3.3 V 16-bit transparent D-type latch with 30 Ω termination resistors; 3-state

Rev. 2 — 1 October 2018

Product data sheet

1. General description

The 74LVT162373 is a high-performance BiCMOS product designed for V_{CC} operation at 3.3 V.

This device is a 16-bit transparent D-type latch with non-inverting 3-state bus compatible outputs. The device can be used as two 8-bit latches or one 16-bit latch. When latch enable (LE) input is HIGH, the Q outputs follow the date (D) inputs. When latch enable is taken LOW, the Q outputs are latched at the levels of the D inputs one setup time prior to the HIGH-to-LOW transition.

The 74LVT162373 is designed with 30 Ω series resistance in both the HIGH-state and LOW-state of the output. This design reduces the noise in applications such as memory address drivers, clock drivers and bus receivers and transmitters.

2. Features and benefits

- 16-bit transparent latch
- 3-state buffers
- Output capability: +12 mA/-12 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/extraction permitted
- Outputs include series resistance of 30 Ω making external termination resistors unnecessary
- 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

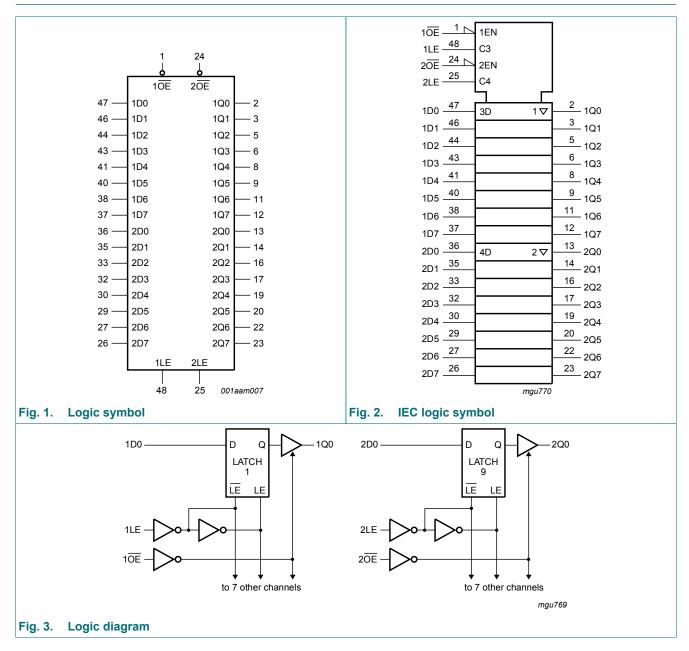
3. Ordering information

Table 1. Ordering information

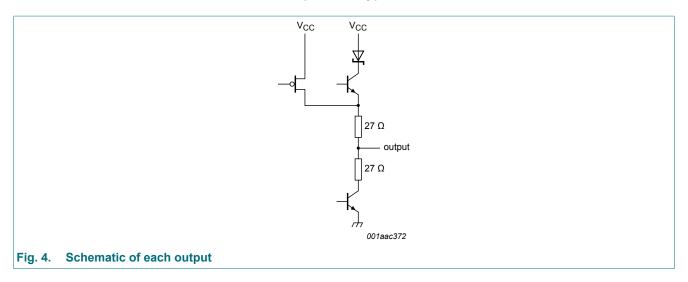
Type number	Package	ckage						
	Temperature range	Name	Description	Version				
74LVT162373DGG	-40 °C to +85 °C		plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1				

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4. Functional diagram

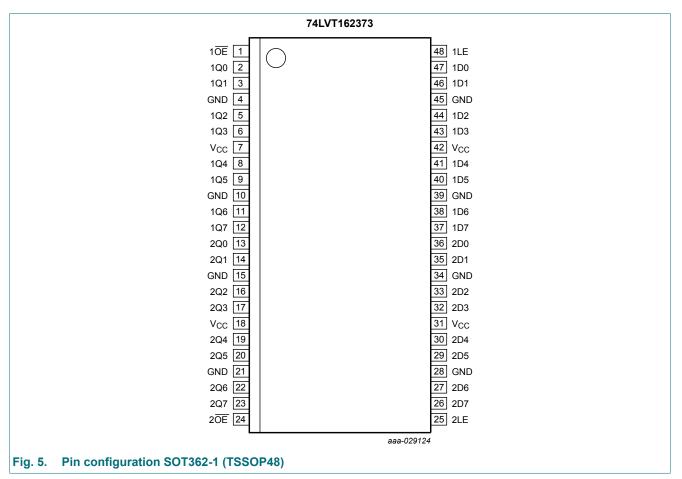


3.3 V 16-bit transparent D-type latch with 30 Ω termination resistors; 3-state



5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1D0, 1D1, 1D2, 1D3, 1D4, 1D5, 1D6, 1D7	47, 46, 44, 43, 41, 40, 38, 37	data inputs
2D0, 2D1, 2D2, 2D3, 2D4, 2D5, 2D6, 2D7	36, 35, 33, 32, 30, 29, 27, 26	data inputs
1Q0, 1Q1, 1Q2, 1Q3, 1Q4, 1Q5, 1Q6, 1Q7	2, 3, 5, 6, 8, 9, 11, 12	data outputs
2Q0, 2Q1, 2Q2, 2Q3, 2Q4, 2Q5, 2Q6, 2Q7	13, 14, 16, 17, 19, 20, 22, 23	data outputs
10E, 20E	1, 24	output enable inputs (active LOW)
1LE, 2LE	48, 25	Latch Enable inputs (active HIGH)
GND	4, 10, 15, 21, 28, 34, 39, 45	ground (0 V)
V _{CC}	7, 18, 31, 42	supply voltage

6. Functional description

Table 3. Function table [1]

Operating mode	Inputs		Internal	Outputs	
	nOE	nLE	nDn	latches	nQn
enable and read register (transparent mode)	L	Н	L	L	L
	L	Н	Н	Н	Н
latch and read register	L	↓	I	L	L
	L	\downarrow	h	Н	Н
Hold	L	L	Х	NC	NC
Latch register and disable outputs	Н	L	Х	NC	Z
	Н	Н	nDn	nDn	Z

[1] H = HIGH voltage level;

L = LOW voltage level;

 \downarrow = HIGH-to-LOW LE transition;

h = HIGH voltage level one set-up time prior to the HIGH-to-LOW LE transition;

I = LOW voltage level one set-up time prior to the HIGH-to-LOW LE transition;

X = don't care;

NC = No change;

Z = high-impedance OFF-state.

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
VI	input voltage		[1]	-0.5	+7.0	V
Vo	output voltage	output in OFF-state or HIGH-state	[1]	-0.5	+7.0	V
I _{IK}	input clamping current	V ₁ < 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

Symbol	Parameter	Conditions	Min	Max	Unit
Тj	junction temperature	[2]	-	150	°C

The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.
 The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V _{CC}	supply voltage		2.7	-	3.6	V
VI	input voltage		0	-	5.5	V
Δt/ΔV	input transition rise and fall rate	outputs enabled	-	-	10	ns/V
T _{amb}	ambient temperature	in free-air	-40	+25	+85	°C

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
V _{IK}	input clamping voltage	V _{CC} = 2.7 V; I _{IK} = -18 mA	-	-0.85	-1.2	V
VIH	HIGH-level input voltage		2.0	-	-	V
V _{IL}	LOW-level input voltage		-	-	0.8	V
V _{OH}	HIGH-level output voltage	V _{CC} = 3.0 V; I _{OH} = -12 mA	2.0	-	-	V
V _{OL}	LOW-level output voltage	V _{CC} = 3.0 V; I _{OL} = 16 mA	-	-	0.8	V
I _{OH}	HIGH-level output current		-	-	-12	mA
I _{OL}	LOW-level output current		-	-	12	mA
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
lį –	input leakage current	all input pins				
		V _{CC} = 0 V or 3.6 V; V _I = 5.5 V	-	0.4	10	μA
		control pins				
		V_{CC} = 3.6 V; V_{I} = V_{CC} or GND	-	0.1	±1	μA
		data pins; V_{CC} = 3.6 V [3]			
		V _I = V _{CC}	-	0.1	1	μA
		V ₁ = 0 V	-	-0.4	-5	μA
I _{OFF}	power-off leakage current	V_{CC} = 0 V; V ₁ or V ₀ = 0 V to 4.5 V	-	0.1	±100	μA
I _{BHL}	bus hold LOW current	nDn inputs; V_{CC} = 3 V; V_{I} = 0.8 V	75	135	-	μA
I _{BHH}	bus hold HIGH current	nDn inputs; V_{CC} = 3 V; V_{I} = 2.0 V	-75	-135	-	μA
I _{BHLO}	bus hold LOW overdrive current	nDn inputs; V_{CC} = 3.6 V; V_{I} = 0 V to 3.6 V [4] 500	-	-	μA
I _{BHHO}	bus hold HIGH overdrive current	nDn inputs; V_{CC} = 3.6 V; V_{I} = 0 V to 3.6 V [4] -	-	-500	μA
I _{CEX}	output high leakage current	output in HIGH-state when $V_0 > V_{CC}$; $V_0 = 5.5 V$; $V_{CC} = 3.0 V$	-	50	125	μA
I _{O(pu/pd)}	power-up/power-down output current	$V_{CC} \le 1.2 \text{ V}; V_0 = 0.5 \text{ V} \text{ to } V_{CC};$ [5 V _I = GND or V _{CC} ; nOE = don't care] -	1	±100	μA

Symbol	Parameter	Conditions		Min	Typ[1]	Мах	Unit
I _{OZ}	OFF-state output current	V_{CC} = 3.6 V; V _I = V _{IH} or V _{IL}					
		V _O = 3.0 V		-	0.5	5	μA
		V _O = 0.5 V		-	0.5	-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	mA
		outputs disabled	[6]	-	0.07	0.12	mA
ΔI _{CC}	additional supply current	per input pin; V_{CC} = 3 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
CI	input capacitance	V ₁ = 0 V or 3.0 V		-	3	-	pF
Co	output capacitance	Outputs disabled; $V_0 = 0 V \text{ or } 3.0 V$		-	9	-	pF

[1]

Typical values are at V_{CC} = 3.3 V and T_{amb} = 25 °C. For valid test results, data must not be loaded into the latches after applying power. [2]

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

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

[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} = 3.0 V to 3.6 V a transition time of 100 μ s is permitted. This parameter is valid for T_{amb} = 25 °C only.

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

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

10. Dynamic characteristics

Table 7. Dynamic characteristics

At recommended operating conditions; Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 10.

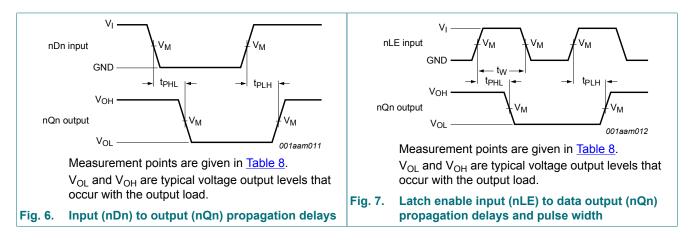
Symbol	Parameter	Conditions	Min	Typ[1]	Мах	Unit
t _{PLH}	LOW to HIGH	nDn to nQn; see <u>Fig. 6</u>				
	propagation delay	V _{CC} = 2.7 V	-	-	5.1	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.5	4.6	ns
t _{PHL}	HIGH to LOW	nDn to nQn; see <u>Fig. 6</u>				
	propagation delay	V _{CC} = 2.7 V	-	-	4.3	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.5	4.0	ns
t _{PLH}	LOW to HIGH	nLE to nQn; see Fig. 7				
	propagation delay	V _{CC} = 2.7 V	-	-	5.8	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	3.0	5.1	ns
t _{PHL}	HIGH to LOW	nLE to nQn; see Fig. 7				
	propagation delay	V _{CC} = 2.7 V	-	-	4.3	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	3.0	4.6	ns
t _{PZH}	OFF-state to HIGH	nOE to nQn; see Fig. 8				
	propagation delay	V _{CC} = 2.7 V	-	-	6.6	ns
		V _{CC} = 3.0 V to 3.6 V	0.1	3.5	5.4	ns
t _{PZL}	OFF-state to LOW	nOE to nQn; see Fig. 8				
	propagation delay	V _{CC} = 2.7 V	-	-	5.5	ns
		V _{CC} = 3.0 V to 3.6 V	0.1	3.2	4.9	ns
t _{PHZ}	HIGH to OFF-state	nOE to nQn; see Fig. 8				
	propagation delay	V _{CC} = 2.7 V	-	-	5.7	ns
		V _{CC} = 3.0 V to 3.6 V	0.1	3.5	5.4	ns

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
t _{PLZ}	LOW to OFF-state	nOE to nQn; see Fig. 8				
	propagation delay	V _{CC} = 2.7 V	-	-	5.0	ns
		V _{CC} = 3.0 V to 3.6 V	0.1	3.2	5.1	ns
t _{su(H)}	set-up time HIGH	nDn to nLE; see Fig. 9				
		V _{CC} = 2.7 V	1.0	-	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	0.1	-	ns
t _{su(L)}	set-up time LOW	nDn to nLE; see Fig. 9				
		V _{CC} = 2.7 V	2.0	-	-	ns
		V _{CC} = 3.0 V to 3.6 V	2.0	0.2	-	ns
t _{h(H)}	hold time HIGH	nDn to nLE; see Fig. 9				
		V _{CC} = 2.7 V	1.0	-	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	0	-	ns
t _{h(L)}	hold time LOW	nDn to nLE; see Fig. 9				
		V _{CC} = 2.7 V	2.0	-	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	0	-	ns
t _{WH}	pulse width HIGH	nLE; see Fig. 7				
		V _{CC} = 2.7 V	1.5	-	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	0.5	-	ns

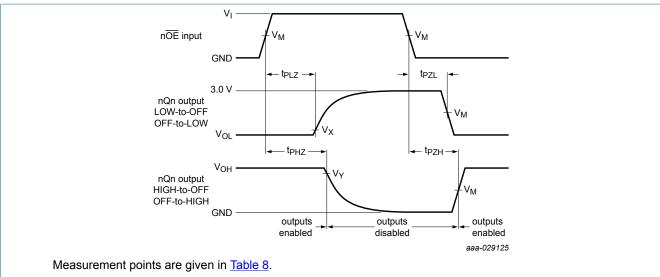
3.3 V 16-bit transparent D-type latch with 30 Ω termination resistors; 3-state

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

10.1. Waveforms and test circuit

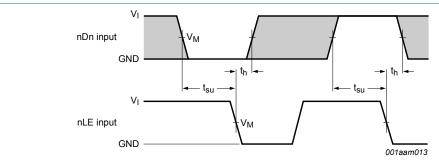


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 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig. 8. OFF-state to HIGH or LOW and HIGH or LOW to OFF-state propagation delays



Measurement points are given in Table 8.

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

Fig. 9. Input (nDn) to output (nLE) data set-up and hold times

Table 8. Measurement points

Input		Output			
VI	V _M	V _M	V _X	V _Y	
2.7 V	1.5 V	1.5 V	V _{OL} + 0.3 V	V _{OH} - 0.3 V	

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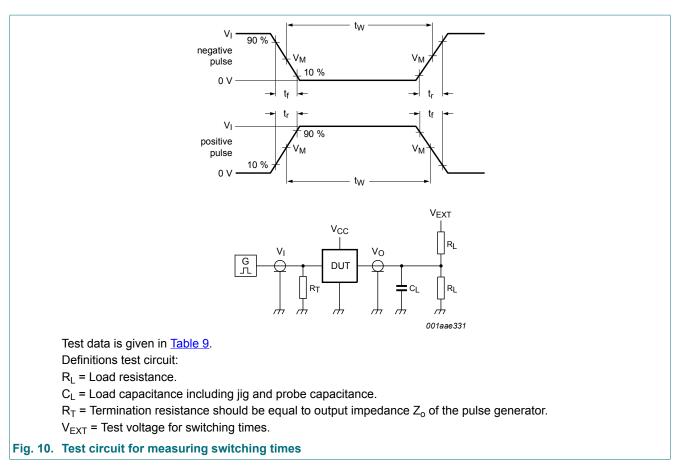


Table 9. Test data

Input			Load		V _{EXT}			
VI	V _I f _i t _W t _r , t _f		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

11. Package outline

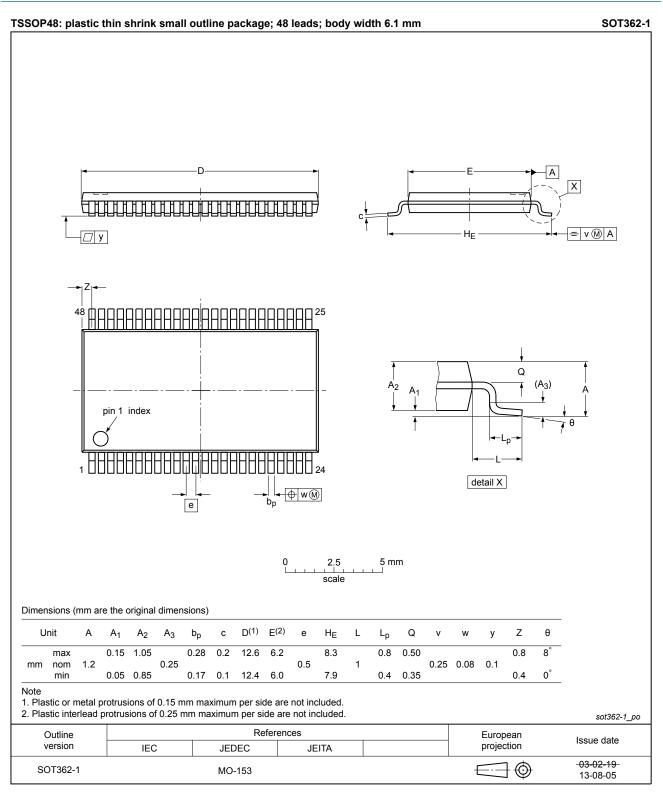


Fig. 11. Package outline SOT362-1 (TSSOP48)

74LVT162373

12. Abbreviations

Table 10. Abbreviations				
Acronym	Description			
BiCMOS	Bipolar Complementary Metal Oxide Semiconductor			
DUT	Device Under Test			
ESD	ElectroStatic Discharge			
MIL	Military			
MM	Machine Model			
TTL	Transistor-Transistor Logic			

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
74LVT162373 v.2	20181001	Product data sheet	-	74LVT162373 v.1	
Modifications:	 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. Type number 74LVT162373DL (SOT370-1) removed. 				
74LVT162373 v.1	19990923	Product specification	-	-	

14. 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.
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