Low-power 2-input AND gate Rev. 4 — 3 November 2021

1. General description

The 74AXP1G08 is a single 2-input AND gate.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device ensures very low static and dynamic power consumption across the entire V_{CC} range from 0.7 V to 2.75 V. It is fully specified for partial power down applications using I_{OFF}. The I_{OFF} circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

2. Features and benefits

- Wide supply voltage range from 0.7 V to 2.75 V
- Low input capacitance; C_I = 0.5 pF (typical)
- Low output capacitance; C_O = 1.0 pF (typical)
- Low dynamic power consumption; C_{PD} = 2.4 pF at V_{CC} = 1.2 V (typical)
- Low static power consumption; I_{CC} = 0.6 μA (85 °C maximum)
- High noise immunity
- Complies with JEDEC standards:
 - JESD8-12A.01 (1.1 V to 1.3 V)
 - JESD8-11A.01 (1.4 V to 1.6 V)
 - JESD8-7A (1.65 V to 1.95 V)
 - JESD8-5A.01 (2.3 V to 2.7 V)
- ESD protection:
 - HBM ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 2000 V
 - CDM JESD22-C101E exceeds 1000 V
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 2.75 V
- Low noise overshoot and undershoot < 10 % of V_{CC}
- I_{OFF} circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from -40 °C to +85 °C

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3. Ordering information

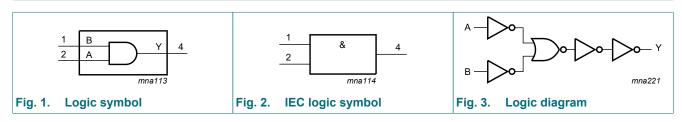
Type number	Package	Package						
	Temperature range	Name	Description	Version				
74AXP1G08GM	-40 °C to +85 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886				
74AXP1G08GN	-40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115				
74AXP1G08GS	-40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202				
74AXP1G08GX	-40 °C to +85 °C	X2SON5	plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.32 mm	SOT1226-3				

4. Marking

Table 2. Marking				
Type number	Marking code[1]			
74AXP1G08GM	rE			
74AXP1G08GN	rE			
74AXP1G08GS	rE			
74AXP1G08GX	rE			

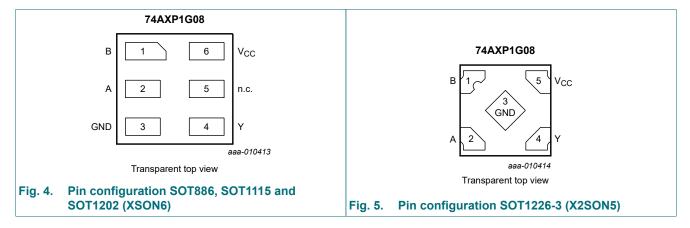
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description Symbol Pin Description X2SON5 XSON6 В 1 1 data input А 2 2 data input 3 GND 3 ground (0 V) Y 4 4 data output n.c. _ 5 not connected V_{CC} 5 6 supply voltage

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level.

Input	Output	
Α	В	Y
L	L	L
L	Н	L
Н	L	L
Н	Н	Н

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Min -0.5 -50	Max +3.3	Unit V
-50		-
	-	A
		mA
-0.5	+3.3	V
-50	-	mA
-0.5	+3.3	V
-	±20	mA
-	50	mA
-50	-	mA
-65	+150	°C
-	250	mW
	-50 -0.5 - - - - - - - - 50 -65	-50 - -0.5 +3.3 - ±20 - 50 -50 - -65 +150

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SOT886 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C. For SOT1115 (XSON6) package: P_{tot} derates linearly with 3.2 mW/K above 71 °C.

For SOT1202 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

For SOT1226-3 (X2SON5) package: P_{tot} derates linearly with 3.0 mW/K above 67 °C.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		0.7	2.75	V
VI	input voltage		0	2.75	V
Vo	output voltage	Active mode	0	V _{CC}	V
		Power-down mode; V_{CC} = 0 V	0	2.75	V
T _{amb}	ambient temperature		-40	+85	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 0.7 V to 2.75 V	0	200	ns/V

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10. Static characteristics

Table 7. Static characteristics

At recommended operating conditions, unless otherwise specified; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		Ta	_{mb} = 25	°C	T _{amb} = -40 °C to +85 °C		Unit
				Min	Тур	Max	Min	Max	1
VIH	HIGH-level input	V _{CC} = 0.75 V to 0.85 V		0.75V _{CC}	-	-	0.75V _{CC}	-	V
	voltage	V _{CC} = 1.1 V to 1.95 V		$0.65V_{CC}$	-	-	0.65V _{CC}	-	V
		V _{CC} = 2.3 V to 2.7 V		1.6	-	-	1.6	-	V
V _{IL}	LOW-level input	V _{CC} = 0.75 V to 0.85 V		-	-	0.25V _{CC}	-	0.25V _{CC}	V
	voltage	V _{CC} = 1.1 V to 1.95 V		-	-	0.35V _{CC}	-	0.35V _{CC}	V
		V _{CC} = 2.3 V to 2.7 V		-	-	0.7	-	0.7	V
V _{OH}	HIGH-level	I _O = -20 μA; V _{CC} = 0.7 V		-	0.69	-	-	-	V
	output voltage	I _O = -100 μA; V _{CC} = 0.75 V		0.65	-	-	0.65	-	V
		I _O = -2 mA; V _{CC} = 1.1 V		0.825	-	-	0.825	-	V
		I _O = -3 mA; V _{CC} = 1.4 V		1.05	-	-	1.05	-	V
		I _O = -4.5 mA; V _{CC} = 1.65 V		1.2	-	-	1.2	-	V
		I _O = -8 mA; V _{CC} = 2.3 V		1.7	-	-	1.7	-	V
V _{OL}		I _O = 20 μA; V _{CC} = 0.7 V		-	0.01	-	-	-	V
	voltage	I _O = 100 μA; V _{CC} = 0.75 V		-	-	0.1	-	0.1	V
		I _O = 2 mA; V _{CC} = 1.1 V		-	-	0.275	-	0.275	V
		I _O = 3 mA; V _{CC} = 1.4 V		-	-	0.35	-	0.35	V
		I _O = 4.5 mA; V _{CC} = 1.65 V		-	-	0.45	-	0.45	V
		I _O = 8 mA; V _{CC} = 2.3 V		-	-	0.7	-	0.7	V
lı	input leakage current	V _I = 0 V to 2.75 V; V _{CC} = 0 V to 2.75 V	[1]	-	0.001	±0.1	-	±0.5	μA
I _{OFF}	power-off leakage current	$V_{I} \text{ or } V_{O} = 0 \text{ V to } 2.75 \text{ V};$ $V_{CC} = 0 \text{ V}$	[1]	-	0.01	±0.1	-	±0.5	μA
∆I _{OFF}	additional power- off leakage current	$V_1 \text{ or } V_0 = 0 \text{ V or } 2.75 \text{ V};$ [1] $V_{CC} = 0 \text{ V to } 0.1 \text{ V}$		-	0.02	±0.1	-	±0.5	μA
I _{CC}	supply current	$V_{I} = 0 V \text{ or } V_{CC}; I_{O} = 0 A$	[1]	-	0.01	0.3	-	0.6	μA
ΔI _{CC}	additional supply current	$V_{I} = V_{CC} - 0.5 V; I_{O} = 0 A;$ $V_{CC} = 2.5 V$		-	2	100	-	150	μA

[1] Typical value is measured at V_{CC} = 1.2 V.

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit, see Fig. 12.

Symbol	Parameter	eter Conditions		_{amb} = 25	°C	T _{amb} = -40 °C to +85 °C		Unit
			Min	Typ[1]	Max	Min	Max	1
t _{pd}	propagation delayA, B to Y; see Fig. 6[2][3]							
		V _{CC} = 0.75 V to 0.85 V	3	11	37	2	122	ns
		V _{CC} = 1.1 V to 1.3 V	2.0	4.3	6.9	1.8	7.3	ns
		V _{CC} = 1.4 V to 1.6 V	1.6	3.2	4.7	1.5	5.0	ns
		V _{CC} = 1.65 V to 1.95 V	1.3	2.6	3.8	1.2	4.1	ns
		V _{CC} = 2.3 V to 2.7 V	1.1	2.0	2.8	0.9	3.0	ns
t _t	transition time	V _{CC} = 2.7 V; see <u>Fig. 6</u> [4]	-	-	-	1.0	-	ns
CI	input capacitance	V _I = 0 V or V _{CC} ; V _{CC} = 0 V to 2.75 V	-	0.5	-	-	-	pF
Co	output capacitance	V _O = 0 V; V _{CC} = 0 V	-	1.0	-	-	-	pF
C _{PD}		$f_i = 1 \text{ MHz}; V_I = 0 \text{ V to } V_{CC}$ [5]						
	capacitance	$V_{CC} = 0.75 V$ to 0.85 V	-	2.3	-	-	-	pF
		V _{CC} = 1.1 V to 1.3 V	-	2.4	-	-	-	pF
		V _{CC} = 1.4 V to 1.6 V	-	2.4	-	-	-	pF
		V _{CC} = 1.65 V to 1.95 V	-	2.5	-	-	-	pF
		V_{CC} = 2.3 V to 2.7 V	-	2.8	-	-	-	pF

All typical values are measured at nominal V_{CC}. [1]

[2]

 t_{pd} is the same as t_{PLH} and t_{PHL} . For additional propagation delay values at different load capacitances see Fig. 7 to Fig. 11. [3]

[4]

[5]

 f_i = input frequency in MHz;

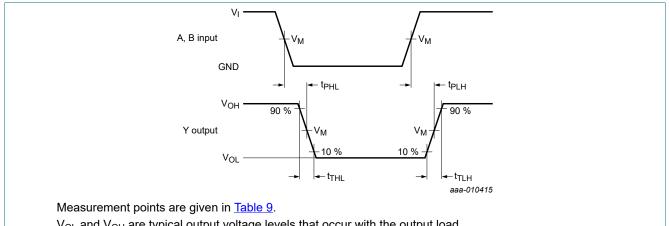
fo = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching.

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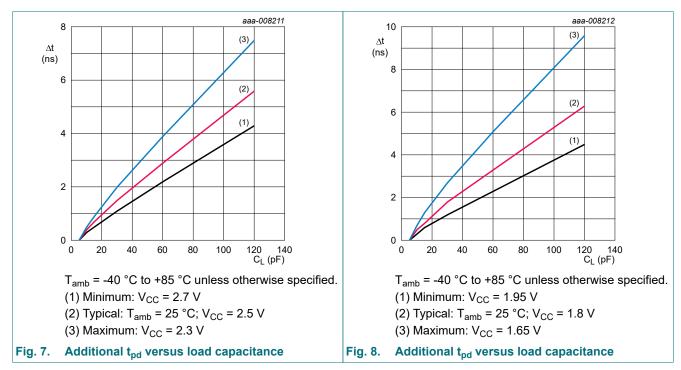
11.1. Waveforms and test circuit

V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

The data input (A, B) to output (Y) propagation delays Fig. 6.

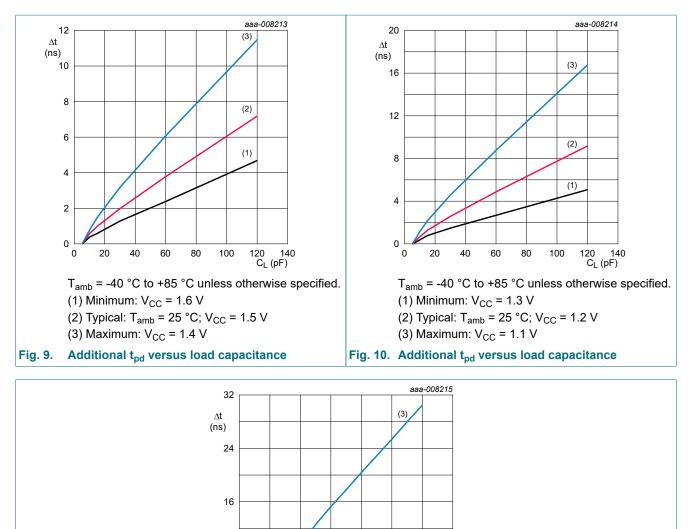
Table 9. Measurement points

Supply voltage	Input	Output		
V _{cc}	V _M	VI	t _r = t _f	V _M
0.75 V to 2.7 V	0.5V _{CC}	V _{CC}	≤ 3.0 ns	0.5V _{CC}



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(2)

(1)

25

30 35 C_L (pF)



(2) Typical: T_{amb} = 25 °C; V_{CC} = 0.8 V

(1) Minimum: V_{CC} = 0.85 V

(3) Maximum: V_{CC} = 0.75 V

8

0

 T_{amb} = -40 °C to +85 °C unless otherwise specified.

0

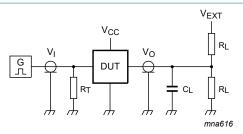
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Test data is given in <u>Table 10</u>.

Definitions for test circuit:

R_L = Load resistance.

 C_{L} = Load capacitance including jig and probe capacitance.

 R_T = Termination resistance should be equal to the output impedance Z_o of the pulse generator.

 V_{EXT} = External voltage for measuring switching times.

Fig. 12. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Load		V _{EXT}		
V _{cc}	CL	RL	t _{PLH} , t _{PHL}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}
0.75 V to 2.7 V	5 pF	10 kΩ	0 V	0 V	$2 \times V_{CC}$

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12. Package outline

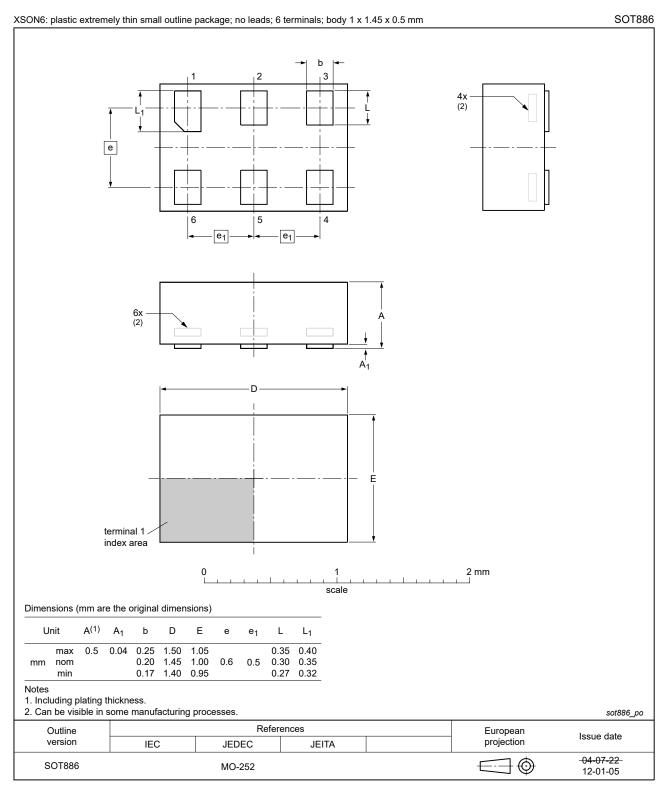
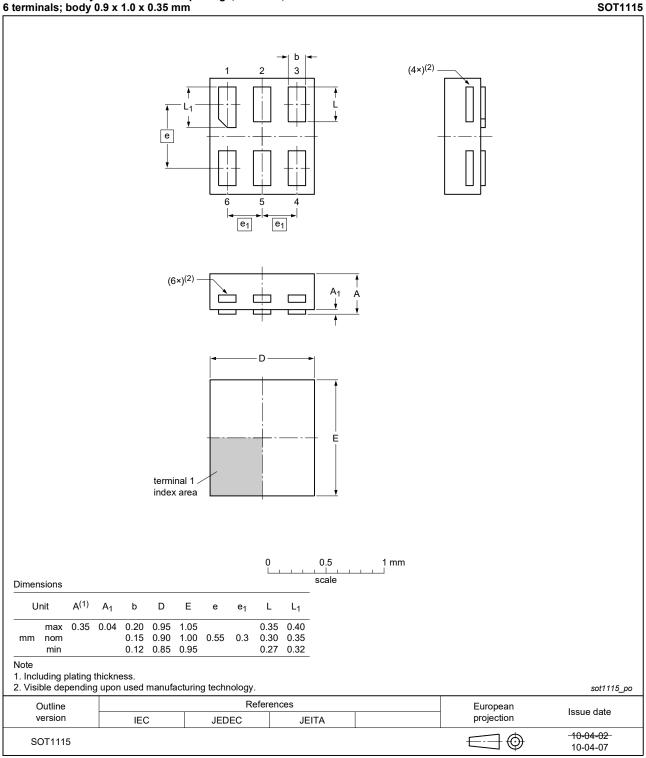


Fig. 13. Package outline SOT886 (XSON6)

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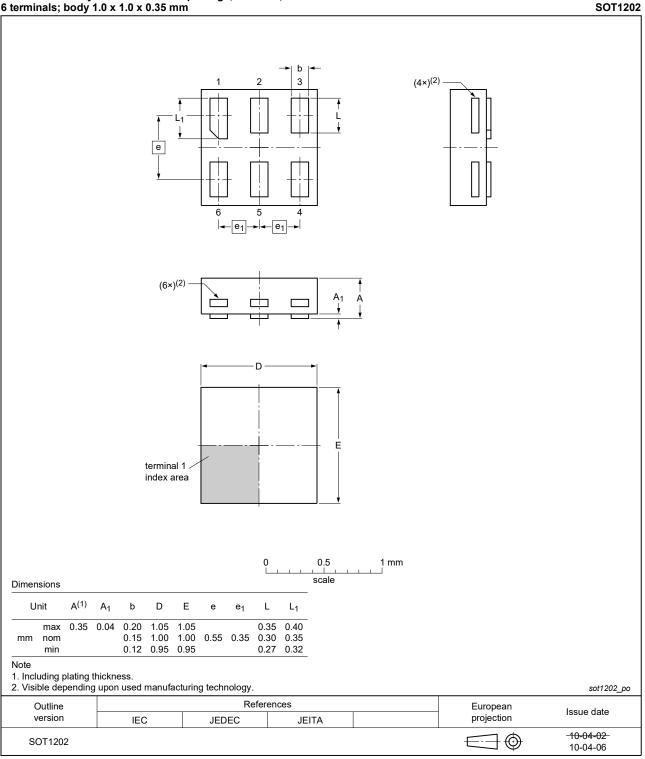
XSON6: extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm





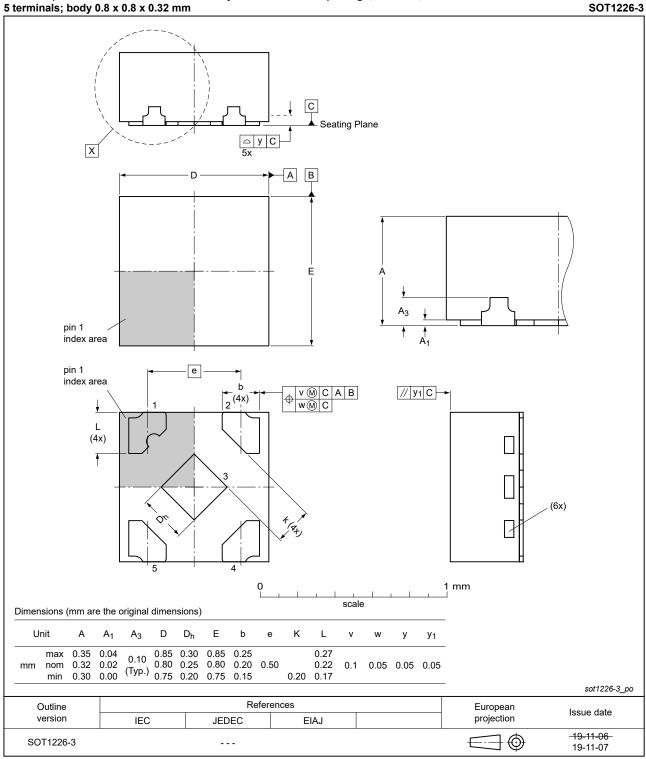
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XSON6: extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 0.35 mm





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X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 x 0.8 x 0.32 mm

Fig. 16. Package outline SOT1226-3 (X2SON5)

13. Abbreviations

Table 11. Abbreviations			
Acronym	Description		
CDM	Charged Device Model		
DUT	Device Under Test		
ESD	ElectroStatic Discharge		
НВМ	Human Body Model		

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes		
74AXP1G08 v.4	20211103	Product data sheet	-	74AXP1G08 v.3		
Modifications:	•	 SOT1226 (X2SON5) package changed to SOT1226-3 (X2SON5) package. <u>Table 5</u>: Derating values for P_{tot} total power dissipation updated. 				
74AXP1G08 v.3	20190318	Product data sheet	-	74AXP1G08 v.2		
Modifications:	of Nexperia • Legal texts	 The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Fig. 5: Pin 1 corrected. 				
74AXP1G08 v.2	20140121	Product data sheet	-	74AXP1G08 v.1		
Modifications:	• <u>Table 1</u> and	<u>Table 1</u> and <u>Table 2</u> : corrected type numbers				
74AXP1G08 v.1	20140115	Product data sheet	-	-		

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15. Legal information

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.
Product [short] data sheet	Production	This document contains the product specification.

 Please consult the most recently issued document before initiating or completing a design.

- [2] The term 'short data sheet' is explained in section "Definitions".
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Product data sheet

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