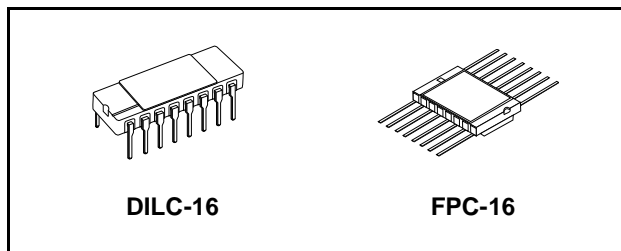


## RAD-HARD HEX BUFFER/CONVERTER (INVERTER)

- HIGH SPEED:  
 $t_{PD} = 8\text{ns}$  (TYP.) at  $V_{CC}=6\text{V}$
- LOW POWER DISSIPATION:  
 $I_{CC} = 1\mu\text{A}$ (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 4049
- 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-9401-037



### ORDER CODES

PACKAGE	FM	EM
DILC	M54HC4049D	M54HC4049D1
FPC	M54HC4049K	M54HC4049K1

The internal circuit is composed of 2 stage inverters, which enables high noise immunity and a stable output.

Input protection circuits are different from those of the high speed CMOS IC's.

The  $V_{CC}$  side diodes are designed to allow logic-level conversion from high-level voltages (up to 13V) to low level voltages.

### DESCRIPTION

The M54HC4049 is an high speed CMOS HEX BUFFER (INVERTING) fabricated with silicon gate C<sup>2</sup>MOS technology.

### PIN CONNECTION

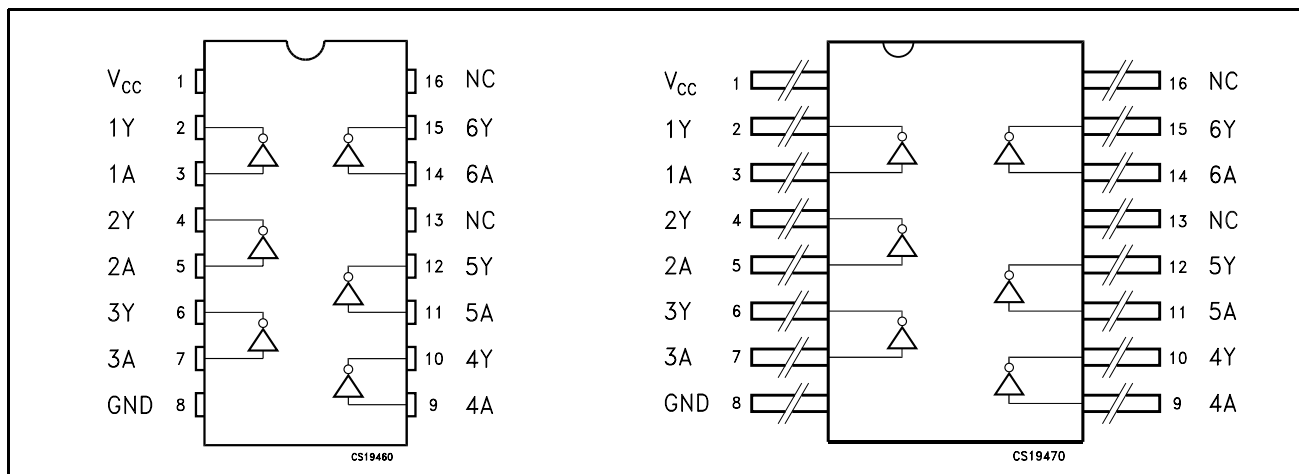


Figure 1: IEC Logic Symbols

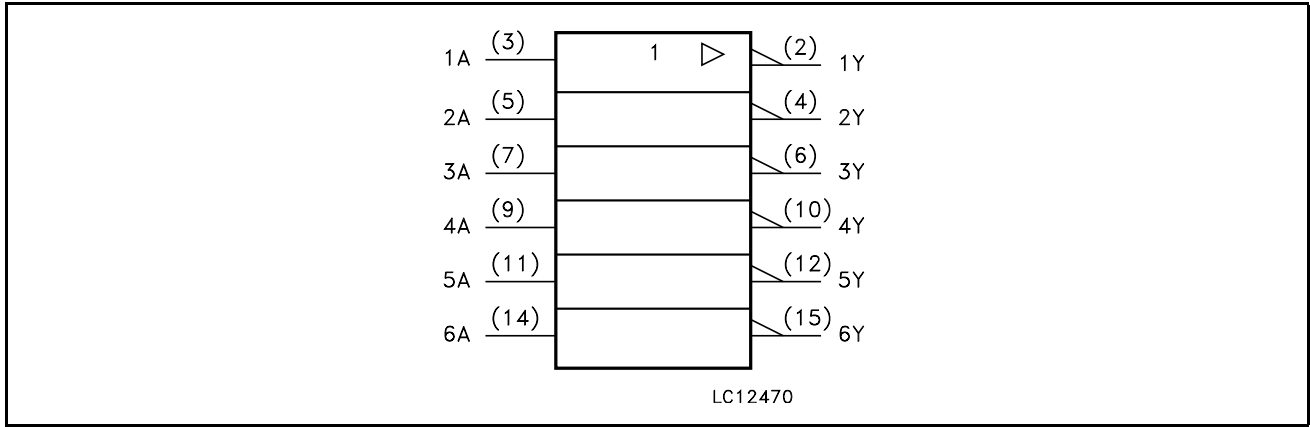


Figure 2: Input And Output Equivalent Circuit

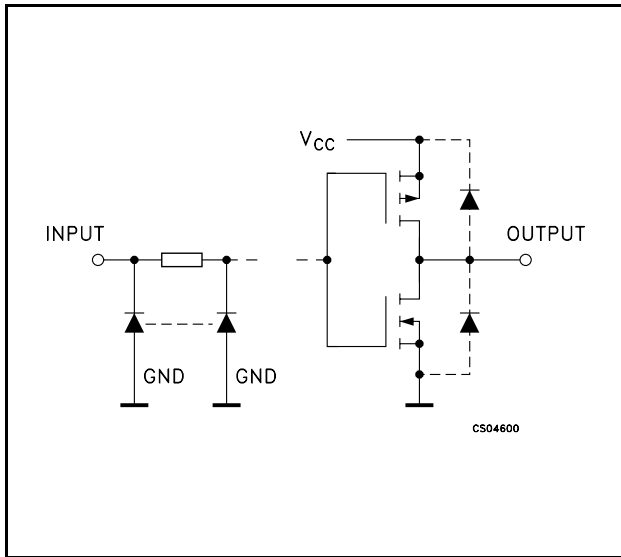


Table 1: Pin Description

PIN N°	SYMBOL	NAME AND FUNCTION
2, 4, 6, 10, 12, 15	1 $\bar{Y}$ to 6 $\bar{Y}$	Data Outputs
3, 5, 7, 9, 11, 14	1A to 6A	Data Inputs
13, 16	NC	Not Connected
8	GND	Ground (0V)
1	V <sub>CC</sub>	Positive Supply Voltage

Table 2: Truth Table

INPUT	OUTPUT
nA	n $\bar{Y}$
L	H
H	L

Table 3: Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	-0.5 to +7	V
V <sub>I</sub>	DC Input Voltage	-0.5 to 15	V
V <sub>O</sub>	DC Output Voltage	-0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	DC Input Diode Current	- 20	mA
I <sub>OK</sub>	DC Output Diode Current	± 20	mA
I <sub>O</sub>	DC Output Current	± 25	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current	± 50	mA
P <sub>D</sub>	Power Dissipation	300	mW
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C
T <sub>L</sub>	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 13	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)		$T_A = 25^\circ C$			-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	$I_O = -20 \mu A$	1.9	2.0		1.9		1.9		V
		4.5	$I_O = -20 \mu A$	4.4	4.5		4.4		4.4		
		6.0	$I_O = -20 \mu A$	5.9	6.0		5.9		5.9		
		4.5	$I_O = -4.0 mA$	4.18	4.31		4.13		4.10		
		6.0	$I_O = -5.2 mA$	5.68	5.8		5.63		5.60		
$V_{OL}$	Low Level Output Voltage	2.0	$I_O = 20 \mu A$		0.0	0.1		0.1		0.1	V
		4.5	$I_O = 20 \mu A$		0.0	0.1		0.1		0.1	
		6.0	$I_O = 20 \mu A$		0.0	0.1		0.1		0.1	
		4.5	$I_O = 4.0 mA$		0.17	0.26		0.33		0.40	
		6.0	$I_O = 5.2 mA$		0.18	0.26		0.33		0.40	
$I_I$	Input Leakage Current	6.0	$V_I = V_{CC}$ or GND $V_I = 13 V$			$\pm 0.1$ $\pm 0.5$		$\pm 1$ $\pm 5$		$\pm 1$	$\mu A$
$I_{CC}$	Quiescent Supply Current	6.0	$V_I = V_{CC}$ or GND			1		10		20	$\mu A$

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

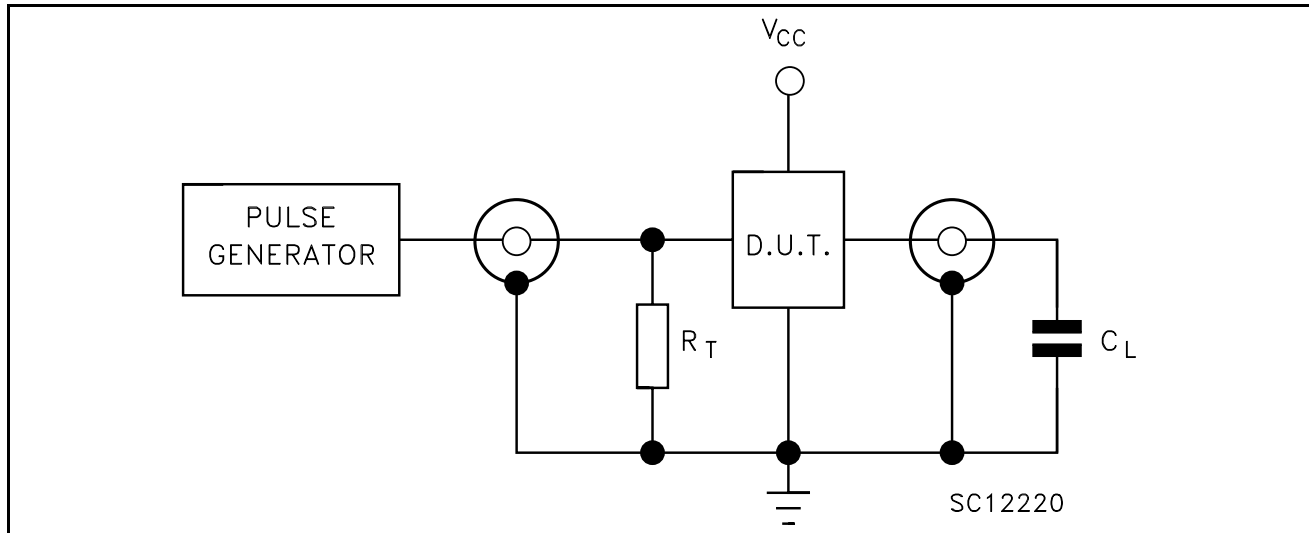
Symbol	Parameter	Test Condition		Value						Unit	
		$V_{CC}$ (V)	$C_L$ (pF)	$T_A = 25^\circ\text{C}$			$-40 \text{ to } 85^\circ\text{C}$		$-55 \text{ to } 125^\circ\text{C}$		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$t_{TLH}$ $t_{THL}$	Output Transition Time	2.0	50		25	60		75		90	ns
		4.5			7	12		15		18	
		6.0			6	10		13		15	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time	2.0	50		30	75		95		115	ns
		4.5			9	15		19		23	
		6.0			8	13		16		20	
		2.0	150		45	100		125		150	
		4.5			14	20		25		30	
		6.0			12	17		21		26	

Table 7: Capacitive Characteristics

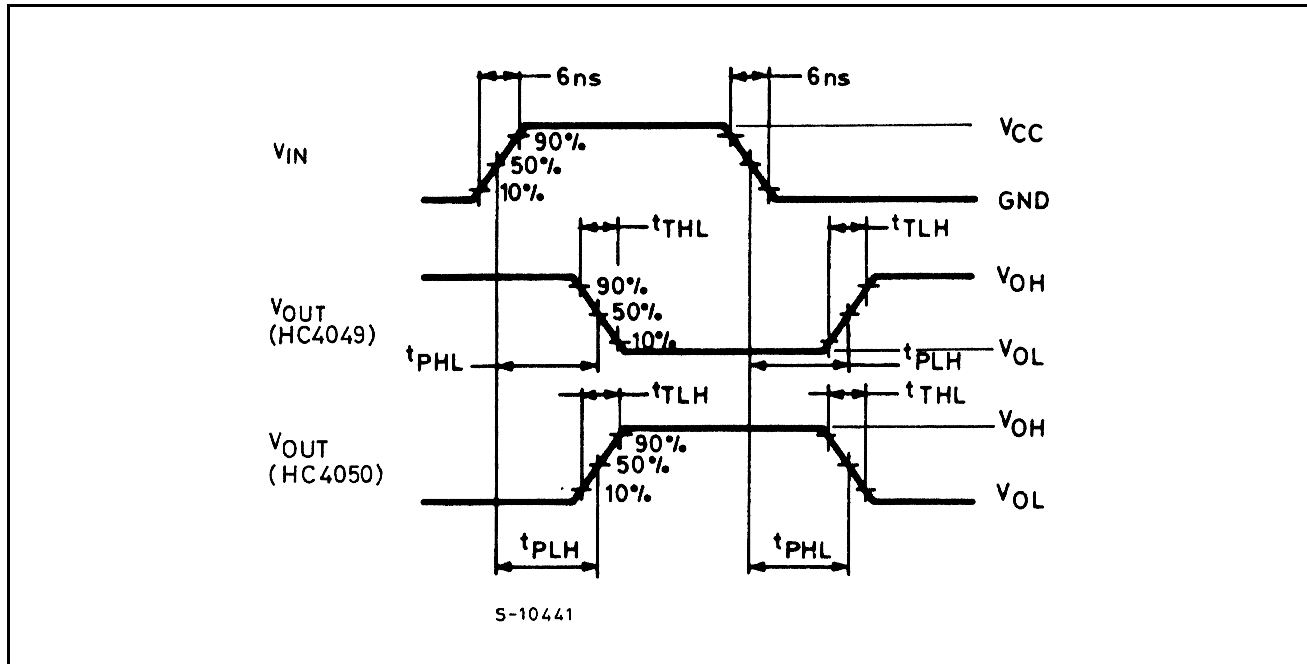
Symbol	Parameter	Test Condition		Value						Unit	
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$			$-40 \text{ to } 85^\circ\text{C}$		$-55 \text{ to } 125^\circ\text{C}$		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$C_{IN}$	Input Capacitance	5.0			5	10		10		10	pF
$C_{PD}$	Power Dissipation Capacitance (note 1)	5.0			26						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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/6$  (per gate)

Figure 3: Test Circuit

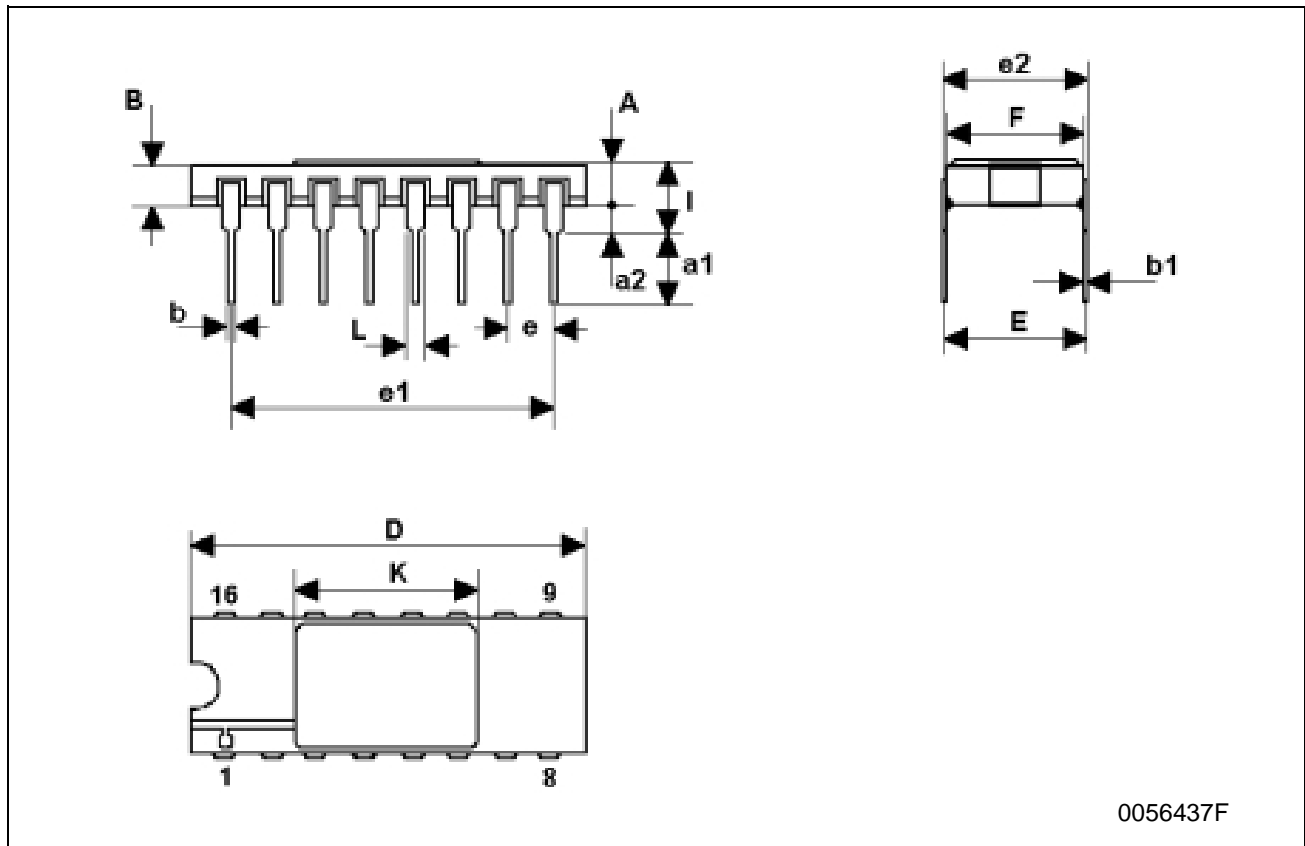


$C_L = 50 \text{ pF}$  or equivalent (includes jig and probe capacitance)  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50 \Omega$ )

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

**DILC-16 MECHANICAL DATA**

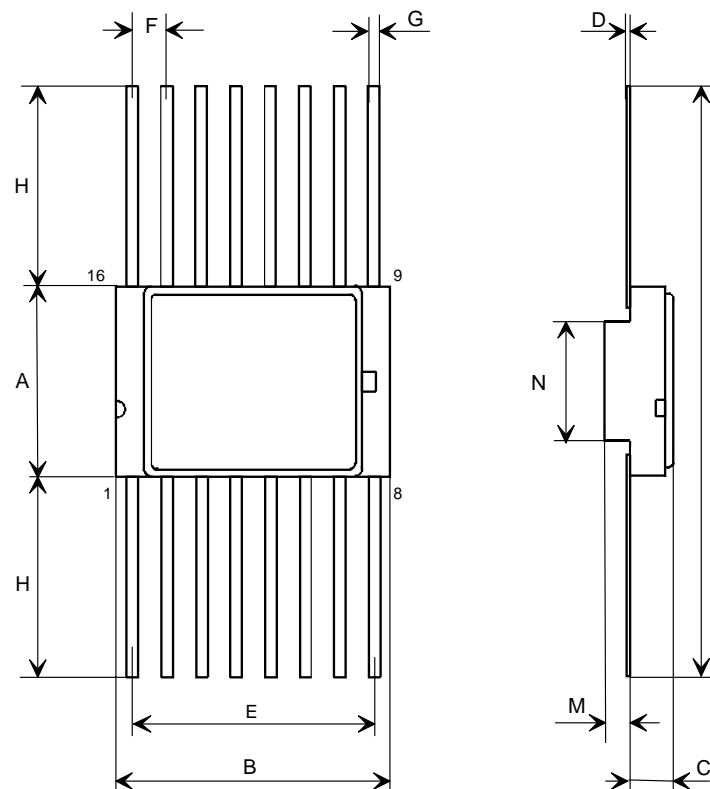
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.1		2.71	0.083		0.107
a1	3.00		3.70	0.118		0.146
a2	0.63	0.88	1.14	0.025	0.035	0.045
B	1.82		2.39	0.072		0.094
b	0.40	0.45	0.50	0.016	0.018	0.020
b1	0.20	0.254	0.30	0.008	0.010	0.012
D	20.06	20.32	20.58	0.790	0.800	0.810
E	7.36	7.62	7.87	0.290	0.300	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	



0016030E

**Table 8: Revision History**

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



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