

Sub-1 μA Current Consumption with CMA3000 by Switching the Supply

Accelerometer's current consumption can be reduced by switching the supply voltage on and off. If the needed sample rate is much lower than the power-on and data ready times a significant amount of power will be saved. This technical note will describe how CMA3000-D01 can be used to achieve sub 1 μA current consumption at 1 Hz sample rate.

1 INTRODUCTION

CMA3000-D01 has wake-up time of 1.3 ms. With 400 S/s and 100 S/s modes 3rd sample and with 40 S/s mode 2nd sample are stable after entering to measurement mode. Taking these output data settling times into account, the required delay after activating the CMA3000 measurement mode in:

- 400 S/s measurement mode, settling delay is approx 7.5 ms,
- 100 S/s measurement mode, settling delay is approx 30 ms and
- 40 S/s measurement mode, settling delay is approx 27ms.

In the power down mode sensor has still a current consumption of 3 μA . When the supply voltage (VDD pin) is pulled down the current consumption will be zero on supply voltage and less than 0.1 μA in I/O supply voltage (DVIO pin). In measurement mode current consumption is 70 μA in 400 S/s, 50 μA in 100 S/s and 11 μA in 40 S/s sample rates, when 2.5 V supply voltage is used. If the required data rate is 1 Hz sensor can start-up and provide reliable acceleration data in time of settling time added to start-up time. Theoretical current consumption in 1 s time period is calculated

$$I = I_{on} \cdot (t_{start-up} + t_{dataready}) + I_{off} \cdot (1 - t_{start-up} - t_{dataready})$$

Resulting current consumptions of product in different measurement modes are:

- 0.8 μA in 400 S/s measurement mode where on-time is 9 ms
- 1.7 μA in 100 S/s measurement mode where on-time is 31 ms and
- 0.4 μA in 40 S/s measurement mode where on-time is 29 ms

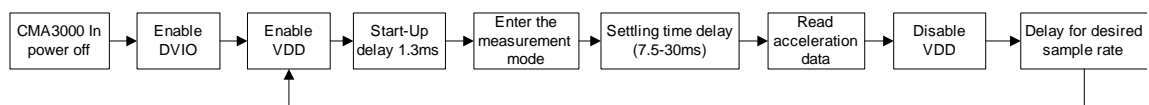


Figure 1 The flow chart of power cycling measurement

In Figure 2 charge and discharge of bypass capacitor between VDD and GND pin can be seen before and after the sampling. Sample rate is set to 1 Hz.

3 TESTS RESULTS

Three CMA3000-D01s were measured in three different measurement modes and the current consumption was calculated by integrating the voltage over shunt resistor.

Figure 4a shows the voltage over shunt resistor with the bypass capacitor in 400 S/s mode and in figure 4b in 40 S/s mode is presented.

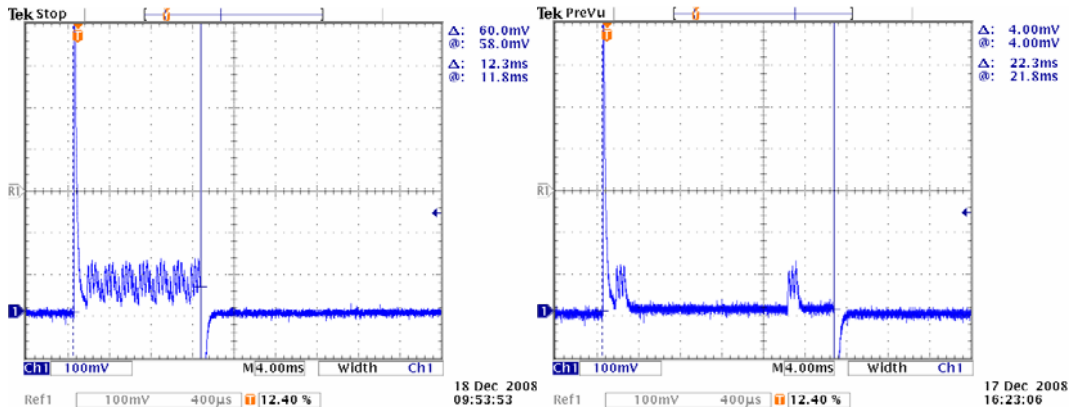


Figure 4a CMA3000-D01 at 400 S/s sample rate and in figure 4b at 40 S/s sample rate

In figure 5 is the charge spike due to 100nF bypass capacitor this corresponds to approximately 0.2 μ A average current consumption that can be decreased from results of table 1 when using the switch between VDD pin and bypass capacitor.

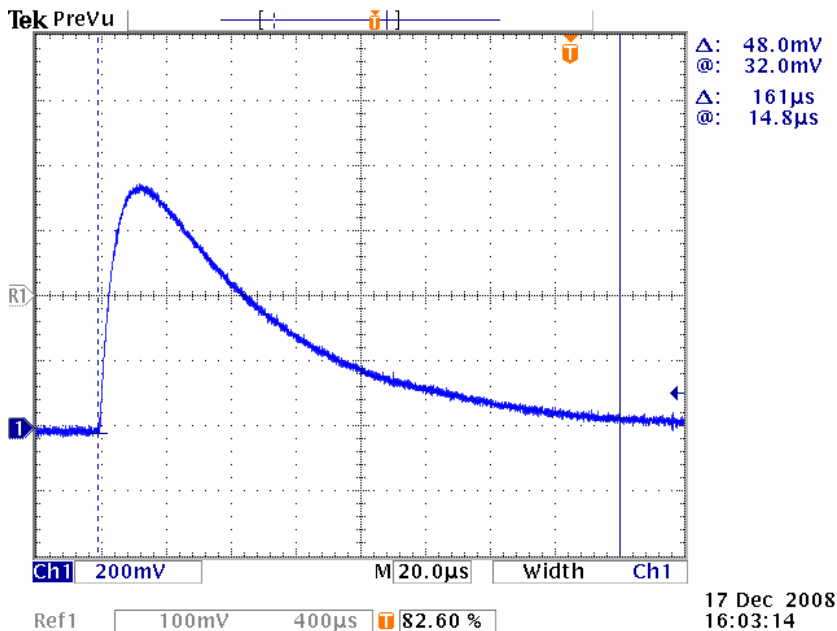


Figure 5 Charging 100nF capacitor before start-up

Table 1 shows the measured current consumption of CMA3000-D01 (Figure 3) in different measurement modes with power cycling rate of 1Hz.

Table 1 Measured current consumption of CMA3000-D01 (Figure 3) in different measurement modes with sample rate of 1Hz

DUT #	400 S/s [μA]	100 S/s [μA]	40 S/s [μA]
1	1.05	1.62	0.68
2	1.02	1.59	0.70
3	1.04	1.60	0.70

Figure 6 illustrates the current consumption of CMA3000-D01 with the switched bypass capacitor.

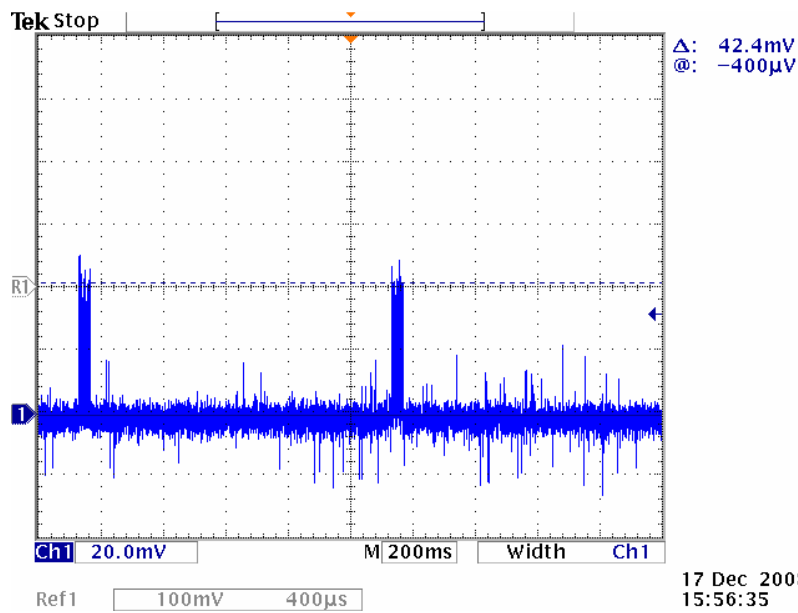


Figure 6 CMA3000-D01 at 400 S/s with the switched bypass capacitor