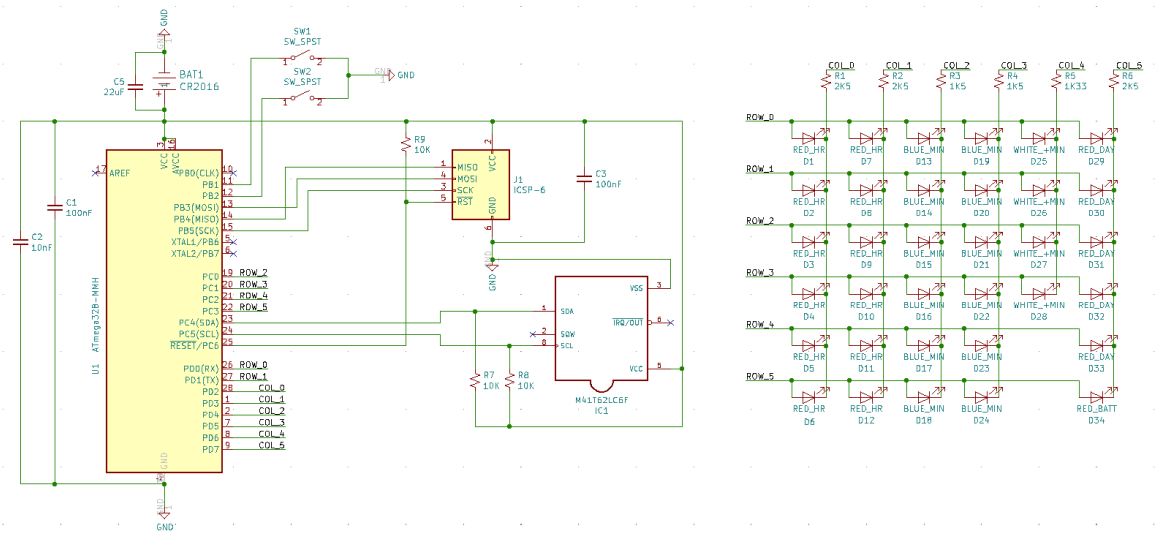
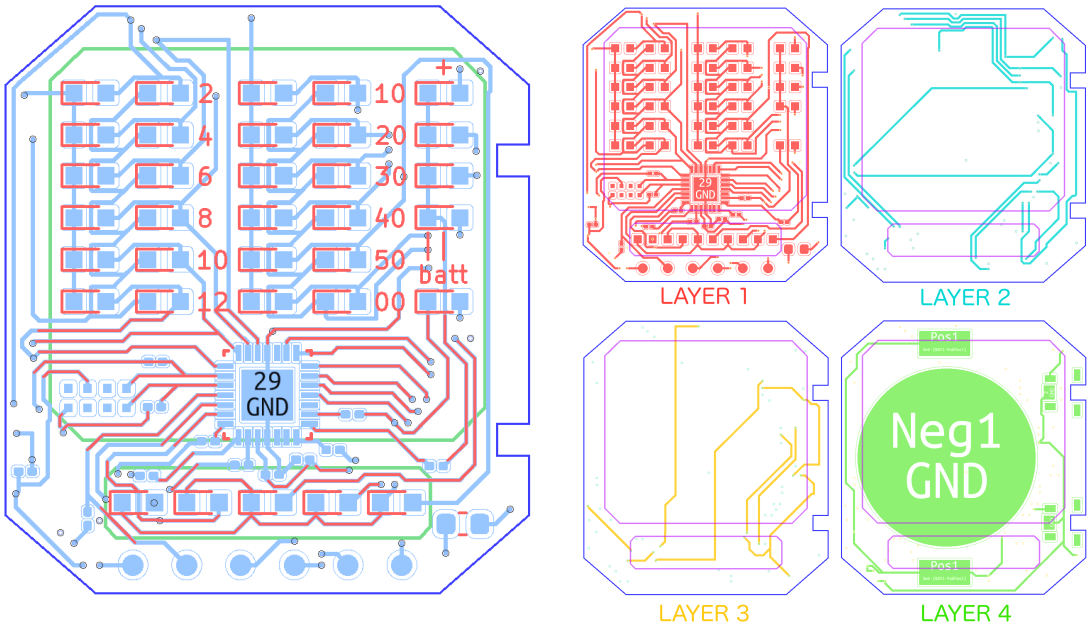
LED watch

Schematic



Printed circuit board

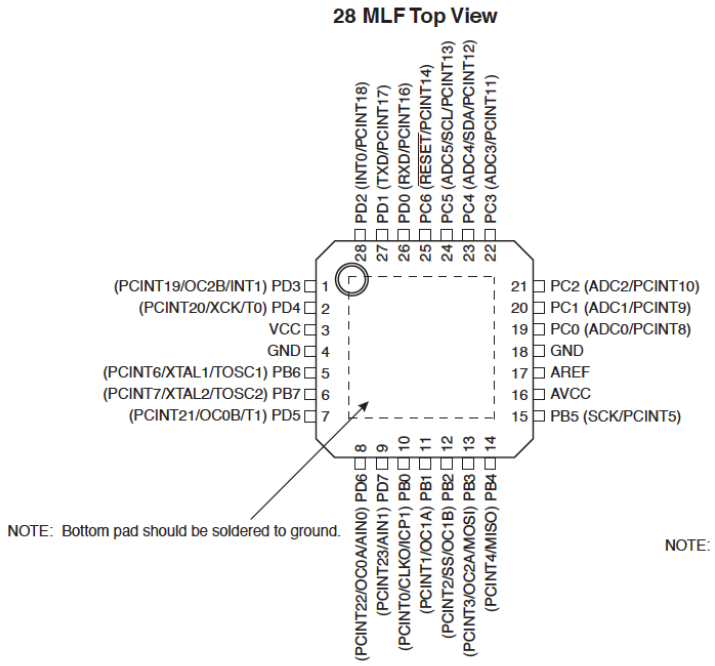


Layer 1 (blue) with silkscreen (red)

Integrated components

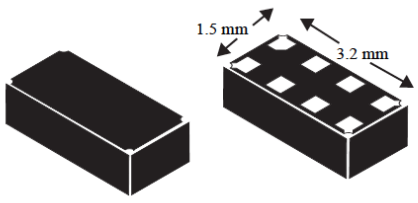
ATMEGA328P

- The ATmega328P is a low power, CMOS 8-bit microcontroller based on the AVR® enhanced RISC architecture. By executing instructions in a single clock cycle, the device achieves CPU throughput approaching one million instructions per second (MIPS) per megahertz, allowing the system designer to optimise power consumption versus processing speed.



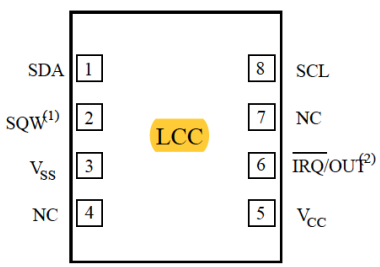
Low-power serial real-time clock (RTC) with alarm

- Serial real-time clock (RTC) with alarm functions
  - 400 kHz I2C serial interface
  - Memory mapped registers for seconds, minutes, hours, day, date, month, year, and century
  - Tenths/hundredths of seconds register
- 350 nA timekeeping current at 3 V
- Timekeeping down to 1.0 V
- 1.3 V to 4.4 V I2C bus operating voltage
  - 4.4 V max VCC suitable for lithium-ion battery operation
- Low operating current of 35 µA (at 400 kHz I2C speed)



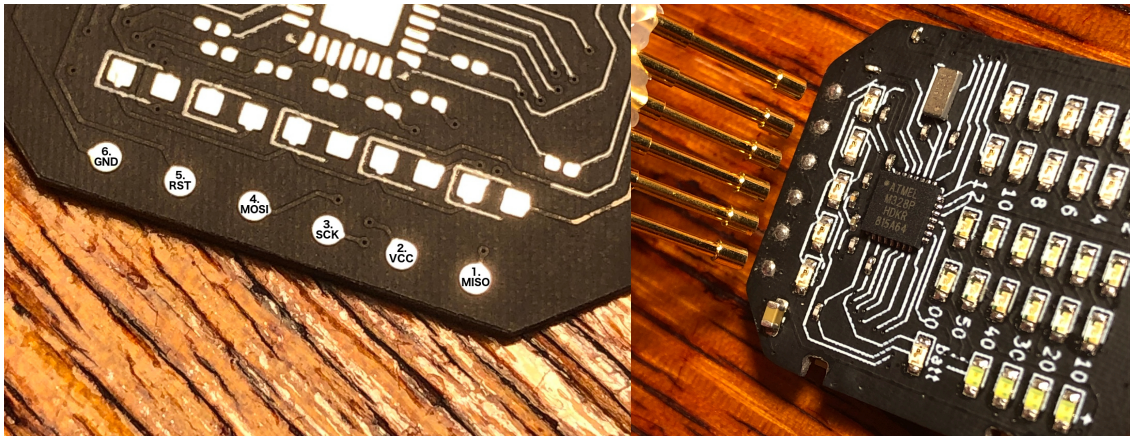
Embedded crystal LCC8 1.5 x 3.2 mm

No external crystal required

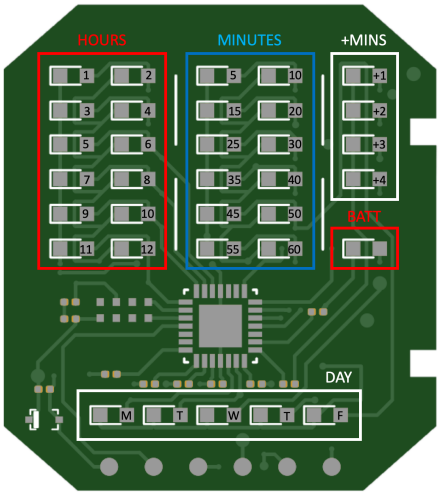


Programming functions

Arduino code is uploaded via In-Circuit Serial Programming (ICSP) pins using pogo pins:



		COLUMNS						
		HOURS		MINS		MIN+	DAY	
		0	1	2	3	4	5	
ROWS	0	1	2	5	10	1+	Mon	timedate_value
		0, 0	0, 1	0, 2	0, 3	0, 4	0, 5	matrix_coords
	1	3	4	15	20	2+	Tue	
		1, 0	1, 1	1, 2	1, 3	1, 4	1, 5	
	2	5	6	25	30	3+	Wed	
		2, 0	2, 1	2, 2	2, 3	2, 4	2, 5	
	3	7	8	35	40	4+	Thu	
		3, 0	3, 1	3, 2	3, 3	3, 4	3, 5	
	4	9	10	45	50		Fri	
		4, 0	4, 1	4, 2	4, 3		4, 5	
	5	11	12	55	0		Batt_low	
		5, 0	5, 1	5, 2	5, 3		5, 5	

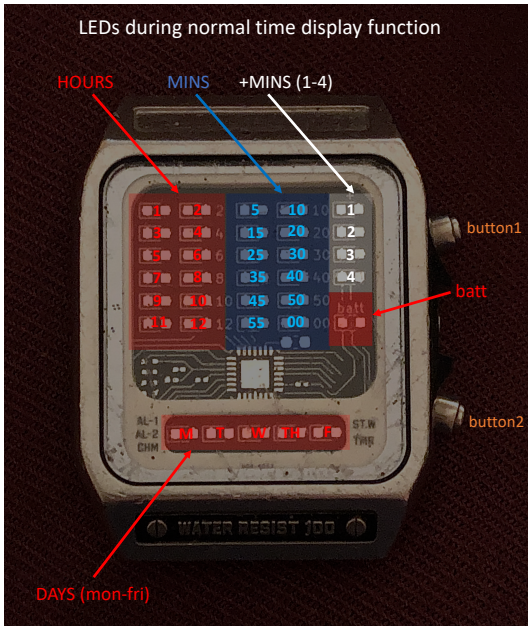


Multiplexed LED matrix (left) and physical location of LEDs on watch face (right)

Only one LED is powered at a time and the microcontroller cycles through all LEDs using 10 I/Os at least 100 cycles per seconds to prevent visible flickering (using persistence of vision).

Display Time

- 1 x button1 press displays the time for 2 seconds



Stopwatch

- The timer increments by seconds up to a maximum of 12 minutes (using hour LEDs)
- Button2 held down for three seconds to activate stopwatch mode
  - D33 LED (Friday) flashes five times (on: 200ms, off: 200ms)
- Button2 held down for three seconds to deactivate
  - D33 LED (Friday) turns off
- Hours function as minutes, minutes as seconds, and +minutes as +seconds