

# Inverting Octal 3-STATE Buffer, Octal 3-STATE Buffer

## MM74HC540, MM74HC541

### General Description

The MM74HC540 and MM74HC541 3-STATE buffers utilize advanced silicon-gate CMOS technology. They possess high drive current outputs which enable high speed operation even when driving large bus capacitances. These circuits achieve speeds comparable to low power Schottky devices, while retaining the advantage of CMOS circuitry, i.e., high noise immunity, and low power consumption. Both devices have a fanout of 15 LS-TTL equivalent inputs.

The MM74HC540 is an inverting buffer and the MM74HC541 is a non-inverting buffer. The 3-STATE control gate operates as a two-input NOR such that if either  $\overline{G1}$  or  $\overline{G2}$  are HIGH, all eight outputs are in the high-impedance state.

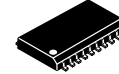
In order to enhance PC board layout, the MM74HC540 and MM74HC541 offers a pinout having inputs and outputs on opposite sides of the package. All inputs are protected from damage due to static discharge by diodes to  $V_{CC}$  and ground.

### Features

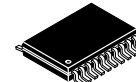
- Typical Propagation Delay: 12 ns
- 3-STATE Outputs for Connection to System Buses
- Wide Power Supply Range: 2–6 V
- Low Quiescent Current: 160  $\mu$ A Maximum (74HC Series)
- Output Current: 6 mA
- These are Pb-Free Devices



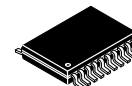
SOIC-20 WB  
CASE 751D-05



SOIC-20, 300 mils  
CASE 751BJ

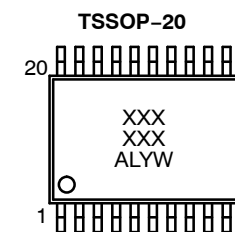
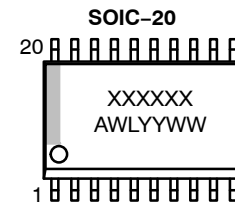


TSSOP-20 WB  
CASE 948E



TSSOP-20, 4.4x6.5  
CASE 948AQ

### MARKING DIAGRAMS



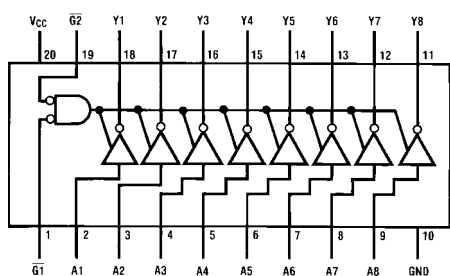
XXXXXX = Specific Device Code  
A = Assembly Location  
WL, L = Wafer Lot Number  
Y = Year  
WW, YW = Work Week

### ORDERING INFORMATION

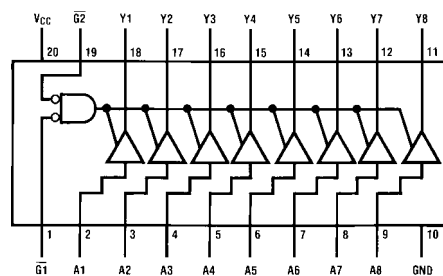
See detailed ordering and shipping information on page 5 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 5.

## MM74HC540, MM74HC541



MM74HC540 (Top View)



MM74HC541 (Top View)

**Figure 1. Connection Diagrams**  
(Pin Assignments for SOIC and TSSOP)

### ABSOLUTE MAXIMUM RATINGS (Note 1)

| Symbol    | Rating                                  | Value                        | Unit |
|-----------|-----------------------------------------|------------------------------|------|
| $V_{CC}$  | 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    |
| $I_{CD}$  | Clamp Diode Current                     | $\pm 20$                     | mA   |
| $I_{OUT}$ | DC Output Current, per pin              | $\pm 35$                     | mA   |
| $I_{CC}$  | DC $V_{CC}$ or GND Current, per pin     | $\pm 70$                     | mA   |
| $T_{STG}$ | Storage Temperature Range               | -65 to +150                  | °C   |
| $P_D$     | Power Dissipation                       | SOIC<br>TSSOP<br>1302<br>833 | mW   |
| $T_L$     | Lead Temperature (Soldering 10 seconds) | 260                          | °C   |

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. Unless otherwise specified all voltages are referenced to ground.

### RECOMMENDED OPERATING CONDITIONS

| Symbol            | Parameter                   | Min                     | Max      | Unit |
|-------------------|-----------------------------|-------------------------|----------|------|
| $V_{CC}$          | Supply Voltage              | 2                       | 6        | V    |
| $V_{IN}, V_{OUT}$ | DC Input or Output Voltage  | 0                       | $V_{CC}$ | V    |
| $T_A$             | Operating Temperature Range | -55                     | +125     | °C   |
| $t_r, t_f$        | Input Rise or Fall Times    | $V_{CC} = 2.0\text{ V}$ | 1000     | ns   |
|                   |                             | $V_{CC} = 4.5\text{ V}$ | 500      | ns   |
|                   |                             | $V_{CC} = 6.0\text{ V}$ | 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.

# MM74HC540, MM74HC541

## DC ELECTRICAL CHARACTERISTICS (Note 2)

| Symbol          | Parameter                              | Conditions                                                                                                                  | V <sub>CC</sub> | T <sub>A</sub> = 25°C |                   | T <sub>A</sub> = -40 to 85°C | T <sub>A</sub> = -55 to 125°C | Unit |
|-----------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------|-------------------|------------------------------|-------------------------------|------|
|                 |                                        |                                                                                                                             |                 | Typ                   | Guaranteed Limits |                              |                               |      |
| V <sub>IH</sub> | Minimum HIGH Level Input Voltage       |                                                                                                                             | 2.0 V           |                       | 1.5               | 1.5                          | 1.5                           | V    |
|                 |                                        |                                                                                                                             | 4.5 V           |                       | 3.15              | 3.15                         | 3.15                          | V    |
|                 |                                        |                                                                                                                             | 6.0 V           |                       | 4.2               | 4.2                          | 4.2                           | V    |
| V <sub>IL</sub> | Maximum LOW Level Input Voltage        |                                                                                                                             | 2.0 V           |                       | 0.5               | 0.5                          | 0.5                           | V    |
|                 |                                        |                                                                                                                             | 4.5 V           |                       | 1.35              | 1.35                         | 1.35                          | V    |
|                 |                                        |                                                                                                                             | 6.0 V           |                       | 1.8               | 1.8                          | 1.8                           | V    |
| V <sub>OH</sub> | Minimum HIGH Level Output Voltage      | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>OUT</sub>   ≤ 20 μA                                         | 2.0 V           | 2.0                   | 1.9               | 1.9                          | 1.9                           | V    |
|                 |                                        |                                                                                                                             | 4.5 V           | 4.5                   | 4.4               | 4.4                          | 4.4                           | V    |
|                 |                                        |                                                                                                                             | 6.0 V           | 6.0                   | 5.9               | 5.9                          | 5.9                           | V    |
|                 |                                        | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>OUT</sub>   ≤ 6.0 mA<br> I <sub>OUT</sub>   ≤ 7.8 mA        | 4.5 V           | 4.2                   | 3.98              | 3.84                         | 3.7                           | V    |
|                 |                                        |                                                                                                                             | 6.0 V           | 5.7                   | 5.48              | 5.34                         | 5.2                           | V    |
|                 |                                        |                                                                                                                             |                 |                       |                   |                              |                               |      |
| V <sub>OL</sub> | Maximum LOW Level Output Voltage       | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>OUT</sub>   ≤ 20 μA                                         | 2.0 V           | 0                     | 0.1               | 0.1                          | 0.1                           | V    |
|                 |                                        |                                                                                                                             | 4.5 V           | 0                     | 0.1               | 0.1                          | 0.1                           | V    |
|                 |                                        |                                                                                                                             | 6.0 V           | 0                     | 0.1               | 0.1                          | 0.1                           | V    |
|                 |                                        | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>OUT</sub>   ≤ 6.0 mA<br> I <sub>OUT</sub>   ≤ 7.8 mA        | 4.5 V           | 0.2                   | 0.26              | 0.33                         | 0.4                           | V    |
|                 |                                        |                                                                                                                             | 6.0 V           | 0.2                   | 0.26              | 0.33                         | 0.4                           | V    |
|                 |                                        |                                                                                                                             |                 |                       |                   |                              |                               |      |
| I <sub>IN</sub> | Maximum Input Current                  | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                                                    | 6.0 V           |                       | ±0.1              | ±1.0                         | ±1.0                          | μA   |
| I <sub>OZ</sub> | Maximum 3-STATE Output Leakage Current | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br>G̅ = V <sub>IH</sub><br>V <sub>OUT</sub> = V <sub>CC</sub> or GND | 6.0 V           |                       | ±0.5              | ±5                           | ±10                           | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current       | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>I <sub>OUT</sub> = 0 μA                                                         | 6.0 V           |                       | 8.0               | 80                           | 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.

2. For a power supply of 5 V ±10% the worst case output voltages (V<sub>OH</sub>, and V<sub>OL</sub>) occur for HC at 4.5 V. Thus the 4.5 V values should be used when designing with this supply. Worst case V<sub>IH</sub> and V<sub>IL</sub> occur at V<sub>CC</sub> = 5.5 V and 4.5 V respectively. (The V<sub>IH</sub> value at 5.5 V is 3.85 V.) The worst case leakage current (I<sub>IN</sub>, I<sub>CC</sub>, and I<sub>OZ</sub>) occur for CMOS at the higher voltage and so the 6.0 V values should be used.

## AC ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C, t<sub>r</sub> = t<sub>f</sub> = 6 ns)

| Symbol                              | Parameter                       | Conditions                                      | Typ | Guaranteed Limit | Unit |
|-------------------------------------|---------------------------------|-------------------------------------------------|-----|------------------|------|
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Propagation Delay (540) | C <sub>L</sub> = 45 pF                          | 12  | 18               | ns   |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Propagation Delay (541) | C <sub>L</sub> = 45 pF                          | 14  | 20               | ns   |
| t <sub>PZH</sub> , t <sub>PZL</sub> | Maximum Output Enable Time      | R <sub>L</sub> = 1 kΩ<br>C <sub>L</sub> = 45 pF | 17  | 28               | ns   |
| t <sub>PHZ</sub> , t <sub>PLZ</sub> | Maximum Output Disable Time     | R <sub>L</sub> = 1 kΩ<br>C <sub>L</sub> = 5 pF  | 15  | 25               | ns   |

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.

# MM74HC540, MM74HC541

## AC ELECTRICAL CHARACTERISTICS

( $V_{CC} = 2.0\text{ V}$  to  $6.0\text{ V}$ ,  $C_L = 50\text{ pF}$ ,  $t_r = t_f = 6\text{ ns}$ , unless otherwise specified)

| Symbol                              | Parameter                              | Conditions                                                           | V <sub>CC</sub> | T <sub>A</sub> = 25°C |                   | T <sub>A</sub> = -40 to 85°C | T <sub>A</sub> = -55 to 125°C | Unit |
|-------------------------------------|----------------------------------------|----------------------------------------------------------------------|-----------------|-----------------------|-------------------|------------------------------|-------------------------------|------|
|                                     |                                        |                                                                      |                 | Typ                   | Guaranteed Limits |                              |                               |      |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Propagation Delay (540)        | C <sub>L</sub> = 50 pF                                               | 2.0 V           | 55                    | 100               | 126                          | 149                           | ns   |
|                                     |                                        | C <sub>L</sub> = 150 pF                                              | 2.0 V           | 83                    | 150               | 190                          | 224                           | ns   |
|                                     |                                        | C <sub>L</sub> = 50 pF                                               | 4.5 V           | 12                    | 20                | 25                           | 30                            | ns   |
|                                     |                                        | C <sub>L</sub> = 150 pF                                              | 4.5 V           | 22                    | 30                | 38                           | 45                            | ns   |
|                                     |                                        | C <sub>L</sub> = 50 pF                                               | 6.0 V           | 11                    | 17                | 21                           | 25                            | ns   |
|                                     |                                        | C <sub>L</sub> = 150 pF                                              | 6.0 V           | 18                    | 26                | 32                           | 38                            | ns   |
|                                     |                                        | C <sub>L</sub> = 50 pF                                               | 2.0 V           | 58                    | 115               | 145                          | 171                           | ns   |
|                                     |                                        | C <sub>L</sub> = 150 pF                                              | 2.0 V           | 83                    | 165               | 208                          | 246                           | ns   |
|                                     |                                        | C <sub>L</sub> = 50 pF                                               | 4.5 V           | 14                    | 23                | 29                           | 34                            | ns   |
|                                     |                                        | C <sub>L</sub> = 150 pF                                              | 4.5 V           | 17                    | 33                | 42                           | 49                            | ns   |
|                                     |                                        | C <sub>L</sub> = 50 pF                                               | 6.0 V           | 11                    | 20                | 25                           | 29                            | ns   |
|                                     |                                        | C <sub>L</sub> = 150 pF                                              | 6.0 V           | 14                    | 28                | 35                           | 42                            | ns   |
| t <sub>PZH</sub> , t <sub>PZL</sub> | Maximum Output Enable Time             | R <sub>L</sub> = 1 kΩ                                                |                 |                       |                   |                              |                               |      |
|                                     |                                        | C <sub>L</sub> = 50 pF                                               | 2.0 V           | 75                    | 150               | 189                          | 224                           | ns   |
|                                     |                                        | C <sub>L</sub> = 150 pF                                              | 4.5 V           | 100                   | 200               | 252                          | 298                           | ns   |
|                                     |                                        | C <sub>L</sub> = 50 pF                                               | 4.5 V           | 15                    | 30                | 38                           | 45                            | ns   |
|                                     |                                        | C <sub>L</sub> = 150 pF                                              | 4.5 V           | 30                    | 40                | 50                           | 60                            | ns   |
|                                     |                                        | C <sub>L</sub> = 50 pF                                               | 6.0 V           | 13                    | 26                | 32                           | 38                            | ns   |
|                                     |                                        | C <sub>L</sub> = 150 pF                                              | 6.0 V           | 17                    | 34                | 43                           | 51                            | ns   |
|                                     |                                        |                                                                      |                 |                       |                   |                              |                               |      |
| t <sub>PHZ</sub> , t <sub>PLZ</sub> | Maximum Output Disable Time            | R <sub>L</sub> = 1 kΩ                                                | 2.0 V           | 75                    | 150               | 189                          | 224                           | ns   |
|                                     |                                        | C <sub>L</sub> = 50 pF                                               | 4.5 V           | 15                    | 30                | 38                           | 45                            | ns   |
|                                     |                                        |                                                                      | 6.0 V           | 13                    | 26                | 32                           | 38                            | ns   |
| t <sub>THL</sub> , t <sub>TLH</sub> | Maximum Output Rise and Fall Time      | C <sub>L</sub> = 50 pF                                               | 2.0 V           | 25                    | 60                | 75                           | 90                            | ns   |
|                                     |                                        |                                                                      | 4.5 V           | 7                     | 12                | 15                           | 18                            | ns   |
|                                     |                                        |                                                                      | 6.0 V           | 6                     | 10                | 13                           | 15                            | ns   |
| C <sub>PD</sub>                     | Power Dissipation Capacitance (Note 3) | $\overline{G}$ = V <sub>IH</sub><br>$\overline{G}$ = V <sub>IL</sub> |                 | 10<br>50              |                   |                              |                               | pF   |
| C <sub>IN</sub>                     | Maximum Input Capacitance              |                                                                      |                 | 5                     | 10                | 10                           | 10                            | pF   |
| C <sub>OUT</sub>                    | Maximum Output Capacitance             |                                                                      |                 | 15                    | 20                | 20                           | 20                            | pF   |

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.  $C_{PD}$  determines the no load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

## MM74HC540, MM74HC541

### ORDERING INFORMATION

| Device        | Marking    | Package                                        | Shipping <sup>†</sup> |
|---------------|------------|------------------------------------------------|-----------------------|
| MM74HC540WM   | HC540A     | SOIC–20 WB<br>(Pb–Free and Halide Free)        | 38 Units / Tube       |
| MM74HC540WMX  | HC540A     |                                                | 1000 / Tape & Reel    |
| MM74HC540MTCX | HC<br>540A | TSSOP–20 WB<br>(Pb–Free)                       | 2500 / Tape & Reel    |
| MM74HC541WM   | HC541A     | SOIC–20 WB<br>(Pb–Free and Halide Free)        | 38 Units / Tube       |
| MM74HC541WMX  | HC541A     | SOIC–20, 300 mils<br>(Pb–Free and Halide Free) | 1000 / Tape & Reel    |
| MM74HC541MTC  | HC<br>541A | TSSOP–20 WB<br>(Pb–Free)                       | 75 Units / Tube       |
| MM74HC541MTCX | HC<br>541A | TSSOP20, 4.4 × 6.5<br>(Pb–Free)                | 2500 / Tape & Reel    |

### DISCONTINUED (Note 4)

|              |            |                          |                 |
|--------------|------------|--------------------------|-----------------|
| MM74HC540MTC | HC<br>540A | TSSOP–20 WB<br>(Pb–Free) | 75 Units / Tube |
|--------------|------------|--------------------------|-----------------|

<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](#).

4. **DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on [www.onsemi.com](http://www.onsemi.com).

**SOIC-20, 300 mils**  
**CASE 751BJ**  
**ISSUE O**

DATE 19 DEC 2008



**TOP VIEW**

| SYMBOL     | MIN      | NOM   | MAX   |
|------------|----------|-------|-------|
| A          | 2.36     | 2.49  | 2.64  |
| A1         | 0.10     |       | 0.30  |
| A2         | 2.05     |       | 2.55  |
| b          | 0.31     | 0.41  | 0.51  |
| c          | 0.20     | 0.27  | 0.33  |
| D          | 12.60    | 12.80 | 13.00 |
| E          | 10.01    | 10.30 | 10.64 |
| E1         | 7.40     | 7.50  | 7.60  |
| e          | 1.27 BSC |       |       |
| h          | 0.25     |       | 0.75  |
| L          | 0.40     | 0.81  | 1.27  |
| $\theta$   | 0°       |       | 8°    |
| $\theta 1$ | 5°       |       | 15°   |



**SIDE VIEW**



**END VIEW**

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MS-013.

|                         |                          |                                                                                                                                                                                     |
|-------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>DESCRIPTION:</b>     | <b>SOIC-20, 300 MILS</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                                  |

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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

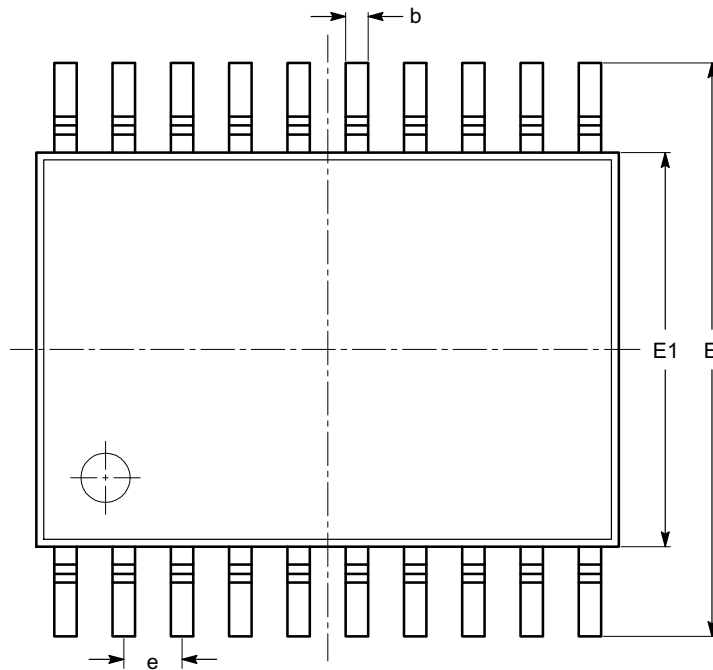
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

|                  |             |                                                                                                                                                                                     |
|------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | SOIC-20 WB  | PAGE 1 OF 1                                                                                                                                                                         |

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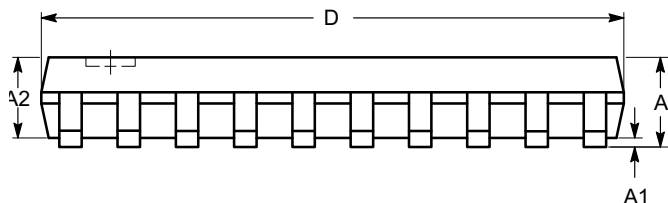
**TSSOP20, 4.4x6.5**  
CASE 948AQ  
ISSUE A

DATE 19 MAR 2009

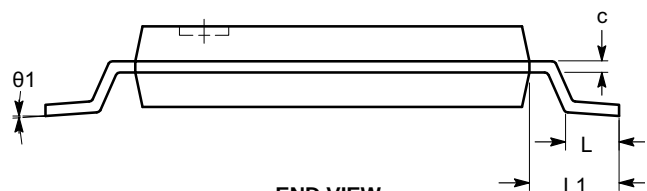


TOP VIEW

| SYMBOL | MIN      | NOM  | MAX  |
|--------|----------|------|------|
| A      |          |      | 1.20 |
| A1     | 0.05     |      | 0.15 |
| A2     | 0.80     |      | 1.05 |
| b      | 0.19     |      | 0.30 |
| c      | 0.09     |      | 0.20 |
| D      | 6.40     | 6.50 | 6.60 |
| E      | 6.30     | 6.40 | 6.50 |
| E1     | 4.30     | 4.40 | 4.50 |
| e      | 0.65 BSC |      |      |
| L      | 0.45     | 0.60 | 0.75 |
| L1     | 1.00 REF |      |      |
| θ      | 0°       |      | 8°   |



SIDE VIEW



END VIEW

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-153.

|                         |                         |                                                                                                                                                                                     |
|-------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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