



Gowin_EMPU_M1

Download Reference Manual

IPUG532-1.0E,2/19/2019

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Revision History

Date	Version	Description
2/19/2019	1.0E	Initial version

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1 Download Flow

Gowin Gowin_EMPU_M1 provides two download flows of hardware design and software design:

1. Use software design output as the ITCM initiation value of hardware design;
 - a). A BIN format file generated by Gowin_EMPU_M1 software design;
 - b). In software design, convert the BIN format file to four hex format files: itcm0, itcm1, itcm2, and itcm3 by the make_hex.py script tool.
 - c). Used as the ITCM initiation value to be read-in.
 - d). Synthesize, place&route, and generate the bitstream files containing software design and hardware design
 - e). Download a bitstream file
2. Merge software design output and hardware design output
 - a) Generate a FS bitstream file by Gowin_EMPU_M1 hardware design.
 - b) A BIN format file generated by Gowin_EMPU_M1 software design;
 - c) Use Gowin "merge_bit.py" script tool to merge the BIN format file into the FS bitstream file.
 - d) Generate the new FS bitstream file after merging
 - e) Download the new FS bitstream file after merging

2 Use Software Design Output as the ITCM Initiation Value of Hardware Design

2.1 Script Tool

Gowin_EMPU_M1_Script\make_hex_script\make_hex.py

2.2 Command Parameters

python make_hex.py bin-file

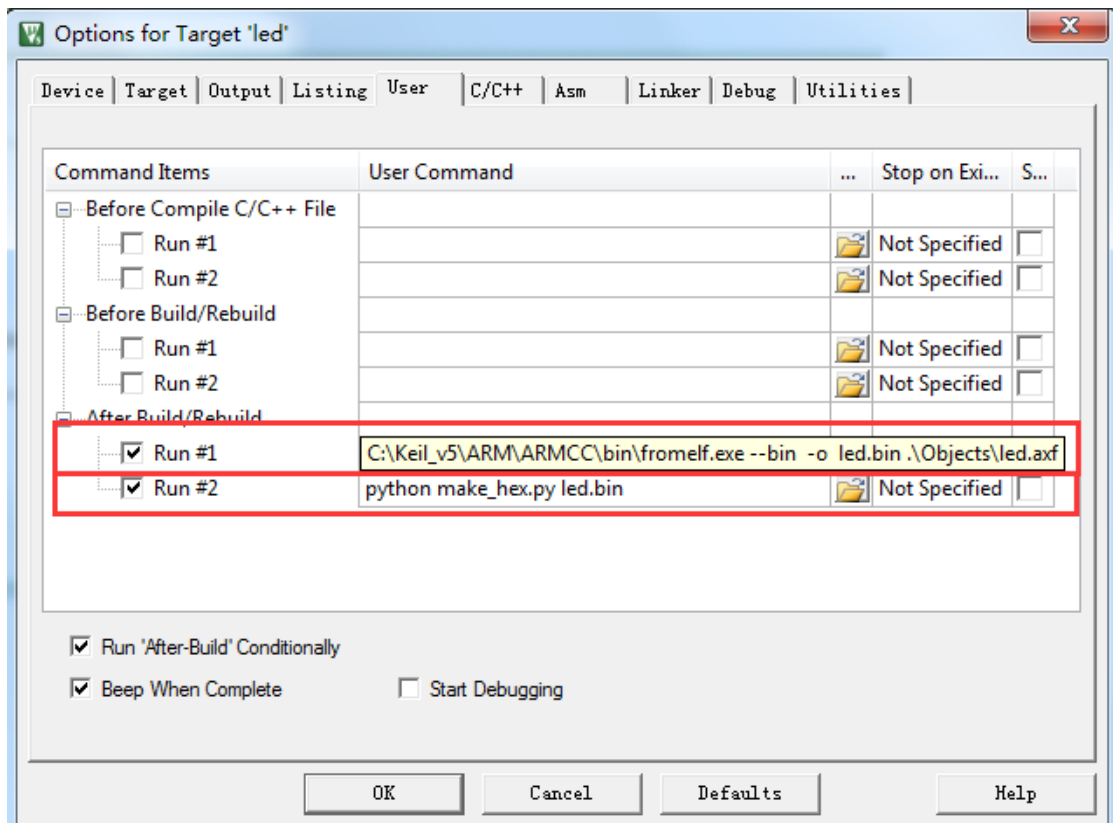
2.3 Software Configuration

Software design outputs BIN format file, convert the BIN format file to four hex format files: itcm0, itcm1, itcm2, and itcm3.

External script can be configured in ARM KEIL Microcontroller Tool. make_hex.py can be called automatically to generate hex format files during project compiling, as shown in Figure 2-1.

- Run #1
fromelf.exe --bin -o bin-file axf-file
- Run #2
python make_hex.py bin-file

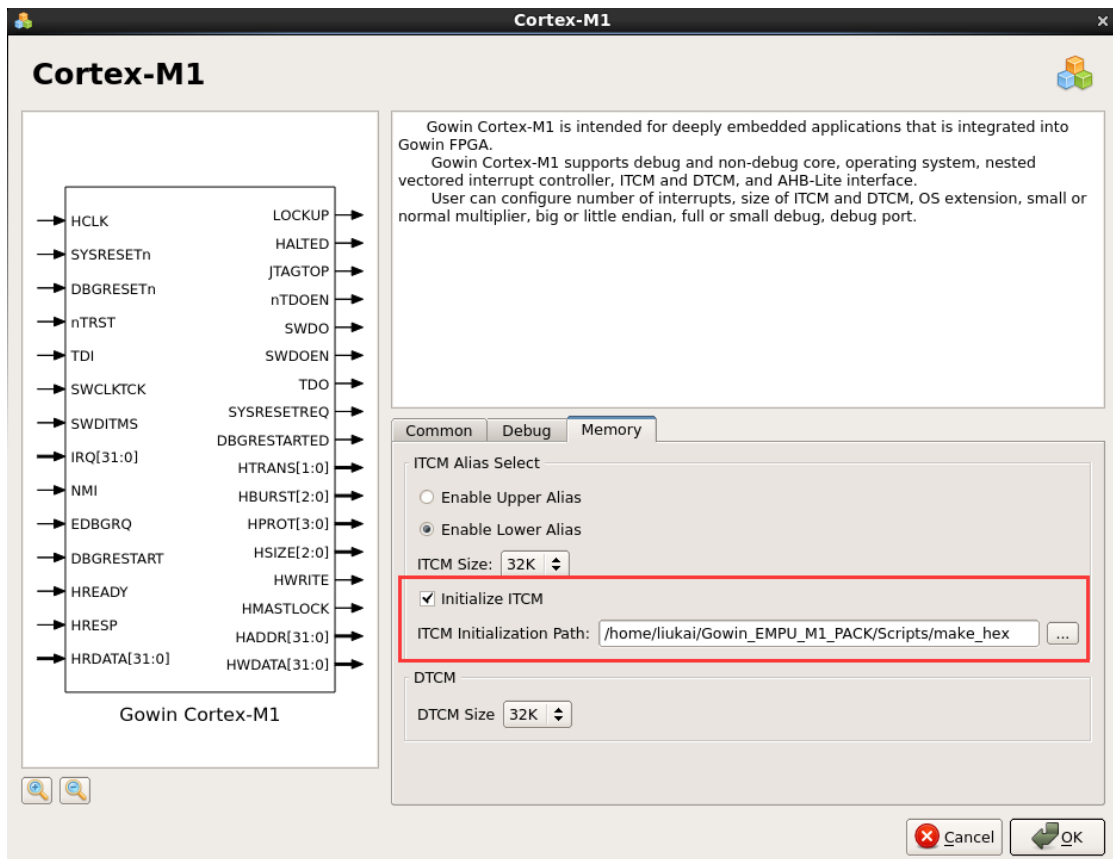
Figure 2-1 External Script Call



2.4 Hardware Configuration

When you configure Cortex-M1 in IP Core Generator, select "Initialize ITCM" and import the four hex format files path as ITCM Initialization Path, as shown in Figure 2-2.

Figure 2-2 Configure ITCM Initialization



2.5 Design Flow

1. Use software design output as the ITCM initiation value of hardware design;
2. Use Synplify_Pro or GowinSynthesis to synthesize;
3. Use Place & Route to generate bitstream file;
4. Download the bitstream file using Gowin Programmer.

3 Merge Software Design Output and Hardware Design Output

3.1 Script Tool

Gowin_EMPU_M1_Script\merge_bit_script\merge_bit.py

3.2 Command Parameters

python merge_bit.py bin-file itcm.loc fs-file

For the description of command parameters, please refer to Table 3-1.

Table 3-1 merge_bit Command Parameters

Parameter	Description
merge_bit.py	The merging script tool of Gowin_EMPU_M1 software design and hardware design
bin-file	A BIN format file generated by Gowin_EMPU_M1 software design
fs-file	A FS bitstream file generated by Gowin_EMPU_M1 hardware design
itcm.loc	ITCM layout position

Generate the new FS bitstream file after merging

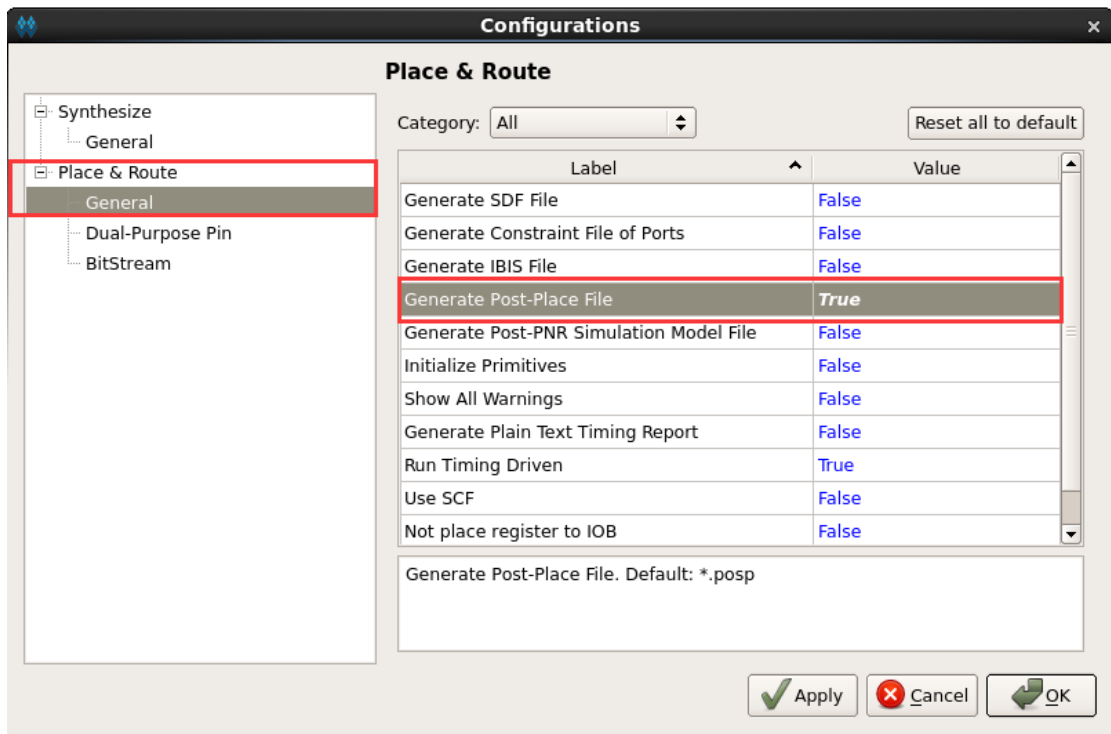
3.3 ITCM Layout Position

- Read posp file to get the ITCM layout position
- Generate itcm.loc and save it to ITCM layout position
- Merge software design output and hardware design output

3.3.1 Configure Place&Route Options

A posp file will be generated when the value of “Place & Route > Generate Post-Place File” is True, as shown in Figure 3-1.

Figure 3-1 posp Configuration



3.3.2 Get ITCM Layout Position

A posp file is generated after place&route. Open the posp file to get the ITCM layout position. As shown in Figure 3-2, the ITCM layout position is from PLACE_BSRAM_R28[9] to PLACE_BSRAM_R28[0].

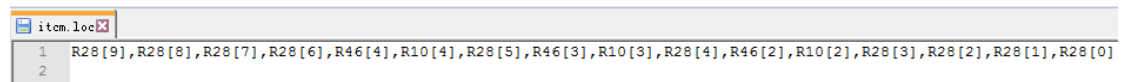
Figure 3-2 ITCM Layout Position

M1_inst/u_CortexM1Integration/u_itcm/mem0_mem0_0_0	PLACE_BSRAM_R28 [0]
M1_inst/u_CortexM1Integration/u_itcm/mem0_mem0_0_1	PLACE_BSRAM_R28 [1]
M1_inst/u_CortexM1Integration/u_itcm/mem0_mem0_0_2	PLACE_BSRAM_R28 [2]
M1_inst/u_CortexM1Integration/u_itcm/mem0_mem0_0_3	PLACE_BSRAM_R28 [3]
M1_inst/u_CortexM1Integration/u_itcm/mem1_mem1_0_0	PLACE_BSRAM_R10 [2]
M1_inst/u_CortexM1Integration/u_itcm/mem1_mem1_0_1	PLACE_BSRAM_R46 [2]
M1_inst/u_CortexM1Integration/u_itcm/mem1_mem1_0_2	PLACE_BSRAM_R28 [4]
M1_inst/u_CortexM1Integration/u_itcm/mem1_mem1_0_3	PLACE_BSRAM_R10 [3]
M1_inst/u_CortexM1Integration/u_itcm/mem2_mem2_0_0	PLACE_BSRAM_R46 [3]
M1_inst/u_CortexM1Integration/u_itcm/mem2_mem2_0_1	PLACE_BSRAM_R28 [5]
M1_inst/u_CortexM1Integration/u_itcm/mem2_mem2_0_2	PLACE_BSRAM_R10 [4]
M1_inst/u_CortexM1Integration/u_itcm/mem2_mem2_0_3	PLACE_BSRAM_R46 [4]
M1_inst/u_CortexM1Integration/u_itcm/mem3_mem3_0_0	PLACE_BSRAM_R28 [6]
M1_inst/u_CortexM1Integration/u_itcm/mem3_mem3_0_1	PLACE_BSRAM_R28 [7]
M1_inst/u_CortexM1Integration/u_itcm/mem3_mem3_0_2	PLACE_BSRAM_R28 [8]
M1_inst/u_CortexM1Integration/u_itcm/mem3_mem3_0_3	PLACE_BSRAM_R28 [9]

3.3.3 Save ITCM Layout Position

Save the ITCM layout position to itcm.loc after getting it from the posp file from the bottom up, as shown in Figure 3-3. From the bottom up means from PLACE_BSRAM_R28[9] to PLACE_BSRAM_R28[0]. Save R28[9] to R28[0] to itcm.loc.

Figure 3-3 itcm.loc



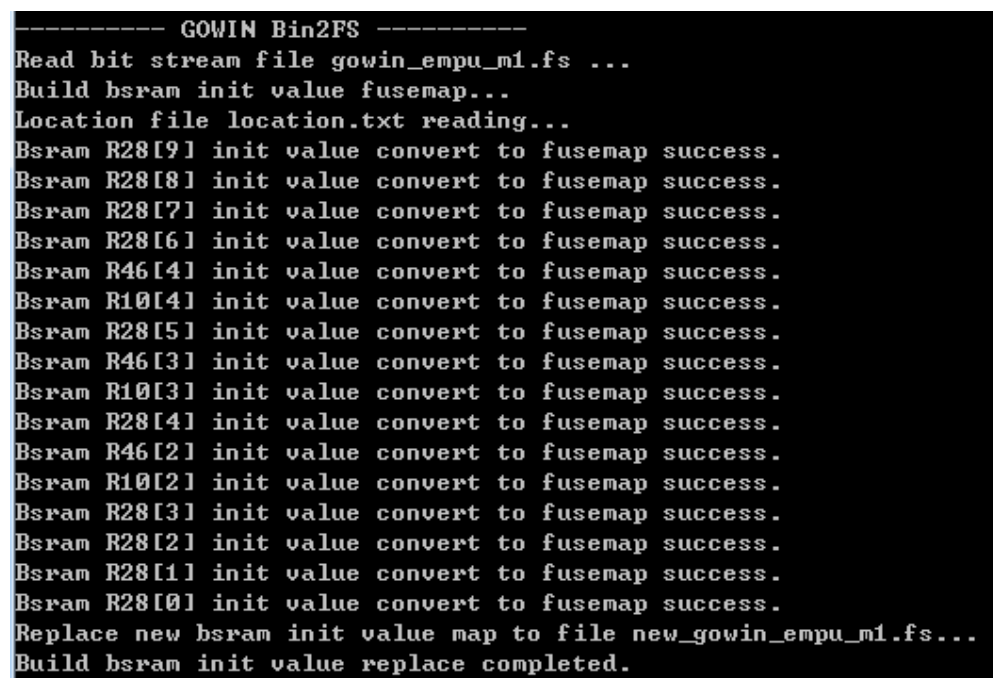
```
itcm.loc
1 R28[9],R28[8],R28[7],R28[6],R46[4],R10[4],R28[5],R46[3],R10[3],R28[4],R46[2],R10[2],R28[3],R28[2],R28[1],R28[0]
2
```

3.4 Design Flow

3.4.1 Merge

1. FS bitstream file generated by hardware design
2. A BIN format file generated by software design;
3. Use merge_bit.py to merge the FS bitstream file and the BIN file and generate a new FS bitstream file, as shown in Figure 3-4.

Figure 3-4 Merge the results of software design and hardware design



```
----- GOWIN Bin2FS -----
Read bit stream file gowin_empu_m1.fs ...
Build bsram init value fusemap...
Location file location.txt reading...
Bsram R28[9] init value convert to fusemap success.
Bsram R28[8] init value convert to fusemap success.
Bsram R28[7] init value convert to fusemap success.
Bsram R28[6] init value convert to fusemap success.
Bsram R46[4] init value convert to fusemap success.
Bsram R10[4] init value convert to fusemap success.
Bsram R28[5] init value convert to fusemap success.
Bsram R46[3] init value convert to fusemap success.
Bsram R10[3] init value convert to fusemap success.
Bsram R28[4] init value convert to fusemap success.
Bsram R46[2] init value convert to fusemap success.
Bsram R10[2] init value convert to fusemap success.
Bsram R28[3] init value convert to fusemap success.
Bsram R28[2] init value convert to fusemap success.
Bsram R28[1] init value convert to fusemap success.
Bsram R28[0] init value convert to fusemap success.
Replace new bsram init value map to file new_gowin_empu_m1.fs...
Build bsram init value replace completed.
```

3.4.2 Download

Download the new FS bitstream file using Gowin Programmer after merging.

For the further details about Gowin Programmer usage, please refer to SUG502, [Gowin Programmer User Guide](#).

