3.3V CMOS HEX INVERTER WITH 5 VOLT TOLERANT I/O

IDT74LVCU04A

FEATURES:

- 0.5 MICRON CMOS Technology
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- 1.27mm pitch SOIC, 0.65mm pitch SSOP and 0.65mm pitch TSSOP packages
- Extended commercial range of – 40°C to +85°C
- VCC = 3.3V ±0.3V, Normal Range
- VCC = 2.3V to 3.6V, Extended Range
- CMOS power levels (0.4µW typ. static)
- Rail-to-Rail output swing for increased noise margin
- All inputs, outputs and I/O are 5 Volt tolerant
- Supports hot insertion

Drive Features for LVCU04A:

- High Output Drivers: ±24mA
- Reduced system switching noise

DESCRIPTION

The LVCU04A hex inverter is built using advanced dual metal CMOS technology. This device contains six independent inverters with unbuffered outputs and performs the Boolean function $Y = \overline{A}$.

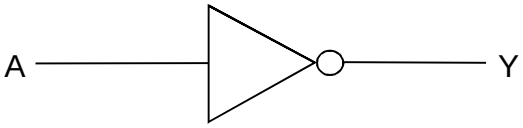
The LVCU04A has been designed with a ±24mA output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.

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.

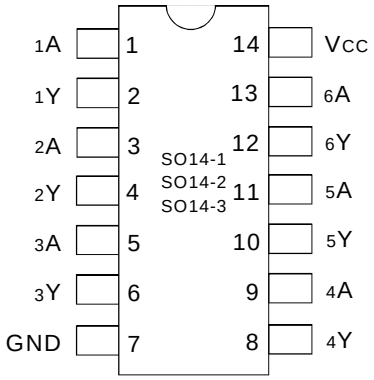
APPLICATIONS:

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

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



SOIC/ SSOP/ TSSOP
TOP VIEW

FUNCTION TABLE (each inverter) (1)

Inputs	Outputs
xA	xY
H	L
L	H

NOTE:
1. H = HIGH Voltage Level
   L = LOW Voltage Level

PIN DESCRIPTION

Pin Names	Description
xA	Data Inputs
xY	Data Outputs

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

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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

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NOTE:
1. As applicable to the device type.

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} = 1.65V		1.32	—	—	V
		V_{CC} = 2.3V		1.84	—	—	
		V_{CC} = 2.7V		2.16	—	—	
		V_{CC} = 3V		2.4	—	—	
		V_{CC} = 3.6V		2.88	—	—	
V_{IL}	Input LOW Voltage Level	V_{CC} = 1.65V		—	—	0.4	V
		V_{CC} = 2.3V		—	—	0.5	
		V_{CC} = 2.7V to 3.6V		—	—	0.65	
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
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
ΔI_{CC}	Quiescent Power Supply Current Variation	One input at V_{CC} – 0.6V other inputs at V_{CC} or GND		—	—	500	µA

NOTE:
1. 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} = 1.65V to 3.6V	I_{OH} = – 0.1mA	V_{CC} – 0.2	—	V
		V_{CC} = 1.65V	I_{OH} = – 4mA	1.2	—	
		V_{CC} = 2.3V	I_{OH} = – 8mA	1.7	—	
		V_{CC} = 2.7V	I_{OH} = – 12mA	2.2	—	
		V_{CC} = 3.0V		2.4	—	
		V_{CC} = 3.0V	I_{OH} = – 24mA	2.2	—	
V_{OL}	Output LOW Voltage	V_{CC} = 1.65V to 3.6V	I_{OL} = 0.1mA	—	0.2	V
		V_{CC} = 1.65V	I_{OL} = 4mA	—	0.45	
		V_{CC} = 2.3V	I_{OL} = 8mA	—	0.7	
		V_{CC} = 2.7V	I_{OL} = 12mA	—	0.4	
		V_{CC} = 3.0V	I_{OL} = 24mA	—	0.55	

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	Vcc = 2.5V±0.2V	Vcc = 3.3V±0.3V	Unit
			Typical	Typical	
C_{PD}	Power Dissipation Capacitance per inverter	C_L = 0pF, f = 10Mhz	—	5	pF

SWITCHING CHARACTERISTICS [1]

Symbol	Parameter	Vcc = 1.8V	Vcc = 2.5V±0.2V		Vcc = 2.7V		Vcc = 3.3V±0.3V		Unit
		Typ.	Min	Max	Min	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation Delay xA to xY	12.7	1	6.7	—	4.7	1	3.8	ns
tsk(o)	Output Skew[2]	—	—	—	—	—	—	1	ns

NOTES:

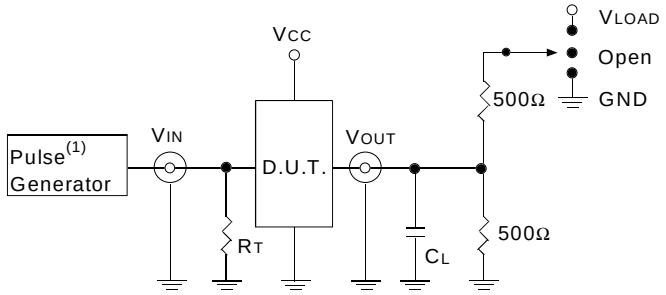
1. See test circuits and waveforms. T_A = – 40°C to + 85°C.
2. Skew between any two outputs of the same package and switching in the same direction.

TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

Symbol	V_{CC}[1]= 2.5V ±0.2V	V_{CC}= 3.3V ±0.3V & 2.7V	Unit
V_{LOAD}	2 x Vcc	6	V
V_{IH}	Vcc	2.7	V
V_T	Vcc / 2	1.5	V
V_{LZ}	V_{OL} + 0.15	V_{OL} + 0.3	V
V_{HZ}	V_{OH} - 0.15	V_{OH} - 0.3	V
C_L	30	50	pF

TEST CIRCUITS 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 ≤ 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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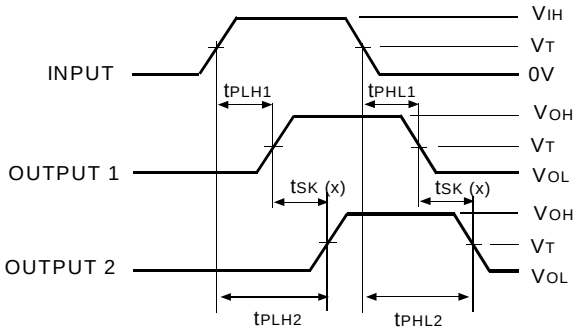
OUTPUT SKEW - tsk (x)

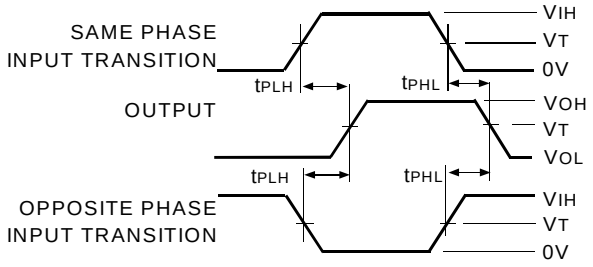


NOTES:

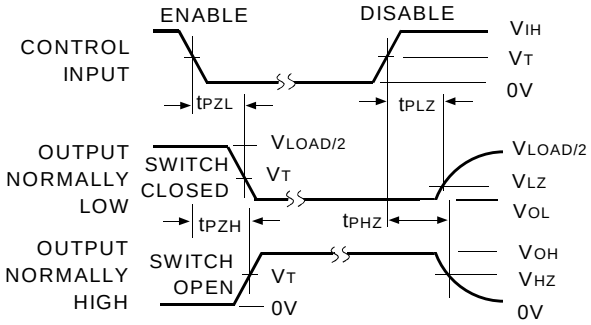
$t_{SK(x)} = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$

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



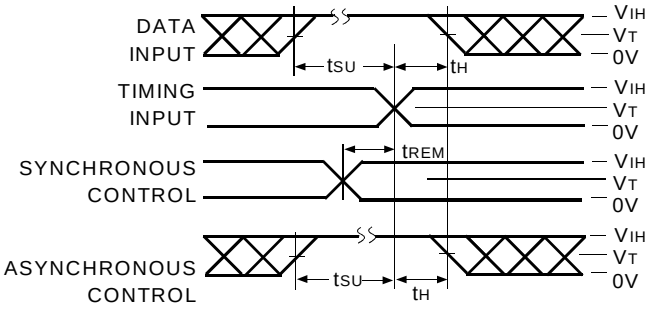
ENABLE AND DISABLE TIMES



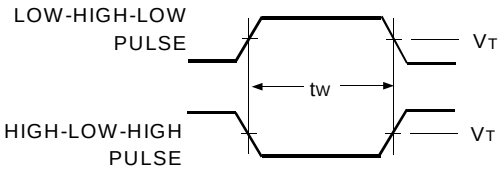
NOTE:

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

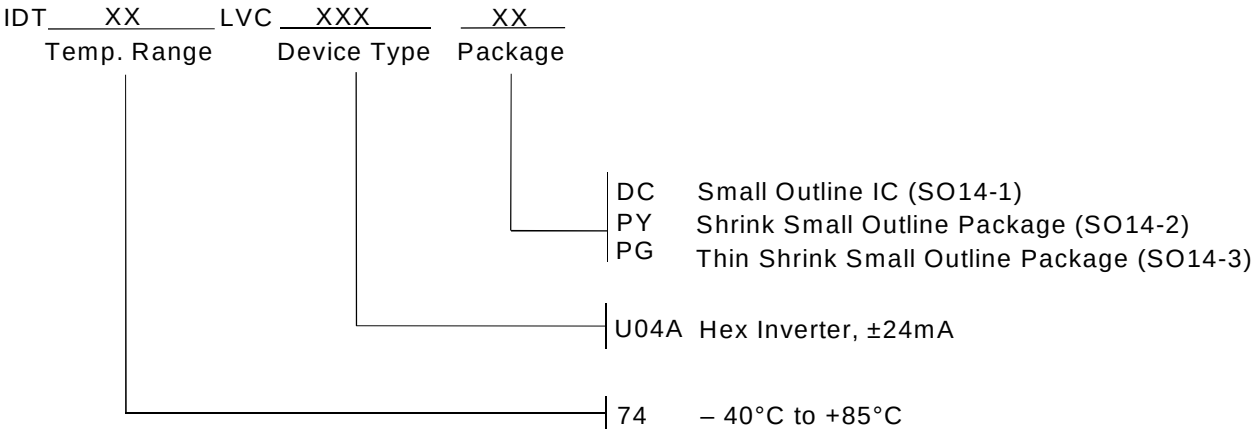
SET-UP, HOLD, AND RELEASE TIMES



PULSE WIDTH



ORDERING INFORMATION



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