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

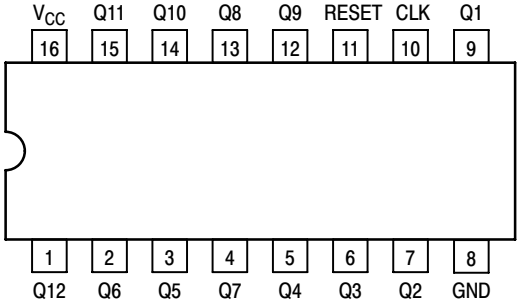

Figure 1. Pinout: 16−Lead Packages Conductors
(Top View)

FUNCTION TABLE

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

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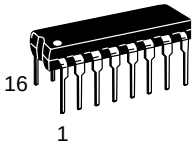
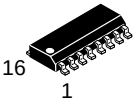
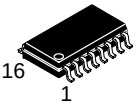


PDIP−16
N SUFFIX
CASE 648



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.

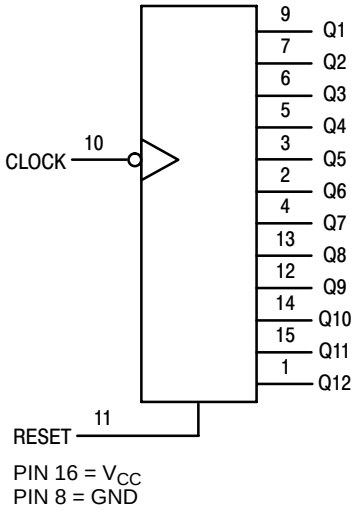


Figure 2. Logic Diagram

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	±20	mA
I_{OUT}	DC Output Current, per Pin	±50	mA
I_{CC}	DC V_{CC} or GND Current per Output Pin	±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 V V_{CC} = 4.5 V V_{CC} = 5.5 V	0 0 0	150 40 25	ns/V

DC CHARACTERISTICS (unless otherwise specified)

Symbol	Parameter	Value	Unit	
I_{CC}	Maximum Quiescent Supply Voltage	80	μA	V_{in} = V_{CC} or GND V_{CC} = 5.5 V, T_A = Worst Case
I_{CC}	Maximum Quiescent Supply Current	8.0	μA	V_{in} = V_{CC} or GND V_{CC} = 5.5 V, T_A = 25°C

DC CHARACTERISTICS

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

*All outputs loaded; thresholds on input associated with output under test.
†Maximum test duration 2.0 ms, one output loaded at a time.

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

Symbol	Parameter	V_{CC}* (V)	74AC T_A = +25°C C_L = 50 pF			74AC T_A = −40°C to +85°C C_L = 50 pF		Unit	Fig. No.
			Min	Typ	Max	Min	Max		
f_{max}	Maximum Clock Frequency	3.3 5.0	110 130	120 140	− −	100 120	− −	MHz	−
n_{CP} to Q1	Propagation Delay n_{CP} to Q1	3.3 5.0	2.0 2.0	− −	11 8.0	2.0 2.0	14 10	ns	−
Q_n to Q_n +1	Propagation Delay Q_n to Q_n +1	3.3 5.0	0 0	− −	5.5 3.5	0 0	6.5 4.5	ns	−
MR to Q t_{HL}	Propagation Delay MR to Q	3.3 5.0	3.0 3.0	− −	12 10	3.0 3.0	15 12	ns	−
t_{rec} n_{CP} to MR	Recovery Time	3.3 5.0	0 0	−2.5 −1.5	− −	0 0	− −	ns	−
t_w n_{CP}	Minimum Pulse Width Clock Pin	3.3 5.0	4.0 3.0	3.5 2.5	− −	4.5 3.5	− −	ns	−
t_w 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.

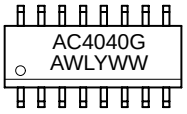
CAPACITANCE

Symbol	Parameter	Value Typ	Unit	Test Conditions
C_{IN}	Input Capacitance	4.5	pF	V_{CC} = 5.0 V
C_{PD}	Power Dissipation Capacitance	50	pF	V_{CC} = 5.0 V

MARKING DIAGRAMS

PDIP−16

SOIC−16

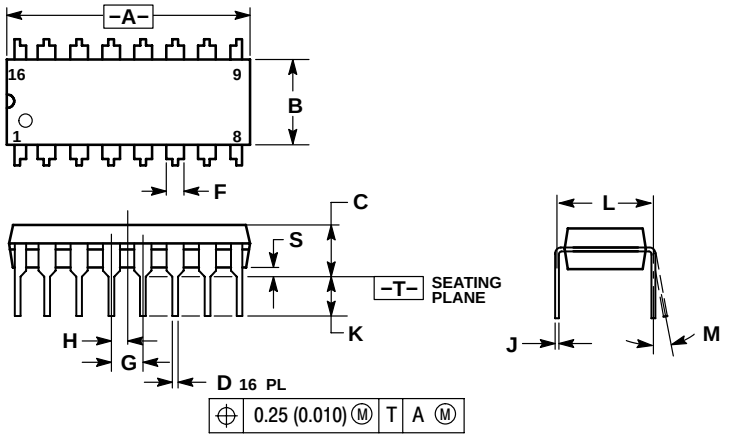


SOEIAJ−16

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

PACKAGE DIMENSIONS

PDIP−16
CASE 648−08
ISSUE T



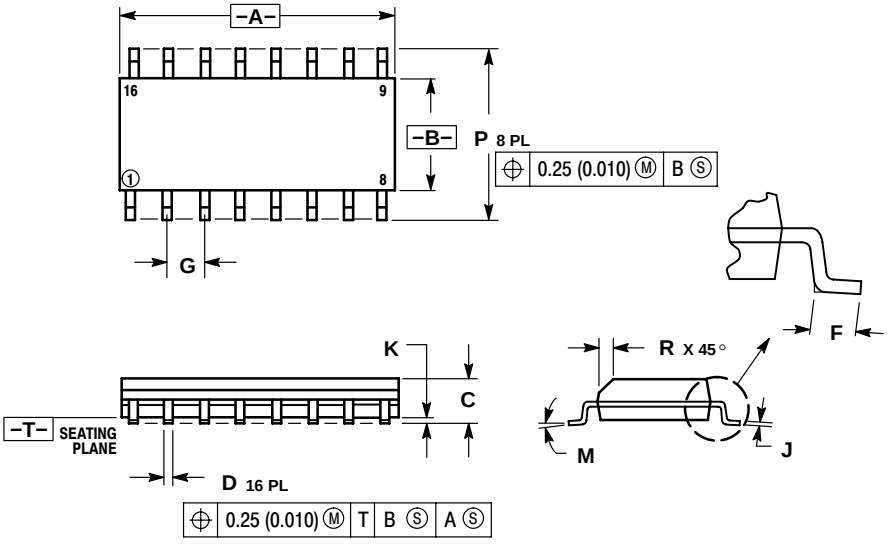
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	INCHES		MILLIMETERS	
DIM	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
2. CATHODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. CATHODE
9. ANODE
10. ANODE
11. ANODE
12. ANODE
13. ANODE
14. ANODE
15. ANODE
16. ANODE

STYLE 2:
PIN 1. COMMON DRAIN
2. COMMON DRAIN
3. COMMON DRAIN
4. COMMON DRAIN
5. COMMON DRAIN
6. COMMON DRAIN
7. COMMON DRAIN
8. COMMON DRAIN
9. GATE
10. SOURCE
11. GATE
12. SOURCE
13. GATE
14. SOURCE
15. GATE
16. SOURCE

SOIC
CASE 751B−05
ISSUE J

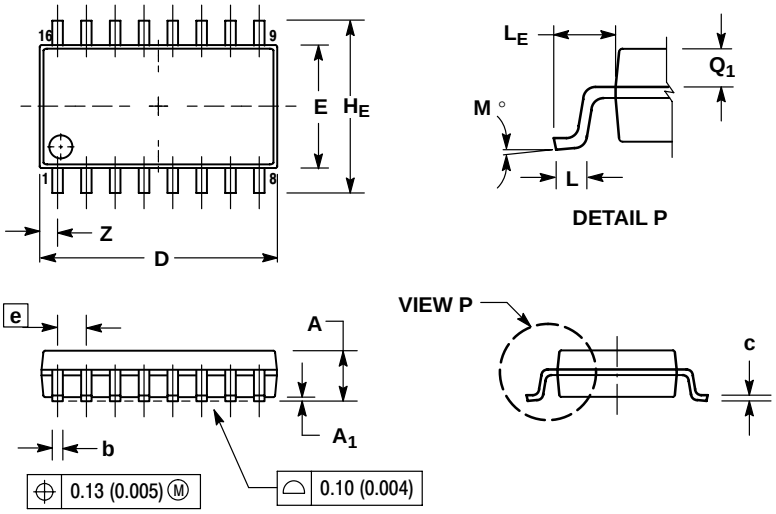


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005)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

	MILLIMETERS		INCHES	
DIM	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

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).

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	---	2.05	---	0.081
A_1	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_E	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
L_E	1.10	1.50	0.043	0.059
M	0 °	10 °	0 °	10 °
Q_1	0.70	0.90	0.028	0.035
Z	---	0.78	---	0.031

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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