8-Bit Dual-Supply Bus Transceiver With Configurable Voltage Translation and 3-State Outputs

UM74AVC8TX245UO ***TSSOP24***
UM74AVC8TX245QA ***QFN24 2.0×4.0***

1 Description

The UM74AVC8TX245 is designed for asynchronous communication between two data buses. The device transmits data from the A bus to the B bus or from the B bus to the A bus, depending on the logic level of the direction-control inputs (DIR1 and DIR2). The output-enable ($\overline{OE}$) input can be used to disable the outputs so the buses are effectively isolated. The UM74AVC8TX245 is designed so that the control pins (DIR and $\overline{OE}$) are referenced to V_{CCA} voltage.

This device is fully specified for partial-power-down applications using I_{OFF}. The I_{OFF} circuitry disables the outputs, thus preventing damaging current backflow through the device when it is powered down. The V_{CC} isolation feature is designed so that if either V_{CC} input supply is below 100mV, all level shifter outputs are disabled and placed into a high impedance state. To put the device into the high-impedance state during power up or power down, tie $\overline{OE}$ to V_{CC} through a pull-up resistor; the current-sinking capability of the driver determines the minimum value of the resistor.

The UM74AVC8TX245 series are available in TSSOP24 and QFN24 2.0×4.0 packages.

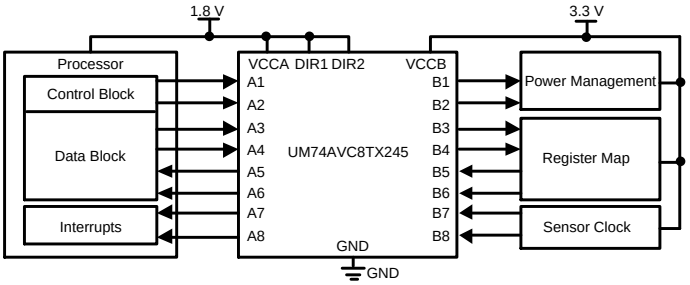
2 Applications

- Enterprise and communications
- Industrial
- Personal electronics
- Wireless infrastructure
- Building automation
- Point of sale

3 Features

- Control inputs V_{IH}/V_{IL} levels are referenced to V_{CCA} voltage
- Multiple direction-control pins to allow simultaneous up and down translation
- I_{OFF} supports partial power-down mode operation
- V_{CC} isolation feature – if either V_{CC} input is at GND, all are in the high-impedance state
- Fully configurable dual-rail design allows each port to operate over the full 1V to 3.6V power supply range
- Backward compatibility with UM74AVC8T245 device
- Up to 400Mbps support when translating from 1.8V to 3.3V
- Latch-up performance exceeds 800 mA per JESD 78, Class II
- ESD protection exceeds JESD22
  - ±8kV Human body model (A114-A)
  - ±2kV Charged-device model

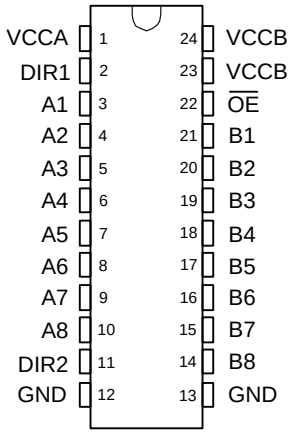
4 Typical Application Schematic

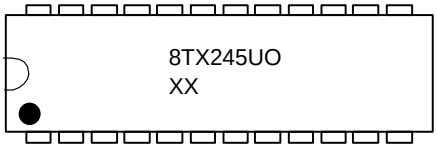


5 Ordering Information

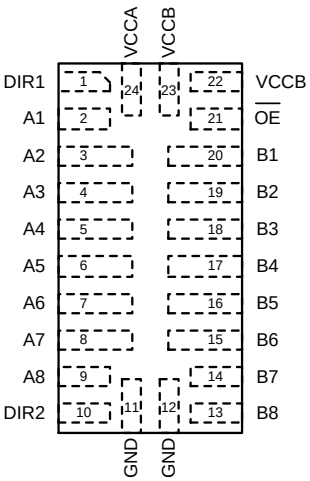
Part Number	Mark Code	Package Type	Shipping Qty
UM74AVC8TX245UO	8TX245UO	TSSOP24	3000pcs/13Inch Tape & Reel
UM74AVC8TX245QA	8TX245	QFN24 2.0×4.0	3000pcs/7Inch Tape & Reel

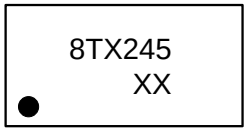
6 Pin Configuration and Function





XX: Week Code
UM74AVC8TX245UO
TSSOP24





XX: Week Code
UM74AVC8TX245QA
QFN24 2.0×4.0

Table 6-1. Pin Functions

Pin No.	Pin Name	Function
1	VCCA	A-port supply voltage. 1V ≤ V_{CCA} ≤ 3.6 V.
2	DIR1	Direction-control signal 1. Referenced to V_{CCA}.
3	A1	Input/output A1. Referenced to V_{CCA}
4	A2	Input/output A2. Referenced to $V_{CCA.}$
5	A3	Input/output A3. Referenced to $V_{CCA.}$
6	A4	Input/output A4. Referenced to $V_{CCA.}$
7	A5	Input/output A5. Referenced to $V_{CCA.}$
8	A6	Input/output A6. Referenced to $V_{CCA.}$
9	A7	Input/output A7. Referenced to $V_{CCA.}$
10	A8	Input/output A8. Referenced to $V_{CCA.}$
11	DIR2	Direction-control signal 2. Referenced to V_{CCA}. Tie to GND to maintain backward compatibility with UM74AVC8T245 device.
12-13	GND	Ground.
14	B8	Input/output B8. Referenced to $V_{CCB.}$
15	B7	Input/output B7. Referenced to $V_{CCB.}$
16	B6	Input/output B6. Referenced to $V_{CCB.}$
17	B5	Input/output B5. Referenced to $V_{CCB.}$
18	B4	Input/output B4. Referenced to $V_{CCB.}$
19	B3	Input/output B3. Referenced to $V_{CCB.}$
20	B2	Input/output B2. Referenced to $V_{CCB.}$
21	B1	Input/output B1. Referenced to $V_{CCB.}$
22	$\overline{OE}$	Output Enable. Pull to GND to enable all outputs. Pull to V_{CCA} to place all outputs in high-impedance mode. Referenced to V_{CCA}.
23-24	VCCB	B-port supply voltage. 1V ≤ V_{CCB} ≤ 3.6 V.

7 Specifications

7.1 Absolute Maximum Ratings (Note 1)

Symbol	Parameter		Value	Unit
V_{CCA}	Supply Voltage		-0.5 to +4.6	V
V_{CCB}	Supply Voltage		-0.5 to +4.6	V
V_I	Input Voltage (Note 2)	A ports	-0.5 to +4.6	V
		B ports	-0.5 to +4.6	
		Control inputs	-0.5 to +4.6	
V_O	Voltage applied to any output in the high-impedance or Power-Off State (Note 2)	A ports	-0.5 to +4.6	V
		B ports	-0.5 to +4.6	
V_O	Voltage Range Applied to Any Output in the High or Low State (Note 2, 3)	A ports	-0.5 to (V_{CCA}+0.5)	V
		B ports	-0.5 to (V_{CCB}+0.5)	
V_{ESD}	Human body model (HBM)	All pins	±8	kV
	Charged device model (CDM)	All pins	±2	kV
I_{IK}	Input clamp current	V_I<0	-50	mA
I_{OK}	Output clamp current	V_O<0	-50	mA
I_O	Continuous Output Current		±50	mA
	Continuous Current through V_{CCA}, V_{CCB}, or GND		±100	mA
T_J	Operating Junction Temperature		-40 to +150	℃
T_{STG}	Storage Temperature		-65 to +150	℃

Note 1: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
Note 2: The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
Note 3: The output positive-voltage rating may be exceeded up to 4.6 V maximum if the output current rating is observed.

7.2 Recommended Operating Conditions (Note 1, 2, 3)

Over recommended operating free-air temperature range (unless otherwise noted).

Symbol	Parameter		V_{CCI}	V_{CCO}	Min	Max	Unit
V_{CCA}	Supply voltage				1	3.6	V
V_{CCB}					1	3.6	
V_{IH}	High-level input voltage	Data inputs	1V		V_{CCI}×0.7		V
			1.1 V to 1.95 V		V_{CCI}×0.65		
			1.95 V to 2.7 V		1.6		
			2. 7V to 3.6 V		2		
V_{IL}	Low-level input voltage	Data inputs	1V			V_{CCI}×0.3	V
			1.1 V to 1.95 V			V_{CCI}×0.35	
			1.95 V to 2.7 V			0.7	
			2. 7V to 3.6 V			0.8	
V_{IH}	High-level input voltage	Control inputs (DIR, $\overline{OE}$) referenced to V_{CCA}	1V		V_{CCI}×0.7		V
			1.1 V to 1.95 V		V_{CCI}×0.65		
			1.95 V to 2.7 V		1.6		
			2. 7V to 3.6 V		2		
V_{IL}	Low-level input voltage	Control inputs (DIR, $\overline{OE}$) referenced to V_{CCA}	1V			V_{CCI}×0.3	V
			1.1 V to 1.95 V			V_{CCI}×0.35	
			1.95 V to 2.7 V			0.7	
			2. 7V to 3.6 V			0.8	
V_I	Input voltage				0	3.6	V
V_O	Output voltage	Active state			0	V_{CCO}	V
		Three-State			0	3.6	
I_{OH}	High-level output current			1.1V to 1.3 V		-3	mA
				1.4 V to 1.6 V		-6	
				1.65 V to 1.95 V		-8	
				2.3 V to 2.7 V		-9	
				3 V to 3.6 V		-12	
I_{OL}	Low-level output current			1.1V to 1.3 V		3	mA
				1.4 V to 1.6 V		6	
				1.65 V to 1.95 V		8	
				2.3 V to 2.7 V		9	
				3 V to 3.6 V		12	
$\Delta t/\Delta V$	Input transition rise or fall rate					10	ns/V
T_A	Operating free-air temperature				-40	125	℃

Note 1: V_{CCI} is the V_{CC} associated with the input port.
Note 2: V_{CCO} is the V_{CC} associated with the output port.
Note 3: All unused or driven (floating) data inputs (I/Os) of the device must be held at logic High or Low (preferably V_{CCI} or GND) to ensure proper device operation and minimize power.

7.3 Package Thermal Impedance

Symbol	Parameter		Value	Unit
$R_{\theta JA}$	Junction-to-ambient thermal resistance	TSSOP24	92.5	℃/W
		QFN24 2.0×4.0	123.1	
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	TSSOP24	34	℃/W
		QFN24 2.0×4.0	65	
$R_{\theta JB}$	Junction-to-board thermal resistance	TSSOP24	47.8	℃/W
		QFN24 2.0×4.0	55.3	

7.4 Electrical Characteristics (Note 1, 2)

Over recommended operating free-air temperature range (unless otherwise noted).

Parameter	Test Conditions		V_{CCA}	V_{CCB}	Min	Typ	Max	Unit
V_{OH}	I_{OH}=-100μA	$V_I=V_{IH}$	1V to 3.6V	1V to 3.6V	V_{CCO}-0.2			V
	I_{OH}=-3mA		1.1V	1.1V	0.85	0.98		
	I_{OH}=-6mA		1.4V	1.4V	1			
	I_{OH}=-8mA		1.65V	1.65V	1.2			
	I_{OH}=-9mA		2.3V	2.3V	1.8			
	I_{OH}=-12mA		3V	3V	2.4			
V_{OL}	I_{OL}=100μA	$V_I=V_{IL}$	1V to 3.6V	1V to 3.6V			0.2	V
	I_{OL}=3mA		1.1V	1.1V		0.1	0.25	
	I_{OL}=6mA		1.4V	1.4V			0.35	
	I_{OL}=8mA		1.65V	1.65V			0.45	
	I_{OL}=9mA		2.3V	2.3V			0.55	
	I_{OL}=12mA		3V	3V			0.7	
I_I Control inputs	V_I = V_{CCA} or GND		1V to 3.6V	1V to 3.6V	-1	0.1	1	μA
I_{OZ} A or B Port	V_O = V_{CCO} or GND, V_I = V_{CCI} or GND, $\overline{OE}$= V_{IH}		3.6V	3.6V	-5	0.1	5	μA
I_{OFF} A or B Port	V_I or V_O = 0 to 3.6V		0V	0V to 3.6V	-5	0.1	5	μA
			0V to 3.6V	0V	-5	0.1	5	
I_{CCA}	V_I=V_{CCI} or GND I_O=0		1V to 3.6V	1V to 3.6V			8	μA
			0V	3.6V	-2			
			3.6V	0V			8	
I_{CCB}	V_I=V_{CCI} or GND I_O=0		1V to 3.6V	1V to 3.6V			8	μA
			0V	3.6V			8	
			3.6V	0V	-2			
I_{CCA}+I_{CCB}	V_I=V_{CCI} or GND I_O=0		1V to 3.6V	1V to 3.6V			16	μA
C_I Control inputs	V_I = 3.3V or GND		3.3V	3.3V			7.5	pF
C_{IO} A or B Port	V_O = 3.3V or GND		3.3V	3.3V			8.5	pF

Note 1: V_{CCI} is the V_{CC} associated with the input port.
Note 2: V_{CCO} is the V_{CC} associated with the output port.

7.5 Switching Characteristics

Over recommended operating free-air temperature range, V_{CCA}= 1V.

Parameter	From (Input)	To (Output)	V_{CCB}	Min	Typ	Max	Unit
t_{PLH}, t_{PHL}	A	B	V_{CCB}=1V	0.5		30	ns
			V_{CCB}=1.2V ±0.1V	0.5		20	
			V_{CCB}=1.5V ±0.1V	0.5		17	
			V_{CCB}=1.8V ±0.15V	0.5		15	
			V_{CCB}=2.5V ±0.2V	0.5		15	
			V_{CCB}=3.3V ±0.3V	0.5		17	
t_{PLH}, t_{PHL}	B	A	V_{CCB}=1V	0.5		30	ns
			V_{CCB}=1.2V ±0.1V	0.5		20	
			V_{CCB}=1.5V ±0.1V	0.5		17	
			V_{CCB}=1.8V ±0.15V	0.5		15	
			V_{CCB}=2.5V ±0.2V	0.5		17	
			V_{CCB}=3.3V ±0.3V	0.5		17	
t_{PZH}, t_{PZL}	$\overline{OE}$	A	V_{CCB}=1V	0.5		35	ns
			V_{CCB}=1.2V ±0.1V	0.5		35	
			V_{CCB}=1.5V ±0.1V	0.5		35	
			V_{CCB}=1.8V ±0.15V	0.5		35	
			V_{CCB}=2.5V ±0.2V	0.5		35	
			V_{CCB}=3.3V ±0.3V	0.5		35	
t_{PZH}, t_{PZL}	$\overline{OE}$	B	V_{CCB}=1V	0.5		40	ns
			V_{CCB}=1.2V ±0.1V	0.5		35	
			V_{CCB}=1.5V ±0.1V	0.5		35	
			V_{CCB}=1.8V ±0.15V	0.5		35	
			V_{CCB}=2.5V ±0.2V	0.5		35	
			V_{CCB}=3.3V ±0.3V	0.5		35	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	A	V_{CCB}=1V	0.5		35	ns
			V_{CCB}=1.2V ±0.1V	0.5		35	
			V_{CCB}=1.5V ±0.1V	0.5		35	
			V_{CCB}=1.8V ±0.15V	0.5		35	
			V_{CCB}=2.5V ±0.2V	0.5		35	
			V_{CCB}=3.3V ±0.3V	0.5		35	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	B	V_{CCB}=1V	0.5		40	ns
			V_{CCB}=1.2V ±0.1V	0.5		35	
			V_{CCB}=1.5V ±0.1V	0.5		35	
			V_{CCB}=1.8V ±0.15V	0.5		35	
			V_{CCB}=2.5V ±0.2V	0.5		35	
			V_{CCB}=3.3V ±0.3V	0.5		35	

7.5 Switching Characteristics (continued)

Over recommended operating free-air temperature range, V_{CCA}= 1.2V ± 0.1V.

Parameter	From (Input)	To (Output)	V_{CCB}	Min	Typ	Max	Unit
t_{PLH}, t_{PHL}	A	B	V_{CCB}=1V	0.5		23	ns
			V_{CCB}=1.2V ±0.1V	0.5		15	
			V_{CCB}=1.5V ±0.1V	0.5		10	
			V_{CCB}=1.8V ±0.15V	0.5		9	
			V_{CCB}=2.5V ±0.2V	0.5		7	
			V_{CCB}=3.3V ±0.3V	0.5		7.5	
t_{PLH}, t_{PHL}	B	A	V_{CCB}=1V	0.5		23	ns
			V_{CCB}=1.2V ±0.1V	0.5		15	
			V_{CCB}=1.5V ±0.1V	0.5		13	
			V_{CCB}=1.8V ±0.15V	0.5		11	
			V_{CCB}=2.5V ±0.2V	0.5		8	
			V_{CCB}=3.3V ±0.3V	0.5		7	
t_{PZH}, t_{PZL}	$\overline{OE}$	A	V_{CCB}=1V	0.5		30	ns
			V_{CCB}=1.2V ±0.1V	0.5		30	
			V_{CCB}=1.5V ±0.1V	0.5		30	
			V_{CCB}=1.8V ±0.15V	0.5		30	
			V_{CCB}=2.5V ±0.2V	0.5		30	
			V_{CCB}=3.3V ±0.3V	0.5		30	
t_{PZH}, t_{PZL}	$\overline{OE}$	B	V_{CCB}=1V	0.5		30	ns
			V_{CCB}=1.2V ±0.1V	0.5		25	
			V_{CCB}=1.5V ±0.1V	0.5		22	
			V_{CCB}=1.8V ±0.15V	0.5		19	
			V_{CCB}=2.5V ±0.2V	0.5		17	
			V_{CCB}=3.3V ±0.3V	0.5		17	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	A	V_{CCB}=1V	0.5		35	ns
			V_{CCB}=1.2V ±0.1V	0.5		30	
			V_{CCB}=1.5V ±0.1V	0.5		30	
			V_{CCB}=1.8V ±0.15V	0.5		30	
			V_{CCB}=2.5V ±0.2V	0.5		30	
			V_{CCB}=3.3V ±0.3V	0.5		30	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	B	V_{CCB}=1V	0.5		35	ns
			V_{CCB}=1.2V ±0.1V	0.5		30	
			V_{CCB}=1.5V ±0.1V	0.5		30	
			V_{CCB}=1.8V ±0.15V	0.5		30	
			V_{CCB}=2.5V ±0.2V	0.5		30	
			V_{CCB}=3.3V ±0.3V	0.5		30	

7.5 Switching Characteristics (continued)

Over recommended operating free-air temperature range, V_{CCA}= 1.5V ± 0.1V.

Parameter	From (Input)	To (Output)	V_{CCB}	Min	Typ	Max	Unit
t_{PLH}, t_{PHL}	A	B	V_{CCB}=1V	0.5		18	ns
			V_{CCB}=1.2V ±0.1V	0.5		13	
			V_{CCB}=1.5V ±0.1V	0.5		9	
			V_{CCB}=1.8V ±0.15V	0.5		7	
			V_{CCB}=2.5V ±0.2V	0.5		6	
			V_{CCB}=3.3V ±0.3V	0.5		5.5	
t_{PLH}, t_{PHL}	B	A	V_{CCB}=1V	0.5		17	ns
			V_{CCB}=1.2V ±0.1V	0.5		11	
			V_{CCB}=1.5V ±0.1V	0.5		9	
			V_{CCB}=1.8V ±0.15V	0.5		7.5	
			V_{CCB}=2.5V ±0.2V	0.5		6	
			V_{CCB}=3.3V ±0.3V	0.5		5	
t_{PZH}, t_{PZL}	$\overline{OE}$	A	V_{CCB}=1V	0.5		23	ns
			V_{CCB}=1.2V ±0.1V	0.5		23	
			V_{CCB}=1.5V ±0.1V	0.5		23	
			V_{CCB}=1.8V ±0.15V	0.5		23	
			V_{CCB}=2.5V ±0.2V	0.5		23	
			V_{CCB}=3.3V ±0.3V	0.5		23	
t_{PZH}, t_{PZL}	$\overline{OE}$	B	V_{CCB}=1V	0.5		27	ns
			V_{CCB}=1.2V ±0.1V	0.5		24	
			V_{CCB}=1.5V ±0.1V	0.5		17	
			V_{CCB}=1.8V ±0.15V	0.5		15	
			V_{CCB}=2.5V ±0.2V	0.5		12	
			V_{CCB}=3.3V ±0.3V	0.5		11	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	A	V_{CCB}=1V	0.5		34	ns
			V_{CCB}=1.2V ±0.1V	0.5		34	
			V_{CCB}=1.5V ±0.1V	0.5		34	
			V_{CCB}=1.8V ±0.15V	0.5		34	
			V_{CCB}=2.5V ±0.2V	0.5		34	
			V_{CCB}=3.3V ±0.3V	0.5		34	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	B	V_{CCB}=1V	0.5		45	ns
			V_{CCB}=1.2V ±0.1V	0.5		40	
			V_{CCB}=1.5V ±0.1V	0.5		35	
			V_{CCB}=1.8V ±0.15V	0.5		31	
			V_{CCB}=2.5V ±0.2V	0.5		28	
			V_{CCB}=3.3V ±0.3V	0.5		25	

7.5 Switching Characteristics (continued)

Over recommended operating free-air temperature range, V_{CCA}= 1.8V ± 0.15V.

Parameter	From (Input)	To (Output)	V_{CCB}	Min	Typ	Max	Unit
t_{PLH}, t_{PHL}	A	B	V_{CCB}=1V	0.5		16	ns
			V_{CCB}=1.2V ±0.1V	0.5		11	
			V_{CCB}=1.5V ±0.1V	0.5		8	
			V_{CCB}=1.8V ±0.15V	0.5		7	
			V_{CCB}=2.5V ±0.2V	0.5		6	
			V_{CCB}=3.3V ±0.3V	0.5		5	
t_{PLH}, t_{PHL}	B	A	V_{CCB}=1V	0.5		16	ns
			V_{CCB}=1.2V ±0.1V	0.5		10	
			V_{CCB}=1.5V ±0.1V	0.5		7	
			V_{CCB}=1.8V ±0.15V	0.5		7	
			V_{CCB}=2.5V ±0.2V	0.5		5	
			V_{CCB}=3.3V ±0.3V	0.5		4	
t_{PZH}, t_{PZL}	$\overline{OE}$	A	V_{CCB}=1V	0.5		17	ns
			V_{CCB}=1.2V ±0.1V	0.5		17	
			V_{CCB}=1.5V ±0.1V	0.5		17	
			V_{CCB}=1.8V ±0.15V	0.5		17	
			V_{CCB}=2.5V ±0.2V	0.5		17	
			V_{CCB}=3.3V ±0.3V	0.5		17	
t_{PZH}, t_{PZL}	$\overline{OE}$	B	V_{CCB}=1V	0.5		23	ns
			V_{CCB}=1.2V ±0.1V	0.5		23	
			V_{CCB}=1.5V ±0.1V	0.5		15	
			V_{CCB}=1.8V ±0.15V	0.5		13	
			V_{CCB}=2.5V ±0.2V	0.5		10	
			V_{CCB}=3.3V ±0.3V	0.5		9	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	A	V_{CCB}=1V	0.5		30	ns
			V_{CCB}=1.2V ±0.1V	0.5		30	
			V_{CCB}=1.5V ±0.1V	0.5		30	
			V_{CCB}=1.8V ±0.15V	0.5		30	
			V_{CCB}=2.5V ±0.2V	0.5		30	
			V_{CCB}=3.3V ±0.3V	0.5		30	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	B	V_{CCB}=1V	0.5		30	ns
			V_{CCB}=1.2V ±0.1V	0.5		30	
			V_{CCB}=1.5V ±0.1V	0.5		30	
			V_{CCB}=1.8V ±0.15V	0.5		30	
			V_{CCB}=2.5V ±0.2V	0.5		30	
			V_{CCB}=3.3V ±0.3V	0.5		30	

7.5 Switching Characteristics (continued)

Over recommended operating free-air temperature range, V_{CCA}= 2.5V ± 0.2V.

Parameter	From (Input)	To (Output)	V_{CCB}	Min	Typ	Max	Unit
t_{PLH}, t_{PHL}	A	B	V_{CCB}=1V	0.5		15	ns
			V_{CCB}=1.2V ±0.1V	0.5		8	
			V_{CCB}=1.5V ±0.1V	0.5		6	
			V_{CCB}=1.8V ±0.15V	0.5		5.5	
			V_{CCB}=2.5V ±0.2V	0.5		5	
			V_{CCB}=3.3V ±0.3V	0.5		4	
t_{PLH}, t_{PHL}	B	A	V_{CCB}=1V	0.5		15	ns
			V_{CCB}=1.2V ±0.1V	0.5		7.5	
			V_{CCB}=1.5V ±0.1V	0.5		6	
			V_{CCB}=1.8V ±0.15V	0.5		5.5	
			V_{CCB}=2.5V ±0.2V	0.5		5	
			V_{CCB}=3.3V ±0.3V	0.5		4	
t_{PZH}, t_{PZL}	$\overline{OE}$	A	V_{CCB}=1V	0.5		16	ns
			V_{CCB}=1.2V ±0.1V	0.5		12	
			V_{CCB}=1.5V ±0.1V	0.5		12	
			V_{CCB}=1.8V ±0.15V	0.5		12	
			V_{CCB}=2.5V ±0.2V	0.5		12	
			V_{CCB}=3.3V ±0.3V	0.5		12	
t_{PZH}, t_{PZL}	$\overline{OE}$	B	V_{CCB}=1V	0.5		21	ns
			V_{CCB}=1.2V ±0.1V	0.5		18	
			V_{CCB}=1.5V ±0.1V	0.5		14	
			V_{CCB}=1.8V ±0.15V	0.5		12	
			V_{CCB}=2.5V ±0.2V	0.5		9	
			V_{CCB}=3.3V ±0.3V	0.5		8	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	A	V_{CCB}=1V	0.5		25	ns
			V_{CCB}=1.2V ±0.1V	0.5		25	
			V_{CCB}=1.5V ±0.1V	0.5		25	
			V_{CCB}=1.8V ±0.15V	0.5		25	
			V_{CCB}=2.5V ±0.2V	0.5		25	
			V_{CCB}=3.3V ±0.3V	0.5		25	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	B	V_{CCB}=1V	0.5		35	ns
			V_{CCB}=1.2V ±0.1V	0.5		32	
			V_{CCB}=1.5V ±0.1V	0.5		30	
			V_{CCB}=1.8V ±0.15V	0.5		28	
			V_{CCB}=2.5V ±0.2V	0.5		25	
			V_{CCB}=3.3V ±0.3V	0.5		23	

7.5 Switching Characteristics (continued)

Over recommended operating free-air temperature range, V_{CCA}= 3.3V ± 0.3V.

Parameter	From (Input)	To (Output)	V_{CCB}	Min	Typ	Max	Unit
t_{PLH}, t_{PHL}	A	B	V_{CCB}=1V	0.5		16	ns
			V_{CCB}=1.2V ±0.1V	0.5		7	
			V_{CCB}=1.5V ±0.1V	0.5		5	
			V_{CCB}=1.8V ±0.15V	0.5		4	
			V_{CCB}=2.5V ±0.2V	0.5		4	
			V_{CCB}=3.3V ±0.3V	0.5		4	
t_{PLH}, t_{PHL}	B	A	V_{CCB}=1V	0.5		16	ns
			V_{CCB}=1.2V ±0.1V	0.5		7	
			V_{CCB}=1.5V ±0.1V	0.5		6	
			V_{CCB}=1.8V ±0.15V	0.5		5	
			V_{CCB}=2.5V ±0.2V	0.5		4	
			V_{CCB}=3.3V ±0.3V	0.5		4	
t_{PZH}, t_{PZL}	$\overline{OE}$	A	V_{CCB}=1V	0.5		15.5	ns
			V_{CCB}=1.2V ±0.1V	0.5		11.5	
			V_{CCB}=1.5V ±0.1V	0.5		10	
			V_{CCB}=1.8V ±0.15V	0.5		10	
			V_{CCB}=2.5V ±0.2V	0.5		10	
			V_{CCB}=3.3V ±0.3V	0.5		10	
t_{PZH}, t_{PZL}	$\overline{OE}$	B	V_{CCB}=1V	0.5		50	ns
			V_{CCB}=1.2V ±0.1V	0.5		20	
			V_{CCB}=1.5V ±0.1V	0.5		14	
			V_{CCB}=1.8V ±0.15V	0.5		11	
			V_{CCB}=2.5V ±0.2V	0.5		8	
			V_{CCB}=3.3V ±0.3V	0.5		7	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	A	V_{CCB}=1V	0.5		22	ns
			V_{CCB}=1.2V ±0.1V	0.5		22	
			V_{CCB}=1.5V ±0.1V	0.5		22	
			V_{CCB}=1.8V ±0.15V	0.5		22	
			V_{CCB}=2.5V ±0.2V	0.5		22	
			V_{CCB}=3.3V ±0.3V	0.5		22	
t_{PHZ}, t_{PLZ}	$\overline{OE}$	B	V_{CCB}=1V	0.5		36	ns
			V_{CCB}=1.2V ±0.1V	0.5		33	
			V_{CCB}=1.5V ±0.1V	0.5		30	
			V_{CCB}=1.8V ±0.15V	0.5		27	
			V_{CCB}=2.5V ±0.2V	0.5		25	
			V_{CCB}=3.3V ±0.3V	0.5		23	

7.6 Operating Characteristics (Note 1)

T_A=25°C.

Parameter			Test Conditions	V_{CCA} = V_{CCB} = 1V	V_{CCA} = V_{CCB} = 1.2V	V_{CCA} = V_{CCB} = 1.5V	V_{CCA} = V_{CCB} = 1.8V	V_{CCA} = V_{CCB} = 2.5V	V_{CCA} = V_{CCB} = 3.3V	Unit
				Typ	Typ	Typ	Typ	Typ	Typ	
C_{PDA}	A to B	Outputs enabled	C_L = 0, f=10MHz, tr = tf = 1ns	2	2.2	2.3	2.5	2.7	3.5	pF
		Outputs disabled		1	1	1	1	1	1	
	B to A	Outputs enabled		12	12	12	12	13	13.5	
		Outputs disabled		1	1	1	1	1	1	
C_{PDB}	A to B	Outputs enabled		12	12	12	12	13	13.5	
		Outputs disabled		1	1	1	1	1	1	
	B to A	Outputs enabled		2	2.2	2.3	2.5	2.7	3.5	
		Outputs disabled		1	1	1	1	1	1	

Note 1: C_{PDA} and C_{PDB} are power dissipation capacitance per transceiver.

8 Parameter Measurement Information

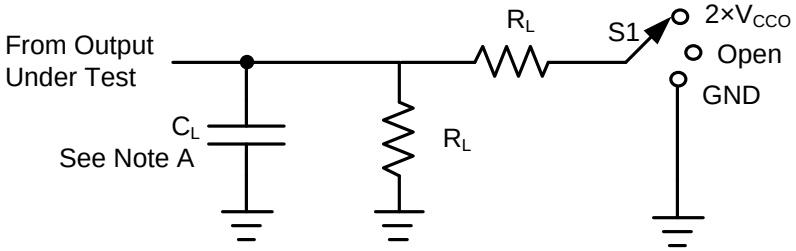


Figure 8-1. Load Circuit

Parameter	V_{CCO}	C_L	R_L	S1	V_{TP}
t_{PD}	1V to 3.6V	15pF	2kΩ	Open	N/A
t_{PLZ}, t_{PZL}	1V to 1.6V	15pF	2kΩ	2 ×V_{CCO}	0.1V
	1.65V to 2.7V	15pF	2kΩ	2 ×V_{CCO}	0.15V
	3V to 3.6V	15pF	2kΩ	2 ×V_{CCO}	0.3V
t_{PHZ}, t_{PZH}	1V to 1.6V	15pF	2kΩ	GND	0.1V
	1.65V to 2.7V	15pF	2kΩ	GND	0.15V
	3V to 3.6V	15pF	2kΩ	GND	0.3V

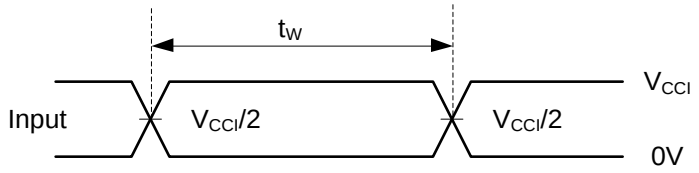


Figure 8-2. Voltage Waveforms Pulse Duration

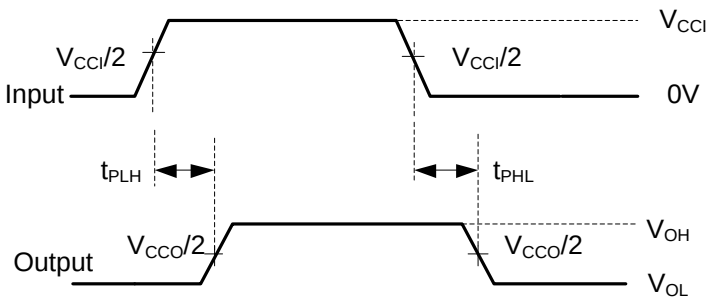


Figure 8-3. Voltage Waveforms Propagation Delay Times

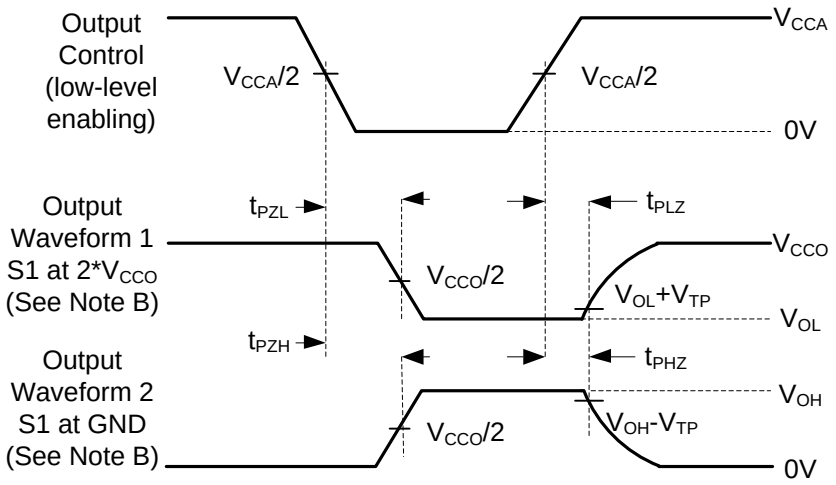


Figure 8-4. Voltage Waveforms Enable and Disable Times

Notes:
A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR≤10 MHz, Z_O = 50Ω, dv/dt ≥ 1V/ns.
D. The outputs are measured one at a time, with one transition per measurement.
E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
F. t_{PZL} and t_{PZH} are the same as t_{en}.
G. t_{PLH} and t_{PHL} are the same as t_{PD}.
H. V_{CCI} is the V_{CC} associated with the input port.
I. V_{CCO} is the V_{CC} associated with the output port.

9 Detailed Description

9.1 Overview

The UM74AVC8TX245 device is an 8-bit, dual-supply non-inverting transceiver with bidirectional voltage level translation. The I/O pins labeled with A and the control pins (DIR1, DIR2 and $\overline{OE}$) are supported by V_{CCA}, and the I/O pins labeled with B are supported by V_{CCB}. The A port and the B port are able to accept I/O voltages ranging from 1 V to 3.6 V.

9.2 Functional Block Diagram

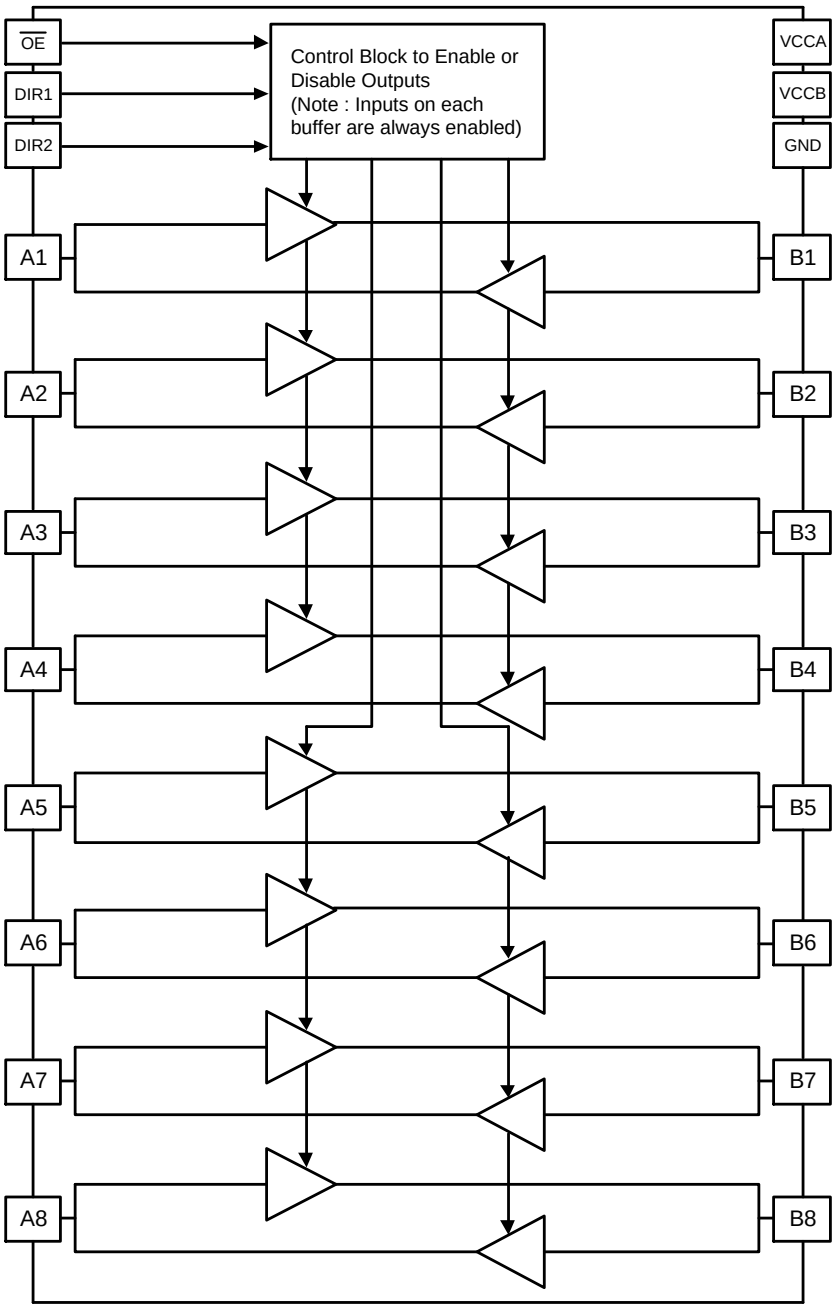


Figure 9-1. UM74AVC8TX245 Block Diagram

10 Feature Description

10.1 Fully Configurable Dual-Rail Design

The fully configurable dual-rail design allows each port to operate over the full 1 V to 3.6 V power-supply range. Both V_{CCA} and V_{CCB} can be supplied at any voltage between 1 V and 3.6 V making the device an excellent choice for translating between any of the low voltage nodes (1 V, 1.2 V, 1.8 V, 2.5 V and 3.3 V).

10.2 Multiple Direction Control Pins

Two control pins are used to configure the 8 data I/Os. I/O channels 1 through 4 are grouped together and I/O channels 5 through 8 are banked together. The benefit of this is to permit simultaneous up-translation and down-translation within one device. This eliminates the need for multiple devices, where each device can only provide up-translation or down-translation sequentially.

10.3 I_{OFF} Supports Partial-Power-Down Mode Operation

I_{OFF} prevents backflow current by disabling I/O output circuits when device is in partial power-down mode. The inputs and outputs for this device enter a high-impedance state when the device is powered down, inhibiting current backflow into the device. The maximum leakage into or out of any input or output pin on the device is specified by I_{OFF} in the Electrical Characteristics.

10.4 I/Os with Integrated Static Pull-Down Resistors

To help avoid floating inputs on the I/Os, this device has 288kΩ typical integrated weak pull-downs on all data I/Os. This feature allows all inputs to be left floating without the concern for unstable outputs or increased current consumption. This also helps to reduce external component count for applications where not all channels are used or need to be fixed low. If an external pull-up is required, it should be no larger than 30kΩ to avoid contention with the 288kΩ internal pull-down.

10.5 V_{CC} Isolation

The I/Os of both ports will enter a high-impedance state when one of the supplies are at GND, while the other supply is still connected to the device (I_{OZ} shown in Electrical Characteristics).

10.6 Device Functional Modes

All control inputs are referenced to V_{CCA} and must be driven to a valid Logic High or Logic Low (that is, not floating) to assure proper device operation and to prevent excessive power consumption. Table 10-1 summarizes the possible modes of device operation based on the configuration of the control inputs.

Table 10-1. Function Table

Control Inputs			Signal Direction	
$\overline{OE}$	DIR1	DIR2	Bits 1:4	Bits 5:8
H	X	X	Disabled (Hi-Z)	
L	L	L	B to A	
L	L	H	B to A	A to B
L	H	L	A to B	
L	H	H	A to B	B to A

11 Application Information

11.1 Application Information

The UM74AVC8TX245 device can be used in level-translation applications for interfacing devices or systems operating at different voltage nodes. Typical Application Circuit depicts an application in which the UM74AVC8TX245 device is up-translating a 1.8V input to a 3.3V output to interface between a system controller and a peripheral device.

11.2 Typical Application

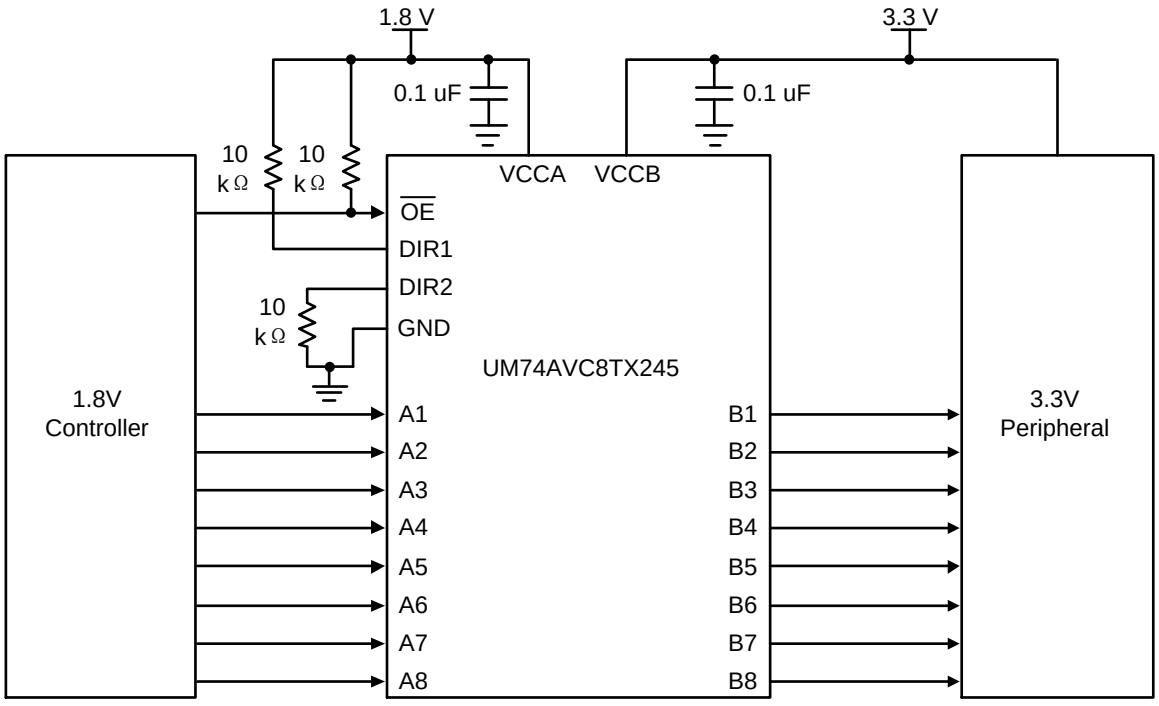
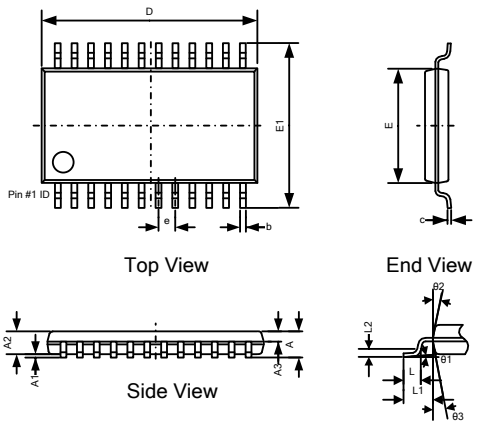


Figure 11-1. UM74AVC8TX245 Typical Application

Package Information

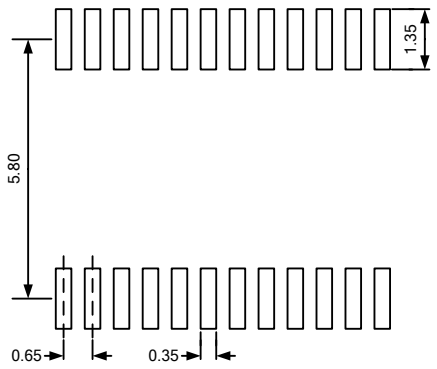
TSSOP24

Outline Drawing



DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	-	-	1.20	-	-	0.047
A1	0.05	-	0.15	0.002	-	0.006
A2	0.80	-	1.05	0.031	-	0.041
A3	0.34	0.44	0.54	0.013	0.017	0.021
b	0.19	-	0.30	0.007	-	0.012
c	0.09	-	0.20	0.004	-	0.008
D	7.70	7.80	7.90	0.308	0.312	0.316
E	4.30	4.40	4.50	0.169	0.173	0.177
E1	6.20	6.40	6.60	0.244	0.252	0.260
e	0.65BSC			0.026BSC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	1.00REF			0.039REF		
L2	0.25BSC			0.010BSC		
θ1	0 °	-	8 °	0 °	-	8 °
θ2	10 °	12 °	14 °	10 °	12 °	14 °
θ3	10 °	12 °	14 °	10 °	12 °	14 °

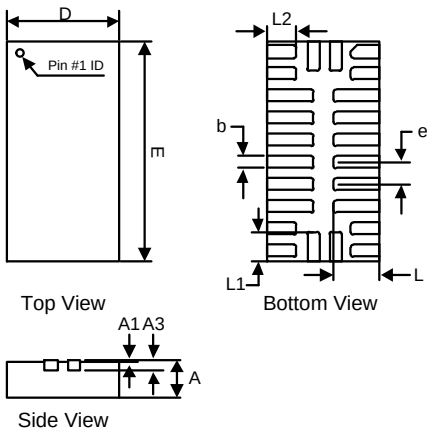
Land Pattern



NOTES:
1. Compound dimension: 7.80×4.40;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

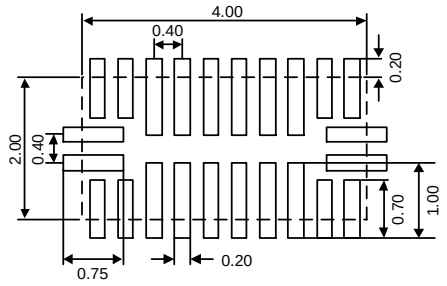
QFN24 2.0×4.0

Outline Drawing



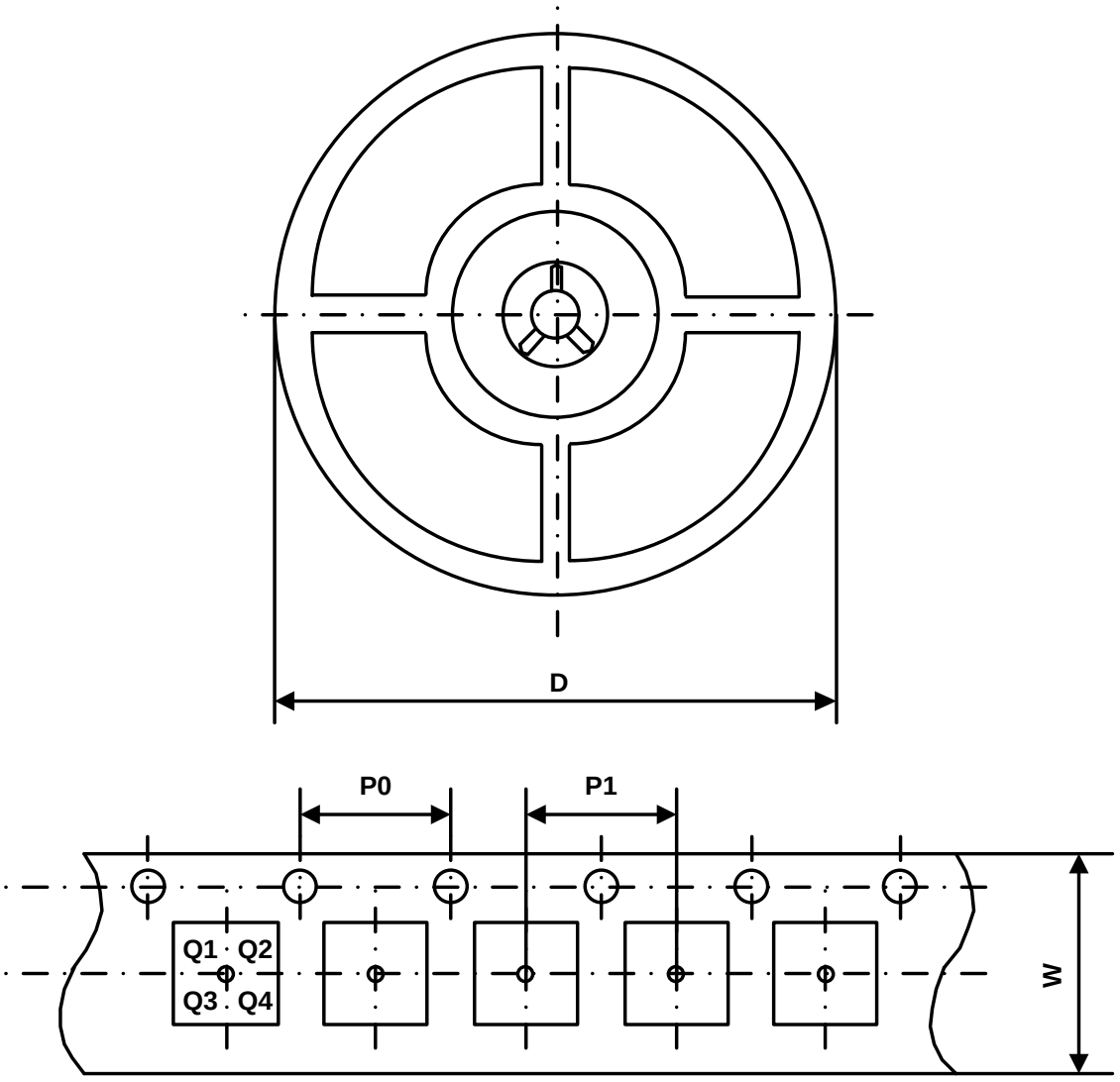
DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	0.50	-	0.60	0.020	-	0.024
A1	0.00	-	0.05	0.000	-	0.002
A3	0.15REF			0.006REF		
D	1.90	2.00	2.10	0.076	0.080	0.084
E	3.90	4.00	4.10	0.156	0.160	0.164
b	0.15	0.20	0.25	0.006	0.008	0.010
L	0.75	0.80	0.85	0.030	0.032	0.034
L1	0.50	0.55	0.60	0.020	0.022	0.024
L2	0.45	0.50	0.55	0.018	0.020	0.022
e	0.40BSC			0.016BSC		

Land Pattern



NOTES:
1. Compound dimension: 2.0×4.0;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Packing Information



Part Number	Package Type	Carrier Width (W)	Pitch (P0)	Pitch (P1)	Reel Size (D)	PIN 1 Quadrant
UM74AVC8TX245UO	TSSOP24	16 mm	4 mm	8 mm	330 mm	Q1
UM74AVC8TX245QA	QFN24 2.0×4.0	12 mm	4 mm	4 mm	180 mm	Q1

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