HT68FV02x Voice Peripheral MCU Development Board User's Guide

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1 Development Environment

1.1 Complete Environment

The development board is connected to a PC using the e-Link.

1.2 Software

Includes Voice MCU Workshop and IDE3000.

1.2.1 Voice MCU Workshop

- Load and program the voice WAV files and configure the sentence arrangement.
- Programmed files output and programming function.
- Generate user development projects in the Professional Mode.

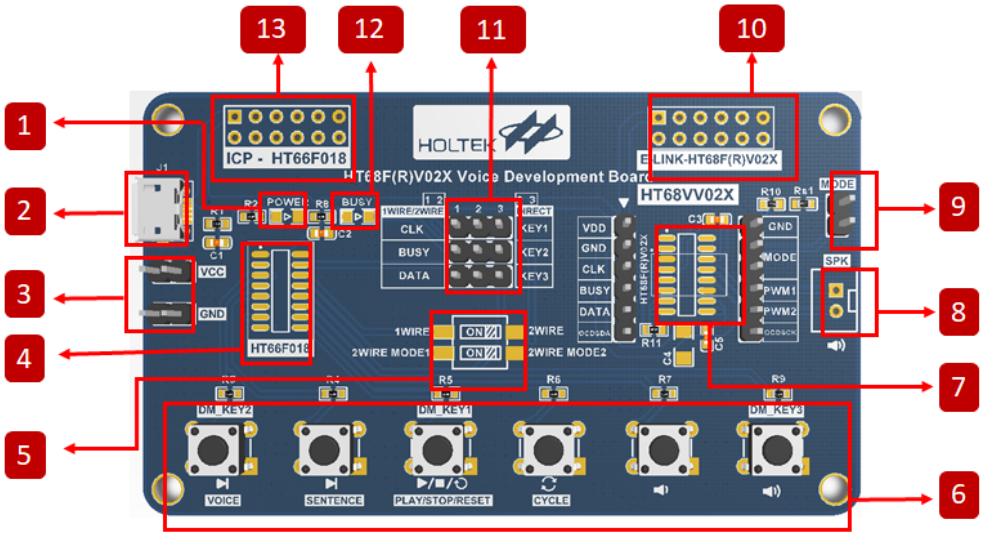
1.2.2 IDE3000

- Edit user development projects in the Professional Mode.

1.3 Hardware

The development board is demonstrated using the HT68VV022 (HT68FV022 EV) together with the HT66F018.

1.3.1 Development Board Introduction

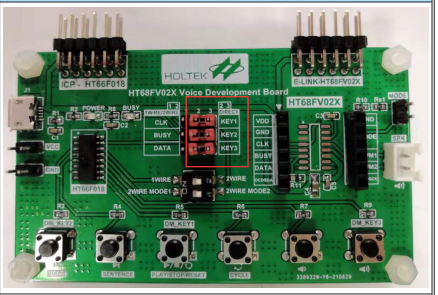
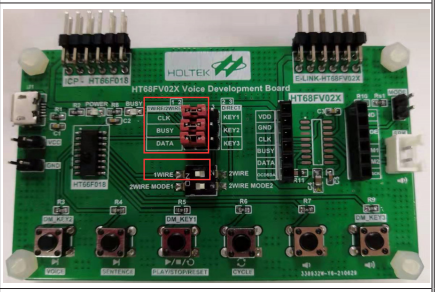
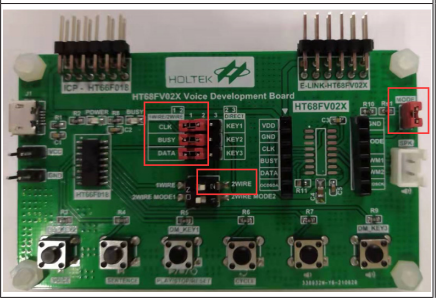
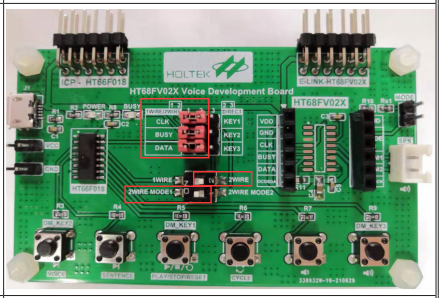
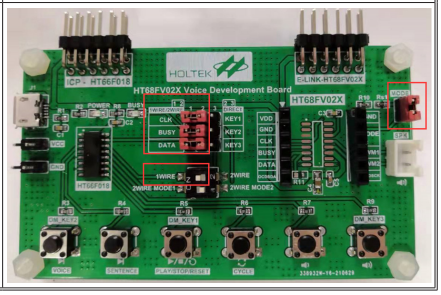


1. Power indicator.
2. Micro USB: USB power supply interface.
3. VDD & GND pin header interface.
4. Master MCU HT66F018.
5. Switch between one-wire mode/two-wire mode 1/two-wire mode 2.
6. Function key × 6.
7. Voice peripheral MCU EV HT68VV02x
8. Speaker interface.
9. Switch between one-wire mode/two-wire mode 1.
10. HT68VV02x e-Link interface.
11. Switch between direct mode and one-wire mode/two-wire mode.
12. Play BUSY indicator.
13. Master HT66F018 ICP interface.

1.4 Development Board Operation Description

1.4.1 Operating Mode Selection

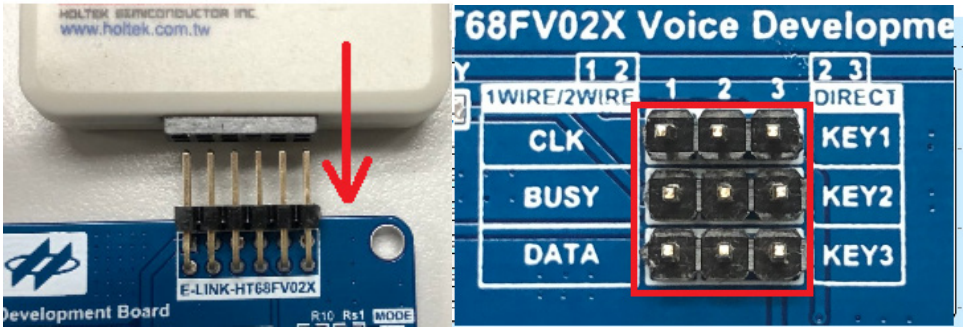
After completing the programming, the operating mode should be selected on the development board according to the Workshop settings, including direct mode, one-wire mode, two-wire mode 1 and two-wire mode 2. The mode selection method and development board operation are shown in the following table:

Operating Mode	Selection Method	Real Product
Direct Mode	1. Select the direct mode in the Voice MCU Workshop 2. Short-circuit the pin headers in columns 2 and 3 with jumpers	
One-Wire Mode	1. Select the one-wire mode in the Voice MCU Workshop 2. Short-circuit the pin headers in columns 1 and 2 with jumpers 3. Switch the DIP switch in the first row to 1WIRE	
	1. Select one of two-wire modes (either) in the Voice MCU Workshop 2. Short-circuit the pin headers in columns 1 and 2 with jumpers 3. Switch the DIP switch in the first row to 2WIRE 4. Short-circuit the two pin headers in the MODE position with jumpers	
Two-Wire Mode 1	1. Select the two-wire mode 1 in the Voice MCU Workshop 2. Short-circuit the pin headers in columns 1 and 2 with jumpers 3. Switch the DIP switch in the first row to 2WIRE 4. Switch the DIP switch in the second row to 2WIRE_MODE1	
	1. Select the one-wire mode in the Voice MCU Workshop 2. Short-circuit the pin headers in columns 1 and 2 with jumpers 3. Switch the DIP switch in the first row to 1WIRE 4. Short-circuit the two pin headers in the MODE position with jumpers	

1.4.2 e-Link Connection

The IDE3000 and Voice MCU Workshop can program and edit an IC using the e-Link. The e-Link can be directly inserted into the HT68VV02x e-Link interface as shown, which is convenient for development.

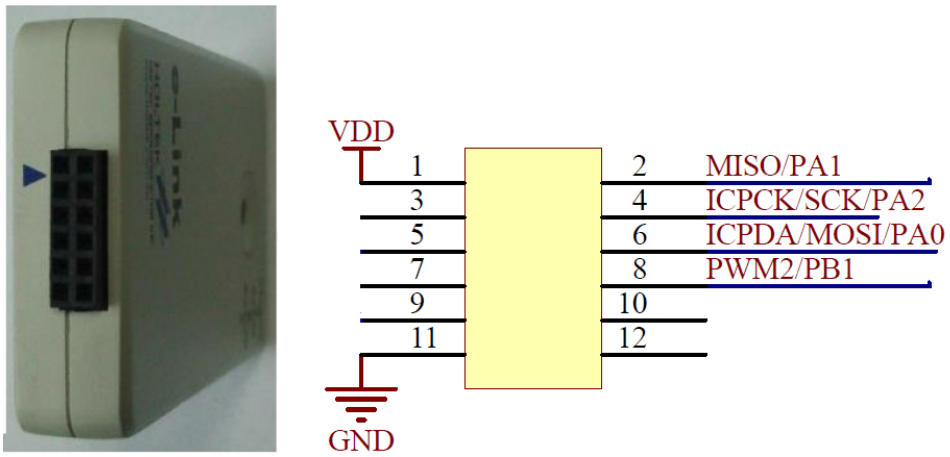
When programming the HT68VV02x, remove the jumper selected in the MODE position to avoid affecting the programming.



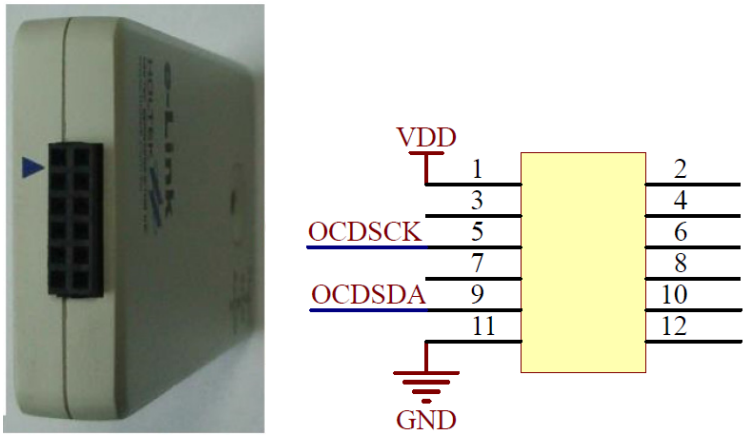
1.4.3 Programming and e-Link Connection Description

1. e-Link Connection:

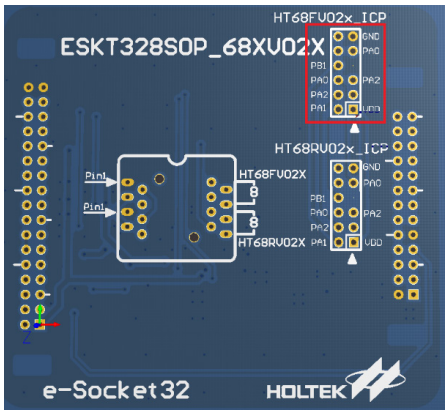
- Use the Voice MCU Workshop for programming

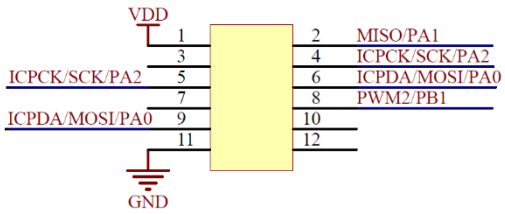


- Use the HT-IDE3000 and HT68VV020 for simulation



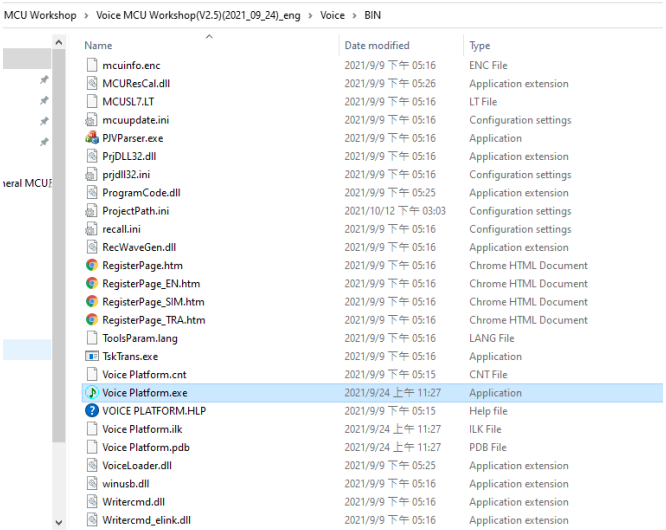
2. Use the e-Socket32 of the e-Writer32 for programming by connecting the ICP



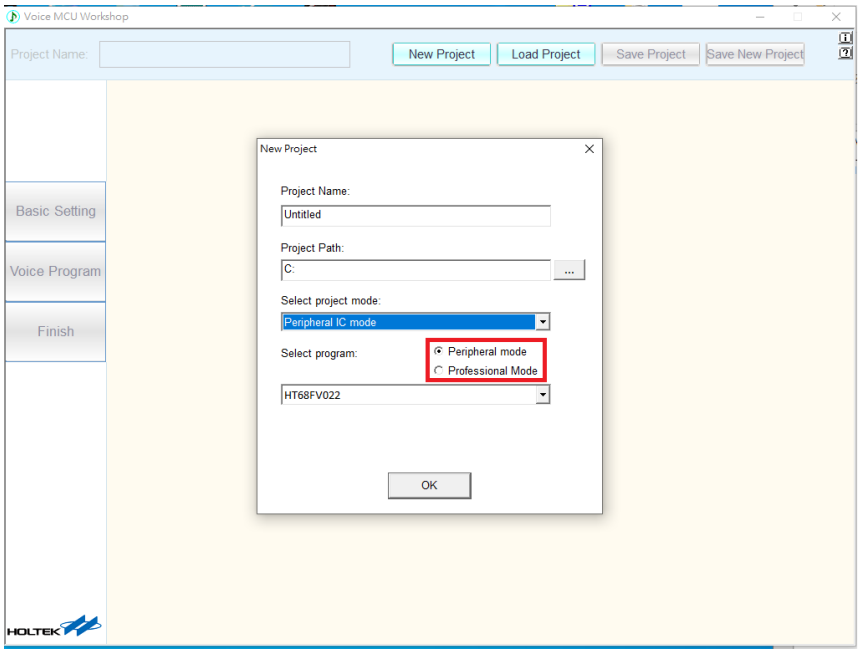


2 Voice MCU Workshop Interface Description

Download and install the latest Voice MCU Workshop from the Holtek website and then execute the "Voice Platform.exe".



Create a new project, select the Peripheral IC mode, and determine whether to use the Peripheral mode or the Professional mode.



2.1 Peripheral Mode

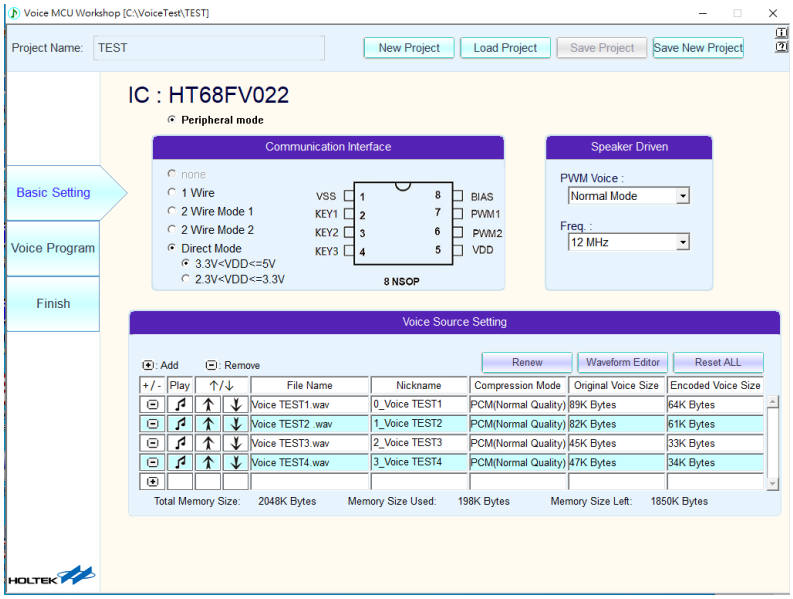
The Basic Setting is shown below, where the control mode, voice mode and MCU frequency can be selected from the communication interface and speaker driver option boxes.

The voice mode is divided into the Green Mode and the Normal Mode, both of which are PWM output mode types. For more details about this, refer to the corresponding datasheet.

The MCU frequency selection will affect the MCU operating voltage and the supported voice compression mode, thus affecting the supported voice length.

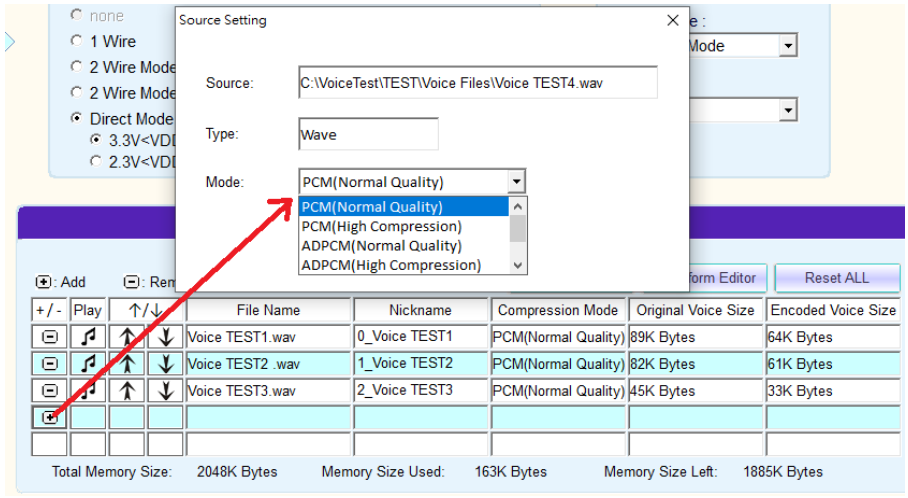
When the MCU frequency is 12MHz, the minimum operating voltage is 2.3V while it is 3.0V for 16MHz.

The MCU frequencies and the supported compression modes are listed as follows:

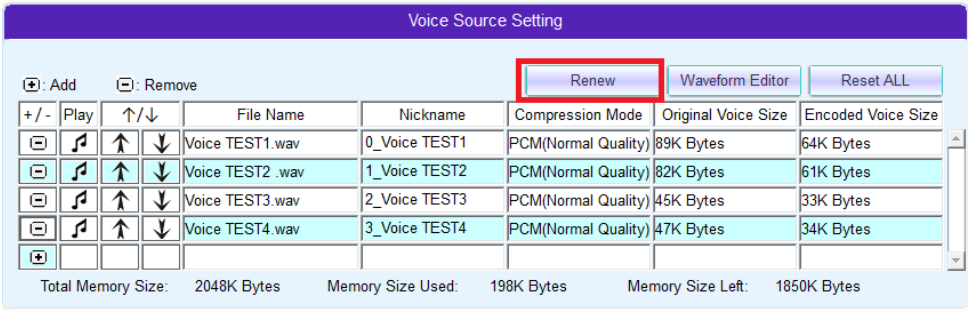


MCU Operating Frequency	Voice Compression Mode	Voice Quality		
		High Quality Low Compression Ratio	Normal Quality Middle Compression Ratio	High Compression High Compression Ratio
16MHz	PCM	√	√	√
	uLaw	×	√	√
	ADPCM	×	√	√
12MHz	PCM	√	√	√
	uLaw	×	√	√
	ADPCM	×	√	√

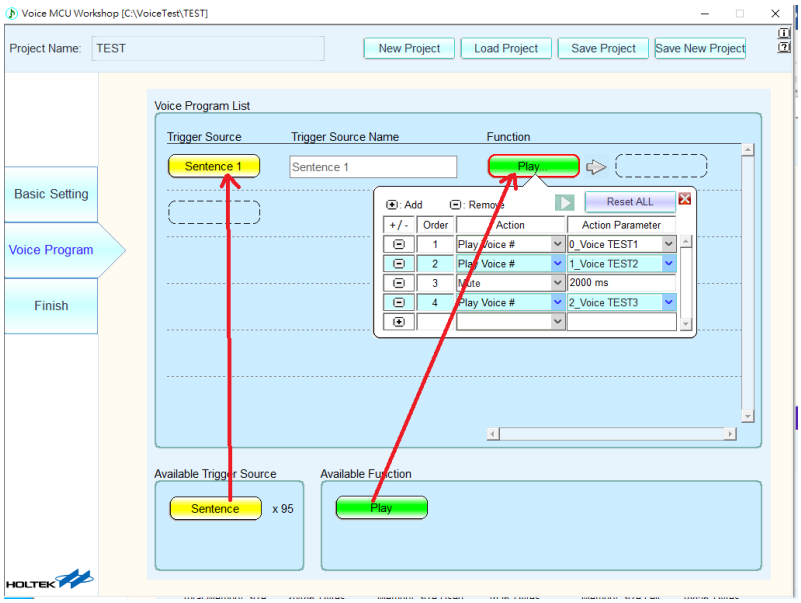
In the voice setting window, select a voice source file and the mode (compression mode & voice quality), then adjust the voice order, as shown below.



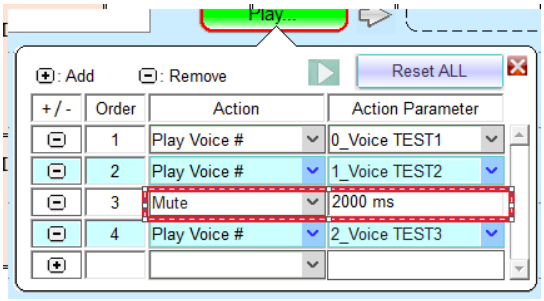
When opening a project generated from old versions of the Voice MCU Workshop, press the "Renew" button in the Voice Source Settings box to update the voice coding data.



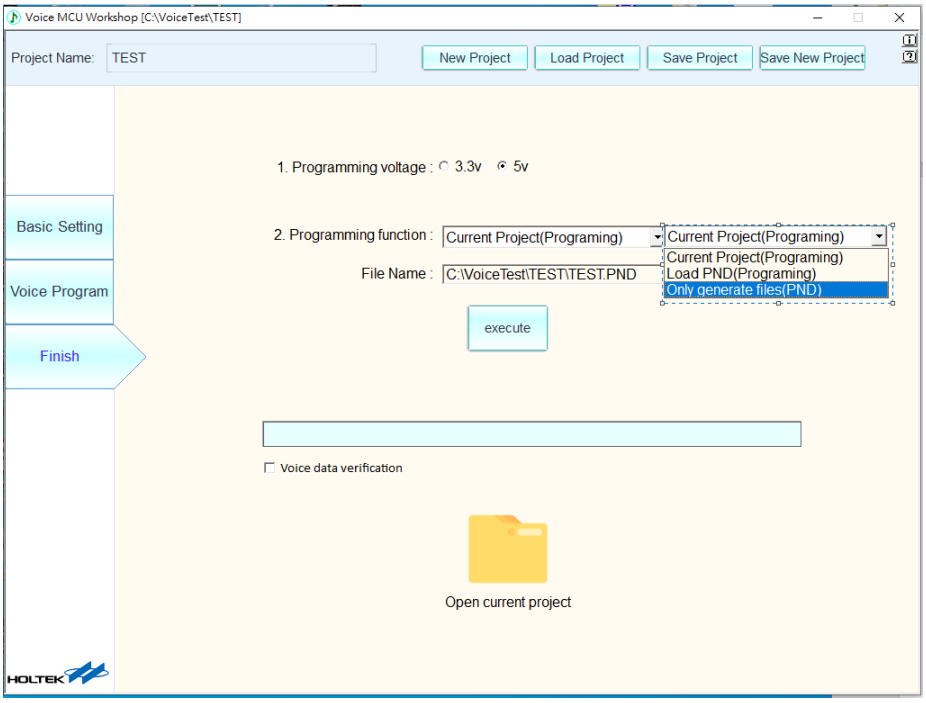
The HT68FV022 supports a voice program. Multiple voices can be combined into a single sentence and a mute time can also be added, as shown below.



Select mute in the Action bar, and fill in the mute time in the Action Parameter bar.

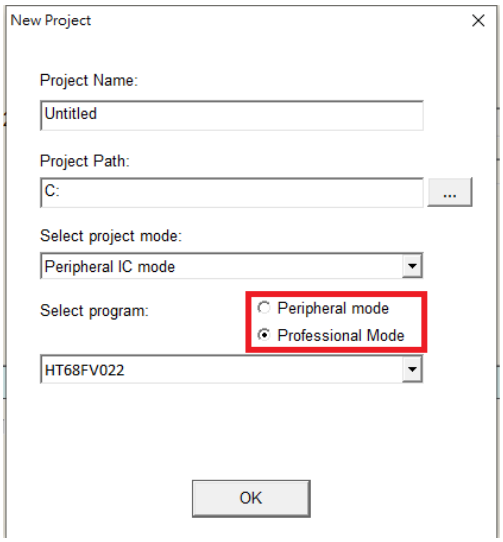


A "*.PND" file is generated by the HT68FV022 after Voice MCU Workshop editing. In the Finish page, the programming function can be selected as shown below, including directly programming the current project, loading the generated file or only generating the files without programming. In addition, the programming voltage should be selected to match the system during programming.

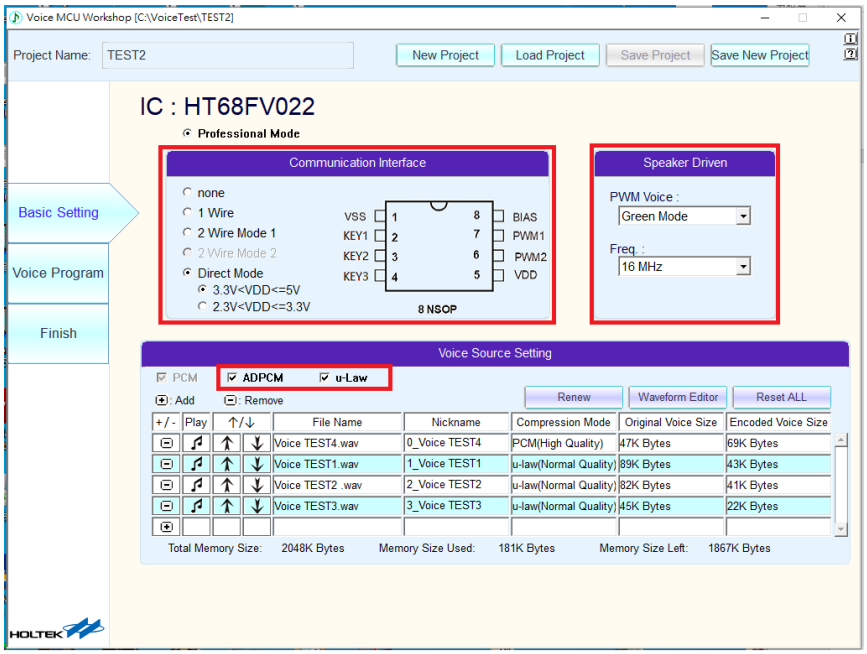


2.2 Professional Mode

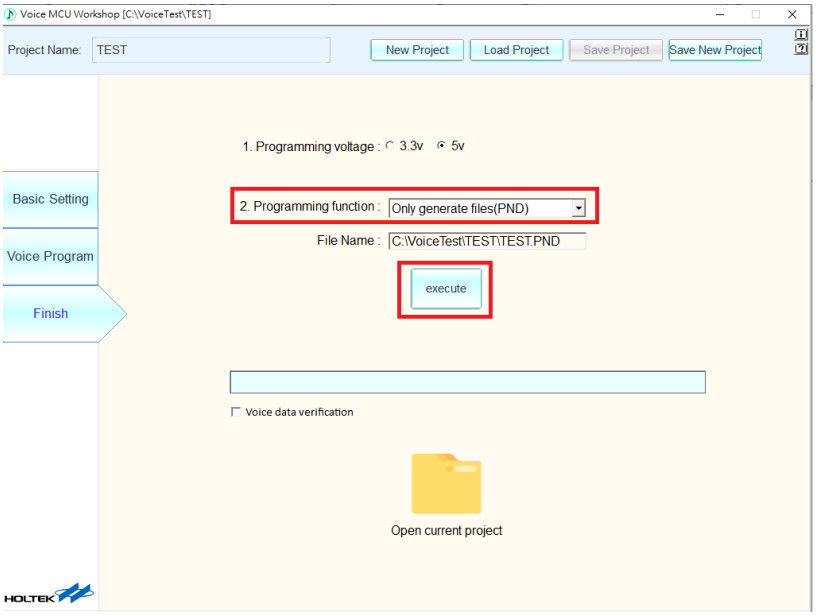
The HT68FV022 provides PCM, uLaw and ADPCM voice decompression modes as well as one-wire, two-wire and direct control interface libraries. The Professional Mode can also be selected for F/W writing according to user requirements. The operation methods for the Professional Mode are described as follows. Start the "Voice Platform.exe" to create a new project and select the Professional Mode as shown below:



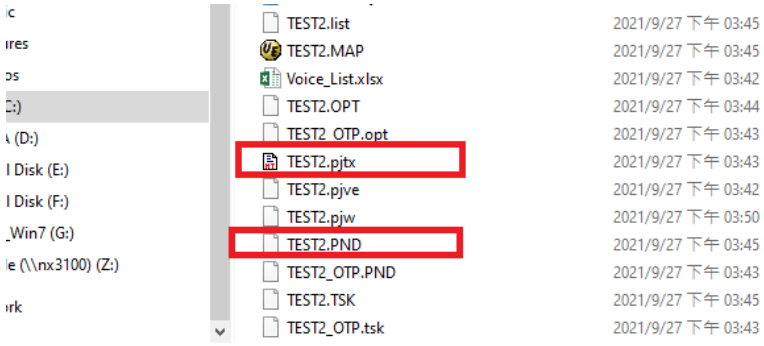
In the Basic Setting page, select the desired decompression mode and library. The library selection will affect the available MCU ROM space, which should be determined according to requirements. The communication interface control mode can select one of the available options, which are the same as the Peripheral mode, or can also select none if no control interface library is used. With regard to the voice compression mode, PCM is required, while ADPCM and uLaw are optional and can choose neither or both. As shown below, the operation methods for the Voice Source Setting and Voice Program are the same as that of the Peripheral mode.



When the programming function is selected to "Only generate files (PND)" in the Finish page, pressing the "execute" button will not perform a programming action but only generate the project files according to user requirements. Click the "open current project" which will open the corresponding project folder, as shown below.



Open the .pjtx file using the IDE3000 to edit the program. For the MCU functions refer to the corresponding datasheet and for the use of the library refer to the following Software Description section. After the program has been edited, a .PND file is generated as shown below. Then use the Voice MCU Workshop to load the .PND file and to program it into an IC.



3 Software Description

3.1 MCU Operating Environment

Oscillators: HIRC	V_{DD}	Low Voltage Reset	Watchdog Timer
16MHz	5V	2.55V	1s
12MHz	5V	2.2V	1s

3.2 Software Usage Instructions

This Firmware only provides the basic settings and applications for the HT68FV022 voice library controller. There are three methods to process voice files. The RAM or ROM space left after using their respective libraries is shown below.

	PCM	PCM+uLaw	PCM+ADPCM	PCM+uLaw+ADPCM
ROM (1K×14)	499	409	333	243
RAM (64×8)	32	32	27	27

In addition, two interface libraries, namely Direct Key (ROM: 137; RAM: 8) and Interface (ROM: 109; RAM: 9), are provided for users to choose according to their requirements. The actual programmable space is calculated by deducting the space required by the interface library from the remaining memory size in the table above.

3.3 Function File Description

The voice file data with PCM, uLaw & ADPCM voice compression is programmed into the HT68FV022 via a one-wire, two-wire or direct control interface in the Professional Mode using the Voice MCU Workshop. The project files will also be generated for users to develop and compile.

These files are described as follows:

- HT68FV02x_PRJ_Voice_Library_Test.asm
  Main program operated according to the selected control interface
- HT68FV02x_PRJ_Def.asm
  Voice compression related variable definitions
- HT68FV02x_PRJ_Customer.asm
  Free compilation area - when no control interface is used

- HT68FV02x_PRJ_Body.inc
  Register and variable definitions.
- HT68FV02x_PRJ_Voice_library_Extern.inc
  Subroutine and variable declarations
- HT68FV02x_PRJ_Voice.hed
  Timer Interrupt count function
- HT68FV02x_PRJ_Voiceworkshop.hed
  Voice Library related definitions

The above files are generated in the Professional Mode using the Voice MCU Workshop.

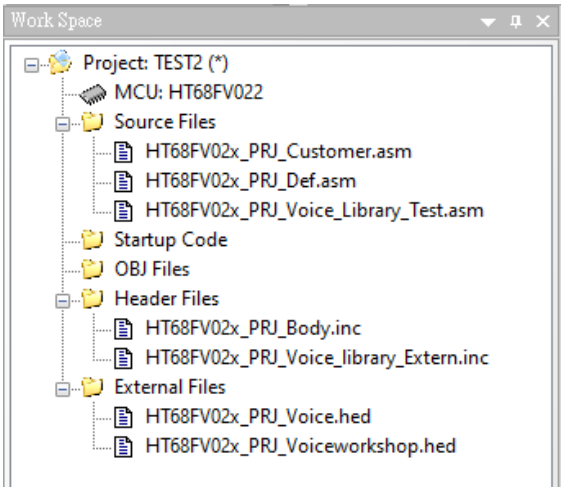


Figure 1. HT66FV022 File Overview Diagram

3.4 Software Main Flow Description

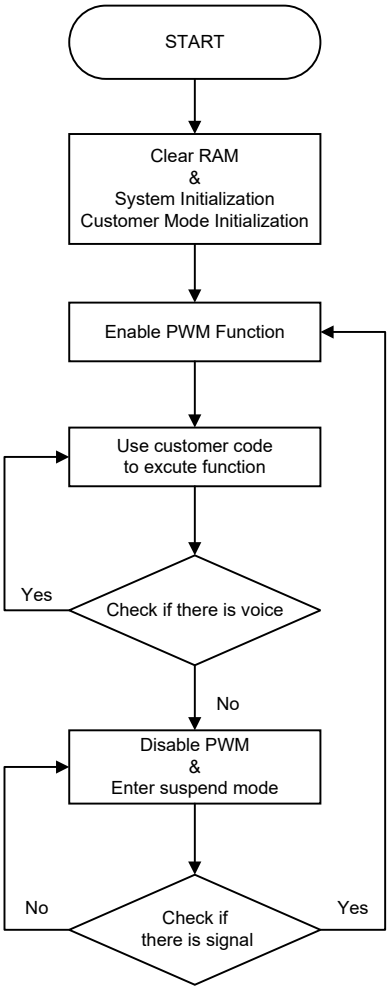


Figure 2. Customer Mode Software Flowchart

1. System Initialization & Customer Mode Initialization:

   Set the HT68FV022 communication interface to SPI.

   Read the Flash information and set the MCU parameters.

   Set the PWM function, LDO and Watchdog Timer.

2. Main Loop:

   (1) Enable the PWM.

   (2) Use customer code.

   For voice or sentence playing, volume control and pin output control.

   (3) Check if there is voice playing.

   - Yes, return to point (2).

   (4) Disable the PWM and enter the suspend mode.

   (5) Check if there is a wake up signal.

   - Yes, return to point (1).
   - No, continue in the suspend mode.

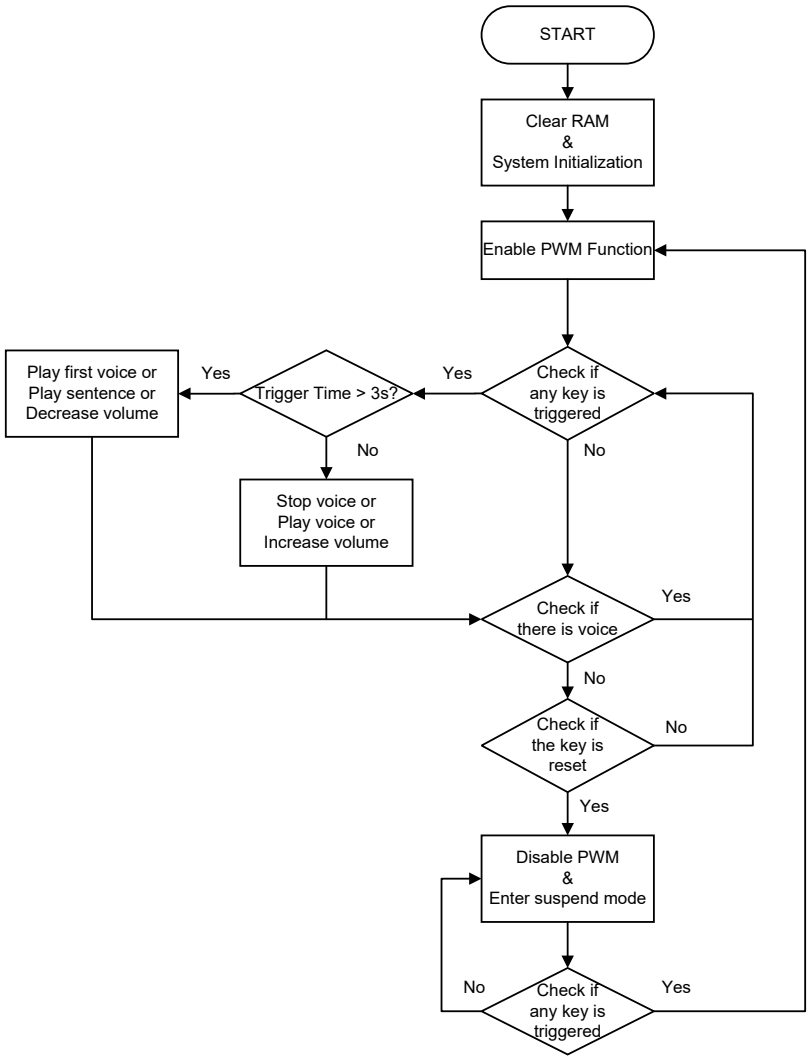


Figure 3. Direct Mode Software Flowchart

1. System Initialization:

   Set the HT68FV022 communication interface to SPI.

   Read the Flash information and set the MCU parameters.

   Set the PWM function, LDO and Watchdog Timer.

2. Main Loop:

   (1) Enable the PWM.

   (2) Check if any key has been triggered.

   - Yes, check if the trigger time is greater than 3 seconds.
     - If it is greater than 3 seconds, the function corresponding to the triggered key will be executed as follows.
       – Key1: play the first voice; Key2: play the next sentence; Key3: decrease the volume.
     - If it is less than 3 seconds, the function corresponding to the triggered key will be executed as follows.
       – Key1: play the last played voice when there is no voice or stop when there is voice; Key2: play the next voice; Key3: increases the volume.

(3) Check if there is a voice playing.

- Yes, return to point (2).

(4) Check if the key has reset.

- No, return to point (2).

(5) Disable the PWM and enter the suspend mode.

(6) Check if there is a wake up key.

- Yes, return to point (1).
- No, continue in the suspend mode.

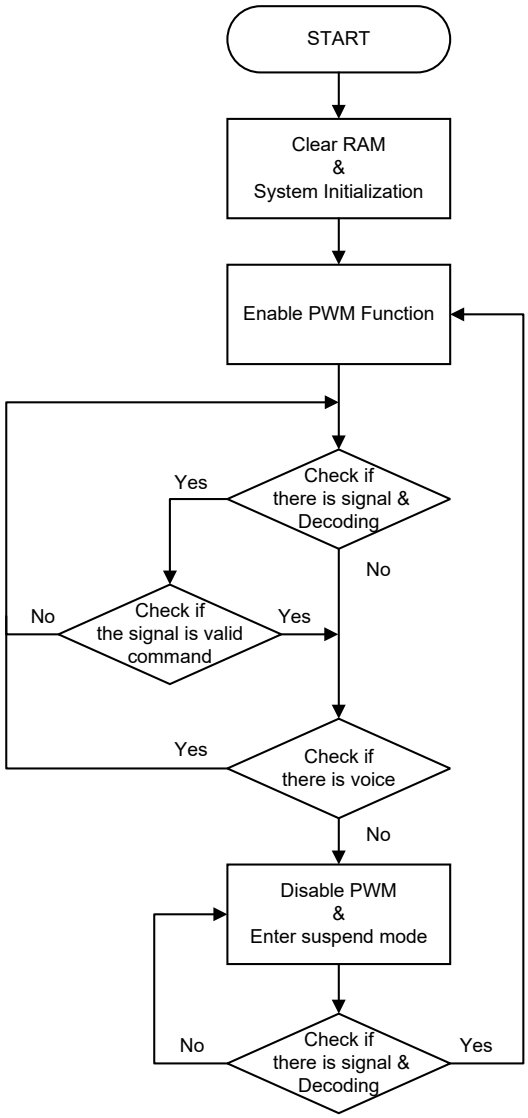


Figure 4. Interface Mode Software Flowchart

1. System Initialization:

   Set the HT68FV022 communication interface to SPI.

   Read the Flash information and set the MCU parameters.

   Set the PWM function, LDO and Watchdog Timer.

2. Main Loop:

(1) Enable the PWM.

(2) Receive the signal and decode.

(3) Check if the signal is a valid command.

- No, return to point (2).

(4) Execute the command action.

(5) Check if there is a voice playing.

- Yes, return to point (2).

(6) Disable the PWM and enter the suspend mode.

(7) Check if there is a wake-up signal.

- Yes, return to point (1).
- No, continue in the suspend mode.

3.5 Software Subroutine Description

3.5.1 Function List

Function Name	Description
Voice Library Subroutine	
_CLRRAM	Clear all RAM data
_System_Initialization	1. Set PA as inputs with internal pull-high and wake-up enabled 2. Set SPI pin function 3. Read information from the SPI Flash - verification code, MCU parameters such as HIRC, LVRC, TBC, PWMC0, etc 4. Set the volume to default
Set_Suspend	Disable the Watchdog Timer, Counter, PWM and LDO functions
Enable_WDT_LDO	Enable the Watchdog Timer, Counter and PWM functions as well as configure LDO
Configure_LDO	Configure the LDO. When the variable bypass_LDO is set to 1, execute this function to disable the LDO.
_Stop_Play	Disable Counter and set the PWM output to 8000H
_Play_Voice_Sentence_Initial	Read the voice file data and set the parameters
Decoding_CMD	Decode the received control command and execute the corresponding action
Set_Volume_With_mvol	Set the voice volume level

Note: 1. The library is associated with the Label in the file, therefore the Label cannot be deleted to avoid unknown errors.

2. As the HT68FV02x_PRJ_Def.asm is used to call various library files, do not change it unless necessary.

3.5.2 Function Description

_CLRRAM
Clear all RAM data
Syntax:
Call _CLRRAM
Parameters:
N/A
Return Values:
N/A

_System_Initialization
1. Set PA as inputs with internal pull-high and wake-up enabled 2. Set SPI pin function 3. Read information from the SPI Flash - verification code, MCU parameters such as HIRC, LVRC, TBC, PWMC0, etc 4. Set the volume to default
Syntax:
Call _System_Initialization
Parameters:
N/A
Return Values:
N/A

Set_Suspend
Disable the Watchdog Timer, Counter, PWM and LDO functions
Syntax:
Call set_suspend
Parameters:
N/A
Return Values:
N/A

Enable_WDT_LDO
Enable the Watchdog Timer, Counter and PWM functions as well as configure LDO
Syntax:
Call Enable_WDT_LDO
Parameters:
Bypass_LDO 1: Disable the LDO function 0: Enable the LDO function
Return Values:
N/A

Configure_LDO
Configure the LDO
Syntax:
Call Configure_LDO
Parameters:
Bypass_LDO 1: Disable the LDO function 0: Enable the LDO function
Return Values:
N/A

_Stop_Play
Disable the Counter and set PWM output to 8000H
Syntax:
Call _Stop_Play
Parameters:
N/A
Return Values:
N/A

_Play_Voice_Sentence_Initial
Read the voice file data and set the parameters
Syntax:
Call _Play_Voice_Sentence_Initial
Parameters:
Fsentence_voice 1: Play sentence 0: Play voice PlayVoiceNumL: play which voice PlaySentenNumL: play which sentence
Return Values:
N/A

Decoding_CMD
Decode the received control command and execute the corresponding action
Syntax:
Jmp Decoding_CMD Exit: check_play_voice_state
Parameters:
data_cmd Execute the corresponding action according to the command list
Return Values:
N/A

Set_Volume_With_mvol
Set the voice volume level
Syntax:
Call Set_Volume_With_mvol
Parameters:
mVol Give a value (0~15) for the desired volume
Return Values:
N/A

3.5.3 Examples

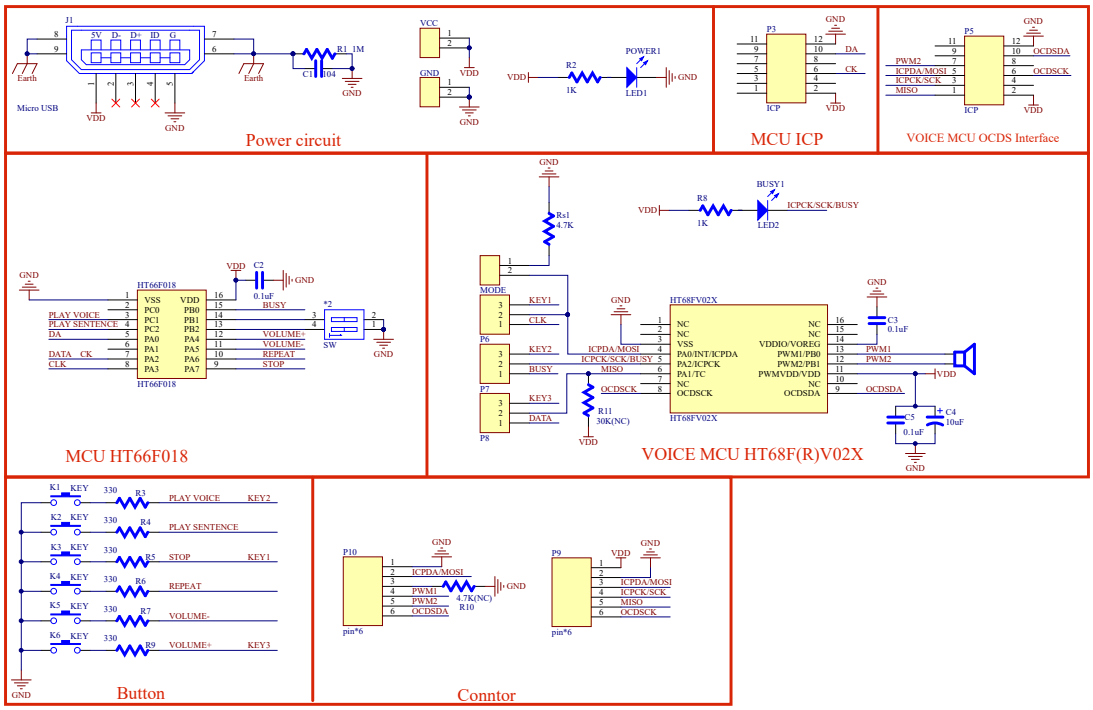
Example 1: Voice list played in a single loop

```
snz  fVoiceStandBy
jmp  check_play_voice_state
clr  fsentence_voice
inc  PlayVoiceNumL
inca max_voice_var
xor  a,PlayVoiceNumL
sz   voice_Z
clr  PlayVoiceNumL
jmp  Play_voice_senetence_with_stop
```

Example 2: Sentence list played in a single loop

```
sz   fSentencePlaying
jmp  check_play_voice_state
set  fsentence_voice
inc  PlaySentenNumL
mov  a,max_sentence_var
xor  a,PlaySentenNumL
sz   voice_Z
clr  PlaySentenNumL
jmp  Play_voice_senetence_with_stop
```

4 Development Board Schematic Diagram



5 Other Information

- Do not modify the internal program of the master MCU HT66F018 in the development board as it has been setup for the HT68FV02x supported control interface.
- If the 1WIRE/2WIRE jumpers and DIP switches change and then it is powered on again, the master MCU HT66F018 can be controlled in the selected mode.