# Xiaomi Mi Band 2

**By:**

**Shashi Shivaraju**
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# 1. Introduction

- **Xiaomi Mi Band 2** is wearable activity tracker/fitness tracker.

- An activity tracker/fitness tracker is a device or application for monitoring and tracking fitness-related metrics.

-  It is a fitness device for health conscious individuals & athletes to assist them in maintaining good physical health by monitoring their physical activities and rest.

- It was released on 7 June, 2016 as a successor to Xiaomi Mi Band 1s and is the latest release in the Mi Band product line.

# 2. Features of Mi Band2

- Mi Band 2 using its internal sensors to monitor users physical activity and provides estimated metrics summarizing the **step count, linear distance and the calories burnt** due to physical activity.

-  It also provides data which describes users **sleep pattern and variation in their heart**
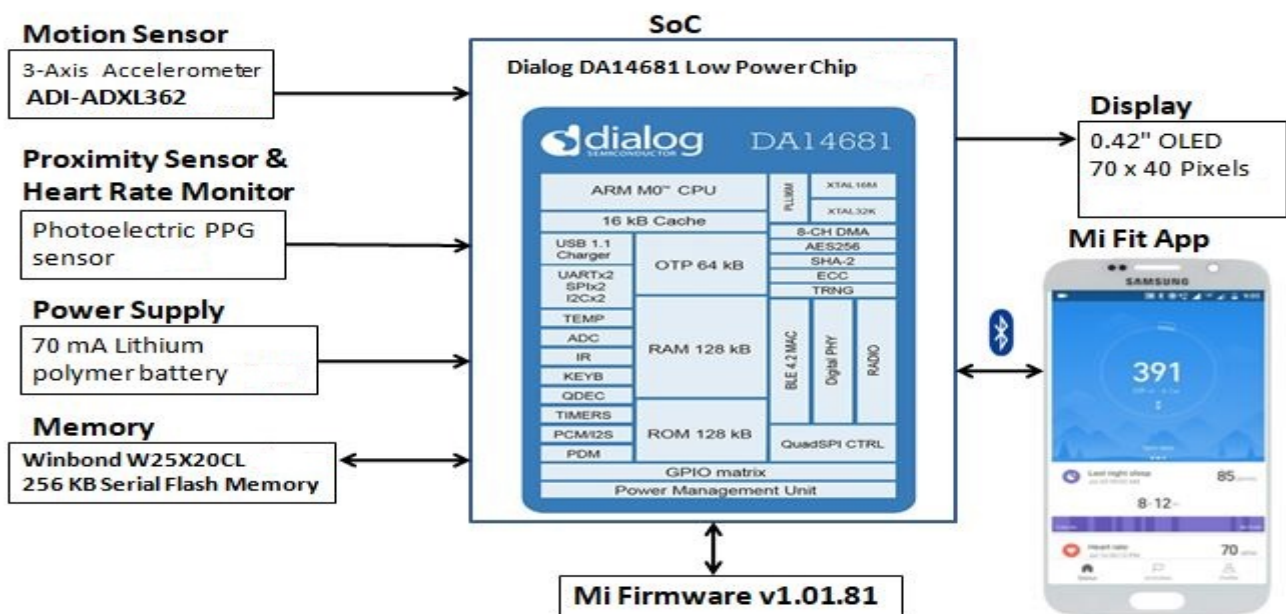
# 3. System Design



Figure 1: Mi Band 2 System Design-Block Representation

- The main component of the system is Dialog DA14681 SoC [System on Chip].It is a 32 bit ARM Cortex M0 based SoC which supports the latest Bluetooth 4.2 standard. In terms of memory it has 128 kB of RAM, 128 kB of ROM and 64kB of OTP (One Time Programmable) memory.
- The Mi Firmware used to operate Mi Band 2 is flashed on to the 128kB ROM in the SoC.
- Dialog DA14681 SoC is interfaced with a motion sensor ADI-ADXL362, a 3-axis accelerometer chip which provides linear accelerations about three axes and this data is used to calculate the step count and linear distance travelled.
- Dialog DA14681 SoC is interfaced with a Photoelectric PPG sensor; 
  Photoelectric PPG consists of a green LED photo emitter and an optical sensor (photo-diode). It takes advantage of the fact that oxygenated and deoxygenated blood has different optical properties to determine the heart rate. The green light pulses from the LED passes through your skin which the blood absorbs some of it, and the rest is sent back. The optical sensor receives the reflected light, and a graph is made. This is further used to determine the heart rate. Also heart rate drops when you enter deep sleep. The device periodically measures heart rate while the user is asleep so that light and deep sleep patterns are tracked.
- Dialog DA14681 SoC is interfaced with 0.42" OLED display module with 70x40 pixel resolution to display results such as step count, distance, calories burnt, heart rate, battery status and time.
- Dialog DA14681 SoC is interfaced with W25X20CL chip to provide additional 256 kB flash memory.
- The device is powered with 70mA Lithium Polymer battery which can be recharged using 5v USB power supply controlled by Power Management Unit [PMU] of the SoC.
- All the components used in the system support low power consumption [below 3V] and the PMU controls the power supply to each component.
- The system is compatible with Mi Fit Application and also 3rd Party Application like Google Fit. The data from the device is synced with the application using Bluetooth 4.2 and the results can be analysed using the application.

The below table describes major components used to build Mi Band 2:

| Component | Description | Manufacturer | Retail Cost (Approx.) |
|---|---|---|---|
| Dialog DA14681 | SoC | Dialog Semiconductor PLC | $2.56 |
| ADI-ADXL362 | 3-Axis Accelerometer Sensor | Analog Devices, Inc. | $4.87 |
| ADI-ADPD2212 | Photoelectric PPG sensor | Analog Devices, Inc. | $3.67 |
| W25X20CL | 256 kB Flash Memory | Winbond Electronics Corporation | $0.46 |
| 0.42" OLED Display | Display Module | Unknown | $2.5 [Generic] |
| 70mA Lithium Polymer Battery | Rechargeable Power Supply | Unknown | $4.5 [Generic] |

# 4. Tear Down

The following images show the components inside Mi Band 2 which are described in System Design above:
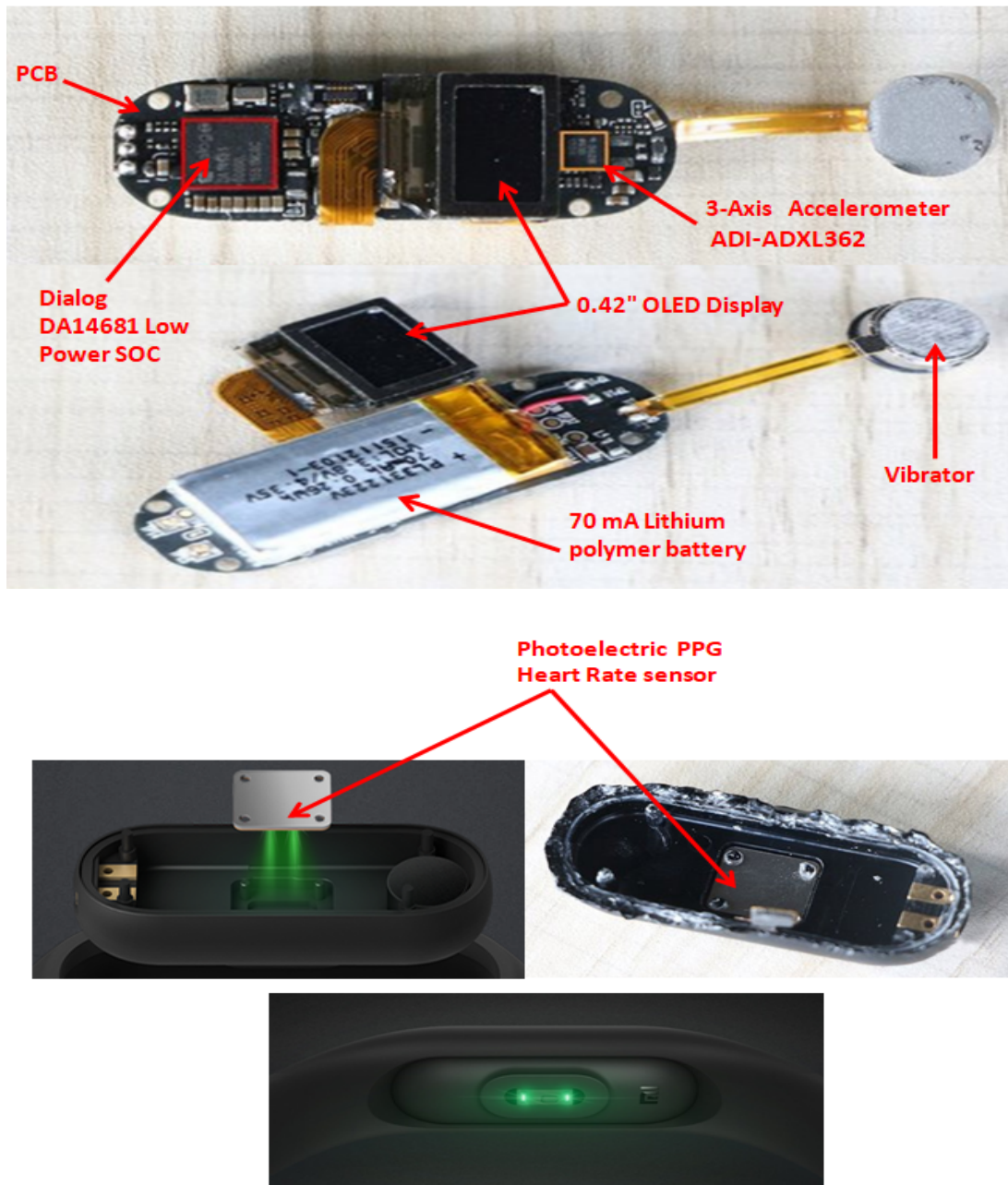




# 5. Cost

The retail price of Mi Band 2 is around **$30**.

# 6. Conclusion

Mi Band 2 is a low cost wearable embedded device built using an ARM based SoC (System on Chip) interfaced with sensor chips like accelerometer, photoelectric sensor. Each component in the system is selected to support low power consumption and the system operates using 70mAh Lithium polymer battery. Due to the limitations tracking algorithms and inaccurate of sensor data it can be beat described as an low cost device for assisting users to live more active lifestyles and not for the accurate data collection.

# Bibliography

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