

DA32UQ User Manual

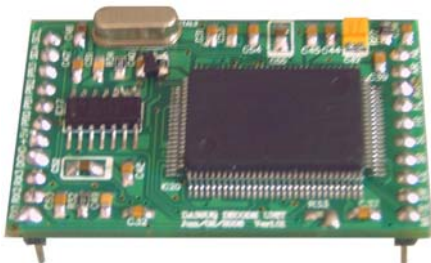
◆ Features

- Apply 24-bit audio DSP, CS8415 96KHz digital receiver, 96 KHz/24bit ADC and DAC.
- Support various 5.1 sound channel decoding such as Dolby digital AC-3, Dolby pro-logic, DTS, and PCM.
- Analog audio frequency output, can select low-pass filter circuits by itself so as to realize different effects.
- Built-in analog input mute, when there is no analog signal, the muting process will automatically go on, there is no need to connect detection circuit outside.
- Digital and analog ground wires are independent, which lowers the requirement of motherboard PCB LAYOUT and gets better performance.
- Use different external bass management methods according to different needs and pure hardware filter is able to get wider dynamic range.
- No DSP effect, user can add different circuits to realize equivalent effects.
- Use external electronic volume control. Prevent digital audio frequency from deteriorating signal-to-noise ratio when volume is small.
- Metal case package in the shape of radio head prevents from disturbing sound and other components and provides excellent EMT function.
- Metal case can be directly installed on the board, being an integrated product with audio board, which improves traditional connection of the decoder board and enhances the reliability and appearance of the product.
- Built-in STL215 singlechip can upgrade directly program online. Users can get new program on Internet when necessary, which provides convenience for debugging and maintenance.
- Provide mute control signal output and use hardware to mute directly.
- Many universal output ports and permit inner CPU to complete the CTD functions.
- Provide the SSB communication mode. It is suitable to develop user mainframe by yourself.

◆ DA32UD and DA32UQ are Pin-compatible Products

DA32UD and DA32UQ can be replaced each other, their differences are as follows:

- DA32UQ's price is lower than the price of DA32UD.
- The bass management of DA32UD is carried out by inner bass software, and it is acceptable that there are many kinds of bass configuration at the same time, while the bass management of DA32UQ is carried out by hardware.
- DA32UD has internal audio effects, with many kinds of DSP effect options; DA32UQ is only external.



Hard & Soft Technology Co., LTD.

<http://www.HSAV.com>

Address: second floor, No.199, Longyin 2nd Road, Xixiang, Shenzhen, China

TEL: 86-0755-27951479 27950879

Technology support: support@HSAV.com

FAX: 86-0755-27950879-213

Business contact: Sales@HSAV.com



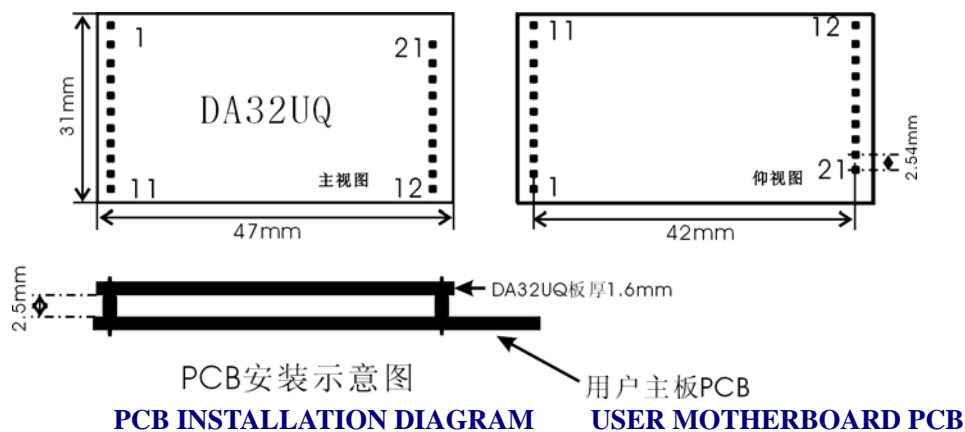
◆ Application Fields

- ✓ Digital audio frequency decoder or analog audio frequency decoder.
- ✓ AV receiving power amplifier.
- ✓ Multi-channel multimedia sound box with power supply and decoding.

◆ Ground Wire Instructions

There is no connection between AGND and GND in DA32UQ that asked for connecting on the user board. If +5V supply ground wire and analog ground wire are not in the power supply terminal, the connection point should near to the DA32UQ pins. GND connects with ground wire of metal outer covering to keep the resistance of ground wire lower for a good effect. Or connecting at the place supplying is also acceptable, while the position nearing the DA32UQ pins is preferable for a better effect.

◆ DA32UQ Dimension Diagram



◆ Instructions of the DA32UQ Socket Ports Connection

- 1) **SCL** Serial clock output port of controlling external volume IC, which is used together with clock of debugging downloading.
- 2) **SDA** Serial data input and output port of controlling external volume IC, which is used together with clock of debugging downloading.
- 3) **PB3** Universal port of input or output.
- 4) **PB2** Universal port of input or output, SCK port of SSB communication port. Normal application is infrared remote receiving input.
- 5) **PB1** Universal port of input or output, SDD port of SSB communication port.
- 6) **PB0** Universal port of input or output, SIN port of SSB communication port.
- 7) **+5V** Supplying +5V input.
- 8) **DGND** Digital ground wire input and output.
- 9) **RX3** Set3 digital input.
- 10) **RX2** Set2 digital input.
- 11) **RX1** Set1 digital input.



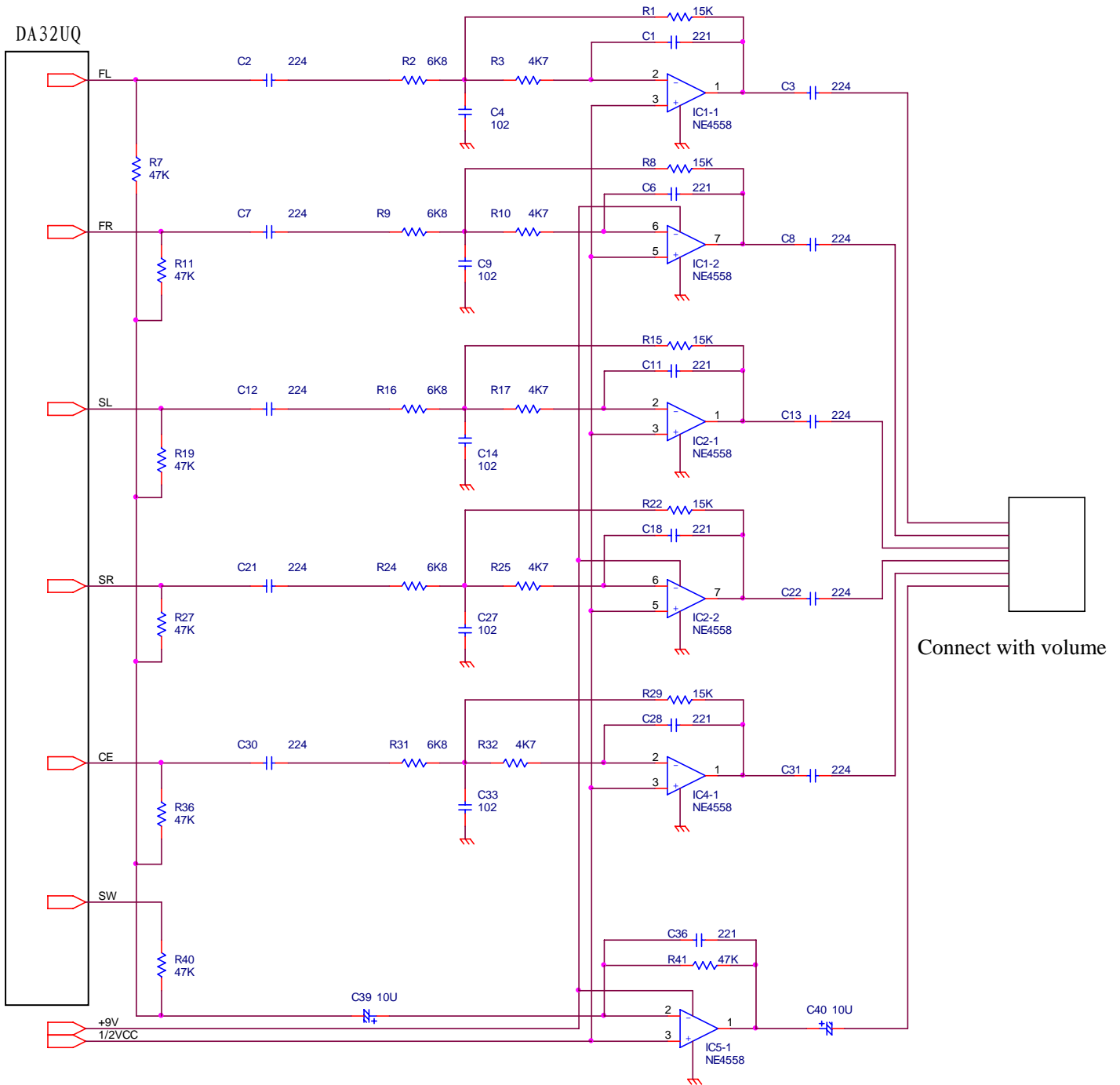
- 12) **MUTE** Muting control signal output. When muting takes effect output high level, when the sound works normally output low level.
- 13) **SW** Extra bass channel signal output.
- 14) **CE** Central channel signal output.
- 15) **SR** Surrounded right channel signal output.
- 16) **SL** Surrounded left channel signal output.
- 17) **FR** Front right channel signal output.
- 18) **FL** Front left channel signal output.
- 19) **AGND** Analog ground wire audio output and power supply input, it does not connected with digital ground and required to be connected from outside.
- 20) **AIR** Analog right channel signal input.
- 21) **AIL** Analog left channel signal input.

◆ Power Supply Instructions

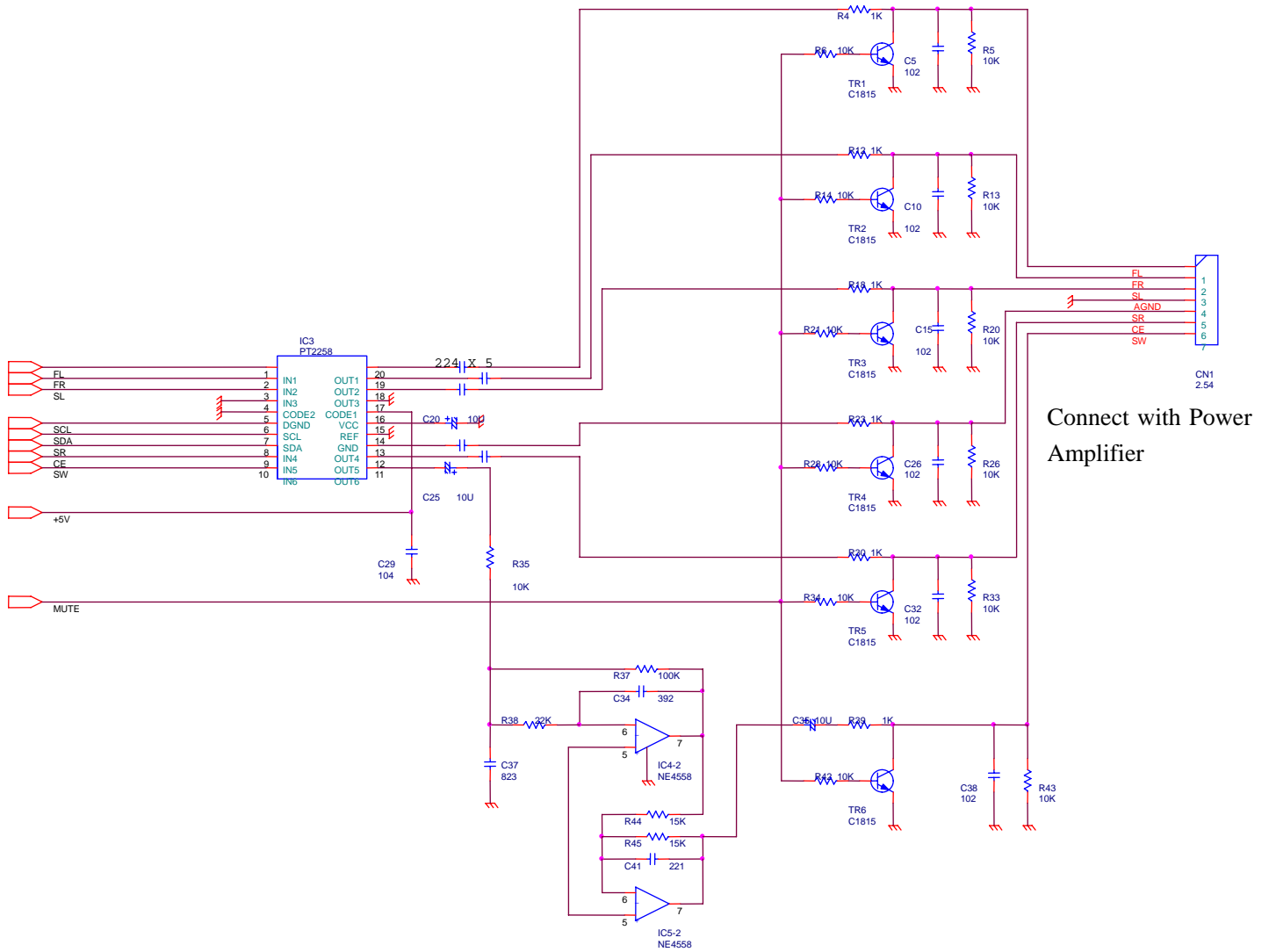
DA32UQ is only a single power supply and normally it only needs voltage-stabilizing IC such as 7805 etc to decrease the voltage for application directly. The audio input and output can adopt single or double power supply to supply electricity according to the user's needs.

◆ Audio Frequency Instructions

± Power supply is the best choice for the sake of a good effect ,if power supply of the complete system is ± power supply. Or single power supply can be adopted. When the single power supply is adopted, as the following diagram, operational amplifier plus input connects with 1/2 power supply. If there is no requirement for the sound, operational amplifier is not required and resistor and capacitor filter can be directly applied, while there will not be good effect of signal output range and high frequency.



Application of the single power supply and 5 satellite small speakers reference circuit diagram



Adopt PT2258 as the volume control and bass management audio output circuit.



◆ Electrical Specification

Sequence Number	Item	Minimum	Typical	Maximum
1	+5V power supply voltage	+4.6V	+5V	+5.5V
2	+5V working current	170mA	180mA	190mA
3	Digital RX input	0.1V(P-P)	0.5V(P-P)	1.0V(P-P)
4	Analog input valid detection level	0.8Vrms	--	--
5	Analog signal output 0@0dB	0.7Vrms	0.8Vrms	0.9Vrms
6	Analog signal output @0dB	2.0Vrms	2.2Vrms	2.3Vrms
7	Output noise power level (digital input CCIR/ARM)	50uV	58uV (S/N = 93dB)	76uV
8	Output noise power level (digital input, not weighted)	560uV	600uV	800uV
9	Output noise power level (digital input, CCTR/ARM)	70uV	76uV (S/N = 90dB)	80uV
10	Output noise power level (digital input, not weighted)	600uV	700uV	800uV
11	Frequency response (20Hz-20KHz)	--	+/-0.5dB	--

Attention: 6, 7, 8, 9, 10, 11 are results tested from supporting multimedia No.1.

◆ The Instructions of DA32UQ Software with Communication Interface

DA32UQ supplies function of mainframe customization and is able to independently finish functions of complete system. If the user's product has single-chip system, SSB bus communication can be used.

DA32UQ configuration has hardware SSB bus and user's single-chip communication and applies 8-bit address and 8-bit data. B7 means the seventh of the data, B6 means the sixth of the data, and the rest can be done in the same manner.

Channel choice code: 0x00 is FL (front left channel); 0x01 is CE (central channel); 0x02 is FR (Front right channel); 0x03 is SL (surrounded channel); 0x04 is SR (surrounded right channel); 0x05 is BL (back left channel); 0x06 is BR (back right channel); 0x07 is SW (extra bass channel).

DA32UQ does not support BL channel and BR channel. But the DA32UQ and the instructions of DA32UD and decoder supporting 7.1-channel are each other compatible.

DA32UQ does not support DSP EFFECT.

DA32UQ does not support speaker setting.



◆ The Table of User Mainframe Writing Instructions

Address	Function (Usual value)	Data and specific instructions
0×01	Choice of input terminal (0×00 input through digital RX1)	<ol style="list-style-type: none"> 1) When B7 is 1 choose analog signal input. 2) When B7 is 0 choose digital input. 3) From B1 to B0, choose the different digital ports. 4) 0×00 input through RX1;0×01 input through RX2;0×02 input through RX3.
0×02	Listening mode switching (0×00 is automation)	<ol style="list-style-type: none"> 1) When B7 is 1 choose function of TEST TONE 2) B3 to B0 are corresponding choice of channels with the same code of channel choice. When 0×08 is chosen, all channels are mute, but enter TEST TONE state.
		<ol style="list-style-type: none"> 1) When B7 is 0 and B6 is 1 choose DSP EFFECT. (DA32UQ does not support) 2) B2 to B0 are choosing different effects. (DA32UQ does not support) 3) 0×00 is MATRIX; 0×01 is LIVE;0×02 is CHURCH;0×03 is STADIUM;0×04 is SIMULATED;0×05 is HALL;0×06 is CHORUS;0×07 is THEATRE.
		<ol style="list-style-type: none"> 1) When B7 is 0 and B6 is 0 choose standard listening mode. 2) B2 to B0 are choosing different effects. 3) 0×00 is digital automation, if input is Dolby digital AC-3, the listening mode is AC-3 DIGITAL; If input is DTS, the listening mode is DTS DIGITAL. 4) 0×01 is stereophonic sound. 5) 0×02 is Dolby Pro logic mode.
0×03	Speaker setting (0×00 is standard configuration 1, all are small speakers with extra bass)	<ol style="list-style-type: none"> 1) B7 is the choice of back channel speaker size, 1 is big speaker (DA32UQ does not support) . 2) B6 is the choice of surrounded channel speaker size, 1 is big speaker (DA32UQ does not support) . 3) B5 is the choice of surrounded channel speaker size, 1 is big speaker (DA32UQ does not support) . 4) B4 is the choice of front channel speaker size, 1 is big speaker (DA32UQ does not support) . 5) B3 is the choice of extra bass channel setting, 1 is not installed (DA32UQ does not support) . 6) B2 is the choice of back channel setting, 1 is not installed (DA32UQ does not support) . 7) B1 is the choice of surrounded channel setting, 1 is not installed. 8) B0 is the choice of central channel setting, 1 is not installed.
0×04	Dolby digital dynamic compression (0×00 does not compress)	<ol style="list-style-type: none"> 1) It will be effective only when the input digital flow is Dolby digital AC-3. When 0×00 is normal does not compress and play repeatedly. The others value with dynamic compression mode play repeatedly.
0×10 To 0×17	Channel delay time adjusting	<ol style="list-style-type: none"> 1) 0×10 is FL channel; 0×11 is CE channel and so on. They respond to relatively code of channel choice. (DA32UQ only support central channel of 0×11 and surrounded channel of 0×13.) 2) Delay time writing of central channel is 0 to 5; in Dolby Digital mode is 0 to 5ms. 3) Delay time writing of surrounded channel is 0 to 15. In DTS and Dolby Digital mode is 0 to 15ms;in Dolby Pro logic mode, reality is 15ms to 30ms. 4) Attention: only when listening mode is digital automation or in Dolby Pro logic mode can take effect.



◆ **The Table of User Mainframe Interrupts and Reading Instructions**

Address	Function (Usual value)	Data and specific instructions
0×7f	Clear interrupt	1) Writing 0×80 will clear SIN application interrupt action caused by address of 0×80. In general, only after reading right, the interrupts will be cleared.
0×80	The state of signal input (read only)	1) B6 to B4 is Dolby digital or DTS input source code format. 2) 0×00 is 1+1, 0×01 is 1/0, 0×02 is 2/0, 0×03 is 3/0, 0×04 is 2/1, 0×05 is 3/1, 0×06 is 2/2, 0×07 is 3/2. 3) B3 is DTS digital signal input. 4) B2 is Dolby digital AC3 signal input. 5) B1 is PCM digital signal input. 6) B0 means no signal input.

◆ **Simple Series Bus Instructions**

SSB is shorted from **Simple Series Bus**, it is composed of three lines, SCK bit clock, and SDD bit digital and SIN address latching and interrupt.

All three lines of SSB are high level when they are free. Normally applying ports of open-drain structure such as 8051 series ports make the level high through pull-ups. If ports with input and output choices are used, the port will be chosen as input when it's free and the output is high. Only when output is low level the port will be chosen as output. This is for the convenience of procedure processing.

SSB must adapt to ports from 2.5V to 5.0V. In case connection wire between the principal and the subordinate is too long, pull-ups can be added or capacitors from several P to hundreds of P can be connected with ground wire to filter disturbance from the circuit.

In SSB, SCK is serial synchronous clock that is outputted by the communication principal. SDD is serial synchronous and bi-directional data. SIN is interrupt port subordinate applying from principal and address latching signal from principal to subordinate. When principal is sending signals to the address, the level is low.

SSB is composed of address, data and answering signal, among which the address is outputted by principal and inputted by subordinate unchangeably; the data is bi-directional transmission, when principal is writing register is output and is reading register is input; And the answering signal offers a mechanism for confirming whether the transmission is right; The confirmation signal is initiated by subordinate and its value is fixed unchangeably as the contrary value of the last data bite. If principal doesn't receive the right answering signal, then it requires re-sending.

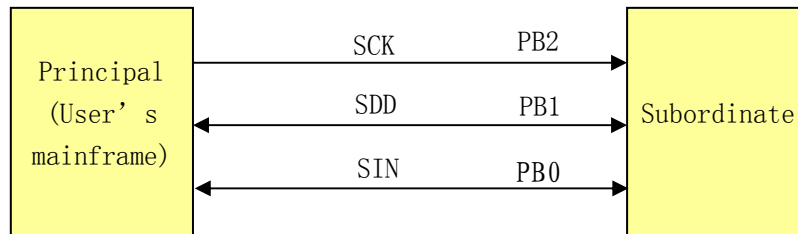
In the transmission of SSB, low bit outputs first. During the transmission of address signal, principal has to put SIN low, while in the process of transmission data and answering must make SIN high.

There are two types of SSB: low speed type and high-speed type, two kinds of control modes are identical. The communication speed of the low type is 33Kbps, namely, each SCK time is 30US (one falling margin to next falling margin). The communication speed of the high type is 1Mbps, namely, each SCK time is 1us.



SSB address is composed of 4 to 8 bits. According to different address bits, there are SSB4 with 4 bits and SSB8 with 16 bits. DA32UQ applies the low speed bus of SSB8.

DA32UQ applies low speed SSB8 bus having 8-bit address and 8-bit data.



SSB Connection diagram between principal (user's mainframe) and subordinate

◆ The Low-speed SSB8 Instructions of DA32UQ

In DA32UQ communication process, the principal is single-chip machine used by the user shorted to be user mainframe. The subordinate is DSP used by DA32UQ, shorted to be DA32UQ.

Suggesting apply the port without input and output control port to communicate. If user mainframe has input and output two choices, only when low level is outputted the choice is output. Such can automatically adapt to SSB level.

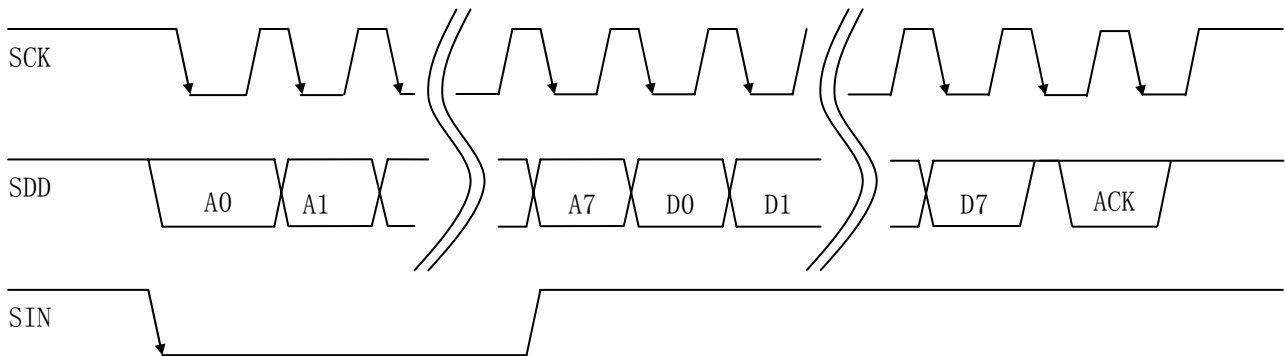
◆ The Time Order Instructions of SSB8 Writing Register Used by DA32UQ

DA32UQ applies low-speed SSB8. The address length is 8 bits and the data length is 8 bits, i.e.1 byte. When the user mainframe writes register, 8-bit address should be written first and low bit should output first. Time order of writing register is as following:

- 1) Make SIN low.
- 2) Output A0 bit of the address first.
- 3) Make SCK low and delay time to a corresponding time (low speed is 15us, high speed is 0.5us).
- 4) Make SCK high and delay time to a corresponding time (low speed is 15us, high speed is 0.5us).
- 5) Output A1 bit of the address.
- 6) Repeat 3 to 5 until finishing A7 bit.
- 7) Make SIN high.
- 8) Output D0 bit and repeat action of the SCK until finishing D7 bit.
- 9) Make SDD high and turn SDD into input, which is in order to prepare for receiving answering bit.
- 10) Make SCK low and delay time, when subordinate will output opposite code of D7 as confirmation signal.



- 11) Make SCK high and when delaying time have finished contrast with the value of reading SDD. If the comparison result is opposite, it means the data is read successfully.
- 12) Make SCK low and delay time, this moment subordinate output SDD as high.
- 13) After making SCK high and delaying time, the register writing is finished.
- 14) If writing is not successful, it will begin rewriting until instructions are written correctly.
- 15) Attention: No matter SIN is high or low, when SCK turns low at the first time, DA32UQ will output SIN as high. If writing and reading have errors, when the bus is free the subordinate will turn low again to send interrupt signals to the principal.



User mainframe writing register orders

◆ The Instructions of Multimedia No.1 Source Code and SSB Routine

Download “Da32uq_ud communication routine. ZIP” document. After decompressing, F71.bat can be directly operated and generate HEX, BIN and AR5 burning and recording file.

Among the example, ROM part have been used of the generated document is less than 4 K, and RAM part is less than 128bytes. The document can operate in AT89C51AK or single-chip machine that is compatible with AT89C51AK.

a) F71_SSB.c can be directly transplanted to user mainframe.

- 1) Documents permitting to be edited and modified are as following:

F71.bat

BATCH document, directly operate F71.bat to generate HEX and BIN files.

F71_main.c

Major module document, main function, main circulation and interrupt processing.

F71_sub.c

Subsidiary module document, key-press processing, initialization and TM1628 display control.

F71_aud.c

Audio frequency processing module document, audio frequency and PT2258 volume control.

F71_ssb.c

SSB module document, it can be directly transplanted to user mainframe.

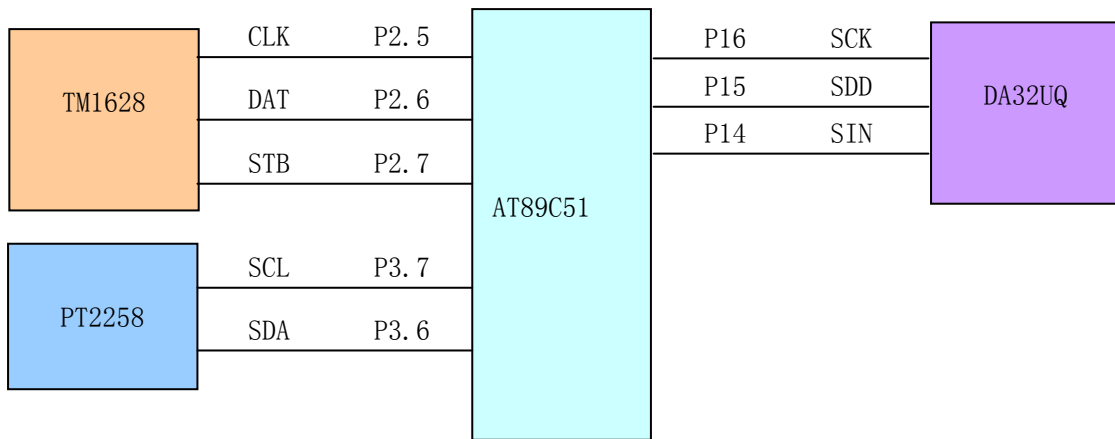
F71_main.h

Header file, all variables are defined in this document.

F71_main.lin
Connecting configuration document.

- 2) Documents do not permit to be edited or modified are as following:
Da32uduq.mak and da32uduq.vcp MSVC project document
F71_main.hex、 F71_main.bin 、 F71_main.Ar5 Generated burning and recording document.

- b) LIB file folder is devices header file and library file.
c) BIN file folder is executable files and relevant tools.



Multimedia No.1 single-chip machine interface diagram

◆ **The Principle Instructions of C Language Writing Source Code Used by HSAV**

1、 Naming principle

Naming of all variable, constant and function is composed of three portions. .

For example, FAUD_Mute is divided to three parts, namely: F, AUD, and _Mute.

The first portion is composed of one letter or one letter and one number, which mean the type of the definition.

Content	Meaning
Capital ‘M’	Means function.
Capital ‘F’	Means indexed variable, 1-bit variable.
Lower case ‘g’	Means 8-bit variable.
Lower case ‘g2’	Means 16-bit variable.
Lower case ‘g4’	Means 32-bit variable.
Lower case ‘g8’	Means 64-bit variable.
Lower case ‘c’	Means constant.
Lower case ‘p’	Means IO port.

The second part is composed of three to four English capital letters that mean the document the naming belongs to. For example, if variable is used in H06_AUD.C, the second part is AUD. Documents in common used are as following,



Content	Meaning
AUD	Universal audio frequency processing file
VOL	Multi-channel volume processing file
SUR	Multi-channel with surrounded sound processing file
SUB	The function of the main file is being expanded. There shouldn't have too many functions in the main file to prevent deteriorating effect.
DOS	Processing file of operating system with USB mainframe or hard disk interface.
MED	Processing files with multimedia audio frequency playing such as mp3.

The third part is concrete content that have one word or several words normally. The first letter of each word is capitalized and underline can be added to each word. As the capitalized letters separate each word, there is no need for underline. The principle is that if it doesn't look good or the word is abbreviated (It's usually capitalized) underline can be used.

2、 Principle of global and local variables

Content	Meaning (compatible with VC++)	C language standard
1-bit indexed variable	EXTR BOOL FAUD_Mute	Nonexistence
8-bit non-mark variable	EXTR BYTE gAUO_Volume	Unsigned char
16-bit non-mark variable	EXTR WORD g2AUO_EQ_Mode	Unsigned int
32-bit non-mark variable	EXTR DWORD g4AUO_Mute_Timer	Unsigned long
Pointer variable	EXTR BYTE *gpAUD_Pointer	Unsigned char
Local variable	EXTR BYTE gLocal_1	Unsigned char

Local variable absolutely forbids using 1 or several letters, e.g., when 'X' is the variable, it is difficult to copy and point out how many bits, there are. All writing should be first-time named and copying is necessary in the process of application, rewriting the same name is not suggested.

As for indexed local variable BOOL FLocal_1 and 8-bit local variable BYTE gLocal_1 etc, the first part of local variable and global variable are the same. For the second part, when 'Local_' is applied means local variable. And the third part is composed of numbers from 1 to 9 and lower case letters from "a" to "z."