# M54HCT245

# RAD HARD OCTAL BUS TRANSCEIVER WITH 3 STATE OUTPUTS (NON INVERTED)

- HIGH SPEED:
  $t_{PD}$ = 13ns (TYP.) at $V_{CC}$ = 4.5V
- LOW POWER DISSIPATION:
  $I_{CC}$ = 4µA(MAX.) at $T_A$=25°C
- COMPATIBLE WITH TTL OUTPUTS:
  $V_{IH}$ = 2V (MIN.) $V_{IL}$ = 0.8V (MAX)
- SYMMETRICAL OUTPUT IMPEDANCE:
  $|I_{OH}|$ = $I_{OL}$ = 6mA (MIN)
- BALANCED PROPAGATION DELAYS:
  $t_{PLH} \cong t_{PHL}$
- PIN AND FUNCTION COMPATIBLE WITH 54 SERIES 245
- 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-9405-014

**DILC-20**          **FPC-20**

## ORDER CODES

| PACKAGE | FM | EM |
|---------|------|------|
| DILC | M54HCT245D | M54HCT245D1 |
| FPC | M54HCT245K | M54HCT245K1 |

## DESCRIPTION

The M54HCT245 is an advanced high-speed CMOS OCTAL BUS TRANSCEIVER (3-STATE) fabricated with silicon gate $C^2MOS$ technology.

This IC is intended for two-way asynchronous communication between data buses, and the direction of data transmission is determined by DIR input. The enable input $\overline{G}$ can be used to disable the device so that the buses are effectively isolated.

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

All floating bus terminals during High Z State must be held HIGH or LOW.

## PIN CONNECTION



CS19170          CS19180
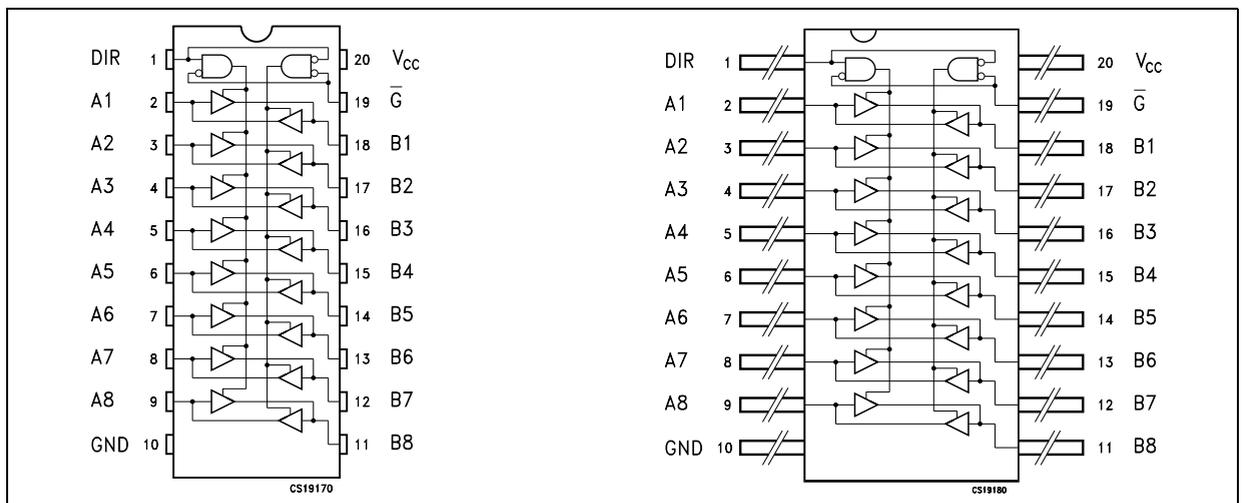
## Figure 1: IEC Logic Symbols
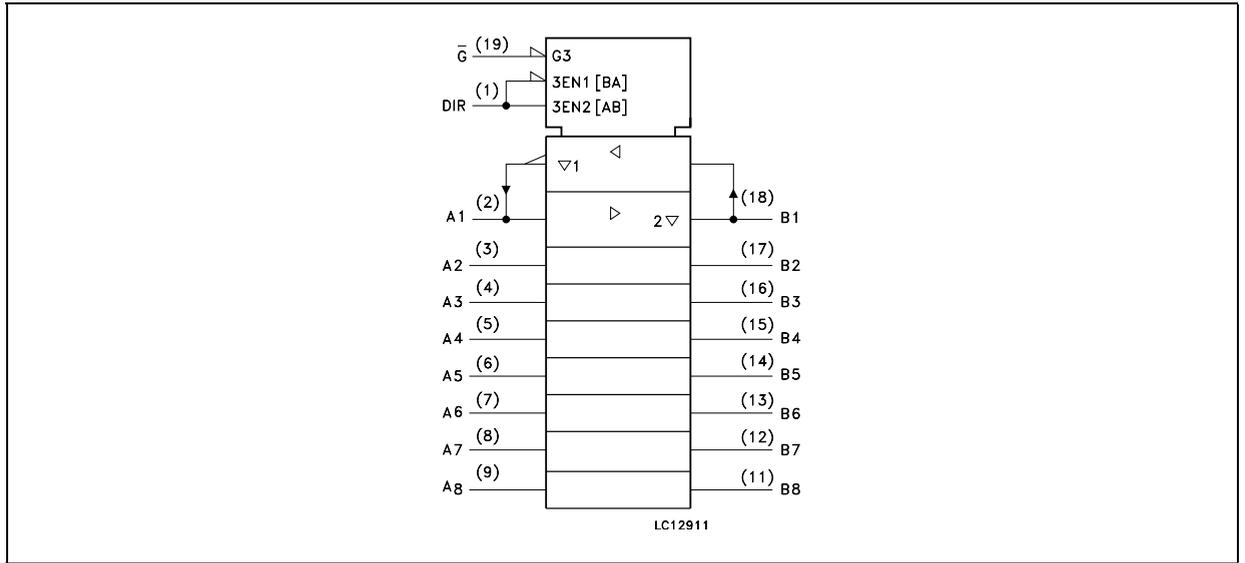


## Figure 2: Input And Output Equivalent Circuit
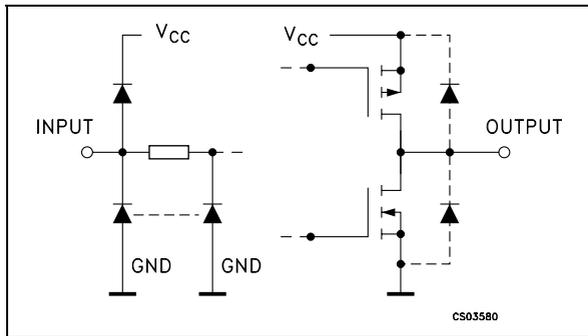


## Table 1: Pin Description

| PIN N° | SYMBOL | NAME AND FUNCTION |
|---|---|---|
| 1 | DIR | Directional Control |
| 2, 3, 4, 5, 6, 7, 8, 9 | A1 to A8 | Data Inputs/Outputs |
| 18, 17, 16, 15, 14, 13, 12, 11 | B1 to B8 | Data Inputs/Outputs |
| 19 | $\overline{G}$ | Output Enable Input |
| 10 | GND | Ground (0V) |
| 20 | $V_{CC}$ | Positive Supply Voltage |

## Table 2: Truth Table

| INPUTS | | FUNCTION | | OUTPUT |
|---|---|---|---|---|
| $\overline{G}$ | DIR | A BUS | B BUS | Yn |
| L | L | OUTPUT | INPUT | A = B |
| L | H | INPUT | OUTPUT | B = A |
| H | X | Z | Z | Z |

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 | 4.5 to 5.5 | 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 ($V_{CC}$ = 4.5 to 5.5V) | 0 to 500 | ns |

**Table 5: DC Specifications**

| Symbol | Parameter | V_CC (V) | Test Condition | T_A = 25°C | | | -40 to 85°C | | -55 to 125°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| $V_{IH}$ | High Level Input Voltage | 4.5 to 5.5 | | 2.0 | | | 2.0 | | 2.0 | | V |
| $V_{IL}$ | Low Level Input Voltage | 4.5 to 5.5 | | | | 0.8 | | 0.8 | | 0.8 | V |
| $V_{OH}$ | High Level Output Voltage | 4.5 | $I_O$=-20 µA | 4.4 | 4.5 | | 4.4 | | 4.4 | | V |
| | | | $I_O$=-6.0 mA | 4.18 | 4.31 | | 4.13 | | 4.10 | | |
| $V_{OL}$ | Low Level Output Voltage | 4.5 | $I_O$=20 µA | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | | $I_O$=6.0 mA | | 0.17 | 0.26 | | 0.33 | | 0.40 | |
| $I_I$ | Input Leakage Current | 5.5 | $V_I = V_{CC}$ or GND | | | ± 0.1 | | ± 1 | | ± 1 | µA |
| $I_{OZ}$ | High Impedance Output Leakage Current | 5.5 | $V_I = V_{IH}$ or $V_{IL}$ $V_O = V_{CC}$ or GND | | | ± 0.5 | | ± 5 | | ± 10 | µA |
| $I_{CC}$ | Quiescent Supply Current | 5.5 | $V_I = V_{CC}$ or GND | | | 4 | | 40 | | 80 | µA |
| $\Delta I_{CC}$ | Additional Worst Case Supply Current | 5.5 | Per Input pin $V_I$ = 0.5V or $V_I$ = 2.4V Other Inputs at $V_{CC}$ or GND $I_O$ = 0 | | | 2.0 | | 2.9 | | 3.0 | mA |

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

| Symbol | Parameter | V_CC (V) | C_L (pF) | Test Condition | T_A = 25°C | | | -40 to 85°C | | -55 to 125°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | |
| $t_{TLH}$ $t_{THL}$ | Output Transition Time | 4.5 | 50 | | | 7 | 12 | | 15 | | 18 | ns |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Time | 4.5 | 50 | | | 13 | 22 | | 28 | | 33 | ns |
| | | | 150 | | | 18 | 30 | | 38 | | 45 | |
| $t_{PZL}$ $t_{PZH}$ | High Impedance Output Enable Time | 4.5 | 50 | $R_L$ = 1 KΩ | | 19 | 30 | | 38 | | 45 | ns |
| | | | 150 | $R_L$ = 1 KΩ | | 24 | 38 | | 48 | | 57 | |
| $t_{PLZ}$ $t_{PHZ}$ | High Impedance Output Disable Time | 4.5 | 50 | $R_L$ = 1 KΩ | | 17 | 30 | | 38 | | 45 | ns |

## Table 7: Capacitive Characteristics

| 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. | |
| $C_{IN}$ | Input Capacitance | | | DIR, $\overline{G}$ | | 5 | 10 | | 10 | | 10 | pF |
| $C_{I/OUT}$ | Output Capacitance | | | An, Bn | | 13 | | | | | | pF |
| $C_{PD}$ | Power Dissipation Capacitance (note 1) | | | | | 41 | | | | | | 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
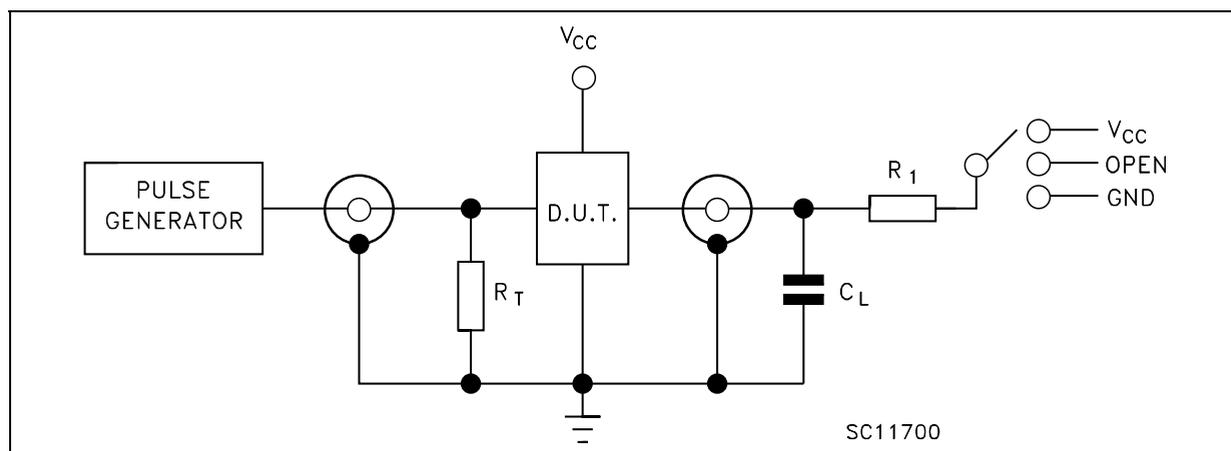


| TEST | SWITCH |
|---|---|
| $t_{PLH}$, $t_{PHL}$ | Open |
| $t_{PZL}$, $t_{PLZ}$ | $V_{CC}$ |
| $t_{PZH}$, $t_{PHZ}$ | GND |

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

**Figure 4: Waveform - Propagation Delay Time** (f=1MHz; 50% duty cycle)
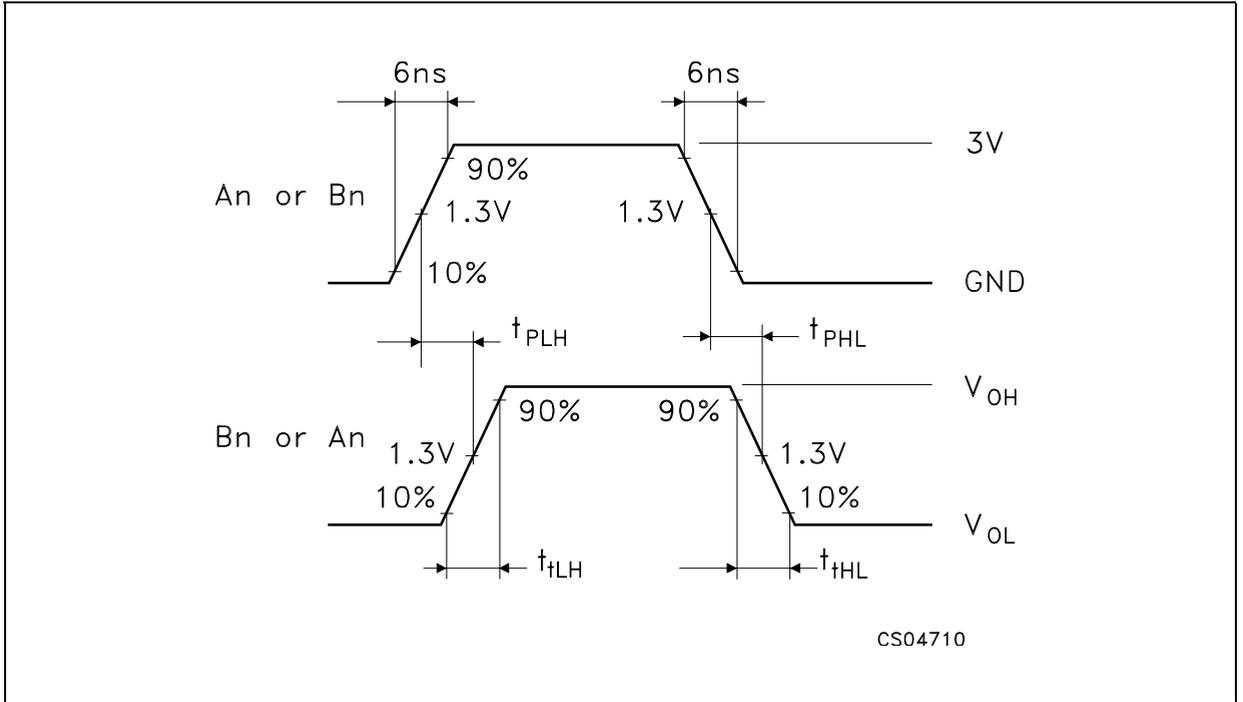


**Figure 5: Waveform - Output Enable And Disable Time** (f=1MHz; 50% duty cycle)
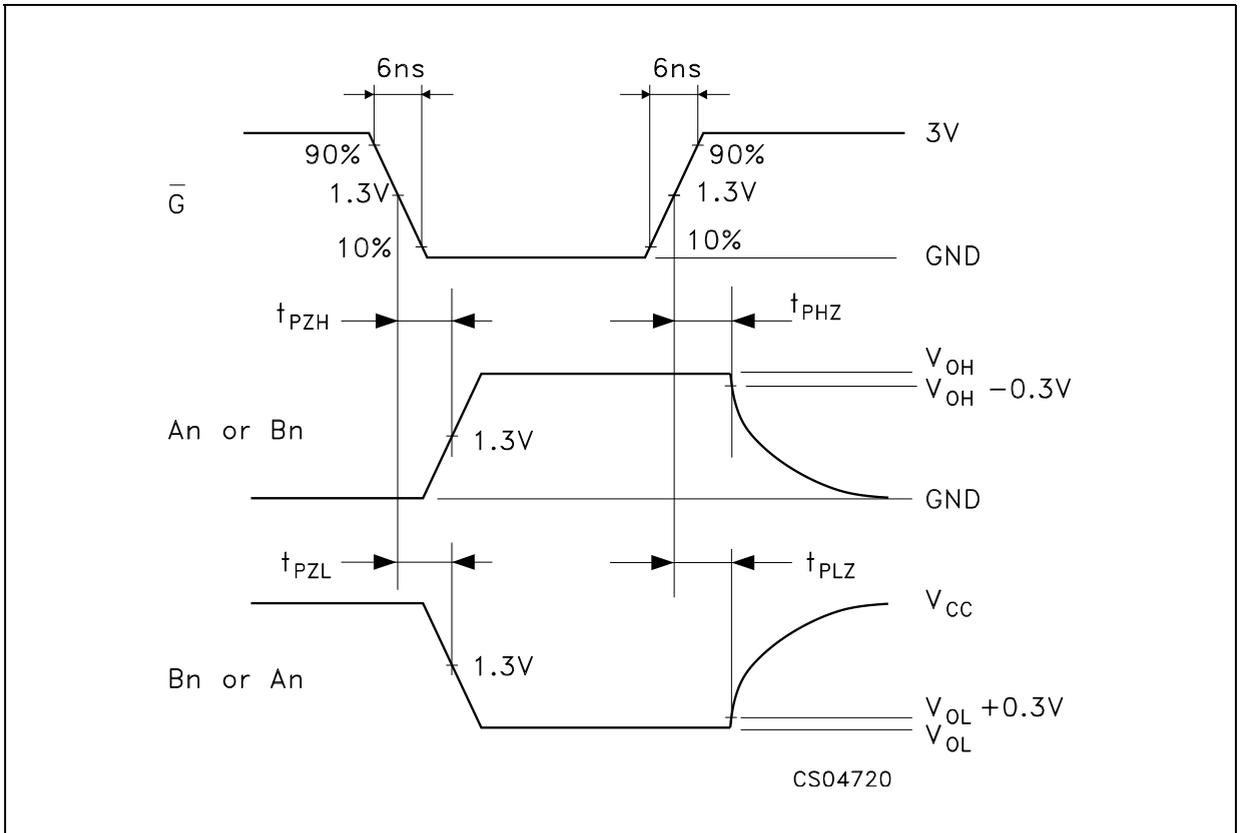
## DILC-20 MECHANICAL DATA

| 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 |
| I | | | 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 |
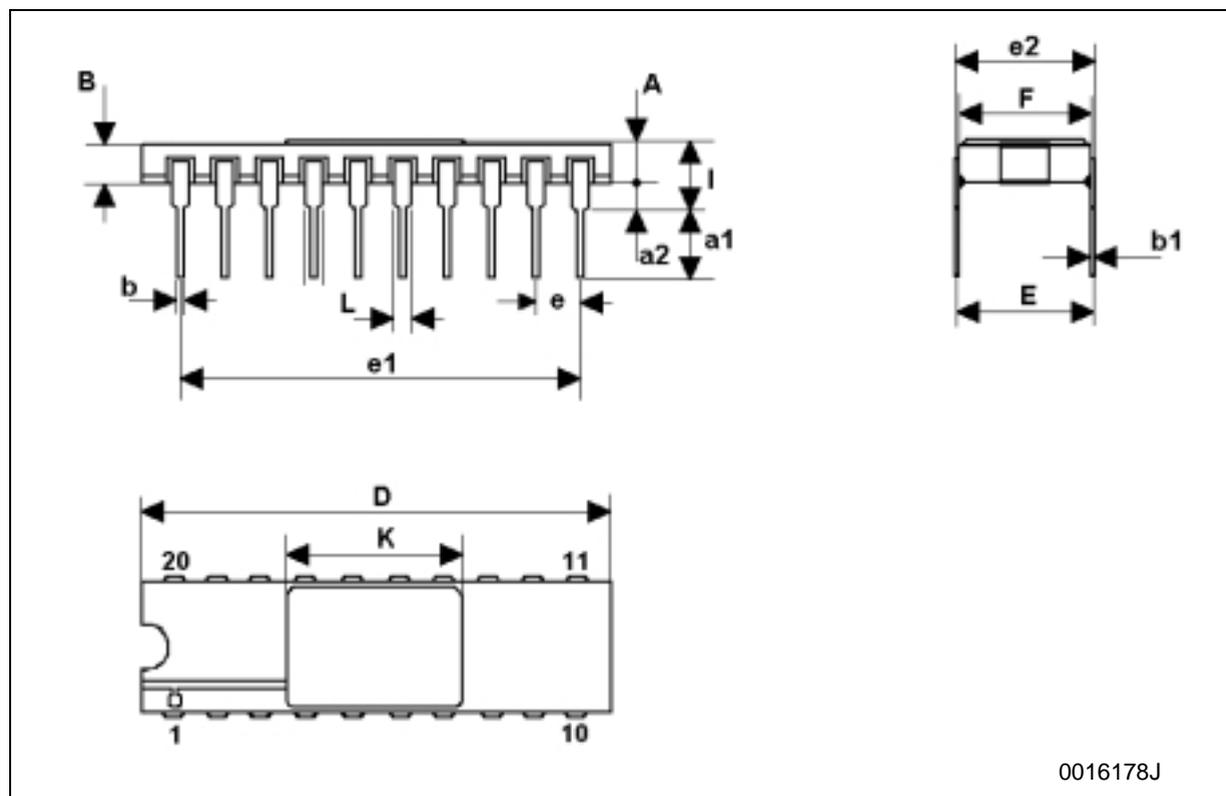


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# FPC-20 MECHANICAL DATA

| 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 |
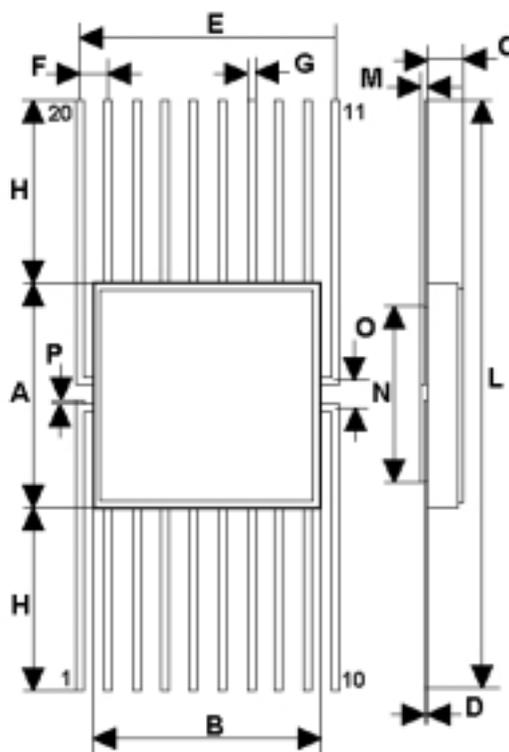


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**Table 8: Revision History**

| Date | Revision | Description of Changes |
|:---:|:---:|:---|
| 15-Jun-2004 | 1 | First Release |