

LC89091JAGEVK



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LC89091JA Digital Audio Interface Receiver Evaluation Board User's Manual

EVAl BOARD USER'S MANUAL

Overview

This board is an evaluation board for the LC89091JA which is a digital audio interface receiver.

In order to evaluate the LC89091JA easily quickly, this board has mounted the I/O connectors convenient for connection with some periphery devices, the test pins, etc. And it can evaluate smoothly by the ability to connect with other digital audio equipment, such as a CD/DVD player, easily.

Contents

• Evaluation Board:	1
• USB-mini Cable:	1
• Peripheral Circuitry Connecting Cable:	6
• CD-ROM:	1

NOTE: Software of attachment CD-ROM operates by Windows XP/7. But, neither MacOS nor OS before Windows XP can be checking operation.

Table 1. APPENDIX CD-ROM CONTENTS

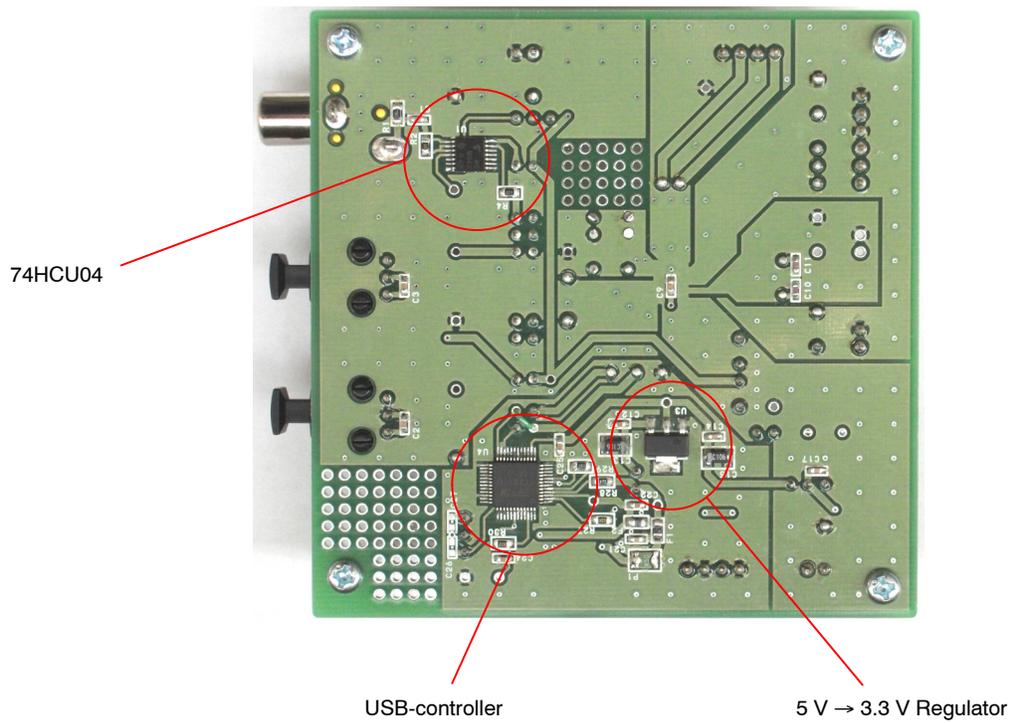
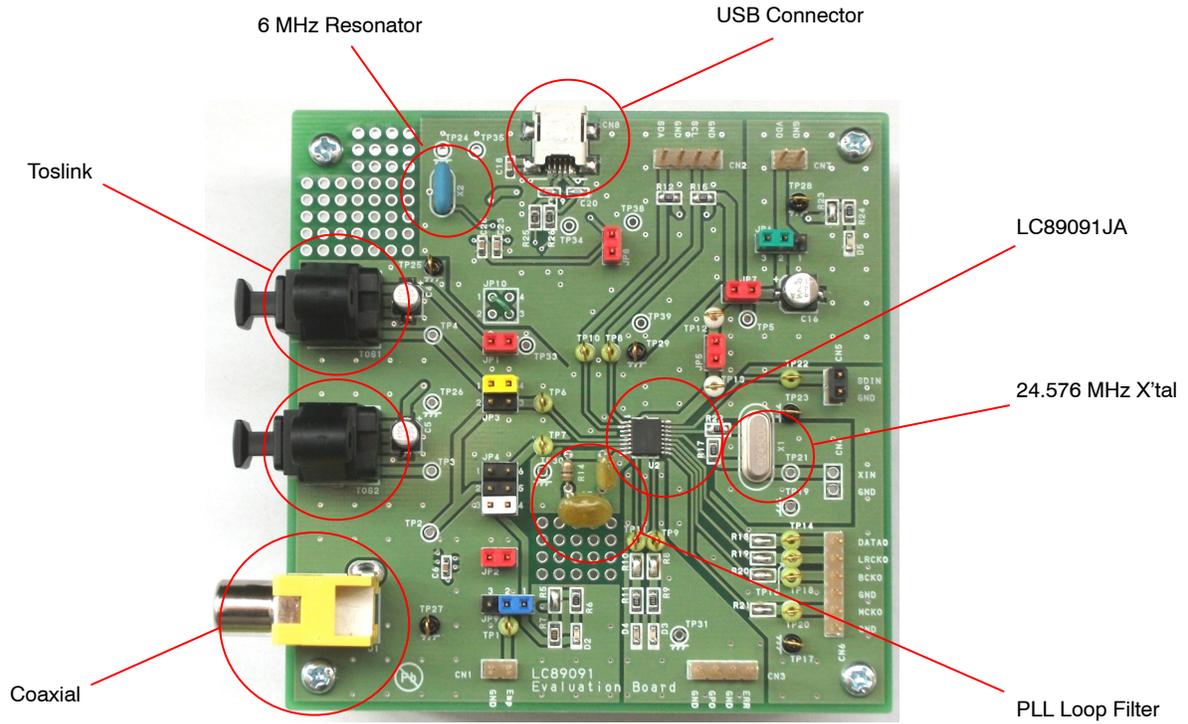
Name	Contents
LC89091JA Register Control Software_e.exe	LC89091JA Register Setting Software
CDM 2.08.28 WHQL Certified	USB Driver
FTCI2C.dll	DLL File
LC89091JAGEVK Operation Manual_e	LC89091JA Evaluation Board Manual

Features

- The Following Parts are Mounted on Evaluation Board
 1. S/PDIF Digital Data Input
 - ◆ Optical Module: TORX147 or TORX141 (Maximum Received Frequency is 96 kHz)
 - ◆ Coaxial: Pin Jack (75 Ω Termination)
 - ◆ Input Amplifier Logic for Coaxial Input: 74HCU04
 2. Oscillation Amplifier Peripheral Circuitry Containing a Crystal Oscillator (24.576 MHz)
 3. USB Microcontroller and USB Connector (Mini B Type)
 4. Regulator for Conversion of 5 V to 3.3 V
 5. Light Emitting Diode
 - ◆ Red LED for PLL Error Flag
 - ◆ Yellow LED for Non-PCM Detection Flag
 - ◆ Green LED for Emphasis Detection Flag
 - ◆ Green LED for Power-on Indicator
 6. Connectors for I/O and External Power Supply
 7. Test Pins (Signal, Power, and GND)
- LC89091JA Power Supply can be Selected USB Bus Power or External Power Supply (3.3 V)
- USB Bus Power is Lowered and Supplied to 3.3 V by a Regulator
- Various Functions are Easily Switched with a Jumper Pin and a Short Plug
- A Microcontroller Interface can also be Supplied from the External Controller

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BOARD EXPLANATION



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CIRCUITRY

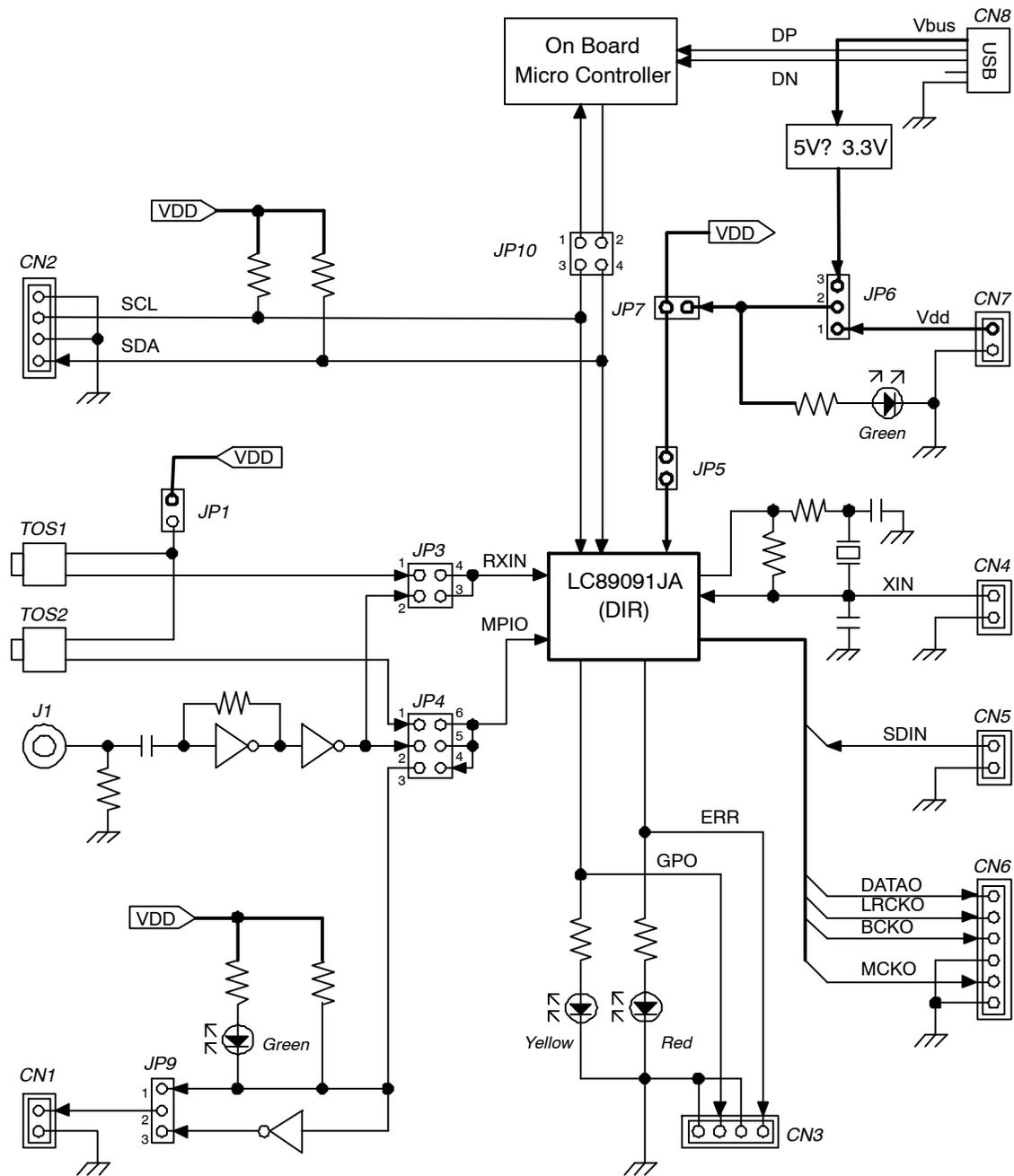


Figure 1. Main Signal Circuitry of LC89091JA Evaluation Board

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BOARD INITIAL STATE

The initial state of evaluation board is the following.

Table 2. BOARD INITIAL STATE AT THE TIME OF SHIPMENT

Parts	Function	State
USB Controller	Power supply	LC89091JA operates by connecting a USB connector to PC. In the first connection, installation of driver requires. The driver recorded on attached CD-ROM installes.
LC89091JA	Power supply	LC89091JA operates by USB bus power. Power supply is supplied through a regulator (3.3 V). Green LED turns on after power supply.
	S/PDIF Input (RXIN)	LC89091JA receives the S/PDIF signal inputted to TOS1. TOS1 output is inputted to RXIN of LC89091JA.
	External Clock Input (XIN, XOUT)	24.576 MHz crystal oscillator is mounted. Oscillation amplifier configures at XIN and XOUT. Oscillation amplifier clock is inputted to system.
	Demodulation Data/Clock (MCKO, BCKO, LRCKO, DATAO)	MCKO, BCKO, LRCKO, and DATAO output clock and data. These output signals can be connected with peripheral circuit at CN6 connector.
	Microcontroller Interface (SCL, SDA)	LC89091JA is controlled with an on-board USB microcontroller. USB microcontroller operates by the control software of attached CD-ROM.
	PLL Error Flag (ERR)	PLL error flag is outputted to ERR terminal. Red LED turns on when PLL is unlocked. It can be connected with peripheral circuit at CN3 connector.
	Non-PCM Flag (GPO)	Non-PCM flag is outputted to GPO terminal. Yellow LED turns on when non-PCM is detected. It can be connected with peripheral circuit at CN3 connector.
	Emphasis Flag (MPIO)	Emphasis flag is outputted to MPIO terminal. Green LED turns on when emphasis information is detected. It can be connected with peripheral circuit at CN1 connector. Reversed emphasis flag outputs to CN1. (refer to J9 setting)
	Serial Audio Data Input (SDIN)	SDIN is connected to GND at CN5 connector. If GND of CN5 connector removes, it can input to SDIN. SDIN input data is outputted to DATAO when PLL is unlocked.
PLL Loop Filter (LPF)	The PLL loop filter is mounted in LPF terminal. It is adjusted so that PLL characteristic may become best. PLL operation dose not be guaranteed if the loop filter is changed.	
Input Amplifier (74HCU04)	S/PDIF Input	S/PDIF signal connected to J1 is not received. It can select by register setting of microcontroller.
	Emphasis Signal Invert	Some circuits of 74HCU04 reverse an emphasis flag.
Optical Module (TOS1)	S/PDIF Input	S/PDIF signal connected to TOS1 is received.
Optical Module (TOS2)	S/PDIF Input	S/PDIF signal connected to TOS2 is not received. It can select by register setting of microcontroller.

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JUMPER PIN EXPLANATION

All the jumper pins are set to perform suitable operation in the shipment state. When changing an operating condition, the following setting tables are switched to reference.

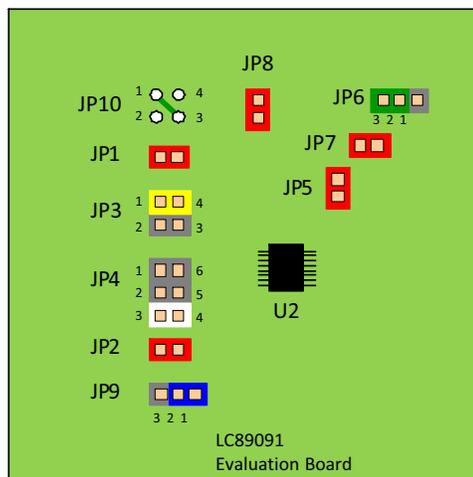


Figure 2. Jumper Pin Arrangement

Table 3. EXPLANATION OF JUMPER PIN

Part Number	Explanation
JP1	Power Supply to Optical Module Open: Don't Supply Short: Supply (Initial)
JP2	Power Supply to 74HCU04 (for Coaxial Amplifier etc.) Open: Don't Supply Short: Supply (Initial)
JP3 (Note 1)	S/PDIF Data Selection of RXIN 1-4: TOS1 Input Data (Initial) 2-3: J1 Input Data
JP4 (Note 1)	S/PDIF Data Selection of MPIO 1-6: TOS2 Input Data * MPIO Must be an Input Setting 2-5: J1 Input Data * MPIO Must be an Input Setting 3-4: Emphasis Flag Output (Initial)
JP5	Current Measurement of LC89091JA Open: Measuring Instrument Insert between TP12 and TP13, and Current is Measured. Short: Don't Measure (Initial)
JP6	Power Supply Method to LC89091JA 1-2: 3.3V Supplies from the Exterior 2-3: USB Bus Power Uses (Initial) * JP8 has to Short
JP7	3.3 V Power Supply Other than a Microcontroller Open: Don't Supply Short: Supply (Initial)
JP8	Power Supply to Regulator Open: Don't Supply Short: Supply USB Vbus Power (Initial)
JP9	Output Selection of Emphasis Flag (CN1 Connector Output) 1-2: MPIO Output (Pull-up Resistor Mounting) 2-3: MPIOinvert Output (Initial) * JP2 has to Short
JP10 (Note 2)	Setting of I ² C Bus 1-3: SCL Uses an On-board USB Microcontroller. (Initial) 2-4: SDA Uses an On-board USB Microcontroller. (Initial) Open: External Microcontroller Uses. * JP10: 1-3,2-4 have to Open

1. The short plug of JP3 and JP4 selection is only one place. Two or more choices make an input signal short.
2. JP10 cannot be set with a short plug because of mistake. It has given lead wiring to substrate both sides.

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I/O CONNECTORS EXPLANATION

Digital input terminals mount two pieces for an optical module, one piece for a coaxial input, and I/O connectors convenient for connection with peripheral device.

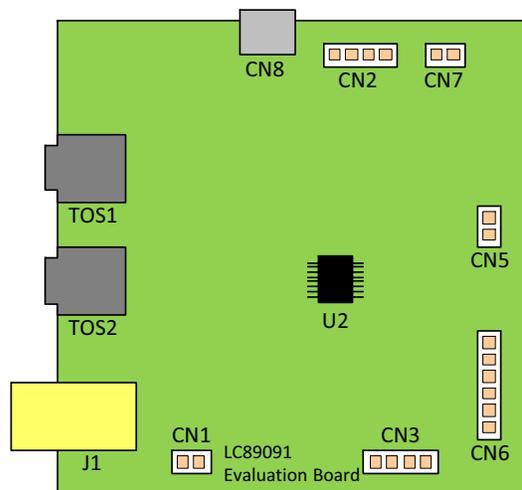


Figure 3. I/O Connector Arrangement

Table 4. EXPLANATION OF I/O CONNECTORS

Part Number	Explanation
J1	S/PDIF Coaxial Pin-jack Input (Audio Data is Inputted to RXIN and MPIO)
TOS1	S/PDIF Optical Module Input (Audio Data is Inputted to RXIN)
TOS2	S/PDIF Optical Module Input (Audio Data is Inputted to MPIO)
CN1	Emphasis Flag Output Connector (MPIO Output Signal)
CN2	I ² C External Microcontorller Interface I/O Connector (SCL and SDA Input/Output Signal)
CN3	PLL Error Flag and Non-PCM Flag Output Connector (ERR and GPO Output Signal)
CN4	External Clock Input Connector (Clock is Inputted to XIN)
CN5	External Serial Audio Data Input Connector (Audio Data is Inputted to SDIN)
CN6	Demodulation Data/Clock Output Connector (MCKO, BCKO, LRCKO, DATAO Output Signal)
CN7	External Power Supply Input Connector (Supply to Vdd)
CN8	USB Connector

Notes:

- The sampling frequency which can be inputted to TORX147 or TORX141 mounted in this board corresponds to 96 kHz. About more than 96 kHz use with coaxial input
- 24.576 MHz crystal oscillator is mounted at XIN terminal. CN4 connector is used when supplying the clock of an external oscillator to XIN. In this case, all of X1, R17, R22, C10, and C11 remove
- This board is not mounted DSP, DAC, and ADC. It is necessary to connect peripheral equipment and a circuit for the various audio characteristics or performing evaluation according to actual application

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OPERATION EXPLANATION

Power Supply

- 3.3 V power supply voltage to LC89091JA (following DUT) has the following supply methods:
 - USB bus power supply: USB bus power (5 V) is lowered to 3.3 V by regulator, and supplies to DUT
 - External power supply: 3.3 V supplies to CN7 connector

- Power supply voltage to DUT selects JP6 with a short plug. Initial setting is selected USB bus power
- Green LED (D5) turns on after power supply
- When evaluating the performance of DUT, power supply recommends an external stabilized power supply (it connects with CN7)

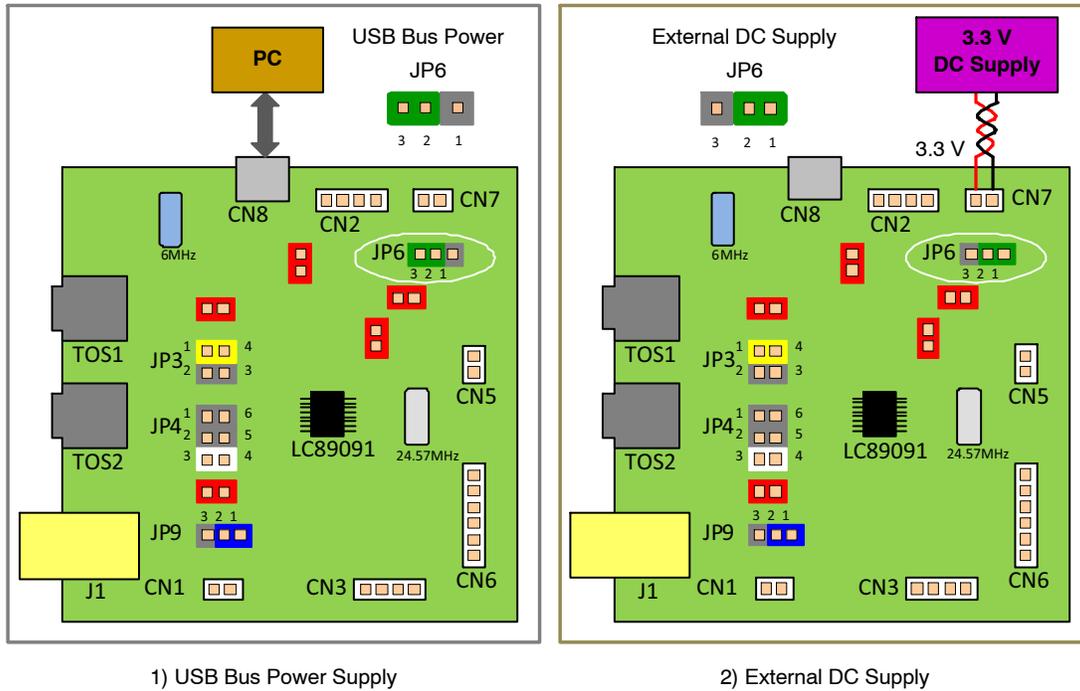


Figure 4. LC89091JA Power Supply Voltage Method

Notes:

- When supplying USB bus power to DUT, JP8 certainly sets a short plug in addition to JP6

Current Measurement:

- This board is provided with the jumper pin for power supply for every block part
- It uses for consumption current measurement of DUT, etc.

Table 5. JUMPER PIN FOR POWER SUPPLY

Part Number	Explanation	Related Function
JP1	Power Supply to TOS1 and TOS2 Optical Module	S/PDIF Optical Module Input
JP2	Power Supply to U1 (74HCU04) Logic IC	S/PDIF Coaxial Input
JP5	Power Supply to DUT	DUT Operation
JP7	Power Supply to Other than Microcontroller	Other than Microcontroller Operation
JP8	Power Supply to Regurator from USB Bus Power	USB Bus Power Supply

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S/PDIF Digital Data Input

- S/PDIF digital inputs are three systems in all (Optical input x2 and Coaxial input x1)
- Only RXIN is possible for the S/PDIF input at the time of shipment
- S/PDIF is inputted to DUT; “Input to TOS1 optical module” → “JP3/1-4 short” → “RXIN terminal”.
- When inputting S/PDIF of coaxial input to RXIN, JP3/1-4 open and JP2-3 short. Don't short both 1-4 and 2-3 of JP3
- MPIO initial state is set as the emphasis flag output at the time of shipment. (JP4/3-4 short) For inputting S/PDIF to MPIO, JP4/1-6 (TOS2 optical module input) or JP4/2-5 (J1 coaxial input) must be short. However, JP4 short plug setting is only either

Notes:

- The following flows are followed when using MPIO as S/PDIF input. When not following the flow, there is a possibility that S/PDIF input and emphasis flag output may short at MPIO
 1. JP4/1-6 or JP4/2-5 short by short-plug
 2. Power supply switches on in the state where there is no S/PDIF input of TOS1, TOS2 (optical module), and J1 (pin jack)
 3. MPSEL register which changes MPIO into an input function with microcontroller interface sets.
 4. It inputs an S/PDIF to TOS1, TOS2 (optical module), and J1 (pin jack)
- The maximum data received frequency of optical module is 96 kHz. Received of 96 kHz or more uses coaxial input

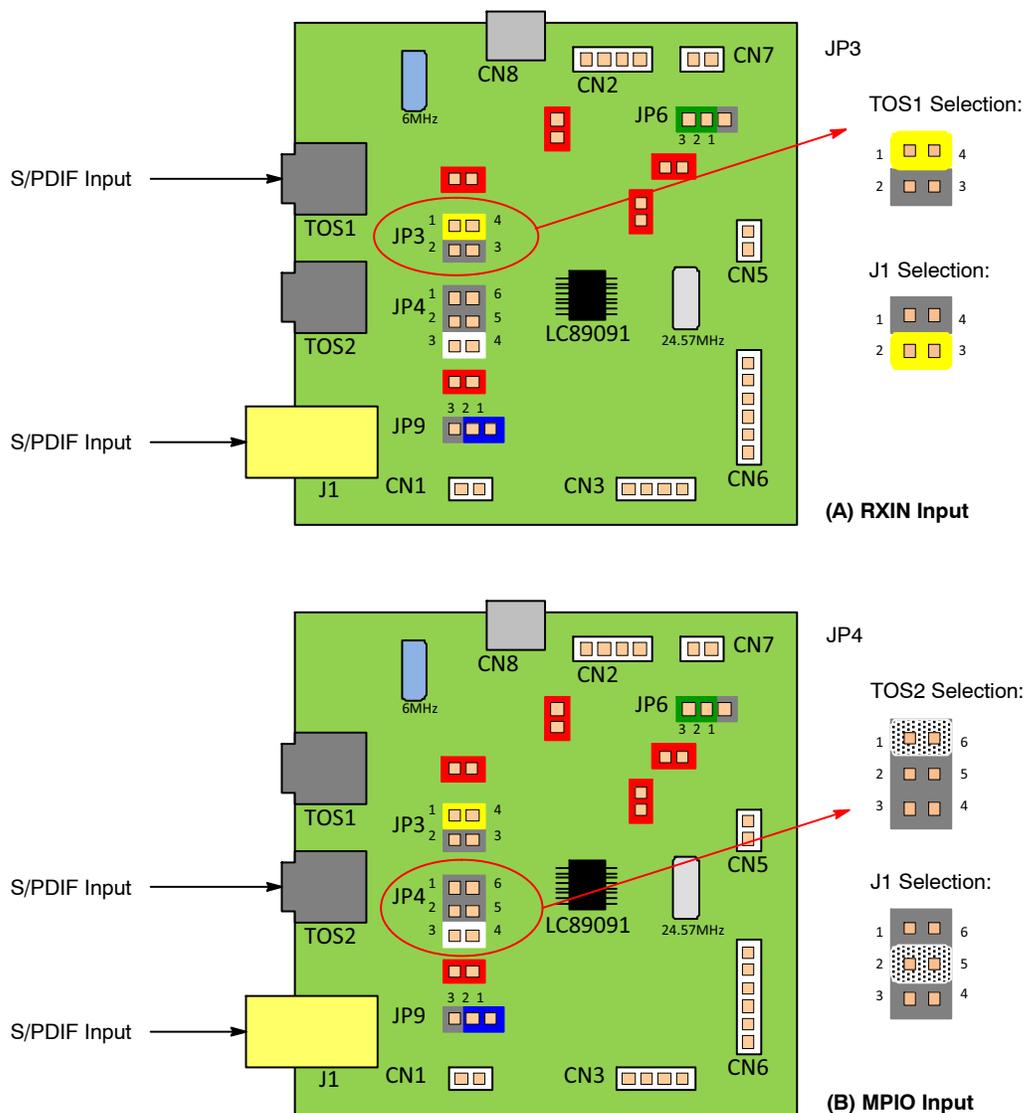


Figure 5. S/PDIF Input Setup

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Emphasis Output (MPIO)

- MPIO initial state is set as the emphasis flag output at the time of shipment
- Pull-up resistor and green LED are mounted at MPIO
- Green LED (D2) turns on when an emphasis is detected
- MPIO output configures as open-drain. And MPIO outputs “L” when emphasis is detected
- CN1 connector is used when connecting with peripheral circuitry. Emphasis flag output to CN1 can be selected by output polarity by JP9

Table 6. CN1 CONNECTOR OUTPUT SELECTION OF EMPHASIS DETECTION FLAG

JP9	Emphasis Detection State	Emp Output of CN1
1-2 Short	No	H
	Yes	L
2-3 Short	No	L
	Yes	H

External Microcontroller Interface

- JP10 initial state is wired by the lead in both sides of the substrate at the time of shipment. The port of an on-board USB microcontroller and the I²C port (SCL, SDA) of DUT are connected
- External controller connected to CN2 connector
- When using CN2 connector, all lead wiring of JP10 is opened

LED Monitors

- LED monitors output various states (see Table 7)
- Current measurement etc, remove the solder in front of LED, when intercepting the signal to LED
 1. Signal interception to D2 (green):
R5 solder is removed
 2. Signal interception to D3 (red):
R8 solder is removed
 3. Signal interception to D4 (yellow):
R10 solder is removed
 4. Signal interception to D5 (green):
R23 solder is removed

Table 7. LED MONITOR STATE (INITIAL)

Part Number	Monitor Terminal	Output State	LED Indication	
			Turn Off	Turn On
D2 (Green)	MPIO	Emphasis Detection State	No	50/15 μs Emphasis
D3 (Red)	ERR	PLL Lock State	Lock	Unlock
D4 (Yellow)	GPO	Non-PCM Data Reception State	No	Non-PCM Reception
D5 (Green)	-	Power On/Off State	Off	On

MICROCONTROLLER INTERFACE OPERATION EXPLANATION

- USB microcontroller is mounted in this board and I²C-bus control is performed
- I²C bus initial state is controlled from on-board USB microcontroller at the time of shipment
- When performing I²C control from the external, all lead wiring of JP10 is removed and control signal is connected to CN2 connector

Operation Software

- In order to use USB microcontroller, it is necessary to connect with PC
- The software for performing installation of USB driver and I²C-bus control read into PC. Installation of USB driver and the details of software are explained after the next page
- The soft wafer is recorded on attached CD-ROM

USB Driver Installation

- When connecting LC89091JA evaluation board with PC for the first time, “USB Serial Converter” and “USB Serial Port” install to PC. If installation is completed, when connecting next time, USB microcontroller is recognized automatically
- Installation follows the following procedures
 1. If evaluation board is connected to PC through USB cable, PC asks for installation of soft wafer. Then, select “(S)”, and click the “next” after inserting attached CD-ROM



Figure 6. USB Driver Installation – Step 1

2. It selects “(S)”. And specify the folder [CDM 2.08.28 WHQL Certified] of CD-ROM drive, and click the “next”

[CDM 2.08.28 WHQL Certified]

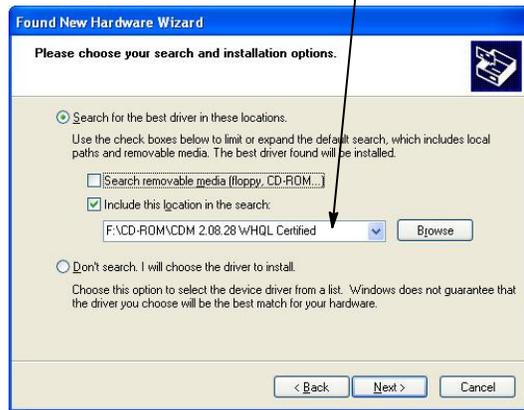


Figure 7. USB Driver Installation – Step 2

3. When the following screen is displayed, installation of “USB Serial Converter” is completion. Click “completion”



Figure 8. USB Driver Installation – Step 3

4. “USB Serial Port” is installed continuously. Specify “CDM 2.08.28 WHQL Certified” in the same way as 2., and click the “next”. Installation is completion when a completion screen is displayed

How to Use Register Setting Software

- The register setting software “LC89091 JA Register Control Software_e.exe” of attached CD-ROM is performed
- This software reads directly from CD-ROM, or it reads into arbitrary directories and performs it

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1. TOP

- Starting of this software is displayed TOP page
- On TOP page, the writing and read-out to the register of DUT are possible

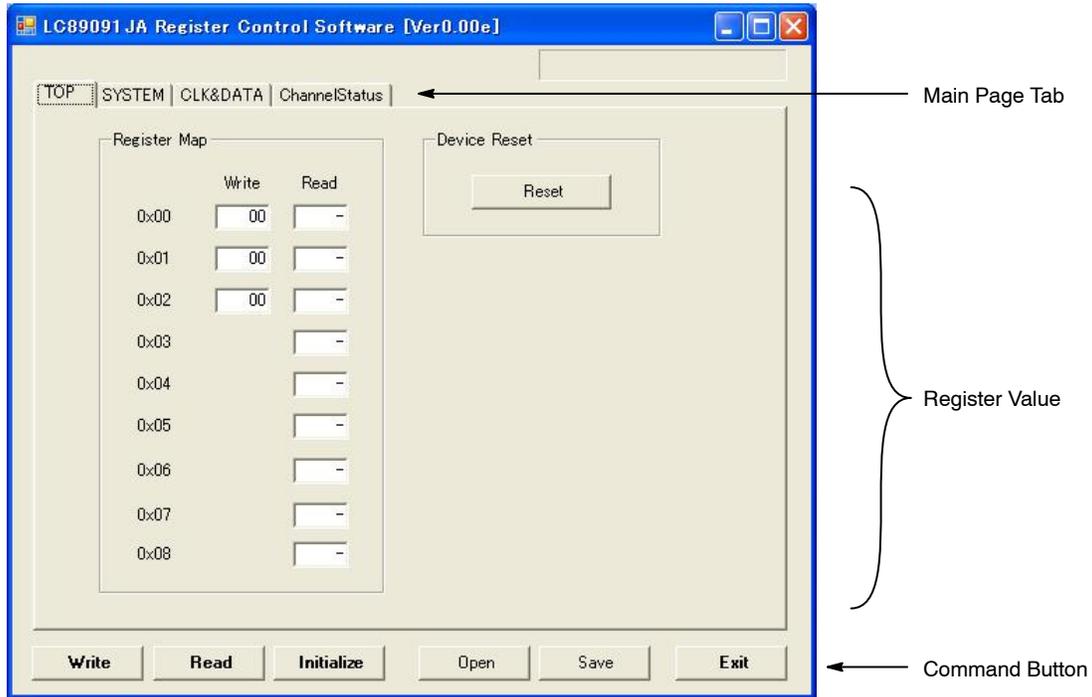


Figure 9. TOP Page Tab

Writing:

- Register value directly inputs to “Register Map”, and *Write* button pushes

Read-out:

- Push on *Read* button is displayed value on “Register Map”

Reset:

- Push on *Reset* button is performed SYSRST register (system reset) and is canceled after that (After 01 is written in 0x00 address, it is re-set as 00)

Initialize:

- Push on *Initialize* button is wrote in an initial state.

Reading of Register Value:

- Register value saved at the local disk C drive is read with *Open* button

Preservation of Register Value:

- Register value saves with *Save* button to the local disk C drive

Finish:

- Push on *Exit* button finishes register setting software

2. SYSTEM

- This menu sets an address 0x00
- Movement of the cursor is displayed detailed contents
- SYSTEM page can not read-out
- Register value can do to check on TOP page

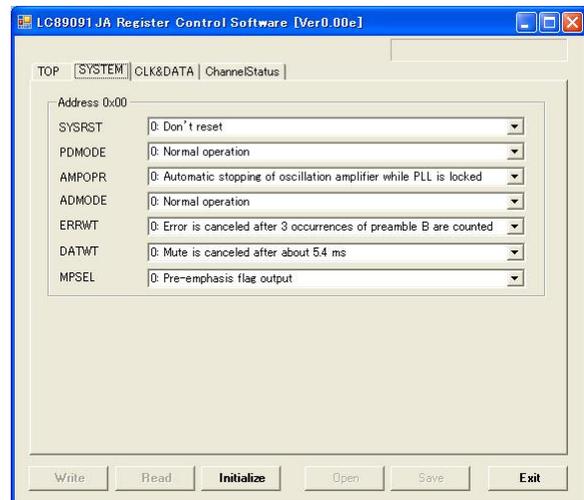


Figure 10. SYSTEM Tab

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3. CLK&DATA

- Movement of the cursor is displayed detail contents
- CLK&DATA page can not read-out
- Register value can do to check on TOP page

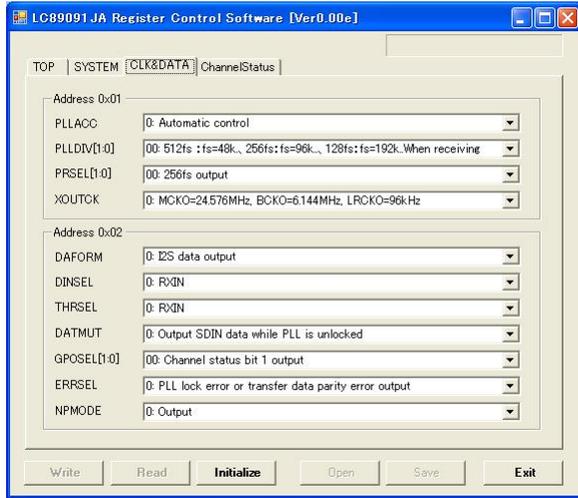


Figure 11. CLK&DATA Tab

4. Channel Status

- This menu read-outs address 0x03 to 0x08

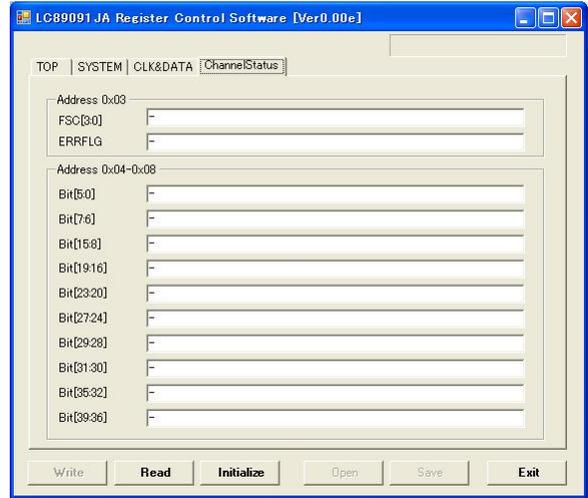


Figure 12. Channel Status Tab

PERIPHERAL CIRCUITY

- LC89091JAGEVK is not equipped with ADC (A/D converter), DAC (D/A converter), and DSP
- Sound quality and property evaluation connect such peripheral circuitry to LC89091JAGEVK
- Before connection of peripheral circuitry impresses power supply voltage, it is completed
- LC89091JA does not have a decoding function of Non-PCM data. When DAC is connected directly, it must be cautious of Non-PCM data input (Dolby Digital, DTS, etc.)

ADC Connection

- When S/PDIF signal is not inputted, ADC output data is outputted from DATAO terminal
- LC89091JA output clocks connect to clock input terminal of ADC
- ADC output data connects to SDIN terminal of LC89091JA. SDIN is 3.3 V tolerance TTL compatible input
- ADC uses the product which is adapted for the specification of LC89091JA

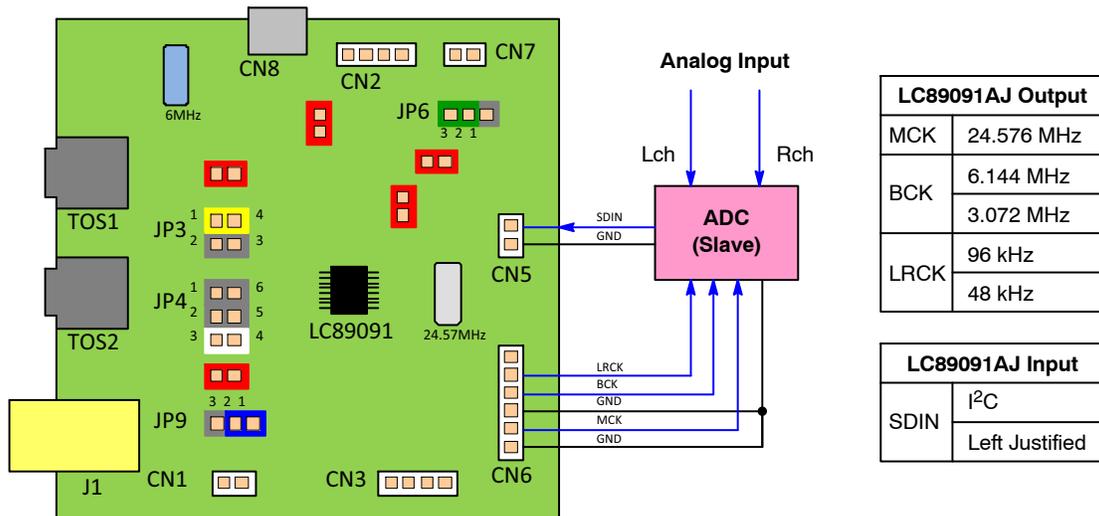


Figure 13. ADC Connection

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DAC Connection

- DAC connects when changing digital data to analog data
- LC89091JA output clock and data connect to each input terminal of DAC

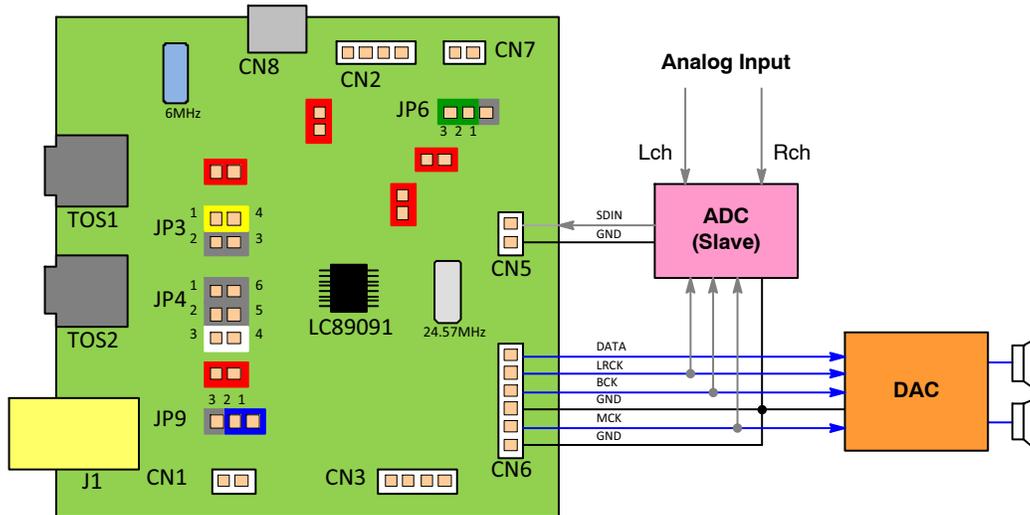


Figure 14. DAC Connection

DSP Connection

- When processing multi-channel data, it connects the audio DSP corresponding to compression data
- Emphasis detection flag (CN1), PLL error flag (CN3), and Non-PCM detection flag (CN3) are also inputted into DSP if needed

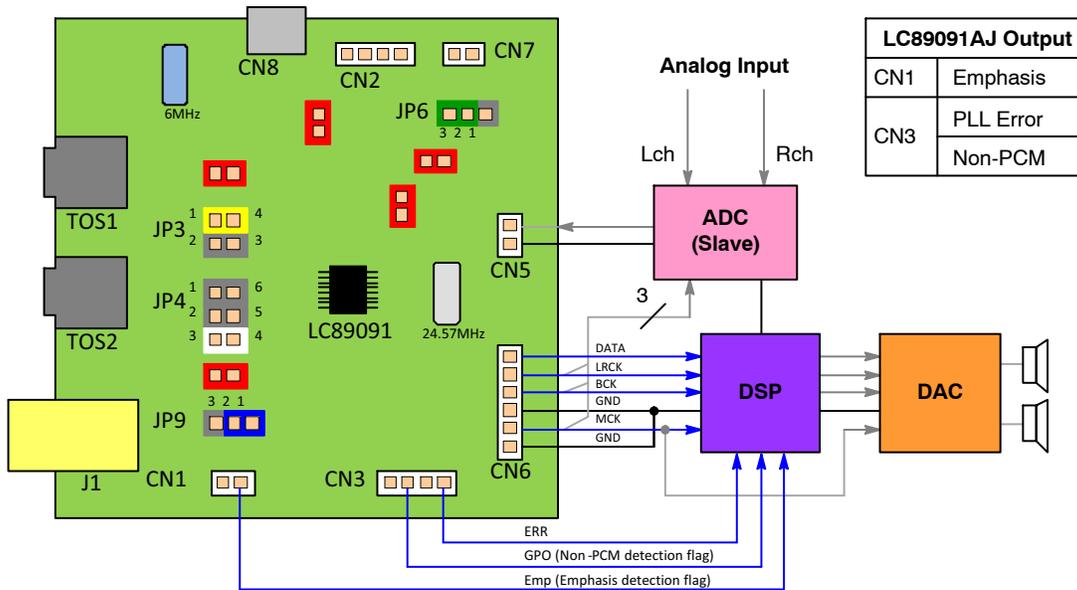
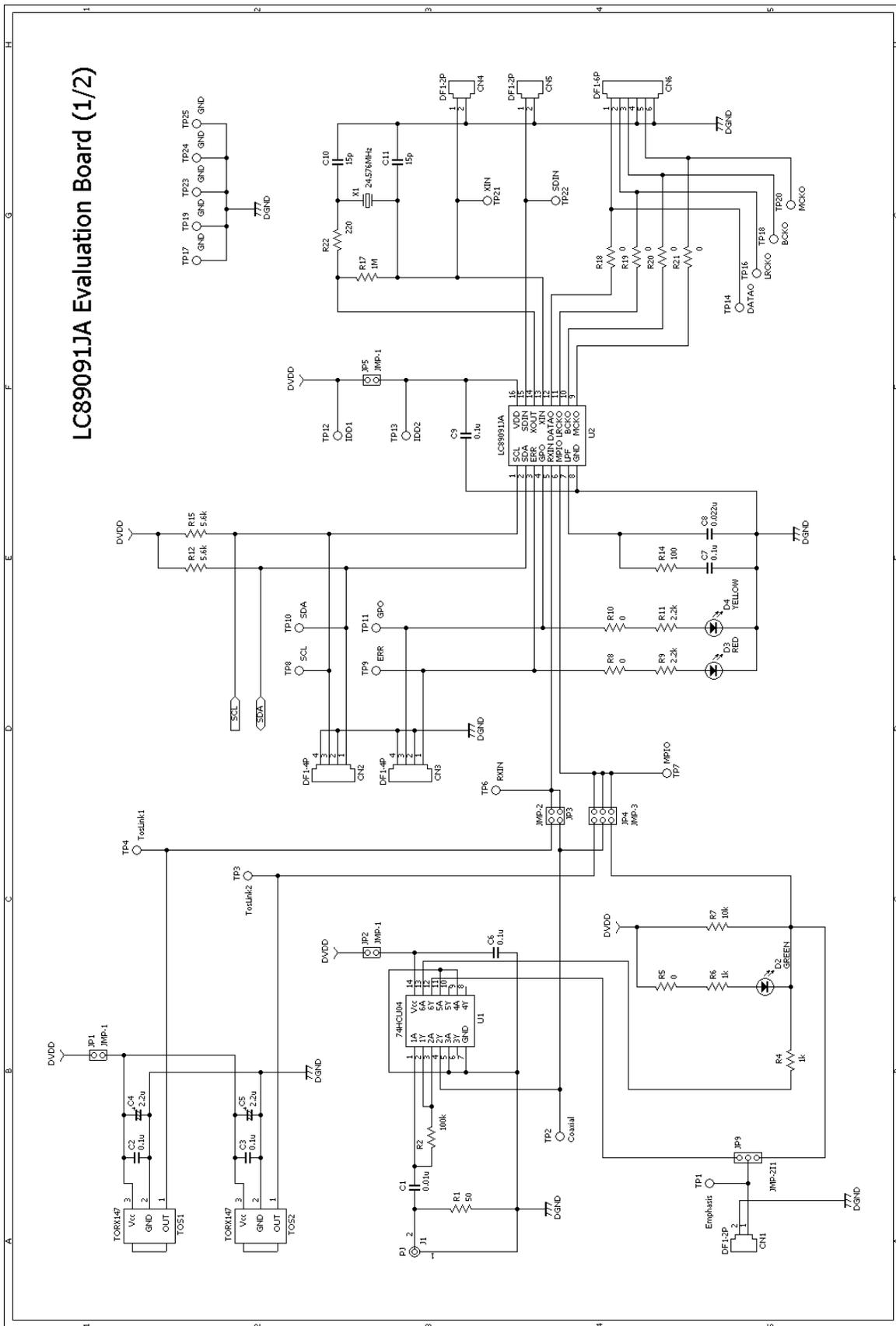


Figure 15. DSP Connection

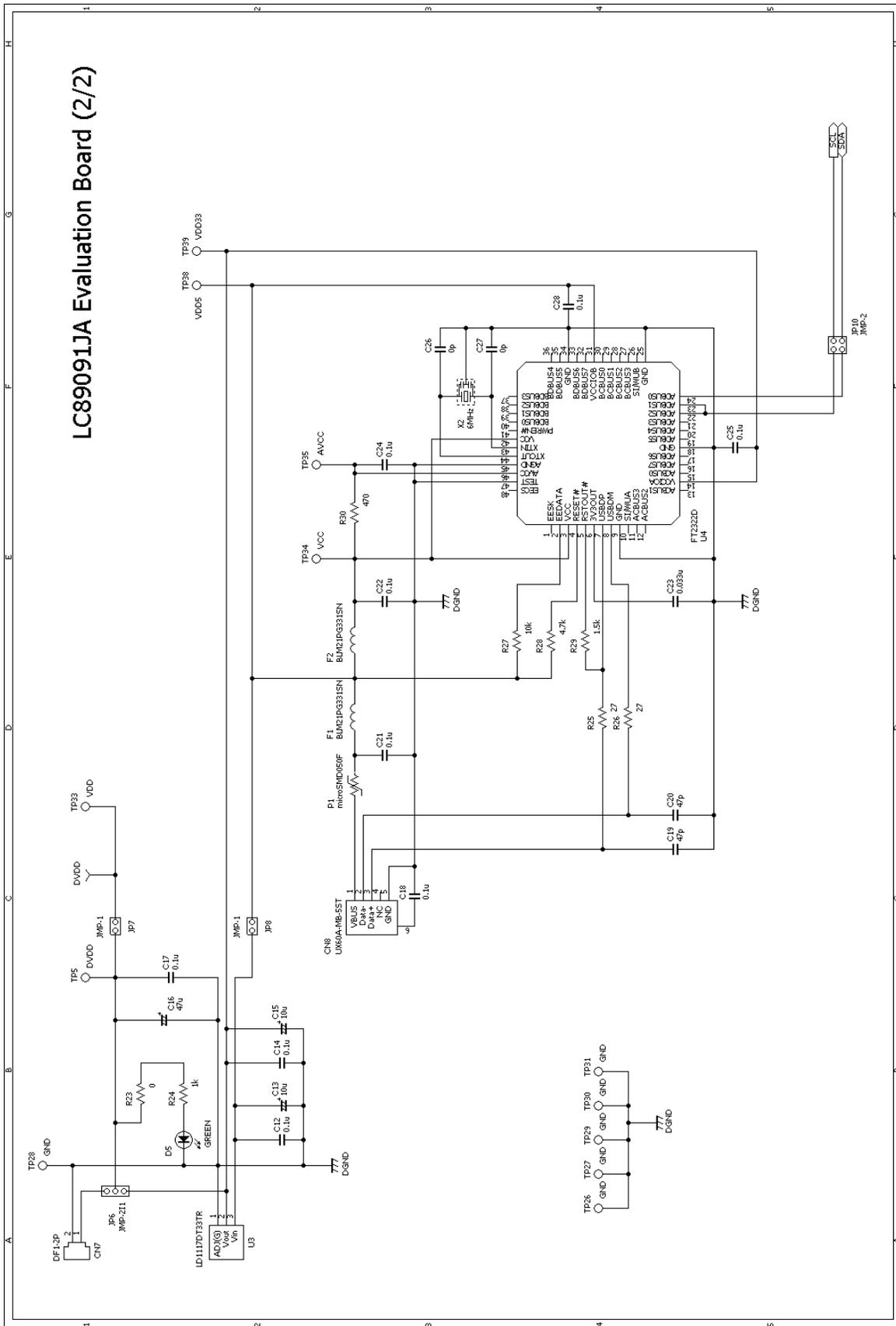
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SCHEMATIC - DUT PERIPHERAL CIRCUITRY



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SCHEMATIC – USB MICROCONTROLLER PERIPHERAL CIRCUITRY



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TEST PROCEDURE

Function Check (PC Doesn't Use)

- Basic operation of LC89091JA can be checked

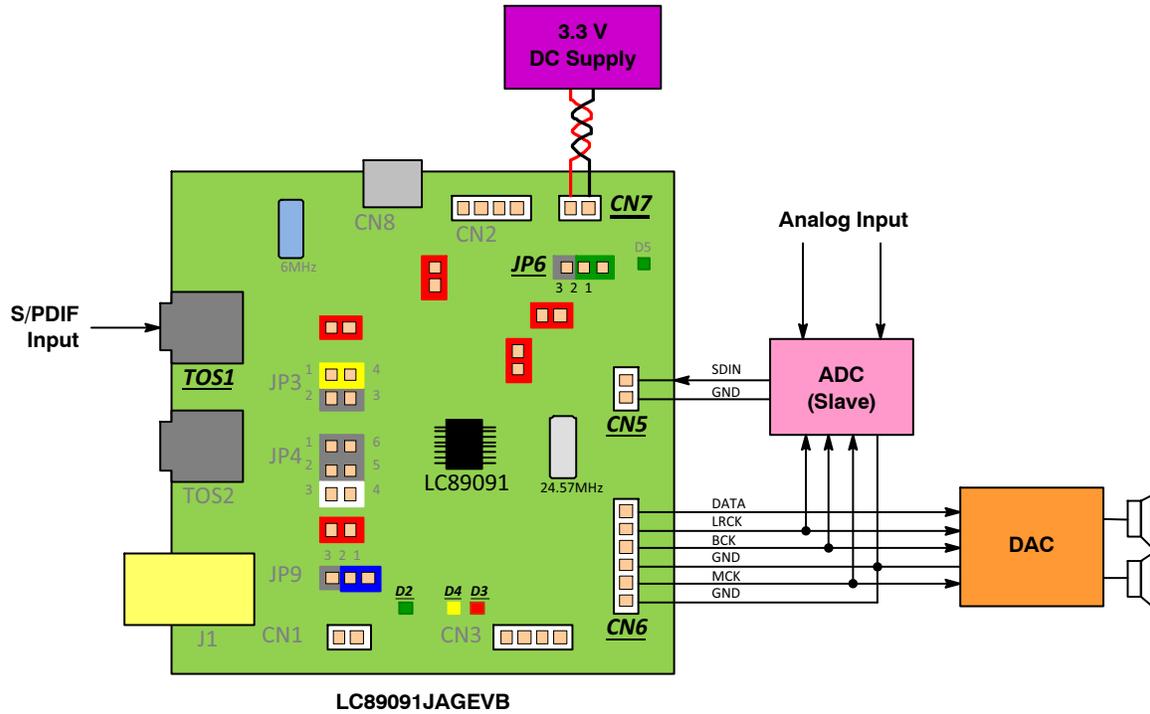


Figure 16.

Power Supply	USB	External DC	DSP Connection	YES	NO
Register Control	YES	NO	PLL Error Monitor	LED (D3)	PC
S/PDIF Input	TOSLINK	COAXIAL	Non-PCM Monitor	LED (D4)	PC
ADC Connection	YES	NO	Emphasis Monitor	LED (D2)	PC
DAC Connection	YES	NO	Demodulation Data	Oscilloscope	Audio Output

S/PDIF		Emphasis Input	LED Indication			DAC Output
Linear-PCM	Non-PCM		D2 Emphasis	D3 PLL Error	D4 Non-PCM	
x	x	x	Off	Turn on	Off	ADC Data
Input	x	No	Off	Off	Off	Demodulation Data
Input	x	Yes	Turn on	Off	Off	Demodulation Data
x	Input	x	Off	Off	Turn on	Demodulation Data

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Function Check (PC Uses)

- PC can be connected by USB and operation of LC89091JA can be checked by I²C control

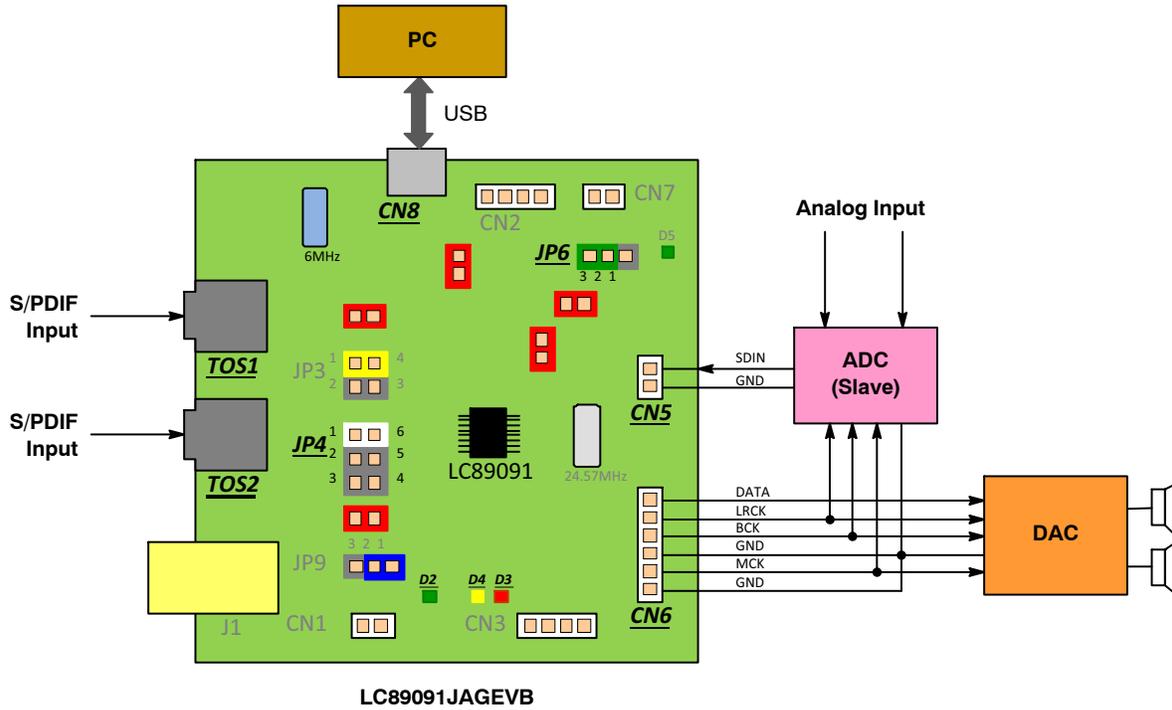


Figure 17.

Power Supply	USB	External DC	DSP Connection	YES	NO
Register Control	YES	NO	PLL Error Monitor	LED (D3)	PC
S/PDIF Input	TOSLINK	COAXIAL	Non-PCM Monitor	LED (D4)	PC
ADC Connection	YES	NO	Emphasis Monitor	LED (D2)	PC
DAC Connection	YES	NO	Demodulation Data	Oscilloscope	Audio Output

Setting Item	R/W	Adr	D7	D6	D5	D4	D3	D2	D1	D0
System	R/W	00h	"0"	MPSEL	DATWT	ERRWT	ADMODE	AMPOPR	PDMODE	SYSRST
Clock	R/W	01h	"0"	"0"	XOUTCK	PRSEL1	PRSEL0	PLLDIV1	PLLDIV0	PLLACC
Data	R/W	02h	NPMODE	ERRSEL	GPOSEL1	GPOSEL0	DATMUT	THRSEL	DINSEL	DAFORM
Fs	R	03h	0	0	0	ERRFLG	FSC3	FSC2	FSC1	FSC0
Channel Status	R	04h	CS7	CS6	CS5	CS4	CS3	CS2	CS1	CS0
	R	05h	CS15	CS14	CS13	CS12	CS11	CS10	CS9	CS8
	R	06h	CS23	CS22	CS21	CS20	CS19	CS18	CS17	CS16
	R	07h	CS31	CS30	CS29	CS28	CS27	CS26	CS25	CS24
	R	08h	CS39	CS38	CS37	CS36	CS35	CS34	CS33	CS32

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Consumption Current Measurement

- The consumption current of LC89091JA can be measured
- JP5 socket remove and a current measurement machine insert in TP12 and TP13
- Current limiting resistor (R5, R8, R10, R23) of LED remove
- The current of various states can be measured by register control (Current at the time of power down, etc.)

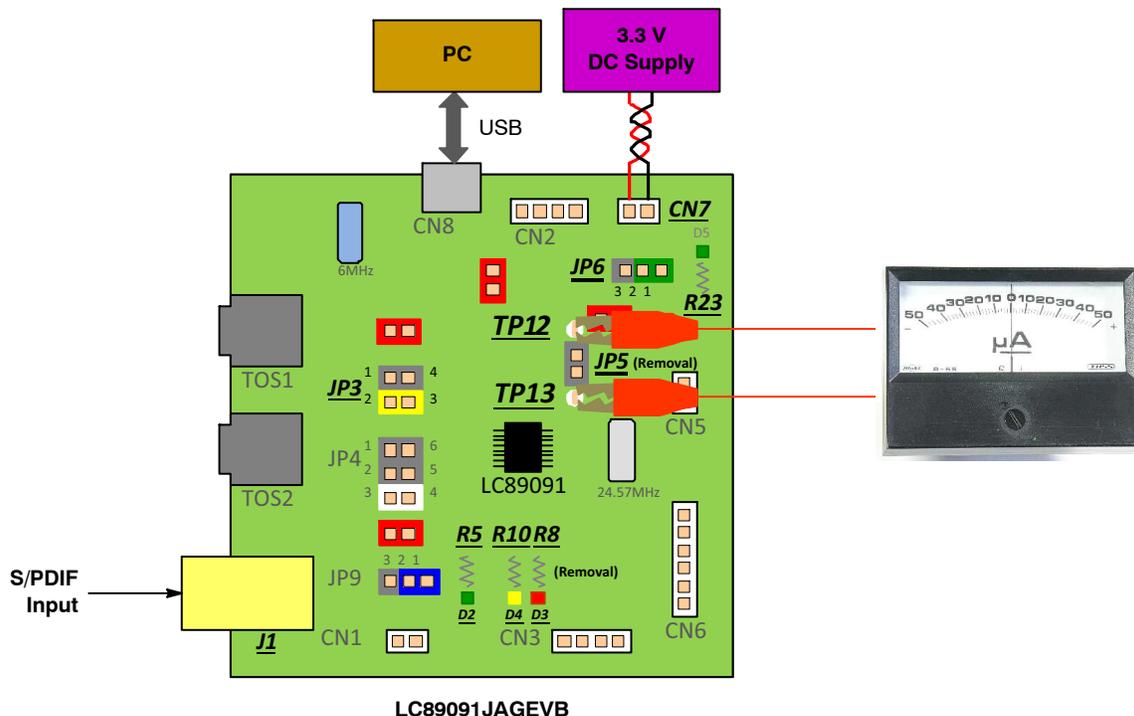


Figure 18.

Power Supply	USB	External DC	DSP Connection	YES	NO
Register Control	YES	NO	PLL Error Monitor	LED (D3)	PC
S/PDIF Input	TOSLINK	COAXIAL	Non-PCM Monitor	LED (D4)	PC
ADC Connection	YES	NO	Emphasis Monitor	LED (D2)	PC
DAC Connection	YES	NO	Demodulation Data	Oscilloscope	Audio Output

Setting Item	R/W	Adr	D7	D6	D5	D4	D3	D2	D1	D0
System	R/W	00h	"0"	MPSEL	DATWT	ERRWT	ADMODE	AMPOPR	PDMODE	SYSRST
Clock	R/W	01h	"0"	"0"	XOUTCK	PRSEL1	PRSEL0	PLLDIV1	PLLDIV0	PLLACC
Data	R/W	02h	NPMODE	ERRSEL	GPOSEL1	GPOSEL0	DATMUT	THRSEL	DINSEL	DAFORM
Fs	R	03h	0	0	0	ERRFLG	FSC3	FSC2	FSC1	FSC0
Channel Status	R	04h	CS7	CS6	CS5	CS4	CS3	CS2	CS1	CS0
	R	05h	CS15	CS14	CS13	CS12	CS11	CS10	CS9	CS8
	R	06h	CS23	CS22	CS21	CS20	CS19	CS18	CS17	CS16
	R	07h	CS31	CS30	CS29	CS28	CS27	CS26	CS25	CS24
	R	08h	CS39	CS38	CS37	CS36	CS35	CS34	CS33	CS32

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Lock-up Time Measurement

- Time until an error flag is canceled is measured after S/PDIF input
- It is set as register ERRSEL (address 02h, D6) = 1

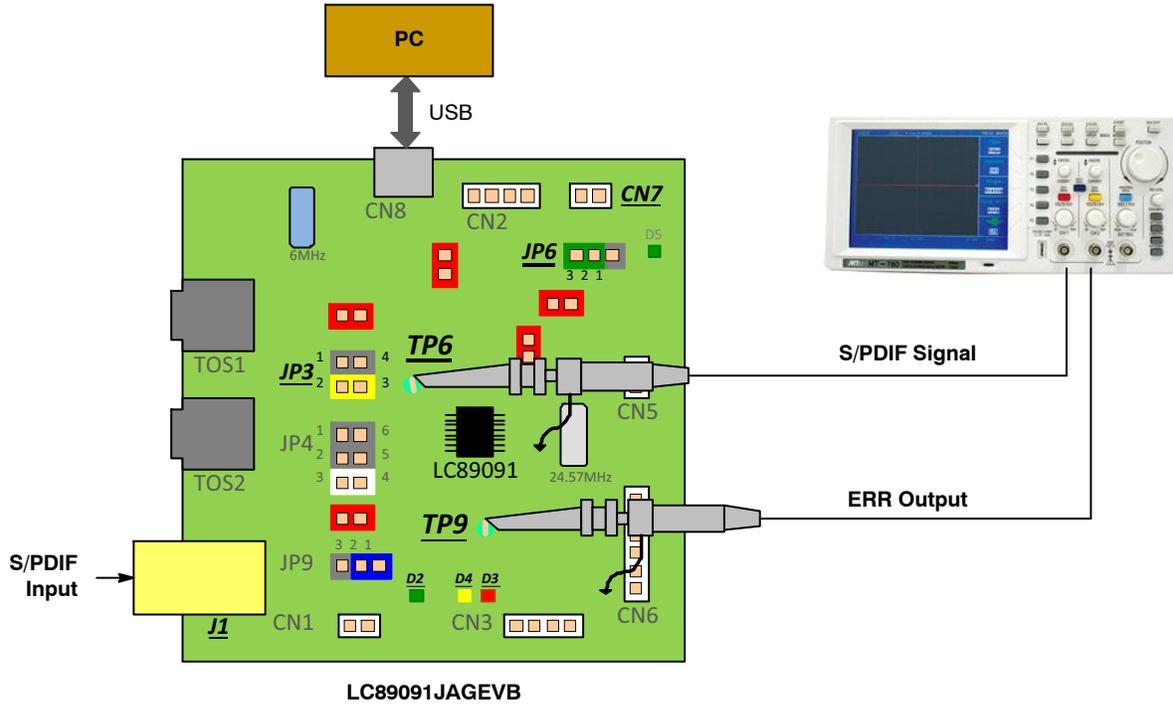


Figure 19.

Power Supply	USB	External DC	DSP Connection	YES	NO
Register Control	YES	NO	PLL Error Monitor	LED (D3)	PC
S/PDIF Input	TOSLINK	COAXIAL	Non-PCM Monitor	LED (D4)	PC
ADC Connection	YES	NO	Emphasis Monitor	LED (D2)	PC
DAC Connection	YES	NO	Demodulation Data	Oscilloscope	Audio Output

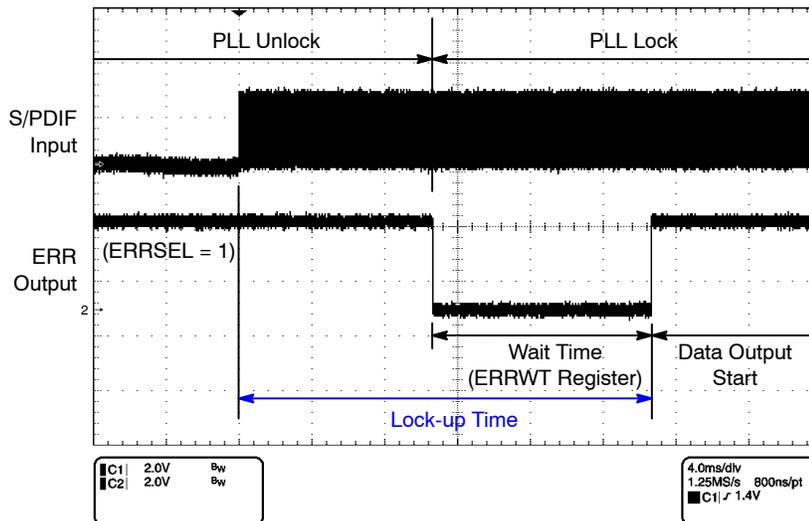


Figure 20.

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PLL Clock Jitter Measurement

- The clock jitter of master clock MCKO is measured with a dedicated device
- S/PDIF's input recommends a coaxial with little influence of reflection

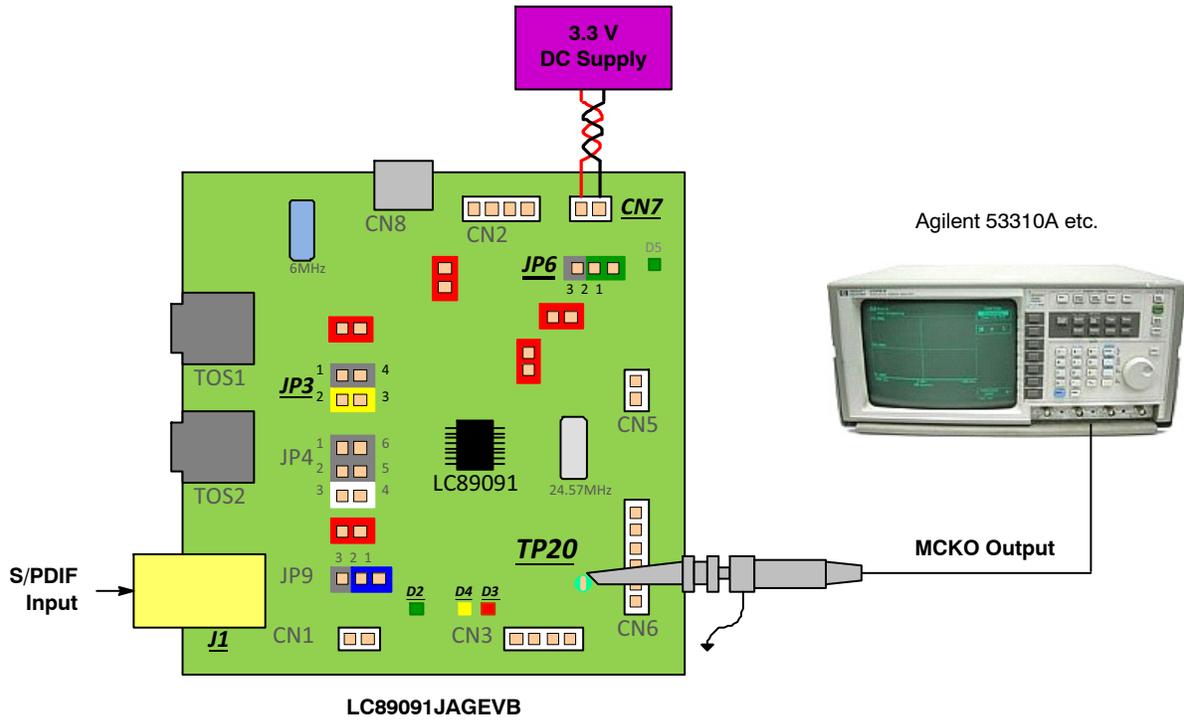


Figure 21.

Power Supply	USB	External DC	DSP Connection	YES	NO
Register Control	YES	NO	PLL Error Monitor	LED (D3)	PC
S/PDIF Input	TOSLINK	COAXIAL	Non-PCM Monitor	LED (D4)	PC
ADC Connection	YES	NO	Emphasis Monitor	LED (D2)	PC
DAC Connection	YES	NO	Demodulation Data	Oscilloscope	Audio Output

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S/PDIF Input Jitter Tolerance Measurement

- S/PDIF including jitter inputs to LC89091 and checks whether data is correctly receivable
- The frequency and amplitude of impressing jitter are based on IEC60958-3
- Please refer to the equipment manual for a measuring method

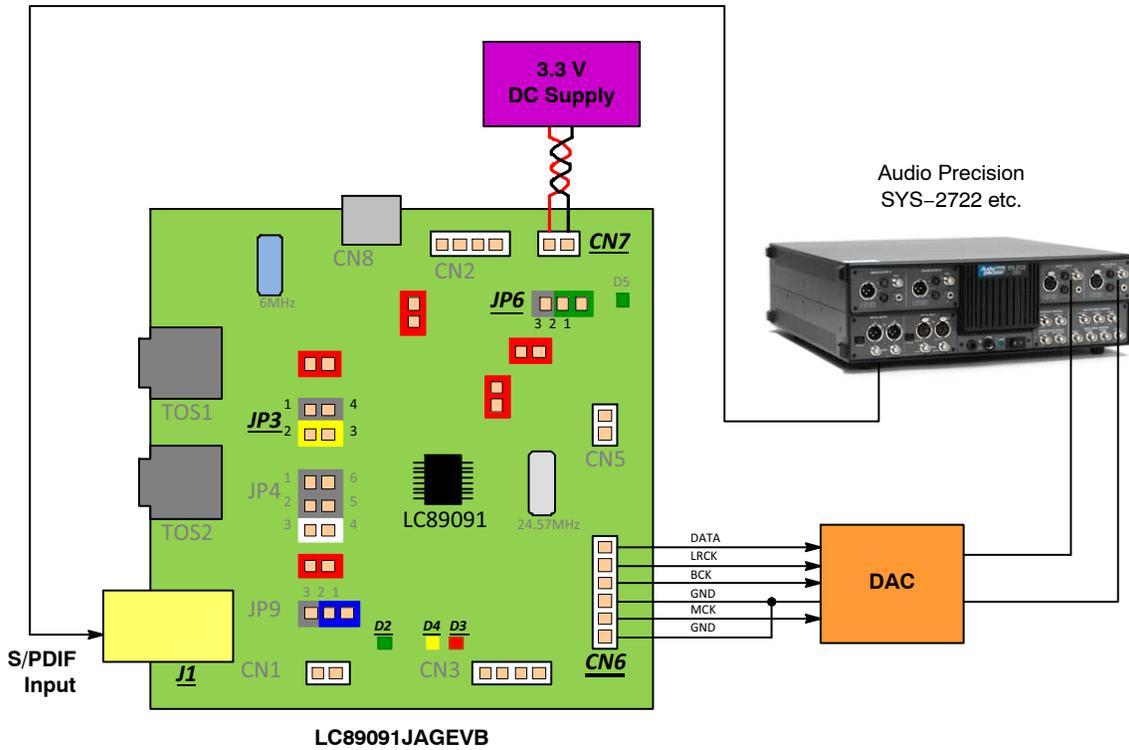


Figure 22.

Power Supply	USB	External DC	DSP Connection	YES	NO
Register Control	YES	NO	PLL Error Monitor	LED (D3)	PC
S/PDIF Input	TOSLINK	COAXIAL	Non-PCM Monitor	LED (D4)	PC
ADC Connection	YES	NO	Emphasis Monitor	LED (D2)	PC
DAC Connection	YES	NO	Demodulation Data	Oscilloscope	Audio Output

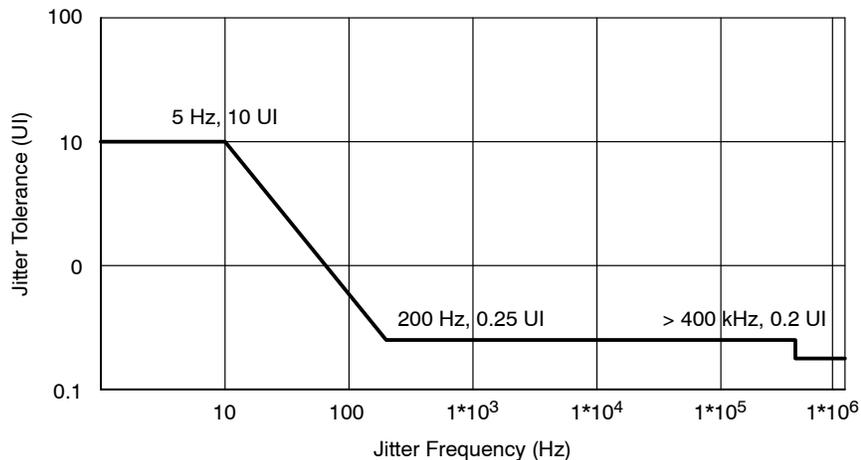


Figure 23. IEC60958-3: Receiver Jitter Tolerance Template

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Example of Sound Quality Evaluation Circuit Configuration

- 2 Channel Stereo Audio

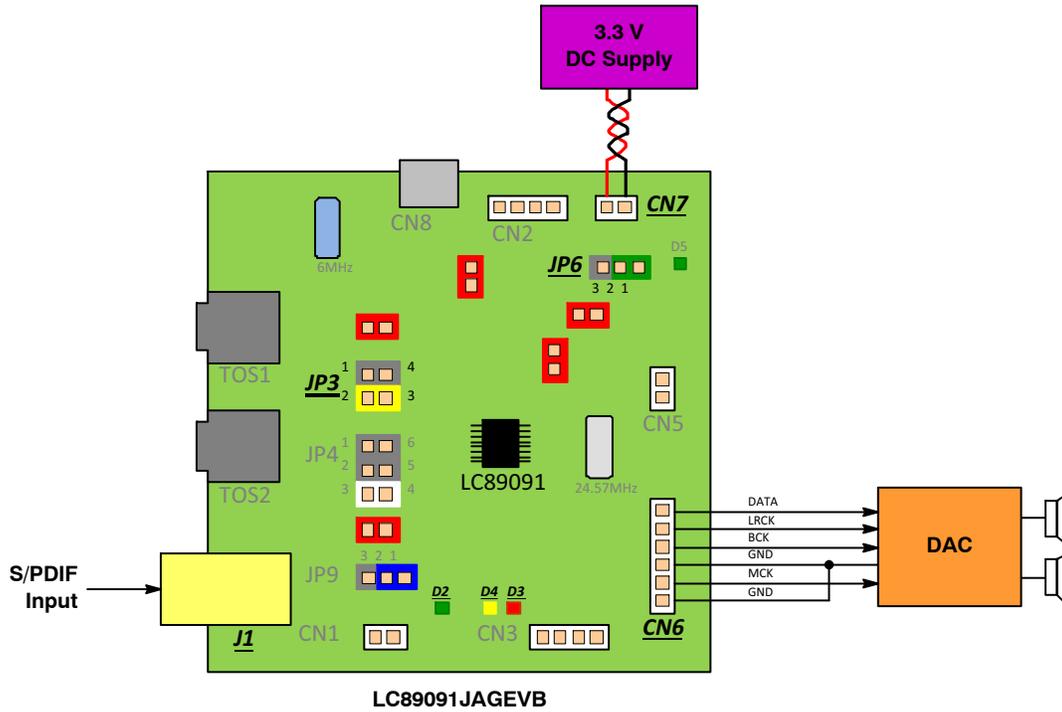


Figure 24.

Power Supply	USB	External DC	DSP Connection	YES	NO
Register Control	YES	NO	PLL Error Monitor	LED (D3)	PC
S/PDIF Input	TOSLINK	COAXIAL	Non-PCM Monitor	LED (D4)	PC
ADC Connection	YES	NO	Emphasis Monitor	LED (D2)	PC
DAC Connection	YES	NO	Demodulation Data	Oscilloscope	Audio Output

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Example of Sound Quality Evaluation Circuit Configuration

- 5.1 Channel Multi-channel Audio

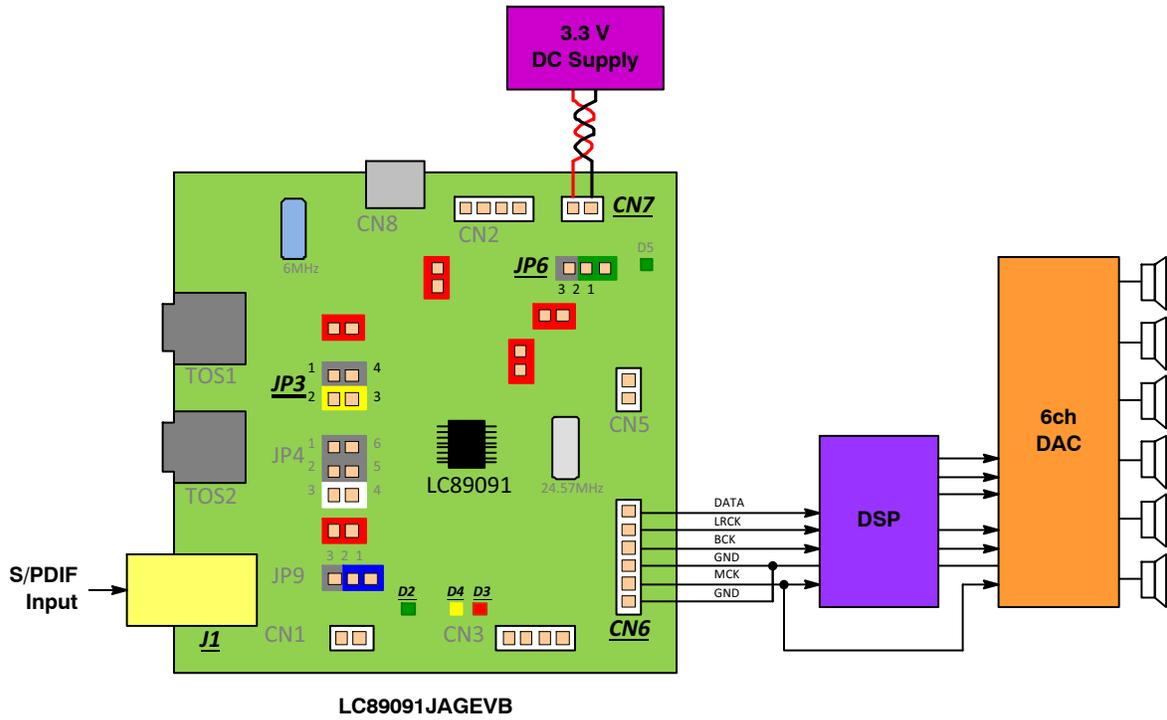


Figure 25.

Power Supply	USB	External DC	DSP Connection	YES	NO
Register Control	YES	NO	PLL Error Monitor	LED (D3)	PC
S/PDIF Input	TOSLINK	COAXIAL	Non-PCM Monitor	LED (D4)	PC
ADC Connection	YES	NO	Emphasis Monitor	LED (D2)	PC
DAC Connection	YES	NO	Demodulation Data	Oscilloscope	Audio Output

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Table 8. BILL OF MATERIALS

Designator	Qty.	Description	Value	Tolerance	Footprint	Manufacturer	Manufacturer's Part Number	Substitution Allowed	Lead Free
C1	1	Chip Capacitor	0.01 μ F, 50 V	\pm 10%	1608	Murata	GRM188B11H103K	Yes	Yes
C2, C3, C6, C9, C12, C14, C17, C18, C21, C22, C24, C25, C28	13	Chip Capacitor	0.1 μ F, 50 V	\pm 10%	1608	Murata	GRM188B11E104K	Yes	Yes
C4, C5	2	Chip Electrolytic Capacitor	2.2 μ F, 50 V	\pm 20%	4.3 x 4.3 (mm)	Japan Chemi-Con	EMVA500ADA2R2MD55G	Yes	Yes
C7	1	Film Capacitor	0.1 μ F, 50 V	\pm 10%	5.08 mm	Nissei	AMZ50V104K	Yes	Yes
C8	1	Film Capacitor	0.022 μ F, 50 V	\pm 10%	5.08 mm	Nissei	AMZ50V223K	Yes	Yes
C10, C11	2	Chip Capacitor	15 pF, 50 V	\pm 5%	1608	Murata	GRM1882C1H150J	Yes	Yes
C13, C15	2	Chip Tantalum Capacitor	10 μ F, 16 V	\pm 20%	3.2 x 1.6 (mm)	Nichicon	F931C106MAA	Yes	Yes
C16	1	Chip Electrolytic Capacitor	47 μ F, 16 V	\pm 20%	5.3 x 5.3 (mm)	Japan Chemi-Con	EMVA160ADA470ME55G	Yes	Yes
C19, C20	2	Chip Capacitor	47 pF, 50 V	\pm 5%	1608	Murata	GRM1882C1H470J	Yes	Yes
C23	1	Chip Capacitor	0.033 μ F, 50 V	\pm 10%	1608	Murata	GRM188B11H333K	Yes	Yes
C26, C27	2	Not Implemented	-	-	-	-	-	Yes	Yes
CN1, CN5, CN7	4	Pin Header	-	-	2.54 mm	Hirosugi-Keiki	PGS-410166-02	Yes	Yes
CN2, CN3	2	Pin Header	-	-	7.62 mm	Hirosugi-Keiki	PGS-410166-04	Yes	Yes
CN6	1	Pin Header	-	-	12.7 mm	Hirosugi-Keiki	PGS-410166-06	Yes	Yes
CN8	1	USB Connector (mini USB)	-	-	9.9 x 9.0 (mm)	HRS	UX60A-MB-5ST	Yes	Yes
D2, D5	2	Chip LED (Green)	6.3 mcd	-	1608	Rohm	SML-D12P8W	Yes	Yes
D3	1	Chip LED (Red)	63 mcd	-	1608	Rohm	SML-D12U8W	Yes	Yes
D4	1	Chip LED (Yellow)	63 mcd	-	1608	Rohm	SML-D12Y8W	Yes	Yes
F1, F2	2	Ferrite Beads	330 Ω , 1,500 mA	\pm 25%	2012	Murata	BLM21PG331SN	Yes	Yes
J1	1	RCA	-	-	14 x 10 (mm)	Marushin	MR-551L	Yes	Yes
JP1, JP2, JP5, JP7, JP8	5	Short Plug	-	-	2.54 mm	KEL	DSP-02-002-431G	Yes	Yes
JP3	1	Short Plug	-	-	2.54 x 2.54 (mm)	KEL	DSP-02-004-431G	Yes	Yes
JP4	1	Short Plug	-	-	2.54 x 5.08 (mm)	KEL	DSP-02-006-431G	Yes	Yes
JP6, JP9	2	Short Plug	-	-	5.08 mm	KEL	DSP-03-003-432G	Yes	Yes
P1	1	PTC (Positive Temperature Coefficient)	500 mA	-	3225	Tyco Electronics	microSMD050F	Yes	Yes
R1	1	Chip Resistor	75 Ω , 1/8 W	\pm 5%	2012	KOA	RK73B2ATTD750J	Yes	Yes
R2	1	Chip Resistor	100 k Ω , 1/8 W	\pm 1%	2012	KOA	RK73H2ATTD1003F	Yes	Yes
R4, R6, R24	3	Chip Resistor	1 k Ω , 1/8 W	\pm 1%	2012	KOA	RK73H2ATTD1001F	Yes	Yes
R5, R8, R10, R18, R19, R20, R21, R23	8	Chip Resistor	0 Ω , 2 A	-	2012	KOA	RK73Z2ATTD	Yes	Yes
R7, R27	2	Chip Resistor	10 k Ω , 1/8 W	\pm 1%	2012	KOA	RK73H2ATTD1002F	Yes	Yes
R9, R11	2	Chip Resistor	2.2 k Ω , 1/8 W	\pm 1%	2012	KOA	RK73H2ATTD2201F	Yes	Yes
R12, R15	2	Chip Resistor	5.6 k Ω , 1/8 W	\pm 1%	2012	KOA	RK73H2ATTD5601F	Yes	Yes
R14	1	Lead Resistor	100 Ω , 1/4 W	\pm 5%	5.08 mm	KOA	CF1/4C101J	Yes	Yes
R17	1	Chip Resistor	1 M Ω , 1/8 W	\pm 1%	2012	KOA	RK73H2ATTD1004F	Yes	Yes
R22	1	Chip Resistor	220 Ω , 1/8 W	\pm 5%	2012	KOA	RK73B2ATTD221J	Yes	Yes
R25, R26	2	Chip Resistor	27 Ω , 1/8 W	\pm 5%	2012	KOA	RK73B2ATTD270J	Yes	Yes
R28	1	Chip Resistor	4.7 k Ω , 1/8 W	\pm 1%	2012	KOA	RK73H2ATTD4701F	Yes	Yes
R29	1	Chip Resistor	1.5 k Ω , 1/8 W	\pm 5%	2012	KOA	RK73B2ATTD152J	Yes	Yes
R30	1	Chip Resistor	470 Ω , 1/8 W	\pm 1%	2012	KOA	RK73H2ATTD4700F	Yes	Yes

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Table 8. BILL OF MATERIALS (continued)

Designator	Qty.	Description	Value	Tolerance	Footprint	Manufacturer	Manufacturer's Part Number	Substitution Allowed	Lead Free
TOS1, TOS2	2	Optical Module	-	-	13.5 × 11.5 (mm)	Toshiba	TORX147	Yes	Yes
TP1, TP6, TP7, TP8, TP9, TP10, TP11, TP14, TP16, TP18, TP20, TP22	12	Test Pin	-	-	-	MAC8	LC-2-G-Olive Green	Yes	Yes
TP12, TP13	2	Test Pin	-	-	-	MAC8	LC-2-G-White	Yes	Yes
TP17, TP23, TP25, TP27, TP28, TP29	6	Test Pin	-	-	-	MAC8	LC-2-G-Black	Yes	Yes
U1	1	Inverter Logic	-	-	TSSOP-14	Toshiba	TC74HCU04AFT	Yes	Yes
U2	1	Digital audio Interface Receiver	-	-	SSOP-16	SANYO	LC89091JA-H	No	Yes
U3	1	Regulator	3.3 V	±1%	SOT223	ST Micro	LD1117S33CTR	Yes	Yes
U4	1	USB Controller	-	-	LQFP-48	FTDI	FT2322D	Yes	Yes
X1	1	Quartz Resonator	24.576 MHz	±30 ppm	11.05 × 4.65 (mm)	KDS	HC-49/U	Yes	Yes
X2	1	Ceramic Resonator	6 MHz	±0.5%	8.0 × 3.0 (mm)	Murata	CSTLS6M00G53-B0	Yes	Yes

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