

## Power Requirements

L rms @ 3V

L LCD

L 1Hz update  $50\mu W \rightarrow 0.017\text{mA}$ 

L ATmega 328P

L Active @ 1MHz  $\rightarrow 0.55\text{mA}$ w/ Modules  
 $\rightarrow 0.582\text{mA}$ L Idle @ 1MHz  $\rightarrow 0.17\text{mA}$  $\rightarrow 0.225\text{mA}$ L Power-Down w/ WDT disabled  $\rightarrow 0.0004\text{mA}$ 

L Percentage additions for each Module (Active / Idle)

L UART - 1.4% / 7.8% \* we're only using UART while charging, so we won't count its consumption

L TWI - 3.0% / 16.6%

L SPI - 2.9% / 15.7%

L DS3231

L VCC = 0V, VBAT = 2.3-5.5V

L Active (I<sup>2</sup>C)  $\rightarrow 0.07\text{mA}$ L Timekeeping  $\rightarrow 0.003\text{mA}$ 

L Active vs Sleep

L Updating LCD

L sec  $\rightarrow 2\text{ms}$ L min  $\rightarrow 4\text{ms}$ L hour  $\rightarrow 6\text{ms}$ 

L RTC Reading Time - 7 Bytes

L 1 ms

L Total Active time  $\approx 20\text{ms} / 1\text{sec}$ 

L 2% duty cycle

L LED - 20mA

L 10s/day?  $\rightarrow 0.0116\%$ 

L 0.0023mA/sec.

## Batteries

L LIR2450

L 120mAh (24mA discharge) -  $I_{\text{REG}} < 60\text{mA}$ 

L 24.5 x 5 mm

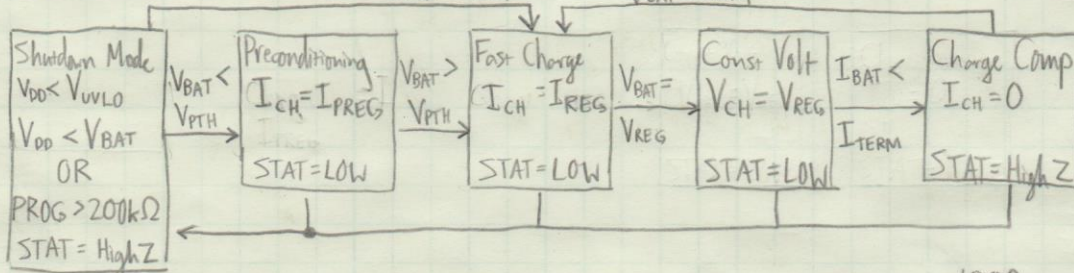
→ L LIR2032

L 40mAh (8mA discharge) -  $I_{\text{REG}} < 17\text{mA}$ 

L 20 x 3.2 mm

## Charger

L MCP73831-2ACI

 $V_{\text{BAT}} > V_{\text{PTH}}$  $V_{\text{BAT}} < V_{\text{RTH}}$  $V_{\text{REG}} = 4.2\text{V}$ UVLO - Undervoltage Lockout =  $0.15\text{V} + V_{\text{BAT}}$ 

V PTH - Preconditioning Threshold

V RTH - Recharge Threshold

I PREG - Preconditioning Regulation

I TERM - Terminating

CH = Charge

$$[k\Omega] R_{\text{REG}} = \frac{1000}{I_{\text{REG}} [\text{mA}]} = 69k\Omega$$

$$I_{\text{REG}} = 14.5\text{mA}$$

$$= 2.793$$

$$= 4.053$$

$$= 0.1 * I_{\text{REG}}$$

$$= 0.075 * I_{\text{REG}}$$



## - DC/DC Booster

- TPS61020

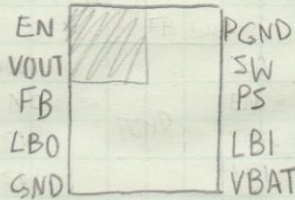
- EN - Enable

- FB - Voltage Feedback

- LBI - Low Batt In

- LBO - Low Batt Out

(open-drain)



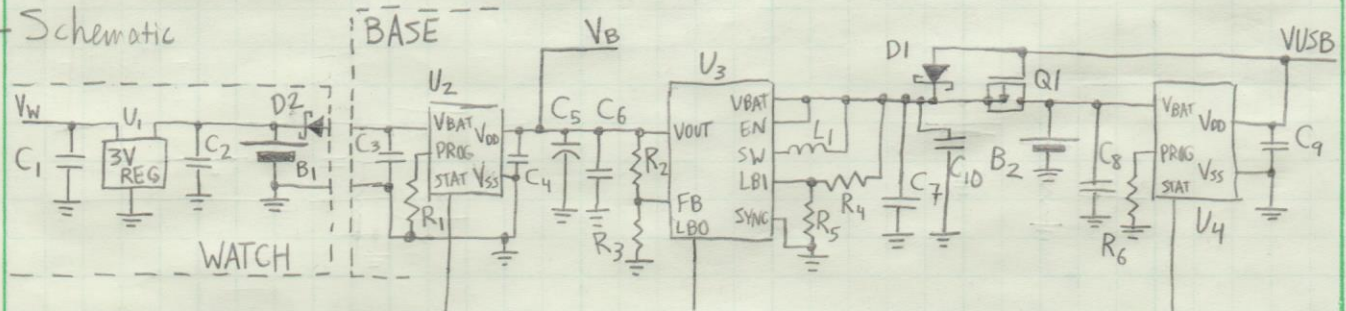
- SYNC - Power save mode

- SW - Boost + rectifying switch

- VBAT - Supply Voltage

- VOUT - DC/DC Output

## - Schematic



D1 - ZLLS400

U1 - S-1317A30

U2 - MCP73831

U3 - TPS61020

U4 - MCP73831

C1 - 1uF

C2 - 1uF

B1 - LIR2032

C3 - 4.7uF

R1 - 69kΩ

C4 - 4.7uF

C5 - 4.7uF

C6 - 2.2uF

R2 - 2.022MΩ

R3 - 220kΩ

L1 - 6.8uH

D2 - CUS10530

R4 - 2MΩ

R5 - 390kΩ

C7 - 10uF

Q1 - DMP2035U

B2 - 18650 Li-Ion

C8 - 4.7uF

R6 - 2.2kΩ

C9 - 4.7uF

C10 - 0.1uF

 $V_W = 3.0V$  $V_B = 5.1V$  $V_{USB} = 5.0V$ 

C6 + C7 - Ceramic

C5 - Low ESR Tantalum

## - Black Box

