



# BUK9880-55

## N-channel TrenchMOS logic level FET

Rev. 03 — 20 April 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Logic level 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 automotive critical applications.

### 1.2 Features and benefits

- AEC Q101 compliant
- Electrostatically robust due to integrated protection diodes
- Low conduction losses due to low on-state resistance

### 1.3 Applications

- Automotive and general purpose power switching

### 1.4 Quick reference data

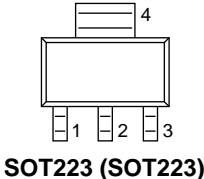
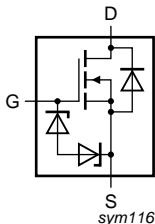
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 150\text{ °C}$	-	-	55	V
$I_D$	drain current	$T_{sp} = 25\text{ °C}$	-	-	7.5	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ °C}$	-	-	1.8	W
<b>Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 5\text{ V}; I_D = 5\text{ A}; T_j = 25\text{ °C}$	-	65	80	m $\Omega$
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 2.5\text{ A}; V_{sup} \leq 25\text{ V}; R_{GS} = 50\text{ }\Omega;$ $V_{GS} = 5\text{ V}; T_{j(init)} = 25\text{ °C};$ unclamped	-	-	30	mJ



## 2. Pinning information

**Table 2. Pinning information**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p>SOT223 (SOT223)</p>	 <p>Sym116</p>
2	D	drain		
3	S	source		
4	D	drain		

## 3. Ordering information

**Table 3. Ordering information**

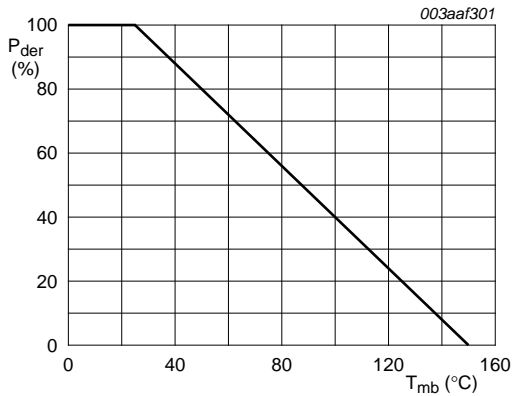
Type number	Package		Version
	Name	Description	
BUK9880-55	SOT223	plastic surface-mounted package with increased heatsink; 4 leads	SOT223

## 4. Limiting values

**Table 4. Limiting values**

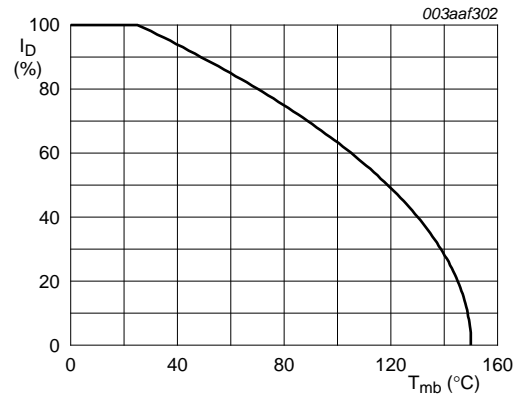
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 150\text{ °C}$	-	55	V
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	55	V
$V_{GS}$	gate-source voltage		-10	10	V
$I_D$	drain current	$T_{amb} = 25\text{ °C}$	-	3.5	A
		$T_{sp} = 25\text{ °C}$	-	7.5	A
		$T_{amb} = 100\text{ °C}$	-	2.2	A
$I_{DM}$	peak drain current	$T_{sp} = 25\text{ °C};$ pulsed	-	40	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ °C}$	-	1.8	W
		$T_{sp} = 25\text{ °C}$	-	8.3	W
$T_{stg}$	storage temperature		-55	150	°C
$T_j$	junction temperature		-55	150	°C
$V_{esd}$	electrostatic discharge voltage	HBM; $C = 100\text{ pF}; R = 1.5\text{ k}\Omega$	-	2	kV
<b>Source-drain diode</b>					
$I_S$	source current	$T_{sp} = 25\text{ °C}$	-	7.5	A
$I_{SM}$	peak source current	pulsed; $T_{sp} = 25\text{ °C}$	-	40	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 2.5\text{ A}; V_{sup} \leq 25\text{ V}; R_{GS} = 50\text{ }\Omega;$ $V_{GS} = 5\text{ V}; T_{j(init)} = 25\text{ °C};$ unclamped	-	30	mJ



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

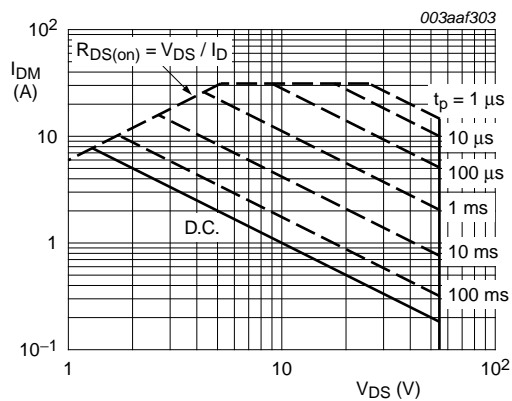
**Fig 1. Normalized total power dissipation as a function of solder point temperature**



$$I_{der} = \frac{I_D}{I_{D(25^{\circ}\text{C})}} \times 100\%$$

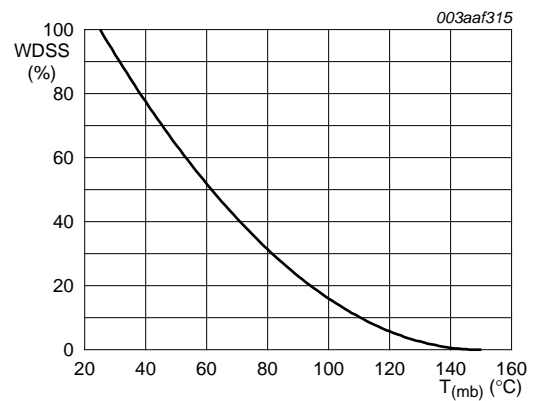
$V_{GS} \geq 5\text{ V}$

**Fig 2. Normalized continuous drain current as a function of solder point temperature**



$T_{sp} = 25^{\circ}\text{C}$

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



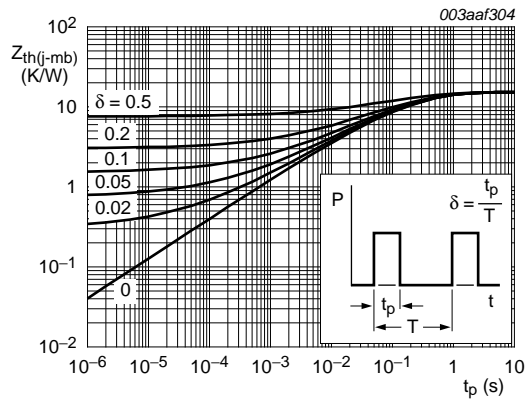
$I_D = 2.5\text{ A}$

**Fig 4. Normalised drain-source non-repetitive avalanche energy as a function of mounting-base temperature**

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	mounted on any printed-circuit board	-	12	15	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	mounted on printed-circuit board	-	-	70	K/W

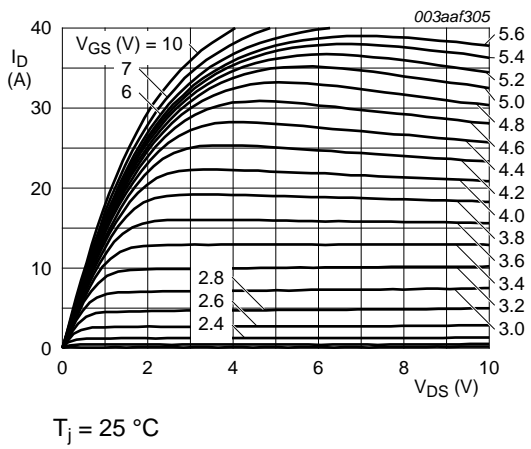


**Fig 5. Transient thermal impedance from junction to solder point as a function of pulse duration**

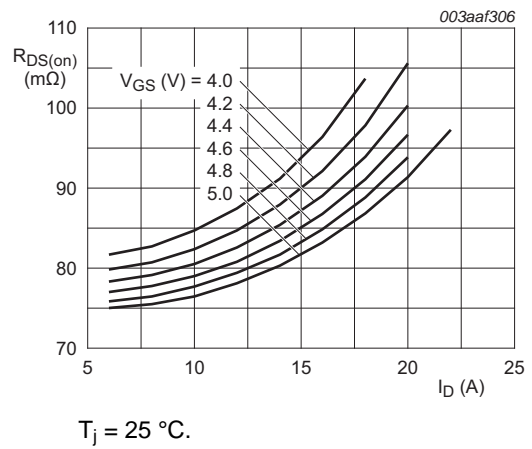
## 6. Characteristics

Table 6. Characteristics

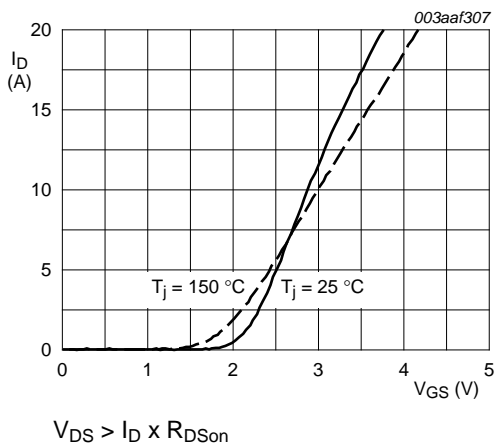
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	50	-	-	V
		$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	55	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C}$	1	1.5	2	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C}$	-	-	2.3	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 150 \text{ }^\circ\text{C}$	0.6	-	-	V
$I_{DSS}$	drain leakage current	$V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.05	10	$\mu\text{A}$
		$V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 150 \text{ }^\circ\text{C}$	-	-	100	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 5 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.02	1	$\mu\text{A}$
		$V_{GS} = -5 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.02	1	$\mu\text{A}$
		$V_{GS} = 5 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 150 \text{ }^\circ\text{C}$	-	-	5	$\mu\text{A}$
		$V_{GS} = -5 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 150 \text{ }^\circ\text{C}$	-	-	5	$\mu\text{A}$
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 5 \text{ V}; I_D = 5 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$	-	-	148	$\text{m}\Omega$
		$V_{GS} = 5 \text{ V}; I_D = 5 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	65	80	$\text{m}\Omega$
$V_{(BR)GSS}$	gate-source breakdown voltage	$V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}; I_G = 1 \text{ mA}$	10	-	-	V
		$V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}; I_G = -1 \text{ mA}$	10	-	-	V
<b>Dynamic characteristics</b>						
$C_{iss}$	input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$	-	500	650	pF
$C_{oss}$	output capacitance		-	110	135	pF
$C_{rss}$	reverse transfer capacitance		-	60	85	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 \text{ V}; R_L = 4.29 \text{ } \Omega; V_{GS} = 5 \text{ V}; R_{G(ext)} = 10 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}; I_D = 7 \text{ A}$	-	10	15	ns
$t_r$	rise time		-	30	50	ns
$t_{d(off)}$	turn-off delay time		-	30	45	ns
$t_f$	fall time		-	30	40	ns
$g_{fs}$	transfer conductance	$V_{DS} = 25 \text{ V}; I_D = 5 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	4	8	-	S
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 5 \text{ A}; V_{GS} = 0 \text{ V}; T_j \geq -55 \text{ }^\circ\text{C}; T_j \leq 175 \text{ }^\circ\text{C}$	-	0.85	1.1	V
$t_{rr}$	reverse recovery time	$I_S = 5 \text{ A}; di_S/dt = -100 \text{ A}/\mu\text{s}; V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j \leq 175 \text{ }^\circ\text{C}$	-	38	-	ns
$Q_r$	recovered charge		-	0.2	-	$\mu\text{C}$



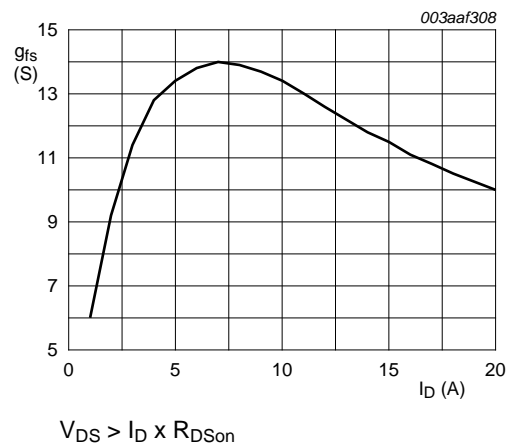
**Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values**



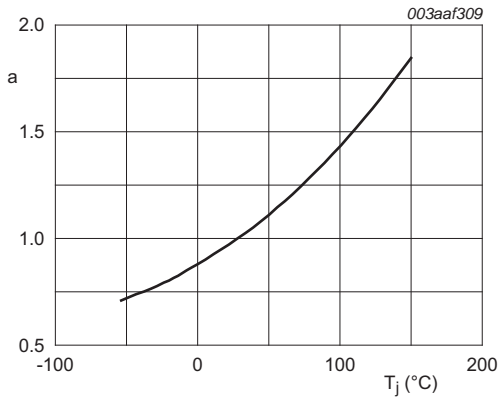
**Fig 7. Drain-source on-state resistance as a function of drain current; typical values**



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



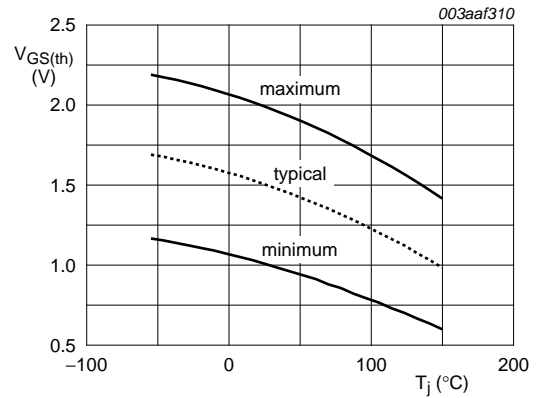
**Fig 9. Forward transconductance as a function of drain current; typical values**



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

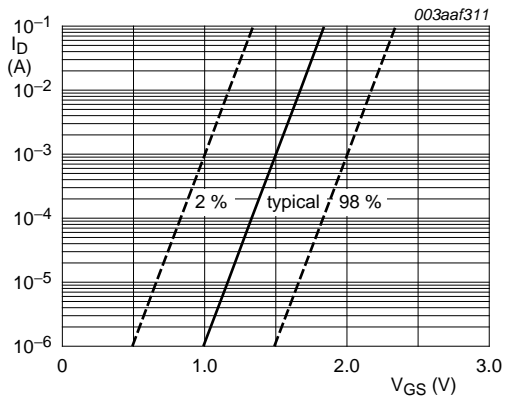
I<sub>D</sub> = 5 A; V<sub>GS</sub> = 5 V

**Fig 10. Normalized drain-source on-state resistance factor as a function of junction temperature**



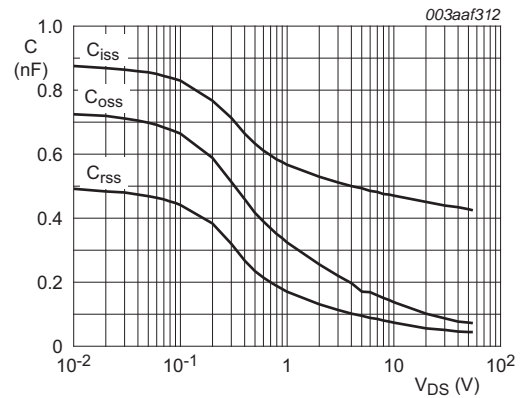
I<sub>D</sub> = 1 mA; V<sub>DS</sub> = V<sub>GS</sub>

**Fig 11. Gate-source threshold voltage as a function of junction temperature**



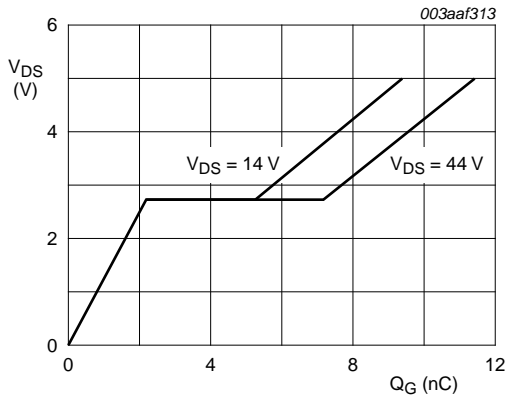
T<sub>j</sub> = 25 °C; V<sub>DS</sub> = V<sub>GS</sub>

**Fig 12. Sub-threshold drain current as a function of gate-source voltage**



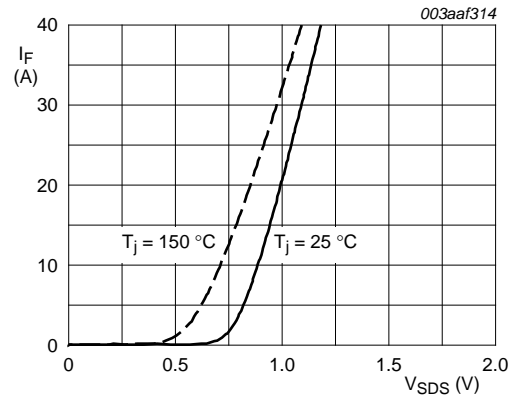
V<sub>GS</sub> = 0 V; f = 1 MHz

**Fig 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



$T_j = 25\text{ }^\circ\text{C}; I_D = 7\text{ A}$

**Fig 14. Gate-source voltage as a function of gate charge; typical values**



$V_{GS} = 0\text{ V}$

**Fig 15. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values**



**7. Package outline**

Plastic surface-mounted package with increased heatsink; 4 leads

SOT223

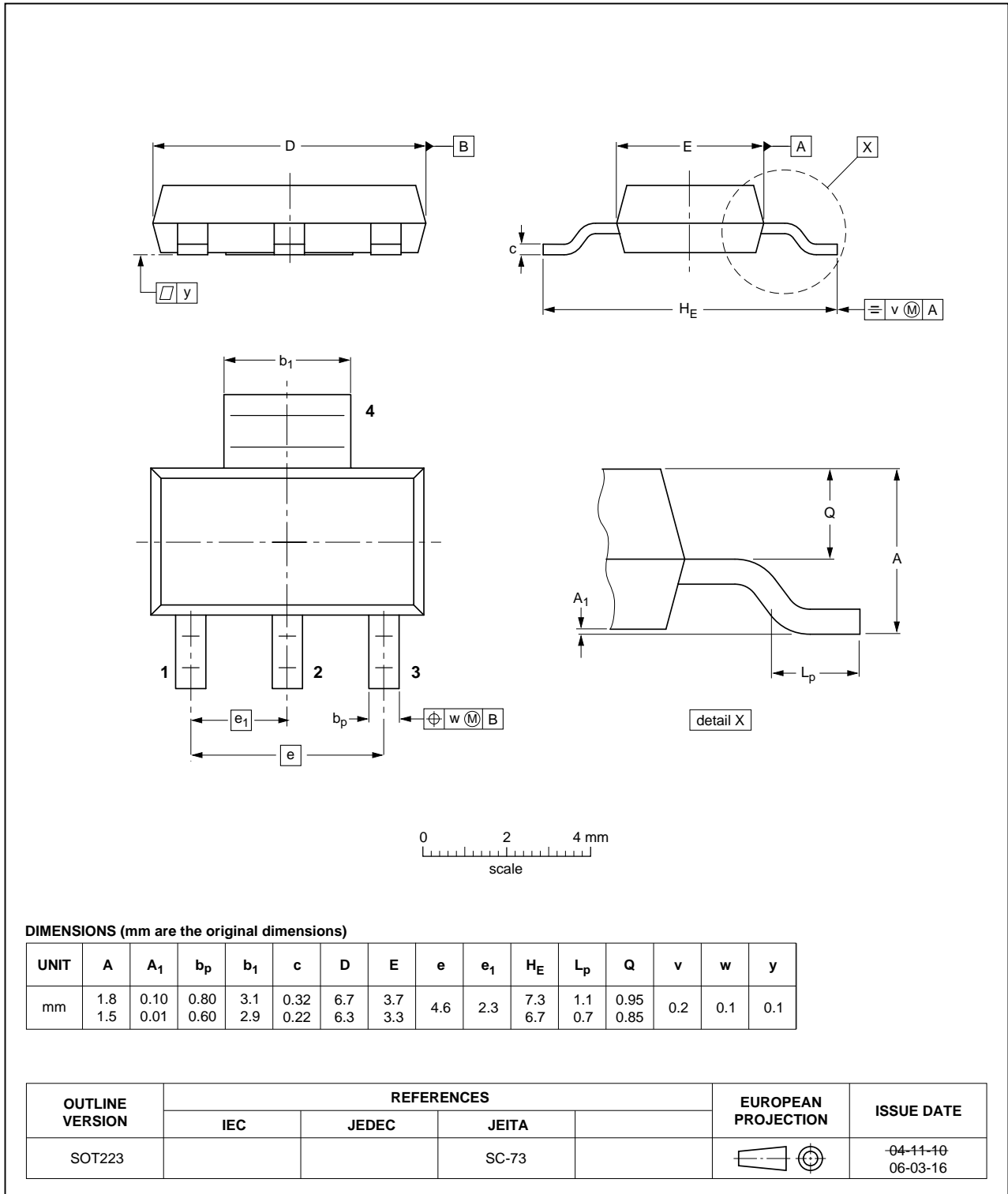


Fig 16. Package outline SOT223 (SOT223)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9880-55 v.3	20110420	Product data sheet	-	BUK9880-55 v.2
Modifications:	<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• Various changes to content.</li></ul>			
BUK9880-55 v.2	19980401	Product specification	-	-

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### 9.1 Data sheet status

Document status <sup>[1]</sup> <sup>[2]</sup>	Product status <sup>[3]</sup>	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.nxp.com>.

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