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R8C/26 GROUP

Power and RTC Control

Abstract

This article introduces an example of using the R8C/26 to control system power and provide a real time clock(RTC) on the SH7722 MigoR platform The demonstration uses a MigoR platform evaluation board, with the SH7722 (Part number R8A7722AC266BGV) as the main processor and R8C/26 as a sub-MCU function to monitor power switch and provide a RTC. The main processor is notified by the R8C/26 with an interrupt IRQ to provide the power control event and RTC information via IIC bus.

Introduction

The example application provided is based on the following configuration:

R8C/26

The R8C/26, part name R5F21262NFP, is a group of the R8C series based on the R8C CPU Core used in the application system with a maximum operating frequency at 20MHz.

ROM: 8K bytes

RAM: 512 bytes

ROM Type: Flash Memory

Package Type: PLQP0032GB-A

MigoR Platform

R8A77220AC266BGV (SH7722) is used as a main processor which incorporates SH4AL-DSP operating at a maximum frequency of 333MHz.

The basic functions of the MigoR, part name YTD07DS7722B, are as following.

FLASH ROM: 64M bytes, 16bits width

SDRAM: 64M bytes, 64bits width

2.2 inches QVGA color LCD display

VGA camera module built-in

Ethernet, TV out, SD Card, etc are built-in

C Compiler

High Performance Embedded Workshop V4.03 by Renesas Technology Corp.
M16C standard toolchain Ver. V.5.40.00 by Renesas Technology Corp.

Contents

R8C/26 Power and RTC Controller

1.1 R8C/26 Key Features

- 8-bit Multifunction Timer with 8-bit prescaler (Timer RA and RB): 2 channels
- Input Capture/Output Compare Timer (Timer RC): 16-bit x 1 channel
- Real-Time Clock Timer with compare match function (Timer RE): 1 channel
- UART/Clock Synchronous Serial Interface: 2 channels
- I^2C-bus Interface (IIC)/Chip-select Clock Synchronous Serial Interface: 1 channel
- LIN Module: 1 channel (Timer RA, UART0)
- 10-bit A/D Converter: 12 channels
- Watchdog Timer
- Clock Generation Circuits: XIN Clock Generation Circuit, On-chip Oscillator (High/Low Speed), XCIN Clock Generation Circuit
- Oscillation Stop Detection Function
- Voltage Detection Circuit
- Power-On Reset Circuit
- I/O Ports: 25 (incl. LED drive ports)
- External Interrupt Pins: 7

1.2 R8C/26 Functions in the MigoR Platform

This section describes the function of the R8C/26 that are provided on the MigoR platform. The major functions for main processor to access are Power ON/OFF control in system, reset generation, RTC control, and IIC slave service. To reset the system, the RESET signal is continuously asserted low for approximately 100ms after system power on. The RTC circuit, which keeps the track of current time, is oscillated by an external crystal resonator at a frequency of 32.768 KHz . The real time clock can be read or written from SH7722 to R8C/26 through IIC and vice versa. The major functions are listed below:

1. Control DC-DC ON/OFF to generate 3.3VDC and 1.2VDC for CPU and whole system logic. When state is OFF, the whole SH7722 system is shutdown.
2. RESET signal control for SH7722 after power ON.
3. Makes use of IRQ1 to inform SH7722 Power ON/OFF events, and RTC second, minute, hour change etc.
4. Detect STATUS0 and PDSTATUS pins from SH7722 that monitor SH7722 operation status (No implemented in Rev A).
5. The R8C/26 is a slave device which is accessed by SH7722.
6. R8C/26 timer RE is used to realize real time clock.
7. Two key switch inputs with interrupt: SW3 control switches system power to ON and SW4 control switches system power to OFF.

1.3 Real-Time Clock Mode (RTC Mode)

In real-time clock mode, a 1-second signal is generated from fC4 using a divide-by-2 frequency divider, a 4-bit counter, and an 8-bit counter. Seconds, minutes, hours, and days of a week are computed based on the generated 1-second signal.

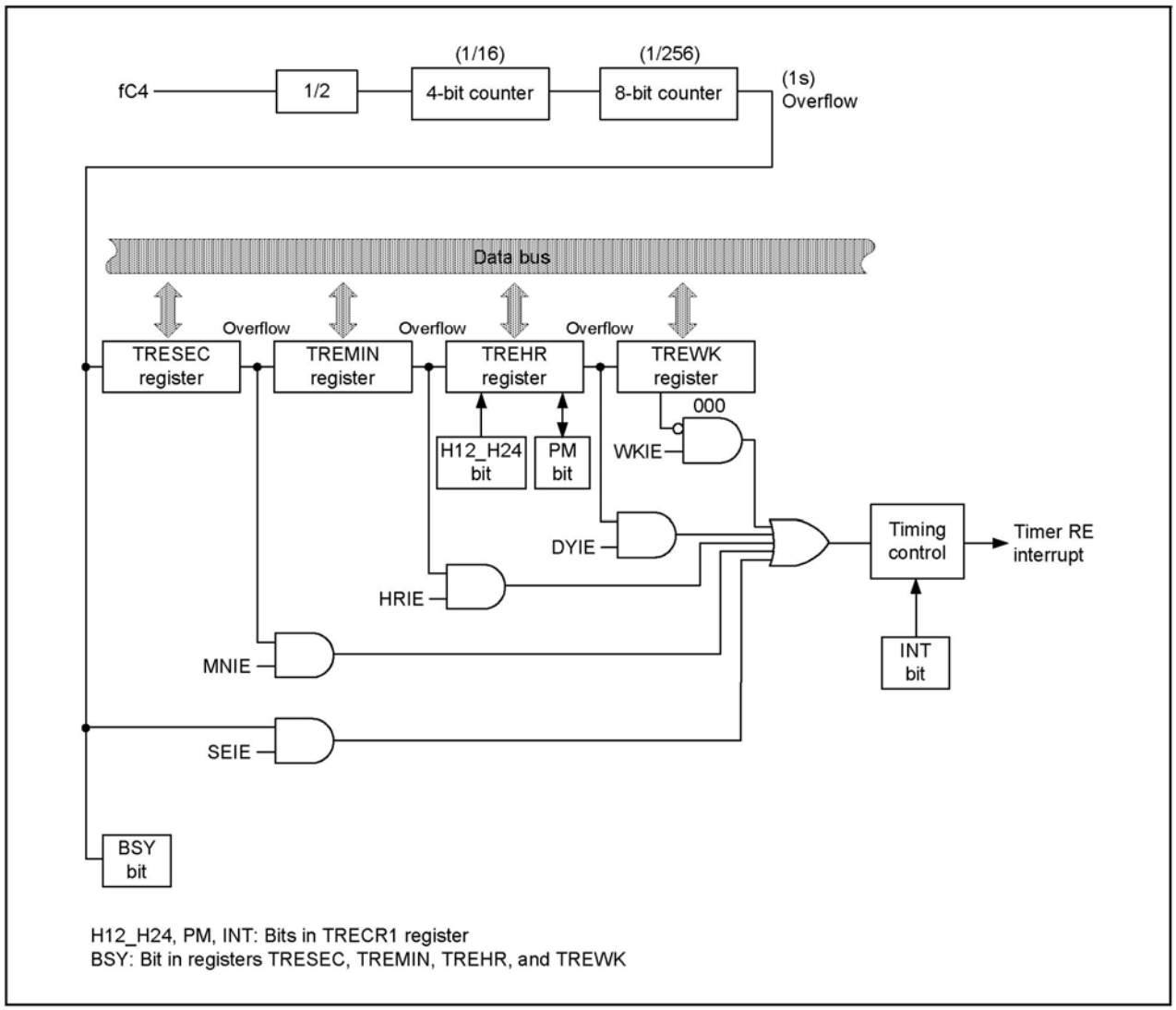


Fig 1 Block diagram of real-time clock mode

Item	Specification
Count source	fC4
Count operation	Increment
Count start condition	1 (count starts) is written to TSTART bit in TRECR1 register
Count stop condition	0 (count stops) is written to TSTART bit in TRECR1 register
Interrupt request generation timing	Select any one of the following: • Update second data • Update minute data • Update hour data • Update day of week data •When day of week data is set to 000b (Sunday)
TREO pin function	Programmable I/O ports or output of f2, f4, or f8
Read from timer	When reading TRESEC, TREMIN, TREHR, or TREWK register, the count value can be read. These values read from registers TRESEC, TREMIN, and TREHR are represented by the BCD code.
Write to timer	When bits TSTART and TCSTF in the TRECR1 register are set to 0 (timer stops), it can be written to registers TRESEC, TREMIN, TREHR, and TREWK. These values written to registers TRESEC, TREMIN, and TREHR are represented by the BCD codes.
Select function	• 12-hour mode/24-hour mode switch function

Table 1 Specifications of real-time clock mode

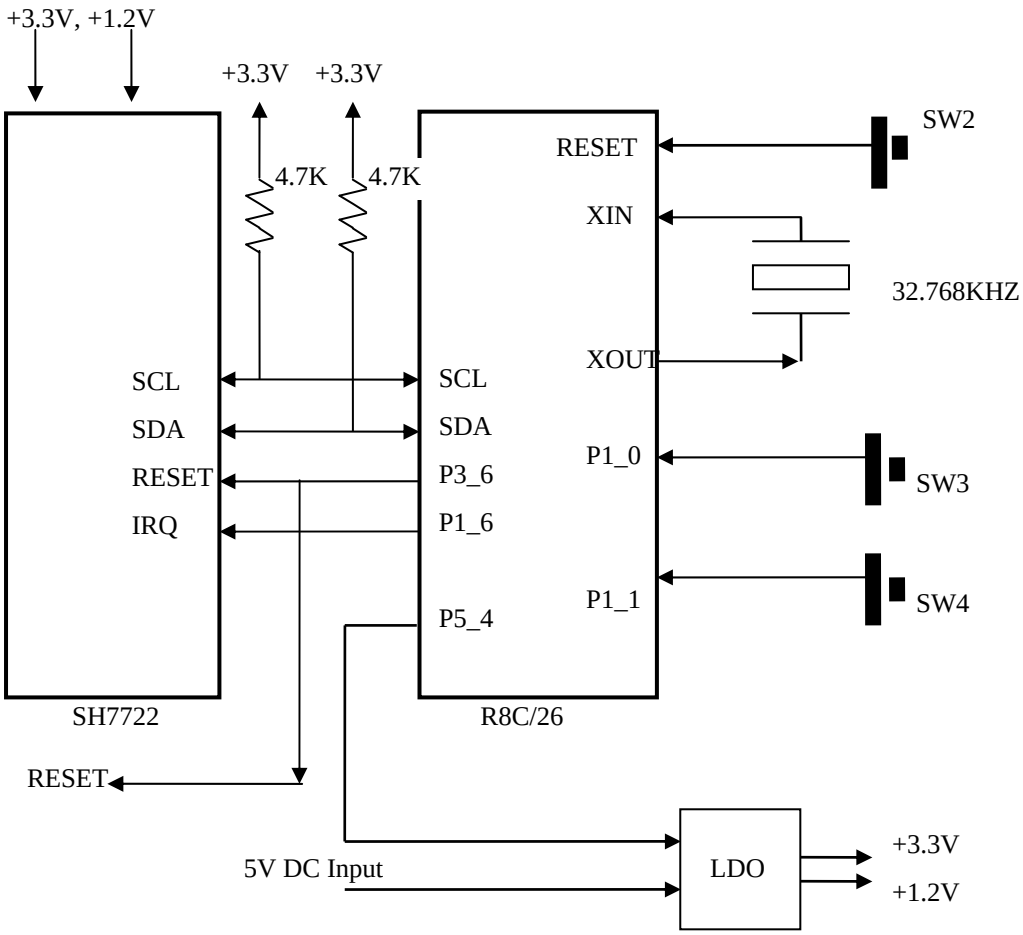
1.4 Interface with the Main Processor SH7722

The two primary uses of the R8C/26 in the MigoR Platform are power control and providing a RTC. The R8C/26 uses a host of functions to accomplish this. The power controller can perform power-on-reset, system reset, CPU shutdown, and booting. The RTC controller lets the SH7722 access a real time clock from the IIC bus directly.

After system power on, the RESET signal is asserted LOW for approximately 100ms. When SW4 is pressed, R8C/26 turns the system off. It is turned to power on and re-asserts RESET for about 10ms when SW3 is pressed. For final target application, the R8C/26 sends an interrupt to the SH7722, which can get the interrupt event code through the IIC bus and decide to enter/exit to/from standby mode. The system must always be powered. In the following example, power will be turned off when SW4 is pressed.

Real Time Clock (RTC), an internal RTC, is a function provided by R8C/26 which keeps RTC when SH7722 is powered off. Interrupt can be triggered by second, minute, or hour change events by R8C/26. The I2C bus is used to transmit the real time clock data between SH7722 and R8C/26.

The concept is shown below.



Note: R8C/26 uses I2C to connect with SH7722
R: Pull up resistance = 4.7K ohm
P3_6: GPIO Pin, power on reset from R8C/26 to SH7722
P5_4 : GPIOPin, enable LDO by sending HIGH level
IRQ: Interrupt pin for power on function
SDA: I2C series data bus
SCL: I2C series clock bus
P1_6: GPIO Pin, interrupt signal to IRQ
LDO : Low Drop Out Regulator

Figure 1 R8C/26 with the MigoR platform

2. Register Definitions in the R8C/26

The registers are allocated by R8C/26 program and accessed by the IIC bus by giving read/write command.

2.1 Device ID Definition

The R8C/26 is a slave device in the MigoR platform. The SH7263 communicates the R8C/26 by IIC through the device address ID value. Device address 0xA0 and 0XA1 are used for WRITE command and READ command, respectively.

SA6	SA5	SA4	SA3	SA2	SA1	SA0	R/W	Description
1	0	1	0	0	0	0	0	WRITE ID
1	0	1	0	0	0	0	1	READ ID

2.2 Power Control and RTC Registers

The R8C/26 is the IIC slave device, the internal register mapping is shown below:

Index (HEX)	Initial value	Register name	Read/Write	Description
0x00	0x00	SYSCFG	R/W	Configuration
0x01	0x00	SECOND	R	Timing count: Seconds
0x02	0x00	MINUTE	R	Timing count: Minutes
0x03	0x00	HOUR	R	Timing count: Hours
0x04	0x00	WEEK	R	Date count: Weeks
0x05	0x01	DAY	R	Date count: Days
0x06	0x01	MONTH	R	Date count: Months
0x07	0x07	YEAR	R	Date count: Years
0x08	0x00	ALARM MINUTE	R	Alarm setting: Minutes
0x09	0x00	ALARM HOUR	R	Alarm setting: Hours

2.3 Register Descriptions

Register SYSCFG is STATUS and CONFIGURATION. It is provided to indicate happened events in the controller and enables the interrupt source of RTC.,

SYSCFG: Bit definition in register, Register Index: 0x00, Initialized value after R8C is reseted: 0x01

Bit Number	Initial value	Read/Write	Function description
7	0	R	Event code when interrupt 0 : None 1 : Second changed 2 : Minute changed 3 : Hour changed 4 : Alarm match 5 : Power off request 6 : Power on request 7 to F , not defined
6	0	R	
5	0	R	
4	0	R	
3	0	R/W	0:Disable Alarm Match Interrupt 1:Enable Alarm Match Interrupt
2	0	R/W	0:Disable Hour Change Interrupt 1:Enable Hour Change Interrupt
1	0	R/W	0:Disable Minute Change Interrupt 1:Enable Minute Change Interrupt
0	1	R/W	0:Disable Second Change Interrupt 1:Enable Second Change Interrupt

SECOND: Bit definition in register, Register Index: 0x01, Initialize: 0x00

Bit number	Initial value	Read/Write	Function description
7	0	R	2^{nd} Digi count bit of second : 0 to 5
6	0	R	
5	0	R	
4	0	R	
3	0	R	1^{st} Digi count bit of second : 0 to 9
2	0	R	
1	0	R	
0	0	R	

MINUTE: Bit definition in register, Register Index: 0x02, Initialize: 0x00

Bit number	Initial value	Read/Write	Function description
7	0	R	2nd Digi count bit of minute : 0 to 5
6	0	R	
5	0	R	
4	0	R	
3	0	R	1st Digi count bit of minute : 0 to 9
2	0	R	
1	0	R	
0	0	R	

HOUR: Bit definition in register, Register Index: 0x03, Initialize: 0x00

Bit number	Initial value	Read/Write	Function description
7	0	R	2nd Digi count bit of hour : 0 to 2
6	0	R	
5	0	R	
4	0	R	
3	0	R	1st Digi count bit of hour : 0 to 3
2	0	R	
1	0	R	
0	0	R	

WEEK: Bit definition in register, Register Index: 0x04, Initialize: 0x00

Bit number	Initial value	Read/Write	Function description		
7	0	R	No used		
6	0	R	No used		
5	0	R	No used		
4	0	R	No used		
3	0	R	0 to 6	0: Sunday	4: Thursday
2	0	R		1: Monday	5: Friday
1	0	R		2: Tuesday	6: Saturday
0	0	R		3: Wednesday	

DAY: Bit definition in register, Register Index: 0x05, Initialize: 0x01

Bit number	Initial value	Read/Write	Function description
7	0	R	No used
6	0	R	No used
5	0	R	No used
4	0	R	1 to 31
3	0	R	
2	0	R	
1	0	R	
0	0	R	

MONTH: Bit definition in register, Register Index: 0x05, Initialize: 0x01

Bit number	Initial value	Read/Write	Function description
7	0	R	No used
6	0	R	No used
5	0	R	No used
4	0	R	1 to 12
3	0	R	
2	0	R	
1	0	R	
0	0	R	

YEAR: Bit definition in register, Register Index: 0x06, Initialize: 0x07

Bit number	Initial value	Read/Write	Function description
7	0	R	Year counter from 7 to 99, 7 stand for year 2007 to year 2099
6	0	R	
5	0	R	
4	0	R	
3	0	R	
2	0	R	
1	0	R	
0	0	R	

ALARM MINUTE: Bit definition in register, Register Index: 0x08, Initialize: 0x00

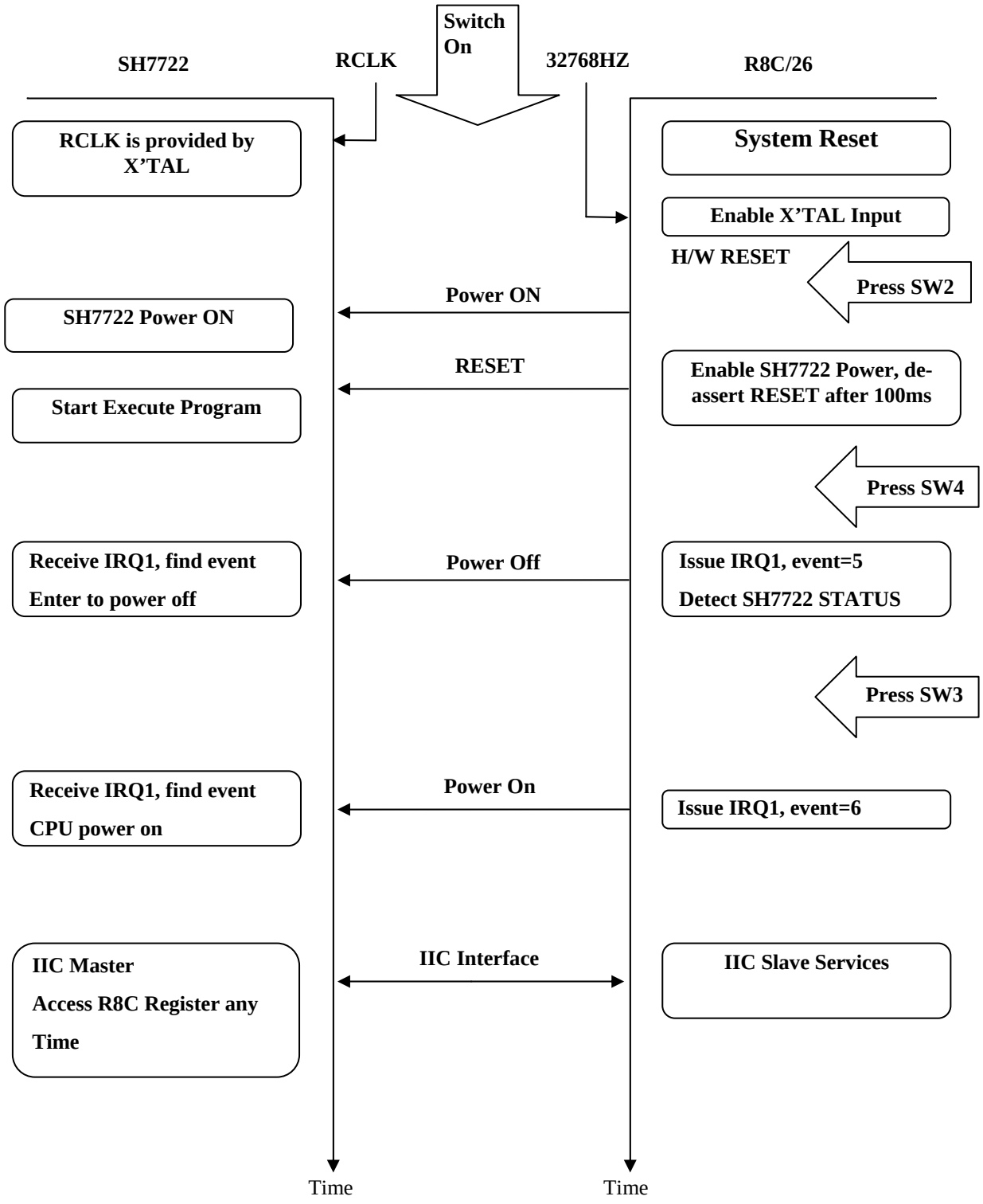
Bit number	Initial value	Read/Write	Function description
7	0	R	2^{nd} Digi count bit of alarm minute : 0 to 5
6	0	R	
5	0	R	
4	0	R	
3	0	R	1^{st} Digi count bit of alarm minute : 0 to 9
2	0	R	
1	0	R	
0	0	R	

ALARM HOUR: Bit definition in register, Register Index: 0x09, Initialize: 0x00

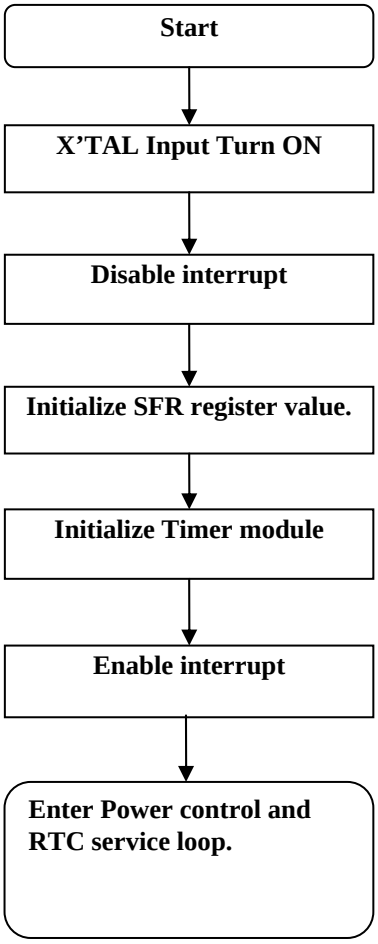
Bit number	Initial value	Read/Write	Function description
7	0	R	2^{nd} Digi count bit of alarm hour : 0 to 2
6	0	R	
5	0	R	
4	0	R	
3	0	R	1^{st} Digi count bit of alarm hour : 0 to 3
2	0	R	
1	0	R	
0	0	R	

3. Flowchart

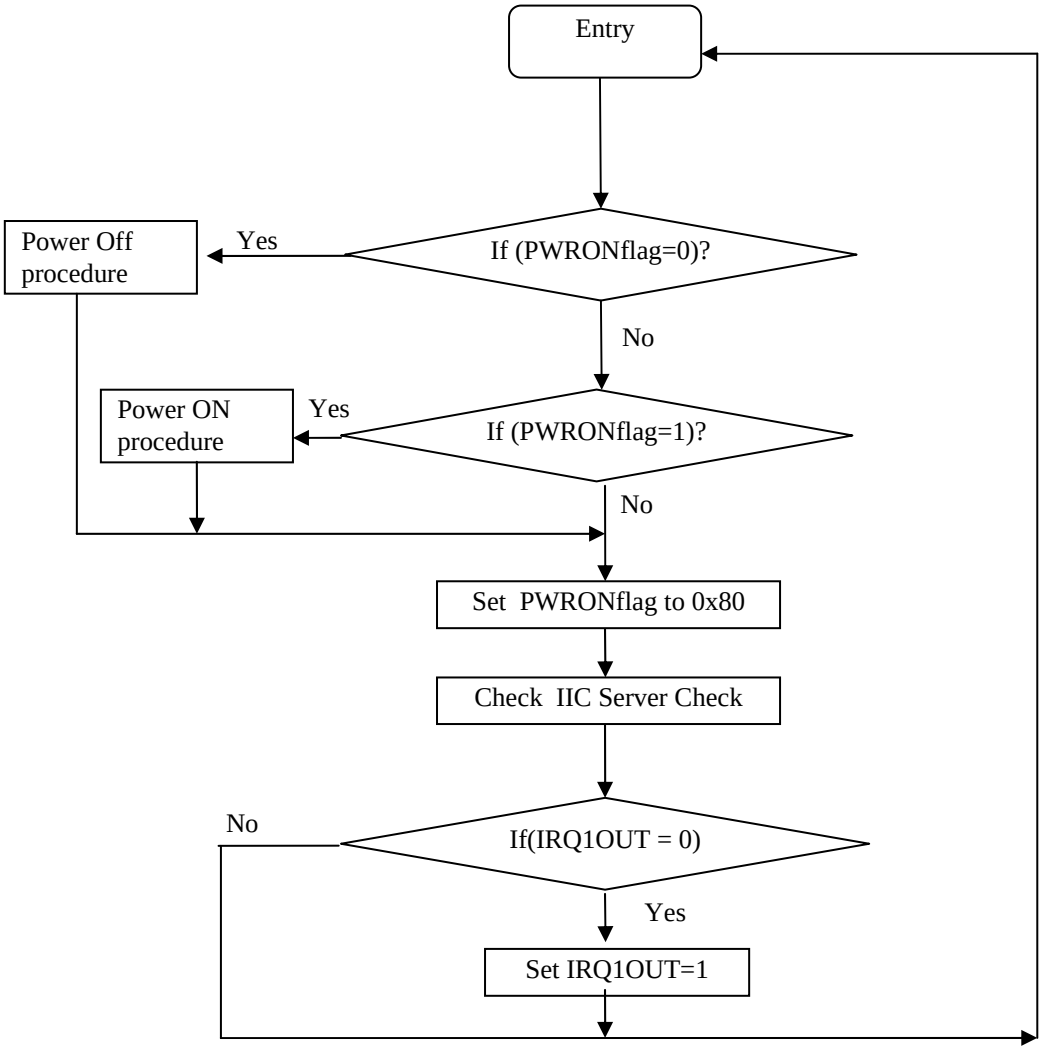
3.1 An Example of Power on/off Application Flow



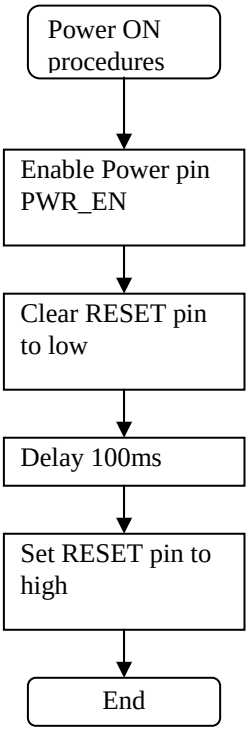
3.2 R8C/26 Power Control and RTC Main Flowchart



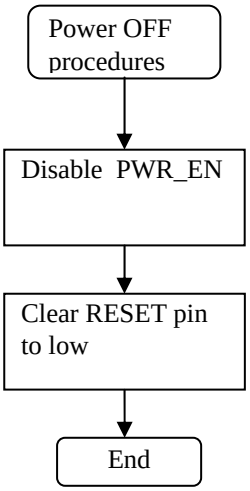
3.3 R8C/26 Power Control and RTC Service Loop Flowchart



3.4 Power on Procedure Flowchart

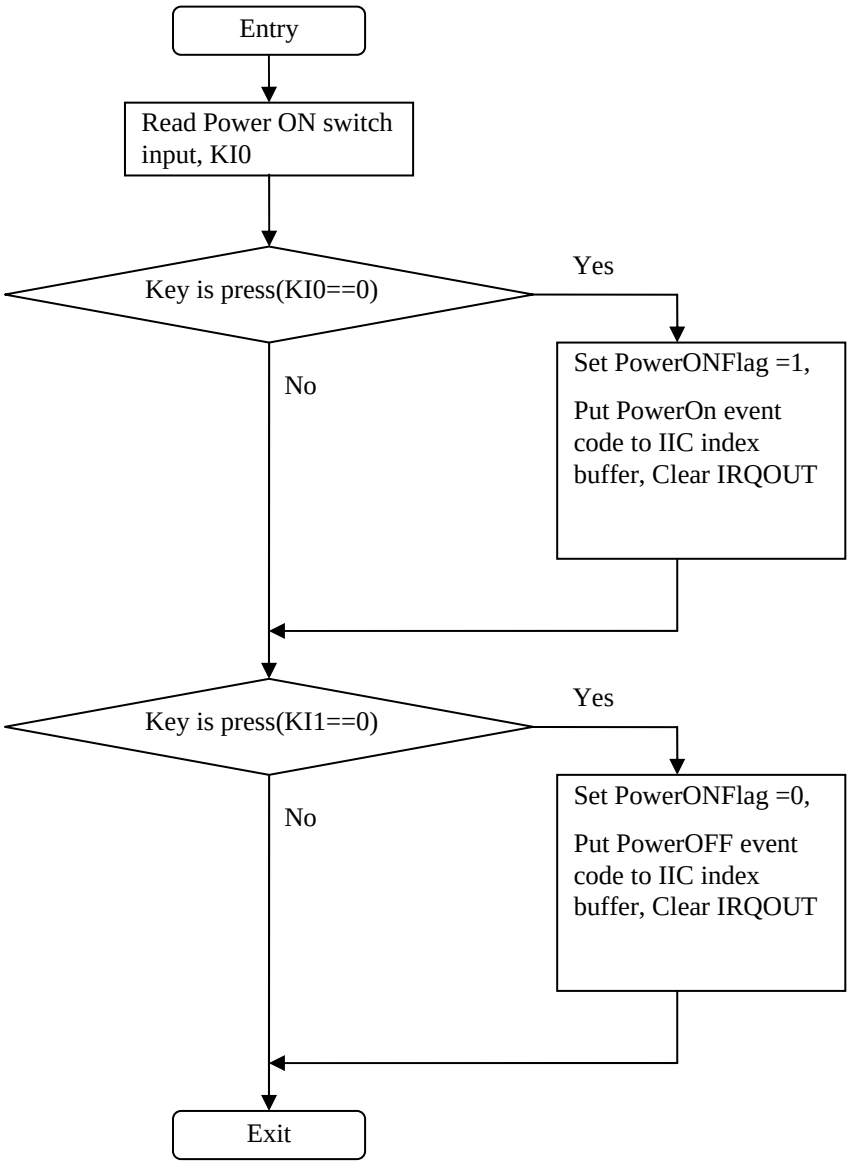


3.5 Power off Procedure Flowchart



3.6 KUPICINT()

The KupicINT() is an interrupt service routine for Input Key scan.



4. Program Code

4.1 Source File

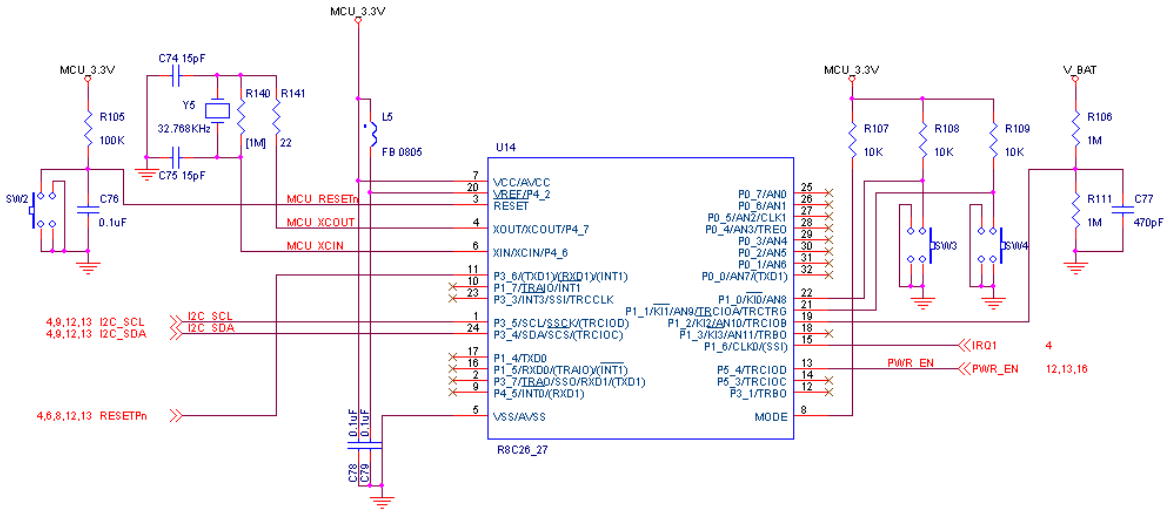
All sources files are included in a HEW (High Performance Embedded Workshop) project workspace, compressed in the file MigoR8CPCR.ZIP. After downloading the file, please extract the folder ¥MigoR8CPCR to C: ¥workspace¥MigoR8CPCR¥.

4.2 Program Source code files list

Table 4 Source File List

Number	Directory	File name	File type	Function description
1	Source\Common	Ncrt0.a30	Assembly code	Start up assembly program for R8C
2	Include	R8CMigoC.h	Header file	Header for this application
3	Source\IIC	R8C_IIC.h	Header file	Header for IIC
4	Include	Sfr_r827.h	Header file	R8C/26,R8C/27 special function register define
5	Source\Common	Sect30.inc	Assembly Including file	Assembly including file for ncrt0.a30. To applicable when using basic I/O library. To do section definition.
6	Source\RTC	R8c_RTC.c	C	Initialize RTC timer, and handle RTC timer interrupt.
7	Source\IIC	R8c_IIC.c	C	Salve IIC program. To initialize IIC component, write IIC buffer, switch and handle IIC state.
8	Source\Timer	R8c_timer.c	C	Timer component. To initialize and setup timer component.
9	Source\Common	R8CMigoC.c	C	Main Program. This is the main tutorial code. For components initialization, and interrupt handler.
10	Source\Common	Sfr_r827.inc	Assembly Including file	To definition of R8C/26 & R8C/27 Group SFR
11	Source\KeyScan	R8C_keyscan.c	C	To handle key interrupt for power control module application.

5. R8C26 Reference Circuit



6. Reference Document

Datasheet
R8C/26 Group Data sheet (R8C Tiny Series)
Download the latest version from the Renesas Technology website.

SH7722 Group Data sheet (SH-Mobile Series)
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Revision Record MigoR Platform -R8C/26 Power on Sample Code

Rev.	Date	Description Page	Summary
1.00	Oct.31.08		First edition issued

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