LED Workshop User Guide

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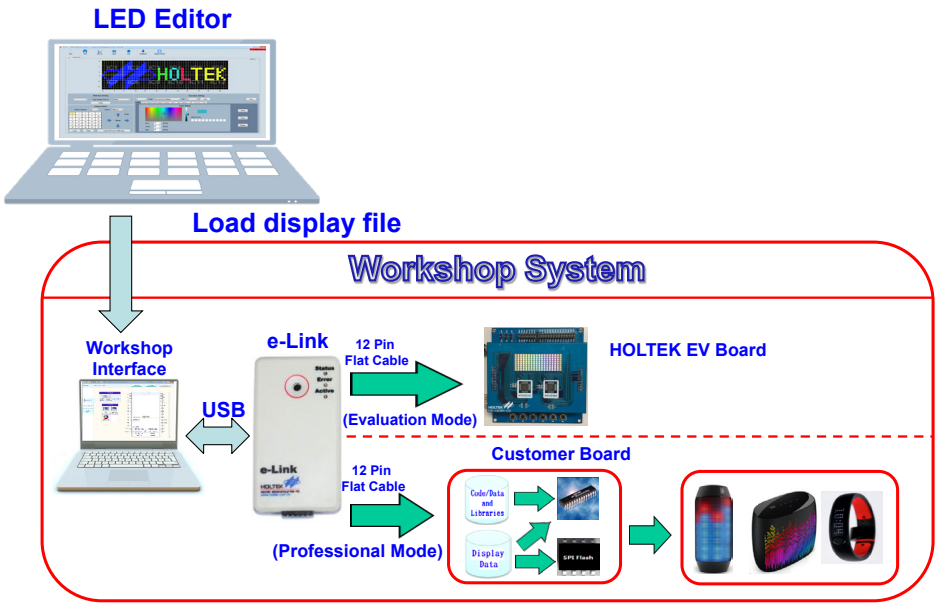
Development Environment

System Configuration



Software

HT16D3xA/B LED Workshop, HT16D3xA/B LED Editor and IDE-3000.

HT16D3xA/B LED Workshop

Used for master MCU selection, MCU resource allocation, key configuration, HT16D3xA/B driver pin setup, external Flash size and pin configuration, LED program settings as well as programming the FLASHROM data to the development board and other functions.

HT16D3xA/B LED Editor

Used for graphics editing and preview, implementing the HT16D3xA/B mode settings and other functions.

IDE-3000

Used for editing and viewing the source program, downloading the program code and PROM data to the development board via the e-link.

Hardware

The Holtek LED Workshop supported Development boards or customer development boards and the e-link (BICE000ELINK0B).

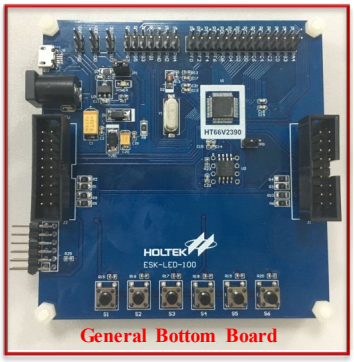
LED Workshop Supported Development Boards

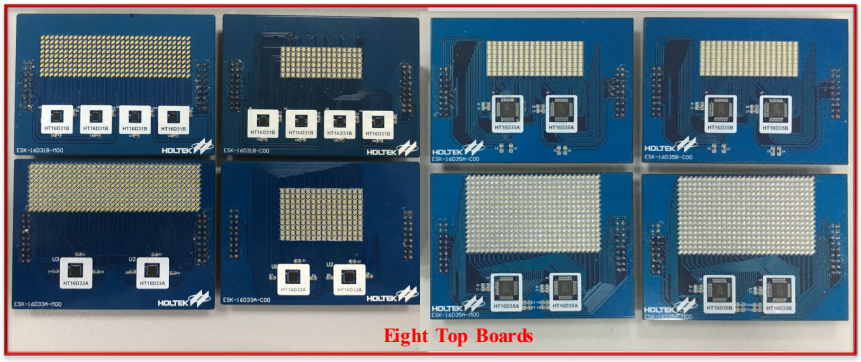
Development Board Types

- Eight Top Boards:
  ① ESK-16D31B-C00, used when the HT16D31B COLOR mode is selected.
  ② ESK-16D33A-C00, used when the HT16D33A COLOR mode is selected.
  ③ ESK-16D31B-M00, used when the HT16D31B MONO mode or GRAY mode is selected.

④ ESK-16D33A-M00, used when the HT16D33A MONO mode or GRAY mode is selected.
⑤ ESK-16D35A-C00, used when the HT16D35A COLOR mode is selected.
⑥ ESK-16D35B-C00, used when the HT16D35B COLOR mode is selected.
⑦ ESK-16D35A-M00, used when the HT16D35A MONO mode or GRAY mode is selected.
⑧ ESK-16D35B-M00, used when the HT16D35B MONO mode or GRAY mode is selected.

- One General Bottom Board: ESK-LED-100



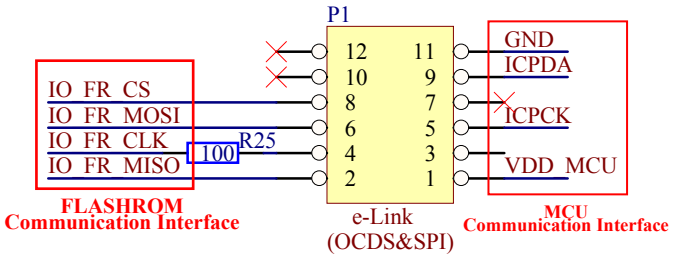


Data Storage

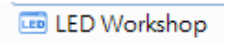
- MCU Internal PROM (Master MCU: HT66F2390)
- External FLASHROM (SST26VF032B)

e-link Connection

Users can develop the required development board on their own. However, due to downloading program and data requirements, the connection with the e-link needs to obey the rules which are shown in the figure below to make sure the programming is correct.

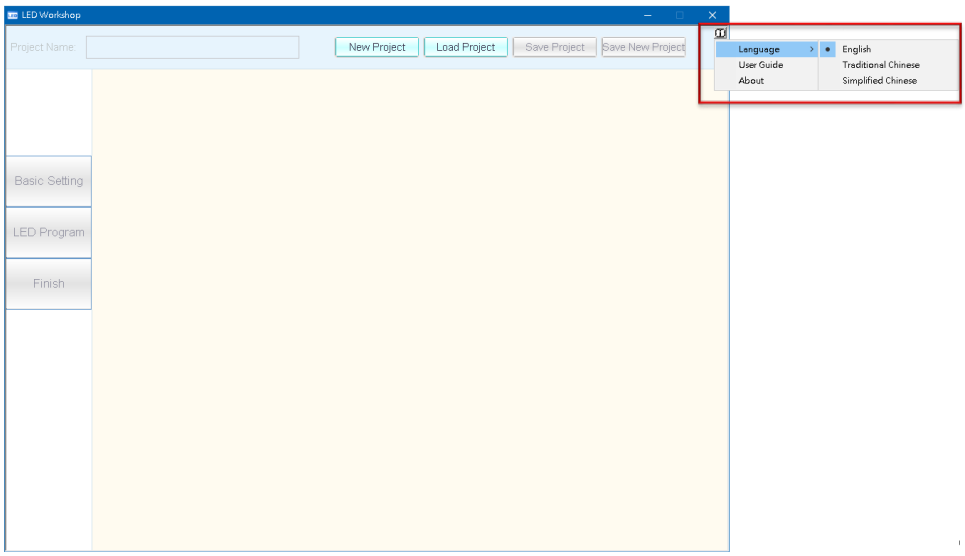


Start the Software

Double-click the  icon and the following screen will appear.

Language Selection

Click the icon in the upper right for the language selection.

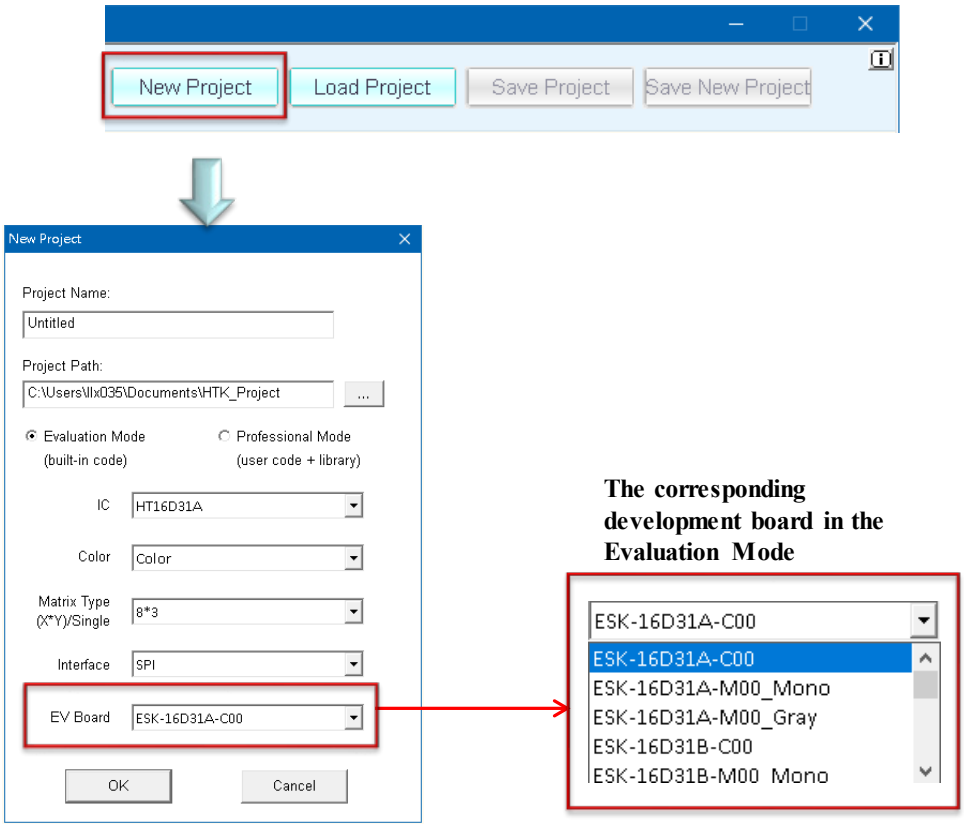


Create a New Project

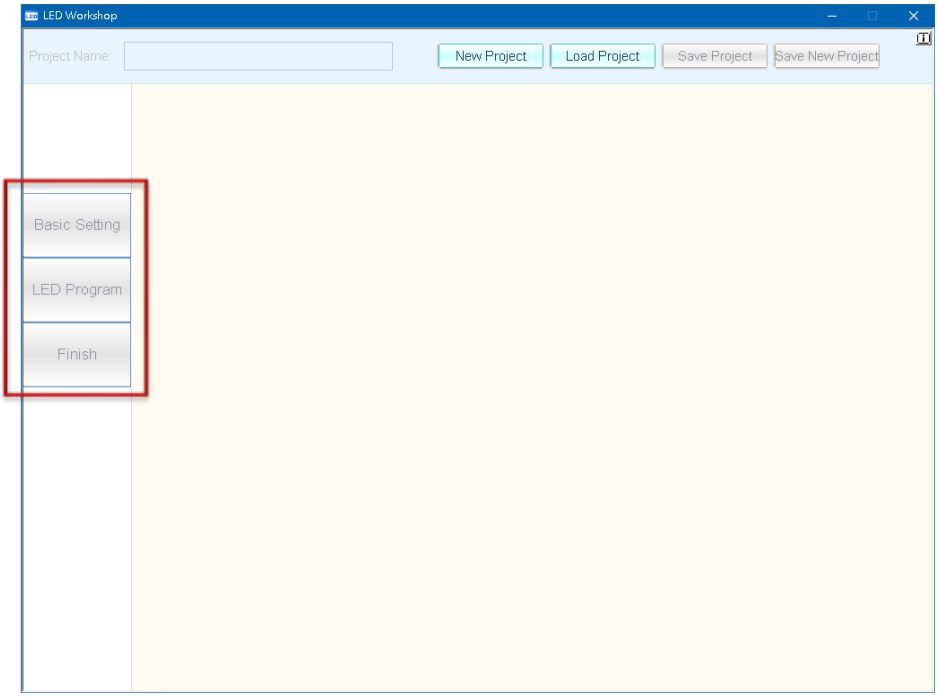
The LED Workshop has two modes which are the Evaluation Mode and the Professional Mode. The Evaluation Mode needs to be demonstrated with the HT16D3xA/B EV Boards that have been developed by Holtek. The Professional Mode is provided to allow customers to use their own development boards. The following sections will describe how to create a new project in these two modes.

Evaluation Mode

After completing the development board and the e-link connection, start the LED Workshop and then click the "New Project" button. A New Project dialog box will pop up as shown below. Then select the corresponding built-in mode according to the connected EV Board and click "OK" after completing the related settings.



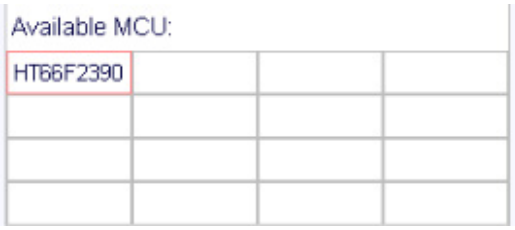
The LED Workshop operation includes three steps which are “Basic Setting”, “LED Program” and “Finish”.



Basic Setting

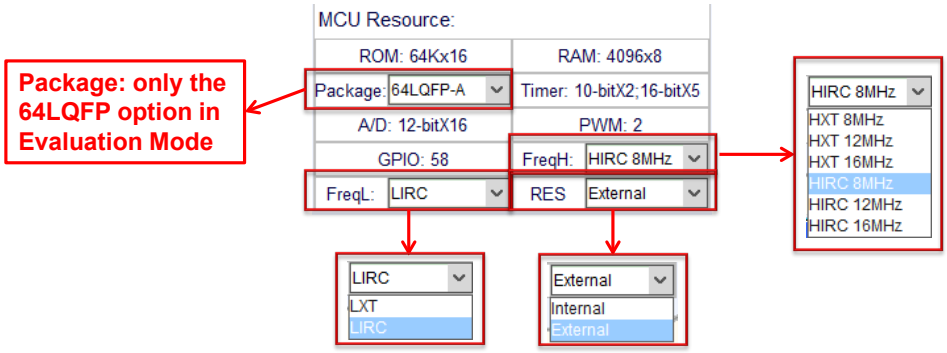
Available MCUs

The supported MCUs are shown in the following table, here only the HT66F2390 is shown.



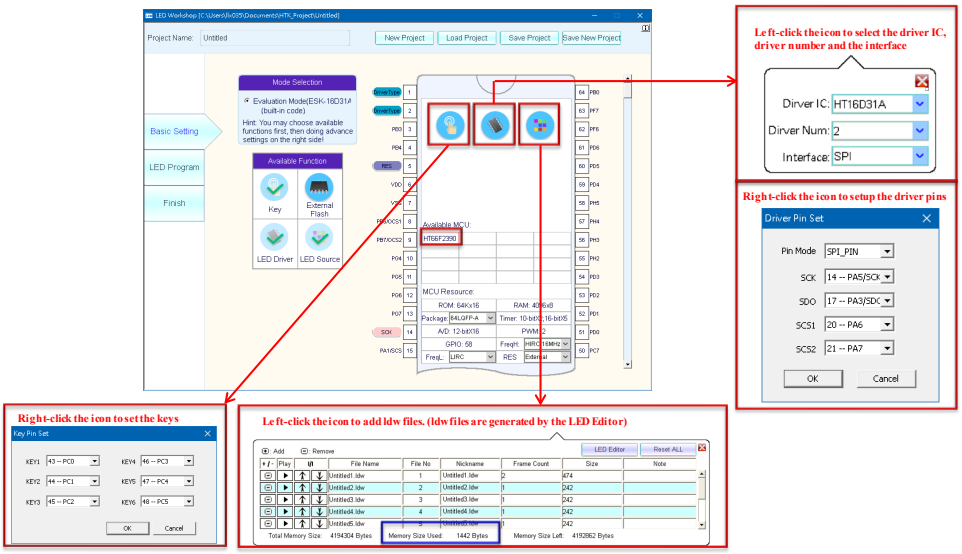
MCU Resources

The configurable MCU resource options are the package, the high speed oscillator (FreqH), the low speed oscillator (FreqL) and the reset circuit.



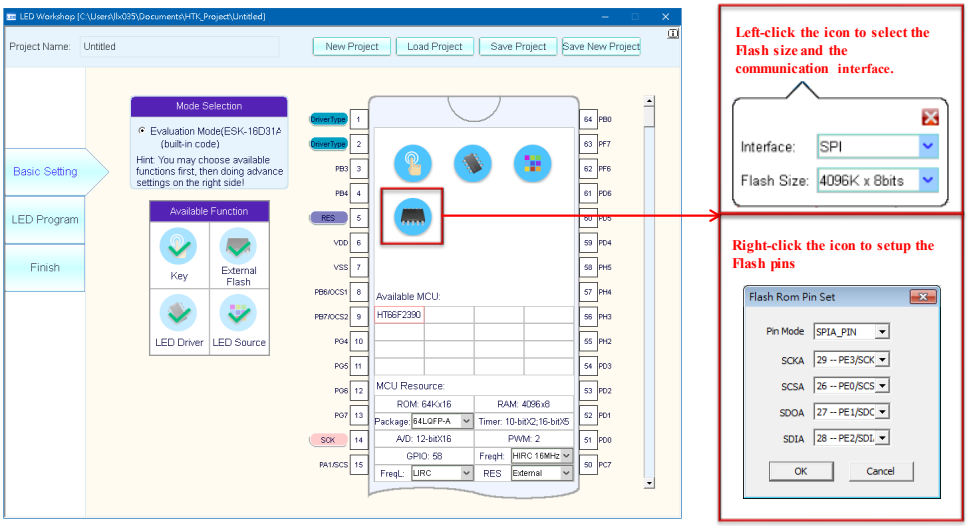
Key, Driver IC, Display Source

Click the HT66F2390 in the "Available MCU" table, and then setup the keys, driver IC and display source which are the necessary options. The interface in the following figure shows the mode in which the data is stored in the internal PROM. Here the used memory size (see the blue box below) should be noted. If it is exceeded, an external flash memory will be required to store the display data. In the Evaluation Mode, if the development board is selected which means the key pins, driver pins and communication interface pins are determined, there is no need to choose them again.



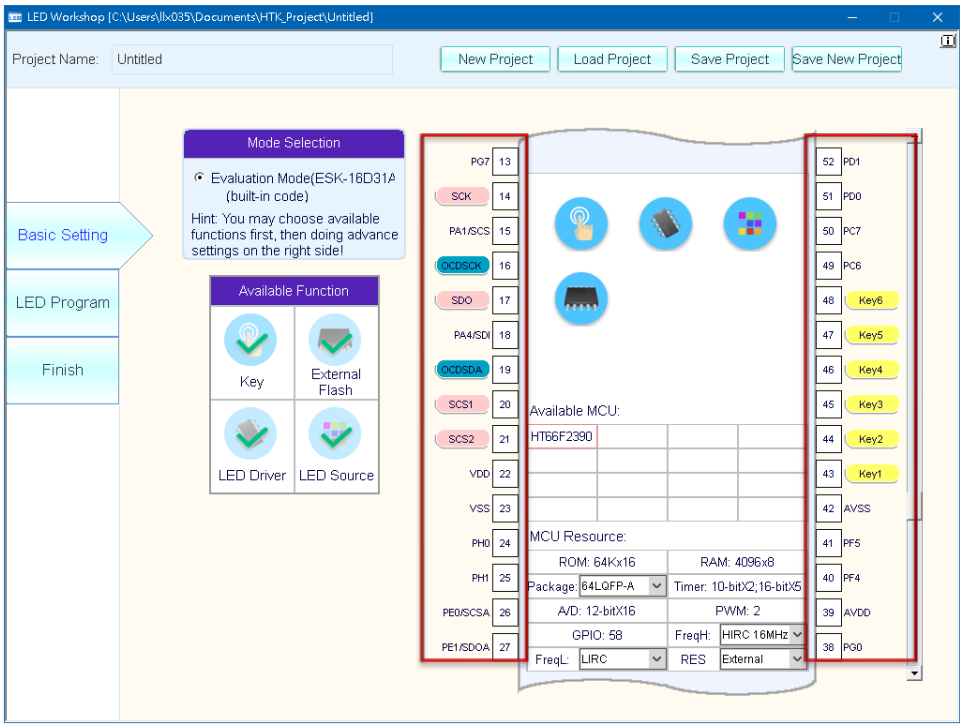
External Flash

To save data into the FLASHROM, click the "External Flash" icon and select the Flash size based on the size of the soldered FLASHROM on the board.



Pin Settings

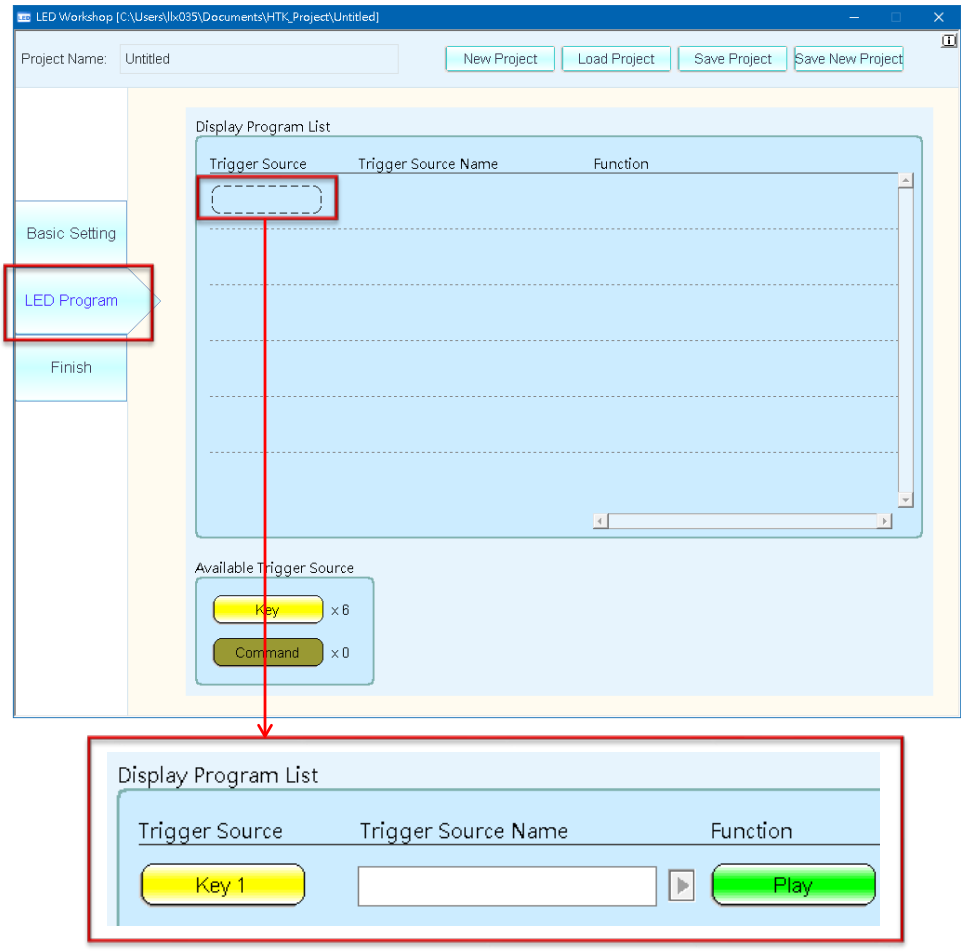
All pin settings will be shown in the diagram. The complete information can be viewed by dragging the slide bar.



LED Program

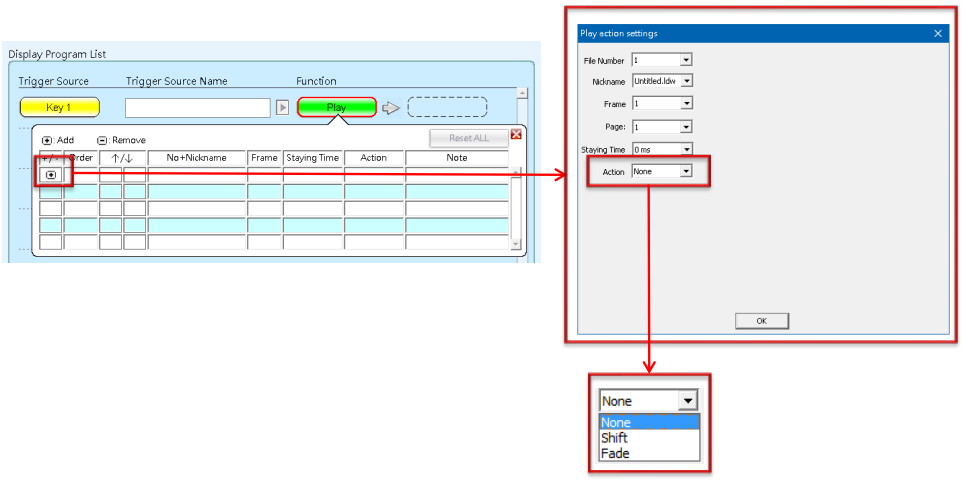
Add Trigger Source

Click the "LED Program" on the left to enter the project logical design page. After clicking on the dashed box, the available trigger sources will be displayed in the dashed box. In the Evaluation Mode, the trigger source is the key.



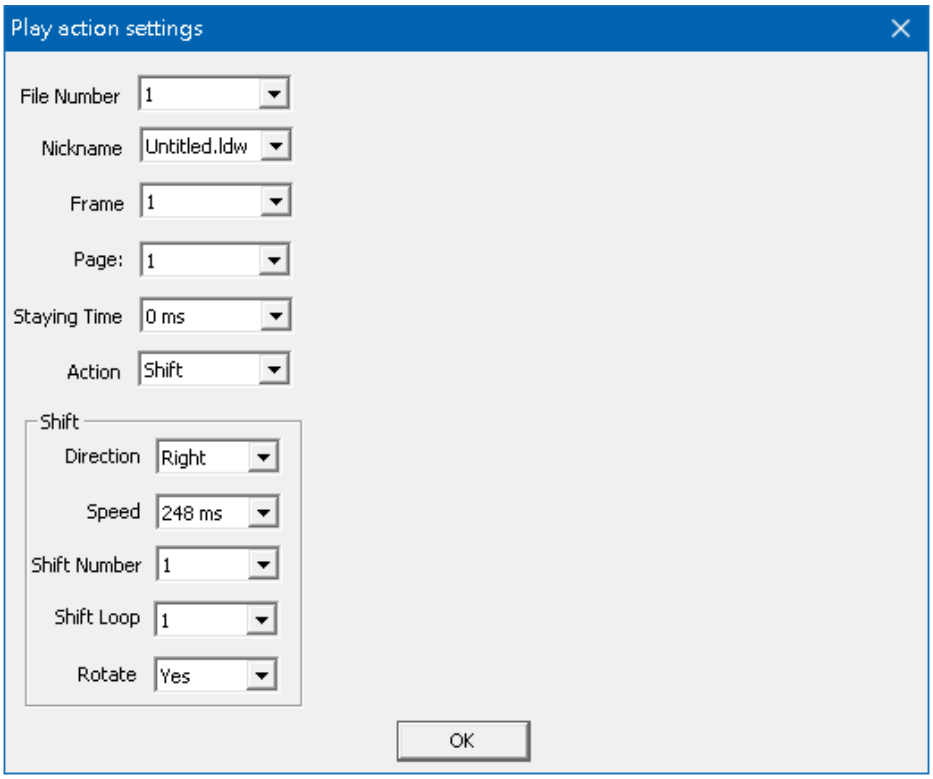
Add Display Actions

Click the "Play" button to set the functions, and then click the "+" button to add the display actions.

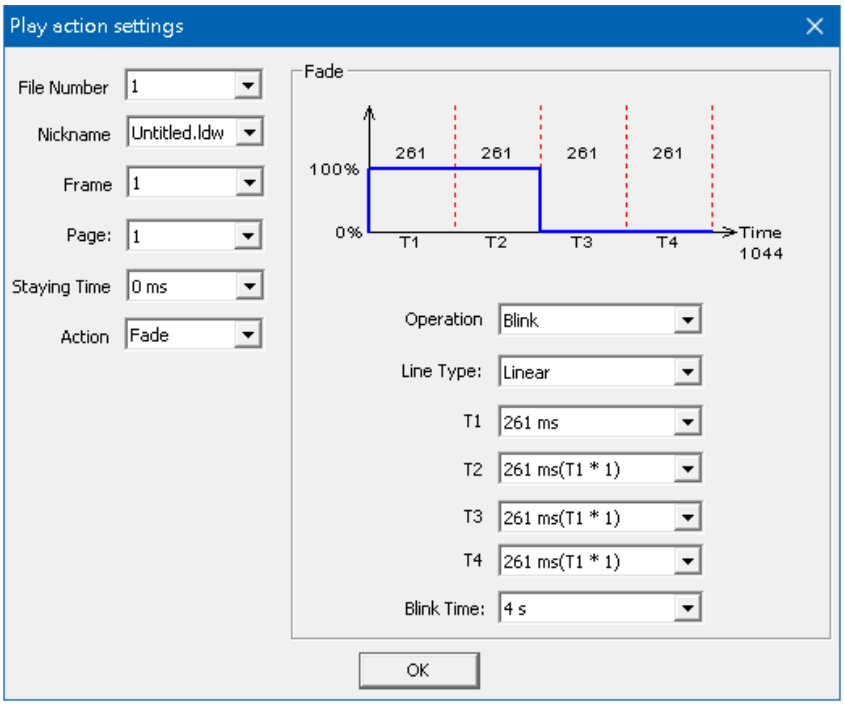


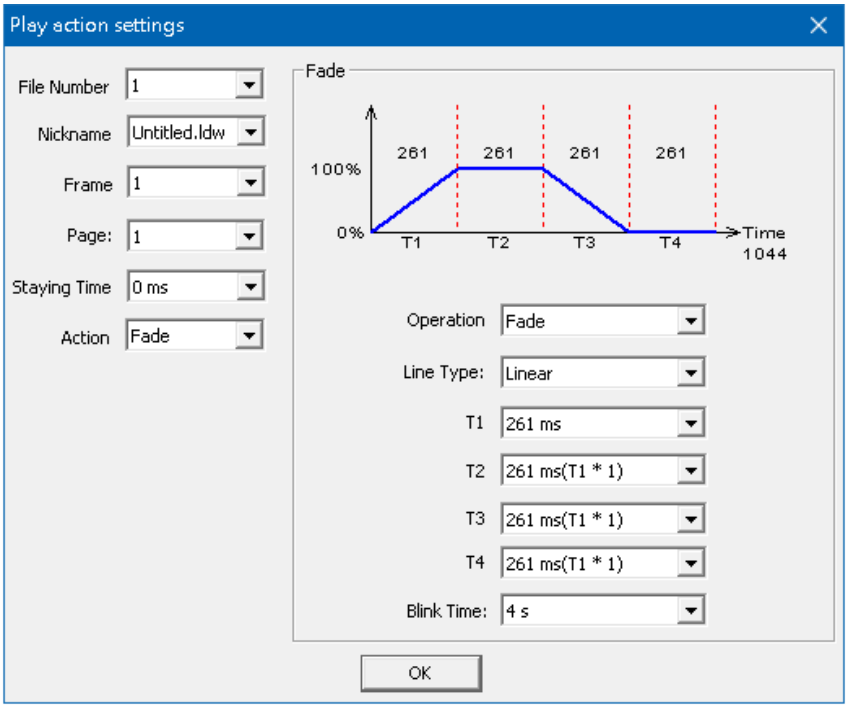
The workshop supports three actions: PLAY+NONE, PLAY+SHIFT and PLAY+FADE. They are controlled by the library functions.

- PLAY+NONE: Display a single frame figure and its function.
- PLAY+SHIFT: Move a single frame figure left or right. The movements can include rotation. The HT16D35A/B supports up, down, left or right movement.



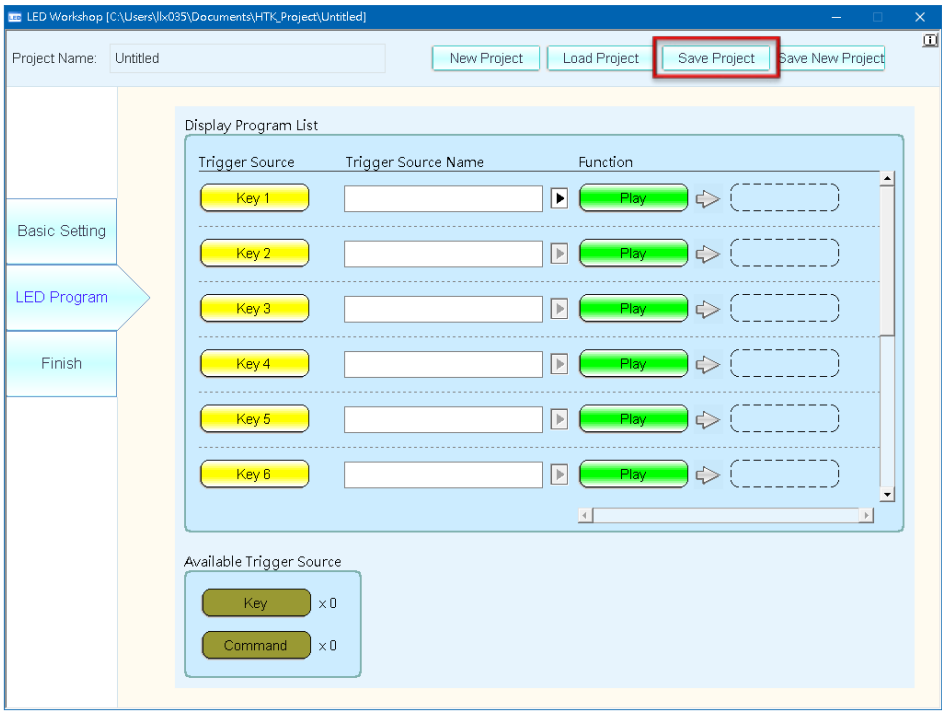
- PLAY+FADE: Includes two operations which are Blink and Fade. The optional time for T1~T4 can be set variously. These two operation waveforms are shown in the figures below.





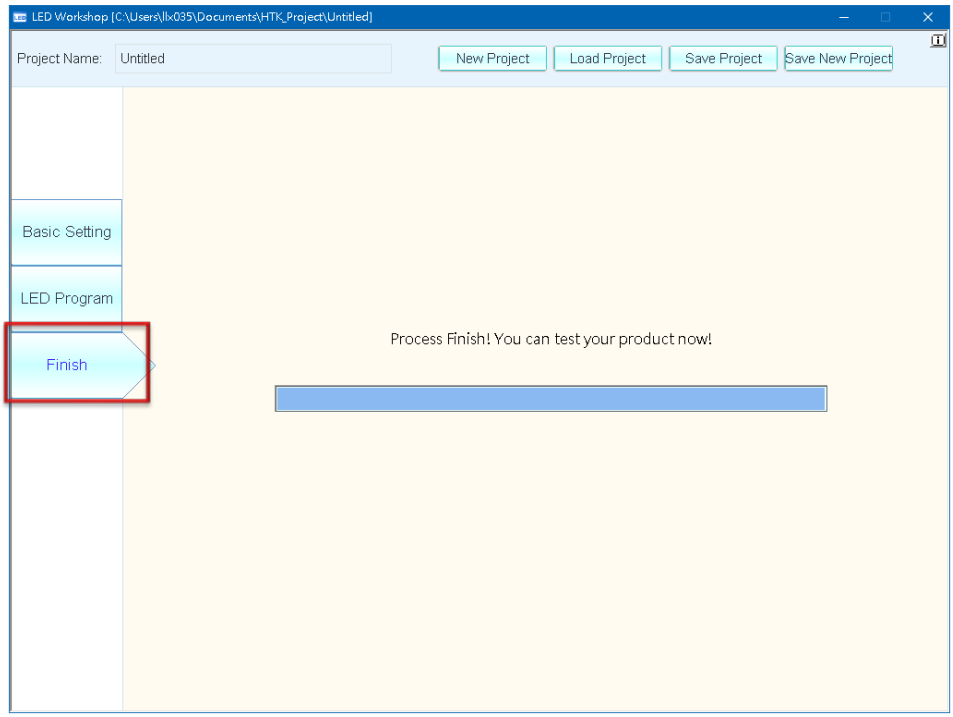
Save Project

Click the “Save Project” button to save the current project after completing the settings. It will create a .pjlw file.



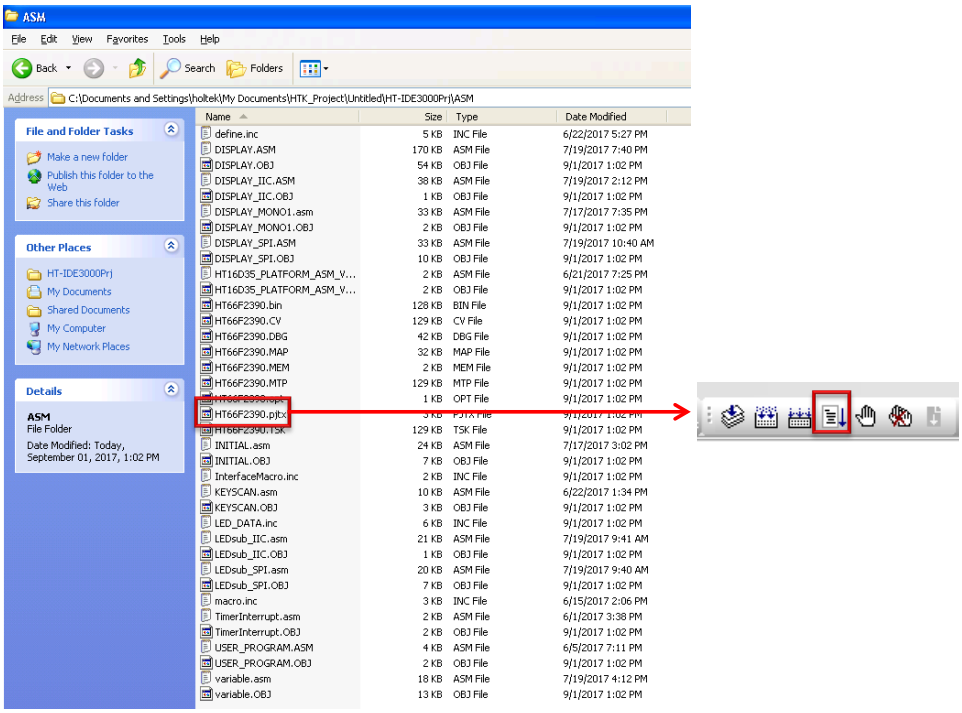
Finish

Click “Finish” on the left to enter the generating display data steps, execute the IDE project, etc.

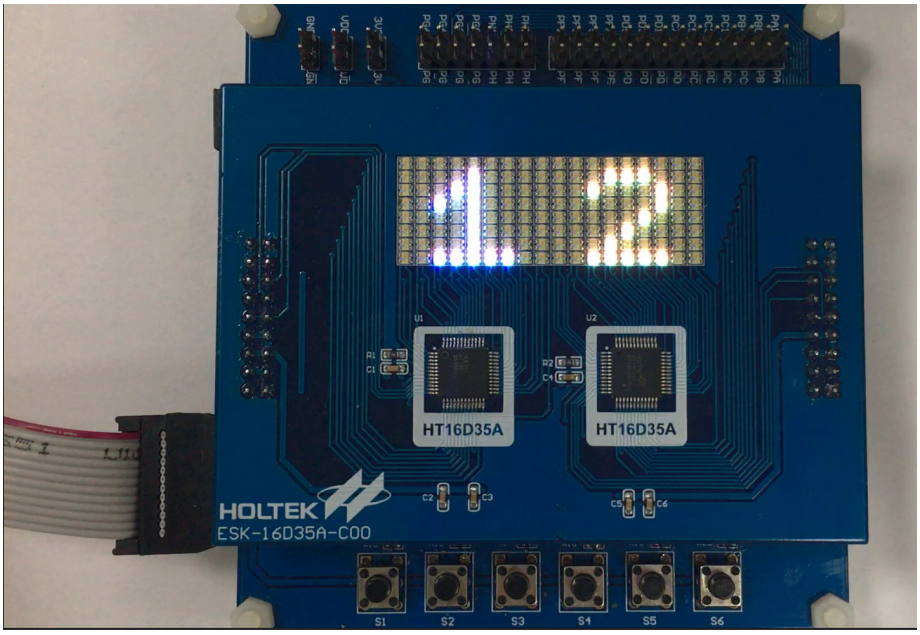


Open IDE Project

To open the generated IDE files, follow the path: workshop Project Name\HT-IDE3000Prj\C or \ ASM. Use the e-link to connect with the development board and click the “execute” icon. Then the images which were setup in the LED Program page can be observed on the development board.

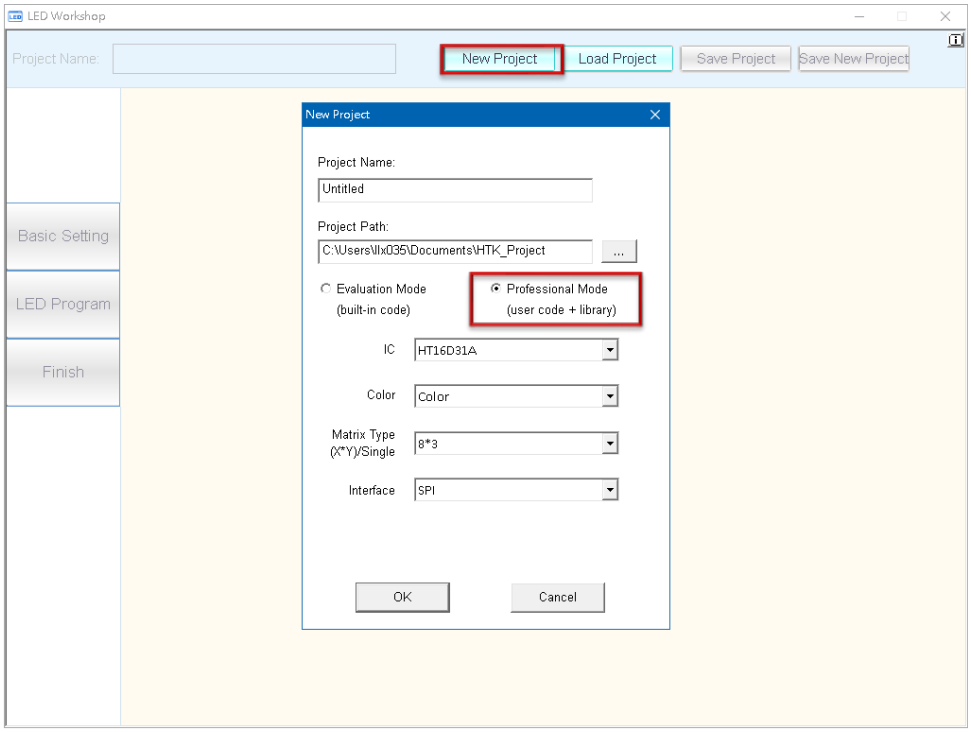


View Images



Professional Mode

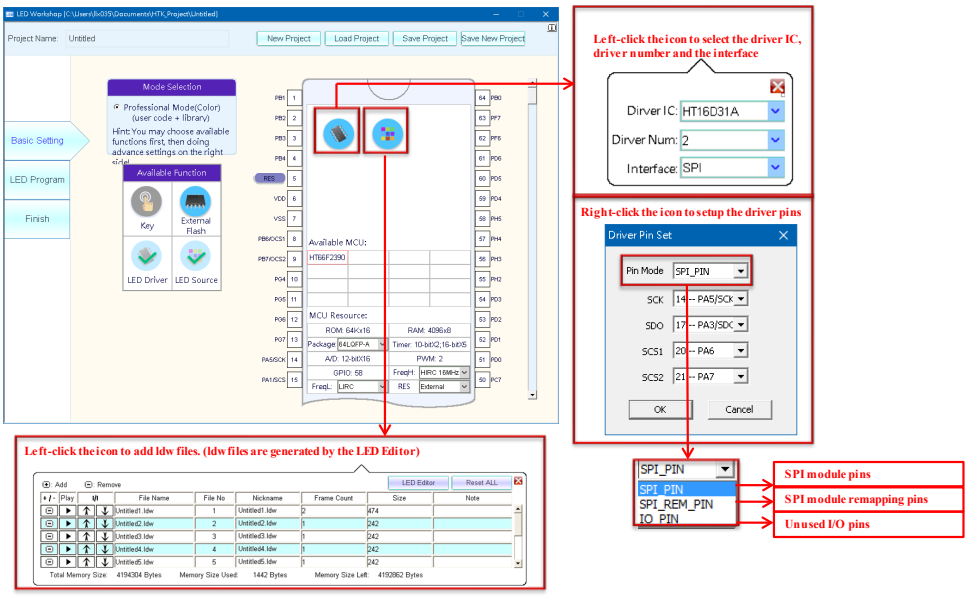
After completing the connection of the development board and the e-link, start the LED Workshop and click the “New Project” button. A New Project dialog box as shown below will pop up. Then click “OK” after completing the related settings.



Basic Setting

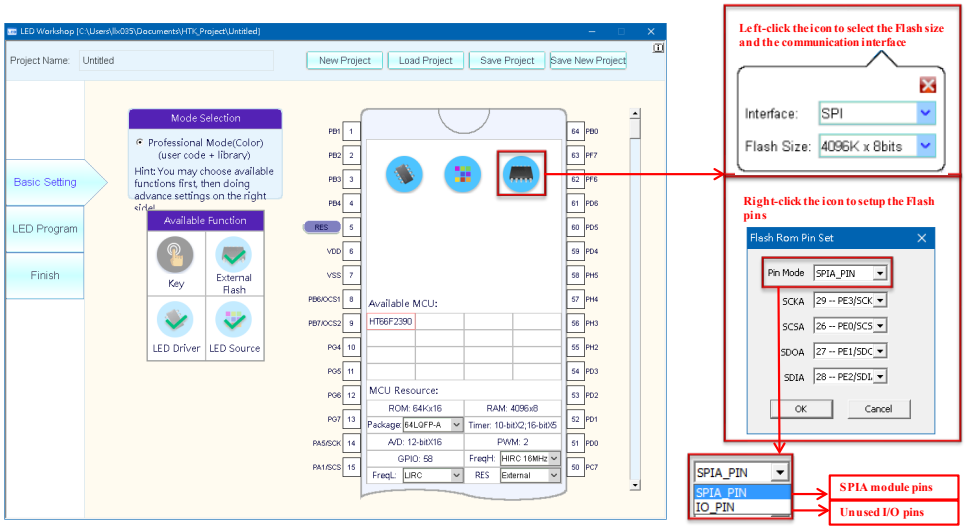
Driver IC, Display Source

Click the HT66F2390 in the "Available MCU" table, and then setup the driver IC and display source which are necessary options. The interface in the following figure shows the mode and that the data is stored in the internal PROM.



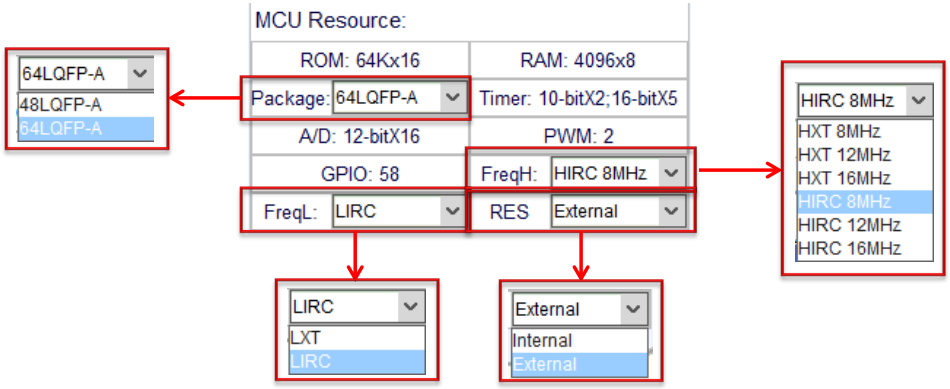
External Flash

To save the data into the FLASHROM, click the "External Flash" icon and select the Flash size based on the size of the soldered FLASHROM on the board.



MCU Resources

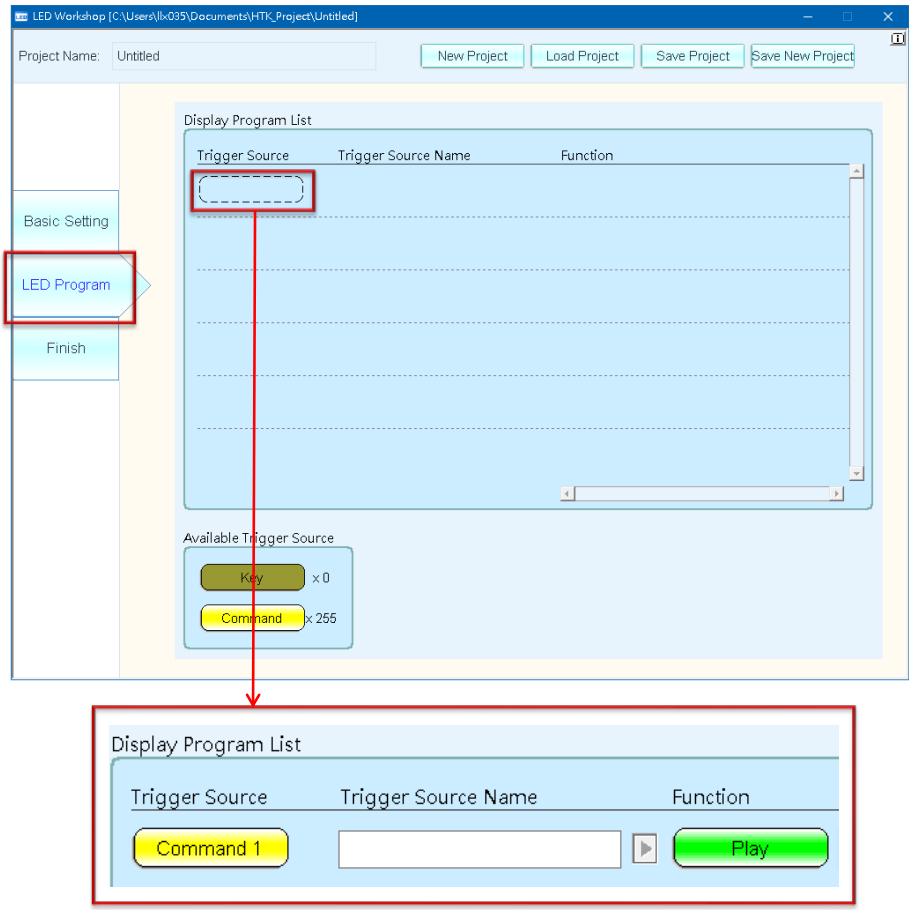
The configurable MCU resource options are the package, the high speed oscillator (FreqH), the low speed oscillator (FreqL) and the reset circuit.



LED Program

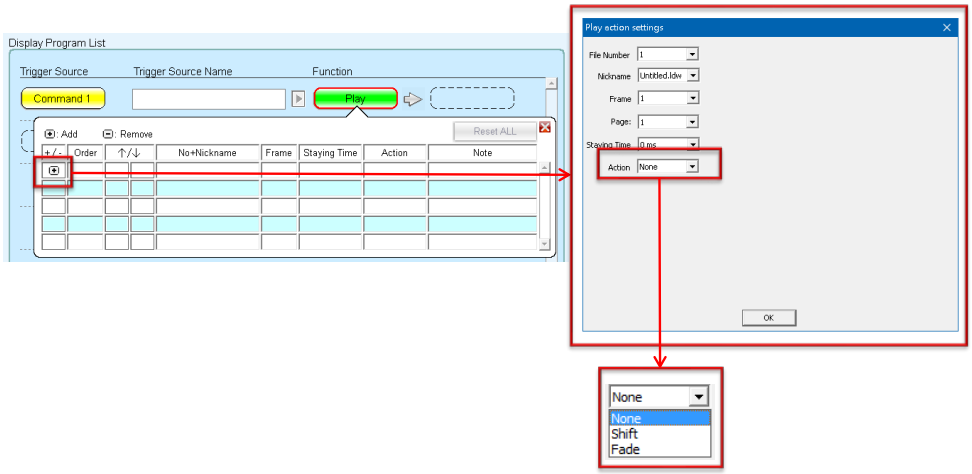
Add Trigger Source

Click the "LED Program" on the left to enter the project logical design page. After clicking on the dashed box, the available trigger sources will be displayed in the dashed box. In the Professional Mode, the trigger source is the command.



Add Display Actions

Click the "Play" button to set the functions, and then click the "+" button to add the display actions. In the Professional Mode, the workshop also supports three actions which are the PLAY+NONE, PLAY+SHIFT and PLAY+FADE. The following operation is the same as in the Evaluation Mode, so it is not described here.



Call Library Functions

The three actions of the PLAY+NONE, PLAY+SHIFT and PLAY+FADE mentioned above are controlled by dedicated library functions respectively. The following content will describe how to call these library functions. Currently the library functions can only be used when two HT16D3xA/B devices are driven.

HT16D31A/B&HT16D33A/B Calling Method

PLAY+NONE

```
void _PLAY_PICTURE_DISPLAY(INT8U LU8V_LDW_INDEX,INT8U LU8V_FRAME_INDEX,INT8U LU8V_PAGE_INDEX)
```

Inlet parameters:

① LU8V_LDW_INDEX: The file No. of the LDW file which is selected in the added files

② LU8V_FRAME_INDEX: The frame No. of the selected LDW file

③ LU8V_PAGE_INDEX: The page No. of the selected frame

Call method:

```
_PLAY_PICTURE_DISPLAY(INT8U LU8V_LDW_INDEX,INT8U LU8V_FRAME_INDEX,INT8U LU8V_PAGE_INDEX)
```

Description: The Inlet parameters should be assigned first before calling the library function. In this example, they are the LU8V_LDW_INDEX, LU8V_FRAME_INDEX and LU8V_PAGE_INDEX. For example, set LU8V_LDW_INDEX=2, LU8V_FRAME_INDEX=1 and LU8V_PAGE_INDEX=1 and then call the function. The first page of the first frame in the No.2 LDW file will be displayed.

PLAY+SHIFT

```
void _PLAY_PICTURE_SHIFT_SETTING(INT8U DIRECTION,INT8U SPEED,INT8U SHIFT_NUM,INT8U SHIFT_LOOP,INT8U ROTATE)
```

Inlet parameters:

① DIRECTION: The image shifting direction

=0, right

=1, left

② SPEED: The image shifting speed

=0~255, the actual speed: shift the image once in the time of (248ms + setting value × 8ms)

③ SHIFT_NUM: The column number that the image will be shifted every time

=1~255, the number of the left or right shifted columns.

④ SIFT_LOOP: The image shifting times

=1~255, the total times that the image will be shifted.

⑤ Rotate: The image shifting includes rotation or not

=0: No rotation

=1: Rotation

Call method:

```
_PLAY_PICTURE_SHIFT_SETTING(INT8U DIRECTION,INT8U SPEED,INT8U SHIFT_NUM,INT8U SHIFT_LOOP,INT8U ROTATE)
```

Description: The Inlet parameters should be assigned first before calling the library function. In this example, they are the DIRECTION, SPEED, SHIFT_NUM, SHIFT_LOOP and ROTATE. For example, set DIRECTION=0, SPEED=1, SHIFT_NUM=1, LOOP=2 and ROTATE=1 and then call the function. The display effects: The image will move one column to the right in every 256ms, including rotation and move totally two times.

PLAY+FADE

```
void _PLAY_PICTURE_FIREFLY_SETTING(INT8U LGS,INT8U FBS,INT8U T1,INT8U T2,INT8U T3,INT8U T4)
```

Inlet parameters:

① LGS: Linear/Gamma effect select

=0, Linear

=1, Gamma

② FBS: Fade/Blink effect select

=0, Fade

=1, Blink

③ T1: T1 time

=0~7 (0: off; 1: 256, 2: 512; 3: 1024; 4: 1536; 5: 2048; 6: 2560; 7: 3072) frame

④ T2: T2 time

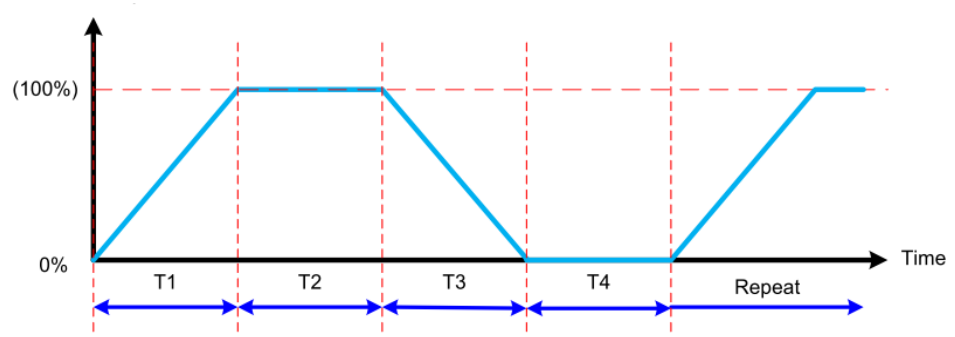
=0~3 (0: T1×0.25; 1: T1×0.5; 2: T1; 3: T1×2)

⑤ T3: T3 time

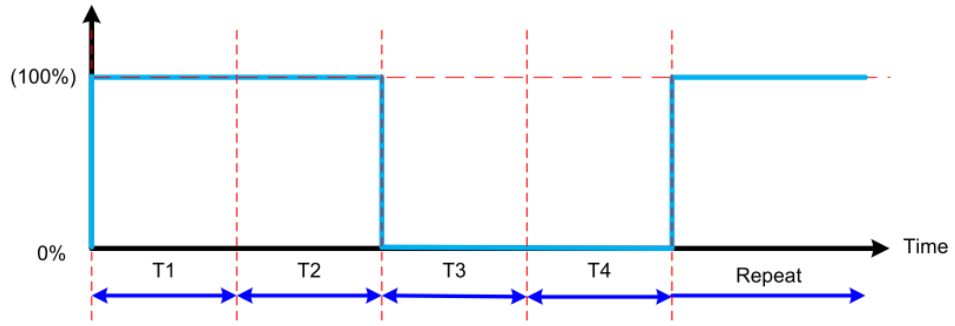
=0~1 (0: T1; 1: T1×2)

⑥ T4: T4 time

=0~3 (0: T1×0.25; 1: T1×0.5; 2: T1; 3: T1×2)



Fade Mode



Blink Mode

Call method:

```
_PLAY_PICTURE_FIREFLY_SETTING(INT8U LGS,INT8U FBS,INT8U T1,INT8U T2,INT8U T3,INT8U T4)
```

Description: The Inlet parameters should be assigned first before calling the library function. In this example, they are the LGS, FBS, T1, T2, T3 and T4. For example, set LGS=0, FBS=1, T1=1, T2=1, T3=1 and T4=1 and then call the function. The effects: The time of the T1~T4 are all 1 time of T1, where the T1 value can be obtained from the corresponding datasheet.

HT16D35A/B Calling Method

Inlet parameter is variable

The Inlet parameters of the following functions must be variables.

PLAY+NONE

```
_PLAY_PICTURE_DISPLAY MACRO Play_Number,Frame
```

Inlet parameters:

① Play_Number: The file No. of the LDW file which is selected in the added files

② Frame: The frame No. of the selected LDW file

Call method:

```
_PLAY_PICTURE_DISPLAY  GU8V_LDW_INDEX,GU8V_FRAME_INDEX
```

Description: Define two variables for storing data. In this example, they are the GU8V_LDW_INDEX and GU8V_FRAME_INDEX. The two variables should be assigned first before calling the library function. For example, set GU8V_LDW_INDEX=2, and GU8V_FRAME_INDEX=1 and then call the function. The first frame of the No.2 LDW file will be displayed.

PLAY+SHIFT

```
_PLAY_PICTURE_SHIFT MACRO COLOR_Direction,COLOR_Speed,COLOR_ShiftNum,COLOR_ShiftLoop,COLOR_Rotate
```

Inlet parameters:

① COLOR_Direction: The image shifting direction

=0~3 (0: up; 1: down; 2: right; 3: left)

② COLOR_Speed: The image shifting speed

=0~255, the actual speed: shift the image once in the time of (96ms + setting value × 8ms)

③ COLOR_ShiftNum: The row or column number that the image will be shifted every time

=1~255, the number of the up or down shifted rows or the left or right shifted columns.

④ COLOR_ShiftLoop: The image shifting times

=1~255, the total times that the image will be shifted.

⑤ COLOR_Rotate: The image shifting includes rotation or not

=0: No rotation

=1: Rotation

Call method:

```
_PLAY_PICTURE_SHIFT  GU8V_SHIFT_DIRECTION,GU8V_SHIFT_SPEED,GU8V_SHIFT_NUM,GU8V_SHIFT_LOOP,GU8V_SHIFT_ROTATE
```

Description: Define five variables for storing data. In this example, they are the GU8V_SHIFT_DIRECTION, GU8V_SHIFT_SPEED, GU8V_SHIFT_NUM, GU8V_SHIFT_LOOP, and GU8V_SHIFT_ROTATE. The five variables should be assigned first before calling the library function. For example, set GU8V_SHIFT_DIRECTION=2, GU8V_SHIFT_SPEED=1, GU8V_SHIFT_NUM=1, GU8V_SHIFT_LOOP=2, and GU8V_SHIFT_ROTATE=1 and then call the function. The display effects: The image will move one column to the right in every 104ms, including rotation and move totally two times.

PLAY+FADE

```
_PLAY_PICTURE_FIREFLY  MACRO COLOR_BFS,COLOR_T1,COLOR_T2,COLOR_T3,COLOR_T4,COLOR_Times
```

Inlet parameters:

① COLOR_BFS: Blink/Fade effect select

=0, Blink

=1, Fade

② COLOR_T1: T1 time

=0~3 (0: 0.5s; 1: 1.0s; 2: 1.5s; 3:2.0s)

③ COLOR_T2: T2 time

=0~3 (0: 0.5s; 1:1.0s; 2: 1.5s; 3:2.0s)

④ COLOR_T3: T3 time

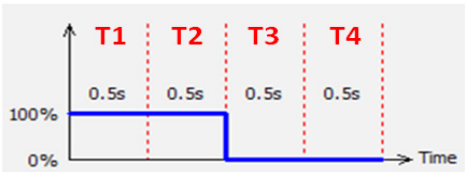
=0~3 (0: 0.5s; 1:1.0s; 2: 1.5s; 3:2.0s)

⑤ COLOR_T4: T4 time

=0~3 (0: 0.5s; 1:1.0s; 2: 1.5s; 3:2.0s)

⑥ COLOR_Times:

=1~255, the number of the image flashing times



Blink Waveform

Fade Waveform

Call method:

```
_PLAY_PICTURE_FIREFLY  GU8V_FIREFLY_FADE,GU8V_FIREFLY_T1,GU8V_FIREFLY_T2,GU8V_FIREFLY_T3,GU8V_FIREFLY_T4,GU8V_FIREFLY_CYCLETIME
```

Description: Define six variables for storing data. In this example, they are the GU8V_FIREFLY_FADE, GU8V_FIREFLY_T1, GU8V_FIREFLY_T2, GU8V_FIREFLY_T3, GU8V_FIREFLY_T4, and GU8V_FIREFLY_CYCLETIME. The six variables should be assigned first before calling the library function. For example, set GU8V_FIREFLY_FADE=0, GU8V_FIREFLY_T1=1, GU8V_FIREFLY_T2=1, GU8V_FIREFLY_T3=1, GU8V_FIREFLY_T4=1, GU8V_FIREFLY_CYCLETIME=1 and then call the function. The effects: The time of the T1~T4 are all 1.0s, blinking effect with flashing one time.

Inlet parameter is immediate data

Except that the inlet parameters must be immediate data, the following three functions are the same as the above functions whose inlet parameter is variable, so the definition of each inlet parameter is not described here.

PLAY+NONE

```
_PLAY_PICTURE_DISPLAY_IM MACRO Play_Number_IM,Frame_IM
```

Call method: `_PLAY_PICTURE_DISPLAY_IM 2,1`

Description: The first frame of the No.2 LDW file will be displayed.

PLAY+SHIFT

```
_PLAY_PICTURE_SHIFT_IM MACRO COLOR_Direction_IM,COLOR_Speed_IM,COLOR_ShiftNum_IM,COLOR_ShiftLoop_IM,COLOR_Rotate_IM
```

Call method: `_PLAY_PICTURE_SHIFT_IM 2,1,1,2,1`

Description: The image will move one column to the right in every 104ms, including rotation and move totally two times.

PLAY+FADE

```
_PLAY_PICTURE_FIREFLY_IM  MACRO COLOR_BFS_IM,COLOR_T1_IM,COLOR_T2_IM,COLOR_T3_IM,COLOR_T4_IM,COLOR_Times_IM
```

Call method: `_PLAY_PICTURE_FIREFLY_IM 0,1,1,1,1,1`

Description: The time of the T1~T4 are all 1.0s, blinking effect with flashing one time.

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