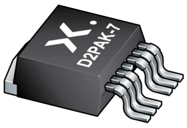


BUK9C10-55BIT

N-channel TrenchPLUS logic level FET

25 August 2014 Product data sheet

1. General description

Logic level N-channel MOSFET in a D2PAK-7 package using TrenchPLUS MOSFET technology. The device includes TrenchPLUS current sensing and integrated diodes for temperature sensing. This product has been designed and qualified to AEC Q101 standard for use in high performance automotive applications.

2. Features and benefits

- AEC-Q101 Compliant
- Enables temperature monitoring due to integrated temperature sensor
- Enables current sense measurement due to integrated current senseFET
- Suitable for thermally demanding environments due to 175 °C rating

3. Applications

- 12 V Automotive systems
- Motors, lamps and solenoid control
- Powertrain, chassis and body applications

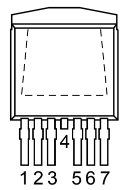
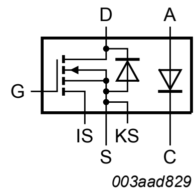
4. Quick reference data

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 = 10 A; T_j = 25 °C; Fig. 16; Fig. 17		-	8.2	10	mΩ
		V_{GS} = 10 V; I_D = 10 A; T_j = 25 °C; Fig. 16; Fig. 17		-	7.5	9	mΩ
I_D/I_{sense}	ratio of drain current to sense current	-55 °C < T_j < 175 °C; V_{GS} = 5 V; Fig. 18		10000	11000	12000	A/A
$S_{F(TSD)}$	temperature sense diode temperature coefficient	I_F = 250 µA; -55 °C ≤ T_j ≤ 175 °C; Fig. 19		-5.7	-6	-6.3	mV/K
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 25 mA; V_{GS} = 0 V; T_j = 25 °C		55	-	-	V
$V_{F(TSD)}$	temperature sense diode forward voltage	I_F = 250 µA; T_j = 25 °C; Fig. 19		2.855	2.9	2.945	V

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 **D2PAK-7 (SOT427)**	
2	IS	current sense		
3	A	anode		
4	D[1]	drain		
5	C	cathode		
6	KS	Kelvin source		
7	S	source		
mb	D	mounting base		

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

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK9C10-55BIT	D2PAK-7	Plastic single-ended surface-mounted package (D2PAK-7); 7 leads (one lead cropped)	SOT427

7. Marking

Table 4. Marking codes

Type number	Marking code
BUK9C10-55BIT	28083 576

8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 175 °C		-	55	V
V_{DGR}	drain-gate voltage	R_{GS} = 20 kΩ; 25 °C ≤ T_j ≤ 175 °C		-	55	V
V_{GS}	gate-source voltage			-15	15	V
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	194	W
I_D	drain current	V_{GS} = 5 V; T_{mb} = 25 °C; Fig. 2; Fig. 3	[1]	-	75	A
		V_{GS} = 5 V; T_{mb} = 100 °C; Fig. 2		-	65	A

Symbol	Parameter	Conditions		Min	Max	Unit
I_{DM}	peak drain current	T_{mb} = 25 °C; pulsed; t_p ≤ 10 µs; Fig. 3		-	401	A
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C
$V_{isol(FET-TSD)}$	FET to temperature sense diode isolation voltage			-	100	V
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 75 A; V_{sup} ≤ 55 V; V_{GS} = 5 V; $T_{j(init)}$ = 25 °C; unclamped; Fig. 4	[2][3][4]	-	215	mJ
Source-drain diode						
I_S	source current	T_{mb} = 25 °C	[1]	-	75	A
I_{SM}	peak source current	pulsed; t_p ≤ 10 µs; T_{mb} = 25 °C		-	401	A
Electrostatic discharge						
V_{ESD}	electrostatic discharge voltage	HBM; C = 100 pF; R = 1.5 kΩ; all pins		-	0.1	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 175 °C.
[3] Refer to application note AN10273 for further information.
[4] Repetitive rating defined in avalanche rating figure.

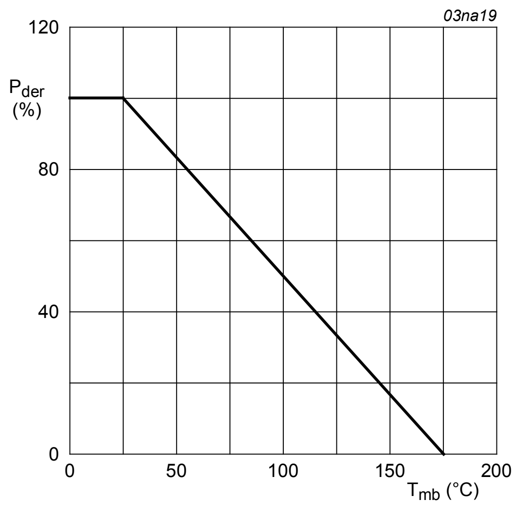
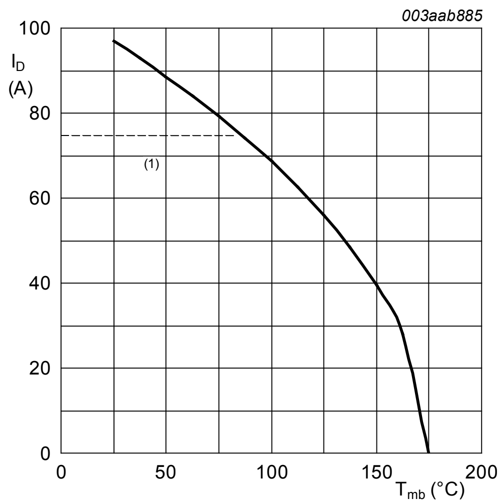


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

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



(1) Capped at 75A due to package

Fig. 2. Continuous drain current as a function of mounting base temperature

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

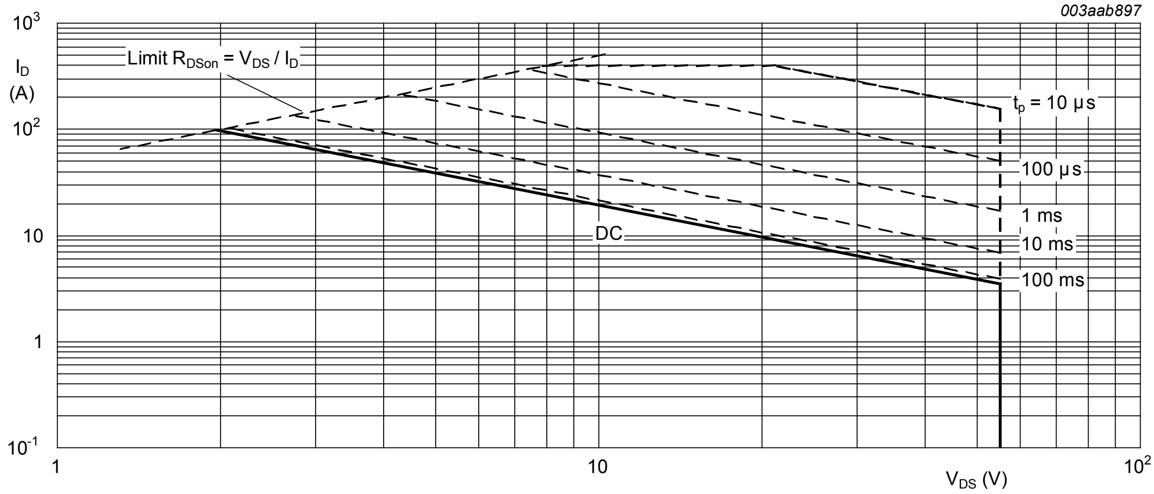


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25°C$; I_{DM} is a single pulse

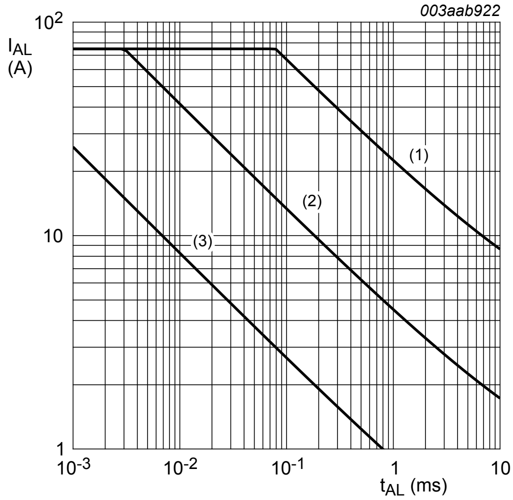


Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

(1) $T_{j\ (init)} = 25°C$; (2) $T_{j\ (init)} = 125°C$; (3) Repetitive Avalanche

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 5		-	0.46	0.78	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	mounted on printed circuit board; Fig. 6; Fig. 7; Fig. 8; Fig. 9		-	61.4	-	K/W

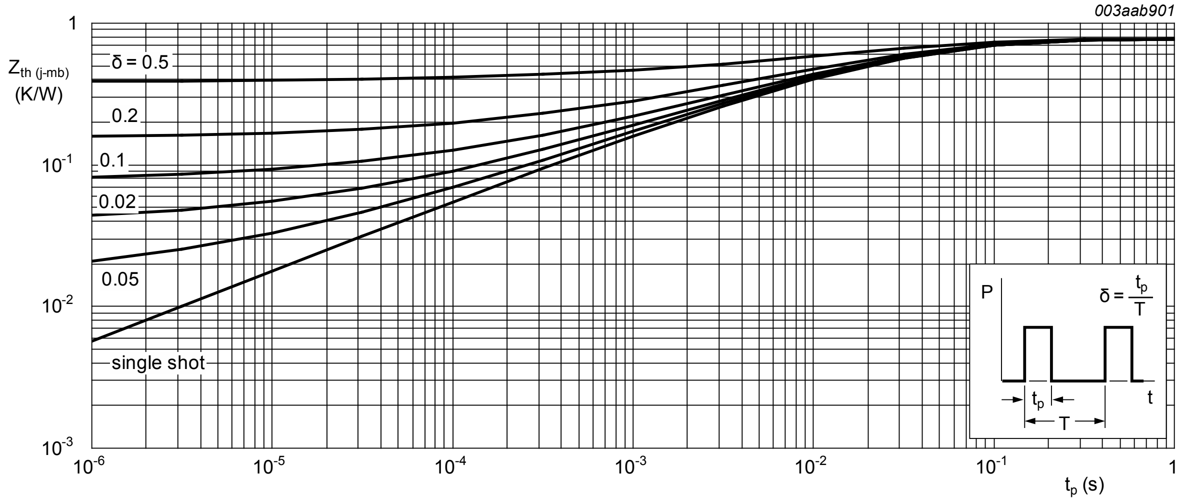
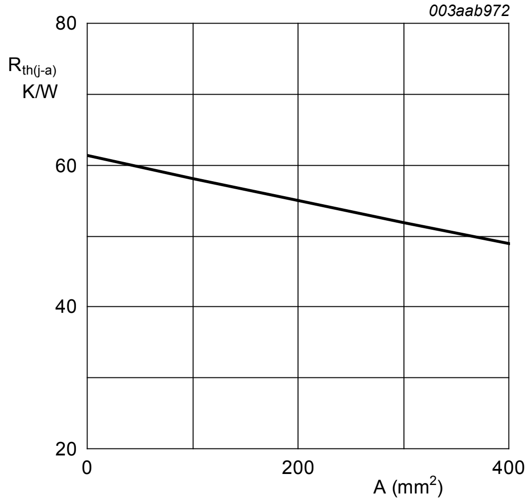


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration



Zero airflow

Fig. 6. Thermal resistance from junction to ambient as a function of printed-circuit board (PCB) heat sink area

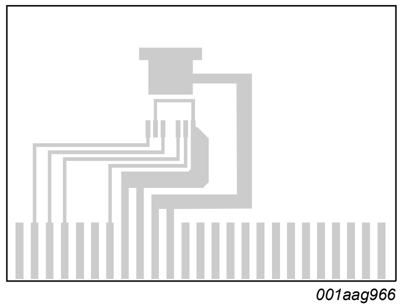


Fig. 7. PCB used for thermal tests; zero heat sink area

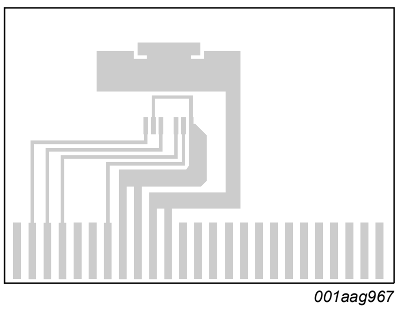


Fig. 8. PCB used for thermal tests; heat sink area 200 mm^2

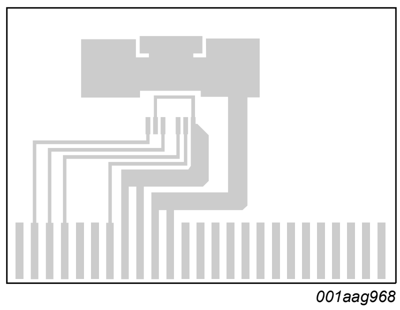


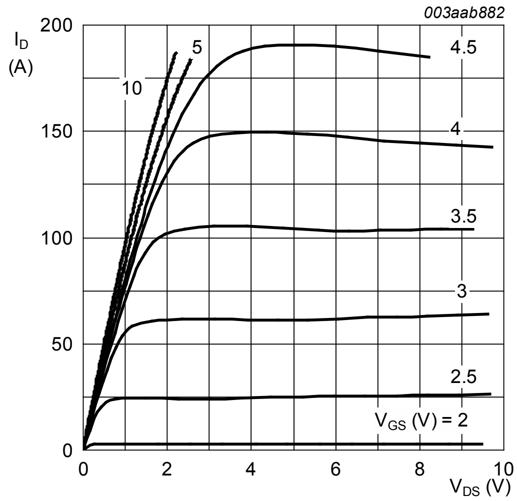
Fig. 9. PCB used for thermal tests; heat sink area 400 mm^2

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 25 mA; V_{GS} = 0 V; T_j = -55 °C		50	-	-	V
		I_D = 25 mA; V_{GS} = 0 V; T_j = 25 °C		55	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C		47	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; Fig. 14; Fig. 15		1.1	1.5	2	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; Fig. 14		0.5	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; Fig. 14		-	-	2.3	V
I_{DSS}	drain leakage current	V_{DS} = 40 V; V_{GS} = 0 V; T_j = 25 °C		-	0.02	1	µA
		V_{DS} = 40 V; V_{GS} = 0 V; T_j = 175 °C		-	-	125	µA
I_{GSS}	gate leakage current	V_{DS} = 0 V; V_{GS} = -15 V; T_j = 25 °C		-	2	100	nA
		V_{DS} = 0 V; V_{GS} = 15 V; T_j = 25 °C		-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 4.5 V; I_D = 10 A; T_j = 25 °C; Fig. 16; Fig. 17		-	8.4	15	mΩ
		V_{GS} = 5 V; I_D = 10 A; T_j = 25 °C; Fig. 16; Fig. 17		-	8.2	10	mΩ
		V_{GS} = 5 V; I_D = 10 A; T_j = 175 °C; Fig. 16; Fig. 17		-	-	20	mΩ
		V_{GS} = 10 V; I_D = 10 A; T_j = 25 °C; Fig. 16; Fig. 17		-	7.5	9	mΩ
I_D/I_{sense}	ratio of drain current to sense current	V_{GS} = 5 V; -55 °C < T_j < 175 °C; Fig. 18		10000	11000	12000	A/A
$S_{F(TSD)}$	temperature sense diode temperature coefficient	I_F = 250 µA; -55 °C ≤ T_j ≤ 175 °C; Fig. 19		-5.7	-6	-6.3	mV/K
$V_{F(TSD)}$	temperature sense diode forward voltage	I_F = 250 µA; T_j = 25 °C; Fig. 19		2.855	2.9	2.945	V
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 10 A; V_{DS} = 44 V; V_{GS} = 5 V; Fig. 20		-	51	-	nC
Q_{GS}	gate-source charge			-	8	-	nC
Q_{GD}	gate-drain charge			-	17	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; T_j = 25 °C; Fig. 21		-	3500	4667	pF
C_{oss}	output capacitance			-	526.7	635	pF

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C_{rss}	reverse transfer capacitance			-	246.2	348	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 30 V; R_L = 3 Ω; V_{GS} = 5 V; $R_{G(ext)}$ = 10 Ω		-	80	-	ns
t_r	rise time			-	32	-	ns
$t_{d(off)}$	turn-off delay time			-	100	-	ns
t_f	fall time			-	170	-	ns
L_D	internal drain inductance	from pin to center of die		-	0.85	-	nH
L_S	internal source inductance	from source lead to source bonding pad		-	1.9	-	nH
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 10 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 22		-	0.85	1.2	V
t_{rr}	reverse recovery time	I_S = 5 A; dI_S/dt = -100 A/µs; V_{GS} = -10 V; V_{DS} = 30 V		-	65.5	-	ns
Q_r	recovered charge			-	122	-	nC



T_j = 25 °C; t_p = 300 µs

Fig. 10. Output characteristics; drain current as a function of drain-source voltage; typical values

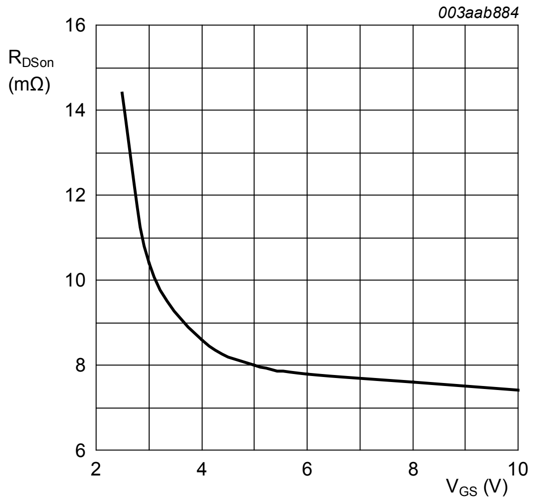
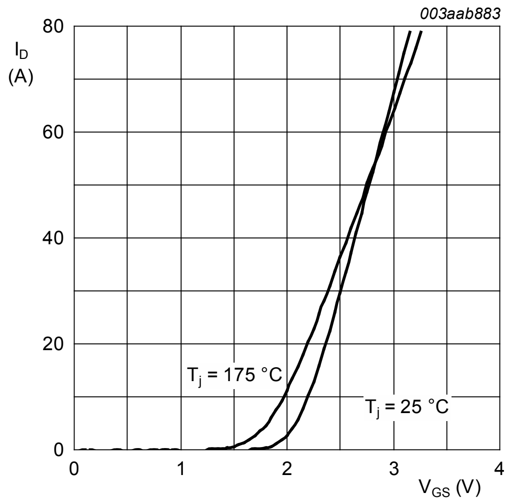


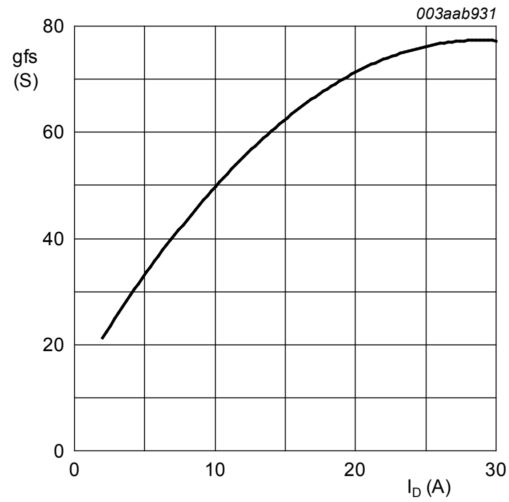
Fig. 11. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25°C;\ I_D = 10A$



V_{DS} = 25 V

Fig. 12. Transfer characteristics; drain current as a function of gate-source voltage; typical values



T_j = 25 °C; V_{DS} = 25 V

Fig. 13. Forward transconductance as a function of drain current; typical values

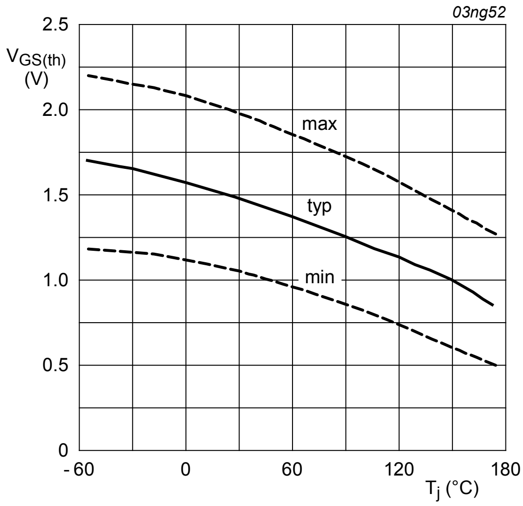


Fig. 14. Gate-source threshold voltage as a function of junction temperature

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

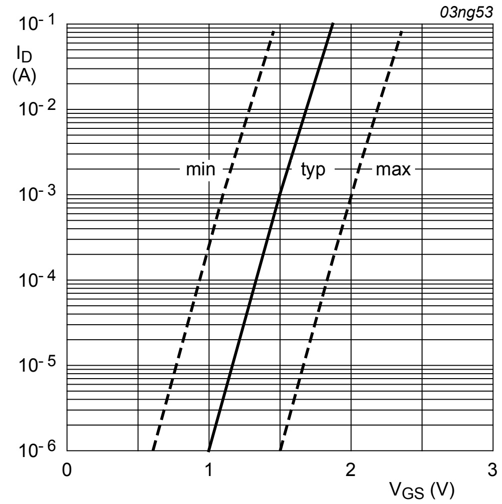
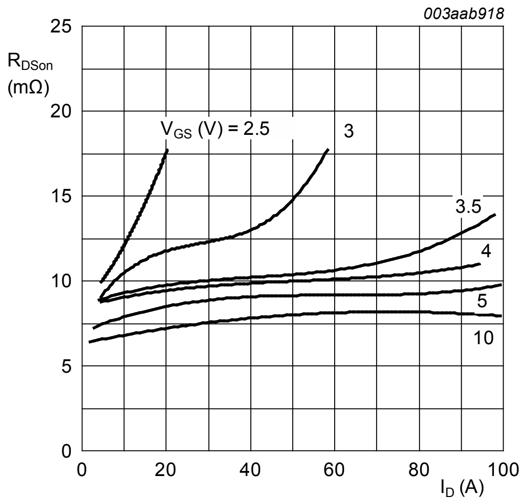


Fig. 15. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25\,°C; V_{DS} = V_{GS}$



T_j = 25 °C; t_p = 300 µs

Fig. 16. Drain-source on-state resistance as a function of drain current; typical values

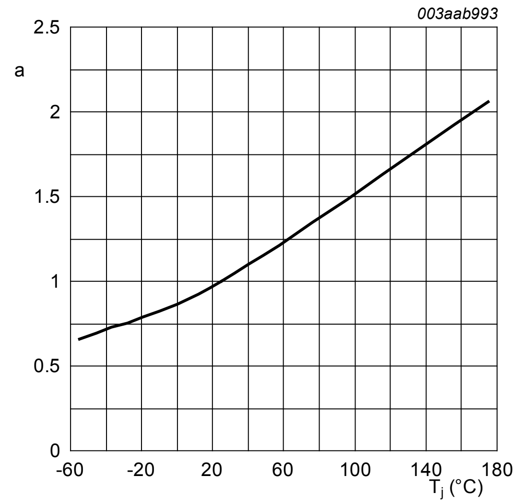
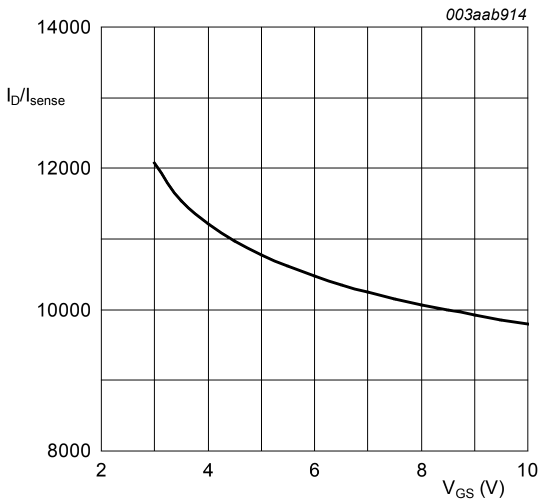


Fig. 17. Normalized drain-source on-state resistance factor as a function of junction temperature

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



T_j = 25 °C; I_D = 10 A

Fig. 18. Ratio of drain current to sense current as a function of gate-source voltage; typical values

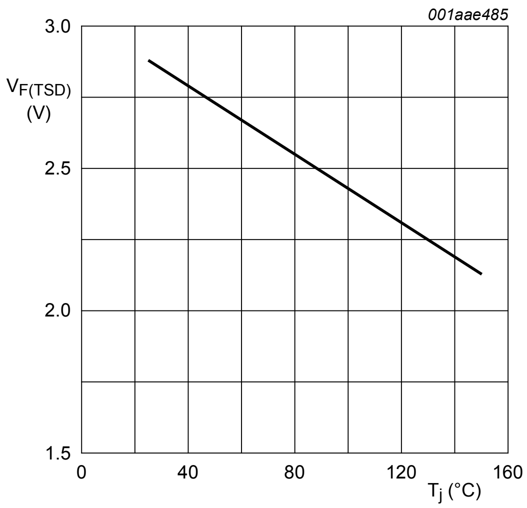
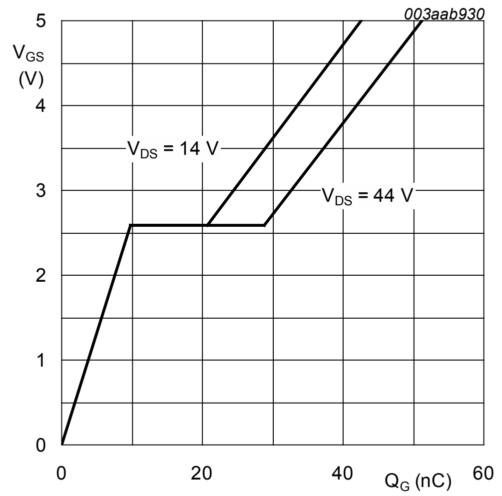


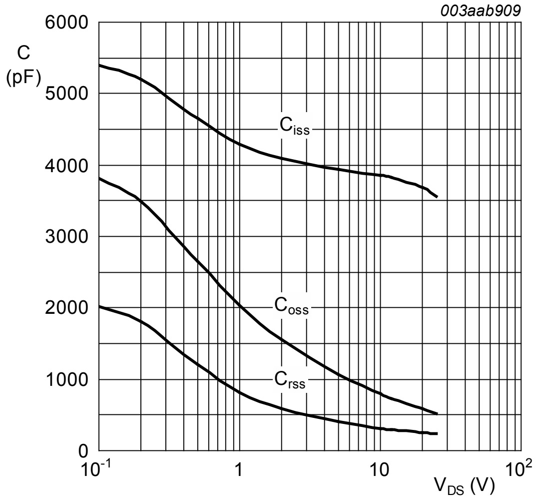
Fig. 19. Temperature sense diode forward voltage as a function of junction temperature; typical values

$$I_F = 250 \mu A$$



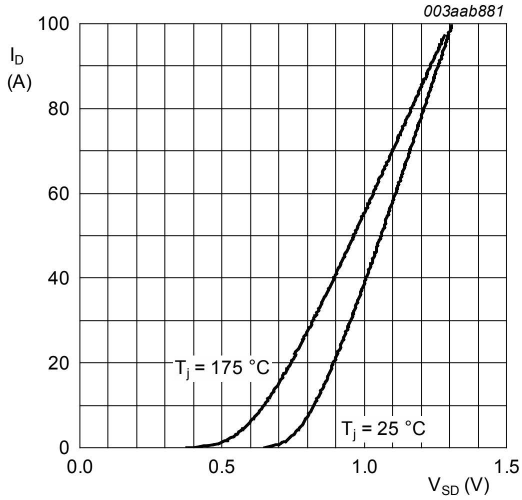
T_j = 25 °C; I_D = 10 A

Fig. 20. Gate-source voltage as a function of gate charge; typical values



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

Fig. 21. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

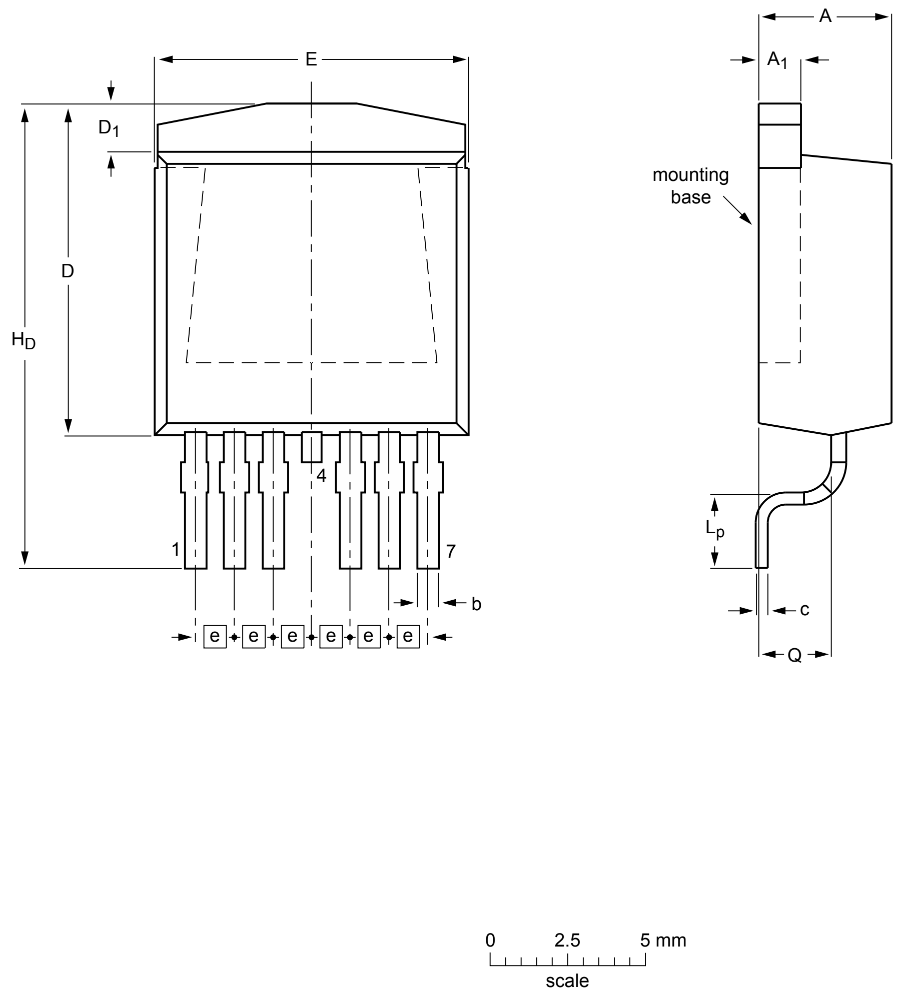


V_{GS} = 0 V

Fig. 22. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values

11. Package outline

Plastic single-ended surface-mounted package (D2PAK-7); 7 leads (one lead cropped) **SOT427**



Dimensions (mm are the original dimensions)

Unit(1)		A	A_1	b	c	D	D_1	E	e	L_p	H_D	Q
mm	max	4.5	1.40	0.85	0.64	11	1.6	10.3		2.90	15.8	2.6
	nom								1.27			
	min	4.1	1.27	0.60	0.46		1.2	9.7		2.10	14.8	2.2

sot427_po

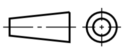
Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT427						~~06-03-16~~ 12-10-16

Fig. 23. Package outline D2PAK-7 (SOT427)

12. Legal information

12.1 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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Date of release: 25 August 2014