九齊科技股份有限公司
Nyquest Technology Co., Ltd.

User Manual

# Q-Audio

## Customizable & Programming-Free Voice Prompt Editor

**Version 1.2**

**Aug. 25, 2023**

# Table of Contents

# 1 Introduction

*Q-Audio* is a tool designed to support NX1 application development. User does not need to write any code, just select the mode, audio and function, the project can be easily completed. User also can download the project files to NX1 IC and SPI Flash for demo or mass production.



## 1.1 What is *Q-Audio*

*Q-Audio* is a simple audio playback tool developed by Nyquest, and allows user to customize UI. User can select the desired mode, audio, and pins through the simple and easy UI of *Q-Audio*. After compiling the project, user can download files to IC / SPI Flash for playback.

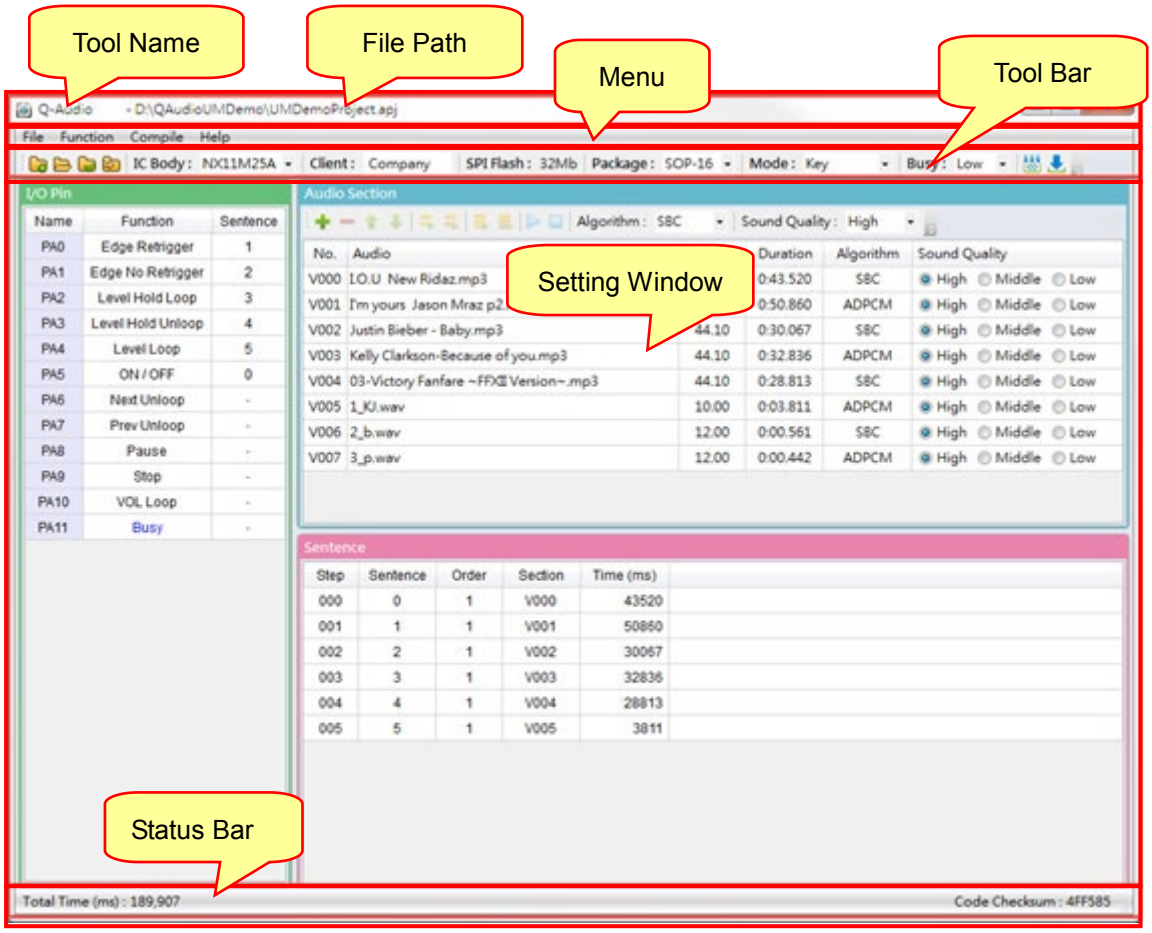
## 1.2 Installation of *Q-Audio*

Please contact Nyquest Technology to acquire the latest version of *Q-Audio*. To install, simply unzip the .zip file and double click the .exe file. Then, follow the instruction of the Installation Wizard to complete the installation.

- A PC with Pentium 1.3GHz or higher CPU, Windows XP/ 7/ 8/ 10.
- At least 1G SDRAM.
- At least 2G free space on the hard disk.
- A display card and monitor that support 1366x768 resolution or higher.
- .NET Framework 4.8 and up installed.

# 2 Function Guide

## 2.1 Interface



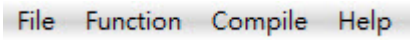

The main interface of *Q-Audio* is shown as above, the related introductions are described below.

- **Menu:** Function menu.
- **Tool Bar:** Commonly used function buttons
- **Setting Window:** The setting window contains I/O Pin, Audio Section and Sentence.
- **Status Bar:** Shows the total time of Sentences and the total checksum of .bin file.

***Note: While failing to compile, please check if there are special characters in the path of executable file. Besides, please mark Q-Audio as trusted in the antivirus software.***

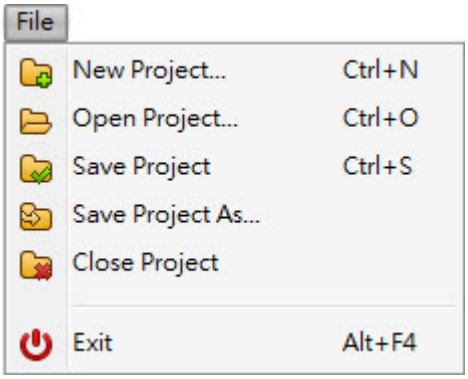
## 2.2 Menu

The menu contains File, Function, Compile and Help.



### 2.2.1 File

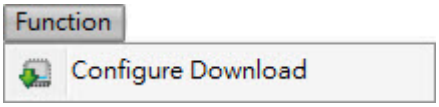
The [File] menu provides the related functions for user to manage project. The following menu will appear by clicking [File]:



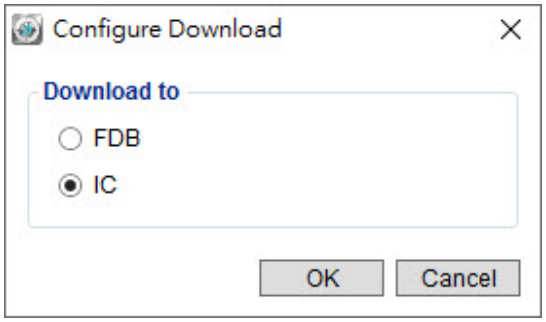

- **New Project...:** Create a new project, the filename extension is .apj.
- **Open Project...:** Open the previous edited project file, the filename extension is .apj.
- **Save Project:** Save the current project file.
- **Save Project As...:** Save the current project file to a specified file folder.
- **Close Project:** Close the current opened project file.
- **Exit:** Exit *Q-Audio*.

### 2.2.2 Function

The following menu will appear by clicking [Function]:

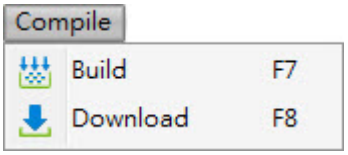



- **Configure Download:** Select the target of download for demo. Use NX_Programmer to connect to the target FDB or IC, and set the proper option in configure download dialog box to download successfully.

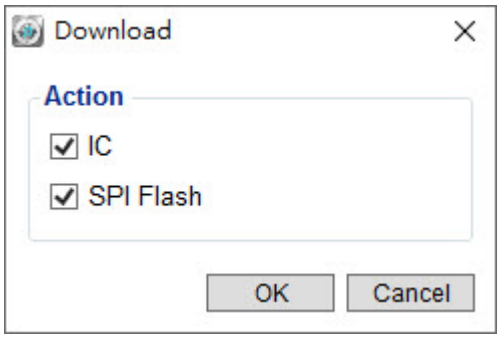


### 2.2.3 Compile

The following menu will appear by clicking [Compile]:



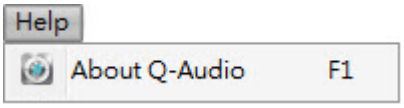

- **Build:** Build the current project file as a .bin file.
- **Download:** Download the .bin file to the hardware tool. It the project is not compiled, it will be compiled before downloading. Download will be executed according to the setting of Configure Download. Since the downloaded content will be different depending on hardware, the setting of Configure Download must be set correctly before downloading. If the target is IC, the Download windows will be shown for users to choose to update content in IC, SPI or both.




***Note: NX11FS23A only supports "Download to IC".***

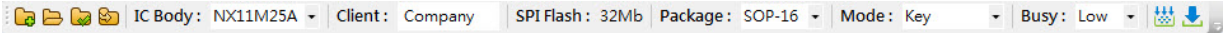
### 2.2.4 Help

The following menu will appear by clicking [Help]:




**About Q-Audio:** Show the *Q-Audio* version and the contact information for technical support.

## 2.3 Tool Bar




**New:** Create a new project, the filename extension is .apj.

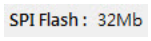
**Open…:** Open an existing project file, the filename extension is .apj.

**Save:** Save the current project file.

**Save as...:** Save the current project file to a specified folder or file name.

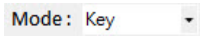

**IC Body:** Select the IC body.


**Client:** Input the client name.

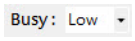



**SPI Flash:** Shows the size of SPI Flash memory of the selected IC.


**Package:** Select the package type: SOP-8 or SOP-16.




**Mode:** Select the audio control modes: MP3, Key, One Line, Three Line, or Matrix 3x8.




**Busy:** Set the level of output signal while audio is playing: High or Low.

**Build:** Build the current project file as a .bin file.

**Download:** Download the built .bin file to hardware tool. Please refer to 2.2.3.

## 2.4 Setting Window

The setting window provides user to quickly set the audio and the functions of pins. It contains I/O Pin, Audio Section and Sentence.

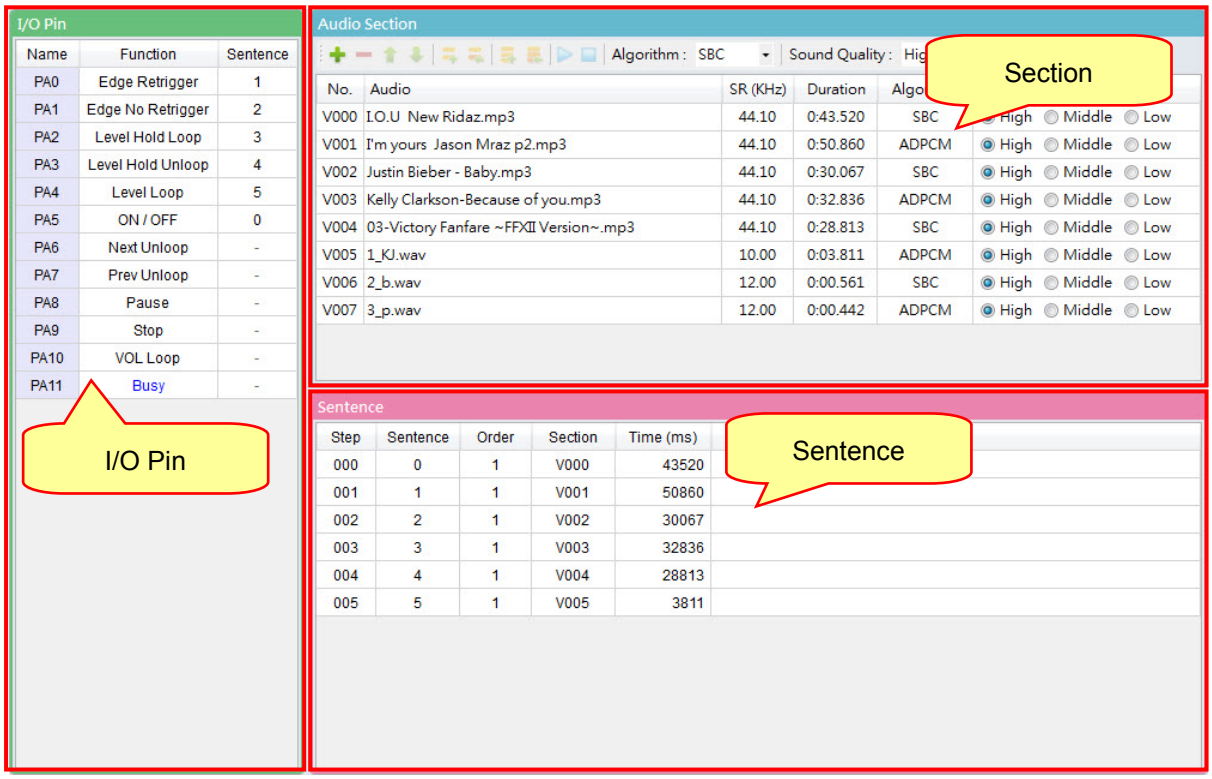
## 2.5 Status Bar

**Total Time:** Shows the total time of all audio that are used in the sentences.

**Code Checksum:** Shows code checksum of the binary file (.bin).

# 3 Setting Window

The Setting Window provides user to quickly set the audio and the functions of pins. It contains I/O Pin, Audio Section Sentence.




## 3.1 I/O Pin

The I/O Pin list will be changed according to the IC Body, Package and Mode.

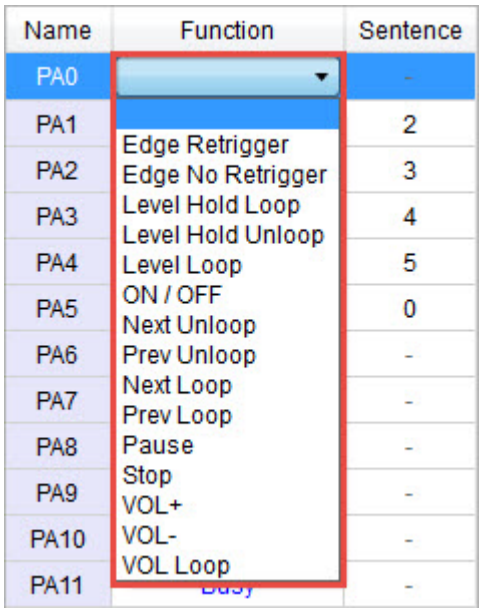
### 3.1.1 MP3, Key, One Line and Three Line Mode

I/O Pin

| Name | Function | Sentence |
|---|---|---|
| PA0 | Edge Retrigger | 1 |
| PA1 | Edge No Retrigger | 2 |
| PA2 | Level Hold Loop | 3 |
| PA3 | Level Hold Unloop | 4 |
| PA4 | Level Loop | 5 |
| PA5 | ON / OFF | 0 |
| PA6 | Next Unloop | - |
| PA7 | Prev Unloop | - |
| PA8 | Pause | - |
| PA9 | Stop | - |
| PA10 | VOL Loop | - |
| PA11 | Busy | - |

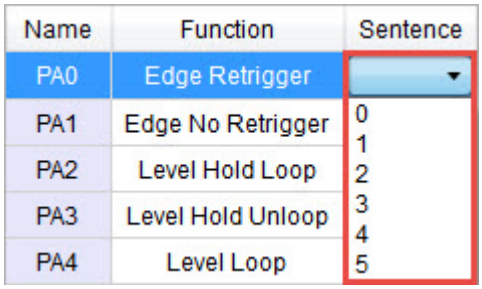
- **Name:** The pin name.
- **Function:** Set the function of pin.
- **Sentence:** According to the function selected in Function column, the Sentence column allows user to specify the sentence number that had been added to Sentence Section for playback.

If the Function column is blank, user can select the function of pin from the dropdown list as shown below.




***Note: The Function options will be different according to the selected Mode and IC Body.***

According to the function selected in [Function] column, the column of [Sentence] will be changed. If the column is blank, user can specify the number of Sentence for playback.

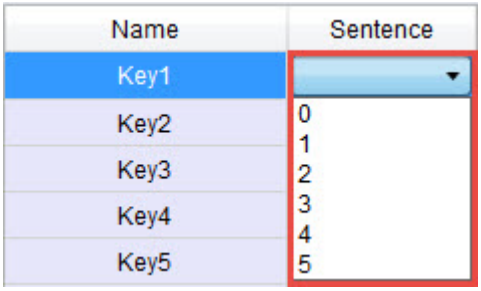


### 3.1.2 Matrix 3x8 Mode

I/O Pin

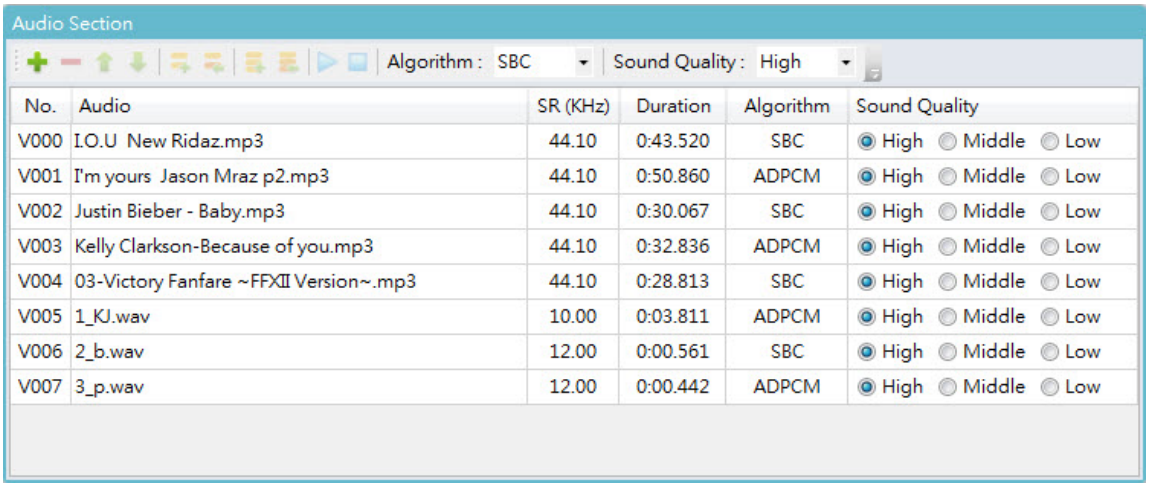
| Name | Sentence |
|---|---|
| Key1 | 0 |
| Key2 | 1 |
| Key3 | 2 |
| Key4 | 3 |
| Key5 | 4 |
| Key6 | 5 |
| Key7 | 0 |
| Key8 | 1 |
| Key9 | 2 |
| Key10 | 3 |
| Key11 | 4 |
| Key12 | 5 |
| Key13 | 0 |
| Key14 | 1 |
| Key15 | 2 |
| Key16 | 3 |
| Key17 | 4 |
| Key18 | 5 |
| Key19 | 0 |
| Key20 | 1 |
| Key21 | 2 |
| Key22 | 3 |
| Key23 | 4 |
| Key24 | 5 |

- **Name:** Shows the key name.
- **Sentence:** According to the function selected in Function column, the Sentence column allows user to specify the sentence number that had been added to Sentence Section for playback, as shown below.



## 3.2 Audio Section

All the audio files will be displayed in the Audio Section. User can use toolbar or right-clicked pop-up menu to add, delete or move files. In Audio Section table, user can use multiple selection to change the settings of multiple audio files. For example, to set ADPCM algorithm for the audio files of V001, V003, V005, and V007, just press and hold the CTRL key and then select the rows of V001, V003, of V005 and V007. These rows will be highlighted to indicate that they are selected, and then click Algorithm to ADPCM on the toolbar to change their algorithms to ADPCM. If user wants to select a range, such as V001~V005, just press and hold the Shift key and then select V001 and V005.




| No. | Audio | SR (KHz) | Duration | Algorithm | Sound Quality |
|---|---|---|---|---|---|
| V000 | I.O.U New Ridaz.mp3 | 44.10 | 0:43.520 | SBC | High Middle Low |
| V001 | I'm yours Jason Mraz p2.mp3 | 44.10 | 0:50.860 | ADPCM | High Middle Low |
| V002 | Justin Bieber - Baby.mp3 | 44.10 | 0:30.067 | SBC | High Middle Low |
| V003 | Kelly Clarkson-Because of you.mp3 | 44.10 | 0:32.836 | ADPCM | High Middle Low |
| V004 | 03-Victory Fanfare ~FFXII Version~.mp3 | 44.10 | 0:28.813 | SBC | High Middle Low |
| V005 | 1_KJ.wav | 10.00 | 0:03.811 | ADPCM | High Middle Low |
| V006 | 2_b.wav | 12.00 | 0:00.561 | SBC | High Middle Low |
| V007 | 3_p.wav | 12.00 | 0:00.442 | ADPCM | High Middle Low |

### 3.2.1 ToolBar

**Add:** Add audio files. User can make multiple selections in the File Dialog.

**Delete:** Delete the selected audio files.

**UP:** Move the selected audio files upward.

**Down:** Move the selected audio files downward.

**Add Step:** Add a step into the sentence.

**Insert Step:** Insert a step above the selected step.

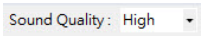
**Add Sentence:** Add one sentence at the end of all sentences.

**Insert Sentence:** Insert a sentence above the selected sentence.

**Play:** Play the selected audio file.

**Stop:** Stop the playing audio file.

Algorithm : SBC **Algorithm:** Three algorithms ADPCM, SBC and PCM are provided for user to choose from. The newly added audio file will set its algorithm based on this setting. User can also use it to change the algorithm of selected audio files as well.




**Sound Quality:** Set the sound quality of audio files. The newly added audio file will set its sound quality based on this setting. User can also use it to change the sound quality of selected audio files as well.

### 3.2.2 No.

The sequence numbers of audio files. The serial number increases sequentially from V000.

### 3.2.3 Audio

The Audio files that have been added. The audio files not used in sentence will not be compiled into ROM.

### 3.2.4 SR

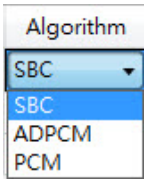
SR shows the sample rate of audio file, its unit is KHz.

### 3.2.5 Duration

The Duration shows the length of the audio file, the format is "minutes:seconds.milliseconds"

### 3.2.6 Algorithm

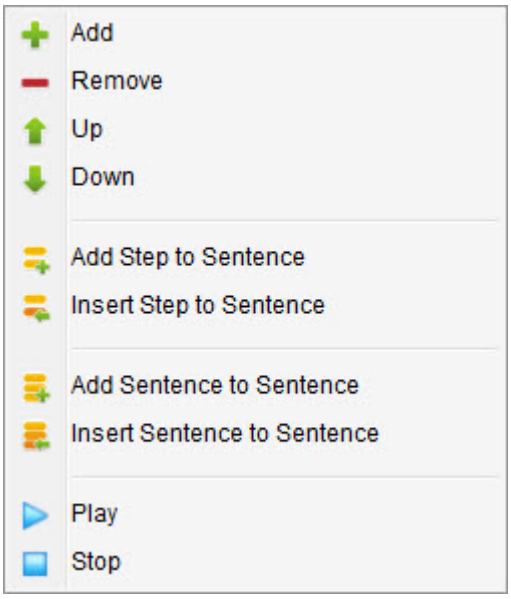
The audio algorithm provides 3 options: ADPCM, SBC and PCM. Among these three algorithms, SBC and ADPCM are lossy compression. SBC has the highest compression rate, and ADPCM is the second. PCM is the original source without compression, the sound quality is the best but the ROM consumption is the most.




### 3.2.7 Sound Quality

User can change the sound quality of the converted audio file by needs.

### 3.2.8 Context Menu




**Add:** Add audio files. User can make multiple selections in the File Dialog.

**Delete:** Delete the selected audio files.

**UP:** Move the selected audio files upward.

**Down:** Move the selected audio files downward.

**Add Step to Sentence:** Add a step into the sentence.

**Insert Step to Sentence:** Insert a step above the selected step.

**Add Sentence to Sentence:** Add one sentence at the end of all sentences.

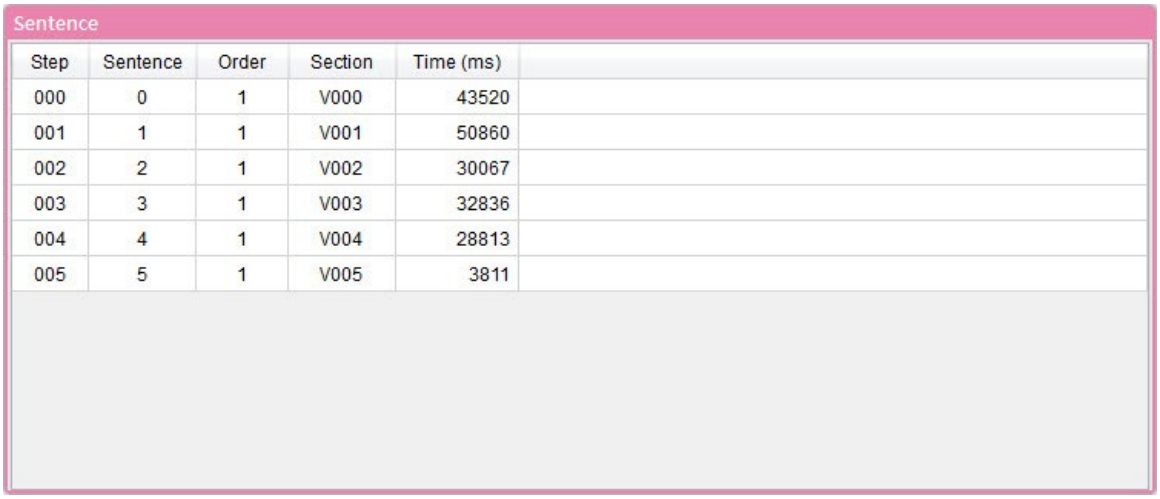
**Insert Sentence to Sentence:** Insert a sentence above the specified sentence.

**Play:** Play the selected audio file.

**Stop:** Stop the playback of audio file.

## 3.3 Sentence

In the Sentence section, the audio files are selected as steps can be arranged and combined to make sentences.


Sentence

| Step | Sentence | Order | Section | Time (ms) |
|---|---|---|---|---|
| 000 | 0 | 1 | V000 | 43520 |
| 001 | 1 | 1 | V001 | 50860 |
| 002 | 2 | 1 | V002 | 30067 |
| 003 | 3 | 1 | V003 | 32836 |
| 004 | 4 | 1 | V004 | 28813 |
| 005 | 5 | 1 | V005 | 3811 |

### 3.3.1 Step

A Step is a piece to be combined as a sentence. A step can have an audio or a mute section. The step sequence starts from 000.

### 3.3.2 Sentence

The Sentence column shows the sentence numbers the steps belong to.

### 3.3.3 Order

The Order column shows the sequence numbers of the steps contained in each sentence. The serial number of all the steps is automatically generated and starts from 1. When the sentence is executed due to an input trigger, steps will be played sequentially.

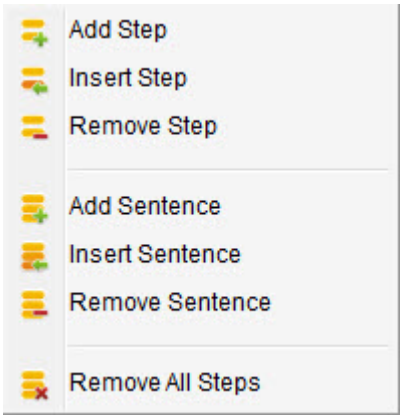
### 3.3.4 Section

Selecting an audio or mute section. The serial number of audio corresponds to that defined on Section.

### 3.3.5 Time

In the Time column, if the Section column is Mute, user can set the length of mute. If the Section column is Audio, it shows the duration of the audio.

### 3.3.6 Context Menu




**Add Step:** Add one step at the end of all steps.

**Insert Step:** Insert one step above the selected step.

**Remove Step:** Remove the selected steps.

**Add Sentence:** Add one sentence at the end of all sentences.

**Insert Sentence:** Insert one sentence above the selected sentence.

**Remove Sentence:** Remove the selected sentences.

**Remove All Steps:** Remove all steps.

# 4 Control Modes

*Q-Audio* provides 5 control modes, user can switch the mode by the tool setting and download the result to NX1_FDB, NX1 IC and SPI Flash.

## 4.1 MP3 Mode

The MP3 mode, as the name suggests, supports the function of MP3 player. The MP3 mode gets 6 key functions and one output by default as the following table shown. User just needs to add the audio file into Audio Section, then arranges the order of tracks to complete settings and download to demonstration.

| Pin | Function | Description |
|---|---|---|
| PA0 | Stop | Input pin. Stop the current playback after triggering. |
| PA1 | Play / Pause | Input pin. Play the paused/stopped track after triggering, or pause the playing track after triggering. |
| PA2 | Next | Input pin. Play the next track after triggering. If the track is the final one, then play from the first track. |
| PA3 | Prev | Input pin. Play the previous track after triggering. If the track is the first one, then play from the final track. |
| PA4 | VOL+ | Input pin. Volume up one level after triggering. There are 8 levels of volume, if the highest volume has been reached, it is maintained at the highest volume. |
| PA5 | VOL- | Input pin. Volume down one level after triggering. There are 8 levels of volume, if the lowest volume has been reached, it is maintained at the lowest volume (mute). |
| PA11 | Busy | Output pin (available for LED). When the audio file is played, it will output signals according to the Busy High or Low. Please set the connection (by Sink or Drive) to output signals as Busy Low or Busy High. |

Because avaliable pins for SOP8 package are less, the corresponding functions will be changed as Stop, Play / Pause, Next and Prev. Different ICs and different packages can use different pins. The following table lists the pin definitions of various ICs and packages.f

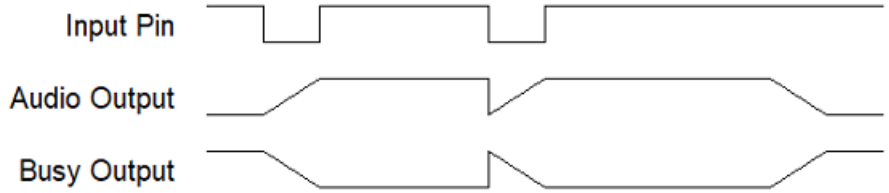
| IC | Stop | Play/Pause | Next | Prev | VOL+ | VOL- | Busy |
|---|---|---|---|---|---|---|---|
| NX1 SOP8 | PA2 | PA3 | PA4 | PA5 | - | - | - |
| NX1 SOP16 | PA0 | PA1 | PA2 | PA3 | PA4 | PA5 | PA11 |
| NX11FS23A SOP8 | PA8 | PA12 | PD0 | PD1 | - | - | - |
| NX11FS23A SOP16 | PA2 | PA3 | PA12 | PA13 | PA14 | PB0 | PB1 |

## 4.2 Key Mode

The Key mode provides user to define the function of each pin. The input pins are triggered at negative edge and the key debounce time is 25ms. Please refer to the following description for details of various control methods.

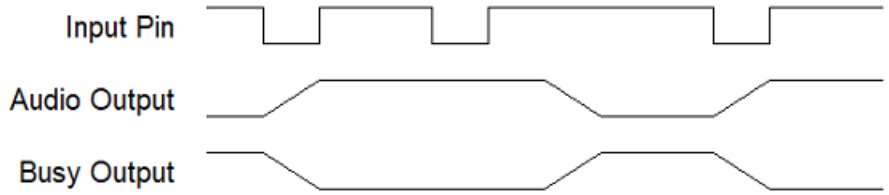
### 4.2.1 Edge Retrigger

Trigger when the input pin detects the falling edge, and starts to play the audio file. If the falling edge is detected during playback, stop the current playback and play from the beginning.



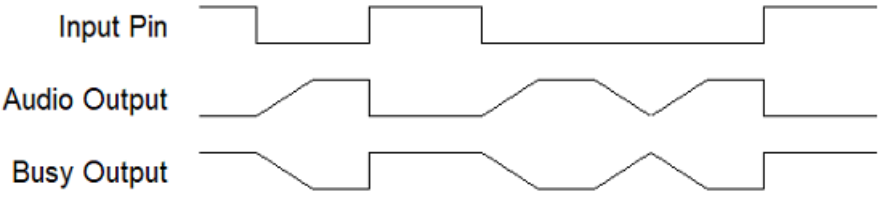

### 4.2.2 Edge No Retrigger

Trigger when the input pin detects the falling edge, and start to play the audio file. If the falling edge is detected during playback, the audio will not be interrupted and continue to play. The falling edge can't retrigger until the playback ends.



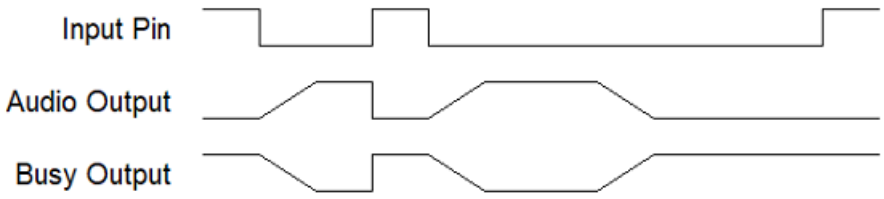

### 4.2.3 Level Hold Loop

Play the file during low level, stop the playback during high level. Repeat the playback if the level holds low. Stop the playback until the input pin detects high level.



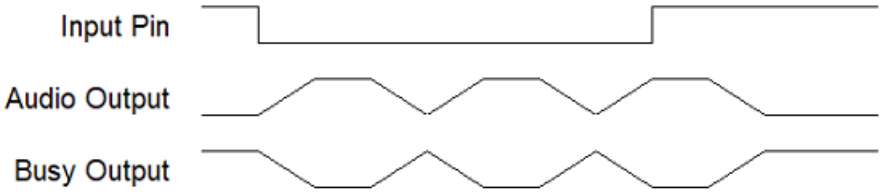

### 4.2.4 Level Hold Unloop

Play the file during low level, stop the playback during high level. Stop playing as it reaches the end of file, even the level keeps low. Replay the audio until the falling edge detected again.



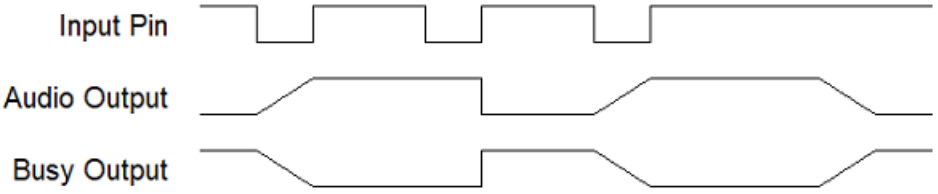

### 4.2.5 Level Loop

Play the audio when input pin detects the low level, and replay the audio when input pin detects low level at the end of playing. If the level changes during the playback, it doesn't affect playback.



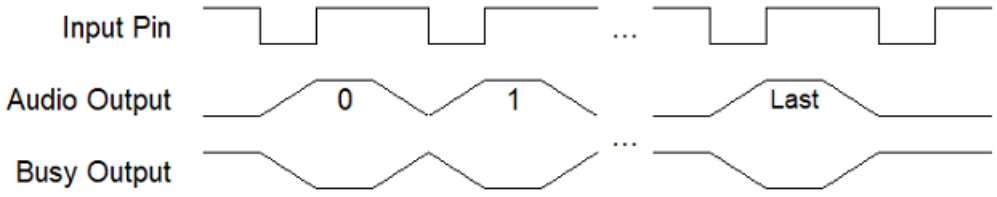

### 4.2.6 On/Off

When the input pin detects the falling edge, start or stop playing, If the audio is not playing, play the audio; if it is playing, stop playing.



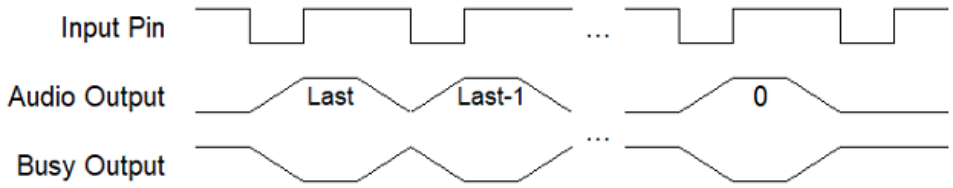

### 4.2.7 Next Unloop

Play the next audio as detecting the falling edge until the final audio. As the last audio ends, the falling edge can't trigger playback anymore.



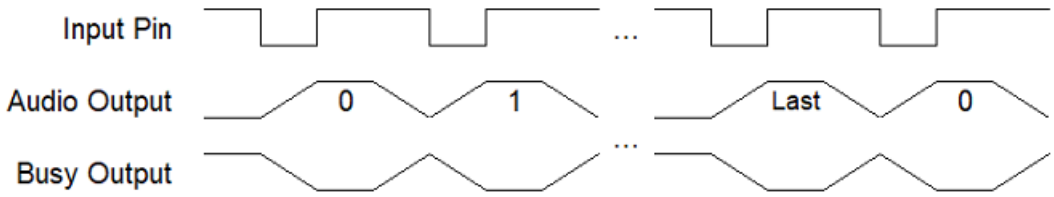

### 4.2.8 Prev Unloop

Play the previous audio as detecting the falling edge until the first audio. As the first audio ends, the falling edge can't trigger playback anymore.



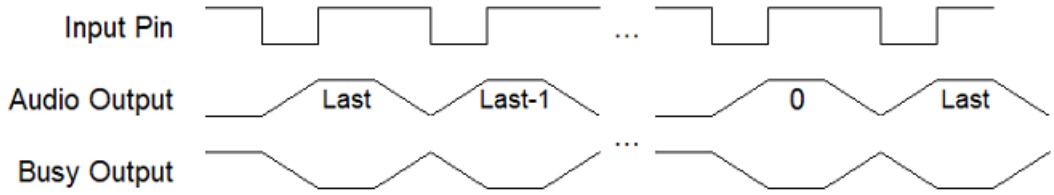

### 4.2.9 Next Loop

Play the next audio as the falling edge detected. When it reaches the last audio, starts over as the falling edge detected.



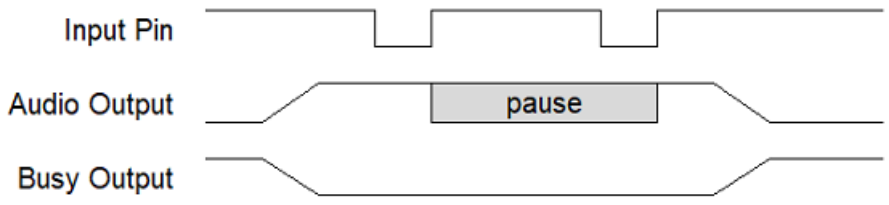

### 4.2.10 Prev Loop

Play the previous audio as the falling edge detected. When it reaches the first audio, starts over from the last audio as the falling edge detected.



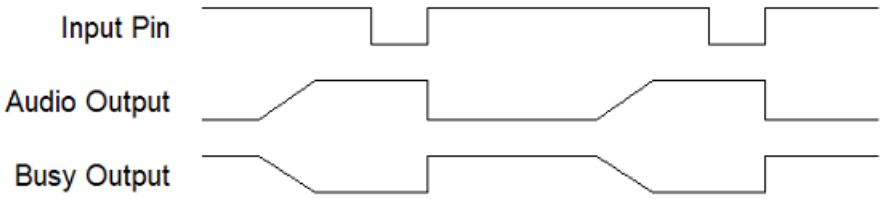

### 4.2.11 Pause

Pause the playback when the input pin detects the falling edge. When the falling edge is detected again, the playback will resume from the pause. If the audio is in stop status, no more action will be executed.




### 4.2.12 Stop

Stop the playback when the input pin detects the falling edge. If the audio is in stop status, no more action will be executed.




#### 4.2.13 Vol+

When the input pin detects the falling edge, the volume will turn up one level. If the volume is the highest, it will stay in the highest volume. There are 8 levels of volume.

#### 4.2.14 Vol-

When the input pin detects the falling edge, the volume will turn down one level. If the volume is the lowest, it will stay in mute. There are 8 levels of volume, the lowest volume is mute.

#### 4.2.15 Vol Loop

Volume up one level when the input pin detects the falling edge. If the volume level is the highest, it will turn up the level from mute.

#### 4.2.16 Busy

The signal for output pin (the output pin is shown in blue on the list). When the audio is playing, the output will keep High or Low as settings. When the playback ends, it will return to its original status.

### 4.3 One Line Mode

The one line mode is that the host only uses one signal line to send serial data to control NX1 as slave for executing the playback, loop, stop ,and volume adjustment functions. Rest of the pins can be set as key functions. Please refer to 4.2 Key Mode for the detailed descriptions.

NX1 pin definitions:

| I/O / PKG | PA0 | PA1 | PA2 | PA3 | PA4 | PA5 | PA6 | PA7 | PA8 | PA9 | PA10 | PA11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOP8 | -- | -- | K1 | K2 | SDA | busy | -- | -- | -- | -- | -- | -- |
| SOP16 | K1 | K2 | K3 | K4 | SDA | K5 | K6 | K7 | K8 | K9 | K10 | busy |

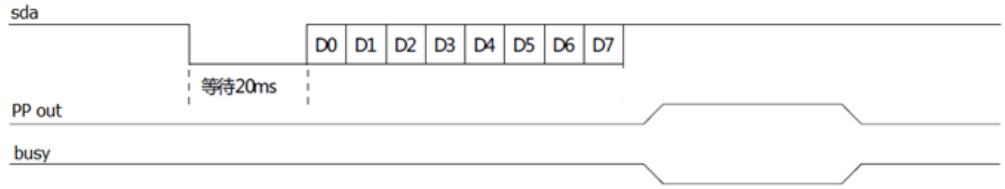
NX11FS23A pin definitions:

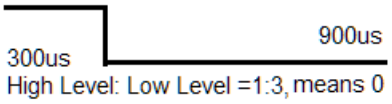
| I/O / PKG | PA2 | PA3 | PA8 | PA12 | PA13 | PA14 | PB0 | PB1 | PB2 | PB3 | PD0 | PD1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOP8 | -- | -- | K1 | SDA | -- | -- | -- | -- | -- | -- | K2 | busy |
| SOP16 | SDA | K1 | K2 | K3 | K4 | K5 | K6 | K7 | K8 | K9 | K10 | busy |

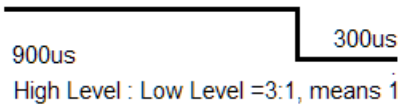
The command is one byte, the commands and descriptions are below.

| Command | Function | Description |
|---|---|---|
| 00~DBH | Play a piece of audio | Play the specified piece of audio. The value is the audio piece, the maximum value can be 219 (DBH) pieces. |
| E0~E7H | Adjust volume | There are 8 levels of volume, E0 is mute, E7 is the highest volume. |
| F2H | Play in loop | If user sends this command during the playback, the piece of audio will be played again. |
| FEH | Stop playback | Stop the playback. |

The one line mode only uses one signal wire to control timing and send data, the data bit will be 0 or 1 according to the different duty cycle. The initial status is high. To start transmit, keep signal low for 20ms to awake IC from sleep status. Then it sends 8 bits data, low bit (LSB) first, high bit (MSB) behind. The data bit is 0 if the duty cycle of high and low level is 1:3, the data bit is 1 if the duty cycle of high and low level is 3:1. Raise the signals to high level after sending data, IC will enter sleep mode to reduce consumption.




The minimum length for level-sending signals must be maintained as 300us. The duty cycle of high and low is 3:1, and the minimum length of signals would be 900us: 300us. Only NX11FS23A SOP16 is except, with the hardware support, the minimum length of signals could be 60us. The duty cycle of high and low is 3:1, and the minimum length of signals would be 180us: 60us.

If the reset signal is applied for special industrial products, please notice that IC takes 32ms to restart, then lower SDA to start sending commands. The Busy is output, the playback of audio will output Busy High or Busy Low according to user's setting.

Please refer to the following C language example for the host procedure. Or contact the agency to acquire the complete example of NY8BM72A.

```
sda=0;
delay1ms(20);   //data pin remains low for 20ms to allow NX1 Flash
                //wake up from deep power down.
for(i=0;i<8;i++)
```

```
    {
        sda=1;
        if(addr & 1) {
            delay100us(9);  // Level high vs low is 900us:300us，send data 1
            sda=0;
            delay100us(3);
        }
        else
        {
            delay100us(3);  // Level high vs low is 300us:900us，send data 0
            sda=0;
            delay100us(9);
        }
        addr>>=1;
    }
    sda=1;
```

## 4.4 Three Line Mode

The three line mode is that the host uses three signal lines to send serial data to control NX1 as slave for executing the playback, loop, stop ,and volume adjustment functions. The definition of three line mode is below.

- CS (Chip Select): The chip select is sent by the host and activated by low level.
- SCL (Serial Clock): The serial clock is sent by the host.
- SDA (Serial Data): The serial data is sent by the host.

| I/O / PKG | PA0 | PA1 | PA2 | PA3 | PA4 | PA5 | PA6 | PA7 | PA8 | PA9 | PA10 | PA11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOP8 | -- | -- | CS | SCL | SDA | busy | -- | -- | -- | -- | -- | -- |
| SOP16 | -- | -- | CS | SCL | SDA | -- | -- | -- | -- | -- | -- | busy |

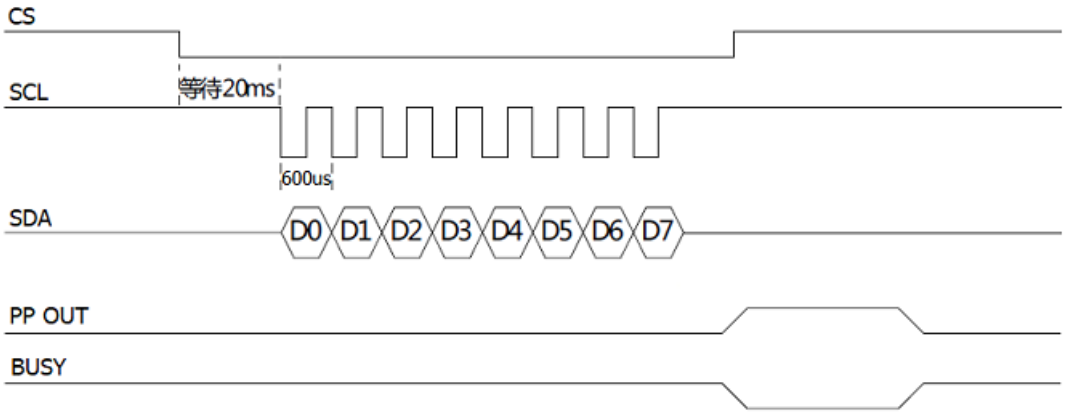
The command is one byte, the commands and descriptions are below.

| Command | Function | Description |
|---|---|---|
| 00~DBH | Play a piece of audio | Play the specified sentence. The value is the number of sentence, the maximum value can be 219 (DBH). |
| E0~E7H | Adjust volume | There are 8 levels of volume, E0 is mute, E7 is the highest volume. |
| F2H | Play in loop | If user sends this command during the playback, the sentence will be played again. |
| FEH | Stop playback | Stop the playback. |

The three-line mode uses three-wire to control timing and send data. The CS signal stays in high level at the initial. To start transmit, keep CS signal low for 20ms to awake IC from sleep status. Then start to sends 8 bits data, low bit (LSB) first, high bit (MSB) behind, and NX1 will receive data in a rising edge of clock. The clock cycle is between 600us~1ms. After sending data, the signal of CS / SCL / SDA need to be

raised to high level, IC will enter sleep mode to reduce consumption.

NX11FS23A SOP16 is the only IC that has the hardware external interruption, the clock circle could be shorten as 60us. For other ICs, the minimum clock circle is 600us.




If the reset signal is applied for special industrial products, please notice that IC takes 32ms to restart, then lower SDA to start sending commands. The Busy is output, the playback of audio will output Busy High or Busy Low according to user's setting.

Please refer to the following C language example for the host procedure. Or contact the agency to acquire the complete example of NY8BM72A.

```
cs=0;
delay1ms(20);   //cs pin remains low for 20ms to allow NX1 Flash
                //wake up from deep power down.
for(i=0;i<8;i++)
{
    scl=0;
    if(addr & 1)
        sda=1;
    else
        sda=0;

    addr>>=1;
    delay100us(3);
    scl=1;
    delay100us(3);
}
cs=1;
```

## 4.5 Matrix 3x8 Mode

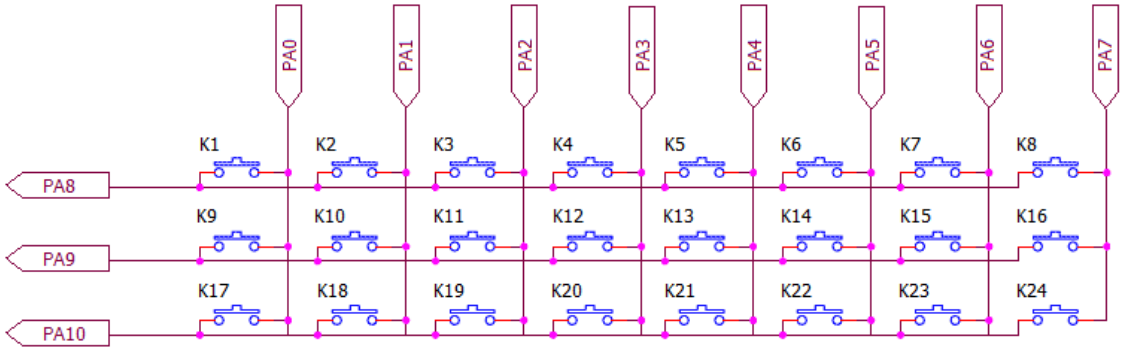
The keys of matrix 3x8 mode only supports Edge Trigger, each key can specify to play a certain sentence. User can set up to 24 sentences.

NX1 pin definition:

| Input / Output | PA0 | PA1 | PA2 | PA3 | PA4 | PA5 | PA6 | PA7 |
|---|---|---|---|---|---|---|---|---|
| PA8 | K1 | K2 | K3 | K4 | K5 | K6 | K7 | K8 |
| PA9 | K9 | K10 | K11 | K12 | K13 | K14 | K15 | K16 |
| PA10 | K17 | K18 | K19 | K20 | K21 | K22 | K23 | K24 |

NX11F23A pin definition:

| Input / Output | PA13 | PA14 | PD0 | PD1 | PB0 | PB1 | PB2 | PB3 |
|---|---|---|---|---|---|---|---|---|
| PA2 | K1 | K2 | K3 | K4 | K5 | K6 | K7 | K8 |
| PA3 | K9 | K10 | K11 | K12 | K13 | K14 | K15 | K16 |
| PA8 | K17 | K18 | K19 | K20 | K21 | K22 | K23 | K24 |




## 4.6 Notices for The Specified IC

Because of the different IC specifications of different hardware, the following descriptions list the notices while using Q-Action with the specified IC. Please refer to IC datasheet for the detailed descriptions.

### 4.6.1 NX11FS23A

The PA8 is Reset pin as powered on, after the start up is completed, PA8 would be changed as GPIO. PA8 cannot be pulled to low level at the moment of power on. This is also the reason why the *Q-Audio* operation interface has some restrictions on the use of PA8.

PA2 has an external interruption function. In the One Line or Three Line mode, PA2 pin can receive signals more quickly by selecting the SOP16 package.

# 5 Revision History

| *Version* | *Date* | *Description* | *Modified Page* |
|---|---|---|---|
| 1.0 | 2020/11/30 | The first version. | - |
| 1.1 | 2022/02/25 | Modify sentence maximum number of the Three Line Mode as 219. | 23 |
| 1.2 | 2023/08/25 | Support NX11FS23A. | - |