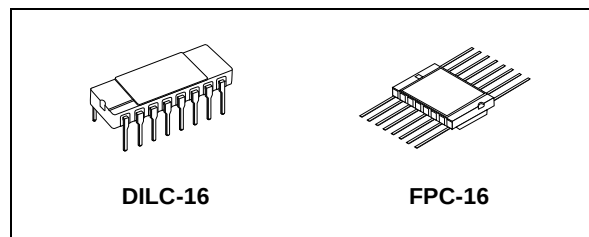


## RAD-HARD QUAD 2 CHANNEL MULTIPLEXER

- HIGH SPEED:  
 $t_{PD} = 10\text{ns}$  (TYP.) at  $V_{CC} = 6\text{V}$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4\mu\text{A}$  (MAX.) at  $T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (MIN.)
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 4\text{mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:  
 $V_{CC}$  (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH 54 SERIES 157
- SPACE GRADE-1: ESA SCC QUALIFIED
- 50 krad QUALIFIED, 100 krad AVAILABLE ON REQUEST
- NO SEL UNDER HIGH LET HEAVY IONS IRRADIATION
- DEVICE FULLY COMPLIANT WITH SCC-9408-057

### DESCRIPTION

The M54HC157 is an high speed CMOS QUAD 2 CHANNEL MULTIPLEXER fabricated with silicon gate C<sup>2</sup>MOS technology.



### ORDER CODES

| PACKAGE | FM        | EM         |
|---------|-----------|------------|
| DILC    | M54HC157D | M54HC157D1 |
| FPC     | M54HC157K | M54HC157K1 |

These device consist of four 2-input digital multiplexer with common select and strobe inputs. When the STROBE input is held high, selection of data is inhibited and all the outputs become low. The SELECT decoding determines whether the A or B inputs get routed to their corresponding Y outputs.

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

### PIN CONNECTION

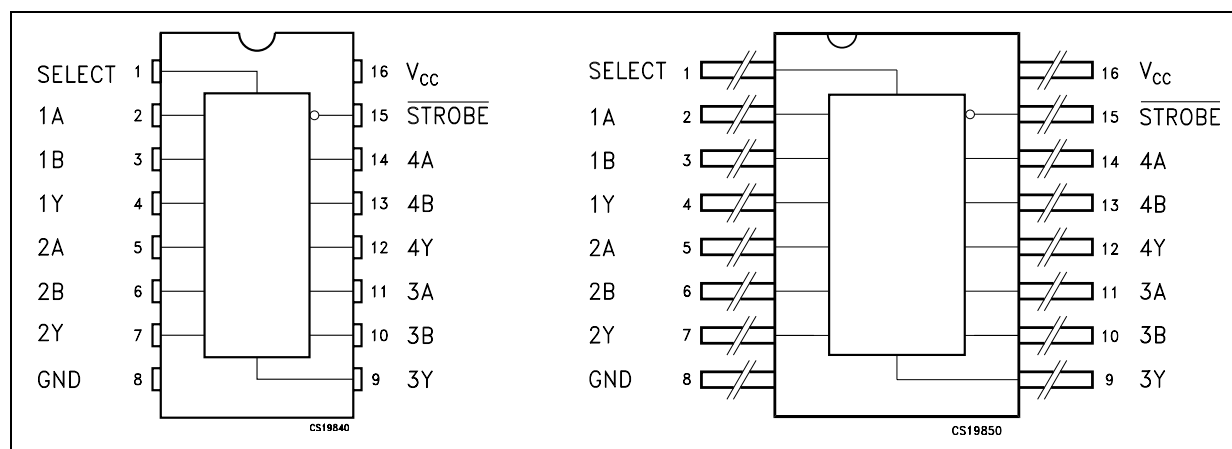


Figure 1: IEC Logic Symbols

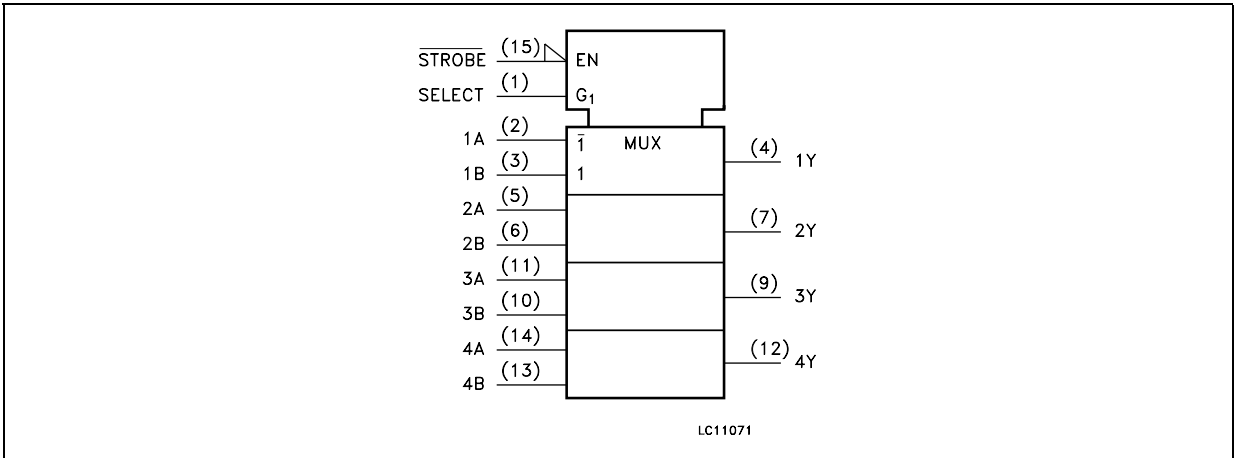


Figure 2: Input And Output Equivalent Circuit

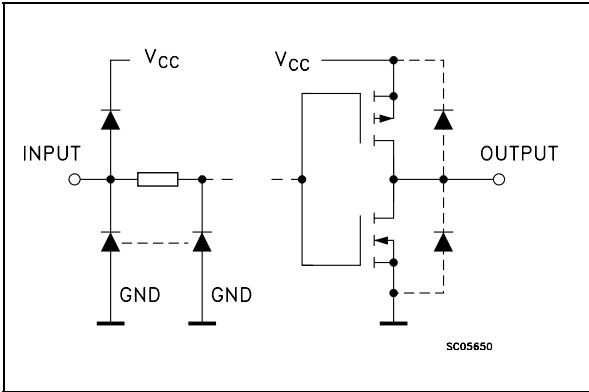


Table 1: Pin Description

| PIN N°       | SYMBOL          | NAME AND FUNCTION         |
|--------------|-----------------|---------------------------|
| 1            | SELECT          | Common Data Select Input  |
| 2, 5, 11, 14 | 1A to 4A        | Data Inputs From Source A |
| 3, 6, 10, 13 | 1B to 4B        | Data Inputs From Source B |
| 4, 7, 9, 12  | 1Y to 4Y        | Multiplexer Output        |
| 15           | STROBE          | Strobe Inputs             |
| 8            | GND             | Ground (0V)               |
| 16           | V <sub>CC</sub> | Positive Supply Voltage   |

Table 2: Truth Table

| INPUTS |        |   |   | OUTPUTS |
|--------|--------|---|---|---------|
| STROBE | SELECT | A | B | Y       |
| H      | X      | X | X | L       |
| L      | L      | L | X | L       |
| L      | L      | H | X | H       |
| L      | H      | X | L | L       |
| L      | H      | X | H | H       |

X : Don't Care

Figure 3: Logic Diagram

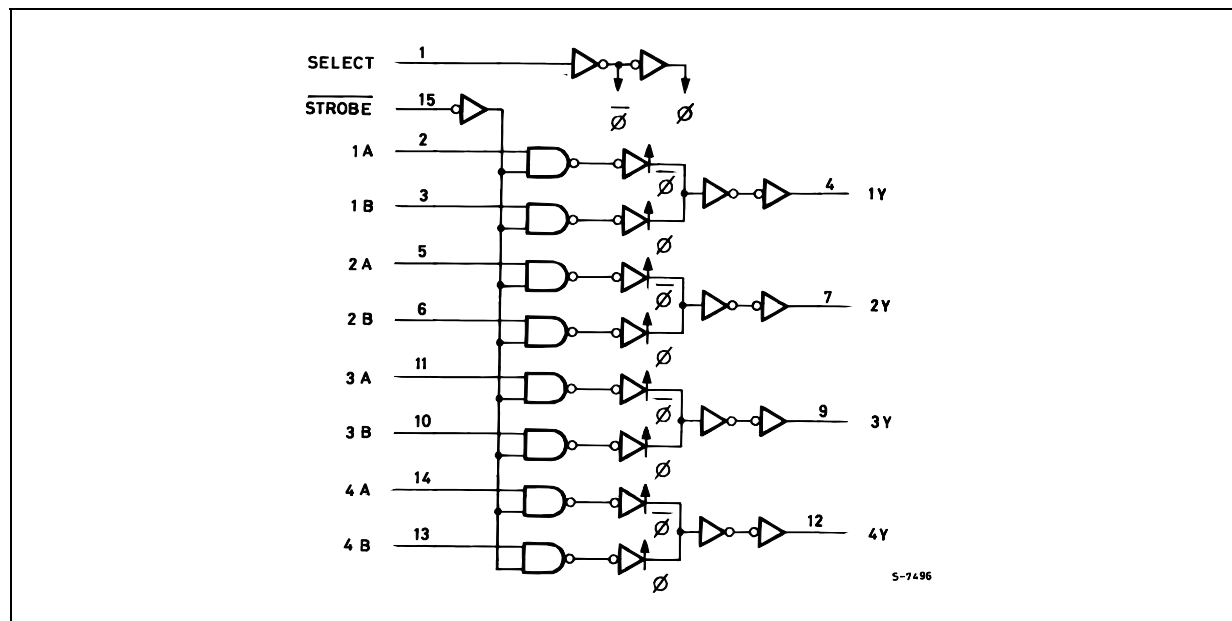


Table 3: Absolute Maximum Ratings

| Symbol                | Parameter                     | Value                  | Unit |
|-----------------------|-------------------------------|------------------------|------|
| $V_{CC}$              | Supply Voltage                | -0.5 to +7             | V    |
| $V_I$                 | DC Input Voltage              | -0.5 to $V_{CC} + 0.5$ | V    |
| $V_O$                 | DC Output Voltage             | -0.5 to $V_{CC} + 0.5$ | V    |
| $I_{IK}$              | DC Input Diode Current        | $\pm 20$               | mA   |
| $I_{OK}$              | DC Output Diode Current       | $\pm 20$               | mA   |
| $I_O$                 | DC Output Current             | $\pm 25$               | mA   |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current | $\pm 50$               | mA   |
| $P_D$                 | Power Dissipation             | 300                    | mW   |
| $T_{stg}$             | Storage Temperature           | -65 to +150            | °C   |
| $T_L$                 | Lead Temperature (10 sec)     | 265                    | °C   |

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

Table 4: Recommended Operating Conditions

| Symbol                          | Parameter                |                        | Value                | Unit |
|---------------------------------|--------------------------|------------------------|----------------------|------|
| V <sub>CC</sub>                 | Supply Voltage           |                        | 2 to 6               | V    |
| V <sub>I</sub>                  | Input Voltage            |                        | 0 to V <sub>CC</sub> | V    |
| V <sub>O</sub>                  | Output Voltage           |                        | 0 to V <sub>CC</sub> | V    |
| T <sub>op</sub>                 | Operating Temperature    |                        | -55 to 125           | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise and Fall Time | V <sub>CC</sub> = 2.0V | 0 to 1000            | ns   |
|                                 |                          | V <sub>CC</sub> = 4.5V | 0 to 500             | ns   |
|                                 |                          | V <sub>CC</sub> = 6.0V | 0 to 400             | ns   |

Table 5: DC Specifications

| Symbol          | Parameter                 | Test Condition         |                                         | Value                 |      |       |             |      |              | Unit |      |
|-----------------|---------------------------|------------------------|-----------------------------------------|-----------------------|------|-------|-------------|------|--------------|------|------|
|                 |                           | V <sub>CC</sub><br>(V) |                                         | T <sub>A</sub> = 25°C |      |       | -40 to 85°C |      | -55 to 125°C |      |      |
|                 |                           |                        |                                         | Min.                  | Typ. | Max.  | Min.        | Max. | Min.         |      | Max. |
| V <sub>IH</sub> | High Level 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 <sub>IL</sub> | Low Level 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  |      |
| V <sub>OH</sub> | High Level Output Voltage | 2.0                    | I <sub>O</sub> =-20 μA                  | 1.9                   | 2.0  |       | 1.9         |      | 1.9          |      | V    |
|                 |                           | 4.5                    | I <sub>O</sub> =-20 μA                  | 4.4                   | 4.5  |       | 4.4         |      | 4.4          |      |      |
|                 |                           | 6.0                    | I <sub>O</sub> =-20 μA                  | 5.9                   | 6.0  |       | 5.9         |      | 5.9          |      |      |
|                 |                           | 4.5                    | I <sub>O</sub> =-4.0 mA                 | 4.18                  | 4.31 |       | 4.13        |      | 4.10         |      |      |
|                 |                           | 6.0                    | I <sub>O</sub> =-5.2 mA                 | 5.68                  | 5.8  |       | 5.63        |      | 5.60         |      |      |
| V <sub>OL</sub> | Low Level Output Voltage  | 2.0                    | I <sub>O</sub> =20 μA                   |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  | V    |
|                 |                           | 4.5                    | I <sub>O</sub> =20 μA                   |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  |      |
|                 |                           | 6.0                    | I <sub>O</sub> =20 μA                   |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  |      |
|                 |                           | 4.5                    | I <sub>O</sub> =4.0 mA                  |                       | 0.17 | 0.26  |             | 0.33 |              | 0.40 |      |
|                 |                           | 6.0                    | I <sub>O</sub> =5.2 mA                  |                       | 0.18 | 0.26  |             | 0.33 |              | 0.40 |      |
| I <sub>I</sub>  | Input Leakage Current     | 6.0                    | V <sub>I</sub> = V <sub>CC</sub> or GND |                       |      | ± 0.1 |             | ± 1  |              | ± 1  | μA   |
| I <sub>CC</sub> | Quiescent Supply Current  | 6.0                    | V <sub>I</sub> = V <sub>CC</sub> or GND |                       |      | 4     |             | 40   |              | 80   | μA   |

\*: Applicable only to DIR, G,  $\overline{G}$  inputTable 6: AC Electrical Characteristics (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

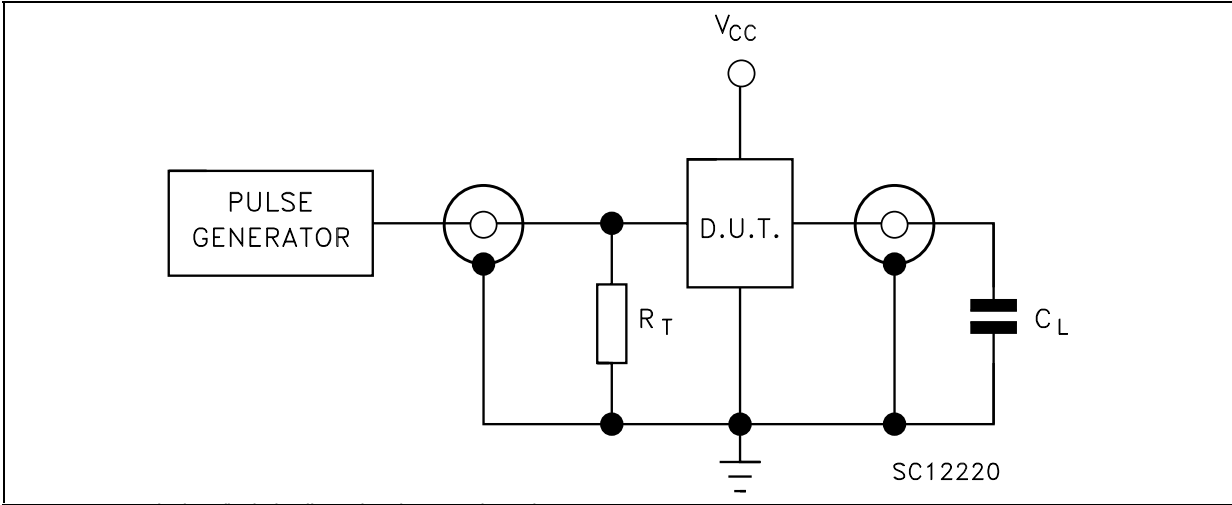
| Symbol                            | Parameter                           | Test Condition         |  | Value                 |      |      |             |      |              | Unit |      |
|-----------------------------------|-------------------------------------|------------------------|--|-----------------------|------|------|-------------|------|--------------|------|------|
|                                   |                                     | V <sub>CC</sub><br>(V) |  | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                                   |                                     |                        |  | Min.                  | Typ. | Max. | Min.        | Max. | Min.         |      | Max. |
| t <sub>TLH</sub> t <sub>THL</sub> | Output Transition Time              | 2.0                    |  |                       | 30   | 75   |             | 95   |              | 110  | ns   |
|                                   |                                     | 4.5                    |  |                       | 8    | 15   |             | 19   |              | 22   |      |
|                                   |                                     | 6.0                    |  |                       | 7    | 13   |             | 16   |              | 19   |      |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delay Time (A, B - Y)   | 2.0                    |  |                       | 30   | 100  |             | 125  |              | 150  | ns   |
|                                   |                                     | 4.5                    |  |                       | 12   | 20   |             | 25   |              | 30   |      |
|                                   |                                     | 6.0                    |  |                       | 10   | 17   |             | 21   |              | 26   |      |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delay Time (SELECT - Y) | 2.0                    |  |                       | 50   | 125  |             | 155  |              | 190  | ns   |
|                                   |                                     | 4.5                    |  |                       | 16   | 25   |             | 31   |              | 38   |      |
|                                   |                                     | 6.0                    |  |                       | 14   | 21   |             | 26   |              | 32   |      |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delay Time (STROBE -Y)  | 2.0                    |  |                       | 36   | 115  |             | 145  |              | 175  | ns   |
|                                   |                                     | 4.5                    |  |                       | 12   | 23   |             | 29   |              | 35   |      |
|                                   |                                     | 6.0                    |  |                       | 10   | 20   |             | 25   |              | 30   |      |

Table 7: Capacitive Characteristics

| Symbol          | Parameter                              | Test Condition         |  | Value                 |      |      |             |      |              | Unit |      |
|-----------------|----------------------------------------|------------------------|--|-----------------------|------|------|-------------|------|--------------|------|------|
|                 |                                        | V <sub>CC</sub><br>(V) |  | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                 |                                        |                        |  | Min.                  | Typ. | Max. | Min.        | Max. | Min.         |      | Max. |
| C <sub>IN</sub> | Input Capacitance                      | 5.0                    |  |                       | 5    | 10   |             | 10   |              | 10   | pF   |
| C <sub>PD</sub> | Power Dissipation Capacitance (note 1) | 5.0                    |  |                       | 47   |      |             |      |              |      | pF   |

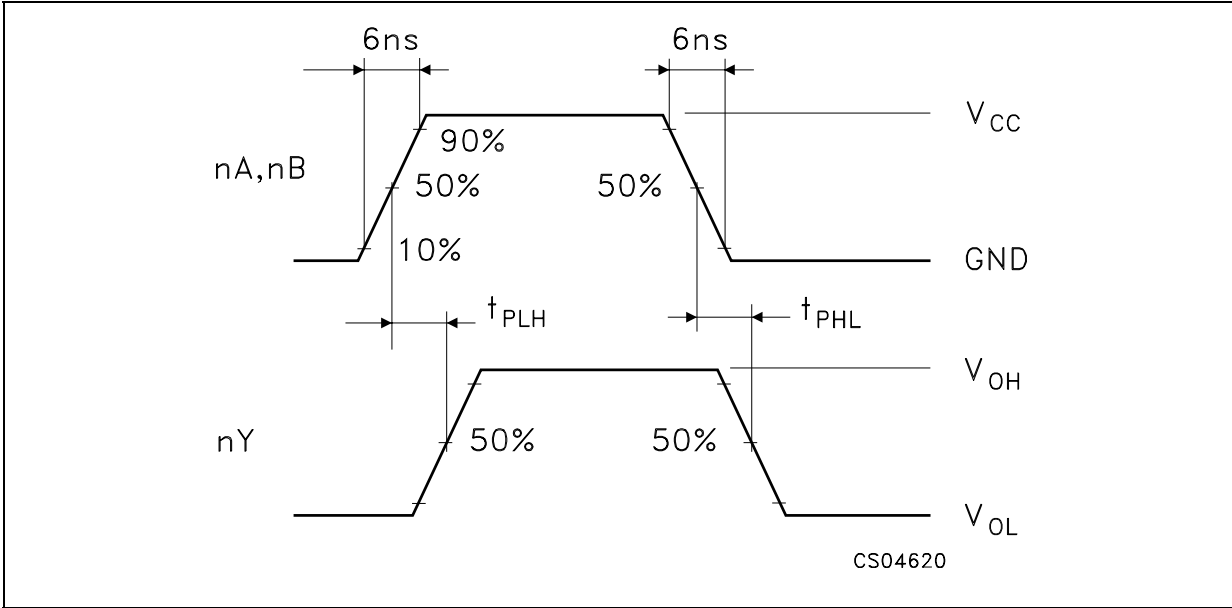
1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$ (per channel)

Figure 4: Test Circuit



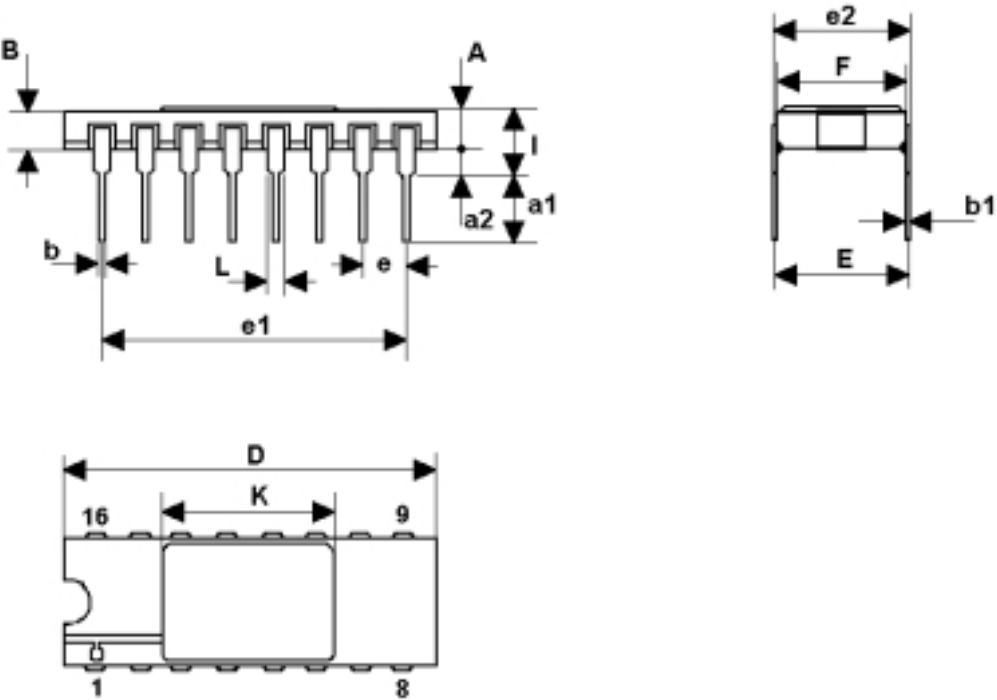
C<sub>L</sub> = 50pF or equivalent (includes jig and probe capacitance)  
R<sub>T</sub> = Z<sub>OUT</sub> of pulse generator (typically 50Ω)

Figure 5: Waveform - Propagation Delay Times (f=1MHz; 50% duty cycle)



DILC-16 MECHANICAL DATA

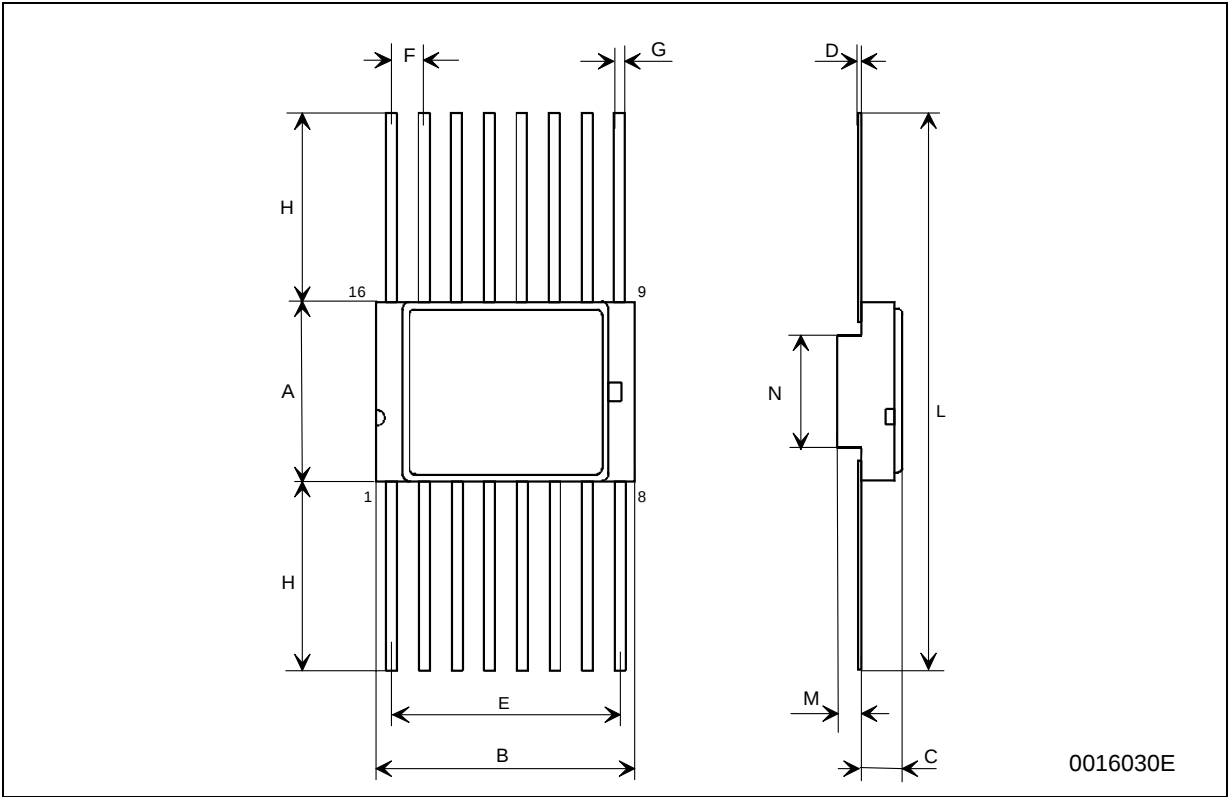
| DIM. | mm.   |       |       | inch  |       |       |
|------|-------|-------|-------|-------|-------|-------|
|      | MIN.  | TYP   | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 2.1   |       | 2.71  | 0.083 |       | 0.107 |
| a1   | 3.00  |       | 3.70  | 0.118 |       | 0.146 |
| a2   | 0.63  | 0.88  | 1.14  | 0.025 | 0.035 | 0.045 |
| B    | 1.82  |       | 2.39  | 0.072 |       | 0.094 |
| b    | 0.40  | 0.45  | 0.50  | 0.016 | 0.018 | 0.020 |
| b1   | 0.20  | 0.254 | 0.30  | 0.008 | 0.010 | 0.012 |
| D    | 20.06 | 20.32 | 20.58 | 0.790 | 0.800 | 0.810 |
| E    | 7.36  | 7.62  | 7.87  | 0.290 | 0.300 | 0.310 |
| e    |       | 2.54  |       |       | 0.100 |       |
| e1   | 17.65 | 17.78 | 17.90 | 0.695 | 0.700 | 0.705 |
| e2   | 7.62  | 7.87  | 8.12  | 0.300 | 0.310 | 0.320 |
| F    | 7.29  | 7.49  | 7.70  | 0.287 | 0.295 | 0.303 |
| I    |       |       | 3.83  |       |       | 0.151 |
| K    | 10.90 |       | 12.1  | 0.429 |       | 0.476 |
| L    | 1.14  |       | 1.5   | 0.045 |       | 0.059 |



0056437F

FPC-16 MECHANICAL DATA

| DIM. | mm.   |       |       | inch  |       |       |
|------|-------|-------|-------|-------|-------|-------|
|      | MIN.  | TYP   | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 6.75  | 6.91  | 7.06  | 0.266 | 0.272 | 0.278 |
| B    | 9.76  | 9.94  | 10.14 | 0.384 | 0.392 | 0.399 |
| C    | 1.49  |       | 1.95  | 0.059 |       | 0.077 |
| D    | 0.102 | 0.127 | 0.152 | 0.004 | 0.005 | 0.006 |
| E    | 8.76  | 8.89  | 9.01  | 0.345 | 0.350 | 0.355 |
| F    |       | 1.27  |       |       | 0.050 |       |
| G    | 0.38  | 0.43  | 0.48  | 0.015 | 0.017 | 0.019 |
| H    | 6.0   |       |       | 0.237 |       |       |
| L    | 18.75 |       | 22.0  | 0.738 |       | 0.867 |
| M    | 0.33  | 0.38  | 0.43  | 0.013 | 0.015 | 0.017 |
| N    |       | 4.31  |       |       | 0.170 |       |



**Table 8: Revision History**

| Date        | Revision | Description of Changes |
|-------------|----------|------------------------|
| 01-Jun-2004 | 1        | First Release          |

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