description

The SN75C189 and SN75C189A are low-power, bipolar, quadruple line receivers that are used to interface data terminal equipment (DTE) with data circuit-terminating equipment (DCE). These devices have been designed to conform to TIA/EIA-232-F.

The SN75C189 has a 0.33-V typical hysteresis, compared with 0.97 V for the SN75C189A. Each receiver has provision for adjustment of the overall input threshold levels. This is achieved by choosing external series resistors and voltages to provide bias levels for the response-control pins. The output is in the high logic state if the input is open circuit or shorted to ground.

These devices have an on-chip filter that rejects input pulses of less than 1-μs duration. An external capacitor can be connected from the control pins to ground to provide further input noise filtering for each receiver.

The SN75C189 and SN75C189A have been designed using low-power techniques in a bipolar technology. In most applications, these receivers interface to single inputs of peripheral devices such as UARTs, ACEs, or microprocessors. By using sampling, such peripheral devices usually are insensitive to the transition times of the input signals. If this is not the case, or for other uses, it is recommended that the SN75C189 and SN75C189A outputs be buffered by single Schmitt input gates or single gates of the HCMOS, ALS, or 74F logic families.

The SN75C189 and SN75C189A are characterized for operation from 0°C to 70°C.
SN75C189, SN75C189A
QUADRUPLE LOW-POWER LINE RECEIVERS

logic symbol†

logic symbol†

logic diagram (each receiver)

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

schematic of inputs and outputs

EQUIVALENT OF EACH INPUT‡

EQUIVALENT OF EACH OUTPUT

† All resistor values shown are nominal.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)§

Supply voltage, \( V_{CC} \) (see Note 1) .................................................. 7 V
Input voltage range, \( V_I \) .......................................................... –30 V to 30 V
Output voltage range, \( V_O \) .......................................................... –0.3 V to \( V_{CC} + 0.3 \) V
Package thermal impedance, \( \theta_{JA} \) (see Note 2): D package ......................... 88°C/W
DB package .............................................................. 96°C/W
N package .............................................................. 80°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds ....................... 260°C
Storage temperature range, \( T_{stg} \) ................................................. –65°C to 150°C

§ 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.

NOTES:
1. All voltages are with respect to network GND.
2. The package thermal impedance is calculated in accordance with JESD 51.
### Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nominal</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CC}$</td>
<td>5</td>
<td>4.5</td>
<td>6</td>
<td>V</td>
</tr>
<tr>
<td>$V_{I}$</td>
<td></td>
<td>-25</td>
<td>25</td>
<td>V</td>
</tr>
<tr>
<td>$I_{OH}$</td>
<td></td>
<td>-3.2</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>$I_{OL}$</td>
<td></td>
<td>3.2</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td>0</td>
<td>70</td>
<td>°C</td>
</tr>
</tbody>
</table>

**NOTE 3:** The algebraic convention, where the more positive (less negative) limit is designated as maximum, is used in this data sheet for logic levels only, e.g., if $-10\, \text{V}$ is a maximum, the typical value is a more negative voltage.

### Electrical Characteristics Over Recommended Free-Air Temperature Range, $V_{CC} = 5\, \text{V} \pm 10\%$ (unless otherwise noted) (see Note 4)

#### Parameters and Test Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{IT+}$</td>
<td>Positive-going input threshold voltage, $V_{CC} = 4.5, \text{V} \to 6, \text{V}$, $I_{OH} = 0, \text{mA}$</td>
<td>0.75</td>
<td>1.25</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$V_{IT-}$</td>
<td>Negative-going input threshold voltage, $V_{CC} = 4.5, \text{V} \to 6, \text{V}$, $I_{OH} = 0, \text{mA}$</td>
<td>0.75</td>
<td>1.25</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$V_{HYS}$</td>
<td>Input hysteresis voltage ($V_{IT+} - V_{IT-}$), $V_{CC} = 4.5, \text{V} \to 6, \text{V}$</td>
<td>0.15</td>
<td>0.33</td>
<td>0.65</td>
<td>V</td>
</tr>
<tr>
<td>$V_{OH}$</td>
<td>High-level output voltage, $V_{CC} = 5, \text{V} \pm 10%$, $V_{I} = 0.75, \text{V}$</td>
<td>3.5</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$V_{OL}$</td>
<td>Low-level output voltage, $V_{CC} = 5, \text{V} \pm 10%$, $I_{OL} = 3.2, \text{mA}$</td>
<td>0.4</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$I_{IH}$</td>
<td>High-level input current, $V_{I} = 25, \text{V}$</td>
<td>3.6</td>
<td>8.3</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>$I_{IL}$</td>
<td>Low-level input current, $V_{I} = -25, \text{V}$</td>
<td>-3.6</td>
<td>-8.3</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>$I_{OS}$</td>
<td>Short-circuit output current, $V_{I} = 5, \text{V}$</td>
<td>-35</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>$I_{CC}$</td>
<td>Supply current, $V_{I} = 5, \text{V}$</td>
<td>420</td>
<td>700</td>
<td></td>
<td>μA</td>
</tr>
</tbody>
</table>

**NOTE 4:** All characteristics are measured with response-control terminal open.

### Switching Characteristics, $V_{CC} = 5\, \text{V} \pm 10\%$, $T_{A} = 25\, \text{°C}$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t_{PLH}$</td>
<td>Propagation delay time, low- to high-level output, $R_{L} = 5, \text{kΩ}$, $C_{L} = 50, \text{pF}$</td>
<td>6</td>
<td></td>
<td>6</td>
<td>μs</td>
</tr>
<tr>
<td>$t_{PHL}$</td>
<td>Propagation delay time, high- to low-level output</td>
<td>6</td>
<td></td>
<td>6</td>
<td>μs</td>
</tr>
<tr>
<td>$t_{TLH}$</td>
<td>Transition time, low- to high-level output$\dagger$</td>
<td>$500, \text{ns}$</td>
<td>$300, \text{ns}$</td>
<td>$1, \text{μs}$</td>
<td>$6, \text{μs}$</td>
</tr>
<tr>
<td>$t_{THL}$</td>
<td>Transition time, high- to low-level output$\dagger$</td>
<td>$500, \text{ns}$</td>
<td>$300, \text{ns}$</td>
<td>$1, \text{μs}$</td>
<td>$6, \text{μs}$</td>
</tr>
<tr>
<td>$t_{w(N)}$</td>
<td>Duration of longest pulse rejected as noise$\ddagger$</td>
<td>$6, \text{μs}$</td>
<td></td>
<td></td>
<td>$1, \text{μs}$</td>
</tr>
</tbody>
</table>

$\dagger$ Measured between 10% and 90% points of output waveform

$\ddagger$ The receiver ignores any positive- or negative-going pulse that is less than the minimum value of $t_{w(N)}$ and accepts any positive- or negative-going pulse greater than the maximum of $t_{w(N)}$.
PARAMETER MEASUREMENT INFORMATION

NOTE A: Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

Figure 1. $V_T^+$, $V_{IT^-}$, $V_{OH}$, $V_{OL}$

NOTE A: Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

Figure 2. $I_{IH}$, $I_{IL}$, $I_{CC}$

NOTE A: Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

Figure 3. $I_{OS}$
PARAMETER MEASUREMENT INFORMATION

TEST CIRCUIT

VOLTAGE WAVEFORMS

NOTES:  
A.  $C_L$ includes probe and jig capacitances.  
B.  The pulse generator has the following characteristics: $Z_O = 50 \, \Omega$, $t_w = 25 \, \mu s$.

Figure 4. Test Circuit and Voltage Waveforms
TYPICAL CHARACTERISTICS

SN75C189
INPUT THRESHOLD VOLTAGE (POSITIVE GOING) vs FREE-AIR TEMPERATURE

VCC = 5.5 V

VIT+ = 1.1 – 1.5 V

Figure 5

SN75C189A
INPUT THRESHOLD VOLTAGE (POSITIVE GOING) vs FREE-AIR TEMPERATURE

VCC = 5.5 V

VIT+ = 1.4 – 2.2 V

Figure 6

SN75C189
INPUT THRESHOLD VOLTAGE (NEGATIVE GOING) vs FREE-AIR TEMPERATURE

VCC = 5.5 V

VIT– = 0.8 – 1.2 V

Figure 7

SN75C189A
INPUT THRESHOLD VOLTAGE (NEGATIVE GOING) vs FREE-AIR TEMPERATURE

VCC = 5.5 V

VIT– = 0.85 – 1.5 V

Figure 8
TYPICAL CHARACTERISTICS

**SN75C189**

**INPUT HYSTERESIS**

*vs FREE-AIR TEMPERATURE*

- **Figure 9**
  - $V_{\text{CC}} = 5 \text{ V}$
  - $V_{\text{hys}}$ vs $T_A$ (Free-Air Temperature in °C)

**SN75C189A**

**INPUT HYSTERESIS**

*vs FREE-AIR TEMPERATURE*

- **Figure 10**
  - $V_{\text{CC}} = 5 \text{ V}$
  - $V_{\text{hys}}$ vs $T_A$ (Free-Air Temperature in °C)

**HIGH-LEVEL OUTPUT VOLTAGE**

*vs FREE-AIR TEMPERATURE*

- **Figure 11**
  - $V_{\text{CC}} = 4.5 \text{ V}$
  - $I_{\text{OH}} = -3.2 \text{ mA}$
  - $V_I = 0.75 \text{ V}$
  - $V_{\text{OH}}$ vs $T_A$ (Free-Air Temperature in °C)

**LOW-LEVEL OUTPUT VOLTAGE**

*vs FREE-AIR TEMPERATURE*

- **Figure 12**
  - $V_{\text{CC}} = 4.5 \text{ V}$
  - $I_{\text{OH}} = -3.2 \text{ mA}$
  - $V_I = 3 \text{ V}$
  - $V_{\text{OL}}$ vs $T_A$ (Free-Air Temperature in °C)
TYPICAL CHARACTERISTICS

**SN75C189**
HIGH-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE

\[ V_{CC} = 4.5 \text{ V} \]
\[ V_{I} = 3 \text{ V} \]

- \[ I_{H} = \text{High-Level Input Current} \text{ mA} \]

![Figure 13](image1.png)

**SN75C189A**
HIGH-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE

\[ V_{CC} = 4.5 \text{ V} \]
\[ V_{I} = 3 \text{ V} \]

- \[ I_{H} = \text{High-Level Input Current} \text{ mA} \]

![Figure 14](image2.png)

**SN75C189**
LOW-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE

\[ V_{CC} = 4.5 \text{ V} \]
\[ V_{I} = 3 \text{ V} \]

- \[ I_{L} = \text{Low-Level Input Current} \text{ mA} \]

![Figure 15](image3.png)

**SN75C189A**
LOW-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE

\[ V_{CC} = 4.5 \text{ V} \]
\[ V_{I} = 3 \text{ V} \]

- \[ I_{L} = \text{Low-Level Input Current} \text{ mA} \]

![Figure 16](image4.png)
TYPICAL CHARACTERISTICS

HIGH-LEVEL SHORT-CIRCUIT OUTPUT CURRENT vs FREE-AIR TEMPERATURE

LOW-LEVEL SHORT-CIRCUIT OUTPUT CURRENT vs FREE-AIR TEMPERATURE

SUPPLY CURRENT vs FREE-AIR TEMPERATURE

PROPAGATION DELAY TIME, LOW-TO HIGH-LEVEL OUTPUT vs FREE-AIR TEMPERATURE

Figure 17

Figure 18

Figure 19

Figure 20
Figure 21
PROPAGATION DELAY TIME,
HIGH-TO LOW-LEVEL OUTPUT

VCC = 4.5 V
CL = 50 pF

Figure 22
TRANSITION TIME,
LOW-TO HIGH-LEVEL OUTPUT

VCC = 4.5 V
CL = 50 pF

Figure 23
TRANSITION TIME,
HIGH-TO LOW-LEVEL OUTPUT

VCC = 4.5 V
CL = 50 pF
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