



# HCF4066B

## QUAD BILATERAL SWITCH FOR TRANSMISSION OR MULTIPLEXING OF ANALOG OR DIGITAL SIGNALS

- 15V DIGITAL OR  $\pm 7.5V$  PEAK TO PEAK SWITCHING
- 125 $\Omega$  TYPICAL ON RESISTANCE FOR 15V OPERATION
- SWITCH ON RESISTANCE MATCHED TO WITHIN 5 $\Omega$  TYP. OVER 15V SIGNAL INPUT RANGE
- ON RESISTANCE FLAT OVER FULL PEAK TO PEAK SIGNAL RANGE
- HIGH ON/OFF OUTPUT VOLTAGE RATIO : 65dB TYP. at  $f_{IS} = 10KHz$ ,  $R_L = 10K\Omega$
- HIGH DEGREE OF LINEARITY :  $< 0.5\%$  DISTORTION TYP. at  $f_{IS} = 1KHz$ ,  $V_{IS} = 5 V_{pp}$ ,  $V_{DD} - V_{SS} \geq 10V$ ,  $R_L = 10K\Omega$
- EXTREMELY LOW OFF SWITCH LEAKAGE RESULTING IN VERY LOW OFFSET CURRENT AND HIGH EFFECTIVE OFF RESISTANCE : 10pA TYP. at  $V_{DD} - V_{SS} = 10V$ ,  $T_{amb} = 25^\circ C$
- EXTREMELY HIGH CONTROL INPUT IMPEDANCE (control circuit isolated from signal circuit  $10^{12}\Omega$  typ.)
- LOW CROSSTALK BETWEEN SWITCHES : 50dB Typ. at  $f_{IS} = 0.9MHz$ ,  $R_L = 1K\Omega$
- MATCHED CONTROL - INPUT TO SIGNAL OUTPUT CAPACITANCE : REDUCES OUTPUT SIGNAL TRANSIENTS
- FREQUENCY RESPONSE SWITCH ON : 40MHz (Typ.)
- QUIESCENT CURRENT SPECIF. UP TO 20V
- 5V, 10V AND 15V PARAMETRIC RATINGS



### ORDER CODES

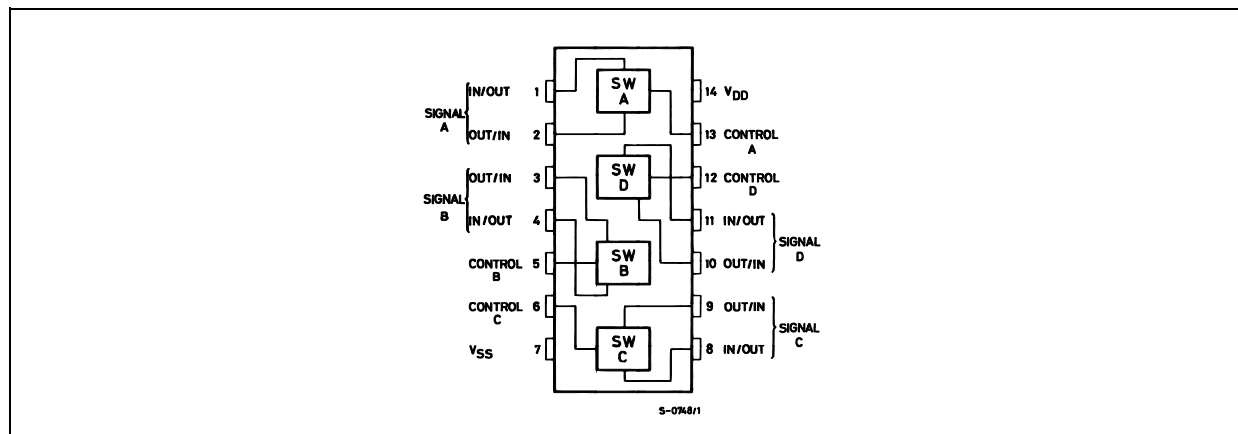
PACKAGE	TUBE	T & R
DIP	HCF4066BEY	
SOP	HCF4066BM1	HCF4066M013TR

- INPUT LEAKAGE CURRENT  
 $I_1 = 100nA$  (MAX) AT  $V_{DD} = 18V$   $T_A = 25^\circ C$
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B " STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"

### DESCRIPTION

The HCF4066B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages. The HCF4066B is a QUAD BILATERAL SWITCH intended for the transmission or multiplexing of analog or digital signals. It is pin for pin compatible with HCF4016B, but exhibits a much lower ON resistance. In addition,

### PIN CONNECTION

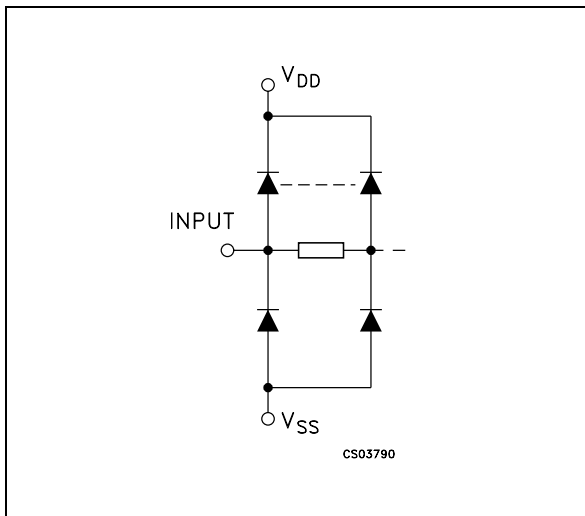


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the ON resistance is relatively constant over the full input signal range. The HCF4066B consists of four independent bilateral switches. A single control signal is required per switch. Both the p and n device in a given switch are biased ON or OFF simultaneously by the control signal. As shown in schematic diagram, the well of the n-channel device on each switch is either tied to the input when the switch is ON or to  $V_{SS}$  when the switch is OFF. This configuration eliminates

the variation of the switch-transistor threshold voltage with input signal, and thus keeps the ON resistance low over the full operating signal range. The advantages over single channel switches include peak input signal voltage swings equal to the full supply voltage, and more constant ON impedance over the input signal range. For sample and hold applications, however, the HCF4016B is recommended.

### INPUT EQUIVALENT CIRCUIT



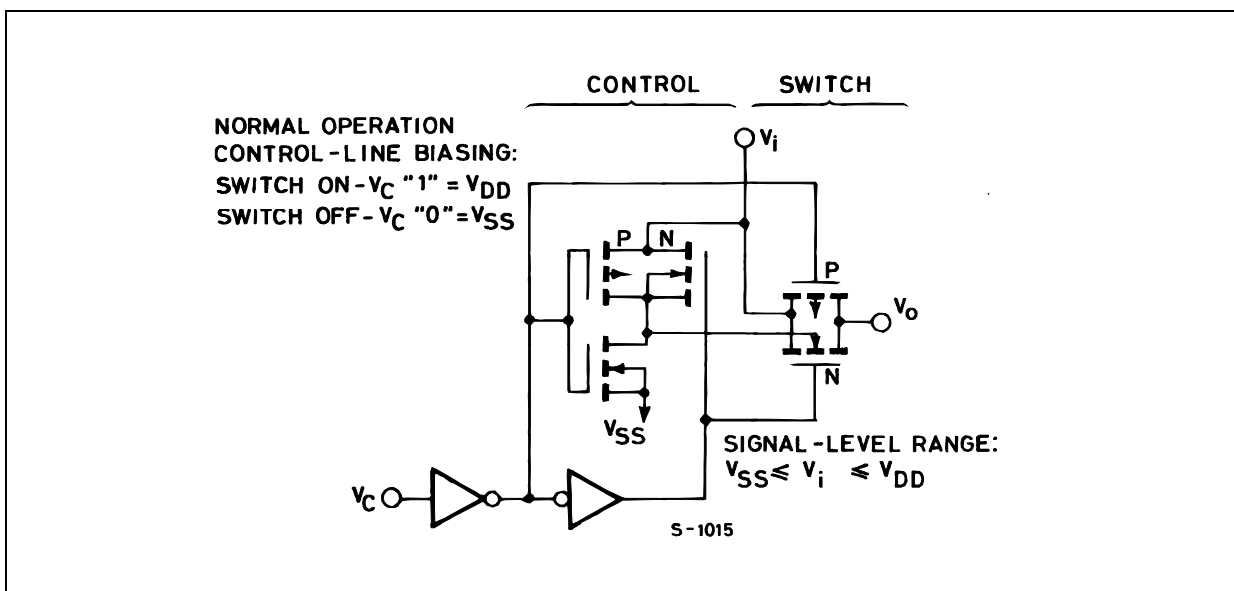
### PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1, 4, 8, 11	A to D I/O	Independent Inputs/Outputs
2, 3, 9, 10	A to D O/I	Independent Outputs/Inputs
13, 5, 6, 12	CONTROL A to D	Enable Inputs
7	$V_{SS}$	Negative Supply Voltage
14	$V_{DD}$	Positive Supply Voltage

### TRUTH TABLE

CONTROL	SWITCH FUNCTION
H	ON
L	OFF

### SCHEMATIC DIAGRAM (1 OF 4 IDENTICAL SWITCHES AND ITS ASSOCIATED CONTROL CIRCUITY)



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{DD}$	Supply Voltage	-0.5 to +22	V
$V_I$	DC Input Voltage	-0.5 to $V_{DD} + 0.5$	V
$I_I$	DC Input Current	$\pm 10$	mA
$P_D$	Power Dissipation per Package	200	mW
	Power Dissipation per Output Transistor	100	mW
$T_{op}$	Operating Temperature	-55 to +125	$^{\circ}\text{C}$
$T_{stg}$	Storage Temperature	-65 to +150	$^{\circ}\text{C}$

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

All voltage values are referred to  $V_{SS}$  pin voltage.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
$V_{DD}$	Supply Voltage	3 to 20	V
$V_I$	Input Voltage	0 to $V_{DD}$	V
$T_{op}$	Operating Temperature	-55 to 125	$^{\circ}\text{C}$

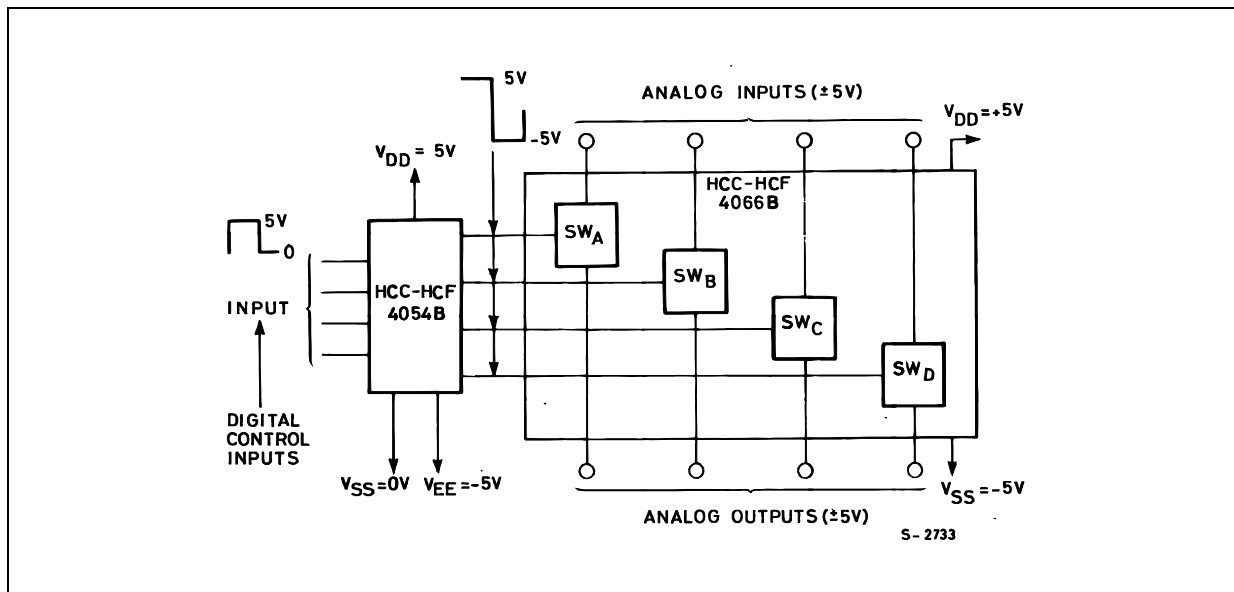
## ELECTRICAL CHARACTERISTICS

( $T_{amb} = 25^{\circ}\text{C}$ , Typical temperature coefficient for all  $V_{DD}$  value is 0.3 %/ $^{\circ}\text{C}$ )

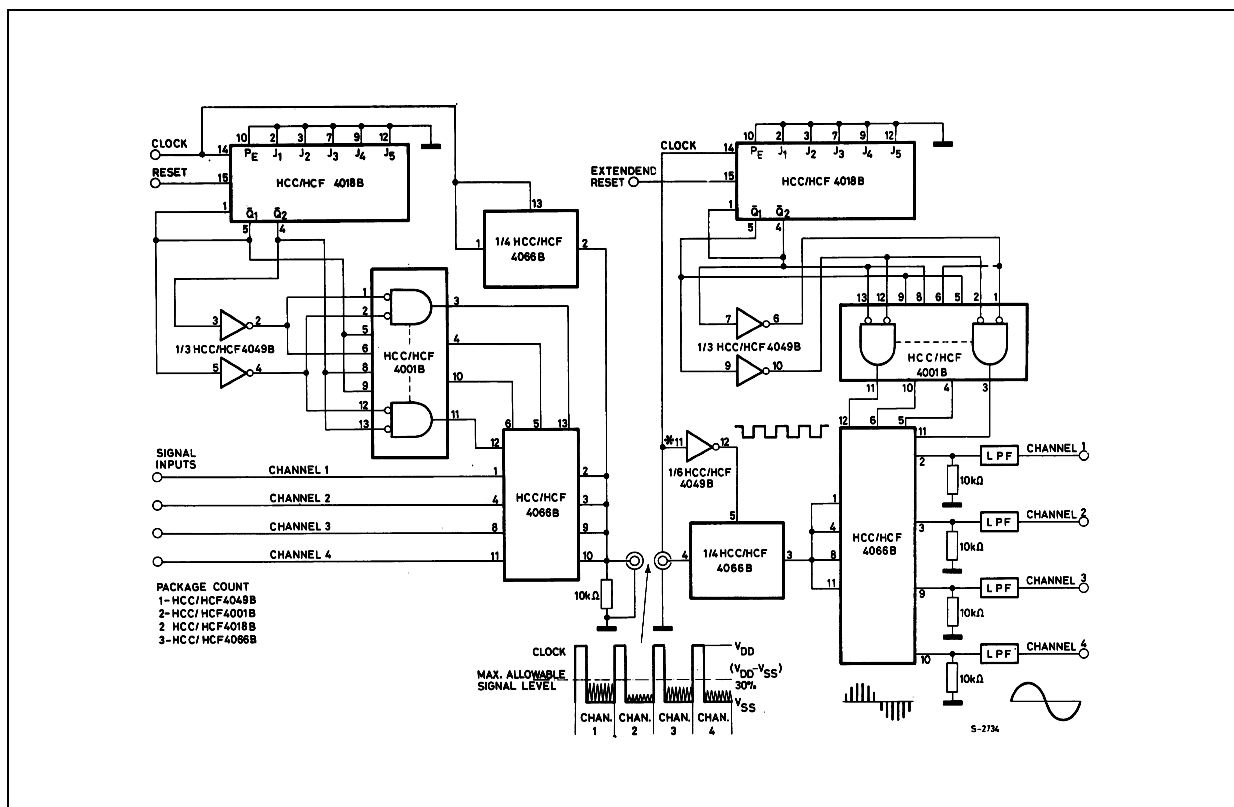
Symbol	Parameter	Test Condition			Value						Unit	
			$V_I$ (V)	$V_{DD}$ (V)	$T_A = 25^{\circ}\text{C}$			$-40$ to $85^{\circ}\text{C}$		$-55$ to $125^{\circ}\text{C}$		
					Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$I_L$	Quiescent Device Current (all switches ON or all switches OFF)		0/5	5		0.01	0.25		7.5		7.5	$\mu\text{A}$
			0/10	10		0.01	0.5		15		15	
			0/15	15		0.01	1		30		30	
			0/20	20		0.02	5		150		150	
<b>SIGNAL INPUTS (<math>V_{IS}</math>) and OUTPUTS (<math>V_{OS}</math>)</b>												
$R_{ON}$	Resistance	$V_C = V_{DD}$ $R_L = 10\text{K}\Omega$ Return to $(V_{DD} - V_{SS})/2$ $V_{IS} = V_{SS}$ to $V_{DD}$	5		470	1050		1200		1200	$\Omega$	
			10		180	400		500		500		
			15		125	240		300		300		
$\Delta_{ON}$	Resistance $\Delta_{RON}$ (between any 2 of 4 switches)	$R_L = 10\text{K}\Omega$ , $V_C = V_{DD}$	5		5						$\Omega$	
			10		10							
			15		15							
TDH	Total Harmonic Distortion	$V_C = V_{DD} = 5\text{V}$ , $V_{SS} = -5\text{V}$ $V_{IS}$ (p-p) = 5V, $R_L = 10\text{K}\Omega$ (sine wave centered in 0V) $f_{IS} = 1\text{KHz}$ sine wave			0.4						%	
	-3dB Cutoff Frequency (Switch on)	$V_C = V_{DD} = 5\text{V}$ , $V_{SS} = -5\text{V}$ $V_{IS}$ (p-p) = 5V, $R_L = 1\text{K}\Omega$ (sine wave centered in 0V)			40						MHz	
	-50dB Feedthrough Frequency (switch off)	$V_C = V_{SS} = -5\text{V}$ $V_{IS}$ (p-p) = 5V, $R_L = 1\text{K}\Omega$ (sine wave centered in 0V)			1						MHz	

Symbol	Parameter	Test Condition			Value						Unit		
			V <sub>I</sub> (V)	V <sub>DD</sub> (V)	T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C			
					Min.	Typ.	Max.	Min.	Max.	Min.		Max.	
	-50dB Crosstalk Frequency	V <sub>C(A)</sub> = V <sub>DD</sub> = +5V V <sub>C(B)</sub> = V <sub>SS</sub> = -5V V <sub>IS(A)</sub> = 5V (p-p) 50Ω source, R <sub>L</sub> = 1KΩ				8						MHz	
t <sub>pd</sub>	Propagation Delay Time (signal input to output)	R <sub>L</sub> = 200KΩ, V <sub>C</sub> = V <sub>DD</sub> V <sub>SS</sub> = GND, C <sub>L</sub> = 50pF V <sub>IS</sub> = 10V square wave centered on 5V t <sub>r</sub> , t <sub>f</sub> = 20ns				20	40					ns	
						10	20						
						7	15						
C <sub>IS</sub>	Input Capacitance	V <sub>C</sub> = V <sub>SS</sub> = -5				8						pF	
C <sub>OS</sub>	Output Capacitance					8							
C <sub>IOS</sub>	Feedthrough					0.5							
	Input/Output Leakage Current Switch OFF	V <sub>C</sub> = 0V V <sub>IS</sub> = 18V, V <sub>OS</sub> = 0V V <sub>IS</sub> = 0V, V <sub>OS</sub> = 18V			18		±10 <sup>-3</sup>	±0.1		±1		±1	μA
<b>CONTROL (V<sub>C</sub>)</b>													
V <sub>ILC</sub>	Control Input Low Voltage	I <sub>IS</sub>   < 10 μA V <sub>IS</sub> = V <sub>SS</sub> , V <sub>OS</sub> = V <sub>DD</sub> and V <sub>IS</sub> = V <sub>DD</sub> , V <sub>OS</sub> = V <sub>SS</sub>			5			1		1		1	V
					10			2		2		2	
					15			2		2		2	
V <sub>IHC</sub>	Control Input High Voltage	V <sub>IS</sub> = V <sub>DD</sub> , V <sub>OS</sub> = V <sub>SS</sub>			5	3.5			3.5		3.5		V
					10	7			7		7		
					15	11			11		11		
I <sub>I</sub>	Input Leakage Current	V <sub>IS</sub> ≤ V <sub>DD</sub> V <sub>DD</sub> - V <sub>SS</sub> = 18V			18		±10 <sup>-5</sup>	±0.1		±1		±1	μA
	Crosstalk (control input to signal output)	V <sub>C</sub> = 10V (sq. wave) t <sub>r</sub> , t <sub>f</sub> = 20ns R <sub>L</sub> = 10KΩ			10		50						mV
	Turn - On Propagation Delay Time	V <sub>IN</sub> = V <sub>DD</sub> , t <sub>r</sub> , t <sub>f</sub> = 20ns C <sub>L</sub> = 50pF, R <sub>L</sub> = 1KΩ			5	35	70						ns
					10	20	40						
					15	15	30						
	Control Input Repetition Rate	V <sub>IS</sub> =V <sub>DD</sub> , V <sub>SS</sub> =GND R <sub>L</sub> = 1KΩ to GND C <sub>L</sub> = 50pF, V <sub>C</sub> = 10V sq. wave center on 5V t <sub>r</sub> , t <sub>f</sub> = 20ns V <sub>OS</sub> =1/2V <sub>OS</sub> at 1KHz			5	6							MHz
					10	9							
					15	9.5							
C <sub>I</sub>	Input Capacitance	Any Input					5	7.5					pF

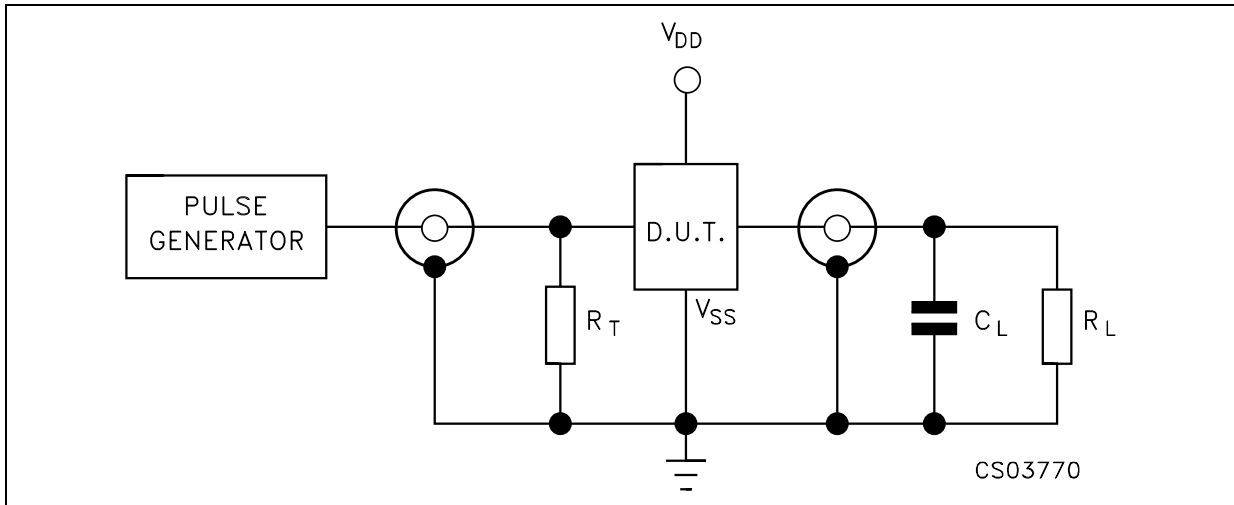
**TYPICAL APPLICATIONS (BIDIRECTIONAL SIGNAL TRANSMISSION VIA DIGITAL CONTROL LOGIC)**



**TYPICAL APPLICATIONS (4-CHANNEL PAM MULTIPLEXER SYSTEM DIAGRAM)**

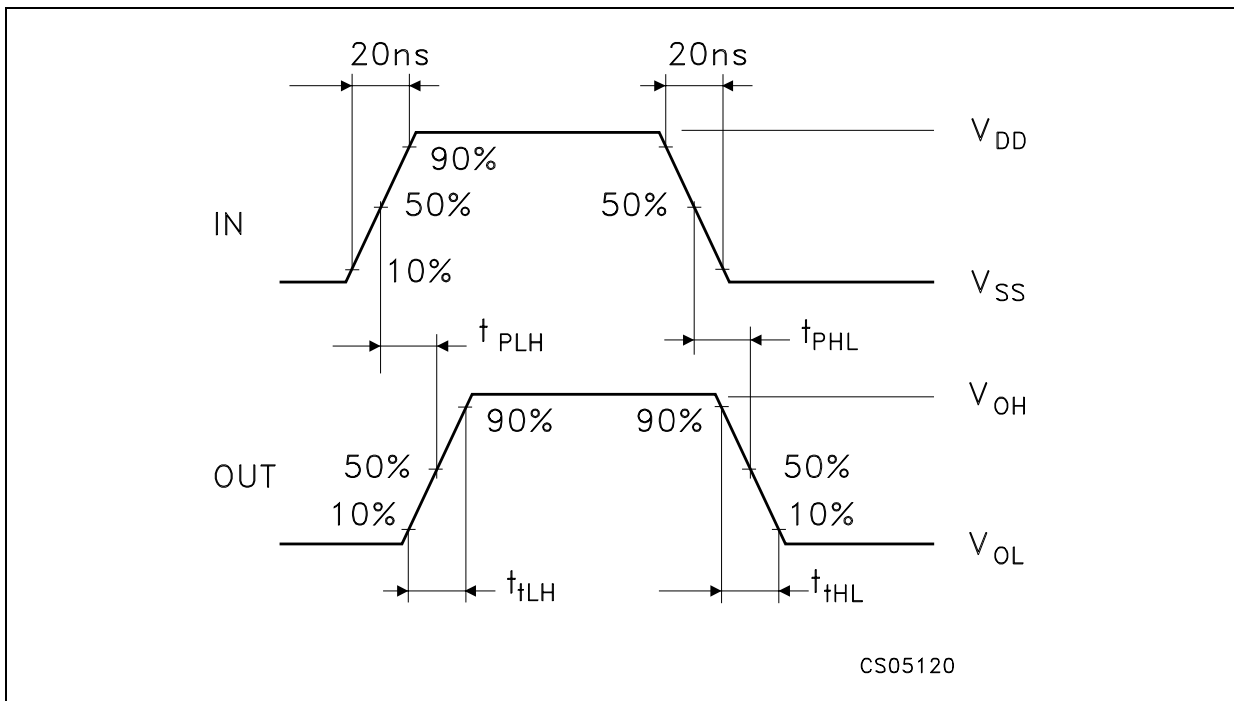


TEST CIRCUIT



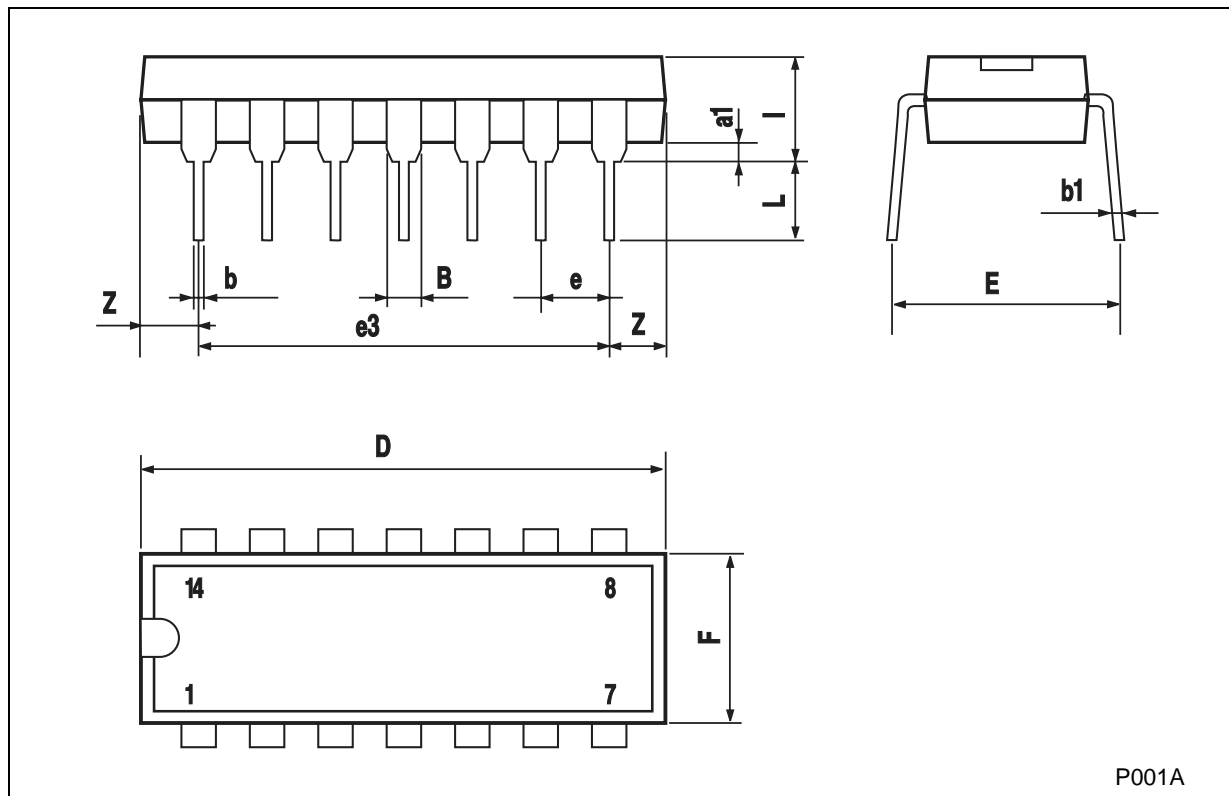
$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = 200\text{k}\Omega$   
 $R_T = Z_{\text{OUT}}$  of pulse generator (typically  $50\Omega$ )

WAVEFORM : PROPAGATION DELAY TIMES ( $f=1\text{MHz}$ ; 50% duty cycle)



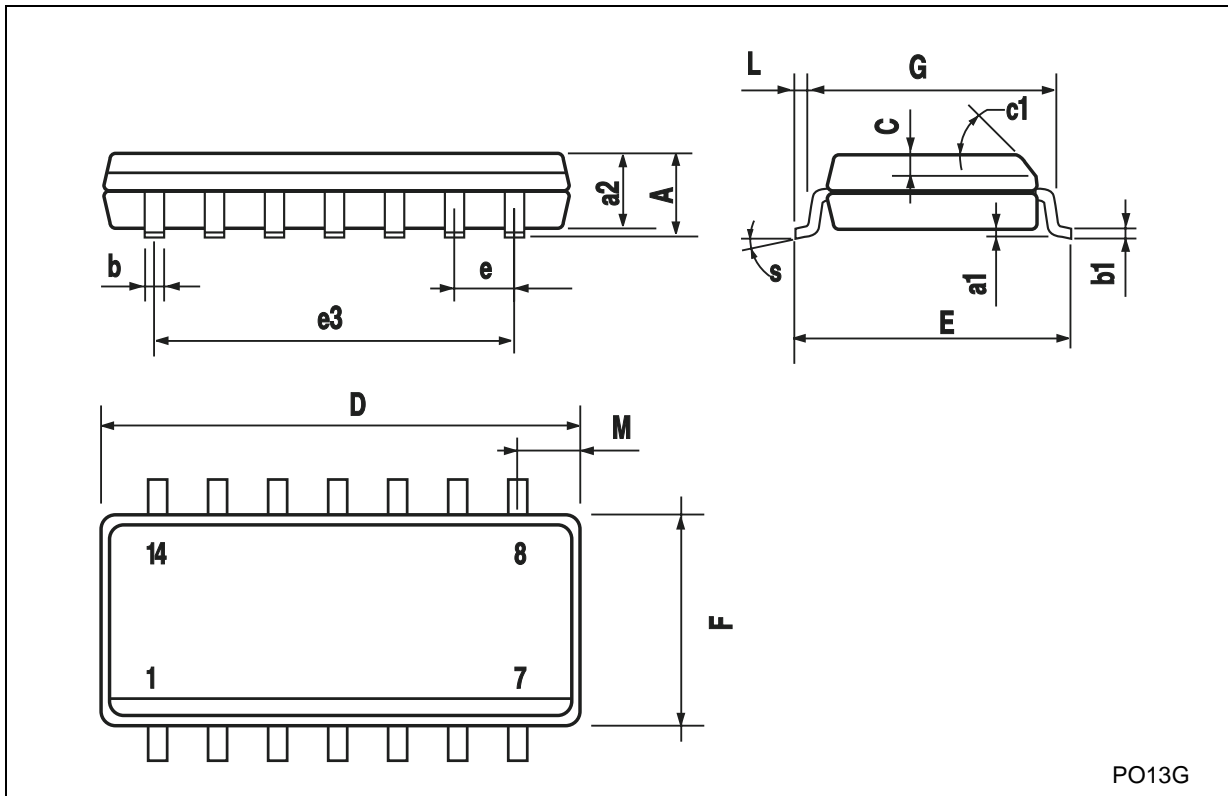
### Plastic DIP-14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100



**SO-14 MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.68			0.026
S	8° (max.)					



PO13G



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