

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

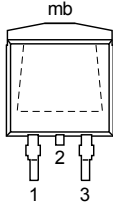
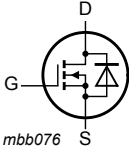
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	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; Fig. 1	-	-	72	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 2	-	-	182	W
Static characteristics						
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
Dynamic characteristics						
Q _{GD}	gate-drain charge	V _{GS} = 10 V; I _D = 20 A; V _{DS} = 80 V; T _j = 25 °C; Fig. 13 ; Fig. 14	-	25.4	35.6	nC



2. Pinning information

Table 2. Pinning information

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

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	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	100	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	100	V
V_{GS}	gate-source voltage	$T_j \leq 175\text{ °C}$; DC	-20	20	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; Fig. 1	-	72	A
		$T_{mb} = 100\text{ °C}$; $V_{GS} = 10\text{ V}$; Fig. 1	-	51	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; Fig. 4	-	288	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 2	-	182	W
T_{stg}	storage temperature		-55	175	°C
T_j	junction temperature		-55	175	°C

Symbol	Parameter	Conditions	Min	Max	Unit
Source-drain diode					
I_S	source current	$T_{mb} = 25\text{ }^\circ\text{C}$	-	72	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ }^\circ\text{C}$	-	288	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 72\text{ A}$; $V_{sup} \leq 100\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$; unclamped; Fig. 3	[1][2]	-	121 mJ

- [1] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
- [2] Refer to application note AN10273 for further information.

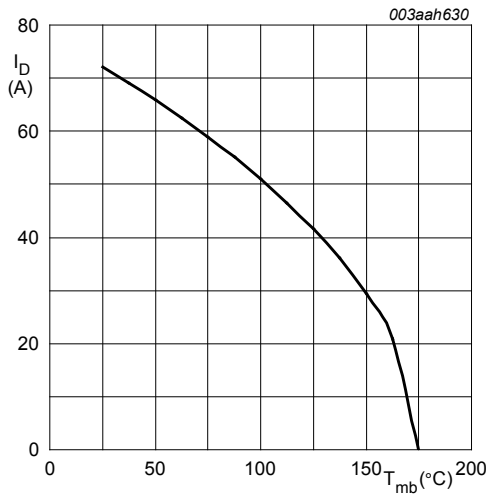


Fig. 1. Continuous drain current as a function of mounting base temperature

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

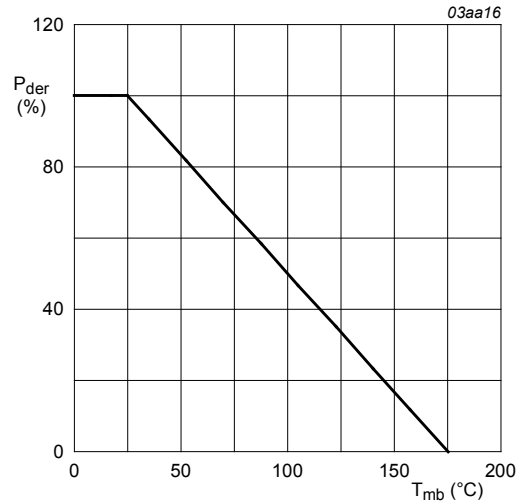


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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

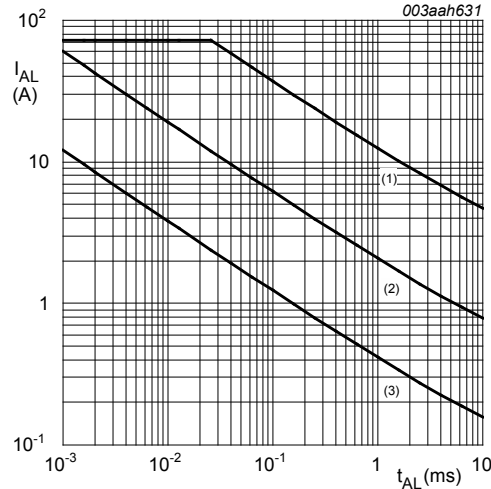


Fig. 3. Avalanche rating; avalanche current as a function of avalanche time

(1) $T_{j (init)} = 25^{\circ}C$; (2) $T_{j (init)} = 150^{\circ}C$; (3) Repetitive Avalanche

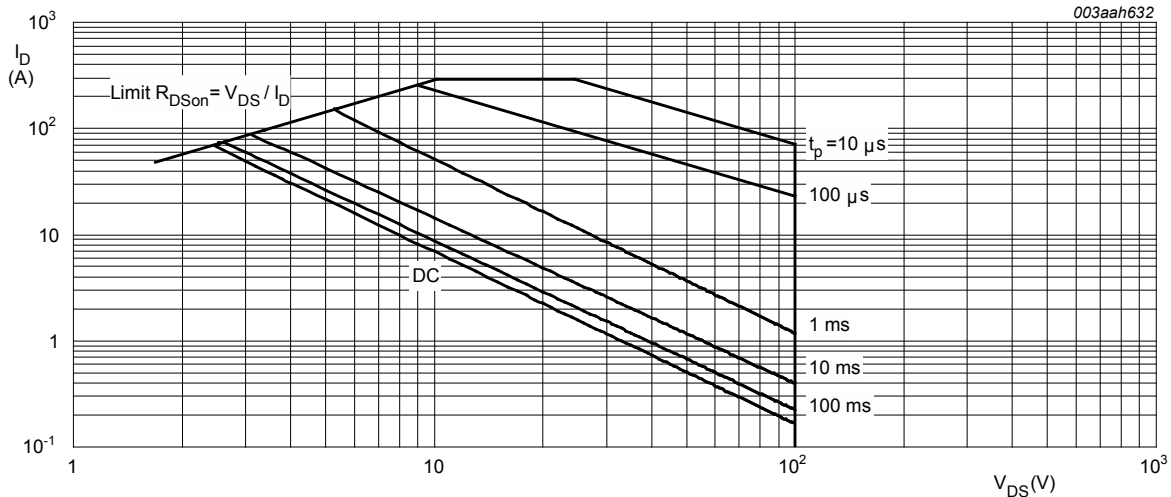


Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	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

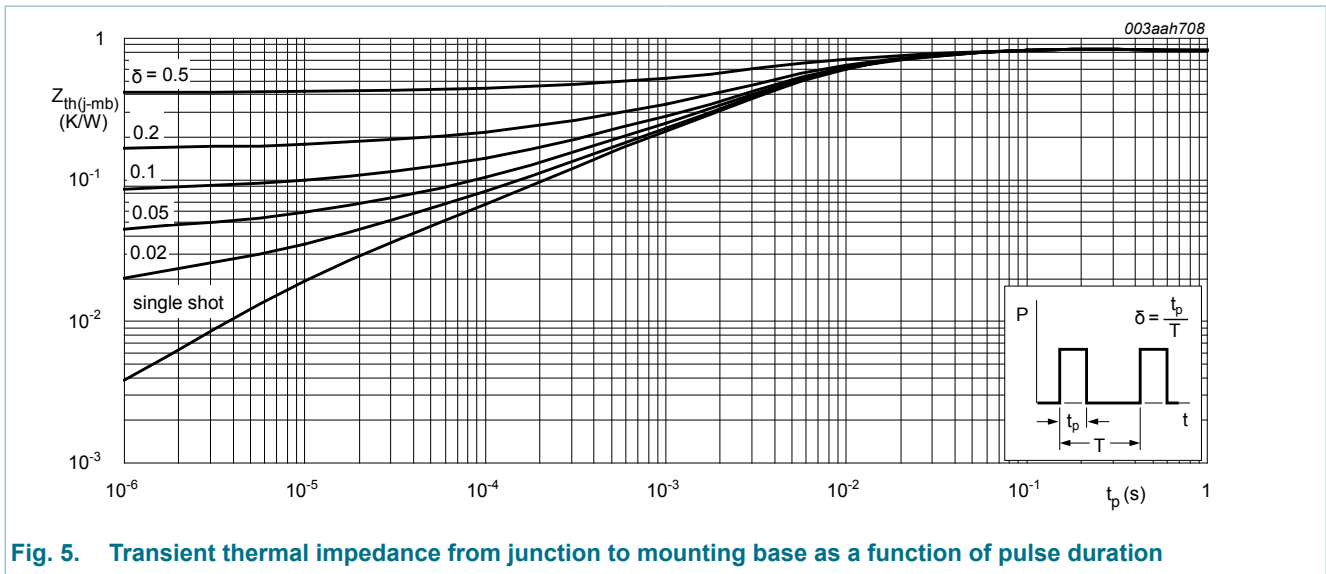


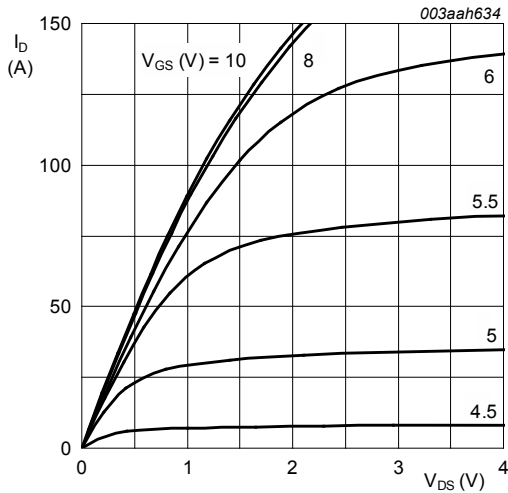
Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

7. Characteristics

Table 7. Characteristics

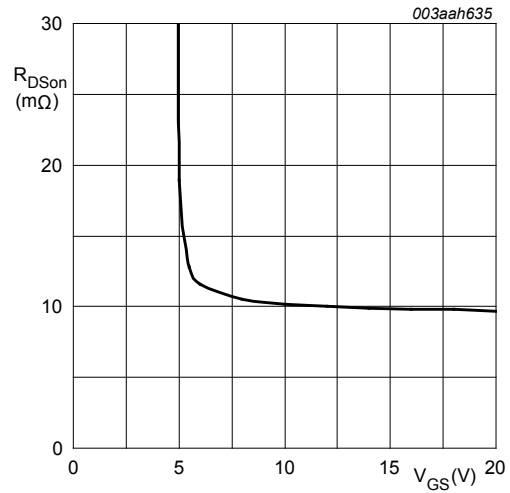
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	100	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	90	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C;$ Fig. 9; Fig. 10	2.4	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C;$ Fig. 9	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C;$ Fig. 9	-	-	4.5	V
I_{DSS}	drain leakage current	$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	0.06	1	μA
		$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ C$	-	-	500	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	2	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	2	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}; T_j = 25 \text{ }^\circ C;$ Fig. 11	-	10.2	13	m Ω
		$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}; T_j = 175 \text{ }^\circ C;$ Fig. 11; Fig. 12	-	-	35.1	m Ω
R_G	gate resistance	$f = 1 \text{ MHz}$	0.48	0.96	1.92	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 20 \text{ A}; V_{DS} = 80 \text{ V}; V_{GS} = 10 \text{ V};$ $T_j = 25 \text{ }^\circ C;$ Fig. 13; Fig. 14	-	69.4	97.2	nC
Q_{GS}	gate-source charge		-	15.5	21.7	nC

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Q_{GD}	gate-drain charge		-	25.4	35.6	nC
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 20\text{ V}; f = 1\text{ MHz}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 15}$	-	3400	4533	pF
C_{oss}	output capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 25\text{ V}; f = 1\text{ MHz}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 15}$	-	327	392	pF
C_{rss}	reverse transfer capacitance		-	225	308	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 80\text{ V}; R_L = 4\text{ }\Omega; V_{GS} = 10\text{ V}; R_{G(ext)} = 5\text{ }\Omega$	-	17.5	26.3	ns
t_r	rise time		-	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 ; $T_j = 25\text{ }^\circ\text{C}$	-	7.5	-	nH
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 20\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 16}$	-	0.83	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}; dI_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V}; V_{DS} = 25\text{ V}$	-	48.8	63.4	ns
Q_r	recovered charge		-	106	137.8	nC



$T_j = 25\text{ }^\circ\text{C}; t_p = 300\text{ }\mu\text{s}$

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



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

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

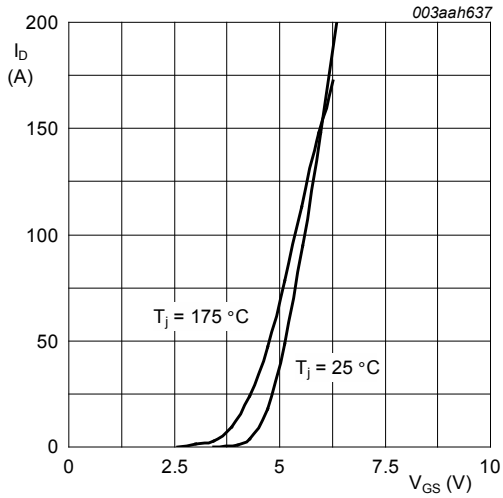


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$V_{DS} = 10V$

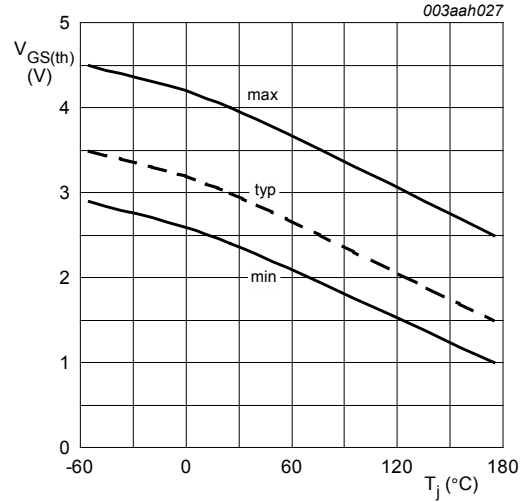


Fig. 9. Gate-source threshold voltage as a function of junction temperature

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

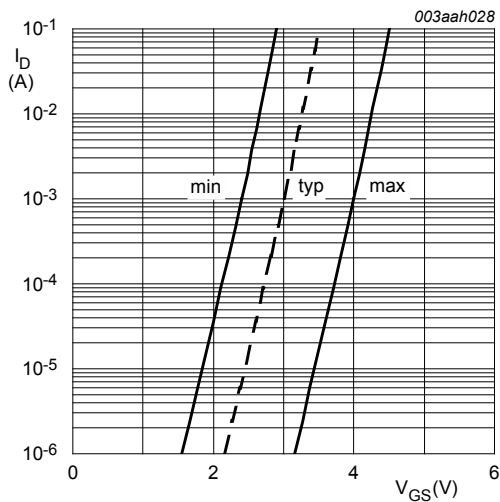
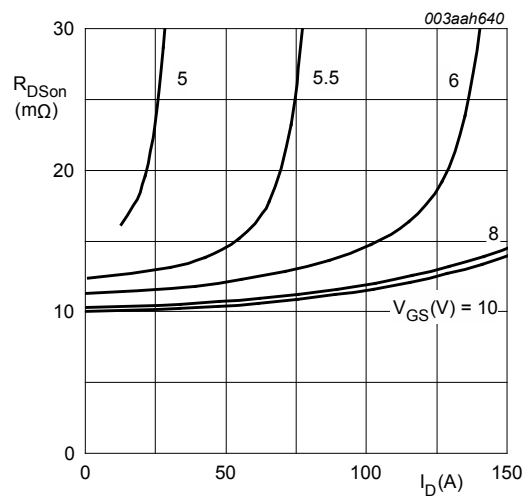


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

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



$T_j = 25^\circ\text{C}; t_p = 300\ \mu\text{s}$

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

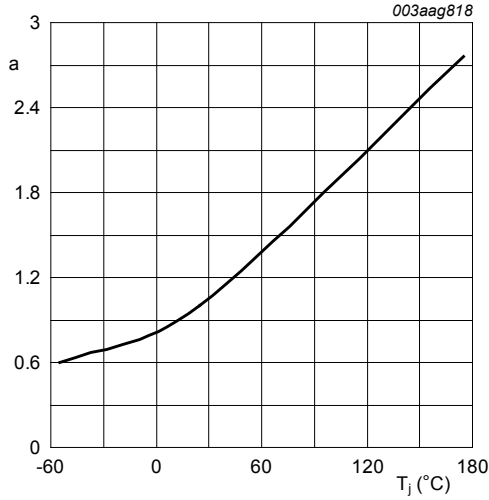


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

$$a = \frac{R_{DS(on)}}{R_{DS(on)(25\text{ }^\circ\text{C})}}$$

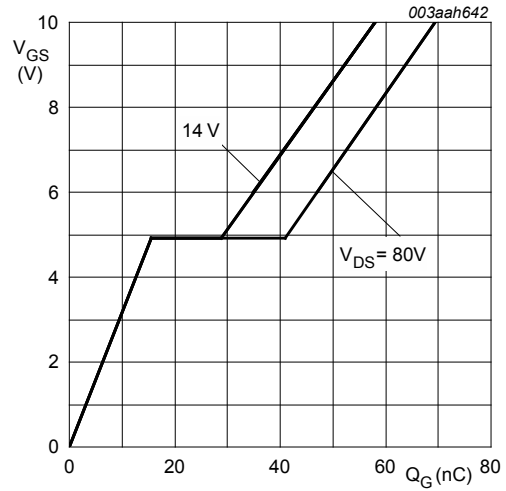


Fig. 13. Gate-source voltage as a function of gate charge; typical values

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

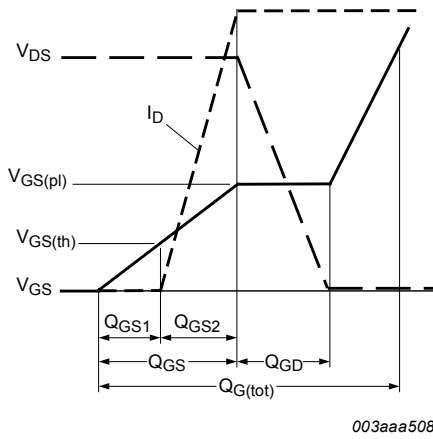


Fig. 14. Gate charge waveform definitions

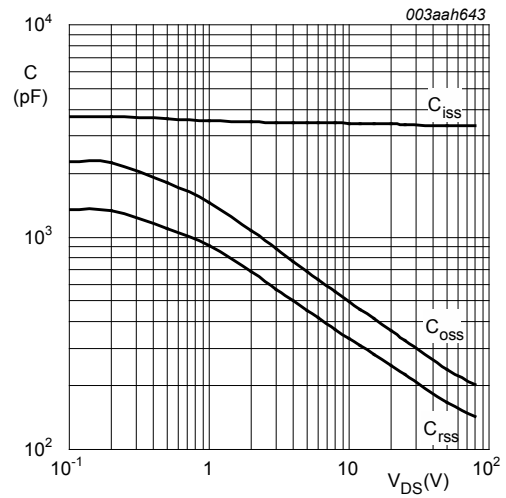


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

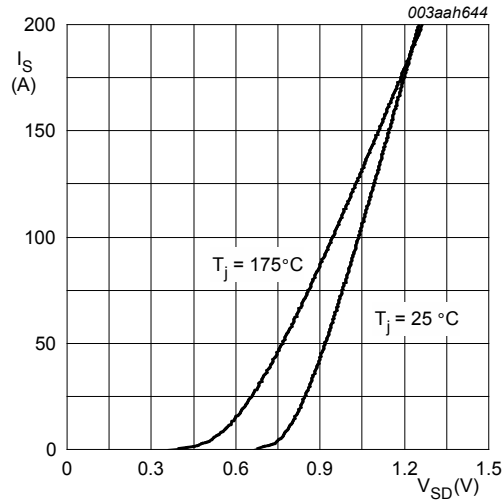


Fig. 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$$V_{GS} = 0V$$

8. Package outline

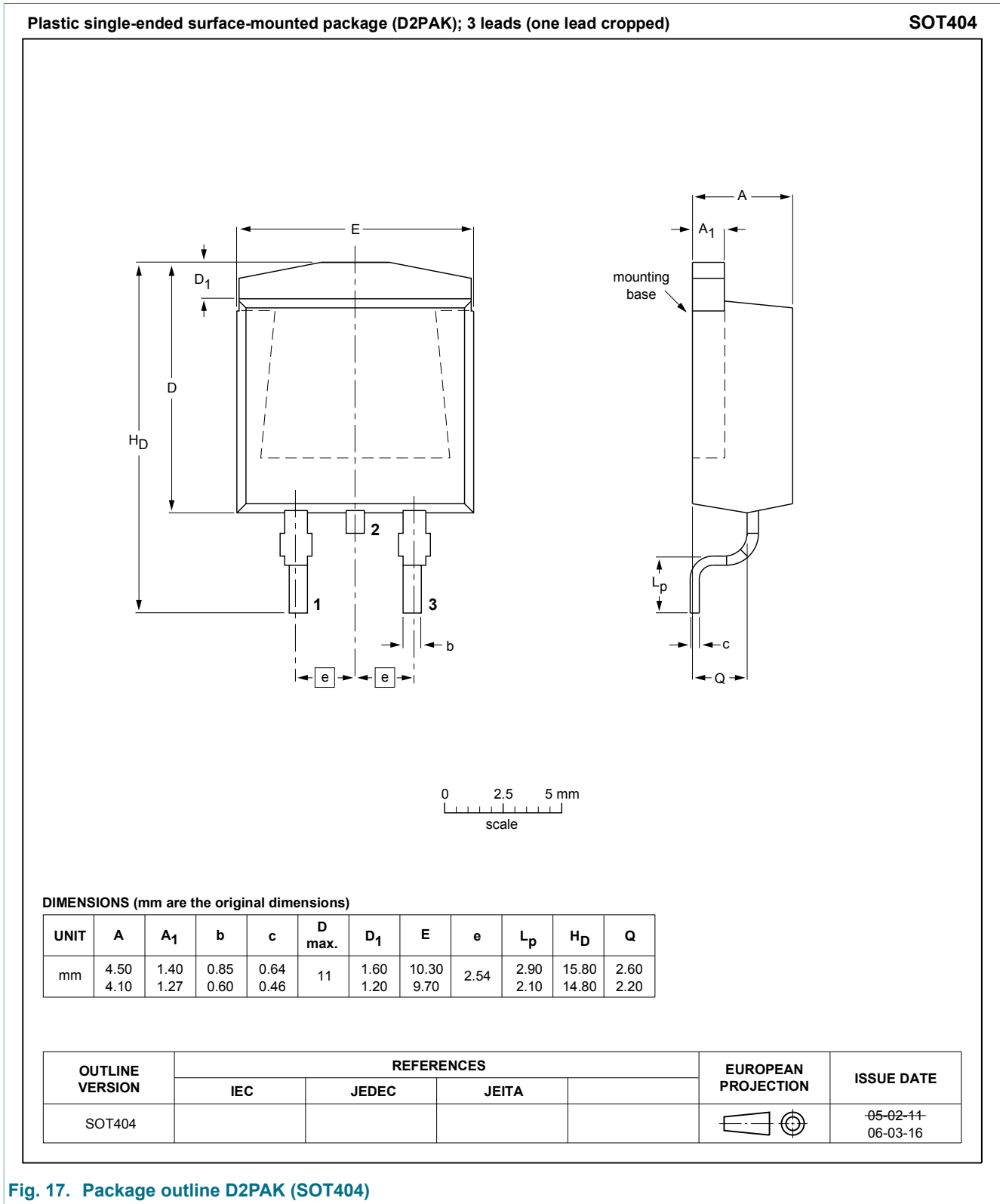


Fig. 17. Package outline D2PAK (SOT404)

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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.
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