



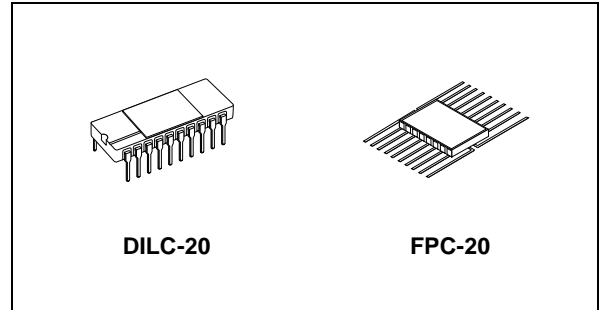
M54HC541

RAD-HARD OCTAL BUS BUFFER WITH 3 STATE OUTPUTS (NON INVERTED)

- HIGH SPEED:
 $t_{PD} = 9\text{ns}$ (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:
 $|I_{OH}| = I_{OL} = 6\text{mA}$ (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 541
- 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-9401-047

DESCRIPTION

The 54HC541 is an advanced high-speed CMOS OCTAL BUS BUFFER (3-STATE) fabricated with silicon gate C²MOS technology. The M54HC541 is a non inverting buffer.



ORDER CODES

| PACKAGE | FM | EM |
|---------|-----------|------------|
| DILC | M54HC541D | M54HC541D1 |
| FPC | M54HC541K | M54HC541K1 |

The 3-STATE control gate operates as a two input AND such that if either G1 and G2 are high, all eight output are in the high impedance state. In order to enhance PC board layout the M54HC541 offer a pinout having inputs and outputs on opposite sides of the package.

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

PIN CONNECTION

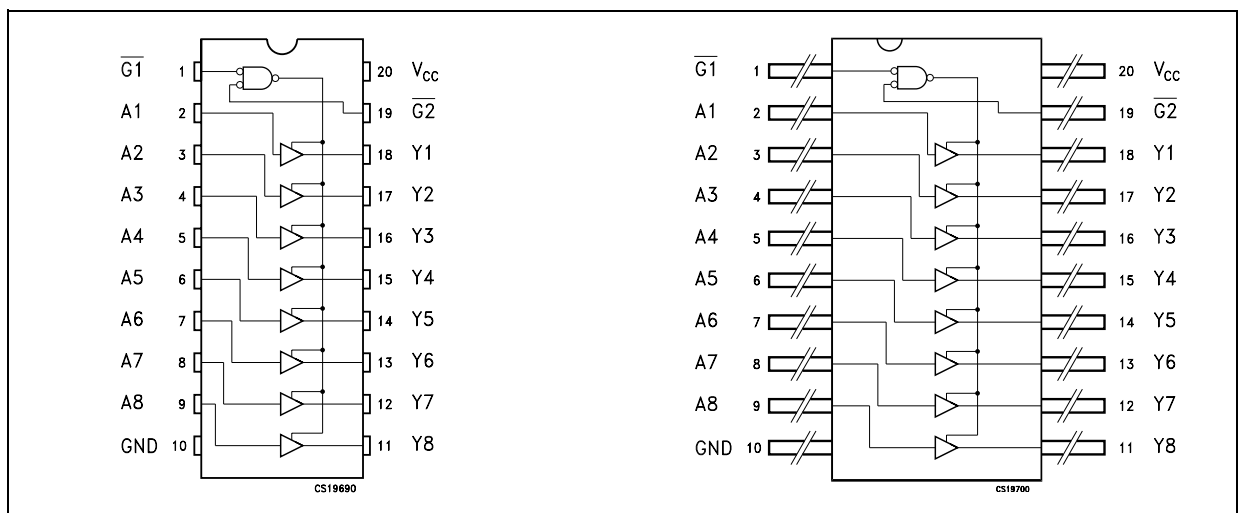


Figure 1: IEC Logic Symbols

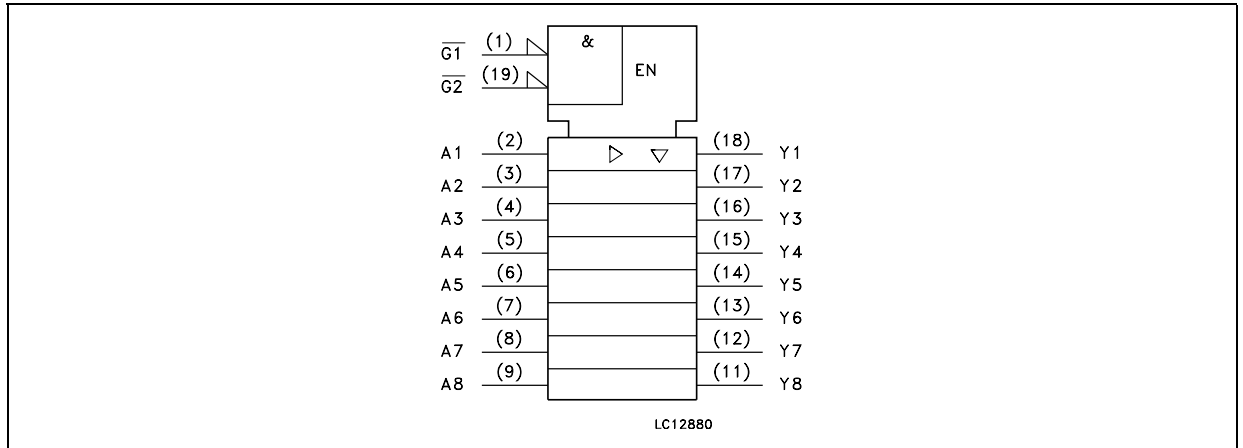


Figure 2: Input And Output Equivalent Circuit

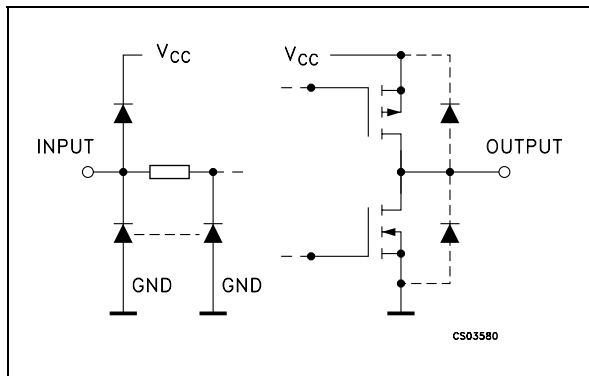


Table 1: Pin Description

| PIN N° | SYMBOL | NAME AND FUNCTION |
|--------------------------------|-----------------|-------------------------|
| 1, 19 | G1, G2 | Output Enable Inputs |
| 2, 3, 4, 5, 6, 7, 8, 9 | A1 to A8 | Data Inputs |
| 18, 17, 16, 15, 14, 13, 12, 11 | Y1 to Y8 | Bus Outputs |
| 10 | GND | Ground (0V) |
| 20 | V _{CC} | Positive Supply Voltage |

Table 2: Truth Table

| INPUT | | OUTPUT | |
|-----------------|-----------------|----------------|----------------|
| $\overline{G1}$ | $\overline{G2}$ | A _n | Y _n |
| H | X | X | Z |
| X | H | X | Z |
| L | L | H | H |
| L | L | L | L |

X : Don't Care
Z : High Impedance

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 | ± 20 | mA |
| I_{OK} | DC Output Diode Current | ± 20 | mA |
| I_O | DC Output Current | ± 35 | mA |
| I_{CC} or I_{GND} | DC V_{CC} or Ground Current | ± 70 | mA |
| P_D | Power Dissipation | 420 | 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_{CC} | Supply Voltage | 2 to 6 | V | |
| V_I | Input Voltage | 0 to V_{CC} | V | |
| V_O | Output Voltage | 0 to V_{CC} | V | |
| T_{op} | Operating Temperature | -55 to 125 | °C | |
| t_r, t_f | Input Rise and Fall Time | $V_{CC} = 2.0V$ | 0 to 1000 | ns |
| | | $V_{CC} = 4.5V$ | 0 to 500 | ns |
| | | $V_{CC} = 6.0V$ | 0 to 400 | ns |

Table 5: DC Specifications

| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | |
|-----------------|---------------------------------------|------------------------|--|-----------------------|------|-------|-------------|------|--------------|------|------|
| | | V _{CC} (V) | | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| V _{IH} | 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 _{IL} | 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 _{OH} | High Level Output Voltage | 2.0 | I _O =-20 μA | 1.9 | 2.0 | | 1.9 | | 1.9 | | V |
| | | 4.5 | I _O =-20 μA | 4.4 | 4.5 | | 4.4 | | 4.4 | | |
| | | 6.0 | I _O =-20 μA | 5.9 | 6.0 | | 5.9 | | 5.9 | | |
| | | 4.5 | I _O =-6.0 mA | 4.18 | 4.31 | | 4.13 | | 4.10 | | |
| | | 6.0 | I _O =-7.8 mA | 5.68 | 5.8 | | 5.63 | | 5.60 | | |
| V _{OL} | Low Level Output Voltage | 2.0 | I _O =20 μA | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | 4.5 | I _O =20 μA | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 6.0 | I _O =20 μA | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 4.5 | I _O =6.0 mA | | 0.17 | 0.26 | | 0.33 | | 0.40 | |
| | | 6.0 | I _O =7.8 mA | | 0.18 | 0.26 | | 0.33 | | 0.40 | |
| I _I | Input Leakage Current | 6.0 | V _I = V _{CC} or GND | | | ± 0.1 | | ± 1 | | ± 1 | μA |
| I _{OZ} | High Impedance Output Leakage Current | 6.0 | V _I = V _{IH} or V _{IL} V _O = V _{CC} or GND | | | ± 0.5 | | ± 5 | | ± 10 | μA |
| I _{CC} | Quiescent Supply Current | 6.0 | V _I = V _{CC} or GND | | | 4 | | 40 | | 80 | μA |

Table 6: AC Electrical Characteristics ($C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

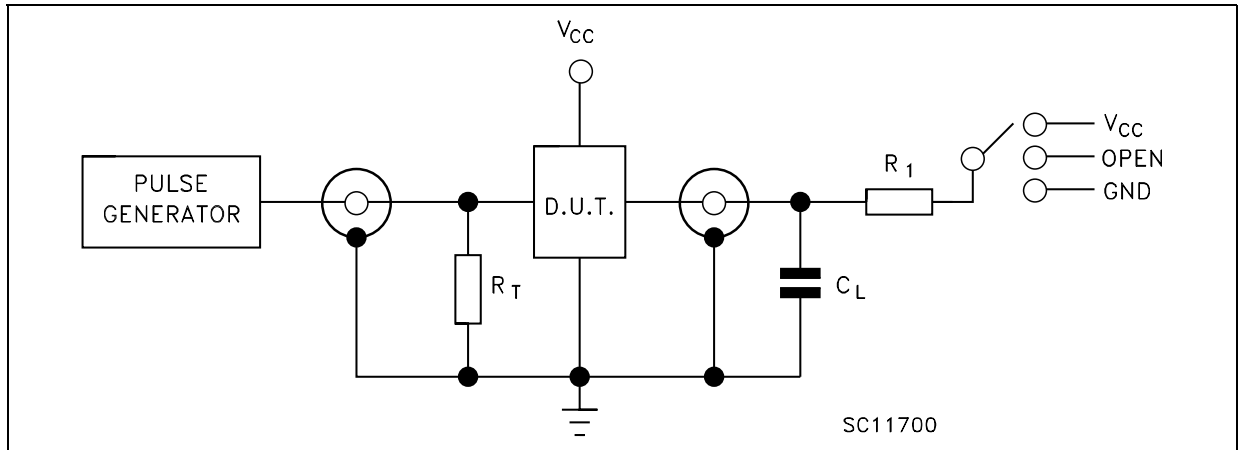
| Symbol | Parameter | Test Condition | | | Value | | | | | | Unit | | |
|---------------------|------------------------------------|-----------------|---------------|--------------------------|--------------------------|------|------|-----------------------------|------|------------------------------|------|------|----|
| | | V_{CC} (V) | C_L (pF) | | $T_A = 25^\circ\text{C}$ | | | -40 to 85°C | | -55 to 125°C | | | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. | |
| t_{TLH} t_{THL} | Output Transition Time | 2.0 | 50 | | | 25 | 60 | | 75 | | 90 | ns | |
| | | 4.5 | | | | 7 | 12 | | 19 | | 18 | | |
| | | 6.0 | | | | 6 | 10 | | 13 | | 15 | | |
| t_{PLH} t_{PHL} | Propagation Delay Time | 2.0 | 50 | | | 40 | 85 | | 105 | | 130 | ns | |
| | | 4.5 | | | | 10 | 17 | | 21 | | 26 | | |
| | | 6.0 | | | | 9 | 14 | | 18 | | 22 | | |
| | | 2.0 | 150 | | | 56 | 115 | | 145 | | 175 | ns | |
| | | 4.5 | | | | 14 | 23 | | 29 | | 35 | | |
| | | 6.0 | | | | 12 | 20 | | 25 | | 30 | | |
| t_{PZL} t_{PZH} | High Impedance Output Enable Time | 2.0 | 50 | $R_L = 1\text{ K}\Omega$ | | 47 | 110 | | 140 | | 165 | ns | |
| | | 4.5 | | | | 13 | 22 | | 28 | | 33 | | |
| | | 6.0 | | | | 11 | 19 | | 24 | | 28 | | |
| | | 2.0 | 150 | | $R_L = 1\text{ K}\Omega$ | | 61 | 135 | | 170 | | 205 | ns |
| | | 4.5 | | | | | 17 | 27 | | 34 | | 41 | |
| | | 6.0 | | | | | 14 | 23 | | 29 | | 35 | |
| t_{PLZ} t_{PHZ} | High Impedance Output Disable Time | 2.0 | 50 | $R_L = 1\text{ K}\Omega$ | | | 52 | 110 | | 140 | | 165 | ns |
| | | 4.5 | | | | | 15 | 22 | | 28 | | 33 | |
| | | 6.0 | | | | | 13 | 19 | | 24 | | 28 | |

Table 7: Capacitive Characteristics

| Symbol | Parameter | Test Condition | | | Value | | | | | | Unit | |
|----------|--|-----------------|--|--|--------------------------|------|------|-----------------------------|------|------------------------------|------|------|
| | | V_{CC} (V) | | | $T_A = 25^\circ\text{C}$ | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| C_{IN} | Input Capacitance | 5.0 | | | | 5 | 10 | | 10 | | 10 | pF |
| C_{PD} | Power Dissipation Capacitance (note 1) | 5.0 | | | | 31 | | | | | | pF |

1) 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. $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$ (per circuit)

Figure 3: Test Circuit



| TEST | SWITCH |
|-----------------------|----------|
| t_{PLH} , t_{PHL} | Open |
| t_{PZL} , t_{PLZ} | V_{CC} |
| t_{PZH} , t_{PHZ} | GND |

$C_L = 50\text{pF}/150\text{pF}$ or equivalent (includes jig and probe capacitance)
 $R_1 = 1\text{K}\Omega$ or equivalent
 $R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

Figure 4: Waveform - Propagation Delay Times ($f=1\text{MHz}$; 50% duty cycle)

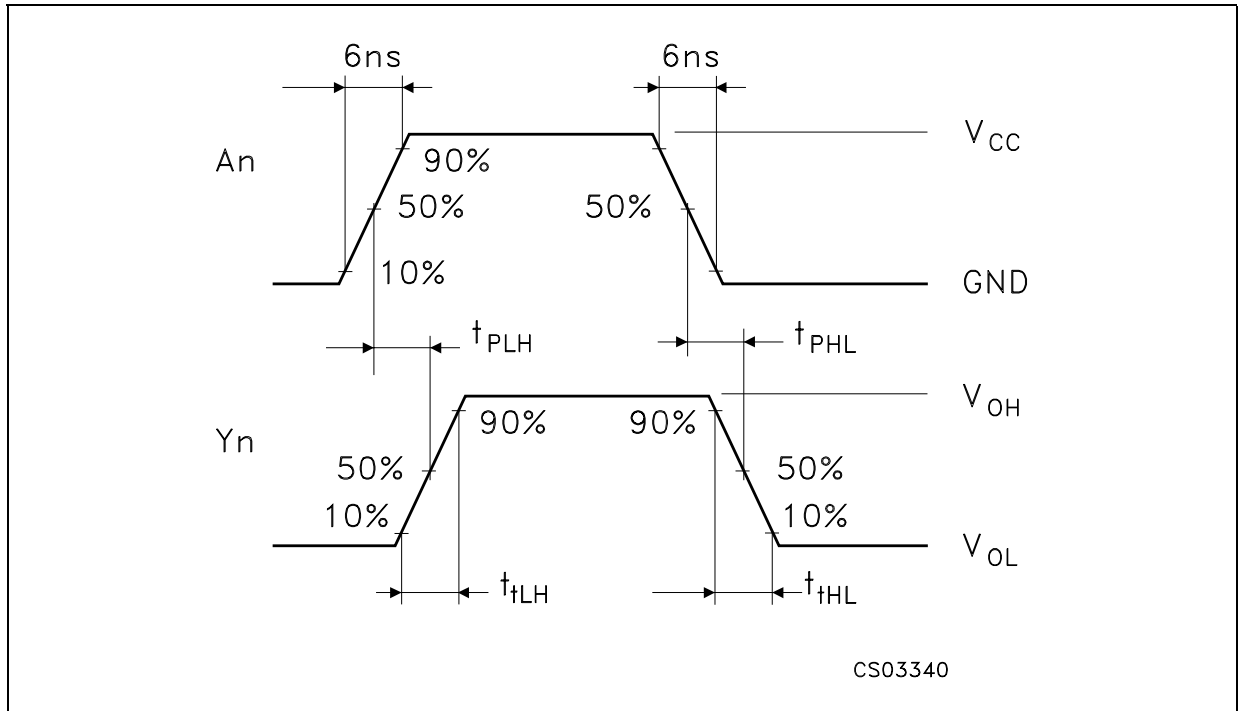
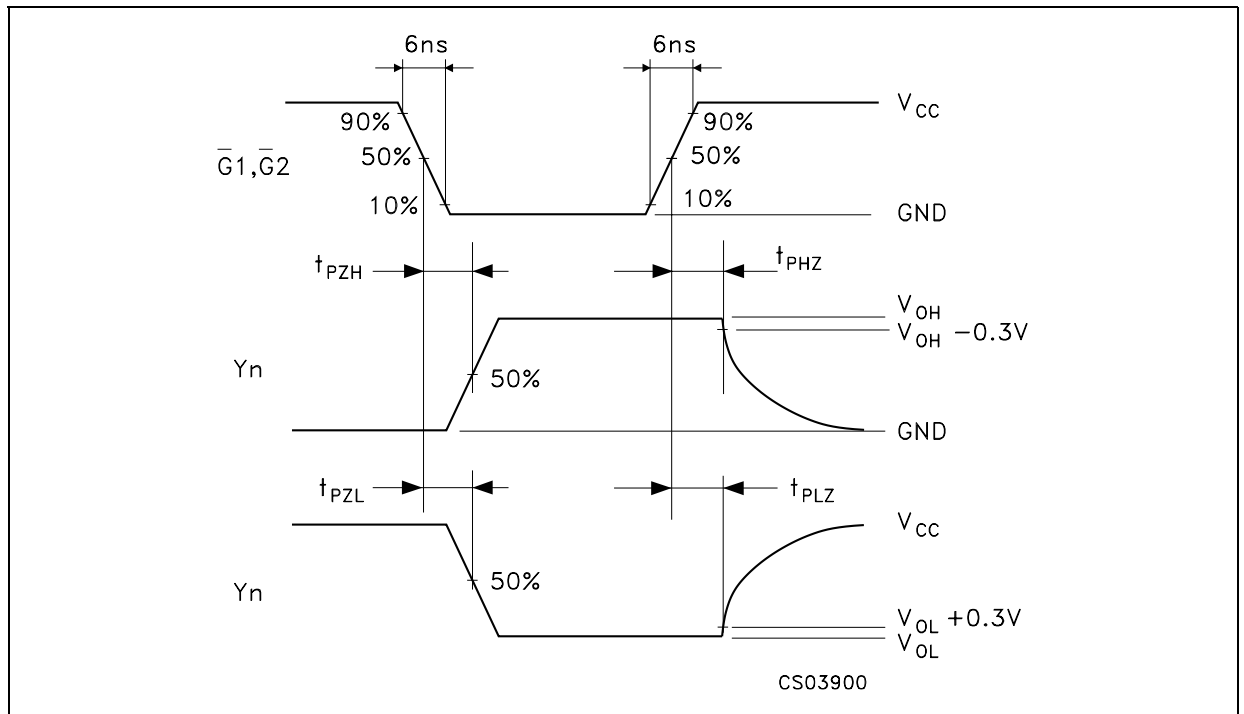
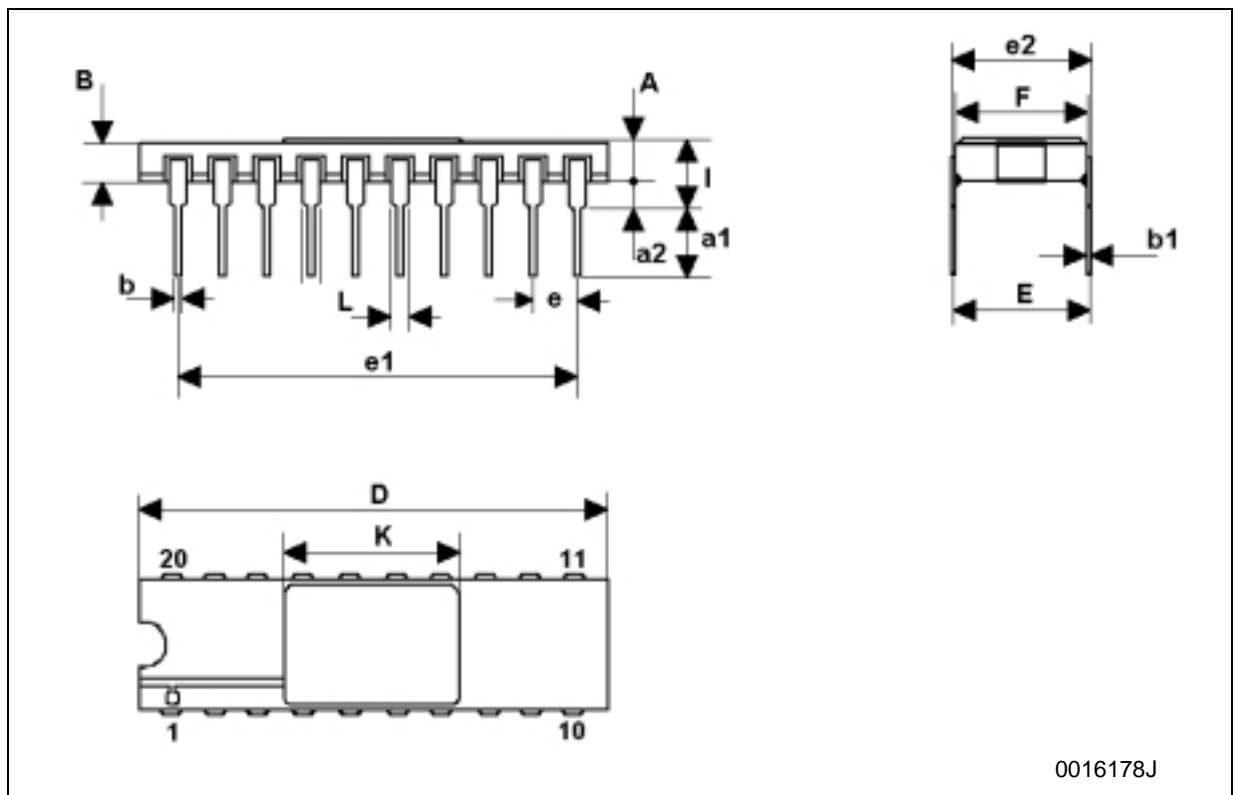


Figure 5: Waveform - Output Enable And Disable Times ($f=1\text{MHz}$; 50% duty cycle)

DILC-20 MECHANICAL DATA

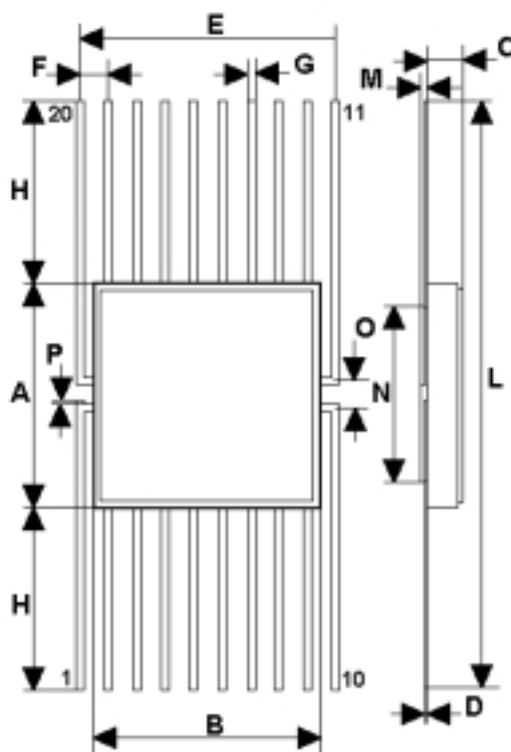
| DIM. | mm. | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 2.1 | | 2.71 | 0.083 | | 0.107 |
| a1 | 3.00 | | 3.70 | 0.118 | | 0.146 |
| a2 | 0.63 | 0.88 | 1.14 | 0.025 | 0.035 | 0.045 |
| B | 1.93 | 2.03 | 2.23 | 0.076 | 0.080 | 0.088 |
| 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 | 25.14 | 25.40 | 25.65 | 0.990 | 1.000 | 1.010 |
| E | 7.36 | 7.62 | 7.87 | 0.290 | 0.300 | 0.310 |
| e | | 2.54 | | | 0.100 | |
| e1 | 22.73 | 22.86 | 22.99 | 0.895 | 0.900 | 0.905 |
| 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 |
| l | | | 3.86 | | | 0.152 |
| K | 11.30 | | 11.56 | 0.445 | | 0.455 |
| L | 1.14 | 1.27 | 1.40 | 0.045 | 0.050 | 0.055 |



0016178J

FPC-20 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 9.98 | 10.16 | 10.34 | 0.393 | 0.400 | 0.407 |
| B | 9.98 | 10.16 | 10.34 | 0.393 | 0.400 | 0.407 |
| C | 1.45 | 1.61 | 1.78 | 0.57 | 0.63 | 0.070 |
| D | 0.10 | 0.127 | 0.18 | 0.004 | 0.005 | 0.007 |
| E | 11.30 | 11.43 | 11.56 | 0.445 | 0.450 | 0.455 |
| F | | 1.27 | | | 0.050 | |
| G | 0.38 | 0.43 | 0.48 | 0.015 | 0.017 | 0.019 |
| H | 7.24 | | 8.16 | 0.285 | | 0.320 |
| L | 24.46 | | 26.67 | 0.960 | | 1.050 |
| M | 0.45 | 0.50 | 0.55 | 0.018 | 0.020 | 0.022 |
| N | | 7.87 | | | 0.310 | |
| O | 1.14 | 1.27 | 1.40 | 0.045 | 0.050 | 0.055 |
| P | 0.10 | 0.18 | 0.25 | 0.004 | 0.007 | 0.010 |



016032F

Table 8: Revision History

| Date | Revision | Description of Changes |
|-------------|-----------------|-------------------------------|
| 14-May-2004 | 1 | First Release |

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