

# BUK9226-100B

TrenchMOS™ logic level FET

Rev. 01 — 10 December 2002

Objective data

## 1. Product profile

### 1.1 Description

N-channel enhancement mode field-effect power transistor in a plastic package using Philips High-Performance Automotive (HPA) TrenchMOS™ technology, featuring very low on-state resistance.

Product availability:

BUK9226-100B in SOT428 (D-PAK)

### 1.2 Features

- TrenchMOS™ technology
- 175 °C rated
- Q101 compliant
- Logic level compatible

### 1.3 Applications

- Automotive systems
- Motors, lamps and solenoids
- 12 V, 24 V, and 42 V loads
- General purpose power switching

### 1.4 Quick reference data

- $E_{DS(AL)S} \leq 147 \text{ mJ}$
- $I_D \leq 48 \text{ A}$
- $R_{DSon} = 22 \text{ m}\Omega$  (typ)
- $P_{tot} \leq 150 \text{ W}$

## 2. Pinning information

Table 1: Pinning - SOT428 (D-PAK), simplified outline and symbol

Pin	Description	Simplified outline	Symbol
1	gate (g)	<p>Top view MBK091</p> <p><b>SOT428 (D-PAK)</b></p>	<p>MBB076</p>
2	drain (d) [1]		
3	source (s)		
mb	mounting base; connected to drain (d)		

[1] It is not possible to make connection to pin 2 of the SOT428 package.



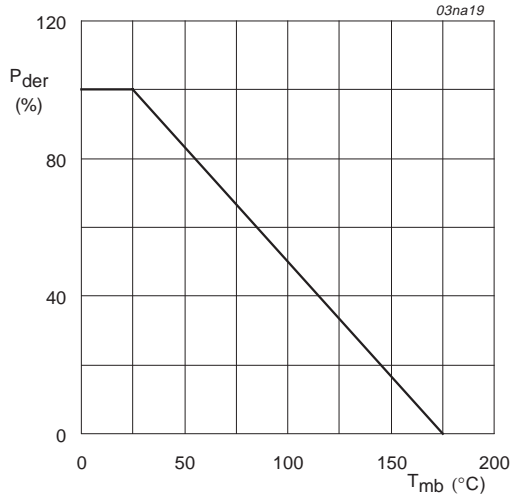
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### 3. Limiting values

**Table 2: Limiting values**

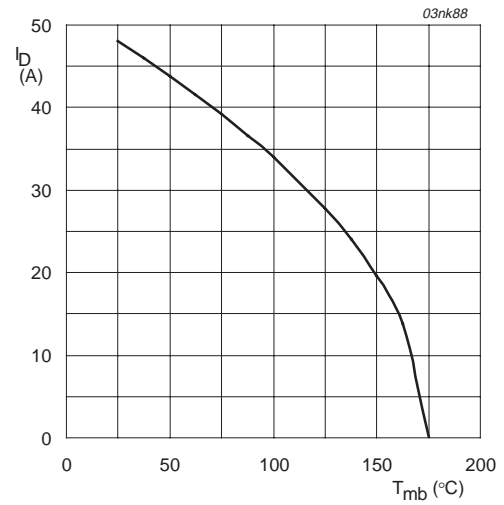
In accordance with the Absolute Maximum Rating System (IEC 60134).

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)		-	$\pm 15$	V
$I_D$	drain current (DC)	$T_{mb} = 25 \text{ }^\circ\text{C}$ ; $V_{GS} = 5 \text{ V}$ ; Figure 2 and 3	-	48	A
		$T_{mb} = 100 \text{ }^\circ\text{C}$ ; $V_{GS} = 5 \text{ V}$ ; Figure 2	-	34	A
$I_{DM}$	peak drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$ ; pulsed; $t_p \leq 10 \text{ }\mu\text{s}$ ; Figure 3	-	192	A
$P_{tot}$	total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$ ; Figure 1	-	150	W
$T_{stg}$	storage temperature		-55	+175	$^\circ\text{C}$
$T_j$	junction temperature		-55	+175	$^\circ\text{C}$
<b>Source-drain diode</b>					
$I_{DR}$	reverse drain current (DC)	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	48	A
$I_{DRM}$	peak reverse drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$ ; pulsed; $t_p \leq 10 \text{ }\mu\text{s}$	-	192	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive avalanche energy	unclamped inductive load; $I_D = 75 \text{ A}$ ; $V_{DS} \leq 100 \text{ V}$ ; $V_{GS} = 5 \text{ V}$ ; $R_{GS} = 50 \text{ }\Omega$ ; starting $T_j = 25 \text{ }^\circ\text{C}$	-	147	mJ



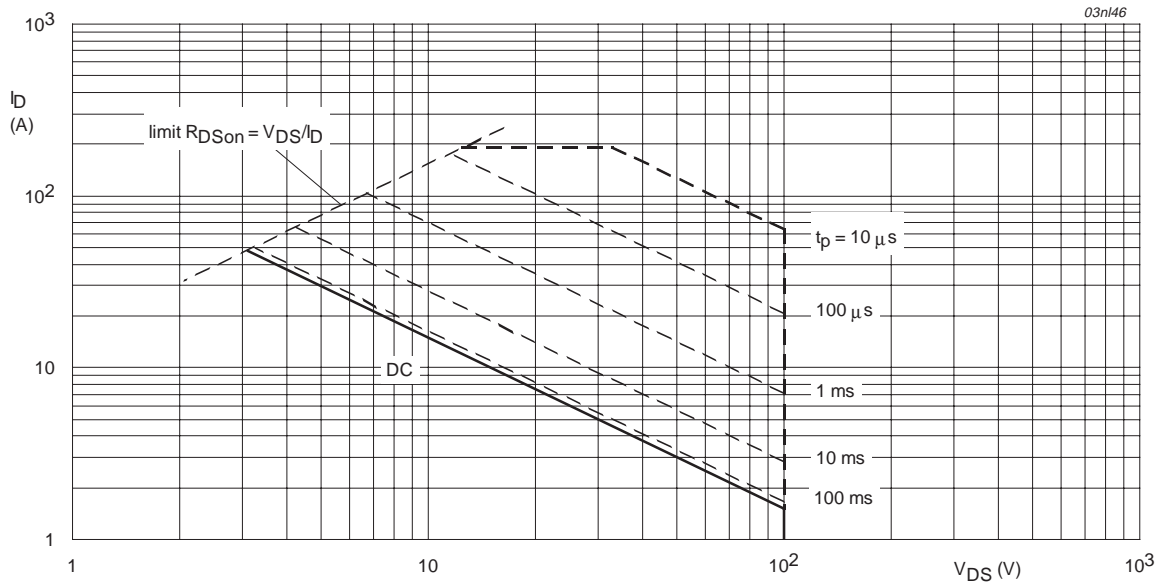
$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ C)}} \times 100\%$$

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



$V_{GS} \geq 5 V$

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



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

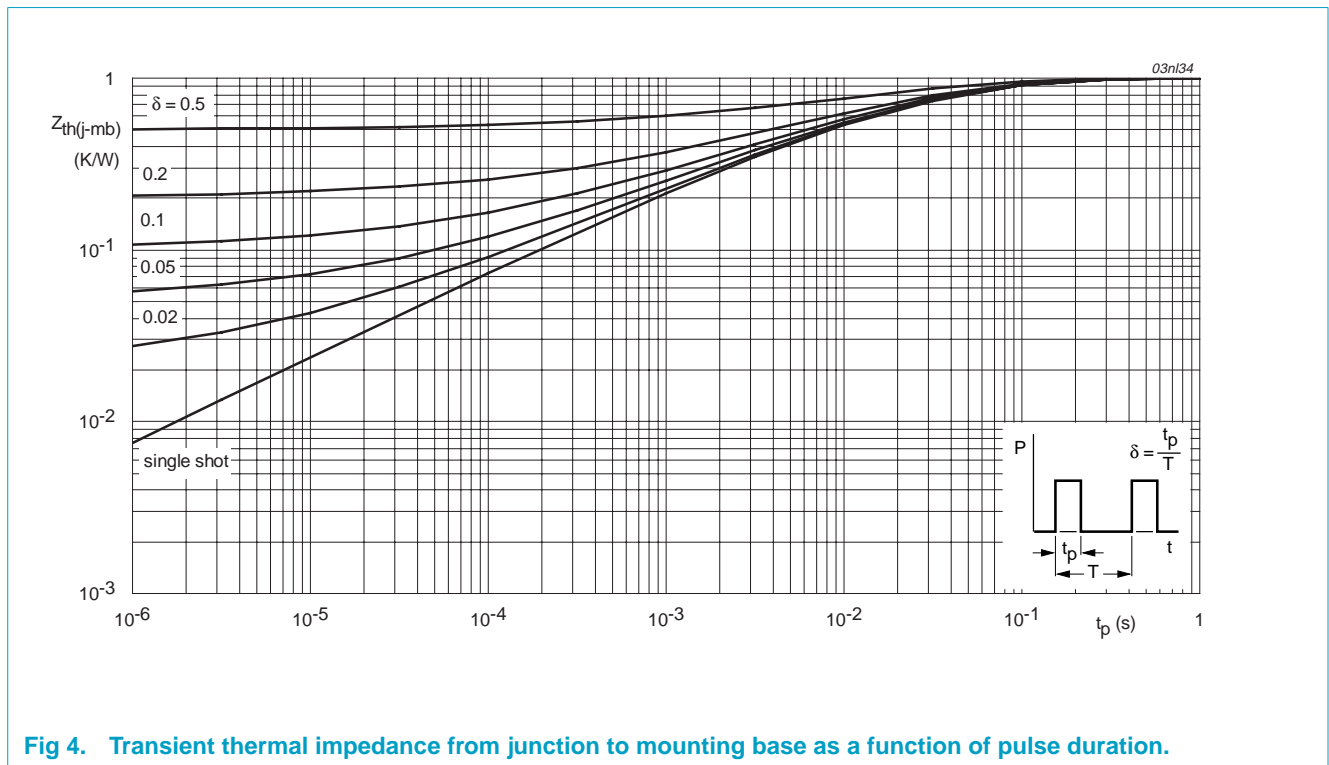
**Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.**

## 4. Thermal characteristics

**Table 3: Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient		-	71.4	-	K/W
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Figure 4	-	0.45	1.0	K/W

### 4.1 Transient thermal impedance

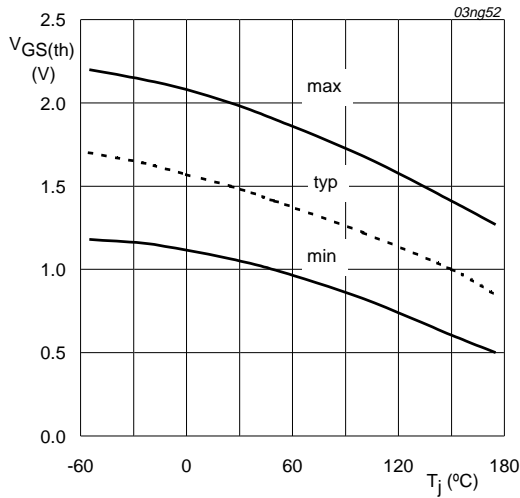


**Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.**

## 5. Characteristics

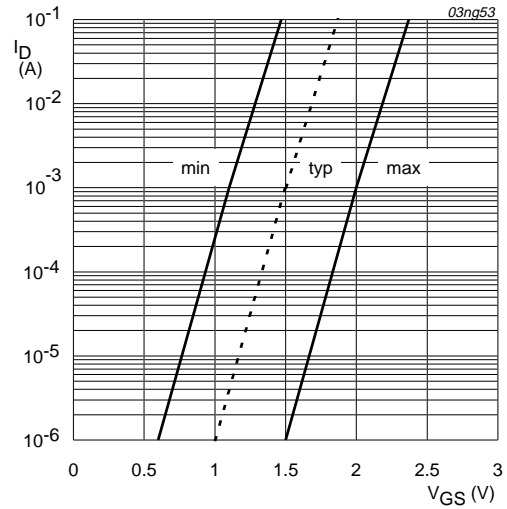
**Table 4: Characteristics**
 $T_j = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25\text{ mA}$ ; $V_{GS} = 0\text{ V}$ $T_j = 25\text{ °C}$	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 5				
		$T_j = 25\text{ °C}$	1.1	1.5	2	V
		$T_j = 175\text{ °C}$	0.5	-	-	V
		$T_j = -55\text{ °C}$	-	-	2.3	V
$I_{DSS}$	drain-source leakage current	$V_{DS} = 100\text{ V}$ ; $V_{GS} = 0\text{ V}$ $T_j = 25\text{ °C}$	-	0.02	1	$\mu\text{A}$
		$T_j = 175\text{ °C}$	-	-	500	$\mu\text{A}$
$I_{GSS}$	gate-source leakage current	$V_{GS} = \pm 15\text{ V}$ ; $V_{DS} = 0\text{ V}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 5\text{ V}$ ; $I_D = 25\text{ A}$ ; Figure 7				
		$T_j = 25\text{ °C}$	-	22	26	m $\Omega$
		$T_j = 175\text{ °C}$	-	-	65	m $\Omega$
		$V_{GS} = 4.5\text{ V}$ ; $I_D = 25\text{ A}$	-	-	29	m $\Omega$
		$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$	-	20	24	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{g(tot)}$	total gate charge	$V_{GS} = 5\text{ V}$ ; $V_{DS} = 80\text{ V}$ ; $I_D = 25\text{ A}$ ;	-	29	-	nC
$Q_{gs}$	gate-source charge		-	5	-	nC
$Q_{gd}$	gate-drain (Miller) charge		-	11	-	nC
$C_{iss}$	input capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 25\text{ V}$ ; $f = 1\text{ MHz}$ ;	-	2854	3805	pF
$C_{oss}$	output capacitance		-	232	278	pF
$C_{rss}$	reverse transfer capacitance		-	81	110	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30\text{ V}$ ; $R_L = 1.2\text{ }\Omega$ ;	-	tbf	-	nS
$t_r$	rise time	$V_{GS} = 5\text{ V}$ ; $R_G = 10\text{ }\Omega$	-	tbf	-	nS
$t_{d(off)}$	turn-off delay time		-	tbf	-	nS
$t_f$	fall time		-	tbf	-	nS
$L_d$	internal drain inductance	measured from drain to centre of die	-	2.5	-	nH
$L_s$	internal source inductance	measured from source lead to source bond pad	-	7.5	-	nH
<b>Source-drain diode</b>						
$V_{SD}$	source-drain (diode forward) voltage	$I_S = 10\text{ A}$ ; $V_{GS} = 0\text{ V}$ ; Figure 7	-	0.85	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20\text{ A}$ ; $dI_S/dt = -100\text{ A}/\mu\text{s}$	-	tbf	-	ns
$Q_r$	recovered charge	$V_{GS} = -10\text{ V}$ ; $V_{DS} = 30\text{ V}$	-	tbf	-	nC



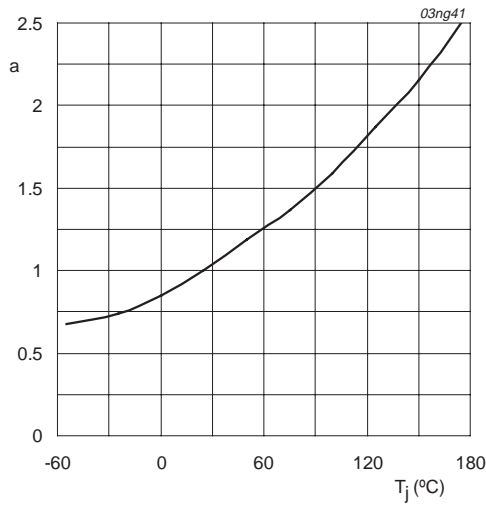
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

**Fig 5. Gate-source threshold voltage as a function of junction temperature.**



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

**Fig 6. Sub-threshold drain current as a function of gate-source voltage.**



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

**Fig 7. Normalized drain-source on-state resistance factor as a function of junction temperature.**

**6. Package outline**

Plastic single-ended surface mounted package (Philips version of D-PAK); 3 leads  
(one lead cropped)

SOT428

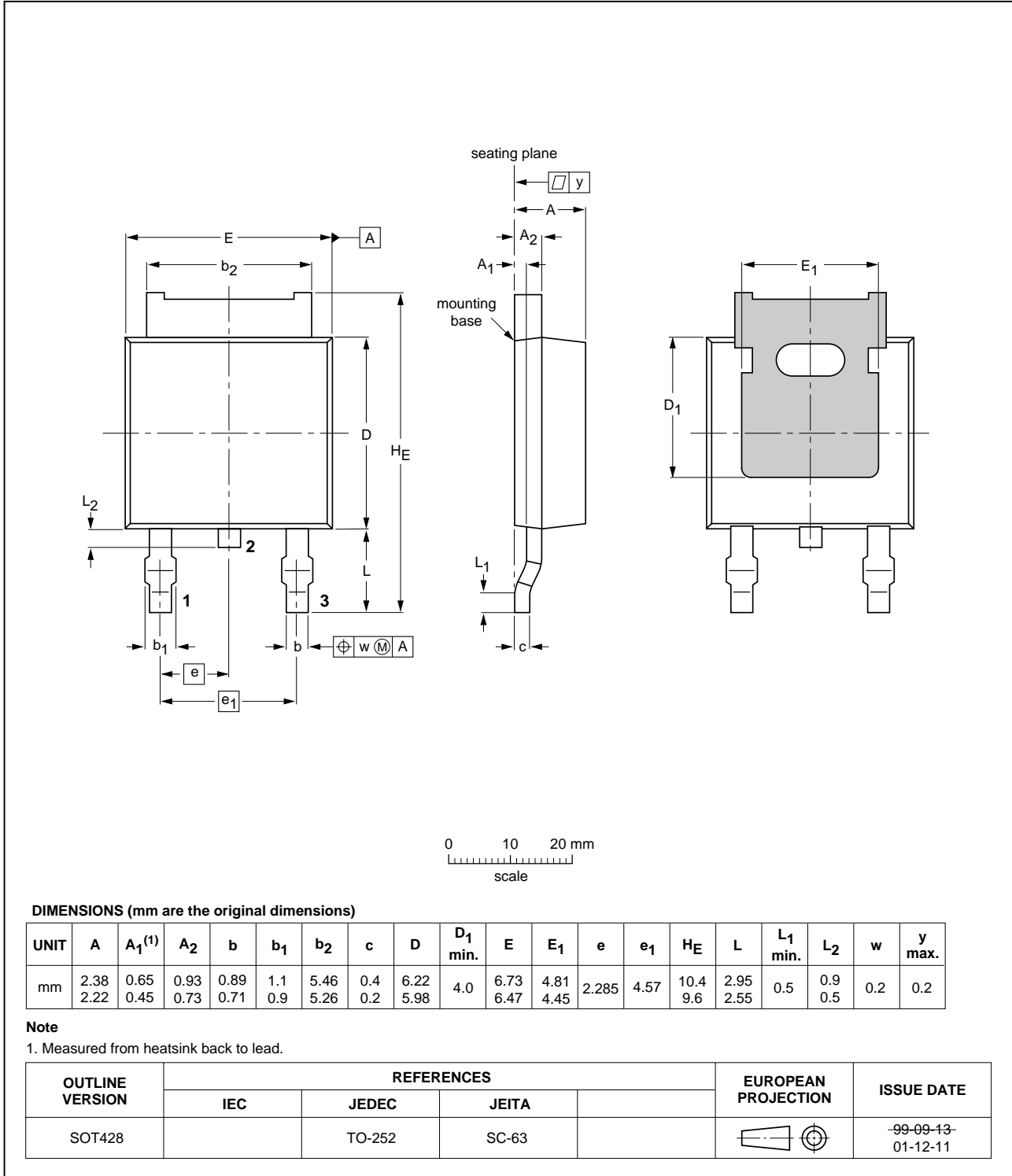


Fig 8. SOT428 (D-PAK)

## 7. Revision history

Table 5: Revision history

Rev	Date	CPCN	Description
01	20021210	-	Objective data (9397 750 10803)



## 8. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2][3]</sup>	Definition
I	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.
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**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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