Features

- Provides year, month, day, weekday, hours, minutes, and seconds based on a 32.768 kHz quartz crystal
- Century flag
- Clock operating voltage: 1.0 V to 5.5 V at room temperature
- Low backup current; typical 0.25 μA at V_{DD} = 3.0 V and Tamb = 25 ˚C
- 400 kHz two-wire I^2C-bus interface (at V_{DD} = 1.8 V to 5.5 V)
- Programmable clock output for peripheral devices (32.768 kHz, 1.024 kHz, 32 Hz, and 1 Hz)
- Alarm and timer functions
- Integrated oscillator capacitor
- Internal Power-On Reset (POR)
- I^2C-bus slave address: read A3h and write A2h
- Open-drain interrupt pin

Description

The PCF8563 is a CMOS Real-Time Clock (RTC)and calendar optimized for low power consumption. A programmable clock output, interrupt output, and voltage-low detector are also provided. All addresses and data are transferred serially via a two-line bidirectional I^2C-bus. Maximum bus speed is 400 kbit/s. The register address is incremented automatically after each written or read day tabte.

Applications

- Mobile telephones
- Portable instruments
- Electronic metering
- Battery powered products

Block Diagram

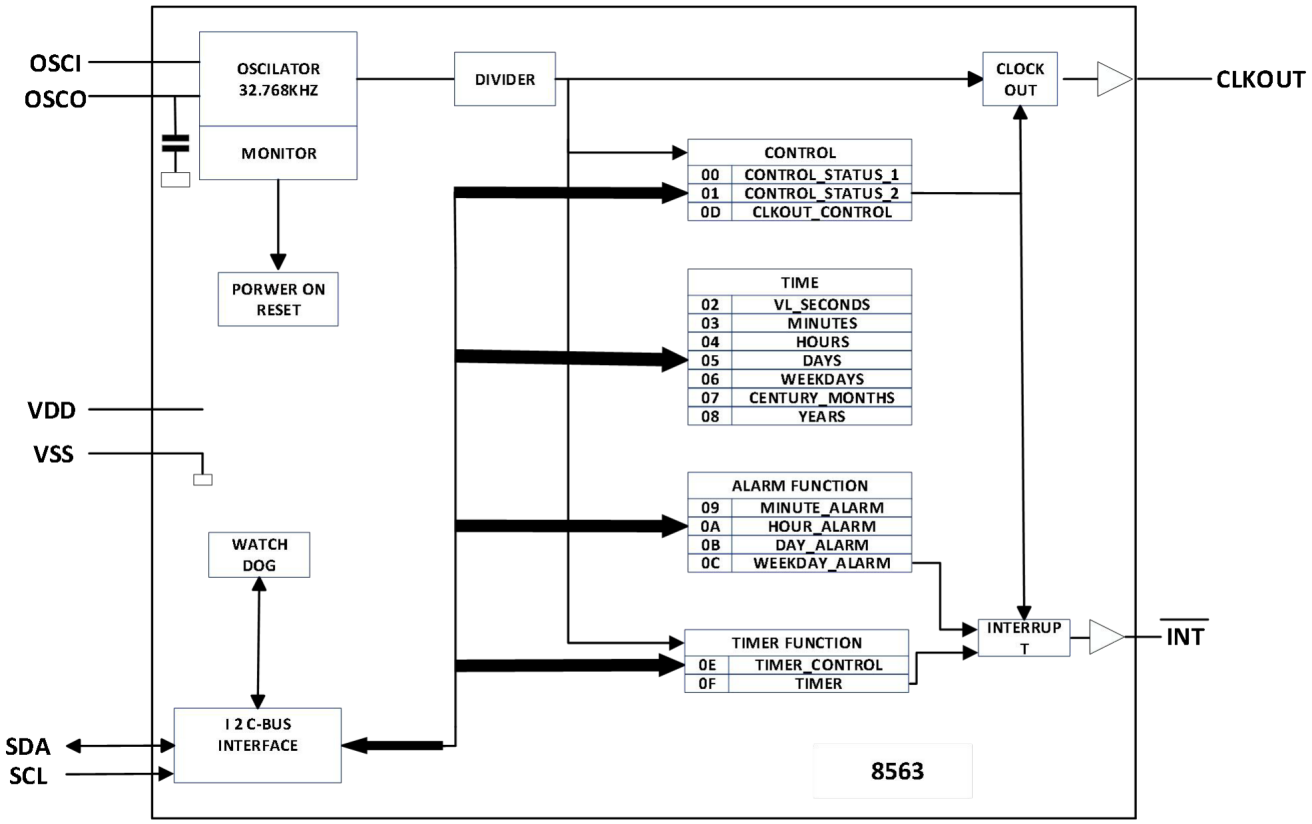


Figure 1. Block diagram of PCF8563

Pinning Information

5.1 Pinning

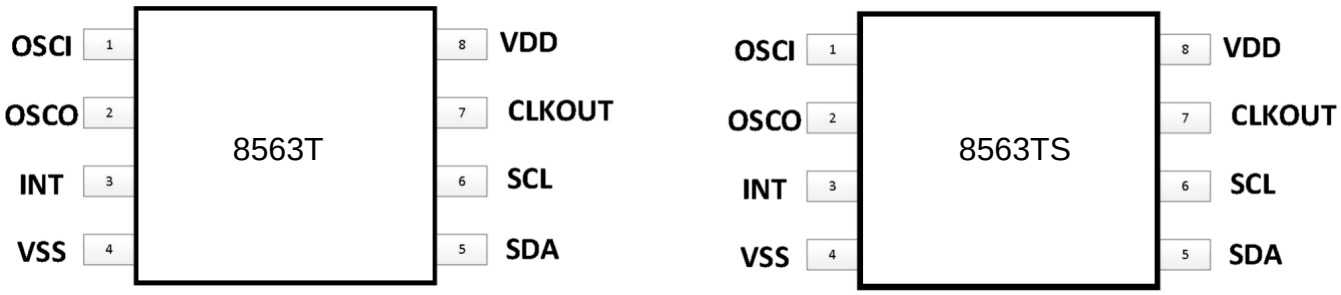


Figure 2. Pin configuration for PCF8563

Pin Description

Table 1. Pin description

SYMBOL	PIN		DESCRIPTION
	MSOP8	SOP8	
OSCI	1	1	oscillator input
OSCO	2	2	oscillator output
INT	3	3	interrupt output (open-drain; active LOW)
V_{SS}	4	4	ground
SDA	5	5	serial data input and output
SCL	6	6	serial clock input
CLKOUT	7	7	clock output, open-drain
V_{DD}	8	8	supply voltage
n.c.	-		not connected; do not connect and do not use as feed

[1] The die paddle (exposed pad) is wired to V_{SS} but should not be electrically connected.

Internal Circuitry

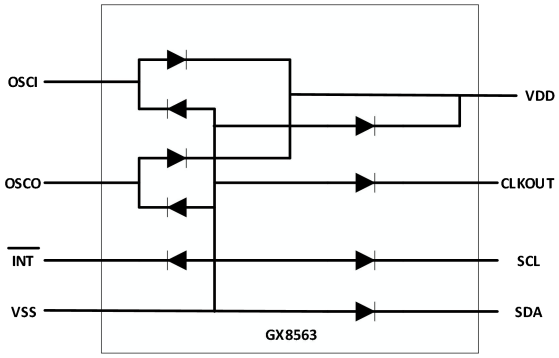


Figure 20. Device diode protection diagram

Limiting Values

Table 26. Limiting values

SYMBOl	PARAMETER	CONDITIONS	MIN	MAX	UNIT
V_{DD}	supply voltage		-0.5	+6.5	V
I_{DD}	supply current		+50	+50	mA
V_I	input voltage	on pins SCL, SDA, and OSCI	-0.5	+6.5	V
V_O	output voltage	on pins CLKOUT and INT	-0.5	+6.5	V
I_I	input current	at any input	-10	+10	mA
IO	output current	at any output	-10	+10	mA
Ptot	total power dissipation		-	300	mW
V_{ESD}	electrostatic discharge voltage	HBM			
		MSOP8	-	±2000	V
T_{stg}	storage temperature		-65	+150	˚C
T_{amb}	ambient temperature	operating device	-40	+85	˚C

Static Characteristics

Table 27. Static characteristics

V_{DD} = 1.0 V to 5.5 V; V_{SS} = 0 V; T_{amb} =-40°C to +85°C; f_{osc} = 32.768 kHz; quartz R_s = 40 kΩ; C_L = 8 pF; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Supplies						
V_{DD}	supply voltage	interface inactive; fSCL = 0 Hz; T_{amb} = 25°C[1]	1.0	-	5.5	V
		interface active; f_{SCL} = 400 kHz[1]	1.8	-	5.5	V
		clock data integrity; T_{amb} = 25°C	V_{low}	-	5.5	V
I_{DD}	supply current	interface active				
		f_{SCL} = 400 kHz	-	-	800	μA
		f_{SCL} = 100 kHz	-	-	200	μA
		interface inactive (f_{SCL}=0Hz); CLKOUT disabled; T_{amb} = 25°C[2]				
		VDD = 5.0 V	-	400	600	nA
		VDD = 3.0 V	-	250	500	nA
		interface inactive (f_{SCL}=0 Hz); CLKOUT disabled; T_{amb}= -40°C to +85°C[2]				
		VDD = 5.0 V	-	500	700	nA
		VDD = 3.0 V	-	400	600	nA
Inputs						
V_{IL}	LOW-level input voltage		V_{SS}	-	0.3V_{DD}	V
V_{IH}	HIGH-level input voltage		0.7V_{DD}	-	V_{DD}	V
I_{LI}	input leakage current	V_I = V_{DD} or V_{SS}	-1	0	+1	uA
C_i	input capacitance		-	-	7	pF
Outputs						
I_{OL}	LOW-level output current	output sink current; V_{OL} = 0.4 V; V_{DD} = 5 V				
		on pin SDA	3	-	-	mA
		on pin INT	1	-	-	mA
		on pin CLKOUT	1	-	-	mA
I_{LO}	output leakage current	V_O = V_{DD} or V_{SS}	-1	0	+1	uA
Voltage detector						
V_{low}	low voltage	T_{amb} = 25°C; sets bit VL;	-	0.9	1.0	V

[1] For reliable oscillator start-up at power-up: $VDD_{(min)power-up} = V_{DD(min)} + 0.3$ V.

[2] Timer source clock = 1/60 Hz, level of pins SCL and SDA is V_{DD} or V_{SS}.

Dynamic Characteristics

Table 28. Dynamic characteristics

V_{DD} = 1.0 V to 5.5 V; V_{SS} = 0 V; T_{amb} =-40°C to +85°C; f_{osc} = 32.768 kHz; quartz R_s = 40 kΩ; C_L = 8 pF; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Oscillator						
C_{OSCO}	capacitance on pin OSCO		15	25	35	pF
$\Delta f_{osc}/f_{osc}$		ΔV_{DD} = 200 mV; T_{amb} = 25°C	-	0.2	-	ppm
Quartz crystal parameters (f = 32.768 kHz)						
R_S	series resistance		-	-	100	
C_L	load capacitance	parallel	7[1]	-	12.5	
C_{trim}	trimmer capacitance	external; on pin OSCI	5	-	25	
CLKOUT output						
δ_{CLKOUT}	duty cycle on pin CLKOUT		-	50	-	%
I²C-bus timing characteristics						
f_{SCL}	SCL clock frequency		-	-	400	kHz
$t_{HD;STA}$	hold time (repeated) START condition		0.6	-	-	µs
$t_{SU;STA}$	set-up time for a repeated START condition		0.6	-	-	µs
t_{LOW}	LOW period of the SCL clock		1.3	-	-	µs
t_{HIGH}	HIGH period of the SCL clock		0.6	-	-	µs
t_r	rise time of both SDA and SCL signals					
		standard-mode	-	-	1	µs
		fast-mode	-	-	0.3	µs
t_f	fall time of both SDA and SCL signals		-	-	0.3	µs
t_{BUF}	bus free time between a STOP and START condition		1.3	-	-	µs
C_b	capacitive load for each bus line		-	-	400	pF
$t_{SU;DAT}$	data set-up time		100	-	-	ns
$t_{HD;DAT}$	data hold time		0	-	-	ns
$t_{SU;STO}$	set-up time for STOP condition		0.6	-	-	µs
$t_{w(spike)}$	spike pulse width	on bus	-	-	50	ns

[1] C_L is a calculation of C_{trim} and C_{OSCO} in series: $C_L = \frac{C_{trim} \cdot C_{OSCO}}{C_{trim} + C_{OSCO}}$

[2] Unspecified for f_{CLKOUT} = 32.768 kHz.

[3] All timing values are valid within the operating supply voltage at ambient temperature and referenced to V_{IL} and V_{IH} with an input voltage swing of V_{SS} to V_{DD}.

[4] I^2C-bus access time between two STARTs or between a START and a STOP condition to this device must be less than one second.

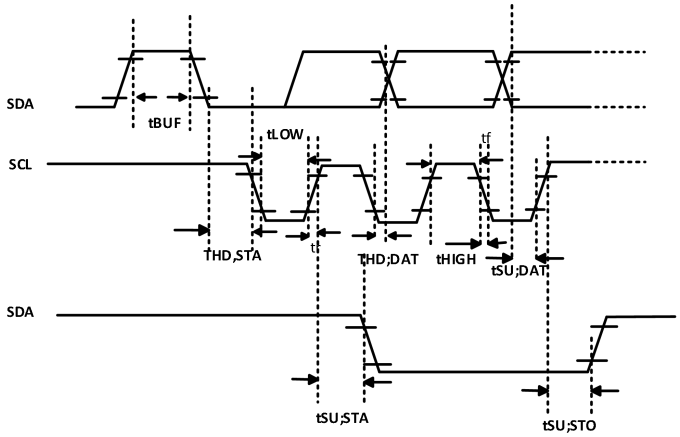


Figure 21. I^2C-bus timing waveforms

12 situation of application

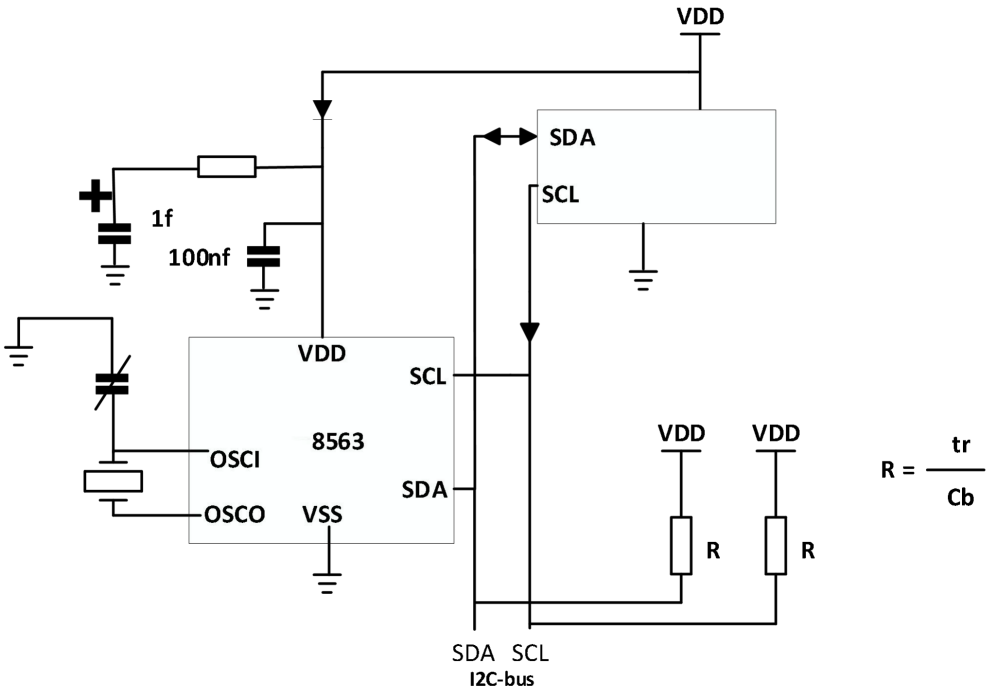
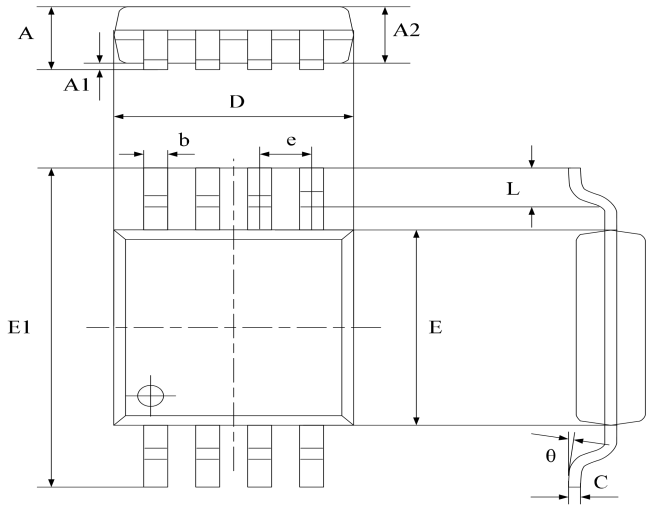


Figure 22. Application diagram

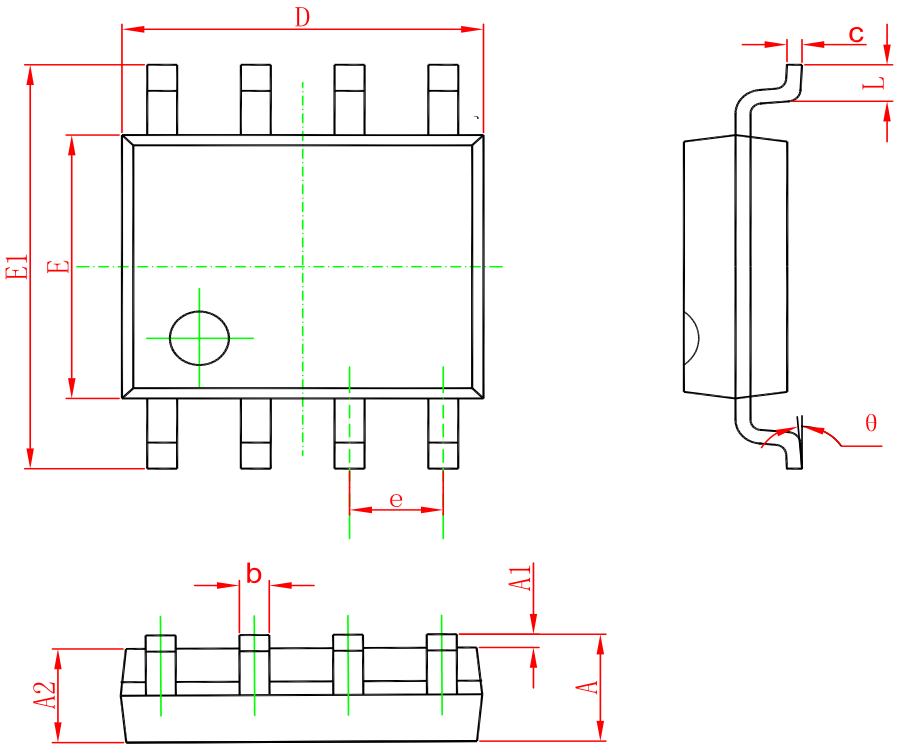
Package Outline

MSOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.100	0.033	0.045
A1	0.050	0.150	0.002	0.006
A2	0.750	0.950	0.031	0.039
b	0.290	0.380	0.012	0.016
C	0.150	0.200	0.006	0.008
D	2.900	3.100	0.118	0.127
E	2.900	3.100	0.118	0.127
E1	4.700	5.100	0.192	0.208
e	0.650typ.		0.026typ.	
L	0.400	0.700	0.016	0.029
θ	0°	8°	0°	8°

SOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Ordering information

Order code	Package	Baseqty	Deliverymode	Marking
UMW PCF8563T	SOP-8	3000	Tape and reel	PCF8563
UMW PCF8563TS	MSOP-8	3000	Tape and reel	P8563