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Team Nexperia

74LVC11

Triple 3-input AND gate Rev. 6 — 17 November 2011

Product data sheet

1. **General description**

The 74LVC11 provides three 3-input AND functions.

2. Features and benefits

- Wide supply voltage range from 1.2 V to 3.6 V
- Inputs accept voltages up to 5.5 V
- CMOS low power consumption
- Direct interface with TTL levels
- Complies with JEDEC standard:
 - ◆ JESD8-7A (1.65 V to 1.95 V)
 - ◆ JESD8-5A (2.3 V to 2.7 V)
 - ◆ JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - ♦ MM JESD22-A115-B exceeds 200 V
 - ◆ CDM JESD22-C101E exceeds 1000 V
- Specified from −40 °C to +85 °C and −40 °C to +125 °C

Ordering information 3.

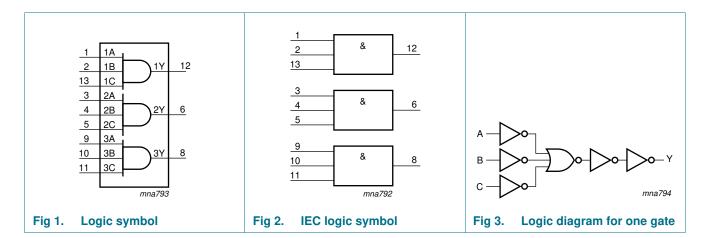
Table 1. **Ordering information**

Type number	Package	Package									
	Temperature range	Name	Description	Version							
74LVC11D	–40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1							
74LVC11DB	–40 °C to +125 °C	SSOP14	plastic shrink small outline package; 14 leads; body width 5.3 mm	SOT337-1							
74LVC11PW	–40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1							
74LVC11BQ	–40 °C to +125 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body $2.5\times3\times0.85$ mm	SOT762-1							



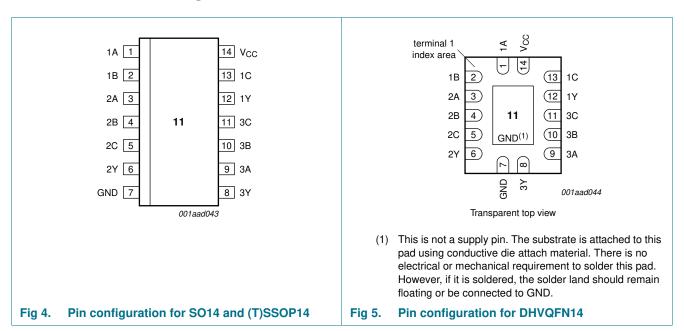
Triple 3-input AND gate

4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1A, 2A, 3A	1, 3, 9	data input
1B, 2B, 3B	2, 4, 10	data input
1C, 2C, 3C	13, 5, 11	data input

74LVC11

Triple 3-input AND gate

 Table 2.
 Pin description ...continued

Symbol	Pin	Description
1Y, 2Y, 3Y	12, 6, 8	data output
GND	7	ground (0 V)
V_{CC}	14	supply voltage

6. Functional description

Table 3. Function selection[1]

Input	nput O:						
nA	nB	nC	nY				
L	X	X	L				
X	L	X	L				
X	X	L	L				
Н	Н	Н	Н				

^[1] H = HIGH voltage level; L = LOW voltage level; X = don't care

7. Limiting values

Table 4. Limiting values

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

	_				
Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-0.5	+6.5	V
I _{IK}	input clamping current	$V_I < 0 V$	-50	-	mA
VI	input voltage		[1] -0.5	+6.5	V
I _{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0 V$	-	±50	mA
V _O	output voltage		<u>[2]</u> –0.5	$V_{CC} + 0.5$	V
Io	output current	$V_O = 0 V to V_{CC}$	-	±50	mA
I _{CC}	supply current		-	100	mA
I _{GND}	ground current		-100	-	mA
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$	<u>[3]</u> _	500	mW
T _{stg}	storage temperature		-65	+150	°C

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

^[2] The output voltage ratings may be exceeded if the output current ratings are observed.

^[3] For SO14 packages: above 70 °C the value of P_D derates linearly with 8 mW/K.
For (T)SSOP14 packages: above 60 °C the value of P_D derates linearly with 5.5 mW/K.
For DHVQFN14 packages: above 60 °C the value of P_D derates linearly with 4.5 mW/K.

Triple 3-input AND gate

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V_{CC}	supply voltage		1.65	-	3.6	V
		functional	1.2	-	-	V
VI	input voltage		0	-	5.5	V
V _O	output voltage		0	-	V_{CC}	V
T _{amb}	ambient temperature		-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.65 \text{ V to } 2.7 \text{ V}$	0	-	20	ns/V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	0	-	10	ns/V

9. Static characteristics

Table 6. Static characteristics

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40	°C to +8	35 °C	–40 °C to	+125 °C	Unit
			Min	Typ[1]	Max	Min	Max	
V_{IH}	HIGH-level	V _{CC} = 1.2 V	1.08	-	-	1.08	-	V
	input voltage	V _{CC} = 1.65 V to 1.95 V	$0.65 \times V_{CC}$	-	-	$0.65 \times V_{CC}$	-	V
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
V_{IL}	LOW-level	V _{CC} = 1.2 V	-	-	0.12	-	0.12	V
	input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	$0.35 \times V_{CC}$	-	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	-	-	0.7	-	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
V _{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}						
		$I_O = -100 \mu A;$ $V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	V _{CC} - 0.2	-	-	$V_{CC}-0.3$	-	V
		$I_O = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	1.05	-	V
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.8	-	-	1.65	-	V
		$I_{O} = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	2.05	-	V
		$I_{O} = -18 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.4	-	-	2.25	-	V
		$I_{O} = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.2	-	-	2.0	-	V
V _{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL}						
	output voltage	$I_O = 100 \mu A;$ $V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	-	-	0.2	-	0.3	V
		$I_O = 4 \text{ mA}$; $V_{CC} = 1.65 \text{ V}$	-	-	0.45	-	0.65	V
		$I_O = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.6	-	8.0	٧
		$I_O = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.4	-	0.6	V
		$I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	-	8.0	V
lı	input leakage current	$V_{CC} = 3.6 \text{ V}; V_I = 5.5 \text{ V or GND}$	-	±0.1	±5	-	±20	μА

Triple 3-input AND gate

Table 6. Static characteristics ... continued

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40	°C to +85	S °C	–40 °C to	Unit	
			Min	Typ[1]	Max	Min	Max	
I _{CC}	supply current	V_{CC} = 3.6 V; V_{I} = V_{CC} or GND; I_{O} = 0 A	-	0.1	10	-	40	μΑ
ΔI_{CC}	additional supply current	per input pin; $V_{CC} = 2.7 \text{ V to } 3.6 \text{ V};$ $V_I = V_{CC} - 0.6 \text{ V};$ $I_O = 0 \text{ A}$	-	5	500	-	5000	μА
C _I	input capacitance	$V_{CC} = 0 \text{ V to } 3.6 \text{ V};$ $V_{I} = \text{GND to } V_{CC}$	-	5.0	-	-	-	pF

^[1] All typical values are measured at V_{CC} = 3.3 V (unless stated otherwise) and T_{amb} = 25 °C.

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Figure 7.

Symbol	Parameter	Conditions		-40	°C to +8	5 °C	–40 °C to	+125 °C	Unit
				Min	Typ[1]	Max	Min	Max	
t_{pd}	propagation delay	nA, nB, nC to nY; see Figure 6	[2]						
		$V_{CC} = 1.2 V$		-	14.0	-	-	-	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.0	4.7	12.2	1.0	14.1	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		1.5	2.8	6.9	1.5	8.0	ns
		$V_{CC} = 2.7 \text{ V}$		1.5	2.9	7.0	1.5	8.1	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		1.5	2.5	6.2	1.5	7.2	ns
C_{PD}	power dissipation	per gate; $V_I = GND$ to V_{CC}	[3]						
	capacitance	$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		-	3.1	-	-	-	pF
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		-	6.2	-	-	-	pF
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		-	9.0	-	-	-	pF

^[1] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.2 V, 1.8 V, 2.5 V, 2.7 V, and 3.3 V respectively.

 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma (C_L \times V_{CC}^2 \times f_o) \text{ where:}$

 f_i = input frequency in MHz; f_o = output frequency in MHz

 C_L = output load capacitance in pF

V_{CC} = supply voltage in Volts

N = number of inputs switching

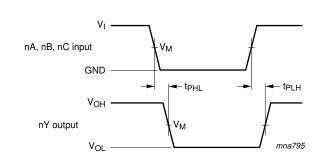
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs

^[2] t_{pd} is the same as t_{PLH} and t_{PHL} .

^[3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

Triple 3-input AND gate

11. AC waveforms

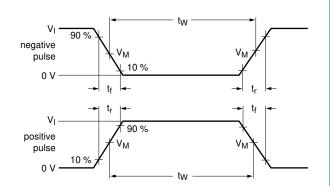


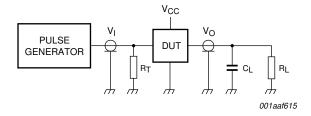
 $V_M = 1.5 \text{ V at } V_{CC} \ge 2.7 \text{ V}$

 V_{M} = 0.5 \times V_{CC} at V_{CC} < 2.7 V.

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

Fig 6. Input (nA, nB and nC) to output (nY) propagation delays





Test data is given in Table 8. 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 output impedance Z_{o} of the pulse generator.

Fig 7. Load circuitry for measuring switching times

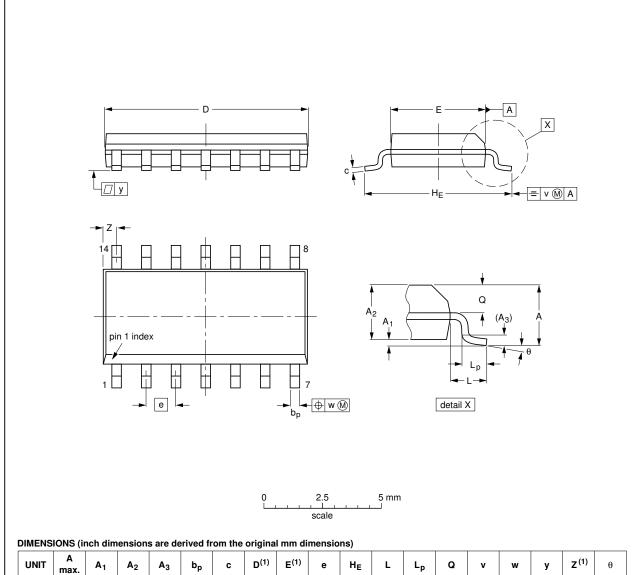
Table 8. Test data

Supply voltage	Input		Load		
	V _I	t _r , t _f	C _L	R _L	
1.2 V	V _{CC}	≤ 2 ns	30 pF	1 kΩ	
1.65 V to 1.95 V	V _{CC}	≤ 2 ns	30 pF	1 kΩ	
2.3 V to 2.7 V	V _{CC}	≤ 2 ns	30 pF	500 Ω	
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	

12. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8°
inches	0.069	0.010 0.004	0.057 0.049	0.01		0.0100 0.0075	0.35 0.34	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	0°

Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

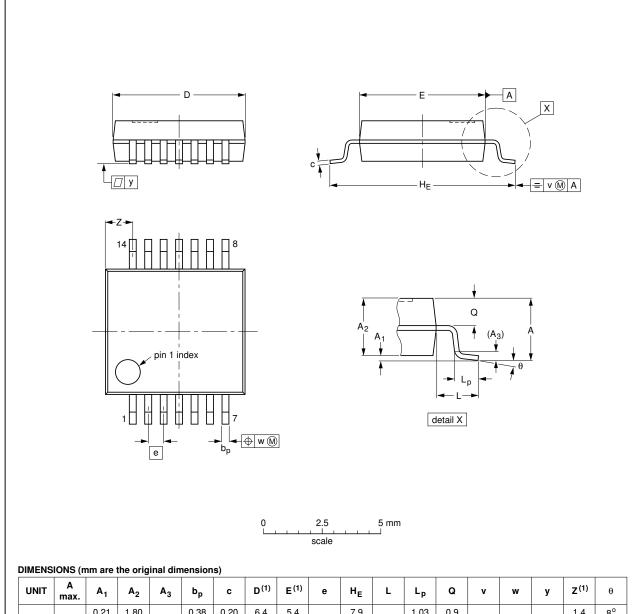
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VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT108-1	076E06	MS-012				99-12-27 03-02-19

Fig 8. Package outline SOT108-1 (SO14)

74LVC11

SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1



-							-,												
	UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	θ
	mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.4 0.9	8° 0°

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

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VERSION	l IE	С	JEDEC J			PROJECTION	ISSUE DATE	
SOT337-	1		MO-150				99-12-27 03-02-19	
							03-02-1	

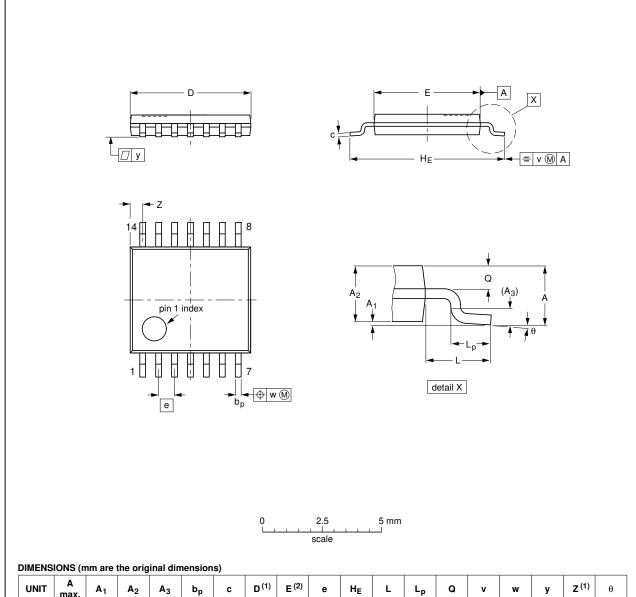
Package outline SOT337-1 (SSOP14) Fig 9.

74LVC11

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TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



UN	IIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E (2)	е	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	θ
mı	m	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.72 0.38	8° 0°

Notes

- 1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

		REFERENCES							
IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE				
	MO-153				99-12-27 03-02-18				
_	IEC				IEC JEDEC JEHA				

Fig 10. Package outline SOT402-1 (TSSOP14)

74LVC1

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DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm SOT762-1

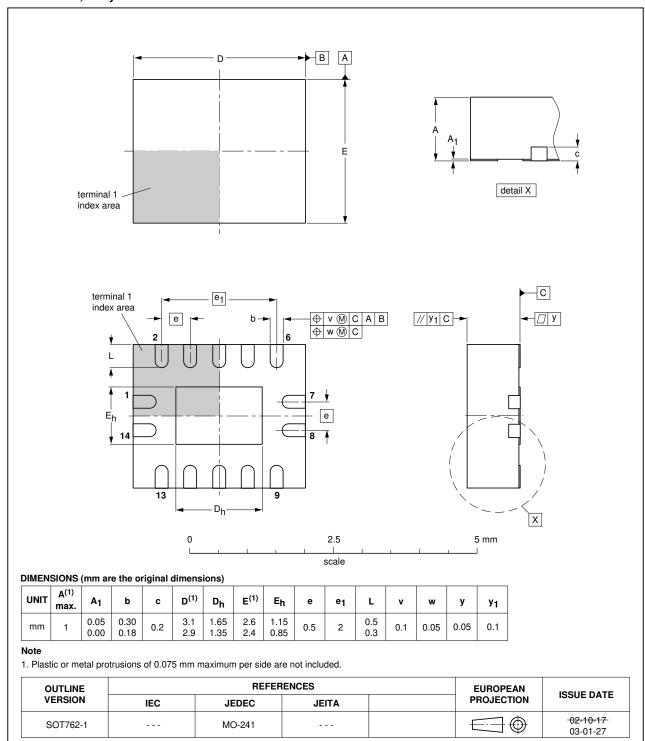


Fig 11. Package outline SOT762-1 (DHVQFN14)

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Triple 3-input AND gate

13. Abbreviations

Table 9. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

14. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC11 v.6	20111117	Product data sheet	-	74LVC11 v.5
Modifications:	 Legal pages up 	odated.		
	 <u>Table 6</u>, bodyre 	ow ΔI_{CC} : condition V_{CC} chan-	ged.	
74LVC11 v.5	20111025	Product data sheet	-	74LVC11 v.4
74LVC11 v.4	20040113	Product specification	-	74LVC11 v.3
74LVC11 v.3	19980428	Product specification	-	74LVC11 v.2
74LVC11 v.2	19980428	Product specification	-	74LVC11 v.1
74LVC11 v.1	-	-	-	-

Triple 3-input AND gate

15. Legal information

15.1 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.
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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