

# Octal 3-State Inverting Buffer/Line Driver/Line Receiver

## High-Performance Silicon-Gate CMOS

### MC74HC240A

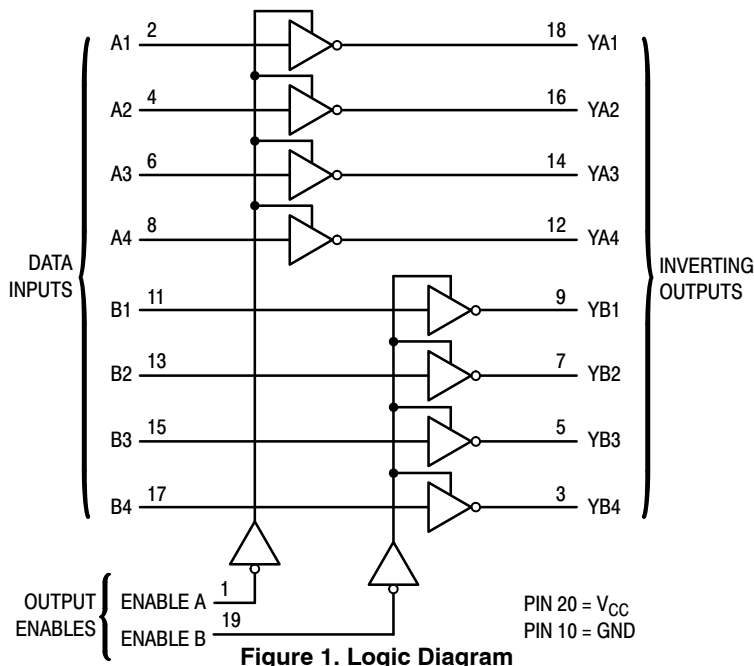
The MC74HC240A is identical in pinout to the LS240. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

This octal noninverting buffer/line driver/line receiver is designed to be used with 3-state memory address drivers, clock drivers, and other sub-oriented systems. The device has inverting outputs and two active-low output enables.

The HC240A is similar in function to the HC244A.

#### Features

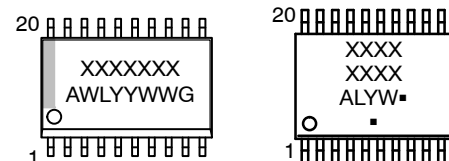
- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7 A
- Chip Complexity: 120 FETs or 30 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 and are RoHS Compliant



#### PIN ASSIGNMENT

ENABLE A	1	20	V <sub>CC</sub>
A1	2	19	ENABLE B
YB4	3	18	YA1
A2	4	17	B4
YB3	5	16	YA2
A3	6	15	B3
YB2	7	14	YA3
A4	8	13	B2
YB1	9	12	YA4
GND	10	11	B1

#### MARKING DIAGRAMS



#### SOIC-20

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

#### TSSOP-20

(Note: Microdot may be in either location)

#### FUNCTION TABLE

Inputs		Outputs
Enable A, Enable B	A, B	YA, YB
L	L	H
L	H	L
H	X	Z

Z = high impedance

#### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

# MC74HC240A

## 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	$\pm 20$	mA
$I_{OUT}$	DC Input Diode Current, Per Pin	$\pm 35$	mA
$I_{CC}$	DC Supply Current, $V_{CC}$ and GND Pins	$\pm 75$	mA
$I_{IK}$	Input Clamp Current ( $V_{IN} < 0$ or $V_{IN} > V_{CC}$ )	$\pm 20$	mA
$I_{OK}$	Output Clamp Current ( $V_{OUT} < 0$ or $V_{OUT} > V_{CC}$ )	$\pm 20$	mA
$T_{STG}$	Storage Temperature Range	-65 to +150	°C
$T_L$	Lead Temperature, 1 mm from Case for 10 secs	260	°C
$T_J$	Junction Temperature Under Bias	+150	°C
$\theta_{JA}$	Thermal Resistance (Note 1) SOIC-20W WQFN20 QFN20 TSSOP-20	96 99 111 150	°C/W
$P_D$	Power Dissipation in Still Air at 25°C SOIC-20W WQFN20 QFN20 TSSOP-20	1302 1256 1127 833	mW
MSL	Moisture Sensitivity SOIC-20W All Other Packages	Level 3 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 > 1000	V

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 76 mm-by-114 mm, 2-ounce copper trace no air flow per JESD51-7.
2. Tested to EIA/JESD78 Class II.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
$V_{CC}$	DC Supply Voltage (Referenced to GND)	2.0	6.0	V
$V_{in}, V_{out}$	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 1) $V_{CC} = 2.0$ V $V_{CC} = 4.5$ V $V_{CC} = 6.0$ V	0 0 0	1000 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.

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

# MC74HC240A

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Guaranteed Limit				Unit
			V <sub>CC</sub> V	–55 to 25°C	≤ 85°C	≤ 125°C	
V <sub>IH</sub>	Minimum High–Level Input Voltage	V <sub>out</sub> = V <sub>CC</sub> – 0.1 V  I <sub>out</sub>   ≤ 20 μA	2.0 3.0 4.5 6.0	1.5 2.1 3.15 4.2	1.5 2.1 3.15 4.2	1.5 2.1 3.15 4.2	V
V <sub>IL</sub>	Maximum Low–Level Input Voltage	V <sub>out</sub> = 0.1 V  I <sub>out</sub>   ≤ 20 μA	2.0 3.0 4.5 6.0	0.5 0.9 1.35 1.8	0.5 0.9 1.35 1.8	0.5 0.9 1.35 1.8	V
V <sub>OH</sub>	Minimum High–Level Output Voltage	V <sub>in</sub> = V <sub>IH</sub>  I <sub>out</sub>   ≤ 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 <sub>in</sub> = V <sub>IH</sub>  I <sub>out</sub>   ≤ 2.4 mA	3.0	2.48	2.34	2.2	
		I <sub>out</sub>   ≤ 6.0 mA	4.5	3.98	3.84	3.7	
		I <sub>out</sub>   ≤ 7.8 mA	6.0	5.48	5.34	5.2	
V <sub>OL</sub>	Maximum Low–Level Output Voltage	V <sub>in</sub> = V <sub>IL</sub>  I <sub>out</sub>   ≤ 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 <sub>in</sub> = V <sub>IL</sub>  I <sub>out</sub>   ≤ 2.4 mA	3.0	0.26	0.33	0.4	
		I <sub>out</sub>   ≤ 6.0 mA	4.5	0.26	0.33	0.4	
		I <sub>out</sub>   ≤ 7.8 mA	6.0	0.26	0.33	0.4	
I <sub>in</sub>	Maximum Input Leakage Current	V <sub>in</sub> = V <sub>CC</sub> or GND	6.0	±0.1	±1.0	±1.0	μA
I <sub>OZ</sub>	Maximum Three–State Leakage Current	Output in High–Impedance State V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>out</sub> = V <sub>CC</sub> or GND	6.0	±0.5	±5.0	±10	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current (per Package)	V <sub>in</sub> = V <sub>CC</sub> or GND I <sub>out</sub> = 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.

# MC74HC240A

## AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V <sub>CC</sub> V	Guaranteed Limit			Unit
			-55 to 25°C	≤ 85°C	≤ 125°C	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, A to YA or B to YB (Figures 1 and 3)	2.0	80	100	120	ns
		3.0	40	50	60	
		4.5	16	20	24	
		6.0	14	17	20	
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Maximum Propagation Delay, Output Enable to YA or YB (Figures 2 and 4)	2.0	110	140	165	ns
		3.0	60	70	80	
		4.5	22	28	33	
		6.0	19	24	28	
t <sub>PZL</sub> , t <sub>PZH</sub>	Maximum Propagation Delay, Output Enable to YA or YB (Figures 2 and 4)	2.0	110	140	165	ns
		3.0	60	70	80	
		4.5	22	28	33	
		6.0	19	24	28	
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output Transition Time, Any Output (Figures 1 and 3)	2.0	60	75	90	ns
		3.0	23	27	32	
		4.5	12	15	18	
		6.0	10	13	15	
C <sub>in</sub>	Maximum Input Capacitance	–	10	10	10	pF
C <sub>out</sub>	Maximum Three-State Output Capacitance (Output in High-Impedance State)	–	15	15	15	pF

C <sub>PD</sub>	Power Dissipation Capacitance (Per Transceiver Channel)*	Typical @ 25°C, V <sub>CC</sub> = 5.0 V	pF
		32	

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.

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

# MC74HC240A

## SWITCHING WAVEFORMS

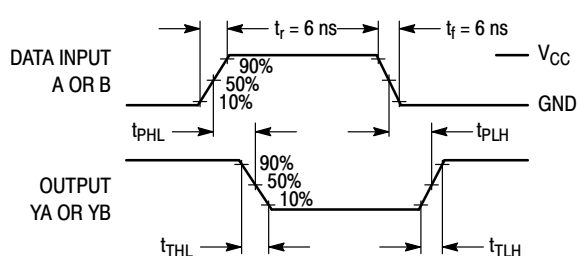


Figure 1.

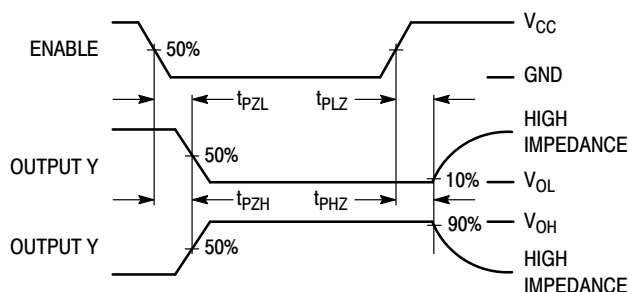
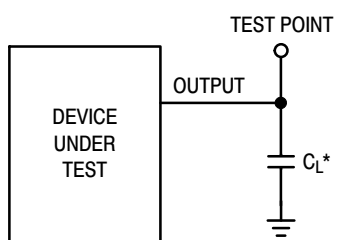
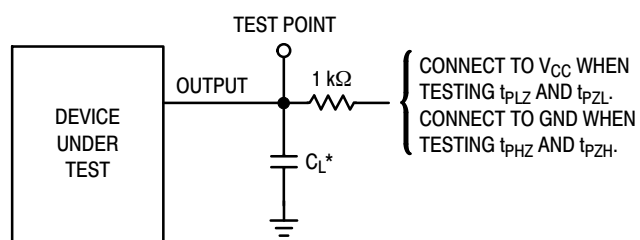


Figure 2.



\*Includes all probe and jig capacitance

Figure 3. Test Circuit



\*Includes all probe and jig capacitance

Figure 4. Test Circuit

## PIN DESCRIPTIONS

### INPUTS

**A1, A2, A3, A4, B1, B2, B3, B4**  
(Pins 2, 4, 6, 8, 11, 13, 15, 17)

Data input pins. Data on these pins appear in inverted form on the corresponding Y outputs, when the outputs are enabled.

### CONTROLS

**Enable A, Enable B (Pins 1, 19)**

Output enables (active-low). When a low level is applied to these pins, the outputs are enabled and the devices

function as inverters. When a high level is applied, the outputs assume the high-impedance state.

### OUTPUTS

**YA1, YA2, YA3, YA4, YB1, YB2, YB3, YB4**  
(Pins 18, 16, 14, 12, 9, 7, 5, 3)

Device outputs. Depending upon the state of the output-enable pins, these outputs are either inverting outputs or high-impedance outputs.

# MC74HC240A

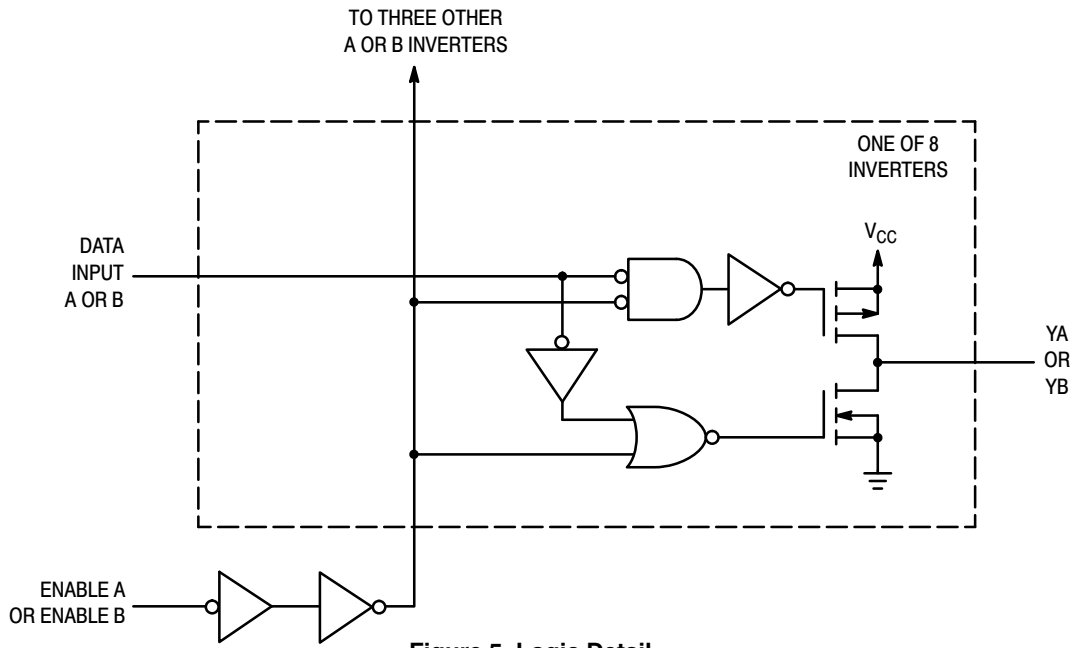


Figure 5. Logic Detail

## ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
MC74HC240ADWG	HC240A	SOIC-20 Wide	38 Units / Rail
MC74HC240ADWR2G	HC240A	SOIC-20 Wide	1000 / Tape & Reel
MC74HC240ADWR2G-Q*	HC240A	SOIC-20 Wide	1000 / Tape & Reel
MC74HC240ADTG	HC 240A	TSSOP-20	75 Units / Rail
MC74HC240ADTR2G	HC 240A	TSSOP-20	2500 / Tape & Reel
MC74HC240ADTR2G-Q*	HC 240A	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.

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



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 **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC  
MARKING DIAGRAM\*

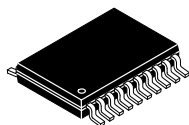


XXXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week  
G = Pb-Free Package

\*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. Some products may not follow the Generic Marking.

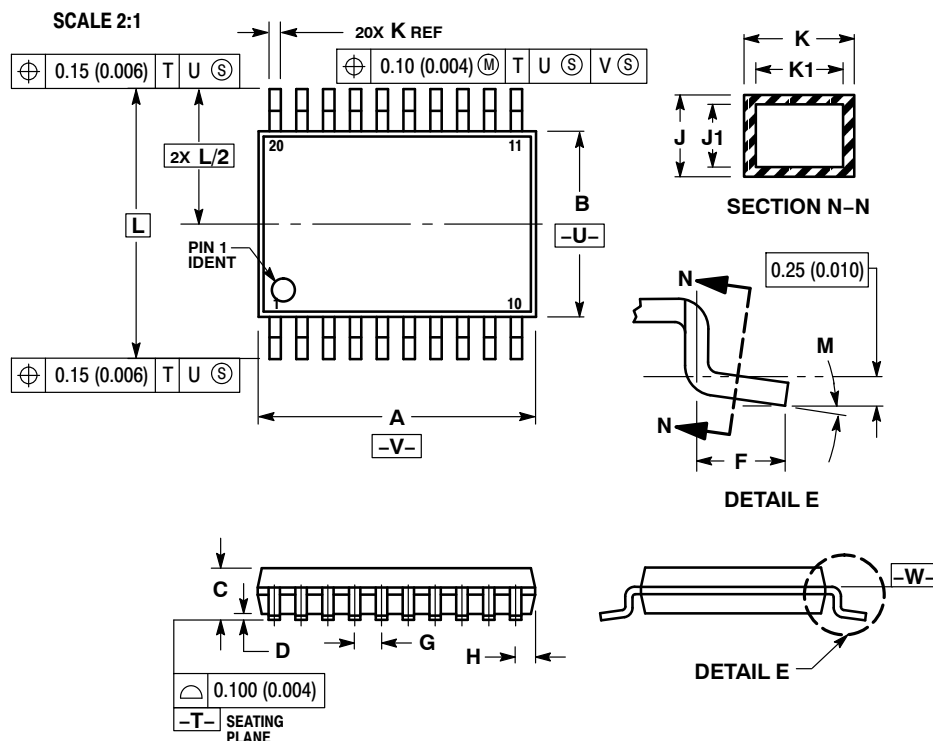
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**TSSOP-20 WB**  
CASE 948E  
ISSUE D

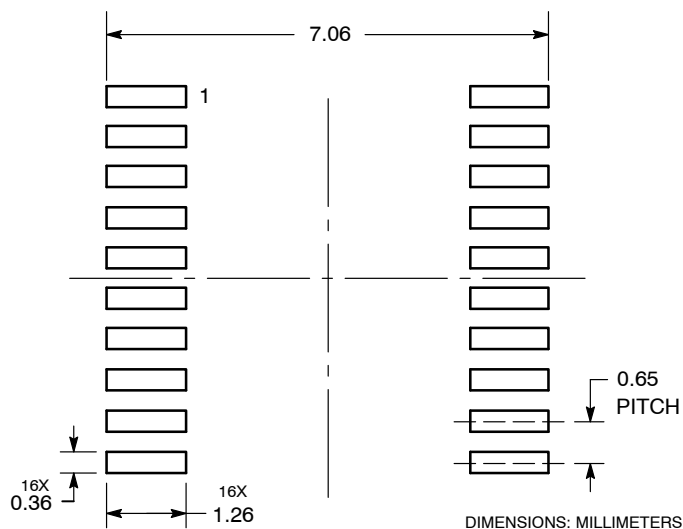
DATE 17 FEB 2016



- 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-.

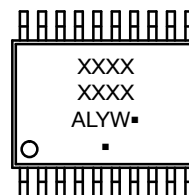
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	6.40	6.60	0.252	0.260
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

**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.

### 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. Some products may not follow the Generic Marking.

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