



3.3V CMOS 16-BIT BUFFER/DRIVER WITH 3-STATE OUTPUTS, 5 VOLT TOLERANT I/O AND BUS-HOLD

IDT74LVCH16241A

FEATURES:

- Typical $t_{sk(0)}$ (Output Skew) < 250ps
- ESD > 2000V per MIL-STD-883, Method 3015;
> 200V using machine model (C = 200pF, R = 0)
- 0.635mm pitch SSOP, 0.50mm pitch TSSOP
and 0.40mm pitch TVSOP packages
- Extended commercial range of -40°C to +85°C
- $V_{CC} = 3.3V \pm 0.3V$, Normal Range
- $V_{CC} = 2.7V$ to 3.6V, Extended Range
- CMOS power levels (0.4μW typ. static)
- All inputs, outputs and I/O are 5 Volt tolerant
- Supports hot insertion

Drive Features for LVCH16241A

- High Output Drivers: $\pm 24mA$
- Reduced system switching noise

APPLICATIONS:

- 5V and 3.3V mixed voltage systems
- Data communication and telecommunication systems

DESCRIPTION:

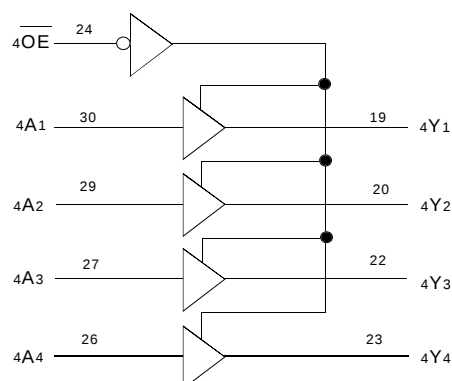
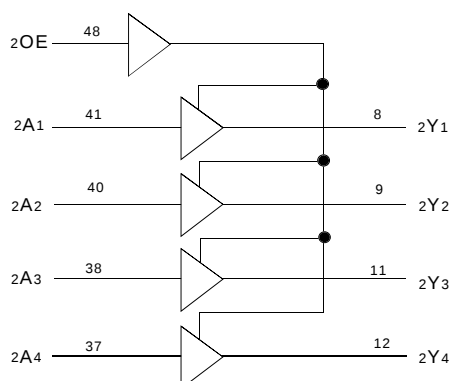
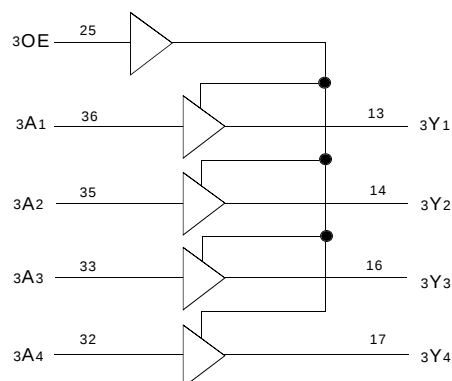
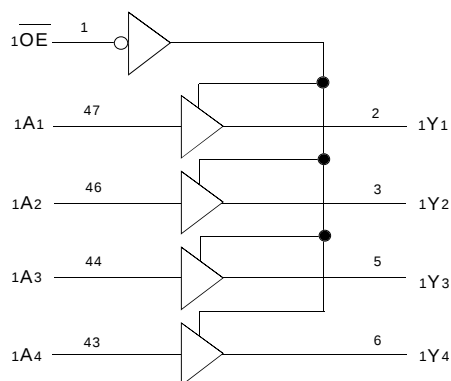
This 16-bit buffer/driver is built using advanced dual metal CMOS technology. This high-speed, low power device is designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. This device can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer, and provides true outputs and complementary output-enable (OE and $\overline{OE}$) inputs.

All pins of this 16-bit buffer/driver can be driven from either 3.3V or 5V devices. This feature allows the use of the device as a translator in a mixed 3.3V/5V supply system.

The LVCH16241A has "bus-hold" which retains the inputs' last state whenever the input goes to a high impedance. This prevents floating inputs and eliminates the need for pull-up/down resistors.

The LVCH16241A has been designed with a $\pm 24mA$ output driver. The driver is capable of driving a moderate to heavy load while maintaining speed performance.

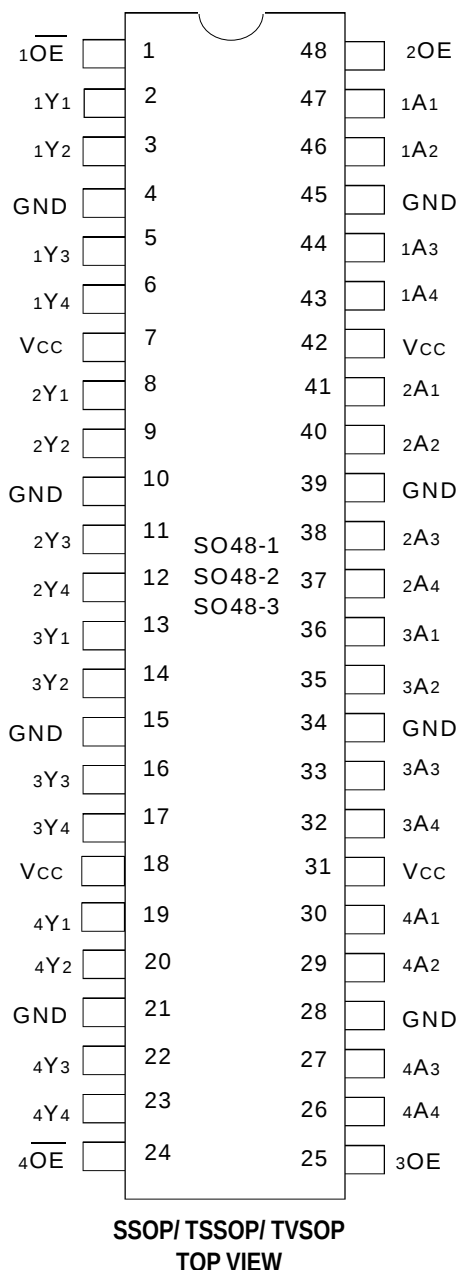
Functional Block Diagram



EXTENDED COMMERCIAL TEMPERATURE RANGE

MARCH 1999

PIN CONFIGURATION



PIN DESCRIPTION

Pin Names	Description
$\overline{xOE}$	3-State Output Enable Inputs (Active LOW)
xOE	3-State Output Enable Inputs
xAx	Data Inputs ⁽¹⁾
XYx	3-State Outputs

ABSOLUTE MAXIMUM RATINGS (1)

Symbol	Description	Max.	Unit
VTERM ⁽²⁾	Terminal Voltage with Respect to GND	– 0.5 to +6.5	V
VTERM ⁽³⁾	Terminal Voltage with Respect to GND	– 0.5 to +6.5	V
TSTG	Storage Temperature	– 65 to +150	°C
IOUT	DC Output Current	– 50 to +50	mA
IIK IOK	Continuous Clamp Current, $V_i < 0$ or $V_o < 0$	– 50	mA
ICC Iss	Continuous Current through each Vcc or GND	±100	mA

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NOTES:

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
- Vcc terminals.
- All terminals except Vcc.

CAPACITANCE ($T_A = +25^\circ\text{C}$, $f = 1.0\text{MHz}$)

Symbol	Parameter ⁽¹⁾	Conditions	Typ.	Max.	Unit
CIN	Input Capacitance	$V_{IN} = 0V$	4.5	6	pF
COUT	Output Capacitance	$V_{OUT} = 0V$	6.5	8	pF
C _{I/O}	I/O Port Capacitance	$V_{IN} = 0V$	6.5	8	pF

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NOTE:

- As applicable to the device type.

FUNCTION TABLES (1)

Inputs		Outputs
$\overline{1OE}$, $\overline{4OE}$	1Ax, 4Ax	1Yx, 4Yx
L	H	H
L	L	L
H	X	Z

Inputs		Outputs
2OE, 3OE	2Ax, 3Ax	2Yx, 3Yx
H	H	H
H	L	L
L	X	Z

NOTES:

- H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
Z = High-Impedance

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Operating Condition: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$

Symbol	Parameter	Test Conditions		Min.	Typ. ⁽¹⁾	Max.	Unit
V_{IH}	Input HIGH Voltage Level	$V_{CC} = 2.3\text{V}$ to 2.7V		1.7	—	—	V
		$V_{CC} = 2.7\text{V}$ to 3.6V		2	—	—	
V_{IL}	Input LOW Voltage Level	$V_{CC} = 2.3\text{V}$ to 2.7V		—	—	0.7	V
		$V_{CC} = 2.7\text{V}$ to 3.6V		—	—	0.8	
I_{IH} I_{IL}	Input Leakage Current	$V_{CC} = 3.6\text{V}$	$V_I = 0$ to 5.5V	—	—	± 5	μA
I_{OZH} I_{OZL}	High Impedance Output Current (3-State Output pins)	$V_{CC} = 3.6\text{V}$	$V_O = 0$ to 5.5V	—	—	± 10	μA
I_{OFF}	Input/Output Power Off Leakage	$V_{CC} = 0\text{V}$, V_{IN} or $V_O \leq 5.5\text{V}$		—	—	± 50	μA
V_{IK}	Clamp Diode Voltage	$V_{CC} = 2.3\text{V}$, $I_{IN} = -18\text{mA}$		—	-0.7	-1.2	V
V_H	Input Hysteresis	$V_{CC} = 3.3\text{V}$		—	100	—	mV
I_{CCL} I_{CCH} I_{CCZ}	Quiescent Power Supply Current	$V_{CC} = 3.6\text{V}$	$V_{IN} = \text{GND}$ or V_{CC}	—	—	10	μA
			$3.6 \leq V_{IN} \leq 5.5\text{V}^{(2)}$	—	—	10	
ΔI_{CC}	Quiescent Power Supply Current Variation	One input at $V_{CC} - 0.6\text{V}$ other inputs at V_{CC} or GND		—	—	500	μA

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NOTES:

1. Typical values are at $V_{CC} = 3.3\text{V}$, $+25^{\circ}\text{C}$ ambient.
2. This applies in the disabled state only.

BUS-HOLD CHARACTERISTICS

Symbol	Parameter ⁽¹⁾	Test Conditions		Min.	Typ. ⁽²⁾	Max.	Unit
I_{BHH} I_{BHL}	Bus-Hold Input Sustain Current	$V_{CC} = 3.0\text{V}$	$V_I = 2.0\text{V}$	-75	—	—	μA
			$V_I = 0.8\text{V}$	75	—	—	
I_{BHH} I_{BHL}	Bus-Hold Input Sustain Current	$V_{CC} = 2.3\text{V}$	$V_I = 1.7\text{V}$	—	—	—	μA
			$V_I = 0.7\text{V}$	—	—	—	
I_{BHHO} I_{BHLO}	Bus-Hold Input Overdrive Current	$V_{CC} = 3.6\text{V}$	$V_I = 0$ to 3.6V	—	—	± 500	μA

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NOTES:

1. Pins with Bus-hold are identified in the pin description.
2. Typical values are at $V_{CC} = 3.3\text{V}$, $+25^{\circ}\text{C}$ ambient.

OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions ⁽⁴⁾		Min.	Max.	Unit
VOH	Output HIGH Voltage	VCC = 2.3V to 3.6V	IOH = – 0.1mA	VCC – 0.2	—	V
		VCC = 2.3V	IOH = – 6mA	2	—	
		VCC = 2.3V	IOH = – 12mA	1.7	—	
		VCC = 2.7V		2.2	—	
		VCC = 3.0V		2.4	—	
		VCC = 3.0V	IOH = – 24mA	2.2	—	
VOL	Output LOW Voltage	VCC = 2.3V to 3.6V	IOL = 0.1mA	—	0.2	V
		VCC = 2.3V	IOL = 6mA	—	0.4	
			IOL = 12mA	—	0.7	
		VCC = 2.7V	IOL = 12mA	—	0.4	
		VCC = 3.0V	IOL = 24mA	—	0.55	

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NOTE:

1. VIH and VIL must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate VCC range. TA = – 40°C to +85°C.

OPERATING CHARACTERISTICS, VCC = 3.3V ± 0.3V, TA = 25°C

Symbol	Parameter	Test Conditions	Typical	Unit
CPD	Power Dissipation Capacitance per buffer/driver Outputs enabled	CL = 0pF, f = 10Mhz		pF
CPD	Power Dissipation Capacitance per buffer/driver Outputs disabled			pF

SWITCHING CHARACTERISTICS (1)

Symbol	Parameter	VCC = 2.7V		VCC = 3.3V±0.3V		Unit
		Min.	Max.	Min.	Max.	
tPLH tPHL	Propagation Delay xAX to xYx	1.5	6	1.5	5	ns
tPZH tPZL	Output Enable Time 1OE to 1Yx, 4OE to 4Yx	1.5	7.1	1.5	6.1	ns
tPHZ tPLZ	Output Disable Time 1OE to 1Yx, 4OE to 4Yx	1.5	6.8	1.5	5.8	ns
tPZH tPZL	Output Enable Time 2OE to 2Yx, 3OE to 3Yx	1.5	7.5	1.5	6.5	ns
tPHZ tPLZ	Output Disable Time 2OE to 2Yx, 3OE to 3Yx	1.5	7.3	1.5	6.3	ns
tSK(0)	Output Skew ⁽²⁾	—			500	ps

NOTES:

1. See test circuits and waveforms. TA = – 40°C to + 85°C.
2. Skew between any two outputs of the same package and switching in the same direction.

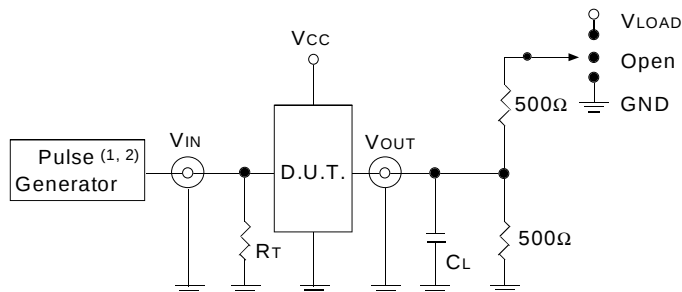
TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

Symbol	V _{CC} (1)= 3.3V ±0.3V	V _{CC} (1)= 2.7V	V _{CC} (2)= 2.5V ±0.2V	Unit
V _{LOAD}	6	6	2 x V _{CC}	V
V _{IH}	2.7	2.7	V _{CC}	V
V _T	1.5	1.5	V _{CC} / 2	V
V _{LZ}	300	300	150	mV
V _{HZ}	300	300	150	mV
C _L	50	50	30	pF

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TEST CIRCUITS FOR ALL OUTPUTS



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DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.

R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

NOTE:

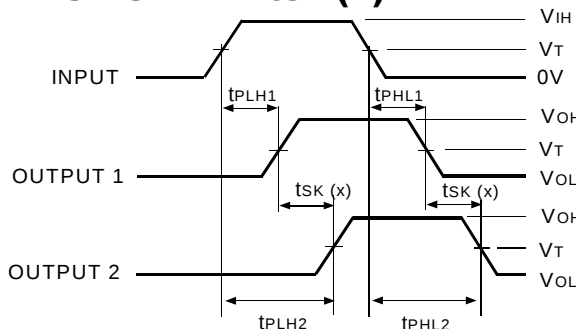
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_r ≤ 2.5ns; t_r ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_r ≤ 2ns; t_r ≤ 2ns.

SWITCH POSITION

Test	Switch
Open Drain Disable Low Enable Low	V _{LOAD}
Disable High Enable High	GND
All Other tests	Open

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OUTPUT SKEW - t_{SK}(x)



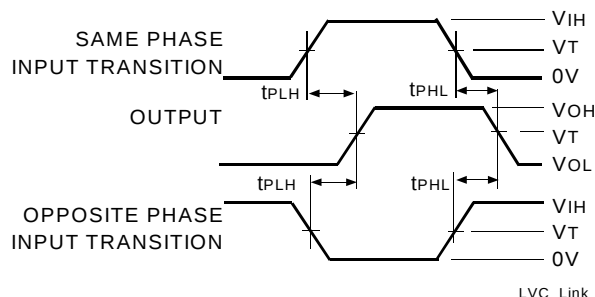
$$t_{SK}(x) = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

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NOTES:

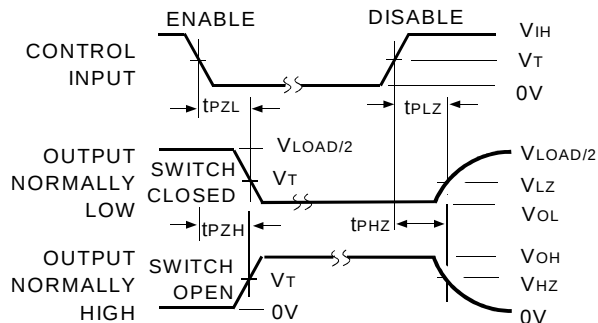
1. For t_{SK}(o) OUTPUT1 and OUTPUT2 are any two outputs.
2. For t_{SK}(b) OUTPUT1 and OUTPUT2 are in the same bank.

PROPAGATION DELAY



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ENABLE AND DISABLE TIMES

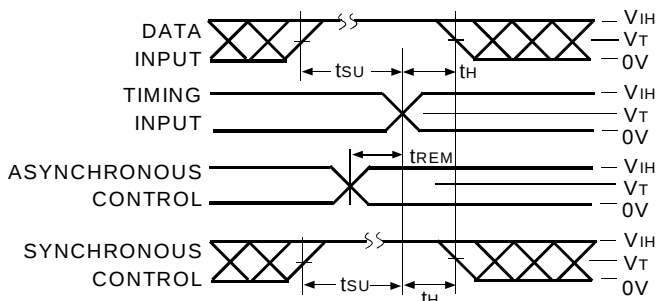


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NOTE:

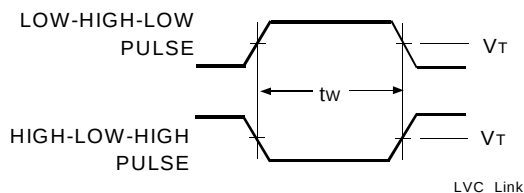
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

SET-UP, HOLD, AND RELEASE TIMES



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PULSE WIDTH



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ORDERING INFORMATION

IDT	XX	LVC	X	XX	XXXX	XX	
	Temp. Range		Bus-Hold	Family	Device Type	Package	
						PV	Shrink Small Outline Package (SO48-1)
						PA	Thin Shrink Small Outline Package (SO48-2)
						PF	Thin Very Small Outline Package (SO48-3)
					241A		16-Bit Buffer/Driver
				16			Double-Density with Resistors, $\pm 24\text{mA}$
			H				Bus-hold
						74	-40°C to +85°C



CORPORATE HEADQUARTERS
 2975 Stender Way
 Santa Clara, CA 95054

for SALES:
 800-345-7015 or 408-727-6116
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