

APPLICATION NOTE

RX64M Group

Sensor solution which utilizes a camera RX Driver Package Application

R01AN2462EJ0100 Rev.1.00 Oct 01, 2015

Introduction

This application note describes how to install the sensor solution sample code on RX64M. The sample code can perform image and video capturing from a connected camera module, pedestrian detection, motion object detection, and distortion correction in the captured video. The sample code also allows user monitoring the detection process via web browser.

This application is based on the industrial network solution using RX64M group TCP/IP protocol stack, a part of RX Driver Package Application (r01an2153). In addition to this, the app note also supports image processing and Web-camera solutions.

This solution uses the image processing middleware of Hitachi Industrial & Control Solutions Ltd. In order to protect the technology of this middleware, the code is protected by the RX64M Trusted Memory (TM, herein) function.

TM function not only blocks reading the code reading from outside of the MCU, but also blocks the MCU to read or copy the protected code. The MCU can only execute the code.

The sample code described in this app note is dedicated for the GR-KAEDE board mounting the RX64M chip.

GR-KAEDE specification and where to purchase:

http://gadget.renesas.com/en/product/kaede.html

RX Driver Package Application is a general term of sample application codes which are combined with RX Driver Package.

For more details of RX Driver Package and its module group, FIT (Firmware Integration Technology), please refer to the following web site:

http://am.renesas.com/products/mpumcu/rx/child/fit.jsp

Target Device RX64M Group(GR-KAEDE)



Contents

1	Overview4
1.1	This Application Note4
1.2	Operating Environment5
1.3	Module Structure
1.4	Projects
2. <i>I</i>	Acquiring a Development Environment9
2.1	Acquire and Install e ² studio9
2.2	Acquire a Compiler Package10
2.3	How to obtain GR-KAEDE board10
3. E	Building a Project11
3.1	Create a Workspace11
3.2	Import a Project12
4. \	/erify Operation15
4.1	Check Dip Switch Setting15
4.2	Build the Project15
4.3	Prepare for Debugging17
4.3.1	Configure Hardware17
4.3.2	Set Up Client PC18
4.4	Debug the Preject
	Debug the Project
5. 8	Specification of Image Processing
5. S 5.1	Debug the Project
5. 5 5.1 5.2	Debug the Project 21 Specification of Image Processing 30 Outline of Performance 30 Outline of Operation 31
5. S 5.1 5.2 5.2.1	Debug the Project
5. 5 5.1 5.2 5.2.1 5.2.2	Debug the Project 21 Specification of Image Processing 30 Outline of Performance 30 Outline of Operation 31 Person Detection 31 Moving Detection 32
5. 5 5.1 5.2 5.2.1 5.2.2 5.3	Debug the Project 21 Specification of Image Processing 30 Outline of Performance 30 Outline of Operation 31 Person Detection 31 Moving Detection 32 File List 33
5. 5.1 5.2 5.2.1 5.2.2 5.3 5.4	Debug the Project 21 Specification of Image Processing 30 Outline of Performance 30 Outline of Operation 31 Person Detection 31 Moving Detection 32 File List 33 Data Structure 34
5. 5.1 5.2 5.2.1 5.2.2 5.3 5.4 5.5	Debug the Project 21 Specification of Image Processing 30 Outline of Performance 30 Outline of Operation 31 Person Detection 31 Moving Detection 32 File List 33 Data Structure 34 Image processing middleware API Reference 35
5. 5 5.1 5.2 5.2.1 5.2.2 5.3 5.4 5.5 5.5.1	Debug the Project 21 Specification of Image Processing 30 Outline of Performance 30 Outline of Operation 31 Person Detection 31 Moving Detection 32 File List 33 Data Structure 34 Image processing middleware API Reference 35 Mdl_IP_Init 35
5. 5 5.1 5.2 5.2.1 5.2.2 5.3 5.4 5.5 5.5.1 5.5.2	Debug the Project 21 Specification of Image Processing 30 Outline of Performance 30 Outline of Operation 31 Person Detection 31 Moving Detection 32 File List 33 Data Structure 34 Image processing middleware API Reference 35 Mdl_IP_Init 35 Mdl_IP_PersonDetection 36
5. 5 5.1 5.2 5.2.1 5.2.2 5.3 5.4 5.5 5.5.1 5.5.2 5.5.2 5.5.3	Debug the Project 21 Specification of Image Processing 30 Outline of Performance 30 Outline of Operation 31 Person Detection 31 Moving Detection 32 File List 33 Data Structure 34 Image processing middleware API Reference 35 Mdl_IP_Init 35 Mdl_IP_PersonDetection 36 Mdl_IP_PersonDetection_ParamChg 37
5. 5 5.1 5.2 5.2.1 5.2.2 5.3 5.4 5.5 5.5.1 5.5.2 5.5.2 5.5.3 5.5.3	Debug the Project 21 Specification of Image Processing 30 Outline of Performance 30 Outline of Operation 31 Person Detection 31 Moving Detection 32 File List 33 Data Structure 34 Image processing middleware API Reference 35 Mdl_IP_Init 35 Mdl_IP_PersonDetection 36 Mdl_IP_MovingDetection 37 Mdl_IP_MovingDetection 38

5.5.6	Mdl_IP_ImgRevise	40
5.5.7	Mdl_IP_ImgRevise_ParamChg	41
6. V	When CS+ is used	42
6.1	Acquire and Install CS+	42
6.2	Install the Project	43
6.3	Change Settings	45
7. 5	Supplement	52
7.1	Capture Data Slow Refreshing on Web Browser	age 52
7.3	Write-Invalid Area in Code Flash	53
8. C	Camera Solution Product Introduction	54
8.1	Gadget Renesas GR-KAEDE Board	54
8.2	Camera and Voice Recording/Playback Demo Using HMI Expansion Board	54



1. Overview

1.1 This Application Note

This application note describes how to install the Sensor solution sample code on RX64M. The sample code can perform image and video capturing from a connected camera module, human detection, motion detection, and distortion correction in the captured video. The sample code also allows user monitoring the detection process via web browser.

This application is based on the industrial network solution using RX64M group TCP/IP protocol stack, a part of RX Driver Package Application (r01an2153). In addition to this, the app note also supports image processing and Web-camera solutions.

The Web server, an application program which runs on the TCP/IP stack, is accessed by Web browser in general and distributes the contents stored on the Web server to the browser via TCP/IP.

The installed application code captures the video data from the camera module (OmniVision's OV7740) on the GR-KAEDE board, performs pedestrian detection and motion object detection, and video distortion correction.

The Web camera application code captures the image data from the attached camera and converts to JPEG file and distributes it to a Web browser via its Web server function. Based on this feature, user can monitor the above image processing transition with a Web browser.

This image processing code is protected by RX64M TM function.

The TM function blocks improper reads or additional code writing in flash memory block 8 and 9 on the RX64M MCU. For more detail of this function, please refer to the following RX64M Group user's manual:

http://www.renesas.com/products/mpumcu/rx/rx600/rx64m/index.jsp

The sample code described in this app node runs on the GR-KAEDE board.

This application note describes how to install this solution sample code.



1.2 Operating Environment

This application note operates in the following environment.

Table 1.2.1 Operating Environment

Microcontroller	RX64M Group
Evaluation board	GR-KAEDE
	In addition to the above board, camera module, AC adapter, and LAN cable are required
	For the board specification and how to purchase, please refer to the following URL:
	http://gadget.renesas.com/en/product/kaede.html
Integrated development	e ² studio, V4.0.1.07 or later
environment (IDE)	Or:
	CS+ V3.01.00 or later
Cross tools	RX Family C/C++ Compiler Package V2.03.00 or later
Emulator	E1 (must be purchased separately)
RX Driver Package	RX64M用RX Driver Package Ver1.00(R01AN2144EJ0100)*
Webブラウザ	Internet Explorer8
	Internet Explorer11(add [192.168.0.3] with compatibility display setting)

Note: * The FIT module in this sample code is updated based on RX Driver Package Ver1.00. For the applicable version, check with "Section 1.3 Module Composition".



Figure 1.2.1 Sample Operating Environment



1.3 Module Structure

This section shows the structure of the modules used by this application note and a list of those modules.



Figure 1.3.1 Module Structure



Table 1.3.1 Modules

Туре	モジュール名	FIT Module Name	Version
	Module Name		
Board Support Package	Board Support Package	r_bsp	2.80
	(BSP Module)		
Device Driver	Compare Match Timer (CMT)	r_cmt_rx	2.41
Device Driver	Ethernet controller	r_ether_rx	1.01
Device Driver	DMA Controller	r_dmaca_rx	1.02
	(DMAC)		
Device Driver	SCI Simple IIC Driver	r_sci_iic_rx	1.50
Device Driver	Parallel Data Capture	r_pdc_rx	1.01
Middleware	JPEG Encoder	r_jpege_rx	1.00
Middleware	M3S-T4-Tiny Interface	r_t4_driver_rx	1.02
(Interface)	Conversion Module		
Middleware	Driver Module for	r_t4_file_driver_rx	1.01
(Interface)	FTP/Web Server		
Middleware	TCP/IP Protocol Stack	r_t4_rx	2.03
	Libery (M3S-T4-		
	Tiny)		
Application	Web Server	r_t4_http_server_rx	1.04
Application	Web Server System	r_httpd_main_rx64m	1.00
	Main Program		

* The functional description of FIT is located in "doc" folder in the module.

Table 1.3.2 Module List out of FIT category (in "renesas_sw_libery" folder)

Туре	Module	FIT Module Name	Version
Middleware	Image processing Middleware	image_proc *	1.00
	(property of Hitachi Industrial and Control Solutions Ltd.)		

Note:*The principle libraries are stored in the TM block so that the debugger cannot access them.



1.4 Projects

This application note includes an e^2 studio and a CS+ project for building and evaluating a web server system. These projects register both a build structure (build mode in CS+) that stores the build settings and a debug structure (debug tool in CS+) that stores debug settings.

The table below lists the build structure and debug structure registered in these projects.

Table 1.4.1 Project Settings

	Structure	Description
Build structure (referred to as build mode in	HardwareDebug (Debug on hardware)	This setting generates a load module with the debug information.
CS+)		■Primary Setting
		• including the debug information
		• Optimization: -optimize=2
Debug structure (referred to as debug tool in CS+)	HardwareDebug (E1) (This is RX E1 (JTAG) in CS+)	The generated load module with this setting can be hardware-debugged with E1 emulator

When using CS+, please refer to "Section 6 In case of using CS+".



2. Acquiring a Development Environment

2.1 Acquire and Install e² studio

The e^2 studio can be downloaded from the Renesas web site.

1. Access the following URL to display the e^2 studio download page.

http://www.renesas.com/e2studio_download

2. Of the displayed items, click Install the e^2 studio 4.0.1.07 installer. (Although there are two versions, one that is broken up into smaller sections, and one that can be downloaded in a single operation, the contents are the same.)

Next, download the e^2 studio installer by following the instructions displayed.

e² studio	e ^a studio 4.0.1.007 installer (Web installer)	Jun.22.15	Renesas e ² studio IDE installation including debug and <u>build phase support</u> (toolchains not included in this download)	Click either of these links.
e ^z studio	e ⁼ studio 4.0.1.007 installer (Offline installer)	Jun.22.15	Renesas e ² studio IDE installation including debug and build phase support (toolchains not included in this download)	

3. Run the downloaded e^2 studio installer to install e^2 studio on your personal computer.

See the e² studio Integrated Development Environment User's Manual: Getting Started Guide for details on the installation procedure.

http://documentation.renesas.com/doc/products/tool/doc/r20ut2771ej0300_e2_start_s.pdf



2.2 Acquire a Compiler Package

The RX Family C/C++ Compiler Package, V2.02.00 or later, is required to build this web server system. This section assumes the user does not own the commercial version and will be using the free evaluation version.

1. Access the following URL to display the e^2 studio download page.

http://www.renesas.com/e2studio_download

2. Of the displayed items, click [Evaluation Software] RX Family C/C++ Compiler Package V2 (without IDE) V2.03.00.

Follow the instructions on the page displayed next to download the compiler installer.



3. Run the downloaded compiler installer to install the compiler on your personal computer.

2.3 How to obtain GR-KAEDE board

For GR-KAEDE specification and where to purchase, please visit the following URL:

http://gadget.renesas.com/en/product/kaede.html



3. Building a Project

3.1 Create a Workspace

- 1. First, execute e^2 studio.
- 2. When Workspace Launcher pops up, enter name of your workspace folder. And then click [OK].

e ² Workspace Launcher	
Select a workspace	
e2 studio stores your projects in a folder called a workspace. Choose a workspace folder to use for this session.	
Workspace: C:¥WorkSpace	Browse Enter a workspace folder.
Use this as the default and do not ask again	
	OK Cancel Click OK

3. When the following window is displayed, click Workbench

la contra de la co
Click Workbench



3.2 Import a Project

Import the project provided with this application note into the newly created workspace.

1. Select Import from the e^2 studio File menu.

e ² (C/C++ - e2 studi	io			
File	Edit Source	Refactor	Navigate	Search	Pr
	New		Alt-	+Shift+N	F
	Open File				
	Close			Ctrl+W	
	Close All		Ctrl+	-Shift+W	
	Save			Ctrl+S	
	Save As				
C	Save All		Ctrl	+Shift+S	
	Revert				
	Move				
	Rename			F2	
8	Refresh			F5	
	Convert Line De	elimiters To	D		۲
۵	Print			Ctrl+P	
	Switch Workspa	ace			F
	Restart				
è	Import			—	_
2	Export				
	Properties		A	Alt+Enter	
	Exit				

2. Select Existing Projects into Workspace from General and click Next.

e² Import	
Select Create new projects from an archive file or directory.	
Select an import source:	Select Existing Projects — into Workspace from General and click Next.
? < Back	_



3. Click Browse.

e² Import					- • ×	ĺ
Import Projects						
Select a directory to search for exist	ing Eclipse projects.					
				ſ		
Select root directory:				- L	Browse	Click here.
○ Select archive file:				-	Browse	
Projects:						
Options						
Search for nested projects						
Copy projects into workspace						
Hide projects that already exist in	the workspace					
Working sets						
Add project to working sets						
Working sets:				-	Select	
0	< Back	Nexts	Finish		Cancel	
•	Back	Next >	Fillisti		Curicer	

4. Select the project folder associated with this application note and click OK.

フォルダーの参照	×	
Select root directory of the projects to import		
Windows	^	
WorkSpace		Salast this project folder
Incomparing the second seco		and click OK
> 🐌 .metadata	=	and check OK.
>] .settings		
Contents		
> 📔 HardwareDebug		
⊳ 🛺 r_bsp		
⊳ 퉬 r_cmt_rx		
🔑 r_config		
⊳ 🔑 r_dmaca_rx		
N r other ry	T	
フォルダー(F): [x&4m_gr_kaede_Hi_Solution]		
新しいフォルダーの作成(N)	OK キャンセル	



5. Check Copy projects into workspace and click Finish.

e² Import								<u> </u>	
Import Projects								7.	
Select a directory to sea	rch for existing Eclipse proje	ects.						1	
	r							_	
Select root directory:	C:¥WorkSpace¥rx64m_gr_	kaede_Hi_Solutio	'n		•	-	Browse		
○ Select archive file:						-	Browse		
Projects:									
▼ rx64m_gr_kaede	Hi_Solution (C:¥WorkSpace	¥rx64m_gr_kaede	e_Hi_Solution)				Select All		
							Deselect All		
Ontions									
Search for nested pro	jects								
Copy projects into wo	rkspace							(Check this box
Hide projects that alr	eady exist in the workspace								and click Finish.
Working sets									
Add project to worki	ng sets								
Working sets:					-	9	Select		
								-	
?	< Ba	ack	Next >	F	inish		Cancel		

"Copy projects into workspace" is not a essential item. If it is not checked, the root directory will be the build scope.



4. Verify Operation

4.1 Check Dip Switch Setting

Check the position of the Dip switch on GR-KAEDE board. The switch positions shown below are the valid settings.



4.2 Build the Project

Use the following procedure to build the project and generate a load module.

1. Click the project to build from the Project Explorer.







2. Click Build project from the Project menu.

3. When "Build complete" is displayed on the Console panel, the build will have completed.





4.3 Prepare for Debugging

4.3.1 **Configure Hardware**

The evaluation board must be configured before starting debugging.

A table of the required equipment and its configuration are shown below.

Table 4.3.1.1 Hardware Configuration

No.	Device	Supplementary Information
1	Development PC	Personal computer used for development.
2	GR-KAEDE	
3	Client PC (web browser)	The development PC can be used for this function.
4	One of the following must be provided as a network environment for connecting the client PC to the GR- KAEDE (web server). 1. If a switching hub is used a. Switching hub b. LAN cable (straight) × 2 2. If cross cables are used	



Figure 4.3.1.1 Switching Hub Configuration (Two Ethernet Channels Used)

4.3.2 Set Up Client PC

Set up the network on the client PC. This section shows the procedure when using Windows 7 as an example.

1. Open the Control Panel on the client PC and click Network and Internet.



2. Click Network and Sharing Center.





3. Click Change adapter settings.



4. Right click Local Area Connection and select Properties.





5. Select Internet Protocol Version 4 (TCP/IPv4) and click Properties.



6. The IP address and other settings will be displayed. Set these as shown below and click OK.

Internet Protocol Version 4 (TCP/IPv4) 8	Properties 🔹 😵	
General		
You can get IP settings assigned autom this capability. Otherwise, you need to for the appropriate IP settings.	atically if your network supports ask your network administrator	
Obtain an IP address automatically	<i>,</i>	
Oge the following IP address:		
JP address:	192.168.0.100	
Sybnet mask:	255.255.255.0	
Default gateway:		
Obtain DNS server address autom	atically	
Ose the following DNS server address	esses:	
Preferred DNS server:		
Alternate DNS server:		
Validate settings upon exit	Adyanced	
	OK Cancel	—— Click here.



4.4 Debug the Project

Use the following procedure to start debugging the project.

- 1. Connect the development PC to the E1 emulator with a USB cable.
- 2. Connect the evaluation board (Renesas Starter Kit+ for RX64M) to the adapter and turn on the power.
- 3. Click Debug Configurations in the e^2 studio Run menu.





4. Click rx64m_gr_kaede_Hi_Solution HardwareDebug under Renesas GDB Hardware Debugging.

e ² Debug Configurations		×	
Create, manage, and run configurations		1	
		~~	
	Name: rx64m_gr_kaede_Hi_Solution.x		
type filter text	📄 Main 🗱 Debugger 🖌 Startup 📴 Common 🤪 Source		
Debug-only GDB Hardware Debugging	Project:	<u>^</u>	
 GDB Simulator Debugging GDB Simulator Debugging (SH, RL78, RH850) 	rx64m_gr_kaede_Hi_Solution Browse		
GHS Local C/C++ Launch	C/C++ Application:		
Renesas GDB Hardware Debugging	HardwareDebug/rx64m_gr_kaede_Hi_Solution.x		
Renesas Simulator Debugging (RX only)	Variables Search Project Browse		
	Build (if required) before launching		
	Build configuration: Use Active	-	Clickhar
	© Enable auto build		- Click here.
	Use workspace settings <u>Configure Workspace Settings</u>		
Filter matched 7 of 11 items	Apply Revert		
(?)	Debug Close		

5. Click StartUp.

6. Click outof_TrustedMemory_Data.mot under Filename amd Click Edit.

Name:	rx64m_gr_kaed	e_Hi_Solution Hardw	areDebug						
📄 Ma	in 🕸 Debugger	🕨 Startup 🛛 🦆 So	urce 🔲 Common						
Initia	lization Commar	ıds						^	
R	eset and Delay (seconds): 3							
EH	alt								
							^		
							Ŧ	Ξ	
Load	image and symb	ools		1					
File	name		Load type	Offset (h	On connect		Add		
	outof_TrustedMe	emory_Data.mot [Image and Sym	0	Yes		Edit		
V	Program Binary	[rx64m_gr_kaede	Image and Sym		Yes		Euiciii		
							Remove		
							Move up		Click here.
							Move down		
Runt	ime Options								
								*	
						Apply	Revert		
						Debug	Close		



7. Change the destination of save file

Pleaseinput:

 $\label{eq:start} $$ workspace_loc:\rx64m_gr_kaede_Hi_Solution}\remesas_sw_library\image_proc\outof_TrustedMemory_Data.mot]$$

Click OK.

Edit download module	
Specify download module name:	
\${workspace_loc:¥rx64m_gr_kaede_Hi_Solution}¥renesas_sw_library¥image_proc¥outof_TrustedMemory_Data.mot	— Enter
Variables Search Project Workspace File System	
OK Cancel	— Click here.

8. Click Debug

e ² Debug Configurations	
Create, manage, and run configurations	The second se
Image: Second Secon	Name: nx64m_gr_kaede_Hi_Solution.x Main
Filter matched 7 of 11 items	Apply Revert
(?)	Debug





	When the load	module download	completes, a Debug	perspective opens.
--	---------------	-----------------	--------------------	--------------------

e ² Debug - rx64m_gr_kaede_Hi_Solution/r_bsp/board/grkaederx64m/resetprg.c - e2 studio	•••	•	
File Edit Source Refactor Navigate Search Project Renesas Views Run Window Help			
🖆 ▼ 🖩 🕲 ≙ 🥸 ▼ 🗞 ▼ 🗟 🔍 🕪 🗉 🖷 🖊 🌫 👁 🗵 🖶 🗮 🖄 🚳 🖗 ▼ 🛈	• 💁 • 🙋 😂 🖋	• 🌛 🛓 • 🖗 • 두 🔇	
			Quick Access 😰 🕸 C/C++ 🎄 Debug
🎋 Debug 🛙 🦓 🖓 🤹 🗱 🖬 👘 🤣 🗸 🖛 🗖	(x)= Variab 🔀 💁 I	Break 🕮 Regist 🛋 M	1odules 🙀 Expre 🥐 Event 📄 IO Re 🖓 🗖
▲			ఓ •4 🗉 🕺 🖇 🔆 🖬 🔽 🗸
# 2 rx64m_gr_kaede_Hi_Solution.x [1]	Name	Туре	Value
Image: A state of the state			
PowerON_Reset_PC() at resetprg.c:122 0xffc3b5f8			
C:/Renesas/e2_studio/DebugComp/rx-elf-gdb -rx-force-v2 (7.8.2)			
📕 GDB server			
R r_pdc_apl.c R r_compress_jpege.h R r_readSampling.c R resetprg.c X		-	🗆 😫 Outline 🗱 🏠 Project Explorer 👘 🗖
122 ffc3b5f8 ⊖ void PowerON Reset PC(void)			
123 {			h c libb
124 /* Stack pointers are setup prior to calling this function - see com	ments above */		# BSP DECLARE STACK
126 /* Initialize the Interrupt Table Register */			platform h
<pre>127 ffc3b606 set_intb((void *)_sectop("C\$VECT"));</pre>			# PSW init
120 129 /* Initialize the Exception Table Register */			# PSW init
<pre>130 ffc3b60f set_extb((void *)_sectop("EXCEPTVECT"));</pre>			# FPSW init
131 132 /* Initialize FPSW for floating-point operations */			↔ INIT IOLIB(void) : void
133 😔 #ifdefROZ			++ CLOSEALL(void) : void
134 #define FPU_ROUND 0x00000001 /* Let FPSW RMbits=01 (round to zero) */			my sw warmstart prec function(void):
· · · · · · · · · · · · · · · · · · ·		•	۰ III ۲
🕒 Console 🗶 🧔 Tasks 🔅 Renesas Co 🔋 Memory Us 🕐 Performanc 🌒 Profile 💱 Real-time	e C 🗞 Trace 🔿 Vi	sual Expr 🚇 Smart Bro.	
ry64m, ar. kaodo Hi, Solution y [Ponosas CDP Hardware Dobugging] (*/Ponosas /o2, studio/DobugComp./oz	olf adh inv force v2 (7	9.2)	
monitor_set_io_access_width_RW_1.90366-9036d.90376-9037d.90386-9038d.90396-9039d.903a6-903	ad. 903b6-903bd. 903c	.0.2) 6-903cd.903d6-903dd.903	e6-903ed, 903f6-903fd, 90820-9083f, 90848-90853, 9(•
monitor set_io_access_width,RW,1,91226-9122d,91236-9123d,91246-9124d,91256-9125d,91266-912	ed,91276-9127d,9128	6-9128d,91296-9129d,912	a6-912ad,912b6-912bd,912c6-912cd,912d6-912dd,9
monitor set_io_access_width,RW,1,91306-9130d,91316-9131d,91326-9132d,91336-9133d,91346-913 monitor_set_io_access_width_RW_1_913e6-913ed_913f6-913fd_91828-9183f_91848-91853_91858_922	4d,91356-9135d,9136	6-9136d,91376-9137d,913 d 92226-9222d 92236-922	86-9138d,91396-9139d,913a6-913ad,913b6-913bd,91
(50,522-0 522-0,522-0 522-0,522-0 5. +
	:		Suspended

9. Click Resume on the toolbar. The program will be executed and a break will occur at the start of the main function.

e ²	Debug	- rx64m_	gr_kaede_l	Hi_Solution,	/r_bsp/bo	oard/grkae	ederx@
File	e Edit	Source	Refactor	Navigate	Search	Project	Ren
đ	} - 8	6 8	🛞 🔻 🔦	 ■ ■		<mark>■ * →</mark>	~

After the break at the start of the main function, click Resume on the tool bar again.

Note: Click Resume symbol again after breaking at the top of main function.

10. Start a web browser on the client PC and enter the following address according to which port the LAN cable is connected.

Web Server Address : http://192.168.0.3

Note: Note that the web address can be changed in the configuration. (rx64m_gr_kaede_Hi_Solution /r_t4_rx/src/config_tcpudp.c)



11. The following list of files will be displayed on the browser.

	168.0.3/	
ファイル(F) 編集(E) ま	表示(V) お気に入り(A) ツール(T)	へレプ(H)
Index of /		
INGEX OF 7		
Name	Last modified	Size
demo_top.htm	1-Sep-2014 00:00:00	2659
demo_ru1.htm	1-Sep-2014 00:00:00	3298
demo_ru2.htm	1-Sep-2014 00:00:00	3429
demo_ru3.htm	1-Sep-2014 00:00:00	3430
	1 0 0014 00.00.00	2100

12-1. When "demo_top.thm" is clicked on the screen of section 11, the following screen is displayed.

[Demo Top Screen]

(一) (日本) (192.168.0.3)の (7) (1)(F) 編集(E) 表示(V) (Y) (Y)(F) (日本) (1)(F)(F)(F)(F)(F)(F)(F)(F)(F)(F)(F)(F)(F)	ieros_st4.htm 影気に入り(A) ツール(T) へルプ(H)		P - C S Renesas RX64M De	mon ×		
RX			Image Capture			
1			Camera 1		_	
2						,
	Normal capture	Human detection	Moving detection	Distortion correction	Capture STOP	
•	2	3	4	5	6	

Icons indicated by (1) to (6) perform the following operations:

- ① Jump to Demo Top Screen (Reload this screen)
- ② Jump to Capture Screen (Normal)
- ③ Jump to Capture Screen (Human Detection)
- ④ Jump to Capture Screen (Motion Object Detection)
- 5 Jump to Capture Screen (Distortion Correction)
- (6) Jump to Demo Top Screen (Reload this screen).



12-2. When "demo_ru1.thm" is clicked on the screen of section 11, the following screen is displayed.

[Capture Screen (Normal)]



Icons indicated by (1) to (6) perform the following operations:

- ① Jump to Demo Top Screen (Reload this screen)
- ② Jump to Capture Screen (Normal)
- ③ Jump to Capture Screen (Human Detection)
- ④ Jump to Capture Screen (Motion Object Detection)
- **(5)** Jump to Capture Screen (Distortion Correction)
- 6 Stay in the current screen but stop capturing

You can change two parameters in this screen. Please find two blocks indicated by red boxes in the screen.

The upper block indicates the current setting of the parameters:

- JPEG QUALITY: Image quality 1 (Lowest) to 128 (Highest) during JPEG encode
- IMAGE SENSOR Read RT: There are two values, register address and register value of the attached camera module. These two values are results of what you updated in the lower block. By the way, some registers are write-only registers. In this case, the upper block of the screen may not display the valid value of the register.

The lower block is where you can change the register value of the attached camera module. Please find two white boxes where you set values. When you click [SET] button, the screen will refresh and the set value is updated. Every time you click the button, the screen will refresh. This is because this demo is driven by the Web server FIT module specification.

We are very sorry we don't explain the camera module specification in this app note. We hope you will find the specification by your own way and change the register value.



12-3. When "demo_ru2.thm" is clicked on the screen of section 11, the following screen is displayed.

[Capture Screen (Human Detection)]



Icons indicated by (1) to (6) perform the following operations:

- ① Jump to Demo Top Screen (Reload this screen)
- ② Jump to Capture Screen (Normal)
- ③ Jump to Capture Screen (Human Detection)
- ④ Jump to Capture Screen (Motion Object Detection)
- **(5)** Jump to Capture Screen (Distortion Correction)
- 6 Stay in the current screen but stop capturing(

You can change two parameters in this screen. Please find two blocks indicated by red boxes and a red circle in the screen.

The upper block indicates the current setting of the parameters:

- Human result: This display shows results of capturing object. The function divides the screen into 9 areas, area 1 to 9, and displays number of detected object by area. If an object stays in multiple areas, the object is counted in one of cover areas.

- threshold(1-9): This parameter indicates the threshold value to detect an object
- sensitivity(1-15): when detecting an object, this parameter indicates the judgement value of contrast and brightens.

The lower block is where you can change these parameter values. Please find two white boxes where you set values. When you click [SET] button, the screen will refresh and the set value is updated. Every time you click the button, the screen will refresh. This is because this demo is driven by the Web server FIT module specification.

'threshold' value: when the object is not properly detected, set a little smaller value. In contract, if the detection is too much, set larger a value.

'sensitivity' value: set a smaller value when you want to perform the detection in the area of which the contrast ansd brightness differentiation is small. And set a greater value for other way around.



12-4. When "demo_ru3.thm" is clicked on the screen of section 11, the following screen is displayed.



[Capture Screen (Motion Object Detection)]

Icons indicated by to perform the following operations:

- ① Jump to Demo Top Screen (Reload this screen)
- ② Jump to Capture Screen (Normal)
- ③ Jump to Capture Screen (Human Detection)
- ④ Jump to Capture Screen (Motion Object Detection)
- 5 Jump to Capture Screen (Distortion Correction)
- 6 Stay in the current screen but stop capturing

You can change two parameters in this screen. Please find two blocks indicated by red boxes and a red circle in the screen.

The upper block indicates the current setting of the parameters:

- Moving result: This display shows results of capturing motion objects. The function divides the screen into 9 areas, area 1 to 9, and displays number of detected objects by area. If an object stays in multiple areas, the object is counted in one of cover areas.

- threshold(1-10): This parameter indicates the threshold value to detect an moving object

- sensitivity(1-10): when detecting a moving object, this parameter indicates the judgement value of brightens differentiation between two pictures (between first and second, and between second and third)

The lower block is where you can change these parameter values. Please find two white boxes where you set values. When you click [SET] button, the screen will refresh and the set value is updated. Every time you click the button, the screen will refresh. This is because this demo is driven by the Web server FIT module specification.

'threshold' value: when the moving object is not properly detected, set a little smaller value. In contract, if the detection is too much, set larger a value.

'sensitivity' value: set a smaller value when you want to perform the detection in the area of which the brightness differentiation is small. And set a greater value for other way around.



12-5. When "demo_ru4.thm" is clicked on the screen of section 11, the following screen is displayed.

[Capture Screen (Distortion Correction)]

C C MELSAS	.oul.htm こんり(A) ツール(T) へんプ(H)		ク・C Reress RX544 De	non_ 1		
			Ceens I		Distinction correction parameter mainting (D) M-correction 1-2 V-correction 1-2 M-correction 1-2 M-correction frame-1-2 faction widd [Dimukd / 1-tokit] (E) H-correction frame-1-27-+127] (E) V-correction frame-1-27-+127] (E)	Upper Block
	Normal capture	Human detection	Moving detection	Distortion correction	Capture STOP	
*	2	3	4	5	6	

Icons indicated by 1 to 6 perform the following operations:

- ① Jump to Demo Top Screen (Reload this screen)
- ② Jump to Capture Screen (Normal)
- ③ Jump to Capture Screen (Human Detection)
- ④ Jump to Capture Screen (Motion Object Detection)
- **(5)** Jump to Capture Screen (Distortion Correction)
- 6 Stay in the current screen but stop capturing

You can change three parameters in this screen. Please find two blocks indicated by red boxes.

The upper block indicates the current setting of the parameters:

- function: 'ON' indicates the distortion correction is active. 'OFF' is the correction is inactive.
- H-correction(-127-+127): this parameter indicates the X-direction offset value of the correction start point in the captured picture. (horizontal direction distortion correction)
- V-correction(-127-+127): this parameter indicates the Y-direction offset value of the correction start point in the captured picture. (vertical direction distortion correction)

The lower block is where you can change these parameter values. Please find three white boxes where you set values. When you click [SET] button, the screen will refresh and the set value is updated. Every time you click the button, the screen will refresh. This is because this demo is driven by the Web server FIT module specification.

'function' value: set 1 when you enable the function.(0:disable)

- 'H-correction' value: set a positive value if you want to move the correction start point to the right direction. And set a negative value for the left direction.
- 'V-correction' value: set a negative value if you want to move the correction start point to the upward direction. And set a positive value for the downward direction.



5. Specification of Image Processing

5.1 Outline of Performance

The picture processing system shown in this application note is the middleware that is provided from Hitach Industrial Control Solutions. The capture data from external camera modules, and this middleware applies "detect human", "detect moving", "adjust distortion". This application note sample code combines the middleware and web camera system, and realizes displaying the result of these detecting. And using Web server CGI function, it is possible to set the parameter for the middleware.

Table 5.1.1. shows the fixed memory area. Please DO NOT USE this area for other functions.

area name	description
used area for internal	<address></address>
ROM	FFC0 0200h~FFC0 C66Bh
	FFFE 0000h~FFFE FFFFh(TM area)
	When using TM area, all TM area will be disable to write. This address area means all of TM area not but real using size.
used area for internal	about 110Kbyte
KAW	<address></address>
	0000 4100h~0001 F942h
on board SDRAM	about 4Mbyte
	<address></address>
	0800 0000h~0840 0000h
	<details></details>
	• capture area (from camera module)
	640(vertical)x480(horizontal) YCbCr422 : for 3 area
	• input/output for image processing
	input 320(vertical)x240(horizontal) gray scale/RGB565 : for 3area
	output 320(vertical)x240(horizontal) RGB565: for 3 area
	• image format conversion (YCbCr422→RGB565) work area
	640(vertical)x480(horizontal) : for 1 area
	• work area for image processing middleware
	320(vertical)x240(horizontal): for 4 area、160(vertical)x120(horizontal): for 2 area

Table 5.1.1. used area



5.2 Outline of Operation

function	function name	outline
person detection	detection person outline	Detect the "standing person" in the image, and "sitting person" in the image. And outlined red line.
	detection person number	Detect the number of person. This function divides the area as 9 area. This function detect the number of person for each 9 area. (max detection number for each 9 area is 5)
moving detection	comparison of image	Compare the 3 images of which it continuousness capture, detect and extract the differences.
adjust distortion	adjust the image	Convert coordinate of image using adjust parameter for combination camera with lens.

Table 5.2.1. Function list

5.2.1 **Person Detection**

This function detects the person(standing person, sitting person) from image captured Camera. This function measures the number of person for each 9 area that divided as 9 area from input image. When person (in the picture) is overlay,

item	data
height of camera	2.5[m]
angle of camera	22[°]
viewing angle of camera	130[°]
Depth distance of detection	max sensibility 4[m]
image size	320(vertical) x
	240(horizontal) [pixel]
image format	gray scale, RAW

Table 5.2.1.1 Function list for person detection

This application note can confirm operation this feature in "4.4 Debug the Project" 12-3.



5.2.2 Moving Detection

Compare image differences for three images of which it continuously captured image, detect the moving position that includes the changing more than the threshold. First, divide the image as 9 areas, and next, max 5 position information will be output in order with large area the detected part.

item	data
image size	320(vertical) x 240(horizontal) [pixel]
image format	gray scale, RAW
number of input image	3(continuously captured image)

This application note can confirm operation this feature in "4.4 Debug the Project" 12-4.

5.2.3 Adjust Distortion

Adjust distortion to input image using property data that calculated camera and lens combination.

item	data
Camera Type	OV7740(OmniVision)
Lens Type	
image size	320(vertical) x 240(horizontal) [pixel]
image format	RGB565, RAW

Table 5.2.3.1 Adjust Distortion input image specification list

This application note can confirm operation this feature in "4.4 Debug the Project" 12-5



5.3 File List

Following list is for the image processing related. Image processing software source code is not opened. The following table shows header file in mainly.

Folder name	File name	Description
renesas_sw_library	Mdl_IP_main.h	Header file for image processing middleware
/image_proc	Mdl_IP_ex.h	Macro definition
	Mdl_IP_prot.h	Header file for each mode data structure
	outof_TrustedMemory_Data.mot	Image processing middleware (open parts)
src	imag_proc.c	Control image processing middleware application code.
	imag_proc.h	Header file for parameter settings

Table 5.4.1 File List for image processing



5.4 Data Structure

[Person detection structure]
typedef struct _PersonDetection_Info {
int flg; // detect 0:none / 1:exist
float score; // score of comparison
int sx, sy, ex, ey; // start X, start Y, end X, end Y
} PersonDetection_Info;
[Person detection result structure]
typedef struct _PersonDetection_Rslt {
int p_dct_cnt[MAX_AREA]; // number of person at area ([0]:area 1 - [8]:area 9)
PersonDetection_Info p_dct_inf[MAX_PERSON]; // Person detection information
} PersonDetection_Rslt;
[Moving detection structure]
typedef struct _MovingDetection_Info {
int flg; // detect 0:none / 1:existing
int area; // area No (1-9)
int sx, sy, ex, ey; // start X, start Y, end X, end Y
} MovingDetection_Info;
[Moving detection result structure]
typedef struct _MovingDetection_Rslt {
int p_dct_cnt; // Number of detection
MovingDetection_Info p_dct_inf[MAX_MOVING]; // information about moving things
} MovingDetection_Rslt;
[Macro definition]
#define MAX_AREA 9

#define MAX_AREA 9
#define MAX_PERSON 5
#define MAX_MOVING 5



5.5 Image processing middleware API Reference

Following table shows image processing middleware APIs in table 5.6.1

Table 5.6.1 f	function list
---------------	---------------

Function Name	Function Outline
Mdl_IP_Init()	Initialize process for standard image processing
Mdl_IP_PersonDetection()	Process for person detection
Mdl_IP_PersonDetection_ParamChg()	Change parameter for person detection
Mdl_IP_MovingDetection()	Process for moving detection
Mdl_IP_MovingDetection_ParamChg()	Change parameter for moving detection
Mdl_IP_ImgRevise()	Process for adjust distortion
Mdl_IP_ImgRevise_ParamChg()	Change parameter for adjust distortion

5.5.1 **Mdl_IP_Init**

Description

Application calls this function before other image processing APIs. This function initializes the internal variables that is in the image processing middleware.

<u>Usage</u>

#include "Mdl_IP_ex.h"

void Mdl_IP_Init(unsigned char *wk_adr);

Parameters

wk_adr input address for work area

Return Value

無し <u>Remark</u>

Argument is the work memory using in the image processing middleware (320x240 : 4 area, 160x120 : 2 area)



5.5.2 Mdl_IP_PersonDetection

Description

This function executes the measurement for person number and position of existing person for the address specified 1^{st} argument. The result of execution will be stored to the 2^{nd} argument (person detect result structure), and, result of image will be output to the 3^{rd} argument.

<u>Usage</u>

#include "Mdl_IP_ex.h"
int Mdl_IP_PersonDetection(

unsigned char *in_img, PersonDetection_Rslt *rslt, unsigned char *extension);

Parameters

in_img	input	address for input image data
rslt	output	detail result about person detection
extension	output	extension area (Please specify NULL)

Return Value

0 normal termination

-1 not executed initialize function Mdl_IP_Init()

<u>Remark</u>

This application note sample code uses 3rd argument as demonstration.



5.5.3 Mdl_IP_PersonDetection_ParamChg

Description

This function sets the 2nd argument to the "5.5.3 Mdl_IP_PersonDetection" internal parameter using 1st argument parameter.

<u>Usage</u>

#include "Mdl IP ex.h"

int Mdl_IP_PersonDetection_ParamChg(int kind, int val);

Parameters

- Kind input type of parameter
- val input setting value

Return Value

- 0 normal termination
- -1 not executed initialize function Mdl_IP_Init()
- -2 specified parameter is out of range
- -3 specified setting data is out of range

<u>Remark</u>

type of parameter

0: Threshold for person detect (setting range: 1-9)

Setting value for threshold to detect "seems to be a person". When the detection accuracy is not good, please set this value to smaller, when the detection is too excessive, please set this value to bigger. (default value is 7)

1: Sensitivity for person detect (setting range: 1-15)

When person detect, specified the threshold value to judge the contrast of the detection candidate part (light and shade) and vividness (number of colors).

In case: Enable part(the contrast is smaller, vividness is lesser), please set this value to smaller. In case: Disable part(the contrast is smaller, vividness is lesser), please set this value to bigger.



5.5.4 Mdl_IP_MovingDetection

Description

This function executes the detecting moving things using the continuous images that specified by $1^{st} - 3^{rd}$ argument.

The result of execution detals will be written to the address that specified 4^{th} argument, and result of image will be written to the address that specified 5^{th} argument.

Usage

#include "Mdl_IP_ex.h"

int Mdl_IP_MovingDetection(unsigned char *in_img1, unsigned char *in_img2

unsigned char *in_img3, MovingDetection_Rslt *rslt, unsigned char *extension);

Parameters

in_img1 input address of input image 1

- in_img2 input address of input image 2
- in_img3 input address of input image 3
- rslt output result of execution details
- extension output extension function (please specify NULL)

Return Value

- 0 normal termination
- -1 not executed initialize function Mdl_IP_Init()

<u>Remark</u>

This application note sample code uses 5^{th} argument as demonstration.



5.5.5 Mdl_IP_MovingDetection_ParamChg

Description

This function sets the 2nd argument to the "5.5.4 Mdl_IP_MovingDetection" internal parameter using 1st argument parameter.

<u>Usage</u>

#include "Mdl_IP_ex.h"

int Mdl_IP_MovingDetection_ParamChg(int kind, int val);

Parameters

None

Return Value

- 0 normal termination
- -1 not executed initialize function Mdl_IP_Init()
- -2 specified parameter is out of range
- -3 specified setting data is out of range

<u>Remark</u>

type of parameter

- 0: Threshold for moving detect (setting range: 1-10)
 - Setting value for threshold to detect "moving". When the detection accuracy is not good, please set this value to smaller, when the detection is too excessive, please set this value to bigger. (default value is 4)
- Sensitivity for moving detect (setting range: 1-10)
 When moving detect, specified the threshold value to judge the brightness differences (between image1 to image2, image2 to image3). When user would like to detect change in little brightness, please set this value to smaller. If not, please set this value to bigger.
 - (default value is 3)
- 2: Upper of processing area (Range of set value: 0-9)
- 3: Lower of processing area (Range of set value: 0-9)
- 4: Left side of processing area (Range of set value: 0-9)
- 5: Right side of processing area (Range of set value: 0-9)

Please specify the correction value from the image edge in the processing region where the moving detect for the setting of 2-5 at intervals of 10%.

As for the upper and the lower, the left side and the ratio right side to the height of the image are made a ratio to the width of the image.

This settings are fixed value as default value in this application note sample code. (default: 0)



5.5.6 Mdl_IP_ImgRevise

Description

This function executes the distortion correction processing for the image stored at the address specified by the

 1^{st} argument. This function is written to the address for which the execution result image was specified by the 2^{nd} argument.

<u>Usage</u>

#include "Mdl_IP_ex.h"

int Mdl_IP_ImgRevise (unsigned char *in_img, unsigned char *out_img);

Parameters

in_img input address for input image

out_img output address for result image of distortion process

Return Value

- 0 normal termination
- -1 not executed initialize function Mdl_IP_Init()

<u>Remark</u>

Destination address for result image of distortion process must be allocated same size as input image.



5.5.7 Mdl_IP_ImgRevise_ParamChg

Description

This function sets the 2nd argument to the "5.5.6 Mdl_IP_ImgRevise" internal parameter using 1st argument parameter.

<u>Usage</u>

#include "Mdl_IP_ex.h"

int Mdl_IP_ImgRevise_ParamChg(int kind, int val);

- **Parameters**
 - kind input type of parameter
 - val input setting value

Return Value

- 0 normal termination
- -1 not executed initialize function Mdl_IP_Init()
- -2 specified parameter is out of range
- -3 specified setting data is out of range

<u>Remark</u>

type of parameter

0: Distortion correction effective/invalidity (Range of set value: 0-1)

This parameter specifies enable/disable for distortion correction.

- When enable 1, disable 0. (default: 1) 1: Horizontal correction value (range :-127-127 of set value)
 - This parameter specifies reference point X coordinates when distorting and correcting it and the offset from an image center position is specified. A negative value and the right side reach a positive value from the image center left. (default: -2)
- 2: Vertical direction correction value (range :-127-127 of set value)

This parameter specifies reference point Y coordinates when distorting and correcting it and the offset from an image center position is specified. A negative value and the lower direction reach a positive value from the image center for above. (default: 80)



6. When CS+ is used

This application note can be evaluated using CS+. Note that RX Family C/C++ Compiler Package V2.03.00 or later is required to build this application note under CS+. This section assumes the user does not own the commercial version and will be using the free evaluation version.

6.1 Acquire and Install CS+

Download CS+ from the Renesas web site.

1. Access the following URL to display the CS+ download page.

http://www.renesas.com/cs+ download

2. Of the displayed items, click [Evaluation Software] CS+ V3.01.00. (Although there are two versions, one that is broken up into smaller sections, and one that can be downloaded in a single operation, the contents are the same.)

Next, download the CS+ installer by following the instructions displayed.

CS+ (formerly Cube Suite+)	(Evaluation Software) CS+ for CCV3.01.00 (Multpart Down bad)	Apr.20.15	This is a sub package included in CS+. Debuggers and evaluation version of compilers are included in the package. The package can be used for updating from CubeSuite+. Supported MCLs: RH850, RX and RL78 families	—— Click this link
CS+ (formerly Cube Suite+)	(Evaluation Software) CS+ for CA,CX V3.00.01 (Multipart Down bad)	Apr.20.15	This is a sub package included in CS+. Debuggers and evaluation version of compilers are included in the package. The package can be used for updating from CubeSuite+. Supported MCLs: V850 Pamily, FL78 Pamily, 78K0R and 78K0	

3. Run the downloaded CS+ installer to CS+ on your personal computer. See the CS+ V3.00.00 Integrated Development Environment User's Manual: Installer.

http://documentation.renesas.com/doc/products/tool/doc/r20ut3094ej0100 csin.pdf



6.2 Install the Project

Install the Renesas common project files provided with this application note in CubeSuite+.

- 1. Decompress the ZIP file in which this application note is provided into an arbitrary folder.
- 2. Start CubeSuite+ and from the start screen, click GO under Open Existing e² studio/CubeSuite/High-performance Embedded Workshop/PM+ project.

GO	A new project can be created. A new project can also be created by reusing the file configuration register	red to an existing project.	
Create New	Multi-core Project		
Open Existin	g Project		
	Loads the project of CS+. Can also be opened directly from the following li	ink.	
	Recent Projects	Favorite Projects	
GO	1. aes_asm_cc	Nothing	
	2. rl78_aes_stack_tree_cc		
Open Existin	g e ² studio/CubeSuite/High-performance Embedded V	Vorkshop/PM+ Project	
	The project created with e-studio and the old top can be converted to the	Cost project.	
	Support version:		
	Support version: studio		- Click here
GO	Support version: e ^a studio The rope file output by e ^a studio can be read. (!) Build options also can be converted between the projects with the sar (!) Only include path and macro options can be converted between the pr	ne compiler (Only CC-RX is supported in this version). ojects with the different compiler.	- Click her
GO Open Sample	Support version: e ⁴ studio The rcpc file output by e ² studio can be read. (!) Build options also can be converted between the projects with the sar (!) Only include path and macro options can be converted between the pro- Project	ne compiler (Only CC-RX is supported in this version). ojects with the different compiler.	- Click her

3. Open the folder decompressed in step 1 above and of those entries, open Web server system project (rx64m_gr_kaede_Hi_Solution folder). From there, select Renesas common project files (rx64m_gr_kaede_Hi_Solution.rcpc) and click Open.

Correction of the second seco	kaede_Hi_Solution >	▼ 4) rx64n	n_gr_kaede_Hi_Solut	t , P	
Organize 🔻 New folder			!≡ ▼ 🚺	0	
🛯 👩 rx64m_gr_kaede_Hi_Solution ^	名前	更新日時	種類	₩ ^	
🌏 .settings	🖉 r_amaca_rx	2015/08/31 10:51	ノアイル ノオル…		
contents	💑 r_dtc_rx	2015/08/31 10:51	ファイル フォル…		
HardwaroDobug	🗞 r_ether_rx	2015/08/31 10:51	ファイル フォル…		
	🗞 r_jpege_rx	2015/08/31 10:51	ファイル フォル…		
Þ 🌌 r_bsp	🜏 r_pdc_rx	2015/08/31 10:51	ファイル フォル…		
⊳ 🌏 r_cmt_rx 🗧	🌏 r_sci_iic_rx	2015/08/31 10:51	ファイル フォル		
崣 r_config	🜏 r_t4_driver_rx	2015/08/31 10:51	ファイル フォル…		
⊳ 🌏 r_dmaca_rx	💑 r_t4_file_driver_rx	2015/08/31 10:51	ファイル フォル…	_	
> 🍌 r dtc rx	🗞 r_t4_http_server_rx	2015/08/31 10:52	ファイル フォル…	=	
File name:	💑 r_t4_rx	2015/08/31 10:51	ファイル フォル…		
	🗞 renesas_sw_library	2015/08/31 10:51	ファイル フォル…		
> T_jpege_rx	🌛 src	2015/08/31 10:51	ファイル フォル		Coloct th
⊳ 🂑 r_pdc_rx	rx64m_gr_kaede_Hi_Solution.rcpc	2015/08/31 10:51	RCPC ファイル	+	_ Select un
> 🌛 r_sci_iic_rx 🚽	ا			- P	item.
ファイルタ(N): 1264m	ar kaodo Hi Solution rong	- Project	Filo for o2 studio (*		
	gr_kaede_Hi_Solution.repc	+ Floject			
		One	a V Court		_Click here
		20	concer	_	



4. Select "rx64m_gr_kaede_Hi_Solution" on the project tree and select required items shown below and then click OK. For the "Target MCU Pin Package" item list, select "R5F564MLCxFB(144pin)".

Project Convert Settings		×	
Project:			
:	Project settings		1
rx64m_gr_kaede_Hi_Soluti	New microcontroller		
	Microcontroller:	RX	Select this item
	New <u>m</u> icrocontroller		
	📇 (Search microco	ntroller) Update	
	R5F564M	LOXEB(144nin) Product Name:R5F564MLCxFB LCxFC(176pin) On-chip ROM size[KBytes]4096 LCxFP(100pin) On-chip RAM size[Bytes]524288 LCxLC(177pin) Additional Information:Package=PLQP0144KA-A LCxLX(100pin) LCxLX(145pin) LDxED(114+in) Topological and the second sec	
	New project		
	Kind of project:	Empty Application(CC-FX)	
	Project name:	rx64m_gr_kaede_Hi_Solution	
	Place:	C.¥WorkSpace¥rx64m_gr_kaede_Hi_Solution	
4	🔽 Backup the project	composition files after conversion	
9		OK Cancel Help	Click here

5. The project will be converted and the converted project opened. Also, the e^2 studio project will be backed up.



6.3 Change Settings

Here we shows how to correct the settings which cannot be inherited in "Renesas Common Project File (rx64m_gr_kaede_Hi_Solution.rcpc)"

	Selec	et binary data file	Click here
		7	
1. Edit un-inheritable parts			
Project Tree 📮 🗶	Property		
			<u> </u>
2 0 🎽 🖻	🔨 CC-RX Property		₽ + +
rx64m gr kaede Hi Solution (Project)	⊿ Input		
R5E564MLCxEB (Microcontroller)	Input object module file	Input object module file[0]	
	Using libraries	Using libraries[3]	
CC-RX (Build Tool)	System libraries	System libraries[0]	
RX Simulator (Debug Tool)	Input binary data file	Input binary data file[40]	
Program Analyzer (Analyze Tool)	Symbol definition	Symbol definition[0]	E
Tile File	Specifies execution start address	No	
	Initiates the prelinker	Automatic control	
	⊿ Output		
🚊 🔲 r_cmt_rx	Output file type	Load module file(-FOrm=Absolute)	
r config	Outputs debugging information	Yes (Outputs to the output file)(-DEBug)	
	Path of the output folder	%ConfigDir%	
	Output file name	%ProjectNaine%.abs	
i∰… 🔜 r_dtc_rx	Outputs the external symbol-allocation information fi	No	
r ether rx	Enables information-level message output	No(-NOMessage)	
	Suppresses the number of information-level message		
······································	Fills in padding data at the end of a section	No	
i∰… 🔜 r_pdc_rx	Address setting for specified vector number	Address setting for specified vector number[0]
n sci jic rx	Address setting for unused vector area		
	Input binary data file		15//
	specifies an input binary data file in the format of <file i<br="">attribute >] [<symbol name="">])" with one per line</symbol></file>	name2(<section 2<="" alignment="" boundary="" name2(<="" td=""><td>JL/Section</td></section>	JL/Section
	CODE or DATA can be specified for the Section attribu	te>	
🗄 🖳 r_t4_http_server_rx	Common Ontio	i Link Ontions Hay Output On / Li	hran Conora / =
n t4 rv			brary Genera / 👻

ext Edit		×
Text:		
%ProjectFolder%/_/%Project %ProjectFolder%/_/%Project %ProjectFolder%/_/%Project %ProjectFolder%/_/%Project %ProjectFolder%/_/%Project %ProjectFolder%/_/%Project	Name%/contents/capture.js{C:4/DATA_ Name%/contents/com.css}(C:4/DATA_cc Name%/contents/demo_r_1htm)(C:4/DAT Name%/contents/demo_r_3htm)(C:4/DAT Name%/contents/demo_ru1htm)(C:4/DAT Name%/contents/demo_ru2htm)(C:4/DAT	capture) om) A_demo_r A_demo_r A_demo_r FA_demo_r FA_demo_r FA_demo_r
•		•
Placeholder:		
Placeholder	Value	Desci 🔶
ActiveProjectDir ActiveProjectMicomName ActiveProjectName BuildModeName	C:¥rx64m_gr_kaede_Hi_Solution R5F564MLCxFB rx64m_gr_kaede_Hi_Solution HardwareDebug	Abso Activ Activ Build –
۰ II	I.	•
	OK Cancel	Help

Edit these files

[Before Edit]

%ProjectFolder%/../%ProjectName%/contents/capture.js}(C:4/DATA,_capture)

%ProjectFolder%/../%ProjectName%/contents/com.css}(C:4/DATA,_com)

 $\label{eq:projectFolder} \ensuremath{\%/../\%ProjectName\%/contents/demo_r_1.htm} (C:4/DATA,_demo_r_1)$

 $\label{eq:projectFolder} \ensuremath{\sc v}\ensuremath{\sc v}\en$



%ProjectFolder%/../%ProjectName%/contents/demo_r_3.htm}(C:4/DATA,_demo_r_3) %ProjectFolder%/../%ProjectName%/contents/demo_ru1.htm}(C:4/DATA,_demo_ru1) %ProjectFolder%/../%ProjectName%/contents/demo_ru2.htm}(C:4/DATA,_demo_ru2) %ProjectFolder%/../%ProjectName%/contents/demo_ru3.htm}(C:4/DATA,_demo_ru3) %ProjectFolder%/../%ProjectName%/contents/demo ru4.htm}(C:4/DATA, demo ru4) %ProjectFolder%/../%ProjectName%/contents/demo_st1.htm}(C:4/DATA,_demo_st1) %ProjectFolder%/../%ProjectName%/contents/demo_st2.htm}(C:4/DATA,_demo_st2) %ProjectFolder%/../%ProjectName%/contents/demo st3.htm}(C:4/DATA, demo st3) %ProjectFolder%/../%ProjectName%/contents/demo_st4.htm}(C:4/DATA,_demo_st4) %ProjectFolder%/../%ProjectName%/contents/demo t 1.htm}(C:4/DATA, demo t 1) %ProjectFolder%/../%ProjectName%/contents/demo_t_2.htm}(C:4/DATA,_demo_t_2) %ProjectFolder%/../%ProjectName%/contents/demo_top.htm}(C:4/DATA,_demo_top) %ProjectFolder%/../%ProjectName%/contents/ic title.gif}(C:4/DATA, ic title) %ProjectFolder%/../%ProjectName%/contents/rx.jpg}(C:4/DATA,_rx) %ProjectFolder%/../%ProjectName%/contents/start.gif}(C:4/DATA,_start) %ProjectFolder%/../%ProjectName%/contents/stop.gif}(C:4/DATA, stop) %MainProjectDir%\%ProjectName%/contents/capture.js(C:4/DATA,_capture) %MainProjectDir%\%ProjectName%/contents/com.css(C:4/DATA,_com) %MainProjectDir%\%ProjectName%/contents/demo r 1.htm(C:4/DATA, demo r 1) %MainProjectDir%\%ProjectName%/contents/demo_r_2.htm(C:4/DATA,_demo_r_2) %MainProjectDir%\%ProjectName%/contents/demo_r_3.htm(C:4/DATA,_demo_r_3) %MainProjectDir%\%ProjectName%/contents/demo_ru1.htm(C:4/DATA,_demo_ru1) %MainProjectDir%\%ProjectName%/contents/demo_ru2.htm(C:4/DATA,_demo_ru2) %MainProjectDir%\%ProjectName%/contents/demo ru3.htm(C:4/DATA, demo ru3) %MainProjectDir%\%ProjectName%/contents/demo ru4.htm(C:4/DATA, demo ru4) %MainProjectDir%\%ProjectName%/contents/demo_st1.htm(C:4/DATA,_demo_st1) %MainProjectDir%\%ProjectName%/contents/demo_st2.htm(C:4/DATA,_demo_st2) %MainProjectDir%\%ProjectName%/contents/demo_st3.htm(C:4/DATA,_demo_st3) %MainProjectDir%\%ProjectName%/contents/demo st4.htm(C:4/DATA, demo st4) %MainProjectDir%\%ProjectName%/contents/demo_t_1.htm(C:4/DATA,_demo_t_1) %MainProjectDir%\%ProjectName%/contents/demo_t_2.htm(C:4/DATA,_demo_t_2) %MainProjectDir%\%ProjectName%/contents/demo top.htm(C:4/DATA, demo top) %MainProjectDir%\%ProjectName%/contents/ic_title.gif(C:4/DATA,_ic_title) %MainProjectDir%\%ProjectName%/contents/rx.jpg(C:4/DATA,_rx) %MainProjectDir%\%ProjectName%/contents/start.gif(C:4/DATA, start) %MainProjectDir%\%ProjectName%/contents/stop.gif(C:4/DATA,_stop)

[After Edit]

Delete unnecessary "}" and path (the following list is edited results) %ProjectFolder%/../%ProjectName%/contents/capture.js(C:4/DATA,_capture) %ProjectFolder%/../%ProjectName%/contents/demo_r_1.htm(C:4/DATA,_demo_r_1) %ProjectFolder%/../%ProjectName%/contents/demo_r_2.htm(C:4/DATA,_demo_r_2) %ProjectFolder%/../%ProjectName%/contents/demo_r_3.htm(C:4/DATA,_demo_r_3) %ProjectFolder%/../%ProjectName%/contents/demo_ru1.htm(C:4/DATA,_demo_ru1) %ProjectFolder%/../%ProjectName%/contents/demo_ru2.htm(C:4/DATA,_demo_ru2) %ProjectFolder%/../%ProjectName%/contents/demo_ru3.htm(C:4/DATA,_demo_ru3) %ProjectFolder%/../%ProjectName%/contents/demo_ru3.htm(C:4/DATA,_demo_ru3) %ProjectFolder%/../%ProjectName%/contents/demo_ru3.htm(C:4/DATA,_demo_ru3) %ProjectFolder%/../%ProjectName%/contents/demo_ru4.htm(C:4/DATA,_demo_ru4) %ProjectFolder%/../%ProjectName%/contents/demo_ru4.htm(C:4/DATA,_demo_ru4)



%ProjectFolder%/../%ProjectName%/contents/demo_st2.htm(C:4/DATA,_demo_st2) %ProjectFolder%/../%ProjectName%/contents/demo_st3.htm(C:4/DATA,_demo_st3)

%ProjectFolder%/../%ProjectName%/contents/demo_st4.htm(C:4/DATA,_demo_st4) %ProjectFolder%/../%ProjectName%/contents/demo_t_1.htm(C:4/DATA,_demo_t_1)

%ProjectFolder%/../%ProjectName%/contents/demo_t_2.htm(C:4/DATA,_demo_t_2)

%ProjectFolder%/../%ProjectName%/contents/demo_top.htm(C:4/DATA,_demo_top)

%ProjectFolder%/../%ProjectName%/contents/ic_title.gif(C:4/DATA,_ic_title)

%ProjectFolder%/../%ProjectName%/contents/rx.jpg(C:4/DATA,_rx)

%ProjectFolder%/../%ProjectName%/contents/start.gif(C:4/DATA,_start)

 $\label{eq:projectFolder} \ensuremath{\sc v}\ensuremath{\sc v}\en$







🗿 File

 r_config
 r_dmaca_rx ⊕-- 🔲 r_dtc_rx

⊕ - 🔲 r_t4_driver_rx 🗄 🔲 r_t4_file_driver_rx r_t4_http_server_rx

∎ Ir t4 rx

3. Change Debug tool to	"RX E1(J	<mark>ГАG)(G)"</mark>					
Project Tree 🕴 📮 🗙	Property					×	
2 3 2 2	RX Simulator	Property				+	
rx64m gr kaede Hi Solution (Project)*	Internal ROB	I/RAM					
R5F564MLCxFB (Microcontroller)	Size of intern	al ROM[KBytes]	4096				
CC-RX (Build Tool) Using Debu	g Tool ►	al RAM[KBytes]	512.0469				
RX Simulator (Debu	م ا	DV E1/Carial)	Little-end	ian data			
Property Property	_	KX EI(Senai)	100			CII:	.1.1
→ File プロパティ(P)		RX E1(JTAG)	120				ck nere
i i - bsp	Peripheral f	RX E20(Serial)	[3]				
i r_cmt_rx	Peripheral c	Tox E20(Denary	1				
i imutation in the second sec		RX E20(JTAG)					
i r_dmaca_rx		RX Simulator					
n ether rx							
+ I ipege rx							
n pdc rx							
r t4 driver ry	Size of internal	ROM[KBytes]					
r t4 file driver ry	Dispidys the size	or the internal nom.					
n h4 m	Connect Sett	ngs / Debug Tool Set	tings 🖌 Download F	le Settings 🖌 Hook	Transaction Settings	-	
4. Add download file							
Project Tree 4	🗙 🜁 Propert	/				- x	
2 🕜 🙎 🔳		JTAG) Property				P - +	
rx64m gr kaede Hi Solution (Projec	t)* A Downk	varl					
R5F564MLCxFB (Microcontroller)	Downlo	ad files		[1]			Click here
CC-RX (Build Tool)	CPU R	eset after download		Yes			
New Fr(TAC) (Palue Tach)	Erase f	lash ROM before downlo	bad	Yes			
RX EI(JIAG) (Debug Tool)	Erase o	ata flash ROM before d	ownload	No			
🔍 Program Analyzer (Analyze Tool)	Automa	tic change method of ev	vent setting position	Suspend event			

_main No

Download files Specifies the file to be downloaded. The download file dialog box is opened by pressing the [..] button. In the download file dialog box, specify the file to be downloaded.

Connect Settings / Debug Tool Settings Download File Settings / Hook Transaction Settings /

Download Files		
Download file list:		Download file property:
rx64m_gr_kaede_Hi_Solutio***	Up Down	Download file information File HardwareDebug¥rx64m_gr File type Load module file Download object Yes Download symbol Yes Specify the PIC/P No Generate the infor Yes
		File Specify the file to be downloaded.
Add Remove		OK Cancel Help

4 Debug Information

R01AN2462EJ0100 Rev.1.00 Oct 01, 2015



5. Add download file as file type is "S record file"
File is stored into"rx64m_gr_kaede_Hi_Solution\renesas_sw_library\image_proc".
File name is"outof_TrustedMemory_Data.mot"

Download Files		•
Download file list:		Download file property:
rx64m_gr_kaede_Hi_Solutio··· -	Up Down	■ Download file information File renesas_sw_library4 File type S record file Officet UNEN 0
		File Specify the file to be downloaded.
Add Remove		
		OK Cancel Help

「OK」をクリックします。

6. Build the project



[Caution before downloading when using JTAG]

You must configure the clock setting manually.

1. "Main Clock Frequency [MHz]" must be "12".

Project Tree 🛛 📮 🗙	P P	roperty		- x	
2 @ 🙎 🗷		RX E1(JTAG) Property		P -+	
rx64m gr kaede Hi Solution (Project)*	4 I	internal ROM/RAM			
R5F564MLCxFB (Microcontroller)	8	size of internal ROM[KBytes]	4096		
CC-RX (Build Tool)	S	Size of internal RAM[KBytes]	552		
S RX E1(ITAG) (Debug Tool)		jize of DataFlash memory[KBytes]	64		
Program Analyzor (Analyzo Tool)		JICK Main clock source	FXTAI		01. 1
Program Analyzer (Analyze roor)		Main clock frequency[MHz]	12.0000	=	— Set this value
J File	7	Operating frequency[MHz]		-	
⊕ In _bsp	P	Allow changing of the clock source on writing interna	No		
i∎… 🔜 r_cmt_rx	⊿ C	Connection with Emulator			
i rconfig		amulator serial No. Composition with Target Beard			
n dmaca rx	I F	Power target from the emulator (MAX 200mA)	No		
n dtc rx	Ċ	Communications method	JTAG		
	l d	JTAG clock[MHz]	16.5		
	⊿ F	Flash			
	ŀ	nput Mode of ID code	Specify the ID code as a 32-digit hexadecimal		
i≘∐ r_pdc_rx		D code			
i r_sci_iic_rx	Mair	n clock frequency[MHz]	MPX1 1000		
🗄 🔲 r_t4_driver_rx	Wher	n EXTAL is selected for "Main clock source", specify	the EXTAL frequency.		
r t4 http server rx					4
r t4 rv	Cor	nnect Settings Debug Tool Settings Dov	while Settings A Hook Transaction Set	ings / 👻	1

2. [Operation Frequency [MHz] must be "120".





7. Supplement

7.1 Notes on Using the Free Evaluation Version of the RX Family C/C++ Compiler Package

There is a usage period limitation and certain usage limitations on the free evaluation version of the RX Family C/C++ Compiler Package. If the usage period is exceeded, load modules may not be generated correctly due to the usage limitations.

See the page on evaluation software on the Renesas web site at the link below.

http://www.renesas.com/products/tools/evaluation_software/index.jsp

7.2 Capture Data Slow Refreshing on Web Browser

Depending your client PC's condition, the browser may not perform capture-refreshing smoothly. In this case, you may be able to improve the performance by increasing the reception points. Currently the sample code offers only 16 reception points at maximum due to using only RAM area.

The required modification blocks are in 4 blocks among 3 files. You must set the same number of reception points in each target block.

[rx64m_gr_kaede_Hi_Solution /r_t4_rx/src/config_tcpudp.c]

1. TCP Reception Point Setting



2. TCP Communication Endpoint Setting



3. HTTP Server Communication Point #define HTTP_TCP_CEP_NUM

[rx64m_gr_kaede_Hi_Solution /src/main.c]

4. Work area used for T4 (TCP/IP Protocol Stack)

The value is the return value of tcpudp_get_ramsize(). The target process must be in the same file.

7.3 Write-Invalid Area in Code Flash

The TM function of RX64M MCU is activated for the shipment of GR-KAEDE boards. Due to this function, user is not able to program his codes in code flash 0xFFFE0000 ~ 0xFFFEFFFF. Please define your code location working around this block.

If you attempt to download your code in this block by mistake, your downloader tool may not give you any warning but completes the download. But the download specific to this area will be invalidated and no program will be updated in this block.

For more detail of this function, please refer to "RX64M Group User's Manual: Hardware"



8. Camera Solution Product Introduction

This application note explains the solution based on CC-RX compiler, GR-KAEDE board, and the camera module connected to GR-KAEDE. But this solution is not limited to only these combinations.

8.1 Gadget Renesas GR-KAEDE Board

Gadget Renesas solution will provide the similar sample code which offers the same feature described in this app note. In this solution, the web compiler based on GNU GCC will be used.

In addition to the above, the libraries provided in the web compiler offer the Arduino UNO compatible API and features since GR-KAEDE provides the Arduino UNO compatible I/O pins on the board. The code development with this solution becomes very easy due to free from deep understanding the MCU functions.

http://gadget.renesas.com/en/product/kaede.html

8.2 Camera and Voice Recording/Playback Demo Using HMI Expansion Board

This is a camera solution using "Renesas Starter Kit+ for RX64M (herein RSK)" and "HMI Expansion Board". This RSK offers more functions of RX64M than GR-KAEDE, such as Ethernet2 port. However, the image processing function does not operate on this solution.

Where to obtain this demo solution: will be announced soon

Information of RSK and HMI Expansion Board:

http://am.renesas.com/products/tools/introductory_evaluation_tools/renesas_starter_kits/rsk_rx64m/index.jsp



Website and Support

Renesas Electronics Website <u>http://www.renesas.com/</u>

Inquiries

http://www.renesas.com/contact/

All trademarks and registered trademarks are the property of their respective owners.



Revision History

		Descript	ion	
Rev.	Date	Page	Summary	
1.00	Oct 01, 2015	-	First edition issued	

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit 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 accordance 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 Microprocessing unit or Microcontroller unit products 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.

Notice

- Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
- Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
- Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
- 4. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
- Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots etc.

"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc.

Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (nuclear reactor control systems, military equipment etc.). You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application for which it is not intended. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by Renesas Electronics.

- 6. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
- 7. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction provention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or systems manufactured by you.
- 8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
- 9. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You should not use Renesas Electronics products or technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. When exporting the Renesas Electronics products or technology described in this document, you should comply with the applicable export control laws and regulations.
- It is the responsibility of the buyer or distributor of Renesas Electronics products, who distributes, disposes of, or otherwise places the product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, Renesas Electronics assumes no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
- 11. This document may not be reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
- 12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.
- (Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.
- (Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.



SALES OFFICES

Renesas Electronics Corporation

http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information.

Renesas Electronics America Inc. 2801 Scott Boulevard Santa Clara, CA 95050-2549, U.S.A. Tel: +1-408-588-6000, Fax: +1-408-588-6130
Renesas Electronics Canada Limited 9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3 Tei: +1-905-237-2004
Renesas Electronics Europe Limited Dukes Meadow, Milliboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K Tel: +44-168-8585-100, Rex: +44-1628-585-900
Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany Tel: +49-211-6503-0, Fax: +49-211-6503-1327
Renesas Electronics (China) Co., Ltd. Room 1709, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100191, P.R.China Tel: +86-10-8235-1155, Fax: +86-10-8235-7679
Renesas Electronics (Shanghai) Co., Ltd. Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, P. R. China 200333 Tel: +86-21-2226-0888, Fax: +86-21-2226-0999
Renesas Electronics Hong Kong Limited Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong Tel: +852-2265-6688, Fax: +852 2868-9022
Renesas Electronics Taiwan Co., Ltd. 13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan Tei: +886-28175-9600, Fax: +888 2-8175-9670
Renesas Electronics Singapore Pte. Ltd. 80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949 Tel: +65-6213-0200, Fax: +65-6213-0300
Renesas Electronics Malaysia Sdn.Bhd. Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia Tei : +60-37955-9390, Fax: +60-37955-9510
Renesas Electronics India Pvt. Ltd. No.777C, 100 Feet Road, HALII Stage, Indiranagar, Bangalore, India Tei: +91-80-67208700, Fax: +91-80-67208777
Renesas Electronics Korea Co., Ltd. 12F., 234 Teheran-ro, Gangnam-Gu, Seoul, 135-080, Korea Tei: +822-4568-3737, Fax: +822-4558-5141