



High-Speed CMOS 3.3V 8-Bit Bidirectional Transceiver with Output Resistor

QS74LVCR2245A

FEATURES/BENEFITS

- 5V tolerant inputs and outputs
- 25Ω series resistor for low switching noise
- $10\mu\text{A}$ I_{CCQ} quiescent power supply current
- Hot insertable
- 2.0V–3.6V V_{CC} supply operation
- $\pm 12\text{mA}$ balanced output drive
- Power down high impedance inputs and outputs
- Input hysteresis for noise immunity
- Meets or exceeds JEDEC Standard 36 specifications
- Multiple power and ground pins for low noise
- Operating temperature range:
–40°C to 85°C
- Latch-up performance exceeds 500mA
- ESD performance:
Human body model > 2000V
Machine model > 200V
- Packages available:
20-pin QSOP
20-pin SOIC

DESCRIPTION

The LVCR2245A is an 8-bit non-inverting transceiver with three-state outputs that is ideal for bus-oriented applications. The Transmit/Receive ($\overline{\text{T/R}}$) input determines the direction of data flow, either from A to B or B to A, and the Output Enable ($\overline{\text{OE}}$) inputs enables the selected port for output. The 3.3V LVC family features low power, low switching noise, and fast switching speeds for low power portable applications as well as high-end, advanced workstation applications. 5V tolerant inputs and outputs allow this LVC product to be used in mixed-voltage applications. The LVCR2245A with integrated output resistor is ideally suited for low noise environments where reduced output overshoot and undershoot are critical requirements. To accommodate hot-plug or live insertion applications, this product is designed not to load an active bus when V_{CC} is removed. However, during power up or power down sequence, $\overline{\text{OE}}$ should be tied to V_{CC} to ensure high-impedance state on the outputs.

Figure 1. Functional Block Diagram

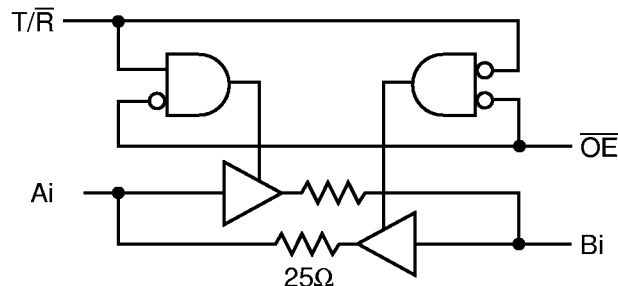


Figure 2. Pin Configuration
(All Pins Top View)

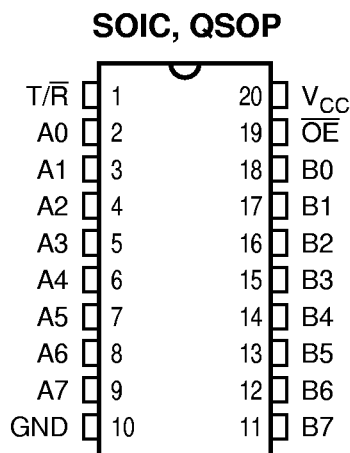


Table 1. Pin Description

Name	I/O	Description
Ai	I/O	Data Bus A
Bi	I/O	Data Bus B
T/R	I	Direction
OE	I	Three-State Output Enable

Table 2. Function Table

OE	T/R	A	B	Function
H	X	Hi-Z	Hi-Z	Disable
L	L	Output	Input	Bus B to Bus A
L	H	Input	Output	Bus A to Bus B

Table 3. Absolute Maximum Ratings

Supply Voltage to Ground	-0.5V to 7.0V
DC Output Voltage V _{OUT}	
Outputs HIGH-Z	-0.5V to 7.0V
Outputs Active	-0.5V to V _{CC} + 0.5V
DC Input Voltage V _{IN}	-0.5V to 7.0V
DC Input Diode Current with V _{IN} < 0	-50mA
DC Output Diode Current	
V _O < 0	-50mA
V _O > V _{CC}	50mA
DC Output Source/Sink Current (I _{OH} /I _{OL})	±50mA
DC Supply Current per Supply Pin	±100mA
DC Ground Current per Ground Pin	±100mA
T _{STG} Storage Temperature	-65°C to 150°C

Note: Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to this device resulting in functional or reliability type failures.

Table 4. Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit	
V _{CC}	Supply Voltage, Operating	2.0	3.6	V	
	Supply Voltage, Data Retention Only	1.5	3.6		
V _{IH}	Input HIGH Voltage	2.0	—	V	
V _{IL}	Input LOW Voltage	—	0.8	V	
V _{IN}	Input Voltage	0	5.5	V	
V _{OUT}	Output Voltage in Active State	0	V _{CC}	V	
	Output Voltage in "OFF" State	0	5.5		
I _{OH}	Output Current HIGH	V _{CC} = 3.0–3.6V	—	–12	mA
		V _{CC} = 2.7V	—	–8	
I _{OL}	Output Current LOW	V _{CC} = 3.0–3.6V	—	–12	mA
		V _{CC} = 2.7V	—	–8	
Δt/Δv	Input Transition Slew Rate	—	10	ns/V	
T _A	Operating Free Air Temperature	–40	85	°C	

Table 5. DC Electrical Characteristics Over Operating Range

Industrial Temperature Range, T_A = –40°C to 85°C

Symbol	Parameter	Test Conditions	Min	Typ ⁽¹⁾	Max	Unit
V _{OH}	Output HIGH Voltage	V _{CC} = 2.7V, I _{OH} = –100μA	V _{CC} – 0.2	—	—	V
		V _{CC} = 2.7V, I _{OH} = –4mA	2.2	—	—	
		V _{CC} = 3.0V, I _{OH} = –6mA	2.4	—	—	
		V _{CC} = 2.7V, I _{OH} = –8mA	2.0	—	—	
		V _{CC} = 3.0V, I _{OH} = –12mA	2.2	—	—	
V _{OL}	Output LOW Voltage	V _{CC} = 2.7V, I _{OL} = 100μA	—	—	0.2	V
		V _{CC} = 2.7V, I _{OL} = 4mA	—	—	0.4	
		V _{CC} = 3.0V, I _{OL} = 6mA	—	—	0.55	
		V _{CC} = 2.7V, I _{OL} = 8mA	—	—	0.6	
		V _{CC} = 3.0V, I _{OL} = 12mA	—	—	0.8	
V _{IK}	Input Clamp Voltage	V _{CC} = 2.7V, I _{IN} = –18mA	—	–0.7	–1.2	V
R _{OUT}	Output Resistance	V _{CC} = 3.0V, I _{OL} = 12mA	—	28	—	Ω
I _I	Input Leakage Current	V _I = 0V, V _I = 5.5V, V _{CC} = 3.6V	—	—	±1.0	μA
I _{OZ}	High-Z I/O Leakage	V _O = 0V, V _O = 5.5V, V _I = V _{IH} or V _{IL} , V _{CC} = 3.6V	—	—	±1.0	μA
I _{OFF}	Power Off Leakage	V _{CC} = 0V, V _I or V _O = 5.5V	—	—	10	μA
I _{CC}	Quiescent Power Supply Current	V _{CC} = 3.6V, V _{IN} = V _{CC} or GND	—	0.1	10	μA
ΔI _{CC}	Quiescent Power Supply Current per Control Inputs at TTL HIGH	V _{CC} = 3.6V, V _{IN} = V _{CC} – 0.6V ⁽²⁾	—	2.0	3.0	μA

Notes:

1. Typical values are at V_{CC} = 3.3V and T_A = 25°C.
2. Per TTL driven input. All other inputs at V_{CC} or GND.

Table 6. Dynamic Switching Characteristics

Symbol	Parameter	Test Conditions	Typ ⁽¹⁾	Unit	
V _{OLP}	Quiet Output Dynamic Peak V _{OL}	C _L = 50pF, V _{CC} = 3.3V V _{IH} = 3.3V, V _{IL} = 0V	0.8	V	
V _{OLV}	Quiet Output Dynamic Valley V _{OL}	C _L = 50pF, V _{CC} = 3.3V V _{IH} = 3.3V, V _{IL} = 0V	0.8	V	
C _{PD}	Power Dissipation	C _L = 50pF, f = 10MHz, V _{CC} = 3.6 ± 0.3V	Output Enable	20	pF
			Output Disable	4	

Note:

1. Typical values are at V_{CC} = 3.3V, 25°C ambient.

Table 7. Capacitance⁽¹⁾

Symbol	Pins	Conditions	Typ	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V, V _{OUT} = 0V, f = 1MHz	7.0	pF
C _{I/O}	I/O Capacitance	V _{IN} = 0V, V _{OUT} = 0V, f = 1MHz	8.0	pF

Note:

1. Capacitance is characterized but not production tested.

Table 8. Switching Characteristics Over Operating Range

Industrial Temperature Range, T_A = -40°C to 85°C.

C_{LOAD} = 50pF, R_{LOAD} = 500Ω unless otherwise noted.

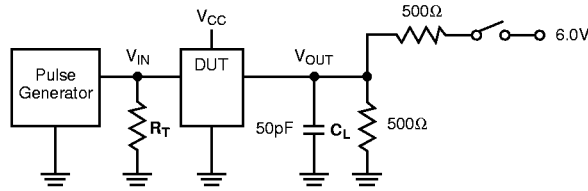
Symbol	Description ⁽¹⁾	V _{CC} = 3.3 ± 0.3V		V _{CC} = 2.7V ⁽²⁾		Unit
		Min	Max	Min	Max	
t _{PD}	Propagation Delay A to B, B to A	1.5	6.3	1.5	7.3	ns
t _{EN}	Output Enable Time \overline{OE} , T/ \overline{R} to A/B	1.5	8.2	1.5	9.5	ns
t _{DIS}	Output Disable Time ⁽²⁾ \overline{OE} , T/ \overline{R} to A/B	1.5	7.8	1.5	8.5	ns
t _{SK(O)}	Output Skew ⁽³⁾	—	0.5	—	—	ns

Notes:

1. Minimums guaranteed but not tested. See Test Circuit and Waveforms.
2. Guaranteed by characterization.
3. Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by characterization but not production tested.

TEST CIRCUIT AND WAVEFORMS

Figure 3. Test Circuit



SWITCH POSITION	
Test	Switch
Open Drain	
Disable LOW	6V
Enable LOW	
Disable HIGH	GND
Enable HIGH	
All Other Inputs	Open

DEFINITIONS:
 C_L = Load capacitance: includes jig and probe capacitance.
 R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

Figure 4. Setup, Hold, and Release Timing

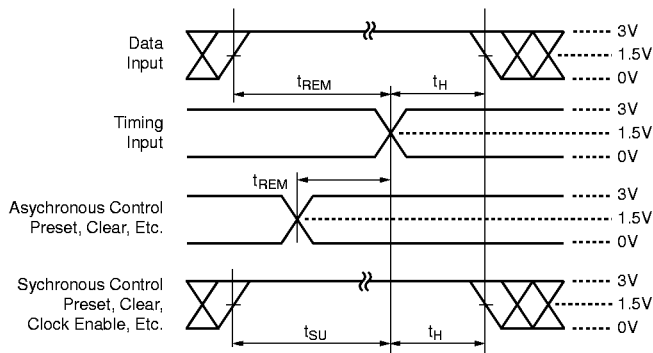


Figure 6. Pulse Width

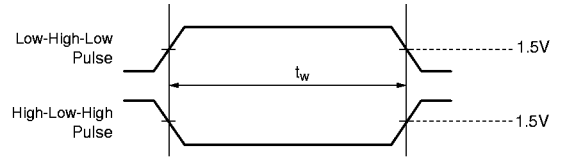
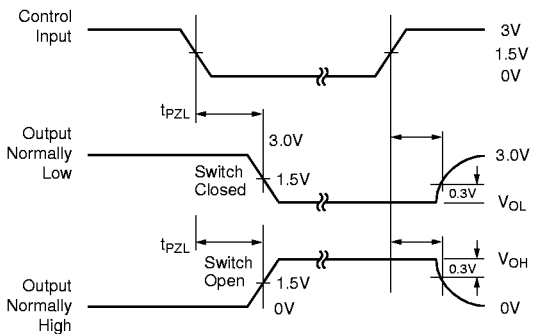


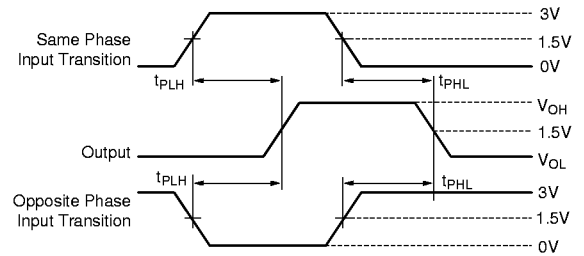
Figure 5. Enable and Disable Timing



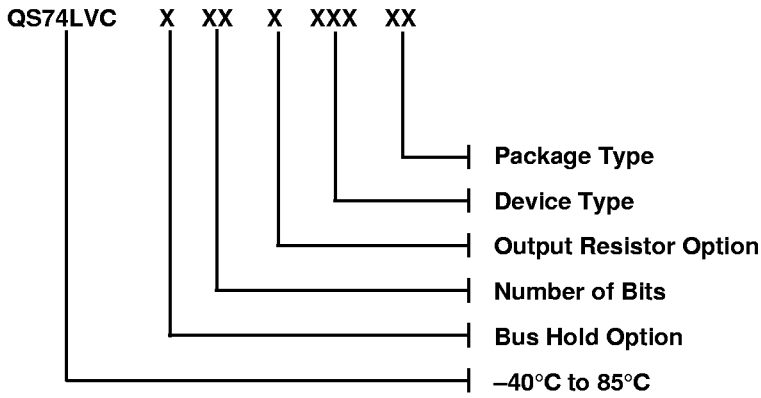
Notes:

1. Input Control Enable = LOW and Input Control Disable = HIGH.
2. Pulse Generator for All Pulses: Rate \leq 1.0MHz;
 $Z_{OUT} \leq 50\Omega$; t_F , $t_R \leq 2.5ns$.

Figure 7. Propagation Delay



ORDERING INFORMATION



Bus Hold Option:
Blank – No Bus Hold

Number of Bits:
Blank – 16-Bit

Output Resistor Option:
2 – Output Resistor

Device Type:
245

Package Type:
Q – QSOP, 150 mil
SO – SOIC, 300 mil