FA95/VA95
RTC Power Control
Application Note

V1.0

Publication Release Date: Mar. 2011

Support Chips:

W55FA Series

Support Platforms:

Non-OS

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1. Introduction

FA95 RTC provides a power control function for system power control. The application note describes the function in detail.

2. Power Control Function

2.1. Power Control Function Overview

RTC Power Control supports power on and power off functions:

Power On

FA95 can be power on by Power Key or RTC alarm.

Power Off

RTC provides three modes to Power off.

- Hardware Force Power Off
  Hardware Force Power Off function is to power off system by holding the power key about the specified period even when software crash.
- Software Force Power Off
  When Power Key is pressed, system can be power off by software.
- Software Power off
  When Power Key is released, system can be power off by software.

2.2. Preliminary Definition

Power Key (PWRKEY)

PWRKEY is the power key for user to power On/Off system power except RTC power.

Power Control Signal (PWCE)

PWCE is the power control signal to control the power control unit.

Power Key Status (PWR_KEY)

Power Key Status
- 1: Indicated the power key status is high
- 0: Indicated the power key is pressed to low.

Software Status (SW_STATUS)

RTC provides 8 bits to store software information. (It will be cleared by IBR).

Hardware Force Power Off Enable (HW_PCLR_EN)

RTC provides a Hardware Force Power Off function to power off system by holding the power key about the specified period even when software crash. The bit is to enable the Hardware Force Power Off function. (It will be clear by IBR)

Hardware Force Power Off Period (PCLR_TIME)

If user holds the power key about the specified period, the system will be power off. The following table is the period setting. (It will be clear by IBR)

Setting	Hold Time to power off	Setting	Hold Time to power off
0	Power off right away	**8**	7~8 second
1	0~1 second	**9**	8~9 second
2	1~2 second	**10**	9~10 second
3	2~3 second	**11**	10~11 second
4	3~4 second	**12**	11~12 second
5	4~5 second	**13**	12~13 second
6	5~6 second	**14**	13~14 second
7	6~7 second	**15**	14~15 second

Power on (PWR_ON)

The bit is used to control PWCE to control system power.
- PWCE will change to high state when this bit changes from 0 to 1 and the Power Key is pressed.
- PWCE will change to low state when this bit changes from 1 to 0 and the Power Key is released.

Power-down Mode

Whole system is power-off except RTC.

Delay Power Control Signal (RPWR_DELAY)

The delay time between Power Key pressed and PWCE high (or Power Key released and PWCE low)

- **3'b000: no change**

- **3′b001: delay 62ms~124ms**
- **3′b010: delay 124ms~248ms**
- **3′b011: delay 186ms~372ms**
- **3′b100: delay 248ms~496ms**
- **3′b101: delay 310ms~620ms**
- **3′b110: delay 372ms~744ms**
- **3′b111: delay 434ms~868ms**

Interrupt Enable & Status

RTC provides three interrupts (They can't keep when Power-down Mode)

- Alarm Interrupt (AIER & AI)
- Time Tick Interrupt (TIER & TI)
- Power Switch Interrupt (PSWIER & PSWI)
  It indicates that the Power Key has been pressed.

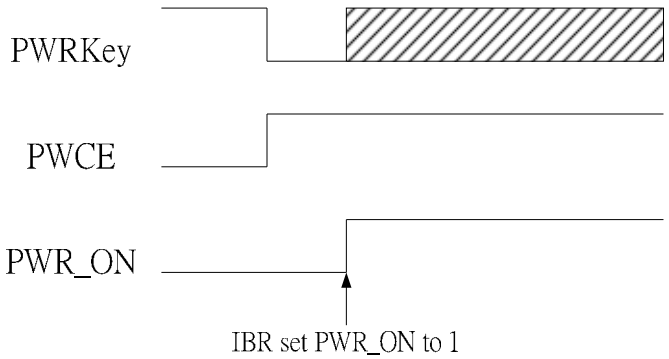
2.3. Power Control Flow

2.3.1. System Power On Control Flow

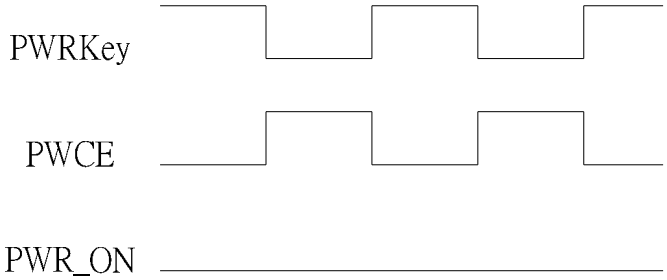
Two ways to power on system:

Power On from Power Key

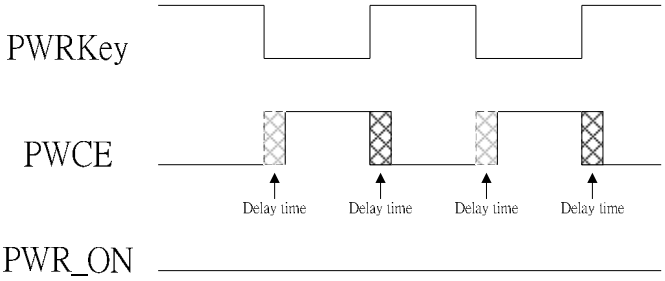
User presses the Power Key to make the Power Control Signal, PWCE to high. If PWR_ON bit is set, the Power Key can be released and the PWCE will be keep on. When system is power on, IBR will set PWR_ON first.



If PWR_ON doesn't be set to 1, the PWCE will back to low when the Power Key is released.



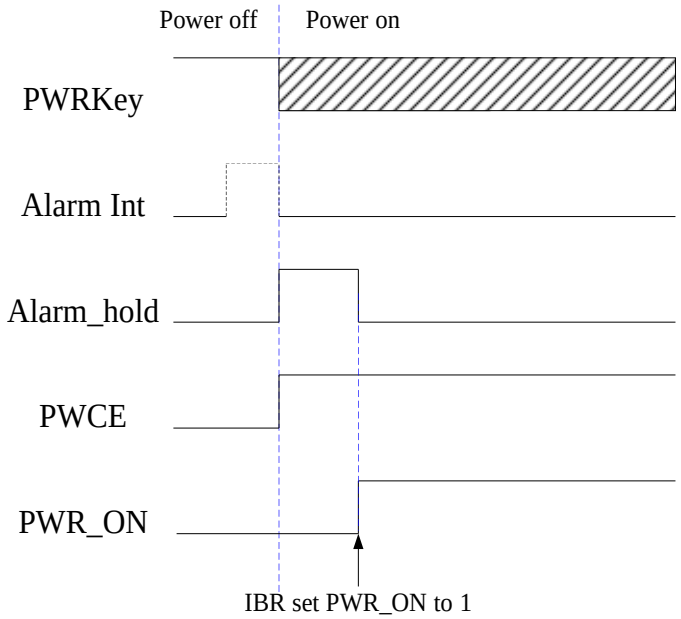
And RTC supports a function (**RPWR_DELAY**) to postpone the time to set PWCE to high when pressing Power Key or to postpone the time to set PWCE to low when releasing Power Key. The delay time is from 62ms to 868ms. The function is default disabled. User can enable it after first power on and the setting can be kept when RTC is powered even whole system is power-off.



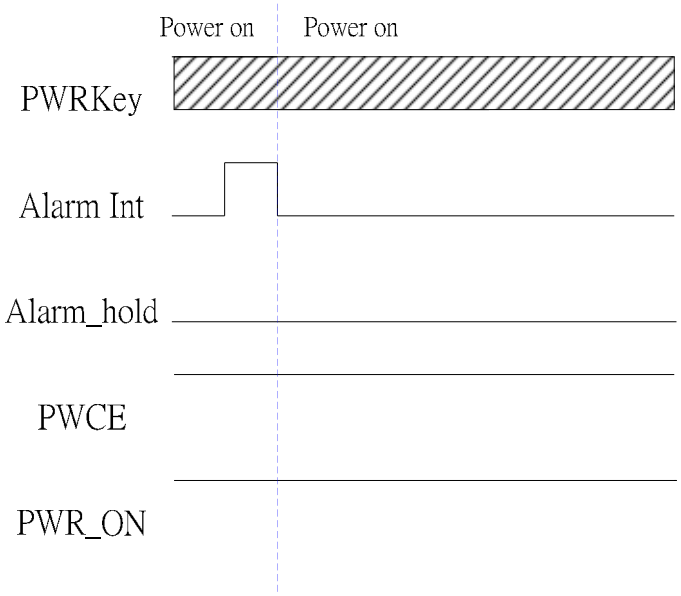
[Note] The function (**RPWR_DELAY**) only works only when Power Key is pressed or released.

Power On from RTC Alarm

In Power-down mode, if RTC alarm occurs, RTC keeps an internal Alarm_hold signal to force the PWCE to high. After PWR_ON is set, the Alarm_hold signal is clear and PWCE is released, then PWCE keeps on by PWR_ON. When system is power on, IBR will set PWR_ON first.

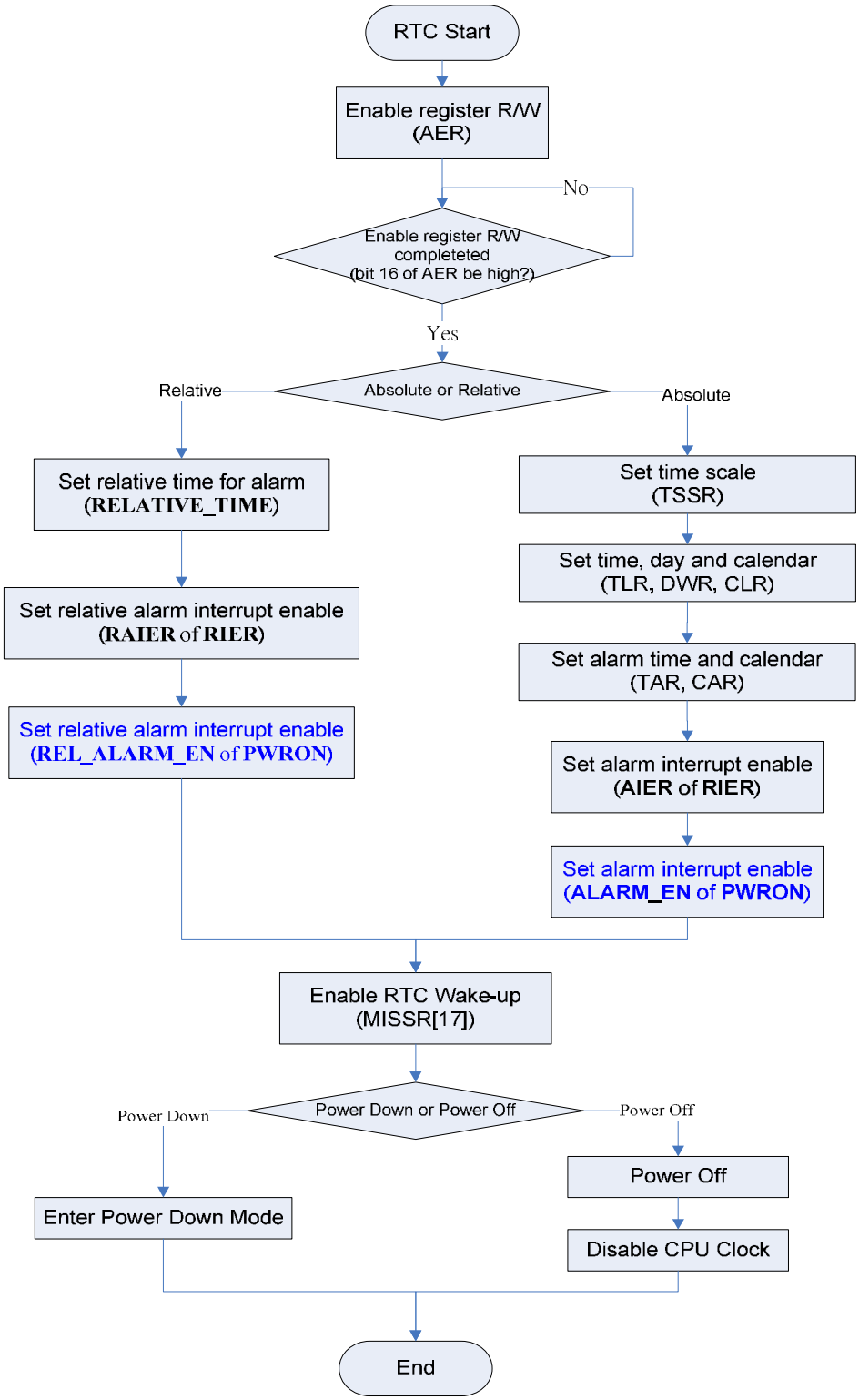


In normal mode, if RTC alarm occurs, the Alarm_hold signal isn't set. Therefore, PWCE doesn't force to high by Alarm_hold.



[Note1] Alarm_hold is set only when PWR_ON is low.
[Note2] If user doesn't want to power on by RTC Alarm, user must let the alarm condition can't be reached to avoid false wakeup. Ex, Clear the alarm time.

The Power down Wakeup from RTC alarm programming flow is as follows.



[Note1] If user won't enable wakeup function, please don't enable the alarm enable bit of **PWRON (REL_ALARM_EN or ALARM_EN)**

Power On Source Judgment

Because the interrupt status flag can't keep in Power-down Mode, user can't use interrupt flag to determine which Power on Source is. The way to confirm it is to check the RTC Alarm time and Current time right after IBR. If they aren't the same (or close), system is power-on from Power Key. The following table is all the cases of Power on Source.

Power Key Status	Time Match	Power on Source
Pressed	No	Power Key
Pressed	Yes	Power Key and RTC Alarm
Released	No	Reset Key/WDT Reset/Power on Exception
Released	Yes	RTC Alarm

Power On Exception

When user removes FA95's battery and put it back later, FA95 will be power on automatically without Power Key pressed or RTC Alarm (like user presses the reset button). Using the above-mentioned condition, we can let FA95 power off in the situation. And the way to differentiate between Reset and Power Exception (ex. Removing FA95's battery) is to write a specific key word in DRAM or SRAM when FA95 is power on and clear it when FA95 is power off normally.(Data in SRAM or DRAM will be lost when FA95's power is off)

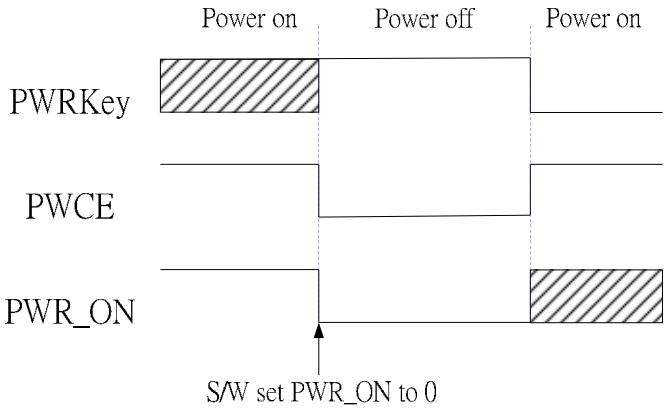
	Specific Key word	Power on source	Software action
Hardware or Software Power Off	Unknown value	Power Key or RTC Alarm	Keep Power On
Reset/WDT	Not Changed	N/A	Keep Power On
Power on Exception	**Unknown value**	**N/A**	**Power off**

2.3.2. System Power Off Control Flow

There are two modes to power off system.

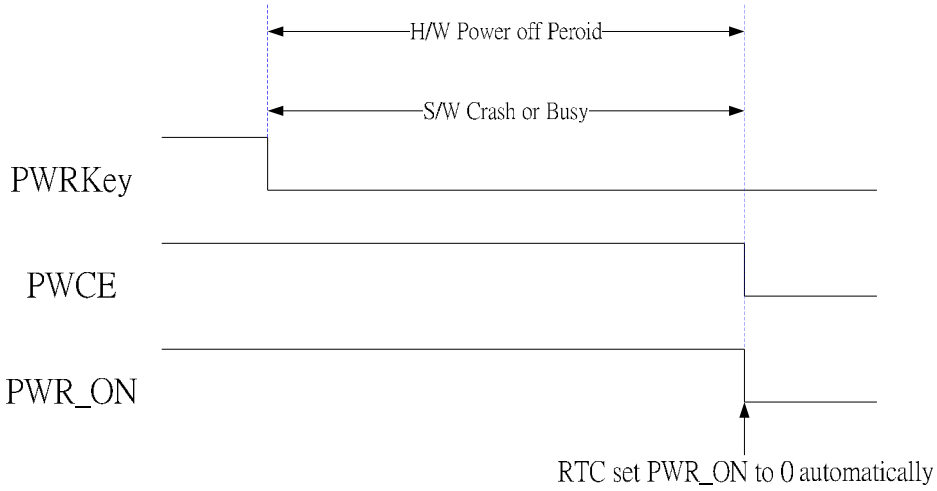
Software Power Off

If user wants to power off system, ex. Specified time to power off or user press power key to power off system, user must set PWR_ON to 0 to power off system any time he wants.



Hardware Force Power Off

RTC provides a Hardware Force Power Off function to power off system even when software crash. After enabling the function (HW_PCLR_EN), if user holds the power key about the specified period, the system will be power off.



2.4. Power Control Flow Truth Table

Here is the Power Control Flow Truth Table except the force mode.

Step	Input				Output	Note
	X1	X2	X3	X4	Y	
	PWRKey	PWR_ON	RST_	Alarm-hold	PWCE	

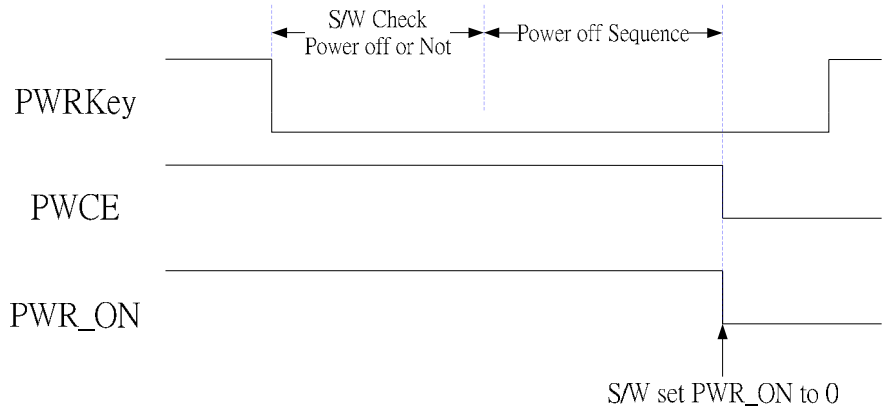
Power key control flow						
0	1	0	0	0	0	RTC powered only (Default state)
1	0	0	X	0	1	Press key, Power On
2	0	1	1	0	1	keep key pressed & S/W Set X2, Power On
3	1	1	1	0	1	Release key, Power keep On
4	0	1	1	0	1	Press key, get INT, intend to power Off
5	1	0	1	0	0	Release key & S/W clean X2, power Off Or S/W clean X2 , don't need press key, power off
Reset						
0	X	1	0	0	1	RST_ active, still keep power when X2=1
Alarm flow						
0	1	0	0	0	0	RTC powered only (Default state)
1	1	0	X	1	1	Alarm
2	1	1	1	0	1	IBR set X2

PWCE (open drain output) = /PWRKEY + Alarm-hold + /PWR_ON when HW_PCLR_EN=0
X1, internal pull-up
X2, it is R/W able
X4, internal signal. Will be 1 after alarm if X2=0, and be cleared after X2 set.
There is Interrupt from key be pressed

2.5. Power off Flow Example

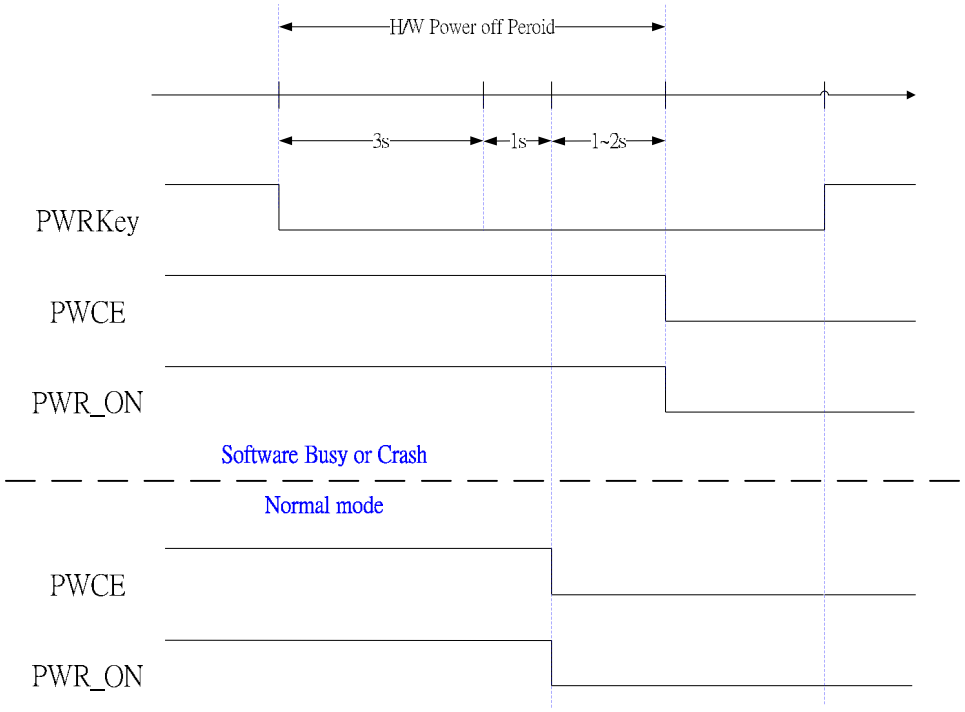
Normal Power Off Flow

When user gets the Power Switch Interrupt, user can decide to do the power off sequence or not to do it. If the Power off sequence is done, user can set PWR_ON to 0 to power off system right away.



Software Busy/Crash Power Off Flow

- The example sets the Hardware Power off period as 6 seconds.
- It takes 3 seconds to decide to do the power off sequence or not to do it.
- It takes 1 second to do power off sequence.



3. Revision History

Version	Date	Description
V1.0	Oct. 17, 2011	▪ Created

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