

# 74ALVC162334A

16-bit registered driver with inverted register enable and 30  $\Omega$  termination resistors (3-state)

Rev. 03 — 13 December 2006

Product data sheet

## 1. General description

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The 74ALVC162334A is a 16-bit universal bus driver. Data flow is controlled by active LOW output enable ( $\overline{OE}$ ), active LOW latch enable ( $\overline{LE}$ ), and clock input (CP).

When  $\overline{LE}$  is LOW, the A to Y data flow is transparent. When  $\overline{LE}$  is HIGH and CP is held at LOW or HIGH, the data is latched; on the LOW to HIGH transient of CP, the A data is stored in the latch/flip-flop.

The 74ALVC162334A is designed with 30  $\Omega$  series resistors in both HIGH or LOW output stages.

When  $\overline{OE}$  is LOW, the outputs are active. When  $\overline{OE}$  is HIGH, the outputs go to the high-impedance OFF-state. Operation of the  $\overline{OE}$  input does not affect the state of the latch/flip-flop.

To ensure the high-impedance state during power-up or power-down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pull-up resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

## 2. Features

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- Wide supply voltage range of 1.2 V to 3.6 V
- Complies with JEDEC standard 8-1A
- CMOS low power consumption
- Direct interface with TTL levels
- Current drive:  $\pm 24$  mA at 3.0 V
- MULTIBYTE flow-through standard pinout architecture
- Low inductance multiple  $V_{CC}$  and GND pins for minimum noise and ground bounce
- Output drive capability 50  $\Omega$  transmission lines at 85  $^{\circ}$ C
- Integrated 30  $\Omega$  termination resistors
- Input diodes to accommodate strong drivers

### 3. Quick reference data

**Table 1. Quick reference data**

$V_{CC} = 3.3 V \pm 0.3 V$ ;  $GND = 0 V$ ;  $t_r = t_f \leq 2.5 ns$ ;  $C_L = 50 pF$  (see [Figure 11](#)).

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
t <sub>PHL</sub>	HIGH-to-LOW propagation delay	An to Yn; <a href="#">Figure 5</a>	1.0	2.8	4.3	ns
		$\overline{LE}$ to Yn; <a href="#">Figure 6</a>	1.3	2.8	4.4	ns
		CP to Yn; <a href="#">Figure 8</a>	1.4	3.2	4.9	ns
t <sub>PLH</sub>	LOW-to-HIGH propagation delay	An to Yn; <a href="#">Figure 5</a>	1.0	2.8	4.3	ns
		$\overline{LE}$ to Yn; <a href="#">Figure 6</a>	1.3	2.8	4.4	ns
		CP to Yn; <a href="#">Figure 8</a>	1.4	3.2	4.9	ns
f <sub>max</sub>	maximum input clock frequency	<a href="#">Figure 8</a>	150	240	-	MHz
C <sub>i</sub>	input capacitance		-	4.0	-	pF
C <sub>io</sub>	input/output capacitance		-	8.0	-	pF
C <sub>PD</sub>	power dissipation capacitance	per buffer; V <sub>I</sub> = GND to V <sub>CC</sub>	<a href="#">[2]</a>			
		transparent mode; output enabled	-	10	-	pF
		transparent mode; output disabled	-	3	-	pF
		clocked mode; output enabled	-	21	-	pF
		clocked mode; output disabled	-	15	-	pF

[1] All typical values are at T<sub>amb</sub> = 25 °C.

[2] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub>) in  $\mu W$ .

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

f<sub>i</sub> = input frequency in MHz;

C<sub>L</sub> = output load capacitance in pF;

f<sub>o</sub> = output frequency in MHz;

V<sub>CC</sub> = supply voltage in V;

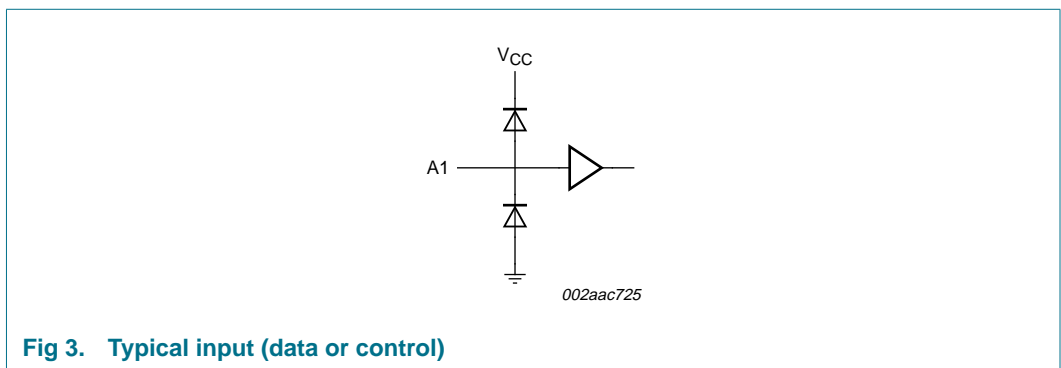
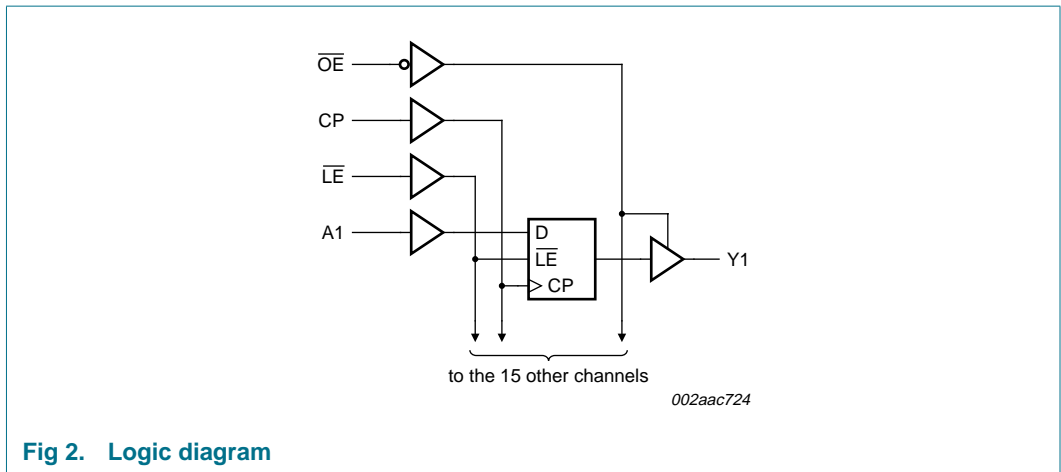
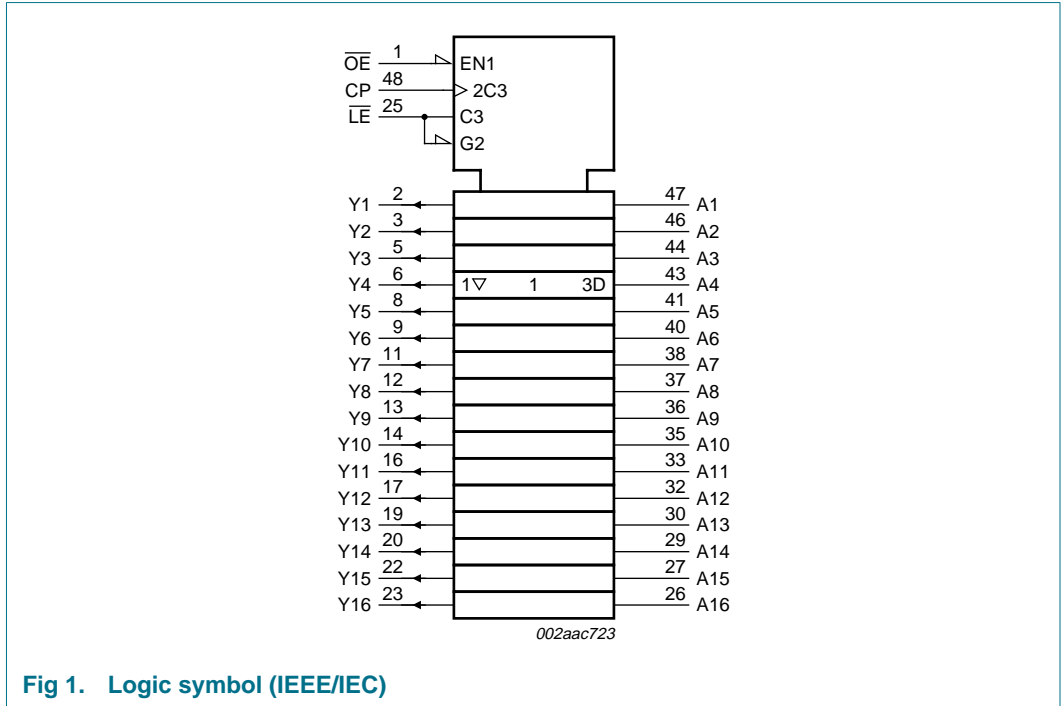
$\Sigma (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

### 4. Ordering information

**Table 2. Ordering information**

Type number	Temperature range	Package		
		Name	Description	Version
74ALVC162334ADGG	-40 °C to +85 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1

## 5. Functional diagram



## 6. Pinning information

### 6.1 Pinning

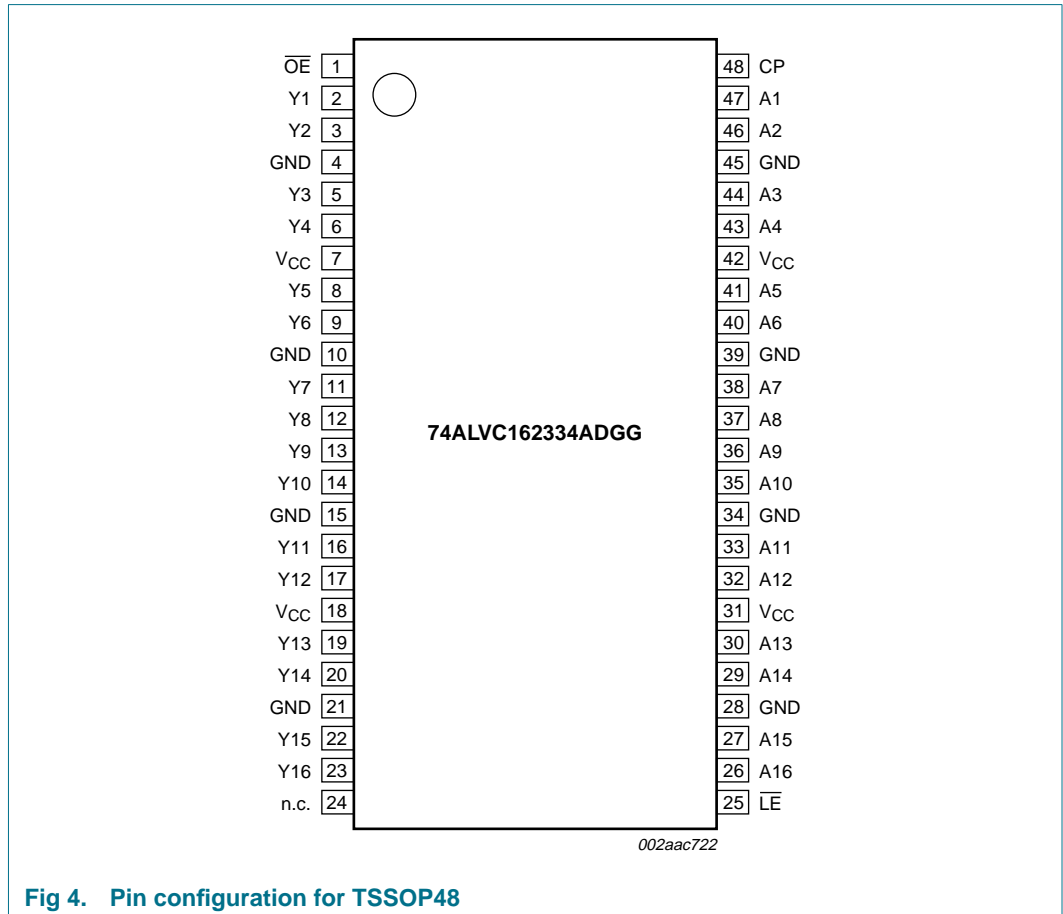


Fig 4. Pin configuration for TSSOP48

### 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
$\overline{OE}$	1	output enable input (active LOW)
Y1	2	data output 1
Y2	3	data output 2
GND	4, 10, 15, 21, 28, 34, 39, 45	ground supply (0 V)
Y3	5	data output 3
Y4	6	data output 4
V <sub>CC</sub>	7, 18, 31, 42	positive supply voltage
Y5	8	data output 5
Y6	9	data output 6
Y7	11	data output 7
Y8	12	data output 8

Table 3. Pin description ...continued

Symbol	Pin	Description
Y9	13	data output 9
Y10	14	data output 10
Y11	16	data output 11
Y12	17	data output 12
Y13	19	data output 13
Y14	20	data output 14
Y15	22	data output 15
Y16	23	data output 16
n.c.	24	not connected
$\overline{\text{LE}}$	25	latch enable input (active LOW)
A16	26	data input 16
A15	27	data input 15
A14	29	data input 14
A13	30	data input 13
A12	32	data input 12
A11	33	data input 11
A10	35	data input 10
A9	36	data input 9
A8	37	data input 8
A7	38	data input 7
A6	40	data input 6
A5	41	data input 5
A4	43	data input 4
A3	44	data input 3
A2	46	data input 2
A1	47	data input 1
CP	48	clock input

## 7. Functional description

Refer to [Figure 1 “Logic symbol \(IEEE/IEC\)”](#) and [Figure 2 “Logic diagram”](#).

### 7.1 Function selection

**Table 4. Function selection**

*H = HIGH voltage level; L = LOW voltage level; X = Don't care; Z = high-impedance OFF-state; ↑ = LOW to HIGH level transition.*

Inputs				Outputs
OE	LE	CP	An	Yn
H	X	X	X	Z
L	L	X	L	L
L	L	X	H	H
L	H	↑	L	L
L	H	↑	H	H
L	H	H	X	Y <sub>0</sub> <sup>[1]</sup>
L	H	L	X	Y <sub>0</sub> <sup>[2]</sup>

[1] Output level before the indicated steady-state input conditions were established, provided that CP is HIGH before LE goes LOW.

[2] Output level before the indicated steady-state input conditions were established.

## 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).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		-0.5	+4.6	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-	-50	mA
$V_I$	input voltage		[1] -0.5	+4.6	V
$I_{OK}$	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	$\pm 50$	mA
$V_O$	output voltage		[1] -0.5	$V_{CC} + 0.5$	V
$I_{O(sink/source)}$	output sink or source current	$V_O = 0$ V to $V_{CC}$	-	$\pm 50$	mA
$I_{CC}$	supply current		-	$\pm 100$	mA
$I_{GND}$	ground current		-	$\pm 100$	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}/pack$	total power dissipation per package	for temperature range -40 °C to +125 °C; above +55 °C derate linearly with 8 mW/K	-	600	mW

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

## 9. Recommended operating conditions

**Table 6. Operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage	2.5 V range for maximum speed performance at 30 pF output load	2.3	-	2.7	V
		3.3 V range for maximum speed performance at 50 pF output load	3.0	-	3.6	V
		for low-voltage applications	1.2	-	3.6	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature	operating in free-air	-40	-	+85	°C
$t_r$	rise time	$V_{CC} = 2.3$ V to 3.0 V	0	-	20	ns/V
		$V_{CC} = 3.0$ V to 3.6 V	0	-	10	ns/V
$t_f$	fall time	$V_{CC} = 2.3$ V to 3.0 V	0	-	20	ns/V
		$V_{CC} = 3.0$ V to 3.6 V	0	-	10	ns/V

## 10. Static characteristics

**Table 7. Static characteristics**

$T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ ; over recommended operating conditions; voltages are referenced to GND (ground = 0 V); unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$	1.7	1.2	-	V
		$V_{CC} = 2.7\text{ V}$ to $3.6\text{ V}$	2.0	1.5	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$	-	1.2	0.7	V
		$V_{CC} = 2.7\text{ V}$ to $3.6\text{ V}$	-	1.5	0.8	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$V_{CC} = 2.3\text{ V}$ to $3.6\text{ V}$ ; $I_O = -100\text{ }\mu\text{A}$	$V_{CC} - 0.2$	$V_{CC}$	-	V
		$V_{CC} = 2.3\text{ V}$ ; $I_O = -4\text{ mA}$	$V_{CC} - 0.4$	$V_{CC} - 0.11$	-	V
		$V_{CC} = 2.3\text{ V}$ ; $I_O = -6\text{ mA}$	$V_{CC} - 0.6$	$V_{CC} - 0.17$	-	V
		$V_{CC} = 2.7\text{ V}$ ; $I_O = -4\text{ mA}$	$V_{CC} - 0.5$	$V_{CC} - 0.09$	-	V
		$V_{CC} = 2.7\text{ V}$ ; $I_O = -8\text{ mA}$	$V_{CC} - 0.7$	$V_{CC} - 0.19$	-	V
		$V_{CC} = 3.0\text{ V}$ ; $I_O = -6\text{ mA}$	$V_{CC} - 0.6$	$V_{CC} - 0.13$	-	V
		$V_{CC} = 3.0\text{ V}$ ; $I_O = -12\text{ mA}$	$V_{CC} - 1.0$	$V_{CC} - 0.27$	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$V_{CC} = 2.3\text{ V}$ to $3.6\text{ V}$ ; $I_O = 100\text{ }\mu\text{A}$	-	GND	0.20	V
		$V_{CC} = 2.3\text{ V}$ ; $I_O = 4\text{ mA}$	-	0.07	0.40	V
		$V_{CC} = 2.3\text{ V}$ ; $I_O = 6\text{ mA}$	-	0.11	0.55	V
		$V_{CC} = 2.7\text{ V}$ ; $I_O = 4\text{ mA}$	-	0.06	0.40	V
		$V_{CC} = 2.7\text{ V}$ ; $I_O = 8\text{ mA}$	-	0.13	0.60	V
		$V_{CC} = 3.0\text{ V}$ ; $I_O = 6\text{ mA}$	-	0.09	0.55	V
		$V_{CC} = 3.0\text{ V}$ ; $I_O = 12\text{ mA}$	-	0.19	0.80	V
$I_{LI}$	input leakage current	$V_{CC} = 2.3\text{ V}$ to $3.6\text{ V}$ ; $V_I = V_{CC}$ or GND	-	0.1	5	$\mu\text{A}$
$I_{OZ}$	off-state output current	3-state; $V_{CC} = 2.3\text{ V}$ to $3.6\text{ V}$ ; $V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND	-	0.1	10	$\mu\text{A}$
$I_{CC}$	supply current	$V_{CC} = 2.3\text{ V}$ to $3.6\text{ V}$ ; $V_I = V_{CC}$ or GND; $I_O = 0\text{ mA}$	-	0.2	40	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	$V_{CC} = 2.3\text{ V}$ to $3.6\text{ V}$ ; $V_I = V_{CC} - 0.6\text{ V}$ ; $I_O = 0\text{ mA}$	-	150	750	$\mu\text{A}$
$C_i$	input capacitance		-	4.0	-	pF
$C_{io}$	input/output capacitance		-	8.0	-	pF
$C_{PD}$	power dissipation capacitance	per buffer; $V_I = \text{GND}$ to $V_{CC}$				
		transparent mode; output enabled	-	10	-	pF
		transparent mode; output disabled	-	3	-	pF
		clocked mode; output enabled	-	21	-	pF
		clocked mode; output disabled	-	15	-	pF

[1] All typical values are at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

[2]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$ ) in  $\mu\text{W}$ .

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

$f_i$  = input frequency in MHz;



$C_L$  = output load capacitance in pF;  
 $f_o$  = output frequency in MHz;  
 $V_{CC}$  = supply voltage in V;  
 $\Sigma (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics for  $V_{CC} = 2.3\text{ V}$  to  $2.7\text{ V}$  range**

$V_{CC} = 2.3\text{ V}$  to  $2.7\text{ V}$ ;  $GND = 0\text{ V}$ ;  $t_r = t_f \leq 2.0\text{ ns}$ ;  $C_L = 30\text{ pF}$  (see [Figure 11](#)).

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
t <sub>PHL</sub>	HIGH-to-LOW propagation delay	An to Yn; <a href="#">Figure 5</a>	1.0	3.5	5.0	ns
		$\overline{\text{LE}}$ to Yn; <a href="#">Figure 6</a>	1.3	3.5	5.0	ns
		CP to Yn; <a href="#">Figure 8</a>	1.4	3.7	5.4	ns
t <sub>PLH</sub>	LOW-to-HIGH propagation delay	An to Yn; <a href="#">Figure 5</a>	1.0	3.5	5.0	ns
		$\overline{\text{LE}}$ to Yn; <a href="#">Figure 6</a>	1.3	3.5	5.0	ns
		CP to Yn; <a href="#">Figure 8</a>	1.4	3.7	5.4	ns
t <sub>PZH</sub>	OFF-state to HIGH propagation delay	$\overline{\text{OE}}$ to Yn; <a href="#">Figure 10</a>	[2] 1.4	3.5	5.0	ns
t <sub>PZL</sub>	OFF-state to LOW propagation delay	$\overline{\text{OE}}$ to Yn; <a href="#">Figure 10</a>	[2] 1.4	3.5	5.0	ns
t <sub>PHZ</sub>	HIGH to OFF-state propagation delay	$\overline{\text{OE}}$ to Yn; <a href="#">Figure 10</a>	[3] 1.0	2.8	4.5	ns
t <sub>PLZ</sub>	LOW to OFF-state propagation delay	$\overline{\text{OE}}$ to Yn; <a href="#">Figure 10</a>	[3] 1.0	2.8	4.5	ns
t <sub>w</sub>	pulse width	CP HIGH or LOW; <a href="#">Figure 8</a>	3.3	1.0	-	ns
		$\overline{\text{LE}}$ HIGH; <a href="#">Figure 6</a>	3.3	0.7	-	ns
t <sub>su</sub>	set-up time	An to CP; <a href="#">Figure 9</a>	1.0	-	-	ns
		An to $\overline{\text{LE}}$ ; <a href="#">Figure 7</a>	1.5	-	-	ns
t <sub>h</sub>	hold time	An to CP; <a href="#">Figure 9</a>	0.4	0.4	-	ns
		An to $\overline{\text{LE}}$ ; <a href="#">Figure 7</a>	1.4	0.4	-	ns
f <sub>max</sub>	maximum input clock frequency	<a href="#">Figure 8</a>	150	190	-	MHz

[1] All typical values are at  $V_{CC} = 2.5\text{ V}$  and  $T_{\text{amb}} = 25\text{ }^\circ\text{C}$ .

[2] 3-state output enable time.

[3] 3-state output disable time.

**Table 9. Dynamic characteristics for  $V_{CC} = 2.7\text{ V}$**

$V_{CC} = 2.7\text{ V}$ ;  $GND = 0\text{ V}$ ;  $t_r = t_f \leq 2.5\text{ ns}$ ;  $C_L = 50\text{ pF}$  (see [Figure 11](#)).

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
t <sub>PHL</sub>	HIGH-to-LOW propagation delay	An to Yn; <a href="#">Figure 5</a>	1.0	3.3	4.6	ns
		$\overline{\text{LE}}$ to Yn; <a href="#">Figure 6</a>	1.3	3.4	4.8	ns
		CP to Yn; <a href="#">Figure 8</a>	1.4	3.8	6.2	ns
t <sub>PLH</sub>	LOW-to-HIGH propagation delay	An to Yn; <a href="#">Figure 5</a>	1.0	3.3	4.6	ns
		$\overline{\text{LE}}$ to Yn; <a href="#">Figure 6</a>	1.3	3.4	4.8	ns
		CP to Yn; <a href="#">Figure 8</a>	1.4	3.8	6.2	ns
t <sub>PZH</sub>	OFF-state to HIGH propagation delay	$\overline{\text{OE}}$ to Yn; <a href="#">Figure 10</a>	[2] 1.1	3.7	6.0	ns
t <sub>PZL</sub>	OFF-state to LOW propagation delay	$\overline{\text{OE}}$ to Yn; <a href="#">Figure 10</a>	[2] 1.1	3.7	6.0	ns
t <sub>PHZ</sub>	HIGH to OFF-state propagation delay	$\overline{\text{OE}}$ to Yn; <a href="#">Figure 10</a>	[3] 1.3	3.5	4.9	ns
t <sub>PLZ</sub>	LOW to OFF-state propagation delay	$\overline{\text{OE}}$ to Yn; <a href="#">Figure 10</a>	[3] 1.3	3.5	4.9	ns

**Table 9. Dynamic characteristics for  $V_{CC} = 2.7\text{ V}$  ...continued**  
 $V_{CC} = 2.7\text{ V}$ ;  $GND = 0\text{ V}$ ;  $t_r = t_f \leq 2.5\text{ ns}$ ;  $C_L = 50\text{ pF}$  (see [Figure 11](#)).

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
$t_w$	pulse width	CP HIGH or LOW; <a href="#">Figure 8</a>	3.3	1.2	-	ns
		$\overline{LE}$ HIGH; <a href="#">Figure 6</a>	3.3	0.6	-	ns
$t_{su}$	set-up time	An to CP; <a href="#">Figure 9</a>	1.0	-	-	ns
		An to $\overline{LE}$ ; <a href="#">Figure 7</a>	1.5	-	-	ns
$t_h$	hold time	An to CP; <a href="#">Figure 9</a>	0.6	0.3	-	ns
		An to $\overline{LE}$ ; <a href="#">Figure 7</a>	1.7	0.4	-	ns
$f_{max}$	maximum input clock frequency	<a href="#">Figure 8</a>	150	190	-	MHz

[1] All typical values are measured at  $T_{amb} = 25\text{ °C}$ .

[2] 3-state output enable time.

[3] 3-state output disable time.

**Table 10. Dynamic characteristics for  $V_{CC} = 3.0\text{ V}$  to  $3.6\text{ V}$  range**  
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ ;  $GND = 0\text{ V}$ ;  $t_r = t_f \leq 2.5\text{ ns}$ ;  $C_L = 50\text{ pF}$  (see [Figure 11](#)).

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
$t_{PHL}$	HIGH-to-LOW propagation delay	An to Yn; <a href="#">Figure 5</a>	1.0	2.8	4.3	ns
		$\overline{LE}$ to Yn; <a href="#">Figure 6</a>	1.3	2.8	4.4	ns
		CP to Yn; <a href="#">Figure 8</a>	1.4	3.2	4.9	ns
$t_{PLH}$	LOW-to-HIGH propagation delay	An to Yn; <a href="#">Figure 5</a>	1.0	2.8	4.3	ns
		$\overline{LE}$ to Yn; <a href="#">Figure 6</a>	1.3	2.8	4.4	ns
		CP to Yn; <a href="#">Figure 8</a>	1.4	3.2	4.9	ns
$t_{PZH}$	OFF-state to HIGH propagation delay	$\overline{OE}$ to Yn; <a href="#">Figure 10</a>	[2] 1.1	2.4	4.5	ns
$t_{PZL}$	OFF-state to LOW propagation delay	$\overline{OE}$ to Yn; <a href="#">Figure 10</a>	[2] 1.1	2.4	4.5	ns
$t_{PHZ}$	HIGH to OFF-state propagation delay	$\overline{OE}$ to Yn; <a href="#">Figure 10</a>	[3] 1.3	2.4	4.8	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	$\overline{OE}$ to Yn; <a href="#">Figure 10</a>	[3] 1.3	2.4	4.8	ns
$t_w$	pulse width	CP HIGH or LOW; <a href="#">Figure 8</a>	3.3	0.7	-	ns
		$\overline{LE}$ HIGH; <a href="#">Figure 6</a>	3.3	0.6	-	ns
$t_{su}$	set-up time	An to CP; <a href="#">Figure 9</a>	1.0	-	-	ns
		An to $\overline{LE}$ ; <a href="#">Figure 7</a>	1.5	-	-	ns
$t_h$	hold time	An to CP; <a href="#">Figure 9</a>	0.9	0.3	-	ns
		An to $\overline{LE}$ ; <a href="#">Figure 7</a>	1.4	0.4	-	ns
$f_{max}$	maximum input clock frequency	<a href="#">Figure 8</a>	150	240	-	MHz

[1] All typical values are measured at  $V_{CC} = 3.3\text{ V}$ ,  $T_{amb} = 25\text{ °C}$ .

[2] 3-state output enable time.

[3] 3-state output disable time.

11.1 AC waveforms

$V_{CC} = 3.0\text{ V to }3.6\text{ V}$  and  $V_{CC} = 2.7\text{ V}$  range:

$$V_M = 1.5\text{ V}; V_X = V_{OL} + 0.3\text{ V}; V_Y = V_{OH} - 0.3\text{ V}; V_I = 2.7\text{ V}.$$

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

$V_{CC} = 2.3\text{ V to }2.7\text{ V}$  and  $V_{CC} < 2.3\text{ V}$  range:

$$V_M = 0.5\text{ V}; V_X = V_{OL} + 0.15\text{ V}; V_Y = V_{OH} - 0.15\text{ V}; V_I = V_{CC}.$$

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

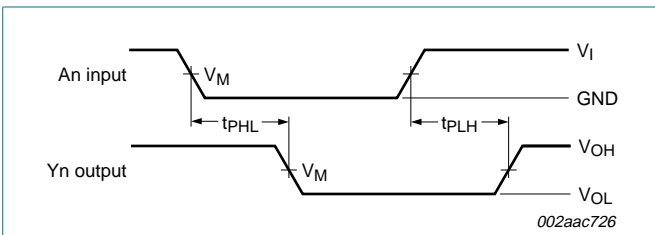


Fig 5. Input (An) to output (Yn) propagation delay

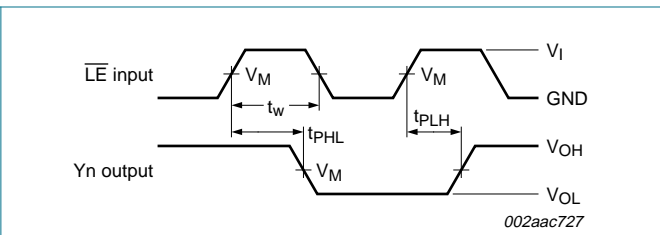
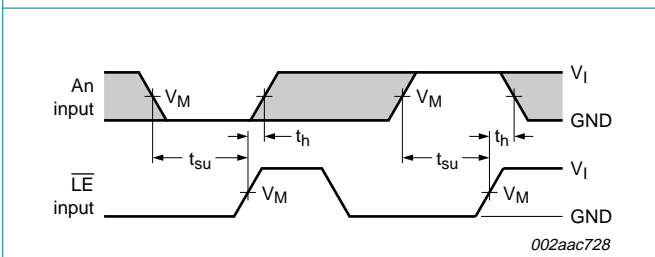


Fig 6.  $\overline{LE}$  input pulse width,  $\overline{LE}$  input to Yn output propagation delays



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

Fig 7. Data set-up and hold times, An input to  $\overline{LE}$  input

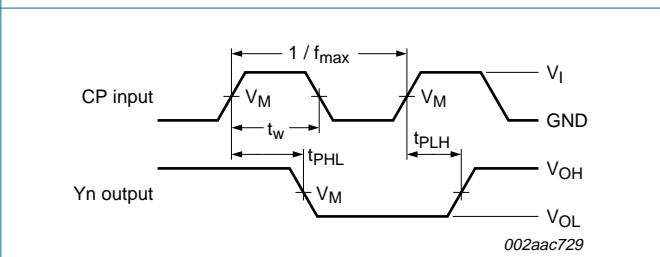
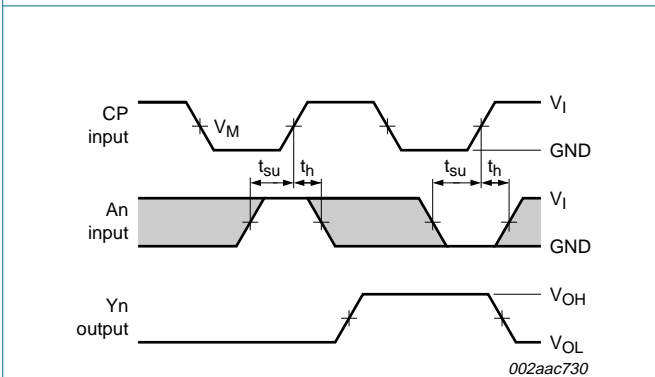


Fig 8. CP to Yn propagation delays, clock pulse width, and maximum clock frequency



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

Fig 9. Data set-up and hold times, An input to CP input

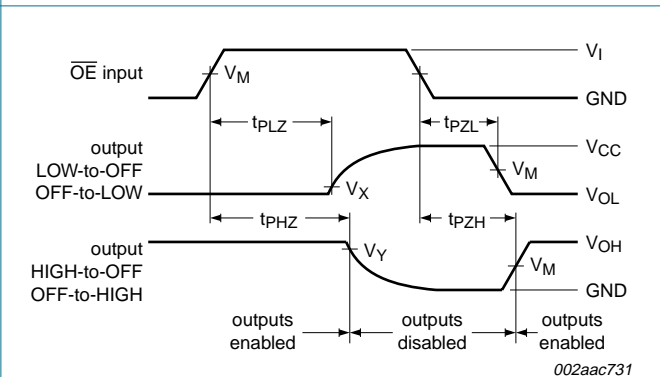


Fig 10. 3-state enable and disable times

12. Test information

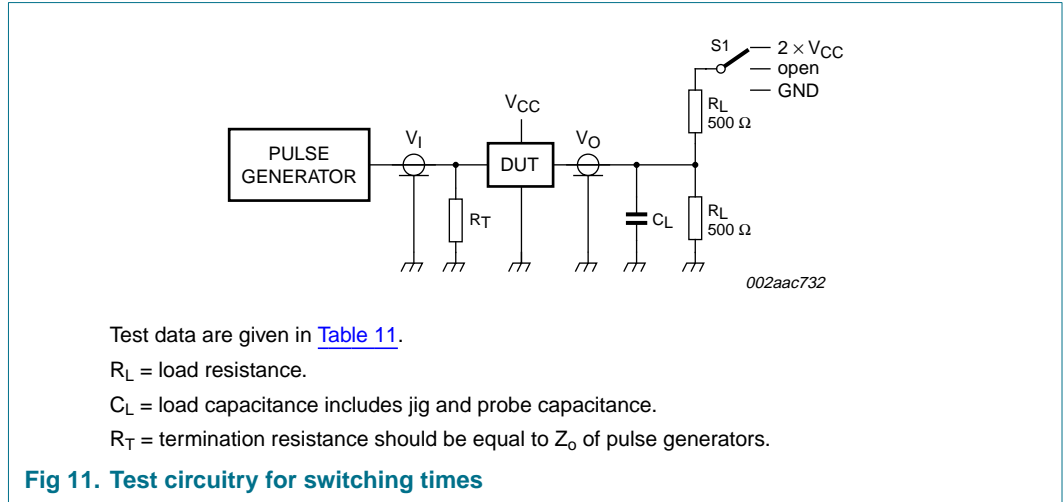


Table 11. Test data

Supply voltage $V_{CC}$	Input		Load		Switch S1		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
2.3 V to 2.7 V	$V_{CC}$	$\leq 2.0$ ns	30 pF	500 $\Omega$	open	GND (0 V)	$2 \times V_{CC}$
2.7 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	GND (0 V)	$2 \times V_{CC}$
3.0 V to 3.6 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	GND (0 V)	$2 \times V_{CC}$

13. Package outline

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1 mm

SOT362-1

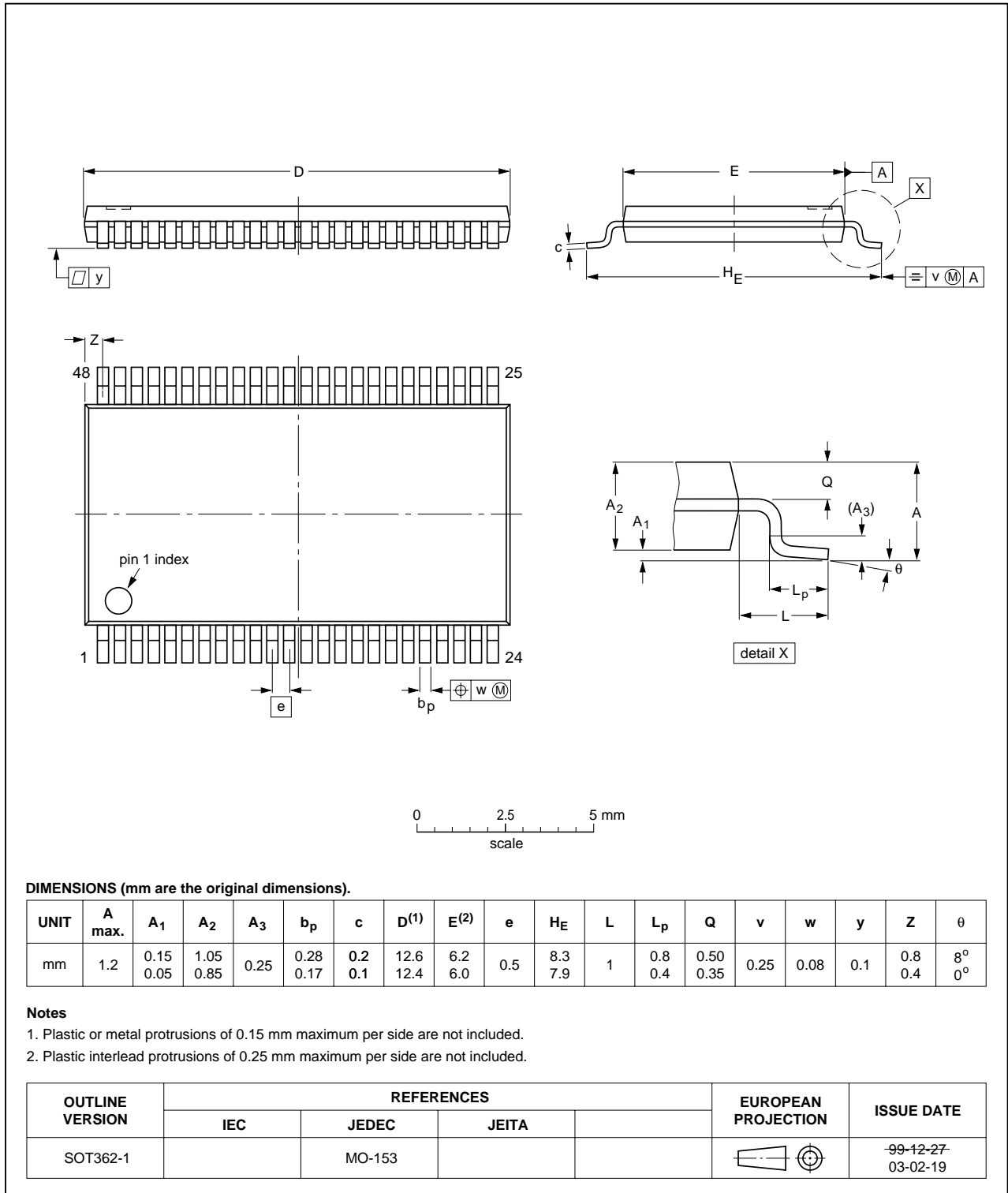


Fig 12. Package outline SOT362-1 (TSSOP48)

## 14. Soldering

This text provides a very brief insight into a complex technology. A more in-depth account of soldering ICs can be found in Application Note *AN10365 "Surface mount reflow soldering description"*.

### 14.1 Introduction to soldering

Soldering is one of the most common methods through which packages are attached to Printed Circuit Boards (PCBs), to form electrical circuits. The soldered joint provides both the mechanical and the electrical connection. There is no single soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and Surface Mount Devices (SMDs) are mixed on one printed wiring board; however, it is not suitable for fine pitch SMDs. Reflow soldering is ideal for the small pitches and high densities that come with increased miniaturization.

### 14.2 Wave and reflow soldering

Wave soldering is a joining technology in which the joints are made by solder coming from a standing wave of liquid solder. The wave soldering process is suitable for the following:

- Through-hole components
- Leaded or leadless SMDs, which are glued to the surface of the printed circuit board

Not all SMDs can be wave soldered. Packages with solder balls, and some leadless packages which have solder lands underneath the body, cannot be wave soldered. Also, leaded SMDs with leads having a pitch smaller than ~0.6 mm cannot be wave soldered, due to an increased probability of bridging.

The reflow soldering process involves applying solder paste to a board, followed by component placement and exposure to a temperature profile. Leaded packages, packages with solder balls, and leadless packages are all reflow solderable.

Key characteristics in both wave and reflow soldering are:

- Board specifications, including the board finish, solder masks and vias
- Package footprints, including solder thieves and orientation
- The moisture sensitivity level of the packages
- Package placement
- Inspection and repair
- Lead-free soldering versus PbSn soldering

### 14.3 Wave soldering

Key characteristics in wave soldering are:

- Process issues, such as application of adhesive and flux, clinching of leads, board transport, the solder wave parameters, and the time during which components are exposed to the wave
- Solder bath specifications, including temperature and impurities

## 14.4 Reflow soldering

Key characteristics in reflow soldering are:

- Lead-free versus SnPb soldering; note that a lead-free reflow process usually leads to higher minimum peak temperatures (see [Figure 13](#)) than a PbSn process, thus reducing the process window
- Solder paste printing issues including smearing, release, and adjusting the process window for a mix of large and small components on one board
- Reflow temperature profile; this profile includes preheat, reflow (in which the board is heated to the peak temperature) and cooling down. It is imperative that the peak temperature is high enough for the solder to make reliable solder joints (a solder paste characteristic). In addition, the peak temperature must be low enough that the packages and/or boards are not damaged. The peak temperature of the package depends on package thickness and volume and is classified in accordance with [Table 12](#) and [13](#)

**Table 12. SnPb eutectic process (from J-STD-020C)**

Package thickness (mm)	Package reflow temperature (°C)	
	Volume (mm <sup>3</sup> )	
	< 350	≥ 350
< 2.5	235	220
≥ 2.5	220	220

**Table 13. Lead-free process (from J-STD-020C)**

Package thickness (mm)	Package reflow temperature (°C)		
	Volume (mm <sup>3</sup> )		
	< 350	350 to 2000	> 2000
< 1.6	260	260	260
1.6 to 2.5	260	250	245
> 2.5	250	245	245

Moisture sensitivity precautions, as indicated on the packing, must be respected at all times.

Studies have shown that small packages reach higher temperatures during reflow soldering, see [Figure 13](#).

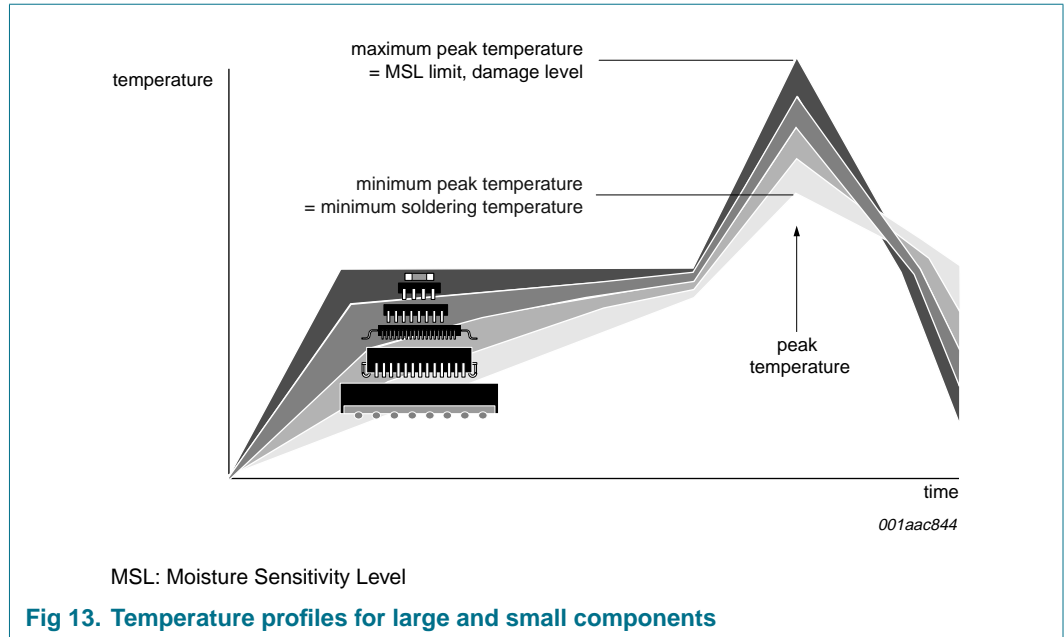


Fig 13. Temperature profiles for large and small components

For further information on temperature profiles, refer to Application Note AN10365 “Surface mount reflow soldering description”.

## 15. Abbreviations

Table 14. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
TTL	Transistor-Transistor Logic

## 16. Revision history

Table 15. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVC162334A_3	20061213	Product data sheet	-	74ALVC162334A_2

- Modifications:
- The format of this data sheet has been redesigned to comply with the new identity guidelines of Nexperia.
  - Legal texts have been adapted to the new company name where appropriate.
  - [Section 1 “General description”](#), 1<sup>st</sup> paragraph, 2<sup>nd</sup> sentence: changed “OE” to “ $\overline{OE}$ ”
  - [Table 2 “Ordering information”](#): changed (SOT364-1; TSSOP56) package to (SOT362-1; TSSOP48) package
  - [Table 3 “Pin description”](#) corrected:
    - changed “Y<sub>1</sub> to Y<sub>18</sub>” to (Y1 to Y16, noted separately)
    - GND pins: added pins 4 and 39
    - V<sub>CC</sub> pins changed from “7, 22, 35, 50” to “7, 18, 31, 42”
    - changed “A<sub>1</sub> to A<sub>18</sub>” to (A1 to A16, noted separately)
  - [Figure 1 “Logic symbol \(IEEE/IEC\)”](#): corrected pin number for Y15 from “21” to “22”



Table 15. Revision history ...continued

Document ID	Release date	Data sheet status	Change notice	Supersedes
Modifications: (continued)				
			<ul style="list-style-type: none"> <li>• <a href="#">Figure 1 “Logic symbol (IEEE/IEC)”</a>: corrected pin number for Y15 from “21” to “22”</li> <li>• <a href="#">Figure 2 “Logic diagram”</a>: <ul style="list-style-type: none"> <li>– changed signal “A<sub>0</sub>” to “A1”</li> <li>– changed signal “Y<sub>0</sub>” to “Y1”</li> <li>– changed “to the 17 other channels” to “to the 15 other channels”</li> </ul> </li> <li>• <a href="#">Table 5 “Limiting values”</a> (title changed from “Absolute maximum ratings”): <ul style="list-style-type: none"> <li>– parameter definition of I<sub>IK</sub> changed from “DC input diode current” to “input clamping current”</li> <li>– parameter definition of I<sub>OK</sub> changed from “DC output diode current” to “output clamping current”</li> <li>– symbol “I<sub>O</sub>” (DC output source or sink current) changed to “I<sub>O(sink/source)</sub>” (output sink or source current)</li> <li>– removed P<sub>tot</sub>/pack information for SSOP package</li> </ul> </li> <li>• <a href="#">Table 7 “Static characteristics”</a> (title changed from “DC electrical characteristics”): <ul style="list-style-type: none"> <li>– changed symbol “I<sub>I</sub>” to “I<sub>LI</sub>”</li> <li>– parameter definition of I<sub>OZ</sub> changed from “3-State output OFF-state current” to “OFF-state output current” (moved “3-state” to Conditions column)</li> <li>– parameter definition of I<sub>CC</sub> changed from “quiescent supply current” to “supply current”</li> <li>– parameter definition of ΔI<sub>CC</sub> changed from “additional quiescent supply current” to “additional supply current”</li> <li>– added C<sub>i</sub>, C<sub>io</sub>, and C<sub>PD</sub> parameters</li> </ul> </li> <li>• <a href="#">Section 11 “Dynamic characteristics”</a>: table “AC characteristics for V<sub>CC</sub> = 3.0 V to 3.6 V range and V<sub>CC</sub> = 2.7 V” separated into 2 tables</li> <li>• <a href="#">Section 11.1 “AC waveforms”</a>: <ul style="list-style-type: none"> <li>– 1<sup>st</sup> paragraph, 2<sup>nd</sup> line: changed “V<sub>M</sub> = 1.5 V<sub>CC</sub>” to “V<sub>M</sub> = 1.5 V”</li> <li>– removed statement “V<sub>M</sub> = 0.5V<sub>CC</sub> at V<sub>CC</sub> = 2.3 V to 2.7 V.” from <a href="#">Figure 5</a>, <a href="#">Figure 6</a>, <a href="#">Figure 7</a>, <a href="#">Figure 8</a>, <a href="#">Figure 9</a> and <a href="#">Figure 10</a> as redundant (depends on voltage as stated above these figures)</li> </ul> </li> <li>• <a href="#">Section 13 “Package outline”</a>: replaced SOT364-1 (TSSOP56) package outline drawing with <a href="#">Figure 12 “Package outline SOT362-1 (TSSOP48)”</a></li> </ul>	
74ALVC162334A_2 (9397 750 07246)	20000620	Product specification	853-2197 23931	74ALVC162334A_1
74ALVC162334A_1 (9397 750 06963)	20000314	Product specification	853-2197 23314	-

## 17. Legal information

### 17.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.nexperia.com>.

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## 19. Contents

<b>1</b>	<b>General description</b> . . . . .	<b>1</b>
<b>2</b>	<b>Features</b> . . . . .	<b>1</b>
<b>3</b>	<b>Quick reference data</b> . . . . .	<b>2</b>
<b>4</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>5</b>	<b>Functional diagram</b> . . . . .	<b>3</b>
<b>6</b>	<b>Pinning information</b> . . . . .	<b>4</b>
6.1	Pinning . . . . .	4
6.2	Pin description . . . . .	4
<b>7</b>	<b>Functional description</b> . . . . .	<b>6</b>
7.1	Function selection . . . . .	6
<b>8</b>	<b>Limiting values</b> . . . . .	<b>7</b>
<b>9</b>	<b>Recommended operating conditions</b> . . . . .	<b>7</b>
<b>10</b>	<b>Static characteristics</b> . . . . .	<b>8</b>
<b>11</b>	<b>Dynamic characteristics</b> . . . . .	<b>9</b>
11.1	AC waveforms . . . . .	11
<b>12</b>	<b>Test information</b> . . . . .	<b>12</b>
<b>13</b>	<b>Package outline</b> . . . . .	<b>13</b>
<b>14</b>	<b>Soldering</b> . . . . .	<b>14</b>
14.1	Introduction to soldering . . . . .	14
14.2	Wave and reflow soldering . . . . .	14
14.3	Wave soldering . . . . .	14
14.4	Reflow soldering . . . . .	15
<b>15</b>	<b>Abbreviations</b> . . . . .	<b>16</b>
<b>16</b>	<b>Revision history</b> . . . . .	<b>16</b>
<b>17</b>	<b>Legal information</b> . . . . .	<b>18</b>
17.1	Data sheet status . . . . .	18
17.2	Definitions . . . . .	18
17.3	Disclaimers . . . . .	18
17.4	Trademarks . . . . .	18
<b>18</b>	<b>Contact information</b> . . . . .	<b>18</b>
<b>19</b>	<b>Contents</b> . . . . .	<b>19</b>

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