



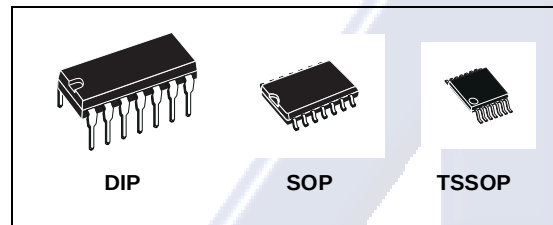
M74HC4024

7 STAGE BINARY COUNTER

- HIGH SPEED :
 $f_{MAX} = 79 \text{ MHz (TYP.) at } V_{CC} = 6V$
- LOW POWER DISSIPATION:
 $I_{CC} = 4\mu A(\text{MAX.}) \text{ at } T_A = 25^\circ C$
- HIGH NOISE IMMUNITY:
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} (\text{MIN.})$
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OH}| = I_{OL} = 4mA (\text{MIN})$
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} \approx t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:
 $V_{CC} (\text{OPR}) = 2V \text{ to } 6V$
- PIN AND FUNCTION COMPATIBLE WITH
74 SERIES 4024

DESCRIPTION

The M74HC4024 is an high speed CMOS 7 STAGE BINARY COUNTER fabricated with silicon gate C²MOS technology. This devices is incremented on the falling edge (negative transition) of the input clock, and all its



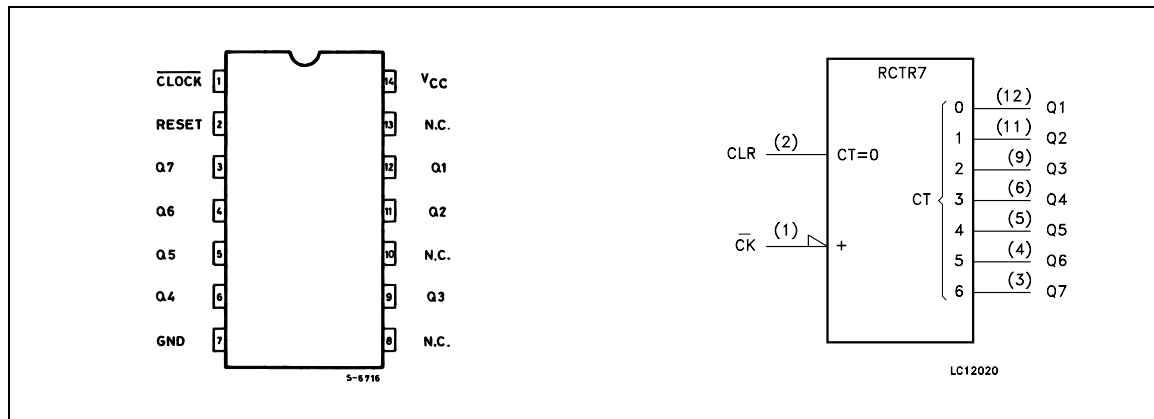
ORDER CODES

PACKAGE	TUBE	T & R
DIP	M74HC4024B1R	
SOP	M74HC4024M1R	M74HC4024RM13TR
TSSOP		M74HC4024TTR

outputs are reset to a low level by applying a logical high level on their reset input (CLEAR). All inputs are equipped with protection circuits against static discharge and transient excess voltage.

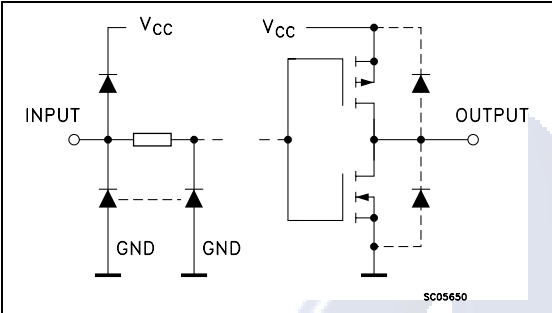
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PIN CONNECTION AND IEC LOGIC SYMBOLS



M74HC4024

INPUT AND OUTPUT EQUIVALENT CIRCUIT



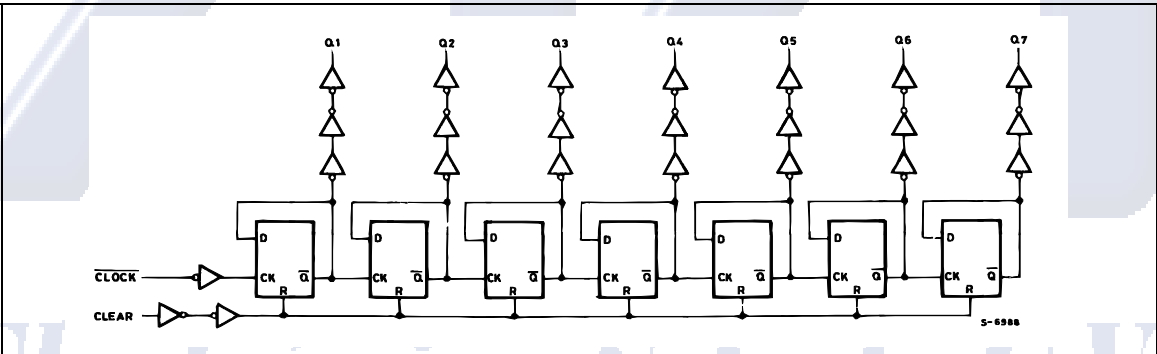
PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1	$\overline{\text{CLOCK}}$	Clock Input (HIGH to LOW, Edge-triggered)
2	CLEAR	Reser Input (Active High)
12, 11, 9, 6, 5, 4, 3	Q1 to Q7	Parallel Inputs
8, 10, 13	NC	Not Connected
7	GND	Ground (0V)
14	Vcc	Positive Supply Voltage

TRUTH TABLE

CLOCK	CLEAR	OUTPUT STATE
X	H	ALL OUTPUTS = "L"
	L	NO CHANGE
	L	ADVANCE TO NEXT STATE

LOGIC DIAGRAM



This logic diagram has not be used to estimate propagation delays

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	± 25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 50	mA
P_D	Power Dissipation	500(*)	mW
T_{stg}	Storage Temperature	-65 to +150	°C
T_L	Lead Temperature (10 sec)	300	°C

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

(*) 500mW at 65 °C; derate to 300mW by 10mW/°C from 65°C to 85°C

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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
		$V_{CC} = 4.5V$	0 to 500
		$V_{CC} = 6.0V$	0 to 400

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 =-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 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 =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			± 0.1		± 1		± 1	μA
I _{CC}	Quiescent Supply Current	6.0	V _I = V _{CC} or GND			4		40		80	μA

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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)		T _A = 25°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			30	75		95		110	ns	
		4.5			8	15		19		22		
		6.0			7	13		16		19		
t _{PLH} t _{PHL}	Propagation Delay Time (Q _n - Q _{n+1})	2.0			24	60		75		90	ns	
		4.5			6	12		15		18		
		6.0			5	10		13		15		
t _{PLH} t _{PHL}	Propagation Delay Time (CLOCK -Q1)	2.0			60	120		150		180	ns	
		4.5			15	24		30		36		
		6.0			13	20		26		31		
t _{PHL}	Propagation Delay Time (CLEAR - Q _n)	2.0			60	120		150		180	ns	
		4.5			15	24		30		36		
		6.0			13	20		26		31		
f _{MAX}	Maximum Clock Frequency	2.0			8	17		7		5.6	MHz	
		4.5			42	67		34		28		
		6.0			49	79		40		34		
t _{W(H)} t _{W(L)}	Minimum Pulse Width (CLOCK)	2.0				24	75		95		110	ns
		4.5				6	15		19		22	
		6.0				5	13		16		19	
t _{W(H)}	Minimum Pulse Width (CLEAR)	2.0				32	75		95		110	ns
		4.5				8	15		19		22	
		6.0				7	13		16		19	
t _{REM}	Minimum Removal Time	2.0					25		30		40	ns
		4.5					5		6		8	
		6.0					5		5		7	

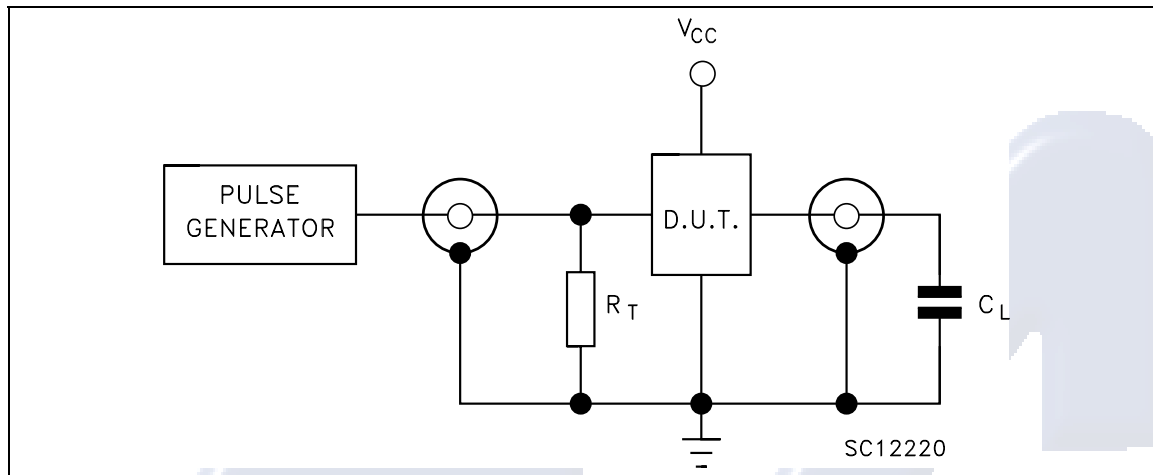
CAPACITIVE CHARACTERISTICS

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	5.0			5	10		10		10	pF
C _{PD}	Power Dissipation Capacitance (note 1)	5.0			34						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. $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}$

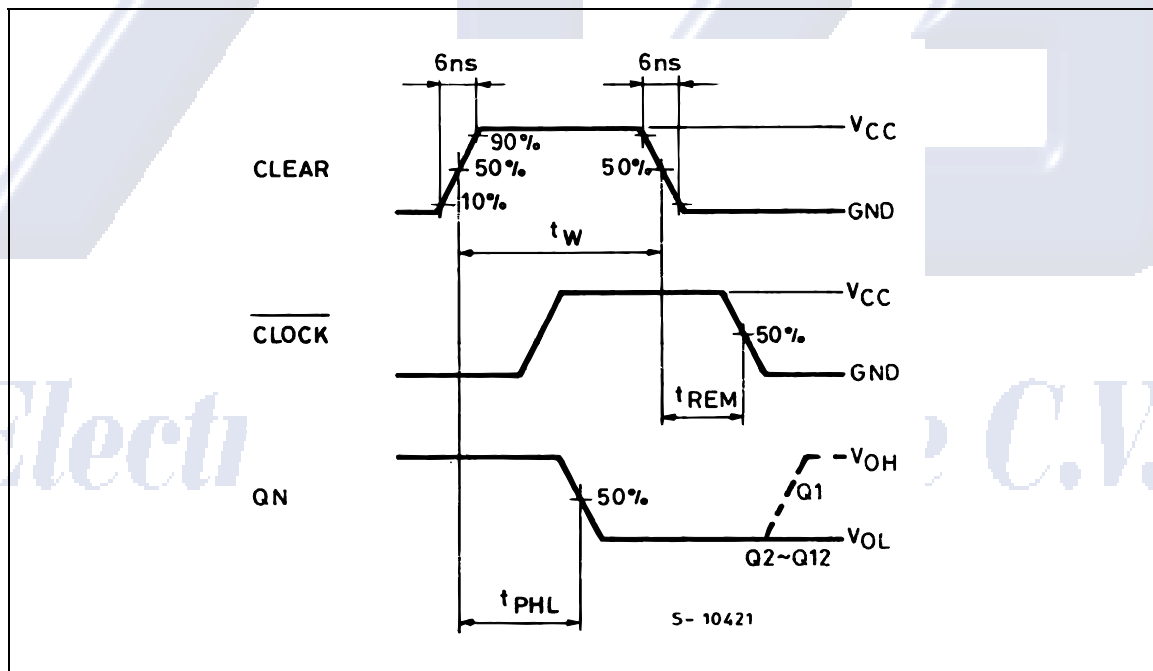
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TEST CIRCUIT



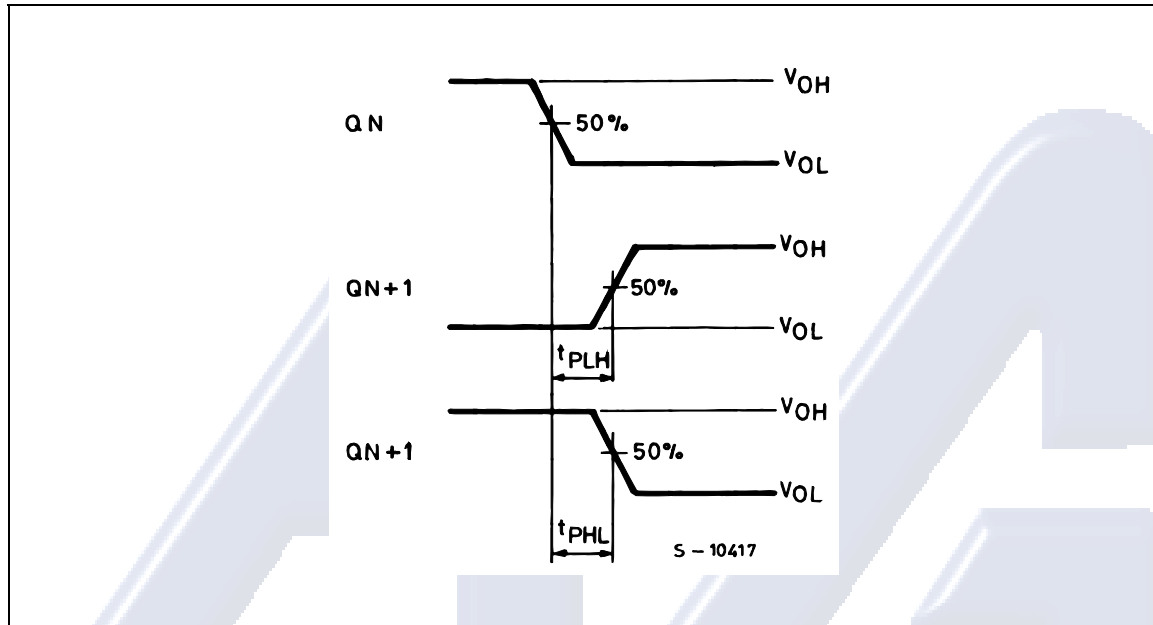
C_L = 50pF or equivalent (includes jig and probe capacitance)
 R_T = Z_{OUT} of pulse generator (typically 50 Ω)

WAVEFORM 1 : MINIMUM PULSE WIDTH (CLEAR) AND REMOVAL TIME ($f=1\text{MHz}$; 50% duty cycle)

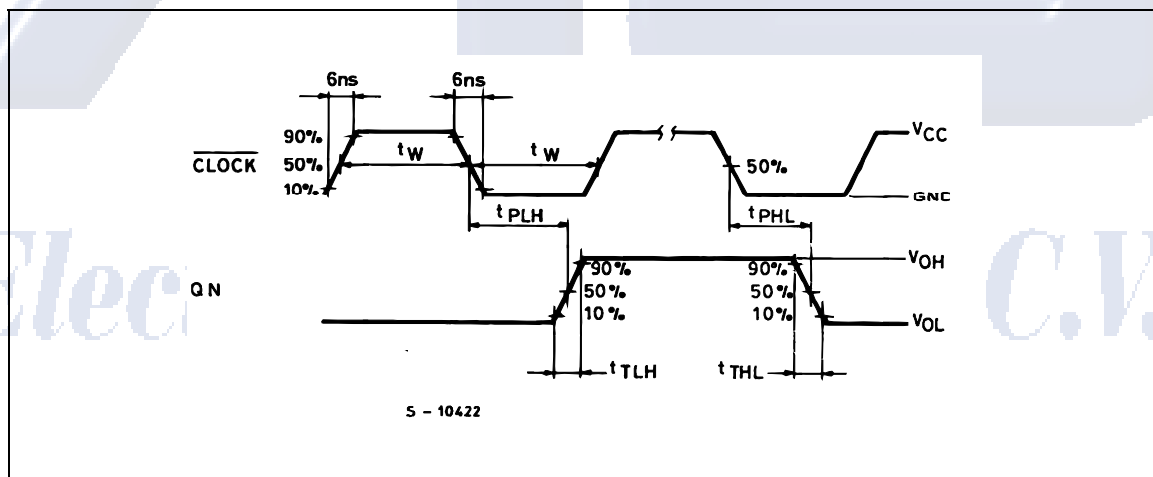


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WAVEFORM 2 : PROPAGATION DELAY TIME ($f=1\text{MHz}$; 50% duty cycle)



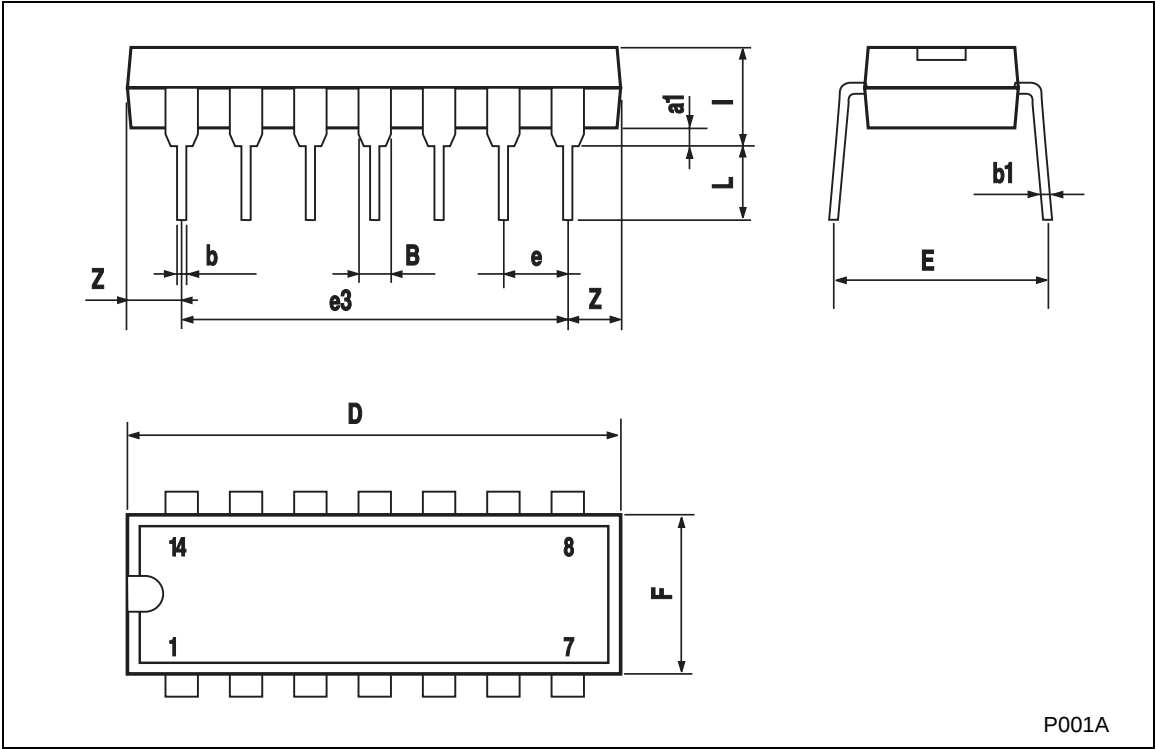
WAVEFORM 3 : MINIMUM PULSE WIDTH (CLOCK), PROPAGATION DELAY TIME ($f=1\text{MHz}$; 50% duty cycle)



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Plastic DIP-14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100



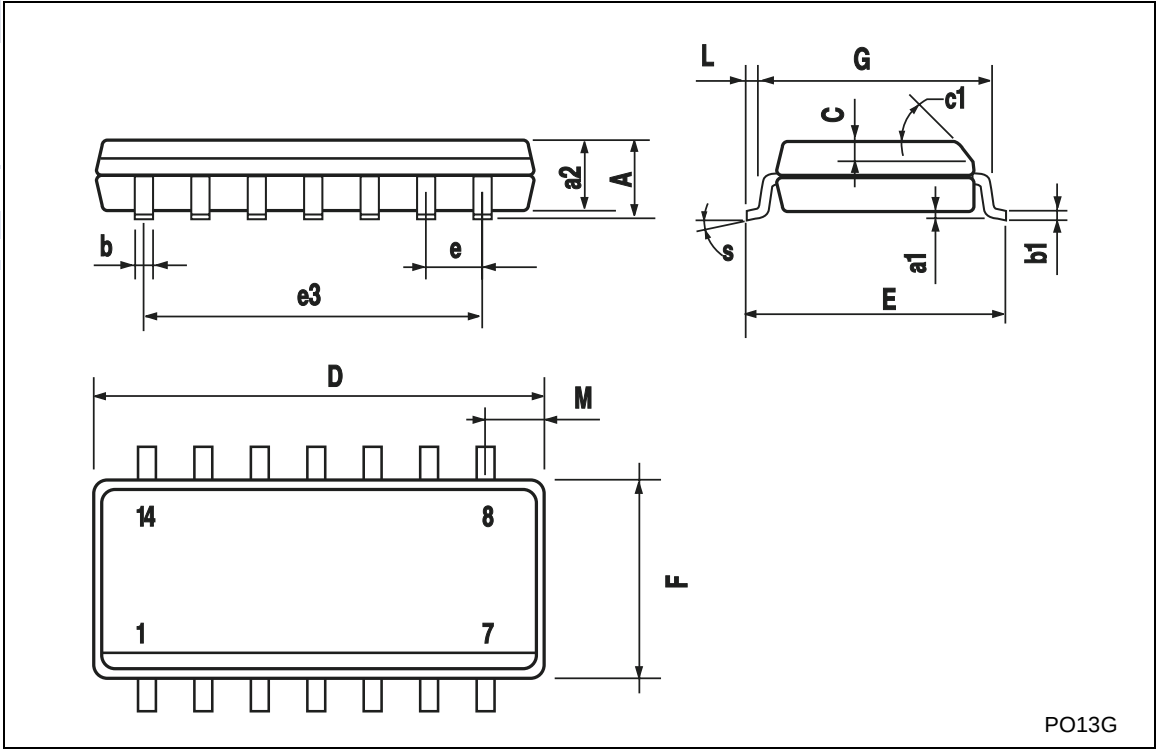
P001A



M74HC4024

SO-14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.68			0.026
S	8° (max.)					



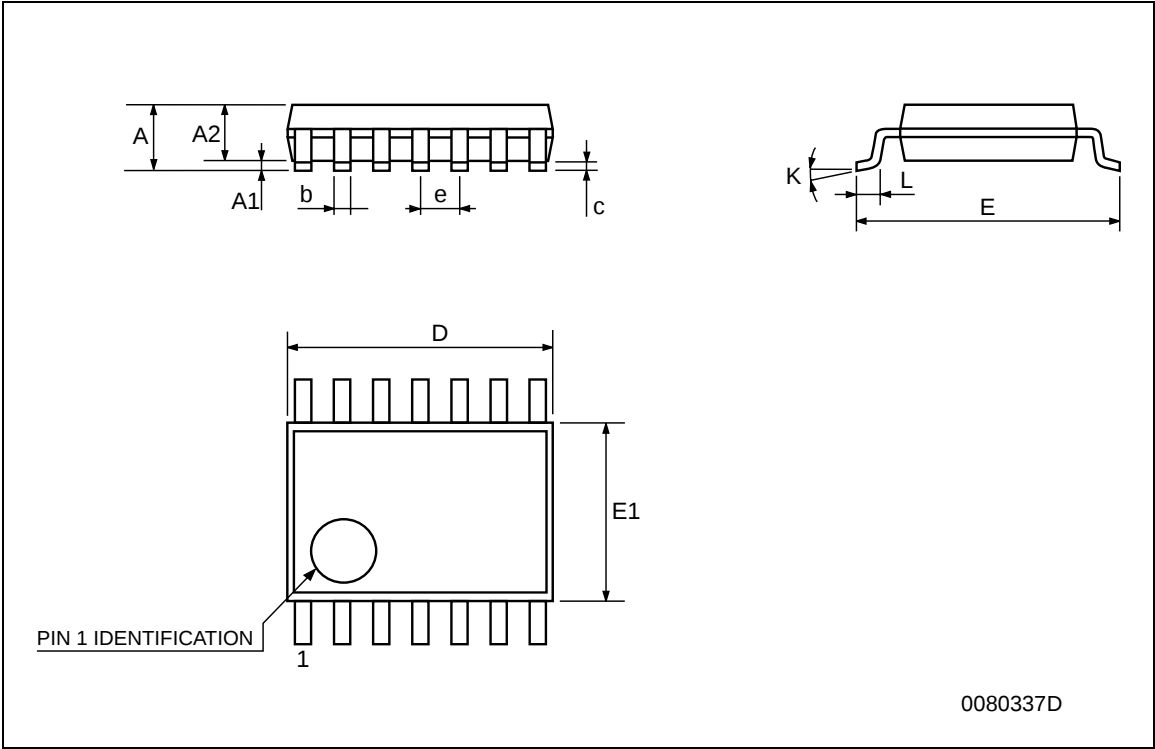
PO13G



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TSSOP14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0089
D	4.9	5	5.1	0.193	0.197	0.201
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030



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