

# MC74HC541A

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

### High-Performance Silicon-Gate CMOS

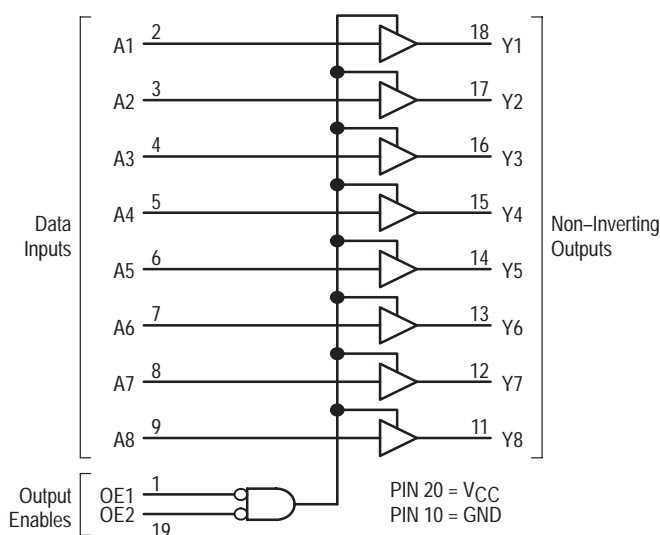
The MC74HC541A is identical in pinout to the LS541. The device inputs are compatible with Standard CMOS outputs. External pullup resistors make them compatible with LSTTL outputs.

The HC541A is an octal non-inverting buffer/line driver/line receiver designed to be used with 3-state memory address drivers, clock drivers, and other bus-oriented systems. This device features inputs and outputs on opposite sides of the package and two ANDed active-low output enables.

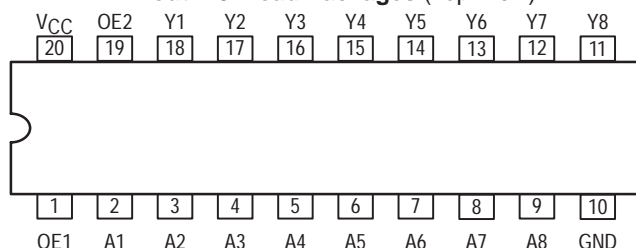
The HC541A is similar in function to the HC540A, which has inverting outputs.

- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS and TTL
- Operating Voltage Range: 2 to 6V
- Low Input Current: 1μA
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance With the JEDEC Standard No. 7A Requirements
- Chip Complexity: 134 FETs or 33.5 Equivalent Gates

#### LOGIC DIAGRAM



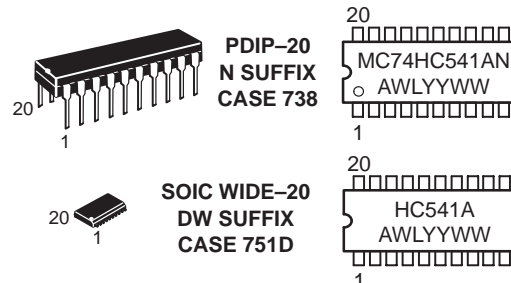
#### Pinout: 20-Lead Packages (Top View)



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#### MARKING DIAGRAMS



A = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week

#### FUNCTION TABLE

| Inputs |     |   | Output Y |
|--------|-----|---|----------|
| OE1    | OE2 | A |          |
| L      | L   | L | L        |
| L      | L   | H | H        |
| H      | X   | X | Z        |
| X      | H   | X | Z        |

Z = High Impedance

X = Don't Care

#### ORDERING INFORMATION

| Device         | Package   | Shipping    |
|----------------|-----------|-------------|
| MC74HC541AN    | PDIP-20   | 1440 / Box  |
| MC74HC541ADW   | SOIC-WIDE | 38 / Rail   |
| MC74HC541ADWR2 | SOIC-WIDE | 1000 / Reel |

# MC74HC541A

## MAXIMUM RATINGS\*

| Symbol    | Parameter  | Value                   | Unit |
|-----------|--|-------------------------|------|
| $V_{CC}$  | DC Supply Voltage (Referenced to GND)  | − 0.5 to + 7.0          | V    |
| $V_{in}$  | DC Input Voltage (Referenced to GND)   | − 0.5 to $V_{CC} + 0.5$ | V    |
| $V_{out}$ | DC Output Voltage (Referenced to GND)  | − 0.5 to $V_{CC} + 0.5$ | V    |
| $I_{in}$  | DC Input Current, per Pin  | ± 20                    | mA   |
| $I_{out}$ | DC Output Current, per Pin   | ± 35                    | mA   |
| $I_{CC}$  | DC Supply Current, $V_{CC}$ and GND Pins                                       | ± 75                    | mA   |
| $P_D$     | Power Dissipation in Still Air,<br>Plastic DIP†<br>SOIC Package†               | 750<br>500              | mW   |
| $T_{stg}$ | Storage Temperature Range  | − 65 to + 150           | °C   |
| $T_L$     | Lead Temperature, 1 mm from Case for 10 Seconds<br>Plastic DIP or SOIC Package | 260                     | °C   |

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$  should be constrained to the range  $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$ . Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.

\*Maximum Ratings are those values beyond which damage to the device may occur.

Functional operation should be restricted to the Recommended Operating Conditions.

†Derating — Plastic DIP: − 10 mW/°C from 65° to 125°C

SOIC Package: − 7 mW/°C from 65° to 125°C

For high frequency or heavy load considerations, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

## RECOMMENDED OPERATING CONDITIONS

| Symbol                             | Parameter  | Min   | Max             | Unit               |    |
|------------------------------------|--|---|-----------------|--------------------|----|
| V <sub>CC</sub>                    | DC Supply Voltage (Referenced to GND)                | 2.0   | 6.0             | V                  |    |
| V <sub>in</sub> , V <sub>out</sub> | DC Input Voltage, Output Voltage (Referenced to GND) | 0   | V <sub>CC</sub> | V                  |    |
| T <sub>A</sub>                     | Operating Temperature Range, All Package Types       | − 55  | + 125           | °C                 |    |
| t <sub>r</sub> , t <sub>f</sub>    | Input Rise/Fall Time<br>(Figure 1)                   | V <sub>CC</sub> = 2.0 V<br>V <sub>CC</sub> = 4.5 V<br>V <sub>CC</sub> = 6.0 V | 0<br>0<br>0     | 1000<br>500<br>400 | ns |

## DC CHARACTERISTICS (Voltages Referenced to GND)

| Symbol   | Parameter                         | Condition  | $V_{CC}$<br>V | Guaranteed Limit |       |        | Unit |
|----------|-----------------------------------|--|---------------|------------------|-------|--------|------|
|          |                                   |  |               | −55 to 25°C      | ≤85°C | ≤125°C |      |
| $V_{IH}$ | Minimum High-Level Input Voltage  | $V_{out} = 0.1 \text{ V}$<br>$ I_{out}  \leq 20 \mu\text{A}$   | 2.0           | 1.50             | 1.50  | 1.50   | V    |
|          |                                   |  | 3.0           | 2.10             | 2.10  | 2.10   |      |
|          |                                   |  | 4.5           | 3.15             | 3.15  | 3.15   |      |
|          |                                   |  | 6.0           | 4.20             | 4.20  | 4.20   |      |
| $V_{IL}$ | Maximum Low-Level Input Voltage   | $V_{out} = V_{CC} - 0.1 \text{ V}$<br>$ I_{out}  \leq 20 \mu\text{A}$  | 2.0           | 0.50             | 0.50  | 0.50   | V    |
|          |                                   |  | 3.0           | 0.90             | 0.90  | 0.90   |      |
|          |                                   |  | 4.5           | 1.35             | 1.35  | 1.35   |      |
|          |                                   |  | 6.0           | 1.80             | 1.80  | 1.80   |      |
| $V_{OH}$ | Minimum High-Level Output Voltage | $V_{in} = V_{IL}$<br>$ I_{out}  \leq 20 \mu\text{A}$   | 2.0           | 1.9              | 1.9   | 1.9    | V    |
|          |                                   |  | 4.5           | 4.4              | 4.4   | 4.4    |      |
|          |                                   |  | 6.0           | 5.9              | 5.9   | 5.9    |      |
|          |                                   | $V_{in} = V_{IL}$<br>$ I_{out}  \leq 3.6 \text{ mA}$<br>$ I_{out}  \leq 6.0 \text{ mA}$<br>$ I_{out}  \leq 7.8 \text{ mA}$ | 3.0           | 2.48             | 2.34  | 2.20   |      |
|          |                                   |  | 4.5           | 3.98             | 3.84  | 3.70   |      |
|          |                                   |  | 6.0           | 5.48             | 5.34  | 5.20   |      |
| $V_{OL}$ | Maximum Low-Level Output Voltage  | $V_{in} = V_{IH}$<br>$ I_{out}  \leq 20 \mu\text{A}$   | 2.0           | 0.1              | 0.1   | 0.1    | V    |
|          |                                   |  | 4.5           | 0.1              | 0.1   | 0.1    |      |
|          |                                   |  | 6.0           | 0.1              | 0.1   | 0.1    |      |
|          |                                   | $V_{in} = V_{IH}$<br>$ I_{out}  \leq 3.6 \text{ mA}$<br>$ I_{out}  \leq 6.0 \text{ mA}$<br>$ I_{out}  \leq 7.8 \text{ mA}$ | 3.0           | 0.26             | 0.33  | 0.40   |      |
|          |                                   |  | 4.5           | 0.26             | 0.33  | 0.40   |      |
|          |                                   |  | 6.0           | 0.26             | 0.33  | 0.40   |      |
| $I_{in}$ | Maximum Input Leakage Current     | $V_{in} = V_{CC} \text{ or GND}$   | 6.0           | ±0.1             | ±1.0  | ±1.0   | μA   |

# MC74HC541A

## DC CHARACTERISTICS (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Condition   | V <sub>CC</sub><br>V | Guaranteed Limit |       |        | Unit |
|-----------------|--|---|----------------------|------------------|-------|--------|------|
|                 |  |   |                      | -55 to 25°C      | ≤85°C | ≤125°C |      |
| I <sub>OZ</sub> | Maximum Three-State Leakage Current            | Output in High Impedance State<br>V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>out</sub> = V <sub>CC</sub> or GND | 6.0                  | ±0.5             | ±5.0  | ±10.0  | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current (per Package) | V <sub>in</sub> = V <sub>CC</sub> or GND<br>I <sub>out</sub> = 0 μA   | 6.0                  | 4                | 40    | 160    | μA   |

NOTE: Information on typical parametric values can be found in Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

## AC CHARACTERISTICS (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6 ns)

| Symbol                                 | Parameter   | V <sub>CC</sub><br>V | Guaranteed Limit |       |        | Unit |
|--|---|----------------------|------------------|-------|--------|------|
|  |   |                      | -55 to 25°C      | ≤85°C | ≤125°C |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Input A to Output Y<br>(Figures 1 and 3)       | 2.0                  | 80               | 100   | 120    | ns   |
|  |   | 3.0                  | 30               | 40    | 55     |      |
|  |   | 4.5                  | 18               | 23    | 28     |      |
|  |   | 6.0                  | 15               | 20    | 25     |      |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub> | Maximum Propagation Delay, Output Enable to Output Y<br>(Figures 2 and 4) | 2.0                  | 110              | 140   | 165    | ns   |
|  |   | 3.0                  | 45               | 60    | 75     |      |
|  |   | 4.5                  | 25               | 31    | 38     |      |
|  |   | 6.0                  | 21               | 26    | 31     |      |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub> | Maximum Propagation Delay, Output Enable to Output Y<br>(Figures 2 and 4) | 2.0                  | 110              | 140   | 165    | ns   |
|  |   | 3.0                  | 45               | 60    | 75     |      |
|  |   | 4.5                  | 25               | 31    | 38     |      |
|  |   | 6.0                  | 21               | 26    | 31     |      |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, Any Output<br>(Figures 1 and 3)           | 2.0                  | 60               | 75    | 90     | ns   |
|  |   | 3.0                  | 22               | 28    | 34     |      |
|  |   | 4.5                  | 12               | 15    | 18     |      |
|  |   | 6.0                  | 10               | 13    | 15     |      |
| C <sub>in</sub>                        | Maximum Input Capacitance   |                      | 10               | 10    | 10     | pF   |
| C <sub>out</sub>                       | Maximum Three-State Output Capacitance (Output in High Impedance State)   |                      | 15               | 15    | 15     | pF   |

NOTE: For propagation delays with loads other than 50 pF, and information on typical parametric values, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

| C <sub>PD</sub> | Power Dissipation Capacitance (Per Buffer)* | Typical @ 25°C, V <sub>CC</sub> = 5.0 V, V <sub>EE</sub> = 0 V | pF |
|-----------------|---|--|----|
|                 |   | 35   |    |

\* Used to determine the no-load dynamic power consumption: P<sub>D</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup> f + I<sub>CC</sub> V<sub>CC</sub>. For load considerations, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

## SWITCHING WAVEFORMS

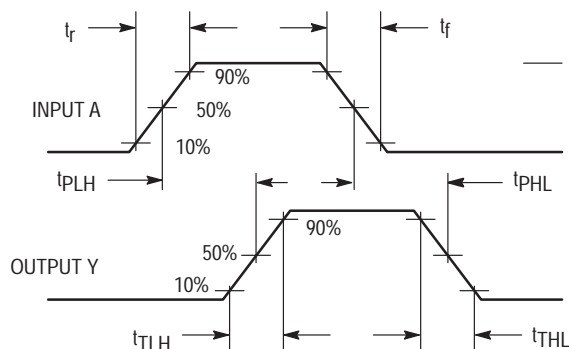


Figure 1.

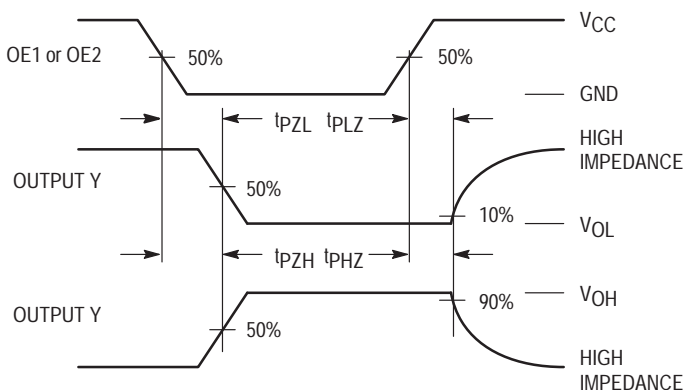
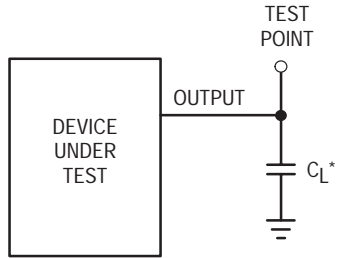


Figure 2.

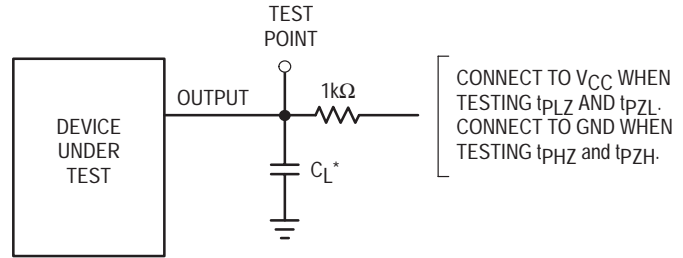
# MC74HC541A

## TEST CIRCUITS



\*Includes all probe and jig capacitance

Figure 3.



\*Includes all probe and jig capacitance

Figure 4.

## PIN DESCRIPTIONS

### INPUTS

**A1, A2, A3, A4, A5, A6, A7, A8 (PINS 2, 3, 4, 5, 6, 7, 8, 9)** — Data input pins. Data on these pins appear in non-inverted form on the corresponding Y outputs, when the outputs are enabled.

### CONTROLS

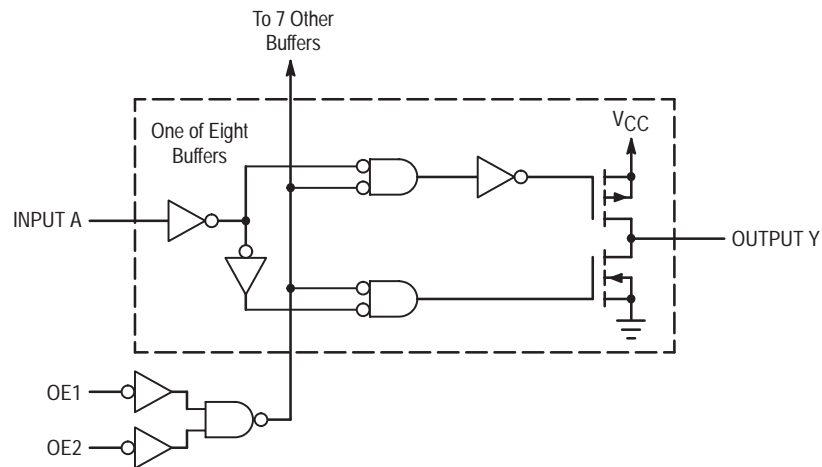
**OE1, OE2 (PINS 1, 19)** — Output enables (active-low). When a low voltage is applied to both of these pins, the

outputs are enabled and the device functions as a non-inverting buffer. When a high voltage is applied to either input, the outputs assume the high impedance state.

### OUTPUTS

**Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8 (PINS 18, 17, 16, 15, 14, 13, 12, 11)** — Device outputs. Depending upon the state of the output enable pins, these outputs are either non-inverting outputs or high-impedance outputs.

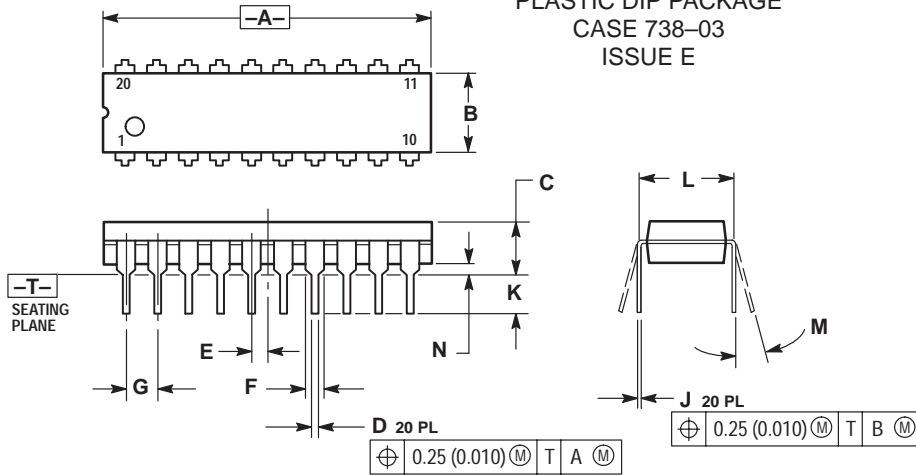
## LOGIC DETAIL



# MC74HC541A

## PACKAGE DIMENSIONS

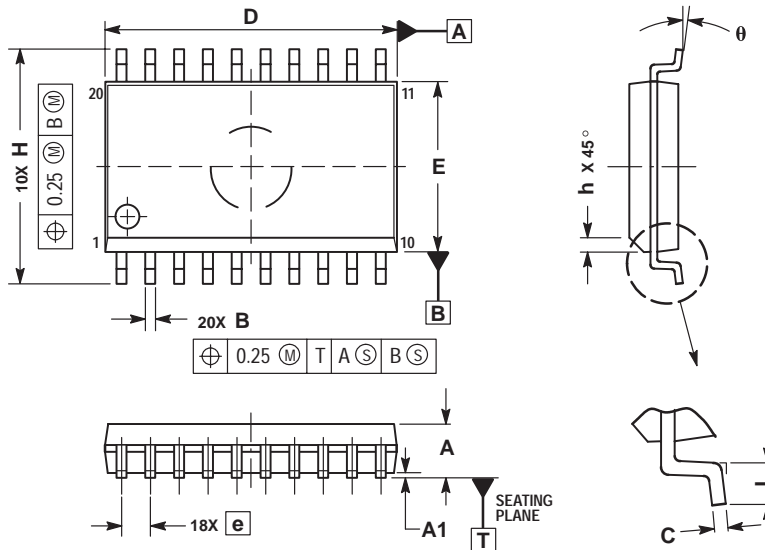
### PDIP-20 N SUFFIX PLASTIC DIP PACKAGE CASE 738-03 ISSUE E



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
  4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 1.010     | 1.070 | 25.66       | 27.17 |
| B   | 0.240     | 0.260 | 6.10        | 6.60  |
| C   | 0.150     | 0.180 | 3.81        | 4.57  |
| D   | 0.015     | 0.022 | 0.39        | 0.55  |
| E   | 0.050 BSC |       | 1.27 BSC    |       |
| F   | 0.050     | 0.070 | 1.27        | 1.77  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.008     | 0.015 | 0.21        | 0.38  |
| J   | 0.110     | 0.140 | 2.80        | 3.55  |
| K   | 0.300 BSC |       | 7.62 BSC    |       |
| L   | 0°        | 15°   | 0°          | 15°   |
| M   | 0.020     | 0.040 | 0.51        | 1.01  |

### SO-20 DW SUFFIX CASE 751D-05 ISSUE F



- 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°    |

## **Notes**

## **Notes**

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