

1. Description

N-channel enhancement mode field-effect power transistor in a plastic package using TrenchMOS™¹ technology, featuring very low on-state resistance.

Product availability:

BUK98180-100A in SOT223 (SC-73).

2. Features

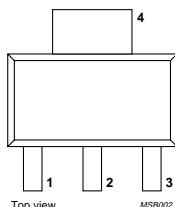
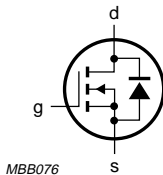
- TrenchMOS™ technology
- Q101 compliant
- 150 °C rated
- Logic level compatible.

3. Applications

- Automotive and general purpose power switching
 - ◆ 12 V, 24 V and 42 V loads
 - ◆ Motors, lamps and solenoids.

4. Pinning information

Table 1: Pinning - SOT223 (SC-73), simplified outline and symbol

Pin	Description	Simplified outline	Symbol
1	gate (g)	 <p>Top view MSB002 - 1</p>	 <p>MBB076</p>
2	drain (d)		
3	source (s)		
4	drain (d)		

SOT223 (SC-73)

1. TrenchMOS is a trademark of Royal Philips Electronics.

5. Quick reference data

Table 2: Quick reference data

Symbol	Parameter	Conditions	Typ	Max	Unit
V_{DS}	drain-source voltage (DC)		–	100	V
I_D	drain current (DC)	$T_{sp} = 25\text{ °C}; V_{GS} = 5\text{ V}$	–	4.6	A
P_{tot}	total power dissipation	$T_{sp} = 25\text{ °C}$	–	8	W
T_j	junction temperature		–	150	°C
R_{DSon}	drain-source on-state resistance	$T_j = 25\text{ °C}; V_{GS} = 5\text{ V}; I_D = 5\text{ A}$	153	180	mΩ
		$T_j = 25\text{ °C}; V_{GS} = 4.5\text{ V}; I_D = 5\text{ A}$	–	201	mΩ
		$T_j = 25\text{ °C}; V_{GS} = 10\text{ V}; I_D = 5\text{ A}$	147	173	mΩ

6. Limiting values

Table 3: Limiting values

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

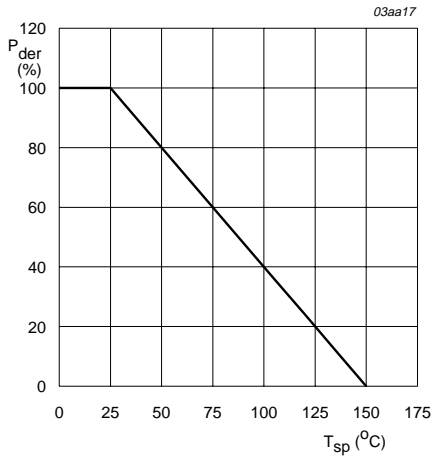
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)		–	100	V
V_{DGR}	drain-gate voltage (DC)	$R_{GS} = 20\text{ k}\Omega$	–	100	V
V_{GS}	gate-source voltage (DC)		–	±10	V
V_{GSM}	non-repetitive gate-source voltage	$t_p \leq 50\text{ }\mu\text{s}$	–	±15	V
I_D	drain current (DC)	$T_{sp} = 25\text{ °C}; V_{GS} = 5\text{ V};$ Figure 2 and 3	–	4.6	A
		$T_{sp} = 100\text{ °C}; V_{GS} = 5\text{ V};$ Figure 2	–	3	A
I_{DM}	peak drain current	$T_{sp} = 25\text{ °C};$ pulsed; $t_p \leq 10\text{ }\mu\text{s};$ Figure 3	–	18	A
P_{tot}	total power dissipation	$T_{sp} = 25\text{ °C};$ Figure 1	–	8	W
T_{stg}	storage temperature		–55	+150	°C
T_j	operating junction temperature		–55	+150	°C

Source-drain diode

I_{DR}	reverse drain current (DC)	$T_{sp} = 25\text{ °C}$	–	4.6	A
I_{DRM}	pulsed reverse drain current	$T_{sp} = 25\text{ °C};$ pulsed; $t_p \leq 10\text{ }\mu\text{s}$	–	18	A

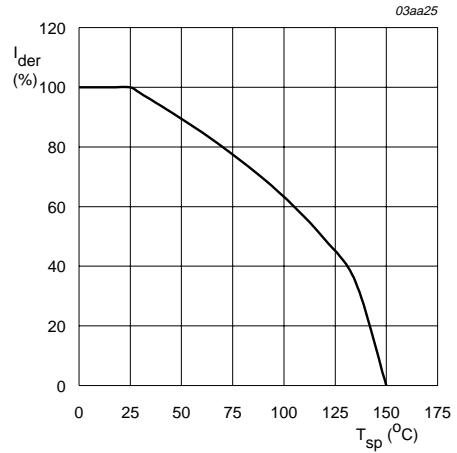
Avalanche ruggedness

W_{DSS}	non-repetitive avalanche energy	unclamped inductive load; $I_D = 4\text{ A};$ $V_{DS} \leq 100\text{ V}; V_{GS} = 5\text{ V}; R_{GS} = 50\text{ }\Omega;$ starting $T_{sp} = 25\text{ °C}$	–	16	mJ
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$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

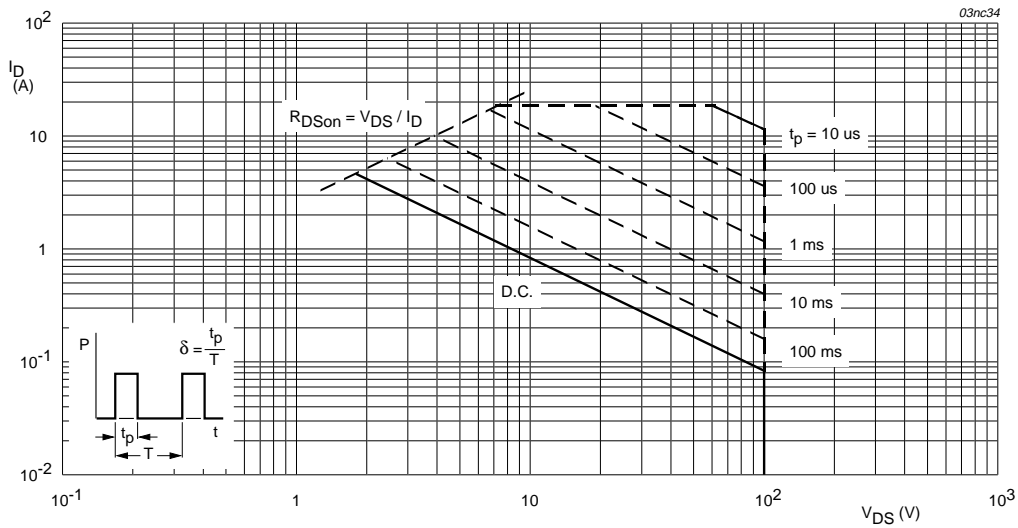
Fig 1. Normalized total power dissipation as a function of solder point temperature.



$$V_{GS} \geq 4.5 \text{ V}$$

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

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



T_{amb} = 25 °C; I_{DM} is single pulse.

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

7. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient		70	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point	Figure 4	15	K/W

7.1 Transient thermal impedance

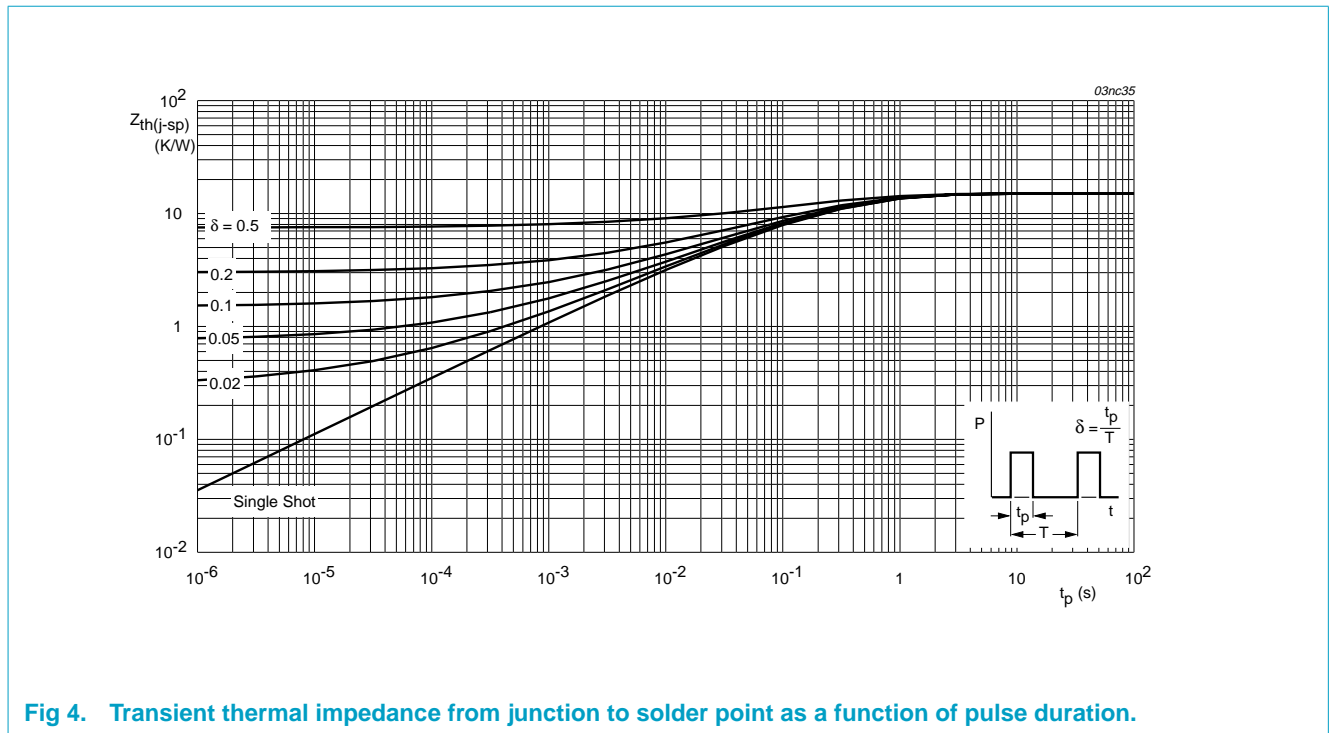


Fig 4. Transient thermal impedance from junction to solder point as a function of pulse duration.

8. Characteristics

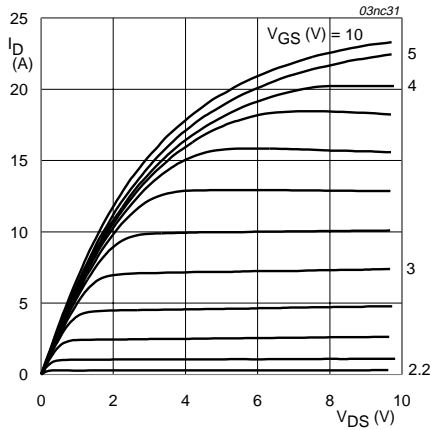
Table 5: Characteristics

$T_j = 25\text{ °C}$ unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25\text{ mA}; V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	100	–	–	V
		$T_j = -55\text{ °C}$	89	–	–	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}; V_{DS} = V_{GS};$ Figure 9				
		$T_j = 25\text{ °C}$	1	1.5	2	V
		$T_j = 150\text{ °C}$	0.6	–	–	V
		$T_j = -55\text{ °C}$	–	–	2.3	V
I_{DSS}	drain-source leakage current	$V_{DS} = 100\text{ V}; V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	–	0.05	10	μA
		$T_j = 150\text{ °C}$	–	–	500	μA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 10\text{ V}; V_{DS} = 0\text{ V}$	–	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 5\text{ V}; I_D = 5\text{ A};$ Figure 7 and 8				
		$T_j = 25\text{ °C}$	–	153	180	m Ω
		$T_j = 150\text{ °C}$	–	–	389	m Ω
		$V_{GS} = 4.5\text{ V}; I_D = 5\text{ A};$	–	–	201	m Ω
		$V_{GS} = 10\text{ V}; I_D = 5\text{ A};$	–	147	173	m Ω
Dynamic characteristics						
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 25\text{ V};$ $f = 1\text{ MHz};$ Figure 12	–	464	619	pF
C_{oss}	output capacitance		–	60	72	pF
C_{rss}	reverse transfer capacitance		–	36	50	pF
$t_{d(on)}$	turn-on delay time	$V_{DD} = 30\text{ V}; R_L = 1.2\text{ }\Omega;$	–	7	–	ns
t_r	rise time	$V_{GS} = 5\text{ V}; R_G = 10\text{ }\Omega$	–	89	–	ns
$t_{d(off)}$	turn-off delay time		–	18	–	ns
t_f	fall time		–	25	–	ns

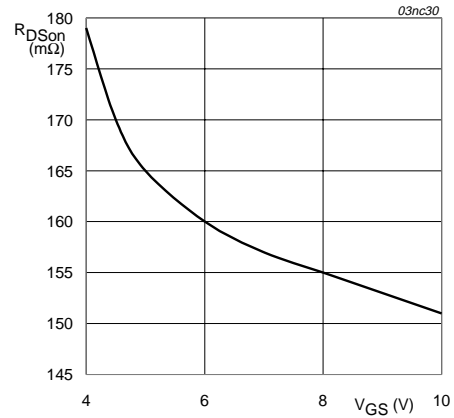
Table 5: Characteristics...continued
T_j = 25 °C unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V _{SD}	source-drain (diode forward) voltage	I _S = 5 A; V _{GS} = 0 V; Figure 15	–	0.85	1.2	V
t _{rr}	reverse recovery time	I _S = 20 A; dI _S /dt = –100 A/μs	–	49	–	ns
Q _r	recovered charge	V _{GS} = –10 V; V _{DS} = 30 V	–	130	–	nC



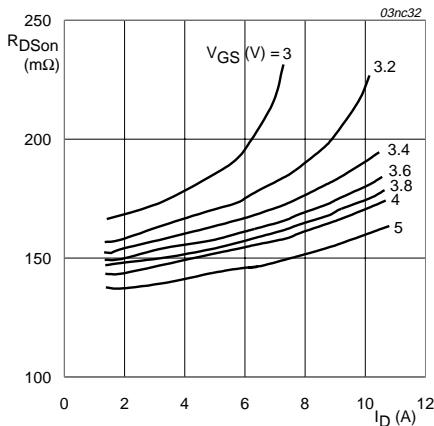
T_j = 25 °C

Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values.



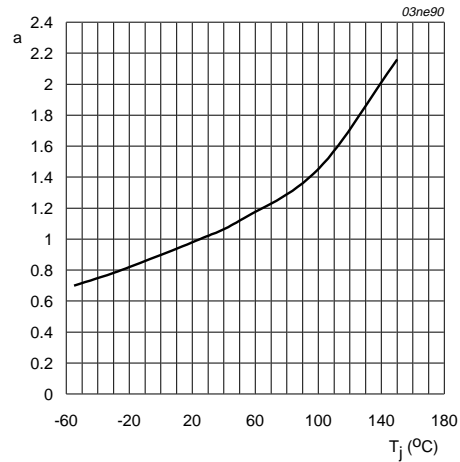
T_j = 25 °C; I_D = 5 A

Fig 6. Drain-source on-state resistance as a function of gate-source voltage; typical values.



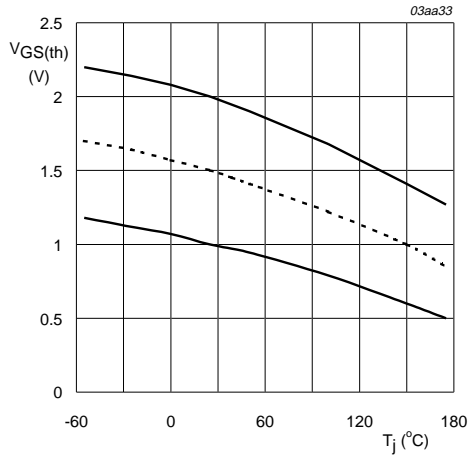
T_j = 25 °C

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



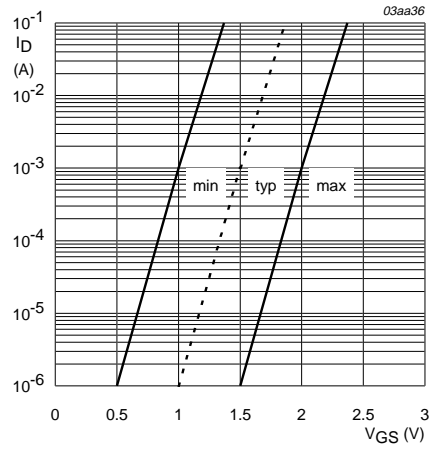
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^{\circ}C)}}$$

Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature.



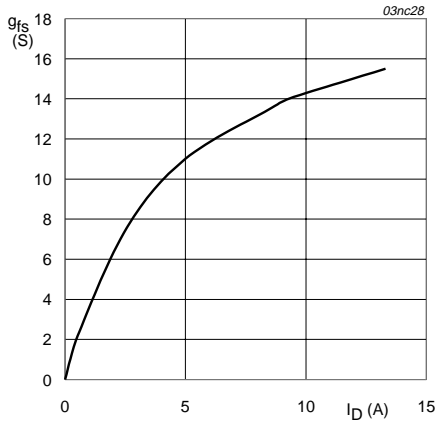
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



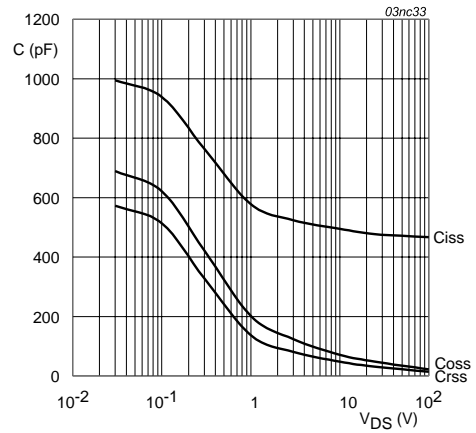
$T_j = 25 \text{ °C}; V_{DS} = V_{GS}$

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



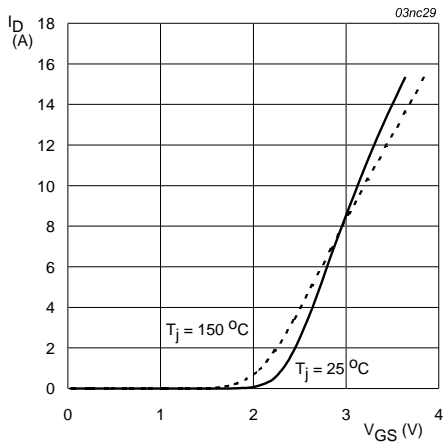
$T_j = 25 \text{ °C}; V_{DS} = 25 \text{ V}$

Fig 11. Forward transconductance as a function of drain current; typical values.



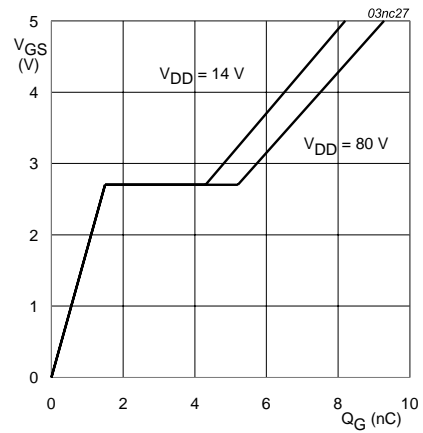
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.



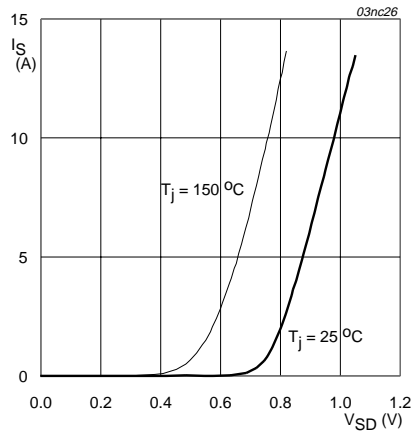
$V_{DS} = 25\text{ V}$

Fig 13. Transfer characteristics: drain current as a function of gate-source voltage; typical values.



$T_j = 25\text{ }^\circ\text{C}; I_D = 5\text{ A}$

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



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

Fig 15. Reverse diode current as a function of reverse diode voltage; typical values.

9. Package outline

Plastic surface mounted package; collector pad for good heat transfer; 4 leads

SOT223

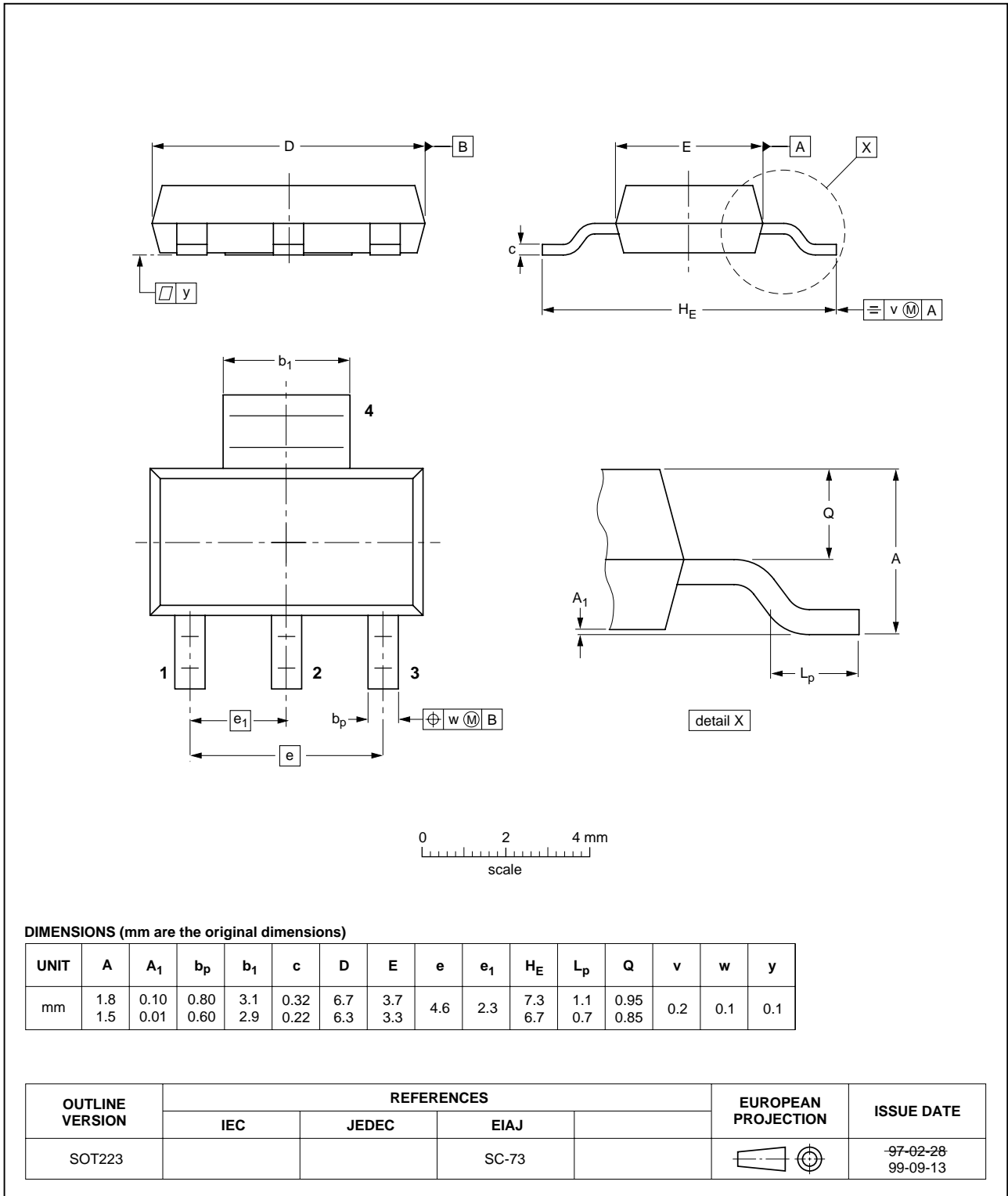
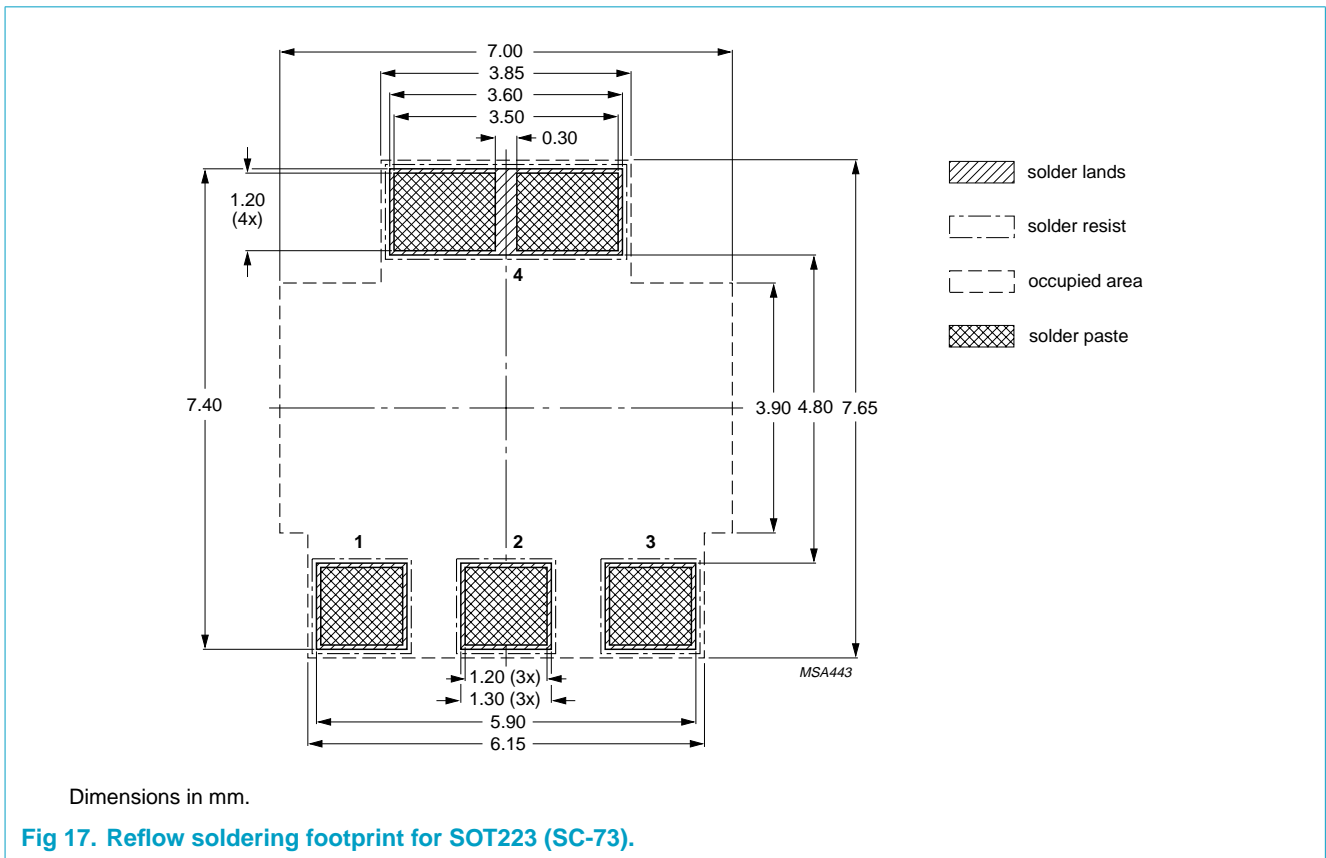


Fig 16. SOT223 (SC-73).

10. Soldering



11. Revision history

Table 6: Revision history

Rev	Date	CPCN	Description
01	20001003	-	Product data; initial version.
02	20010518	-	Product data; second version. Updated Figure 13 , Figure 8 , Figure 3 , and Figure 4 .

12. Data sheet status

Data sheet status ^[1]	Product status ^[2]	Definition
Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Changes will be communicated according to the Customer Product/Process Change Notification (CPCN) procedure SNW-SQ-650A.

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

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Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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Argentina: see South America

Australia: Tel. +61 2 9704 8141, Fax. +61 2 9704 8139

Austria: Tel. +43 160 101, Fax. +43 160 101 1210

Belarus: Tel. +375 17 220 0733, Fax. +375 17 220 0773

Belgium: see The Netherlands

Brazil: see South America

Bulgaria: Tel. +359 268 9211, Fax. +359 268 9102

Canada: Tel. +1 800 234 7381

China/Hong Kong: Tel. +852 2 319 7888, Fax. +852 2 319 7700

Colombia: see South America

Czech Republic: see Austria

Denmark: Tel. +45 3 288 2636, Fax. +45 3 157 0044

Finland: Tel. +358 961 5800, Fax. +358 96 158 0920

France: Tel. +33 1 4728 6600, Fax. +33 1 4728 6638

Germany: Tel. +49 40 23 5360, Fax. +49 402 353 6300

Hungary: Tel. +36 1 382 1700, Fax. +36 1 382 1800

India: Tel. +91 22 493 8541, Fax. +91 22 493 8722

Indonesia: see Singapore

Ireland: Tel. +353 17 64 0000, Fax. +353 17 64 0200

Israel: Tel. +972 36 45 0444, Fax. +972 36 49 1007

Italy: Tel. +39 039 203 6838, Fax. +39 039 203 6800

Japan: Tel. +81 33 740 5130, Fax. +81 3 3740 5057

Korea: Tel. +82 27 09 1412, Fax. +82 27 09 1415

Malaysia: Tel. +60 37 50 5214, Fax. +60 37 57 4880

Mexico: Tel. +9-5 800 234 7381

Middle East: see Italy

For all other countries apply to: Philips Semiconductors,
Marketing Communications,
Building BE, P.O. Box 218, 5600 MD EINDHOVEN,
The Netherlands, Fax. +31 40 272 4825

Netherlands: Tel. +31 40 278 2785, Fax. +31 40 278 8399

New Zealand: Tel. +64 98 49 4160, Fax. +64 98 49 7811

Norway: Tel. +47 22 74 8000, Fax. +47 22 74 8341

Philippines: Tel. +63 28 16 6380, Fax. +63 28 17 3474

Poland: Tel. +48 22 5710 000, Fax. +48 22 5710 001

Portugal: see Spain

Romania: see Italy

Russia: Tel. +7 095 755 6918, Fax. +7 095 755 6919

Singapore: Tel. +65 350 2538, Fax. +65 251 6500

Slovakia: see Austria

Slovenia: see Italy

South Africa: Tel. +27 11 471 5401, Fax. +27 11 471 5398

South America: Tel. +55 11 821 2333, Fax. +55 11 829 1849

Spain: Tel. +34 33 01 6312, Fax. +34 33 01 4107

Sweden: Tel. +46 86 32 2000, Fax. +46 86 32 2745

Switzerland: Tel. +41 14 88 2686, Fax. +41 14 81 7730

Taiwan: Tel. +886 22 134 2451, Fax. +886 22 134 2874

Thailand: Tel. +66 23 61 7910, Fax. +66 23 98 3447

Turkey: Tel. +90 216 522 1500, Fax. +90 216 522 1813

Ukraine: Tel. +380 44 264 2776, Fax. +380 44 268 0461

United Kingdom: Tel. +44 208 730 5000, Fax. +44 208 754 8421

United States: Tel. +1 800 234 7381

Uruguay: see South America

Vietnam: see Singapore

Yugoslavia: Tel. +381 11 3341 299, Fax. +381 11 3342 553

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