



3.3V CMOS 20-BIT BUFFER WITH 5 VOLT TOLERANT I/O AND BUS-HOLD

IDT74LVCH16827A

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 LVCH16827A:

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

APPLICATIONS:

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

DESCRIPTION

This 20-bit buffer is built using advanced dual metal CMOS technology. The 20-bit bus driver provides high-performance bus interface buffering for wide data/address paths or busses carrying parity. Two pair of NAND-ed output enable controls offer maximum control flexibility and are organized to operate the device as two 10-bit buffers or one 20-bit buffer. Flow-through organization of signal pins simplifies layout. All inputs are designed with hysteresis for improved noise margin.

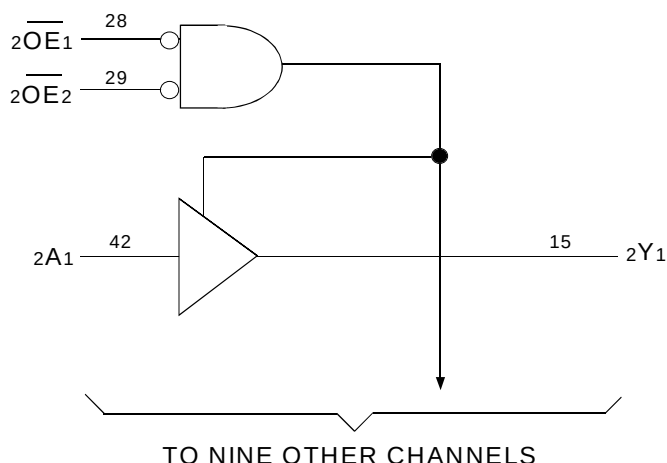
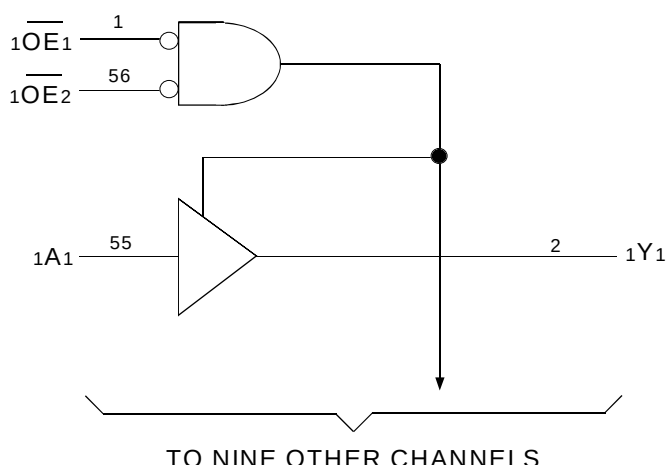
The LVCH16827A buffer is ideally suited for driving high capacitance loads and low impedance backplanes. The output buffers are designed with power off disable capability to allow "live insertion" of boards when used as backplane drivers.

All pins 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.

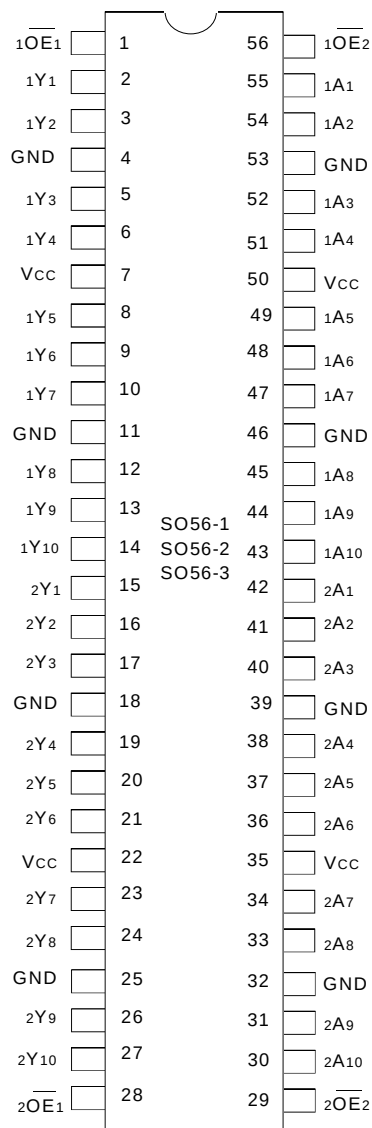
The LVCH16827A has been designed with a $\pm 24mA$ output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.

The LVCH16827A 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



SSOP/ TSSOP/ TVSOP
TOP VIEW

PIN DESCRIPTION

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

NOTE:

- These pins have "Bus-hold". All other pins are standard inputs, outputs, or I/Os.

ABSOLUTE MAXIMUM RATINGS (1)

Symbol	Description	Max.	Unit
$V_{TERM}^{(2)}$	Terminal Voltage with Respect to GND	- 0.5 to +6.5	V
$V_{TERM}^{(3)}$	Terminal Voltage with Respect to GND	- 0.5 to +6.5	V
TSTG	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

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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.
- V_{CC} terminals.
- All terminals except V_{CC} .

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

Symbol	Parameter ⁽¹⁾	Conditions	Typ.	Max.	Unit
C_{IN}	Input Capacitance	$V_{IN} = 0V$	4.5	6	pF
C_{OUT}	Output Capacitance	$V_{OUT} = 0V$	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 TABLE (1)

Inputs			Outputs
$\overline{xOE}1$	$\overline{xOE}2$	xAx	xYx
L	L	L	L
L	L	H	H
H	X	X	Z
X	H	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 ⁽¹⁾		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	5	1.5	4.4	ns
tPZH tPZL	Output Enable Time xOE _x to xYx	1.5	8	1.5	7	ns
tPHZ tPLZ	Output Disable Time xOE _x to xYx	1.5	6	1.5	5.7	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.

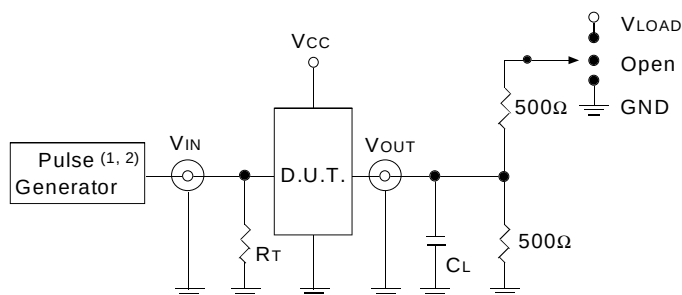
TEST CIRCUITS AND WAVEFORMS

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:

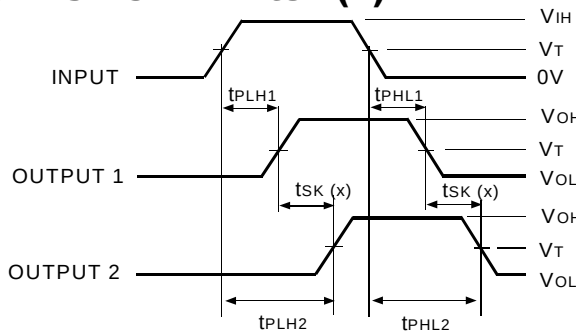
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_r ≤ 2.5ns; t_r ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_r ≤ 2ns; t_r ≤ 2ns.

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)



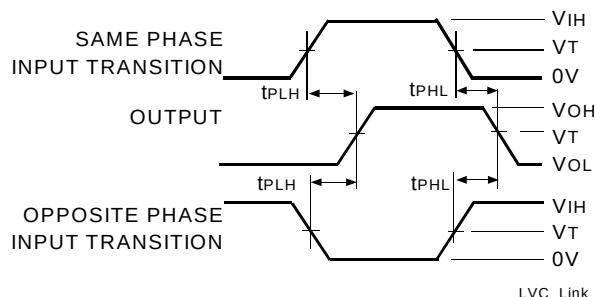
$$t_{SK}(x) = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

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NOTES:

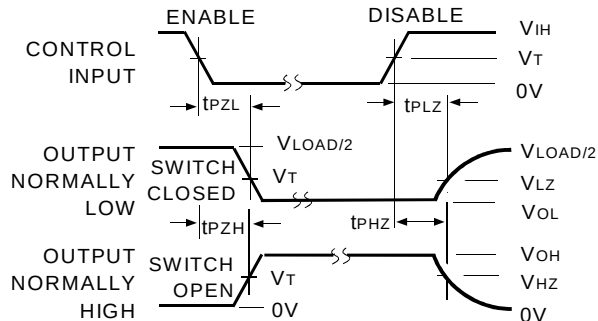
1. For t_{SK}(o) OUTPUT1 and OUTPUT2 are any two outputs.
2. For t_{SK}(b) OUTPUT1 and OUTPUT2 are in the same bank.

PROPAGATION DELAY



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ENABLE AND DISABLE TIMES

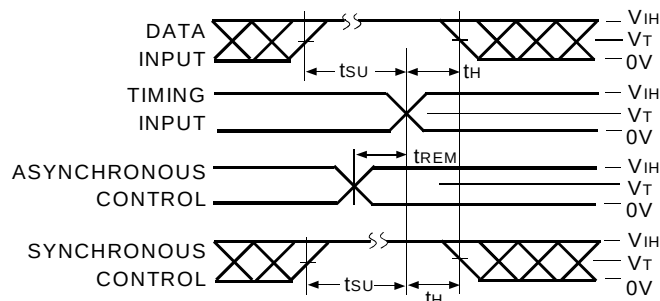


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NOTE:

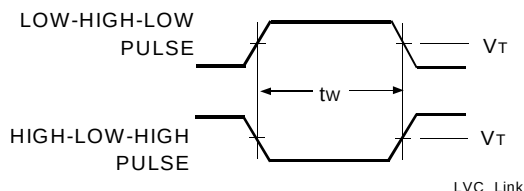
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

SET-UP, HOLD, AND RELEASE TIMES



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PULSE WIDTH



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IDT XX LVC X XX XXXX XX
Temp. Range Bus-Hold Family Device Type Package

	PV	Shrink Small Outline Package (SO56-1)
	PA	Thin Shrink Small Outline Package (SO56-2)
	PF	Thin Very Small Outline Package (SO56-3)
	827A	20-Bit Buffer with 5 Volt Tolerant I/O
	16	Double-Density with Resistors, $\pm 24\text{mA}$
	H	Bus-hold
	74	-40°C to $+85^{\circ}\text{C}$



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