

**U74LVX4051****CMOS IC****8-Channel Analog
Multiplexer/Demultiplexer****■ DESCRIPTION**

The **U74LVX4051** is a high speed, low-voltage drive analog multiplexer/demultiplexer using silicon gate CMOS technology. In 3V and 5V systems these can achieve high-speed operation with the low power dissipation that is a feature of CMOS.

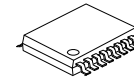
The **U74LVX4051** offer analog/digital signal selection as well as mixed signals. The 4051 has an 8-Channel configuration.

The switches for each channel are turned on by the control pin digital signals.

Although the control signal logical amplitude (V_{CC} -GND) is small, the device can perform large-amplitude (V_{CC} - V_{EE}) signal switching.

For example, if $V_{CC}=3V$, GND=0V and $V_{EE}=-3V$, signals between -3V and +3V can be switched from the logical circuit using a signal 3V power supply.

All input pins are equipped with a newly developed input protection circuit that avoids the need for a diode on the plus side (forward side from the input to the V_{CC}). As a result, for example, 5V signals can be permitted on the inputs even when the power supply voltage to the circuits is off. As a result of this input power protection, the **U74LVX4051** can be used in a variety of applications, including in the system which has two power supplies, and in battery backup circuits.



TSSOP-16

■ FEATURES

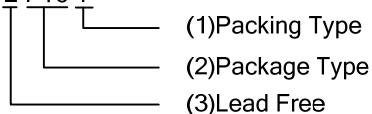
- * Low ON resistance: $R_{ON}=22\Omega$ (Typ.)($V_{CC}-V_{EE}=3V$)
- * $R_{ON}=15\Omega$ (Typ.)($V_{CC}-V_{EE}=6V$)
- * High Speed: $t_{pd}=3ns$ (Typ.)($V_{CC}=3V$)
- * Low power Dissipation: $I_{CC}=4\mu A$ (Max.)($T_A=25^\circ C$)

- * Input level: $V_{IL}=0.8V$ (Max.)($V_{CC}=3V$)
- $V_{IH}=2.0V$ (Min.)($V_{CC}=3V$)
- * Power down protection is provided on all control inputs
- * Pin and function compatible with U74HC4051

■ ORDERING INFORMATION

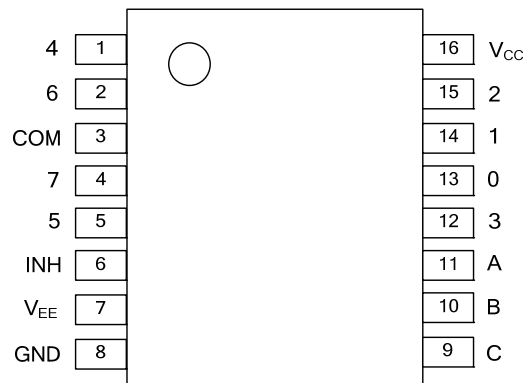
Ordering Number		Package	Packing
Lead Free	Halogen Free		
U74LVX4051L-P16-T	U74LVX4051G-P16-T	TSSOP-16	Tube
U74LVX4051L-P16-R	U74LVX4051G-P16-R	TSSOP-16	Tape Reel

U74LVX4051L-P16-T



- (1) T: Tube, R: Tape Reel
- (2) P16: TSSOP-16
- (3) L: Lead Free, G: Halogen Free

■ PIN CONFIGURATION

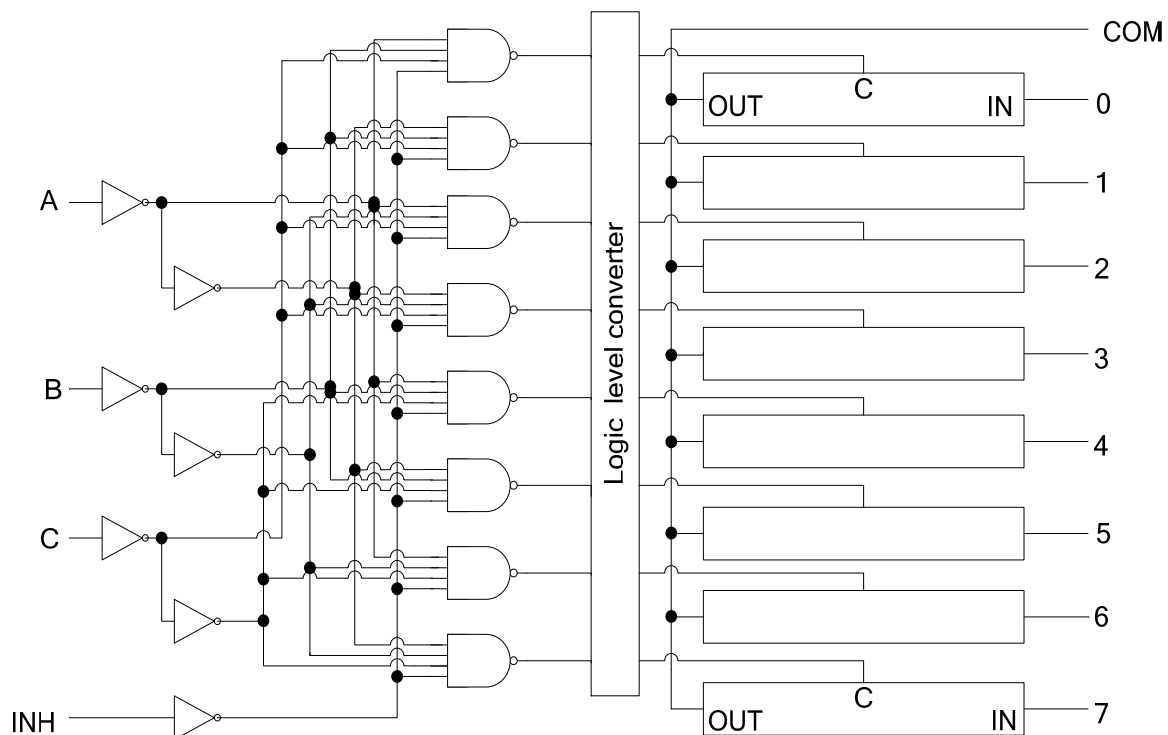


■ FUNCTION TABLE

CONTROL INPUTS				"ON" Channel
INH	C	B	A	LVX4051
L	L	L	L	0
L	L	L	H	1
L	L	H	L	2
L	L	H	H	3
L	H	L	L	4
L	H	L	H	5
L	H	H	L	6
L	H	H	H	7
H	X	X	X	None

Note: H: HIGH voltage level; L: LOW voltage level; X: Don't care

■ LOGIC DIAGRAM (positive logic)



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Power Supply Voltage	V_{CC}	-0.5 ~ +7.0	V
	$V_{CC} \sim V_{EE}$	-0.5 ~ +7.0	
Control Input Voltage	V_{IN}	-0.5 ~ +7.0	V
Switch I/O voltage	$V_{I/O}$	$V_{EE} - 0.5 \sim V_{CC} + 0.5$	V
Input diode current	I_{IK}	-20	mA
I/O diode Current	$I_{I/O}$	±20	mA
Switch through current	I_T	±25	mA
DC Vcc or ground current	I_{CC}	±50	mA
Power dissipation	P_D	450	mW
Operating Temperature	T_{OPR}	-40 ~ +85	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Supply Voltage	V_{CC}		2.0		6.0	V
	V_{EE}		-4		0	
	$V_{CC} \sim V_{EE}$		2		6	
Input Voltage	V_{IN}		0		6	V
Switch I/O Voltage	$V_{I/O}$		V_{EE}		V_{CC}	V
Input Rise and Fall time	dt/dv	$V_{CC} = 3.3V \pm 0.3$	0		100	ns/V
		$V_{CC} = 5V \pm 0.5$	0		20	

■ DC ELECTRICAL CHARACTERISTICS (T_A=25°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Input voltage	High-level	V _{IH}	V _{CC} =2V		1.5			V
			V _{CC} =3V		2.0			
			V _{CC} =4.5V		3.15			
			V _{CC} =6V		4.2			
	Low-level	V _{IL}	V _{CC} =2V				0.5	
			V _{CC} =3V				0.8	
			V _{CC} =4.5V				1.35	
			V _{CC} =6V				1.8	
ON resistance		R _{ON}	V _{IN} =V _{IL} or V _{IH} V _{I/O} =V _{EE} to V _{EE} I _{I/O} =2mA	V _{CC} =2V, V _{EE} =GND		200		Ω
				V _{CC} =3V, V _{EE} =GND		45	86	
				V _{CC} =4.5V, V _{EE} =GND		24	37	
				V _{CC} =3V, V _{EE} =-3V		17	26	
			V _{IN} =V _{IL} or V _{IH} V _{I/O} =V _{CC} to V _{EE} I _{I/O} =2mA	V _{CC} =2V, V _{EE} =GND		28	73	
				V _{CC} =3V, V _{EE} =GND		22	38	
				V _{CC} =4.5V, V _{EE} =GND		17	27	
				V _{CC} =3V, V _{EE} =-3V		15	24	
Difference of ON resistance between switches		ΔR _{ON}	V _{IN} =V _{IL} or V _{IH} V _{I/O} =V _{CC} to V _{EE} I _{I/O} =2mA	V _{CC} =2V, V _{EE} =GND		10	25	Ω
				V _{CC} =3V, V _{EE} =GND		5	15	
				V _{CC} =4.5V, V _{EE} =GND		5	13	
				V _{CC} =3V, V _{EE} =-3V		5	10	
Input/Output Leakage Current (switch off)		I _{OFF}	V _{OS} =V _{CC} or GND, V _{IS} =GND or V _{CC} , V _{IN} =V _{IH} OR V _{IL}	V _{CC} =3V, V _{EE} =GND			±0.25	μA
				V _{CC} =3V, V _{EE} =-3V			±0.5	
Quiescent Supply Current		I _{CC}	V _{IN} =V _{CC} or GND	V _{CC} =3V, V _{EE} =GND			4.0	μA
				V _{CC} =3V, V _{EE} =-3V			8.0	μA
Input/Output leakage current (switch on, output open)		I _{IN}	V _{OS} =V _{CC} or GND, V _{IN} =V _{IH} or V _{IL}	V _{CC} =3V, V _{EE} =GND			±0.25	μA
				V _{CC} =3V, V _{EE} =-3V			±0.5	
Control input current		I _{IN}	V _{IN} =V _{CC} or GND	V _{CC} =6V, V _{EE} =GND			±0.1	μA

■ AC ELECTRICAL CHARACTERISTICS ($T_A=25^{\circ}\text{C}$, Input $t_R/t_F=3\text{ns}$, $\text{GND}=0\text{V}$, $C_L=50\text{pF}$)

See Fig. 1, Fig. 2 and Fig. 3 for test circuit and waveforms.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Phase difference between input and output	t_{pLH}/t_{pHL}	$V_{CC}=2\text{V}, V_{EE}=\text{GND}$		3.2	6.0	ns
		$V_{CC}=3\text{V}, V_{EE}=\text{GND}$		1.8	3.0	
		$V_{CC}=4.5\text{V}, V_{EE}=\text{GND}$		1.3	1.8	
		$V_{CC}=3\text{V}, V_{EE}=-3\text{V}$		1.1	1.3	
Output enable time (Note 1)	t_{pZL}/t_{pZH}	$V_{CC}=2\text{V}, V_{EE}=\text{GND}$		9	17	ns
		$V_{CC}=3\text{V}, V_{EE}=\text{GND}$		5.7	9	
		$V_{CC}=4.5\text{V}, V_{EE}=\text{GND}$		4.5	6	
		$V_{CC}=3\text{V}, V_{EE}=-3\text{V}$		5.8	8	
Output disable time (Note 1)	t_{pLZ}/t_{pHZ}	$V_{CC}=2\text{V}, V_{EE}=\text{GND}$		13.5	21	ns
		$V_{CC}=3\text{V}, V_{EE}=\text{GND}$		11.3	15	
		$V_{CC}=4.5\text{V}, V_{EE}=\text{GND}$		10.3	12	
		$V_{CC}=3\text{V}, V_{EE}=-3\text{V}$		10.9	13	
Control input capacitance (Note 2)	C_{IN}			5	10	pF
COMMON terminal capacitance (Note 2)	C_{IS}	$V_{CC}=3\text{V}, V_{EE}=-3\text{V}$		11	25	pF
SWITCH terminal capacitance (Note 2)	C_{OS}	$V_{CC}=3\text{V}, V_{EE}=-3\text{V}$		6	13	pF
Feedthrough capacitance (Note 2)	C_{IOS}	$V_{CC}=3\text{V}, V_{EE}=-3\text{V}$		3	6	pF
Power dissipation capacitance (Note 3)	C_{PD}	$V_{CC}=6\text{V}, V_{EE}=\text{GND}$		14		pF

Note: 1. $R_L=1\text{k}$

2. C_{IN} , C_{IS} , C_{OS} and C_{IOS} are guaranteed by the design.
3. C_{PD} is defined as the value of the internal equivalent capacitance of IC which is calculated from the operating current consumption without load.

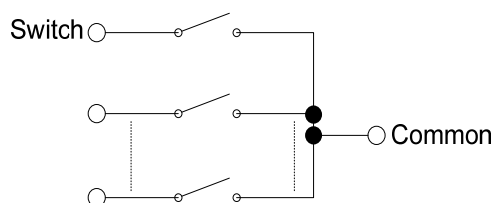
Average operating current can be obtained by the equation.

$$I_{CC}(\text{OPR})=C_{PD}\times V_{CC}\times f_{IN}+V_{CC}$$

■ ANALOG SWITCH CHARACTERISTICS (GND=0V, T_A=25°C) (Note)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Sine Wave Distortion	THD	R _L =10k, C _L =50pF, f _{IN} =1k	V _{IN} =2Vp-p, V _{CC} =3V, V _{EE} =0V		0.1	%
			V _{IN} =4Vp-p, V _{CC} =4.5V, V _{EE} =0V		0.03	
			V _{IN} =6Vp-p, V _{CC} =3V, V _{EE} =-0.3V		0.02	
Frequency response (switch on)	f _{MAX}	Adjust f _{IN} voltage to obtain 0dBm at V _{OS} . Increase fin frequency until dB meter reads -3dB. R _L =50Ω, C _L =10pF, f _{IN} =1MHz, sine wave (Figure 4)	V _{CC} =3V, V _{EE} =0V		150	MHz
			V _{CC} =4.5V, V _{EE} =0V		150	
			V _{CC} =3V, V _{EE} =-3V		150	
Feed through attenuation (switch off)		V _{IN} is centered at (V _{CC} -V _{EE})/2. Adjust input for 0dBm. R _L =600Ω, C _L =50pF, f _{IN} =1MHz, sine wave (Figure 5)	V _{CC} =3V, V _{EE} =0V		-45	dB
			V _{CC} =4.5V, V _{EE} =0V		-45	
			V _{CC} =3V, V _{EE} =-3V		-45	
		R _L =50Ω, C _L =10pF, f _{IN} =1MHz, sine wave	V _{CC} =3V, V _{EE} =0V		-60	dB
			V _{CC} =4.5V, V _{EE} =0V		-60	
			V _{CC} =3V, V _{EE} =-3V		-60	
Crosstalk (control input to signal output)		R _L =600Ω, C _L =50pF, f _{IN} =1MHz, square wave (t _r =t _f =6ns) (Figure 6)	V _{CC} =3V, V _{EE} =0V		90	mV
			V _{CC} =4.5V, V _{EE} =0V		150	
			V _{CC} =3V, V _{EE} =-3V		120	
Crosstalk (between any switches)		Adjust V _{IN} to obtain 0dBm at input. R _L =600Ω, C _L =50pF, f _{IN} =1MHz, sine wave (Figure 7)	V _{CC} =3V, V _{EE} =0V		-45	dB
			V _{CC} =4.5V, V _{EE} =0V		-45	
			V _{CC} =3V, V _{EE} =-3V		-45	

Note: These characteristics are determined by design of devices.



■ TEST CIRCUIT AND WAVEFORMS

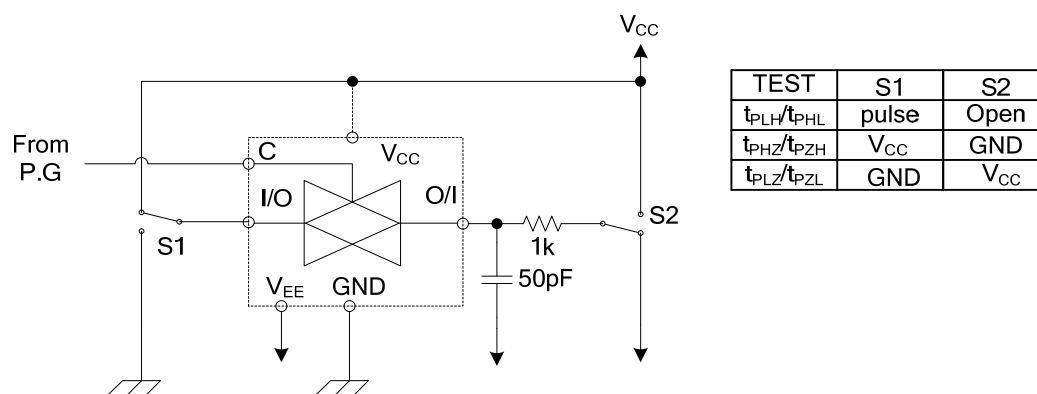


Fig. 1 Load circuitry for switching times.

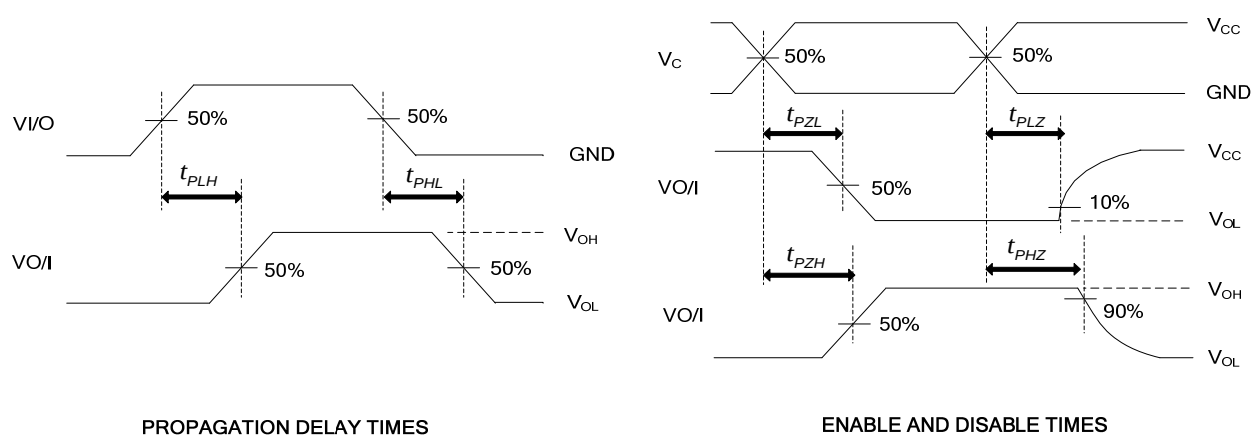


Fig. 2 Propagation delay from input to output and enable, disable times.

■ AC TEST CIRCUIT

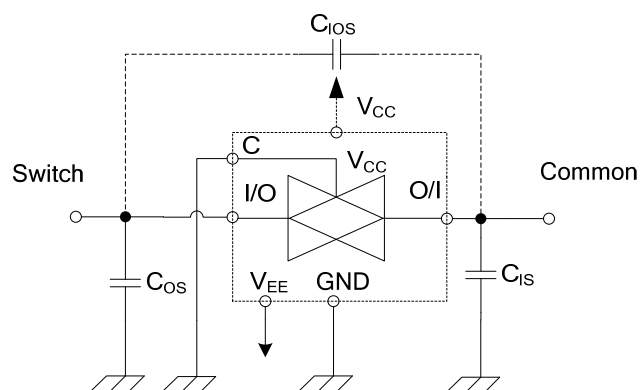


Fig. 3 C_{ios} , C_{is} , C_{os}

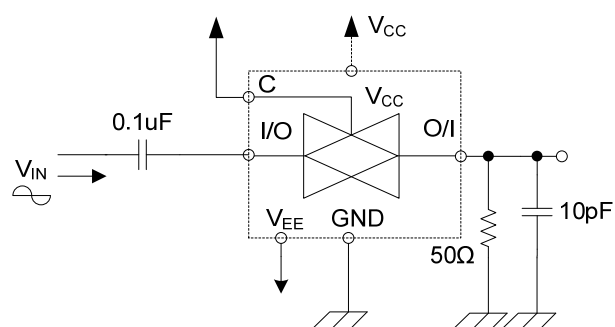


Fig. 4 Frequency Response (switch on)

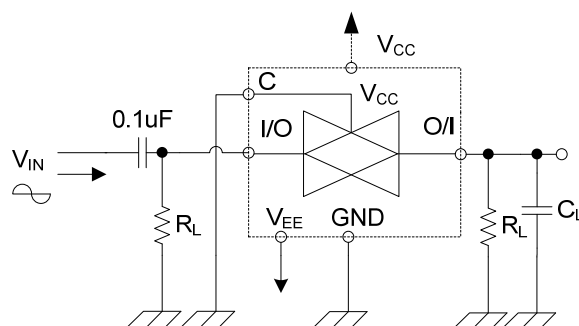


Fig. 5 Feedthrough

■ AC TEST CIRCUIT(Cont.)

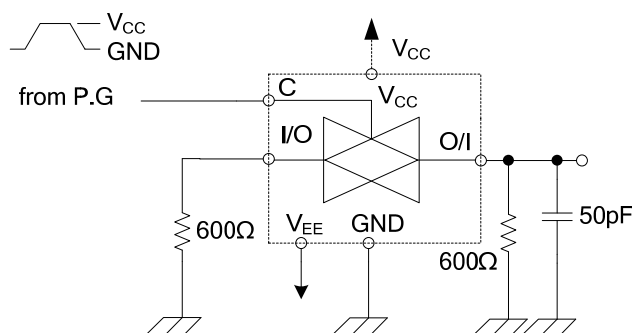


Fig. 6 Cross Talk (control input to output signal)

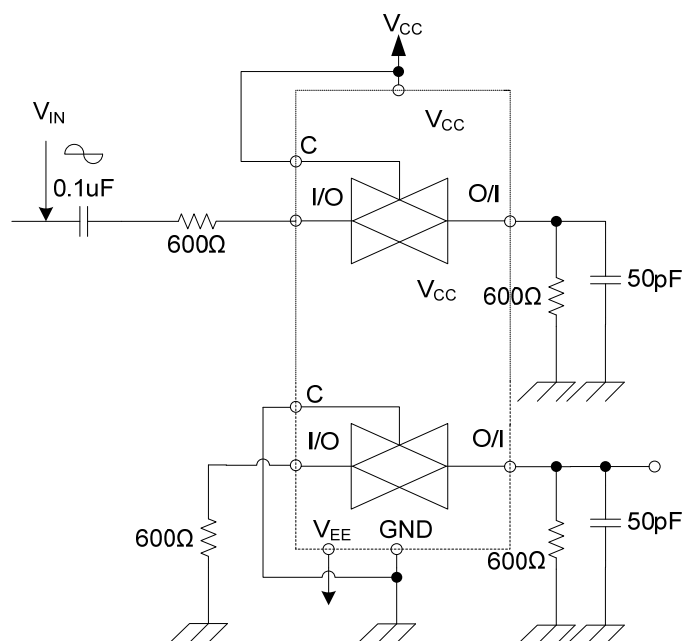


Fig. 7 Cross Talk (between any two switches)

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