
LAB EMBEDDED SYSTEM DESIGN 2 PROJECT

Currents

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1 Happy Gecko – Energy modes

We jump between EM0 and EM2. *The following data is from the datasheet.*

EM0 230 $\mu\text{A}/\text{MHz}$ (24 MHz = 5,52 nA)

EM1 67 $\mu\text{A}/\text{MHz}$

EM2 0,95 μA (RTC disabled – not in our case since every hour we need to wake up?)

EM3 0,65 μA

EM4 20 nA

2 ADXL362

We use the accelerometer now @ 12,5 Hz ODR¹ so the actual current should be lower. *The following data is from the datasheet.*

100 Hz ODR @ 2V 1,8 μA

400 Hz ODR @ 2V 3,0 μA

Wakeup mode @ 2V 270 nA²

3 Happy Gecko + ADXL362

The following data is approximated using measurements.

Both active 2,30 mA

Happy Gecko @ EM2, ADXL active < 4 μA ³

¹Output Data Rate

²Not yet implemented, 6 checks/second.

³ADXL measuring @ ODR 12,5 Hz and waiting to generate an interrupt.

4 Time and current estimates

The following data is approximated using measurements and common sense. They are pretty worst-case and should represent the total currents used by everything.

Every hour measurements 1s @ 2,8 mA

Four times a day sending LoRaWAN data 2s @ 30 mA

Sleep 5 μ A

$$E_{measure/day} = 24 [times] \cdot 1 [second] \cdot 2,8 mA \cdot 3,3 V = 0,22176 [J]$$

$$E_{send/day} = 4 [times] \cdot 2 [seconds] \cdot 30 mA \cdot 3,3 V = 0,792 [J]$$

$$t_{sleep} = (24 [hours] \cdot 60 [minutes] \cdot 60 [seconds]) - 24 \cdot 1 [second] - 2 \cdot 4 [seconds]$$
$$t_{sleep} = 86368 [seconds]$$

$$E_{sleep/day} = 86368 [seconds] \cdot 5 \mu A \cdot 3,3 V = 1,425072 [J]$$

$$E_{total/day} = 0,22176 [J] + 0,792 [J] + 1,425072 [J] = 2,438832 [J]$$

- $[J] \Rightarrow [mAh]: /3,6/V_{DD}$
- How much years will it last? (at least 5!)
 1. You have a number in Joules/day, convert it to the mean current throughout the whole day.
 2. Take the mAh value of the battery and use it to calculate the lifetime in years.

$$\% \text{ sleeping/day} = \frac{sleep/day}{total/day} = \frac{86368 [seconds]}{86400 [seconds]} = 99,963\%$$