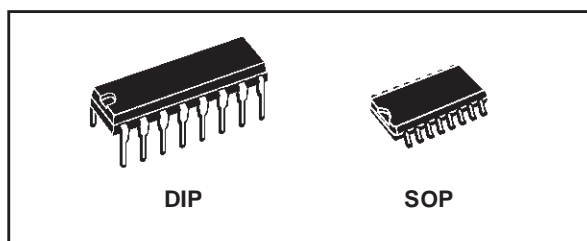




HCF4060B

14-STAGE RIPPLE CARRY BINARY COUNTER/DIVIDER AND OSCILLATOR

- MEDIUM-SPEED OPERATION
- COMMON RESET
- FULLY STATIC OPERATION
- BUFFERED INPUTS AND OUTPUTS
- QUIESCENT CURRENT SPECIFIED UP TO 20V
- 5V, 10V AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT
 $I_l = 100\text{nA (MAX) AT } V_{DD} = 18\text{V } T_A = 25^\circ\text{C}$
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"



ORDER CODES

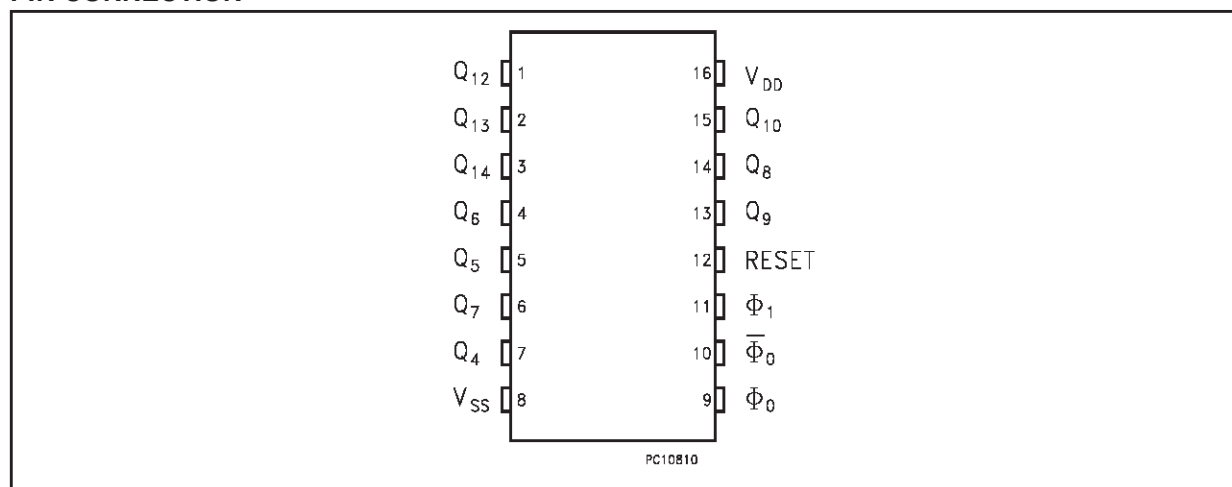
| PACKAGE | TUBE | T & R |
|---------|------------|---------------|
| DIP | HCF4060BEY | |
| SOP | HCF4060BM1 | HCF4002M013TR |

DESCRIPTION

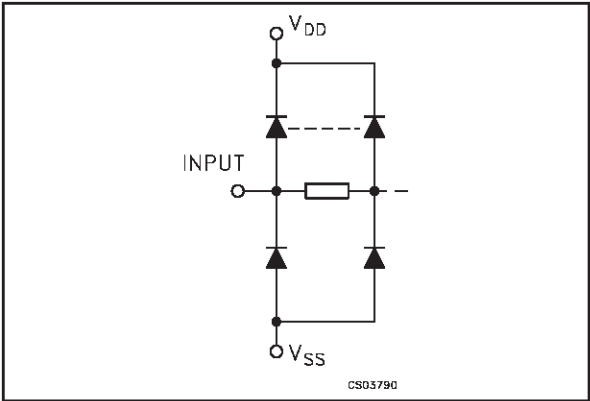
The HCF4060B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages. The HCF4060B consist of an oscillator section and 14 ripple carry binary counter stages. The oscillator configuration allows design of either RC or crystal oscillator circuits. A RESET input is provided which reset the counter to the all 0's

state and disable oscillator. A high level on the RESET line accomplishes the reset function. All counter stages are master slave flip-flops. The state of the counter is advanced one step in binary order on the negative transition of ϕ_1 (and ϕ_0). All inputs and outputs are fully buffered. Schmitt trigger action on the clock pin permits unlimited clock rise and fall time.

PIN CONNECTION



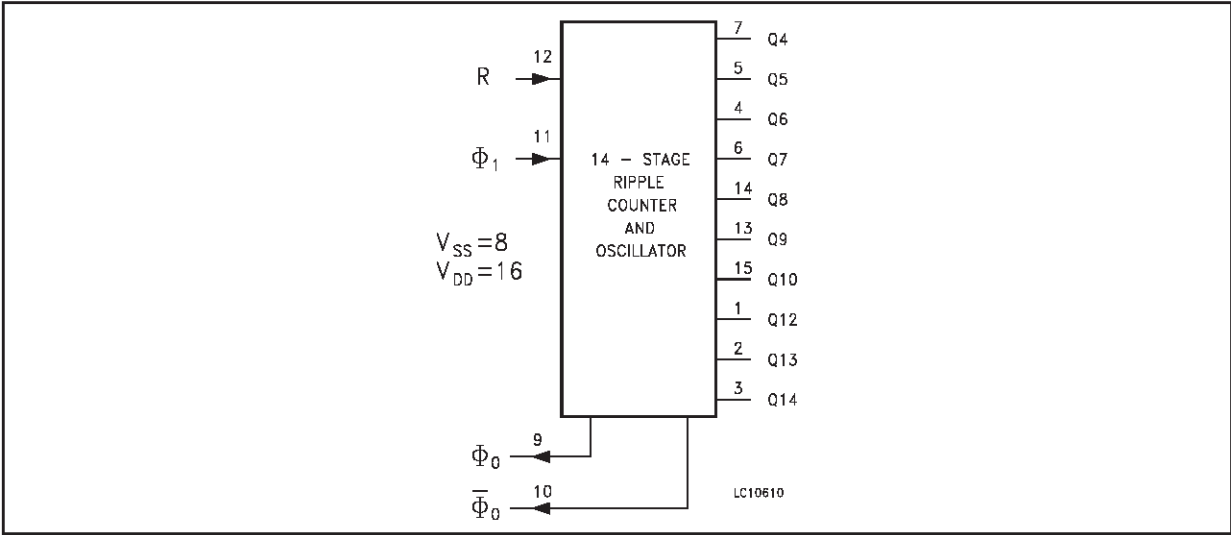
INPUT EQUIVALENT CIRCUIT



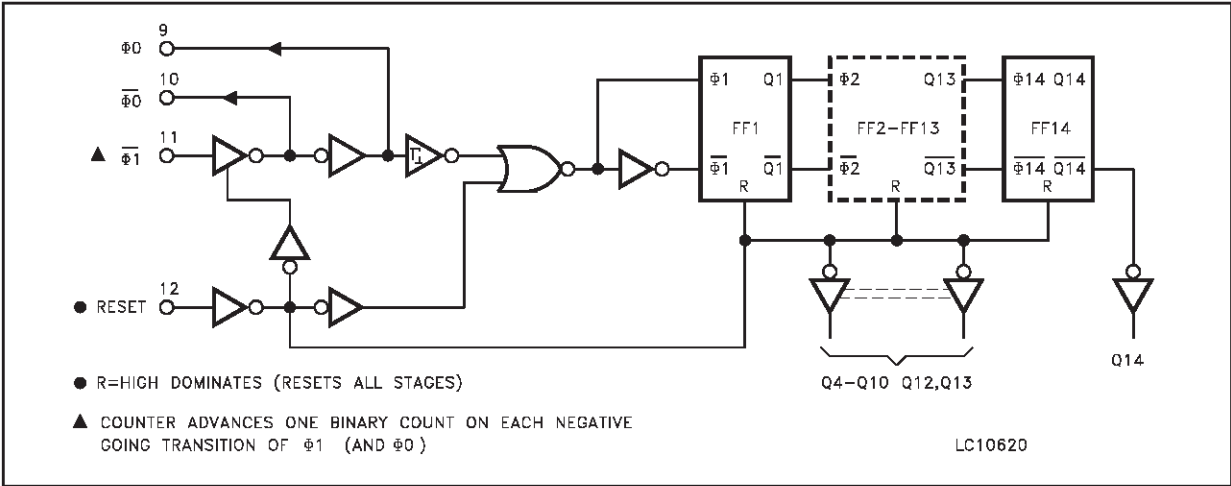
PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|---------------------------------|----------------------------------------------------------------|-------------------------|
| 1, 2, 3, 4, 5, 6, 7, 13, 14, 15 | $Q_{12}, Q_{13}, Q_{14}, Q_6, Q_5, Q_7, Q_4, Q_9, Q_8, Q_{10}$ | Outputs |
| 9, 10, 11 | $\Phi_0, \overline{\Phi}_0, \Phi_1$ | Oscillator Input |
| 12 | RESET | Reset |
| 8 | V_{SS} | Negative Supply Voltage |
| 16 | V_{DD} | Positive Supply Voltage |

FUNCTIONAL DIAGRAM



LOGIC DIAGRAM



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 |

DC SPECIFICATIONS

| Symbol | Parameter | Test Condition | | | | Value | | | | | | | Unit |
|-----------------|---------------------------|-----------------------|-----------------------|--------------------------|------------------------|-----------------------|-------------------|------|-------------|------|--------------|------|------|
| | | V _I (V) | V _O (V) | I _O (μA) | V _{DD} (V) | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| I _L | Quiescent Current | 0/5 | | | 5 | | 0.04 | 5 | | 5 | | 150 | μA |
| | | 0/10 | | | 10 | | 0.04 | 10 | | 10 | | 300 | |
| | | 0/15 | | | 15 | | 0.04 | 20 | | 20 | | 600 | |
| | | 0/20 | | | 20 | | 0.08 | 100 | | 100 | | 3000 | |
| V _{OH} | High Level Output Voltage | 0/5 | | <1 | 5 | 4.95 | | | 4.95 | | 4.95 | | V |
| | | 0/10 | | <1 | 10 | 9.95 | | | 9.95 | | 9.95 | | |
| | | 0/15 | | <1 | 15 | 14.95 | | | 14.95 | | 14.95 | | |
| V _{OL} | Low Level Output Voltage | 5/0 | | <1 | 5 | | 0.05 | | | 0.05 | | 0.05 | V |
| | | 10/0 | | <1 | 10 | | 0.05 | | | 0.05 | | 0.05 | |
| | | 15/0 | | <1 | 15 | | 0.05 | | | 0.05 | | 0.05 | |
| V _{IH} | High Level Input Voltage | | 0.5/4.5 | <1 | 5 | 3.5 | | | 3.5 | | 3.5 | | V |
| | | | 1/9 | <1 | 10 | 7 | | | 7 | | 7 | | |
| | | | 1.5/13.5 | <1 | 15 | 11 | | | 11 | | 11 | | |
| V _{IL} | Low Level Input Voltage | | 4.5/0.5 | <1 | 5 | | | 1.5 | | 1.5 | | 1.5 | V |
| | | | 9/1 | <1 | 10 | | | 3 | | 3 | | 3 | |
| | | | 13.5/1.5 | <1 | 15 | | | 4 | | 4 | | 4 | |
| I _{OH} | Output Drive Current | 0/5 | 2.5 | <1 | 5 | -1.36 | -3.2 | | -1.15 | | -1.1 | | mA |
| | | 0/5 | 4.6 | <1 | 5 | -0.44 | -1 | | -0.36 | | -0.36 | | |
| | | 0/10 | 9.5 | <1 | 10 | -1.1 | -2.6 | | -0.9 | | -0.9 | | |
| | | 0/15 | 13.5 | <1 | 15 | -3.0 | -6.8 | | -2.4 | | -2.4 | | |
| I _{OL} | Output Sink Current | 0/5 | 0.4 | <1 | 5 | 0.44 | 1 | | 0.36 | | 0.36 | | mA |
| | | 0/10 | 0.5 | <1 | 10 | 1.1 | 2.6 | | 0.9 | | 0.9 | | |
| | | 0/15 | 1.5 | <1 | 15 | 3.0 | 6.8 | | 2.4 | | 2.4 | | |
| I _I | Input Leakage Current | 0/18 | Any Input | | 18 | | ±10 ⁻⁵ | ±0.3 | | ±0.3 | | ±1 | μA |
| C _I | Input Capacitance | | Any Input | | | | 5 | 7.5 | | | | | pF |

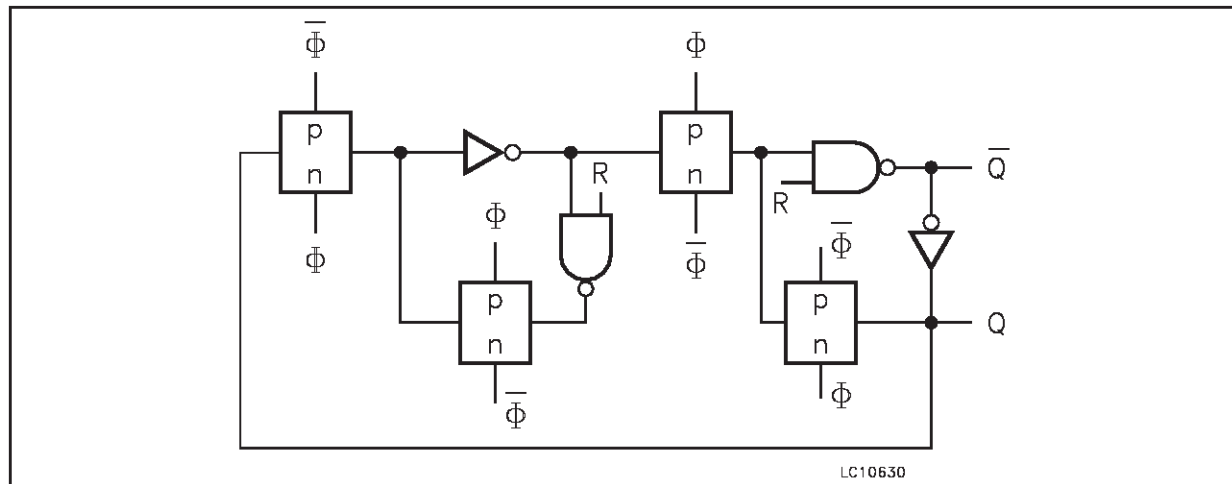
The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD}=5V, 2V min. with V_{DD}=10V, 2.5V min. with V_{DD}=15V

DYNAMIC ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}\text{C}$, $C_L = 50\text{pF}$, $R_L = 200\text{K}\Omega$, $t_r = t_f = 20\text{ ns}$)

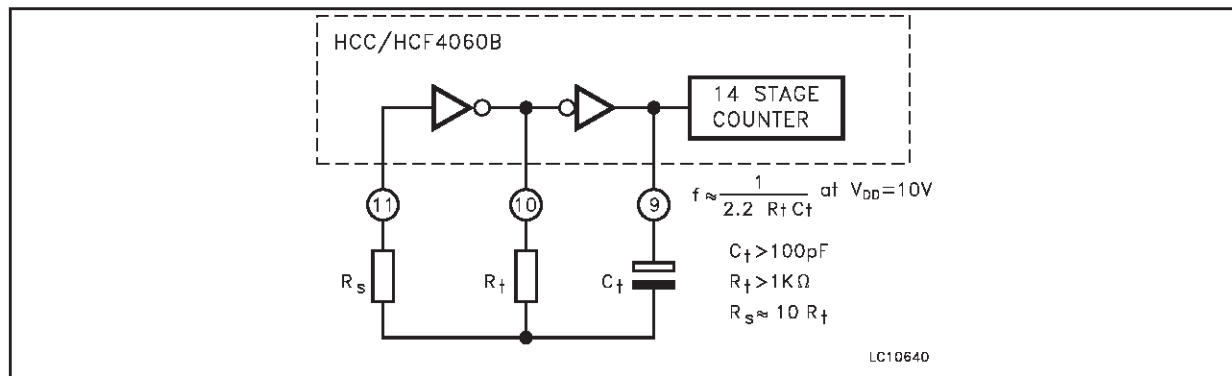
| Symbol | Parameter | Test Condition | | Value (*) | | | Unit |
|-----------------------------------|--------------------------------------------------------------|---------------------|--------------------------------|-----------|------|------|------|
| | | V _{DD} (V) | | Min. | Typ. | Max. | |
| t _{TLH} t _{THL} | Output Transition Time | 5 | | | 100 | 200 | ns |
| | | 10 | | | 50 | 100 | |
| | | 15 | | | 40 | 80 | |
| t _{PLH} t _{PHL} | Propagation Delay Time (ϕ to Q ₄ out) | 5 | | | 370 | 740 | ns |
| | | 10 | | | 150 | 300 | |
| | | 15 | | | 100 | 200 | |
| t _{PLH} t _{PHL} | Propagation Delay Time (Q _n to Q _{n+1}) | 5 | | | 100 | 200 | ns |
| | | 10 | | | 50 | 100 | |
| | | 15 | | | 40 | 80 | |
| t _W | Input Pulse Width | 5 | f = 100 KHz | | 50 | 100 | ns |
| | | 10 | | | 20 | 40 | |
| | | 15 | | | 15 | 30 | |
| t _r t _f | Input Pulse Rise and Fall Time | 5 | | Unlimited | | | μs |
| | | 10 | | | | | |
| | | 15 | | | | | |
| f _{max} | Maximum Clock Input Frequency | 5 | | 3.5 | 7 | | MHz |
| | | 10 | | 8 | 16 | | |
| | | 15 | | 12 | 24 | | |
| RESET OPERATION | | | | | | | |
| t _{PHL} | Propagation Delay Time | 5 | | | 180 | 360 | ns |
| | | 10 | | | 80 | 160 | |
| | | 15 | | | 50 | 100 | |
| t _W | Input Pulse Width | 5 | | | 60 | 120 | ns |
| | | 10 | | | 30 | 60 | |
| | | 15 | | | 20 | 40 | |
| RC OPERATION | | | | | | | |
| | Variation of Frequency (Unit-to-Unit) | 5 | Cx= 200pF, Rs= 560KΩ, Rx= 50KΩ | 18 | 21.5 | 25 | KHz |
| | | 10 | | 20 | 23 | 26 | |
| | | 15 | | 21.1 | 24 | 27 | |
| | Variation of Frequency With Voltage Change (Same Unit) | 5 to 10 | Cx= 200pF, Rs= 560KΩ, Rx= 50KΩ | | | 2 | KHz |
| | | 10 to 15 | | | | 1 | |
| R _X | | 5 | Cx= 10μF | | | 20 | MΩ |
| | | 10 | Cx= 50μF | | | 20 | |
| | | 15 | Cx= 10μF | | | 10 | |
| C _X | | 5 | Rx= 500KΩ | | | 1000 | mF |
| | | 10 | Rx= 300KΩ | | | 50 | |
| | | 15 | Rx= 300KΩ | | | 50 | |
| | Maximum Oscillator Frequency (**) | 10 | Rx= 5KΩ, Cx= 15pF | 530 | 650 | 810 | pF |
| | | 15 | | 690 | 800 | 940 | |

(*) Typical temperature coefficient for all V_{DD} values is 0.3 %/ $^{\circ}\text{C}$, all input rise and fall times = 20 ns.(**) RC Oscillator applications are not recommended at supply voltages below 7V for $R_x = 50\text{K}\Omega$

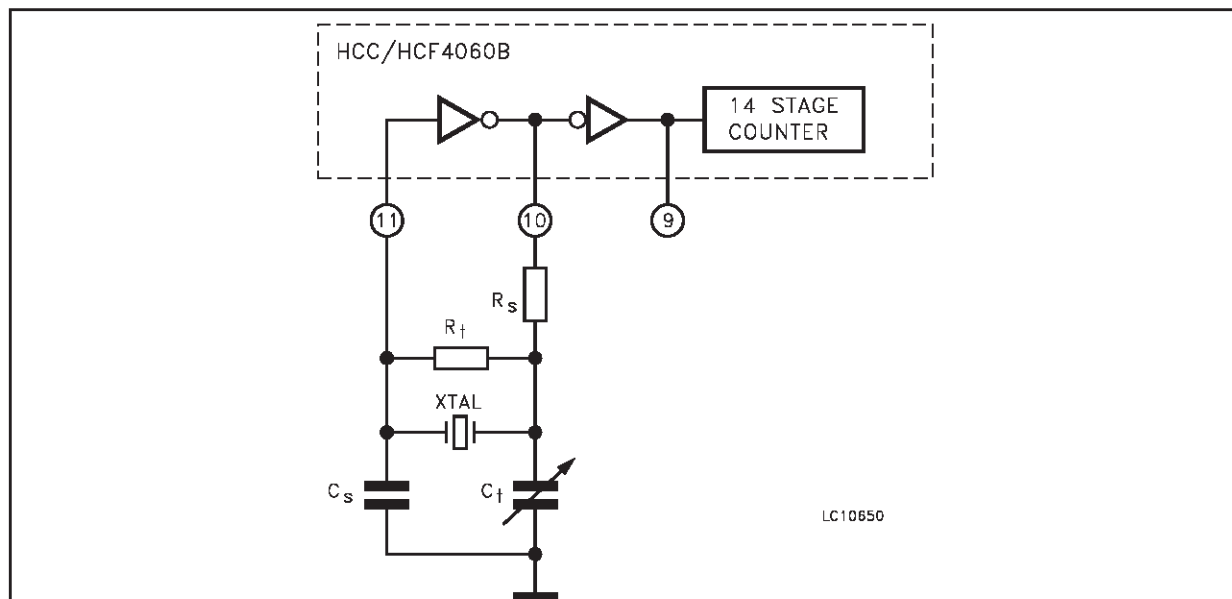
DETAIL OF TYPICAL FLIP-FLOP STAGE



TYPICAL RC OSCILLATOR CIRCUIT

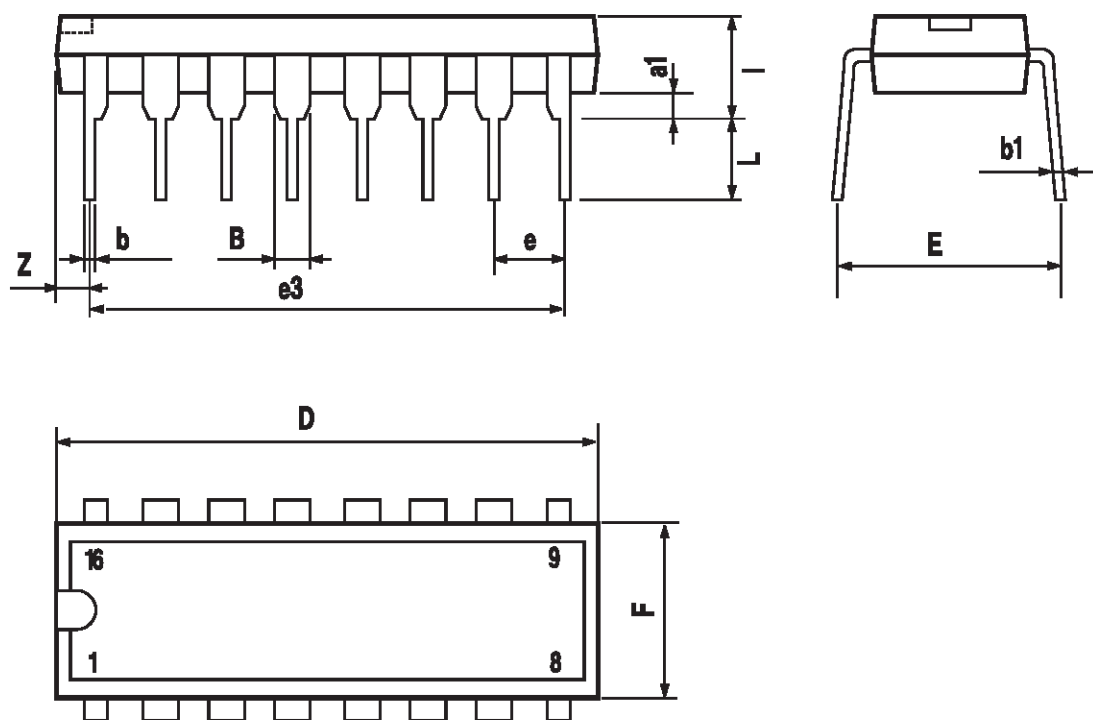


TYPICAL CRYSTAL OSCILLATOR CIRCUIT



Plastic DIP-16 (0.25) MECHANICAL DATA

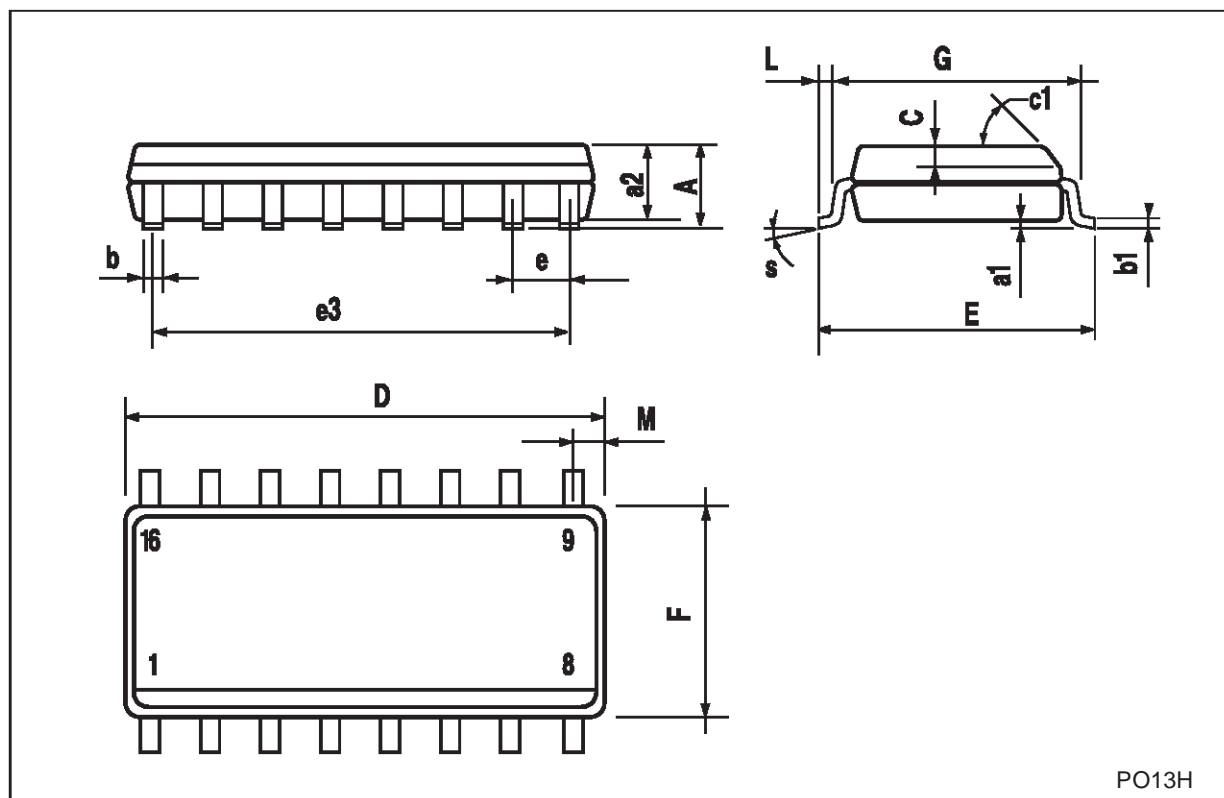
| DIM. | mm. | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 17.78 | | | 0.700 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | | | 1.27 | | | 0.050 |



P001C

SO-16 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 | 9.8 | | 10 | 0.385 | | 0.393 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 8.89 | | | 0.350 | |
| 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 | | | 0.62 | | | 0.024 |
| S | 8° (max.) | | | | | |



PO13H

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