BUK724R5-30C

N-channel TrenchMOS standard level FET

Rev. 01 — 1 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

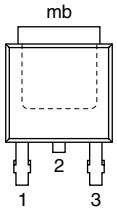
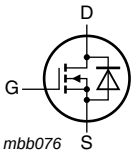
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	30	V
I_D	drain current	$V_{GS} = 10$ V; $T_j = 25$ °C; see Figure 1	[1]	-	-	75	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2		-	-	157	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10$ V; $I_D = 25$ A; $T_j = 25$ °C; see Figure 12; see Figure 13		-	3.8	4.5	mΩ
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75$ A; $V_{sup} \leq 30$ V; $R_{GS} = 50$ Ω; $V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; unclamped		-	-	329	mJ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 10$ V; $I_D = 25$ A; $V_{DS} = 24$ V; $T_j = 25$ °C; see Figure 14		-	21	-	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[1]		
3	S	source		
mb	D	mounting base; connected to drain		

SOT428 (DPAK)

[1] It is not possible to make connection to pin 2.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK724R5-30C	DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

4. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	30	V
V_{DGR}	drain-gate voltage	R_{GS} = 20 kΩ		-	-	30	V
V_{GS}	gate-source voltage			-20	-	20	V
I_D	drain current	V_{GS} = 10 V; T_j = 25 °C; see Figure 1; see Figure 4	[1]	-	-	136	A
		T_{mb} = 100 °C; V_{GS} = 10 V; see Figure 1	[2]	-	-	75	A
		V_{GS} = 10 V; T_j = 25 °C; see Figure 1	[2]	-	-	75	A
I_{DM}	peak drain current	$t_p \leq 10$ µs; pulsed; T_j = 25 °C; see Figure 4		-	-	543	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; see Figure 2		-	-	157	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	[2]	-	-	75	A
			[1]	-	-	136	A
I_{SM}	peak source current	$t_p \leq 10$ µs; pulsed; T_{mb} = 25 °C		-	-	543	A
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 75 A; $V_{sup} \leq 30$ V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped		-	-	329	mJ
$E_{DS(AL)R}$	repetitive drain-source avalanche energy	see Figure 3	[3][4][5]	-	-	-	J

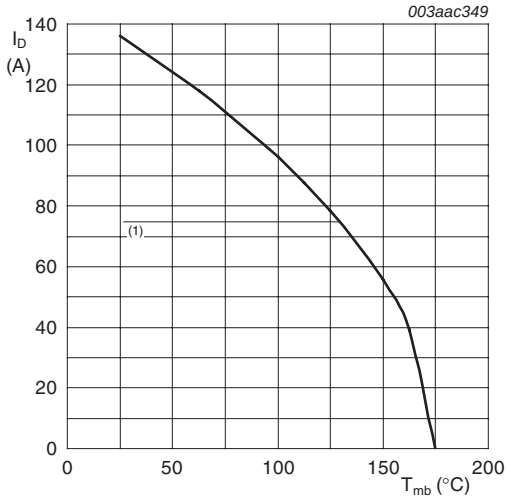
[1] Current is limited by power dissipation chip rating.

[2] Continuous current is limited by package.

[3] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

[4] Repetitive avalanche rating limited by average junction temperature of 170 °C.

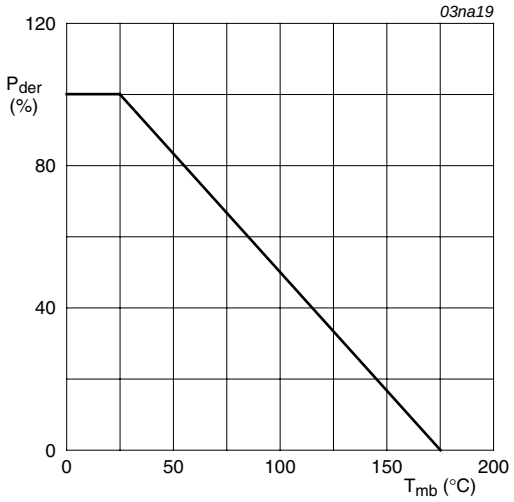
[5] Refer to application note AN10273 for further information.



$V_{GS} \geq 5V$

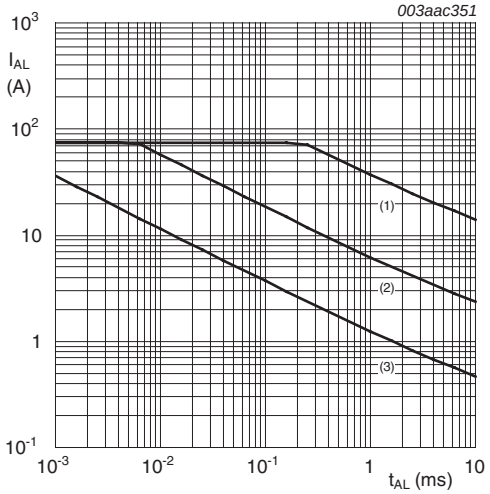
(1) Capped at 75 A due to package.

Fig 1. 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

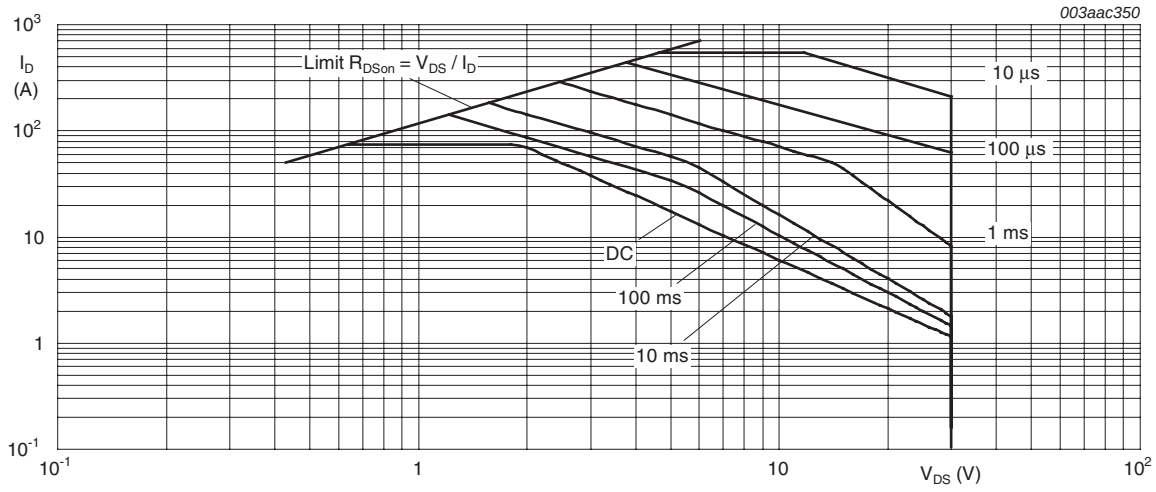


(1) Single-pulse; $T_j = 25\,°C$.

(2) Single-pulse; $T_j = 150\,°C$.

(3) Repetitive.

Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time



$T_{mb} = 25\,°C; I_{DM}$ is single pulse
(1) Capped at 75 A due to package.

Fig 4. 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 5	-	0.65	0.95	K/W
$R_{th(j\text{-}a)}$	thermal resistance from junction to ambient		-	70	-	K/W

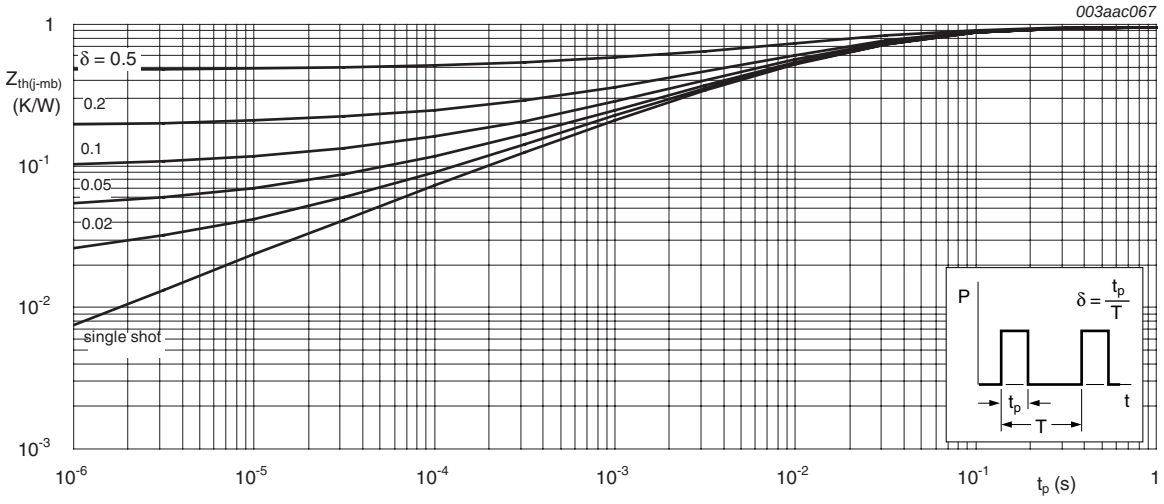


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

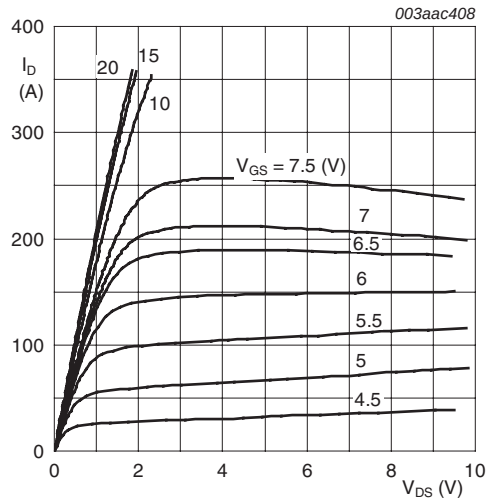
6. Characteristics

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	30	-	-	V
		I_D = 0.25 mA; V_{GS} = 0 V; T_j = -55 °C	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 10; see Figure 11	2	3	4	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; see Figure 10	1	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 10	-	-	4.4	V
I_{DSS}	drain leakage current	V_{DS} = 30 V; V_{GS} = 0 V; T_j = 175 °C	-	-	500	µA
		V_{DS} = 30 V; V_{GS} = 0 V; T_j = 25 °C	-	0.02	1	µA
I_{GSS}	gate leakage current	V_{DS} = 0 V; V_{GS} = 20 V; T_j = 25 °C	-	2	100	nA
		V_{DS} = 0 V; V_{GS} = -20 V; T_j = 25 °C	-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 175 °C; see Figure 12	-	-	8.5	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 12; see Figure 13	-	3.8	4.5	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 24 V; V_{GS} = 10 V; T_j = 25 °C; see Figure 14	-	62	-	nC
Q_{GS}	gate-source charge	I_D = 25 A; V_{DS} = 24 V; V_{GS} = 10 V; T_j 25 °C; see Figure 14	-	14	-	nC
Q_{GD}	gate-drain charge	I_D = 25 A; V_{DS} = 24 V; V_{GS} = 10 V; T_j = 25 °C; see Figure 14	-	21	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; T_j = 25 °C; see Figure 15	-	2820	3760	pF
C_{oss}	output capacitance		-	670	804	pF
C_{rss}	reverse transfer capacitance		-	422	580	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 25 V; R_L = 1 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 10 Ω; T_j = 25 °C	-	24	-	ns
t_r	rise time	V_{DS} = 25 V; R_L = 1 Ω; V_{GS} = 10 V; $R_{G(ext)}$ 10 Ω; T_j = 25 °C	-	51	-	ns
$t_{d(off)}$	turn-off delay time	V_{DS} = 25 V; R_L = 1 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 10 Ω; T_j = 25 °C	-	85	-	ns
t_f	fall time		-	62	-	ns
L_D	internal drain inductance	measured from drain to centre of die ; T_j = 25 °C	-	2.5	-	nH
L_S	internal source inductance	measured from source lead to source bond pad ; T_j = 25 °C	-	7.5	-	nH

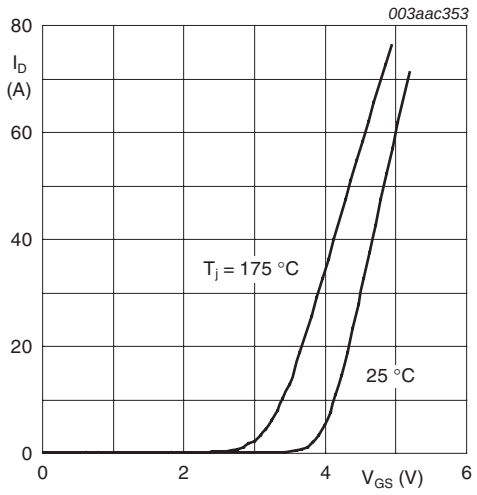
Table 6. Characteristics *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 20 A; V_{GS} = 0 V; T_j = 25 °C; see Figure 16	-	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} = 25 V; T_j = 25 °C	-	40	-	ns
Q_r	recovered charge		-	44	-	nC



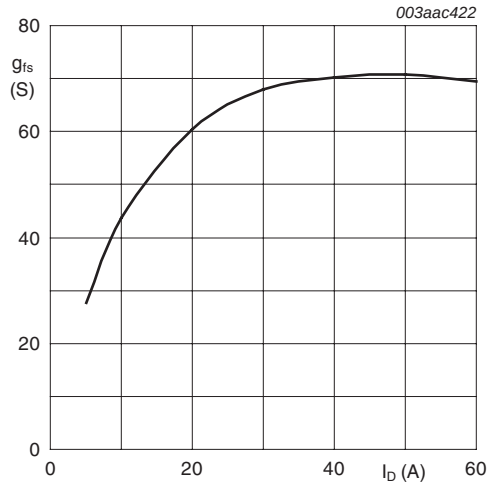
$T_j = 25°C$

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



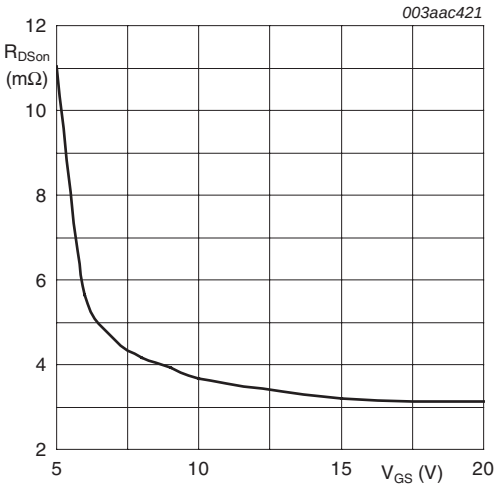
$V_{DS} = 25V$

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



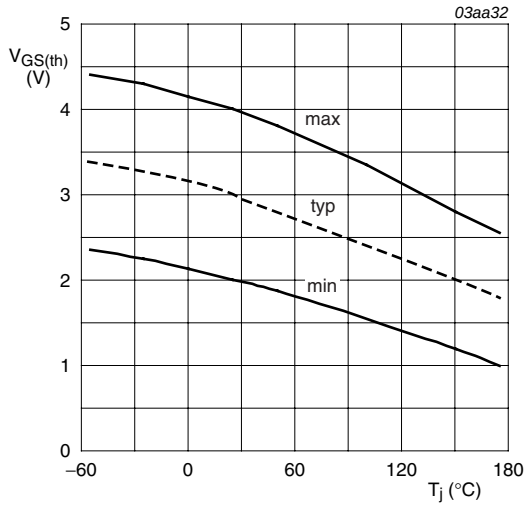
$T_j = 25°C; V_{DS} = 25V$

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



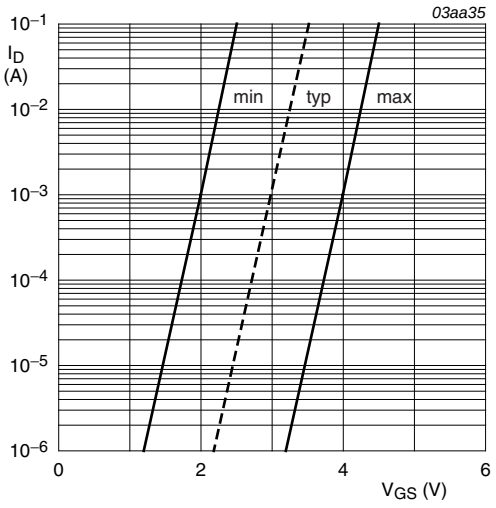
$T_j = 25°C; I_D = 15A$

Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



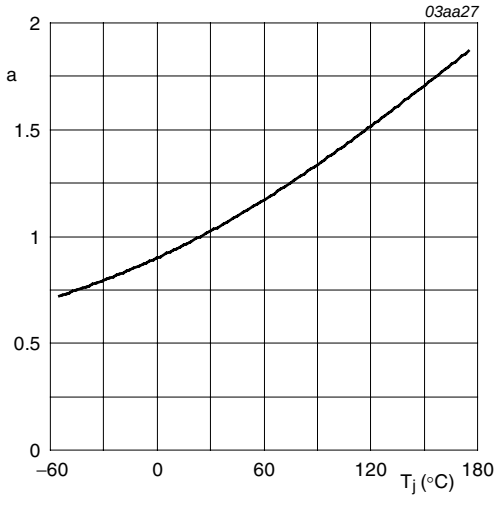
$$I_D = 1mA; V_{DS} = V_{GS}$$

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



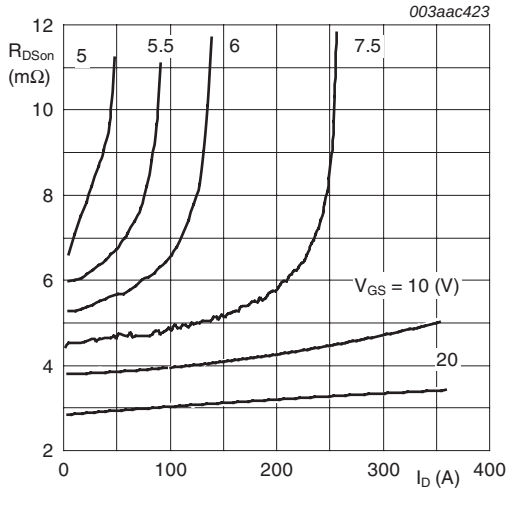
$$T_j = 25\,°C; V_{DS} = 5V$$

Fig 11. Sub-threshold drain current as a function of gate-source voltage



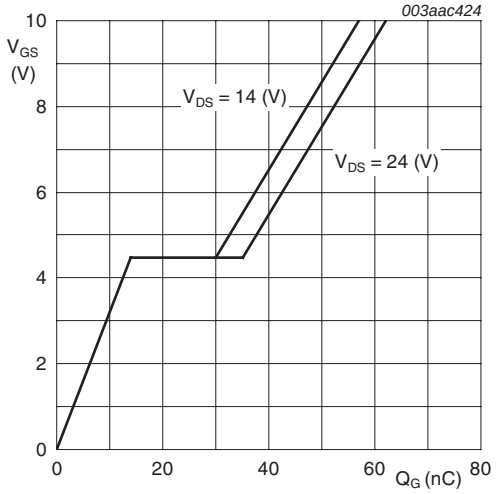
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature



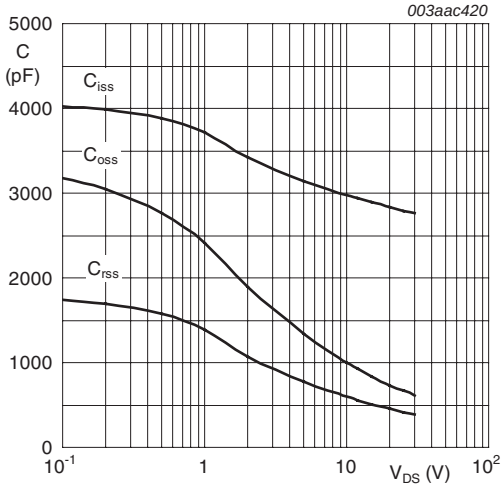
$$T_j = 25\,°C$$

Fig 13. Drain-source on-state resistance as a function of drain current; typical values



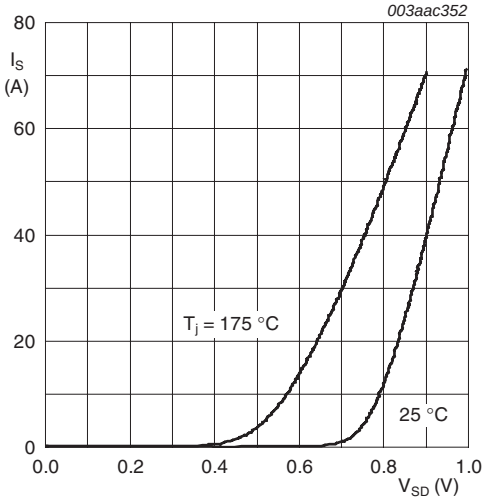
$T_j = 25\,°C; I_D = 25A$

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



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

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

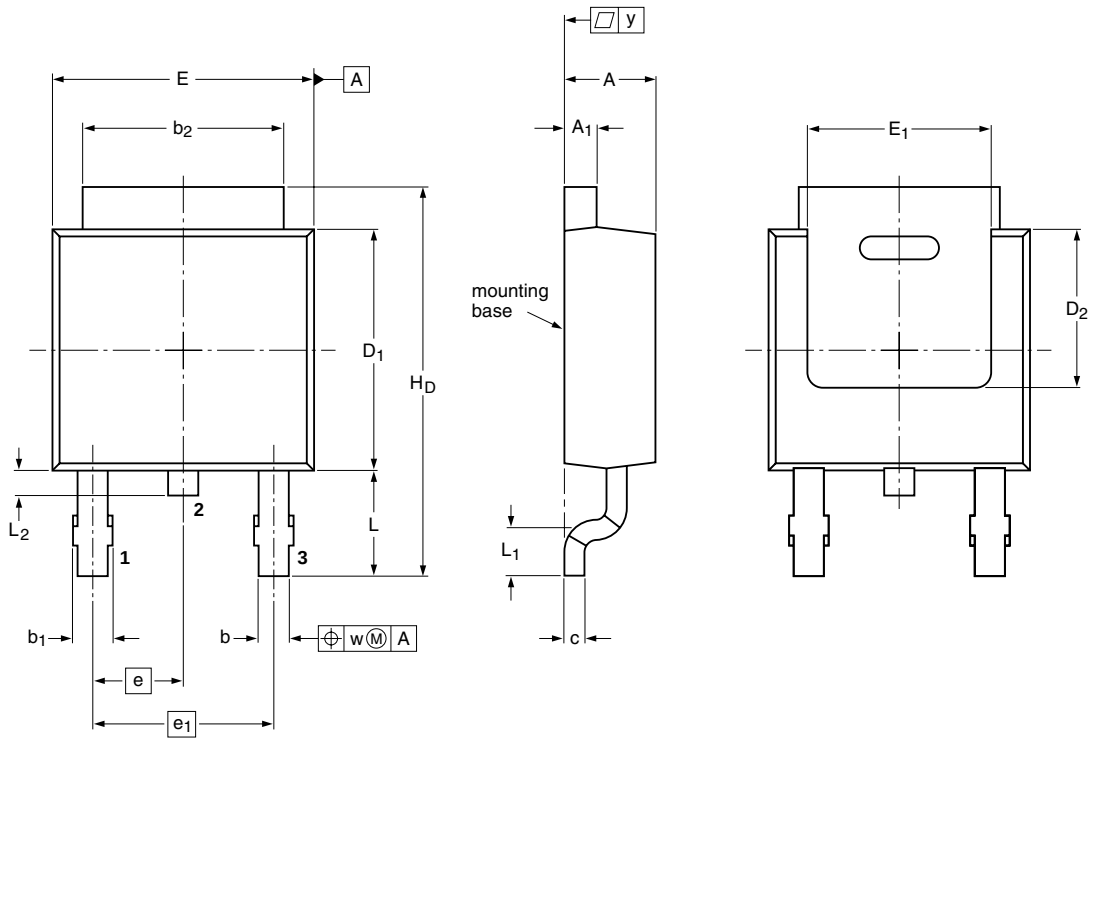


$V_{GS} = 0V$

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

7. Package outline

Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped) **SOT428**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	b_2	c	D_1	D_2 min	E	E_1 min	e	e_1	H_D	L	L_1 min	L_2	w	y max
mm	2.38 2.22	0.93 0.46	0.89 0.71	1.1 0.9	5.46 5.00	0.56 0.20	6.22 5.98	4.0	6.73 6.47	4.45	2.285	4.57	10.4 9.6	2.95 2.55	0.5	0.9 0.5	0.2	0.2

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT428		TO-252	SC-63			~~06-02-14~~ 06-03-16

Fig 17. Package outline SOT428 (DPAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK724R5-30C v.1	20100701	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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