74LVT16374A; 74LVTH16374A

3.3 V 16-bit edge-triggered D-type flip-flop; 3-state

Rev. 07 — 22 March 2010 Product data sheet

1. General description

The 74LVT16374A; 74LVTH16374A are high performance BiCMOS products designed for V_{CC} operation at 3.3 V.

This device is a 16-bit edge-triggered D-type flip-flop featuring non-inverting 3-state outputs. The device can be used as two 8-bit flip-flops or one 16-bit flip-flop. On the positive transition of the clock (nCP), the nQn outputs of the flip-flop take on the logic levels set up at the nDn inputs.

2. Features and benefits

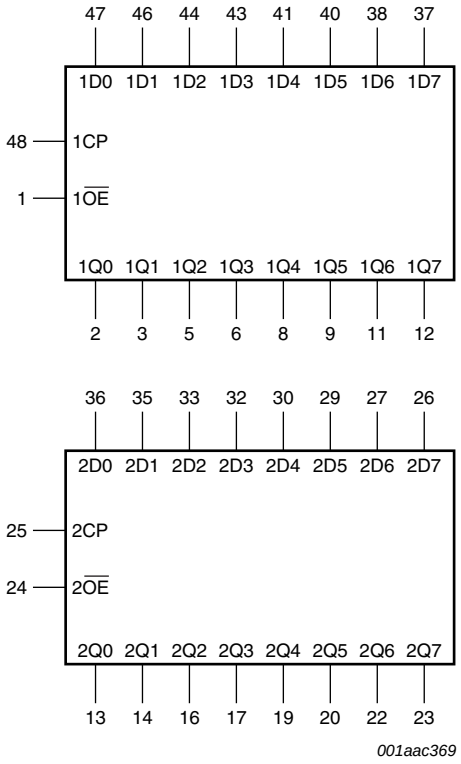
- 16-bit edge-triggered flip-flop
- 3-state buffers
- Output capability: +64 mA and −32 mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5 V supply
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Live insertion and extraction permitted
- Power-up reset
- Power-up 3-state
- No bus current loading when output is tied to 5 V bus
- Latch-up protection:
  - JESD78B Class II exceeds 500 mA
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V

3. Ordering information

Table 1. Ordering information

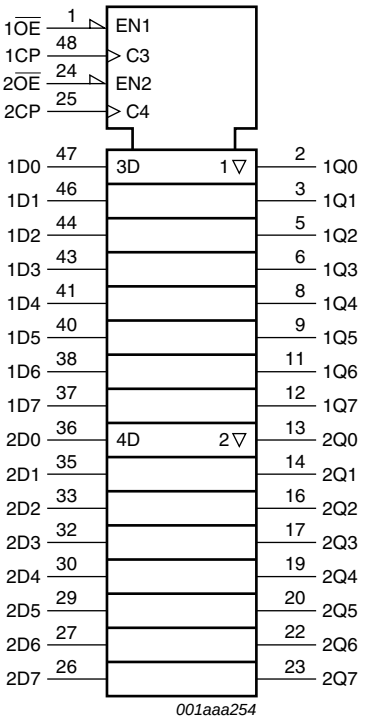
Type number	Package			
	Temperature range	Name	Description	Version
74LVT16374ADL	−40 °C to +85 °C	SSOP48	plastic shrink small outline package; 48 leads; body width 7.5 mm	SOT370-1
74LVT16374ADGG	−40 °C to +85 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1
74LVTH16374ADGG				
74LVT16374AEV	−40 °C to +85 °C	VFBGA56	plastic very thin fine-pitch ball grid array package; 56 balls; body 4.5 × 7 × 0.65 mm	SOT702-1
74LVTH16374ABQ	−40 °C to +85 °C	HXQFN60U	plastic thermal enhanced extremely thin quad flat package; no leads; 60 terminals; UTLP based; body 4 × 6 × 0.5 mm	SOT1134-1

4. Functional diagram



Pin numbers are shown for SSOP48 and TSSOP48 packages only.

Fig 1. Logic symbol



Pin numbers are shown for SSOP48 and TSSOP48 packages only.

Fig 2. IEC logic symbol

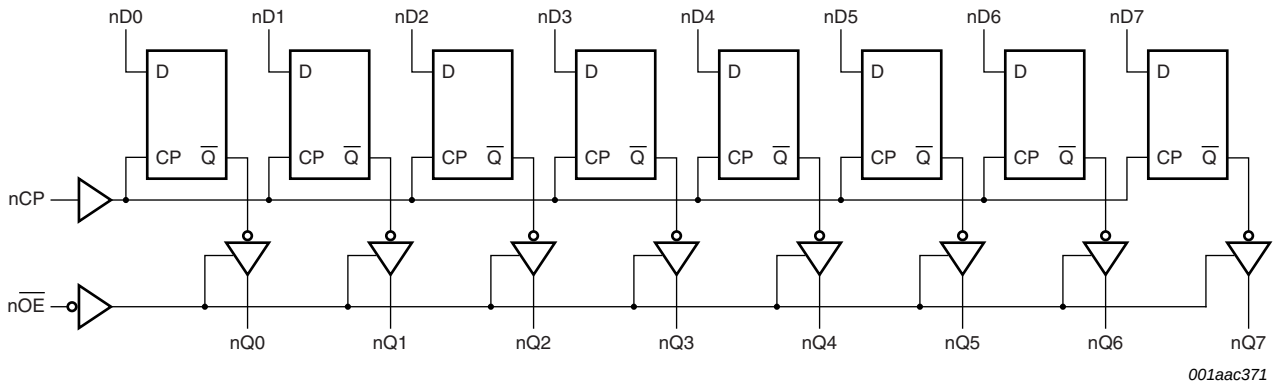


Fig 3. Logic diagram

5. Pinning information

5.1 Pinning

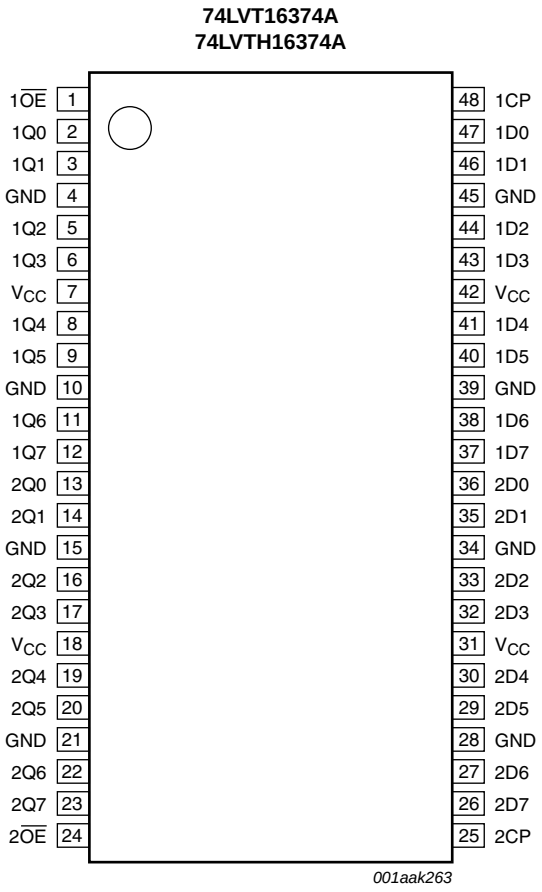
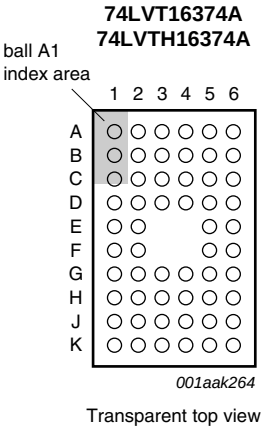
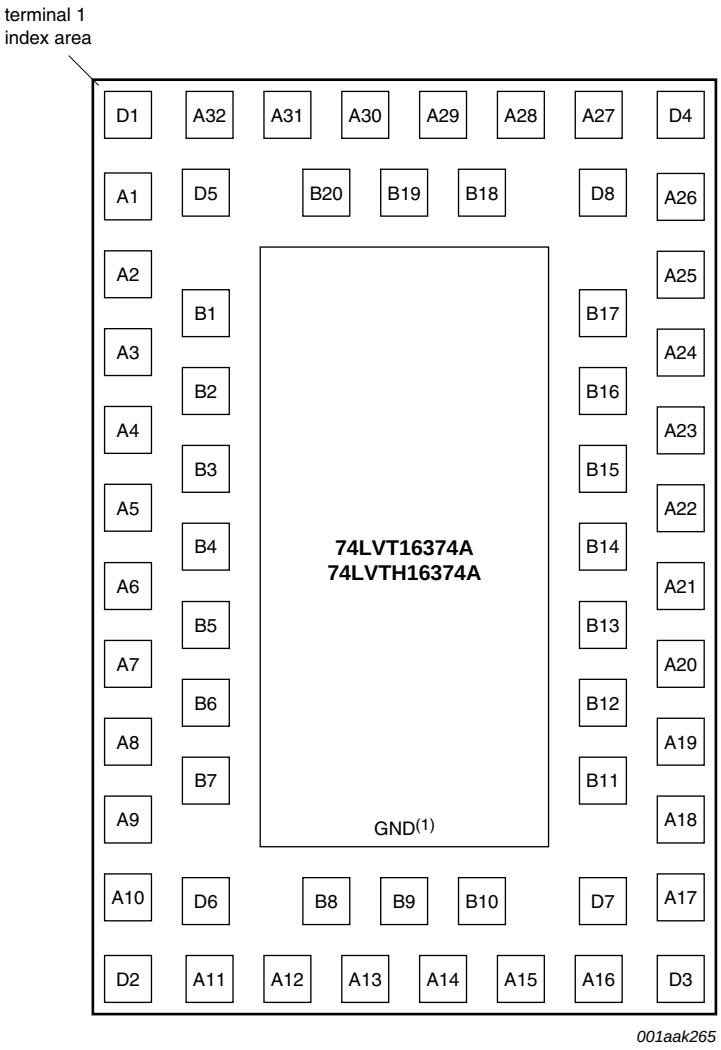


Fig 4. Pin configuration for SOT370-1 (SSOP48) and SOT362-1 (TSSOP48)



Transparent top view

Fig 5. Pin configuration for SOT702-1 (VFBGA56)



Transparent top view

(1) The die substrate is attached to this pad using conductive die attach material. It can not be used as a supply pin or input.

Fig 6. Pin configuration SOT1134-1 (HXQFN60U)

5.2 Pin description

Table 2. Pin description

Symbol	Pin			Description
	SOT370-1 and SOT362-1	SOT702-1	SOT1134-1	
$1\overline{OE}$, $2\overline{OE}$	1, 24	A1, K1	A30, A13	output enable input (active LOW)
1CP, 2CP	48, 25	A6, K6	A29, A14	clock input
1Q0 to 1Q7	2, 3, 5, 6, 8, 9, 11, 12	B2, B1, C2, C1, D2, D1, E2, E1	B20, A31, D5, D1, A2, B2, B3, A5	data output
2Q0 to 2Q7	13, 14, 16, 17, 19, 20, 22, 23	F1, F2, G1, G2, H1, H2, J1, J2	A6, B5, B6, A9, D2, D6, A12, B8	data output
GND	4, 10, 15, 21, 28, 34, 39, 45	B3, D3, G3, J3, J4, G4, D4, B4	A32, A3, A8, A11, A16, A19, A24, A27	ground (0 V)
V_{CC}	7, 18, 31, 42	C3, H3, H4, C4	A1, A10, A17, A26	supply voltage
1D0 to 1D7	47, 46, 44, 43, 41, 40, 38, 37	B5, B6, C5, C6, D5, D6, E5, E6	B18, A28, D8, D4, A25, B16, B15, A22	data input
2D0 to 2D7	36, 35, 33, 32, 30, 29, 27, 26	F6, F5, G6, G5, H6, H5, J6, J5	A21, B13, B12, A18, D3, D7, A15, B10	data input
n.c.	-	A2, A3, A4, A5, K2, K3, K4, K5	A4, A7, A20, A23, B1, B4, B7, B9, B11, B14, B17, B19	not connected

6. Functional description

Table 3. Function table[1]

Operating mode	Input			Internal register	Output
	$n\overline{OE}$	nCP	nDn		nQ0 to nQ7
Load and read register	L	↑	l	L	L
	L	↑	h	H	H
Hold	L	NC	X	NC	NC
Disable outputs	H	NC	X	NC	Z
	H	↑	nDn	nDn	Z

[1] H = HIGH voltage level;
h = HIGH voltage level one set-up time prior to the HIGH-to-LOW clock transition;
L = LOW voltage level;
l = LOW voltage level one set-up time prior to the HIGH-to-LOW clock transition;
NC = no change;
X = don't care;
Z = high-impedance OFF-state;
↑ = LOW-to-HIGH clock transition.

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	+4.6	V
V_I	input voltage		[1]	−0.5	+7.0	V
V_O	output voltage	output in OFF-state or HIGH-state	[1]	−0.5	+7.0	V
I_{IK}	input clamping current	$V_I < 0$ V		−50	-	mA
I_{OK}	output clamping current	$V_O < 0$ V		−50	-	mA
I_O	output current	output in LOW-state		-	128	mA
		output in HIGH-state		−64	-	mA
T_{stg}	storage temperature			−65	+150	°C
T_j	junction temperature		[2]	-	150	°C
P_{tot}	total power dissipation	T_{amb} = −40 °C to +85 °C				
		(T)SSOP48 package	[3]	-	500	mW
		VFBGA56 and HXQFN60U package	[4]	-	1000	mW

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

[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

[3] Above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.

[4] Above 70 °C the value of P_{tot} derates linearly with 1.8 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		2.7	-	3.6	V
V_I	input voltage		0	-	5.5	V
V_{IH}	HIGH-level input voltage		2.0	-	-	V
V_{IL}	LOW-level input voltage		-	-	0.8	V
I_{OH}	HIGH-level output current		−32	-	-	mA
I_{OL}	LOW-level output current	none	-	-	32	mA
		current duty cycle ≤ 50 %; $f_i \geq 1$ kHz	-	-	64	mA
T_{amb}	ambient temperature	in free-air	−40	-	+85	°C
$\Delta t/\Delta V$	input transition rise and fall rate	outputs enabled	-	-	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		Min	Typ[1]	Max	Unit
T_{amb} = −40 °C to +85 °C							
V_{IK}	input clamping voltage	V_{CC} = 2.7 V; I_{IK} = −18 mA		−1.2	−0.85	-	V
V_{OH}	HIGH-level output voltage	I_{OH} = −100 μA; V_{CC} = 2.7 V to 3.6 V		V_{CC} − 0.2	V_{CC}	-	V
		I_{OH} = −8 mA; V_{CC} = 2.7 V		2.4	2.5	-	V
		I_{OH} = −32 mA; V_{CC} = 3.0 V		2.0	2.3	-	V
V_{OL}	LOW-level output voltage	V_{CC} = 2.7 V					
		I_{OL} = 100 μA		-	0.07	0.2	V
		I_{OL} = 24 mA		-	0.3	0.5	V
		V_{CC} = 3.0 V					
		I_{OL} = 16 mA		-	0.25	0.4	V
		I_{OL} = 32 mA		-	0.3	0.5	V
		I_{OL} = 64 mA		-	0.4	0.55	V
$V_{OL(pu)}$	power-up LOW-level output voltage	V_{CC} = 3.6 V; I_O = 1 mA; V_I = V_{CC} or GND	[2]	-	0.1	0.55	V
I_I	input leakage current	control pins					
		V_{CC} = 3.6 V; V_I = V_{CC} or GND		-	0.1	±1	μA
		V_{CC} = 0 V or 3.6 V; V_I = 5.5 V		-	0.4	10	μA
		input data pins	[3]				
		V_{CC} = 0 V or 3.6 V; V_I = 5.5 V		-	0.4	10	μA
		V_{CC} = 3.6 V; V_I = V_{CC}		-	0.1	1	μA
		V_{CC} = 3.6 V; V_I = 0 V		−5	−0.4	-	μA
I_{OFF}	power-off leakage current	V_{CC} = 0 V; V_I or V_O = 0 V to 4.5 V		-	0.1	±100	μA
I_{BHL}	bus hold LOW current	V_{CC} = 3 V; V_I = 0.8 V		75	135	-	μA
I_{BHH}	bus hold HIGH current	V_{CC} = 3 V; V_I = 2.0 V		-	−135	−75	μA
I_{BHLO}	bus hold LOW overdrive current	input data pins; V_I = 0 V to 3.6 V; V_{CC} = 3.6 V	[4]	500	-	-	μA
I_{BHHO}	bus hold HIGH overdrive current	input data pins; V_I = 0 V to 3.6 V; V_{CC} = 3.6 V	[4]	-	-	−500	μA
I_{LO}	output leakage current	output in HIGH-state when V_O > V_{CC}; V_O = 5.5 V; V_{CC} = 3.0 V		-	50	125	μA
$I_{O(pu/pd)}$	power-up/power-down output current	V_{CC} ≤ 1.2 V; V_O = 0.5 V to V_{CC}; V_I = GND or V_{CC}; $\overline{nOE}$ = don't care	[5]	-	1	±100	μA
I_{OZ}	OFF-state output current	V_{CC} = 3.6 V; V_I = V_{IH} or V_{IL}					
		output HIGH: V_O = 3.0 V		-	0.5	5	μA
		output LOW: V_O = 0.5 V		−5	0.5	-	μA
I_{CC}	supply current	V_{CC} = 3.6 V; V_I = GND or V_{CC}; I_O = 0 A					
		outputs HIGH		-	0.07	0.12	mA
		outputs LOW		-	4.0	6.0	mA
		outputs disabled	[6]	-	0.07	0.12	mA

Table 6. Static characteristics *…continued*

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

Symbol	Parameter	Conditions		Min	Typ[1]	Max	Unit
ΔI_{CC}	additional supply current	per input pin; V_{CC} = 3.0 V to 3.6 V; one input at V_{CC} − 0.6 V, other inputs at V_{CC} or GND	[7]	-	0.1	0.2	mA
C_I	input capacitance	input pins; V_I = 0 V or 3.0 V		-	3	-	pF
C_O	output capacitance	output pins nQn; outputs disabled; V_O = 0 V or V_{CC}		-	9	-	pF

[1] Typical values are measured at V_{CC} = 3.3 V and at T_{amb} = 25 °C.

[2] For valid test results, data must not be loaded into the flips-flops (or latches) after applying power.

[3] Unused pins at V_{CC} or GND.

[4] This is the bus hold overdrive current required to force the input to the opposite logic state.

[5] This parameter is valid for any V_{CC} between 0 V and 1.2 V with a transition time of up to 10 ms. From V_{CC} = 1.2 V to V_{CC} = 3.3 V ± 0.3 V a transition time of 100 μs is permitted. This parameter is valid for T_{amb} = 25 °C only.

[6] I_{CC} is measured with outputs pulled to V_{CC} or GND.

[7] This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND.

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 10.

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
T_{amb} = −40 °C to +85 °C						
f_{max}	maximum frequency	nCP; V_{CC} = 3.3 V ± 0.3 V; see Figure 7	150	-	-	MHz
t_{PLH}	LOW to HIGH propagation delay	nCP to nQn; see Figure 7				
		V_{CC} = 3.3 V ± 0.3 V	1.5	2.9	5.0	ns
		V_{CC} = 2.7 V	-	-	5.6	ns
t_{PHL}	HIGH to LOW propagation delay	nCP to nQn; see Figure 7				
		V_{CC} = 3.3 V ± 0.3 V	1.5	3.0	5.0	ns
		V_{CC} = 2.7 V	-	-	5.6	ns
t_{PZH}	OFF-state to HIGH propagation delay	$\overline{nOE}$ to nQn; see Figure 8				
		V_{CC} = 3.3 V ± 0.3 V	1.5	3.2	4.8	ns
		V_{CC} = 2.7 V	-	-	6.0	ns
t_{PZL}	OFF-state to LOW propagation delay	$\overline{nOE}$ to nQn; see Figure 8				
		V_{CC} = 3.3 V ± 0.3 V	1.5	3.0	4.6	ns
		V_{CC} = 2.7 V	-	-	5.2	ns
t_{PHZ}	HIGH to OFF-state propagation delay	$\overline{nOE}$ to nQn; see Figure 8				
		V_{CC} = 3.3 V ± 0.3 V	1.5	3.9	5.4	ns
		V_{CC} = 2.7 V	-	-	6.0	ns
t_{PLZ}	LOW to OFF-state propagation delay	$\overline{nOE}$ to nQn; see Figure 8				
		V_{CC} = 3.3 V ± 0.3 V	1.5	3.4	4.6	ns
		V_{CC} = 2.7 V	-	-	5.0	ns

Table 7. Dynamic characteristics *...continued*

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 10.

Symbol	Parameter	Conditions		Min	Typ[1]	Max	Unit
t_{su}	set-up time	nDn to nCP; HIGH or LOW; see Figure 9	[2]				
		V_{CC} = 3.3 V ± 0.3 V		2.0	0.7	-	ns
		V_{CC} = 2.7 V		2.0	-	-	ns
t_h	hold time	nDn to nCP; HIGH or LOW; see Figure 9	[3]				
		V_{CC} = 3.3 V ± 0.3 V		0.8	0	-	ns
		V_{CC} = 2.7 V		0.1	-	-	ns
t_W	pulse width	nCP HIGH; see Figure 7	[4]				
		V_{CC} = 3.3 V ± 0.3 V		1.5	0.6	-	ns
		V_{CC} = 2.7 V		1.5	-	-	ns
		nCP LOW; see Figure 7					
		V_{CC} = 3.3 V ± 0.3 V		3.0	1.6	-	ns
		V_{CC} = 2.7 V		3.0	-	-	ns

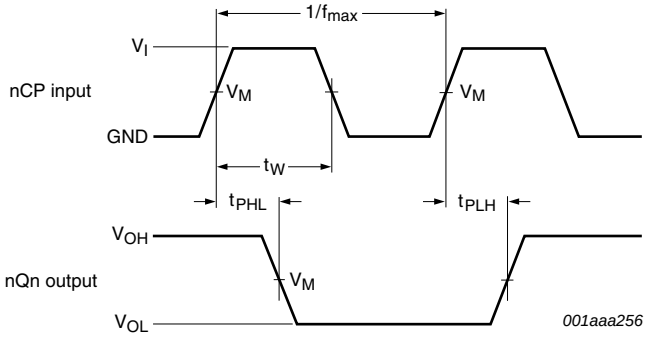
[1] All typical values are at V_{CC} = 3.3 V and T_{amb} = 25 °C.

[2] t_{su} is the same as $t_{su(H)}$ and $t_{su(L)}$.

[3] t_h is the same as $t_{h(H)}$ and $t_{h(L)}$.

[4] t_W is the same as $t_{W(H)}$ and $t_{W(L)}$.

11. Waveforms



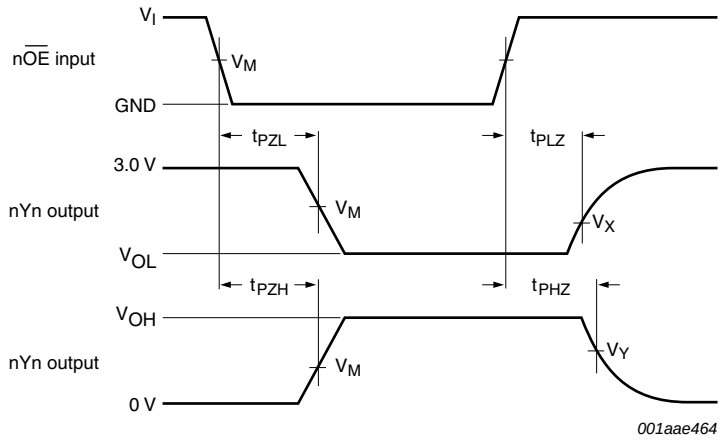
Measurement points are given in Table 8.

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

Fig 7. Propagation delay clock input to output, clock pulse width and maximum clock frequency

Table 8. Measurement points

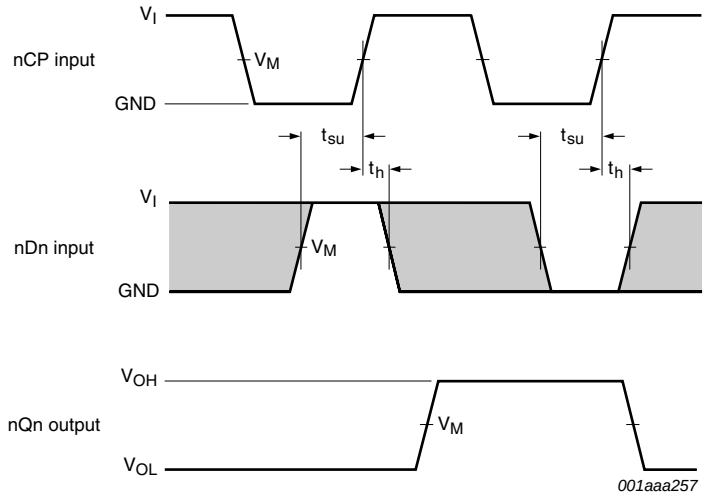
Input	Output		
V_M	V_M	V_X	V_Y
1.5 V	1.5 V	V_{OL} + 0.3 V	V_{OH} − 0.3 V



Measurements points are given in Table 8.

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

Fig 8. Enable and disable times

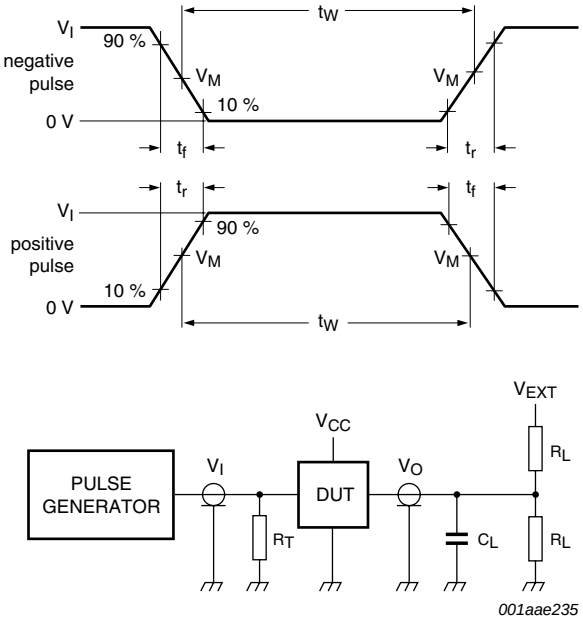


Measurement points are given in Table 8.

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

Remark: The shaded areas indicate when the input is permitted to change for predictable output performance.

Fig 9. Data set-up and hold times



Test data is given in Table 9.

Definitions 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.

V_{EXT} = Test voltage for switching times.

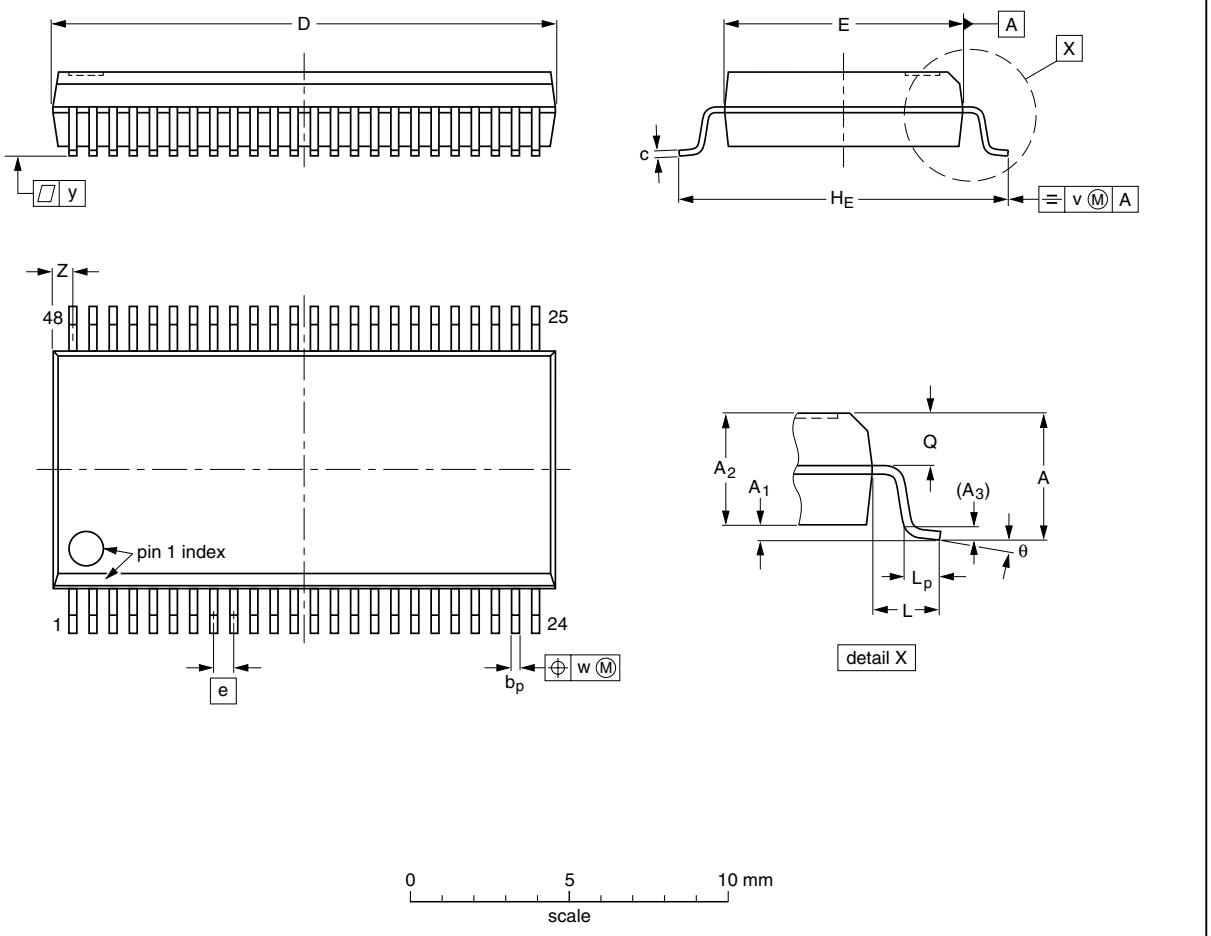
Fig 10. Test circuit for measuring switching times

Table 9. Test data

Input				Load		V_{EXT}		
V_I	f_i	t_W	t_r, t_f	C_L	R_L	t_{PHZ}, t_{PZH}	t_{PLZ}, t_{PZL}	t_{PLH}, t_{PHL}
2.7 V	≤ 10 MHz	500 ns	≤ 2.5 ns	50 pF	500 Ω	GND	6 V	open

12. Package outline

SSOP48: plastic shrink small outline package; 48 leads; body width 7.5 mm **SOT370-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.8	0.4 0.2	2.35 2.20	0.25	0.3 0.2	0.22 0.13	16.00 15.75	7.6 7.4	0.635	10.4 10.1	1.4	1.0 0.6	1.2 1.0	0.25	0.18	0.1	0.85 0.40	8° 0°

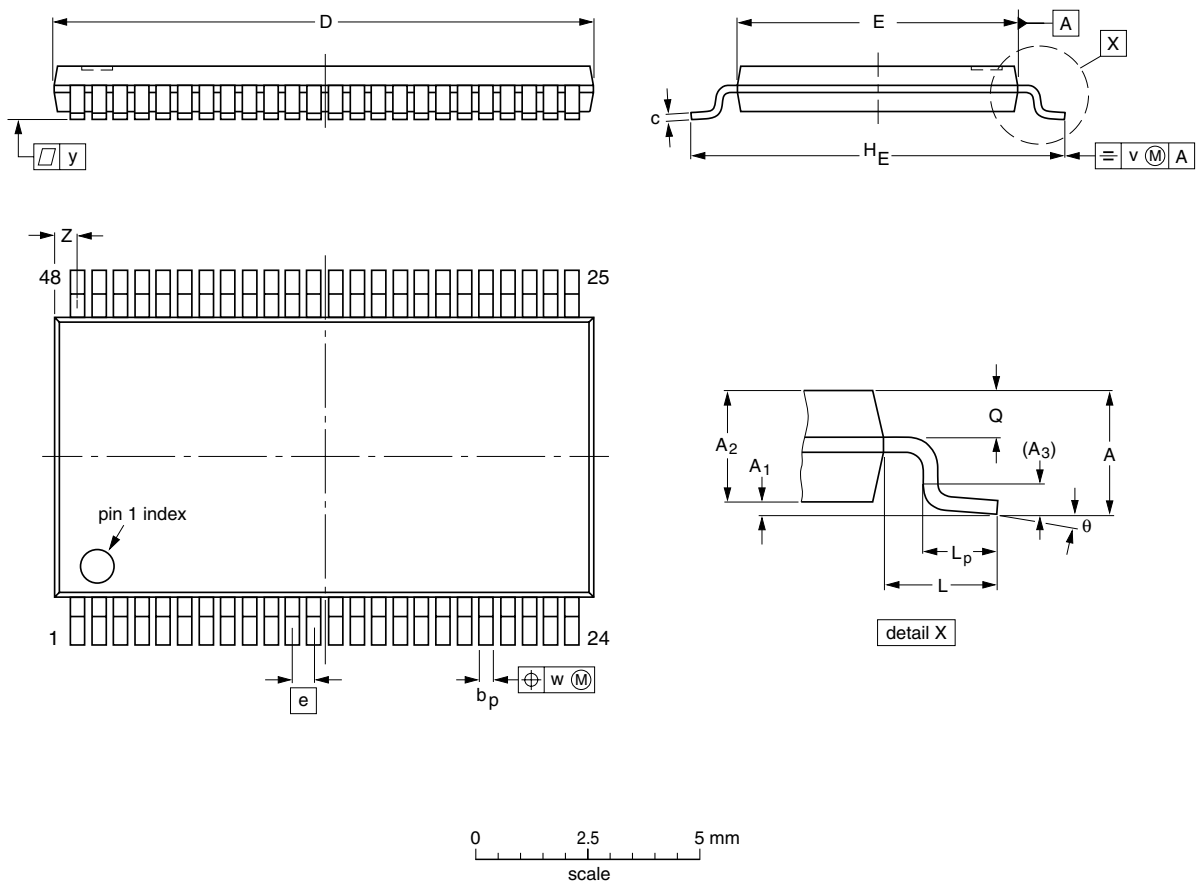
Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT370-1		MO-118				~~99-12-27~~ 03-02-19

Fig 11. Package outline SOT370-1 (SSOP48)

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1 mm **SOT362-1**



DIMENSIONS (mm are the original dimensions).

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	Q	v	w	y	Z	θ
mm	1.2	0.15 0.05	1.05 0.85	0.25	0.28 0.17	0.2 0.1	12.6 12.4	6.2 6.0	0.5	8.3 7.9	1	0.8 0.4	0.50 0.35	0.25	0.08	0.1	0.8 0.4	8^o 0^o

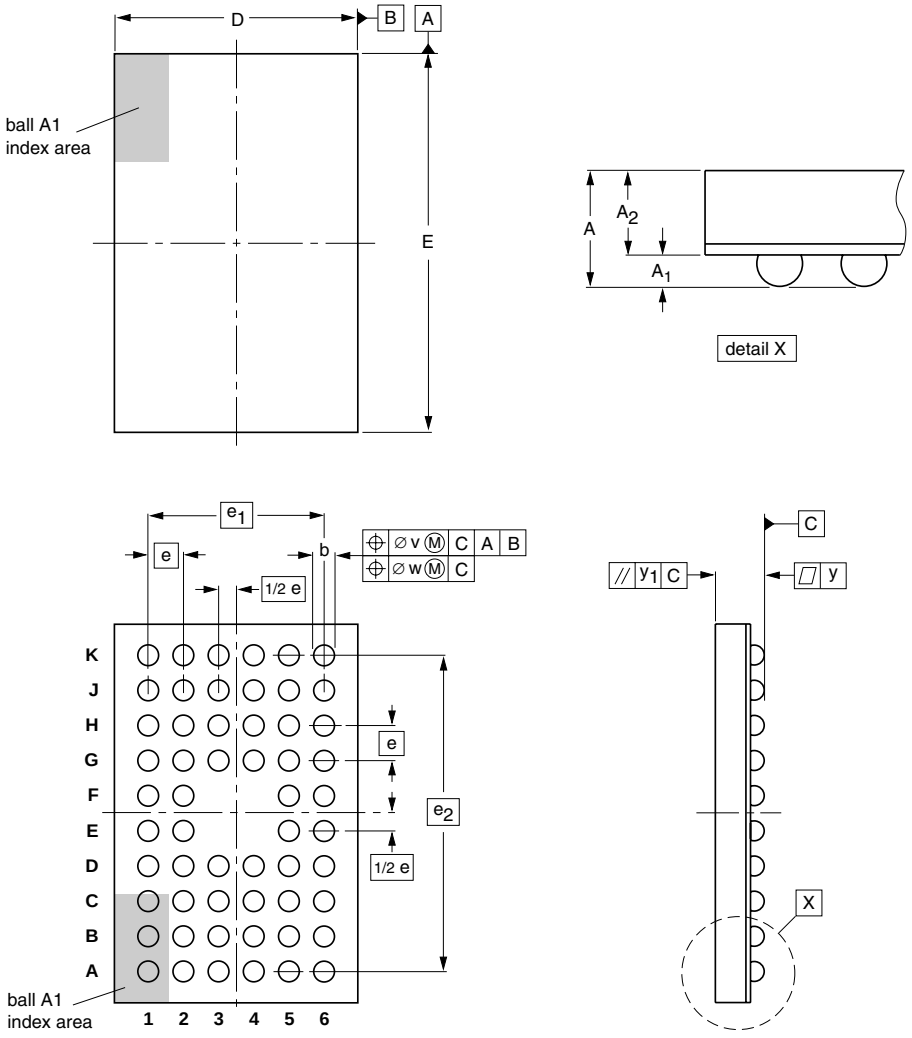
Notes

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.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT362-1		MO-153				~~99-12-27~~ 03-02-19

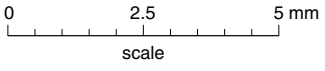
Fig 12. Package outline SOT362-1 (TSSOP48)

VFBGA56: plastic very thin fine-pitch ball grid array package; 56 balls; body 4.5 x 7 x 0.65 mm **SOT702-1**



DIMENSIONS (mm are the original dimensions)

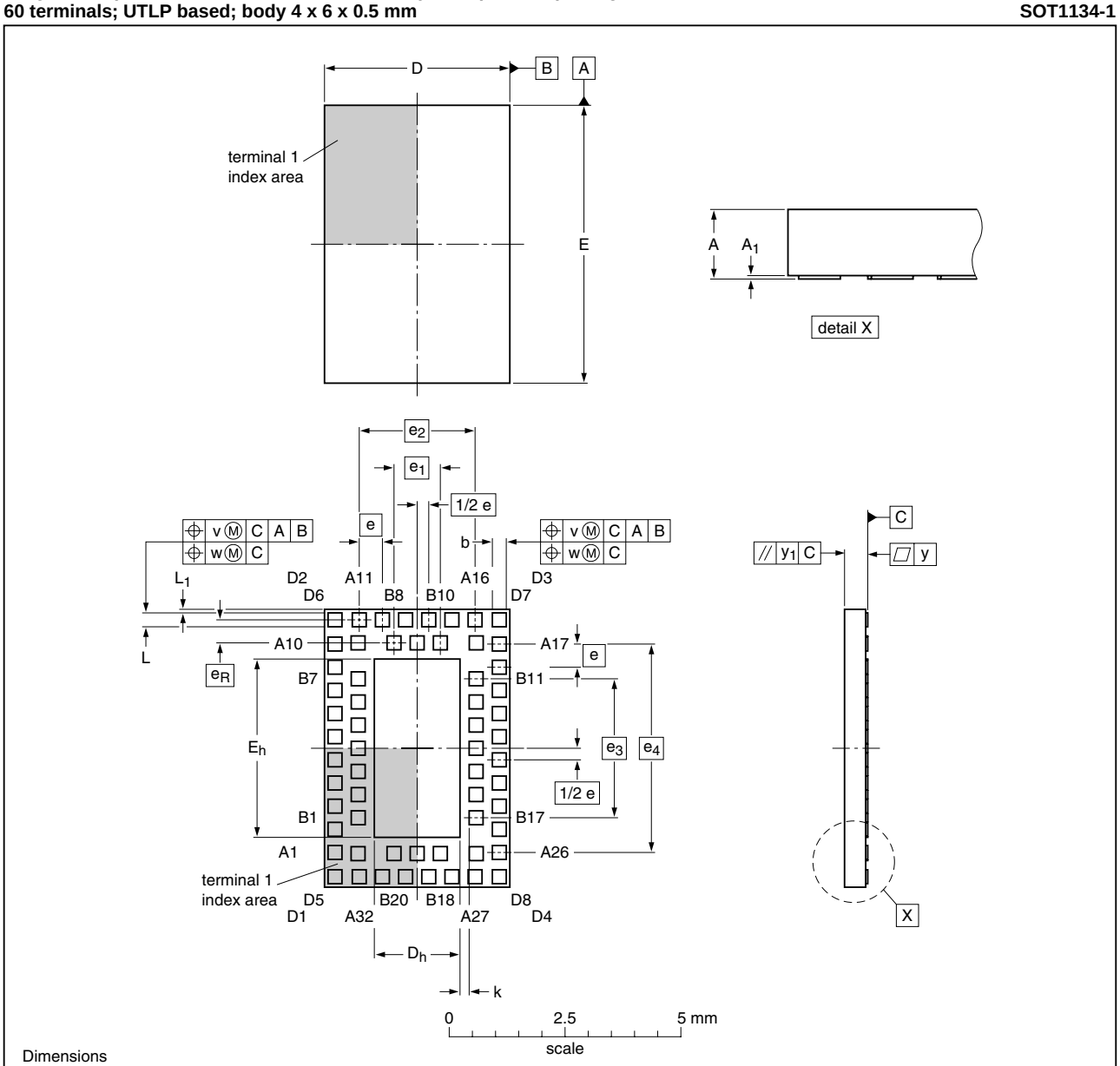
UNIT	A max.	A_1	A_2	b	D	E	e	e_1	e_2	v	w	y	y_1
mm	1	0.3 0.2	0.7 0.6	0.45 0.35	4.6 4.4	7.1 6.9	0.65	3.25	5.85	0.15	0.08	0.08	0.1



OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT702-1		MO-225				~~02-08-08~~ 03-07-01

Fig 13. Package outline SOT702-1 (VFBGA56)

HXQFN60U: plastic thermal enhanced extremely thin quad flat package; no leads; 60 terminals; UTLP based; body 4 x 6 x 0.5 mm **SOT1134-1**



Dimensions

Unit	A	A_1	b	D	D_h	E	E_h	e	e_1	e_2	e_3	e_4	eR	k	L	L_1	v	w	y	y_1
max	0.50	0.05	0.35	4.1	1.90	6.1	3.90							0.25	0.35	0.125				
mm nom	0.48	0.02	0.30	4.0	1.85	6.0	3.85	0.5	1	2.5	3	4.5	0.5	0.20	0.30	0.075	0.07	0.05	0.08	0.1
min	0.46	0.00	0.25	3.9	1.80	5.9	3.80							0.15	0.25	0.025				

sot1134-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1134-1	- - -	- - -	- - -			~~08-12-17~~ 09-01-22

Fig 14. Package outline SOT1134-1 (HXQFN60U)

13. Abbreviations

Table 10. Abbreviations

Acronym	Description
BiCMOS	Bipolar Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT_LVTH16374A_7	20100322	Product data sheet	-	74LVT_LVTH16374A_6
Modifications:	• 74LVTH16374ABQ changed from HUQFN60U (SOT1025-1) to HXQFN60U (SOT1134-1) package.			
74LVT_LVTH16374A_6	20100118	product data sheet	-	74LVT16374A_5
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Added type numbers 74LVTH16374ADGG (TSSOP48) and 74LVTH16374ABQ (HUQFN60U)			
74LVT16374A_5	20040916	product data sheet	-	74LVT16374A_4
74LVT16374A_4	20021101	product specification	-	74LVT16374A_3
74LVT16374A_3	19991018	product specification	-	74LVT16374A_2
74LVT16374A_2	19980219	product specification	-	-

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.

15.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

15.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use in automotive applications — This NXP Semiconductors product has been qualified for use in automotive applications. The product is not designed, authorized or warranted to be suitable for use in medical, military, aircraft, space or life support equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on a weakness or default in the customer application/use or the application/use of customer's third party customer(s) (hereinafter both referred to as "Application"). It is customer's sole responsibility to check whether the NXP Semiconductors product is suitable and fit for the Application planned. Customer has to do all necessary testing for the Application in order to avoid a default of the Application and the product. NXP Semiconductors does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from national authorities.

15.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

16. Contact information

For more information, please visit: **http://www.nxp.com**

For sales office addresses, please send an email to: **salesaddresses@nxp.com**

17. Contents

1 General description 1
2 Features and benefits 1
3 Ordering information 2
4 Functional diagram 2
5 Pinning information 3
5.1 Pinning 3
5.2 Pin description 5
6 Functional description 5
7 Limiting values 6
8 Recommended operating conditions 6
9 Static characteristics 7
10 Dynamic characteristics 8
11 Waveforms 9
12 Package outline 12
13 Abbreviations 16
14 Revision history 16
15 Legal information 17
15.1 Data sheet status 17
15.2 Definitions 17
15.3 Disclaimers 17
15.4 Trademarks 17
16 Contact information 18
17 Contents 19

For more information, please visit: http://www.nxp.com
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 22 March 2010
Document identifier: 74LVT_LVTH16374A_7