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

IDT74LVCH2541A

FEATURES:

- 0.5 MICRON CMOS Technology
- 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)
- Rail-to-rail output swing for increased noise margin
- All inputs, outputs, and I/O are 5V tolerant
- Supports hot insertion
- Available in SOIC, SSOP, QSOP, and TSSOP packages

DRIVE FEATURES:

- Balanced Output Drivers: ±12mA
- Low switching noise

APPLICATIONS:

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

DESCRIPTION:

The LVCH2541A octal buffer/driver is built using advanced dual metal CMOS technology. This device is ideal for driving bus lines or buffering memory address registers. This device features inputs and outputs on opposite sides of the package to facilitate printed circuit board layout.

The 3-state control gate is a 2-input AND gate with active-low inputs so that if either output enable ($\overline{OE1}$ or $\overline{OE2}$) input is high, all eight outputs are in the high-impedance state.
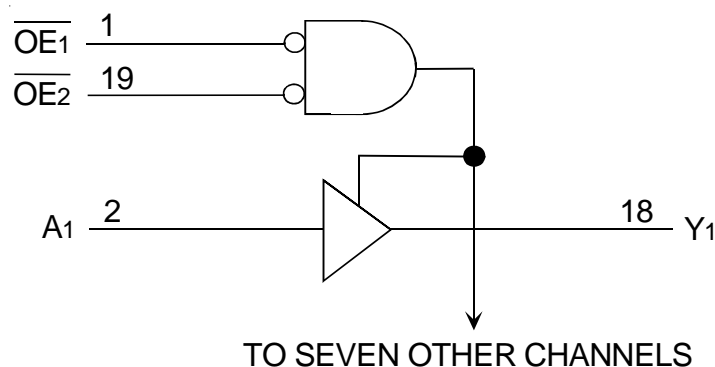
The LVCH2541A has series resistors in the device output structure which will significantly reduce line noise when used with light loads. This driver has been developed to drive ±12mA at the designated thresholds.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.
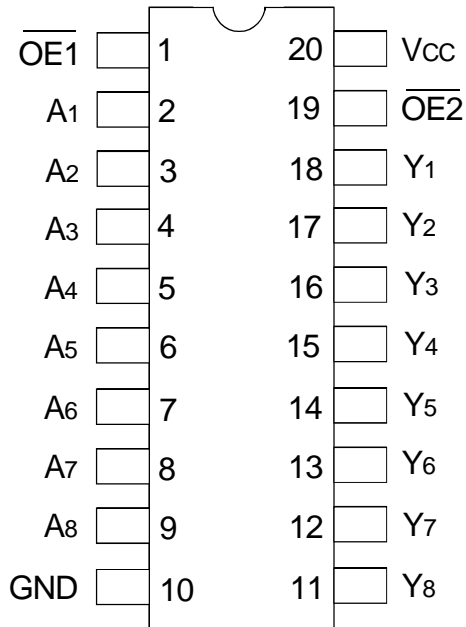
Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of this device as a translator in a mixed 3.3V/5V system environment.

The LVCH2541A 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

TO SEVEN OTHER CHANNELS

INDUSTRIAL TEMPERATURE RANGE

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DSC-4939/1

PIN CONFIGURATION

$\overline{OE1}$	1	20	V_{CC}
A_1	2	19	$\overline{OE2}$
A_2	3	18	Y_1
A_3	4	17	Y_2
A_4	5	16	Y_3
A_5	6	15	Y_4
A_6	7	14	Y_5
A_7	8	13	Y_6
A_8	9	12	Y_7
GND	10	11	Y_8

**SOIC/ SSOP/ QSOP/ TSSOP
TOP VIEW**

ABSOLUTE MAXIMUM RATINGS[1]

Symbol	Description	Max	Unit
V_{TERM}	Terminal Voltage with Respect to GND	–0.5 to +6.5	V
T_{STG}	Storage Temperature	–65 to +150	°C
I_{OUT}	DC Output Current	–50 to +50	mA
I_{IK} I_{OK}	Continuous Clamp Current, $V_I < 0$ or $V_O < 0$	–50	mA
I_{CC} I_{SS}	Continuous Current through each V_{CC} 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 (T_A = +25°C, F = 1.0MHz)

Symbol	Parameter[1]	Conditions	Typ.	Max.	Unit
C_{IN}	Input Capacitance	$V_{IN} = 0V$	4.5	6	pF
C_{OUT}	Output Capacitance	$V_{OUT} = 0V$	5.5	8	pF
$C_{I/O}$	I/O Port Capacitance	$V_{IN} = 0V$	6.5	8	pF

NOTE:
1. As applicable to the device type.

PIN DESCRIPTION

Pin Names	Description
$\overline{OE}_1$, $\overline{OE}_2$	Output Enable Inputs (Active LOW)
A x	Data Inputs[1]
Y x	Data Outputs

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

FUNCTION TABLE[1]

Inputs			Outputs
$\overline{OE}_1$	$\overline{OE}_2$	Ax	Yx
L	L	L	L
L	L	H	H
H	X	X	Z
X	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} I_{CCZ}	Quiescent Power Supply Current	V_{CC} = 3.6V	V_{IN} = GND or V_{CC}	—	—	10	µA
			$3.6 \leq V_{IN} \leq 5.5V$[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} I_{BHLO}	Bus-Hold Input Overdrive Current	V_{CC} = 3.6V	V_I = 0 to 3.6V	—	—	±500	µA

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, V_{CC} = 3.3V ± 0.3V, T_A = 25°C

Symbol	Parameter	Test Conditions	Typical	Unit
C_{PD}	Power Dissipation Capacitance per Transceiver Outputs enabled	C_L = 0pF, f = 10Mhz	33	pF
C_{PD}	Power Dissipation Capacitance per Transceiver Outputs disabled		2	

SWITCHING CHARACTERISTICS[1]

Symbol	Parameter	V_{CC} = 2.7V		V_{CC} = 3.3V ± 0.3V		Unit
		Min.	Max.	Min.	Max.	
t_{PLH}	Propagation Delay	1.5	7.3	1.5	6.3	ns
t_{PHL}	Ax to Yx					
t_{PZH}	Output Enable Time	1.5	9.3	1.5	8.3	ns
t_{PZL}	$\overline{OE}$x to Yx					
t_{PHZ}	Output Disable Time	1.5	8.3	1.5	7.3	ns
t_{PLZ}	$\overline{OE}$x to Yx					
$t_{SK(o)}$	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 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
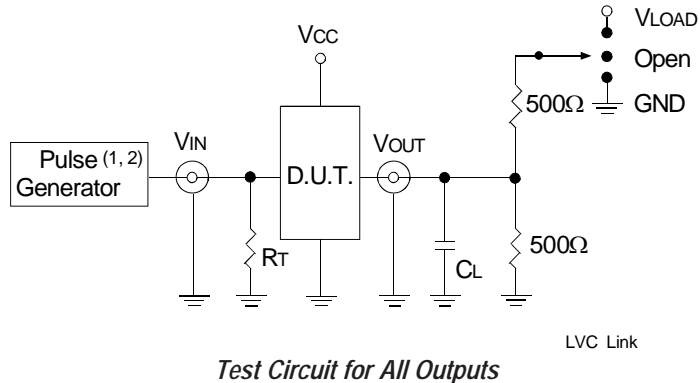
Test Circuit for All Outputs

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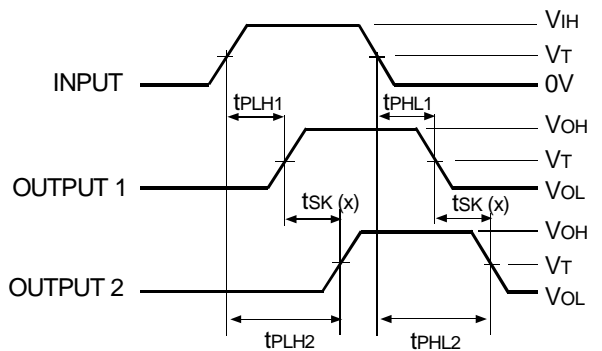
$t_{SK}(x) = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$
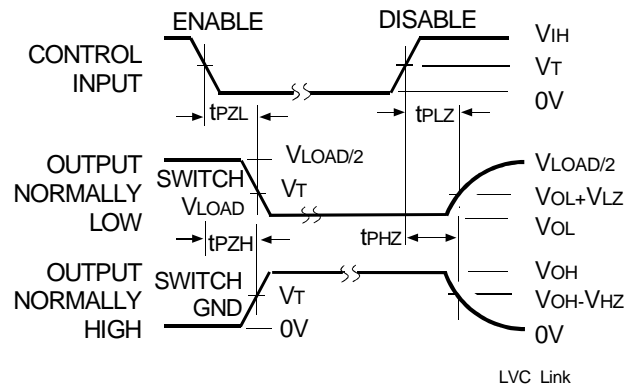
Output Skew - $t_{SK}(x)$ LVC Link

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.
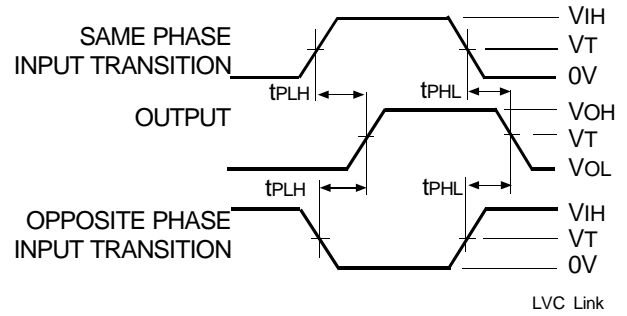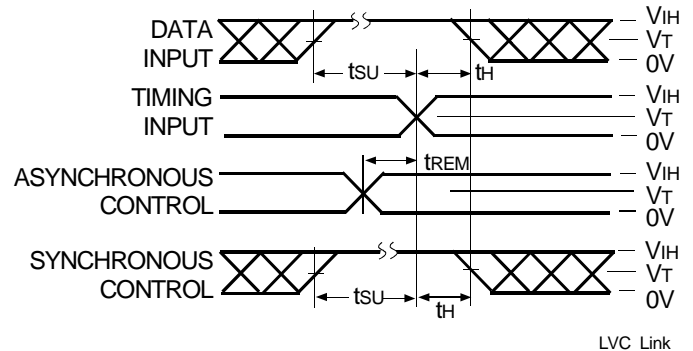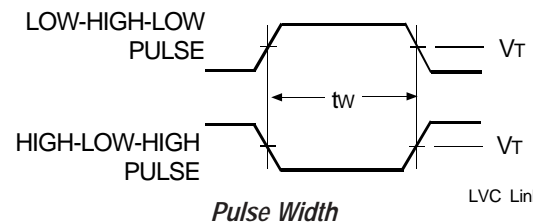
Propagation Delay

Enable and Disable Times

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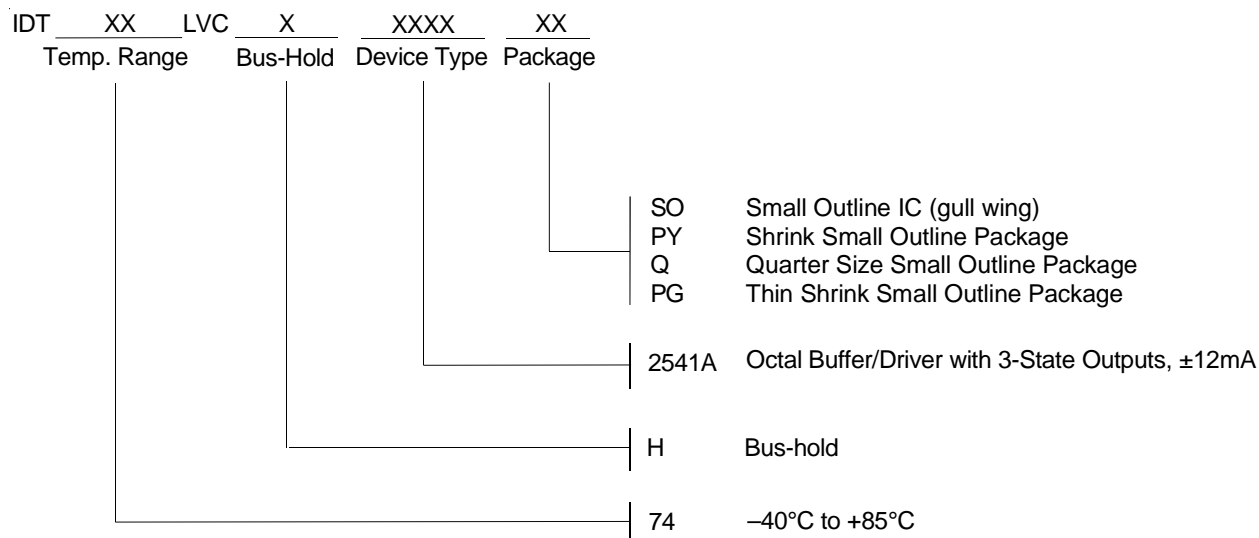1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

Set-up, Hold, and Release Times

Pulse Width

ORDERING INFORMATION

IDT ___XX___ LVC ___X___ __XXXX__ __XX__
    Temp. Range   Bus-Hold Device Type Package

SO	Small Outline IC (gull wing)
PY	Shrink Small Outline Package
Q	Quarter Size Small Outline Package
PG	Thin Shrink Small Outline Package

2541A	Octal Buffer/Driver with 3-State Outputs, ±12mA

H	Bus-hold

74	−40°C to +85°C