AGT Output and Underflow Interrupt Sample Code (Using CMSIS Driver Package) for RE01 1500KB Group

AGT Output and Underflow Interrupt Sample Code Using CMSIS Driver Package

Summary

This application note describes a sample code using the RE01 1500KB Group CMSIS driver package. The sample code can be found in the project delivered with this application note.

Contents

1. Specifications

1.1 Description of Project

A sample code project is delivered with this application note. This sample code project is configured to match the settings of R7F0E015D2CFB mounted on the Evaluation Kit RE01 1500KB. When using another device, change the device settings in the project to those of the target device.

1.2 Pins Used

The pins used by the sample code are shown below.

I/O Port	Pin Function
P009	LED0

1.3 File Configuration

Table 1-1 shows the files that were added or changed in the sample code.

Table 1-1 Files Added or Changed in Sample Code

File Name	Overview of Processing or Configuration	Remarks
main.c	Main processing	
r_system_cfg.h	System configuration	Registering IRQ interrupts to NVIC
r_core_cfg.h	Clock configuration	Setting clock oscillator operation and source

2. Operating Environment

2.1 Device

RE Family RE01 1500KB Group

2.2 Development Environment

The sample code was developed with the following environment (Table 2-1).

Table 2-1 USART Sample Code Operating Environment

IDE	Compiler	Debugger
IAR EWARM V8.3 or later (IAR Embedded Workbench® for ARM)	IAR v8.32 or Later	IAR I-Jet
		Segger J-Link(OB)
Renesas e2 studio V.7 or later	GCC V.6 GNU 6-2017-q2-update	Segger J-Link(OB)

2.3 Target Board

Evaluation Kit RE01 1500KB

3. Description of Software

This sample code generates AGT0 output pulse of 5Hz from AGT0O(P808) and toggles LED0 output level every 500 ms. Table 3-1 shows the specifications of this sample code.

Table 3-1 Sample code specifications

Item	Configuration
System Clock	MOSC 32 MHz
Timer	AGT0
AGT Clock Source	Subclock 32 kHz, 1/1 division
AGT Mode	Pulse output mode
AGT Output	Enabled

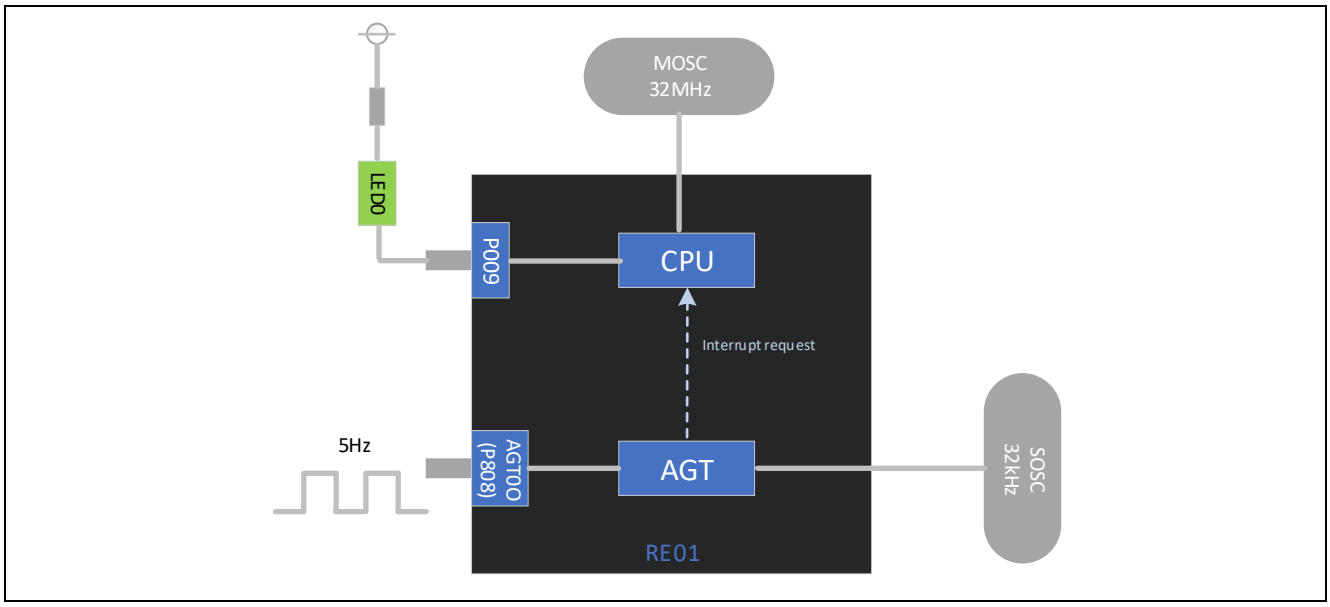

Figure 3.1 System block diagram for AGT sample code

3.1 Changes in Driver Settings

Table 3-2 Changes in Drivers

Item	File Location	Details
Registering IRQ3 interrupt to NVIC	[r_system_cfg.h] SYSTEM_CFG_EVENT_ NUMBER_AGT0_AGTI	Change to (SYSTEM_IRQ_EVENT_NUMBER3)
Changing clock operation and source	[r_core_cfg.h]	
	SYSTEM_CFG_MOSC_ENABLE	Change to (1) : Enable
	SYSTEM_CFG_MOCO_ENABLE	Change to (0) : Disable
	SYSTEM_CFG_SOSC_ENABLE	Change to (1) : Enable
	SYSTEM_CFG_CLOCK_SOURCE	Change to (3) : Select MOSC

3.2 List of Functions

The functions added to the sample code are described here.

main	
Overview	Main processing
Header	None
Declaration	void main(void)
Description	This function calls the system initialization function. Then, it sets up AGT0 and AGT0_AGTI interrupt.
Argument	None
Return Value	None

AGT0_callback	
Overview	AGT0 callback processing
Header	None
Declaration	static void AGT0_callback(void)
Description	This function sets the routines for AGT0 underflow interrupt. Underflow flag is cleared and LED is toggled on/off every 500 ms.
Argument	None
Return Value	None

On_RAM_Func	
Overview	Sample function to be allocated to RAM
Header	None
Declaration	static void On_RAM_Func (void)
Description	This function is a sample function which is allocated to RAM. It consists of 4 nop (no operation) instruction.
Argument	None
Return Value	None

3.3 Flowcharts

The flowcharts of main processing, AGT0 callback processing, and On_RAM_Func() processing are respectively shown in Figure 3.2, Figure 3.3, and Figure 3.4.

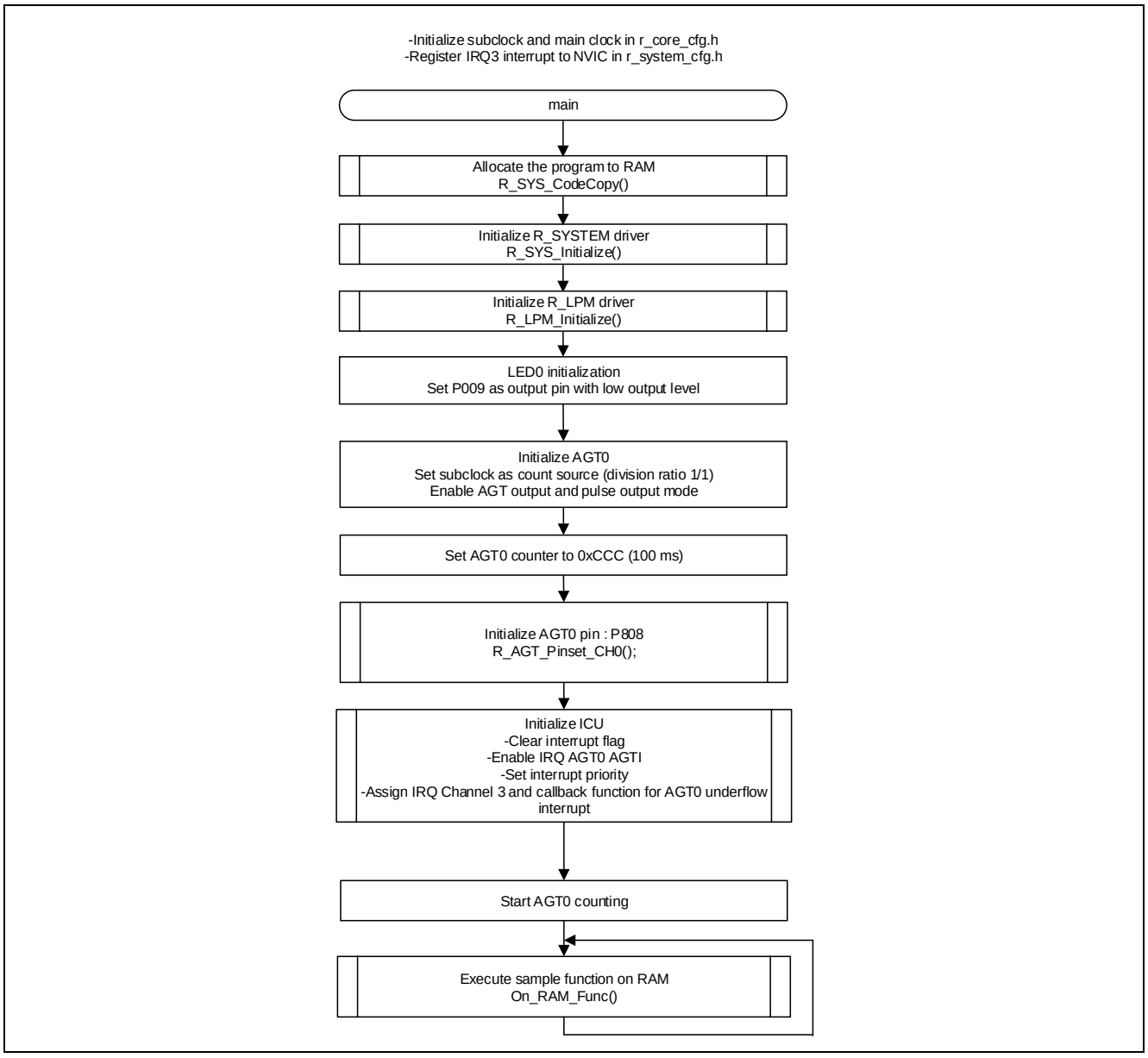

Figure 3.2 Main Processing

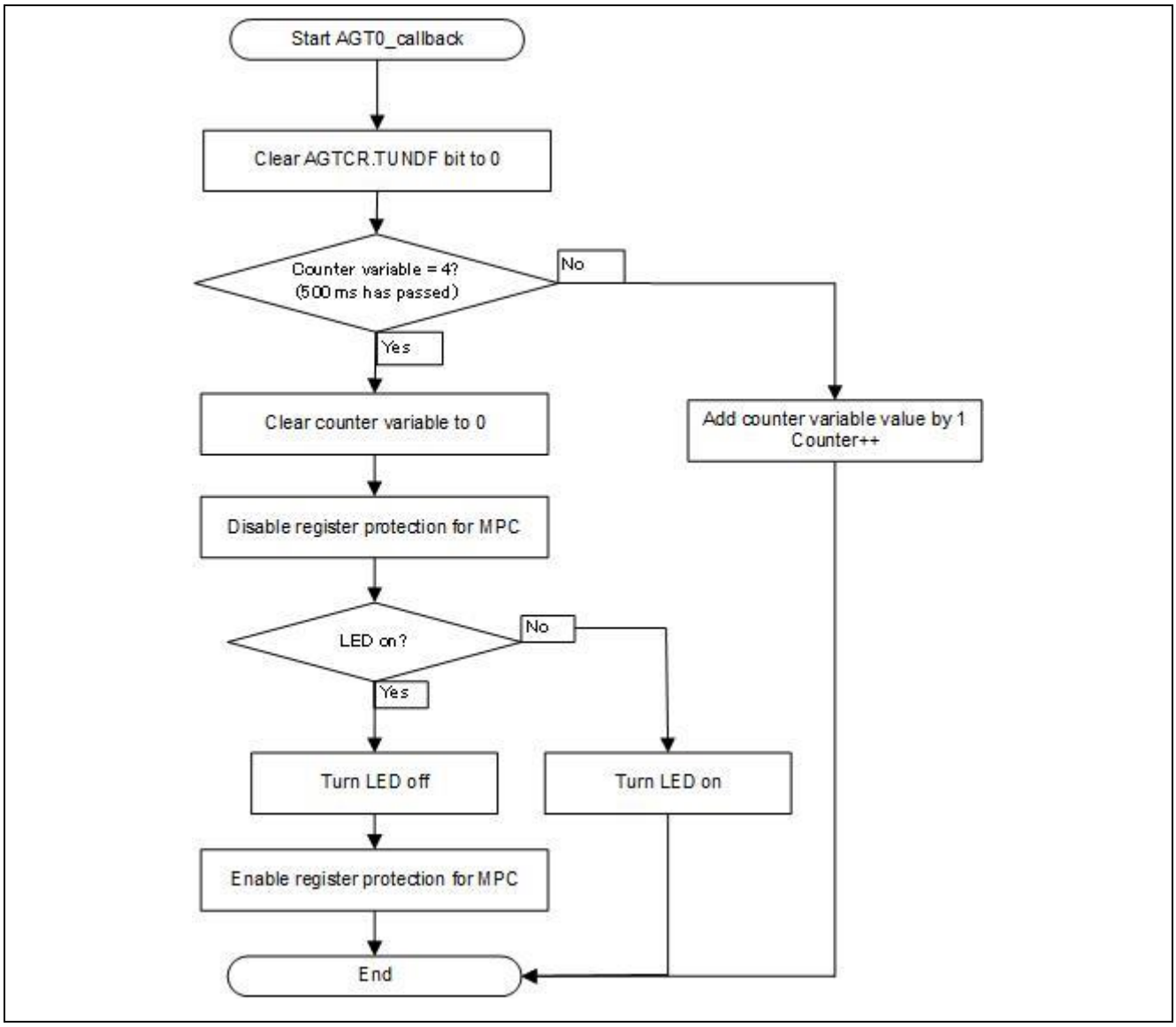

Figure 3.3 AGT0 Callback Processing

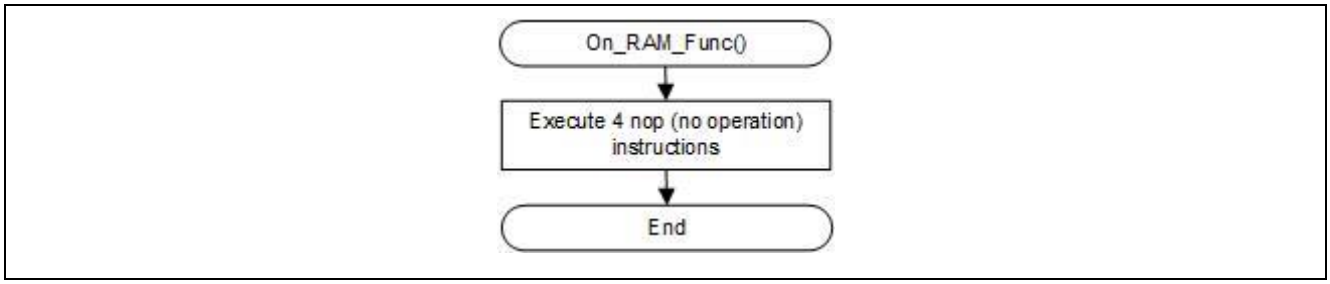

Figure 3.4 On_RAM_Func Processing

4. Sample Code

Sample code can be downloaded from the Renesas Electronics website.

5. Reference Documents

User's Manual: Hardware

RE01 1500KB Group User's Manual: Hardware R01UH0796

(The latest version can be downloaded from the Renesas Electronics website.)

Technical Update/Technical News

(The latest version can be downloaded from the Renesas Electronics website.)

User's Manual: Development Tools

(The latest version can be downloaded from the Renesas Electronics website.)

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Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Oct. 2, 2019	—	First edition issued

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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 reaches the level at which resetting 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

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(Rev.4.0-1 November 2017)

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