

# MC74HCT574A

## Octal 3-State Noninverting D Flip-Flop with LSTTL-Compatible Inputs

### High-Performance Silicon-Gate CMOS

The MC74HCT574A is identical in pinout to the LS574. This device may be used as a level converter for interfacing TTL or NMOS outputs to High Speed CMOS inputs.

Data meeting the setup time is clocked to the outputs with the rising edge of the Clock. The Output Enable input does not affect the states of the flip-flops, but when Output Enable is high, all device outputs are forced to the high-impedance state. Thus, data may be stored even when the outputs are not enabled.

The HCT574A is identical in function to the HCT374A but has the flip-flop inputs on the opposite side of the package from the outputs to facilitate PC board layout.

#### Features

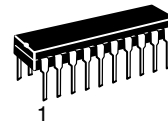
- Output Drive Capability: 15 LSTTL Loads
- TTL NMOS Compatible Input Levels
- Outputs Directly Interface to CMOS, NMOS and TTL
- Operating Voltage Range: 4.5 to 5.5 V
- Low Input Current: 1.0  $\mu$ A
- In Compliance with the Requirements Defined by JEDEC Standard No. 7 A
- Chip Complexity: 286 FETs or 71.5 Equivalent Gates
- These Devices are Pb-Free and are RoHS Compliant



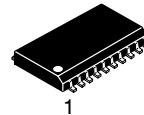
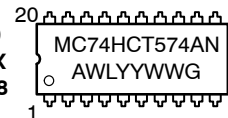
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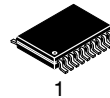
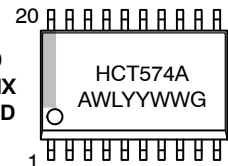
#### MARKING DIAGRAMS



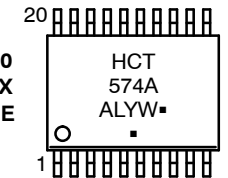
PDIP-20  
N SUFFIX  
CASE 738



SOIC-20  
DW SUFFIX  
CASE 751D



TSSOP-20  
DT SUFFIX  
CASE 948E



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

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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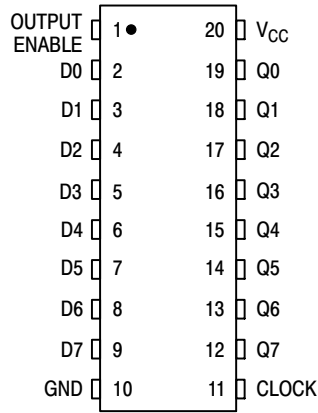


Figure 1. Pin Assignment

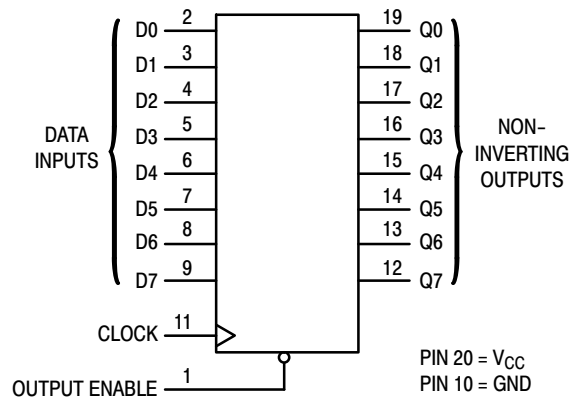


Figure 2. Logic Diagram

Design Criteria	Value	Units
Internal Gate Count*	71.5	ea
Internal Gate Propagation Delay	1.5	ns
Internal Gate Power Dissipation	5.0	$\mu$ W
Speed Power Product	0.0075	pJ

\*Equivalent to a two-input NAND gate.

## FUNCTION TABLE

Inputs			Output
OE	Clock	D	Q
L		H	H
L		L	L
L	L,H,	X	No Change
H	X	X	Z

X = don't care

Z = high impedance

## ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
MC74HCT574ANG	PDIP-20 (Pb-Free)	18 Units / Box
MC74HCT574ADWG	SOIC-20 WIDE (Pb-Free)	38 Units / Rail
MC74HCT574ADWR2G	SOIC-20 WIDE (Pb-Free)	1000 Tape & Reel
MC74HCT574ADTR2G	TSSOP-20*	2500 Tape & Reel

<sup>†</sup>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.

\*This package is inherently Pb-Free.

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## 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	$\pm 35$	mA
$I_{CC}$	DC Supply Current, $V_{CC}$ and GND Pins	$\pm 75$	mA
$P_D$	Power Dissipation in Still Air, Plastic DIP† SOIC Package†	750 500	mW
$T_{stg}$	Storage Temperature	- 65 to + 150	°C
$T_L$	Lead Temperature, 1 mm from Case for 10 secs (Plastic DIP or SOIC Package)	260	°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$  should be constrained to the range  $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$ . Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

†Derating - Plastic DIP: - 10 mW/°C from 65° to 125°C  
- SOIC Package: - 7 mW/°C from 65° to 125°C

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
$V_{CC}$	DC Supply Voltage (Referenced to GND)	4.5	5.5	V
$V_{in}, V_{out}$	DC Input Voltage, Output Voltage (Referenced to GND)	0	$V_{CC}$	V
$T_A$	Operating Temperature, All Package Types	- 55	+ 125	°C
$t_r, t_f$	Input Rise and Fall Time (Figure 3)	0	500	ns

## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	$V_{CC}$ V	Guaranteed Limit			Unit
				- 55 to 25° C	$\leq 85^\circ C$	$\leq 125^\circ C$	
$V_{IH}$	Minimum High-Level Input Voltage	$V_{out} = 0.1 \text{ V or } V_{CC} - 0.1 \text{ V}$ $ I_{out}  \leq 20 \mu A$	4.5	2.0	2.0	2.0	V
			5.5	2.0	2.0	2.0	
$V_{IL}$	Maximum Low-Level Input Voltage	$V_{out} = 0.1 \text{ V or } V_{CC} - 0.1 \text{ V}$ $ I_{out}  \leq 20 \mu A$	4.5	0.8	0.8	0.8	V
			5.5	0.8	0.8	0.8	
$V_{OH}$	Minimum High-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out}  \leq 20 \mu A$	4.5	4.4	4.4	4.4	V
			5.5	5.4	5.4	5.4	
$V_{OL}$	Maximum Low-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out}  \leq 6.0 \text{ mA}$	4.5	3.98	3.84	3.7	V
			5.5	0.1	0.1	0.1	
$V_{OL}$	Maximum Low-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out}  \leq 20 \mu A$	4.5	0.1	0.1	0.1	V
			5.5	0.1	0.1	0.1	
$V_{OL}$	Maximum Low-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out}  \leq 6.0 \text{ mA}$	4.5	0.26	0.33	0.4	V
			5.5	0.26	0.33	0.4	
$I_{in}$	Maximum Input Leakage Current	$V_{in} = V_{CC} \text{ or } GND$	5.5	$\pm 0.1$	$\pm 1.0$	$\pm 1.0$	$\mu A$
$I_{CC}$	Maximum Quiescent Supply Current (per Package)	$V_{in} = V_{CC} \text{ or } GND$ $I_{out} = 0 \mu A$	5.5	4.0	40	160	$\mu A$
$I_{OZ}$	Maximum Three-State Leakage Current	$V_{in} = V_{IL} \text{ or } V_{IH}$ (Note 1) $V_{out} = V_{CC} \text{ or } GND$	5.5	- 0.5	- 5.0	- 10	$\mu A$
$\Delta I_{CC}$	Additional Quiescent Supply Current	$V_{in} = 2.4 \text{ V, Any One Input}$ $V_{in} = V_{CC} \text{ or } GND, \text{ Other Inputs}$ $I_{out} = 0 \mu A$	5.5	$\geq - 55^\circ C$	$25^\circ C \text{ to } 125^\circ C$		mA
				2.9	2.4		

1. Output in high-impedance state.

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## AC ELECTRICAL CHARACTERISTICS ( $V_{CC} = 5.0\text{ V} \pm 10\%$ , $C_L = 50\text{ pF}$ , Input $t_r = t_f = 6.0\text{ ns}$ )

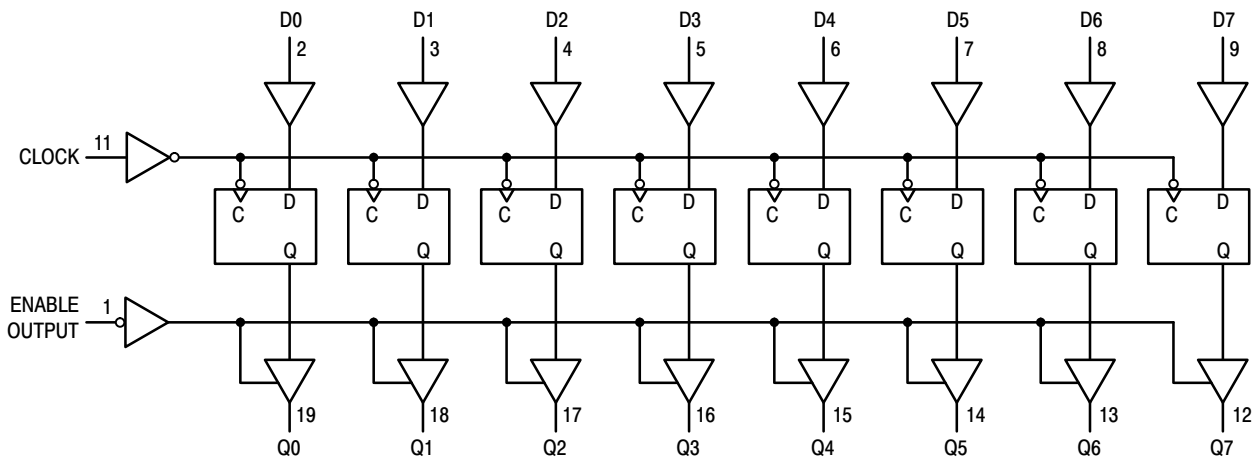
Symbol	Parameter	Guaranteed Limit			Unit
		- 55 to 25°C	≤ 85°C	≤ 125°C	
$f_{MAX}$	Maximum Clock Frequency (50% Duty Cycle) (Figures 3 and 6)	30	24	20	MHz
$t_{PLH}$ , $t_{PHL}$	Maximum Propagation Delay, Clock to Q (Figures 3 and 6)	30	38	45	ns
$t_{PLZ}$ , $t_{PHZ}$	Maximum Propagation Delay, Output Enable to Q (Figures 4 and 7)	28	35	42	ns
$t_{PZH}$ , $t_{PZL}$	Maximum Propagation Delay Time, Output Enable to Q (Figures 4 and 7)	28	35	42	ns
$t_{TLH}$ , $t_{THL}$	Maximum Output Transition Time, Any Output (Figures 3, 4 and 6)	12	15	18	ns
$C_{in}$	Maximum Input Capacitance	10	10	10	pF
$C_{PD}$	Power Dissipation Capacitance (Per Flip-Flop)*	Typical @ 25°C, $V_{CC} = 5.0\text{ V}$			pF
		58			

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

## TIMING REQUIREMENTS ( $V_{CC} = 5.0\text{ V} \pm 10\%$ , $C_L = 50\text{ pF}$ , Input $t_r = t_f = 6.0\text{ ns}$ )

Symbol	Parameter	Figure	Guaranteed Limit						Unit
			- 55 to 25°C		≤ 85°C		≤ 125°C		
			Min	Max	Min	Max	Min	Max	
$t_{su}$	Minimum Setup Time, Data to Clock	5	10		13		15		ns
$t_h$	Minimum Hold Time, Clock to Data	5	5.0		5.0		5.0		ns
$t_w$	Minimum Pulse Width, Clock	3	15		19		22		ns
$t_r, t_f$	Maximum Input Rise and Fall Times	3		500		500		500	ns

## EXPANDED LOGIC DIAGRAM



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## SWITCHING WAVEFORMS

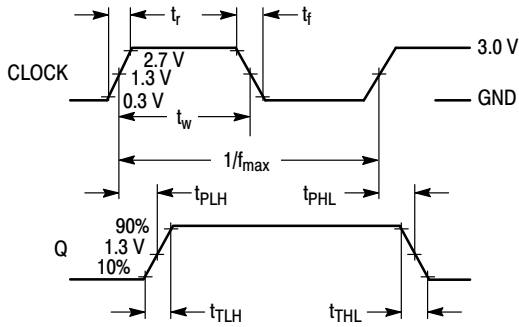


Figure 3.

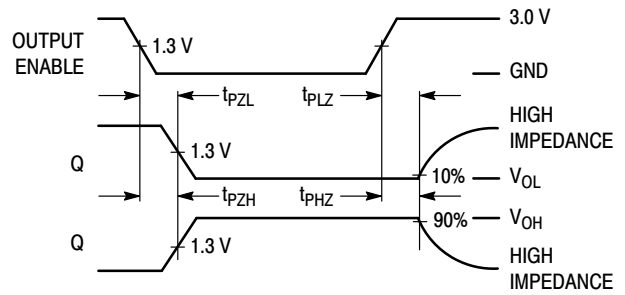


Figure 4.

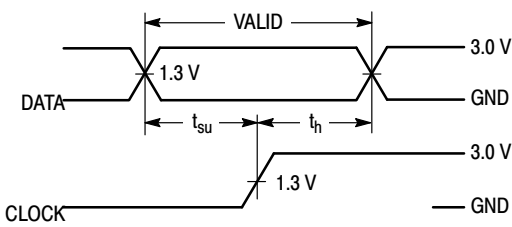


Figure 5.

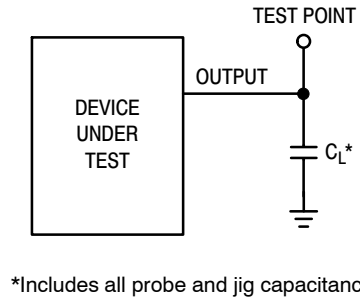


Figure 6. Test Circuit

\*Includes all probe and jig capacitance

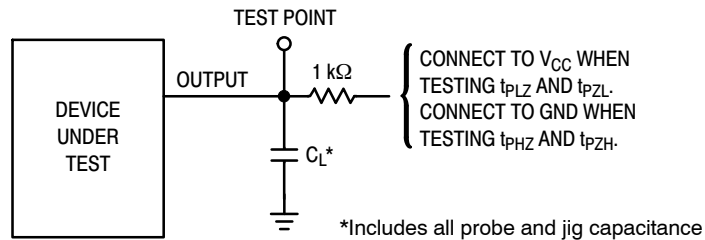


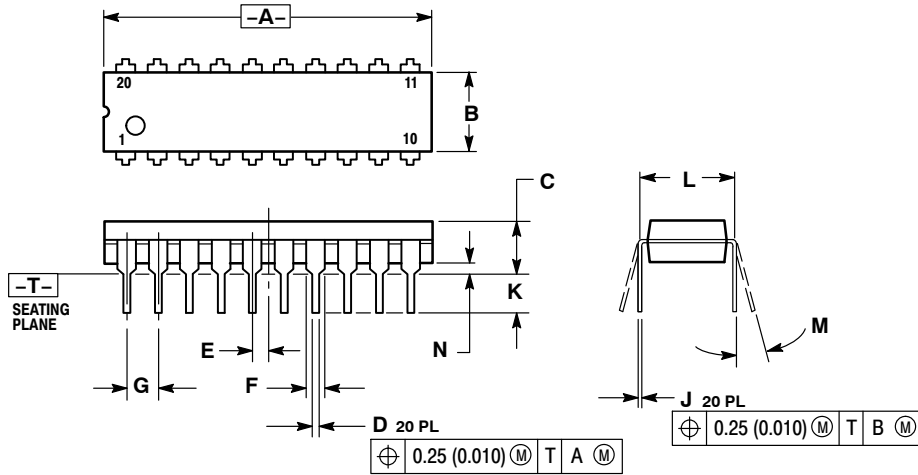
Figure 7. Test Circuit

\*Includes all probe and jig capacitance

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## PACKAGE DIMENSIONS

PDIP-20  
N SUFFIX  
PLASTIC DIP PACKAGE  
CASE 738-03  
ISSUE E

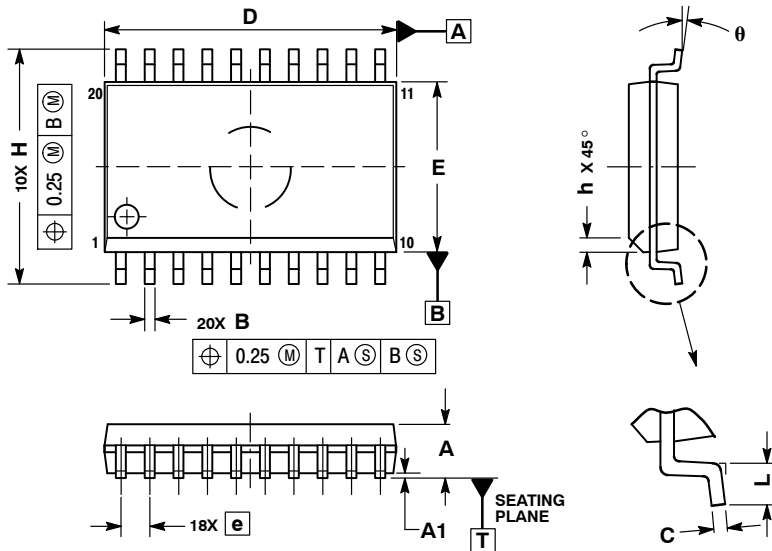


NOTES:

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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.010	1.070	25.66	27.17
B	0.240	0.260	6.10	6.60
C	0.150	0.180	3.81	4.57
D	0.015	0.022	0.39	0.55
E	0.050 BSC		1.27 BSC	
F	0.050	0.070	1.27	1.77
G	0.100 BSC		2.54 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.140	2.80	3.55
L	0.300 BSC		7.62 BSC	
M	0°	15°	0°	15°
N	0.020	0.040	0.51	1.01

SOIC-20  
DW SUFFIX  
CASE 751D-05  
ISSUE G



NOTES:

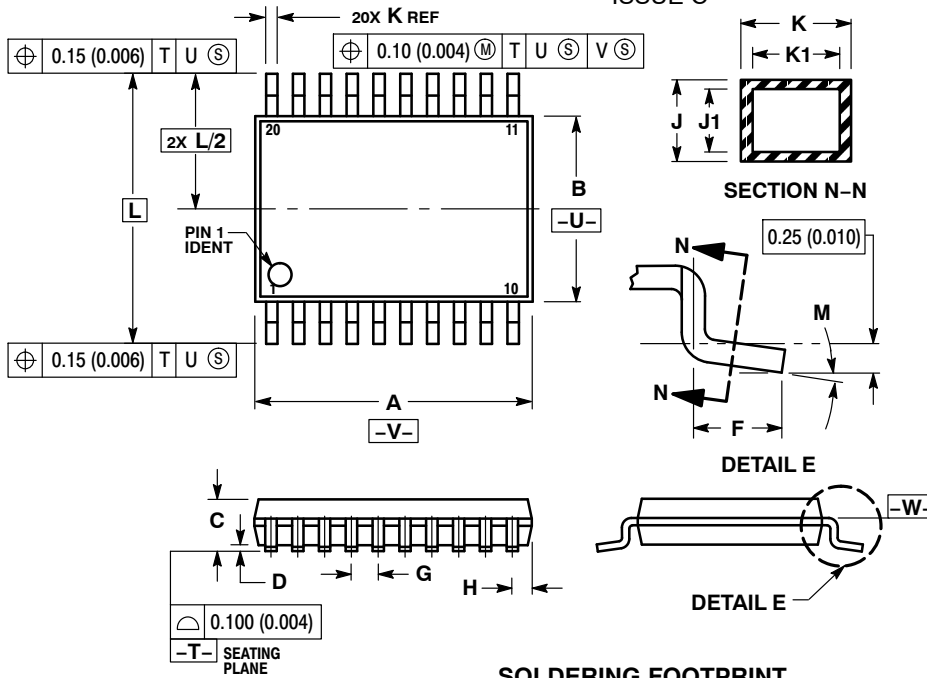
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS	
	MIN	MAX
A	2.35	2.65
A1	0.10	0.25
B	0.35	0.49
C	0.23	0.32
D	12.65	12.95
E	7.40	7.60
e	1.27 BSC	
H	10.05	10.55
h	0.25	0.75
L	0.50	0.90
θ	0°	7°

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## PACKAGE DIMENSIONS

TSSOP-20  
DT SUFFIX  
CASE 948E-02  
ISSUE C

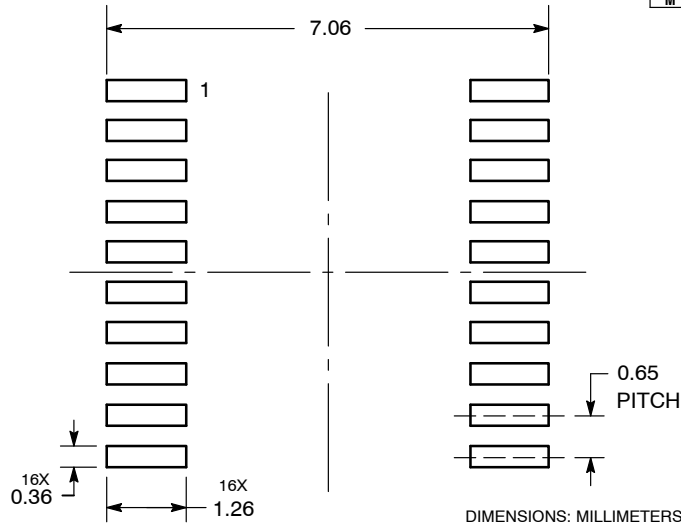


**NOTES:**

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	6.40	6.60	0.252	0.260
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	0.27	0.37	0.011	0.015
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°

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