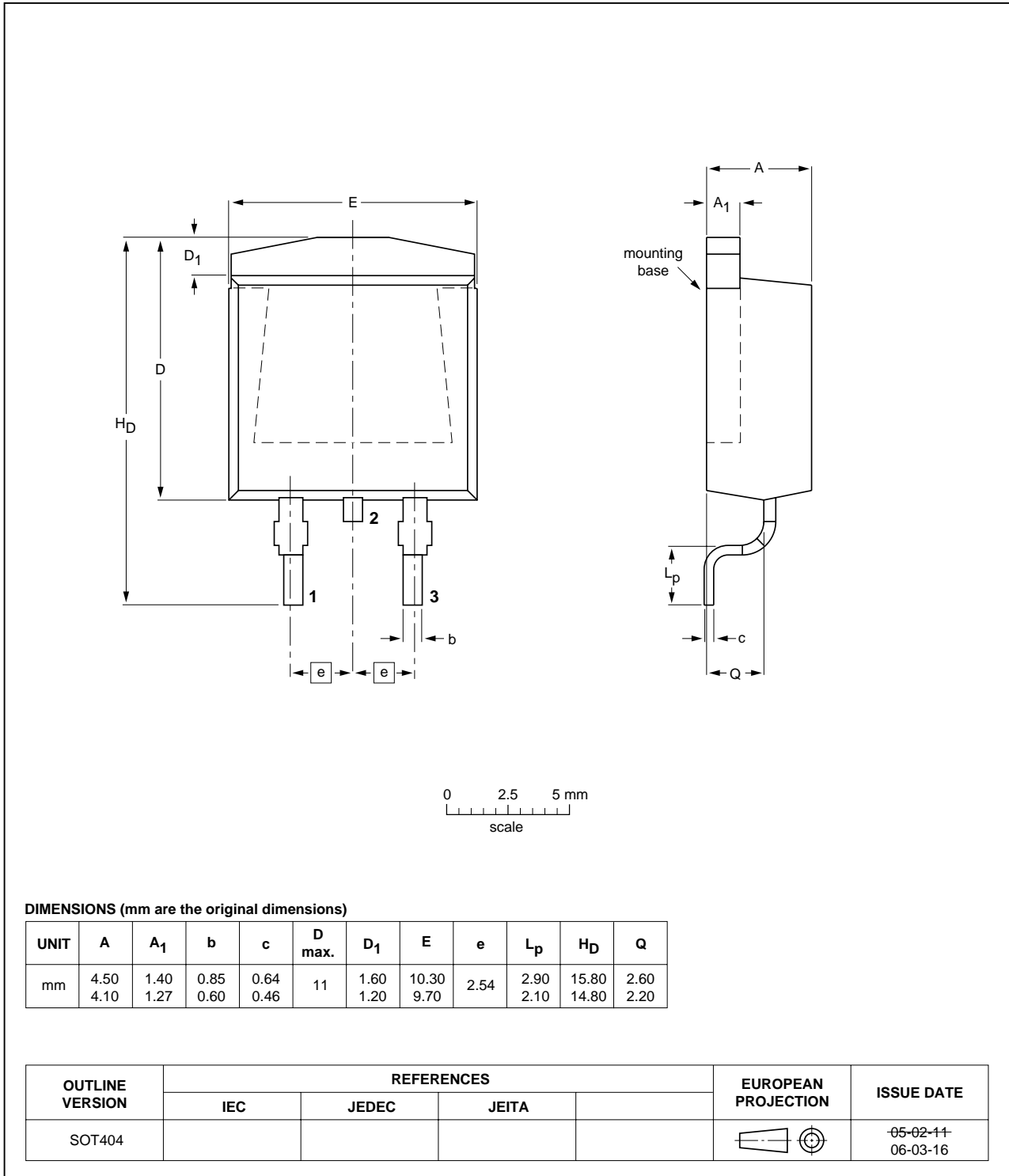
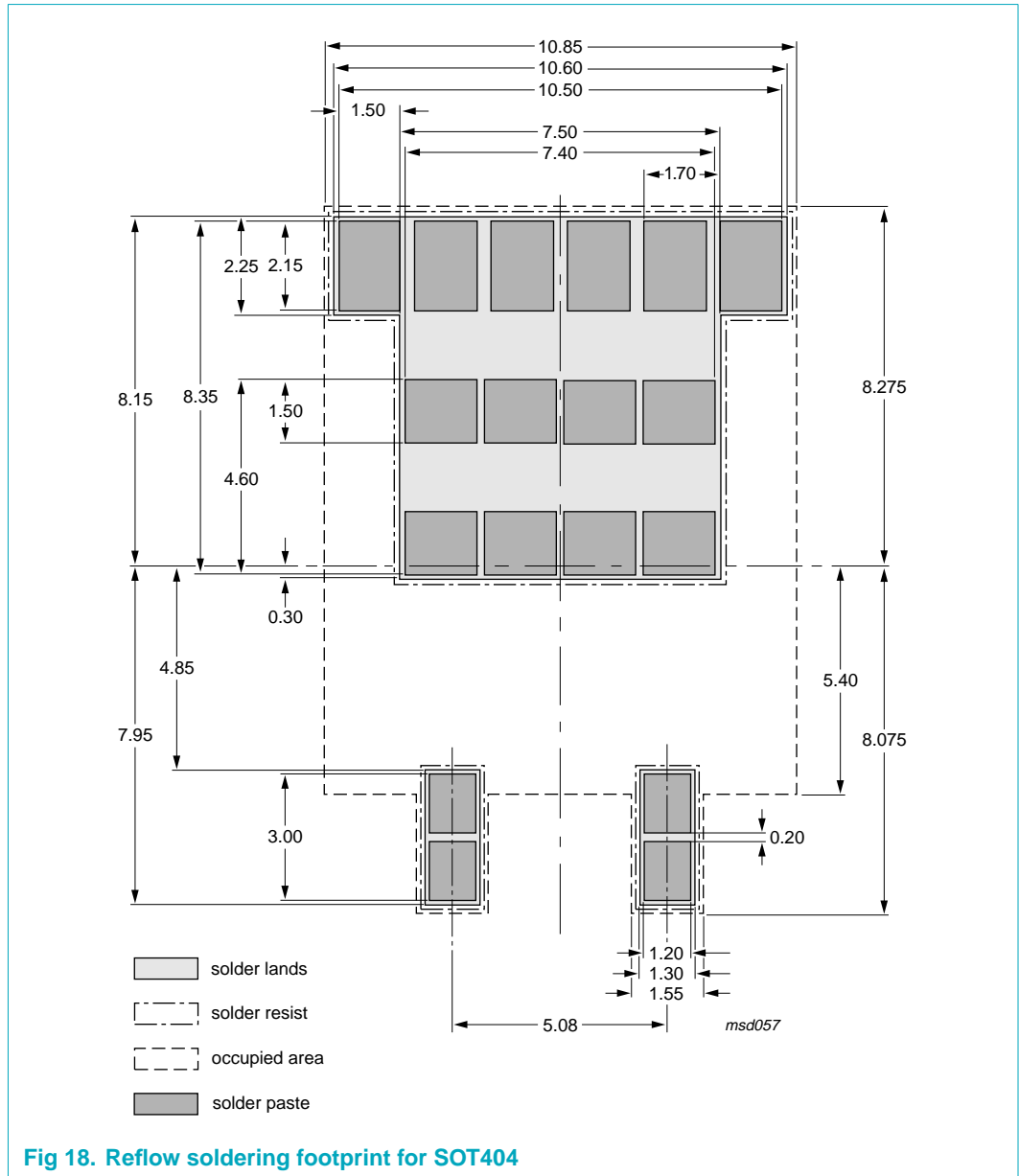


Fig 17. Package outline SOT404 (D2PAK)

8. Soldering



9. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK764R0-75C_1	20060817	Product data sheet	-	-

10. Legal information

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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