

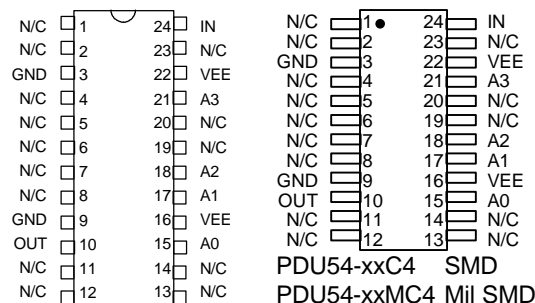
# 4-BIT, ECL-INTERFACED PROGRAMMABLE DELAY LINE (SERIES PDU54)



## FEATURES

- Digitally programmable in 16 delay steps
- Monotonic delay-versus-address variation
- Precise and stable delays
- Input & outputs fully 100K-ECL interfaced & buffered
- Available in 24-pin DIP (600 mil) socket or SMD

## PACKAGES



## FUNCTIONAL DESCRIPTION

The PDU54-series device is a 4-bit digitally programmable delay line. The delay,  $TD_A$ , from the input pin (IN) to the output pin (OUT) depends on the address code (A3-A0) according to the following formula:

$$TD_A = TD_0 + T_{INC} * A$$

where A is the address code,  $T_{INC}$  is the incremental delay of the device, and  $TD_0$  is the inherent delay of the device. The incremental delay is specified by the dash number of the device and can range from 100ps through 3000ps, inclusively. The address is not latched and must remain asserted during normal operation.

## PIN DESCRIPTIONS

- IN Signal Input
- OUT Signal Output
- A3-A0 Address Bits
- VEE -5 Volts
- GND Ground

## SERIES SPECIFICATIONS

- **Total programmed delay tolerance:** 5% or 40ps, whichever is greater
- **Inherent delay ( $TD_0$ ):** 3.3ns typical
- **Address to input setup ( $T_{AIS}$ ):** 2.9ns
- **Operating temperature:** 0° to 85° C
- **Temperature coefficient:** 100PPM/°C (excludes  $TD_0$ )
- **Supply voltage  $V_{EE}$ :** -5VDC  $\pm$  0.7V
- **Power Supply Current:** -300ma typical (50 $\Omega$  to -2V)
- **Minimum pulse width:** 3ns or 10% of total delay, whichever is greater
- **Minimum period:** 8ns or 2 x pulse width, whichever is greater

## DASH NUMBER SPECIFICATIONS

| Part Number | Incremental Delay Per Step (ps) | Total Delay Change (ns) |
|-------------|---------------------------------|-------------------------|
| PDU54-100   | 100 $\pm$ 50                    | 1.50                    |
| PDU54-200   | 200 $\pm$ 60                    | 3.00                    |
| PDU54-250   | 250 $\pm$ 60                    | 3.75                    |
| PDU54-400   | 400 $\pm$ 80                    | 6.00                    |
| PDU54-500   | 500 $\pm$ 100                   | 7.50                    |
| PDU54-750   | 750 $\pm$ 100                   | 11.25                   |
| PDU54-1000  | 1000 $\pm$ 200                  | 15.00                   |
| PDU54-1200  | 1200 $\pm$ 200                  | 18.00                   |
| PDU54-1500  | 1500 $\pm$ 200                  | 22.50                   |
| PDU54-2000  | 2000 $\pm$ 400                  | 30.00                   |
| PDU54-2500  | 2500 $\pm$ 400                  | 37.50                   |
| PDU54-3000  | 3000 $\pm$ 500                  | 45.00                   |

**NOTE:** Any dash number between 100 and 3000 not shown is also available.

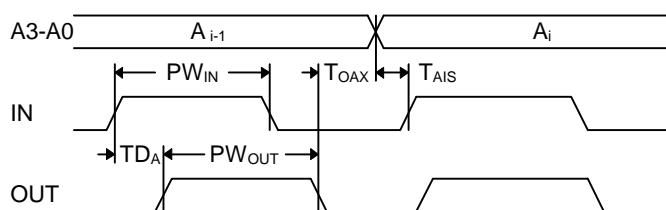


Figure 1: Timing Diagram

## APPLICATION NOTES

### ADDRESS UPDATE

The PDU54 is a memory device. As such, special precautions must be taken when changing the delay address in order to prevent spurious output signals. The timing restrictions are shown in Figure 1.

After the last signal edge to be delayed has appeared on the OUT pin, a minimum time,  $T_{OAX}$ , is required before the address lines can change. This time is given by the following relation:

$$T_{OAX} = \max \{ (A_i - A_{i-1}) * T_{INC} , 0 \}$$

where  $A_{i-1}$  and  $A_i$  are the old and new address codes, respectively. Violation of this constraint may, depending on the history of the input signal, cause spurious signals to appear on the OUT pin. The possibility of spurious signals persists until the required  $T_{OAX}$  has elapsed.

### INPUT RESTRICTIONS

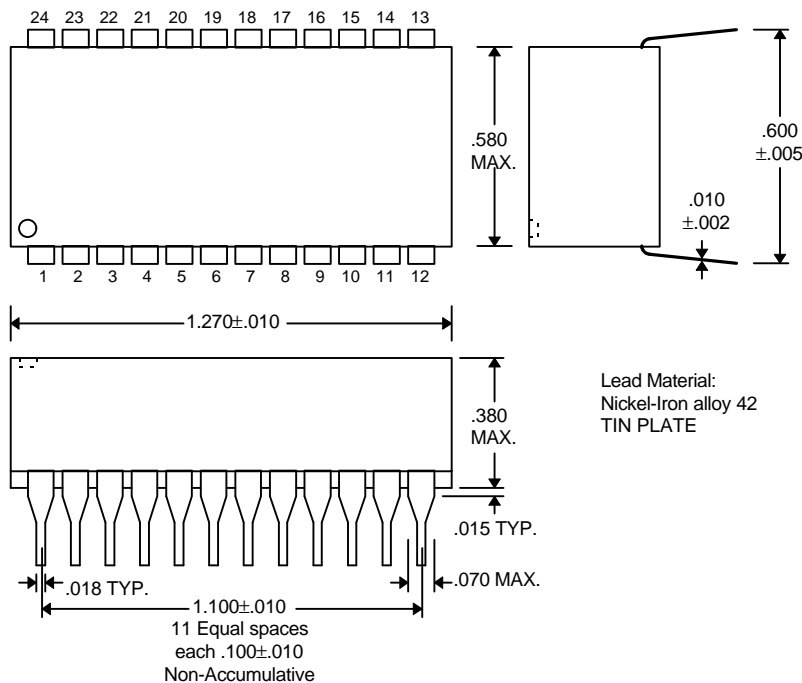
There are three types of restrictions on input pulse width and period listed in the **AC Characteristics** table. The **recommended**

conditions are those for which the delay tolerance specifications and monotonicity are guaranteed. The **suggested** conditions are those for which signals will propagate through the unit without significant distortion. The **absolute** conditions are those for which the unit will produce some type of output for a given input.

When operating the unit between the recommended and absolute conditions, the delays may deviate from their values at low frequency. However, these deviations will remain constant from pulse to pulse if the input pulse width and period remain fixed. In other words, the delay of the unit exhibits frequency and pulse width dependence when operated beyond the recommended conditions. Please consult the technical staff at Data Delay Devices if your application has specific high-frequency requirements.

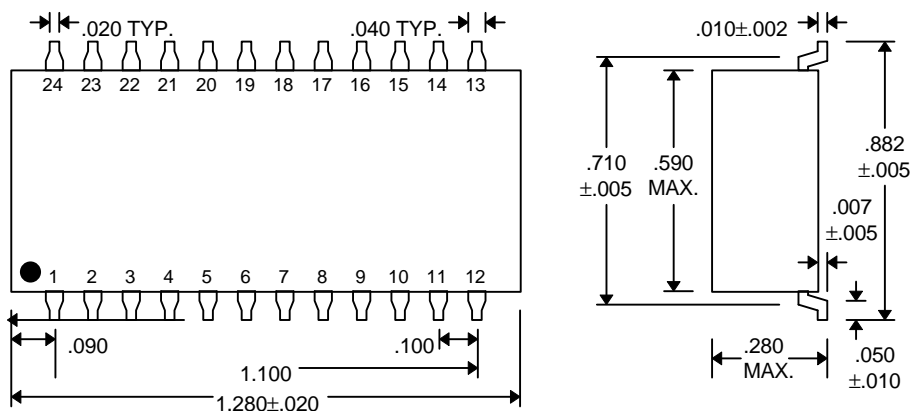
Please note that the increment tolerances listed represent a design goal. Although most delay increments will fall within tolerance, they are not guaranteed throughout the address range of the unit. Monotonicity is, however, guaranteed over all addresses.

## PACKAGE DIMENSIONS



**PDU54-xx (Commercial DIP)**  
**PDU54-xxM (Military DIP)**

## PACKAGE DIMENSIONS (cont'd)



**PDU54-xxC4 (Commercial SMD)**

**PDU54-xxMC4 (Military SMD)**

## DEVICE SPECIFICATIONS

**TABLE 1: AC CHARACTERISTICS**

| PARAMETER                   |             | SYMBOL     | MIN      | TYP | UNITS       |
|-----------------------------|-------------|------------|----------|-----|-------------|
| Total Programmable Delay    |             | $TD_T$     |          | 7   | $T_{INC}$   |
| Inherent Delay              |             | $TD_0$     |          | 3.3 | ns          |
| Address to Input Setup Time |             | $T_{AIS}$  | 2.9      |     | ns          |
| Output to Address Change    |             | $T_{OAX}$  | See Text |     |             |
| Input Period                | Absolute    | $PER_{IN}$ | 20       |     | % of $TD_T$ |
|                             | Suggested   | $PER_{IN}$ | 40       |     | % of $TD_T$ |
|                             | Recommended | $PER_{IN}$ | 200      |     | % of $TD_T$ |
| Input Pulse Width           | Absolute    | $PW_{IN}$  | 10       |     | % of $TD_T$ |
|                             | Suggested   | $PW_{IN}$  | 20       |     | % of $TD_T$ |
|                             | Recommended | $PW_{IN}$  | 100      |     | % of $TD_T$ |

**TABLE 2: ABSOLUTE MAXIMUM RATINGS**

| PARAMETER           | SYMBOL     | MIN            | MAX | UNITS | NOTES  |
|---------------------|------------|----------------|-----|-------|--------|
| DC Supply Voltage   | $V_{EE}$   | -7.0           | 0.3 | V     |        |
| Input Pin Voltage   | $V_{IN}$   | $V_{EE} - 0.3$ | 0.3 | V     |        |
| Storage Temperature | $T_{STRG}$ | -65            | 150 | C     |        |
| Lead Temperature    | $T_{LEAD}$ |                | 300 | C     | 10 sec |

**TABLE 3: DC ELECTRICAL CHARACTERISTICS**

(0C to 85C)

| PARAMETER                 | SYMBOL   | MIN    | MAX    | UNITS   | NOTES                           |
|---------------------------|----------|--------|--------|---------|---------------------------------|
| High Level Output Voltage | $V_{OH}$ | -1.025 | -0.880 | V       | $V_{IH} = MAX, 50\Omega$ to -2V |
| Low Level Output Voltage  | $V_{OL}$ | -1.810 | -1.620 | V       | $V_{IL} = MIN, 50\Omega$ to -2V |
| High Level Input Voltage  | $V_{IH}$ | -1.165 | -0.880 | V       |                                 |
| Low Level Input Voltage   | $V_{IL}$ | -1.810 | -1.475 | V       |                                 |
| High Level Input Current  | $I_{IH}$ |        | 340    | $\mu A$ | $V_{IH} = MAX$                  |
| Low Level Input Current   | $I_{IL}$ | 0.5    |        | $\mu A$ | $V_{IL} = MIN$                  |

## DELAY LINE AUTOMATED TESTING

### TEST CONDITIONS

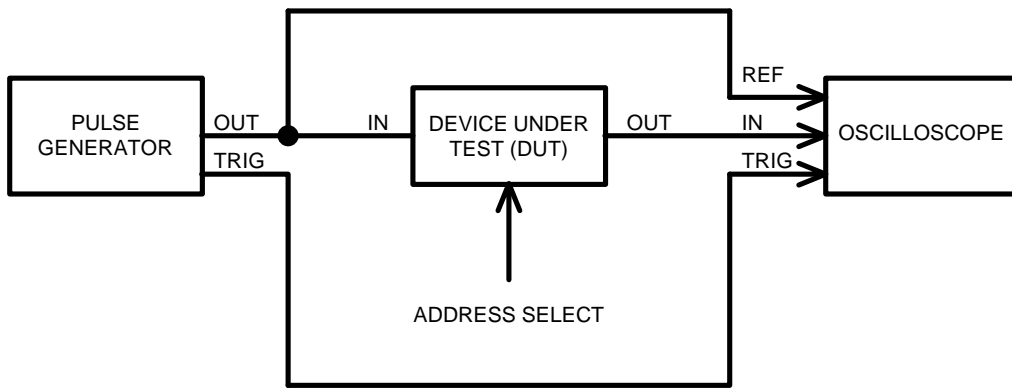
**INPUT:**

**Ambient Temperature:**  $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$   
**Supply Voltage (Vcc):**  $-4.5\text{V} \pm 0.1\text{V}$   
**Input Pulse:** Standard 100K ECL levels  
**Source Impedance:**  $50\Omega$  Max.  
**Rise/Fall Time:** 1.0 ns Max. (measured between 20% and 80%)  
**Pulse Width:**  $\text{PW}_{\text{IN}} = 10\text{ns}$   
**Period:**  $\text{PER}_{\text{IN}} = 100\text{ns}$

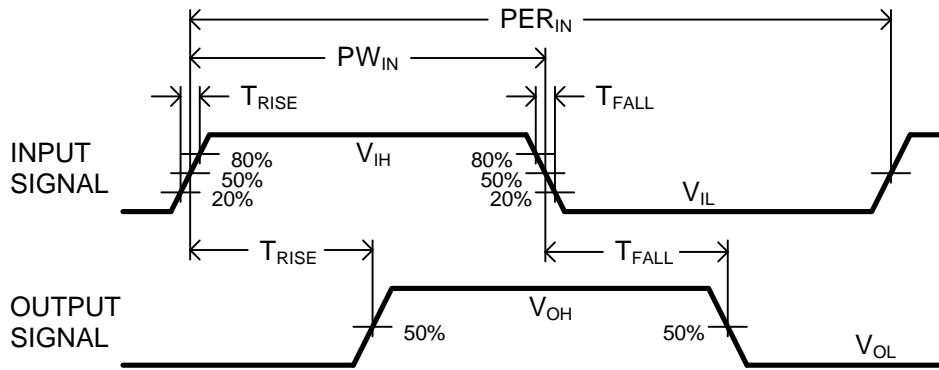
**OUTPUT:**

**Load:**  $50\Omega$  to  $-2\text{V}$   
**C<sub>load</sub>:**  $5\text{pf} \pm 10\%$   
**Threshold:**  $(V_{\text{OH}} + V_{\text{OL}}) / 2$   
 (Rising & Falling)

**NOTE:** The above conditions are for test only and do not in any way restrict the operation of the device.



**Test Setup**



**Timing Diagram For Testing**