

# MC74VHC574

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

The MC74VHC574 is an advanced high speed CMOS octal flip-flop with 3-state output fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

This 8-bit D-type flip-flop is controlled by a clock input and an output enable input. When the output enable input is high, the eight outputs are in a high impedance state.

The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output. The inputs tolerate voltages up to 7 V, allowing the interface of 5 V systems to 3 V systems.

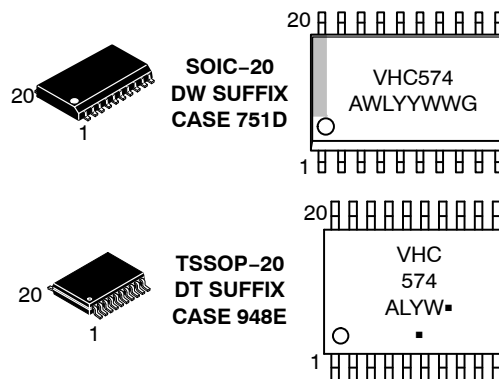
- High Speed:  $f_{max} = 180$  MHz (Typ) at  $V_{CC} = 5$  V
- Low Power Dissipation:  $I_{CC} = 4$   $\mu$ A (Max) at  $T_A = 25^\circ$ C
- High Noise Immunity:  $V_{NIH} = V_{NIL} = 28\%$   $V_{CC}$
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Designed for 2 V to 5.5 V Operating Range
- Low Noise:  $V_{OLP} = 1.2$  V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: HBM > 2000 V; Machine Model > 200 V
- Chip Complexity: 266 FETs or 66.5 Equivalent Gates
- These Devices are Pb-Free and are RoHS Compliant



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<http://onsemi.com>

### MARKING DIAGRAMS



VHC574 = Specific Device Code  
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†
MC74VHC574DWR2G	SOIC-20	1000 / T&R
MC74VHC574DWG	SOIC-20	38 / Rail
MC74VHC574DTR2G	TSSOP-20	2500 / T&R
MC74VHC574DTG	TSSOP-20	75 / Rail

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

# MC74VHC574

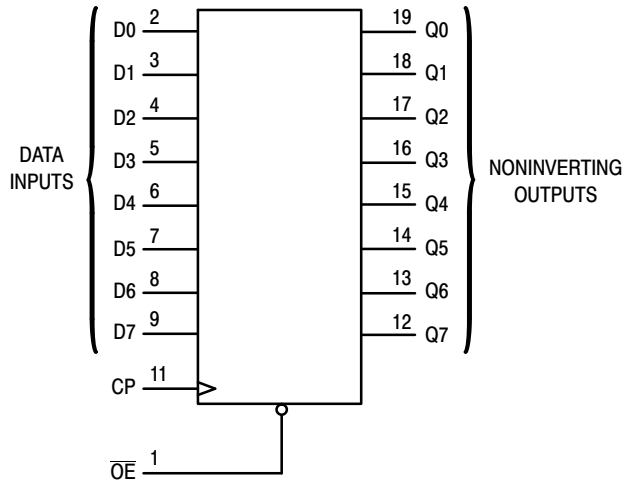


Figure 1. LOGIC DIAGRAM

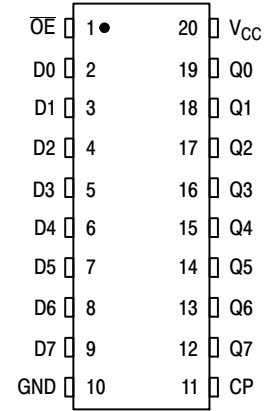


Figure 2. PIN ASSIGNMENT

## FUNCTION TABLE

INPUTS			OUTPUT
OE	CP	D	Q
L	↗	H	H
L	↘	L	L
L	L, H, ↗, ↘	X	No Change
H	X	X	Z

# MC74VHC574

## MAXIMUM RATINGS\*

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	- 0.5 to + 7.0	V
V <sub>in</sub>	DC Input Voltage	- 0.5 to + 7.0	V
V <sub>out</sub>	DC Output Voltage	- 0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	Input Diode Current	- 20	mA
I <sub>OK</sub>	Output Diode Current	± 20	mA
I <sub>out</sub>	DC Output Current, per Pin	± 25	mA
I <sub>CC</sub>	DC Supply Current, V <sub>CC</sub> and GND Pins	± 75	mA
P <sub>D</sub>	Power Dissipation in Still Air, SOIC Packages† TSSOP Package†	500 450	mW
T <sub>stg</sub>	Storage Temperature	- 65 to + 150	°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<sub>in</sub> and V<sub>out</sub> should be constrained to the range GND ≤ (V<sub>in</sub> or V<sub>out</sub>) ≤ V<sub>CC</sub>. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.

\* Absolute maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute-maximum-rated conditions is not implied.

† Derating — SOIC Packages: - 7 mW/°C from 65° to 125°C  
TSSOP Package: - 6.1 mW/°C from 65° to 125°C

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	DC Supply Voltage	2.0	5.5	V
V <sub>in</sub>	DC Input Voltage	0	5.5	V
V <sub>out</sub>	DC Output Voltage	0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature	- 40	+ 85	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time	V <sub>CC</sub> = 3.3V V <sub>CC</sub> = 5.0V	0 100 20	ns/V

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V <sub>CC</sub> V	T <sub>A</sub> = 25°C			T <sub>A</sub> = - 40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
V <sub>IH</sub>	Minimum High-Level Input Voltage		2.0 3.0 to 5.5	1.50 V <sub>CC</sub> × 0.7			1.50 V <sub>CC</sub> × 0.7		V
V <sub>IL</sub>	Maximum Low-Level Input Voltage		2.0 3.0 to 5.5			0.50 V <sub>CC</sub> × 0.3		0.50 V <sub>CC</sub> × 0.3	V
V <sub>OH</sub>	Minimum High-Level Output Voltage	V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = - 50μA	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5		1.9 2.9 4.4		V
		V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = - 4mA I <sub>OH</sub> = - 8mA	3.0 4.5	2.58 3.94			2.48 3.80		
V <sub>OL</sub>	Maximum Low-Level Output Voltage	V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 50μA	2.0 3.0 4.5		0.0 0.0 0.0	0.1 0.1 0.1		0.1 0.1 0.1	V
		V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 4mA I <sub>OL</sub> = 8mA	3.0 4.5			0.36 0.36		0.44 0.44	

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## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V <sub>CC</sub> V	T <sub>A</sub> = 25°C			T <sub>A</sub> = - 40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
I <sub>in</sub>	Maximum Input Leakage Current	V <sub>in</sub> = 5.5V or GND	0 to 5.5			± 0.1		± 1.0	μA
I <sub>OZ</sub>	Maximum Three-State Leakage Current	V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>out</sub> = V <sub>CC</sub> or GND	5.5			± 0.25		± 2.5	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current	V <sub>in</sub> = V <sub>CC</sub> or GND	5.5			4.0		40.0	μA

## AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3.0ns)

Symbol	Parameter	Test Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> = - 40 to 85°C		Unit
			Min	Typ	Max	Min	Max	
f <sub>max</sub>	Maximum Clock Frequency (50% Duty Cycle)	V <sub>CC</sub> = 3.3 ± 0.3V C <sub>L</sub> = 15pF	80	125	—	65	—	ns
		V <sub>CC</sub> = 3.3 ± 0.3V C <sub>L</sub> = 50pF	50	75	—	45	—	
t <sub>pLH</sub> , t <sub>pHL</sub>	Maximum Propagation Delay, CP to Q	V <sub>CC</sub> = 5.0 ± 0.5V C <sub>L</sub> = 15pF	130	180	—	110	—	ns
		V <sub>CC</sub> = 5.0 ± 0.5V C <sub>L</sub> = 50pF	85	115	—	75	—	
t <sub>pLH</sub> , t <sub>pHL</sub>	Maximum Propagation Delay, CP to Q	V <sub>CC</sub> = 3.3 ± 0.3 C <sub>L</sub> = 15pF	—	8.5	13.2	1.0	15.5	ns
		V <sub>CC</sub> = 3.3 ± 0.3 C <sub>L</sub> = 50pF	—	11.0	16.7	1.0	19.0	
t <sub>pZL</sub> , t <sub>pZH</sub>	Output Enable Time, OE to Q	V <sub>CC</sub> = 5.0 ± 0.5V C <sub>L</sub> = 15pF	—	5.6	8.6	1.0	10.0	ns
		V <sub>CC</sub> = 5.0 ± 0.5V C <sub>L</sub> = 50pF	—	7.1	10.6	1.0	12.0	
t <sub>pZL</sub> , t <sub>pZH</sub>	Output Enable Time, OE to Q	V <sub>CC</sub> = 3.3 ± 0.3V C <sub>L</sub> = 15pF	—	8.2	12.8	1.0	15.0	ns
		V <sub>CC</sub> = 3.3 ± 0.3V R <sub>L</sub> = 1kΩ C <sub>L</sub> = 50pF	—	10.7	16.3	1.0	18.5	
t <sub>pZL</sub> , t <sub>pZH</sub>	Output Enable Time, OE to Q	V <sub>CC</sub> = 5.0 ± 0.5V C <sub>L</sub> = 15pF	—	5.9	9.0	1.0	10.5	ns
		V <sub>CC</sub> = 5.0 ± 0.5V R <sub>L</sub> = 1kΩ C <sub>L</sub> = 50pF	—	7.4	11.0	1.0	12.5	
t <sub>pLZ</sub> , t <sub>pHZ</sub>	Output Disable Time, OE to Q	V <sub>CC</sub> = 3.3 ± 0.3V C <sub>L</sub> = 50pF	—	11.0	15.0	1.0	17.0	ns
		V <sub>CC</sub> = 3.3 ± 0.3V R <sub>L</sub> = 1kΩ	—	—	—	—	—	
t <sub>OSLH</sub> , t <sub>OSHL</sub>	Output to Output Skew	V <sub>CC</sub> = 5.0 ± 0.5V C <sub>L</sub> = 50pF	—	—	1.5	—	1.5	ns
		V <sub>CC</sub> = 5.0 ± 0.5V (Note 1) C <sub>L</sub> = 50pF	—	—	1.0	—	1.0	
C <sub>in</sub>	Maximum Input Capacitance		—	4	10	—	10	pF
C <sub>out</sub>	Maximum Three-State Output Capacitance, Output in High-Impedance State		—	6	—	—	—	pF

C <sub>PD</sub>	Power Dissipation Capacitance (Note 2)	Typical @ 25°C, V <sub>CC</sub> = 5.0V	
		28	pF

- Parameter guaranteed by design. t<sub>OSLH</sub> = |t<sub>pLHm</sub> - t<sub>pLHn</sub>|, t<sub>OSHL</sub> = |t<sub>pHLm</sub> - t<sub>pHLn</sub>|.
- C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>/8 (per flip-flop). C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

# MC74VHC574

## NOISE CHARACTERISTICS (Input $t_r = t_f = 3.0\text{ns}$ , $C_L = 50\text{pF}$ , $V_{CC} = 5.0\text{V}$ )

Symbol	Parameter	$T_A = 25^\circ\text{C}$		Unit
		Typ	Max	
$V_{OLP}$	Quiet Output Maximum Dynamic $V_{OL}$	0.9	1.2	V
$V_{OLV}$	Quiet Output Minimum Dynamic $V_{OL}$	-0.9	-1.2	V
$V_{IHD}$	Minimum High Level Dynamic Input Voltage	—	3.5	V
$V_{ILD}$	Maximum Low Level Dynamic Input Voltage	—	1.5	V

## TIMING REQUIREMENTS (Input $t_r = t_f = 3.0\text{ns}$ )

Symbol	Parameter	Test Conditions	$T_A = 25^\circ\text{C}$		$T_A = -40$ to $85^\circ\text{C}$	Unit
			Typ	Limit	Limit	
$t_{su}$	Minimum Setup Time, D to CP	$V_{CC} = 3.3 \pm 0.3\text{ V}$	—	3.5	3.5	ns
		$V_{CC} = 5.0 \pm 0.5\text{ V}$	—	3.5	3.5	
$t_h$	Minimum Hold Time, CP to D	$V_{CC} = 3.3 \pm 0.3\text{ V}$	—	1.5	1.5	ns
		$V_{CC} = 5.0 \pm 0.5\text{ V}$	—	1.5	1.5	
$t_w$	Minimum Pulse Width, CP	$V_{CC} = 3.3 \pm 0.3\text{ V}$	—	5.0	5.5	ns
		$V_{CC} = 5.0 \pm 0.5\text{ V}$	—	5.0	5.0	

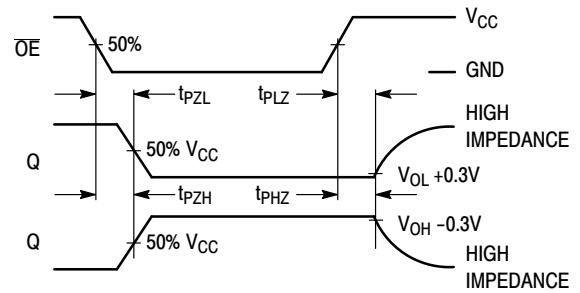
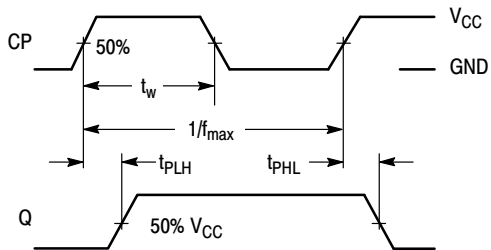


Figure 3. Switching Waveforms

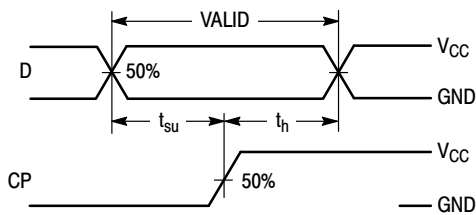
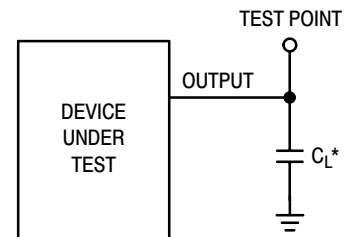


Figure 4.



\*Includes all probe and jig capacitance

Figure 5.

# MC74VHC574

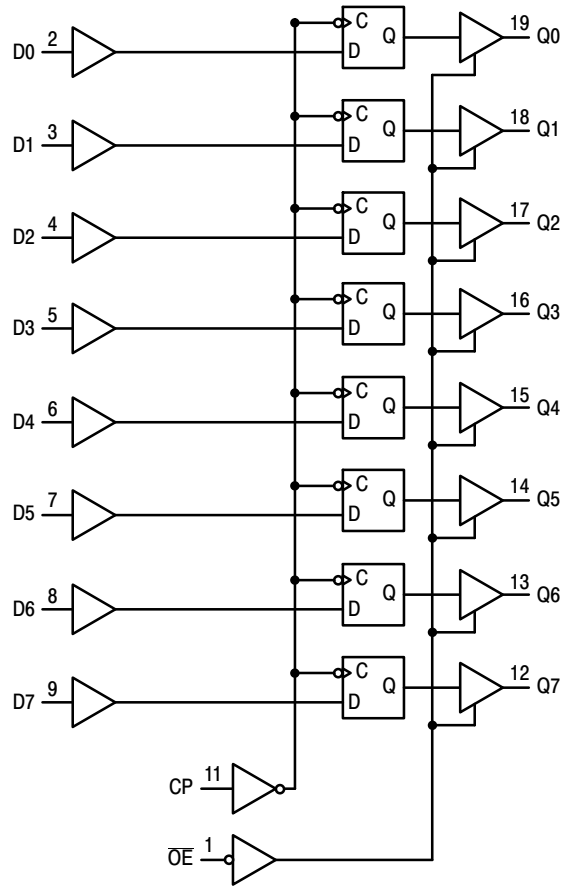
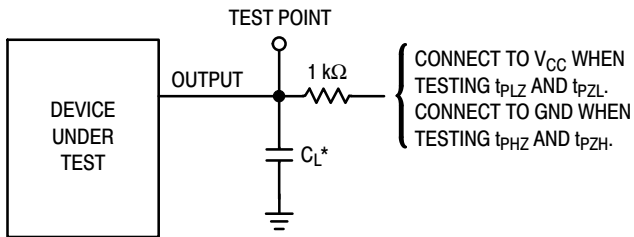


Figure 6. Expanded Logic Diagram



\*Includes all probe and jig capacitance

Figure 7. Test Circuit

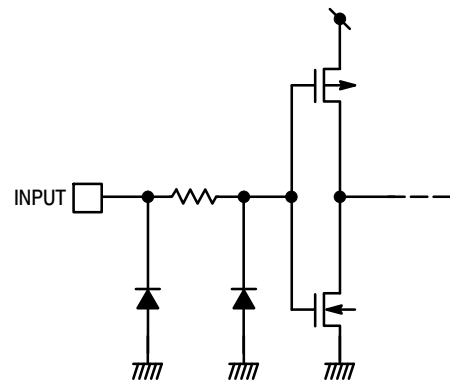


Figure 8. INPUT EQUIVALENT CIRCUIT

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 1:1

SOIC-20 WB  
CASE 751D-05  
ISSUE H

DATE 22 APR 2015

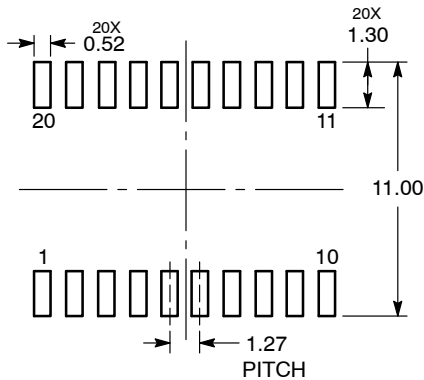


NOTES:

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°

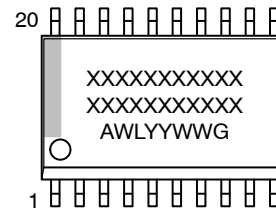
RECOMMENDED  
SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

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

GENERIC  
MARKING DIAGRAM\*



- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- YY = 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.

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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

ON Semiconductor®



TSSOP-20 WB  
CASE 948E  
ISSUE D

DATE 17 FEB 2016

SCALE 2:1



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°



SOLDERING FOOTPRINT



GENERIC MARKING DIAGRAM\*



- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = 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.

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