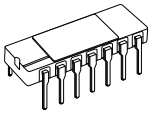
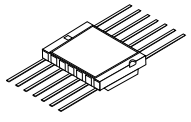
M54HC4066

RAD-HARD QUAD BILATERAL SWITCH

- HIGH SPEED:
  t_{PD} = 7ns (TYP.) at V_{CC} = 6V
- LOW POWER DISSIPATION:
  I_{CC} = 1μA(MAX.) at T_A=25°C
- LOW "ON" RESISTANCE:
  R_{ON} = 50Ω TYP. AT V_{CC} = 9V, $I_{I/O}$ = 100 μA
- WIDE OPERATING VOLTAGE RANGE V_{CC} (OPR) = 2V TO 12V
- SINE WAVE DISTORTION:
  0.042% at V_{CC} = 4V f = 1KHz
- HIGH NOISE IMMUNITY:
  V_{NIH} = V_{NIL} = 28% V_{CC} (MIN.)
- PIN AND FUNCTION COMPATIBLE WITH 54 SERIES 4066
- 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-9408-052



DILC-14



FPC-14

ORDER CODES

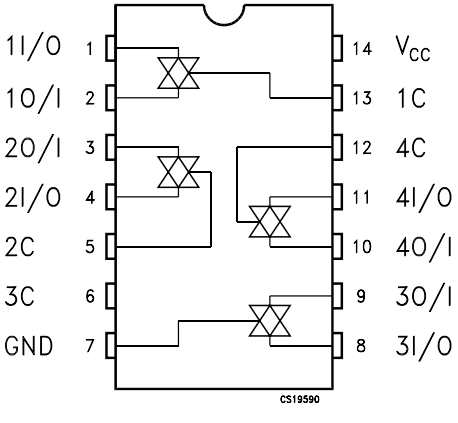
PACKAGE	FM	EM
DILC	M54HC4066D	M54HC4066D1
FPC	M54HC4066K	M54HC4066K1

DESCRIPTION

The M54HC4066 is an high speed CMOS QUAD BILATERAL SWITCH fabricated with silicon gate C^2MOS technology.

The C input is provided to control the switch; the switch is on when the C input is held high and off when C is held low.

PIN CONNECTION



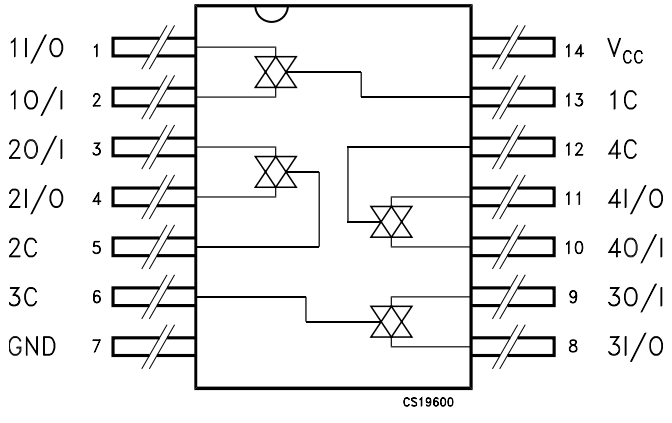


Figure 1: IEC Logic Symbols

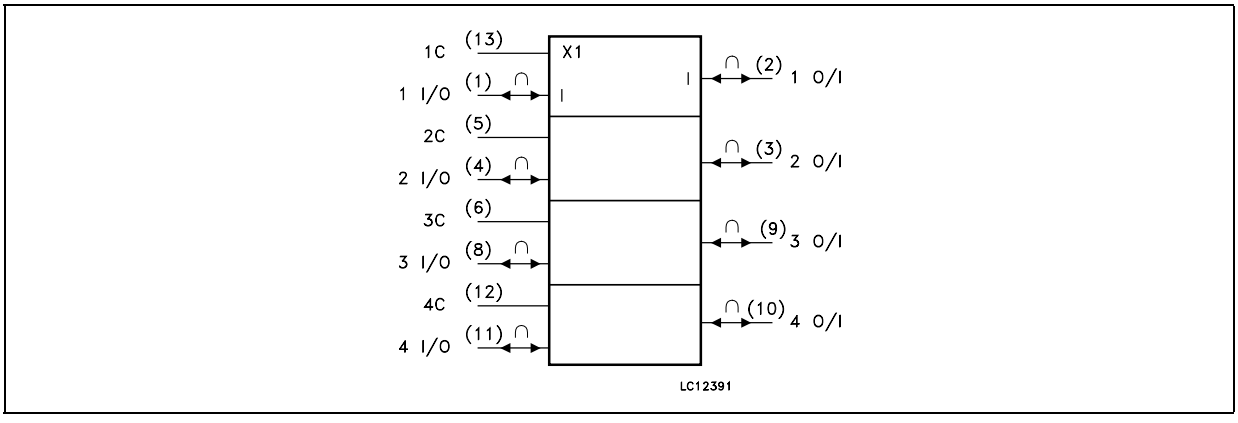


Figure 2: Logic Diagram

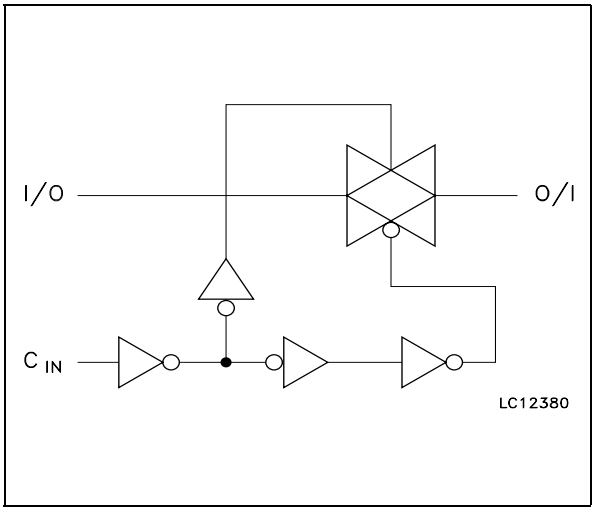


Table 1: Pin Description

PIN N°	SYMBOL	NAME AND FUNCTION
1, 4, 8, 11	1 to 4 I/O	Independent Inputs/Outputs
2, 3, 9, 10	1 to 4 O/I	Independent Outputs/ Inputs
13, 5, 6, 12	1C to 4C	Enable Inputs (Active High)
7	GND	Ground (0V)
14	V_{CC}	Positive Supply Voltage

Table 2: Truth Table

CONTROL	SWITCH FUNCTION
H	ON
L	OFF

Table 3: Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.5 to +13	V
V_{IN}	DC Input Voltage	-0.5 to V_{CC} + 0.5	V
$V_{I/O}$	DC Input/Output Voltage	-0.5 to V_{CC} + 0.5	V
I_{OK}	Control Input DC Diode Current	± 20	mA
I_{IOK}	I/O DC Diode Current	± 20	mA
I_O	DC Output Source Sink Current Per Output Pin	± 25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 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_{CC}	Supply Voltage		2 to 12	V
V_{IN}	Input Voltage (Control)		0 to V_{CC}	V
$V_{I/O}$	I/O 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	
		V_{CC} = 6.0V	0 to 400	
		V_{CC} = 10.0V	0 to 250	

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_{IHC}	High Level Control Input Voltage	2.0		1.5			1.5		1.5		V
		4.5		3.15			3.15		3.15		
		9.0		6.3			6.3		6.3		
		12.0		8.4			8.4		8.4		
V_{ILC}	Low Level Control Input Voltage	2.0				0.5		0.5		0.5	V
		4.5				1.35		1.35		1.35	
		9.0				2.7		2.7		2.7	
		12.0				3.6		3.6		3.6	
R_{ON}	ON Resistance	4.5	$V_I = V_{IHC}$ $V_{I/O} = V_{CC}$ to GND $I_{I/O} \leq 1mA$		96	170		200		250	Ω
		9.0			55	85		100		150	
		12.0			45	80		90		120	
		4.5	$V_I = V_{IHC}$ $V_{I/O} = V_{CC}$ or GND $I_{I/O} \leq 1mA$		70	100		130		160	
		9.0			50	75		95		115	
		12.0			45	70		90		110	
ΔR_{ON}	Difference of ON Resistance between switches	4.5	$V_I = V_{IHC}$ $V_{I/O} = V_{CC}$ or GND $I_{I/O} \leq 1mA$		10						Ω
		9.0			5						
		12.0			5						
I_{OFF}	Input/Output Leakage Current (SWITCH OFF)	12.0	$V_{OS} = V_{CC}$ or GND $V_{IS} = V_{CC}$ or GND $V_{IN} = V_{ILC}$			± 0.1		± 1		± 2	µA
I_{IZ}	Switch Input Leakage Current (SWITCH ON, OUTPUT OPEN)	12.0	$V_{OS} = V_{CC}$ or GND $V_{IN} = V_{IHC}$			± 0.1		± 1		± 2	µA
I_{IN}	Control Input Current	6.0	$V_I = V_{CC}$ or GND			± 0.1		± 1		± 1	µA
I_{CC}	Quiescent Supply Current	6.0	$V_I = V_{CC}$ or GND			1		10		20	µA
		9.0				4		40		80	
		12.0				8		80		160	

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

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.	
$\Phi_{I/O}$	Phase Difference Between Input and Output	2.0			10	50		65		75	ns
		4.5			4	10		13		15	
		9.0			3	8		10		13	
		12.0			3	7		9		10	
t_{PZL} t_{PZH}	Output Enable Time	2.0	R_L = 1KΩ		18	100		125		150	ns
		4.5			8	20		25		30	
		9.0			6	12		22		27	
		12.0			6	12		18		25	
t_{PLZ} t_{PHZ}	Output Disable Time	2.0	R_L = 1KΩ		20	115		145		175	ns
		4.5			10	23		29		35	
		9.0			8	20		25		30	
		12.0			8	18		22		27	
	Maximum Control Input Frequency	2.0	R_L = 1KΩ C_L = 15 pF V_{OUT} = 1/2 V_{CC}		30						MHz
		4.5			30						
		9.0			30						
		12.0			30						

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				5	10		10		10	pF
$C_{I/O}$	Switch Terminal Capacitance				6						pF
C_{IOS}	Feed Through Capacitance				0.5						pF
C_{PD}	Power Dissipation Capacitance (note 1)				15						pF

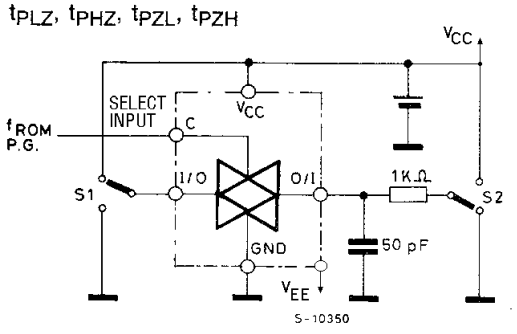
1) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}$

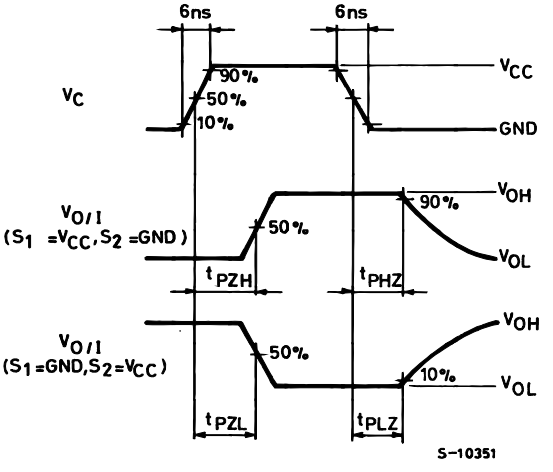
Table 8: Analog Switch Characteristics (GND = 0V;T_A = 25°C)

Symbol	Parameter	Test Condition			Value	Unit
		V_{CC} (V)	V_{IN} (V_{p-p})		Typ.	
	Sine Wave Distortion (THD)	4.5	4	f_{IN} = 1 KHz R_L = 10 KΩ, C_L = 50 pF	0.05	%
		9.0	8		0.04	
f_{MAX}	Frequency Response (Switch ON)	4.5	Adjust f_{IN} voltage to obtain 0 dBm at V_{OS}. Increase f_{IN} Frequency until dB meter reads -3dB R_L = 50Ω, C_L = 10 pF		200	MHz
		9.0			200	
	Feed through Attenuation (Switch OFF)	4.5	V_{IN} is centered at V_{CC}/2. Adjust input for 0 dBm R_L = 600Ω C_L = 50 pF, f_{IN} = 1MHz sine wave		-60	dB
		9.0			-60	
	Crosstalk (Control Input to Signal Output)	4.5	R_L = 600Ω, C_L = 50 pF, f_{IN} = 1MHz square wave (t_r = t_f =6ns)		60	mV
		9.0			100	
	Crosstalk (Between Any Switches)	4.5	Adjust V_{IN} to Obtain 0 dBmat input R_L = 600Ω, C_L = 50 pF, f_{IN} = 1MHz sine wave		-60	dB
		9.0			-60	

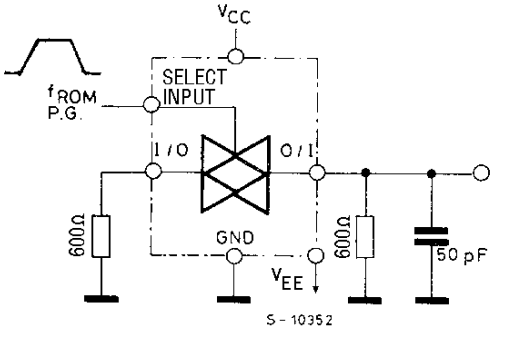
Figure 3: Switching Characteristics Test Circuit

t_{PLZ}, t_{PHZ}, t_{PZL}, t_{PZH}



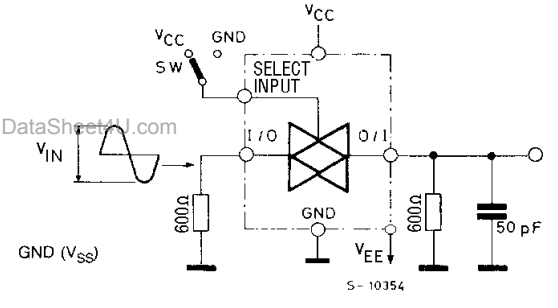


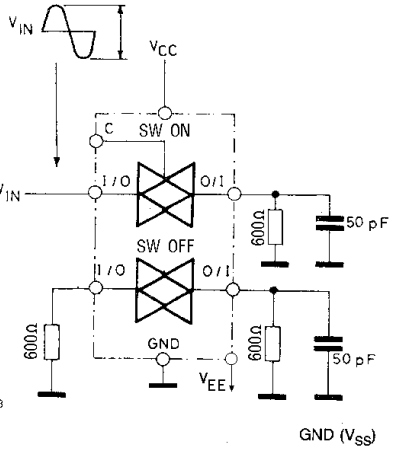
CROSSTALK (control to output)



CROSSTALK BETWEEN ANY TWO SWITCHES

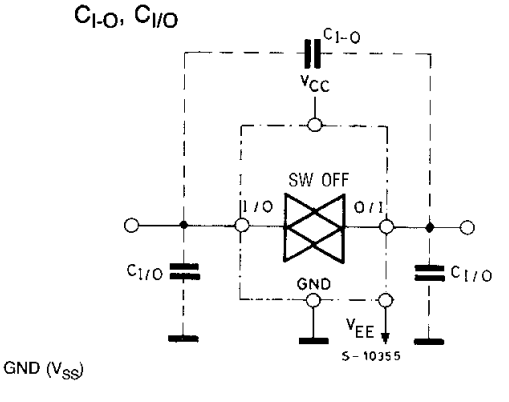
BANDWIDTH AND FEEDTHROUGH ATTENUATION





MAXIMUM CONTROL FREQUENCY

C_{I-O}, $C_{I/O}$



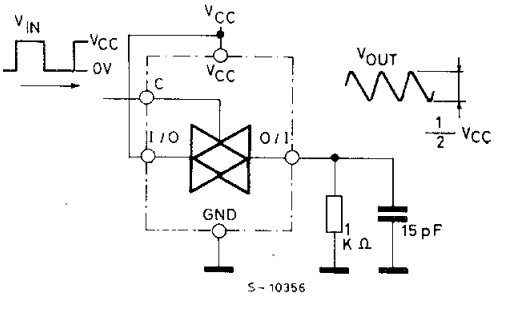


Figure 4: Channel Resistance (R_{ON})

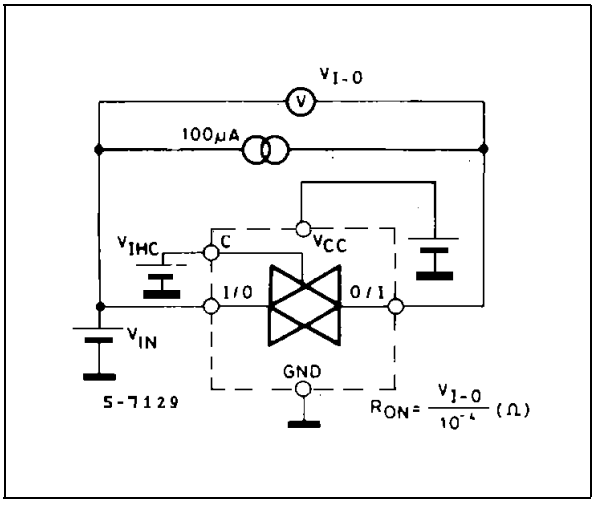
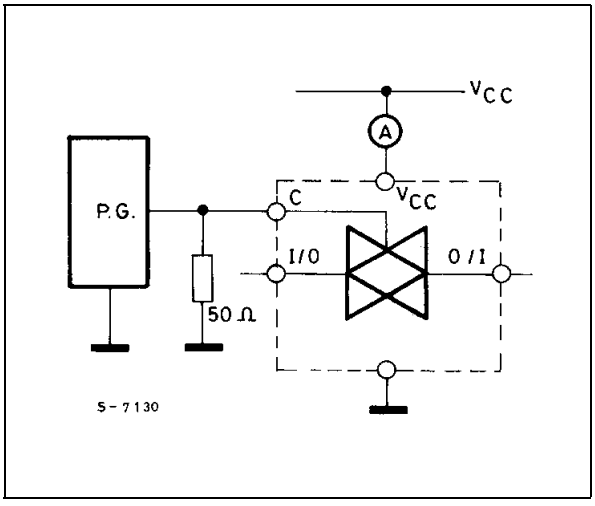
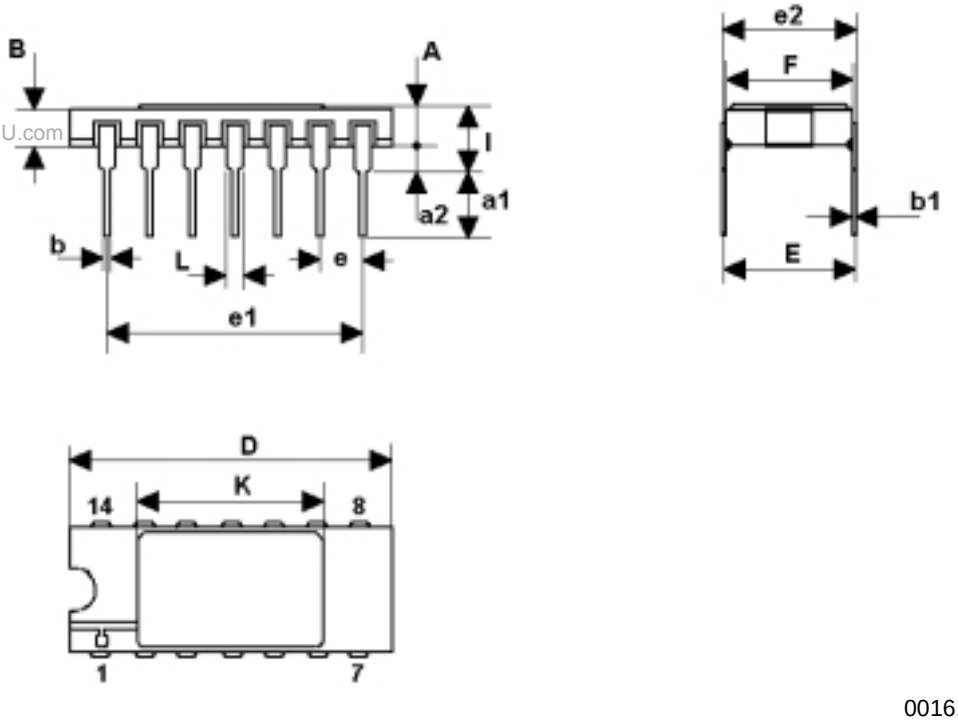


Figure 5: I_{CC} (Opr.)



DILC-14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.1		2.54	0.083		0.100
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	2.03	2.39	0.072	0.080	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	18.79	19.00	19.20	0.740	0.748	0.756
E	7.36	7.62	7.87	0.290	0.300	0.310
e		2.54			0.100	
e1	15.11	15.24	15.37	0.595	0.600	0.605
e2	7.62	7.87	8.12	0.300	0.310	0.320
F	7.11		7.75	0.280		0.305
I			3.70			0.146
K	10.90		12.1	0.429		0.476
L	1.14	1.27	1.5	0.045	0.050	0.059



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FPC-14 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	9.95	10.14	0.384	0.392	0.399
C	1.49		1.95	0.059		0.077
D	0.10	0.127	0.15	0.004	0.005	0.006
E	7.50	7.62	7.75	0.295	0.300	0.305
F		1.27			0.050	
G	0.38	0.43	0.48	0.015	0.017	0.019
H		6.0			0.236	
L	18.75		22.0	0.738		0.866
M		0.38			0.015	
N		4.31			0.170	

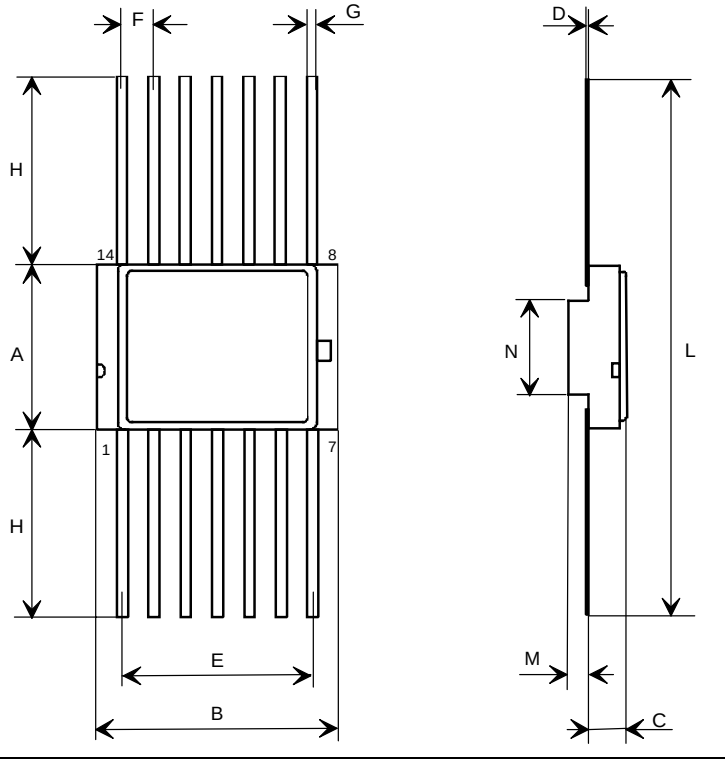

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Table 9: Revision History

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