# **Development Tool Startup Manual**

# RENESAS

# R-IN32M3-CL Industry Ethernet Communication LSI

R18UZ0024EJ0201 Rev.2.01 Apr 19, 2019

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### 1. How to obtain and install the IAR software and license

#### 1.1 Download the IAR Embedded Workbench software

Download IAR Embedded Workbench software from http://www.iar.com.



#### Important notes:

To use the R-IN32 sample code you must install IAR Embedded Workbench version 6.60 or higher. If you want to use one of the SEGGER J-Link debuggers (J-Link Plus or J-Link Lite CortexM-19 as shown in chapter 3) you must install the IAR Embedded Workbench version 6.70 or higher. This will include the J-Link driver software required for R-IN32M3 flash support.



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Resources       IAR Embedded Workbench         Buying our products       Frequently asked questions         My Pages       Contact         Contact       Support, source code for runtime libraries is not included. The 30-day time-limit evaluation must not be used for product development or any other kind of commercial use.         Kickstart, size-limited evaluation license:         Code size limited license without any time limitation but, no MISRA C support, no power debug functionality, source code for runtime libraries is not included.         Processor or core       Time-limited license         AVR       v6.60         AVR       v6.21         AVR       v6.21         AVR       v4.20         AVR       v4.20         ColdFire       v1.23         V1.23       v1.23 (16/32K)	Downloads	requirement is that you for prospective custome	need to register with us. The ers to test and evaluate IAR	e evaluation license is intended Systems software.
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Frequently asked questions       Fully functional for 30 days after installation with the following limitations: no MI: C support, source code for runtime libraries is not included. The 30-day time-limit evaluation must not be used for product development or any other kind of commercial use.         Kickstart, size-limited evaluation license:         Code size limited license without any time limitation but, no MISRA C support, no power debug functionality, source code for runtime libraries is not included.         Processor or core       Time-limited license         ARM       v6.60       v6.60 (32K)         AVR       v6.21       v6.21 (4K)         AVR32       v4.20       v4.20 (32K)         ColdFire       v1.23       v1.23 (16/32K)	Buying our produces	30-day time-limite	d evaluation license:	
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Kickstart, size-limited evaluation license:         Code size limited license without any time limitation but, no MISRA C support, no power debug functionality, source code for runtime libraries is not included.         Processor or core       Time-limited license       Size-limited license         ARM       v6.60       v6.60 (32K)         AVR       v6.21       v6.21 (4K)         AVR32       v4.20       v4.20 (32K)         ColdFire       v1.23       v1.23 (16/32K)	Contact	commercial use.		
Code size limited license without any time limitation but, no MISRA C support, no power debug functionality, source code for runtime libraries is not included.         Processor or core       Time-limited license       Size-limited license         ARM       v6.60       v6.60 (32K)         AVR       v6.21       v6.21 (4K)         AVR32       v4.20       v4.20 (32K)         ColdFire       v1.23       v1.23 (16/32K)         VC612       v2.20       v2.20		Kickstart, size-lim	ited evaluation license:	
Processor or core         Time-limited license         Size-limited license           ARM         v6.60         v6.60 (32K)           AVR         v6.21         v6.21 (4K)           AVR32         v4.20         v4.20 (32K)           ColdFire         v1.23         v1.23 (16/32K)		Code size limited license power debug functional	e without any time limitation b lity, source code for runtime	ut, no MISRA C support, no libraries is not included.
ARM         v6.60         v6.60 (32k)           AVR         v6.21         v6.21 (4k)           AVR32         v4.20         v4.20 (32k)           ColdFire         v1.23         v1.23 (16/32K)		Processor or core	Time-limited license	Size-limited license
AVR         v6.21         v6.21 (4K)           AVR32         v4.20         v4.20 (32K)           ColdFire         v1.23         v1.23 (16/32K)		ARM	v6.60	v6.60 (32K)
AVR32         v4.20         v4.20 (32K)           ColdFire         v1.23         v1.23 (16/32K)		AVR	v6.21	v6.21 (4K)
ColdFire         v1.23         v1.23 (16/32K)           HCS12         v2.20		AVR32	v4.20	v4.20 (32K)
HC\$12 12.2.0		ColdFire	v1.23	v1.23 (16/32K)
HC512 V3.20		HCS12	v3.20	



#### 1.2 Install IAR Embedded Workbench

(1) Double click the downloaded file, the following window will appear as the software is uncompressed.

Extracting drivers¥S tellarisICDI¥stellarisjodi_com_amd64.cat Extracting drivers¥S tellarisICDI¥stellarisjodi_com_x86.cat Extracting drivers¥S tellarisICDI¥stellarisjodi_debug_amd64.cat Extracting drivers¥S tellarisICDI¥stellarisjodi_debug_x86.cat Extracting drivers¥S tellarisICDI¥stellarisjodi_debug_x86.cat Extracting drivers¥S tellarisICDI¥wdfCoInstaller01.009.dll Extracting drivers¥S tellarisICDI¥wuDFUpdate_01.009.dll Extracting drivers¥S tellarisICDI¥WUDFUpdate_01.009.dll Extracting drivers¥S tellarisICDI¥wuDFUpdate_01.009.dll Extracting drivers¥ti=xds¥ti_emupack_setup.exe Extracting ew¥setup.exe
Destination folder
C.#Osers#a0033122#AppData#Local#Temp#RarsFX0
Installation progress

The window shown above will be opened automatically and the necessary files will be uncompressed to a temporary folder under the C:\Users directory. After uncompressing, the window shown below will open automatically.

#### (2) Click [Install IAR Embedded Workbench®].

-			
	IAR Embedded Workbench®	Japanese	
	for ARM		
	Installation and licensing information		
	Install IAR Embedded Workbench <sup>®</sup>		
	Release notes		
	Install drivers		
	Explore the installation media		
	Exit	<b>EIAR</b> SYSTEMS	



#### (3) Obtain an evaluation license

Note: There are two types of evaluation licenses from IAR: Time limited (30 days) and Code size limited. It is possible to use the 32KB code size-limited evaluation license for an operation check of R-IN32 sample code. Since some sample code such as TCP / IP stack exceeds 32 KB size, operation check can not be performed.

ense Wizard	X
Welcome	
This wizard will help you to activate your IAR Embedded Workbench for ARM li	cense.
C Life conversions number, enter it here:	
Register with IAR Systems to get an evaluation license	
Don't run the Wizard for this product at startup.	AR TEMS
< 戻る(田) <b>沐へ(松) &gt;</b>	キャンセル







(4) IAR will email license information to the email address entered into the form above. Generally both license types (time limited and code size limited) will work for R-IN32M3 sample software (<32KB code memory size). Please refer to the IAR website for more details on the evaluation license limitations.

<b>EIAR</b> SYSTEMS	
Register for Evaluation	
Evaluation license type *	
<ul> <li>Time limited (30 days)</li> <li>IAR Embedded Workbench for ARM, v. 6.50, Evaluation version</li> </ul>	
Code size limited IAR Embedded Workbench for ARM, v. 6.50, 32K Kickstart Edition	
First name *	
Last name *	
Title	
Email *	
Phone *	
Extension:	

Please click [Submit Registration] after entering data into the required fields.

• Yes	
O No	
Vhich RTOS vendor would you be interested in?	
○ cmx	
O Eforce	
Express Logic	
O FreeRTOS	
O Freescale MQX	
O Micrium	
O Micro Digital	
O Quadros	
O Sciopta	
O SEGGER	
O Wittenstein	
Other, please specify:	
uitron	
indicates a required field. Submit Registration Iv registering, you accept to receive information from IAR Systems in the future.	



(5) A link of the form <u>https://register.iar.com/confirm?key=XXXX</u> will be sent to your email address; please click this link to confirm registration and obtain your evaluation license key.

<b>IAR</b> SYSTEMS	
Please Confirm Registration The specified email address An email has now been sent to the address you specified (co.jp), asking you to confirm the registration. Follow the instructions in that email to receive information on how to proceed.  IAR Systems website	

From: IAR Systems + To:	<u>詳細ヘッダ〜</u> 2013/2/5, Tue 10:54 ★
Dear Developer,	
We have received your web registration for the	product
IAR Embedded Workbench for ARM, v. 6.50, 32K	.Kickstart Edition
Please confirm this registration by opening th	e web page
https://register.iar.com/confirm?kev=588c4814=5600	<u>d=4ck</u> key=XXXX-XXX-XXX-XXXX-XXXX
You must confirm the registration within 14 da	ys from when this email was sent.
If you have received this email in error, you registrations are erased from our system after	do not need to do anything. Unconfirmed 14 days.
You cannot reply to this email. Please use the ( <u>http://www.iar.com/contact/</u> ) if you have any con	Contact page on our website mments or questions.
Best regards,	
IAR Systems	



The 14-digit license key will be shown as below. This license key is bound to the PC you used for the registration, so different licenses are required for different PCs.

<b>EIAR</b> SYSTEMS	
Registration Complete         Thank you for your registration!         You have been assigned the following license number:         XXXX-XXXX	
Enter the license number in your License Wizard and click the <b>Next</b> button.	

(6) After the above procedure, installation and registration of IAR Embedded Workbench is complete.

License Wizard	
Register	
When you register you will receive a license number for an evaluatio	n license.
Register	
Enter the license number you received after registering and click Ne	
XXXX	
<b>00</b>	SYSTEMS
〈戻る(g)	法へQU> キャンセル



# 2. Setting and Connection for R-IN32M3-CL

Please connect the board with cables as shown below. Please refer to board specification for the detail. (<u>http://www.tessera.co.jp/eng/ts-r-in32m3-e.html</u>)

#### 2.1 Boot mode setting for R-IN32M3-CL

R-IN32M3 have two external terminal named BOOT0 and BOOT1. Boot mode is selected depend on status of these terminal. Regarding R-IN32M3-CL board, Boot mode is selected by DIP-SW (SW1).

DIP-SW	(SW1)	Dest mode selection
1	2	Boot mode selection
ON(High)	ON(High)	Instruction RAM boot (test)
ON(High)	OFF(Low)	External MPU boot
OFF(Low)	ON(High)	External serial flash ROM boot
OFF(Low)	OFF(Low)	External parallel flash ROM boot

Table 2.1 Boot mode selection





#### **Instruction RAM boot**

In the case of using I-jet debugger and executing on Instruction RAM of R-IN32M3, set MODE SW as below.

MODE SW (SW1 [1:8]): |ON |ON |OFF|OFF|OFF|OFF|OFF|OFF|

#### External parallel flash ROM boot

In the case of using I-jet debugger and executing on External parallel flash ROM of R-IN32M3, set MODE SW as below.

Furthermore, In the case of writing to Parallel FlashROM, use same setting.

MODE SW (SW1 [1:8]): |OFF |OFF |OFF|OFF|OFF|OFF|OFF|

#### External serial flash ROM boot

In the case of using I-jet debugger and executing on External serial flash ROM of R-IN32M3, set MODE SW as below.

Furthermore, In the case of writing to Serial FlashROM, use same setting.

MODE SW (SW1 [1:8]): |OFF |ON |OFF|OFF|OFF|OFF|OFF|OFF|



#### 2.2 Boot Procedure for R-IN32M3-CL board

Please connect the board with cables as shown below.

Please refer to board specification for the detail. (http://www.tessera.co.jp/eng/ts-r-in32m3-e.html)

- (1) Please connect the USB connector of PC with the enclosed USB (mini-B) cable.
- (2) Connect Port 0 on the right side of the picture below with Ethernet cable (recommend category 5).
- (3) Please connect the 20-pin half-pitch connector included with the IAR to the header (3). The No. 1 terminal of the cable is red on the left side.

Please connect debugger and the USB port of PC with the specified USB cable enclosed with debugger I-jet.

- (4) Please select the MODE\_SW.
- (5) Please connect D to C adaptor of 5V/3A.









#### 2.3 Updates of the Flash loader program of IAR Embedded Workbench

If writing to the FlashROM of the R-IN32M3-CL board fail, copy the file under the sample program (\IAR\_flashloader\flashloader

#### Copy source

 $\label{eq:lashloader} AR_flashloader \ Renesas$ 



#### • Destination Folder

C:\Program Files\IAR Systems\Embedded Workbench xxx\arm\config\flashloader

Organize 🔻 🔚 Open 🛛 Include in library	✓ Share with ▼ New folder		:= 🕶 🔟 🔞
🌗 IAR Systems 🥒	Name ^	Date modified	Type Siz.
Embedded Workbench 6.5_2	📕 Freescale	2013/10/17 19:32	File folder
Embedded Workbench 6.5_3	🔑 Fujitsu	2013/10/17 19:43	File folder
Embedded Workbench 6.6	📙 Holtek	2013/10/17 19:43	File folder
	🐌 Infineon	2013/10/17 19:44	File folder
	] Micronas	2013/10/17 19:47	File folder
🚺 config	Microsemi	2013/10/17 19:34	File folder
🍌 debugger	NordicSemi	2013/10/17 19:47	File folder
Je devices	Nuvoton	2013/10/17 19:47	File folder
🥼 flashloader	NXP	2013/10/17 19:50	File folder
🚛 ide 🔔		2013/10/17 19:49	File folder
	ONSemiconductor	2013/10/17 19:50	File folder
template	Renesas	2013/10/17 19:50	File folder
i doc	Samsung	2013/10/17 19:50	File folder
July drivers	SiliconLaboratories	2013/10/17 19:50	File folder
examples	Sonix	2013/10/17 19:50	File folder
jinc 🛛	st .	2013/10/17 19:50	File folder
iib		2013/10/17 19:54	File folder
	Toshiba	2013/10/17 19:54	File folder
src		2013/10/17 20:01	File folder
hutor -		2013/10/17 20:01	



# 3. Installation of USB Serial Conversion Driver

#### 3.1 Obtain the driver

In the case of connecting PC with the USB cable enclosed with R-IN32M3-EC board, the FT232R USB UART driver may be requested.

(Note: If the OS of PC is Win7, there is no need to install driver. In fact, the driver can be installed automatically in Win7.)

Please install the driver after obtaining it from the address below. http://www.ftdichip.com/Drivers/VCP.htm

as a result of making th	iese changes.								
Currently Supported \	VCP Drivers:								
			P	rocesso	or Archited	cture			
Operating System	Release Date	x86 (32- bit)	x64 (64- bit)	PPC	ARM	MIPSII	MIPSIV	SH4	Comments
Windows 8.1	2013-10-21	<u>2.08.30</u> 8.1	<u>2.08.30</u> 8.1	-	-	-	-	-	2.08.30 WHQL Certified for Win 8.1 Available as setup executable <u>Release Notes</u>
Windows*	2013-08-01 🔇	2.08.30	2.08.30	•	•	-	-	-	2.08.30 WHQL Certified Available as setup executable <u>Release Notes</u>
Linux	2009-05-14	1.5.0	1.5.0	-	-	-	-	-	All FTDI devices now supported in Ubuntu 11.10, kernel 3.0. 19 Refer to <u>TN-101</u> if you need a custom VCP VID/PID in Linux
Mac OS X	2012-08-10	2.2.18	<u>2.2.18</u>	<u>2.2.18</u>	-	-	-	-	Refer to TN-105 if you need a custom VCP VID/PID in MAC 0
Windows CE 4.2- 5.2**	2012-01-06	1.1.0.10	-	-	1.1.0.14	1.1.0.10	1.1.0.10	1.1.0.10	
Windows CE 6.0	2012-01-06	1.1.0.10	-	-	1.1.0.14	1.1.0.10	1.1.0.10	1.1.0.10	

\*Also, as Windows 8 RT is a closed system not allowing for 3rd party driver installation our Windows 8 driver will not support this variant of the OS.

Download the file named "CDM 2.08.30 WHQL Certified.zip".



#### 3.2 Install FT232R USB UART Driver

After uncompressing the file into local folder, select[It installs from a list or a specific place (recommendation).] and click[Next(N) >]. Please choose folder [CDM 2.08.30 WHQL Certified] and click [OK].

Update Driver Software - FT232R USB UART	×
G 📋 Update Driver Software - FT232R USB UART	
Browse for driver software on your computer	
Search for driver software in this location:	
✓ Include subfolders	
→ Let me pick from a list of device drivers on my computer This list will show installed driver software compatible with the device, and all driver software in the same category as the device.	
Must Creat	1



Browse For Folder Select the folder that contains drivers for your hardware.	×
E → Local Disk (Q:)     E → Network     CDM v2.08.30 WHQL Certified     amd64     iia86     iiia6	
Eolder: CDM v2.08.30 WHQL Certified	

<ul> <li>Update Driver Software - USB Serial Converter</li> <li>Windows has successfully updated your driver software</li> <li>Windows has finished installing the driver software for this device:</li> <li>USB Serial Converter</li> </ul>	<ul> <li>Update Driver Software - USB Serial Converter</li> <li>Windows has successfully updated your driver software</li> <li>Windows has finished installing the driver software for this device:</li> <li>USB Serial Converter</li> </ul>	Image: Second	Update Driver Software - USB Serial Converter	×
Windows has successfully updated your driver software Windows has finished installing the driver software for this device: USB Serial Converter	Windows has successfully updated your driver software Windows has finished installing the driver software for this device: USB Serial Converter	Windows has successfully updated your driver software Windows has finished installing the driver software for this device: USB Serial Converter	🔋 👔 Update Driver Software - USB Serial Converter	
Windows has finished installing the driver software for this device: USB Serial Converter	Windows has finished installing the driver software for this device: USB Serial Converter	Windows has finished installing the driver software for this device: USB Serial Converter	Windows has successfully updated your driver software	
USB Serial Converter	USB Serial Converter	USB Serial Converter	Windows has finished installing the driver software for this device:	
			USB Serial Converter	
			( <u>C</u> ose	

Click [Close]



#### 3.3 Install USB Serial Port Driver

Install USB Serial Port driver. After uncompressing the file into local folder, select [It installs from a list or a specific place (recommendation).] and click [Next(N) >]. Please choose folder [CDM 2.08.30 WHQL Certified] and click [OK].

Browse For Folder Select the folder that contains drivers for your hardware.	X
<ul> <li>         ← ■ Local Disk (Q:)         <ul> <li></li></ul></li></ul>	•
Eolder: CDM v2.08.30 WHQL Certified	el





Click [Close]



## 4. UART Setting

Install serial terminal software (such as TeraTerm) on your PC and set it up as shown below:

© TCP/IP	Host: myhost.e>	kample.com	-
\$	☑ History Service: ○ Telnet ◎ SSH ○ Other	TCP port#: 22 SSH version: SSH2 Protocol: UNSPE	
● Serial	Port: COM19:	USB Serial Port (COM19	) -

Please set the port according to your PC configuration.

💆 СОМ19	:9600baud - Tera Term VT
File Edit	Setup Control Window Help
	Terminal Window Font Keyboard
	Serial port Proxy SSH SSH Authentication SSH Forwarding

Tera Term: Serial port	setup	<b>X</b>
Port:	COM19 -	ОК
Baud rate:	115200 -	
Data:	8 bit 🔹	Cancel
Parity:		
Stop:	1 bit 🔹	Help
Flow control:		
Transmit dela O mse	ay ec/char 0 msec/	'line

Set the baud rate to 115200, data to 8-bit, no parity, 1 stop bit, and no flow control.





Tera Term: Terminal setup		
Terminal size 80 X 24 V Term size = win size	New-line Receive: CR  Transmit CR+LE Cancel	
Auto window resize	Help	
Answerback:	□ Auto switch (VT<->TEK)	

Please set the terminal software to transmit "CR+LF" for new lines (In TeraTerm the option is [Transmit] under [New-line] in [Terminal setup] as shown above.)



## 5. Sample Program

#### 5.1 Download Sample Program

Please download Sample program for R-IN32M3 from below web site.

https://www.renesas.com/us/en/products/factory-automation/multi-protocol-communication.html#sampleCodes

#### R-IN32M3-CL sample program: R-IN32M3 Series Driver/Middleware Set for R-IN32M3 TESSERA Board

support the grow dustrial networkir	th of the new Industrial Internet og protocols such as EtherCAT <sup>®</sup> , I	t of Things (IoT) and Industry PROFINET <sup>®</sup> and Ethernet/IPT	/ 4.0 initiatives, industri <sup>M</sup> to enable real-time co	al designers are leveragi nnectivity in the factory	ng Ethernet-based floor, resulting in improved
erational efficient	cies and reduced costs.			, , , , , , , , , , , , , , , , , , ,	
e challenge is sel mplex real-time o	ecting a cost-effective platform t perations.	hat supports the leading pro	otocols, while implemen	ting technologies to imp	rove management of
Product Ir	fo Product List	Design Support	Documents	Downloads	Sample Code
tches 3 Function:	FA protocol			✓ Page 1 of 1 →	10 20 All) Results per pa
tches 3 Function: Download Selected Clear all	FA protocol Title Project Files Application Note	Function	Solution & Technology	C Page 1 of 1 S Date/ Rev.	10 20 All Results per pag Related Products
tches 3 Function: Download Selected Clear all	FA protocol Title Project Files Application Note R-IN32M-EC Driver/Middlewa for R-IN32M3-EC IAR KickStan Release Note Project (EWARM / ICCARM ) Application Note	FA protocol	Solution & Technology	Page 1 of 1     Date/     Rev.  Dec.27.18 Rev.3.1.5	10       20       All       Results per page         Related       Products         R-IN32M3
atches 3 Function: Download Selected Clear all	FA protocol Title Project Files Application Note R-IN32M-EC Driver/Middlewa for R-IN32M3-EC IAR KickStarl Release Note Project (EWARM / ICCARM ) Application Note R-IN32M3 Series Driver/Midd Set for R-IN32M3 TESSERA Bo Release Note Project (EWARM / ICCARM ) Application Note	re Set : Kit FA protocol	Solution & Technology	Date/ Rev.           Date/ Rev.           Dec.27.18 Rev.3.1.5	10       20       All       Results per page         Related       Products         R-IN32M3       R-IN32M3



By using R-IN32M3-CL board, you can use 3 sample programs "interval\_timer", "os\_sample" and "osless\_sampl".

					-	
Organize 🔻 Include in library 👻 S	hare with	<ul> <li>New folder</li> </ul>			8==	- 🔟 🕐
🗆 鷆 r-in32m3_samplesoft	<u>▲</u> Na	ame *	Date modified	Туре		Size
Bevice		eep_writer	2013/11/11 9:43	File folder		
		EtherCAT	2013/11/11 9:43	File folder		
🖂 📗 RIN32M3		EtherCAT_SSC	2013/11/11 9:43	File folder		
🕀 🏬 Include		interval_timer	2013/11/11 9:43	File folder		
🕀 퉲 Library		os_sample	2013/11/11 9:43	File folder		
🖃 뷀 Source		osless_sample	2013/11/11 9:43	File folder		
🕑 🌆 Driver						
🛨 🌆 Middleware						
Froject	-					

"eep\_writer", "EtherCAT", "EtherCAT\_SSC" is sample program for R-IN32M3-EC board.



#### 5.2 Boot "os\_sample" program from EWARM tool

EWARM tool corresponding to "os\_sample" starts when you Double-Click Below file, \Device\Renesas\RIN32M3\Source\Project\os\_sample\IAR\main.eww

Organize 🔻 🔀 Open 🔻 New folde	er		= 🛨 🚺 🔞
🖟 r-in32m3_samplesoft	Name ^	Date modified	Туре
CMSIS	]] NOR Boot	2013/11/11 13:53	File folder
Renesas	\mu RAM Debug	2013/11/11 13:47	File folder
RIN32M3	🕌 Serial Flash Boot	2013/11/11 13:53	File folder
Include	\mu settings	2013/11/11 14:23	File folder
🍌 Library	boot_norflash.icf	2013/09/27 16:57	ICF File
Source	boot_serialflash.icf	2013/09/27 16:57	ICF File
J Driver	nit.mac	2013/09/11 16:37	秀丸マクロファイル
Middleware     Project	iram.icf	2013/09/11 16:37	ICF File
eep writer	main.dep	2013/11/12 15:45	DEP File
EtherCAT	main.ewd	2013/09/27 16:57	EWD File
EtherCAT_SSC	main.ewp	2013/11/12 10:11	EWP File
🍌 interval_timer	main.eww	2013/09/11 16:37	IAR IDE Workspace
os_sample			
ARM			
osless sample			
Templates	<b>-</b> [ 4]		



#### 5.3 Build configuration setting

Please select Build configuration setting from next 3 types, RAM Debug, Serial Flash Boot, and NOR Boot.

- In the case of using I-jet debugger and executing on Instruction RAM of R-IN32M3, select "RAM debug".
- 2) In the case of using I-jet debugger and executing on External serial flash ROM of R-IN32M3, select "Serial Flash Boot".
- 3) In the case of using I-jet debugger and executing on External parallel flash ROM of R-IN32M3, select "NOR Boot"





#### 5.4 Compiler Setting

After select workspace, please right-click "main" file and later click "Options....." too.



Please add Defined symbols "RIN32M3\_CL" at C/C++ Compiler Category as below.

Options for node "main Category:	Factory Settings
General Options C/C++ Compiler Assembler Output Convert Custom Build Build Actions	Multi-file Compilation Discard Unused Publics Language 2 Code Optimizations Output List Preprocessor [] [gnore standard include directories] Additional include directories: (one per line) [] [SPR0-LDIRS/
Linker Debugger Simulator Angel CMSIS DAP GDB Server IAR ROM-monit	\$PR0J_DIR\$/////Include       \$PR0J_DIR\$//////Include       Preinclude file:
IAR ROM-monit I-jet/JTAGjet J-Link/J-Trace TI Stellaris Macraigor PE micro	RIN32M3_CL Preserve comments Generate #line directives
	OK Cancel



#### 5.5 Debugger(I-Jet) Setting

Please select "I-jet/JTAGjet" at Debugger Category as below

Category:       Factory Set         General Options       C/C++ Compiler         Assembler       Output Converb         Custom Build       Driver         Build Actions       I-iet/JTAGiet         Linker       Simulator         Angel       CMSIS DAP         GDB Server       IAR ROM-monit         Ijet/JTAGjet       J-Link/J-Trace         TI Stellaris       ST-LINK         TI Stellaris       ST-LINK

As an alternative to the I-jet debugger you can use other debuggers as well, which are supported by the IAR Embedded Workbench. To modify the debugger type you have to switch to the [Project]  $\rightarrow$  [Options ...] dialog and select the category [Debugger]. Please click in the drop down menu the debugger you want to use and click [OK].

One example is the SEGGER J-Link Lite CortexM-19 (<u>http://www.segger.com/jlink-lite-cortexm.html</u>). At Renesas Electronics Europe you can optionally order a R-IN32M3-CL Starter Kit with the Segger J-Link Lite included. The J-Link debugger already includes the required 20 pin half pitch flat ribbon cable and the USB cable as seen in the picture below.





#### 5.6 Linker Setting

Category:       Factory Settings         General Options          C/C++ Compiler       Assembler         Output Converte       Output Converte         Custom Build       Build Actions         Linker       Output Converte         Debugger       Owerride de fault         Simulator       Angel         CMSIS DAP       GDB Server         IAR ROM-monit       I-jet/JTAGjet         J-Link/J-Trace       TI Stellaris
--

The R-IN32M3 board supports different boot options which can be selected via bit 1 and bit 2 of the MODE\_SW switch. To select one of this option you have to select the right linker parameter in the IAR environment. In the Linker Category on the left side of the [Project] / [Options...] menu use the [Config] tab in the right window and modify \*.icf file as shown below:

For execution on the R-IN32 internal RAM (iRAM))

- For booting from parallel NOR flash
- For booting from serial flash

- : iram.icf
- $: boot\_norflash.icf$
- : boot\_serialflash.icf



#### 5.7 Build and Execute "os\_sample" program

Please click [Project] / [Rebuild All] at Upper side of IAR window.

🎾 main - IAR Fi	mbedded Workbench IDE					1	
File Edit View	Project Tools Window He	eln					
Vorkspace	Add Eiles Add Group Import File List Add Project Connection Edit Configurations		<b>·</b>	<	<b>₽ 4</b>	) di C	∦ 🕅 🟓 f0 ▾ ¥
🗆 🗇 main - De	Remo <u>v</u> e						
H → ⊞ 🗀 Driver H → ⊞ 🗀 Middlew	Create <u>N</u> ew Project Add <u>E</u> xisting Project						
-⊞ C main.c	Options	Alt+F7					
L-⊞ 🗀 Output	Version Control System	•					
	<u>M</u> ake <u>C</u> ompile Rebuild All	F7 Ctrl+F7					
	C <u>l</u> ean B <u>a</u> tch build	F8					
	Stop Build	Ctrl+Break					
	Download and Debug Debug wit <u>h</u> out Downloading Ma <u>k</u> e & Restart Debugger Restart Debugger Do <u>w</u> nload	Ctrl+D Ctrl+R Ctrl+Shift+R					
	SFR Setup Open Device File	•					
main							
× Messages syscalls.c system_RI uart.c vectors_M	s N32M3.c						

After complication of the build process you can execute the generated SW:

Click (1) to download code to target.

Click (2) to run the program.

Eile Edit View Project Debu	g Disassembly I-jet/JTAGjet Tools Window Help	•
5 • S2682	Make	e & Res
ETM SWO		
Workspace >		) <b>- ×</b>
Debug	return 1;	^
Files 👫 🗠	- 3	
🗆 🗇 main - Deb 🗸		
Here Middleware		
	Baran none	
- 🕀 💽 main.c	Gretval none	
	<pre>#pragma required= vectors rom tbl</pre>	
	⇒ roidiar_program_start( void )	
	iar_init_vfp();	
	//cmain();	
	iar_data_init3();	
	// Replace vectors address	
main	<pre>SCB-&gt;VTOR = (uint32_t)_vector_table;</pre>	2 ~
× .		
Log	10: Doubled ever at 0:4 0000000; doubleding into per unitable memory	
Tue Feb 05, 2013 14:44:4	10: 10876 bytes downloaded (342.62 Kbytes/sec)	
Tue Feb 05, 2013 14:44:4	10: SWO: CPU clock = 72000kHz, Auto divider = 4	
Tue Feb 05, 2013 14:44:4	10: Download completed.	
Tue Feb 05, 2013 14:44:4 Tue Feb 05, 2013 14:44:4	IU: LowLevelReset(software, delay 200) II: SWO: CPL (dock = 72000kHz, Auto divider = 4	-
Tue Feb 05, 2013 14:44:4	1): Target reset	
		>
Debug Les Doubl		



Only at the 1st time of starting(1)[Download and Debug], [Memory Configuration Alert] and [Memory Configuration] window may sequentially pop up, in this case, please click [OK]. (It will not pop up any more.)

Memory Configuration Alert
The first time that you debug a project in C-SPY, you must setup or review the memory configuration.



If the program is operating normally, it is displayed as "hello world" at Serial terminal.



when you input "0","1","2","3" from serial terminal, Outputs level which are assigned at pins from 0 to 3 of CN20 of R-IN32M3 CL board are inverted.







# 6. Connection with PLC (MELSEC-Q Series) from MITSUBISHI

#### 6.1 Sample stack for CC-Link IE Field

Please download sample stack of CC-Link IE Field (Intelligent Device Station) for R-IN32M3 from below web site. https://www.renesas.com/us/en/products/factory-automation/multi-protocol-communication.html#sampleCodes

CC-Link IE sample stack : R-IN32M3-CL CC-Link IE Driver/Middleware Set for R-IN32M3-CL

Place the sample application "CCLinkIE" folder in the downloaded CC-Link IE sample in the following folder of the R-IN 32 M 3 sample program.

And by referring to the procedure in Chapter2 and 4, download this program to R-IN32M3-CL Board. Below table show board setting for CC-Link IE Field.

SW	Setting
SW23 bit2	ON
SW23 bit3	ON

#### Table.5.1 DIP Switch setting for CC-LINK IE Field



#### 6.2 Connection with PLC (MELSEC-Q) of Mitsubishi

Please connect Windows PC ,PLC and R-IN32M3-CL board as shown below.

-Windows PC and CPU module of PLC connect with USB interface.

-Control network module of PLC and R-IN32M3-CL board connect with USB interface.



#### 6.3 Installation of GX-Works2 of Mitsubishi

Please purchase GX-Works2 from Mitsubishi electric products and install the tool. http://www.mitsubishielectric.co.jp/fa/products/cnt/plceng/lineup/gx\_works2/index.html



#### 6.4 Start GX-Works2

There is project file of GX-Works2 in the CC-Link IE sample stack. Gx-Works2 is started by executing the project file. \CCLinkIE\GX\_Works2\

#### 6.5 Writing BIDIR program to CPU module

Before writing the program to the PLC to probably have to change the PLC type with the menu "Project / Change PLC Type ...". In case you have entered a different PLC type than given in the sample program, GX-Works2 is asking you to confirm the conversion of the supplied sample PLC program.

Cha PL PL	ange PLC Type       Concel         C. Series       OK         QCPU (Q mode)       OK         Cancel       Column (QobUDEH)         QOBUDEH       OK         Devices or instructions might need to be modified to use.       Please check the change list and modify the changed devices or instructions.	
	3	

After this step you can download the BIDIR sample project into the PLC with the menu "Online / Write to PLC ..." as shown below.

<u>Project Edit Find/Replace Compile Vi</u>	iew <u>O</u> n	line De <u>b</u> ug <u>D</u> iagnostics <u>T</u>	ool <u>W</u> indo	w	<u>H</u> elp				-	8,
i 🗅 🖻 💾 🎒 💿 🛛 🛛 💡 🚺	6 🗊 🏧	Read from PLC			🛼 🎇   🗷 📫 🥔	=, ; ! 🖽	1 📩 📩	a 🗖	M 🖌	Ţ
🔁 🗉 🗖 🗱 🖷 🎇 🐯 🙀 📿		Write to PLC			- [	) = : : : : :	1 H -1-1 4 1F5 F6 sf	같음 달	}	9
Navigation		verify with PEC							4	▶ •
Project		Remote Operation(S)					C UND	K18100	00	1.4
	- 1	Redundant Operation								
The Parameter	-	Password/Keyword		•		वाध्याव]	DO	80	L0	1
- A Intelligent Function Module		Soft Security Key Management	t					[IMCP	DI	1
- 🚱 Global Device Comment		PLC Memory Operation		•			[#XP	00	E48300	1
🗄 😼 Program Setting		Delete PLC Data	3				-[#XP	00	<b>E48</b> 300	1
E- COU		PLC Us <u>e</u> r Data						40000	DI	
2mm		Export to ROM Format					1000		828900	1
MAIN		Program Memory <u>B</u> atch Down	load							1
MAINX		Latch Data Backup					[#X0>	00	E48300	1
		PLC Module Change		•					-[60	1
T R Device Memory		Set <u>C</u> lock								
🖉 Device Initial Value		Register/Cancel Display Modu	le Menu							
		<u>M</u> onitor		•						
		Wa <u>t</u> ch		•						
		Local Device Batch Read +Save	e CSV							

The following dialog window appears to select the related project parts which are going to be downloaded into the PLC. Click on the "Select All" button, then press "Execute" button. A progress window appears which is showing the download status and the downloaded program items.



the research the second second							Current and T	
erial Port PLC Module Connection(USB)				0			System Im	age
🗐 🌔 🏹 🔿 Read 🛛 🄇	· Write	⊂ Verify	y	⊖ De	elete			
PLC Module 💦 🚺 Intelligent Func	tion Module E	ecution Targ	get Data(	No	/ Yes )			
itle								
👫 Edit Data 🛛 🛛 Pa	arameter+Program	Select All	Cancel	All Sele	ections			
Module Name/Data Nam	ne	Title	Target	Detail	Last Change	Target Memory	Size	
PLC Data				3		Program Memory/De		
- E Rogram (Program File)				Detail	2012/04/24 10:00 FE			
					2013/04/24 10:08:55			
244					2013/04/24 10:08:55			=
🎦 MAINX				i	2013/12/20 15:07:24			
- 🔁 🛃 Parameter								
PLC/Network/Remote Pass	word/Switch Setti			-	2013/04/24 09:47:43			- 11
				Detail 🗌	2013/04/24 09:47:43			
				Detail	2010/04/24 00:41:40			-
ated Functions <<	<b>-</b> 81 <i>a</i>	<u> </u>		1		Exec		Close
ated Functions <	User Data Write	Title	Format F	<b>1</b>	Clear PLC Memory	Exec Arrange PLC	cute	Close
lated Functions <	User Data Write	Title	Format F Memory	PLC V	Clear PLC Memory	Exec Exec Arrange PLC Memory		Close
lated Functions <	User Data Write	Title	Format F Memor	L PLC P	Clear PLC Memory	Exer Exer Arrange PLC Memory		Close
lated Functions <	User Data Write	Title	Format P Memor		Clear PLC Memory	Exer		Close
ated Functions <	User Data Write	Title	Format F Memory		Clear PLC Memory	Exer		Close
ated Functions <	User Data Write	Title	Format F Memor		Clear PLC Memory	Exer Arrange PLC Memory		Close
lated Functions <	User Data Write	Title	Format P Memor		Clear PLC Memory	Exer		Close
ated Functions <<	User Data Write		Format F Memor		Clear PLC Memory	Exer Arrange PLC Memory		Close
lated Functions <<	User Data Write	Title	Format F Memor	ed d : Cance pleted	Clear PLC Memory	Exer Arrange PLC Memory		Close



#### 6.6 Confirmation of communication between PLC and R-IN32M3-CL

R-IN32M3-CL send status of rotary SW17 and SW20 to PLC. PLC send 8bit data correspond with received data as Table 5.2 to R-IN32M3-CL. R-IN32M3-CL output to LED(D48-D55) according to the received data.

SW	Value	LED lighting pattern
SW17 SW20	0, 0	Increment
SW17 SW20	0, 1	Decrement
SW17 SW20	0, 2	All Off
SW17 SW20	0, 3	All On

Table.5.2 Rotary Switch and LED lighting pattern





# 7. KEIL MDK-ARM Setup

This section shows how to setup KEIL MDK-ARM.

#### 7.1 Board and emulator preparation

Prepare R-IN32M3-CL Board (e.g. TS-R-IN32M3-CL\_002 from Tessera Technology) and MDK-ARM emulator (e.g. ULINK).

Please do setting the board by referring "2.1 Boot mode setting for R-IN32M3-CL" section.



#### 7.2 Download MDK-ARM

Install MDK-ARM from KEIL web page (<u>https://www.keil.com/)</u>. The example of MDK-ARM V5.11 is showed as bellows.





First Name:					
Last Name:					
E-mail:					
Company:					
Address:					
City:					
State/Province:	Select Your State or	Province -			
Zip/Postal Code:					
Country:	Select Your Country	-			
Phone:					
l am using devices from: (Select all that apply)	Analog Devices Atmel Cypress Energy Micro Freescale Fujtsu	Holtek Infineon Nuvoton NXP Other Samsung		SiLabs ST Ti Toshiba Other	
Which ARM architectures are you using? (Select all that apply)	Cortex-M0 Cortex-M1 Cortex-M3		Cortex-M4		
Do you h	ave any questions or o	comments?			





#### 7.3 Install MDK-ARM

#### 7.3.1 Install tools

Install MDK-ARM by executing "MDK5xxx.EXE" (xxx is a version).

Setup MDK-ARM V5.11a		X
Keil MDK-ARM Setup completed MDK-ARM V5.11a		ARM
MDK-ARM Core Setup has performed all requested operations successfully.		
Show Release Notes.		
Keil MDK-ARM Setup		
	Back Finish C</td <td>ancel</td>	ancel

#### 7.3.2 Install Device Family Pack (DFP)

After install tools, "Pack Installer" window is opened<sup>Note</sup>. In this window, select "R-IN32M3-CL" in "Devices" tab and press the install button with "Keil::R-IN32M3\_DFP" in "Packs" tab.

File Deales Window	Hele						
File Packs window	neip						
Device: Renesas - F	R-IN32M3-EC						
Packs Exampl	les	4	4	Devices	Boards		Þ
Pack	Action Description		Search	n:		• ×	
ARM::CMSIS	Update CMSIS (Cortex Microcontrol	ller Software Interface	Device	2	/	Summary	
Keil: MDK-Middlewa	Vpdate Keil MDK-ARM Professiona	Middleware for ARM		Analog De	vices	12 Devices	
Keil:R-IN32M3_DFP	Instan Renesas R-IN32M3 Series D	evice Support and Exa		ARM		10 Devices	
IwIP::IwIP	Sector Investment Investment Investment	mentation of the TCP/I	•	Atmel		122 Devices	
wolfSSL:CyaSSL	V Install Light weight SSL/TLS and C	rypt Library for Embed		Energy Mie	cro	238 Devices	
				Freescale		177 Devices	_
				Infineon		81 Devices	_
			····	Maxim		4 Devices	_
			-	Nuvoton		373 Devices	_
			1	NXP		248 Devices	-
			Ĩ.	Renesas	MD C	2 Devices	-
				R-INSZ	N22M2-CI	APM Cortex-M2 100 MHz 512 kB PAM	-
			•	CI P.I	N32M3-EC	ARM Cortex-M3, 100 MHz, 512 kB RAM	
				SONIX		40 Devices	
				Spansion		307 Devices	
				STMicroel	ectronics	361 Devices	
			•-•	Texas Instr	uments	340 Devices	
			•-•	Toshiba		67 Devices	
		<u> </u>					
Completed requested action	ins					ONLINE	11.

Note: The window is also opened by [Project]->[Manage]->[Pack Installer...] from tools bar.



#### 7.3.3 Copy sample program

There are two ways to get sample program. The one way is to get from "Pack Installer", the other way is from Renesas web page.

#### (1) The Pack Installer case

Select sample program in "Examples" tab, and press the "Copy" button.

	Help				
Device: Renesas	R-IN32M3-CL				
Packs Examp	les		4	Devices Boards	
Show examples fro	m installed Pasks only			Search:	• ×
Frample		/ Action	Description	Device /	Summary
- OS Sample (TS-R-IN	32M3-CL)	🚸 Сору	OS Sample examp	🖅 🔗 Analog Devices	13 Devices
OS-less Sample (TS-	R-IN32M3-CL)	🚸 Сору	OS less Sample e	🛨 🔗 ARM	18 Devices
				🛨 🔗 Atmel	122 Devices
				🗈 🄗 Energy Micro	198 Devices
				🗈 🔗 Freescale	203 Devices
				🛨 🏈 Infineon	81 Devices
				🗈 🤗 Maxim	4 Devices
				🛨 🔗 Nuvoton	377 Devices
				I NXP	255 Devices
				Renesas	2 Devices
				🖃 🏤 R-IN32M3 Series	2 Devices
				R-IN32M3-CL	ARM Cortex-M3, 100 MHz, 512 kB RAM
				R-IN32M3-EC	ARM Cortex-M3, 100 MHz, 512 kB RAM
				💿 🔗 Silicon Labs	40 Devices
				🖅 🔗 SONiX	40 Devices
				😥 🏈 Spansion	307 Devices
				I → STMicroelectronics	406 Devices
				🗈 🄗 Texas Instruments	340 Devices
				主 🔗 Toshiba	67 Devices
•			•		
Ready					ONLINE

#### (2) The Renesas web case

Please visit Renesas web page and get "Driver/Middleware" sample software. http://www.renesas.com/products/soc/assp/fa\_lsi/multi\_protocol\_communication/r-in32m3/peer/sample\_software.jsp



#### 7.4 How to operate MDK-ARM

#### 7.4.1 $\mu$ Vision5 settings

 $\mu$  Vision5 is started by double clicking the project file "\*.uvprojx".

After booting  $\mu$  Vision5, select the target setting for the device and boot mode.



By pressing "Options for Target..." button, target settings can be customized changed. For example, flash loader can be changed.

D:¥Documents¥Boards	Tessera¥TS-R-IN32M3-Cl	L¥os_sample¥os_s	ample.uvprojx - µVis
File Edit View Project	Flash Debug Peripheral	s Tools SVCS V	Vindow Help
🗋 😂 🗟 🥔 👗 🔖	B 9 0 ← ⇒	四限限	🗏 🗐 //= //= 🖉
🔗 🕮 🕮 🧼 🔜 🗱	R-IN32M3-CL extMem (R/	] 🔊 🛔 🔓 🔶	🐡 💩
Project			
🖃 쓚 Project: os_sample			
🖨 ᇶ R-IN32M3-CL ext	fem (RAM)		
🖨 🦾 Source Group	1		
Retarget.c			
- Serial.c			
- 🗋 main.c			
kernel_cfg	c		
1			



Target setting name is different between the one get from Pack Installer and the one get from Renesas web.

#### (1) Sample project from Pack Installer

#### Table7.1 $\mu$ Visioin5 target setting (sample project from Pack Installer)

Target name	Settings				
	ROM code placed in	Instruction code	Flash loader		
		executed in			
R-IN32M3-CL intRAM	Instruction RAM	Instruction RAM	Not used		
R-IN32M3-CL intRAM(SWO)	Instruction RAM	Instruction RAM	Not used		
R-IN32M3-CL extMem	External Memory	External Memory	For S29GL128S		
R-IN32M3-CL extMem(RAM)	External Memory	Instruction RAM	For S29GL128S		
R-IN32M3-CL extSPI	Serial Flash	Serial Flash	For S25FL064P		
R-IN32M3-CL extSPI(RAM)	Serial Flash	Instruction RAM	For S25FL064P		

#### (2) Sample project from Renesas web

#### Table7.2 $\mu$ Visioin5 target setting (sample project from Renesas web)

Target name	Settings					
	ROM code placed in	Instruction code	Flash loader			
		executed in				
RAM Debug - CL Board	Instruction RAM	Instruction RAM	Not used			
NOR Boot - CL Board	External Memory	Instruction RAM	For S29GL128S			
Serial Flash Boot - CL Board	Serial Flash	Instruction RAM	For S25FL064P			



#### 7.4.2 $\mu$ Vision5 operation

#### 7.4.2.1 ROM code generation

Build the program and generate ROM code by pressing "Build" button, after target settings.



#### 7.4.2.2 Download ROM code to flash memory

If the internal RAM boot is selected, jump to "7.4.2.3 Start debugger" section.

If the other boot mode is selected, press "Download" button to download ROM code to flash memory. This operation uses flash loader set by target setting.



In the case of success, "Erase Done", "Programming Done", "Verify OK" messages are showed in the Log.



#### 7.4.2.3 Start debugger

By pressing "Start/Stop Debug Session" button (or [Ctrl]+[F5] key), debugger starts.



#### 7.4.2.4 Start debugging

By pressing "Run" button, program run and start debugging.

#### 7.4.2.5 Stop debugger

By pressing "Start/Stop Debug Session" button (or [Ctrl]+[F5] key) again, debugger stops.



# REVISION HISTORY R-IN32M3 Series StarterKit Setup Procedure

Rev.	Date		Description
		Page	Summary
1.00	Dec 26,2013	-	First Edition issued
1.01	Feb 07,2014	P4	Add important note about IAR SW version 6.70 for SEGGER debuggers
1.02	MAR 13,2014	P30	Add 5.Connection with PLC(MELSEC-Q Series) from MITSUBISHI
2.00	DEC 25,2014	-	Add new section "6.KEIL MDK-ARM Setup".
2.01	Apr 19,2019		Update broken links, etc.

# 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. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

The state of the product is undefined at the time 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 time 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 time 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 time when power is supplied until the power is supplied until the power reaches the level at which reseting is specified.

3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. 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 the 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.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is 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. Additionally, 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.

6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.).

7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of 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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