FAIRCHILD SEMICONDUCTOR™

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74VCX16244
Low Voltage 16-Bit Buffer/Line Driver with 3.6V Tolerant Inputs and Outputs

General Description

The VCX16244 contains sixteen non-inverting buffers with 3-STATE outputs to be employed as a memory and address driver, clock driver, or bus oriented transmitter/receiver. The device is nibble (4-bit) controlled. Each nibble has separate 3-STATE control inputs which can be shorted together for full 16-bit operation.

The 74VCX16244 is designed for low voltage (1.8V, 2.5V or 3.3V) V_{CC} applications with I/O capability up to 3.6V.

The 74VCX16244 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining low CMOS power dissipation.

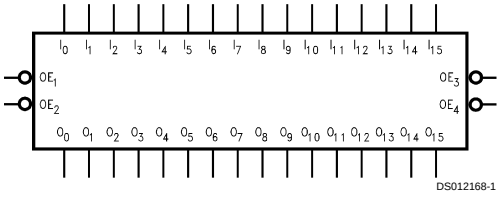
Features

- 1.8V–3.6V V_{CC} supply operation
- 3.6V tolerant inputs and outputs
- t_{pd}
  - 2.5 ns max for 3.0V to 3.6V V_{CC}
  - 3.2 ns max for 2.3V to 2.7V V_{CC}
  - 5.7 ns max for 1.8V V_{CC}
- Power-off high impedance inputs and outputs
- Support live insertion and withdrawal
- Static Drive (I_{OH}/I_{OL})
  - ±24 mA @ 3.0V V_{CC}
  - ±18 mA @ 2.3V V_{CC}
  - ±6 mA @ 1.8V V_{CC}
- Uses patented noise/EMI reduction circuitry
- Latch-up performance exceeds 300 mA
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V

Ordering Code:

Ordering Code	Package Descriptions	Topmark	Package Number
74VCX16244MTD	48 Lead Thin Shrink Small Outline, JEDEC 6.1mm	VCX16244	MTD48
74VCX16244MTDX	48 Lead Thin Shrink Small Outline, JEDEC 6.1mm (tape and reel)	VCX16244	MTD48

Logic Symbol

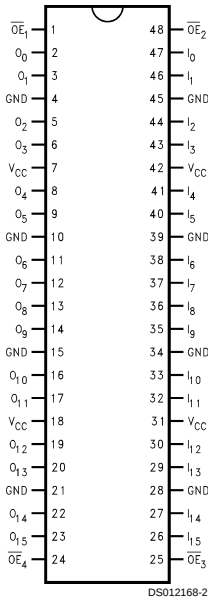


Pin Descriptions

Pin Names	Description
$\overline{OE}_n$	Output Enable Input (Active Low)
I_0–I_{15}	Inputs
O_0–O_{15}	Outputs

Connection Diagram

Pin Assignment for TSSOP



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Functional Description

The 74VCX16244 contains sixteen non-inverting buffers with 3-STATE outputs. The device is nibble (4 bits) controlled with each nibble functioning identically, but independent of each other. The control pins may be shorted together to obtain full 16-bit operation.The 3-STATE outputs are controlled by an Output Enable ($\overline{OE}_n$) input. When $\overline{OE}_n$ is LOW, the outputs are in the 2-state mode. When $\overline{OE}_n$ is HIGH, the standard outputs are in the high impedance mode but this does not interfere with entering new data into the inputs.

Truth Tables

Inputs		Outputs
$\overline{OE}_1$	I_0–I_3	O_0–O_3
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_2$	I_4–I_7	O_4–O_7
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_3$	I_8–I_{11}	O_8–O_{11}
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_4$	I_{12}–I_{15}	O_{12}–O_{15}
L	L	L
L	H	H
H	X	Z

H = High Voltage Level
L = Low Voltage Level
X = Immaterial (HIGH or LOW, inputs may not float)
Z = High Impedance

Absolute Maximum Ratings (Note 1)

Supply Voltage (V_{CC})	−0.5V to +4.6V
DC Input Voltage (V_I)	−0.5V to +4.6V
Output Voltage (V_O)	
Outputs 3-STATED	−0.5V to +4.6V
Outputs Active (Note 2)	−0.5V to V_{CC} +0.5V
DC Input Diode Current (I_{IK}) V_I < 0V	−50 mA
DC Output Diode Current (I_{OK})	
V_O < 0V	−50 mA
V_O > V_{CC}	+50 mA
DC Output Source/Sink Current	
(I_{OH}/I_{OL})	±50 mA
DC V_{CC} or GND Current per	
Supply Pin (I_{CC} or GND)	±100 mA
Storage Temperature Range (T_{STG})	−65˚C to +150˚C

Recommended Operating Conditions (Note 3)

Power Supply	
Operating	1.8V to 3.6V
Data Retention Only	1.2V to 3.6V
Input Voltage	−0.3V to +3.6V
Output Voltage (V_O)	
Output in Active States	0V to V_{CC}
Output in 3-State	0.0V to 3.6V
Output Current in I_{OH}/I_{OL}	
V_{CC} = 3.0V to 3.6V	±24 mA
V_{CC} = 2.3V to 2.7V	±18 mA
V_{CC} = 1.8V	±6 mA
Free Air Operating Temperature	
(T_A)	−40˚C to +85˚C
Minimum Input Edge Rate (dT/dV)	
V_{IN} = 0.8V to 2.0V, V_{CC} = 3.0V	10 ns/V

Note 1: The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: I_O Absolute Maximum Rating must be observed.

Note 3: Floating or unused inputs must be held HIGH or LOW.

DC Electrical Characteristics VCX16244 (2.7V < V_{CC} ≤ 3.6V)

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{IH}	HIGH Level Input Voltage		2.7–3.6	2.0		V
V_{IL}	LOW Level Input Voltage		2.7–3.6		0.8	V
V_{OH}	HIGH Level Output Voltage	I_{OH} = −100 µA	2.7–3.6	V_{CC} − 0.2		V
		I_{OH} = −12 mA	2.7	2.2		V
		I_{OH} = −18 mA	3.0	2.4		V
		I_{OH} = −24 mA	3.0	2.2		V
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 µA	2.7–3.6		0.2	V
		I_{OL} = 12 mA	2.7		0.4	V
		I_{OL} = 18 mA	3.0		0.4	V
		I_{OL} = 24 mA	3.0		0.55	V
I_I	Input Leakage Current	0 ≤ V_I ≤ 3.6V	2.7–3.6		±5.0	µA
I_{OZ}	3-STATE Output Leakage	0 ≤ V_O ≤ 3.6V V_I = V_{IH} or V_{IL}	2.7–3.6		±10	µA
I_{OFF}	Power-OFF Leakage Current	0 ≤ (V_I , V_O) ≤ 3.6V	0		10	µA
I_{CC}	Quiescent Supply Current	V_I = V_{CC} or GND	2.7–3.6		20	µA
		V_{CC} ≤ (V_I, V_O) ≤ 3.6V	2.7–3.6		±20	µA
ΔI_{CC}	Increase in I_{CC} per Input	V_{IH} = V_{CC} −0.6V	2.7–3.6		750	µA

DC Electrical Characteristics VCX16244 (2.3V ≤ V_{CC} ≤ 2.7V)

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{IH}	HIGH Level Input Voltage		2.3–2.7	1.6		V
V_{IL}	LOW Level Input Voltage		2.3–2.7		0.7	V
V_{OH}	HIGH Level Output Voltage	I_{OH} = −100 µA	2.3–2.7	V_{CC} − 0.2		V
		I_{OH} = −6 mA	2.3	2.0		V
		I_{OH} = −12 mA	2.3	1.8		V
		I_{OH} = −16 mA	2.3	1.7		V
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 µA	2.3–2.7		0.2	V
		I_{OL} = 12 mA	2.3		0.4	V
		I_{OL} = 18 mA	2.3		0.6	V
I_I	Input Leakage Current	0 ≤ V_I ≤ 3.6V	2.3–2.7		±5.0	µA
I_{OZ}	3-STATE Output Leakage	0 ≤ V_O ≤ 3.6V V_I = V_{IH} or V_{IL}	2.3–2.7		±10	µA
I_{OFF}	Power-OFF Leakage Current	0 ≤ (V_I , V_O) ≤ 3.6V	0		10	µA
I_{CC}	Quiescent Supply Current	V_I = V_{CC} or GND	2.3–2.7		20	µA
		V_{CC} ≤ (V_I, V_O) ≤ 3.6V	2.3–2.7		±20	µA

DC Electrical Characteristics VCX16244 (1.8V ≤ V_{CC} < 2.3V)

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{IH}	HIGH Level Input Voltage		1.8–2.3	0.7 x V_{CC}		V
V_{IL}	LOW Level Input Voltage		1.8–2.3		0.2 x V_{CC}	V
V_{OH}	HIGH Level Output Voltage	I_{OH} = −100 µA	1.8	V_{CC} − 0.2		V
		I_{OH} = −6 mA	1.8	1.4		V
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 µA	1.8		0.2	V
		I_{OL} = 6 mA	1.8		0.3	V
I_I	Input Leakage Current	0 ≤ V_I ≤ 3.6V	1.8		±5.0	µA
I_{OZ}	3-STATE Output Leakage	0 ≤ V_O ≤ 3.6V V_I = V_{IH} or V_{IL}	1.8		±10	µA
I_{OFF}	Power-OFF Leakage Current	0 ≤ (V_I , V_O) ≤ 3.6V	0		10	µA
I_{CC}	Quiescent Supply Current	V_I = V_{CC} or GND	1.8		20	µA
		V_{CC} ≤ (V_I, V_O) ≤ 3.6V	1.8		±20	µA

AC Electrical Characteristics VCX16244

(Note 4)

Symbol	Parameter	$T_A = -40^\circ C$ to $+85^\circ C$, $C_L = 30$ pF, $R_L = 500\Omega$						Units
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.5V \pm 0.2V$		$V_{CC} = 1.8V$		
		Min	Max	Min	Max	Min	Max	
t_{PHL}, t_{PLH}	Prop Delay	0.8	2.5	1.0	3.2	1.5	5.7	ns
t_{PZL}, t_{PZH}	Output Enable Time	0.8	3.5	1.0	4.3	1.5	7.0	ns
t_{PLZ}, t_{PHZ}	Output Disable Time	0.8	3.5	1.0	3.8	1.5	5.0	ns
t_{OSHL} t_{OSLH}	Output to Output Skew (Note 5)		0.5		0.5		0.5	ns

Note 4: For $C_L = 50$pF, add approximately 300 ps to the AC maximum specification.

Note 5: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH to LOW (t_{OSHL}) or LOW to HIGH (t_{OSLH}).

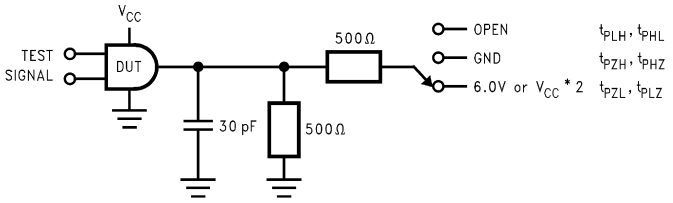
Dynamic Switching Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = +25^\circ C$ Typical	Units
V_{OLP}	Quiet Output Dynamic Peak V_{OL}	$C_L = 30$ pF, $V_{IH} = V_{CC}$, $V_{IL} = 0V$	1.8	0.25	V
			2.5	0.6	
			3.3	0.8	
V_{OLV}	Quiet Output Dynamic Valley V_{OL}	$C_L = 30$ pF, $V_{IH} = V_{CC}$, $V_{IL} = 0V$	1.8	−0.25	V
			2.5	−0.6	
			3.3	−0.8	
V_{OHV}	Quiet Output Dynamic Valley V_{OH}	$C_L = 30$ pF, $V_{IH} = V_{CC}$, $V_{IL} = 0V$	1.8	1.5	V
			2.5	1.9	
			3.3	2.2	

Capacitance

Symbol	Parameter	Conditions	$T_A = +25^\circ C$ Typical	Units
C_{IN}	Input Capacitance	$V_{CC} = 1.8$, 2.5V or 3.3V, $V_I = 0V$ or V_{CC}	6	pF
C_{OUT}	Output Capacitance	$V_I = 0V$ or V_{CC}, $V_{CC} = 1.8V$, 2.5V or 3.3V	7	pF
C_{PD}	Power Dissipation Capacitance	$V_I = 0V$ or V_{CC}, F = 10 MHz, $V_{CC} = 1.8V$, 2.5V or 3.3V	20	pF

AC Loading and Waveforms



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TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6V at V_{CC} = 3.3 ±0.3V; V_{CC} x 2 at V_{CC} = 2.5 ±0.2V; 1.8V
t_{PZH}, t_{PHZ}	GND

FIGURE 1. AC Test Circuit

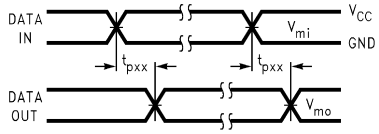

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FIGURE 2. Waveform for Inverting and Non-Inverting Functions

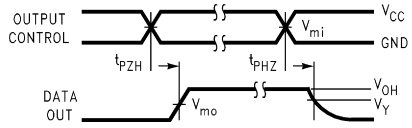

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FIGURE 3. 3-STATE Output High Enable and Disable Times for Low Voltage Logic

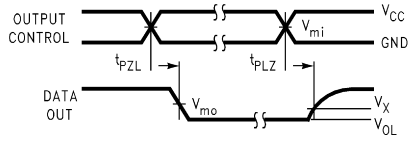

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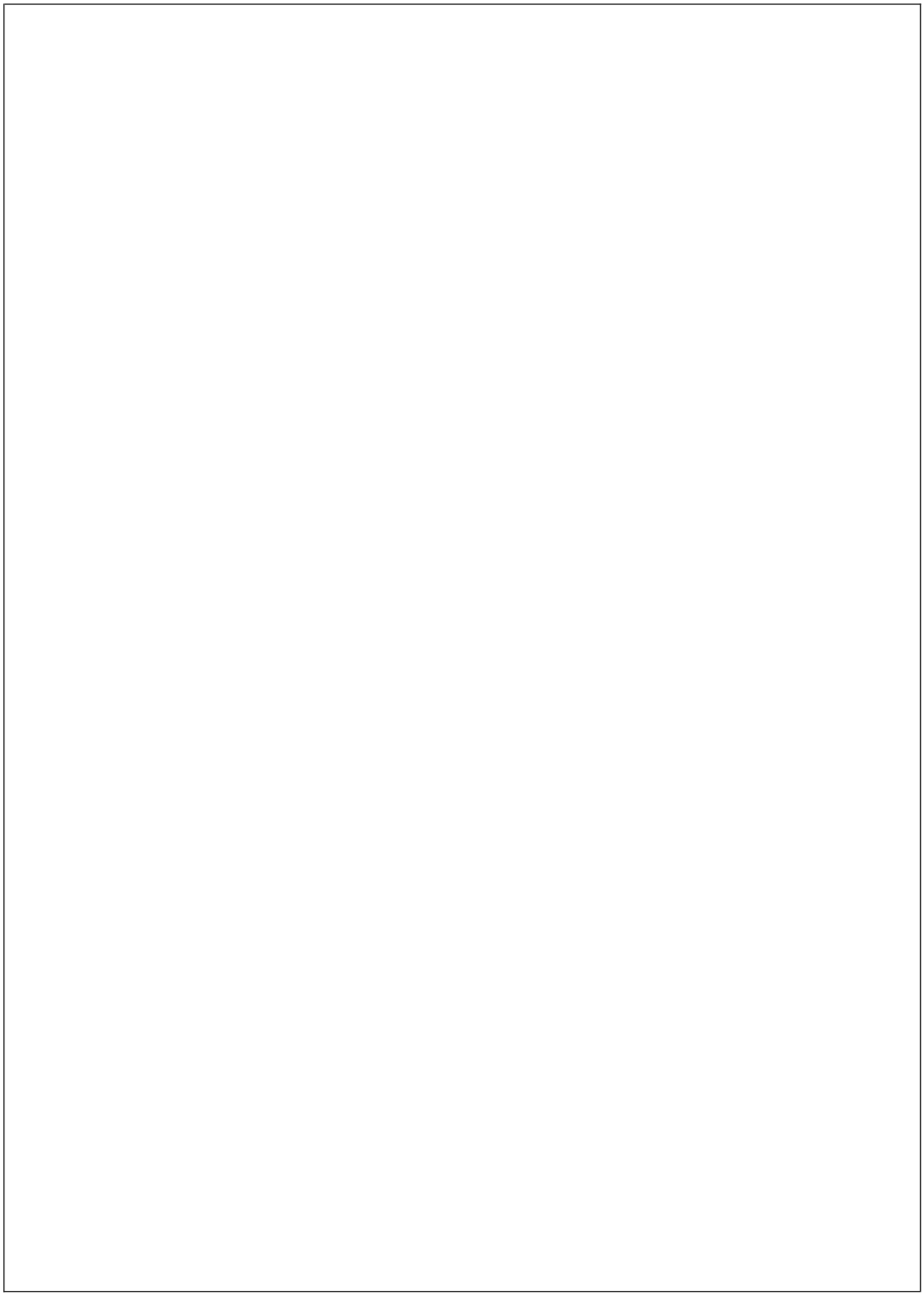
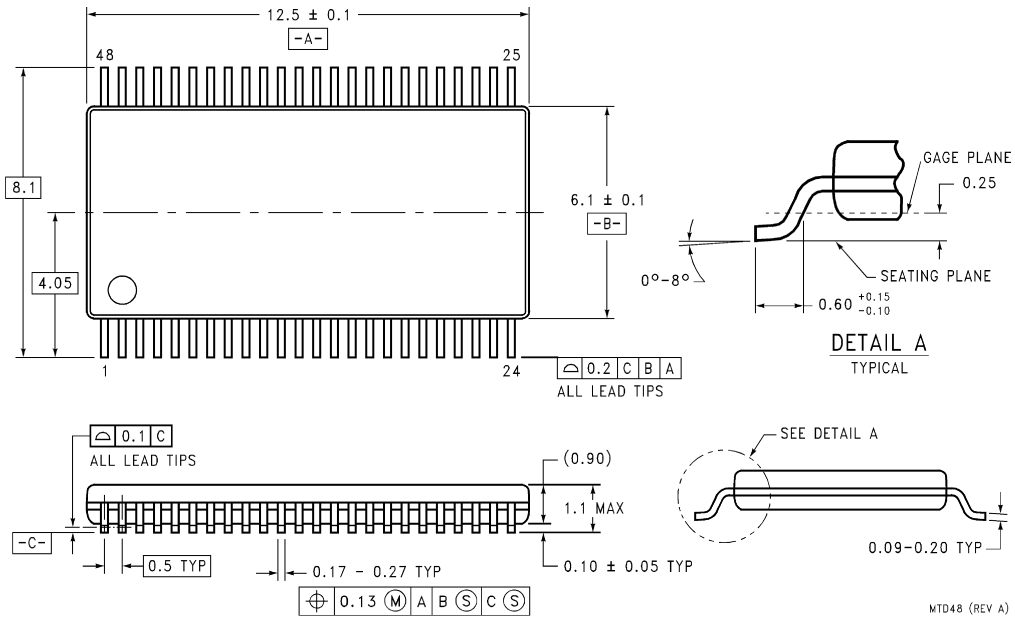
FIGURE 4. 3-STATE Output Low Enable and Disable Times for Low Voltage Logic

Symbol	V_{CC}		
	3.3V ± 0.3V	**2.5V ± 0.2V**	**1.8V**
V_{mi}	1.5V	V_{CC}/2	V_{CC}/2
V_{mo}	1.5V	V_{CC}/2	V_{CC}/2
V_X	V_{OL} +0.3V	V_{OL} +0.15V	V_{OL} +0.15V
V_Y	V_{OH} −0.3V	V_{OH} −0.15V	V_{OH} −0.15V



Physical Dimensions inches (millimeters) unless otherwise noted



48-Lead Thin Shrink Small Outline Package, JEDEC, 6.1 mm Body Width
Order Number 74VCX16244MTD or 74VCX16244MTDX
Package Number MTD48

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