

Digital Audio Delay

General Description

The NJU26901 is a digital audio delay. The NJU26901 provides delay-time adjustment function and digital audio interface.

Package



NJU26901M

FEATURES

- 2-Channel Audio Delay (24 bits data width).
Delay Time 85msec at fs = 48kHz (128msec at fs = 32kHz , 43msec at fs = 96kHz)
- 4 delay time modes($\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 max. delay) are selectable without a micro-computer.
- To make long delay time, the NJU26901 can be connected serially.
- Non-audio-signal data can be delayed by the NJU26901.

Hardware Specification

- Digital Audio Interface : 1 Input port / 1 Output port
- Digital Audio Format : I²S 24bit BCK : 64fs, Slave Mode
- Audio Bit Clock (BCK) Frequency : 13MHz Max (approximate fs=200KHz)
- Package : DMP8 (Pb-Free)
- Power Supply : 2.5V (+3.3V input tolerant)

Function Block Diagram

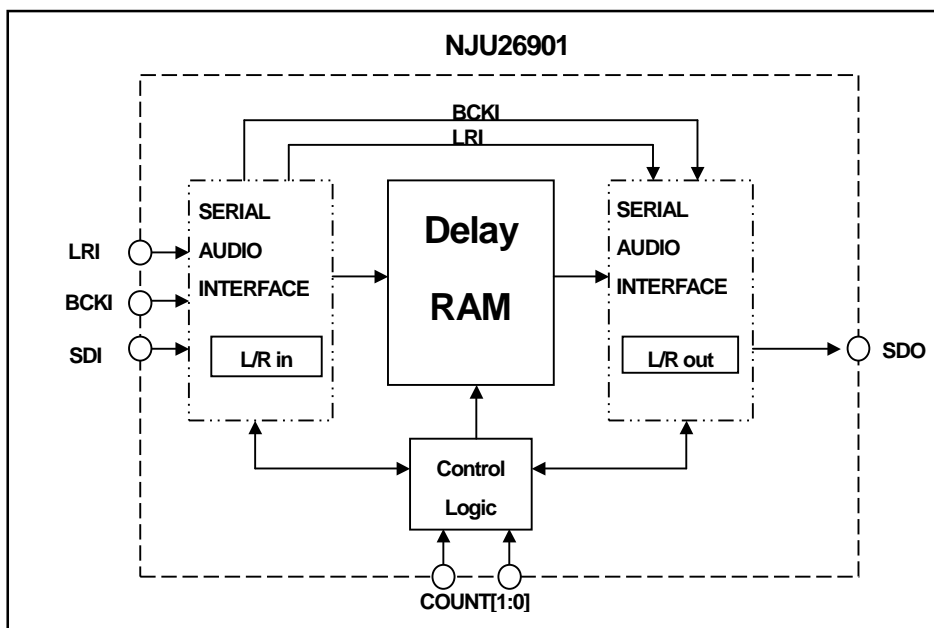


Fig. 1 Function Block Diagram

Pin Assignment

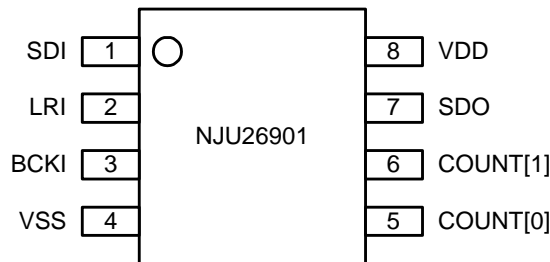


Fig. 2 Pin Assignment

Pin Description

Table 1 Pin Description

Pin No.	Symbol	I/O	Description
1	SDI	I	Audio Data Input
2	LRI	I	LR Clock Input
3	BCKI	I	Bit Clock Input
4	VSS	-	GND
5	COUNT[0]	Ipu	Delay Time Control 0
6	COUNT[1]	Ipu	Delay Time Control 1
7	SDO	O	Audio Data Output
8	VDD	-	Power Supply +2.5V

I : Input

Ipu : Input(internal pull-up)

O : Output

Absolute Maximum Ratings

Table 2 Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Power Supply Voltage	V_{DD}	-0.3 to +3.05	V
Input Pin Voltage	V_{TMI}	-0.3 to +3.6 ($V_{DD} \geq 2.25V$) -0.3 to +3.05 ($V_{DD} < 2.25V$)	V
Power Dissipation	P_D	100	mW
Operating Temperature	T_{OPR}	-40 to +85	°C
Storage Temperature	T_{STR}	-40 to +125	°C

■ Electric Characteristics

Table 3 Electric Characteristics

($V_{DD}=2.5V, T_a=25^{\circ}C$)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Units
Operating V_{DD} Voltage	V_{DD}		2.25	2.5	2.75	V
Operating Current	I_{DD}	BCKI:13MHz SDO:C _L =25pF	-	1.0	-	mA
Operating Temperature	T_{OPR}		-40	25	85	°C
High Level Input Voltage	V_{IH}		2.0	-	3.3	V
Low Level Input Voltage	V_{IL}		-	-	0.5	V
High Level Output Voltage	V_{OH}	$I_{OH} = -2mA$ $I_{OH} = -100\mu A$	$V_{DD}-0.4$ $V_{DD}-0.1$	-	-	V
Low Level Output Voltage	V_{OL}	$I_{OL} = 2mA$ $I_{OL} = 100\mu A$	-	-	0.4 0.1	V
Input Current	I_{IN}	$V_{IN} = V_{SS}$ to 3.6V	-15	-	+15	μA
Input Current	$I_{IN(PU)}$	$V_{IN} = V_{SS}$ to 3.6V	-100	-	+15	μA
Input Capacitance	C_{IN}		-	10	-	pF
Input Rise/Fall transition Time	t_r / t_f		-	-	100	ns

■ Equivalent Circuit

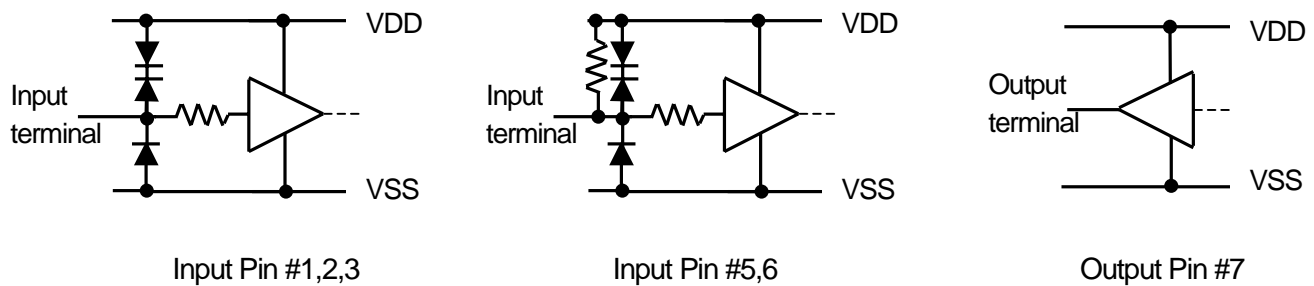


Fig. 3 Input Terminal Equivalent Circuit

Serial Audio Timing

Table 4 Serial Audio Input Timing Parameters

Parameter	Symbol	Test Condition	Min	Typ.	Max	Units
BCKI Frequency	f_{BCK}		-	-	13	MHz
BCKI Period						
L Pulse Width	t_{SIL}		35	-	-	ns
H Pulse Width	t_{SIH}		35	-	-	ns
BCKI to LRI Time	T_{SLI}		15	-	-	ns
LRI to BCKI Time	t_{LSI}		15	-	-	ns
Data Setup Time	t_{DS}		15	-	-	ns
Data Hold Time	t_{DH}		15	-	-	ns
Data Output Delay	t_{DOD}	SDO=25pF		-	15	ns

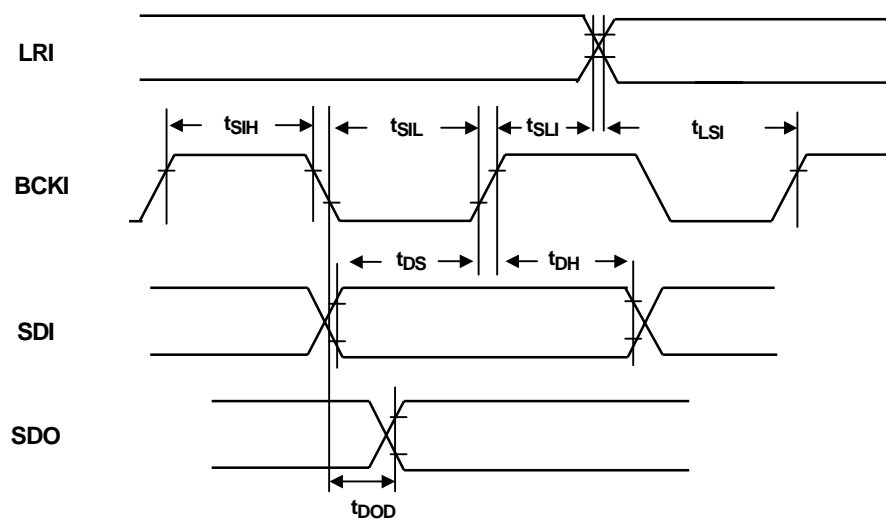


Fig. 4 Serial Audio Input / Output Timing

Serial Audio Interface

Digital Audio format is I²S 24bit 64fs in fig. 5. The input and output format are the same I²S 24bit 64fs.

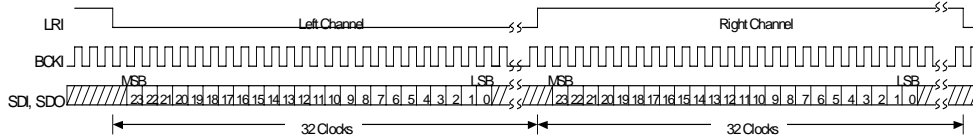


Fig 5 Digital Audio Format (I²S 24bits 64fs)

Function Description

- SDI(#1) is serial audio input pin. The input audio data should be connected to this pin. The NJU26901 fetches in the input audio data every LRI edge.
- LRI(#2) is LR clock input pin. This LR clock frequency is the same frequency of the input audio signal. LRI="Low" shows SDI and SDO data are left channel data. LRI="High" shows SDI and SDO data are right channel data.
- BCKI(#3) is bit clock input pin. This BCKI clock frequency is 64 times as large as the input audio signal.
- SDO(#7) is serial audio output pin. The delayed audio data come out through this pin.
- VDD(#8) is 2.5V power supply pin. VSS(#4) is GND pin. The decoupling capacitor is necessary between VDD and VSS.
- The input pins can interface to 3.3V ICs. The output pins can interface to 2.5V ICs. Refer to table3 "Electric Characteristics".
- After Power-on RESET, there is possibility the NJU26901 generates random data for the delay time period set by COUNT[0],[1] pins. If necessary, the mute circuit should be added.

Delay Time

- The NJU26901 provides maximum 4097 samples delay and slave-mode audio interface. The delay time depends on sampling frequency.
- Delay time is controlled by COUNT[0], COUNT[1]. Table 5 shows Delay Time vs Sampling Frequency.
- Detail delay time is evaluated by the following formula.

$$\text{Delay time} = \{1/(fs)\} \times (\text{sampling number} + 1) \quad [\text{sec}]$$
- The sampling number is incremented every LRI clock.

Table 5 Delay Time vs Sampling Frequency

Sampling Frequency (fs)	4/4 (COUNT[1:0]=11)	3/4 (COUNT[1:0]=01)	1/2 (COUNT[1:0]= 10)	1/4 (COUNT[1:0]= 00)
192KHz	21ms	16ms	11ms	5ms
96KHz	43ms	32ms	21ms	11ms
88.2KHz	47ms	35ms	23ms	12ms
48KHz	85ms	64ms	43ms	21ms
44.1KHz	93ms	69ms	46ms	23ms
32KHz	128ms	96ms	64ms	32ms
Sampling number	(4097)	(3073)	(2049)	(1025)

Change Delay Time Setting

The delay-time is set by COUNT[0],[1]. The delay-time can be changed during the NJU26901 operation. In case the delay-time setting is changed, the NJU26901 sets up the new delay-time and initializes itself again within 2 BCKI rising edge.

After setting the new delay-time, the NJU26901 holds SDO low-level, mute, during the new delay-time period. After mute, the audio data come out through SDO.

The NJU26901 discards the input data which come during new delay-time setting period.

Application block diagram

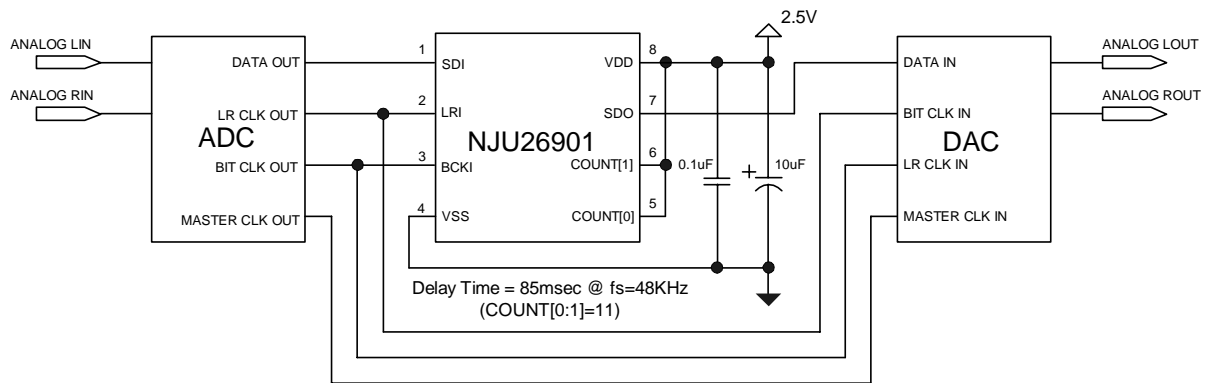
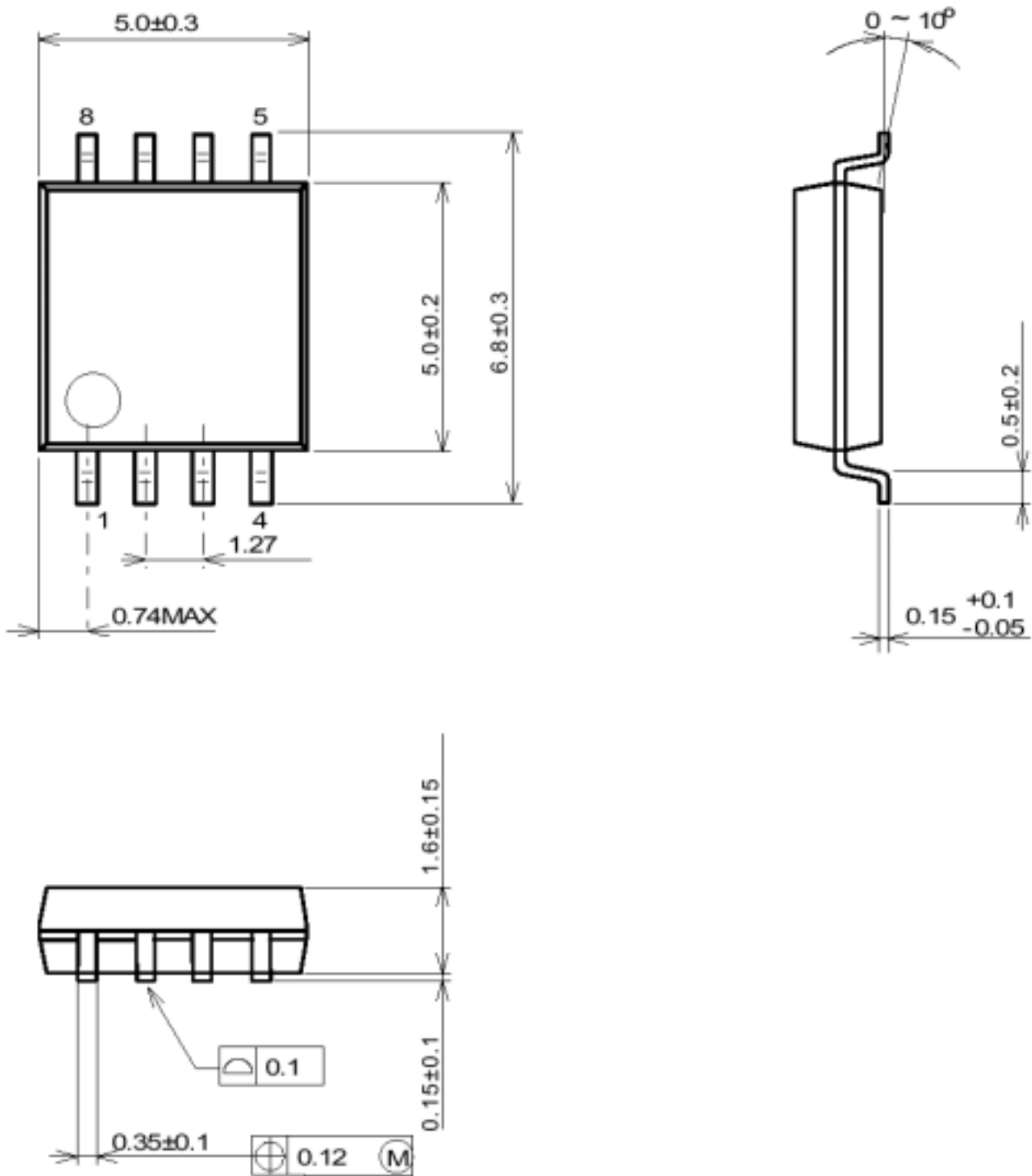


Fig. 6 Application Block Diagram

■ Package Dimensions (EMP8, Pb-Free)



UNIT : mm

Fig. 7 Package Dimensions

[CAUTION]
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