BUK9C10-65BIT

N-channel TrenchPLUS logic level FET

Rev. 02 — 21 June 2010 **Product data sheet**

1. Product profile

1.1 General description

N-channel enhancement mode field-effect power transistor in SOT427. Device is manufactured using Nexperia High-Performance TrenchPLUS technology, featuring very low on-state resistance, integrated current sensing transistors and over temperature protection diodes.

1.2 Features and benefits

- AEC-Q101 compliant
- Low conduction losses due to low on-state resistance

1.3 Applications

- Lamp switching
- Motor drive systems
- Power distribution
- Solenoid drivers

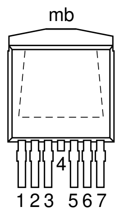
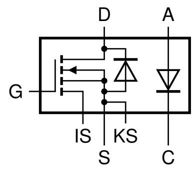
1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
R_{DSon}	drain-source on-state resistance	V_{GS} = 5 V; I_D = 25 A; T_j = 25 °C; see Figure 13; see Figure 12	-	8.5	10	mΩ
I_D/I_{sense}	ratio of drain current to sense current	T_j = 25 °C; V_{GS} = 5 V; see Figure 14	8094	8993	9892	A/A
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C	65	-	-	V

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 SOT427 (D2PAK)	 003aad829
2	IS	current sense		
3	A	anode		
4	D	drain		
5	K	cathode		
6	KS	Kelvin source		
7	S	source		
mb	D	mb		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK9C10-65BIT	D2PAK	plastic single-ended surface-mounted package (D2PAK); 7 leads (one lead cropped)	SOT427

4. Limiting values

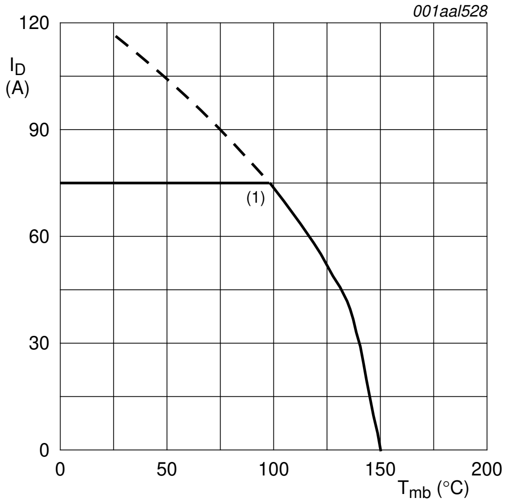
Table 4. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 150 °C		-	-	65	V
V_{DGR}	drain-gate voltage	R_{GS} = 20 kΩ; 25 °C ≤ T_j ≤ 150 °C		-	-	65	V
V_{GS}	gate-source voltage			-15	-	15	V
I_D	drain current	V_{GS} = 5 V; T_{mb} = 25 °C; see Figure 1	[1]	-	-	75	A
		V_{GS} = 5 V; T_{mb} = 100 °C; see Figure 1	[1]	-	-	60	A
I_{DM}	peak drain current	T_{mb} = 25 °C; single pulse; t_p ≤ 10 µs; see Figure 4		-	-	346	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; see Figure 2		-	-	171	W
T_{stg}	storage temperature			-55	-	150	°C
T_j	junction temperature			-55	-	150	°C
$V_{isol(FET-TSD)}$	FET to temperature sense diode isolation voltage			-	-	100	V
Source-drain diode							
I_S	source current	T_{mb} = 25 °C	[1]	-	-	75	A
I_{SM}	peak source current	single pulse; t_p ≤ 10 µs; T_{mb} = 25 °C		-	-	346	A
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 75 A; V_{sup} = 65 V; V_{GS} = 5 V; $T_{j(init)}$ = 25 °C; unclamped; see Figure 3	[2][3]	-	-	0.214	J
Electrostatic discharge							
V_{ESD}	electrostatic discharge voltage	HBM; C = 100 pF; R = 1.5 kΩ; all pins		-	-	0.15	kV
		HBM; C = 100 pF; R = 1.5 kΩ; pin 4 to pin 7		-	-	4	kV

[1] Current is limited by package

[2] Single-pulse avalanche rating limited by maximum junction temperature of 150 °C.

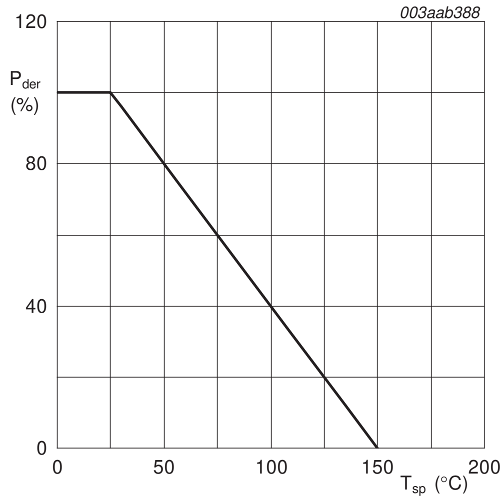
[3] Refer to application note AN10273 for further information.



$$V_{GS} \geq 5\,V$$

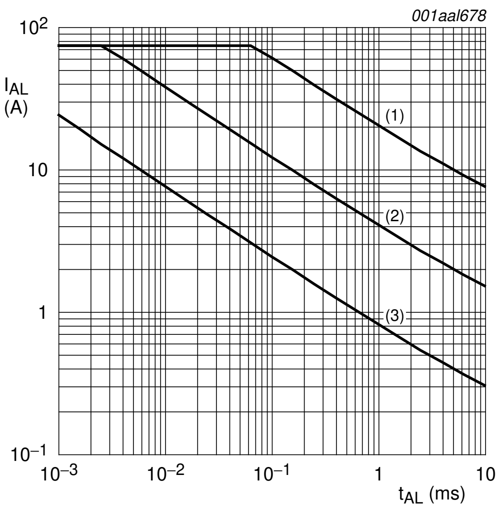
(1)Current is limited by package

Fig 1. Continuous drain current as a function of solder point temperature



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

Fig 2. Normalized total power dissipation as a function of solder point temperature

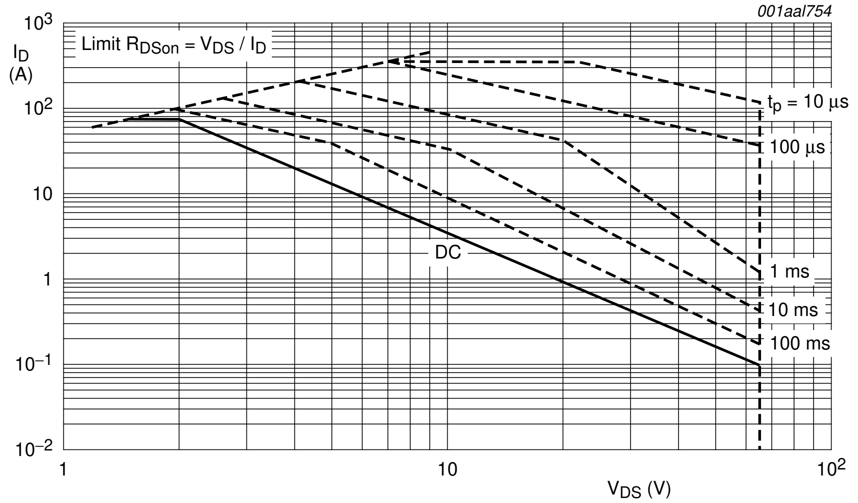


(1) Single-pulse; $T_j = 25\,°C$.

(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

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
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 5	-	-	0.73	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient		-	61	-	K/W

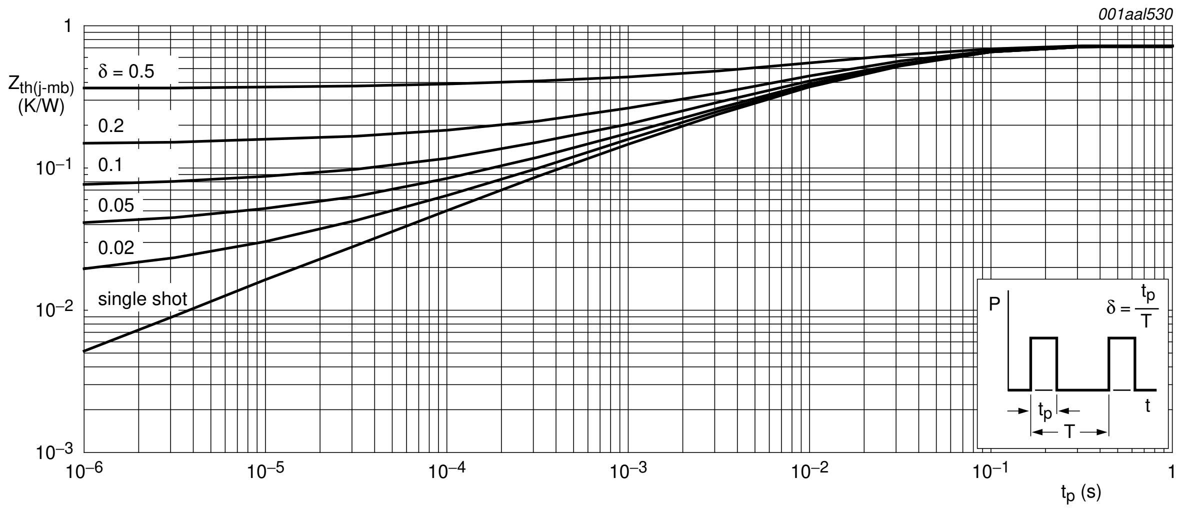


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C	65	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C	59	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 10; see Figure 11	1	1.5	2	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 150 °C; see Figure 10; see Figure 11	0.5	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 10; see Figure 11	-	-	2.3	V
I_{DSS}	drain leakage current	V_{DS} = 52 V; V_{GS} = 0 V; T_j = 25 °C	-	0.02	3	µA
		V_{DS} = 52 V; V_{GS} = 0 V; T_j = 150 °C	-	-	125	µA
I_{GSS}	gate leakage current	V_{DS} = 0 V; V_{GS} = 15 V; T_j = 25 °C	-	2	300	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 4.5 V; I_D = 25 A; T_j = 25 °C; see Figure 12; see Figure 13	-	-	11	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 25 °C; see Figure 13; see Figure 12	-	8.5	10	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 150 °C; see Figure 13; see Figure 12	-	-	20	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 13; see Figure 12	-	-	8.3	mΩ
I_D/I_{sense}	ratio of drain current to sense current	V_{GS} = 5 V; T_j = 25 °C; see Figure 14	8094	8993	9892	A/A
$S_{F(TSD)}$	temperature sense diode temperature coefficient	I_F = 250 µA; 25 °C ≤ T_j ≤ 150 °C; see Figure 15	-5.4	-5.7	-6	mV/K
$V_{F(TSD)}$	temperature sense diode forward voltage	I_F = 250 µA; T_j = 25 °C; see Figure 15	2.855	2.9	2.945	V
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 20 A; V_{DS} = 52 V; V_{GS} = 5 V; see Figure 16	-	59.6	-	nC
Q_{GS}	gate-source charge		-	10.4	-	nC
Q_{GD}	gate-drain charge		-	21.6	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; T_j = 25 °C; see Figure 17	-	4170	-	pF
C_{oss}	output capacitance		-	521	-	pF
C_{rss}	reverse transfer capacitance		-	194	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 30 V; R_L = 1.5 Ω; V_{GS} = 5 V; $R_{G(ext)}$ = 10 Ω	-	40	-	ns
t_r	rise time		-	113	-	ns
$t_{d(off)}$	turn-off delay time		-	193	-	ns
t_f	fall time		-	108	-	ns
L_D	internal drain inductance	from pin to center of die	-	0.9	-	nH

Table 6. Characteristics *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
L_S	internal source inductance	from source lead to source bonding pad	-	2	-	nH
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 10 A; V_{GS} = 0 V; T_j = 25 °C; see Figure 18	-	0.85	1.2	V
t_{rr}	reverse recovery time	I_S = 10 A; dI_S/dt = -100 A/µs; V_{GS} = -10 V; V_{DS} = 30 V	-	51	-	ns
Q_r	recovered charge		-	0.12	-	nC

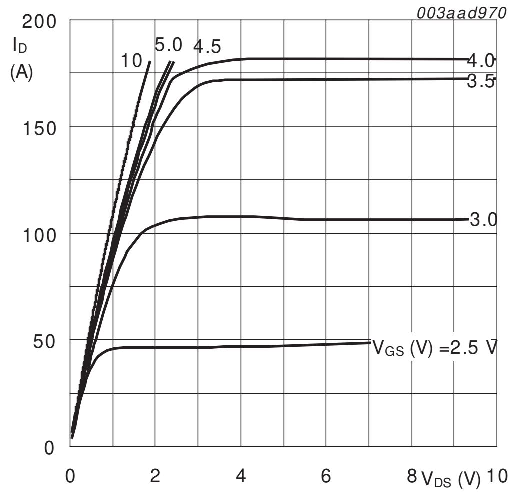


Fig 6. Output characterizations; drain current as a function of drain-source voltage; typical values.

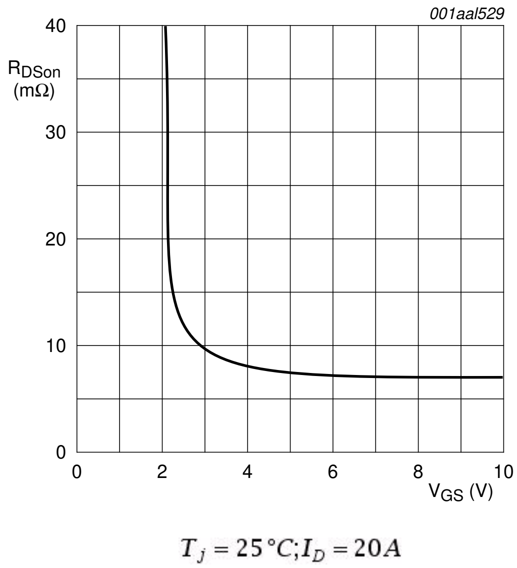
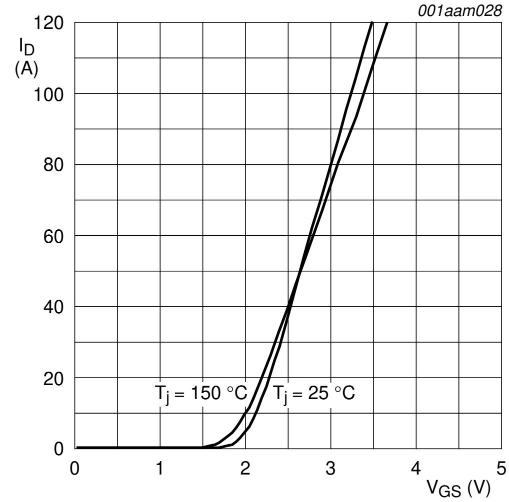
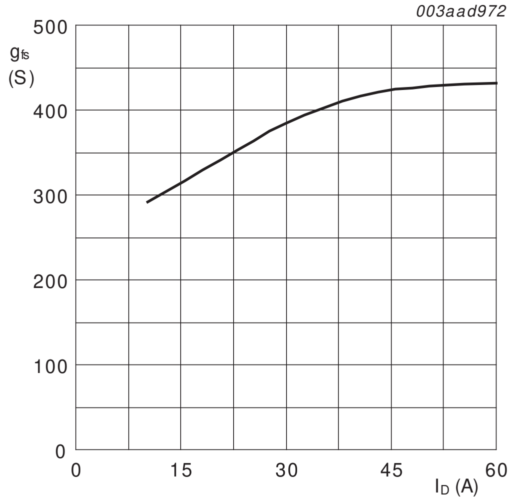


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values



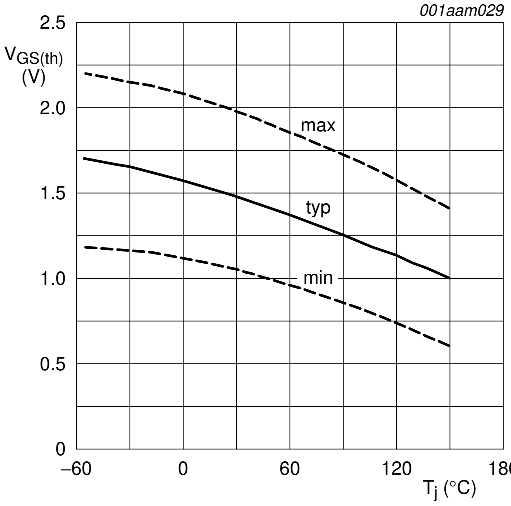
$V_{DS} = 25V$

Fig 8. Transfer Characteristics; drain current as a function of gate-source voltage; typical values.



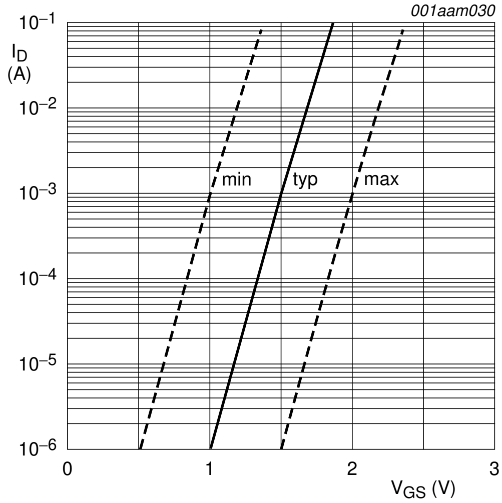
$T_j = 25\,°C; V_{DS} = 25V$

Fig 9. Forward transconductance as a function of drain current; typical values.



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

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



$T_j = 25\,°C; V_{DS} = V_{GS}$

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

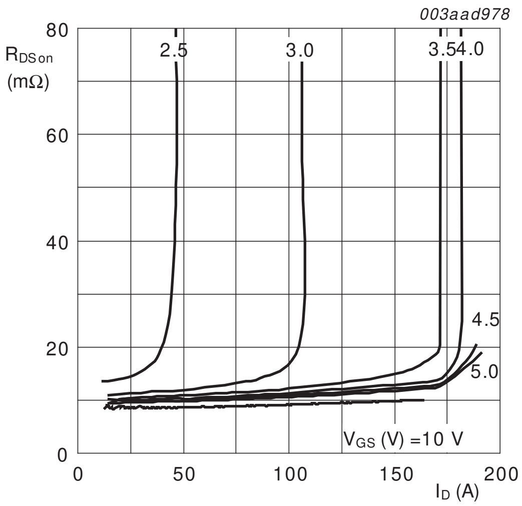
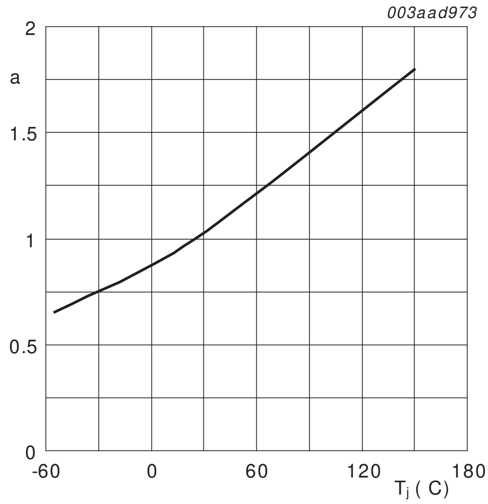
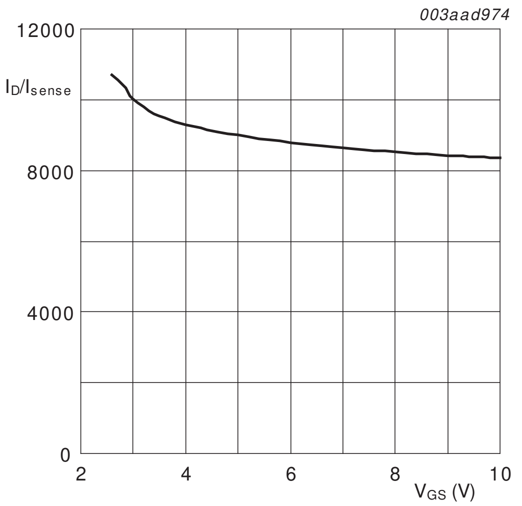


Fig 12. Drain-source on-state resistance as a function of drain current; typical values



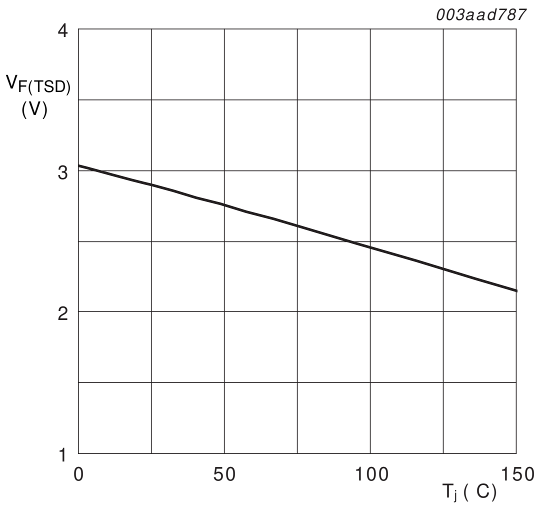
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

Fig 13. Normalized drain-source on-state resistance factor as a function of junction temperature



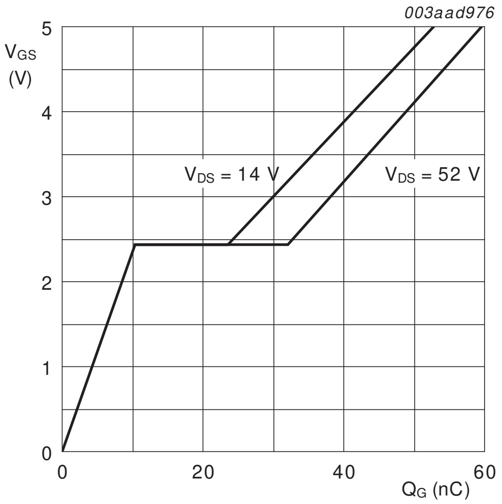
$$T_j = 25\,°C; I_D = 25A$$

Fig 14. Ratio of drain current to sense current as a function of gate-source voltage; typical values



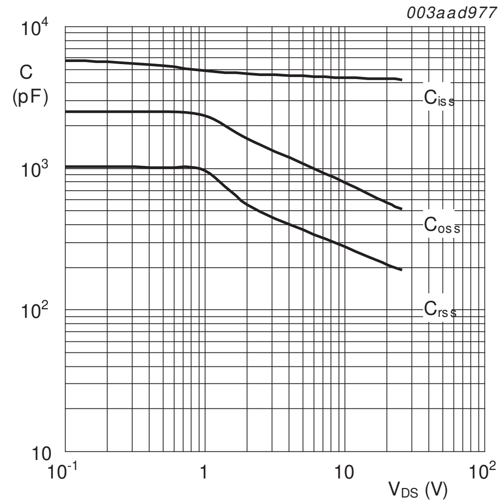
$$I_F = 250\mu A$$

Fig 15. Temperature sense diode forward voltage as a function of junction temperature



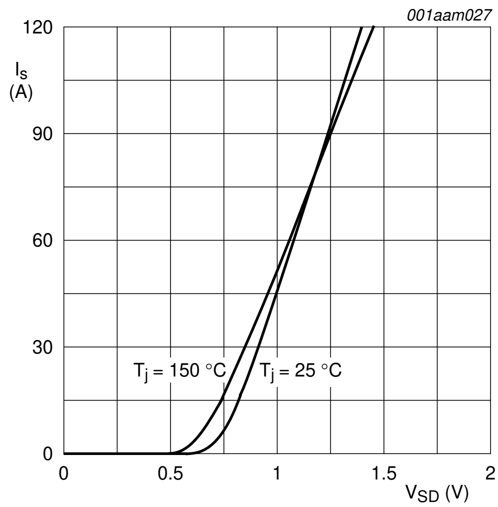
T_j = 25°C; I_D = 10A

Fig 16. Gate-source voltage as a function of turn-on gate charge; typical values



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

Fig 17. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

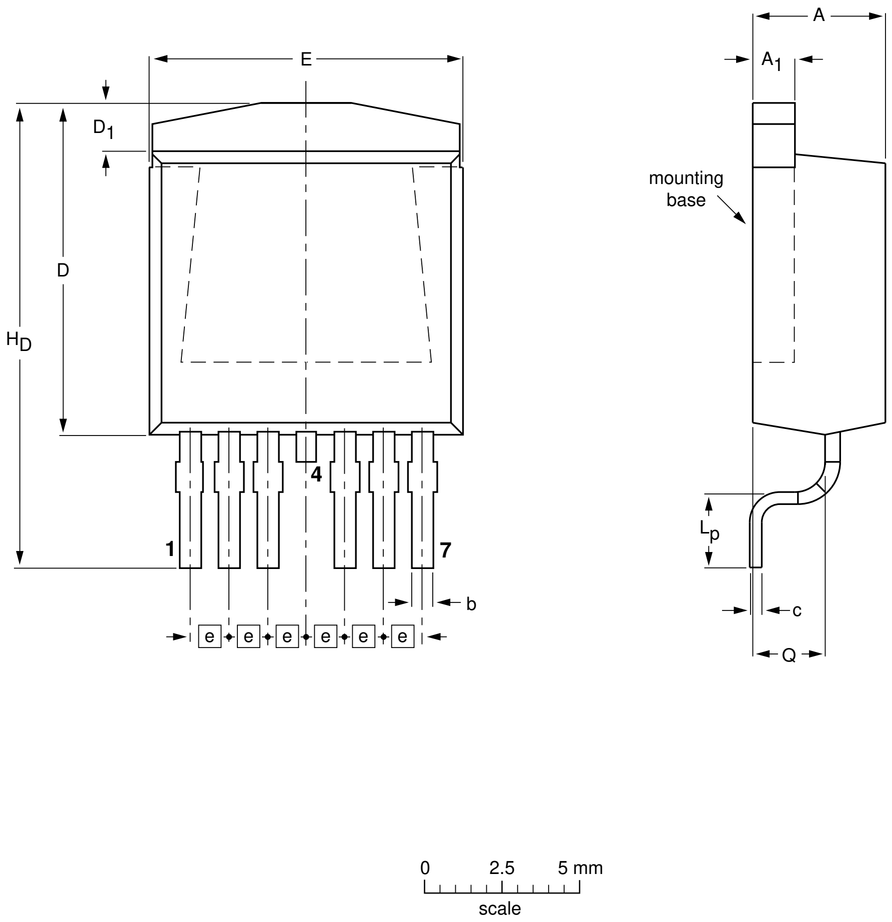


$V_{GS} = 0V$

Fig 18. 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 19. Package outline SOT427 (D2PAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9C10-65BIT v.2	20100621	Product data sheet	-	BUK9C10-65BIT v.1
Modifications:	• Status changed from preliminary to product.			
BUK9C10-65BIT v.1	20100531	Preliminary 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.nexperia.com.

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11. Contents

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Date of release: 21 June 2010