

# MC74AC4040

## 12-Stage Binary Ripple Counter

The MC74AC4040 consists of 12 master-slave flip-flops. The output of each flip-flop feeds the next and the frequency at each output is half that of the preceding one. The state of the counter advances on the negative-going edge of the Clock input. Reset is asynchronous and active-high.

State changes of the Q outputs do not occur simultaneously because of internal ripple delays. Therefore, decoded output signals are subject to decoding spikes and may have to be gated with the Clock of the MC74AC4040 for some designs.

### Features

- 140 MHz Typ. Clock
- Outputs Source/Sink 24 mA
- Operating Voltage Range: 2.0 to 6.0 V
- High Noise Immunity
- Pb-Free Packages are Available

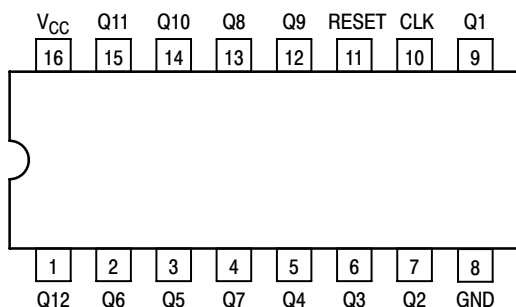


Figure 1. Pinout: 16-Lead Packages Conductors (Top View)

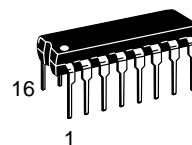
### FUNCTION TABLE

Clock	Reset	Output State
	L	No Change
	L	Advance to next state
X	H	All Outputs are low

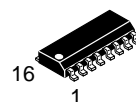


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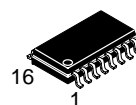
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PDIP-16  
N SUFFIX  
CASE 648



SOIC-16  
D SUFFIX  
CASE 751B



SOEIAJ-16  
M SUFFIX  
CASE 966

### ORDERING INFORMATION

Device	Package	Shipping†
MC74AC4040N	PDIP-16	25 Units/Rail
MC74AC4040NG	PDIP-16 (Pb-Free)	25 Units/Rail
MC74AC4040D	SOIC-16	48 Units/Rail
MC74AC4040DG	SOIC-16 (Pb-Free)	48 Units/Rail
MC74AC4040DR2	SOIC-16	2500 Tape & Reel
MC74AC4040DR2G	SOIC-16 (Pb-Free)	2500 Tape & Reel
MC74AC4040M	SOEIAJ-16	50 Units/Rail

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

### DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 4 of this data sheet.

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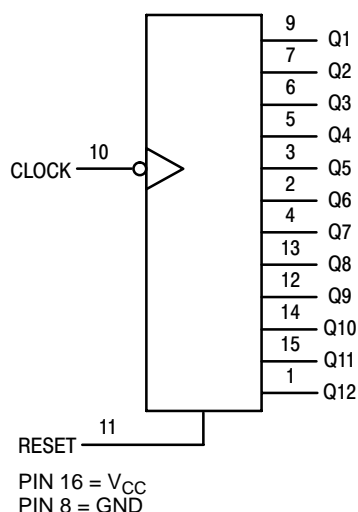


Figure 2. Logic Diagram

## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
$V_{IN}$	DC Input Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V
$V_{OUT}$	DC Output Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V
$I_{IN}$	DC Input Current, per Pin	$\pm 20$	mA
$I_{OUT}$	DC Output Current, per Pin	$\pm 50$	mA
$I_{CC}$	DC $V_{CC}$ or GND Current per Output Pin	$\pm 50$	mA
$P_D$	Power Dissipation in Still Air Plastic† SOIC Package†	750 500	mW
$T_{stg}$	Storage Temperature	-65 to +150	°C
$T_L$	Lead Temperature, 1 mm from Case for 10 seconds (Plastic DIP or SOIC Package)	260	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

†Derating: Plastic DIP: - 10mW/°C from 65°C to 125°C SOIC Package: -7.0 mW/°C from 65°C to 125°C

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
$V_{CC}$	DC Supply Voltage (Referenced to GND)	2.0	6.0	V
$V_{IN}/V_{OUT}$	Input Voltage, Output Voltage (Referenced to GND)	0	$V_{CC}$	-
$T_A$	Operating Temperature, All Package Types	-40	+85	°C
$t_r/t_f$	Input Rise/Fall Time (Figure 1) $V_{CC} = 3.0\text{ V}$ $V_{CC} = 4.5\text{ V}$ $V_{CC} = 5.5\text{ V}$	0	150 40 25	ns/V

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## DC CHARACTERISTICS (unless otherwise specified)

Symbol	Parameter	Value	Unit	
$I_{CC}$	Maximum Quiescent Supply Voltage	80	$\mu A$	$V_{in} = V_{CC}$ or GND $V_{CC} = 5.5 V, T_A = \text{Worst Case}$
$I_{CC}$	Maximum Quiescent Supply Current	8.0	$\mu A$	$V_{in} = V_{CC}$ or GND $V_{CC} = 5.5 V, T_A = 25^\circ C$

## DC CHARACTERISTICS

Symbol	Parameter	$V_{CC}$ (V)	74AC		74AC		Unit	Conditions	
			$T_A = +25^\circ C$		$T_A = -40^\circ C$ to $+85^\circ C$				
			Typ	Guaranteed Limits					
$V_{IH}$	Minimum High Level Input Voltage	3.0	–	2.1	2.1		V	$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$	
		4.5	–	3.15	3.15				
		5.5	–	3.85	3.85				
$V_{IL}$	Maximum Low Level Input Voltage	3.0	–	0.9	0.9		V	$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$	
		4.5	–	1.35	1.35				
		5.5	–	1.65	1.65				
$V_{OH}$	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9		V	$I_{OUT} = -50 \mu A$	
		4.5	4.49	4.4	4.4				
		5.5	5.49	5.4	5.4				
			3.0	–	2.56	2.46		V	* $V_{IN} = V_{IL}$ or $V_{IH}$ –12 mA $I_{OH}$ –24 mA –24 mA
			4.5	–	3.86	3.76			
			5.5	–	4.86	4.76			
$V_{OL}$	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1		V	$I_{OUT} = 50 \mu A$	
		4.5	0.001	0.1	0.1				
		5.5	0.001	0.1	0.1				
			3.0	–	0.36	0.44		V	* $V_{IN} = V_{IL}$ or $V_{IH}$ 12 mA $I_{OL}$ 24 mA 24 mA
			4.5	–	0.36	0.44			
			5.5	–	0.36	0.44			
$I_{IN}$	Maximum Input Leakage Current	5.5	–	$\pm 0.1$	$\pm 1.0$		$\mu A$	$V_I = V_{CC}, GND$	
$I_{OLD}$	Minimum Dynamic Output Current†	5.5	–	–	75		mA	$V_{OLD} = 1.65 V \text{ Max}$	
$I_{OHD}$		5.5	–	–	–75		mA	$V_{OHD} = 3.85 V \text{ Min}$	

\*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

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**AC CHARACTERISTICS** (For Figures and Waveforms – See Section 3 of the ON Semiconductor FACT Data Book, DL138/D)

Symbol	Parameter	V <sub>CC</sub> * (V)	74AC			74AC		Unit	Fig. No.
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF			
			Min	Typ	Max	Min	Max		
f <sub>max</sub>	Maximum Clock Frequency	3.3 5.0	110 130	120 140	– –	100 120	– –	MHz	–
t <sub>CP</sub> to Q1	Propagation Delay t <sub>CP</sub> to Q1	3.3 5.0	2.0 2.0	– –	11 8.0	2.0 2.0	14 10	ns	–
Q <sub>n</sub> to Q <sub>n+1</sub>	Propagation Delay Q <sub>n</sub> to Q <sub>n+1</sub>	3.3 5.0	0 0	– –	5.5 3.5	0 0	6.5 4.5	ns	–
MR to Q t <sub>HL</sub>	Propagation Delay MR to Q	3.3 5.0	3.0 3.0	– –	12 10	3.0 3.0	15 12	ns	–
t <sub>rec</sub> t <sub>CP</sub> to MR	Recovery Time	3.3 5.0	0 0	-2.5 -1.5	– –	0 0	– –	ns	–
t <sub>w</sub> n <sub>CP</sub>	Minimum Pulse Width Clock Pin	3.3 5.0	4.0 3.0	3.5 2.5	– –	4.5 3.5	– –	ns	–
t <sub>w</sub> MR	Minimum Pulse Width Master Reset	3.3 3.0	4.0 3.0	3.5 2.5	– –	4.5 3.5	– –	ns	–

\*Voltage Range 3.3 V is 3.3 V ±0.3 V.

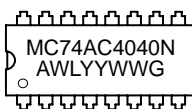
\*Voltage Range 5.0 V is 5.0 V ±0.5 V.

## CAPACITANCE

Symbol	Parameter	Value Typ	Unit	Test Conditions
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = 5.0 V
C <sub>PD</sub>	Power Dissipation Capacitance	50	pF	V <sub>CC</sub> = 5.0 V

## MARKING DIAGRAMS

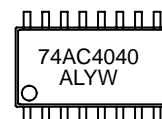
**PDIP-16**



**SOIC-16**



**SOEIAJ-16**

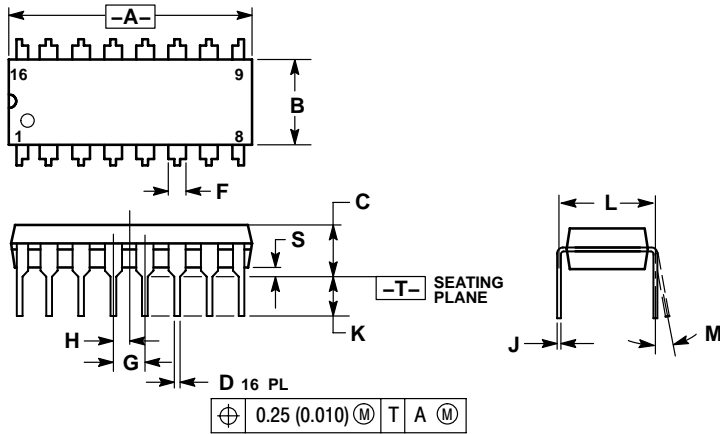


A = Assembly Location  
 WL, L = Wafer Lot  
 YY, Y = Year  
 WW, W = Work Week  
 G = Pb-Free Package

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## PACKAGE DIMENSIONS

### PDIP-16 CASE 648-08 ISSUE T



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
- DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
- DIMENSION B DOES NOT INCLUDE MOLD FLASH.
- ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

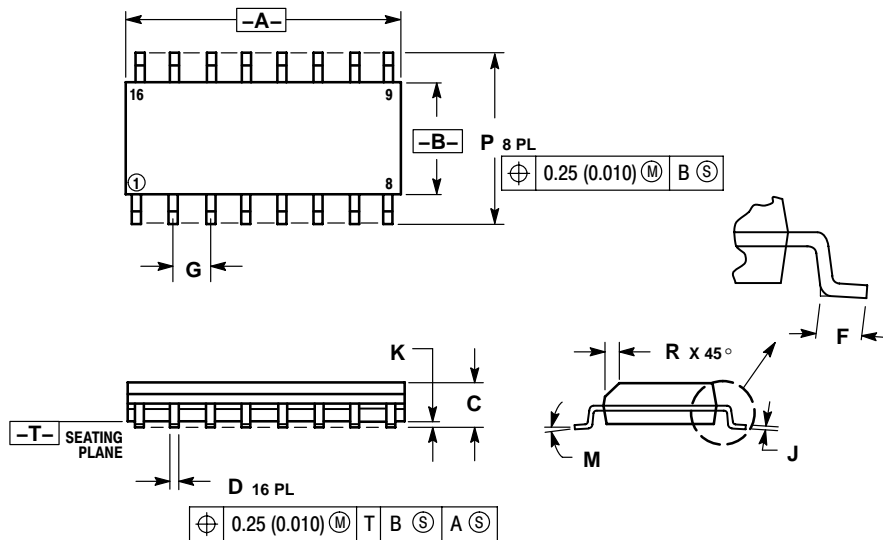
STYLE 1:

- PIN 1. CATHODE
- CATHODE
- CATHODE
- CATHODE
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- CATHODE
- ANODE
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STYLE 2:

- PIN 1. COMMON DRAIN
- COMMON DRAIN
- COMMON DRAIN
- COMMON DRAIN
- COMMON DRAIN
- COMMON DRAIN
- COMMON DRAIN
- COMMON DRAIN
- GATE
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### SOIC CASE 751B-05 ISSUE J



NOTES:

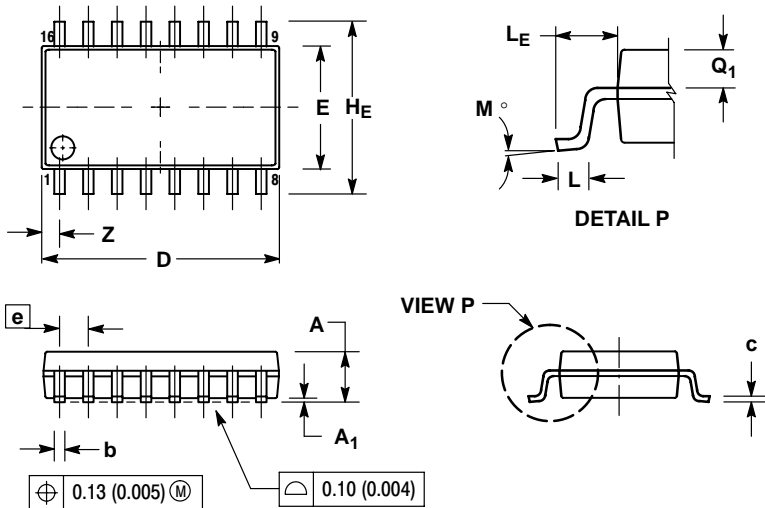
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
- MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
- DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

# MC74AC4040

## PACKAGE DIMENSIONS

SOEIAJ-16  
CASE 966-01  
ISSUE A



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	---	2.05	---	0.081
A <sub>1</sub>	0.05	0.20	0.002	0.008
b	0.35	0.50	0.014	0.020
c	0.10	0.20	0.007	0.011
D	9.90	10.50	0.390	0.413
E	5.10	5.45	0.201	0.215
e	1.27 BSC		0.050 BSC	
H <sub>E</sub>	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
L <sub>E</sub>	1.10	1.50	0.043	0.059
M	0°	10°	0°	10°
Q <sub>1</sub>	0.70	0.90	0.028	0.035
Z	---	0.78	---	0.031

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