NXP real-time clock/calendars with SPI or I²C-bus interfaces PCF2124, PCA2125, PCF8563, PCA8565, and PCF8583

Real-time clocks for low power, high temps, or scratch-pad memory

Designed for a range of demanding applications, these real-time clocks/calendars are driven by a low-power 32.768-kHz quartz oscillator, use the SPI or I²C-bus for serial data transfer, and typically consume less than 1 µW of power.

Key features

- 32.768-kHz quartz crystal
- Resolution: seconds, minutes, hours, weekday, day, month, year
- Clock operating voltage: 1.2 to 5.5 V
- Low backup current: 0.5 µA (typ) at V_{DD} =1.8 and Tamb = 25 °C
- Three-line SPI with separate data I/O
- Serial interface: 0 to 4.3 MHz at V_{DD} = 1.8 to 2.7 V, 7 MHz at V_{DD} > 2.7 V
- Interrupt outputs for one second or one minute
- Freely programmable timer and alarm functions, each with interrupt capability
- Freely programmable Watchdog™ timer
- Integrated oscillator capacitor
- Internal power-on reset
- Open-drain interrupt pin

Applications

- Timing
- Time measurement
- Clock calendar
- Industrial control
- Power-management units (PMUs)
- Metering
- Time reference

Each of these CMOS-based, real-time clock/calendars uses a low-power 32.768-kHz quartz oscillator to provide clock and calendar functions. The calendar functions track year, month, date, and day with built-in century and leap-year flags.

The clock functions track hour, minute, second, and hundredth of a second in 12- or 24-hour format. Programmable alarm settings and universal timer functions increase flexibility.

A typical power consumption of less than 1 µW means all of these real-time clocks (RTCs) can be powered by a very small battery cell or a small super-cap. And, because they're housed in tiny packages (TSSOP HVSON), they fit nearly anywhere.

The product line includes the following:

- NXP real-time clock/calendar with SPI interface PCF2124 for low-power applications
- NXP real-time clock/calendar with SPI interface PCA2125 for high-temperature applications
- NXP real-time clock/calendar with I²C-bus interface PCF8563 for low-power applications

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- NXP real-time-clock/calendar with I²C-bus interface PCA8565 for high-temperature applications
- NXP real-time clock/calendar with I²C-bus interface PCF8583 where additional scratch pad RAM is required

Addresses and data are transferred serially via an SPI bus with a maximum speed of 7.0 Mbps (PCF2124, PCA2125) or via a two-line, bidirectional I²C-bus that operates at a maximum speed of 400 kbps (PCF8563 and PCA8565) or 100 kbps (PCF8583). The built-in word address register is incremented automatically after each data byte is written or read.

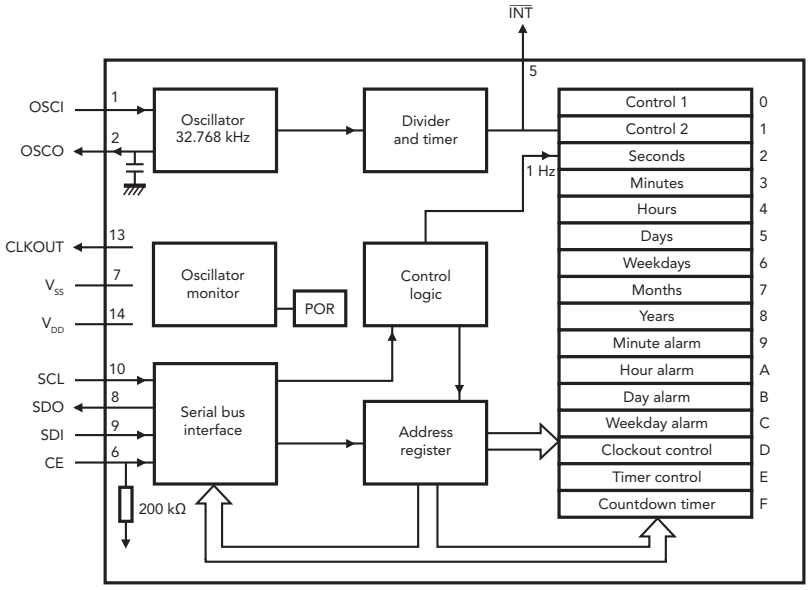
With the PCF8583, the address pin A0 is used to program the software address, so two devices can be connected to the bus without additional hardware.

Each RTC has an internal power-on reset and a programmable clock output with open drain configuration to drive peripheral devices. A low-voltage detector (not included on the PCF8583) ensures the integrity of all clock functions.

Power consumption is kept to a minimum in all the devices. The PCF2124 and PCF8563, optimized for battery-powered applications, consume as little as 250 nA at 3 V.

The PCA8565 and PCA2125 oscillator operates over a wider temperature range (125 °C maximum) and is suitable for use in the harsh environments found within automobiles. Power consumption remains low — only 700 nA at 2 V.

All the clocks have ESD protection that exceeds 2,000 V HBM per JESD22-A114, 200 V MM per JESD22-A115, and 1,000 V CDM per JESD22-C101. Latch-up testing, performed in accordance with JEDEC Standard JESD78, exceeds 100 mA.



PCF2124 and PCA2125 block diagram

Selection guide

Characteristic	PCF2124	PCA2125	PCF8563	PCA8565	PCF8583
Interface	SPI	SPI	I²C-bus	I²C-bus	I²C-bus
Interface speed	7 MHz	7 MHz	400 kHz	400 kHz	100 kHz
Clock/calendar function	•	•	•	•	•
Alarm, timer functions	•	•	•	•	•
Low-voltage detection	•	•	•	•	
Power consumption	250 nA @ 3 V	550 nA @ 2 V	250 nA @ 3 V	700 nA @ 3 V	1 µA @ 1 V
Temperature range	-40 to +85 °C	-40 to +125 °C	-40 to +85 °C	-40 to +125 °C	-40 to +85 °C
Additional RAM					240 bytes

Packaging information

Package	Tube (112)	Tape and reel (118)
DIP 8	PCF8563P, PCF8583P	Not available
SO	PCF8563T, PCF8583T	PCF8563T, PCF8583T
TSSOP8	PCF8563TS, PCA8565TS	PCF8563TS, PCA8565TS
TSSOP20	PCF2124TS, PCA2125TS	PCF2124TS, PCA2125TS
HVSON10	PCF8563BS, PCA8565BS	PCF8563BS, PCA8565BS
HVQFN20	PCF8583BS, PCF2124BS	PCF8583BS, PCF2124BS

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