



# **I2C 2005-1 Demonstration Board**

## **Real Time Clock (RTC)**

Oct, 2006

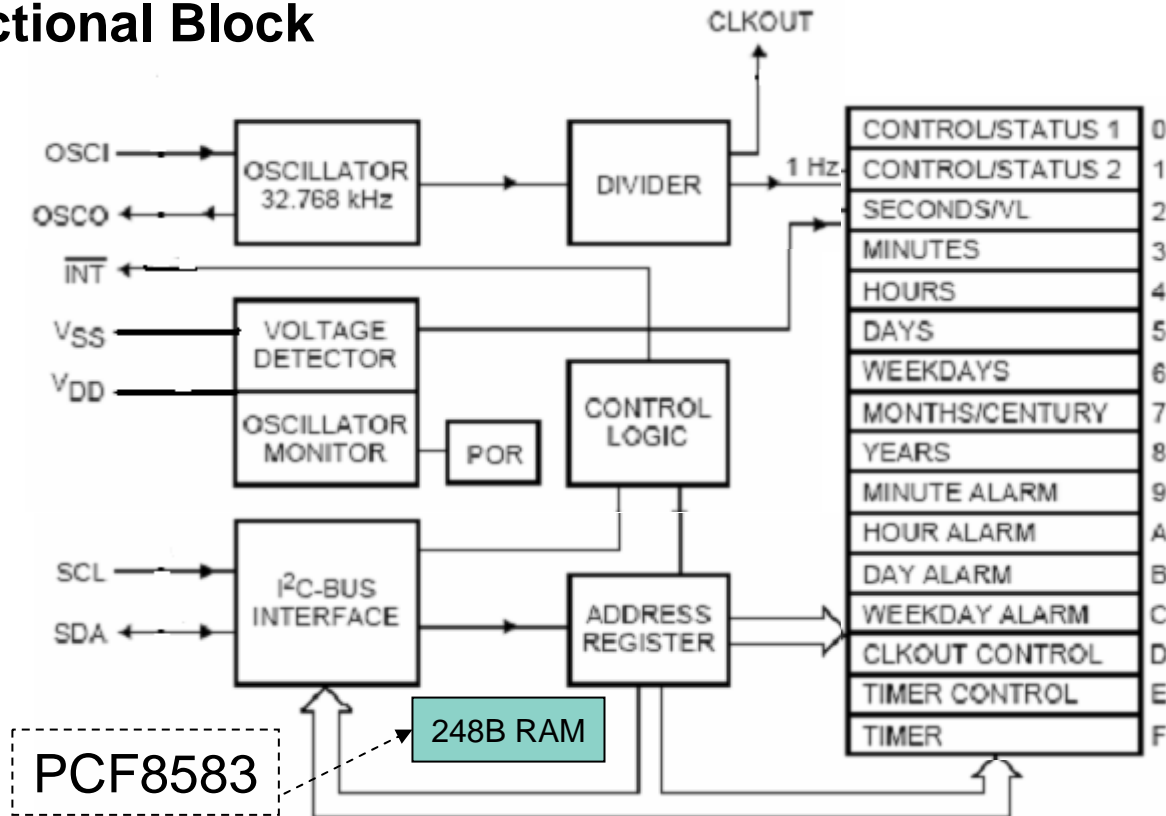
# PCF8563 Real Time Clock



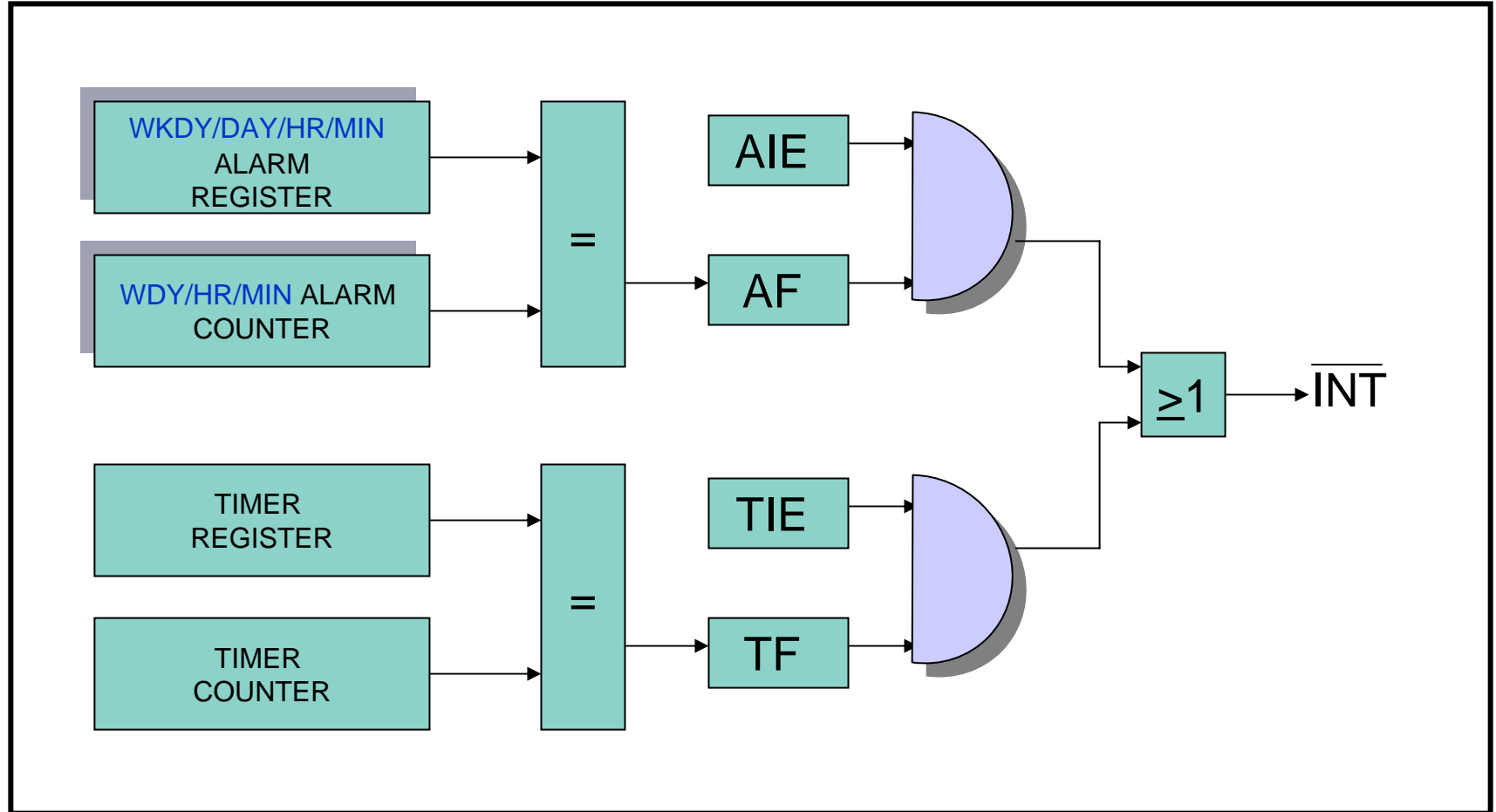
- ▶ Provide years, months, weekdays, days, hours, minutes, seconds based on 32 kHz quartz crystal
- ▶ Support ALARM (minutes, hours, days and weeks) and TIMER modes
- ▶ Open drain interrupt output for ALARM and TIMER
- ▶ Century flag
- ▶ Operating voltage ranges from 1.8 V to 5.5 V
- ▶ 0.25  $\mu$ A backup current at 3 V and 25 °C
- ▶ Support 100 kHz (PCF8583) and 400 kHz I<sup>2</sup>C interface
- ▶ Programmable clock output (32.768 kHz, 1024 Hz, 32 Hz, 1 Hz)
- ▶ Integrated oscillator capacitor
- ▶ Integrated 248 Byte RAM (PCF8583)

# PCF8563 Block Diagram

## Functional Block



# ALARM & TIMER INTERRUPT



# RTC Selection Table

| Features                             | PCF8563           | PCF8573             | PCF8583             | PCF8593            |
|--------------------------------------|-------------------|---------------------|---------------------|--------------------|
| I <sup>2</sup> C-bus interface speed | 400kHz            | 100kHz              | 100kHz              | 100kHz             |
| Scratch pad RAM                      | 0                 | 0                   | 248 Bytes           | 0                  |
| Years and leap year tracking         | yes               | no                  | yes                 | yes                |
| Year counter                         | 2 digit +1 bit    | no                  | 2 bit               | 2 bit              |
| 1/10, 1/100 s counter                | no                | no                  | 10ms                | 10ms               |
| Programmable alarm                   | yes               | yes                 | yes                 | yes                |
| Low voltage detector                 | yes               | no                  | no                  | no                 |
| Supply voltage for I2C-bus           | 1.8 – 5.5V        | 2.5– 6.0V           | 2.5– 6.0V           | 2.5– 6.0V          |
| Supply voltage for clock             | 1.0 – 5.5V        | 1.1–6.0V            | 1.1–6.0V            | 1.1–6.0V           |
| Typical power consumption            | 250nA @<br>VDD=1V | 3µA@1.5V<br>12µA@5V | 2µA@1.0V<br>10µA@5V | 1µA@2.0V<br>4µA@5V |
| Packages                             | DIL/SO8<br>TSSOP8 | DIL/SO16            | DIL/SO8             | DIL/SO8            |

# Real Time Clock Applications

E-metering Timestamp



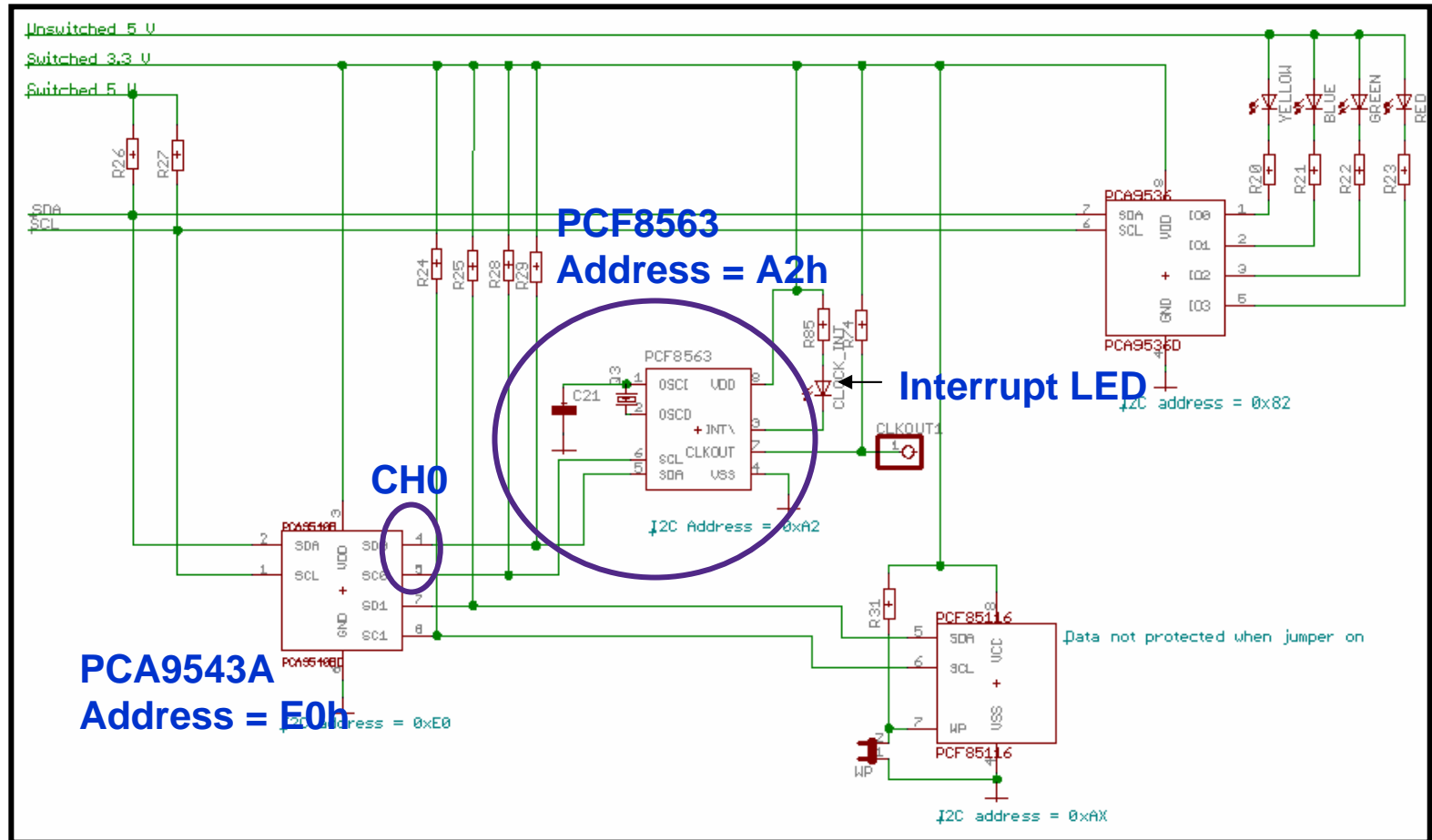
Clock



Digital Timer & Calendar



# PCF8563 Training Board Schematic



# PCF8563 – Software GUI

Timer & Alarm Control/Status      Clock      Calender

Alarm Clock

Reset      Timer      Clock output control

**Win-I2CUSB Lite - [PCF8563 Real time clock/calendar]**

File Device Options Window Help

| Name              | Value |
|-------------------|-------|
| 00 control/status | 00    |
| 01 control/status | 00    |
| 02 seconds        | 17    |
| 03 minutes        | 49    |
| 04 hours          | 17    |
| 05 day            | 12    |
| 06 weekdays       | 06    |
| 07 month/century  | 05    |
| 08 years          | 06    |
| 09 minute alarm   | 80    |
| 0A hour alarm     | 80    |
| 0B day alarm      | 92    |
| 0C weekday alarm  | 86    |
| 0D CLKOUT control | 80    |
| 0E timer control  | 03    |
| 0F timer          | FF    |

Active Register = 0x00

Read Register Write Register

Read All Write All

Auto ☐ Reset

**Control/Status 1**

TEST1 ☐ STOP ☐ TESTC ☐

**Control/Status 2**

TI/TP ☐ AF ☐ TF ☐ AIE ☐ TIE ☐

**CLKOUT control**

Frequency 32.768 kHz

CLKOUT active ☒

**Timer Control**

Countdown Frequency 1/60 Hz

Timer Disabled ☐ Timer (hex) FF

**Clock Time**

Hour Min. Sec

17:49:17

Read Time Cyclic Read Start

Clock integrity not guaranteed ☐

**Clock Date**

Month Day Year

5 12 2006

FRI

Read Date

**Set Alarm Time**

Hour Min.

00:00

Minute Alarm Disabled ☒ Hour Alarm Disabled ☒ Day Alarm Disabled ☒ Weekday Alm Disabled ☒

**Alarm Date**

Day

12

FRI

Hardware Not Detected 3.3V off 5.0V off



# PCF8563 Alarm Mode Exercise

1. Click on the reset push button to reset alarm, timer, clock and calendar
2. Alarm mode: Minute, hour, day, or week
3. Click on the cyclic read push button
4. Select the alarm minute enable checkbox
5. Select the alarm interrupt enable (AIE) checkbox
6. Set alarm to 1 minute
7. Do a “write all” on the screen to update the register
8. What do you see when the clock time reaches 1 minute?
  - Interrupt is asserted and interrupt LED is on
  - Alarm flag (AF) status bit is set
9. Clear AF (by uncheck the box and do a “Write All”)

# PCF8563 Timer Mode Exercise

1. The timer has a selectable count down frequency ranging from 1/64Hz to 4096 Hz, and an 8-bit or 256 count down value
2. Chose 1 Hz (1 sec) timer count down frequency
3. Program a count down value of 12
4. Select timer interrupt enable (TIE) checkbox
5. Enable timer
6. Perform a “ write all “ command
7. Wait for 12 seconds, read the status register, and observe the Interrupt LED light
8. What happens to TF and LED?
  - TF is set
  - LED is ON

