74LVC4245A

Octal dual supply translating transceiver; 3-state

Product data sheet

1. General description

The 74LVC4245A is an octal dual supply translating transceiver featuring non-inverting 3-state bus compatible outputs in both send and receive directions. It is designed to interface between a 3 V and 5 V bus in a mixed 3 V and 5 V supply environment.

The device features an output enable input (pin $\overline{OE}$) for easy cascading and a send/receive input (pin DIR) for direction control. Pin $\overline{OE}$ controls the outputs so that the buses are effectively isolated.

In suspend mode, when V_{CCA} is zero, there will be no current flow from one supply to the other supply. The A-outputs must be set 3-state and the voltage on the A-bus must be smaller than V_{diode} (typical 0.7 V).

$V_{CCA} \geq V_{CCB}$, except in suspend mode.

2. Features

- 5 V tolerant inputs/outputs, for interfacing with 5 V logic
- Wide supply voltage range:
  - 3 V port (V_{CCB}): 1.5 V to 3.6 V
  - 5 V port (V_{CCA}): 1.5 V to 5.5 V
- CMOS low-power consumption
- Direct interface with TTL levels
- Inputs accept voltages up to 5.5 V
- High-impedance when V_{CC} = 0 V
- Complies with JEDEC standard no. JESD8B/JESD36
- ESD protection:
  - HBM JESD22-A114E exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from –40 °C to +85 °C and –40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC4245AD	–40 °C to +125 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
74LVC4245ADB	–40 °C to +125 °C	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1
74LVC4245APW	–40 °C to +125 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1
74LVC4245ABQ	–40 °C to +125 °C	DHVQFN24	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 24 terminals; body 3.5 × 5.5 × 0.85 mm	SOT815-1

4. Functional diagram

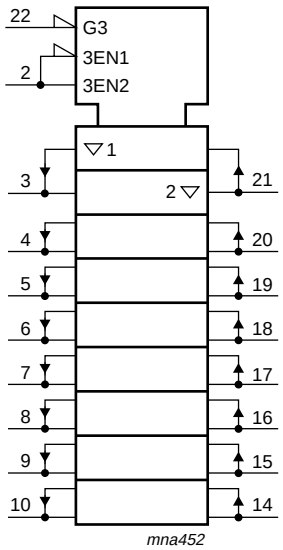


Fig 1. IEC Logic symbol

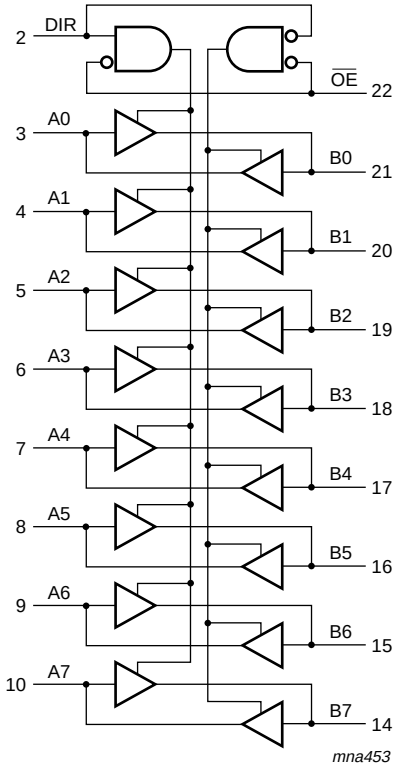


Fig 2. Logic diagram

6. Functional description

Table 3. Functional table[1]

Input		Input/output	
$\overline{OE}$	DIR	An	Bn
L	L	A = B	input
L	H	input	B = A
H	X	Z	Z

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; 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_{CCA}	supply voltage 5 V port			–0.5	+6.5	V
V_{CCB}	supply voltage 3 V port			–0.5	+4.6	V
I_{IK}	input clamping current	$V_I < 0$ V		–50	-	mA
V_I	input voltage		[1]	–0.5	+6.5	V
I_{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V		-	±50	mA
V_O	output voltage	output HIGH or LOW state	[1]	–0.5	V_{CC} + 0.5	V
		output 3-state	[1]	–0.5	+6.5	V
I_O	output current	V_O = 0 V to V_{CC}		-	±50	mA
I_{CC}	supply current			-	100	mA
I_{GND}	ground current			–100	-	mA
T_{stg}	storage temperature			–65	+150	°C
P_{tot}	power dissipation	T_{amb} = –40 °C to +125 °C	[2]	-	500	mW

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

[2] For SO24 packages: above 70 °C the value of P_{tot} derates linearly with 8 mW/K.
For (T)SSOP24 packages: above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.
For DHVQFN24 packages: above 60 °C the value of P_{tot} derates linearly with 4.5 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CCA}	supply voltage 5 V port (for maximum speed performance)	$V_{CCA} \geq V_{CCB}$; see Figure 5	1.5	-	5.5	V
V_{CCB}	supply voltage 3 V port (for low-voltage applications)	$V_{CCA} \geq V_{CCB}$; see Figure 5	1.5	-	3.6	V
V_I	input voltage	for control inputs	0	-	5.5	V
V_O	output voltage	output HIGH or LOW state	0	-	V_{CC}	V
		output 3-state	0	-	5.5	V
T_{amb}	ambient temperature		–40	-	+125	°C

Table 5. Recommended operating conditions *…continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CCB} = 2.7 V to 3.0 V	-	-	20	ns/V
		V_{CCB} = 3.0 V to 3.6 V	-	-	10	ns/V
		V_{CCA} = 3.0 V to 4.5 V	-	-	20	ns/V
		V_{CCA} = 4.5 V to 5.5 V	-	-	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_{IH}	HIGH-level input voltage	V_{CCB} = 2.7 V to 3.6 V	2.0	-	-	V
		V_{CCA} = 4.5 V to 5.5 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CCB} = 2.7 V to 3.6 V	-	-	0.8	V
		V_{CCA} = 4.5 V to 5.5 V	-	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		V_{CCB} = 2.7 V to 3.6 V; I_O = −100 µA	V_{CCB} − 0.2	V_{CCB}	-	V
		V_{CCB} = 2.7 V; I_O = −12 mA	V_{CCB} − 0.5	-	-	V
		V_{CCB} = 3.0 V; I_O = −24 mA	V_{CCB} − 0.8	-	-	V
		V_{CCA} = 4.5 V to 5.5 V; I_O = −100 µA	V_{CCA} − 0.2	V_{CCA}	-	V
		V_{CCA} = 4.5 V; I_O = −12 mA	V_{CCA} − 0.5	-	-	V
		V_{CCA} = 4.5 V; I_O = −24 mA	V_{CCA} − 0.8	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		V_{CCB} = 2.7 V to 3.6 V; I_O = 100 µA	-	-	0.20	V
		V_{CCB} = 2.7 V; I_O = 12 mA	-	-	0.40	V
		V_{CCB} = 3.0 V; I_O = 24 mA	-	-	0.55	V
		V_{CCA} = 4.5 V to 5.5 V; I_O = 100 µA	-	-	0.20	V
		V_{CCA} = 4.5 V; I_O = 12 mA	-	-	0.40	V
		V_{CCA} = 4.5 V; I_O = 24 mA	-	-	0.55	V
I_I	input leakage current	V_I = 5.5 V or GND	-	±0.1	±5	µA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} [2]				
		V_{CCB} = 3.6 V; $V_O = V_{CCB}$ or GND	-	±0.1	±5	µA
		V_{CCA} = 5.5 V; $V_O = V_{CCA}$ or GND	-	±0.1	±5	µA
I_{CC}	supply current	I_O = 0 A				
		V_{CCB} = 3.6 V; other inputs at V_{CCB} or GND	-	0.1	10	µA
		V_{CCA} = 5.5 V; other inputs at V_{CCA} or GND	-	0.1	10	µA

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 control pin; I_O = 0 A	[3]				
		V_{CCB} = 2.7 V to 3.6 V; $V_I = V_{CCB} - 0.6$ V; other inputs at V_{CCB} or GND		-	5	500	µA
		V_{CCA} = 4.5 V to 5.5 V; $V_I = V_{CCA} - 0.6$ V; other inputs at V_{CCA} or GND		-	5	500	µA
C_I	input capacitance			-	4.0	-	pF
$C_{I/O}$	input/output capacitance	An and Bn		-	5.0	-	pF
T_{amb} = −40 °C to +125 °C							
V_{IH}	HIGH-level input voltage	V_{CCB} = 2.7 V to 3.6 V		2.0	-	-	V
		V_{CCA} = 4.5 V to 5.5 V		2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CCB} = 2.7 V to 3.6 V		-	-	0.8	V
		V_{CCA} = 4.5 V to 5.5 V		-	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		V_{CCB} = 2.7 V to 3.6 V; I_O = −100 µA		V_{CCB} − 0.3	-	-	V
		V_{CCB} = 2.7 V; I_O = −12 mA		V_{CCB} − 0.65	-	-	V
		V_{CCB} = 3.0 V; I_O = −24 mA		V_{CCB} − 1.0	-	-	V
		V_{CCA} = 4.5 V to 5.5 V; I_O = −100 µA		V_{CCA} − 0.3	-	-	V
		V_{CCA} = 4.5 V; I_O = −12 mA		V_{CCA} − 0.65	-	-	V
		V_{CCA} = 4.5 V; I_O = −24 mA		V_{CCA} − 1.0	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		V_{CCB} = 2.7 V to 3.6 V; I_O = 100 µA		-	-	0.30	V
		V_{CCB} = 2.7 V; I_O = 12 mA		-	-	0.60	V
		V_{CCB} = 3.0 V; I_O = 24 mA		-	-	0.80	V
		V_{CCA} = 4.5 V to 5.5 V; I_O = 100 µA		-	-	0.30	V
		V_{CCA} = 4.5 V; I_O = 12 mA		-	-	0.60	V
		V_{CCA} = 4.5 V; I_O = 24 mA		-	-	0.80	V
I_I	input leakage current	V_I = 5.5 V or GND		-	-	±20	µA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL}	[2]				
		V_{CCB} = 3.6 V; $V_O = V_{CCB}$ or GND		-	-	±20	µA
		V_{CCA} = 5.5 V; $V_O = V_{CCA}$ or GND		-	-	±20	µA
I_{CC}	supply current	I_O = 0 A					
		V_{CCB} = 3.6 V; other inputs at V_{CCB} or GND		-	-	40	µA
		V_{CCA} = 5.5 V; other inputs at V_{CCA} or GND		-	-	40	µA

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 control pin; I_O = 0 A	[3]				
		V_{CCB} = 2.7 V to 3.6 V; $V_I = V_{CCB} - 0.6$ V; other inputs at V_{CCB} or GND		-	-	5000	µA
		V_{CCA} = 4.5 V to 5.5 V; $V_I = V_{CCA} - 0.6$ V; other inputs at V_{CCA} or GND		-	-	5000	µA

[1] All typical values are measured at V_{CCA} = 5.0 V, V_{CCB} = 3.3 V and T_{amb} = 25 °C.

[2] For transceivers, the parameter I_{OZ} includes the input leakage current.

[3] V_{CCB} = 2.7 V to 3.6 V: other inputs at V_{CCB} or GND.
V_{CCA} = 4.5 V to 5.5 V: other inputs at V_{CCA} or GND.

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). V_{CCA} = 4.5 V to 5.5 V; $t_r = t_f \leq$ 2.5 ns. For test circuit see Figure 8.

Symbol	Parameter	Conditions	V_{CCB}	–40 °C to +85 °C			–40 °C to +125 °C		Unit
				Min	Typ[1]	Max	Min	Max	
t_{PHL}	HIGH to LOW propagation delay	An to Bn; see Figure 6	2.7 V	1.0	3.6	6.3	1.0	8.0	ns
			3.0 V to 3.6 V	1.0	3.3	6.3	1.0	8.0	ns
		Bn to An; see Figure 6	2.7 V	1.0	3.4	6.1	1.0	8.0	ns
			3.0 V to 3.6 V	1.0	3.4	6.1	1.0	8.0	ns
t_{PLH}	LOW to HIGH propagation delay	An to Bn; see Figure 6	2.7 V	1.0	3.3	6.7	1.0	8.5	ns
			3.0 V to 3.6 V	1.0	2.8	6.5	1.0	8.5	ns
		Bn to An; see Figure 6	2.7 V	1.0	3.0	5.0	1.0	6.5	ns
			3.0 V to 3.6 V	1.0	3.0	5.0	1.0	6.5	ns
t_{PZL}	OFF-state to LOW propagation delay	$\overline{OE}$ to An; see Figure 7	2.7 V	1.0	4.5	9.0	1.0	11.5	ns
			3.0 V to 3.6 V	1.0	4.5	9.0	1.0	11.5	ns
		$\overline{OE}$ to Bn; see Figure 7	2.7 V	1.0	4.4	8.7	1.0	11.0	ns
			3.0 V to 3.6 V	1.0	3.8	8.1	1.0	10.5	ns
t_{PZH}	OFF-state to HIGH propagation delay	$\overline{OE}$ to An; see Figure 7	2.7 V	1.0	4.5	8.1	1.0	10.5	ns
			3.0 V to 3.6 V	1.0	4.5	8.1	1.0	10.5	ns
		$\overline{OE}$ to Bn; see Figure 7	2.7 V	1.0	4.3	8.7	1.0	11.0	ns
			3.0 V to 3.6 V	1.0	3.2	8.1	1.0	10.5	ns
t_{PLZ}	LOW to OFF-state propagation delay	$\overline{OE}$ to An; see Figure 7	2.7 V	1.0	2.9	7.0	1.0	9.0	ns
			3.0 V to 3.6 V	1.0	2.9	7.0	1.0	9.0	ns
		$\overline{OE}$ to Bn; see Figure 7	2.7 V	1.0	3.9	7.7	1.0	10.0	ns
			3.0 V to 3.6 V	1.0	3.5	7.7	1.0	10.0	ns
t_{PHZ}	HIGH to OFF-state propagation delay	$\overline{OE}$ to An; see Figure 7	2.7 V	1.0	2.8	5.8	1.0	7.5	ns
			3.0 V to 3.6 V	1.0	2.8	5.8	1.0	7.5	ns
		$\overline{OE}$ to Bn; see Figure 7	2.7 V	1.0	3.3	7.8	1.0	10.0	ns
			3.0 V to 3.6 V	1.0	2.9	7.8	1.0	10.0	ns

Table 7. Dynamic characteristics *...continued*

Voltages are referenced to GND (ground = 0 V). V_{CCA} = 4.5 V to 5.5 V; $t_r = t_f \leq 2.5$ ns. For test circuit see Figure 8.

Symbol	Parameter	Conditions	V_{CCB}		–40 °C to +85 °C			–40 °C to +125 °C		Unit
					Min	Typ[1]	Max	Min	Max	
$t_{sk(o)}$	output skew time			[2]	-	-	1.0	-	1.5	ns
C_{PD}	power dissipation capacitance	5 V port: Bn to An; V_I = GND to V_{CCA}; V_{CCA} = 5.0 V		[3]						
		outputs enabled	-		-	17	-	-	-	pF
		outputs disabled	-		-	5	-	-	-	pF
		3 V port: An to Bn; V_I = GND to V_{CCB}; V_{CCB} = 3.3 V		[3]						
		outputs enabled	-		-	17	-	-	-	pF
		outputs disabled	-		-	5	-	-	-	pF

[1] Typical values are measured at T_{amb} = 25 °C, V_{CCA} = 5.0 V, and V_{CCB} = 2.7 V and 3.3 V respectively.

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

[3] C_{PD} is used to determine the dynamic power dissipation (P_D 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_i = input frequency in MHz; f_o = output frequency in MHz
C_L = output load capacitance in pF
V_{CC} = supply voltage in Volts
N = number of inputs switching
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs

11. AC waveforms

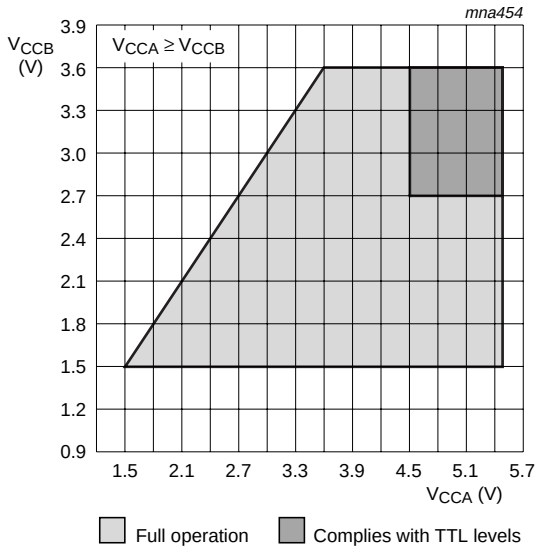
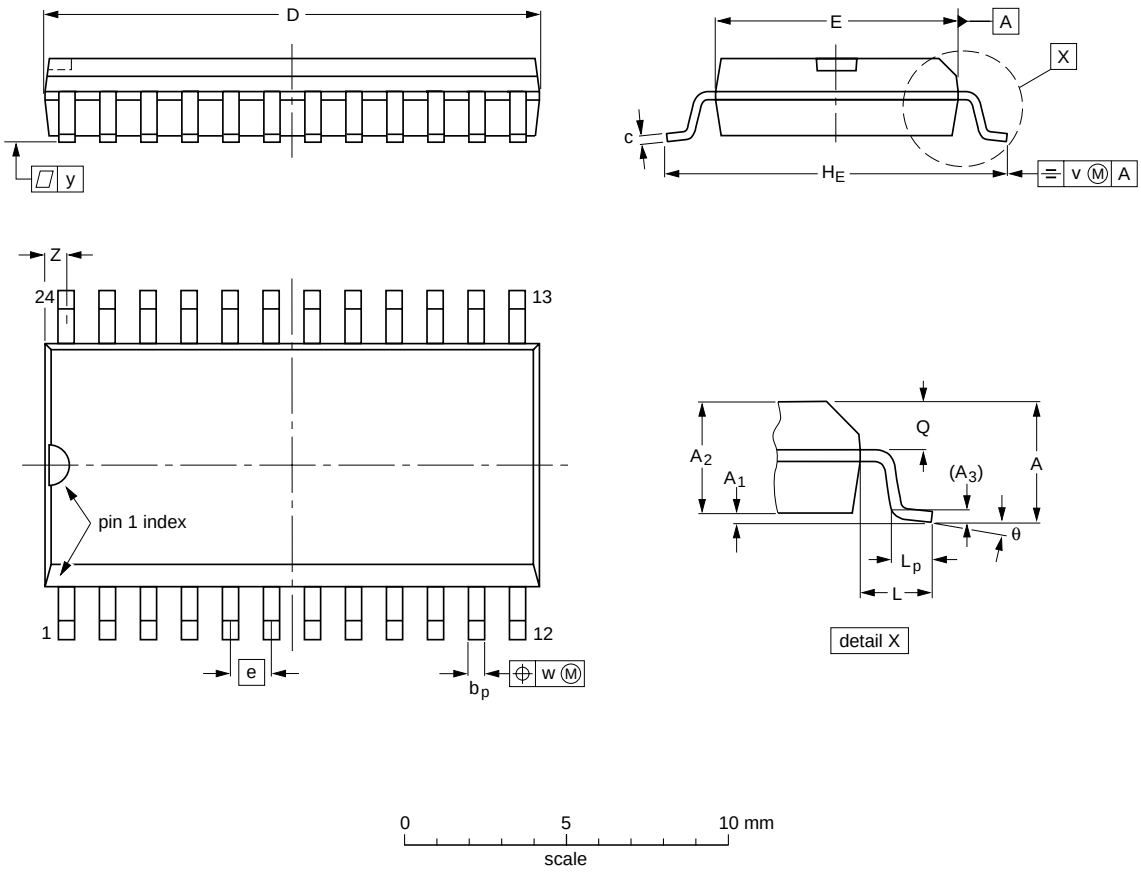


Fig 5. Supply operation area

12. Package outline

SO24: plastic small outline package; 24 leads; body width 7.5 mm **SOT137-1**



DIMENSIONS (inch dimensions are derived from the original mm 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	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	15.6 15.2	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8^o 0^o
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.61 0.60	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	
	IEC	JEDEC	JEITA			
SOT137-1	075E05	MS-013				

Fig 9. Package outline SOT137-1 (SO24)