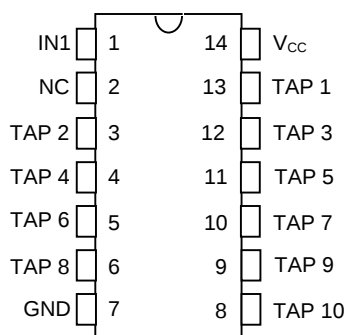


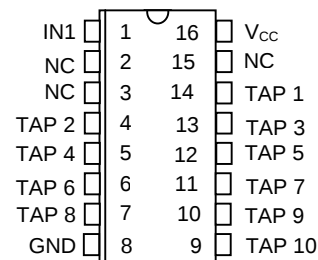
### FEATURES

- All-silicon time delay
- 10 taps equally spaced
- Delays are stable and precise
- Leading and trailing edge accuracy
- Delay tolerance  $\pm 5\%$  or  $\pm 2$  ns, whichever is greater
- Economical
- Auto-insertable, low profile
- Standard 14-pin DIP or 16-pin SOIC
- Low-power CMOS
- TTL/CMOS-compatible
- Vapor phase, IR and wave solderable
- Custom delays available
- Fast turn prototypes

### PIN ASSIGNMENT



DS1010 14-Pin DIP (300-mil)  
See Mech. Drawings Section



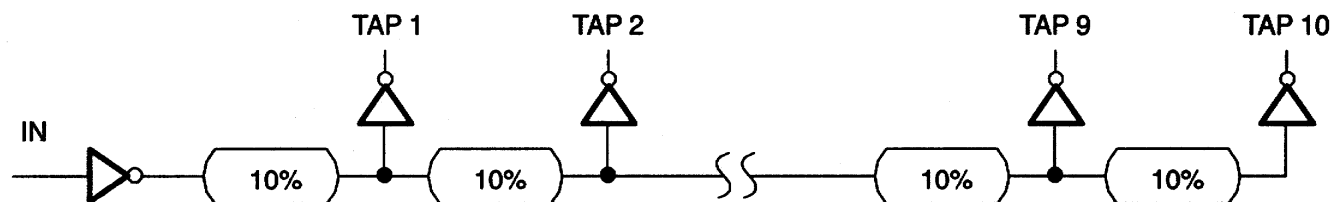
DS1010S 16-Pin SOIC  
(300-mil)  
See Mech. Drawings Section

### PIN DESCRIPTION

|                 |                     |
|-----------------|---------------------|
| TAP 1 - TAP 10  | - TAP Output Number |
| V <sub>CC</sub> | - 5 Volts           |
| GND             | - Ground            |
| NC              | - No Connection     |
| IN              | - Input             |

### DESCRIPTION

The DS1010 series delay line has ten equally spaced taps providing delays from 5 ns to 500 ns. The devices are offered in a standard 14-pin DIP which is pin-compatible with hybrid delay lines. Alternatively, a 16-pin SOIC is available for surface mount technology which reduces PC board area. Since the DS1010 is an all-silicon solution, better economy is achieved when compared to older methods using hybrid techniques. The DS1010 series delay lines provide a nominal accuracy of  $\pm 5\%$  or  $\pm 2$  ns, whichever is greater. The DS1010 reproduces the input logic state at the TAP 10 output after a fixed delay as specified by the dash number extension of the part number. The DS1010 is designed to produce both leading and trailing edge with equal precision. Each tap is capable of driving up to 10 74LS type loads. Dallas Semiconductor can customize standard products to meet special needs. For special requests and rapid delivery, call (972) 371-4348.

**LOGIC DIAGRAM** Figure 1**PART NUMBER DELAY TABLE ( $t_{PHL}$ ,  $t_{PLH}$ )** Table 1

| CATALOG P/N | TOTAL DELAY | DELAY/TAP (ns) |
|-------------|-------------|----------------|
| DS1010-50   | 50          | 5              |
| DS1010-60   | 60          | 6              |
| DS1010-75   | 75          | 7.5            |
| DS1010-80   | 80          | 8              |
| DS1010-100  | 100         | 10             |
| DS1010-125  | 125         | 12.5           |
| DS1010-150  | 150         | 15             |
| DS1010-175  | 175         | 17.5           |
| DS1010-200  | 200         | 20             |
| DS1010-250  | 250         | 25             |
| DS1010-300  | 300         | 30             |
| DS1010-350  | 350         | 35             |
| DS1010-400  | 400         | 40             |
| DS1010-450  | 450         | 45             |
| DS1010-500  | 500         | 50             |

Custom delays available.

**ABSOLUTE MAXIMUM RATINGS\***

|                                       |                      |
|---------------------------------------|----------------------|
| Voltage on Any Pin Relative to Ground | -1.0V to +7.0V       |
| Operating Temperature                 | 0°C to 70°C          |
| Storage Temperature                   | -55°C to +125°C      |
| Soldering Temperature                 | 260°C for 10 seconds |
| Short Circuit Output Current          | 50 mA for 1 second   |

\* This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

**DC ELECTRICAL CHARACTERISTICS** (0°C to 70°C;  $V_{CC} = 5.0V \pm 5\%$ )

| PARAMETER                 | SYM      | TEST CONDITION                           | MIN  | TYP  | MAX            | UNITS   | NOTES |
|---------------------------|----------|------------------------------------------|------|------|----------------|---------|-------|
| Supply Voltage            | $V_{CC}$ |                                          | 4.75 | 5.00 | 5.25           | V       | 1     |
| High Level Input Voltage  | $V_{IH}$ |                                          | 2.2  |      | $V_{CC} + 0.5$ | V       | 1     |
| Low Level Input Voltage   | $V_{IL}$ |                                          | -0.5 |      | 0.8            | V       | 1     |
| Input Leakage Current     | $I_I$    | $0.0V \leq V_I \leq V_{CC}$              | -1.0 |      | 1.0            | $\mu A$ |       |
| Active Current            | $I_{CC}$ | $V_{CC} = \text{Max};$<br>Period = Min.  |      | 40   | 150            | mA      | 2     |
| High Level Output Current | $I_{OH}$ | $V_{CC} = \text{Min.}$<br>$V_{OH} = 4$   |      |      | -1.0           | mA      |       |
| Low Level Output Current  | $I_{OL}$ | $V_{CC} = \text{Min.}$<br>$V_{OL} = 0.5$ | 12   |      |                | mA      |       |

**AC ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ C$ ;  $V_{CC} = 5V \pm 5\%$ )

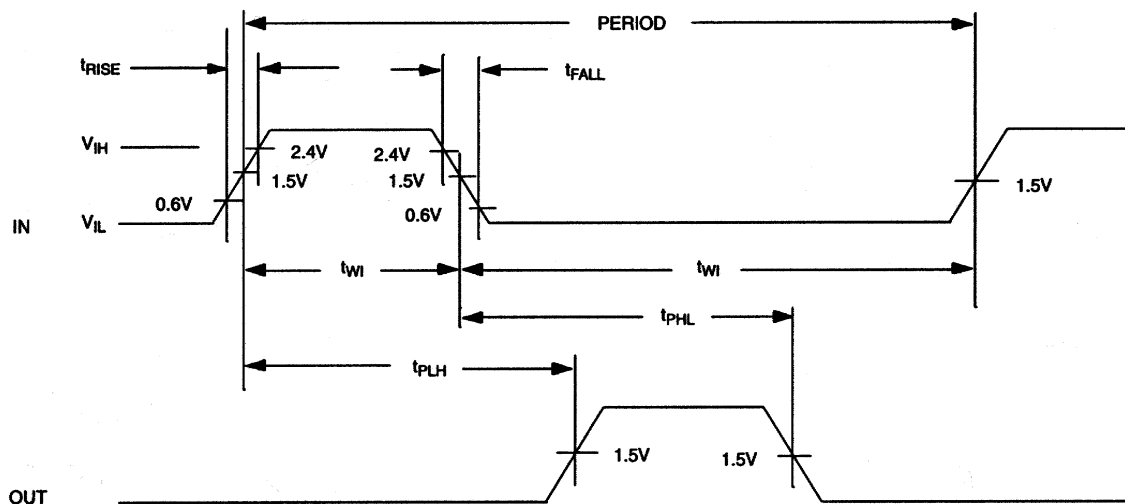
| PARAMETER                          | SYMBOL    | MIN                     | TYP     | MAX | UNITS | NOTES            |
|------------------------------------|-----------|-------------------------|---------|-----|-------|------------------|
| Input Pulse Width                  | $t_{WI}$  | 40% of TAP 10 $t_{PLH}$ |         |     | ns    | 8                |
| Input to Tap Delay (leading edge)  | $t_{PLH}$ |                         | Table 1 |     | ns    | 3, 4, 5, 6, 7, 9 |
| Input to Tap Delay (trailing edge) | $t_{PHL}$ |                         | Table 1 |     | ns    | 3, 4, 5, 6, 7, 9 |
| Power-up Time                      | $t_{PU}$  |                         |         | 100 | ms    |                  |
|                                    | Period    | 4 ( $t_{WI}$ )          |         |     | ns    | 8                |

**CAPACITANCE** ( $T_A = 25^\circ C$ )

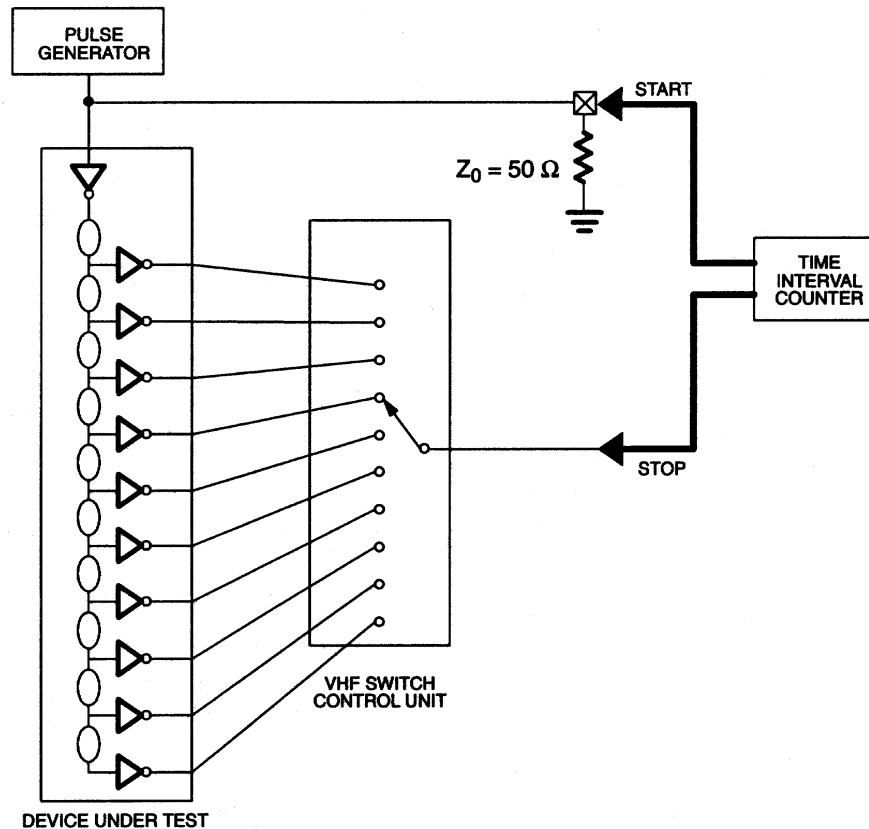
| PARAMETER         | SYMBOL   | MIN | TYP | MAX | UNITS | NOTES |
|-------------------|----------|-----|-----|-----|-------|-------|
| Input Capacitance | $C_{IN}$ |     | 5   | 10  | pF    |       |

**NOTES:**

1. All voltages are referenced to ground.
2. Measured with outputs open.
3.  $V_{CC} = 5V$  @  $25^{\circ}C$ . Input-to-tap delays accurate on both rising and falling edges within  $\pm 2$  ns or  $\pm 5\%$  whichever is greater.
4. See "Test Conditions" section.
5. For DS1010 delay lines with a TAP 10 delay of 100 ns or greater, temperature variations from  $25^{\circ}C$  to  $0^{\circ}C$  or  $70^{\circ}C$  may produce an additional input-to-tap delay shift of  $\pm 2$  ns or  $\pm 3\%$ , whichever is greater.
6. For DS1010 delay lines with a TAP 10 delay less than 100 ns, temperature variations from  $25^{\circ}C$  to  $0^{\circ}C$  or  $70^{\circ}C$  may produce an additional input-to-tap delay shift of  $\pm 1$  ns or  $\pm 9\%$ , whichever is greater.
7. All tap delays tend to vary unidirectionally with temperature or voltage changes. For example, if TAP 1 slows down, all other taps will also slow down; TAP 3 can never be faster than TAP 2.
8. Pulse width and period specifications may be exceeded; however, accuracy will be application-sensitive (decoupling, layout, etc.).
9. Certain high-frequency applications not recommended for -50 in 16-pin package. Consult factory.

**TIMING DIAGRAM: SILICON DELAY LINE Figure 2**

## TEST CIRCUIT Figure 3



## TERMINOLOGY

**Period:** The time elapsed between the leading edge of the first pulse and the leading edge of the following pulse.

**t<sub>WI</sub> (Pulse Width):** The elapsed time on the pulse between the 1.5V point on the leading edge and the 1.5V point on the trailing edge, or the 1.5V point on the trailing edge and the 1.5V point on the leading edge.

**t<sub>RISE</sub> (Input Rise Time):** The elapsed time between the 20% and the 80% point on the leading edge of the input pulse.

**t<sub>FALL</sub> (Input Fall Time):** The elapsed time between the 80% and the 20% point on the trailing edge of the input pulse.

**t<sub>PLH</sub> (Time Delay Rising):** The elapsed time between the 1.5V point on the leading edge of the input pulse and the 1.5V point on the leading edge of any tap output pulse.

**t<sub>PHL</sub> (Time Delay, Falling):** The elapsed time between the 1.5V point on the trailing edge of the input pulse and the 1.5V point on the trailing edge of any tap output pulse.

## TEST SETUP DESCRIPTION

Figure 3 illustrates the hardware configuration used for measuring the timing parameters on the DS1010. The input waveform is produced by a precision pulse generator under software control. Time delays are measured by a time interval counter (20 ps resolution) connected between the input and each tap. Each tap is selected and connected to the counter by a VHF switch control unit. All measurements are fully automated, with each instrument controlled by a central computer over an IEEE 488 bus.

## TEST CONDITIONS

### INPUT:

|                                     |                                                                             |
|-------------------------------------|-----------------------------------------------------------------------------|
| Ambient Temperature:                | $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$                                  |
| Supply Voltage ( $V_{\text{CC}}$ ): | $5.0\text{V} \pm 0.1\text{V}$                                               |
| Input Pulse:                        | High = $3.0\text{V} \pm 0.1\text{V}$<br>Low = $0.0\text{V} \pm 0.1\text{V}$ |
| Source Impedance:                   | 50 ohm max.                                                                 |
| Rise and Fall Time:                 | 3.0 ns max.                                                                 |
| Pulse Width:                        | 500 ns (1 $\mu\text{s}$ for -500)                                           |
| Period:                             | 1 $\mu\text{s}$ ( 2 $\mu\text{s}$ for -500)                                 |

### OUTPUT:

Each output is loaded with the equivalent of one 74FO4 input gate. Delay is measured at the 1.5V level on the rising and falling edge.

### NOTE:

Above conditions are for test only and do not restrict the operation of the device under other data sheet conditions.

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