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# MM74HCT540, Inverting Octal 3-STATE Buffer MM74HCT541, Octal 3-STATE Buffer

## Features

- TTL input compatible
- Typical propagation delay: 12ns
- 3-STATE outputs for connection to system buses
- Low quiescent current: 80µA
- Output current: 6mA (Min.)

## General Description

The MM74HCT540 and MM74HCT541 3-STATE buffers utilize advanced silicon-gate CMOS technology and are general purpose high speed inverting and non-inverting buffers. 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 low power consumption of CMOS. Both devices are TTL input compatible and have a fanout of 15 LS-TTL equivalent inputs.

MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices. These parts are also plug-in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

The MM74HCT540 is an inverting buffer and the MM74HCT541 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 MM74HCT540 and MM74HCT541 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.

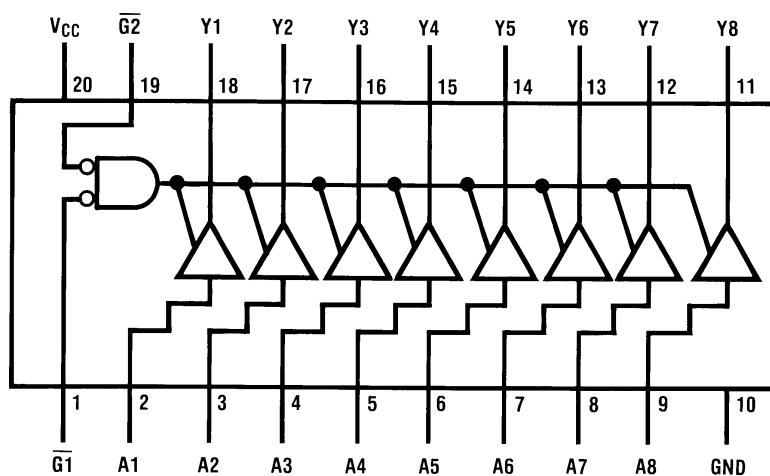
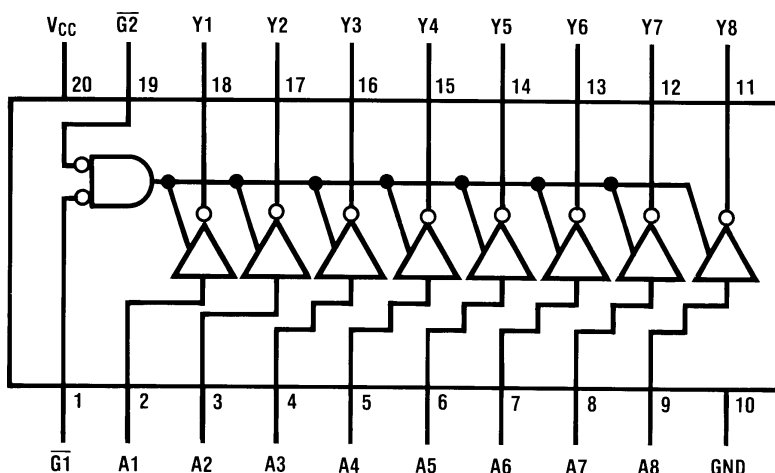
## Ordering Information

| Order Number  | Package Number | Package Description                                                         |
|---------------|----------------|-----------------------------------------------------------------------------|
| MM74HCT540WM  | M20B           | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  |
| MM74HCT540SJ  | M20D           | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide               |
| MM74HCT540MTC | MTC20          | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| MM74HCT541WM  | M20B           | 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  |
| MM74HCT541SJ  | M20D           | 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide               |
| MM74HCT541MTC | MTC20          | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| MM74HCT541N   | N20A           | 20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide      |

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering number.

## Connection Diagrams

### Pin Assignments for DIP, SOIC, SOP and TSSOP



## Absolute Maximum Ratings<sup>(1)</sup>

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol           | Parameter                                        | Rating                  |
|------------------|--------------------------------------------------|-------------------------|
| $V_{CC}$         | Supply Voltage                                   | −0.5 to +7.0V           |
| $V_{IN}$         | DC Input Voltage                                 | −1.5 to $V_{CC} + 1.5V$ |
| $V_{OUT}$        | DC Output Voltage                                | −0.5 to $V_{CC} + 0.5V$ |
| $I_{IK}, I_{OK}$ | Clamp Diode Current                              | ±20mA                   |
| $I_{OUT}$        | DC Output Current, per pin                       | ±35mA                   |
| $I_{CC}$         | DC $V_{CC}$ or GND Current, per pin              | ±70mA                   |
| $T_{STG}$        | Storage Temperature Range                        | −65°C to +150°C         |
| $P_D$            | Power Dissipation<br>Note 2<br>S.O. Package only | 600mW<br>500mW          |
| $T_L$            | Lead Temperature (Soldering 10 seconds)          | 260°C                   |

### Note:

1. Unless otherwise specified all voltages are referenced to ground.
2. Power Dissipation temperature derating — plastic “N” package: −12mW/°C from 65°C to 85°C.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

| Symbol            | Parameter                   | Min. | Max.     | Units |
|-------------------|-----------------------------|------|----------|-------|
| $V_{CC}$          | Supply Voltage              | 4.5  | 5.5      | V     |
| $V_{IN}, V_{OUT}$ | DC Input or Output Voltage  | 0    | $V_{CC}$ | V     |
| $T_A$             | Operating Temperature Range | −40  | +85      | °C    |
| $t_r, t_f$        | Input Rise and Fall Times   |      | 500      | ns    |

**DC Electrical Characteristics** $V_{CC} = 5V \pm 10\%$  (unless otherwise specified)

| Symbol          | Parameter                              | Conditions                                                                           | T <sub>A</sub> = 25°C |                       | T <sub>A</sub> = −40<br>to 85°C | T <sub>A</sub> = −55<br>to 125°C | Units |
|-----------------|----------------------------------------|--------------------------------------------------------------------------------------|-----------------------|-----------------------|---------------------------------|----------------------------------|-------|
|                 |                                        |                                                                                      | Typ.                  | Guaranteed Limits     |                                 |                                  |       |
| V <sub>IH</sub> | Minimum HIGH Level Input Voltage       |                                                                                      |                       | 2.0                   | 2.0                             | 2.0                              | V     |
| V <sub>IL</sub> | Maximum LOW Level Input Voltage        |                                                                                      |                       | 0.8                   | 0.8                             | 0.8                              | 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>   = 20μA | V <sub>CC</sub>       | V <sub>CC</sub> − 0.1 | V <sub>CC</sub> − 0.1           | V <sub>CC</sub> − 0.1            | V     |
|                 |                                        | I <sub>OUT</sub>   = 6.0mA, V <sub>CC</sub> = 4.5V                                   | 4.2                   | 3.98                  | 3.84                            | 3.7                              |       |
|                 |                                        | I <sub>OUT</sub>   = 7.2mA, V <sub>CC</sub> = 5.5V                                   | 5.2                   | 4.98                  | 4.84                            | 4.7                              |       |
| V <sub>OL</sub> | Maximum LOW Level Voltage              | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> :<br> I <sub>OUT</sub>   = 20μA | 0                     | 0.1                   | 0.1                             | 0.1                              | V     |
|                 |                                        | I <sub>OUT</sub>   = 6.0mA, V <sub>CC</sub> = 4.5V                                   | 0.2                   | 0.26                  | 0.33                            | 0.4                              |       |
|                 |                                        | I <sub>OUT</sub>   = 7.2mA, V <sub>CC</sub> = 5.5V                                   | 0.2                   | 0.26                  | 0.33                            | 0.4                              |       |
| I <sub>IN</sub> | Maximum Input Current                  | V <sub>IN</sub> = V <sub>CC</sub> or GND                                             |                       | ±0.1                  | ±1.0                            | ±1.0                             | μA    |
| I <sub>OZ</sub> | Maximum 3-STATE Output Leakage Current | V <sub>OUT</sub> = V <sub>CC</sub> or GND, $\overline{G}$ = V <sub>IH</sub>          |                       | ±0.5                  | ±5.0                            | ±10                              | μA    |
| I <sub>CC</sub> | Maximum Quiescent Supply Current       | V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0μA                     |                       | 8.0                   | 80                              | 160                              | μA    |
|                 |                                        | V <sub>IN</sub> = 2.4V or 0.5V <sup>(3)</sup>                                        | 0.6                   | 1.0                   | 1.3                             | 1.5                              | mA    |

**Note:**3. Measured per input. All other inputs at  $V_{CC}$  or GND.

## AC Electrical Characteristics

MM74HCT540:  $V_{CC} = 5.0V$ ,  $t_r = t_f = 6ns$ ,  $T_A = 25^\circ C$ , (unless otherwise specified).

| Symbol                | Parameter                        | Conditions                      | Typ. | Guaranteed Limits | Units |
|-----------------------|----------------------------------|---------------------------------|------|-------------------|-------|
| $t_{PHL}$ , $t_{PLH}$ | Maximum Output Propagation Delay | $C_L = 45pF$                    | 12   | 18                | ns    |
| $t_{PZL}$ , $t_{PZH}$ | Maximum Output Enable Time       | $C_L = 45pF$ , $R_L = 1k\Omega$ | 14   | 28                | ns    |
| $t_{PLZ}$ , $t_{PHZ}$ | Maximum Output Disable Time      | $C_L = 5pF$ , $R_L = 1k\Omega$  | 13   | 25                | ns    |

## AC Electrical Characteristics

MM74HCT540:  $V_{CC} = 5.0V \pm 10\%$ ,  $t_r = t_f = 6ns$  (unless otherwise specified).

| Symbol                              | Parameter                                    | Conditions                                  |                                  | T <sub>A</sub> = 25°C |                   | T <sub>A</sub> = −40<br>to 85°C | T <sub>A</sub> = −55<br>to 125°C | Units |
|-------------------------------------|----------------------------------------------|---------------------------------------------|----------------------------------|-----------------------|-------------------|---------------------------------|----------------------------------|-------|
|                                     |                                              |                                             |                                  | Typ.                  | Guaranteed Limits |                                 |                                  |       |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Output Propagation Delay             | C <sub>L</sub> = 50pF                       |                                  | 12                    | 20                | 25                              | 30                               | ns    |
|                                     |                                              | C <sub>L</sub> = 150pF                      |                                  | 22                    | 30                | 38                              | 45                               |       |
| t <sub>PZH</sub> , t <sub>PZL</sub> | Maximum Output Enable Time                   | R <sub>L</sub> = 1kΩ                        | C <sub>L</sub> = 50pF            | 15                    | 30                | 38                              | 45                               | ns    |
|                                     |                                              |                                             | C <sub>L</sub> = 150pF           | 20                    | 40                | 50                              | 60                               |       |
| t <sub>PHZ</sub> , t <sub>PLZ</sub> | Maximum Output Disable Time                  | R <sub>L</sub> = 1kΩ, C <sub>L</sub> = 50pF |                                  | 15                    | 30                | 38                              | 45                               | ns    |
| t <sub>THL</sub> , t <sub>TLH</sub> | Maximum Output Rise and Fall Time            | C <sub>L</sub> = 50pF                       |                                  | 6                     | 12                | 15                              | 18                               | ns    |
| C <sub>IN</sub>                     | Maximum Input Capacitance                    |                                             |                                  | 5                     | 10                | 10                              | 10                               | pF    |
| C <sub>OUT</sub>                    | Maximum Output Capacitance                   |                                             |                                  | 15                    | 20                | 20                              | 20                               | pF    |
| C <sub>PD</sub>                     | Power Dissipation Capacitance <sup>(4)</sup> | (per output)                                | $\overline{G}$ = V <sub>CC</sub> | 12                    |                   |                                 |                                  | pF    |
|                                     |                                              |                                             | $\overline{G}$ = GND             | 50                    |                   |                                 |                                  |       |

### Note:

4.  $C_{PD}$  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,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

**AC Electrical Characteristics**MM74HCT541:  $V_{CC} = 5.0V$ ,  $t_r = t_f = 6ns$ ,  $T_A = 25^\circ C$ , (unless otherwise specified).

| Symbol                | Parameter                        | Conditions                      | Typ. | Guaranteed Limits | Units |
|-----------------------|----------------------------------|---------------------------------|------|-------------------|-------|
| $t_{PHL}$ , $t_{PLH}$ | Maximum Output Propagation Delay | $C_L = 45pF$                    | 13   | 20                | ns    |
| $t_{PZL}$ , $t_{PZH}$ | Maximum Output Enable Time       | $C_L = 45pF$ , $R_L = 1k\Omega$ | 17   | 28                | ns    |
| $t_{PLZ}$ , $t_{PHZ}$ | Maximum Output Disable Time      | $C_L = 5pF$ , $R_L = 1k\Omega$  | 15   | 25                | ns    |

**AC Electrical Characteristics**MM74HCT541:  $V_{CC} = 5.0V \pm 10\%$ ,  $t_r = t_f = 6ns$  (unless otherwise specified).

| Symbol                | Parameter                                    | Conditions                      | $T_A = 25^\circ C$ |    | $T_A = -40$<br>to $85^\circ C$ |    | $T_A = -55$<br>to $125^\circ C$ |  | Units |
|-----------------------|----------------------------------------------|---------------------------------|--------------------|----|--------------------------------|----|---------------------------------|--|-------|
|                       |                                              |                                 | Typ.               |    | Guaranteed Limits              |    |                                 |  |       |
| $t_{PHL}$ , $t_{PLH}$ | Maximum Output Propagation Delay             | $C_L = 50pF$                    | 14                 | 23 | 29                             | 34 |                                 |  | ns    |
|                       |                                              | $C_L = 150pF$                   | 17                 | 33 | 42                             | 49 |                                 |  |       |
| $t_{PZH}$ , $t_{PZL}$ | Maximum Output Enable Time                   | $R_L = 1k\Omega$ , $C_L = 50pF$ | 17                 | 30 | 38                             | 45 |                                 |  | ns    |
|                       |                                              | $C_L = 150pF$                   | 22                 | 40 | 50                             | 60 |                                 |  |       |
| $t_{PHZ}$ , $t_{PLZ}$ | Maximum Output Disable Time                  | $R_L = 1k\Omega$ , $C_L = 50pF$ | 17                 | 30 | 38                             | 45 |                                 |  | ns    |
| $t_{THL}$ , $t_{TLH}$ | Maximum Output Rise and Fall Time            | $C_L = 50pF$                    | 6                  | 12 | 15                             | 18 |                                 |  | ns    |
| $C_{IN}$              | Maximum Input Capacitance                    |                                 | 5                  | 10 | 10                             | 10 |                                 |  | pF    |
| $C_{OUT}$             | Maximum Output Capacitance                   |                                 | 15                 | 20 | 20                             | 20 |                                 |  | pF    |
| $C_{PD}$              | Power Dissipation Capacitance <sup>(5)</sup> | (per output)                    | $\bar{G} = V_{CC}$ | 12 |                                |    |                                 |  | pF    |
|                       |                                              |                                 | $\bar{G} = GND$    | 45 |                                |    |                                 |  |       |

**Note:**

5.  $C_{PD}$  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,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

## Physical Dimensions

Dimensions are in inches (millimeters) unless otherwise noted.

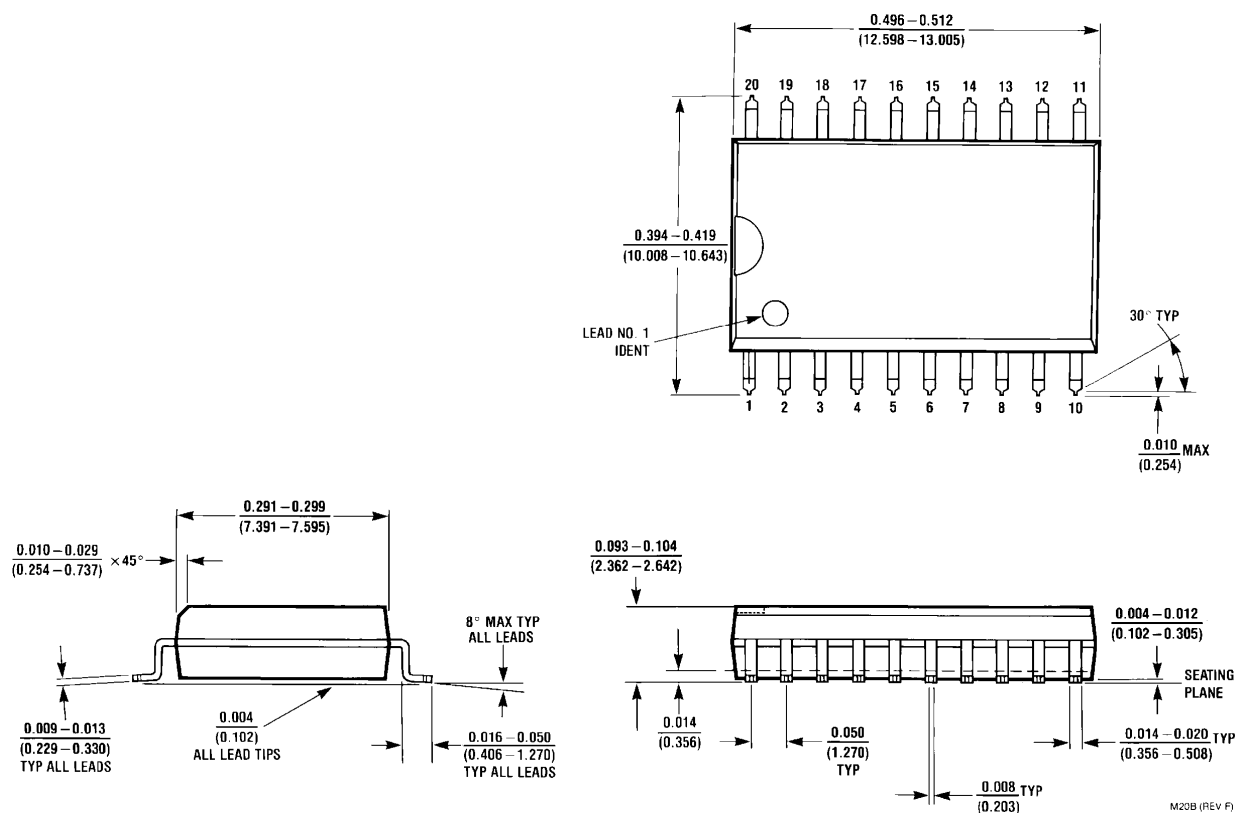
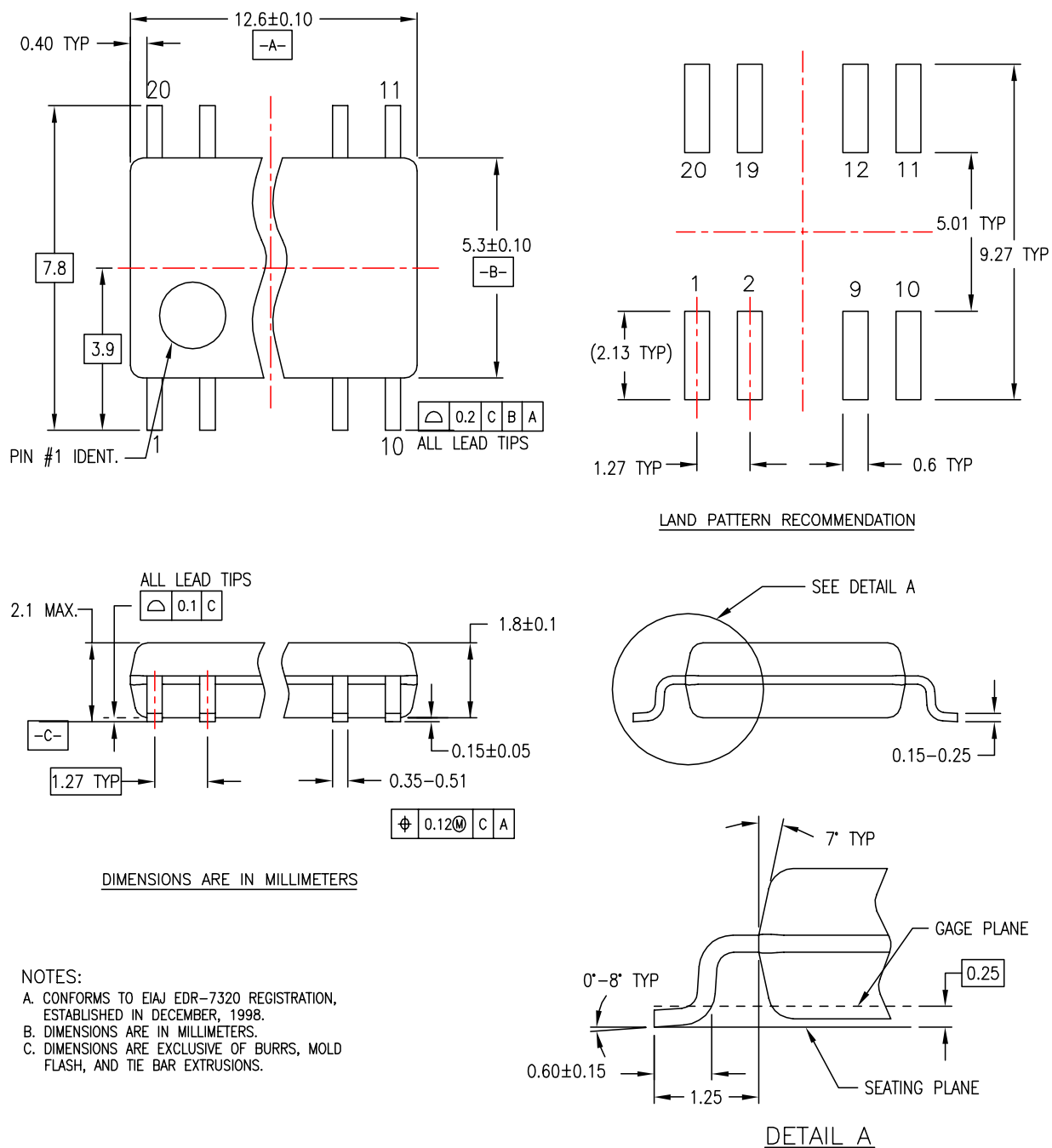


Figure 1. 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide Package Number M20B

# Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.

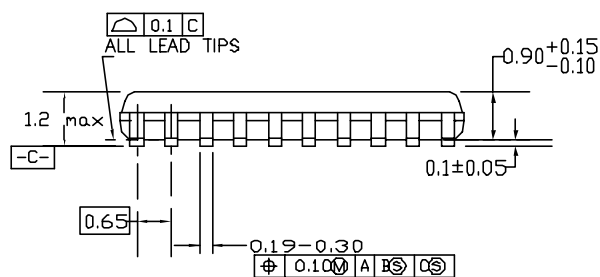
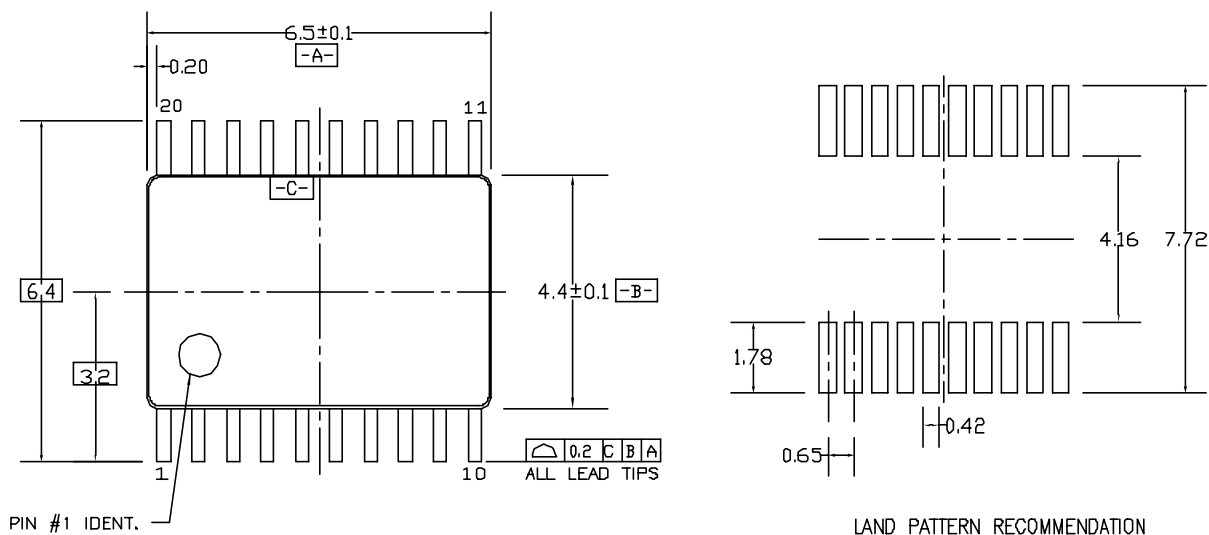


M20DREV C

**Figure 2. 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide  
Package Number M20D**

# Physical Dimensions (Continued)

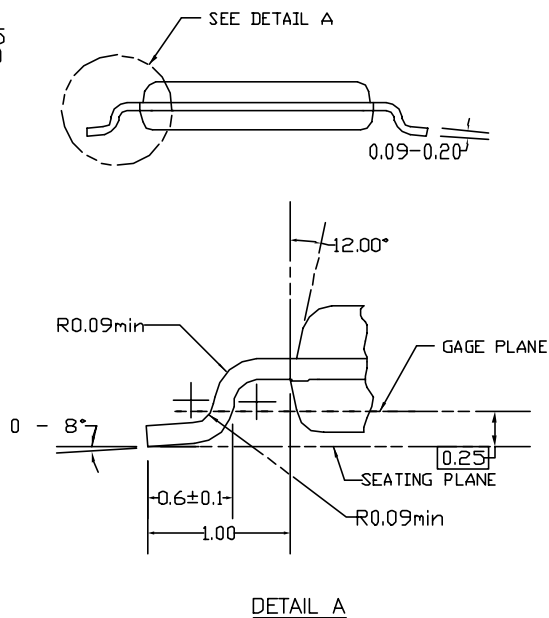
Dimensions are in millimeters unless otherwise noted.



DIMENSIONS ARE IN MILLIMETERS

## NOTES:

- CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLDS FLASH, AND TIE BAR EXTRUSIONS.
- DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

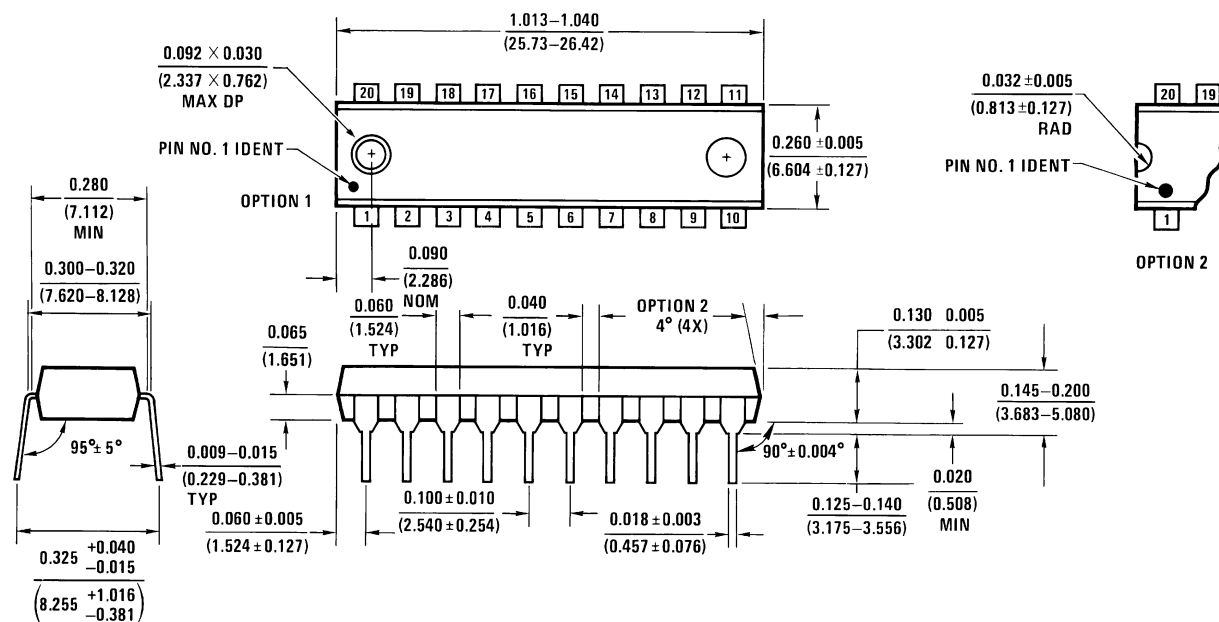


MTC20REVD1

**Figure 3. 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC20**

**Physical Dimensions** (Continued)

Dimensions are in inches (millimeters) unless otherwise noted.



N20A (REV G)

**Figure 4. 20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide  
Package Number N20A**

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