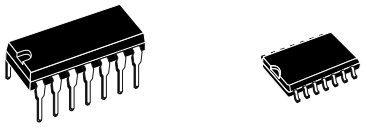
# HCF4066B

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

- 15V DIGITAL OR ± 7.5V PEAK TO PEAK SWITCHING
- 125Ω TYPICAL ON RESISTANCE FOR 15V OPERATION
- SWITCH ON RESISTANCE MATCHED TO WITHIN 5Ω 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, $R_L$ = 10KΩ
- HIGH DEGREE OF LINEARITY: < 0.5% DISTORTION TYP. at $f_{IS}$ = 1KHz, $V_{IS}$ = 5 $V_{pp}$, $V_{DD}$ - $V_{SS}$ ≥ 10V, RL = 10KΩ
- 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°C
- EXTREMELY HIGH CONTROL INPUT IMPEDANCE (control circuit isolated from signal circuit $10^{12}$Ω typ.)
- LOW CROSSTALK BETWEEN SWITCHES: 50dB Typ. at $f_{IS}$ = 0.9MHz, $R_L$ = 1KΩ
- 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



DIP SOP

### ORDER CODES

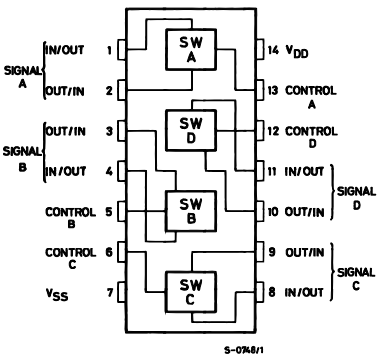
| PACKAGE | TUBE | T & R |
|---|---|---|
| DIP | HCF4066BEY | |
| SOP | HCF4066BM1 | HCF4066M013TR |

- INPUT LEAKAGE CURRENT $I_I$ = 100nA (MAX) AT $V_{DD}$ = 18V $T_A$ = 25°C
- 100% TESTED FOR QUIESCENT CURRENT

### DESCRIPTION

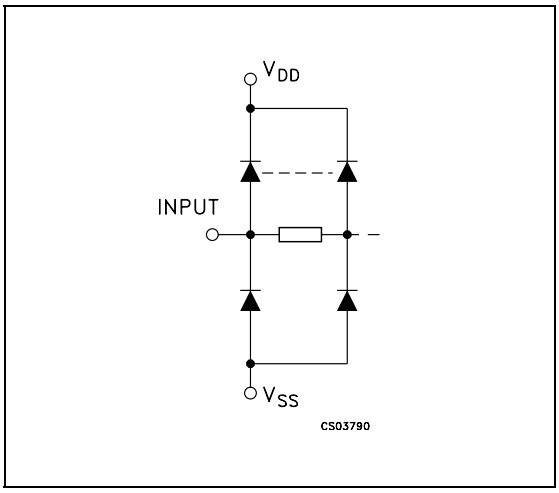
The HCF4066B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages.
The HCF4066B is a QUAD BILATERAL SWITCH intended for the transmission or multiplexing of analog or digital signals.
It is pin for pin compatible with HCF4016B, but exhibits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

### PIN CONNECTION



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**



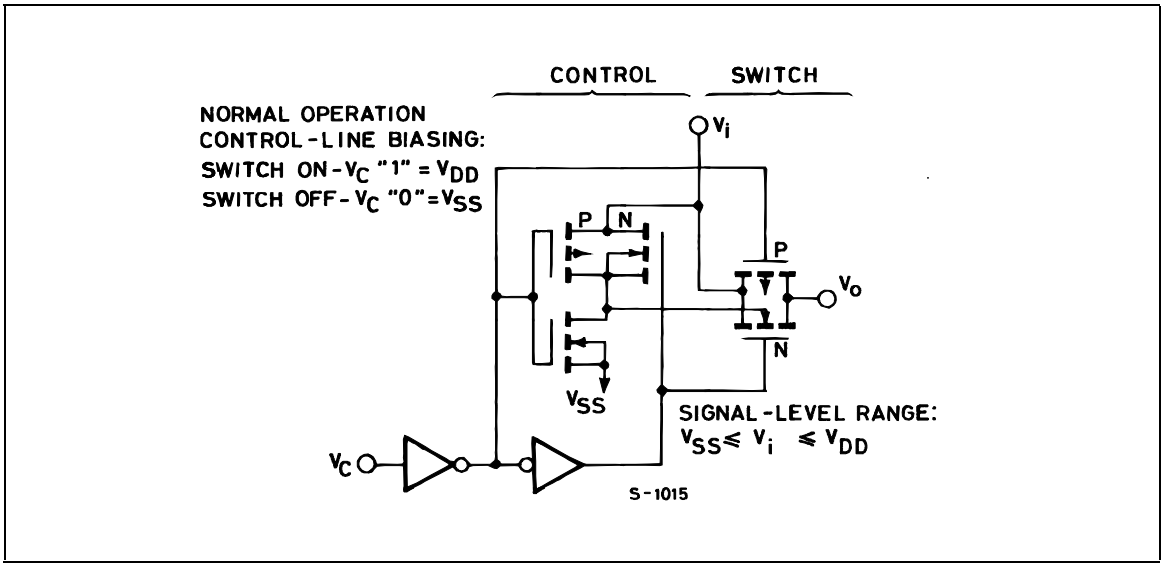

**PIN DESCRIPTION**

| PIN N° | 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 | ± 10 | mA |
| $P_D$ | Power Dissipation per Package | 200 | mW |
| | Power Dissipation per Output Transistor | 100 | mW |
| $T_{op}$ | Operating Temperature | -55 to +125 | °C |
| $T_{stg}$ | Storage Temperature | -65 to +150 | °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 | °C |

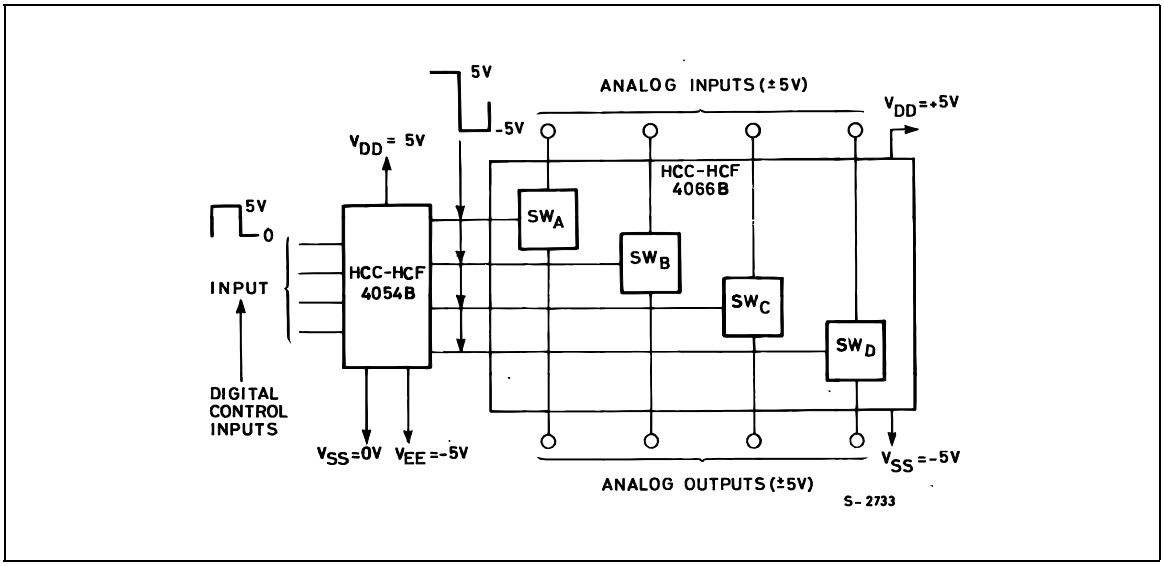
## ELECTRICAL CHARACTERISTICS

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

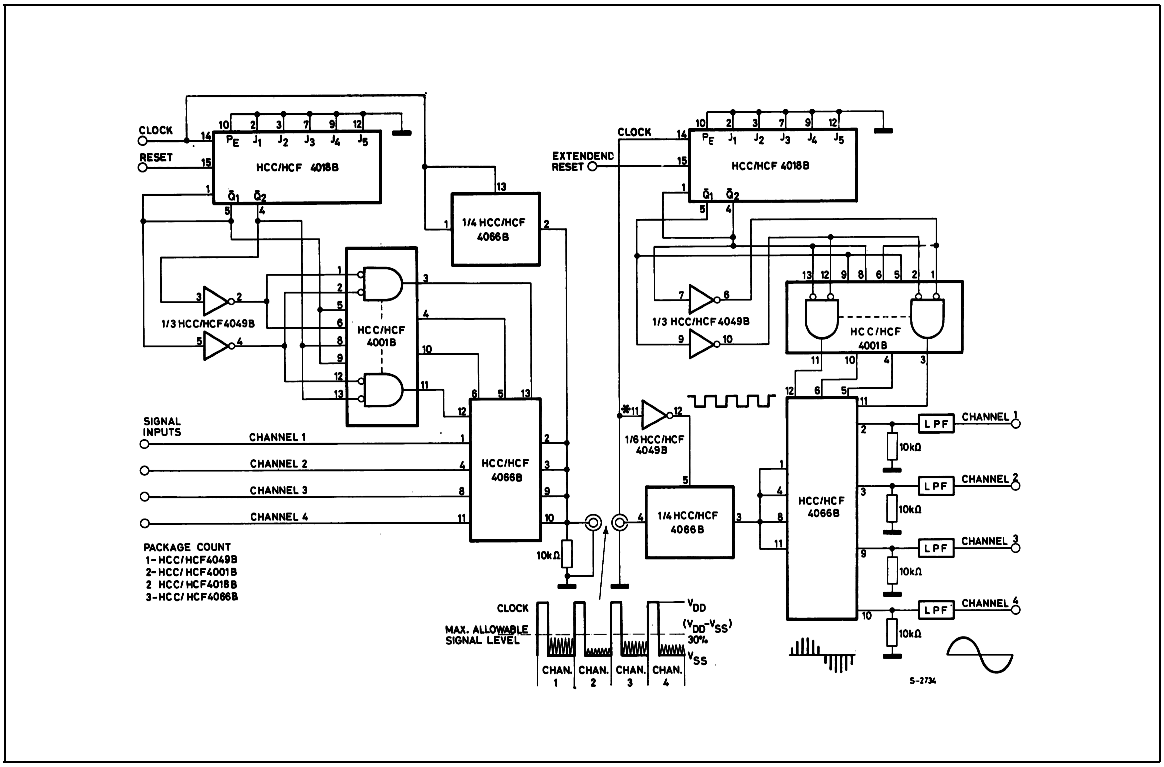
| Symbol | Parameter | Test Condition | $V_I$ (V) | $V_{DD}$ (V) | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $T_A$ = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| $I_L$ | Quiescent Device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

| Symbol | Parameter | Test Condition | $V_I$ (V) | $V_{DD}$ (V) | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $T_A$ = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| | -50dB Crosstalk Frequency | $V_{C(A)} = V_{DD} = +5V$<br>$V_{C(B)} = V_{SS} = -5V$<br>$V_{IS(A)} = 5V$ (p-p)<br>50Ω source, $R_L = 1K\Omega$ | | | | 8 | | | | | | MHz |
| $t_{pd}$ | Propagation Delay Time (signal input to output) | $R_L = 200K\Omega$, $V_C = V_{DD}$<br>$V_{SS}$ = GND, $C_L$ = 50pF<br>$V_{IS}$= 10V<br>square wave centered on 5V<br>$t_r$, $t_f$ = 20ns | | | | 20 | 40 | | | | | ns |
| | | | | | | 10 | 20 | | | | | |
| | | | | | | 7 | 15 | | | | | |
| $C_{IS}$ | Input Capacitance | $V_C = V_{SS} = -5$ | | +5 | | 8 | | | | | | pF |
| $C_{OS}$ | Output Capacitance | | | | | 8 | | | | | | |
| $C_{IOS}$ | Feedthrough | | | | | 0.5 | | | | | | |
| | Input/Output Leakage Current Switch OFF | $V_C$ = 0V<br>$V_{IS}$ = 18V, $V_{OS}$ = 0V<br>$V_{IS}$ = 0V, $V_{OS}$ = 18V | | 18 | | $\pm 10^{-3}$ | ±0.1 | | ±1 | | ±1 | µA |
| **CONTROL ($V_C$)** | | | | | | | | | | | | |
| $V_{ILC}$ | Control Input Low Voltage | $\lvert I_{IS} \rvert < 10\ \mu A$<br>$V_{IS} = V_{SS}$, $V_{OS} = V_{DD}$<br>and<br>$V_{IS} = V_{DD}$, $V_{OS} = V_{SS}$ | | 5 | | | 1 | | 1 | | 1 | V |
| | | | | 10 | | | 2 | | 2 | | 2 | |
| | | | | 15 | | | 2 | | 2 | | 2 | |
| $V_{IHC}$ | Control Input High Voltage | | | 5 | 3.5 | | | 3.5 | | 3.5 | | V |
| | | | | 10 | 7 | | | 7 | | 7 | | |
| | | | | 15 | 11 | | | 11 | | 11 | | |
| $I_I$ | Input Leakage Current | $V_{IS} \le V_{DD}$<br>$V_{DD} - V_{SS}$ = 18V | | 18 | | $\pm 10^{-5}$ | ±0.1 | | ±1 | | ±1 | µA |
| | Crosstalk (control input to signal output) | $V_C$ = 10V (sq. wave)<br>$t_r$, $t_f$ = 20ns<br>$R_L = 10K\Omega$ | | 10 | | 50 | | | | | | mV |
| | Turn - On Propagation Delay Time | $V_{IN} = V_{DD}$, $t_r$, $t_f$ = 20ns<br>$C_L$ = 50pF, $R_L = 1K\Omega$ | | 5 | | 35 | 70 | | | | | ns |
| | | | | 10 | | 20 | 40 | | | | | |
| | | | | 15 | | 15 | 30 | | | | | |
| | Control Input Repetition Rate | $V_{IS}=V_{DD}$, $V_{SS}$=GND<br>$R_L = 1K\Omega$ to GND<br>$C_L$ = 50pF, $V_C$ = 10V<br>sq. wave center on 5V<br>$t_r$, $t_f$ = 20ns<br>$V_{OS}=1/2V_{OS}$ at 1KHz | | 5 | | 6 | | | | | | MHz |
| | | | | 10 | | 9 | | | | | | |
| | | | | 15 | | 9.5 | | | | | | |
| $C_I$ | Input Capacitance | Any Input | | | | 5 | 7.5 | | | | | pF |

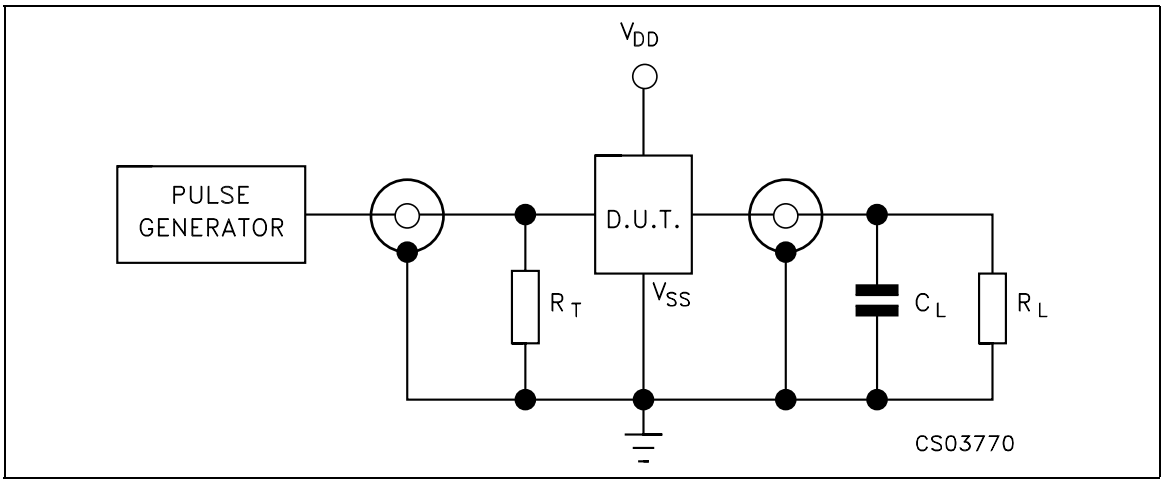
**TYPICAL APPLICATIONS** (BIDIRECTIONAL SIGNAL TRANSMISSION VIA DIGITAL CONTROL LOGIC)




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

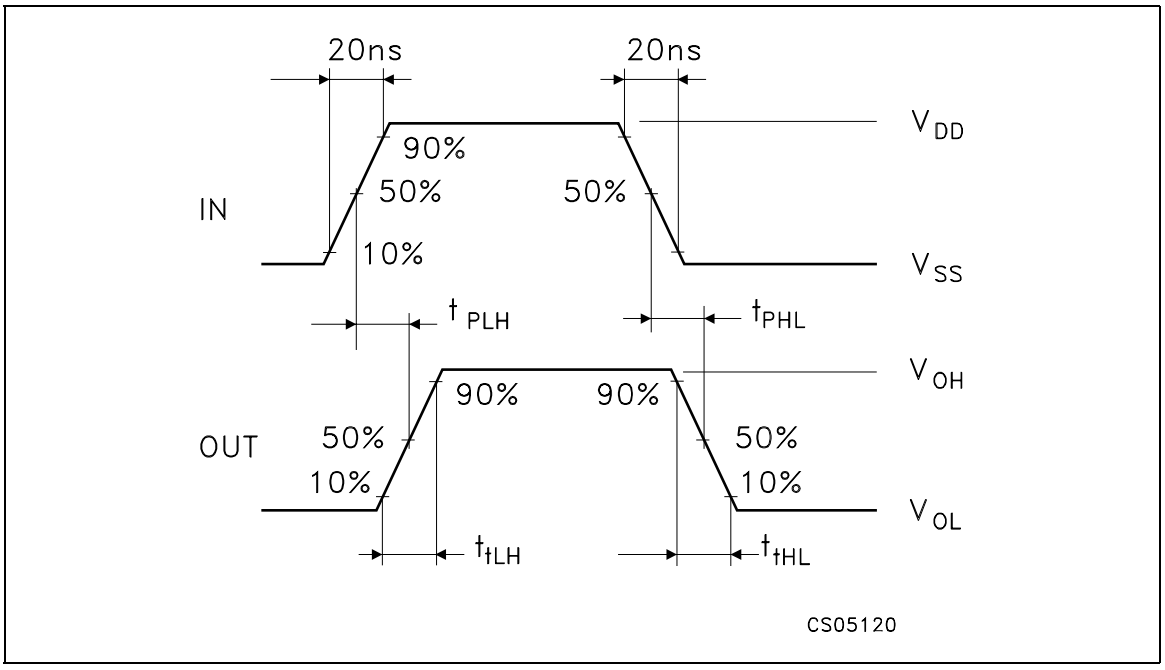


## TEST CIRCUIT



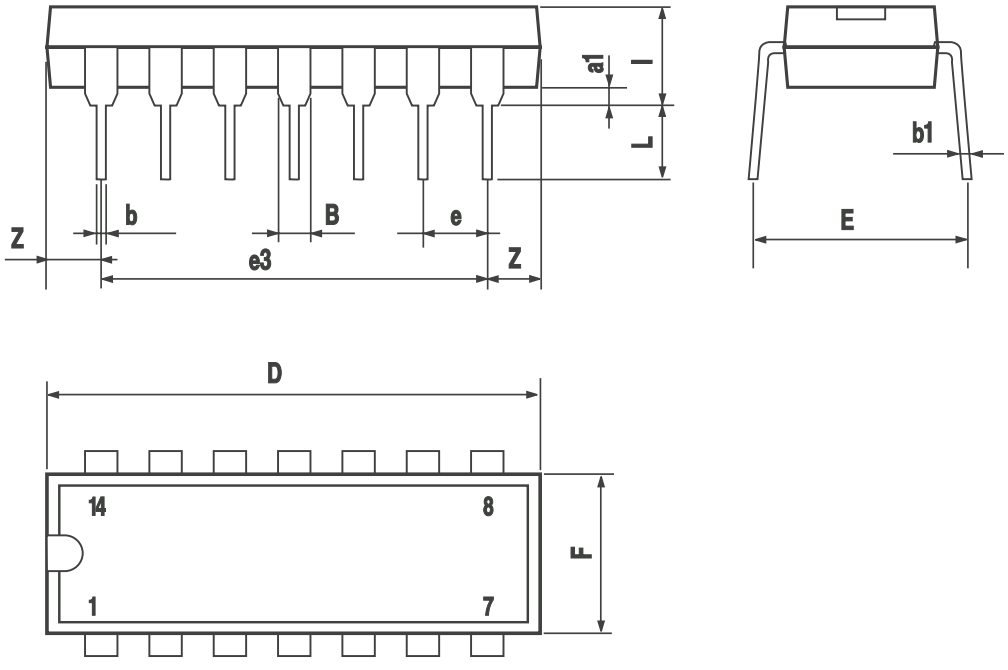

$C_L$ = 50pF or equivalent (includes jig and probe capacitance)
$R_L$ = 200KΩ
$R_T$ = $Z_{OUT}$ of pulse generator (typically 50Ω)

**WAVEFORM: PROPAGATION DELAY TIMES** (f=1MHz; 50% duty cycle)



## Plastic DIP-14 MECHANICAL DATA

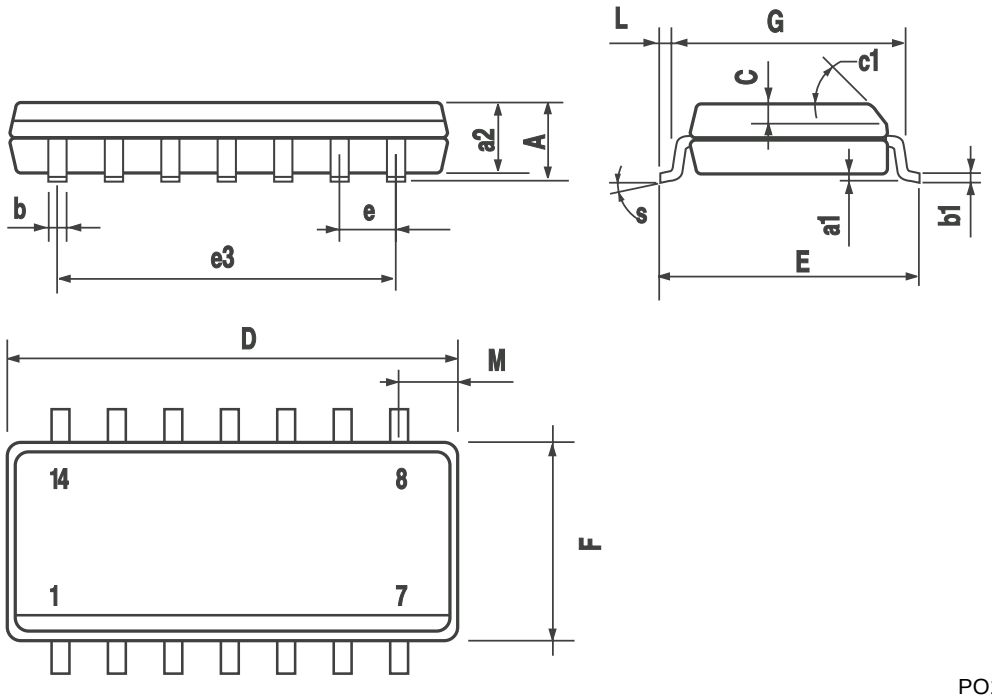
| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 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 |




P001A

## SO-14 MECHANICAL DATA

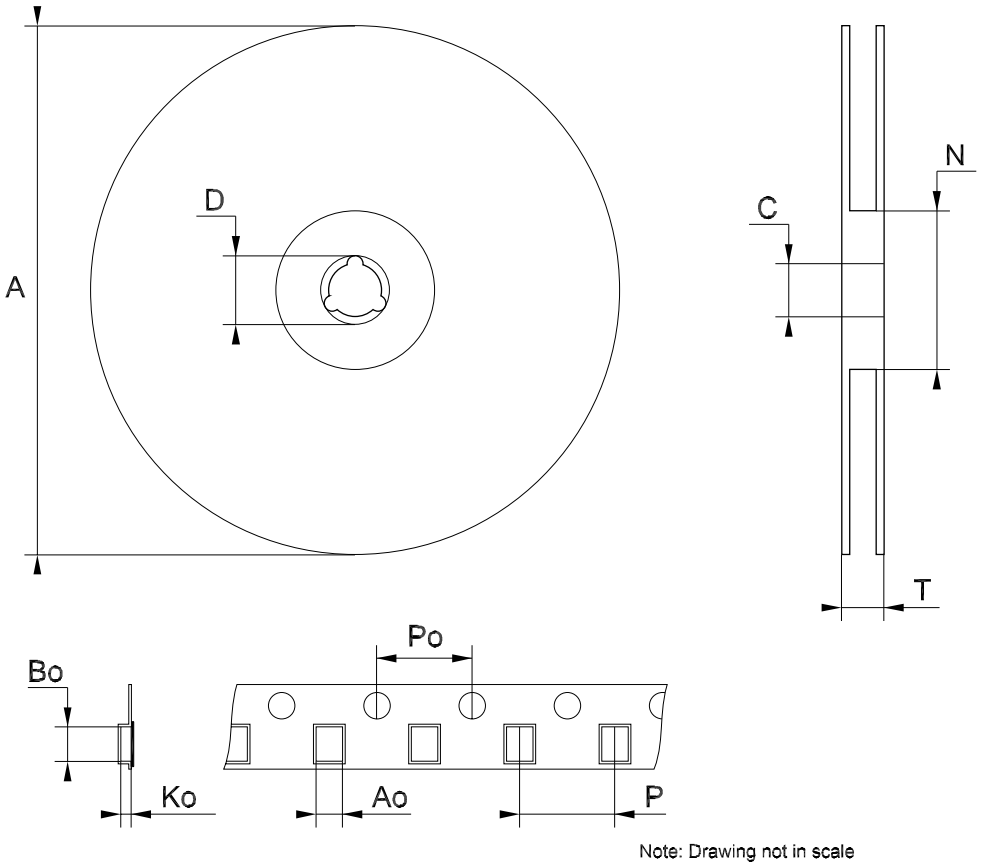
| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.003 | | 0.007 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 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

## Tape & Reel SO-14 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 330 | | | 12.992 |
| C | 12.8 | | 13.2 | 0.504 | | 0.519 |
| D | 20.2 | | | 0.795 | | |
| N | 60 | | | 2.362 | | |
| T | | | 22.4 | | | 0.882 |
| Ao | 6.4 | | 6.6 | 0.252 | | 0.260 |
| Bo | 9 | | 9.2 | 0.354 | | 0.362 |
| Ko | 2.1 | | 2.3 | 0.082 | | 0.090 |
| Po | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 7.9 | | 8.1 | 0.311 | | 0.319 |




Note: Drawing not in scale