

## Philips Components

|               |                       |
|---------------|-----------------------|
| Document No.  | 853-1436              |
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| Status        | Product Specification |
| ECL Products  |                       |

# 10129

## Line Receiver

### Quad TTL-to-ECL Translator

#### FEATURES

- Typical propagation delay: 10.0ns
- Typical TTL supply current ( $I_{CC}$ ): 3.0mA
- Typical ECL supply current ( $-I_{EE}$ ): 144mA

#### DESCRIPTION

The 10129 is intended to allow interfacing of 10K family types with other logic devices or systems. The enable, reset and strobe inputs are compatible with 10K family logic levels whereas data inputs accept TTL logic levels compatible with IBM-type busses. The information received from the bus is stored temporarily in latch storage elements.

The strobe input is useful to provide accurate synchronization of signals and/or connection to 10K family type level busses. When the enable is Low, the reset input is disabled and the outputs will follow the data inputs. The latches store data when the enable goes High. Unused data inputs must be tied to  $V_{CC}$  or ground. On the other hand, enable, strobe and reset inputs must be tied to  $V_{IL}$  or  $V_{EE}$  if unused.

The outputs are enabled when the strobe input is High. Two modes of operation are provided. In the first mode, obtained by tying the hysteresis control input to  $V_{EE}$ , the input threshold points of the D inputs are fixed. In the second mode this hysteresis control input is connected to ground which gives an hysteresis input effect useful for increasing the D input noise margin.

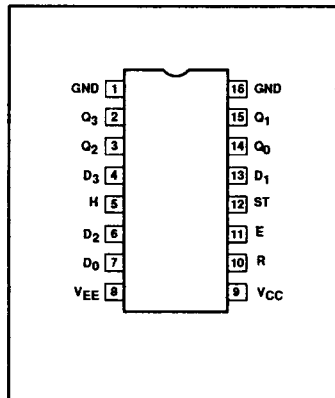
#### ORDERING INFORMATION

| DESCRIPTION        | ORDER CODE |
|--------------------|------------|
| 16-Pin Plastic DIP | 10129N     |
| 16-Pin Ceramic DIP | 10129F     |

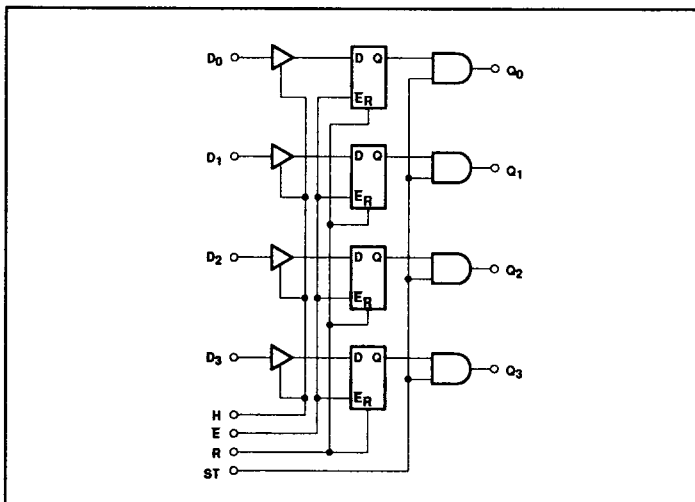
#### PIN DESCRIPTION

| PINS        | DESCRIPTION              |
|-------------|--------------------------|
| $D_0 - D_3$ | Data Inputs              |
| H           | Hysteresis control Input |
| E           | Enable Input             |
| R           | Reset Input              |
| ST          | Strobe Input             |
| $Q_1 - Q_3$ | Data Outputs             |

#### PIN CONFIGURATION



#### LOGIC DIAGRAM



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## FUNCTION TABLE

| INPUTS         |   |    |   | OUTPUT           |
|----------------|---|----|---|------------------|
| D <sub>n</sub> | E | ST | R | Q <sub>n+1</sub> |
| X              | X | L  | X | L                |
| X              | H | X  | H | L                |
| L              | L | H  | X | H                |
| X              | H | H  | L | Q <sub>n</sub>   |
| H              | L | H  | X | H                |

H = High voltage level

L = Low voltage level

X = Don't care

## ABSOLUTE MAXIMUM RATINGS FOR ECL-COMPATIBLE LINES

| SYMBOL          | PARAMETER                                                                           | LIMIT                | UNIT |
|-----------------|-------------------------------------------------------------------------------------|----------------------|------|
| V <sub>EE</sub> | Supply voltage                                                                      | -8.0                 | V    |
| V <sub>IN</sub> | Input voltage (V <sub>IN</sub> should never be more negative than V <sub>EE</sub> ) | 0 to V <sub>EE</sub> | V    |
| I <sub>O</sub>  | Output source current (continuous)                                                  | -50                  | mA   |
| T <sub>S</sub>  | Storage temperature range                                                           | -55 to +150          | °C   |
| T <sub>J</sub>  | Maximum junction temperature                                                        | Ceramic Package      | +165 |
|                 |                                                                                     | Plastic Package      | +150 |

## NOTE:

Operation beyond the limits set forth in this table may impair the useful life of the device. Unless otherwise noted, these limits are specified over the operating ambient temperature range.

## ABSOLUTE MAXIMUM RATINGS FOR TTL-COMPATIBLE LINES

| SYMBOL          | PARAMETER          | LIMIT                    | UNIT |
|-----------------|--------------------|--------------------------|------|
| V <sub>CC</sub> | TTL supply voltage | -5.0 to +7.0             | V    |
| V <sub>IN</sub> | Input voltage      | -0.5 to V <sub>TTL</sub> | V    |
| I <sub>IN</sub> | Input current      | -30 to +5                | mA   |

## NOTE:

Operation beyond the limits set forth in this table may impair the useful life of the device. Unless otherwise noted, these limits are specified over the operating ambient temperature range.

## DC OPERATING CONDITIONS FOR ALL INPUT LEVELS

| SYMBOL          | PARAMETER                           | LIMITS |      |      | UNIT |
|-----------------|-------------------------------------|--------|------|------|------|
|                 |                                     | MIN.   | NOM. | MAX. |      |
| GND             | Circuit ground                      | 0      | 0    | 0    | V    |
| V <sub>EE</sub> | ECL supply voltage                  |        | -5.2 |      | V    |
| V <sub>CC</sub> | TTL supply voltage                  |        | +5.0 |      | V    |
| T <sub>A</sub>  | Operating ambient temperature range | -30    | +25  | +85  | °C   |

## NOTE:

When operating at V<sub>EE</sub> other than specified voltage (-5.2V), the DC and AC Characteristics will vary slightly from specified values. (See table of DC Characteristics.)

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## DC OPERATING CONDITIONS FOR ECL INPUT LEVELS

| SYMBOL    | PARAMETER                          | TEST<br>CONDITION           | LIMITS |      |       | UNIT |
|-----------|------------------------------------|-----------------------------|--------|------|-------|------|
|           |                                    |                             | MIN.   | NOM. | MAX.  |      |
| $V_{IH}$  | High level input voltage           | $T_A = -30^{\circ}\text{C}$ |        |      | -890  | mV   |
|           |                                    | $T_A = +25^{\circ}\text{C}$ |        |      | -810  | mV   |
|           |                                    | $T_A = +85^{\circ}\text{C}$ |        |      | -700  | mV   |
| $V_{IHT}$ | High level input threshold voltage | $T_A = -30^{\circ}\text{C}$ | -1205  |      |       | mV   |
|           |                                    | $T_A = +25^{\circ}\text{C}$ | -1105  |      |       | mV   |
|           |                                    | $T_A = +85^{\circ}\text{C}$ | -1035  |      |       | mV   |
| $V_{ILT}$ | Low level input threshold voltage  | $T_A = -30^{\circ}\text{C}$ |        |      | -1500 | mV   |
|           |                                    | $T_A = +25^{\circ}\text{C}$ |        |      | -1475 | mV   |
|           |                                    | $T_A = +85^{\circ}\text{C}$ |        |      | -1440 | mV   |
| $V_{IL}$  | Low level input voltage            | $T_A = -30^{\circ}\text{C}$ | -1890  |      |       | mV   |
|           |                                    | $T_A = +25^{\circ}\text{C}$ | -1850  |      |       | mV   |
|           |                                    | $T_A = +85^{\circ}\text{C}$ | -1825  |      |       | mV   |

## DC OPERATING CONDITIONS FOR TTL INPUT LEVELS

| SYMBOL     | PARAMETER                          | TEST<br>CONDITION           | LIMITS |      |       | UNIT |
|------------|------------------------------------|-----------------------------|--------|------|-------|------|
|            |                                    |                             | MIN.   | NOM. | MAX.  |      |
| $V_{IH}$   | High level input voltage           | $T_A = -30^{\circ}\text{C}$ | 3.000  |      |       | V    |
|            |                                    | $T_A = +25^{\circ}\text{C}$ | 3.000  |      |       | V    |
|            |                                    | $T_A = +85^{\circ}\text{C}$ | 3.000  |      |       | V    |
| $V_{IHT}'$ | High level input threshold voltage | $T_A = -30^{\circ}\text{C}$ | 2.000  |      |       | V    |
|            |                                    | $T_A = +25^{\circ}\text{C}$ | 2.000  |      |       | V    |
|            |                                    | $T_A = +85^{\circ}\text{C}$ | 2.000  |      |       | V    |
| $V_{ILT}'$ | Low level input threshold voltage  | $T_A = -30^{\circ}\text{C}$ |        |      | 0.800 | V    |
|            |                                    | $T_A = +25^{\circ}\text{C}$ |        |      | 0.800 | V    |
|            |                                    | $T_A = +85^{\circ}\text{C}$ |        |      | 0.800 | V    |
| $V_{IL}$   | Low level input voltage            | $T_A = -30^{\circ}\text{C}$ |        |      | 0.400 | V    |
|            |                                    | $T_A = +25^{\circ}\text{C}$ |        |      | 0.400 | V    |
|            |                                    | $T_A = +85^{\circ}\text{C}$ |        |      | 0.400 | V    |

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DC OPERATING CONDITIONS FOR IBM INPUT LEVELS

| SYMBOL             | PARAMETER                          | TEST<br>CONDITION      | LIMITS |      |       | UNIT |
|--------------------|------------------------------------|------------------------|--------|------|-------|------|
|                    |                                    |                        | MIN.   | NOM. | MAX.  |      |
| V <sub>IH</sub>    | High level input voltage           | T <sub>A</sub> = -30°C | 3.110  |      |       | V    |
|                    |                                    | T <sub>A</sub> = +25°C | 3.110  |      |       | V    |
|                    |                                    | T <sub>A</sub> = +85°C | 3.110  |      |       | V    |
| V <sub>IHT</sub> ' | High level input threshold voltage | T <sub>A</sub> = -30°C |        |      |       | V    |
|                    |                                    | T <sub>A</sub> = +25°C | 1.700  |      |       | V    |
|                    |                                    | T <sub>A</sub> = +85°C |        |      |       | V    |
| V <sub>ILT</sub> ' | Low level input threshold voltage  | T <sub>A</sub> = -30°C |        |      |       | V    |
|                    |                                    | T <sub>A</sub> = +25°C |        |      | 0.700 | V    |
|                    |                                    | T <sub>A</sub> = +85°C |        |      |       | V    |
| V <sub>IL</sub>    | Low level input voltage            | T <sub>A</sub> = -30°C |        |      | 0.150 | V    |
|                    |                                    | T <sub>A</sub> = +25°C |        |      | 0.150 | V    |
|                    |                                    | T <sub>A</sub> = +85°C |        |      | 0.150 | V    |

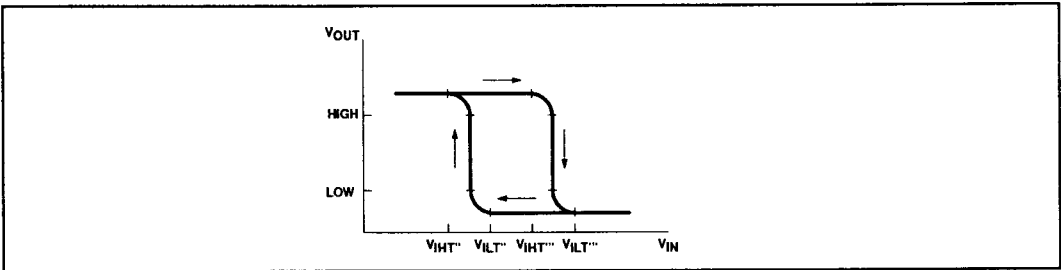
DC OPERATING CONDITIONS FOR HYSTERESIS MODE THRESHOLD VOLTAGES

| SYMBOL               | PARAMETER                                          | TEST<br>CONDITION      | LIMITS |      |       | UNIT |
|----------------------|----------------------------------------------------|------------------------|--------|------|-------|------|
|                      |                                                    |                        | MIN.   | NOM. | MAX.  |      |
| V <sub>IHT</sub> ''  | Hysteresis mode High level input threshold voltage | T <sub>A</sub> = -30°C | 2.900  |      |       | V    |
|                      |                                                    | T <sub>A</sub> = +25°C | 2.600  |      |       | V    |
|                      |                                                    | T <sub>A</sub> = +85°C | 2.300  |      |       | V    |
| V <sub>ILT</sub> ''  | Hysteresis mode Low level input threshold voltage  | T <sub>A</sub> = -30°C |        |      | 2.000 | V    |
|                      |                                                    | T <sub>A</sub> = +25°C |        |      | 1.700 | V    |
|                      |                                                    | T <sub>A</sub> = +85°C |        |      | 1.400 | V    |
| V <sub>IHT</sub> ''' | Hysteresis mode High level input threshold voltage | T <sub>A</sub> = -30°C | 2.200  |      |       | V    |
|                      |                                                    | T <sub>A</sub> = +25°C | 1.900  |      |       | V    |
|                      |                                                    | T <sub>A</sub> = +85°C | 1.600  |      |       | V    |
| V <sub>ILT</sub> ''' | Hysteresis mode Low level input threshold voltage  | T <sub>A</sub> = -30°C |        |      | 1.300 | V    |
|                      |                                                    | T <sub>A</sub> = +25°C |        |      | 1.000 | V    |
|                      |                                                    | T <sub>A</sub> = +85°C |        |      | 0.700 | V    |

NOTE:

V<sub>IHT</sub>'', V<sub>IL</sub>'', V<sub>IHT</sub>''' and V<sub>IL</sub>''' are logic "1" and "0" threshold voltages in the hystersis mode.

HYSTERISIS MODE THRESHOLD VOLTAGES



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**DC ELECTRICAL CHARACTERISTICS** GND = ground,  $V_{EE} = -5.2V \pm 0.010V$ ,  $V_{CC} = +5.0V \pm 0.010V$ ,  $T_A = -30^\circ\text{C}$  to  $+85^\circ\text{C}$  output loading  $50\Omega$  to  $-2.0V \pm 0.010V$  unless otherwise specified<sup>1,3</sup>

| SYMBOL     | PARAMETER                           |                            | TEST CONDITIONS <sup>2</sup>                         | LIMITS |      |       | UNIT          |
|------------|-------------------------------------|----------------------------|------------------------------------------------------|--------|------|-------|---------------|
|            |                                     |                            |                                                      | MIN.   | TYP. | MAX.  |               |
| $V_{OH}$   | High level output voltage           | $T_A = -30^\circ\text{C}$  | $ST = V_{IHMAX}$ , $E = V_{ILMIN}$ , $R = V_{ILMIN}$ | -1060  |      | -890  | mV            |
|            |                                     | $T_A = +25^\circ\text{C}$  |                                                      | -960   |      | -810  | mV            |
|            |                                     | $T_A = +85^\circ\text{C}$  |                                                      | -890   |      | -700  | mV            |
| $V_{OHT}$  | High level output threshold voltage | $T_A = -30^\circ\text{C}$  | $ST = V_{IHMAX}$ , $E = V_{ILMIN}$ , $R = V_{ILMIN}$ | -1080  |      |       | mV            |
|            |                                     | $T_A = +25^\circ\text{C}$  |                                                      | -980   |      |       | mV            |
|            |                                     | $T_A = +85^\circ\text{C}$  |                                                      | -910   |      |       | mV            |
| $V_{OLT}$  | Low level output threshold voltage  | $T_A = -30^\circ\text{C}$  | $ST = V_{IHMAX}$ , $E = V_{ILMIN}$ , $R = V_{ILMIN}$ |        |      | -1655 | mV            |
|            |                                     | $T_A = +25^\circ\text{C}$  |                                                      |        |      | -1630 | mV            |
|            |                                     | $T_A = +85^\circ\text{C}$  |                                                      |        |      | -1595 | mV            |
| $V_{OL}$   | Low level output voltage            | $T_A = -30^\circ\text{C}$  | $ST = V_{IHMAX}$ , $E = V_{ILMIN}$ , $R = V_{ILMIN}$ | -1890  |      | -1675 | mV            |
|            |                                     | $T_A = +25^\circ\text{C}$  |                                                      | -1850  |      | -1650 | mV            |
|            |                                     | $T_A = +85^\circ\text{C}$  |                                                      | -1825  |      | -1615 | mV            |
| $I_H$      | High level input current            | $D_n$<br>inputs            | $T_A = -30^\circ\text{C}$                            |        |      | 150   | $\mu\text{A}$ |
|            |                                     |                            | $T_A = +25^\circ\text{C}$                            |        |      | 95    | $\mu\text{A}$ |
|            |                                     |                            | $T_A = +85^\circ\text{C}$                            |        |      | 95    | $\mu\text{A}$ |
|            |                                     | $R$<br>input               | $T_A = -30^\circ\text{C}$                            |        |      | 720   | $\mu\text{A}$ |
|            |                                     |                            | $T_A = +25^\circ\text{C}$                            |        |      | 450   | $\mu\text{A}$ |
|            |                                     |                            | $T_A = +85^\circ\text{C}$                            |        |      | 450   | $\mu\text{A}$ |
|            |                                     | $E, ST$<br>inputs          | $T_A = -30^\circ\text{C}$                            |        |      | 390   | $\mu\text{A}$ |
|            |                                     |                            | $T_A = +25^\circ\text{C}$                            |        |      | 245   | $\mu\text{A}$ |
|            |                                     |                            | $T_A = +85^\circ\text{C}$                            |        |      | 245   | $\mu\text{A}$ |
| $-I_{CBO}$ | Input leakage current               | $D_n$<br>inputs            | $T_A = -30^\circ\text{C}$                            |        |      | 1.5   | $\mu\text{A}$ |
|            |                                     |                            | $T_A = +25^\circ\text{C}$                            |        |      | 1.0   | $\mu\text{A}$ |
|            |                                     |                            | $T_A = +85^\circ\text{C}$                            |        |      | 1.0   | $\mu\text{A}$ |
| $I_L$      | Low level input current             | $R, E$<br><br>ST<br>inputs | $T_A = -30^\circ\text{C}$                            | 0.5    |      |       | $\mu\text{A}$ |
|            |                                     |                            | $T_A = +25^\circ\text{C}$                            | 0.5    |      |       | $\mu\text{A}$ |
|            |                                     |                            | $T_A = +85^\circ\text{C}$                            | 0.3    |      |       | $\mu\text{A}$ |

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## DC ELECTRICAL CHARACTERISTICS (Continued)

| SYMBOL                                | PARAMETER                              | TEST CONDITIONS <sup>2</sup> |                                                                                    | LIMITS |       |      | UNIT |
|---------------------------------------|----------------------------------------|------------------------------|------------------------------------------------------------------------------------|--------|-------|------|------|
|                                       |                                        |                              |                                                                                    | MIN.   | TYP.  | MAX. |      |
| -I <sub>EE</sub>                      | ECL supply current                     | T <sub>A</sub> = -30°C       | Connect H to GND<br><br>ST = V <sub>IHMIN</sub> , E = V <sub>LLMIN</sub>           |        |       | 167  | mA   |
|                                       |                                        | T <sub>A</sub> = +25°C       |                                                                                    |        |       | 152  | mA   |
|                                       |                                        | T <sub>A</sub> = +85°C       |                                                                                    |        |       | 167  | mA   |
|                                       |                                        | T <sub>A</sub> = -30°C       | Apply V <sub>EE</sub> to H<br><br>ST = V <sub>IHMIN</sub> , E = V <sub>LLMIN</sub> |        |       | 189  | mA   |
|                                       |                                        | T <sub>A</sub> = +25°C       |                                                                                    |        |       | 172  | mA   |
|                                       |                                        | T <sub>A</sub> = +85°C       |                                                                                    |        |       | 189  | mA   |
| I <sub>CC</sub>                       | TTL supply current                     | T <sub>A</sub> = -30°C       | Apply V <sub>EE</sub> to H                                                         |        |       | 8.0  | mA   |
|                                       |                                        | T <sub>A</sub> = +25°C       |                                                                                    |        |       | 8.0  | mA   |
|                                       |                                        | T <sub>A</sub> = +85°C       |                                                                                    |        |       | 8.0  | mA   |
| $\frac{\Delta V_{OH}}{\Delta V_{EE}}$ | High level output voltage compensation | T <sub>A</sub> = +25°C       |                                                                                    |        | 0.016 |      | V/V  |
| $\frac{\Delta V_{OL}}{\Delta V_{EE}}$ | Low level output voltage compensation  |                              |                                                                                    |        | 0.250 |      | V/V  |
| $\frac{\Delta V_{BB}}{\Delta V_{EE}}$ | Reference bias voltage compensation    |                              |                                                                                    |        | 0.148 |      | V/V  |

## NOTES:

- The specified limits represent the worst case values for the parameter. Since these worst case values normally occur at the supply voltage and temperature extremes, additional noise immunity can be achieved by decreasing the allowable operating condition ranges.
- Conditions for testing shown in the tables are not necessarily worst case. For worst case testing guidelines, refer to DC Testing, Chapter 1, Section 3.
- The specified limits shown in the DC Electrical Characteristics table can be met only after thermal equilibrium has been established. Thermal equilibrium is established by applying power for at least 2 minutes, while maintaining transverse airflow of 2.5 meters/sec (500 linear feet/min) over the device, mounted either in a test socket or on a printed circuit board. Test voltage values are given in the DC Operating Conditions table.

AC ELECTRICAL CHARACTERISTICS GND = ground,  $V_{EE} = -5.2V \pm 0.010V$ ,  $V_{CC} = +5.0V \pm 0.010V$ 

| SYMBOL                               | PARAMETER                                                              | TEST CONDITIONS                           | LIMITS                 |            |                        |              |            |                        |            |          | UNIT |
|--------------------------------------|------------------------------------------------------------------------|-------------------------------------------|------------------------|------------|------------------------|--------------|------------|------------------------|------------|----------|------|
|                                      |                                                                        |                                           | T <sub>A</sub> = -30°C |            | T <sub>A</sub> = +25°C |              |            | T <sub>A</sub> = +85°C |            |          |      |
|                                      |                                                                        |                                           | MIN.                   | MAX.       | MIN.                   | TYP.         | MAX.       | MIN.                   | MAX.       |          |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay without Hysteresis, D <sub>n</sub> to Q <sub>n</sub> | Connect H to V <sub>EE</sub> , Waveform 1 | 3.7<br>3.7             | 15<br>15   | 3.7<br>3.7             | 10.0<br>10.0 | 15<br>15   | 3.7<br>3.7             | 30<br>40   | ns<br>ns |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay with Hysteresis, D <sub>n</sub> to Q <sub>n</sub>    | Connect H to GND, Waveform 1              | 6.6<br>3.7             | 30<br>17   | 6.7<br>3.7             | 18.0<br>10.0 | 25<br>15   | 6.6<br>3.7             | 30<br>40   | ns<br>ns |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay E to Q <sub>n</sub>                                  | Waveforms 2, 4                            | 2.7<br>2.7             | 11<br>11   | 2.7<br>2.7             | 5.0<br>5.0   | 9.0<br>9.0 | 2.7<br>2.7             | 11<br>11   | ns<br>ns |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay ST to Q <sub>n</sub>                                 | Waveform 3                                | 1.6<br>1.6             | 8.0<br>8.0 | 1.6<br>1.6             | 4.0<br>4.0   | 7.0<br>7.0 | 1.6<br>1.6             | 8.0<br>8.0 | ns<br>ns |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay R to Q <sub>n</sub>                                  | Waveform 4                                | 2.0<br>2.0             | 8.0<br>8.0 | 2.0<br>2.0             | 5.0<br>5.0   | 6.5<br>6.5 | 2.0<br>2.0             | 8.0<br>8.0 | ns<br>ns |      |
| t <sub>s</sub>                       | Setup time D <sub>n</sub> to E                                         | Waveform 5                                | 30                     |            | 2.7                    | 15.0         |            | 30                     |            | ns       |      |
| t <sub>h</sub>                       | Hold time D <sub>n</sub> to E                                          | Waveform 5                                | 0                      |            | -2.0                   | 15.0         |            | -2.0                   |            | ns       |      |
| t <sub>TLH</sub><br>t <sub>THL</sub> | Transition time 20% to 80%, 80% to 20%                                 | Waveforms 1, 2, 3, 4                      | 1.5<br>1.5             | 5.0<br>5.0 | 1.5<br>1.5             | 2.0<br>2.0   | 4.3<br>4.3 | 1.5<br>1.5             | 5.0<br>5.0 | ns<br>ns |      |

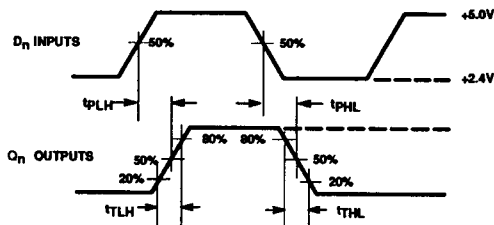
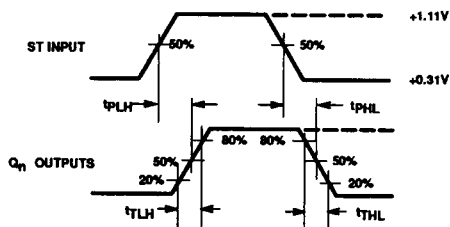
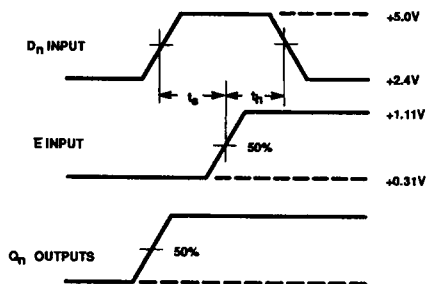
## NOTE:

For AC test setup information, see AC Testing, Chapter 2, Section 3.

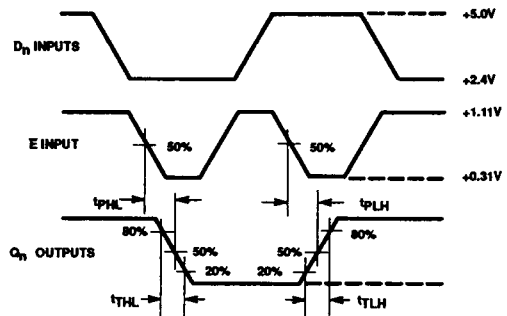
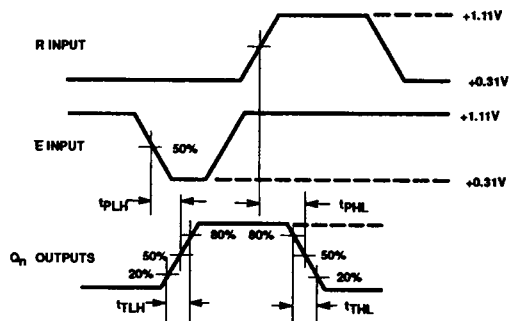
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## AC WAVEFORMS

Waveform 1.  $D_n$  Timing (E and R are Low, ST is High)Waveform 3. Strobe Timing (E and R are Low,  $D_n$  is High)

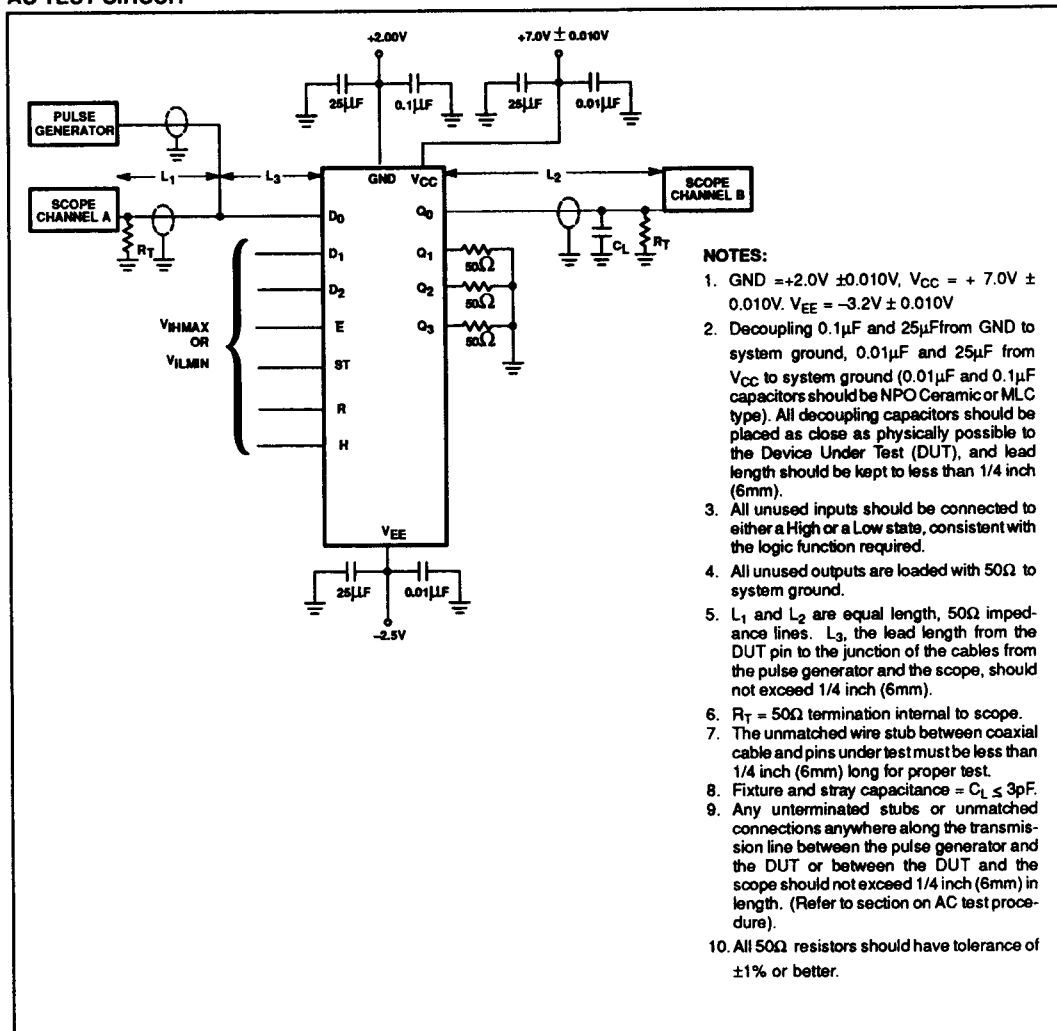
Waveform 5. Setup and Hold Times

Waveform 2.  $D_n$  Timing (R is Low, ST is High)Waveform 4. Reset Timing ( $D_n$  and ST are High)

## Line Receiver

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## AC TEST CIRCUIT

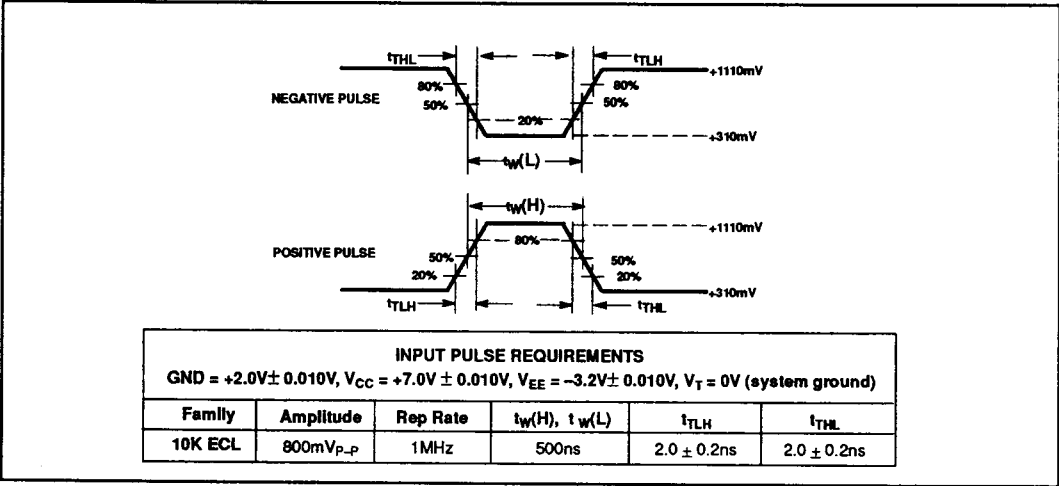




Line Receiver

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ECL INPUT PULSE DEFINITION



TTL INPUT PULSE DEFINITION

