SIGNAL LEVEL SENSOR SYSTEM

### GENERAL DESCRIPTION

The NJU7181 is a signal level sensor system IC. It sends a High flag to the microprocessor or other equipments whenever it detects the existence of the audio signal.

The **NJU7181** includes a delay circuit which allows the IC continue to hold the flag after the absence of the audio signal. This holding time can be adjusted with external capacitor.

Together with its adjustable Input Sensitivity *(by external resistor)* & its characteristic of low current consumption and low operating voltage, **NJU7181** is suitable for Eco-Design of Energy-using Products and for battery operated applications.

### FEATURES

- Operating Voltage: 0.9 to 5.5V
- Low Operating Current: 55μA typ.
- Delay circuit for long Recovery time
- Adjustable Recovery time by external capacitor
- Adjustable Input Sensitivity by external resistance
- C-MOS Technology
- Package Outline: MSOP8 (TVSP8)*

*MEET JEDEC MO-187-DA / THIN TYPE

### APPLICATIONS

- Power Saving for battery operated devices
- Muting Application
- Memory saving for recording devices
- Half- duplex transmission application

### BLOCK DIAGRAM

![Block Diagram](image-url)
PIN CONFIGURATION

### MSOP8 (TVSP8)

<table>
<thead>
<tr>
<th>No.</th>
<th>Symbol</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IN</td>
<td>AC Input</td>
</tr>
<tr>
<td>2</td>
<td>AMP_OUT</td>
<td>Amplifier Output</td>
</tr>
<tr>
<td>3</td>
<td>TRIN</td>
<td>External Trigger Input</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>5</td>
<td>CAP_D</td>
<td>Delay Time Capacitor</td>
</tr>
<tr>
<td>6</td>
<td>RES_D</td>
<td>Delay Time Resister</td>
</tr>
<tr>
<td>7</td>
<td>OUT</td>
<td>DC Output</td>
</tr>
<tr>
<td>8</td>
<td>V'</td>
<td>Supply Voltage</td>
</tr>
</tbody>
</table>

### ESON8

Surface Backside
## ABSOLUTE MAXIMUM RATING (Ta=25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>RATING</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>V⁺</td>
<td>+7 V</td>
<td></td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>P_D</td>
<td>MSOP8 (TVSP8): 470 (Note1) ESON8: 450</td>
<td>mW</td>
</tr>
<tr>
<td>Maximum Input Voltage</td>
<td>V_{MAX}</td>
<td>0 ~ V⁺ (Note2)</td>
<td>V</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>Topr</td>
<td>-40 ~ +85°C</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>Tstg</td>
<td>-40 ~ +125°C</td>
<td>°C</td>
</tr>
</tbody>
</table>

(Note1) EIA/JEDEC STANDARD Test board (76.2x114.3x1.6mm, 2layer, FR-4) mounting  
(Note2) Don’t put Input Voltage more than Power Supply Voltage.

## ELECTRICAL CHARACTERISTICS

(Ta=25°C, V⁺=3V, R₁=10kΩ, R₂=100kΩ, R₃=220kΩ, Cᵣ=10nF)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITION</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>V⁺</td>
<td></td>
<td>0.9</td>
<td>-</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Operating Current</td>
<td>I_DD</td>
<td>No signal, Rₖ=∞</td>
<td>-</td>
<td>55</td>
<td>100</td>
<td>µA</td>
</tr>
<tr>
<td>Input Sensitivity</td>
<td>V_{INS}</td>
<td>f=1kHz</td>
<td>-45</td>
<td>-41.5</td>
<td>-38</td>
<td>dBV</td>
</tr>
<tr>
<td>Delay Time 1</td>
<td>T_{delay1}</td>
<td></td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>Sec</td>
</tr>
<tr>
<td>Delay Time 2</td>
<td>T_{delay2}</td>
<td>V⁺=0.9V</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>Sec</td>
</tr>
<tr>
<td>Delay Time 3</td>
<td>T_{delay3}</td>
<td>Cᵣ=10µF</td>
<td>-</td>
<td>1,500</td>
<td>-</td>
<td>Sec</td>
</tr>
</tbody>
</table>

## DC CHARACTERISTICS

### DC Output Terminal (7pin)  
(Ta=25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITION</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Level Output Voltage</td>
<td>V_{OH}</td>
<td>I_{SOURCE}=1mA</td>
<td>V⁺-0.2</td>
<td>-</td>
<td>V⁺</td>
<td>V</td>
</tr>
<tr>
<td>Low Level Output Voltage</td>
<td>V_{OL}</td>
<td>I_{SINK}=1mA</td>
<td>0</td>
<td>-</td>
<td>0.2</td>
<td>V</td>
</tr>
</tbody>
</table>

### External Trigger Switch Terminal (3pin)  
(Ta=25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITION</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Level Input Voltage</td>
<td>V_{IH}</td>
<td></td>
<td>V⁺-0.2</td>
<td>-</td>
<td>V⁺</td>
<td>V</td>
</tr>
<tr>
<td>Low Level Input Voltage</td>
<td>V_{IL}</td>
<td></td>
<td>0</td>
<td>-</td>
<td>0.2</td>
<td>V</td>
</tr>
</tbody>
</table>
APPLICATION CIRCUIT

Audio Signal Input

Main Path

External Trigger

Level Detector

Delay

Latch

DC Output

High or Low DC voltage information (to Micro Processor, etc)

Input sensitivity (Detection level)

Delay Time (Adjustable from a few seconds to a few minutes by C0)

Audio Signal Input

Low

High

Low

DC Output (NJU7181)
Attack Time:

Note:

Supply De-coupling capacitor has to be placed near IC (especially when IC socket is being used).

Feedback Capacitor is required to prevent the possibility of oscillation in the input stage.
**APPLICATION NOTE**

- **DC Output Waveform Scenario**

  **Scenario 1: Power-ON**
  - Output will be high initially when NJU7181 is first powered up even if there is no input signal detected.

  ![Power-ON Diagram]

  **Scenario 2: Only Audio Signal detected**
  - Output will be or maintain high when *either an input signal or trigger signal is detected*. The delay circuit will only be activated *when both signals is not present*. NJU7181 will then hold the output level for a delay time which can be adjusted by the Capacitor value @ pin 5.

  ![Audio Signal Diagram]
**Scenario 3:** Trigger Signal detected (Case 1)
- Output will be or maintain high when either an input signal or trigger signal is detected. The delay circuit will only be activated when both signals is not present. Output is set to Low state when a delay time passes. Output is set to High state when either an input signal or trigger signal is detected again.

![Case 1: Trigger signal present (After output LOW)](image)

**Scenario 4:** Trigger Signal detected (Case 2)
- Output will be or maintain high when either an input signal or trigger signal is detected. When hold time is shorter than a delay time, output maintains High state (Counter RESET). NJU7181 will then hold the output level for a delay time which can be adjusted by the Capacitor value @ pin 5.

![Case 2: Trigger signal present (During output HIGH)](image)
◆ Input Sensitivity [Ta =25°C]
The input sensitivity is defined as follows.

\[ V_{INS}=20\log\left(\frac{R1}{R2}\right) - 21.5 \text{ [dBV]} \quad (1) \]

Note) The input sensitivity recommends the setting of -60dBV (1mVrms) or more.
Note) The R2 value should be 100kΩ or more.

◆ Frequency Response
The input capacitor “Ci” forms HPF with “R1”. The cut-off frequency is defined as follows. Please decide C1 value in consideration of the frequency response necessary for the signal-detecting.

\[ f_c=\frac{1}{(2\pi \times C_i \times R_1)} \text{ [Hz]} \quad (2) \]

◆ Delay time [With R_D = 220Kohm]
The Recovery time is defined as follows.

\[ T_{delay}=1.5 \times 10^8 \times C_R \text{ [sec]} \quad (3) \]
## TERMINAL DESCRIPTION

<table>
<thead>
<tr>
<th>Terminal</th>
<th>SYMBOL</th>
<th>FUNCTION</th>
<th>EQUIVALENT CIRCUIT</th>
<th>VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IN</td>
<td>AC Input</td>
<td><img src="image" alt="Equivalent Circuit 1" /></td>
<td>0.3V</td>
</tr>
<tr>
<td>2</td>
<td>AMP_OUT</td>
<td>Amplifier Output</td>
<td><img src="image" alt="Equivalent Circuit 2" /></td>
<td>0.3V</td>
</tr>
<tr>
<td>3</td>
<td>TRIN</td>
<td>External Trigger Input</td>
<td><img src="image" alt="Equivalent Circuit 3" /></td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>CAP_D</td>
<td>Delay Time Capacitor</td>
<td><img src="image" alt="Equivalent Circuit 4" /></td>
<td>0V</td>
</tr>
</tbody>
</table>
### TERMINAL DESCRIPTION

<table>
<thead>
<tr>
<th>Terminal</th>
<th>SYMBOL</th>
<th>FUNCTION</th>
<th>EQUIVALENT CIRCUIT</th>
<th>VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>RES_D</td>
<td>Delay Time Resistor</td>
<td><img src="image" alt="Resistor Circuit" /></td>
<td>3μA x R_D</td>
</tr>
<tr>
<td>7</td>
<td>OUT</td>
<td>DC Output</td>
<td><img src="image" alt="Diode Circuit" /></td>
<td>0 or V^+</td>
</tr>
<tr>
<td>8</td>
<td>V^+</td>
<td>Supply Voltage</td>
<td><img src="image" alt="Input Buffer Circuit" /></td>
<td>V^+</td>
</tr>
</tbody>
</table>
**TYPICAL CHARACTERISTICS**

**Operating Current Vs Operating Voltage**

*Cd = 10nF, Rd = 220kΩ, No Input*

**Operating Current Vs Temperature**

*VDD = 3V, Cd = 10nF, Rd = 220kΩ, No Input*

**Output Voltage Vs Output Current Source**

*VDD = 3V, Ta = 25°C, Cd = 10nF, Rd = 220kΩ, Output = High*

**Output Voltage Vs Output Current Sink**

*VDD = 3V, Ta = 25°C, Cd = 10nF, Rd = 220kΩ, Output = High*

**Output Voltage Vs Temperature**

*VDD = 3V, Cd = 10nF, Rd = 220kΩ, Output = High, Current Source = 1mA*

**Output Voltage Vs Temperature**

*VDD = 3V, Cd = 10nF, Rd = 220kΩ, Output = High, Current Sink = 1mA*
TYPICAL CHARACTERISTICS

Input Sensitivity Vs Temperature
VDD = 3V, Cd = 10nF, Rd = 220kΩ, R1=10kΩ, R2=100kΩ

Input Sensitivity Vs Supply Voltage
VDD = 3V, Ta = 25°C, Cd = 10nF, Rd = 220kΩ, R1=10kΩ, R2=100kΩ

Delay Time Vs Capacitor
VDD = 3V, Ta = 25°C, Rd = 220kΩ, R1=10kΩ, R2=100kΩ

Gain vs Frequency
VDD = 3V, Ta = 25°C, Cd = 10nF, Rd = 220kΩ, Measure @ pin 2 (AMP_OUT)

[CAUTION]
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