

Hex D Flip-Flop with Common Clock and Reset

High-Performance Silicon-Gate CMOS

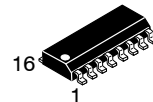
MC74HC174A

The MC74HC174A is identical in pinout to the LS174. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

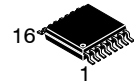
This device consists of six D flip-flops with common Clock and Reset inputs. Each flip-flop is loaded with a low-to-high transition of the Clock input. Reset is asynchronous and active-low.

Features

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1.0 μ A
- In Compliance with the Requirements Defined by JEDEC Standard No. 7 A
- Chip Complexity: 162 FETs or 40.5 Equivalent Gates
- -Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable*
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



SOIC-16
D SUFFIX
CASE 751B

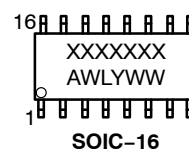


TSSOP-16
DT SUFFIX
CASE 948F

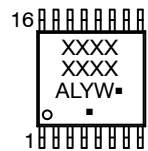


QFN16
MN SUFFIX
CASE 485AW

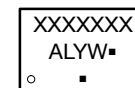
MARKING DIAGRAMS



SOIC-16



TSSOP-16

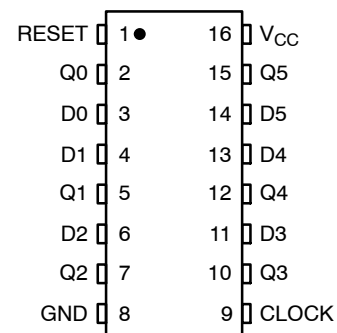


QFN16

XXXXXXX = Specific Device Code
 A = Assembly Location
 WL, L = Wafer Lot
 Y = Year
 WW, W = Work Week
 G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

PIN ASSIGNMENT



ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 7 of this data sheet.

MC74HC174A

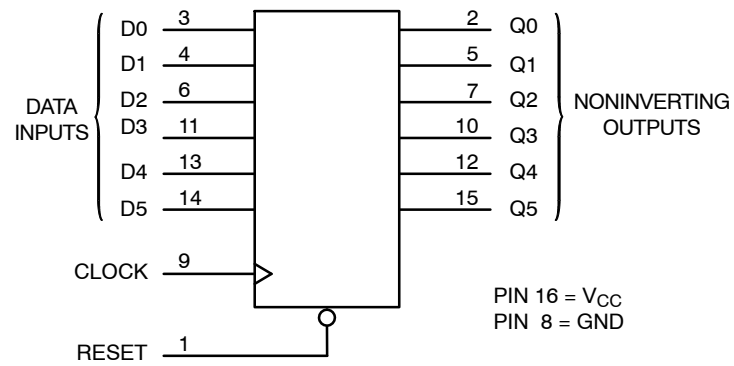


Figure 1. Logic Diagram

FUNCTION TABLE

Inputs			Output
Reset	Clock	D	Q
L	X	X	L
H	↗	H	H
H	↘	L	L
H	L	X	No Change
H	↘	X	No Change

MC74HC174A

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{CC}	DC Supply Voltage	−0.5 to +6.5	V
V _{IN}	DC Input Voltage	−0.5 to V _{CC} +0.5	V
V _{OUT}	DC Output Voltage	−0.5 to V _{CC} +0.5	V
I _{IN}	DC Input Diode Current, per Pin	±20	mA
I _{OUT}	DC Output Diode Current, per Pin	±25	mA
I _{CC}	DC Supply Current, V _{CC} and GND Pins	±50	mA
I _{IK}	Input Clamp Current (V _{IN} < 0 or V _{IN} > V _{CC})	±20	mA
I _{OK}	Output Clamp Current (V _{OUT} < 0 or V _{OUT} > V _{CC})	±20	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 1) SOIC−16126 QFN16118 TSSOP−16159		°C/W
P _D	Power Dissipation in Still Air at 25°C SOIC−16995 QFN161062 TSSOP−16787		mW
MSL	Moisture Sensitivity	Level 1	–
F _R	Flammability Rating Oxygen Index: 28 to 34	UL 94 V−0 @ 0.125 in.	–
V _{ESD}	ESD Withstand Voltage (Note 2) Human Body Model Charged Device Model	2000 N/A	V
I _{LATCHUP}	Latchup Performance (Note 3)	±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. Measured with minimum pad spacing on an FR4 board, using 76mm-by-114mm, 2-ounce copper trace no air flow per JESD51-7.
2. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.
3. Tested to EIA/JESD78 Class II.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V _{CC}	DC Supply Voltage	2.0	6.0	V
V _{IN} , V _{OUT}	DC Input Voltage, Output Voltage (Note 4)	0	V _{CC}	V
T _A	Operating Temperature, All Package Types	−55	+125	°C
t _r , t _f	CLOCK Input Rise and Fall Time (Figure 3) V_{CC} = 2.0 V V_{CC} = 3.3 V V_{CC} = 4.5 V V_{CC} = 6.0 V	0 0 0 0	1000 700 500 400	ns

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.

4. Unused inputs may not be left open. All inputs must be tied to a high- or low-logic input voltage level.

MC74HC174A

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CC} V	Guaranteed Limit			Unit
				-55°C to 25°C	≤ 85°C	≤ 125°C	
V _{IH}	Minimum High-Level Input Voltage	V _{OUT} = 0.1 V or V _{CC} - 0.1 V I _{OUT} ≤ 20 μA	2.0 4.5 6.0	1.5 3.15 4.2	1.5 3.15 4.2	1.5 3.15 4.2	V
V _{IL}	Maximum Low-Level Input Voltage	V _{OUT} = 0.1 V or V _{CC} - 0.1 V I _{OUT} ≤ 20 μA	2.0 4.5 6.0	0.5 1.35 1.8	0.5 1.35 1.8	0.5 1.35 1.8	V
V _{OH}	Minimum High-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0 4.5 6.0	1.9 4.4 5.9	1.9 4.4 5.9	1.9 4.4 5.9	V
		V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 4.0 mA I _{OUT} ≤ 5.2 mA	4.5 6.0	3.98 5.48	3.84 5.34	3.7 5.2	
V _{OL}	Maximum Low-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0 4.5 6.0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V
		V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 4.0 mA I _{OUT} ≤ 5.2 mA	4.5 6.0	0.26 0.26	0.33 0.33	0.4 0.4	
I _{IN}	Maximum Input Leakage Current	V _{IN} = V _{CC} or GND	6.0	±0.1	±1.0	±1.0	μA
I _{CC}	Maximum Quiescent Supply Current (per Package)	V _{IN} = V _{CC} or GND I _{OUT} = 0 μA	6.0	4.0	40	160	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			-55°C to 25°C	≤ 85°C	≤ 125°C	
f _{max}	Maximum Clock Frequency (50% Duty Cycle) (Figures 2, 5)	2.0 4.5 6.0	6.0 30 35	4.8 24 28	4.0 20 24	MHz
t _{PLH} t _{PHL}	Maximum Propagation Delay, Clock to Q (Figures 3, 5)	2.0 4.5 6.0	110 22 19	140 28 24	165 33 28	ns
t _{PLH} t _{PHL}	Maximum Propagation Delay, Reset to Q (Figures 2, 5)	2.0 4.5 6.0	110 21 19	140 28 24	160 32 27	ns
t _{TLH} t _{THL}	Maximum Output Transition Time, Any Output (Figures 2, 5)	2.0 4.5 6.0	75 15 13	95 19 16	110 22 19	ns
C _{in}	Maximum Input Capacitance		10	10	10	pF

C _{PD}	Power Dissipation Capacitance, per Enabled Output (Note 5)	Typical @ 25°C, V _{CC} = 5.0 V	pF
		62	

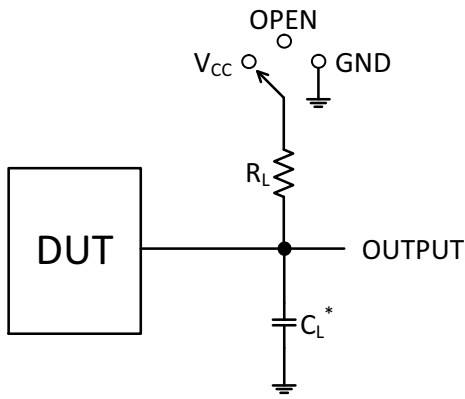
5. Used to determine the no-load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$.

MC74HC174A

TIMING REQUIREMENTS

Symbol	Parameter	Figure	V _{CC} V	Guaranteed Limit						Unit
				-55°C to 25°C		≤ 85°C		≤ 125°C		
				Min	Max	Min	Max	Min	Max	
t _{su}	Minimum Setup Time, Data to Clock	5	2.0 4.5 6.0	50 10 9.0		65 13 11		75 15 13		ns
t _h	Minimum Hold Time, Clock to Data	5	2.0 4.5 6.0	5.0 5.0 5.0		5.0 5.0 5.0		5.0 5.0 5.0		ns
t _{rec}	Minimum Recovery Time, Reset Inactive to Clock	4	2.0 4.5 6.0	5.0 5.0 5.0		5.0 5.0 5.0		5.0 5.0 5.0		ns
t _w	Minimum Pulse Width, Clock	3	2.0 4.5 6.0	75 15 13		95 19 16		110 22 19		ns
t _w	Minimum Pulse Width, Reset	4	2.0 4.5 6.0	75 15 13		95 19 16		110 22 19		ns
t _r , t _f	Maximum Input Rise and Fall Times	3	2.0 4.5 6.0		1000 500 400		1000 500 400		1000 500 400	ns

MC74HC174A



* C_L Includes probe and jig capacitance

Test	Switch Position	C_L	R_L
t_{PLH} / t_{PHL}	Open	50 pF	1 k Ω
t_{PLZ} / t_{PZL}	V_{CC}		
t_{PHZ} / t_{PZH}	GND		

Figure 2. Test Circuit

SWITCHING WAVEFORMS

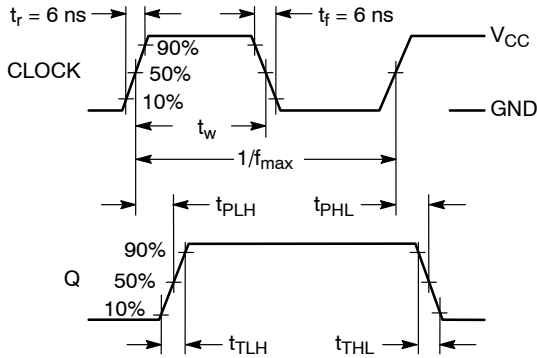


Figure 3. Switching Waveform

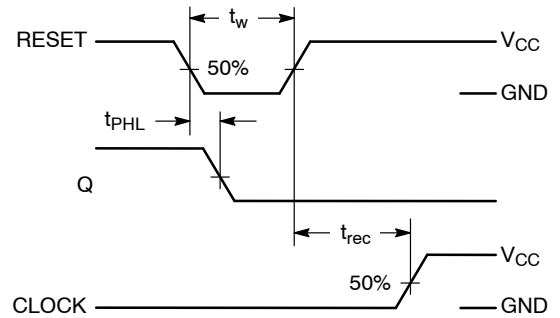


Figure 4. Switching Waveform

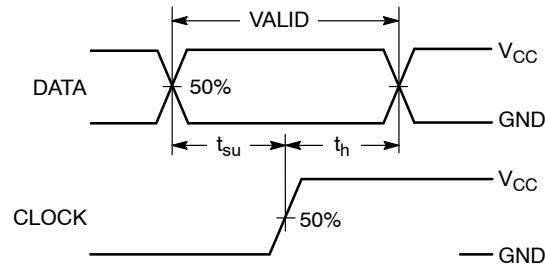


Figure 5. Switching Waveform

MC74HC174A

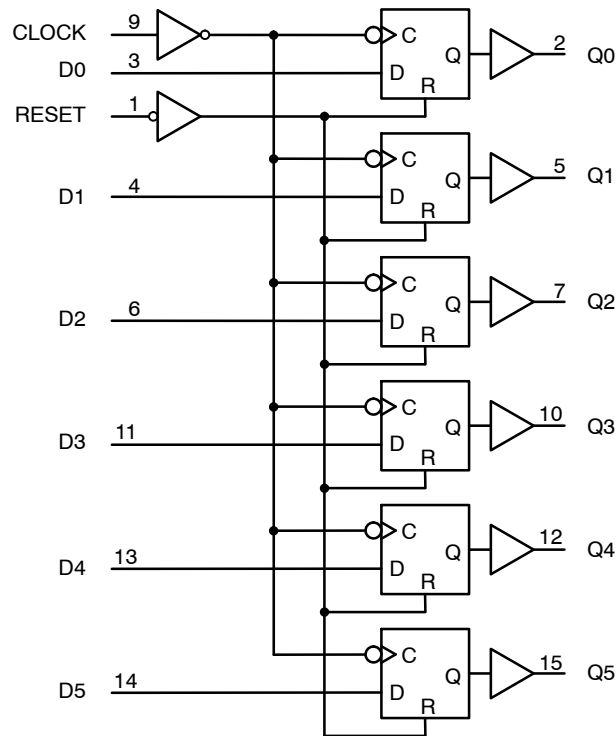


Figure 6. Expanded Logic Diagram

ORDERING INFORMATION

Device	Marking	Package	Shipping†
MC74HC174ADR2G	HC174AG	SOIC-16	2500 Units / Tape & Reel
MC74HC174ADR2G-Q*	HC174AG	SOIC-16	2500 Units / Tape & Reel
MC74HC174ADTR2G	HC 174A	TSSOP-16	2500 Units / Tape & Reel
MC74HC174ADTR2G-Q*	HC 174A	TSSOP-16	2500 Units / Tape & Reel

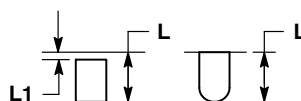
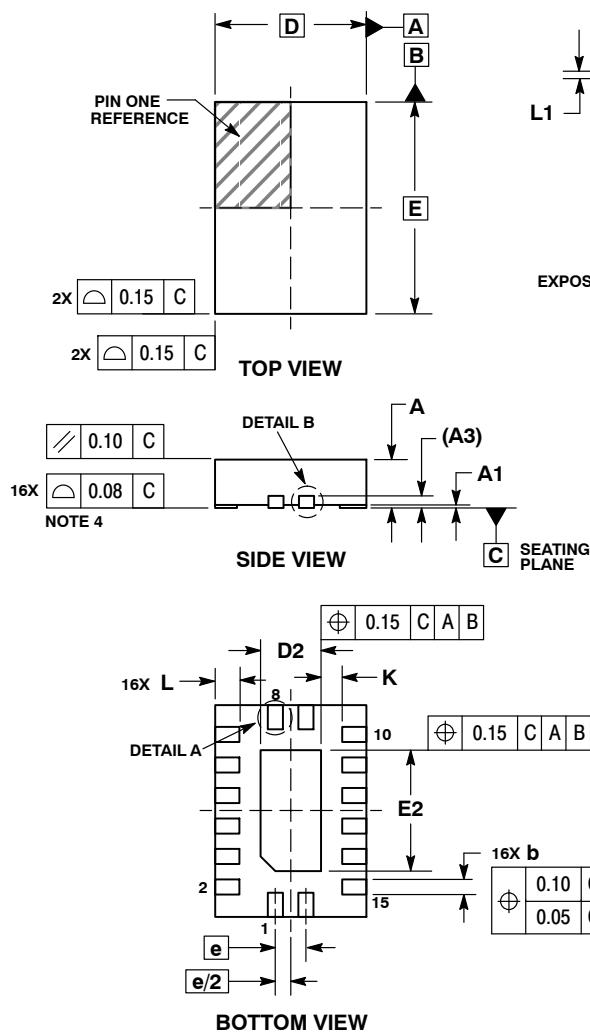
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*-Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

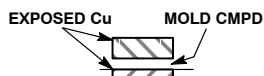
MC74HC174A

PACKAGE DIMENSIONS

QFN16, 2.5x3.5, 0.5P
CASE 485AW
ISSUE O



DETAIL A
ALTERNATE TERMINAL
CONSTRUCTIONS



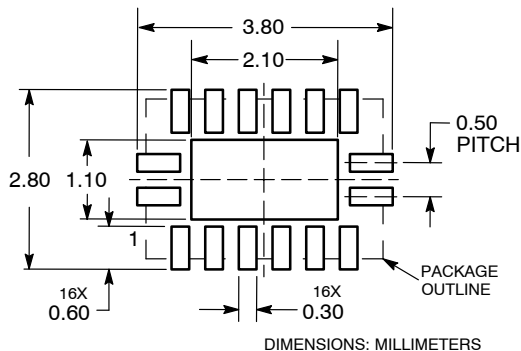
DETAIL B
ALTERNATE
CONSTRUCTIONS

NOTES:

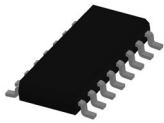
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A3	0.20	REF
b	0.20	0.30
D	2.50	BSC
D2	0.85	1.15
E	3.50	BSC
E2	1.85	2.15
e	0.50	BSC
K	0.20	---
L	0.35	0.45
L1	---	0.15

RECOMMENDED SOLDERING FOOTPRINT*



*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

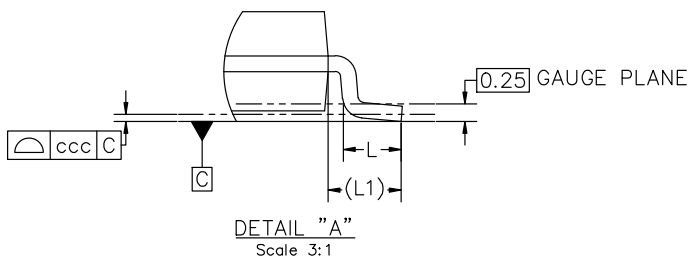
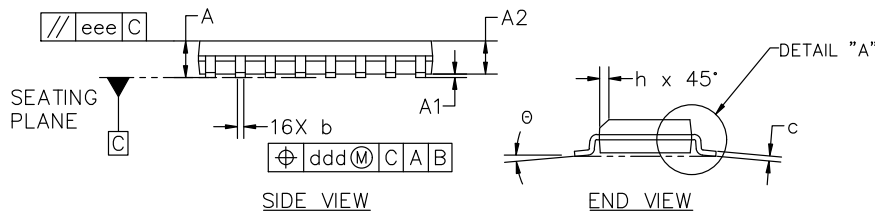
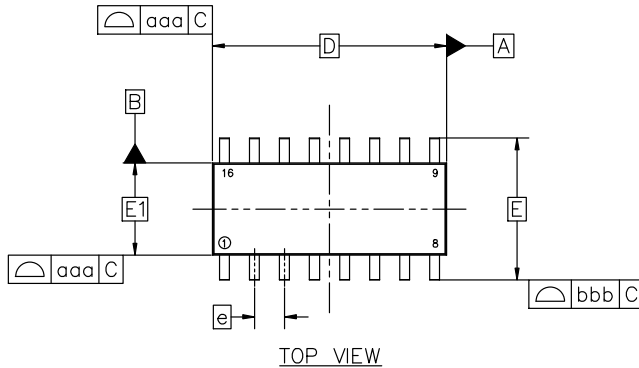


SOIC-16 9.90x3.90x1.37 1.27P
CASE 751B
ISSUE M

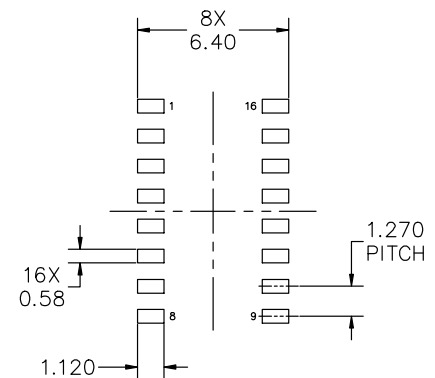
DATE 18 OCT 2024

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.



MILLIMETERS			
DIM	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.18	0.25
A2	1.25	1.37	1.50
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		



RECOMMENDED MOUNTING FOOTPRINT

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

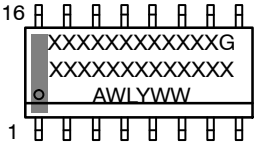
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SOIC-16 9.90x3.90x1.37 1.27P
CASE 751B
ISSUE M

DATE 18 OCT 2024

GENERIC
MARKING DIAGRAM*

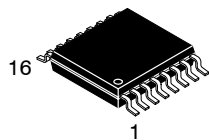


XXXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
G = Pb-Free Package

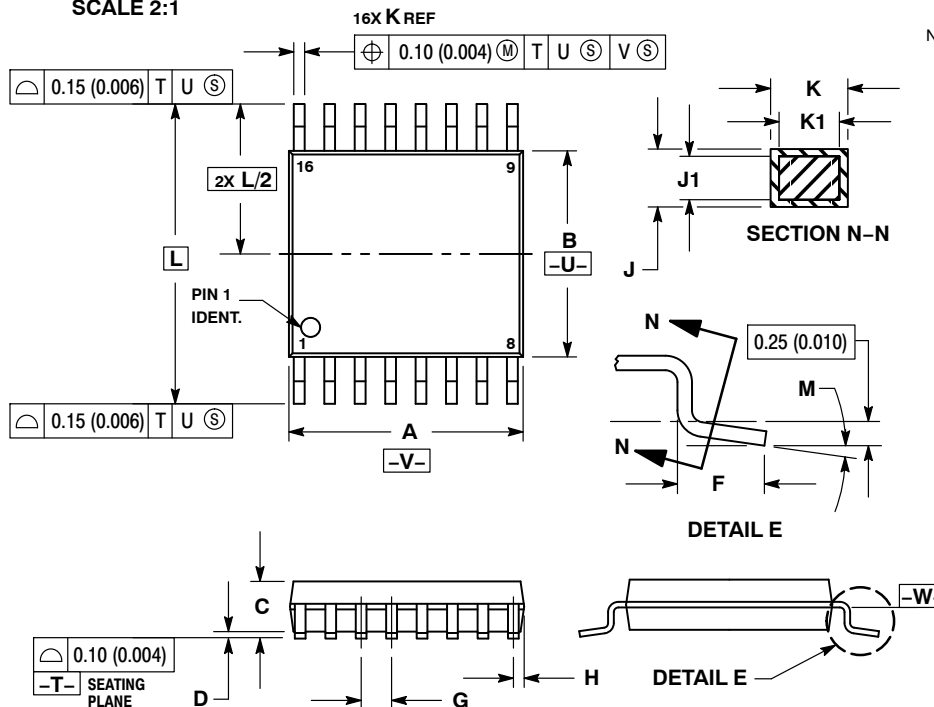
*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

STYLE 1: PIN 1. COLLECTOR 2. BASE 3. EMITTER 4. NO CONNECTION 5. EMITTER 6. BASE 7. COLLECTOR 8. COLLECTOR 9. BASE 10. EMITTER 11. NO CONNECTION 12. EMITTER 13. BASE 14. COLLECTOR 15. EMITTER 16. COLLECTOR	STYLE 2: PIN 1. CATHODE 2. ANODE 3. NO CONNECTION 4. CATHODE 5. CATHODE 6. NO CONNECTION 7. ANODE 8. CATHODE 9. CATHODE 10. ANODE 11. NO CONNECTION 12. CATHODE 13. CATHODE 14. NO CONNECTION 15. ANODE 16. CATHODE	STYLE 3: PIN 1. COLLECTOR, DYE #1 2. BASE, #1 3. EMITTER, #1 4. COLLECTOR, #1 5. COLLECTOR, #2 6. BASE, #2 7. EMITTER, #2 8. COLLECTOR, #2 9. COLLECTOR, #3 10. BASE, #3 11. EMITTER, #3 12. COLLECTOR, #3 13. COLLECTOR, #4 14. BASE, #4 15. EMITTER, #4 16. COLLECTOR, #4	STYLE 4: PIN 1. COLLECTOR, DYE #1 2. COLLECTOR, #1 3. COLLECTOR, #2 4. COLLECTOR, #2 5. COLLECTOR, #3 6. COLLECTOR, #3 7. COLLECTOR, #4 8. COLLECTOR, #4 9. BASE, #4 10. EMITTER, #4 11. BASE, #3 12. EMITTER, #3 13. BASE, #2 14. EMITTER, #2 15. BASE, #1 16. EMITTER, #1
STYLE 5: PIN 1. DRAIN, DYE #1 2. DRAIN, #1 3. DRAIN, #2 4. DRAIN, #2 5. DRAIN, #3 6. DRAIN, #3 7. DRAIN, #4 8. DRAIN, #4 9. GATE, #4 10. SOURCE, #4 11. GATE, #3 12. SOURCE, #3 13. GATE, #2 14. SOURCE, #2 15. GATE, #1 16. SOURCE, #1	STYLE 6: 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 7: PIN 1. SOURCE N-CH 2. COMMON DRAIN (OUTPUT) 3. COMMON DRAIN (OUTPUT) 4. GATE P-CH 5. COMMON DRAIN (OUTPUT) 6. COMMON DRAIN (OUTPUT) 7. COMMON DRAIN (OUTPUT) 8. SOURCE P-CH 9. SOURCE P-CH 10. COMMON DRAIN (OUTPUT) 11. COMMON DRAIN (OUTPUT) 12. COMMON DRAIN (OUTPUT) 13. GATE N-CH 14. COMMON DRAIN (OUTPUT) 15. COMMON DRAIN (OUTPUT) 16. SOURCE N-CH	

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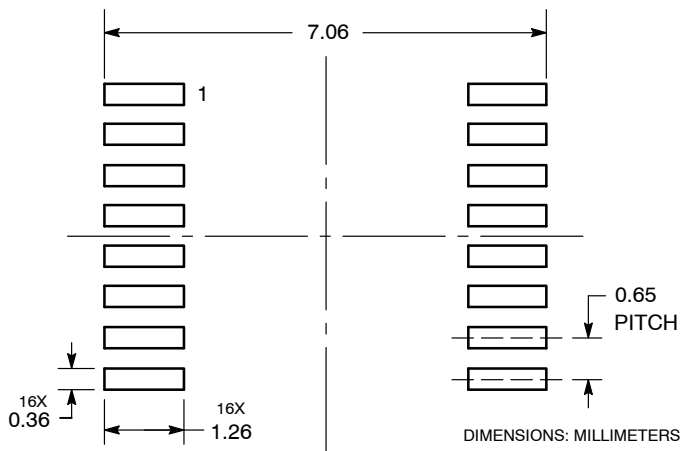
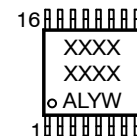

TSSOP-16 WB
CASE 948F
ISSUE B

DATE 19 OCT 2006


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.18	0.28	0.007	0.011
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

**RECOMMENDED
SOLDERING FOOTPRINT***

**GENERIC
MARKING DIAGRAM***


XXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
G or ■ = 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.

*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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