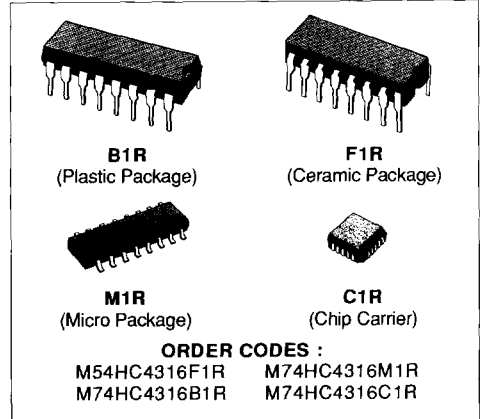


QUAD BILATERAL SWITCH

- **HIGH SPEED**
 $t_{PD} = 13 \text{ ns}$ (TYP.) AT $V_{CC} = 5V$
- **LOW "ON" RESISTANCE:**
 120Ω TYP. ($V_{CC} - V_{EE} = 2 \text{ V}$)
 50Ω TYP. ($V_{CC} - V_{EE} = 4.5 \text{ V}$)
 35Ω TYP. ($V_{CC} - V_{EE} = 9 \text{ V}$)
- **WIDE ANALOG INPUT VOLTAGE RANGE: $\pm 6V$**
- **LOW CROSSTALK BETWEEN SWITCHES**
- **FAST SWITCHING**
- **SINE WAVE DISTORTION**
 0.020 (TYP.) AT $V_{CC} - V_{EE} = 9V$
- **HIGH NOISE IMMUNITY**
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (MIN.)
- **LOW POWER DISSIPATION**
 $I_{CC} = 1\mu A$ (MAX.) AT $V_{CC} = 5V$
- **PIN AND FUNCTION COMPATIBLE WITH 4316B**



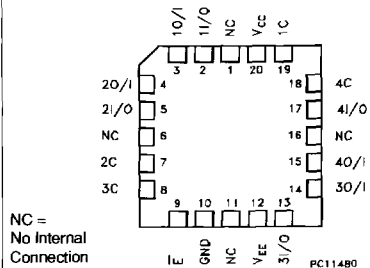
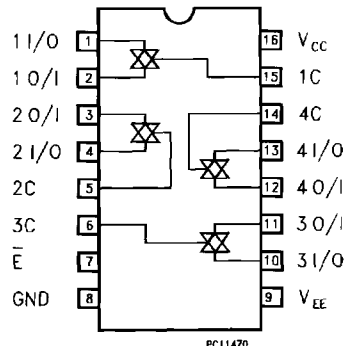
DESCRIPTION

The M54/74HC4316 is a high speed CMOS QUAD BILATERAL SWITCH fabricated in silicon gate C^2 MOS technology. It has high speed performance combined with true CMOS low power consumption. HC4316 has four independent analogue switches. Each switch has two input/output terminals (n/I, nO/I) and an active high select input (nC).

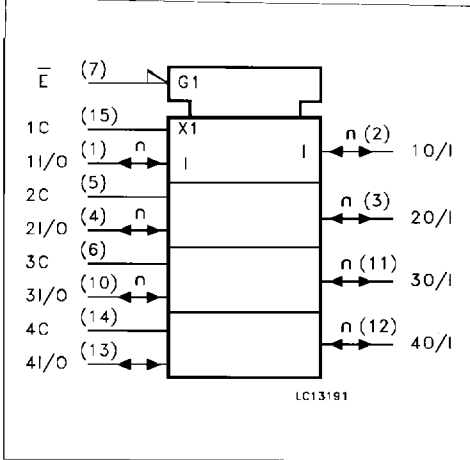
When the enable input is high all four analog switches are off. The supply voltage for the digital signals applied to V_{CC} and GND must be within the range 0 to 6 V. The voltage swing on the analogue Input/Outputs can be between V_{CC} (Positive Limit) and V_{EE} (Negative Limit). The voltage between V_{CC} and V_{EE} must not exceed 12 V.

All input are equipped with protection circuits against static discharge and transient excess voltage.

PIN CONNECTIONS (top view)



IEC LOGIC SYMBOL



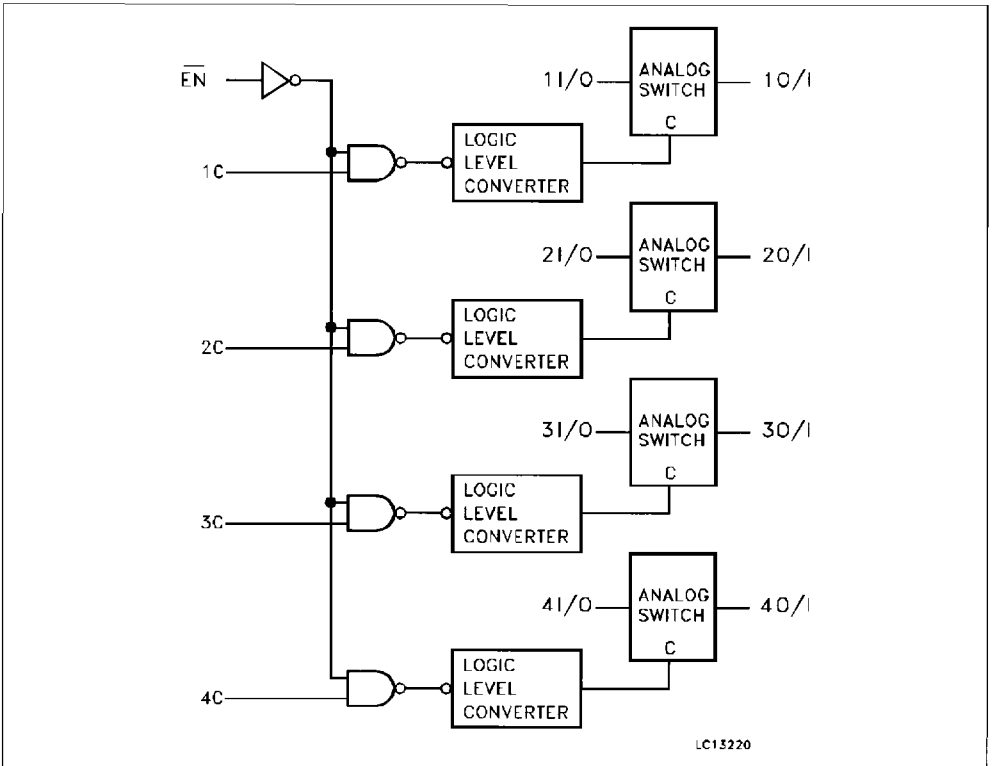
PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1, 4, 10, 13	1 to 4 I/O	Independent Inputs/Outputs
2, 3, 11, 12	1 to 4 O/I	Independent Outputs/Inputs
7	\bar{E}	Enable Inputs (Active LOW)
15, 5, 6, 14	1C to 4C	Enable Inputs (Active HIGH)
9	V_{EE}	Negative Supply Voltage
8	GND	Ground (0V)
16	V_{CC}	Positive Supply Voltage

TRUTH TABLE

		SWITCH FUNCTION
ENABLE	CONTROL	
L	H	ON
L	L	OFF
H	X	OFF

LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage	-0.5 to +7	V
V _{CC} - V _{EE}	Supply Voltage	-0.5 to +13	V
V _I	Control Input Voltage	-0.5 to V _{CC} + 0.5	V
V _{I/O}	Switch I/O Voltage	V _{EE} - 0.5 to V _{CC} + 0.5	V
I _{IK}	DC Input Diode Current	± 20	mA
I _{OK}	DC Output Diode Current	± 20	mA
I _O	DC Output Source Sink Current Per Output Pin	± 25	mA
I _{CC} or I _{GND}	DC V _{CC} or Ground Current	± 50	mA
P _D	Power Dissipation	500 (*)	mW
T _{stg}	Storage Temperature	-65 to +150	°C
T _L	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.
 (*) 500 mW: ≅ 65 °C derate to 300 mW by 10mW/°C; 65 °C to 85 °C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit	
V _{CC}	Supply Voltage	2 to 6	V	
V _{EE}	Supply Voltage	-6 to 0	V	
V _{CC} - V _{EE}	Supply Voltage	2 to 12	V	
V _I	Input Voltage	0 to V _{CC}	V	
V _{I/O}	Switch I/O Voltage	V _{EE} to V _{CC}	V	
T _{op}	Operating Temperature: M54HC Series M74HC Series	-55 to +125 -40 to +85	°C °C	
t _r , t _f	Input Rise and Fall Time	V _{CC} = 2 V V _{CC} = 4.5 V V _{CC} = 6 V	0 to 1000 0 to 500 0 to 400	ns

DC SPECIFICATIONS

Symbol	Parameter	Test Conditions		Value						Unit		
		V _{CC} (V)	V _{EE} (V)	T _A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC			
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.	
V _{IHC}	High Level Control Input Voltage	2.0		1.5			1.5		1.5		V	
		4.5		3.15			3.15		3.15			
		6.0		4.2			4.2		4.2			
V _{ILC}	Low Level Control Input Voltage	2.0				0.5		0.5		0.5	V	
		4.5				1.35		1.35		1.35		
		6.0				1.8		1.8		1.8		
R _{ON}	ON Resistance	4.5	GND	V _{IN} = V _{IHC} V _{IO} = V _{CC} to V _{EE} I _{IO} = 0.1 mA		70	170		200		Ω	
		4.5	-4.5			50	85		105			
		6.0	-6.0			30	70		85			
		2.0	GND	V _{IN} = V _{IHC} V _{IO} = V _{CC} or V _{EE} I _{IO} = 0.1 mA		120	180		215			
		4.5	GND			50	80		100			
		4.5	-4.5			35	60		75			
		6.0	-6.0			20	40		60			
ΔR _{ON}	Difference of ON Resistance Between Switches	4.5	GND	V _{IN} = V _{IHC} or V _{ILC} V _{IO} = V _{CC} to V _{EE} I _{IO} = 0.1 mA		10	15		20		Ω	
		4.5	-4.5			5	10		15			
		6.0	-6.0			5	10		15			
I _{OFF}	Input/Output Leakage Current (SWITCH OFF)	6.0	GND	V _{OS} = V _{CC} or GND V _{IS} = V _{CC} or GND V _{IN} = V _{IHC} or V _{ILC}			±0.06		±0.6		±2	μA
		6.0	-6.0				±0.1		±1		±2	
I _{IZ}	Switch Input Leakage Current (SWITCH ON, OUTPUT OPEN)	6.0	GND	V _{OS} = V _{CC} or GND V _{IN} = V _{ILC} or V _{IHC}			±0.06		±0.6		±2	μA
		6.0	-6.0				±0.1		±1		±2	
I _{IN}	Control Input Current	6.0	V _I = V _{CC} or GND		10 ⁻⁵	±0.1		±1		±1	μA	

AC ELECTRICAL CHARACTERISTICS ($C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

Symbol	Parameter	Test Conditions		Value						Unit	
		V _{CC} (V)		T _A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
θ _{I/O}	Phase Difference Between Input and Output	2.0	GND		12	30		40			ns
		4.5	GND		3	6		8			
		6.0	GND		3	5		7			
		4.5	-4.5		2	4		5			
		6.0	-6.0		2	4		5			
t _{PZL} t _{PZH}	Output Enable Time (E, C-OUT)	2.0	GND	R _L = 1KΩ	56	115		145			ns
		4.5	GND		14	23		29			
		6.0	GND		12	20		25			
		4.5	-4.5		13	21		26			
		6.0	-6.0		11	18		23			
t _{PLZ} t _{PHZ}	Output Disable Time (E, C-OUT)	2.0	GND	R _L = 1KΩ	112	205		255			ns
		4.5	GND		28	41		51			
		6.0	GND		24	35		43			
		4.5	-4.5		24	34		43			
		6.0	-6.0		21	29		36			
	Maximum Control Input Frequency	2.0	GND	R _L = 1KΩ C _L = 15 pF V _{OUT} = 1/2 V _{CC}	2						MHz
		4.5	GND		9						
		6.0	GND		11						
C _{IN}	Input Capacitance				5	10		10		10	pF
C _{I/O}	Switch Terminal Capacitance	4.5		-4.5	5						pF
C _{IOS}	Feed Through Capacitance	4.5		-4.5	1						pF
C _{PD} (*)	Power Dissipation Capacitance	5.0		GND		16					pF

(*) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

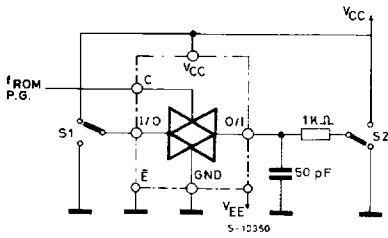
ANALOG SWITCH CHARACTERISTICS (GND = 0 V T_A = 25 °C)

Symbol	Parameter	Test Conditions			Value	Unit	
		V _{CC} (V)	V _{EE} (V)	V _{IN} (V _{p-p})			Typ.
	Sine Wave Distortion (THD)	2.25	2.25	4	f _{IN} = 1 KHz R _L = 10 Ω C _L = 50 pF	0.025	%
		4.5	4.5	8		0.020	
		6.0	6.0	11		0.018	
f _{MAX}	Frequency Response (Switch ON)	2.25	2.25	Adjust f _{IN} voltage to Obtain 0 dBm at V _{OS} .		28	MHz
		4.5	4.5	Increase f _{IN} Frequency until dB Meter reads -3dB		42	
		6.0	6.0	R _L = 50 Ω C _L = 10 pF f _{IN} = 1 KHz sine wave	43		
	Feedthrough Attenuation (Switch OFF)	2.25	2.25	V _{IN} is centered at V _{CC} /2. Adjust input for 0 dBm		-50	dB
		4.5	4.5	R _L = 600 Ω C _L = 50 pF f _{IN} = 1 MHz sine wave	-50		
		6.0	6.0		-50		
	Crosstalk (Control Input to Signal Output)	2.25	2.25	R _L = 600 Ω C _L = 50 pF			mV
		4.5	4.5	f _{IN} = 1 KHz square wave (t _r = t _f = 6ns)		5	
		6.0	6.0				
	Crosstalk (Between Any Switches)	2.25	2.25	Adjust V _{IN} to Obtain 0 dBm at input		-50	dB
		4.5	4.5	R _L = 600 Ω C _L = 50 pF f _{IN} = 1 MHz sine wave	-50		
		6.0	6.0		-50		

SWITCHING CHARACTERISTICS TEST CIRCUIT

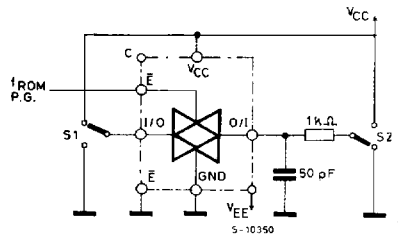
CONTROL

tPLZ, tPHZ, tPZL, tPZH.

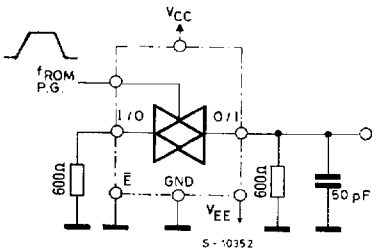


ENABLE

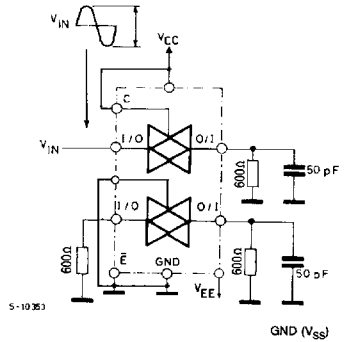
tPLZ, tPHZ, tPZL, tPZH.



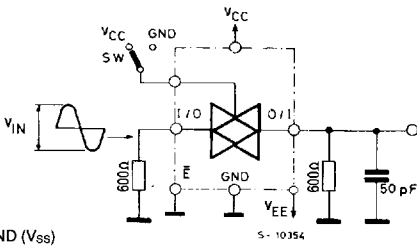
CROSSTALK (control to output)



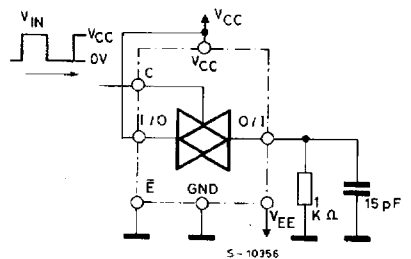
CROSSTALK BETWEEN ANY TWO SWITCHES



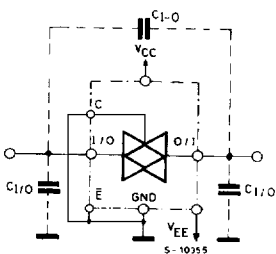
BANDWIDTH AND FEEDTHROUGH ATTENUATION



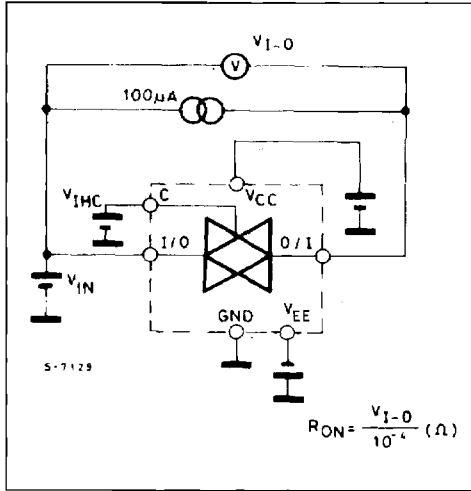
MAXIMUM CONTROL FREQUENCY



C_{L0} C_{I0}



CHANNEL RESISTANCE (RON)



I_{CC} (Opr.)

