

## 2V Operation Clock-less Switching Driver for Class D Amplifier

### ■ GENERAL DESCRIPTION

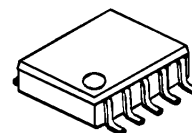
The **NJU8710** is a 2V operation clock-less switching driver for a class D Amplifier with separated power supply between Input and Output.

The **NJU8710** provides powerful drivability in both of sink and source without flow-through current. Therefore, it can be used to the buffer or the switch as a driver IC.

Furthermore it converts 1bit digital signal input, such as PWM or PDM signal, to analog signal output of the hi-fi audio level through a simple external LC low-pass filter.

The **NJU8710** realizes very high power-efficiency because of the class D operation and low voltage operation. Therefore, it is suitable for battery powered applications and others.

### ■ PACKAGE OUTLINE

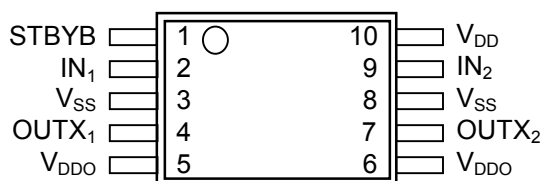


NJU8710R

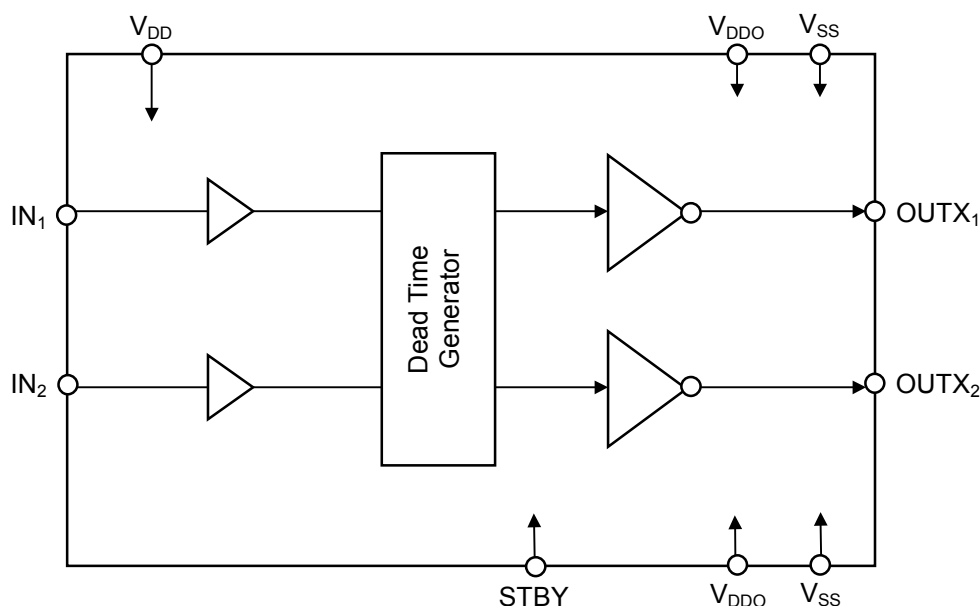
### ■ FEATURES

- 2-channel 1bit Digital Signal Input
- Standby(Hi-Z) Control function
- Operating Voltage : 1.7V to 2.7V
- Driving Voltage : 1.7V to  $V_{DD}$
- CMOS Technology
- Package Outline : VSP10

### ■ PIN CONFIGURATION



### ■ BLOCK DIAGRAM



## ■ TERMINAL DESCRIPTION

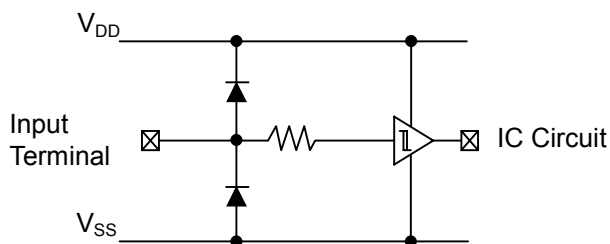
No.	SYMBOL	I/O	Function
10	$V_{DD}$	–	Power Supply: $V_{DD}=2V$
5 6	$V_{DDO}$	–	Output Power Supply: $V_{DDO}=2V$
3 8	$V_{SS}$	–	Power GND and Output GND terminal: $V_{SS}=0V$
2 9	$IN_1$ $IN_2$	I	1-bit Data Input Terminal
4 7	$OUTX_1$ $OUTX_2$	O	Output Terminal $OUTX_1$ terminal outputs the inverted signal of $IN_1$ terminal, $OUTX_2$ terminal outputs the inverted signal of $IN_2$ terminal.
1	STBYB	I	Standby Control Terminal (L:Standby)

\* $V_{SS}$ (Terminal No.3,8) should be connected at a nearest point to the IC.

\* $V_{DDO}$ (Terminal No.5,6) should be connected at a nearest point to the IC.

\*STBYB(Terminal No.1) must be connected to  $V_{DD}$ , when this function is not used.

## ■ INPUT TERMINAL STRUCTURE



## ■ FUNCTIONAL DESCRIPTION

### (1) Signal Output ( $OUTX_1$ , $OUTX_2$ Terminal)

Output signal becomes a inverted input signal. A flow-through current at the signal polarity transition doesn't generate by optimized dead time control circuit. Output signal is converted to analog signal via external 2nd-order or higher LC filter.

A switching regulator with a high response against a voltage fluctuation is the best selection for the  $V_{DDO}$ , which is the power supply for output drivers. To obtain better T.H.D. performance, the stabilization of the power is required.

### (2) Standby Control Function

By setting the STBYB terminal to "L", the **NJU8710** becomes standby condition. During standby condition,  $OUTX_1$  and  $OUTX_2$  are in Hi-Z.

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>DD</sub>	-0.3 to +4.0	V
	V <sub>DDO</sub>	-0.3 to +2.7	V
Input Voltage	V <sub>in</sub>	-0.3 to V <sub>DD</sub> +0.3	V
Operating Temperature	T <sub>opr</sub>	-40 to +85	°C
Storage Temperature	T <sub>stg</sub>	-40 to +125	°C
Power Dissipation	VSP10 P <sub>D</sub>	450*	mW
Power Supply Voltage Condition	-	V <sub>DD</sub> ≥ V <sub>DDO</sub>	V

\* : Mounted on two-layer board of based on the JEDEC.

Note 1) All voltage values are specified as V<sub>SS</sub>=0V.

Note 2) If the LSI is used on condition beyond the absolute maximum rating, the LSI may be destroyed. Using LSI within electrical characteristics is strongly recommended for normal operation. Use beyond the electrical characteristics conditions will cause malfunction and poor reliability.

Note 3) De-coupling capacitors should be connected between V<sub>DD</sub>-V<sub>SS</sub> and V<sub>DDO</sub>-V<sub>SS</sub> due to the stabilized operation.

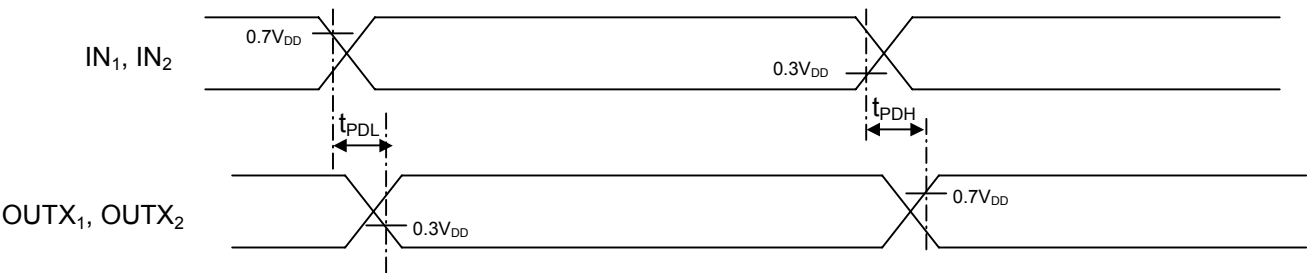
## ■ ELECTRICAL CHARACTERISTICS

(Ta=25°C, V<sub>DD</sub>=V<sub>DDO</sub>=2.0V, V<sub>SS</sub>=0.0V, unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V <sub>DD</sub> Supply Voltage	V <sub>DD</sub>		1.7	2.0	2.7	V
V <sub>DDO</sub> Supply Voltage	V <sub>DDO</sub>		1.7	2.0	V <sub>DD</sub>	V
Output Driver High side Resistance	R <sub>H</sub>	V <sub>OUT</sub> =V <sub>DDO</sub> -0.1V	-	1.5	2	Ω
Output Driver Low side Resistance	R <sub>L</sub>	V <sub>OUT</sub> =0.1V	-	1.5	2	Ω
Operating Current at Hi-Z Output	I <sub>ST</sub>	IN <sub>1</sub> , IN <sub>2</sub> , STBYB="L"	-	-	1	μA
Operating Current at no input signal	I <sub>DD</sub>	No-load operating, IN <sub>1</sub> =IN <sub>2</sub> =1.4MHz	-	0.05	T.B.D	mA
	I <sub>DDO</sub>		-	0.6	T.B.D	
Input Voltage	V <sub>IH</sub>		0.7V <sub>DD</sub>	-	V <sub>DD</sub>	V
	V <sub>IL</sub>		0	-	0.3V <sub>DD</sub>	V
Input Leakage Current	I <sub>LK</sub>		-	-	±1	μA

■ TIMING CHARACTERISTICS

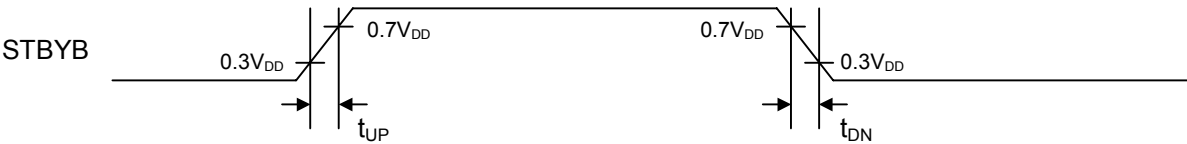
- Signal Spread Characteristics



(Ta=25°C, V<sub>DD</sub>=V<sub>DDO</sub>=2.0V, V<sub>SS</sub>=0.0V unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Maximum Operating Frequency	f <sub>Max</sub>		-	-	25	MHz
Signal Spread Time (H → L)	t <sub>PDL</sub>		-	-	20	ns
Signal Spread Time (L → H)	t <sub>PDH</sub>		-	-	20	ns

- Output Control Signal Input (STBYB)

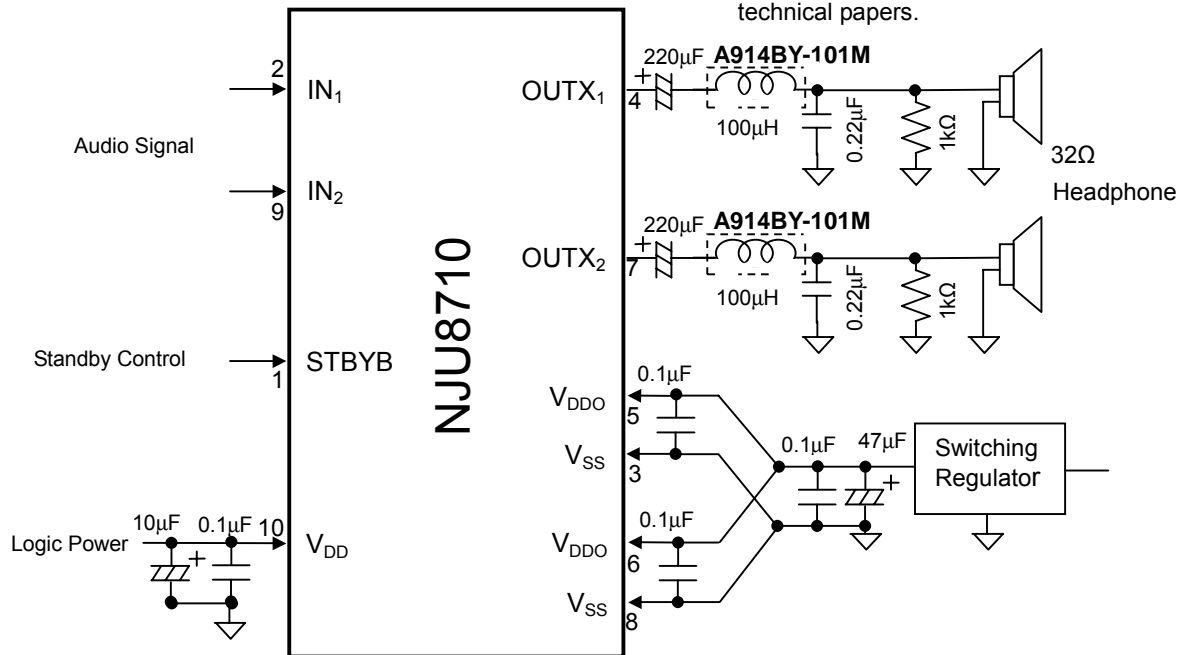


(Ta=25°C, V<sub>DD</sub>=V<sub>DDO</sub>=2.0V, V<sub>SS</sub>=0.0V unless otherwise noted)

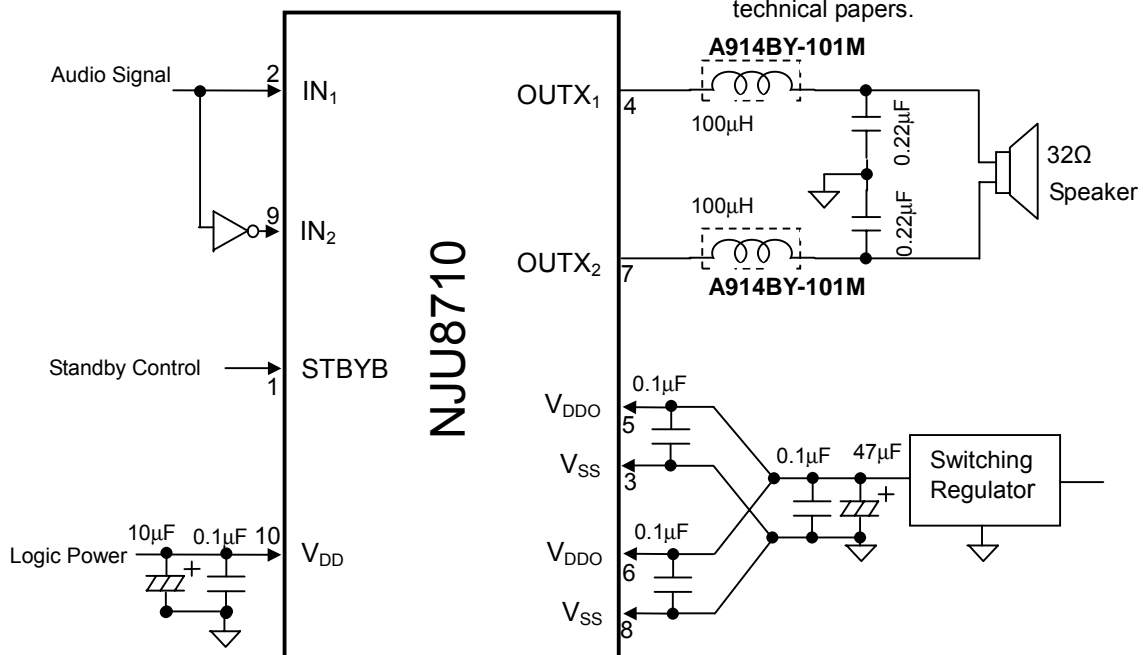
PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Rise Time	t <sub>UP</sub>		-	-	50	ns
Fall Time	t <sub>DN</sub>		-	-	50	ns

## ■ APPLICATION CIRCUIT (Analog Signal Output)

- Stereo OTL application example



- Monaural BTL application example



Note 4) De-coupling capacitors must be connected between each power supply terminal and GND terminal.

Note 5) The power supply for V<sub>DDO</sub> requires fast driving response performance such as a switching regulator for T.H.D..

Note 6) The bigger capacitor value of external AC-coupling capacitors realize better low frequency response characteristics. In addition, ESR(Equivalent Series Resistance) should be low.

Note 7) The above circuit shows only application example and does not guarantee the any electrical characteristics. Therefore, please consider and check the circuit carefully to fit your application.

**[CAUTION]**

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