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

IDT74LVCH162244A

FEATURES:

- Typical $t_{SK(o)}$ (Output Skew) < 250ps
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- V_{CC} = 3.3V ± 0.3V, Normal Range
- V_{CC} = 2.7V to 3.6V, Extended Range
- CMOS power levels (0.4µ W typ. static)
- All inputs, outputs, and I/O are 5V tolerant
- Available in TSSOP package

DRIVE FEATURES:

- Balanced Output Drivers: ±12mA
- Full internal series termination

APPLICATIONS:

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

DESCRIPTION:

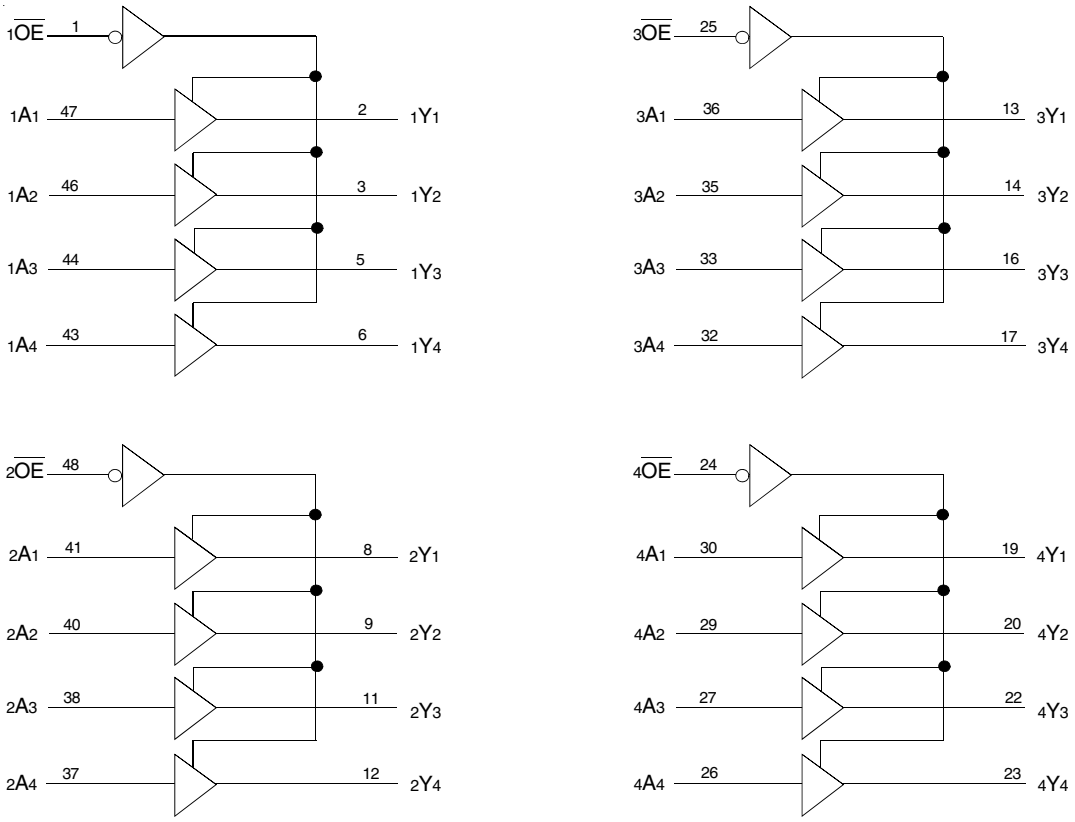
The LVCH162244A 16-bit buffer/driver is built using advanced dual metal CMOS technology. The LVCH162244A is designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The device can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. This device provides true outputs and symmetrical active-low output-enable ($\overline{OE}$) 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 this device as a translator in a mixed 3.3V/5V supply system.

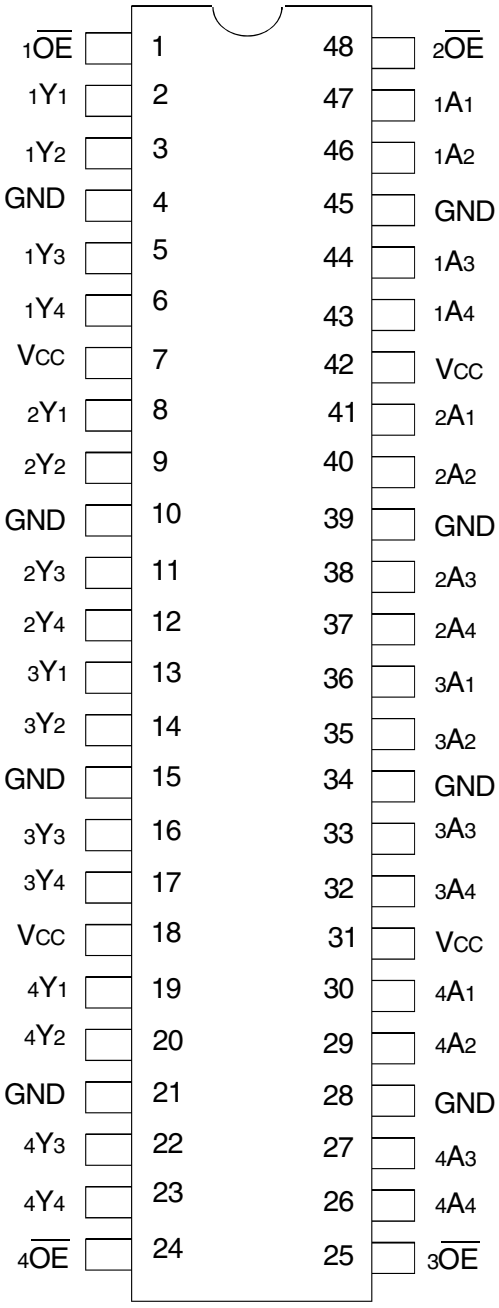
The LVCH162244A has series resistors in the device output structure which will significantly reduce line noise when used with light loads. This driver has been developed to drive ±12mA at the designated threshold levels.

The LVCH162244A 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.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



TSSOP
TOP VIEW

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Description	Max	Unit
VTERM	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, VI < 0 or VO < 0	–50	mA
ICC ISS	Continuous Current through each VCC or GND	±100	mA

NOTE:
1. 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.

CAPACITANCE (TA = +25°C, F = 1.0MHz)

Symbol	Parameter(1)	Conditions	Typ.	Max.	Unit
CIN	Input Capacitance	VIN = 0V	4.5	6	pF
COUT	Output Capacitance	VOUT = 0V	6.5	8	pF
CI/O	I/O Port Capacitance	VIN = 0V	6.5	8	pF

NOTE:
1. As applicable to the device type.

PIN DESCRIPTION

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

NOTE:
1. These pins have "Bus-Hold". All other pins are standard inputs, outputs, or I/Os.

FUNCTION TABLE (EACH 4-BIT BUFFER)(1)

Inputs		Outputs
x$\overline{OE}$	xAx	xYx
L	L	L
L	H	H
H	X	Z

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

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Operating Condition: T_A = –40°C to +85°C

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

NOTES:
1. Typical values are at V_{CC} = 3.3V, +25°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}	Bus-Hold Input Sustain Current	V_{CC} = 3V	V_I = 2V	–75	—	—	µA
I_{BHL}			V_I = 0.8V	75	—	—	
I_{BHH}	Bus-Hold Input Sustain Current	V_{CC} = 2.3V	V_I = 1.7V	—	—	—	µA
I_{BHL}			V_I = 0.7V	—	—	—	
I_{BHHO}	Bus-Hold Input Overdrive Current	V_{CC} = 3.6V	V_I = 0 to 3.6V	—	—	±500	µA
I_{BHLO}							

NOTES:
1. Pins with Bus-Hold are identified in the pin description.
2. Typical values are at V_{CC} = 3.3V, +25°C ambient.

OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]		Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC} = 2.3V to 3.6V	I_{OH} = – 0.1mA	V_{CC} – 0.2	—	V
		V_{CC} = 2.3V	I_{OH} = – 4mA	1.9	—	
			I_{OH} = – 6mA	1.7	—	
		V_{CC} = 2.7V	I_{OH} = – 4mA	2.2	—	
			I_{OH} = – 8mA	2	—	
		V_{CC} = 3V	I_{OH} = – 6mA	2.4	—	
			I_{OH} = – 12mA	2	—	
V_{OL}	Output LOW Voltage	V_{CC} = 2.3V to 3.6V	I_{OL} = 0.1mA	—	0.2	V
		V_{CC} = 2.3V	I_{OL} = 4mA	—	0.4	
			I_{OL} = 6mA	—	0.55	
		V_{CC} = 2.7V	I_{OL} = 4mA	—	0.4	
			I_{OL} = 8mA	—	0.6	
		V_{CC} = 3V	I_{OL} = 6mA	—	0.55	
			I_{OL} = 12mA	—	0.8	

NOTE:
1. V_{IH} and V_{IL} must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate V_{CC} range. T_A = – 40°C to + 85°C.

OPERATING CHARACTERISTICS, T_A = 25°C

Symbol	Parameter	Test Conditions	Typical	Unit
C_{PD}	Power Dissipation Capacitance per Buffer/Driver Outputs enabled	C_L = 0pF, f = 10Mhz	35	pF
C_{PD}	Power Dissipation Capacitance per Buffer/Driver Outputs disabled		4	

SWITCHING CHARACTERISTICS[1]

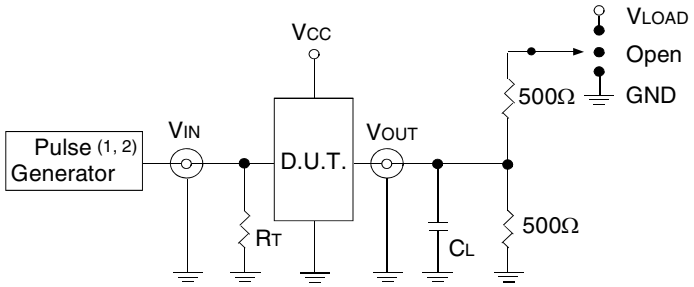
		V_{CC} = 2.7V		V_{CC} = 3.3V ± 0.3V		
Symbol	Parameter	Min.	Max.	Min.	Max.	Unit
t_{PLH} t_{PHL}	Propagation Delay xAx to xYx	—	5.6	1.1	4.4	ns
t_{PZH} t_{PZL}	Output Enable Time x$\overline{OE}$ to xYx	—	6.9	1	5.5	ns
t_{PHZ} t_{PLZ}	Output Disable Time x$\overline{OE}$ to xYx	—	6.8	1.8	6.3	ns
$t_{SK(o)}$	Output Skew[2]	—	—	—	500	ps

NOTES:
1. See TEST CIRCUITS AND WAVEFORMS. T_A = – 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 Vcc	V
V_{IH}	2.7	2.7	Vcc	V
V_T	1.5	1.5	Vcc / 2	V
V_{LZ}	300	300	150	mV
V_{HZ}	300	300	150	mV
C_L	50	50	30	pF



Test Circuit for All Outputs

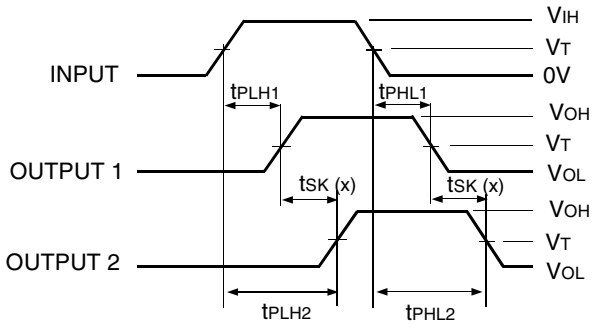
LVC Link

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

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

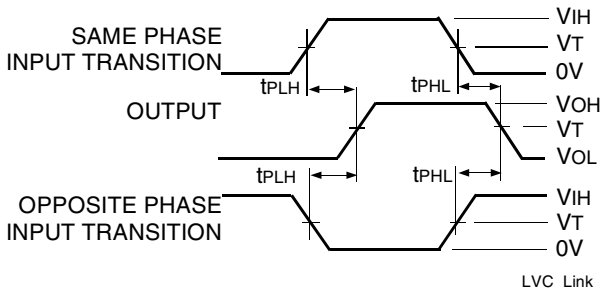


$t_{SK(x)} = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$

LVC Link

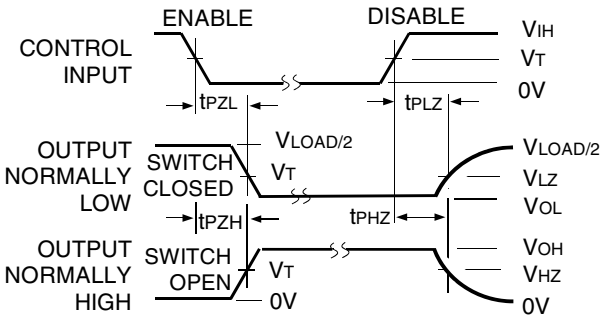
Output Skew - $t_{SK(x)}$

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.



LVC Link

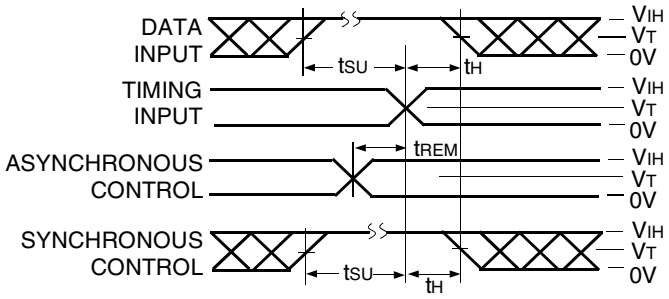
Propagation Delay



LVC Link

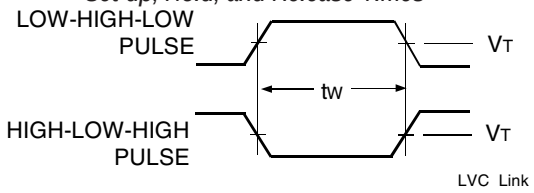
Enable and Disable Times

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



LVC Link

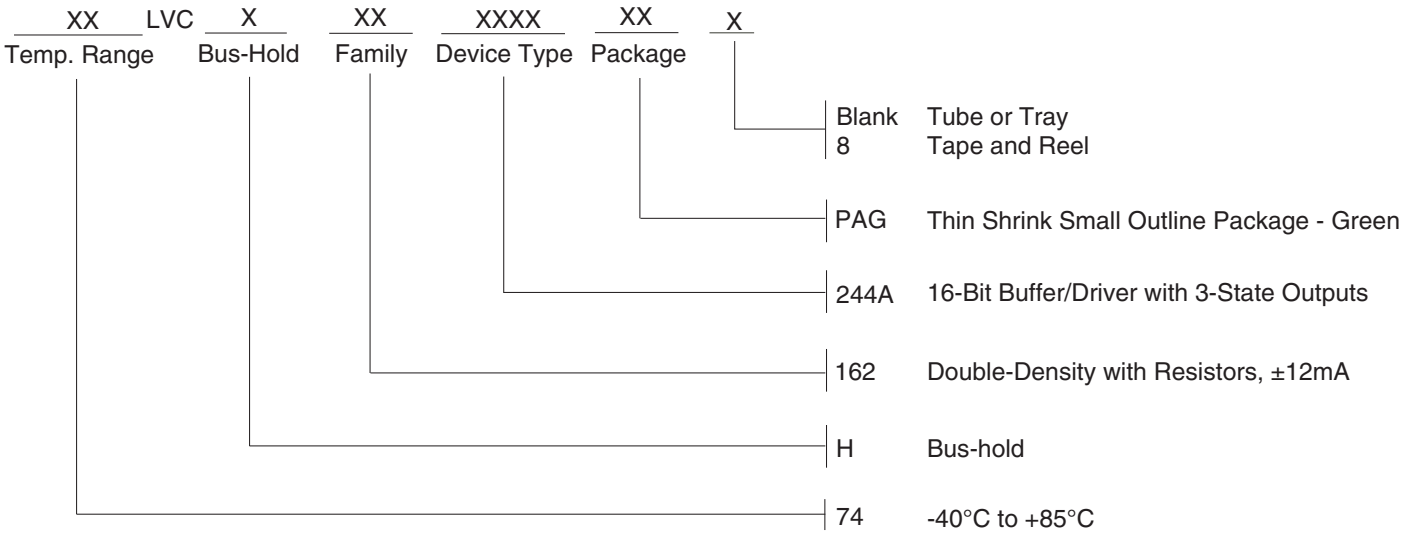
Set-up, Hold, and Release Times



LVC Link

Pulse Width

ORDERING INFORMATION



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