

## 74ABT16952

### 16-Bit Registered Transceiver with 3-STATE Outputs

#### General Description

The ABT16952 is a 16-bit registered transceiver. Two 8-bit back to back registers store data flowing in both directions between two bidirectional buses. Separate clock, clock enable and 3-STATE output enable signals are provided for each register. The output pins are guaranteed to source 32 mA and to sink 64 mA.

#### Features

- Separate clock, clock enable and 3-STATE output enable provided for each register
- A and B output sink capability of 64 mA source capability of 32 mA
- Guaranteed latchup protection
- High impedance glitch free bus loading during entire power up and power down cycle
- Nondestructive hot insertion capability

#### Ordering Code:

| Order Number   | Package Number | Package Description                                                         |
|----------------|----------------|-----------------------------------------------------------------------------|
| 74ABT16952CSSC | MS56A          | 56-Lead Shrink Small Outline Package (SSOP), JEDEC MO-118, 0.300" Wide      |
| 74ABT16952CMTD | MTD56          | 56-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide |

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

#### Pin Descriptions

| Pin Names                             | Description                                           |
|---------------------------------------|-------------------------------------------------------|
| A <sub>0</sub> –A <sub>15</sub>       | Data Register A Inputs/<br>B-Register 3-STATE Outputs |
| B <sub>0</sub> –B <sub>15</sub>       | Data Register B Inputs/<br>A-Register 3-STATE Outputs |
| CPAB <sub>n</sub> , CPBA <sub>n</sub> | Clock Pulse Inputs                                    |
| CEA <sub>n</sub> , CEB <sub>n</sub>   | Clock Enable                                          |
| OEAB <sub>n</sub> , OEBA <sub>n</sub> | Output Enable Inputs                                  |

#### Output Control

| OE | Internal Q | Output | Function        |
|----|------------|--------|-----------------|
| H  | X          | Z      | Disable Outputs |
| L  | L          | L      | Enable Outputs  |
| L  | H          | H      |                 |

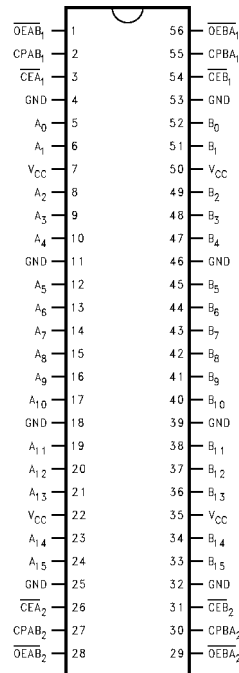
#### Register Function Table

(Applies to A or B Register)

| Inputs |    |    | Internal | Function  |
|--------|----|----|----------|-----------|
| D      | CP | CE | Q        |           |
| X      | X  | H  | NC       | Hold Data |
| L      | ↗  | L  | L        | Load Data |
| H      | ↗  | L  | H        |           |

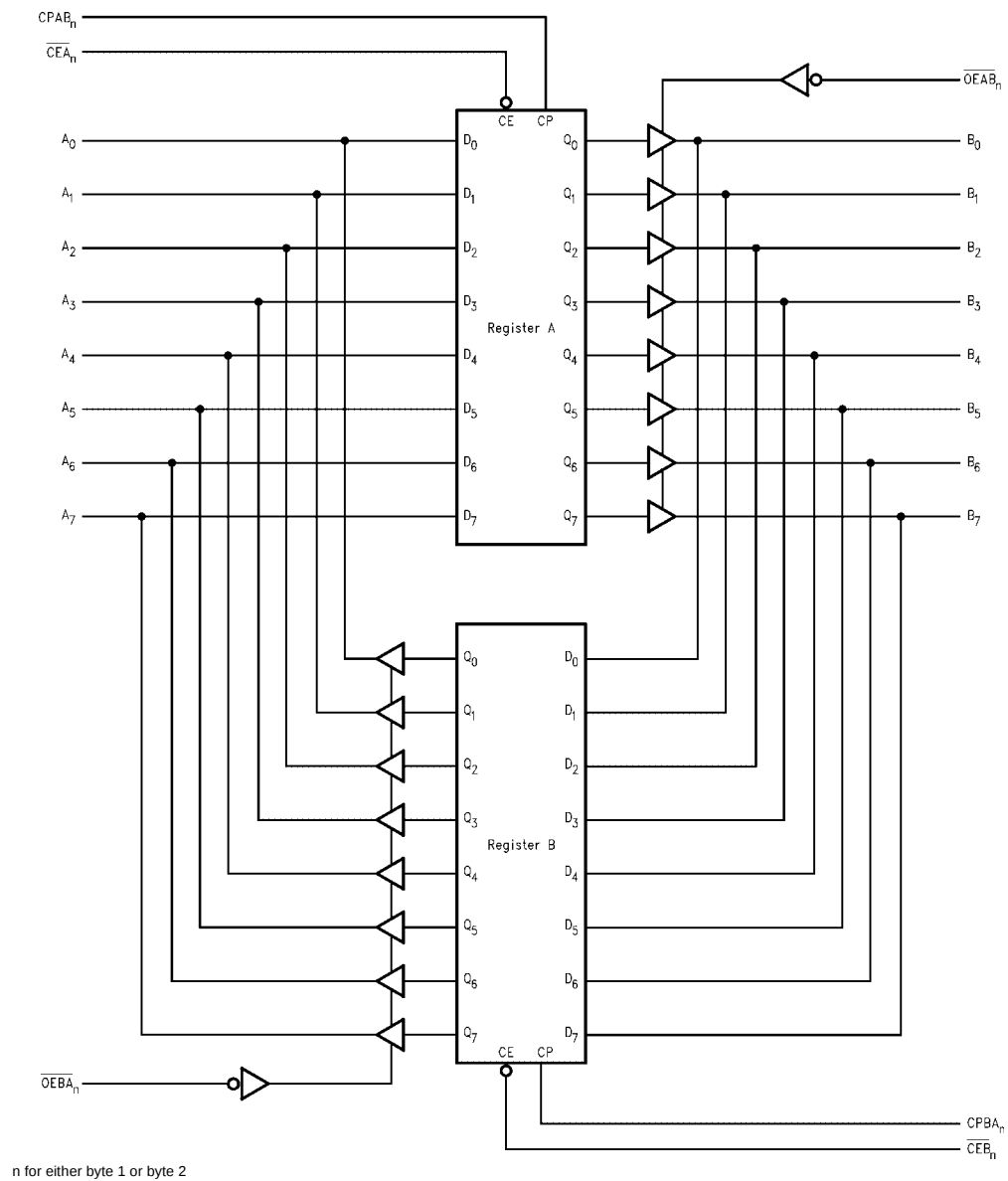
H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
Z = HIGH Impedance  
↗ = LOW-to-HIGH Transition  
NC = No Change

#### Connection Diagram



74ABT16952 16-Bit Registered Transceiver with 3-STATE Outputs

## Block Diagram



**Absolute Maximum Ratings**(Note 1)

|                                                                    |                                      |
|--------------------------------------------------------------------|--------------------------------------|
| Storage Temperature                                                | –65°C to +150°C                      |
| Ambient Temperature under Bias                                     | –55°C to +125°C                      |
| Junction Temperature under Bias                                    | –55°C to +150°C                      |
| V <sub>CC</sub> Pin Potential to Ground Pin                        | –0.5V to +7.0V                       |
| Input Voltage (Note 2)                                             | –0.5V to +7.0V                       |
| Input Current (Note 2)                                             | –30 mA to +5.0 mA                    |
| Voltage Applied to Any Output<br>in the Disable or Power-Off State | –0.5V to +5.5V                       |
| in the HIGH State                                                  | –0.5V to V <sub>CC</sub>             |
| Current Applied to Output<br>in LOW State (Max)                    | twice the rated I <sub>OL</sub> (mA) |
| DC Latchup Source Current                                          | –500 mA                              |
| Over Voltage Latchup (I/O)                                         | 10V                                  |

**Recommended Operating Conditions**

|                                                 |                |
|-------------------------------------------------|----------------|
| Free Air Ambient Temperature                    | –40°C to +85°C |
| Supply Voltage                                  | +4.5V to +5.5V |
| Minimum Input Edge Rate ( $\Delta V/\Delta t$ ) |                |
| Data Input                                      | 50 mV/ns       |
| Enable Input                                    | 20 mV/ns       |
| Clock Input                                     | 100 mV/ns      |

**Note 1:** Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

**Note 2:** Either voltage limit or current limit is sufficient to protect inputs.

**DC Electrical Characteristics**

| Symbol                             | Parameter                               | Min        | Typ | Max      | Units      | V <sub>CC</sub> | Conditions                                                                                                                |
|------------------------------------|-----------------------------------------|------------|-----|----------|------------|-----------------|---------------------------------------------------------------------------------------------------------------------------|
| V <sub>IH</sub>                    | Input HIGH Voltage                      | 2.0        |     |          | V          |                 | Recognized HIGH Signal                                                                                                    |
| V <sub>IL</sub>                    | Input LOW Voltage                       |            |     | 0.8      | V          |                 | Recognized LOW Signal                                                                                                     |
| V <sub>CD</sub>                    | Input Clamp Diode Voltage               |            |     | –1.2     | V          | Min             | I <sub>IN</sub> = –18 mA (Non I/O Pins)                                                                                   |
| V <sub>OH</sub>                    | Output HIGH Voltage                     | 2.5<br>2.0 |     |          | V          | Min             | I <sub>OH</sub> = –3 mA (A <sub>n</sub> , B <sub>n</sub> )<br>I <sub>OH</sub> = –32 mA (A <sub>n</sub> , B <sub>n</sub> ) |
| V <sub>OL</sub>                    | Output LOW Voltage                      |            |     | 0.55     | V          | Min             | I <sub>OL</sub> = 64 mA (A <sub>n</sub> , B <sub>n</sub> )                                                                |
| V <sub>ID</sub>                    | Input Leakage Test                      | 4.75       |     |          | V          | 0.0             | I <sub>ID</sub> = 1.9 $\mu$ A (Non-I/O Pins)<br>All Other Pins Grounded                                                   |
| I <sub>IH</sub>                    | Input HIGH Current                      |            |     | 1<br>1   | $\mu$ A    | Max             | V <sub>IN</sub> = 2.7V (Non-I/O Pins) (Note 4)<br>V <sub>IN</sub> = V <sub>CC</sub> (Non-I/O Pins)                        |
| I <sub>BVI</sub>                   | Input HIGH Current Breakdown Test       |            |     | 7        | $\mu$ A    | Max             | V <sub>IN</sub> = 7.0V (Non-I/O Pins)                                                                                     |
| I <sub>BVIT</sub>                  | Input HIGH Current Breakdown Test (I/O) |            |     | 100      | $\mu$ A    | Max             | V <sub>IN</sub> = 5.5V (A <sub>n</sub> , B <sub>n</sub> )                                                                 |
| I <sub>IL</sub>                    | Input LOW Current                       |            |     | –1<br>–1 | $\mu$ A    | Max             | V <sub>IN</sub> = 0.5V (Non-I/O Pins) (Note 4)<br>V <sub>IN</sub> = 0.0V (Non-I/O Pins)                                   |
| I <sub>IH</sub> + I <sub>OZH</sub> | Output Leakage Current                  |            |     | 10       | $\mu$ A    | 0V–5.5V         | V <sub>OUT</sub> = 2.7V (A <sub>n</sub> , B <sub>n</sub> );<br>OEA or OEB = 2.0V                                          |
| I <sub>IL</sub> + I <sub>OZL</sub> | Output Leakage Current                  |            |     | –10      | $\mu$ A    | 0V–5.5V         | V <sub>OUT</sub> = 0.5V (A <sub>n</sub> , B <sub>n</sub> );<br>OEA or OEB = 2.0V                                          |
| I <sub>OS</sub>                    | Output Short-Circuit Current            | –100       |     | –275     | mA         | Max             | V <sub>OUT</sub> = 0V (A <sub>n</sub> , B <sub>n</sub> )                                                                  |
| I <sub>CEX</sub>                   | Output HIGH Leakage Current             |            |     | 50       | $\mu$ A    | Max             | V <sub>OUT</sub> = V <sub>CC</sub> (A <sub>n</sub> , B <sub>n</sub> )                                                     |
| I <sub>ZZ</sub>                    | Bus Drainage Test                       |            |     | 100      | $\mu$ A    | 0.0V            | V <sub>OUT</sub> = 5.5V (A <sub>n</sub> , B <sub>n</sub> );<br>All Others GND                                             |
| I <sub>CCH</sub>                   | Power Supply Current                    |            |     | 1.0      | mA         | Max             | All Outputs HIGH                                                                                                          |
| I <sub>CCL</sub>                   | Power Supply Current                    |            |     | 60       | mA         | Max             | All Outputs LOW                                                                                                           |
| I <sub>CCZ</sub>                   | Power Supply Current                    |            |     | 1.0      | mA         | Max             | Outputs 3-STATE;<br>All Others GND                                                                                        |
| I <sub>CCT</sub>                   | Additional I <sub>CC</sub> /Input       |            |     | 2.5      | mA         | Max             | V <sub>I</sub> = V <sub>CC</sub> – 2.1V; All Others<br>at V <sub>CC</sub> or GND                                          |
| I <sub>CCD</sub>                   | Dynamic I <sub>CC</sub><br>(Note 4)     | No Load    |     | 0.18     | mA/<br>MHz | Max             | Outputs OPEN<br>OEA or OEB = GND,<br>Non-I/O = GND or V <sub>CC</sub><br>One Bit toggling, 50% duty cycle<br>(Note 3)     |

**Note 3:** For 8-bit toggling, I<sub>CCD</sub> <1.4 mA/MHz.

**Note 4:** Guaranteed, but not tested.

## AC Electrical Characteristics

(SSOP Package)

| Symbol           | Parameter                                                                  | T <sub>A</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |     | T <sub>A</sub> = -40°C to +85°C<br>V <sub>CC</sub> = 4.5V to 5.5V<br>C <sub>L</sub> = 50 pF |     | Units |
|------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----|---------------------------------------------------------------------------------------------|-----|-------|
|                  |                                                                            | Min                                                                         | Max | Min                                                                                         | Max |       |
| f <sub>MAX</sub> | Maximum Clock Frequency                                                    | 200                                                                         |     | 200                                                                                         |     | MHz   |
| t <sub>PLH</sub> | Propagation Delay                                                          | 1.5                                                                         | 5.3 | 1.5                                                                                         | 5.3 | ns    |
| t <sub>PHL</sub> | CPAB <sub>n</sub> or CPBA <sub>n</sub> to A <sub>n</sub> or B <sub>n</sub> | 1.5                                                                         | 5.3 | 1.5                                                                                         | 5.3 |       |
| t <sub>PZH</sub> | Output Enable Time                                                         | 1.5                                                                         | 5.5 | 1.5                                                                                         | 5.5 | ns    |
| t <sub>PZL</sub> | OEAB <sub>n</sub> or OEBA <sub>n</sub> to A <sub>n</sub> or B <sub>n</sub> | 1.5                                                                         | 5.5 | 1.5                                                                                         | 5.5 |       |
| t <sub>PHZ</sub> | Output Disable Time                                                        | 1.5                                                                         | 6.0 | 1.5                                                                                         | 6.0 | ns    |
| t <sub>PLZ</sub> | OEAB <sub>n</sub> or OEBA <sub>n</sub> to A <sub>n</sub> or B <sub>n</sub> | 1.5                                                                         | 6.0 | 1.5                                                                                         | 6.0 |       |

## AC Operating Requirements

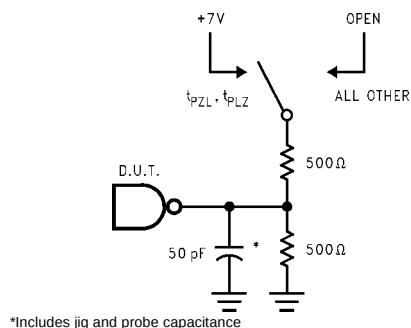
| Symbol             | Parameter                                                                              | T <sub>A</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |     | T <sub>A</sub> = -40°C to +85°C<br>V <sub>CC</sub> = 4.5V to 5.5V<br>C <sub>L</sub> = 50 pF |     | Units |
|--------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----|---------------------------------------------------------------------------------------------|-----|-------|
|                    |                                                                                        | Min                                                                         | Max | Min                                                                                         | Max |       |
| t <sub>S</sub> (H) | Setup Time, HIGH                                                                       | 2.5                                                                         |     | 2.5                                                                                         |     | ns    |
| t <sub>S</sub> (L) | or LOW A <sub>n</sub> or B <sub>n</sub> to CPAB <sub>n</sub> or CPBA <sub>n</sub>      | 2.5                                                                         |     | 2.5                                                                                         |     |       |
| t <sub>H</sub> (H) | Hold Time, HIGH                                                                        | 1.5                                                                         |     | 1.5                                                                                         |     | ns    |
| t <sub>H</sub> (L) | or LOW A <sub>n</sub> or B <sub>n</sub> to CPAB <sub>n</sub> or CPBA <sub>n</sub>      | 1.5                                                                         |     | 1.5                                                                                         |     |       |
| t <sub>S</sub> (H) | Setup Time, HIGH                                                                       | 2.5                                                                         |     | 2.5                                                                                         |     | ns    |
| t <sub>S</sub> (L) | or LOW CEAB <sub>n</sub> or CEB <sub>n</sub> to CPAB <sub>n</sub> or CPBA <sub>n</sub> | 2.5                                                                         |     | 2.5                                                                                         |     |       |
| t <sub>H</sub> (H) | Hold Time, HIGH                                                                        | 1.5                                                                         |     | 1.5                                                                                         |     | ns    |
| t <sub>H</sub> (L) | or LOW CEAB <sub>n</sub> or CEB <sub>n</sub> to CPAB <sub>n</sub> or CPBA <sub>n</sub> | 1.5                                                                         |     | 1.5                                                                                         |     |       |
| t <sub>W</sub> (H) | Pulse Width, HIGH                                                                      | 3.0                                                                         |     | 3.0                                                                                         |     | ns    |
| t <sub>W</sub> (L) | or LOW to CPAB <sub>n</sub> or CPBA <sub>n</sub>                                       | 3.0                                                                         |     | 3.0                                                                                         |     |       |

### Capacitance

| Symbol                    | Parameter          | Typ | Units | Conditions<br>T <sub>A</sub> = 25°C                       |
|---------------------------|--------------------|-----|-------|-----------------------------------------------------------|
| C <sub>IN</sub>           | Input Capacitance  | 5   | pF    | V <sub>CC</sub> = 0V (Non I/O Pins)                       |
| C <sub>I/O</sub> (Note 5) | Output Capacitance | 11  | pF    | V <sub>CC</sub> = 5.0V (A <sub>n</sub> , B <sub>n</sub> ) |

**Note 5:** C<sub>I/O</sub> is measured at frequency f = 1 MHz, per MIL-STD-883, Method 3012.

## AC Loading



\*Includes jig and probe capacitance

FIGURE 1. Standard AC Test Load

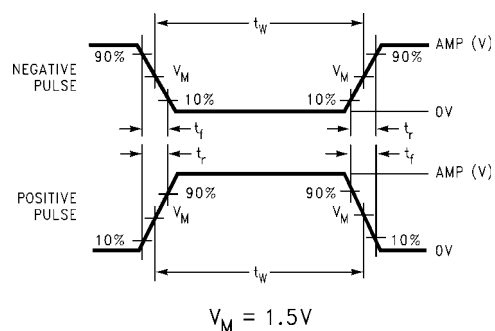


FIGURE 2. Test Input Signal Levels

| Amplitude | Rep. Rate | $t_W$  | $t_r$  | $t_f$  |
|-----------|-----------|--------|--------|--------|
| 3.0V      | 1 MHz     | 500 ns | 2.5 ns | 2.5 ns |

FIGURE 3. Input Signal Requirements

## AC Waveforms

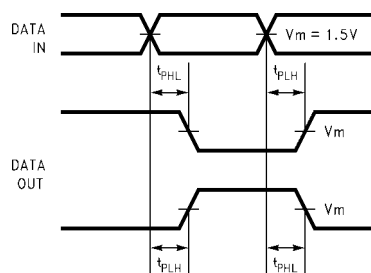


FIGURE 4. Propagation Delay Waveforms for Inverting and Non-Inverting Functions

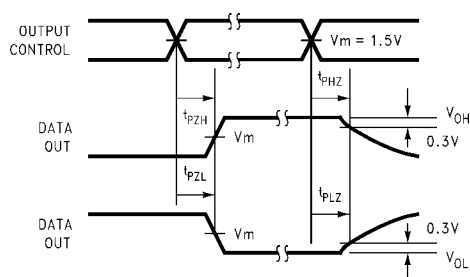


FIGURE 6. 3-STATE Output HIGH and LOW Enable and Disable Times

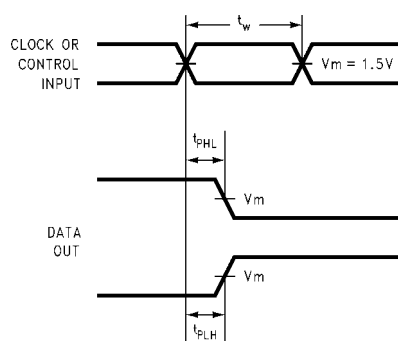


FIGURE 5. Propagation Delay, Pulse Width Waveforms

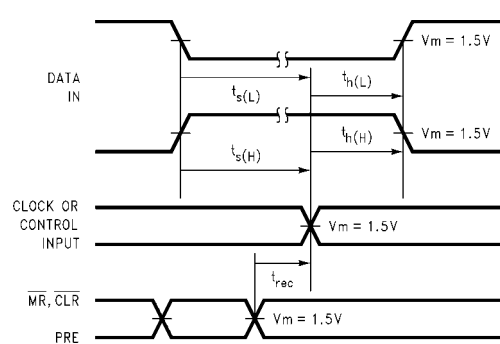
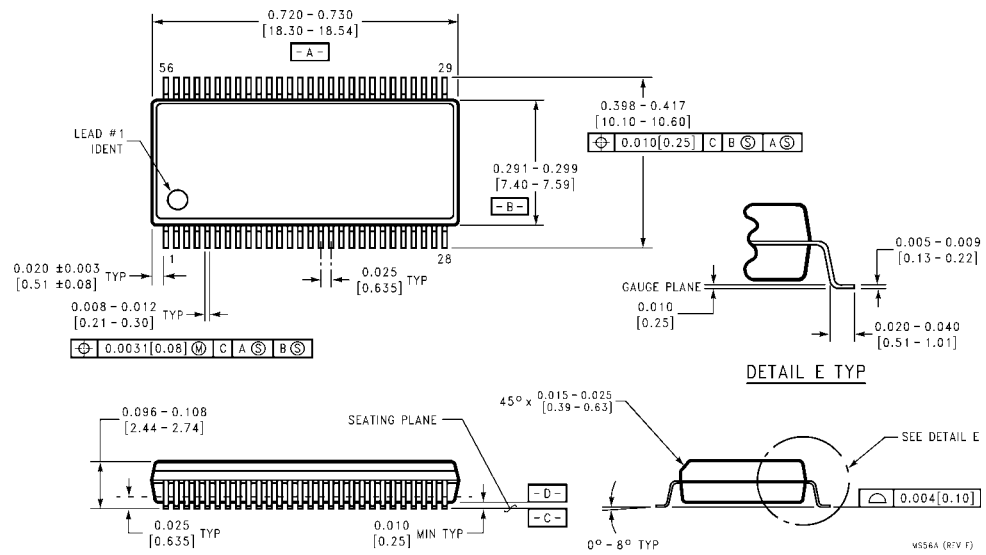


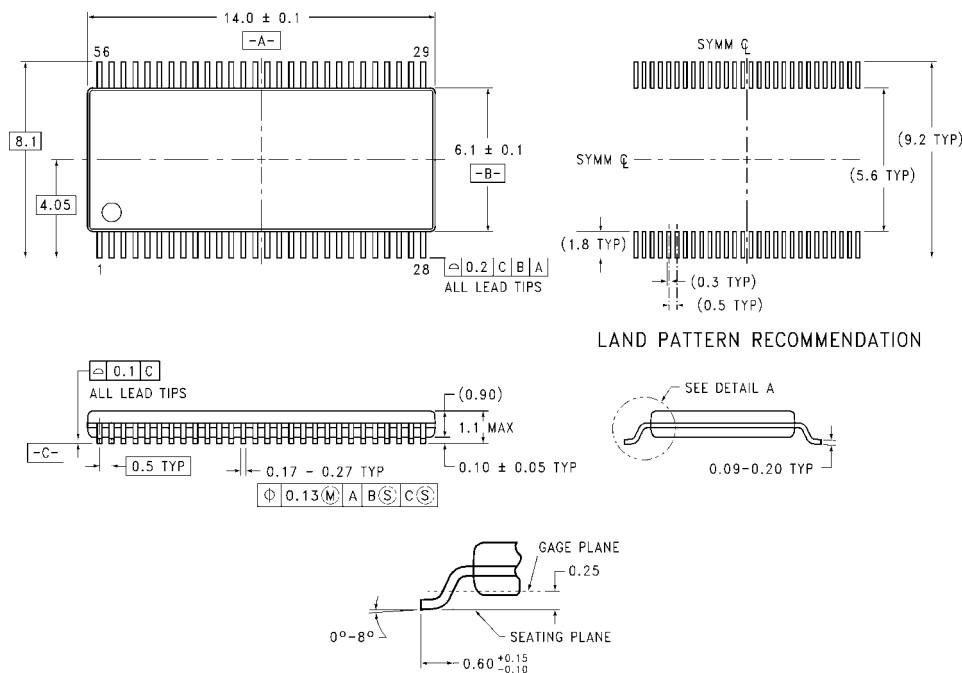
FIGURE 7. Setup Time, Hold Time and Recovery Time Waveforms

# Physical Dimensions inches (millimeters) unless otherwise noted



**56-Lead Shrink Small Outline Package (SSOP), JEDEC MO-118, 0.300" Wide  
Package Number MS56A**

# Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



56-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide  
Package Number MTD56

MTD56 (REV B)

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