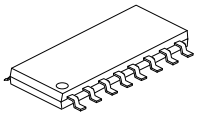
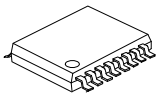
U74LVX4051

CMOS IC

8-CHANNEL ANALOG MULTIPLEXER/DEMULTIPLEXER



SOP-16



TSSOP-16

■ 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 switchses 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 (forword 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 bachup circuits.

■ FEATURES

* Low ON resistance: R_{ON}=22Ω(Typ.)(V_{CC}-V_{EE}=3V)
* R_{ON}=15Ω(Typ.)(V_{CC}-V_{EE}=6V)
* High Speed: t_{pd}=3ns (Typ.)(V_{CC}=3V)
* Low power Dissipation: I_{CC}=4μA (Max.)(T_A=25°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
U74LVX4051G-S16-R	SOP-16	Tape Reel
U74LVX4051G-P16-R	TSSOP-16	Tape Reel

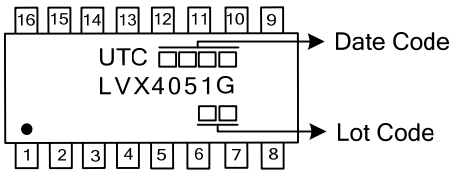
U74LVX4051G-S16-R

(1)Packing Type — (1) R: Tape Reel

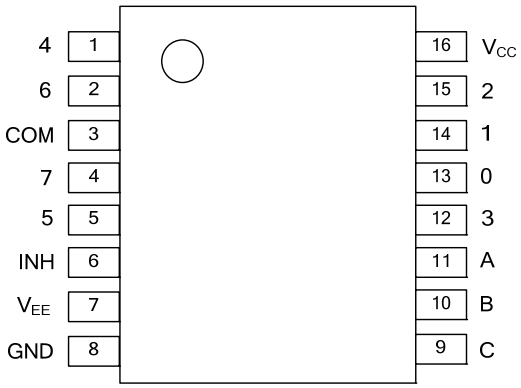
(2)Package Type — (2) S16: SOP-16, P16: TSSOP-16

(3)Green Package — (3) G: Halogen Free and Lead Free

■ MARKING



■ PIN CONFIGURATION

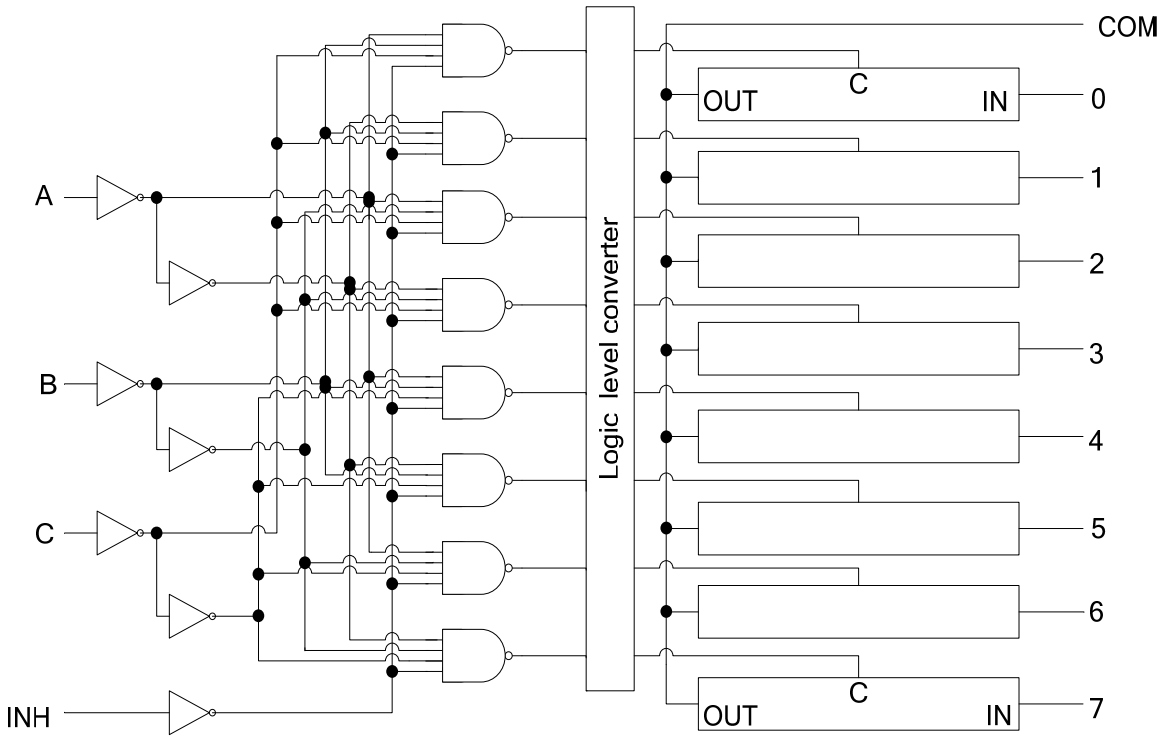


■ FUNCTION TABLE

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}~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~V_{CC}+0.5	V
Input diode current		I_{IK}	-20	mA
I/O diode Current		I_{IOK}	±20	mA
Switch through current		I_T	±25	mA
DC Vcc or ground current		I_{CC}	±50	mA
Power dissipation	SOP-16	P_D	500	mW
	TSSOP-16		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}~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±0.3	0		100	ns/V
		V_{CC}=5V±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_{CC} 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} or 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°C, Input t_R/t_F =3ns, GND=0V, C_L=50pF)

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}=2V, V_{EE}=GND		3.2	6.0	ns
		V_{CC}=3V, V_{EE}=GND		1.8	3.0	
		V_{CC}=4.5V, V_{EE}=GND		1.3	1.8	
		V_{CC}=3V, V_{EE}=-3V		1.1	1.3	
Output enable time (Note 1)	t_{PZL}/t_{PZH}	V_{CC}=2V, V_{EE}=GND		9	17	ns
		V_{CC}=3V, V_{EE}=GND		5.7	9	
		V_{CC}=4.5V, V_{EE}=GND		4.5	6	
		V_{CC}=3V, V_{EE}=-3V		5.8	8	
Output disable time (Note 1)	t_{PLZ}/t_{PHZ}	V_{CC}=2V, V_{EE}=GND		13.5	21	ns
		V_{CC}=3V, V_{EE}=GND		11.3	15	
		V_{CC}=4.5V, V_{EE}=GND		10.3	12	
		V_{CC}=3V, V_{EE}=-3V		10.9	13	
Control input capacitance (Note 2)	C_{IN}			5	10	pF
COMMON terminal capacitance (Note 2)	C_{IS}	V_{CC}=3V, V_{EE}=-3V		11	25	pF
SWITCH terminal capacitance (Note 2)	C_{OS}	V_{CC}=3V, V_{EE}=-3V		6	13	pF
Feedthrough capacitance (Note 2)	C_{IOS}	V_{CC}=3V, V_{EE}=-3V		3	6	pF
Power dissipation capacitance (Note 3)	C_{PD}	V_{CC}=6V, V_{EE}=GND		14		pF

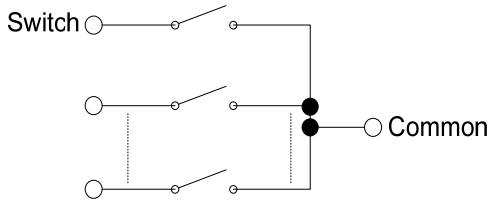
Note: 1. R_L=1k

2. C_{IN}, C_{IS}, C_{OS} and C_{IOS} are guaranteed by the design.
3. CPD 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.
   $I_{CC}(OPR)=C_{PD}\times V_{CC}\times f_{IN}+V_{CC}$

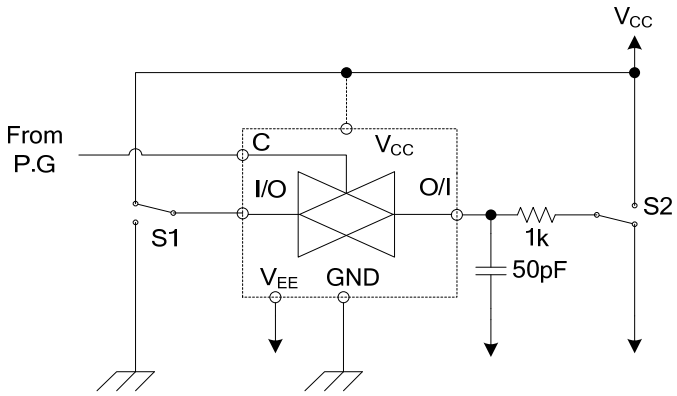
■ ANALOG SWITCH CHARACTERISTICS (GND=0V,T_A=25°C) (Note)

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 fIN 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



TEST	S1	S2
t_{PLH}/t_{PHL}	pulse	Open
t_{PHZ}/t_{PZH}	V_{CC}	GND
t_{PLZ}/t_{PZL}	GND	V_{CC}

Fig. 1 Load circuitry for switching times.

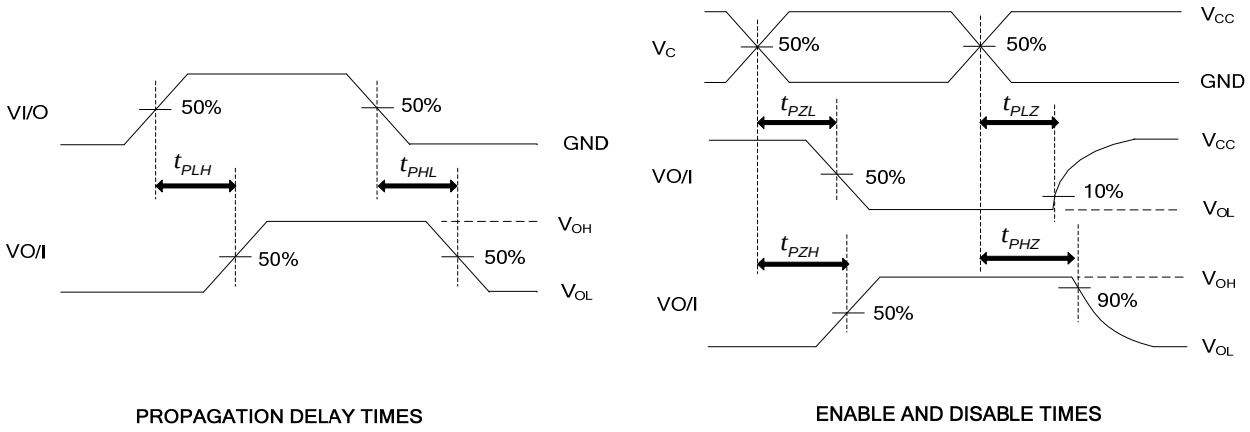


Fig. 2 Propagation delay from input to output and enable, disable times.

■ AC TEST CIRCUIT

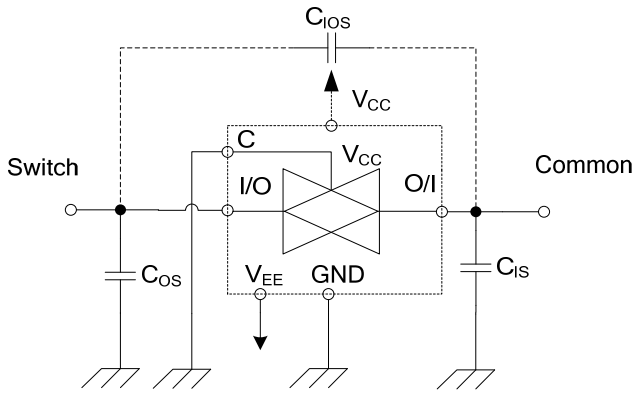


Fig. 3 C_{IOS}, C_{IS}, C_{OS}

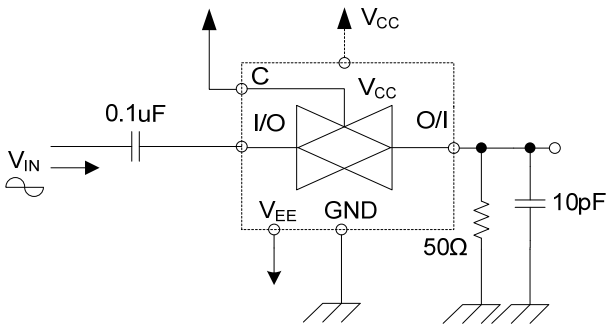


Fig. 4 Frequency Response (switch on)

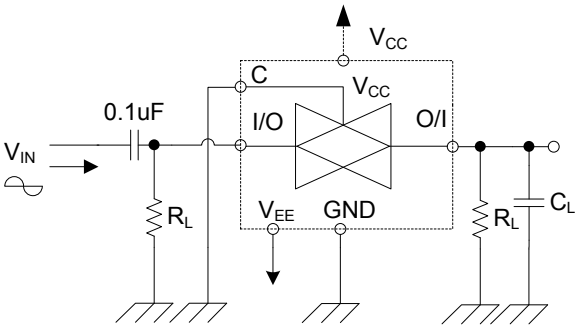


Fig. 5 Feedthrough

■ AC TEST CIRCUIT(Cont.)

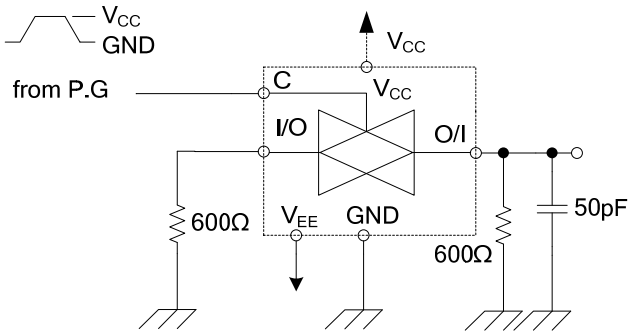


Fig. 6 Cross Talk (control input to output signal)

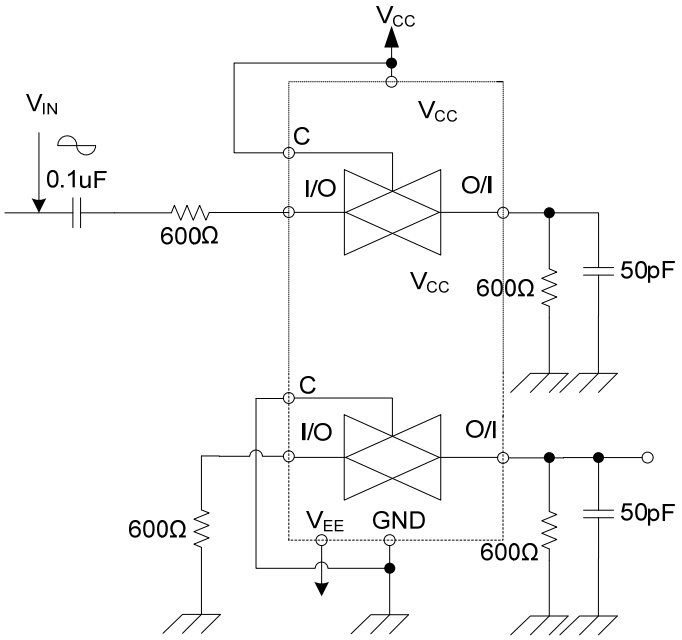


Fig. 7 Cross Talk (between any two switches)