



3.3V CMOS DUAL 2-LINE TO 4-LINE DECODER/DEMULTIPLEXER WITH 5 VOLT TOLERANT I/O

IDT74LVC139A

FEATURES:

- 0.5 MICRON CMOS Technology
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- $V_{CC} = 3.3V \pm 0.3V$, Normal Range
- $V_{CC} = 2.7V$ to $3.6V$, Extended Range
- CMOS power levels ($0.4\mu W$ typ. static)
- Rail-to-Rail output swing for increased noise margin
- All inputs, outputs, and I/Os are 5V tolerant
- Supports hot insertion
- Available in QSOP, SOIC, SSOP, and TSSOP packages

DRIVE FEATURES:

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

DESCRIPTION:

This dual 2-line to 4-line decoder/demultiplexer is built using advanced dual metal CMOS technology. The LVC139A comprises two individual 2-line to 4-line decoders in a single package. The active-low enable ($\overline{G}$) input can be used as a data line in demultiplexing applications. This decoder/demultiplexer features fully buffered inputs, each of which represents only one normalized load to its driving circuit.

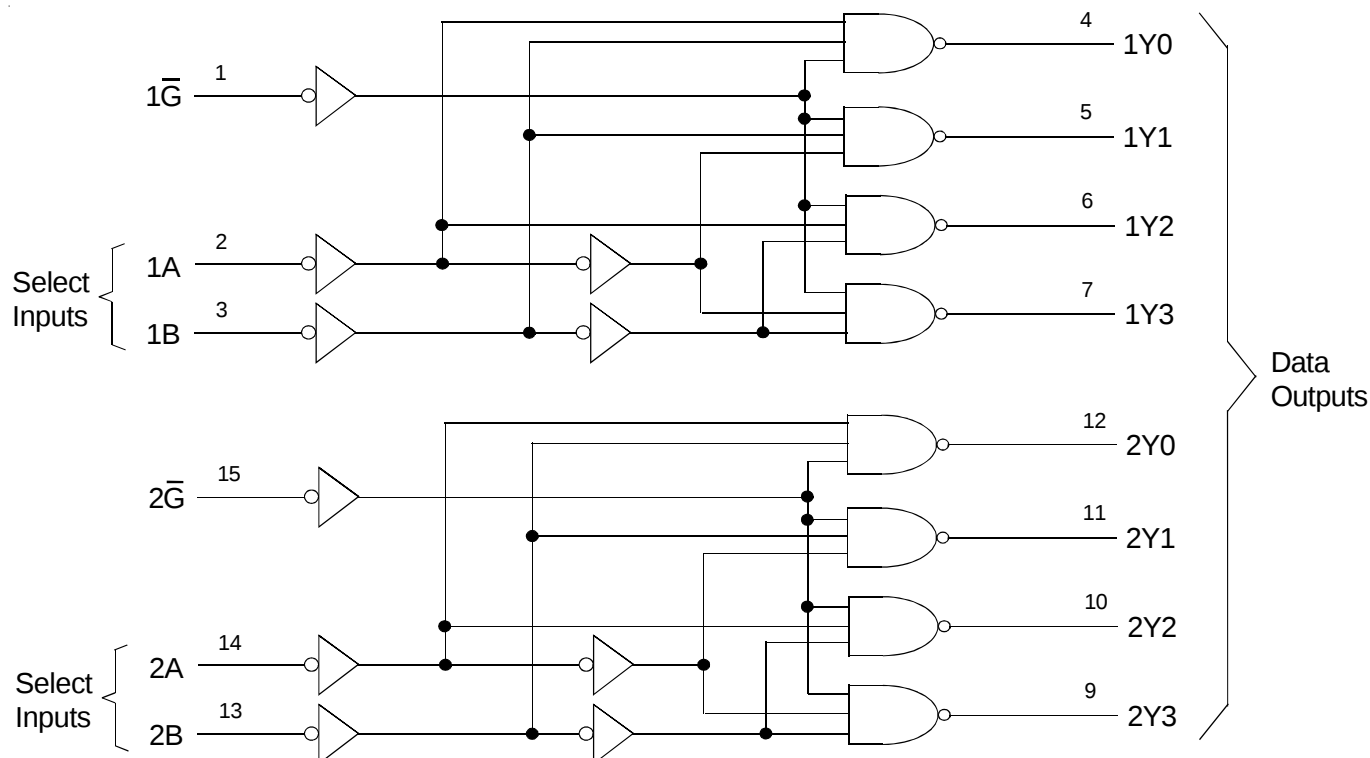
Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of this device as a translator in a mixed 3.3V/5V supply system.

The LVC139A has been designed with a $\pm 24mA$ output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.

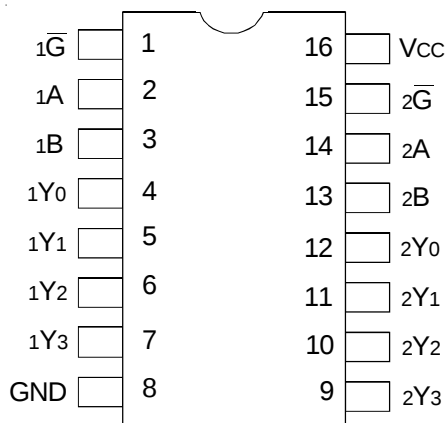
APPLICATIONS:

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

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



QSOP/ SOIC/ SSOP/ 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:

- 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:

- As applicable to the device type.

PIN DESCRIPTION

Pin Names	Description
x $\overline{G}$	Input Enables (Active LOW)
xA, xB	Select Data Inputs
xYx	Data Outputs

FUNCTION TABLE⁽¹⁾

Inputs			Outputs			
xG	Select		xY3	xY2	xY1	xY0
	xB	xA				
L	L	L	H	H	H	L
L	L	H	H	H	L	H
L	H	L	H	L	H	H
L	H	H	L	H	H	H
H	X	X	H	H	H	H

NOTE:

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

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_{OL}	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
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

NOTE:

1. 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
V_{OH}	Output HIGH Voltage	$V_{CC} = 2.3\text{V}$ to 3.6V	$I_{OH} = -0.1\text{mA}$	$V_{CC} - 0.2$	—	V
		$V_{CC} = 2.3\text{V}$	$I_{OH} = -6\text{mA}$	2	—	
		$V_{CC} = 2.3\text{V}$	$I_{OH} = -12\text{mA}$	1.7	—	
		$V_{CC} = 2.7\text{V}$		2.2	—	
		$V_{CC} = 3\text{V}$		2.4	—	
		$V_{CC} = 3\text{V}$	$I_{OH} = -24\text{mA}$	2.2	—	
V_{OL}	Output LOW Voltage	$V_{CC} = 2.3\text{V}$ to 3.6V	$I_{OL} = 0.1\text{mA}$	—	0.2	V
		$V_{CC} = 2.3\text{V}$	$I_{OL} = 6\text{mA}$	—	0.4	
			$I_{OL} = 12\text{mA}$	—	0.7	
		$V_{CC} = 2.7\text{V}$	$I_{OL} = 12\text{mA}$	—	0.4	
		$V_{CC} = 3\text{V}$	$I_{OL} = 24\text{mA}$	—	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.
 $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$.

OPERATING CHARACTERISTICS, $V_{CC} = 3.3V \pm 0.3V$, $T_A = 25^\circ C$

Symbol	Parameter	Test Conditions	Typical	Unit
CPD	Power Dissipation Capacitance per Gate	$C_L = 0pF$, $f = 10MHz$	30.5	pF

SWITCHING CHARACTERISTICS⁽¹⁾

Symbol	Parameter	$V_{CC} = 2.5V \pm 0.2V$		$V_{CC} = 2.7V$		$V_{CC} = 3.3V \pm 0.3V$		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
t_{PLH} t_{PHL}	Propagation Delay xA or xB to xYx	—	—	—	7.3	1	6.2	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{xG}$ to xYx	—	—	—	5.2	1	4.7	ns
$t_{sk(0)}$	Output Skew ⁽²⁾	—	—	—	—	—	1	ns

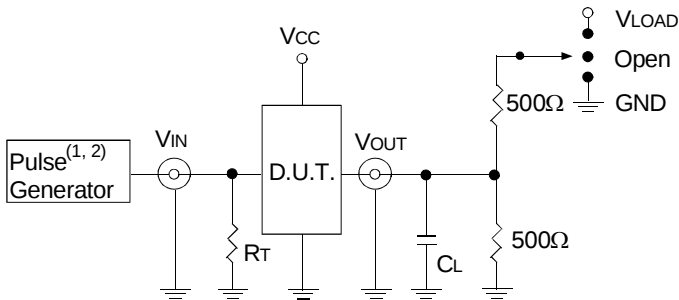
NOTES:

1. See TEST CIRCUITS AND WAVEFORMS. $T_A = -40^\circ C$ to $+85^\circ C$.
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} ⁽²⁾ = 3.3V ± 0.3V & 2.7V	Unit
V _{LOAD}	2 x V _{CC}	6	V
V _{IH}	V _{CC}	2.7	V
V _T	V _{CC} / 2	1.5	V
V _{LZ}	150	300	mV
V _{HZ}	150	300	mV
C _L	30	50	pF



Test Circuit for All Outputs

DEFINITIONS:

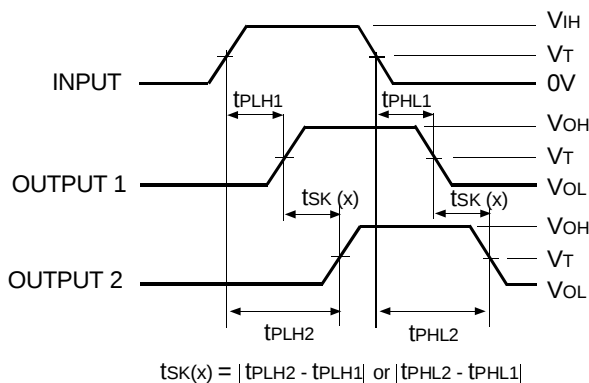
C_L = Load capacitance: includes jig and probe capacitance.
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

NOTES:

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

SWITCH POSITION

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

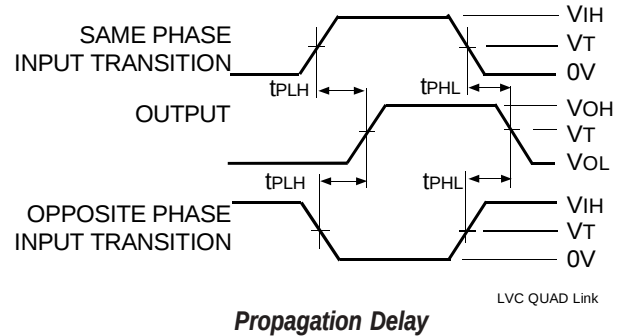


$$t_{SK}(x) = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

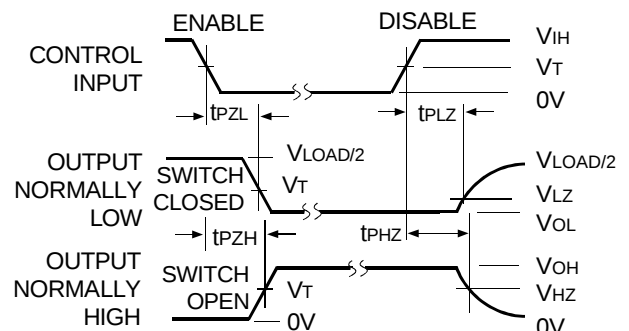
Output Skew - t_{SK}(x)

NOTES:

1. For t_{SK}(0) OUTPUT1 and OUTPUT2 are any two outputs.
2. For t_{SK}(b) OUTPUT1 and OUTPUT2 are in the same bank.



Propagation Delay

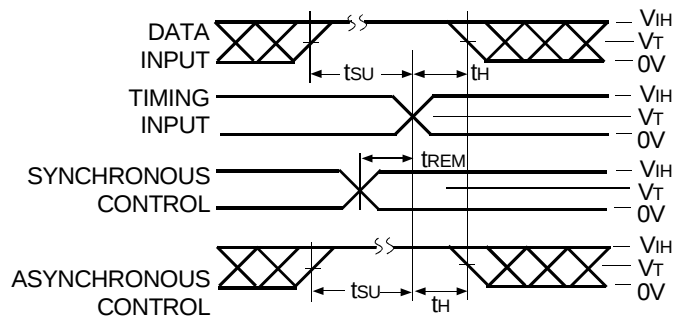


Enable and Disable Times

NOTE:

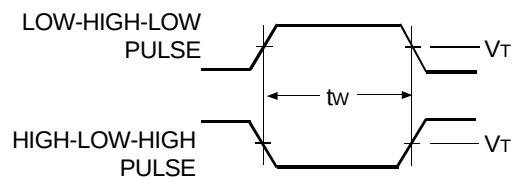
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

Enable and Disable Times



Set-up, Hold, and Release Times

Set-up, Hold, and Release Times



Pulse Width

Pulse Width

ORDERING INFORMATION

IDT	XX	LVC	XXXX	XX	
Temp. Range			Device Type	Package	
				Q	Quarter Size Outline Package
				DC	Small Outline IC
				PY	Shrink Small Outline Package
				PG	Thin Shrink Small Outline Package
			139A		Dual 2-Line to 4-Line Decoder/Demultiplexer, $\pm 24\text{mA}$
				74	-40°C to +85°C



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