

# 74LVC646A

Octal bus transceiver/register; 3-state

Rev. 5 — 28 March 2013

Product data sheet

## 1. General description

The 74LVC646A consists of non-inverting bus transceiver circuits with 3-state outputs, D-type flip-flops and control circuitry arranged for multiplexed transmission of data directly from the internal registers. Data on the A or B bus is clocked in the internal registers, as the appropriate clock (CPAB or CPBA) goes to a HIGH logic level. Output enable ( $\overline{OE}$ ) and direction (DIR) inputs are provided to control the transceiver function. In the transceiver mode, data present at the high-impedance port may be stored in either the A or B register, or in both. With the select source inputs (SAB and SBA), stored and real-time (transparent mode) data can be multiplexed. The direction (DIR) input determines which bus receives data when  $\overline{OE}$  is active (LOW). In the isolation mode ( $\overline{OE}$  = HIGH), A data may be stored in the B register and/or B data may be stored in the A register. When an output function is disabled, the input function is still enabled and may be used to store and transmit data. Only one of the two buses A or B may be driven at a time.

Inputs can be driven from either 3.3 V or 5 V devices. When disabled, up to 5.5 V can be applied to the outputs. These features allow the use of these devices as translators in mixed 3.3 V and 5 V applications.

## 2. Features and benefits

- 5 V tolerant inputs/outputs for interfacing with 5 V logic
- Supply voltage range from 1.2 V to 3.6 V
- CMOS low-power consumption
- Direct interface with TTL levels
- 8-bit octal transceiver with D-type latch
- Back-to-back registers for storage
- Separate controls for data flow in each direction
- Supports partial power-down applications; inputs/outputs are high-impedance when  $V_{CC} = 0$  V
- 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.



### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVC646AD	-40 °C to +125 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
74LVC646ADB	-40 °C to +125 °C	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1
74LVC646APW	-40 °C to +125 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1

### 4. Functional diagram

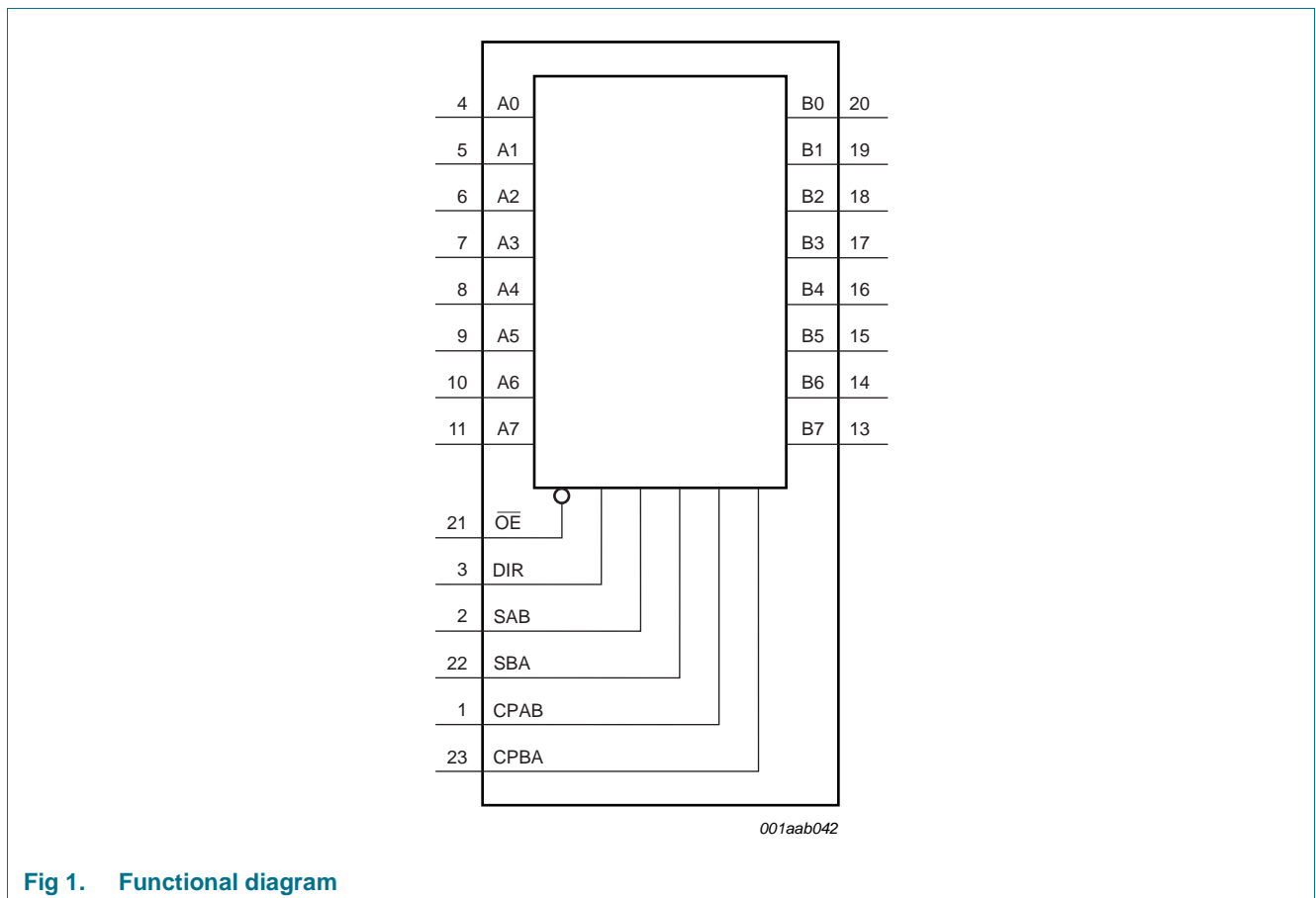


Fig 1. Functional diagram

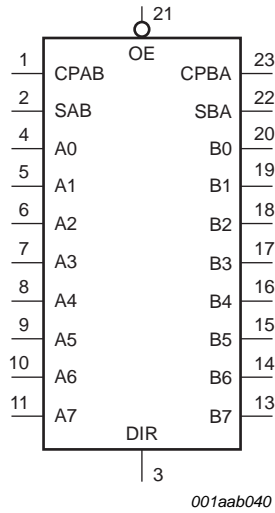


Fig 2. Logic symbol

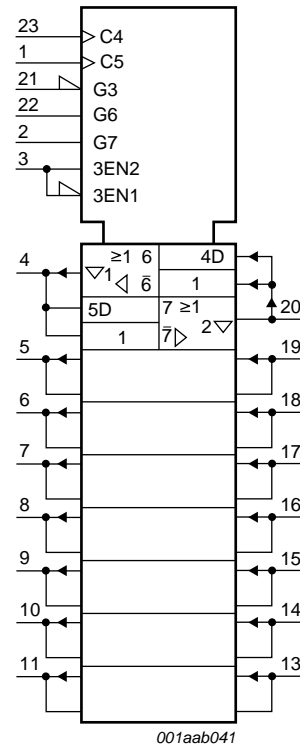


Fig 3. IEC logic symbol

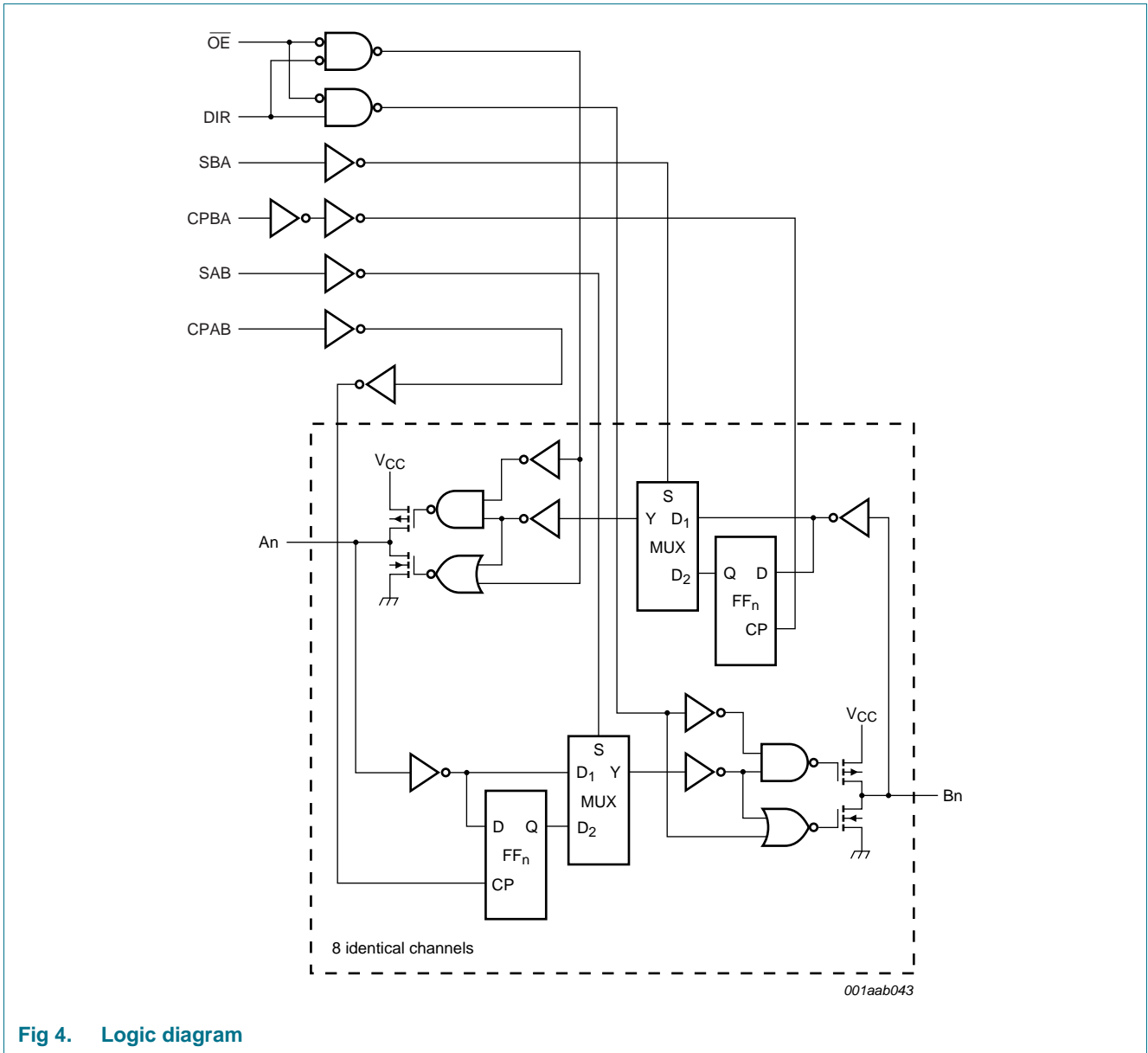


Fig 4. Logic diagram

## 5. Pinning information

### 5.1 Pinning

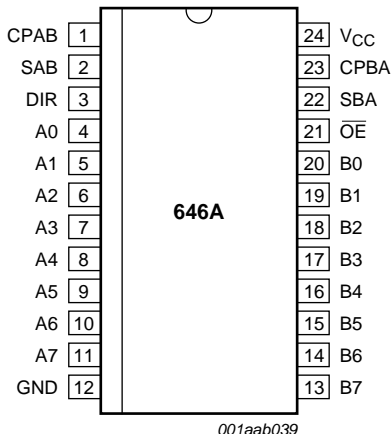


Fig 5. Pin configuration SO24 and (T)SSOP24

### 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
CPAB	1	A to B clock input (LOW to HIGH; edge-triggered)
SAB	2	A to B select source input
SBA	22	B to A select source input
DIR	3	direction control input
A[0:7]	4, 5, 6, 7, 8, 9, 10, 11	A data input/output
B[0:7]	20, 19, 18, 17, 16, 15, 14, 13	B data input/output
$\overline{OE}$	21	output enable input (active LOW)
CPBA	23	B to A clock input (LOW to HIGH, edge-triggered)
GND	12	ground (0 V)
V <sub>CC</sub>	24	supply voltage

## 6. Functional description

Table 3. Function table<sup>[1]</sup>

Input						Data I/O		Function
$\overline{\text{OE}}$	DIR	CPAB	CPBA	SAB	SBA	A0 to A7	B0 to B7	
X	X	↑	X	X	X	input	unspecified <sup>[2]</sup>	store A and B unspecified
X	X	X	↑	X	X	unspecified <sup>[2]</sup>	input	store B and A unspecified
H	X	↑	↑	X	X	input	input	store A and B data
H	X	H or L	H or L	X	X	input	input	hold storage; isolation
L	L	X	X	X	L	output	input	real-time B data to A bus
L	L	X	H or L	X	H	output	input	stored B data to A bus
L	H	X	X	L	X	input	output	real-time A data to B bus
L	H	H or L	X	H	X	input	output	stored A data to B bus

[1] H = HIGH voltage level

L = LOW voltage level

X = don't care

↑ = LOW to HIGH level transition

[2] The data output functions are enabled or disabled by various signals at the  $\overline{\text{OE}}$  and DIR inputs. Data input functions are always enabled, i.e. data at the bus inputs are stored on every LOW to HIGH transition on the clock inputs.

## 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
$V_{\text{CC}}$	supply voltage		-0.5	+6.5	V
$I_{\text{IK}}$	input clamping current	$V_{\text{I}} < 0 \text{ V}$	-50	-	mA
$V_{\text{I}}$	input voltage		<sup>[1]</sup> -0.5	+6.5	V
$I_{\text{OK}}$	output clamping current	$V_{\text{O}} > V_{\text{CC}}$ or $V_{\text{O}} < 0 \text{ V}$	-	±50	mA
$V_{\text{O}}$	output voltage	output HIGH or LOW state	<sup>[2]</sup> -0.5	$V_{\text{CC}} + 0.5$	V
		output 3-state	<sup>[2]</sup> -0.5	+6.5	V
$I_{\text{O}}$	output current	$V_{\text{O}} = 0 \text{ V to } V_{\text{CC}}$	-	±50	mA
$I_{\text{CC}}$	supply current		-	100	mA
$I_{\text{GND}}$	ground current		-100	-	mA
$T_{\text{stg}}$	storage temperature		-65	+150	°C
$P_{\text{tot}}$	total power dissipation	$T_{\text{amb}} = -40 \text{ °C to } +125 \text{ °C}$	<sup>[3]</sup> -	500	mW

[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 SO24 packages: above 70 °C the value of  $P_{\text{tot}}$  derates linearly with 8 mW/K.

For (T)SSOP24 packages: above 60 °C the value of  $P_{\text{tot}}$  derates linearly with 5.5 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	supply voltage		1.65	-	3.6	V
		functional	1.2	-	-	V
V <sub>I</sub>	input voltage		0	-	5.5	V
V <sub>O</sub>	output voltage	HIGH or LOW state	0	-	V <sub>CC</sub>	V
		3-state	0	-	5.5	V
T <sub>amb</sub>	ambient temperature	in free air	-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 1.65 V to 2.7 V	0	-	20	ns/V
		V <sub>CC</sub> = 2.7 V to 3.6 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 +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.2 V	1.08	-	-	1.08	-	V
		V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 × V <sub>CC</sub>	-	-	0.65 × V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.2 V	-	-	0.12	-	0.12	V
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35 × V <sub>CC</sub>	-	0.35 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V	V <sub>CC</sub> - 0.2	-	-	V <sub>CC</sub> - 0.3	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	1.2	-	-	1.05	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.8	-	-	1.65	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	-	-	2.05	-	V
		I <sub>O</sub> = -18 mA; V <sub>CC</sub> = 3.0 V	2.4	-	-	2.25	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V	-	-	0.2	-	0.3	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	-	0.65	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.6	-	0.8	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.4	-	0.6	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.55	-	0.8	V
I <sub>I</sub>	input leakage current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 5.5 V or GND	-	±0.1	±5	-	±20	μA

**Table 6. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 3.6 V; V <sub>O</sub> = 5.5 V or GND; [2]	-	0.1	±10	-	±20	μA
I <sub>OFF</sub>	power-off leakage current	V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 5.5 V	-	0.1	±10	-	±20	μA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	0.1	10	-	40	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 2.7 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A	-	5	500	-	5000	μA
C <sub>I</sub>	input capacitance	V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND to V <sub>CC</sub>	-	5.0	-	-	-	pF
C <sub>I/O</sub>	input/output capacitance	V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND to V <sub>CC</sub>	-	10.0	-	-	-	pF

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V (unless stated otherwise) and T<sub>amb</sub> = 25 °C.

[2] For transceivers, the parameter I<sub>OZ</sub> includes the input leakage current.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**





Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 11](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
t <sub>pd</sub>	propagation delay	An, Bn to Bn, An; see <a href="#">Figure 6</a> [2]						
		V <sub>CC</sub> = 1.2 V	-	17	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.8	6.9	15.8	1.8	18.2	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	3.7	8.2	1.5	9.4	ns
		V <sub>CC</sub> = 2.7 V	1.5	3.6	7.8	1.5	10.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	3.1	6.8	1.0	8.0	ns
		CPAB, CPBA to Bn, An; see <a href="#">Figure 7</a> [2]						
		V <sub>CC</sub> = 1.2 V	-	19	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.4	8.6	17.8	2.4	20.5	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	4.5	9.1	1.7	10.5	ns
		V <sub>CC</sub> = 2.7 V	1.5	4.1	8.6	1.5	11.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	3.8	7.6	1.0	9.5	ns
		SAB, SBA to Bn, An; see <a href="#">Figure 8</a> [2]						
		V <sub>CC</sub> = 1.2 V	-	19	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.5	7.6	19.8	1.5	22.9	ns
V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	4.0	10.2	1.5	11.8	ns		
V <sub>CC</sub> = 2.7 V	1.5	4.0	9.5	1.5	12.0	ns		
V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	3.4	8.5	1.0	11.0	ns		



**Table 7. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 11](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
t <sub>en</sub>	enable time	OE to An and Bn; see <a href="#">Figure 9</a> 						
		V <sub>CC</sub> = 1.2 V	-	20	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.4	7.2	17.8	2.4	20.6	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.0	4.1	9.8	2.0	11.3	ns
		V <sub>CC</sub> = 2.7 V	1.5	4.2	8.8	1.5	11.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	3.3	7.8	1.0	10.0	ns
		DIR to An and Bn; see <a href="#">Figure 10</a> 						
		V <sub>CC</sub> = 1.2 V	-	20	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.9	8.0	18.1	2.9	20.9	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.4	4.5	9.9	2.4	11.5	ns
		V <sub>CC</sub> = 2.7 V	1.5	4.2	8.9	1.5	11.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	3.6	7.9	1.0	10.0	ns
t <sub>dis</sub>	disable time	OE to An and Bn; see <a href="#">Figure 9</a> 						
		V <sub>CC</sub> = 1.2 V	-	10	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	3.6	5.0	10.4	3.6	12.0	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.8	5.9	1.0	6.8	ns
		V <sub>CC</sub> = 2.7 V	1.5	3.6	7.1	1.5	9.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	3.3	6.1	1.0	8.0	ns
		DIR to An and Bn; see <a href="#">Figure 10</a> 						
		V <sub>CC</sub> = 1.2 V	-	10	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.9	3.9	10.1	2.9	11.7	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.1	5.7	1.0	6.6	ns
		V <sub>CC</sub> = 2.7 V	1.5	3.5	7.0	1.5	9.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.8	6.0	1.0	7.5	ns
t <sub>W</sub>	pulse width	clock HIGH or LOW of CPAB or CPBA; see <a href="#">Figure 7</a>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	5.0	-	-	5.0	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	4.0	-	-	4.0	-	ns
		V <sub>CC</sub> = 2.7 V	3.3	-	-	3.3	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	3.3	1.9	-	3.3	-	ns
t <sub>su</sub>	set-up time	An, Bn to CPAB, CPBA; see <a href="#">Figure 7</a>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	3.5	-	-	3.5	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.5	-	-	2.5	-	ns
		V <sub>CC</sub> = 2.7 V	1.6	-	-	1.6	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	0.35	-	1.5	-	ns

**Table 7. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 11](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			-40 °C to +125 °C		Unit	
			Min	Typ <sup>[1]</sup>	Max	Min	Max		
t <sub>h</sub>	hold time	An, Bn to CPAB, CPBA; see <a href="#">Figure 7</a>							
		V <sub>CC</sub> = 1.65 V to 1.95 V	3.0	-	-	3.0	-	ns	
		V <sub>CC</sub> = 2.3 V to 2.7 V	2.0	-	-	2.0	-	ns	
		V <sub>CC</sub> = 2.7 V	1.0	-	-	1.0	-	ns	
f <sub>max</sub>	maximum frequency	see <a href="#">Figure 7</a>							
		V <sub>CC</sub> = 1.65 V to 1.95 V	100	-	-	80	-	MHz	
		V <sub>CC</sub> = 2.3 V to 2.7 V	125	-	-	100	-	MHz	
		V <sub>CC</sub> = 2.7 V	150	-	-	120	-	MHz	
t <sub>sk(o)</sub>	output skew time	V <sub>CC</sub> = 3.0 V to 3.6 V	<a href="#">[3]</a>	-	-	1.0	-	1.5	ns
C <sub>PD</sub>	power dissipation capacitance	per input; V <sub>I</sub> = GND to V <sub>CC</sub>	<a href="#">[4]</a>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	8.0	-	-	-	-	pF
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	11.7	-	-	-	-	pF
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	15.0	-	-	-	-	pF

[1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.2 V, 1.8 V, 2.5 V, 2.7 V and 3.3 V respectively.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.

t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

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

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

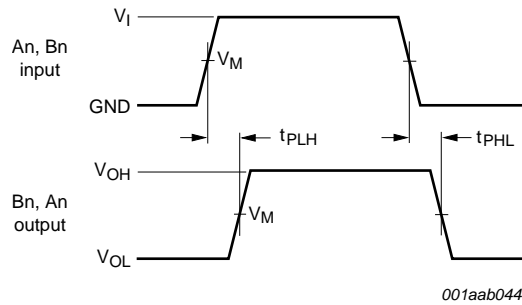
C<sub>L</sub> = output load capacitance in pF

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

N = number of inputs switching

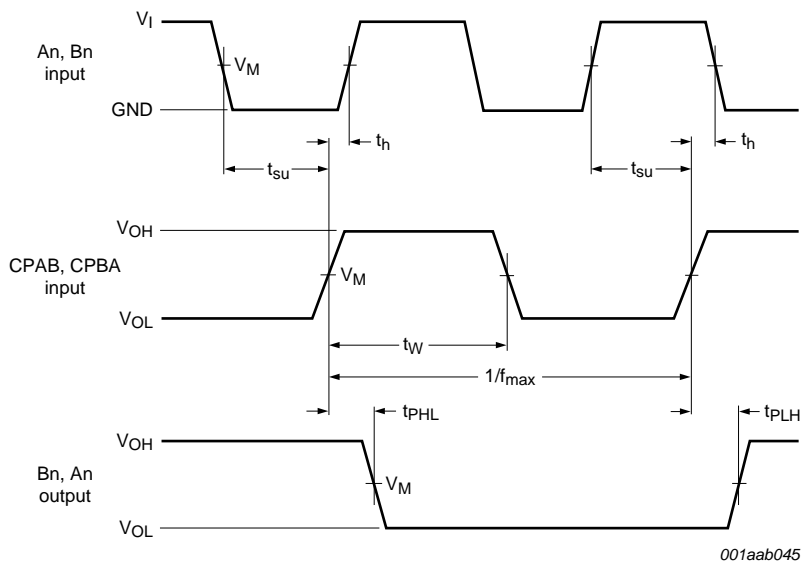
$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs

11. Waveforms



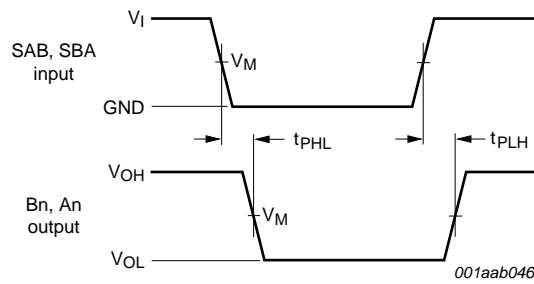
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig 6. Input (An and Bn) to output (Bn and An) propagation delays**



Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

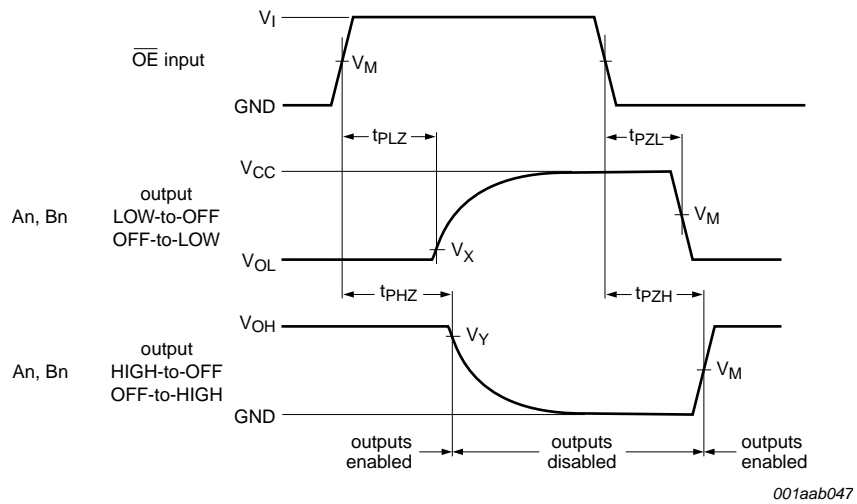
**Fig 7. The An, Bn to CPAB, CPBA set-up and hold times, clock CPAB and CPBA pulse width, maximum frequency, and the CPAB, CPBA to output Bn, An propagation delays**



Measurement points are given in [Table 8](#).

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

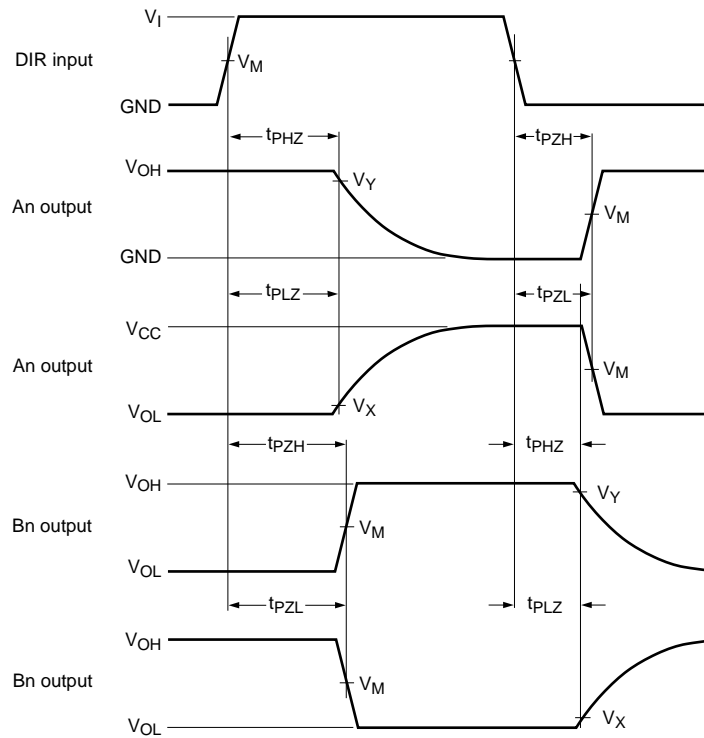
**Fig 8. The input SAB and SBA to output Bn and An propagation delay times**



Measurement points are given in [Table 8](#).

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

**Fig 9. The input  $\overline{OE}$  to output An and Bn 3-state enable and disable times**



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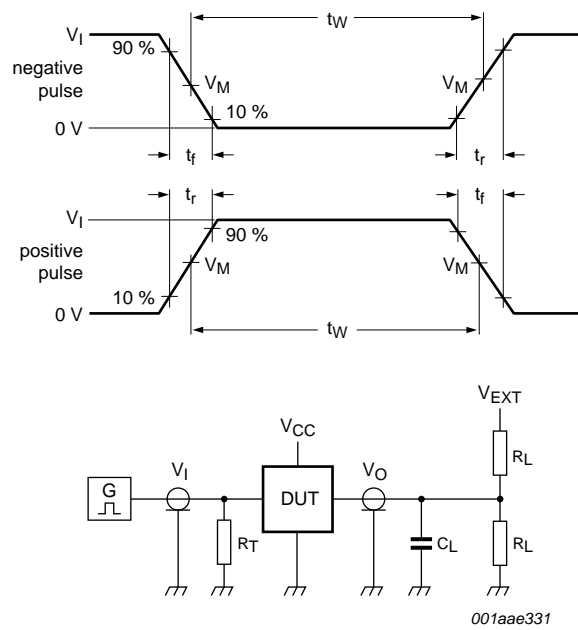
Measurement points are given in [Table 8](#).

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

**Fig 10. The input showing the input DIR to output An, Bn 3-state enable and disable times**

**Table 8. Measurement points**

Supply voltage	Input		Output		
$V_{CC}$	$V_I$	$V_M$	$V_M$	$V_X$	$V_Y$
1.2 V	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
1.65 V to 1.95 V	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.3 V to 2.7 V	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.7 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$
3.0 V to 3.6 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$



Test data is given in [Table 9](#).

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.

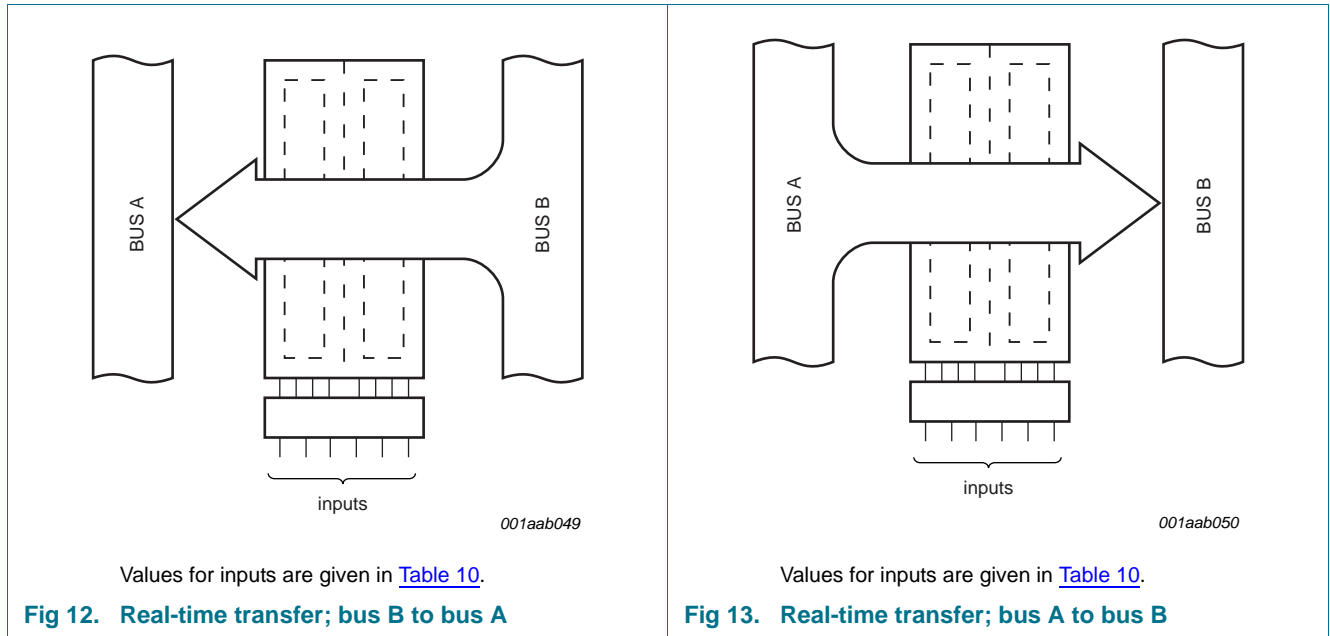
$V_{EXT}$  = External voltage for measuring switching times.

**Fig 11. Load circuitry for switching times**

**Table 9. Test data**

Supply voltage	Input		Load		$V_{EXT}$		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PLZ}, t_{PZL}$	$t_{PHZ}, t_{PZH}$
1.2 V	$V_{CC}$	$\leq 2$ ns	30 pF	1 k $\Omega$	open	$2 \times V_{CC}$	GND
1.65 V to 1.95 V	$V_{CC}$	$\leq 2$ ns	30 pF	1 k $\Omega$	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	$V_{CC}$	$\leq 2$ ns	30 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND

## 12. Application information



**Table 10. Real-time transfer<sup>[1]</sup>**

Direction	Input					
	OE	DIR	CPAB	CPBA	SAB	SBA
Bus B to bus A	L	L	X	X	X	L
Bus A to bus B	L	H	X	X	L	X

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

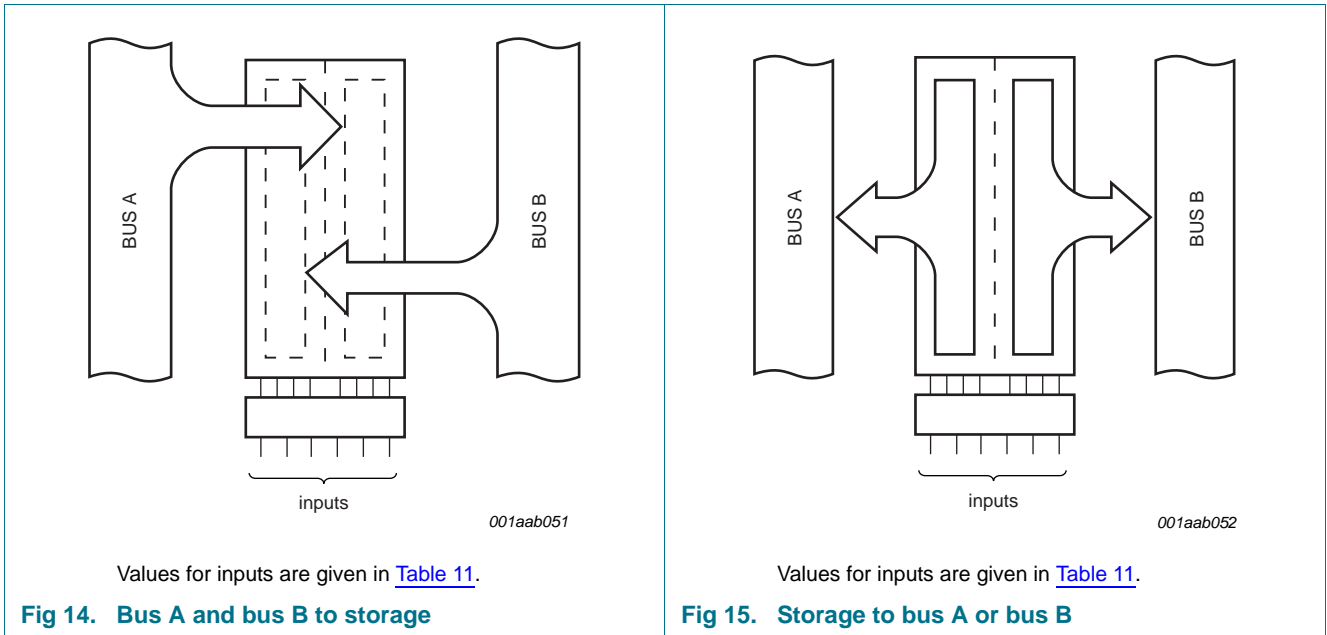


Table 11. Storage transfer<sup>[1]</sup>

Function	Input					
	OE	DIR	CPAB	CPBA	SAB	SBA
Bus A to storage	X	X	↑	X	X	X
Bus B to storage	X	X	X	↑	X	X
Bus A and B to storage	H	X	↑	↑	X	X
Storage to bus A	L	L	X	H or L	X	H
Storage to bus B	L	H	H or L	X	H	X

[1] H = HIGH voltage level  
 L = LOW voltage level  
 X = don't care  
 ↑ = LOW to HIGH level transition



13. Package outline

SO24: plastic small outline package; 24 leads; body width 7.5 mm

SOT137-1

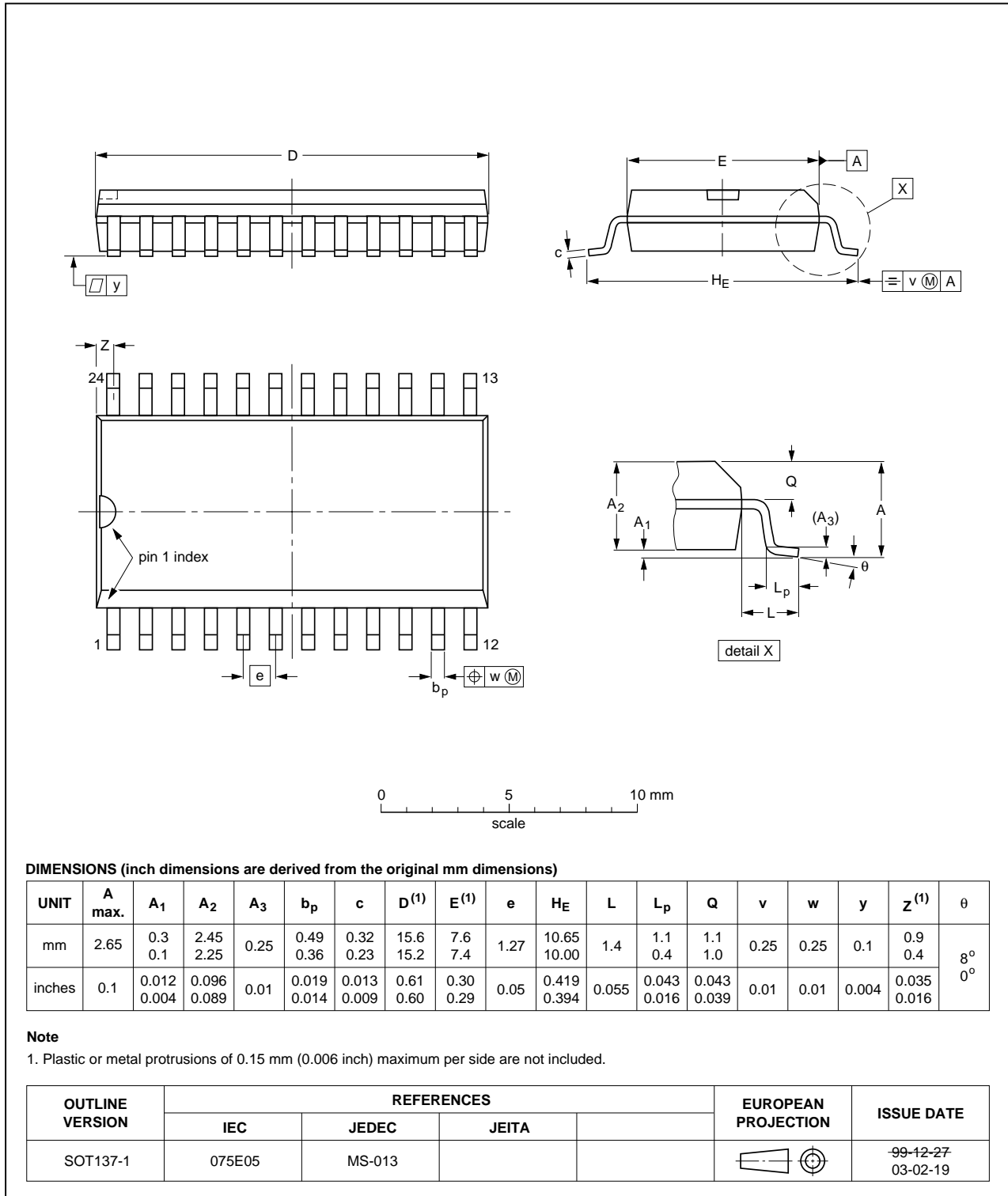


Fig 16. Package outline SOT137-1 (SO24)

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm

SOT340-1

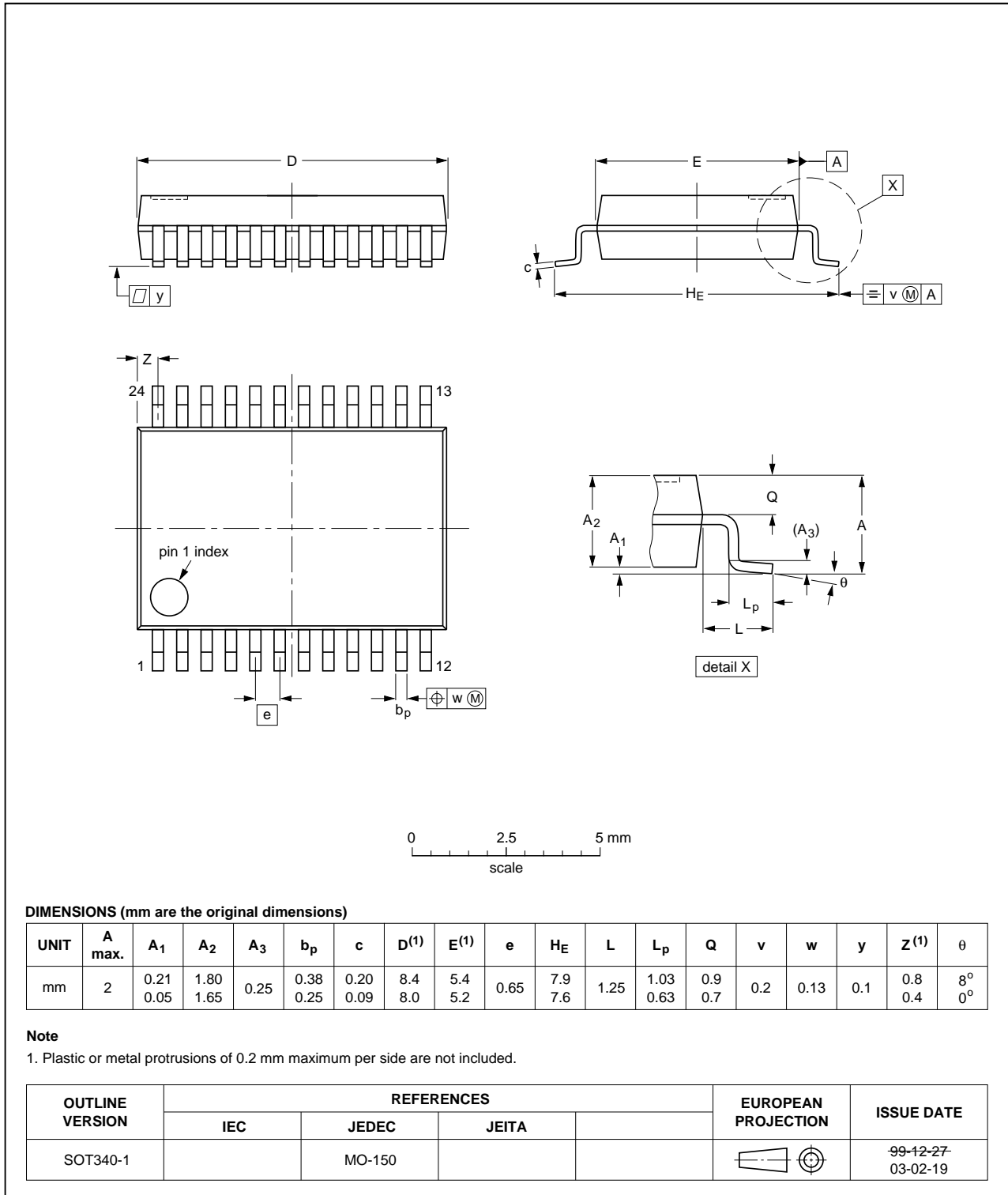


Fig 17. Package outline SOT340-1 (SSOP24)

TSSOP24: plastic thin shrink small outline package; 24 leads; body width 4.4 mm

SOT355-1

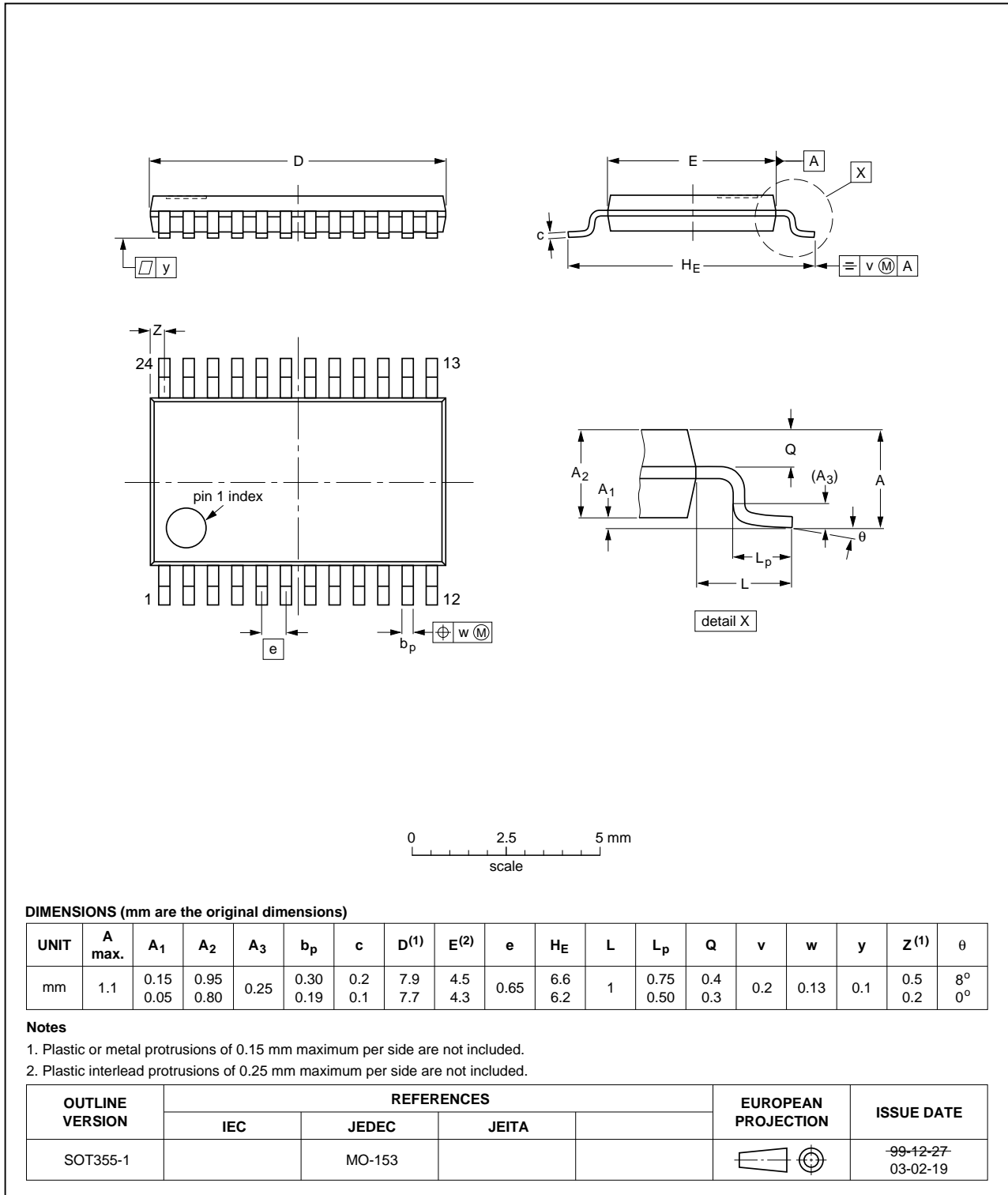


Fig 18. Package outline SOT355-1 (TSSOP24)

## 14. Abbreviations

Table 12. Abbreviations

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

## 15. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC646A v.5	20130328	Product data sheet	-	74LVC646A v.4
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Table 4</a>, <a href="#">Table 5</a>, <a href="#">Table 6</a>, <a href="#">Table 7</a>, <a href="#">Table 8</a> and <a href="#">Table 9</a>: values added for lower voltage ranges.</li> </ul>			
74LVC646A v.4	20040629	Product specification	-	74LVC646A v.3
74LVC646A v.3	20000621	Product specification	-	74LVC646A v.2
74LVC646A v.2	19980729	Product specification	-	74LVC646A v.1
74LVC646A v.1	19980325	Product specification	-	-

## 16. Legal information

### 16.1 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.nxp.com>.

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