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
- These are Pb−Free Devices

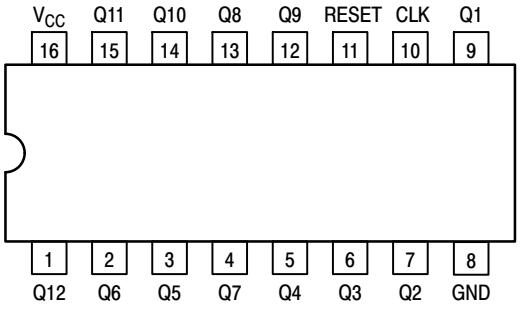

Figure 1. Pinout: 16−Lead Packages Conductors
(Top View)

FUNCTION TABLE

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

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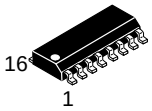
MARKING DIAGRAM



SOIC−16
D SUFFIX
CASE 751B

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

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

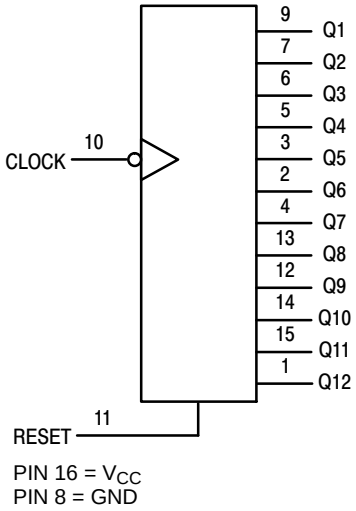


Figure 2. Logic Diagram

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage	−0.5 to +7.0	V
V_I	DC Input Voltage	$-0.5 \le V_{CC} +0.5$	V
V_O	DC Output Voltage (Note 1)	$-0.5 \le V_{CC} +0.5$	V
I_{IK}	DC Input Diode Current	±20	mA
I_{OK}	DC Output Diode Current	±50	mA
I_O	DC Output Sink/Source Current	±50	mA
I_{CC}	DC Supply Current per Output Pin	±50	mA
I_{GND}	DC Ground Current per Output Pin	±50	mA
T_{STG}	Storage Temperature Range	−65 to +150	°C
T_L	Lead temperature, 1 mm from Case for 10 Seconds	260	°C
T_J	Junction temperature under Bias	+150	°C
θ_{JA}	Thermal Resistance (Note 2)	69.1	°C/W
P_D	Power Dissipation in Still Air at 65°C (Note 3)	500	mW
MSL	Moisture Sensitivity	Level 1	
F_R	Flammability Rating Oxygen Index: 30% − 35%	UL 94 V−0 @ 0.125 in	
V_{ESD}	ESD Withstand Voltage Human Body Model (Note 4) Machine Model (Note 5) Charged Device Model (Note 6)	> 2000 > 200 > 1000	V
$I_{Latch-Up}$	Latch−Up Performance Above V_{CC} and Below GND at 85°C (Note 7)	±100	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. I_O absolute maximum rating must be observed.
2. The package thermal impedance is calculated in accordance with JESD51−7.
3. 500 mW at 65°C; derate to 300 mW by 10 mW/ from 65°C to 85°C.
4. Tested to EIA/JESD22−A114−A.
5. Tested to EIA/JESD22−A115−A.
6. Tested to JESD22−C101−A.
7. Tested to EIA/JESD78.

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

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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 = +25°C Guaranteed Limits	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

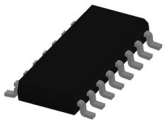
Symbol	Parameter	Value Typ	Unit	Test Conditions
C_{IN}	Input Capacitance	4.5	pF	V_{CC} = 5.0 V
C_{PD}	Power Dissipation Capacitance	50	pF	V_{CC} = 5.0 V

ORDERING INFORMATION

Part Number	Package	Shipping†
MC74AC4040DG	SOIC−16 (Pb−Free)	48 Units / Rail
MC74AC4040DR2G	SOIC−16 (Pb−Free)	2500 / Tape & Reel

†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.

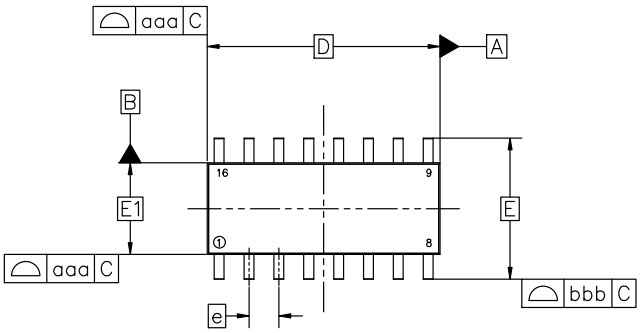
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS



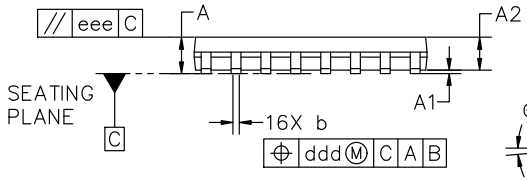
SOIC−16 9.90x3.90x1.50 1.27P
CASE 751B
ISSUE L

DATE 29 MAY 2024

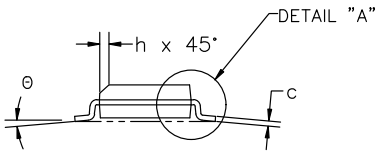
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. DIMENSION IN MILLIMETERS. ANGLE IN DEGREES.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15mm PER SIDE.
5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127mm TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUM MATERIAL CONDITION.



TOP VIEW

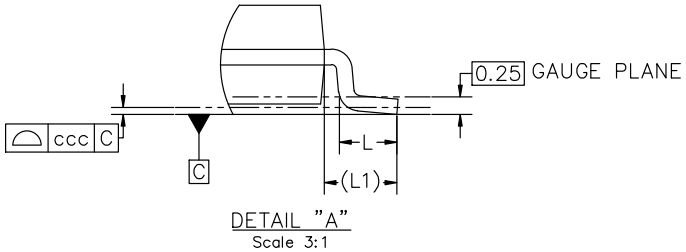


SIDE VIEW

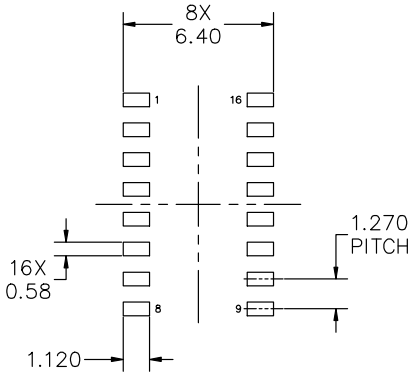


END VIEW

MILLIMETERS			
DIM	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.00	0.05	0.10
A2	1.35	1.50	1.65
b	0.35	0.42	0.49
c	0.19	0.22	0.25
D	9.90 BSC		
E	6.00 BSC		
E1	3.90 BSC		
e	1.27 BSC		
h	0.25	−−−	0.50
L	0.40	0.83	1.25
L1	1.05 REF		
θ	0°	−−−	7°
TOLERANCE OF FORM AND POSITION			
aaa	0.10		
bbb	0.20		
ccc	0.10		
ddd	0.25		
eee	0.10		



DETAIL "A"
Scale 3:1



RECOMMENDED MOUNTING FOOTPRINT

*FOR ADDITIONAL INFORMATION ON OUR PB−FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE onsemi SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D

DOCUMENT NUMBER:	98ASB42566B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
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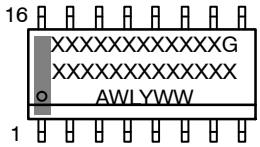
SOIC−16 9.90x3.90x1.50 1.27P
CASE 751B
ISSUE L

DATE 29 MAY 2024

GENERIC
MARKING DIAGRAM*



XXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
G = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

STYLE 1:		STYLE 2:		STYLE 3:		STYLE 4:	
PIN 1.	COLLECTOR	PIN 1.	CATHODE	PIN 1.	COLLECTOR, DYE #1	PIN 1.	COLLECTOR, DYE #1
2.	BASE	2.	ANODE	2.	BASE, #1	2.	COLLECTOR, #1
3.	EMITTER	3.	NO CONNECTION	3.	EMITTER, #1	3.	COLLECTOR, #2
4.	NO CONNECTION	4.	CATHODE	4.	COLLECTOR, #1	4.	COLLECTOR, #2
5.	EMITTER	5.	CATHODE	5.	COLLECTOR, #2	5.	COLLECTOR, #3
6.	BASE	6.	NO CONNECTION	6.	BASE, #2	6.	COLLECTOR, #3
7.	COLLECTOR	7.	ANODE	7.	EMITTER, #2	7.	COLLECTOR, #4
8.	COLLECTOR	8.	CATHODE	8.	COLLECTOR, #2	8.	COLLECTOR, #4
9.	BASE	9.	CATHODE	9.	COLLECTOR, #3	9.	BASE, #4
10.	EMITTER	10.	ANODE	10.	BASE, #3	10.	EMITTER, #4
11.	NO CONNECTION	11.	NO CONNECTION	11.	EMITTER, #3	11.	BASE, #3
12.	EMITTER	12.	CATHODE	12.	COLLECTOR, #3	12.	EMITTER, #3
13.	BASE	13.	CATHODE	13.	COLLECTOR, #4	13.	BASE, #2
14.	COLLECTOR	14.	NO CONNECTION	14.	BASE, #4	14.	EMITTER, #2
15.	EMITTER	15.	ANODE	15.	EMITTER, #4	15.	BASE, #1
16.	COLLECTOR	16.	CATHODE	16.	COLLECTOR, #4	16.	EMITTER, #1

STYLE 5:		STYLE 6:		STYLE 7:	
PIN 1.	DRAIN, DYE #1	PIN 1.	CATHODE	PIN 1.	SOURCE N-CH
2.	DRAIN, #1	2.	CATHODE	2.	COMMON DRAIN (OUTPUT)
3.	DRAIN, #2	3.	CATHODE	3.	COMMON DRAIN (OUTPUT)
4.	DRAIN, #2	4.	CATHODE	4.	GATE P-CH
5.	DRAIN, #3	5.	CATHODE	5.	COMMON DRAIN (OUTPUT)
6.	DRAIN, #3	6.	CATHODE	6.	COMMON DRAIN (OUTPUT)
7.	DRAIN, #4	7.	CATHODE	7.	COMMON DRAIN (OUTPUT)
8.	DRAIN, #4	8.	CATHODE	8.	SOURCE P-CH
9.	GATE, #4	9.	ANODE	9.	SOURCE P-CH
10.	SOURCE, #4	10.	ANODE	10.	COMMON DRAIN (OUTPUT)
11.	GATE, #3	11.	ANODE	11.	COMMON DRAIN (OUTPUT)
12.	SOURCE, #3	12.	ANODE	12.	COMMON DRAIN (OUTPUT)
13.	GATE, #2	13.	ANODE	13.	GATE N-CH
14.	SOURCE, #2	14.	ANODE	14.	COMMON DRAIN (OUTPUT)
15.	GATE, #1	15.	ANODE	15.	COMMON DRAIN (OUTPUT)
16.	SOURCE, #1	16.	ANODE	16.	SOURCE N-CH

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