# Octal D-Type Flip-Flop with 3-State Outputs

The MC74AC374/74ACT374 is a high–speed, low–power octal D–type flip–flop featuring separate D–type inputs for each flip–flop and 3–state outputs for bus–oriented applications. A buffered Clock (CP) and Output Enable ( $\overline{OE}$ ) are common to all flip–flops.

#### **Features**

- Buffered Positive Edge-Triggered Clock
- 3-State Outputs for Bus-Oriented Applications
- Outputs Source/Sink 24 mA
- See MC74AC273 for Reset Version
- See MC74AC377 for Clock Enable Version
- See MC74AC373 for Transparent Latch Version
- See MC74AC574 for Broadside Pinout Version
- See MC74AC564 for Broadside Pinout Version with Inverted Outputs
- 'ACT374 Has TTL Compatible Inputs
- These are Pb-Free Devices

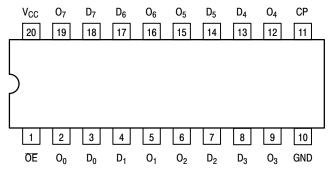


Figure 1. Pinout: 20 Lead Packages Conductors
(Top View)

#### **PIN ASSIGNMENT**

PIN	FUNCTION
D <sub>0</sub> -D <sub>7</sub>	Data Inputs
СР	Clock Pulse Input
ŌĒ	3-State Output Enable Input
O <sub>0</sub> -O <sub>7</sub>	3–State Outputs



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SOIC-20W DW SUFFIX CASE 751D



TSSOP-20 DT SUFFIX CASE 948E

#### **DEVICE MARKING INFORMATION**

See general marking information in the device marking section on page 6 of this data sheet.

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

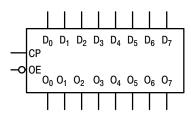


Figure 2. Logic Symbol

#### **TRUTH TABLE**

	Inputs					
D <sub>n</sub>	СР	ŌĒ	On			
Н	7	L	Н			
L	7	L	L			
Х	X	Н	Z			

H = HIGH Voltage Level

L = LOW Voltage Level

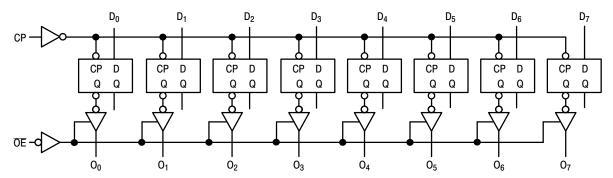
X = Immaterial

Z = High Impedance

\_= LOW-to-HIGH Transition

#### **FUNCTIONAL DESCRIPTION**

The MC74AC374/74ACT374 consists of eight edgetriggered flip-flops with individual D-type inputs and 3-state true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable ( $\overline{OE}$ ) LOW, the contents of the eight flip-flops are available at the outputs. When the  $\overline{OE}$  is HIGH, the outputs go to the high impedance state. Operation of the  $\overline{OE}$  input does not affect the state of the flip-flops.



NOTE: That this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Figure 3. Logic Diagram

#### **MAXIMUM RATINGS**

Symbol	Parameter		Value	Unit
V <sub>CC</sub>	DC Supply Voltage (Referenced to GND)		-0.5 to +7.0	V
V <sub>IN</sub>	DC Input Voltage (Referenced to GND)		–0.5 to V <sub>CC</sub> +0.5	V
V <sub>OUT</sub>	DC Output Voltage (Referenced to GND) (Note 1)		-0.5 to V <sub>CC</sub> +0.5	V
I <sub>IK</sub>	DC Input Diode Current		±20	mA
I <sub>OK</sub>	DC Output Diode Current		±50	mA
I <sub>OUT</sub>	DC Output Sink/Source Current		±50	mA
I <sub>CC</sub>	DC Supply Current, per Output Pin		±50	mA
I <sub>GND</sub>	DC Ground Current, per Output Pin		±100	mA
T <sub>STG</sub>	Storage Temperature Range		-65  to  +150	°C
TL	Lead temperature, 1 mm from Case for 10 Seconds		260	°C
$T_J$	Junction Temperature Under Bias		140	°C
$\theta_{JA}$	Thermal Resistance (Note 2)	SOIC TSSOP	65.8 110.7	°C/W
MSL	Moisture Sensitivity		Level 1	
F <sub>R</sub>	Flammability Rating Oxygen Index	k: 30% – 35%	UL 94 V-0 @ 0.125 in	
V <sub>ESD</sub>	ESD Withstand Voltage  Human Body M  Machine M  Charged Device M	lodel (Note 4)	> 2000 > 200 > 1000	V
I <sub>Latchup</sub>	Latchup Performance Above V <sub>CC</sub> and Below GND at 8	35°C (Note 6)	±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<sub>OUT</sub> absolute maximum rating must be observed.
- 2. The package thermal impedance is calculated in accordance with JESD 51–7.
- 3. Tested to EIA/JESD22-A114-A.
- 4. Tested to EIA/JESD22-A115-A.
- 5. Tested to JESD22-C101-A.
- 6. Tested to EIA/JESD78.

#### RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Тур	Max	Unit	
V	Cumply Voltage	'AC	2.0	5.0	6.0	V
V <sub>CC</sub>	Supply Voltage	'ACT	4.5	5.0	5.5	V
V <sub>IN</sub> , V <sub>OUT</sub>	DC Input Voltage, Output Voltage (Ref. to GND)		0		V <sub>CC</sub>	V
		V <sub>CC</sub> @ 3.0 V	_	150	-	
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time (Note 1)  'AC Devices except Schmitt Inputs	V <sub>CC</sub> @ 4.5 V	_	40	-	ns/V
		V <sub>CC</sub> @ 5.5 V	_	25	-	
	Input Rise and Fall Time (Note 2)	V <sub>CC</sub> @ 4.5 V	_	10	_	20/1
t <sub>r</sub> , t <sub>f</sub>	'ACT Devices except Schmitt Inputs	V <sub>CC</sub> @ 5.5 V	_	8.0	-	ns/V
T <sub>A</sub>	Operating Ambient Temperature Range	-40	25	85	°C	
Іон	Output Current – High			_	-24	mA
I <sub>OL</sub>	Output Current – Low			_	24	mA

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.

- 1. V<sub>IN</sub> from 30% to 70% V<sub>CC</sub>; see individual Data Sheets for devices that differ from the typical input rise and fall times.
- 2. V<sub>IN</sub> from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

#### **DC CHARACTERISTICS**

			74.	AC	74AC			
Symbol	Parameter $V_{CC}$ $T_A = +25^{\circ}C$		$T_A = -40^{\circ}C$ to $+85^{\circ}C$	Unit	Conditions			
		(*)	Тур	Gu	aranteed Limits			
V <sub>IH</sub>	Minimum High Level	3.0	1.5	2.1	2.1		V <sub>OUT</sub> = 0.1 V	
	Input Voltage	4.5	2.25	3.15	3.15	V	or V <sub>CC</sub> – 0.1 V	
		5.5	2.75	3.85	3.85			
V <sub>IL</sub>	Maximum Low Level	3.0	1.5	0.9	0.9		V <sub>OUT</sub> = 0.1 V	
	Input Voltage	4.5	2.25	1.35	1.35	V	or V <sub>CC</sub> – 0.1 V	
		5.5	2.75	1.65	1.65			
V <sub>OH</sub>	Minimum High Level	3.0	2.99	2.9	2.9		I <sub>OUT</sub> = -50 μA	
	Output Voltage	4.5	4.49	4.4	4.4	V		
		5.5	5.49	5.4	5.4			
		3.0 4.5 5.5	- - -	2.56 3.86 4.86	2.46 3.76 4.76	V	$^{*}V_{IN} = V_{IL} \text{ or } V_{IH}$ $-12 \text{ m.}$ $I_{OH}$ $-24 \text{ m.}$ $-24 \text{ m.}$	
V <sub>OL</sub>	Maximum Low Level	3.0	0.002	0.1	0.1		I <sub>OUT</sub> = 50 μA	
	Output Voltage	4.5	0.001	0.1	0.1	V		
		5.5	0.001	0.1	0.1			
		3.0 4.5 5.5	- - -	0.36 0.36 0.36	0.44 0.44 0.44	V	$^*$ V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> 12 mA $^{I}$ OL 24 mA 24 mA	
I <sub>IN</sub>	Maximum Input Leakage Current	5.5	-	±0.1	±1.0	μΑ	V <sub>I</sub> = V <sub>CC</sub> , GND	
I <sub>OZ</sub>	Maximum 3-State Current	5.5	-	±0.5	±5.0	μΑ	$V_{I}$ (OE) = $V_{IL}$ , $V_{II}$ $V_{I}$ = $V_{CC}$ , GND $V_{O}$ = $V_{CC}$ , GND	
l <sub>OLD</sub>	†Minimum Dynamic	5.5	_	_	75	mA	V <sub>OLD</sub> = 1.65 V M	
I <sub>OHD</sub>	Output Current	5.5	-	-	-75	mA	V <sub>OHD</sub> = 3.85 V M	
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	_	8.0	80	μΑ	V <sub>IN</sub> = V <sub>CC</sub> or GN	

<sup>\*</sup>All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time. NOTE:  $I_{IN}$  and  $I_{CC}$  @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V  $V_{CC}$ .

#### AC CHARACTERISTICS (For Figures and Waveforms – See AND8277/D at www.onsemi.com)

				74AC		74.	AC		
Symbol	Parameter	V <sub>CC</sub> * (V)		T <sub>A</sub> = +25°( C <sub>L</sub> = 50 pF		T <sub>A</sub> = - to +8 C <sub>L</sub> = 9		Unit	Fig. No.
			Min	Тур	Max	Min	Max		
f <sub>max</sub>	Maximum Clock Frequency	3.3 5.0	60 100	110 155	-	60 100	-	MHz	3–3
t <sub>PLH</sub>	Propagation Delay CP to O <sub>n</sub>	3.3 5.0	3.0 2.5	11 8.0	13.5 9.5	1.5 1.5	15.5 10.5	ns	3–6
t <sub>PHL</sub>	Propagation Delay CP to O <sub>n</sub>	3.3 5.0	2.5 2.0	10 7.0	12.5 9.0	2.0 1.5	14 10	ns	3–6
t <sub>PZH</sub>	Output Enable Time	3.3 5.0	3.0 2.0	9.5 7.0	11.5 8.5	1.5 1.0	13 9.5	ns	3–7
t <sub>PZL</sub>	Output Enable Time	3.3 5.0	2.5 2.0	9.0 6.5	11.5 8.5	1.5 1.0	13 9.5	ns	3–8
t <sub>PHZ</sub>	Output Disable Time	3.3 5.0	3.0 2.0	10.5 8.0	12.5 11	2.0 2.0	14.5 12.5	ns	3–7
t <sub>PLZ</sub>	Output Disable Time	3.3 5.0	2.0 1.5	8.0 6.5	11.5 8.5	1.0 1.0	12.5 10	ns	3–8

<sup>\*</sup>Voltage Range 3.3 V is 3.3 V  $\pm 0.3$  V. Voltage Range 5.0 V is 5.0 V  $\pm 0.5$  V.

#### **AC OPERATING REQUIREMENTS**

				74AC	74AC		
Symbol	Parameter	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Unit	Fig. No.		
			Тур	Guarantee	d Minimum		
	Setup Time, HIGH or LOW	3.3	2.0	5.5	6.0		2.0
t <sub>s</sub>	D <sub>n</sub> to CP	5.0	1.0	4.0	4.5	ns	3–9
	Hold Time, HIGH or LOW	3.3	-1.0	1.0	1.0		2.0
t <sub>h</sub>	D <sub>n</sub> to CP	5.0	0	1.5	1.5	ns	3–9
	CP Pulse Width	3.3	4.0	5.5	6.0		0.0
t <sub>w</sub>	HIGH or LOW	5.0	2.5	4.0	4.5	ns	3–6

<sup>\*</sup>Voltage Range 3.3 V is 3.3 V ±0.3 V. Voltage Range 5.0 V is 5.0 V ±0.5 V.

#### **DC CHARACTERISTICS**

			74	CT	74ACT			
Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = -	+25°C	T <sub>A</sub> = -40°C to +85°C	Unit	Conditions	
			Тур	Gua	ranteed Limits			
V <sub>IH</sub>	Minimum High Level Input Voltage	4.5 5.5	1.5 1.5	2.0 2.0	2.0 2.0	V	$V_{OUT} = 0.1 \text{ V}$ or $V_{CC} - 0.1 \text{ V}$	
V <sub>IL</sub>	Maximum Low Level Input Voltage	4.5 5.5	1.5 1.5	0.8 0.8	0.8 0.8	V	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> – 0.1 V	
V <sub>OH</sub>	Minimum High Level Output Voltage	4.5 5.5	4.49 5.49	4.4 5.4	4.4 5.4	V	I <sub>OUT</sub> = -50 μA	
		4.5 5.5	_ _	3.86 4.86	3.76 4.76	V	$^*V_{IN} = V_{IL} \text{ or } V_{IH}$ $I_{OH} -24 \text{ mA}$ $-24 \text{ mA}$	
V <sub>OL</sub>	Maximum Low Level Output Voltage	4.5 5.5	0.001 0.001	0.1 0.1	0.1 0.1	V	I <sub>OUT</sub> = 50 μA	
		4.5 5.5	_ _	0.36 0.36	0.44 0.44	V	$^*V_{IN} = V_{IL} \text{ or } V_{IH}$ $^{24} \text{ mA}$ $^{1}OL$ $^{24} \text{ mA}$	
I <sub>IN</sub>	Maximum Input Leakage Current	5.5	_	±0.1	±1.0	μΑ	V <sub>I</sub> = V <sub>CC</sub> , GND	
$\Delta I_{CCT}$	Additional Max. I <sub>CC</sub> /Input	5.5	0.6	_	1.5	mA	$V_{I} = V_{CC} - 2.1 \text{ V}$	
I <sub>OZ</sub>	Maximum 3-State Current	5.5	-	±0.5	±5.0	μΑ	$V_{I}$ (OE) = $V_{IL}$ , $V_{IH}$ $V_{I}$ = $V_{CC}$ , GND $V_{O}$ = $V_{CC}$ , GND	
I <sub>OLD</sub>	†Minimum Dynamic	5.5	_	-	75	mA	V <sub>OLD</sub> = 1.65 V Max	
I <sub>OHD</sub>	Output Current	5.5	-	_	-75	mA	V <sub>OHD</sub> = 3.85 V Min	
Icc	Maximum Quiescent Supply Current	5.5	-	8.0	80	μΑ	V <sub>IN</sub> = V <sub>CC</sub> or GND	

<sup>\*</sup>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 AND8277/D at www.onsemi.com)

				74ACT		744	CT		
Symbol	Parameter	V <sub>CC</sub> * (V)		Γ <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = - to +8 C <sub>L</sub> = 8	35°C	Unit	Fig. No.
			Min	Тур	Max	Min	Max		
f <sub>max</sub>	Maximum Clock Frequency	5.0	100	160	1	90	1	MHz	3–3
t <sub>PLH</sub>	Propagation Delay CP to O <sub>n</sub>	5.0	2.0	8.5	10	2.0	11.5	ns	3–6
t <sub>PHL</sub>	Propagation Delay CP to O <sub>n</sub>	5.0	2.0	8.0	9.5	1.5	11	ns	3–6
t <sub>PZH</sub>	Output Enable Time	5.0	2.0	8.0	9.5	1.5	10.5	ns	3–7
t <sub>PZL</sub>	Output Enable Time	5.0	1.5	8.0	9.0	1.5	10.5	ns	3–8
t <sub>PHZ</sub>	Output Disable Time	5.0	1.5	8.5	11.5	1.0	12.5	ns	3–7
t <sub>PLZ</sub>	Output Disable Time	5.0	1.5	7.0	8.5	1.0	10	ns	3–8

<sup>\*</sup>Voltage Range 5.0 V is 5.0 V ±0.5 V.

#### AC OPERATING REQUIREMENTS (For Figures and Waveforms - See AND8277/D at www.onsemi.com)

			74A	CT	74ACT				
Symbol	Parameter	V <sub>CC</sub> * (V)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF	Unit	Fig. No.
			Typ Guara		nteed Minimum				
t <sub>s</sub>	Setup Time, HIGH or LOW D <sub>n</sub> to CP	5.0	1.0	5.0	5.5	ns	3–9		
t <sub>h</sub>	Hold Time, HIGH or LOW D <sub>n</sub> to CP	5.0	0	1.5	1.5	ns	3–9		
t <sub>w</sub>	CP Pulse Width HIGH or LOW	5.0	2.5	5.0	5.0	ns	3–6		

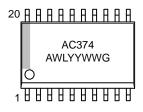
<sup>\*</sup>Voltage Range 5.0 V is 5.0 V ±0.5 V.

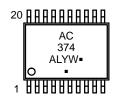
#### **CAPACITANCE**

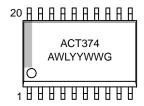
Symbol	Parameter	Value Typ	Unit	Test Conditions
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = 5.0 V
C <sub>PD</sub>	Power Dissipation Capacitance	80	pF	V <sub>CC</sub> = 5.0 V

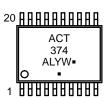
#### **MARKING DIAGRAMS**

SOIC-20W TSSOP-20









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**

Device	Package	Shipping <sup>†</sup>
MC74AC374DWG	SOIC-20 (Pb-Free)	38 Units / Rail
MC74AC374DWR2G	SOIC-20 (Pb-Free)	1000 / Tape & Reel
MC74ACT374DWG	SOIC-20 (Pb-Free)	38 Units / Rail
MC74ACT374DWR2G	SOIC-20 (Pb-Free)	1000 / Tape & Reel
MC74AC374DTR2G	TSSOP-20 (Pb-Free)	2500 / Tape & Reel
MC74ACT374DTR2G	TSSOP-20 (Pb-Free)	2500 / Tape & Reel

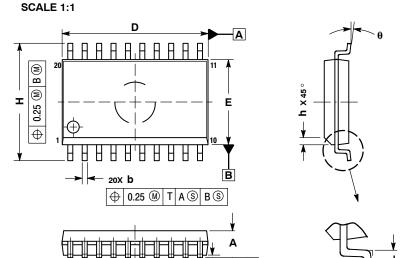
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.





SOIC-20 WB CASE 751D-05 **ISSUE H** 

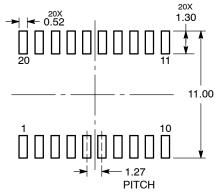
**DATE 22 APR 2015** 



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

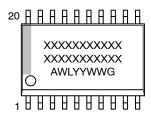
	MILLIMETERS		
DIM	MIN	MAX	
Α	2.35	2.65	
A1	0.10	0.25	
b	0.35	0.49	
С	0.23	0.32	
D	12.65	12.95	
E	7.40	7.60	
е	1.27 BSC		
Н	10.05	10.55	
h	0.25	0.75	
L	0.50	0.90	
A	0 °	7 °	

#### **RECOMMENDED SOLDERING FOOTPRINT\***



DIMENSIONS: MILLIMETERS

#### **GENERIC MARKING DIAGRAM\***



XXXXX = Specific Device Code = Assembly Location

WL = Wafer Lot ΥY = Year WW = Work Week = 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.

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DESCRIPTION:	SOIC-20 WB		PAGE 1 OF 1

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<sup>\*</sup>For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

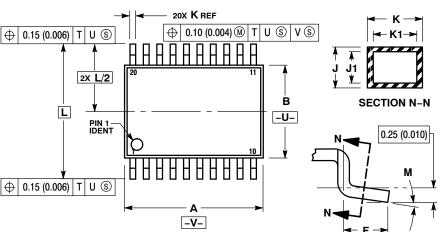
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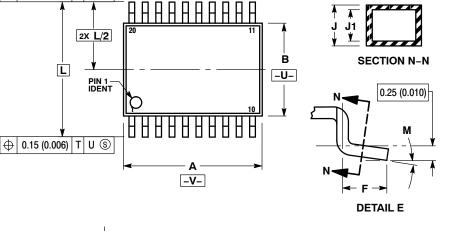
-T- SEATING

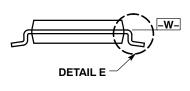


#### TSSOP-20 WB CASE 948E ISSUE D

**DATE 17 FEB 2016** 







#### NOTES:

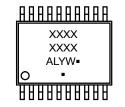
- DIMENSIONING AND TOLERANCING PER
- ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
- 3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
- FLASH, PROTRUSIONS OR GATE BURRS.
  MOLD FLASH OR GATE BURRS SHALL NOT
  EXCEED 0.15 (0.006) PER SIDE.

  4. DIMENSION B DOES NOT INCLUDE
  INTERLEAD FLASH OR PROTRUSION.
  INTERLEAD FLASH OR PROTRUSION
  SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
  DIMENSION K DOES NOT INCLUDE
  DAMBAR PROTRUSION. ALLOWABLE
  DAMBAR PROTRUSION SHALL BE 0.08
  (0.003) TOTAL IN EXCESS OF THE K
- (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
- TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.

  7. DIMENSION A AND B ARE TO BE
- DETERMINED AT DATUM PLANE -W-.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
Α	6.40	6.60	0.252	0.260
В	4.30	4.50	0.169	0.177
С		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	
Н	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°

#### **GENERIC MARKING DIAGRAM\***



= Assembly Location

= Wafer Lot

= Year

= Work Week

= Pb-Free Package

(Note: Microdot may be in either location)

\*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.

◀	7.06
1 	
16X 0.36 16X 1.26	DIMENSIONS: MILLIMETERS

**SOLDERING FOOTPRINT** 

DESCRIPTION:	TSSOP-20 WB		PAGE 1 OF 1
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