BUK6C3R3-75C

N-channel TrenchMOS intermediate level FET

Rev. 3 — 18 January 2012 **Product data sheet**

1. Product profile

1.1 General description

Intermediate level gate drive N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using 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
- High current handling capability, up to 320 A
- Low conduction losses due to very low on-state resistance
- Suitable for standard and logic level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

1.3 Applications

- 12 V and 24 V automotive systems
- Electric and electro-hydraulic power steering
- Motors, lamps and solenoids
- Start-Stop micro-hybrid applications
- Transmission control
- Ultra high performance power switching

1.4 Quick reference data

Table 1. Quick reference data

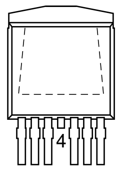
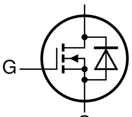
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C	-	-	75	V
I_D	drain current	$V_{GS} = 10$ V; $T_{mb} = 25$ °C; see Figure 1	-	-	181	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2	-	-	300	W
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10$ V; $I_D = 90$ A; $T_j = 25$ °C; see Figure 11	-	2.85	3.4	mΩ

Table 1. Quick reference data *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
Q_{GD}	gate-drain charge	I_D = 25 A; V_{DS} = 60 V; V_{GS} = 10 V; see Figure 13; see Figure 14	-	76	-	nC
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 120 A; V_{sup} < 75 V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped	-	-	560	mJ

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 SOT427 (D2PAK)	
2	S	source		
3	S	source		
4	D	drain[1]		
5	S	source		
6	S	source		
7	S	source		
mb	D	mounting base; connected to drain		

[1] It is not possible to connect to pin 4 of the SOT427 package.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK6C3R3-75C	D2PAK	plastic single-ended surface-mounted package (D2PAK); 7 leads (one lead cropped)	SOT427

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	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	75	V
V_{GS}	gate-source voltage	Pulsed	[1]	-20	20	V
		DC	[2]	-16	16	V
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 10 V; see Figure 1		-	181	A
		T_{mb} = 100 °C; V_{GS} = 10 V; see Figure 1		-	128	A
I_{DM}	peak drain current	T_{mb} = 25 °C; pulsed; $t_p \leq 10$ µs; see Figure 3		-	723	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; see Figure 2		-	300	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		-	181	A
I_{SM}	peak source current	pulsed; $t_p \leq 10$ µs; T_{mb} = 25 °C		-	723	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 120 A; V_{sup} < 75 V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped		-	560	mJ

[1] Accumulated pulse duration not to exceed 5mins.

[2] -16V accumulated duration not to exceed 168 hrs.

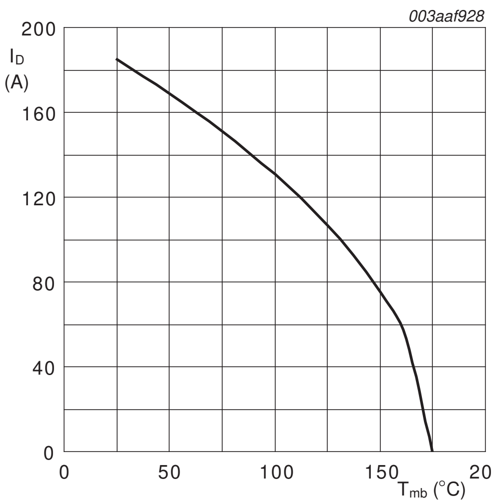
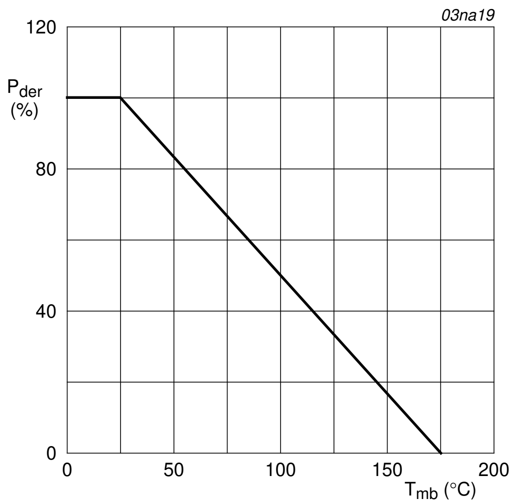
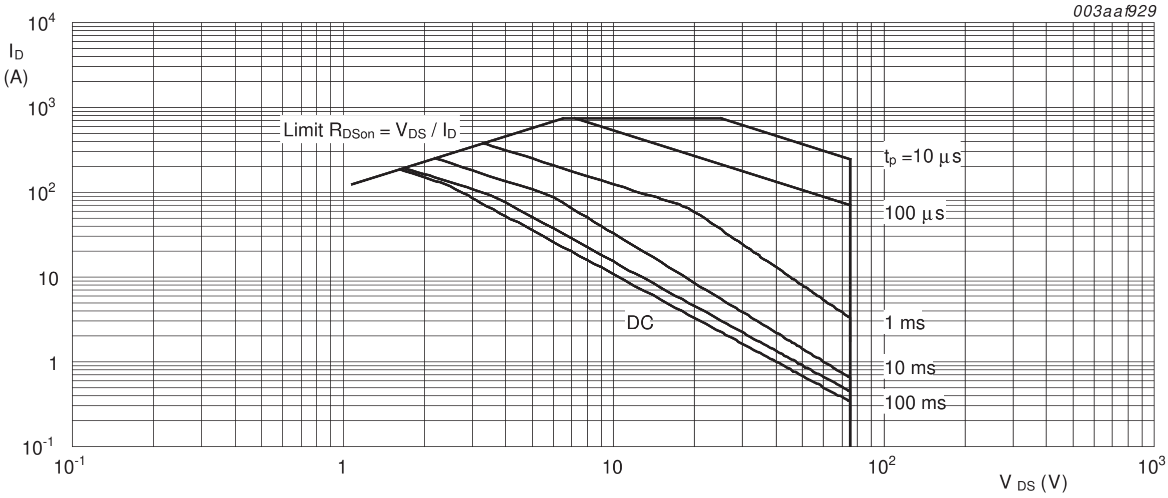


Fig 1. Continuous drain current as a function of mounting base temperature



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

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



$T_{mb} = 25$ °C; I_{DM} is a 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
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	-	0.5	K/W

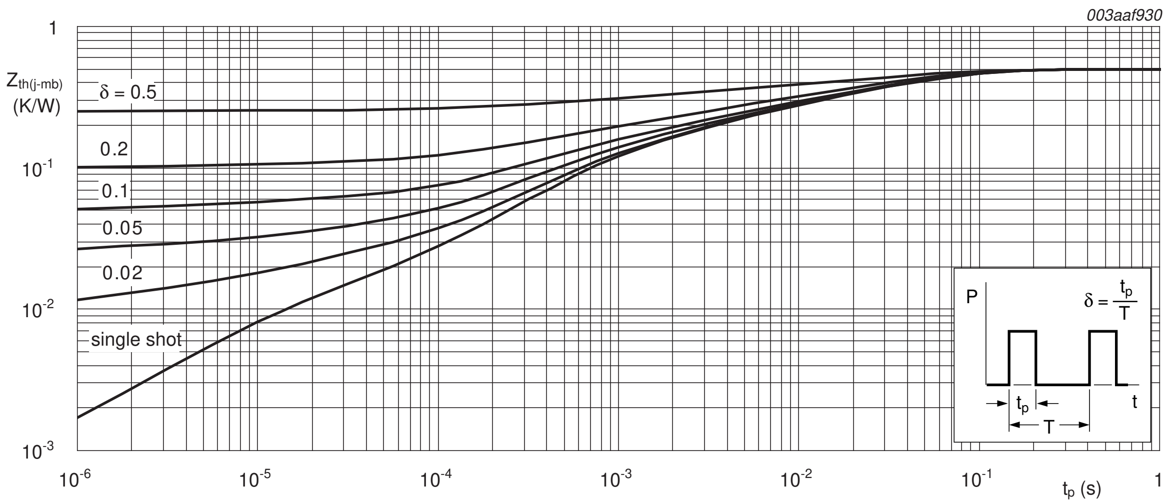
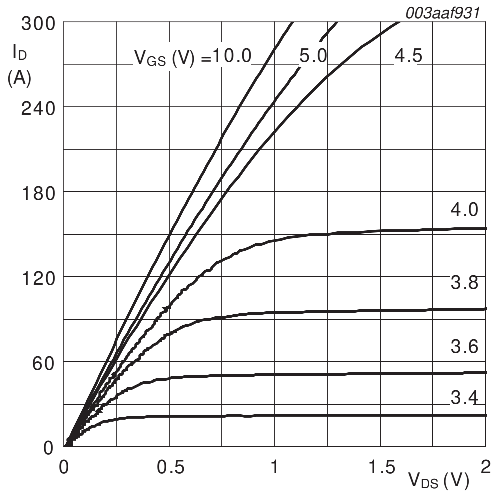


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

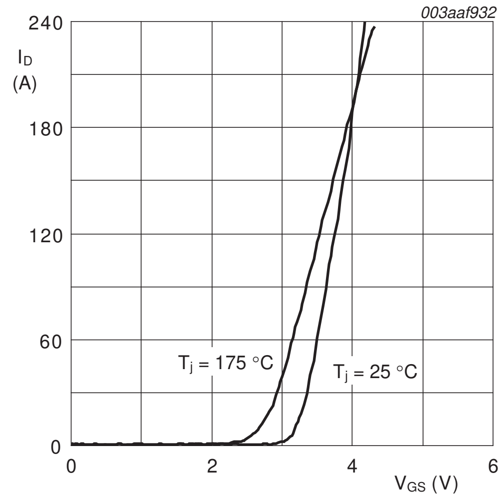
Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C	75	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C	68	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 9; see Figure 10	1.8	2.3	2.8	V
V_{GSth}	gate-source threshold voltage	I_D = 2.5 mA; V_{DS} = V_{GS}; T_j = 175 °C; see Figure 10	0.8	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 10	-	-	3.3	V
I_{DSS}	drain leakage current	V_{DS} = 75 V; V_{GS} = 0 V; T_j = 25 °C	-	0.04	1	µA
		V_{DS} = 75 V; V_{GS} = 0 V; T_j = 175 °C	-	-	500	µA
I_{GSS}	gate leakage current	V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C	-	2	100	nA
		V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C	-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 90 A; T_j = 25 °C; see Figure 11	-	2.85	3.4	mΩ
		V_{GS} = 5 V; I_D = 90 A; T_j = 25 °C; see Figure 11	-	3.35	4.3	mΩ
		V_{GS} = 4.5 V; I_D = 90 A; T_j = 25 °C; see Figure 11	-	3.7	5.1	mΩ
		V_{GS} 10 V; I_D = 90 A; T_j = 175 °C; see Figure 11; see Figure 12	-	-	9.2	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 60 V; V_{GS} = 10 V; see Figure 13; see Figure 14	-	253	-	nC
		I_D = 25 A; V_{DS} = 60 V; V_{GS} = 5 V; see Figure 13; see Figure 14	-	140	-	nC
Q_{GS}	gate-source charge	I_D = 25 A; V_{DS} = 60 V; V_{GS} = 10 V; see Figure 13; see Figure 14	-	45	-	nC
Q_{GD}	gate-drain charge		-	76	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; T_j = 25 °C; see Figure 15	-	11840	15800	pF
C_{oss}	output capacitance		-	873	1050	pF
C_{rss}	reverse transfer capacitance		-	546	750	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 40 V; R_L = 0.4 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 10 Ω	-	45	-	ns
t_r	rise time		-	217	-	ns
$t_{d(off)}$	turn-off delay time		-	384	-	ns
t_f	fall time		-	165	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 80 A; V_{GS} = 0 V; T_j = 25 °C; see Figure 16	-	0.8	1.2	V
t_{rr}	reverse recovery time	I_S = 25 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 40 V	-	63	-	ns
Q_r	recovered charge		-	165	-	nC



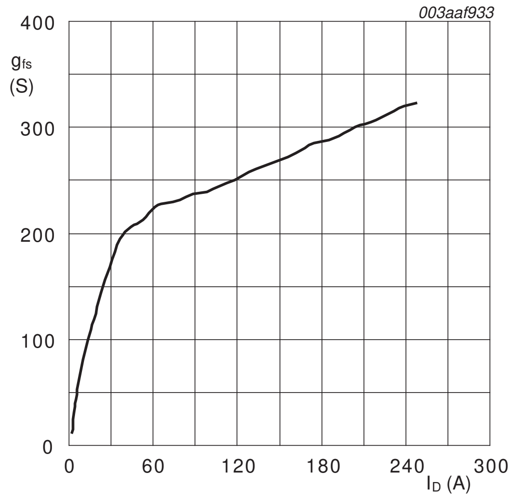
T_j = 25 °C; t_p = 300 μs

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



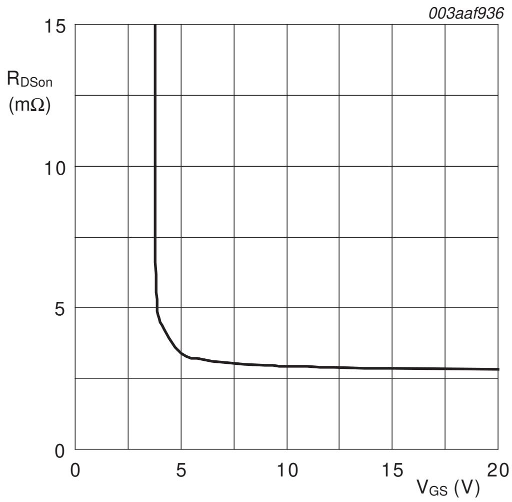
$V_{DS} > I_D \times R_{DSon}$

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



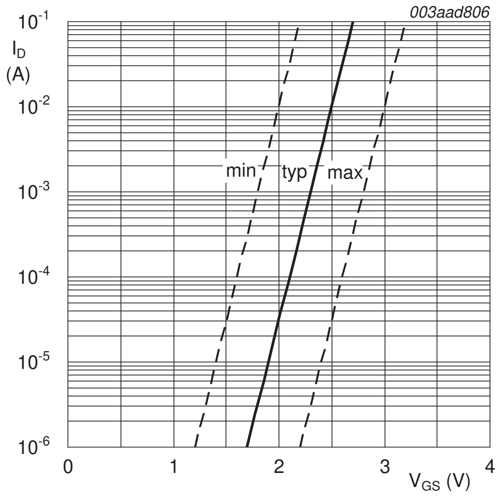
$T_j = 25\,°C; V_{DS} = 25\,V$

Fig 7. Forward transconductance as a function of drain current; typical values



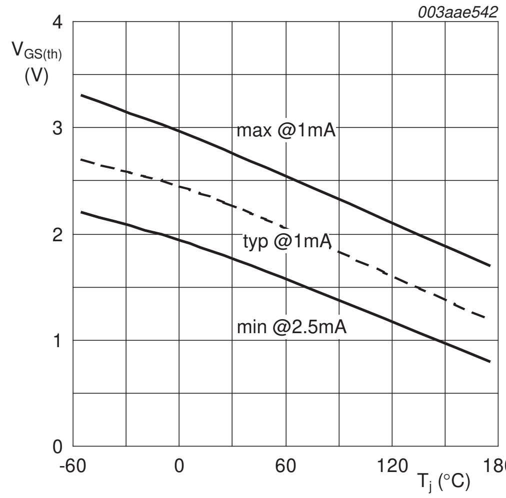
$T_j = 25\,°C; I_D = 90\,A$

Fig 8. Drain-source on-state resistance as a function of gate-source voltage; typical values



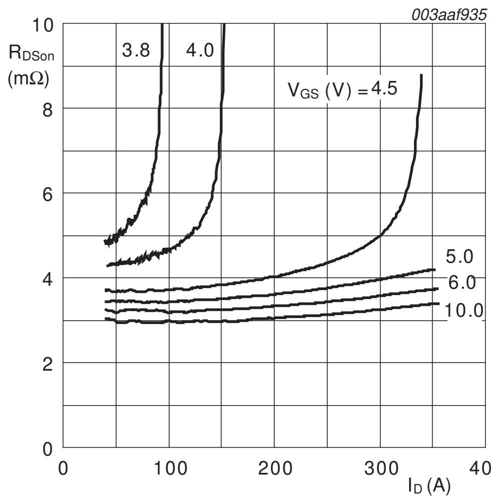
$T_j = 25\,°C; V_{DS} = 5V$

Fig 9. Sub-threshold drain current as a function of gate-source voltage



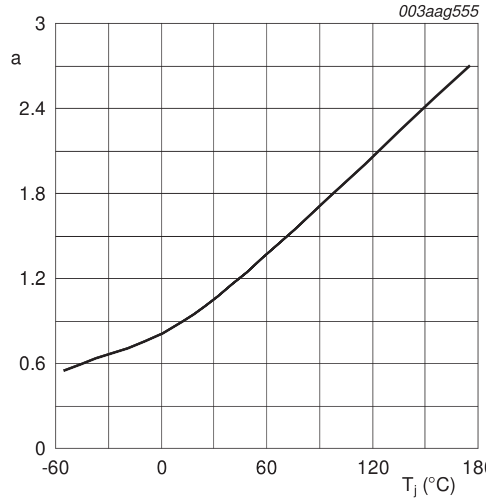
$I_D = 1mA; V_{DS} = V_{GS}$

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



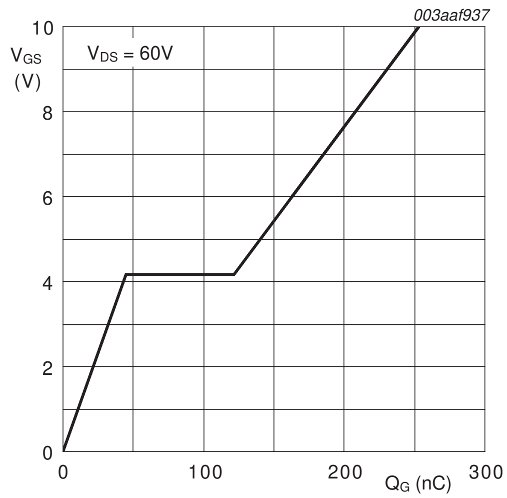
$T_j = 25\,°C$

Fig 11. Drain-source on-state resistance as a function of drain current; typical values



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

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



T_j = 25 °C; I_D = 25 A

Fig 13. Gate-source voltage as a function of gate charge; typical values

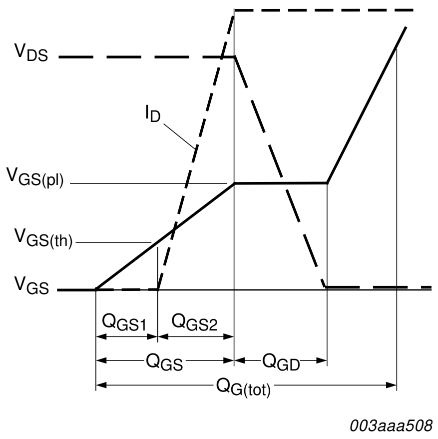
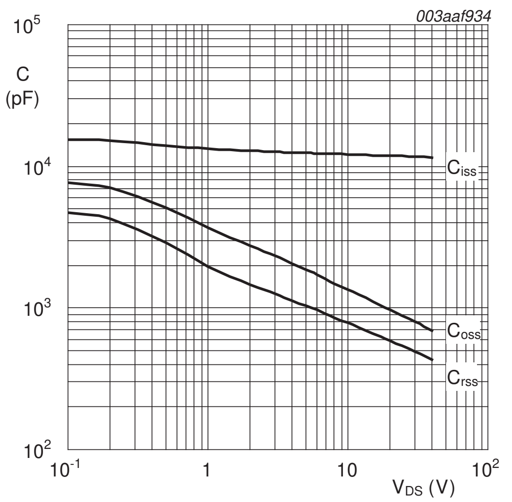
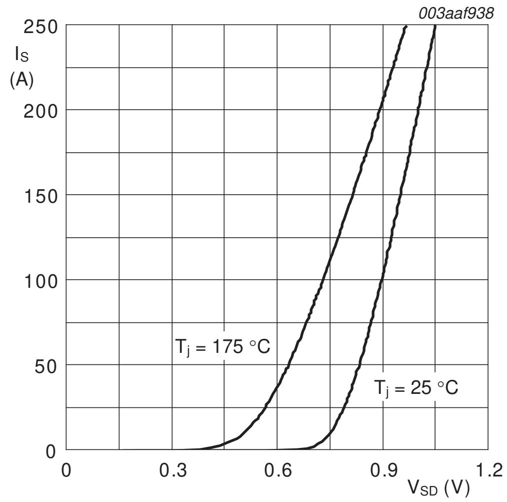


Fig 14. Gate charge waveform definitions



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

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

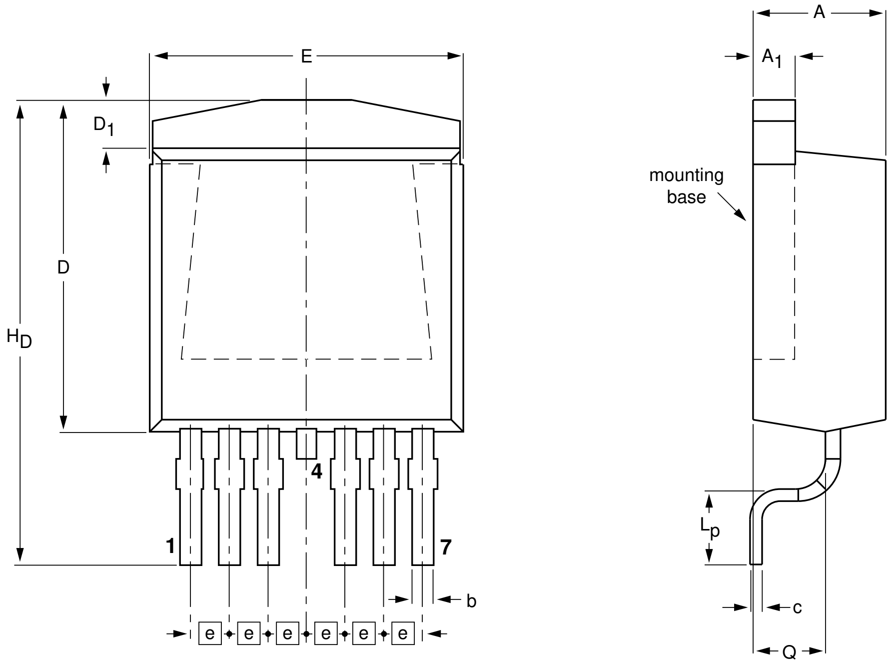


V_{GS} = 0 V

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 (D2PAK); 7 leads (one lead cropped) **SOT427**



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	1.27	2.90 2.10	15.80 14.80	2.60 2.20

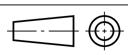
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT427						~~05-03-09~~ 06-03-16

Fig 17. Package outline SOT427 (D2PAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK6C3R3-75C v.3	20120118	Product data sheet	-	BUK6C3R3-75C v.2
Modifications:	• Status changed from preliminary to product.			
BUK6C3R3-75C v.2	20111221	Preliminary data sheet	-	BUK6C3R3-75C v.1

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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11. Contents

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Date of release: 18 January 2012