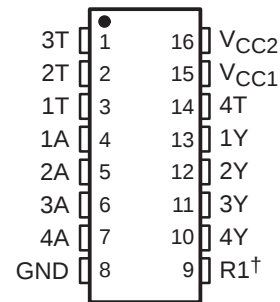


# SN75154 QUADRUPLE LINE RECEIVER

SLLS083B – NOVEMBER 1970 – REVISED MAY 1995

- Meets or Exceeds the Requirements of ANSI Standard EIA/TIA-232-E and ITU Recommendation V.28
- Input Resistance . . . 3 k $\Omega$  to 7 k $\Omega$  Over Full EIA/TIA-232-E Voltage Range
- Input Threshold Adjustable to Meet Fail-Safe Requirements Without Using External Components
- Built-In Hysteresis for Increased Noise Immunity
- Inverting Output Compatible With TTL
- Output With Active Pullup for Symmetrical Switching Speeds
- Standard Supply Voltages . . . 5 V or 12 V

D OR N PACKAGE  
(TOP VIEW)



† For function of R1, see schematic

## description

The SN75154 is a monolithic low-power Schottky line receiver designed to satisfy the requirements of the standard interface between data terminal equipment and data communication equipment as defined by ANSI Standard EIA/TIA-232-E. Other applications are for relatively short, single-line, point-to-point data transmission and for level translators. Operation is normally from a single 5-V supply; however, a built-in option allows operation from a 12-V supply without the use of additional components. The output is compatible with most TTL circuits when either supply voltage is used.

In normal operation, the threshold-control terminals are connected to the  $V_{CC1}$  terminal, even if power is being supplied via the alternate  $V_{CC2}$  terminal. This provides a wide hysteresis loop, which is the difference between the positive-going and negative-going threshold voltages. See typical characteristics. In this mode of operation, if the input voltage goes to zero, the output voltage will remain at the low or high level as determined by the previous input.

For fail-safe operation, the threshold-control terminals are open. This reduces the hysteresis loop by causing the negative-going threshold voltage to be above zero. The positive-going threshold voltage remains above zero as it is unaffected by the disposition of the threshold terminals. In the fail-safe mode, if the input voltage goes to zero or an open-circuit condition, the output will go to the high level regardless of the previous input condition.

The SN75154 is characterized for operation from 0°C to 70°C.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

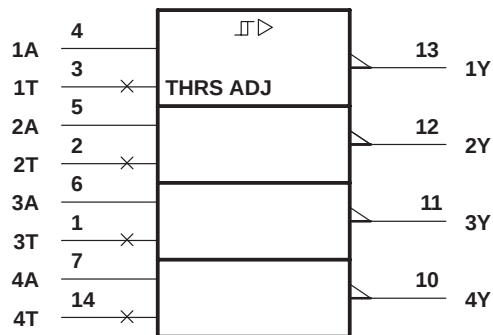
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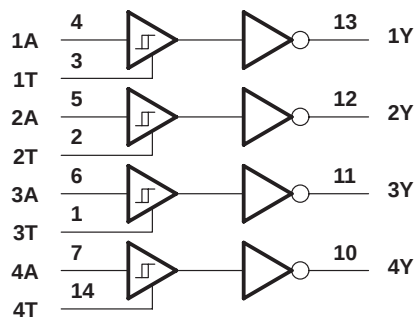
SN75154  
QUADRUPLE LINE RECEIVER

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logic symbol†

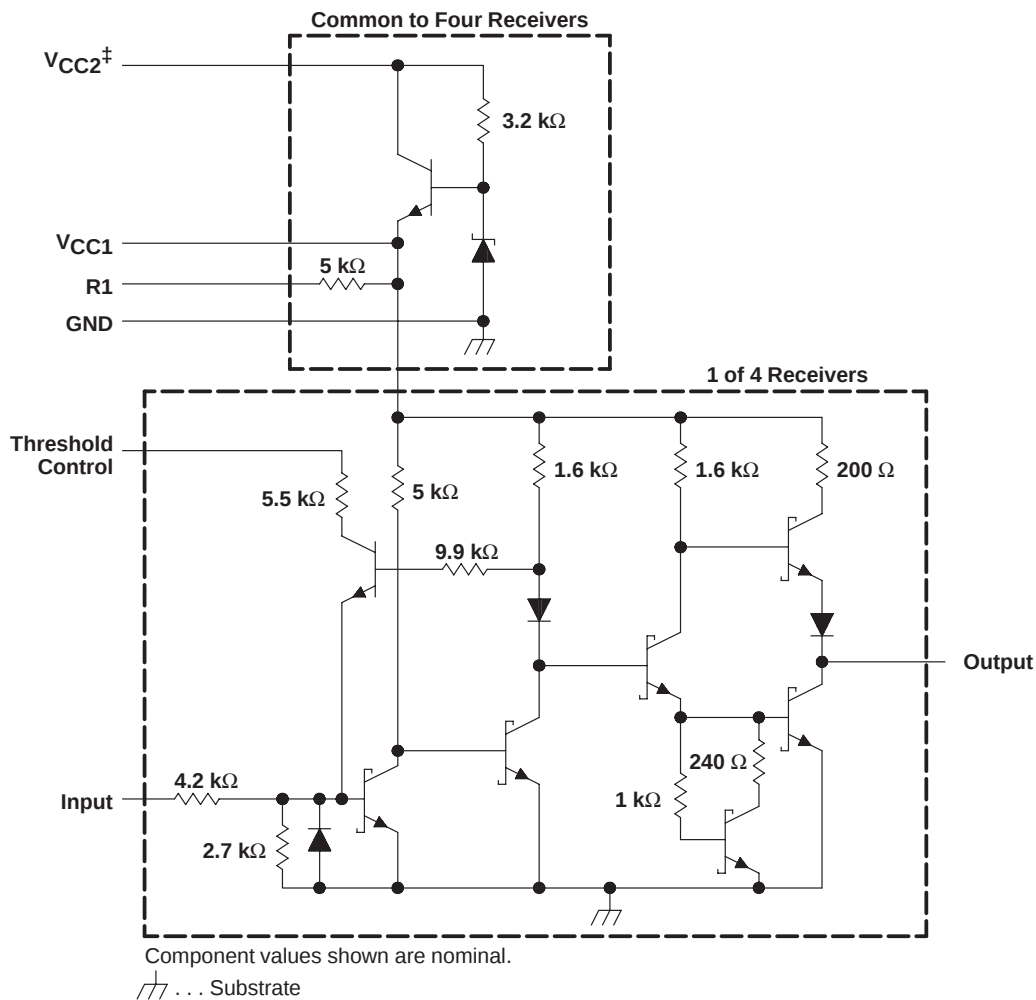


logic diagram (positive logic)



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

schematic



‡ When  $V_{CC1}$  is used,  $V_{CC2}$  may be left open or shorted to  $V_{CC1}$ . When  $V_{CC2}$  is used,  $V_{CC1}$  must be left open or connected to the threshold control pins.

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>**

|                                                              |                              |
|--------------------------------------------------------------|------------------------------|
| Normal supply voltage, $V_{CC1}$ (see Note 1)                | 7 V                          |
| Alternate supply voltage, $V_{CC2}$                          | 14 V                         |
| Input voltage, $V_I$                                         | $\pm 25$ V                   |
| Continuous total power dissipation                           | See Dissipation Rating Table |
| Operating free-air temperature range, $T_A$                  | 0°C to 70°C                  |
| Storage temperature range, $T_{stg}$                         | –65°C to 150°C               |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | 260°C                        |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: Voltage values are with respect to network GND terminal.

**DISSIPATION RATING TABLE**

| PACKAGE | $T_A \leq 25^\circ\text{C}$<br>POWER RATING | DERATING FACTOR<br>ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$<br>POWER RATING |
|---------|---------------------------------------------|---------------------------------------------------|------------------------------------------|
| D       | 950 mW                                      | 7.6 mW/°C                                         | 608 mW                                   |
| N       | 1150 mW                                     | 9.2 mW/°C                                         | 736 mW                                   |
| NS      | 625 mW                                      | 5.0 mW/°C                                         | 400 mW                                   |

**recommended operating conditions**

|                                                 | MIN  | NOM | MAX  | UNIT          |
|-------------------------------------------------|------|-----|------|---------------|
| Normal supply voltage, $V_{CC1}$                | 4.5  | 5   | 5.5  | V             |
| Alternate supply voltage, $V_{CC2}$             | 10.8 | 12  | 13.2 | V             |
| High-level input voltage, $V_{IH}$ (see Note 2) | 3    |     | 15   | V             |
| Low-level input voltage, $V_{IL}$ (see Note 2)  | –15  |     | –3   | V             |
| High-level output current, $I_{OH}$             |      |     | –400 | $\mu\text{A}$ |
| Low-level output current, $I_{OL}$              |      |     | 16   | mA            |
| Operating free-air temperature, $T_A$           | 0    |     | 70   | °C            |

NOTE 2: The algebraic convention, where the less positive (more negative) limit is designated as minimum, is used in this data sheet for logic and threshold levels only, e.g., when 0 V is the maximum, the minimum limit is a more negative voltage.

# SN75154

## QUADRUPLE LINE RECEIVER

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**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

| PARAMETER            |                                                           |                     | TEST FIGURE | TEST CONDITIONS                                  | MIN | TYP <sup>†</sup> | MAX | UNIT |
|----------------------|-----------------------------------------------------------|---------------------|-------------|--------------------------------------------------|-----|------------------|-----|------|
| V <sub>IT+</sub>     | Positive-going input threshold voltage                    | Normal operation    | 1           |                                                  | 0.8 | 2.2              | 3   | V    |
|                      |                                                           | Fail-safe operation |             |                                                  | 0.8 | 2.2              | 3   |      |
| V <sub>IT−</sub>     | Negative-going input threshold voltage                    | Normal operation    | 1           |                                                  | −3  | −1.1             | 0   | V    |
|                      |                                                           | Fail-safe operation |             |                                                  | 0.8 | 1.4              | 3   |      |
| V <sub>hys</sub>     | Hysteresis voltage (V <sub>IT+</sub> − V <sub>IT−</sub> ) | Normal operation    | 1           |                                                  | 0.8 | 3.3              | 6   | V    |
|                      |                                                           | Fail-safe operation |             |                                                  | 0   | 0.8              | 2.2 |      |
| V <sub>OH</sub>      | High-level output voltage                                 |                     | 1           | I <sub>OH</sub> = −400 μA                        | 2.4 | 3.5              |     | V    |
| V <sub>OL</sub>      | Low-level output voltage                                  |                     | 1           | I <sub>OL</sub> = 16 mA                          |     | 0.29             | 0.4 | V    |
| r <sub>i</sub>       | Input resistance                                          |                     | 2           | ΔV <sub>I</sub> = −25 V to −14 V                 | 3   | 5                | 7   | kΩ   |
|                      |                                                           |                     |             | ΔV <sub>I</sub> = −14 V to −3 V                  | 3   | 5                | 7   |      |
|                      |                                                           |                     |             | ΔV <sub>I</sub> = −3 V to 3 V                    | 3   | 6                | 8   |      |
|                      |                                                           |                     |             | ΔV <sub>I</sub> = 3 V to 14 V                    | 3   | 5                | 7   |      |
|                      |                                                           |                     |             | ΔV <sub>I</sub> = 14 V to 25 V                   | 3   | 5                | 7   |      |
| V <sub>I(open)</sub> | Open-circuit input voltage                                |                     | 3           | I <sub>I</sub> = 0                               | 0   | 0.2              | 2   | V    |
| I <sub>OS</sub>      | Short-circuit output current <sup>‡</sup>                 |                     | 4           | V <sub>CC1</sub> = 5.5 V, V <sub>I</sub> = −5 V  | −10 | −20              | −40 | mA   |
| I <sub>CC1</sub>     | Supply current from V <sub>CC1</sub>                      |                     | 5           | V <sub>CC1</sub> = 5.5 V, T <sub>A</sub> = 25°C  |     | 20               | 35  | mA   |
| I <sub>CC2</sub>     | Supply current from V <sub>CC2</sub>                      |                     |             | V <sub>CC2</sub> = 13.2 V, T <sub>A</sub> = 25°C |     | 23               | 40  |      |

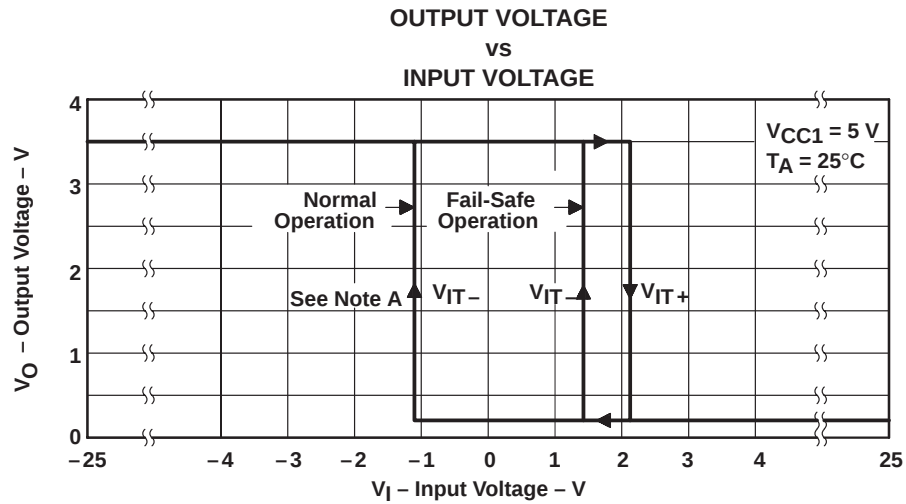
† All typical values are at  $V_{CC1} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

‡ Not more than one output should be shorted at a time.

**switching characteristics,  $V_{CC1} = 5 \text{ V}, T_A = 25^\circ\text{C}, N = 10$**

| PARAMETER |                                                   | TEST FIGURE | TEST CONDITIONS                         | MIN | TYP | MAX | UNIT |
|-----------|---------------------------------------------------|-------------|-----------------------------------------|-----|-----|-----|------|
| $t_{PLH}$ | Propagation delay time, low- to high-level output | 6           | $C_L = 50 \text{ pF}, R_L = 390 \Omega$ |     | 11  |     | ns   |
| $t_{PHL}$ | Propagation delay time, high- to low-level output |             |                                         |     | 8   |     | ns   |
| $t_{TLH}$ | Transition time, low- to high-level output        |             |                                         |     | 7   |     | ns   |
| $t_{THL}$ | Transition time, high- to low-level output        |             |                                         |     | 2.2 |     | ns   |

## TYPICAL CHARACTERISTICS



NOTE A: For normal operation, the threshold controls are connected to  $V_{CC1}$ . For fail-safe operation, the threshold controls are open.

Figure 1

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PARAMETER MEASUREMENT INFORMATION

dc test circuits†

| TEST TABLE                                                                  |                 |        |                  |                 |                  |                  |
|-----------------------------------------------------------------------------|-----------------|--------|------------------|-----------------|------------------|------------------|
| TEST                                                                        | MEASURE         | A      | T                | Y               | V <sub>CC1</sub> | V <sub>CC2</sub> |
| Open-circuit input (fail safe)                                              | V <sub>OH</sub> | Open   | Open             | I <sub>OH</sub> | 4.5 V            | Open             |
|                                                                             | V <sub>OH</sub> | Open   | Open             | I <sub>OH</sub> | Open             | 10.8 V           |
| V <sub>IT+</sub> min, V <sub>IT−</sub> min (fail safe)                      | V <sub>OH</sub> | 0.8 V  | Open             | I <sub>OH</sub> | 5.5 V            | Open             |
|                                                                             | V <sub>OH</sub> | 0.8 V  | Open             | I <sub>OH</sub> | Open             | 13.2 V           |
| V <sub>IT+</sub> min (normal)                                               | V <sub>OH</sub> | Note A | V <sub>CC1</sub> | I <sub>OH</sub> | 5.5 V and T      | Open             |
|                                                                             | V <sub>OH</sub> | Note A | V <sub>CC1</sub> | I <sub>OH</sub> | T                | 13.2 V           |
| V <sub>IL</sub> max, V <sub>IT+</sub> min (normal)                          | V <sub>OH</sub> | −3 V   | V <sub>CC1</sub> | I <sub>OH</sub> | 5.5 V and T      | Open             |
|                                                                             | V <sub>OH</sub> | −3 V   | V <sub>CC1</sub> | I <sub>OH</sub> | T                | 13.2 V           |
| V <sub>IH</sub> min, V <sub>IT+</sub> max, V <sub>IT−</sub> max (fail safe) | V <sub>OL</sub> | 3 V    | Open             | I <sub>OL</sub> | 4.5 V            | Open             |
|                                                                             | V <sub>OL</sub> | 3 V    | Open             | I <sub>OL</sub> | Open             | 10.8 V           |
| V <sub>IH</sub> min, V <sub>IT+</sub> max (normal)                          | V <sub>OL</sub> | 3 V    | V <sub>CC1</sub> | I <sub>OL</sub> | 4.5 V and T      | Open             |
|                                                                             | V <sub>OL</sub> | 3 V    | V <sub>CC1</sub> | I <sub>OL</sub> | T                | 10.8 V           |
| V <sub>IT−</sub> max (normal)                                               | V <sub>OL</sub> | Note B | V <sub>CC1</sub> | I <sub>OL</sub> | 5.5 V and T      | Open             |
|                                                                             | V <sub>OL</sub> | Note B | V <sub>CC1</sub> | I <sub>OL</sub> | T                | 13.2 V           |

NOTES: A. Momentarily apply −5 V, then 0.8 V.  
 B. Momentarily apply 5 V, then GND.

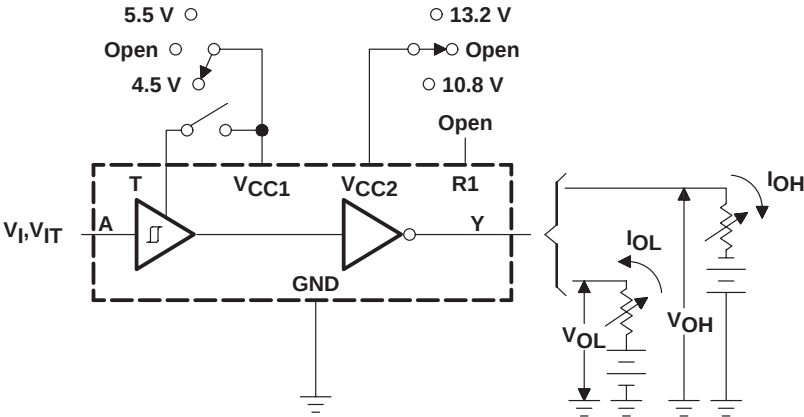


Figure 2. VIH, VIL, VIT+, VIT−, VOH, VOL

† Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

## PARAMETER MEASUREMENT INFORMATION

### dc test circuits<sup>†</sup> (continued)

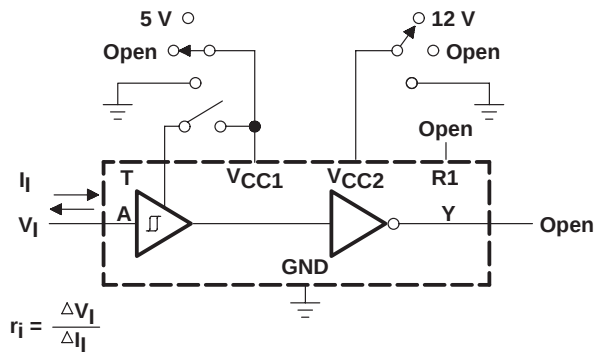


Figure 3. Input Resistance

TEST TABLE

| T                | V <sub>CC1</sub> | V <sub>CC2</sub> |
|------------------|------------------|------------------|
| Open             | 5 V              | Open             |
| Open             | GND              | Open             |
| Open             | Open             | Open             |
| V <sub>CC1</sub> | T and 5 V        | Open             |
| GND              | GND              | Open             |
| Open             | Open             | 12 V             |
| Open             | Open             | GND              |
| V <sub>CC1</sub> | T                | 12 V             |
| V <sub>CC1</sub> | T                | GND              |
| V <sub>CC1</sub> | T                | Open             |

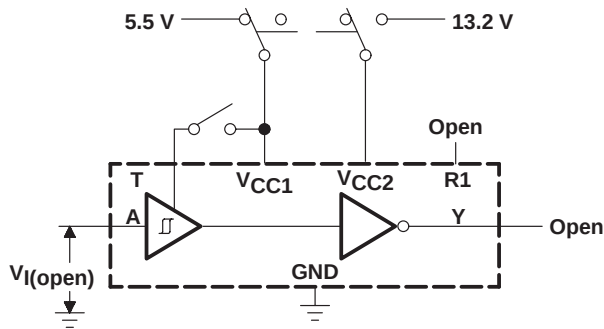
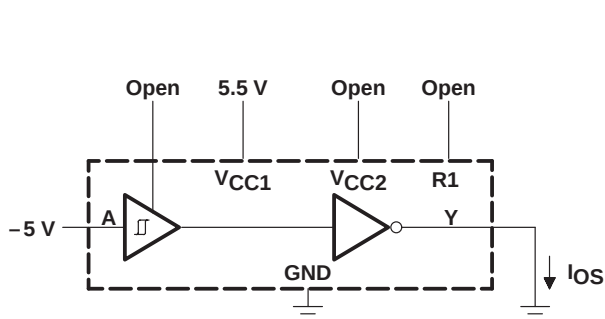


Figure 4. Input Voltage (Open)

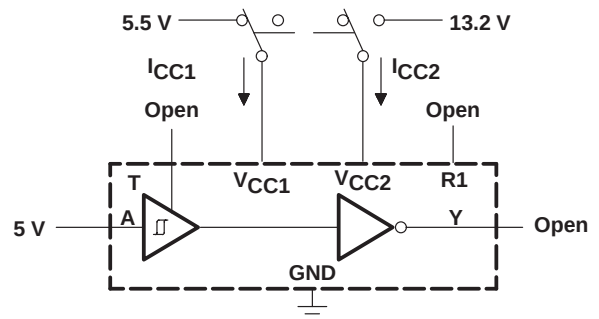
TEST TABLE

| T                | V <sub>CC1</sub> | V <sub>CC2</sub> |
|------------------|------------------|------------------|
| Open             | 5.5 V            | Open             |
| V <sub>CC1</sub> | 5.5 V            | Open             |
| Open             | Open             | 13.2 V           |
| V <sub>CC1</sub> | T                | 13.2 V           |



Each output is tested separately.

Figure 5. Output Short-Circuit Current



All four line receivers are tested simultaneously.

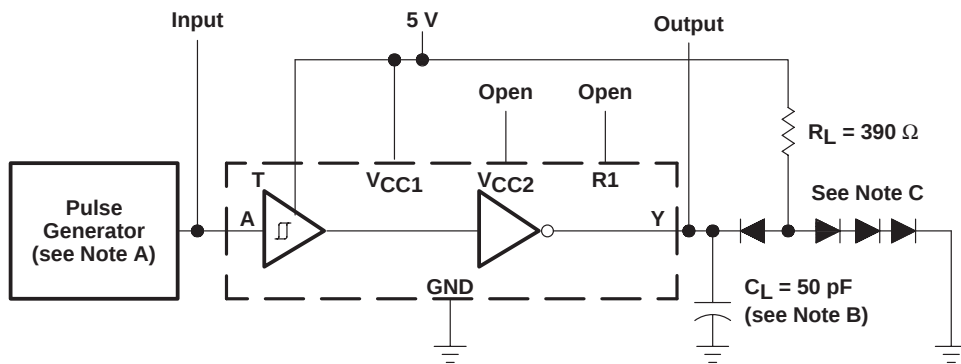
Figure 6. Supply Current

<sup>†</sup> Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

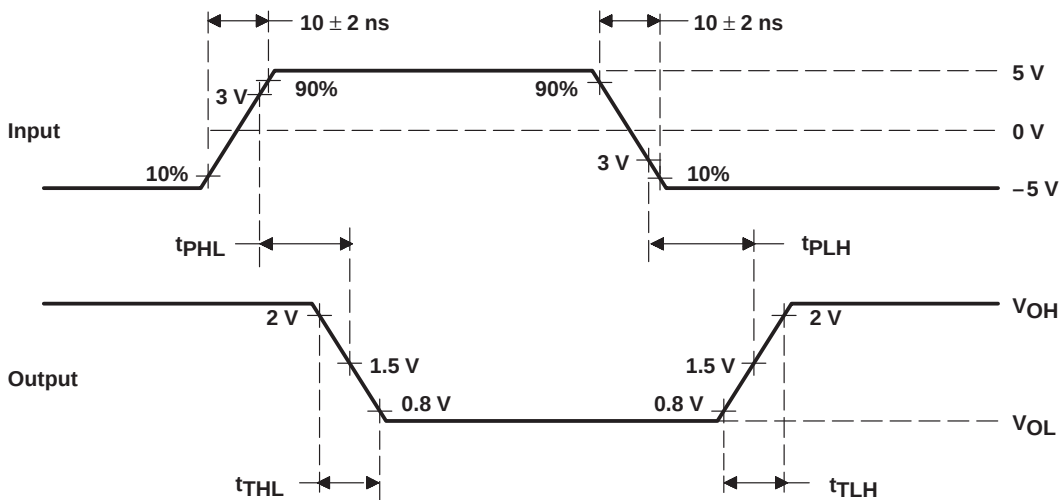
## QUADRUPLE LINE RECEIVER

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## PARAMETER MEASUREMENT INFORMATION



## TEST CIRCUIT



## VOLTAGE WAVEFORMS

NOTES: A. The pulse generator has the following characteristics:  $Z_O = 50 \, \Omega$ ,  $t_W \leq 200 \, \text{ns}$ , duty cycle  $\leq 20\%$ .  
B.  $C_L$  includes probe and jig capacitance.  
C. All diodes are 1N3064.

### Figure 6. Test Circuit and Voltage Waveforms

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