

BUK7613-100E

N-channel TrenchMOS standard level FET

5 October 2012

Product data sheet

1. Product profile

1.1 General description

Standard level N-channel MOSFET in a SOT404 package using TrenchMOS technology. This product has been designed and qualified to AEC Q101 standard for use in high performance automotive applications.

1.2 Features and benefits

- AEC Q101 compliant
- Repetitive avalanche rated
- Suitable for thermally demanding environments due to 175 °C rating
- True standard level gate with VGS(th) rating of greater than 1V at 175 °C

1.3 Applications

- 12V, 24V and 48V Automotive systems
- Motors, lamps and solenoid control
- 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	Тур	Max	Unit
V _{DS}	drain-source voltage	T _j ≥ 25 °C; T _j ≤ 175 °C		-	-	100	V
I _D	drain current	V _{GS} = 10 V; T _{mb} = 25 °C; <u>Fig. 1</u>		-	-	72	Α
P _{tot}	total power dissipation	T _{mb} = 25 °C; <u>Fig. 2</u>		-	-	182	W
Static characte	eristics			,			
R _{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}; T_j = 25 ^{\circ}\text{C};$ Fig. 11		-	10.2	13	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}; V_{DS} = 80 \text{ V};$ $T_j = 25 \text{ °C}; Fig. 13; Fig. 14$		-	25.4	35.6	nC



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2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	mb	D I
2	D	drain		
3	S	source		G
mb	D	mounting base; connected to drain	D2PAK (SOT404)	mbb076 S

3. Ordering information

Table 3. Ordering information

Type number	Package				
	Name	Description	Version		
BUK7613-100E	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404		

4. Marking

Table 4. Marking codes

Type number	Marking code
BUK7613-100E	BUK7613-100E

5. Limiting values

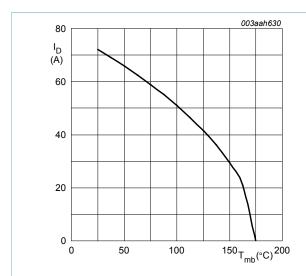
Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	T _j ≥ 25 °C; T _j ≤ 175 °C	-	100	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20 \text{ k}\Omega$	-	100	V
V_{GS}	gate-source voltage	T _j ≤ 175 °C; DC	-20	20	V
I _D	drain current	T _{mb} = 25 °C; V _{GS} = 10 V; <u>Fig. 1</u>	-	72	Α
		T _{mb} = 100 °C; V _{GS} = 10 V; <u>Fig. 1</u>	-	51	Α
I _{DM}	peak drain current	T_{mb} = 25 °C; pulsed; $t_p \le 10 \mu s$; Fig. 4	-	288	Α
P _{tot}	total power dissipation	T _{mb} = 25 °C; <u>Fig. 2</u>	-	182	W
T _{stg}	storage temperature		-55	175	°C
Tj	junction temperature		-55	175	°C
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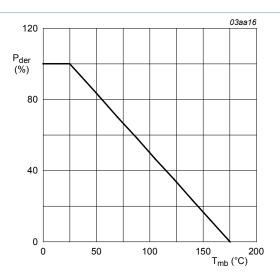
Symbol	Parameter	Conditions		Min	Max	Unit
Source-dra	in diode					
Is	source current	T _{mb} = 25 °C		-	72	Α
I _{SM}	peak source current	pulsed; $t_p \le 10 \ \mu s$; $T_{mb} = 25 \ ^{\circ}C$		-	288	Α
Avalanche	ruggedness					
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I_D = 72 A; V_{sup} ≤ 100 V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped; Fig. 3	[1][2]	-	121	mJ

- Single-pulse avalanche rating limited by maximum junction temperature of 175 $^{\circ}\text{C}.$ Refer to application note AN10273 for further information.



Continuous drain current as a function of mounting base temperature

$$V_{GS} \ge 10V$$



Normalized total power dissipation as a function of mounting base temperature

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

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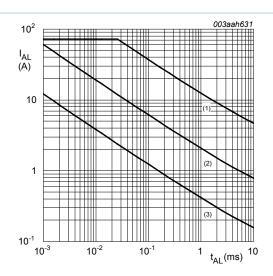
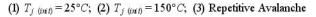


Fig. 3. Avalanche rating; avalanche current as a function of avalanche time



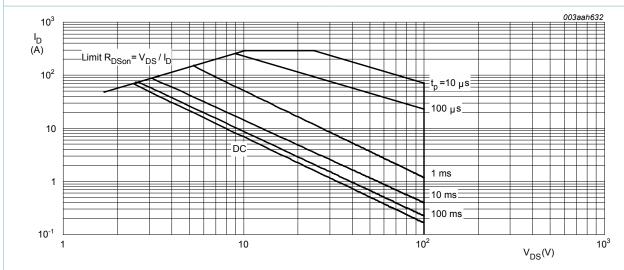


Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

 $T_{mb} = 25^{\circ}C$; I_{DM} is a single pulse

6. Thermal characteristics

Table 6. Thermal characteristics

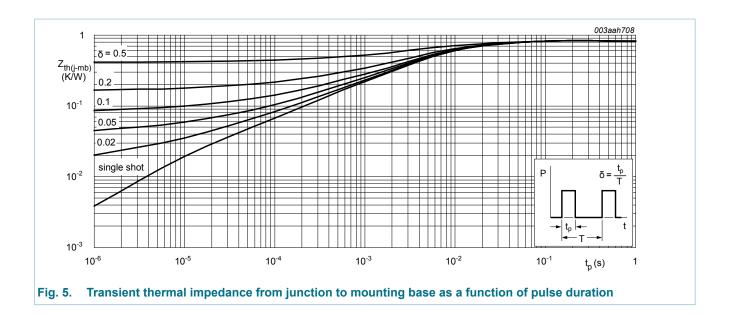
Symbol	Parameter	Conditions	Min	Тур	Max	Unit
R _{th(j-mb)}	thermal resistance from junction to mounting base	Fig. 5	-	-	0.82	K/W
R _{th(j-a)}	thermal resistance from junction to ambient	minimum footprint ; mounted on a printed-circuit board	-	50	-	K/W

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7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Static chara	acteristics					
V _{(BR)DSS}	drain-source	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 ^{\circ}C$	100	-		V
	breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 ^{\circ}C$	90	-	-	V
V _{GS(th)}	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ °C};$ Fig. 9; Fig. 10	2.4	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ °C};$ Fig. 9	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ °C};$ Fig. 9	-	-	4.5	V
I _{DSS} drain leakage	drain leakage current	V _{DS} = 100 V; V _{GS} = 0 V; T _j = 25 °C	-	0.06	1	μΑ
		V _{DS} = 100 V; V _{GS} = 0 V; T _j = 175 °C	-	-	500	μΑ
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} = 20 A; T_{j} = 25 °C; Fig. 11	-	10.2	13	mΩ
		V _{GS} = 10 V; I _D = 20 A; T _j = 175 °C; Fig. 11; Fig. 12	-	-	35.1	mΩ
R _G	gate resistance	f = 1 MHz	0.48	0.96	1.92	Ω
Dynamic ch	naracteristics		'			,
Q _{G(tot)}	total gate charge	I _D = 20 A; V _{DS} = 80 V; V _{GS} = 10 V;	-	69.4	97.2	nC
Q _{GS}	gate-source charge	T _j = 25 °C; <u>Fig. 13</u> ; <u>Fig. 14</u>	-	15.5	21.7	nC

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Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Q_{GD}	gate-drain charge		-	25.4	35.6	nC
C _{iss}	input capacitance	V _{GS} = 0 V; V _{DS} = 20 V; f = 1 MHz; T _j = 25 °C; <u>Fig. 15</u>	-	3400	4533	pF
C _{oss}	output capacitance	V _{GS} = 0 V; V _{DS} = 25 V; f = 1 MHz;	-	327	392	pF
C _{rss}	reverse transfer capacitance	T _j = 25 °C; <u>Fig. 15</u>	-	225	308	pF
t _{d(on)}	turn-on delay time	V_{DS} = 80 V; R_{L} = 4 Ω ; V_{GS} = 10 V;	-	17.5	26.3	ns
t _r	rise time	$R_{G(ext)} = 5 \Omega$	-	34	51	ns
$t_{d(off)}$	turn-off delay time		-	44.8	67.2	ns
t _f	fall time		-	34.1	51.2	ns
L _D	internal drain inductance	from upper edge of mounting base to centre of die	-	2.5	-	nH
L _S	internal source inductance	measured from source lead to source bond pad ; $T_j = 25 ^{\circ}\text{C}$	-	7.5	-	nH
Source-dra	in diode		ı			
V _{SD}	source-drain voltage	$I_S = 20 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 ^{\circ}\text{C}; Fig. 16$	-	0.83	1.2	V
t _{rr}	reverse recovery time	$I_S = 20 \text{ A}; dI_S/dt = -100 \text{ A/}\mu\text{s}; V_{GS} = 0 \text{ V};$	-	48.8	63.4	ns
Qr	recovered charge	V _{DS} = 25 V	-	106	137.8	nC

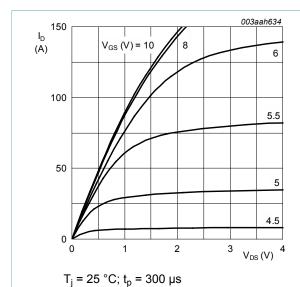


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

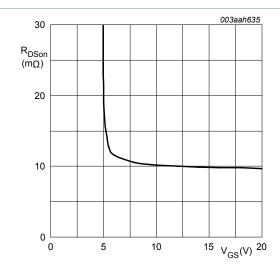


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$$T_j = 25$$
°C; $I_D = 20$ A

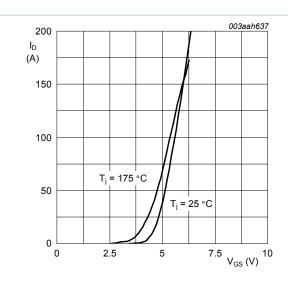


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values



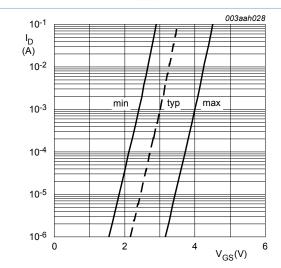


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

$$T_j = 25^{\circ}C; \ V_{DS} = 5V$$

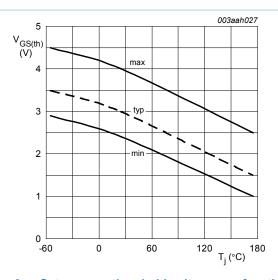
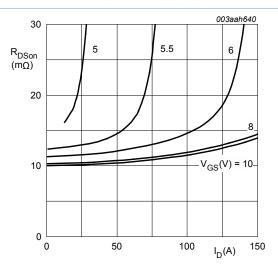


Fig. 9. Gate-source threshold voltage as a function of junction temperature

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



 $T_i = 25 \, ^{\circ}C; t_p = 300 \, \mu s$

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

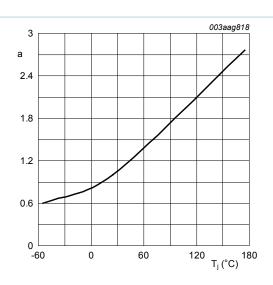


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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

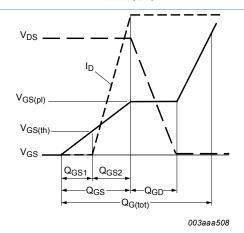


Fig. 14. Gate charge waveform definitions

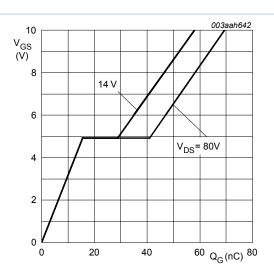


Fig. 13. Gate-source voltage as a function of gate charge; typical values

$$T_j = 25^{\circ}C; I_D = 20A$$

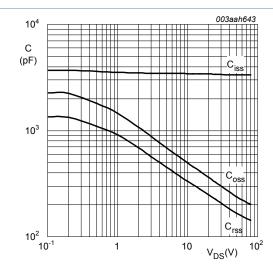


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

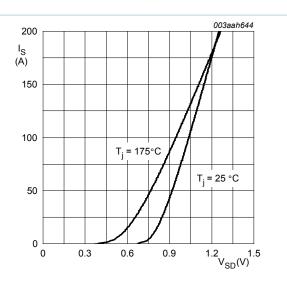


Fig. 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$$V_{GS} = 0V$$

8. Package outline

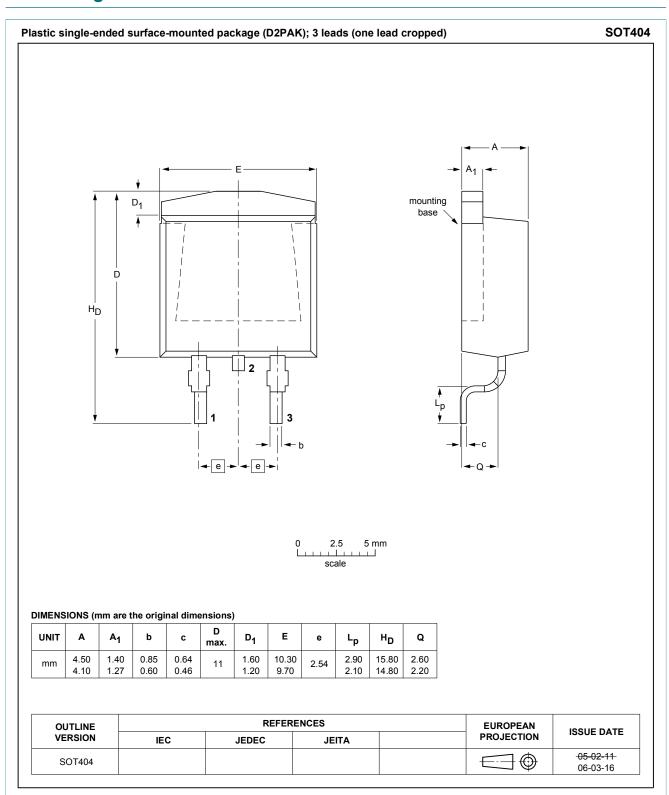


Fig. 17. Package outline D2PAK (SOT404)

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Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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