RX600 Series

M3S-GUI-LIB: GUI Library Introduction Guide

R20AN0077EJ0101
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Introduction

This document explains how to use RX600 Series M3S-GUI-LIB (GUI Library) and describes the included sample program files.

GUI Library enables programs generated by M3S-GUI-BUILDER (GUI Builder) to run on matching microcontrollers (MCUs). Please refer to the installation guide of GUI Builder.

GUI Builder and GUI Library are available for download from the Renesas Electronics Web site.

Supported Device

RX600 Series MCUs

Contents

1. Product Configuration

GUI Builder comprises the following elements.

- M3S-GUI-LIB V.2.01 Release00
- M3S-GUI-LIB V.2.01 Release00 Installation Guide (this document: r20an0077ej0101_rx_gui.pdf)

Part number of this product : R0MRX60GL0011RRC

To install GUI Builder, run **setup.exe**. Note that it is necessary to agree to the terms of the software license agreement during the installation process.

The following files are copied during the installation process.

Table 1.1 Product Configuration

Installer(setup.exe)	For Windows installer. Installer will show the GUI product agreement. if user admits this agreement, installer will copy the GUI file to the path below. C:\Renesas\ an_r20an0077ej_rx_gui_v201r00
Documentation(doc)	
r20an0077ej0101_rx_gui.pdf	Introduction Guide
GUI library(lib)	
mgt_rx_little.lib mgt_rx_big.lib	GUI library
Header file(include)	
mgt.h	Header file for GUI library
ximg.h	Header file for plugin
font_sample_mgt.h	Header file for sample font
Graphic library(lib_ext)	
rx600lewgp16.lib rx600bewgp16.lib	M3S-GRAPHIC-LIB (Graphic Library), Free evaluation version
font_sample_rx_little.lib font_sample_rx_big.lib	Sample font data
Sample program(sample)	
WQVGA_Design_sample	Visual C# project
GUI_RX62N_RSK_sample	Development environment for RN62N-RSK

The version of the library included in this product.

Table 1.2 Versions

Library	Version
GUI library	1.1.1.01

2. Specifications

GUI Library conforms to the specifications of GUI Builder. GUI Library(Win32 version) supports output state transition information,but GUI Library(RX version) does not.For details, see the GUI Builder User's Manual.

2.1 Development Tools

The development tools used with GUI Library are listed below.

Integrated development environment

High Performance Embedded Workshop, version 4.09.00.007 or later

C compiler

C/C++ Compiler Package for RX Family, version 1.01, release 00 or later

The library is generated by using the following options (default).

Little-endian version

-cpu=rx600 -output=obj="$(CONFIGDIR)\$(FILELEAF).obj" -nologo

Big-endian version

As above, with the following setting added: -endian=big

2.2 ROM, RAM, and Stack Sizes

The sizes of the ROM, RAM, and stacks used by GUI Library are as follows.

Table 2.1 ROM, RAM, and Stack Sizes

Category	Size
GUI Library RAM (sections B and R)	about 450byte
GUI Library ROM (sections P and C and D and L)	about 7kB
ROM (GUI Library+ Graphic Library)	about 16kB
Sample font data (1byte font)	about 3.2kB
Sample font data (2byte font)	about 256kB

Table 2.2 Stack Sizes

API Function	Stack Size [Bytes] (Graphic Library Only)
mgt_init	8
mgt_flip	16
mgt_use_fontset	4
mgt_set_rdb	20
mgt_tick	472
mgt_reset_focus	32
mgt_transit	8
mgt_hide_control	8
mgt_show_control	8
mgt_invalidate	24
mgt_get_current_form	4
mgt_get_clientdata	8
mgt_get_image	56
mgt_get_checkbox_value	8
mgt_set_checkbox_value	32
mgt_set_button_image	32
mgt_set_form_image	32
mgt_set_picturebox_image	32
mgt_set_listbox_data	32
mgt_set_label_text	32
mgt_make_bitmap	8
_ximg_init	4
_ximg_set_plugin	4

Note: These values apply to the provided sample program. The stack sizes differ depending on the graphic library used. The user should therefore use a stack calculation tool such as Call Walker to determine the actual stack sizes.

2.3 Version information

GUI Library has version information as strings. User can access this version information.

define:

```
extern const uint8_t R_gui_lib_version[];
```

GUI Library has version information showed below.

little endian:

"M3S-GUI-LIB version 1.1.1.01 for RX LITTLE endian.(Jun 13 2011, 15:17:31)"

big endian:

"M3S-GUI-LIB version 1.1.1.01 for RX BIG endian.(Jun 13 2011, 15:17:34)"

3. Using GUI Library

GUI Library is required in order to run programs generated by GUI Builder on RX MCUs. Depending on the hardware configuration, control drivers may also be necessary for the display device (LCD, etc.) or input device (touch panel, etc.).

GUI Library uses Graphic Library to write image data to the frame buffer of the display device. The peripheral configuration of the libraries is shown below.

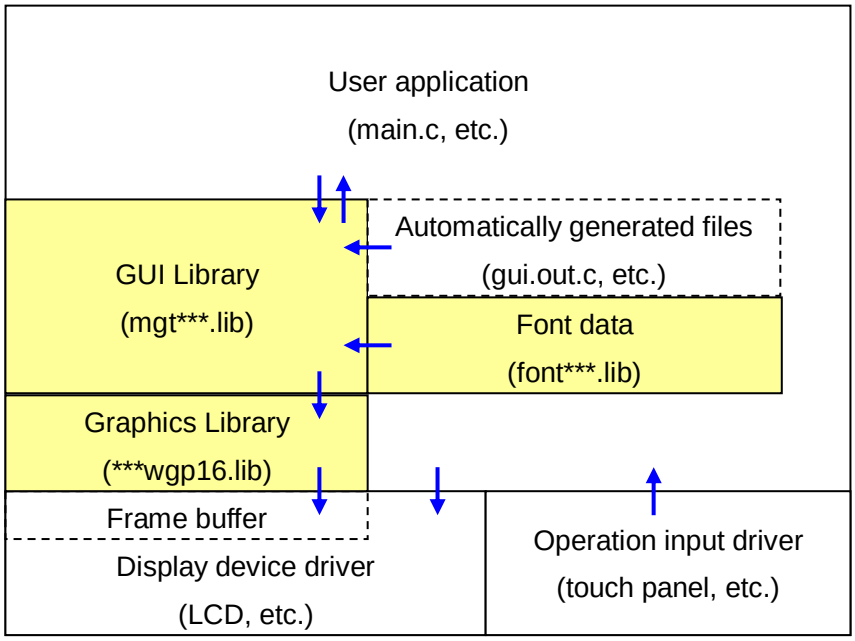

Figure 3.1 Peripheral Configuration of Libraries

The following library files should be included in the project, together with the files (gui.out.c, etc.) generated automatically by GUI Builder.

Little-endian version:

mgt_rx_little.lib font_sample_rx_little.lib rx600lewgp16.lib

Big-endian version:

mgt_rx_big.lib font_sample_rx_big.lib rx600bewgp16.lib

With the exception of hardware-dependent files (such as main.c), GUI-related files generated by GUI Builder can be used with a variety of different MCUs.

4. Using the Sample Program

The sample program is based on the LCD Direct Drive (RX600 Series Direct Drive LCD Demonstration Application Note Rev.1.01) sample program and is included with GUI Library. And JPEG plug-in function is available.

LCD Direct Drive runs on the following hardware.

- RX62N TFT-LCD Direct-Drive Demo Kit

Please refer to the following website if you need details of these products.

product	website
RX62N TFT-LCD Direct-Drive Demo Kit	http://www.renesas.eu/products/tools/introductory_evaluation_tools/renesas_starter_kits/rx62n_tftlcd_dddemokit/rx62n_tftlcd_dddemokit.jsp
LCD Direct Drive	http://www.renesas.com/products/mpumcu/rx/Application_Notes.jsp
JPEG decoder	http://japan.renesas.com/mw/jpeglib

4.1 Outline of sample program

Sample program explains two type of implementation.

- Sample program1 : Pictures in external memory. (default)
- Sample program2 : Pictures in internal ROM.

These sample programs can be switched to define “USE_FETCH_IMAGE”

If user uses “USE_FETCH_IMAGE”, user can select type of reading images from external memory to define “GUI_MEMORY_ACCESS_TYPE”

These sample programs can use JPEG plug-in to define “GUI_PLUGIN_JPEG”.

4.2 Procedure of running sample program

There is procedure of running sample program as follows.

4.2.1 Build Visual C# project

This section explains procedure of from GUI design to output C source code including GUI design if user needs some GUI design changing, user starts Visual C# project. (WQVGA_Design_sample.sln) If user edits GUI design, user should adjust RX62N sample program to GUI design.

(1) Copy from “bin” directory existing in GUI builder install directory to same directory of WQVGA_Design_sample.sln.
(2) Start windows command prompt
(3) Set current directory to WQVGA_Design_sample directory.
Execute “make.bat”
Confirm make.bat outputs gui.out.
- Makefile is set as default output picture format is JPG. If user would like to use bitmap, delete “--jpg” option in the Makefile.

(4) Execute “make.bat copy”.
Confirm gui.out is copied to auto_gen directory in the sample program..

4.2.2 Build RX62N sample program

This section explains procedure of from build to execute. There are two versions sample program. Sample program1 has usage to read pictures from external memory. Sample program2 has pictures in internal ROM.

Sample program1 : Pictures in external memory. (default)

(1) Start GUI_RX62N_RSK_sample\ DirectLCD.hws
(2) Active “r_Packages” project (default) and build LCD direct drive library. This project generates library and header files for sample program.
(3) Active “guiimg” project and build. This project generates guiimg.bin come from pictures information. guiimg.bin is used when user reads pictures from external memory.
(4) Active “DirectLCD” project. Set “USE_FETCH_IMAGE” macro (default) and build. “0 Errors, 5 warning” message will be displayed, this is not problems for running because this warnings comes from about unused section name and changing of toolchain version.
(5) Download sample program using E1/E20
(6) (Only first time execution of sample program) Execute “$(PROJDIR)\ResourceLoad.hdc” script in emulator command line.
This script initialize SDRAM and expand picture image from guiimg.bin. And this script writes image to serial flash and start sample program.
(7) (After second time execution of sample program) Execute “Reset GO” button to start sample program.

Sample program2 : Pictures in internal ROM

(1) Execute procedure of sample program1 (1) and (2)
(2) Active “DirectLCD”. Disable “USE_FETCH_IMAGE” macro and build. “0 Errors, 5 warning” message will be displayed, this is not problems for running because this warnings comes from about unused section name and changing of toolchain version.
(3) Download sample program using E1/E20
(4) Execute “Reset GO” button to start sample program.

4.3 Description of sample programs

4.3.1 Interface of images decoder library

GUI library can be plugged-in JPEG/GIF/PNG decoder. Sample program can expand jpeg images to use JPEG decoder as plug-in. Please refer to the r_gui_plugin_jpeg.c and place of GUI_PLUGIN_JPEG macro to know how to implement images plug-in.

If user does not use plug-in, please disable GUI_PLUGIN_JPEG macro.

4.3.2 Usage of reading pictures from external memory

Sample program reads pictures from serial flash when GUI library requests and expands SDRAM (variable : Resources). Sample program has three type of reading. This type can be switched using “GUI_MEMORY_ACCESS_TYPE” macro. Please align type of reading and “Resources” size to user environment. And please refer to the “r_gui_fetch_img_flash.c” to know how to use other memory device. Default “GUI_MEMORY_ACCESS_TYPE” is 2, and “Resources” has 2MByte area.

This section explains about “GUI_MEMORY_ACCESS_TYPE”.

“GUI_MEMORY_ACCESS_TYPE” has three type of allocating memory for “Resources”.

- Case1: All pictures are always expanded in “Resources” using as static memory.
  Case1 has advantage which GUI library read pictures speedy. Because the all pictures are always expanded in “Resources”. But Case1 has disadvantage which “Resources” should have static much memory.
- Case2: All pictures are expanded in “Resources” using as reusable memory.
  Case2 has advantage which “Resources” can be reused after GUI library uses. But Case2 has disadvantage which “Resources” should have much temporary memory.
- Case3: One picture is expanded in “Resources”
  Case3 has advantage which “Resources” can be allocated as less memory. But Case3 has disadvantage which GUI library read pictures slowly.

“Resources” data structure

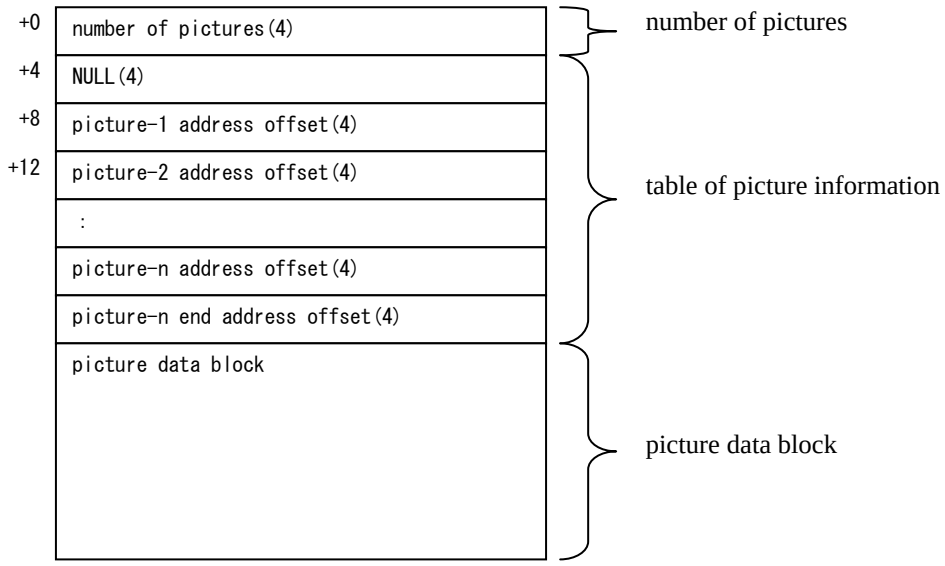

Figure 4.1 “Resources” data structure

The section after this explains about “picture data block”.

- Case1: All pictures are always expanded in “Resources” using as static memory
  - GUI_MEMORY_ACCESS_TYPE is 0.
  - Sample program reads and expands all picture data when GUI library requests at first time.
  - After expands picture, sample program does not need expanding again. So “Resources” variable needs same size of all pictures.

- Case2: All pictures are expanded in “Resources” using as reusable dynamic memory.
  - GUI_MEMORY_ACCESS_TYPE is 1.
  - Sample program reads table of picture information at first time when GUI library requests getting pictures. Next, sample program stores pictures to “picture data block” using as cache area.
  - When GUI library requests same picture, external memory access is needless, because cache area is available until executing function (IMAGE_CACHE_CLEAR()). Cache area is cleared when display state transition. User can use “Resources” area after clearing cache.

- Case3: One picture is expanded in “Resources” using as un-reusable dynamic memory.
  - GUI_MEMORY_ACCESS_TYPE is 2.
  - Sample program reads table of picture information at first time when GUI library requests getting pictures. Next, sample program stores picture to “picture data block” using as one time buffer area and picture box cache area.
  - Please execute IMAGE_CACHE_REQ() macro before user sets to picture box..
  - User can aling border of one time buffer area and picture box cache area to use CACHE_INDEX() macro.

4.4 Changes of LCD direct drive sample program

Following lists are changes of LCD direct drive sample program for the GUI library sample program

Change:	RX Toolchain version to 1.1.0.0
Remove:	Files is not needed
Add:	Files are needed
Add:	Include path
Add:	Macro definition
Add:	L section definition
Edit:	EventMgr.c for GUI main process and using external memory to read pictures
Remove:	Build phase “ResourceBuild”
Edit:	config_r_ddlcd.h for to change display direction of LCD panel
Fix:	touchscreen.c for change delay task.
Edit:	ResourceLoad.hdc for guiimg.bin
Fix:	r_Packages project setting

directory	file name	description
\GuiBuilder	r_gui_main.c	GUI-related initialization, main process, etc.
	r_gui_user.c	GUI-related user-defined functions and operation processes
	r_gui_fetch_img_sflash.c	Source file for reading from flash memory
	r_gui_ipeg_plugin.c	Source file for JPEG plug-in
	r_gui_fetch_img.h	Header file for reading from external memory
\GuiBuilder\auto_gen	gui.out.c	Automatically generated file
	gui.out.h	Automatically generated file
	gui.out.img0001 ～ 0017	Automatically generated files
	gui.out.img.c	Automatically generated file
\GuiBuilder\include	mgt.h	Header file for GUI Library
	ximg.h	Header file for GUI Library
	font_sample_mgt.h	Header file for Graphic Library
	r_expand_jpegd.h	Header file for JPEG decoder
\GuiBuilder\lib	mgt_rx_little.lib	GUI library
	font_sample_rx_little.lib	Sample font data
	rx600lewgp16.lib	Graphics library
	jpegd_rx_little.lib	JPEG decoder library
	expand_jpegd_rx_little.lib	JPEG expand library

Note: The above directories are relative paths from **$(WORKSPDIR)**.

5. Notes

- LCD Direct Driver sample program outputs build errors when user uses RX Toolchain V.1.0.2.0 or later version. GUI library sample program has temporary fix for this problem. LCD Direct Driver should be exchanged newer version if user needed.
- If user uses HDD which is encrypted environment, there is a case that LCD Direct Drive library build is crashed. Please use HDD which is un-encrypted environment, if user has any problems about LCD Direct Drive library build.

Website and Support

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http://www.renesas.com/

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http://www.renesas.com/inquiry

Revision Record

		Description	
Rev.	**Date**	**Page**	**Summary**
1.00	Apr.20.11	—	First edition issued
1.01	Jun.20.11	—	Release with GUI Library Ver.2.01

General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Handling of Unused Pins

   Handle unused pins in accord with the directions given under Handling of Unused Pins in the manual.

   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment when power is supplied.

   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
   In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

   — When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

   — The characteristics of an MPU or MCU in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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