Octal Buffer, Non-Inverting, Low Voltage, 3-State

The MC74LCX244 is a high performance, non–inverting octal buffer operating from a 2.3 to 5.5 V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A V_I specification of 5.5 V allows MC74LCX244 inputs to be safely driven from 5 V devices. The MC74LCX244 is suitable for memory address driving and all TTL level bus oriented transceiver applications.

Current drive capability is 24 mA at the outputs. The Output Enable (OE) input, when HIGH, disables the output by placing them in a HIGH Z condition.

Features

- Designed for 2.3 to 5.5 V V_{CC} Operation
- 5 V Tolerant Interface Capability With 5 V TTL Logic
- Supports Live Insertion and Withdrawal
- I_{OFF} Specification Guarantees High Impedance When $V_{CC} = 0 \text{ V}$
- LVTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10 μA)
 Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance:
 - ♦ Human Body Model >2000 V
 - ♦ Machine Model >200 V
- NLV Prefix 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



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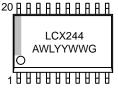


SOIC-20 WB DW SUFFIX CASE 751D

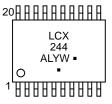
TSSOP-20 DT SUFFIX CASE 948E

QFN20 MN SUFFIX CASES 485AA & 485CB

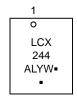
MARKING DIAGRAMS



SOIC-20 WB



TSSOP-20





QFN20 - 485AA

QFN20 - 485CB

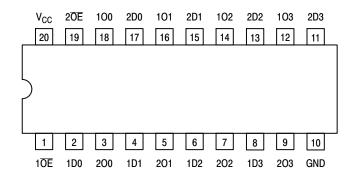
A = Assembly Location
L, WL = Wafer Lot
Y, YY = Year
W, WW = Work Week

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 6 of this data sheet.



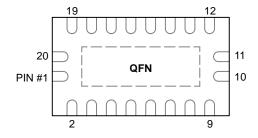


Figure 1. Pinouts: 20-Lead (Top View)

PIN NAMES

| PINS | FUNCTION | |
|----------|----------------------|--|
| nOE | Output Enable Inputs | |
| 1Dn, 2Dn | Data Inputs | |
| 10n, 20n | 3-State Outputs | |

TRUTH TABLE

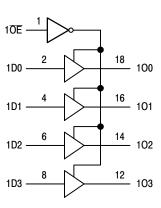
| INPUTS | | OUTPUTS |
|----------------------------|------------|----------|
| 1 <u>0E</u> 2 <u>0E</u> | 1Dn 2Dn | 10n, 20n |
| L | L | L |
| L | Н | Н |
| Н | Х | Z |

H = High Voltage Level

L = Low Voltage Level

Z = High Impedance State
X = High or Low Voltage Level and Transitions are Acceptable

For I_{CC} reasons, DO NOT FLOAT Inputs



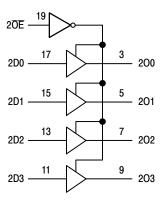


Figure 2. Logic Diagram

MAXIMUM RATINGS

| Symbol | Parameter | Value | Condition | Units |
|------------------|---|---------------------------------|--------------------------------------|-------|
| V _{CC} | DC Supply Voltage | -0.5 to +7.0 | | V |
| VI | DC Input Voltage | $-0.5 \le V_1 \le +7.0$ | | V |
| Vo | DC Output Voltage | $-0.5 \le V_{O} \le +7.0$ | Output in 3-State | V |
| | | $-0.5 \le V_O \le V_{CC} + 0.5$ | Output in HIGH or LOW State (Note 1) | V |
| I _{IK} | DC Input Diode Current | -50 | V _I < GND | mA |
| I _{OK} | DC Output Diode Current | -50 | V _O < GND | mA |
| | | +50 | V _O > V _{CC} | mA |
| Io | DC Output Source/Sink Current | ±50 | | mA |
| I _{CC} | DC Supply Current Per Supply Pin | ±100 | | mA |
| I _{GND} | DC Ground Current Per Ground Pin | ±100 | | mA |
| T _{STG} | Storage Temperature Range | -65 to +150 | | °C |
| T _L | Lead Temperature, 1 mm from Case for 10 Seconds | T _L = 260 | | °C |
| TJ | Junction Temperature Under Bias | T _J = 150 | | °C |
| θ_{JA} | Thermal Resistance (Note 2) | $\theta_{JA} = 140$ | | °C/W |
| MSL | Moisture Sensitivity | | Level 1 | |

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.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Тур | Max | Units |
|-----------------|---|------------|----------------------|------------------------|-------|
| V _{CC} | Supply Voltage Operating Data Retention Only | 2.0 1.5 | 2.5, 3.3 2.5, 3.3 | 5.5 5.5 | V |
| VI | Input Voltage | 0 | | 5.5 | V |
| Vo | Output Voltage HIGH or LOW State 3–State | 0 | | V _{CC} 5.5 | V |
| I _{OH} | HIGH Level Output Current $V_{CC} = 3.0 \text{ V} - 3.6 \text{ V}$ $V_{CC} = 2.7 \text{ V} - 3.0 \text{ V}$ | | | -24 -12 | mA |
| I _{OL} | LOW Level Output Current V _{CC} = 3.0 V - 3.6 V V _{CC} = 2.7 V - 3.0 V | | | 24 12 | mA |
| T _A | Operating Free–Air Temperature | -55 | | +125 | °C |
| Δt/ΔV | Input Transition Rise or Fall Rate, V_{IN} from 0.8 V to 2.0 V, V_{CC} = 3.0 V | 0 | | 10 | ns/V |

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.} I_O absolute maximum rating must be observed.

^{2.} Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace no air flow.

DC ELECTRICAL CHARACTERISTICS

| | | | T _A = −55°C | to +125°C | |
|------------------|---------------------------------------|---|------------------------|-----------|-------|
| Symbol | Characteristic | Condition | Min | Max | Units |
| V _{IH} | HIGH Level Input Voltage (Note 3) | 2.3 V ≤ V _{CC} ≤ 2.7 V | 1.7 | | V |
| | | 2.7 V ≤ V _{CC} ≤ 3.6 V | 2.0 | |] |
| V _{IL} | LOW Level Input Voltage (Note 3) | 2.3 V ≤ V _{CC} ≤ 2.7 V | | 0.7 | V |
| | | 2.7 V ≤ V _{CC} ≤ 3.6 V | | 0.8 | |
| V _{OH} | HIGH Level Output Voltage | $2.3 \text{ V} \le \text{V}_{CC} \le 3.6 \text{ V}; \text{I}_{OL} = 100 \mu\text{A}$ | V _{CC} - 0.2 | | V |
| | | $V_{CC} = 2.3 \text{ V; } I_{OH} = -8 \text{ mA}$ | 1.8 | |] |
| | | $V_{CC} = 2.7 \text{ V; } I_{OH} = -12 \text{ mA}$ | 2.2 | |] |
| | | $V_{CC} = 3.0 \text{ V; } I_{OH} = -18 \text{ mA}$ | 2.4 | | |
| | | $V_{CC} = 3.0 \text{ V; } I_{OH} = -24 \text{ mA}$ | 2.2 | | |
| V _{OL} | LOW Level Output Voltage | $2.3 \text{ V} \le \text{V}_{CC} \le 3.6 \text{ V}; \text{I}_{OL} = 100 \mu\text{A}$ | | 0.2 | V |
| | | $V_{CC} = 2.3 \text{ V; } I_{OL} = 8 \text{ mA}$ | | 0.6 | |
| | | $V_{CC} = 2.7 \text{ V}; I_{OL} = 12 \text{ mA}$ | | 0.4 | |
| | | $V_{CC} = 3.0 \text{ V}; I_{OL} = 16 \text{ mA}$ | | 0.4 | |
| | | $V_{CC} = 3.0 \text{ V}; I_{OL} = 24 \text{ mA}$ | | 0.55 | |
| l _{OZ} | 3-State Output Current | $V_{CC} = 3.6 \text{ V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_{OUT} = 0 \text{ to } 5.5 \text{ V}$ | | ±5 | μΑ |
| I _{OFF} | Power Off Leakage Current | $V_{CC} = 0$, $V_{IN} = 5.5$ V or $V_{OUT} = 5.5$ V | | 10 | μΑ |
| I _{IN} | Input Leakage Current | V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND | | ±5 | μΑ |
| I _{CC} | Quiescent Supply Current | V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND | | 10 | μΑ |
| ΔI_{CC} | Increase in I _{CC} per Input | $2.3 \le V_{CC} \le 3.6 \text{ V}; V_{IH} = V_{CC} - 0.6 \text{ V}$ | | 500 | μΑ |

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. 3. These values of V_I are used to test DC electrical characteristics only.

AC CHARACTERISTICS ($t_R = t_F = 2.5 \text{ ns}; R_L = 500 \Omega$)

| | | | | | Lin | nits | | | |
|--|---|----------|-----------------------|------------|------------------------|------------|----------------------|------------|-------|
| | | | | | T _A = -55°C | to +125°C | | | |
| | | | V _{CC} = 3.0 | V to 3.6 V | V _{CC} = | : 2.7 V | V _{CC} = 2. | 5 V ± 0.2 | |
| | | | C _L = | 50 pF | C _L = | 50 pF | C _L = | 30 pF | |
| Symbol | Parameter | Waveform | Min | Max | Min | Max | Min | Max | Units |
| t _{PLH} | Propagation Delay Input to Output | 1 | 1.5 1.5 | 6.5 6.5 | 1.5 1.5 | 7.5 7.5 | 1.5 1.5 | 7.8 7.8 | ns |
| t _{PZH} | Output Enable Time to High and Low Level | 2 | 1.5 1.5 | 8.0 8.0 | 1.5 1.5 | 9.0 9.0 | 1.5 1.5 | 10 10 | ns |
| t _{PHZ} | Output Disable Time From High and Low Level | 2 | 1.5 1.5 | 7.0 7.0 | 1.5 1.5 | 8.0 8.0 | 1.5 1.5 | 8.4 8.4 | ns |
| t _{OSHL} t _{OSLH} | Output-to-Output Skew (Note 4) | | | 1.0 1.0 | | | | | ns |

^{4.} Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH–to–LOW (t_{OSHL}) or LOW–to–HIGH (t_{OSLH}); parameter guaranteed by design.

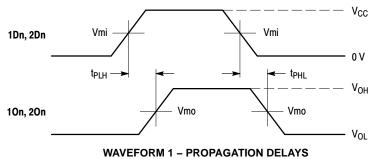
DYNAMIC SWITCHING CHARACTERISTICS

| | | | Т | A = +25°C | ; | |
|------------------|-------------------------------------|---|-----|--------------|-----|-------|
| Symbol | Characteristic | Condition | Min | Тур | Max | Units |
| V _{OLP} | Dynamic LOW Peak Voltage (Note 5) | $\begin{array}{c} V_{CC} = 3.3 \text{ V, } C_L = 50 \text{ pF, } V_{IH} = 3.3 \text{ V, } V_{IL} = 0 \text{ V} \\ V_{CC} = 2.5 \text{ V, } C_L = 30 \text{ pF, } V_{IH} = 2.5 \text{ V, } V_{IL} = 0 \text{ V} \end{array}$ | | 0.8 0.6 | | V |
| V _{OLV} | Dynamic LOW Valley Voltage (Note 5) | $V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$ $V_{CC} = 2.5 \text{ V}, C_L = 30 \text{ pF}, V_{IH} = 2.5 \text{ V}, V_{IL} = 0 \text{ V}$ | | -0.8 -0.6 | | V |

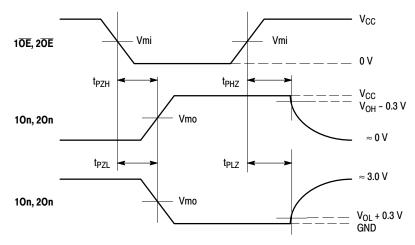
^{5.} Number of outputs defined as "n". Measured with "n-1" outputs switching from HIGH-to-LOW or LOW-to-HIGH. The remaining output is measured in the LOW state.

CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Condition | Typical | Units |
|------------------|-------------------------------|--|---------|-------|
| C _{IN} | Input Capacitance | $V_{CC} = 3.3 \text{ V}, V_{I} = 0 \text{ V or } V_{CC}$ | 7 | pF |
| C _{OUT} | Output Capacitance | $V_{CC} = 3.3 \text{ V}, V_{I} = 0 \text{ V or } V_{CC}$ | 8 | pF |
| C _{PD} | Power Dissipation Capacitance | 10 MHz, V_{CC} = 3.3 V, V_{I} = 0 V or V_{CC} | 25 | pF |



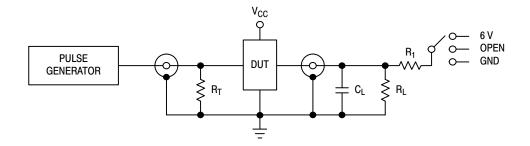
 $t_R = t_F = 2.5 \text{ ns}, 10\% \text{ to } 90\%; f = 1 \text{ MHz}; t_W = 500 \text{ ns}$



WAVEFORM 2 – OUTPUT ENABLE AND DISABLE TIMES $t_R=t_F=2.5~\text{ns},~10\%~\text{to}~90\%;~f=1~\text{MHz};~t_W=500~\text{ns}$

Figure 3. AC Waveforms

| | V _{CC} | | | | |
|----------|-------------------------|-------------------------|--------------------------|--|--|
| Symbol | 3.3 V \pm 0.3 V | 2.7 V | 2.5 V \pm 0.2 V | | |
| Vmi | 1.5 V | 1.5 V | V _{CC} /2 | | |
| Vmo | 1.5 V | 1.5 V | V _{CC} /2 | | |
| V_{HZ} | V _{OL} + 0.3 V | V _{OL} + 0.3 V | V _{OL} + 0.15 V | | |
| V_{LZ} | V _{OH} – 0.3 V | V _{OH} – 0.3 V | V _{OH} – 015 V | | |



| TEST | SWITCH |
|--|--|
| t _{PLH} , t _{PHL} | Open |
| t _{PZL} , t _{PLZ} | 6 V at $V_{CC} = 3.3 \pm 0.3 \text{ V}$ 6 V at $V_{CC} = 2.5 \pm 0.2 \text{ V}$ |
| Open Collector/Drain t _{PLH} and t _{PHL} | 6 V |
| t _{PZH} , t _{PHZ} | GND |

 C_L = 50 pF at V_{CC} = 3.3 ± 0.3 V or equivalent (includes jig and probe capacitance) C_L = 30 pF at V_{CC} = 2.5 ± 0.2 V or equivalent (includes jig and probe capacitance) R_L = R_1 = 500 Ω or equivalent R_T = Z_{OUT} of pulse generator (typically 50 Ω)

Figure 4. Test Circuit

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|-------------------|-----------------------------|-----------------------|
| MC74LCX244DWG | SOIC-20 WB (Pb-Free) | 38 Units / Rail |
| MC74LCX244DWR2G | SOIC-20 WB (Pb-Free) | 1000 / Tape & Reel |
| MC74LCX244DTG | TSSOP-20 (Pb-Free) | 75 Units / Rail |
| MC74LCX244DTR2G | TSSOP-20 (Pb-Free) | 2500 / Tape & Reel |
| NLV74LCX244DTR2G* | TSSOP-20 (Pb-Free) | 2500 / Tape & Reel |
| MC74LCX244MNTWG | QFN20, 2.5x4.5 (Pb-Free) | 3000 / Tape & Reel |
| MC74LCX244MN2TWG | QFN20, 2.5x3.5 (Pb-Free) | 3000 / 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.

^{*}NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable





QFN20, 2.5x4.5 MM CASE 485AA-01 **ISSUE B**

DATE 30 APR 2010

NOTES:

- NOTES:

 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

 2. CONTROLLING DIMENSION: MILLIMETERS.

 3. DIMENSIONS & APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.

 4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| | MILLIMETERS | | | | |
|-----|-------------|------|--|--|--|
| DIM | MIN MAX | | | | |
| Α | 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 | | | |
| Е | 4.50 | BSC | | | |
| E2 | 2.85 | 3.15 | | | |
| е | 0.50 BSC | | | | |
| K | 0.20 | | | | |
| L | 0.35 | 0.45 | | | |

GENERIC MARKING DIAGRAM*



XXXX = Specific Device Code

= Assembly Location Α

= Wafer Lot L Υ = Year W = Work Week

= Pb-Free Package

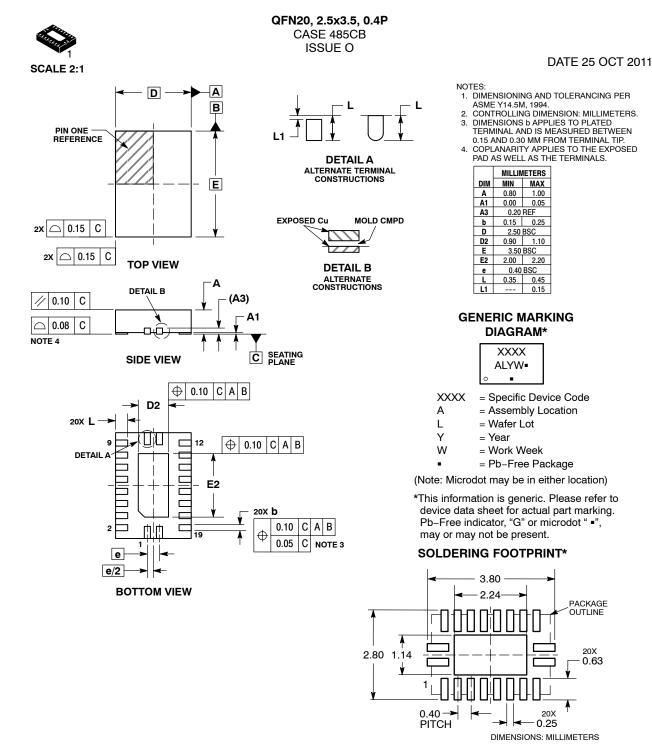
(Note: Microdot may be in either location)

*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.

| 20 | 1550 |
|---|--|
| CALE 2:1 | |
| PIN ONE REFERENCE— | D A B |
| 2X \(\times 0.15 \) C 2X \(\times 0.15 \) C \(\times 0.10 \) C 20X \(\times 0.08 \) C | TOP VIEW (A3) A1 C SEATING PLANE SIDE VIEW |
| 20X L 9 20X b 20X b 0.10 C A B 0.05 C NOTE 3 | D2 e e e e e e e e e e e e e e e e e e e |

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|------------------|-------------------|---|-------------|--|
| DESCRIPTION: | QFN20. 2.5X4.5 MM | | PAGE 1 OF 1 | |

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*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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|------------------|----------------------|---|-------------|
| | QFN20, 2.5X3.5, 0.4P | | PAGE 1 OF 1 |

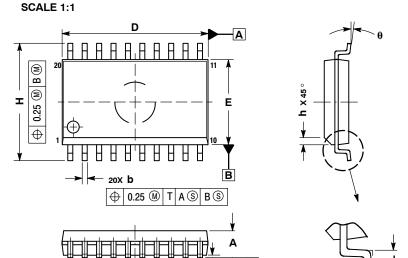
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SOIC-20 WB CASE 751D-05 **ISSUE H**

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

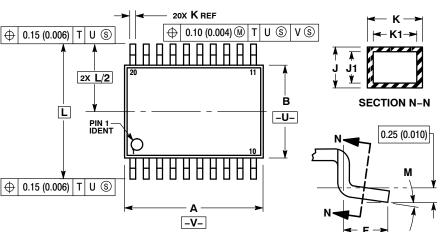
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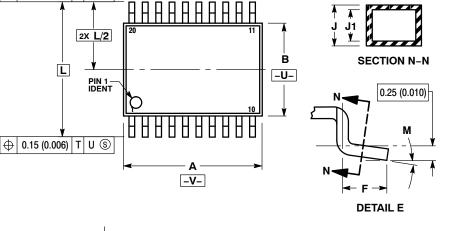
-T- SEATING

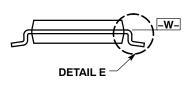


TSSOP-20 WB CASE 948E ISSUE D

DATE 17 FEB 2016







NOTES:

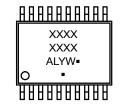
- DIMENSIONING AND TOLERANCING PER
- ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
- 3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
- FLASH, PROTRUSIONS OR GATE BURRS.
 MOLD FLASH OR GATE BURRS SHALL NOT
 EXCEED 0.15 (0.006) PER SIDE.

 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 | | MILLIMETERS | | INC | 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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