CONFIGURATION, POR AND POWER CONSUMPTION

The MEAS series of digital sensors use the latest CMOS sensor conditioning circuitry (SCC) to create a low cost, high performance digital output pressure (14-bit) and temperature (11-bit) sensor designed to meet the strictest requirements from OEM customers.

The MS45x5DO, 86BSD, 85BSD and 154BSD are the latest offering from MEAS to offer digital communication to pressure sensor OEMs. This application note will focus on the following aspects:

1. Configuration Description
    1.1. Standard Configuration
        1.1.1. Data Fetch Commands
        1.1.2. Polling Strategies
    1.2. Low Power Configuration
        1.2.1. Read_MR
        1.2.2. Write_MR
2. Power On Reset (POR) Details
3. Power Consumption, -L option

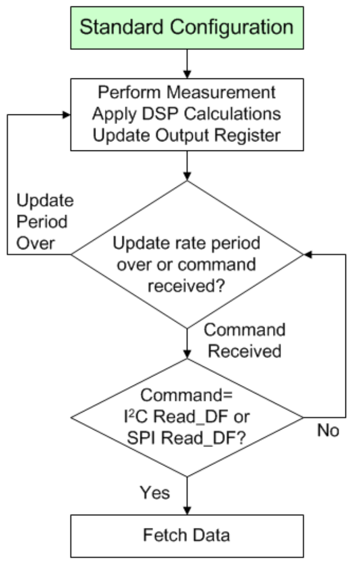
Reference Documentation

Interfacing to MEAS Digital Pressure Modules
MS4515DO/MS4525DO Datasheets
86BSD, 85BSD Datasheets

CONFIGURATION DESCRIPTION

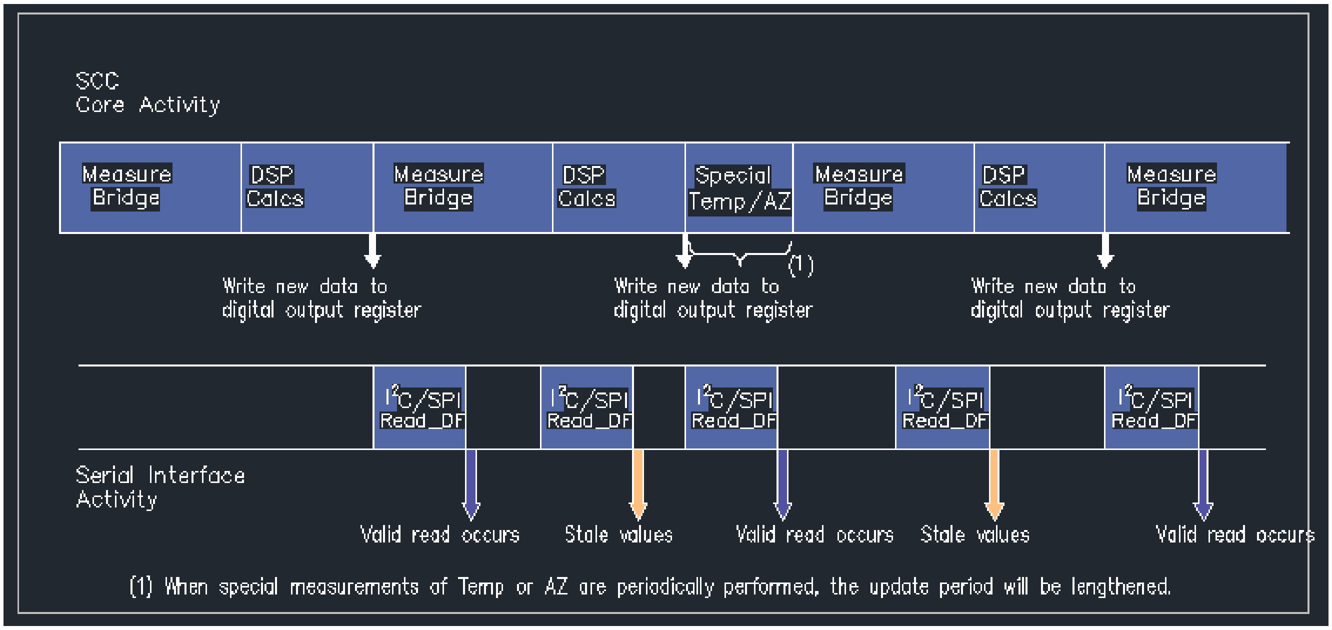
Standard Configuration
In Standard Configuration, the SCC will apply power continuously to the sensor element while the digital core performs A2D measurements, correction calculations and then updates the I2C/SPI output register (Figure 1). In this mode, data is continuously updated at a fixed rate without powering down. The master can then fetch the data in I2C or SPI with a Read_DF command. Valid data output to the digital register occurs after the measurement and the DSP calculations are complete.

Figure 1. Flow Diagram of Standard Configuration



As shown in Figure 2, after a valid output has been read by the master, the status bits are set to "stale," indicating that the measurement has not been updated since the last Read_DF. This "polling mode" allows the application to simply read the digital output at any time and be assured the data is no older than the update period. The chip should be polled at a frequency slower than 20% more than the update time (0.5*1.2=0.6mS or 1.666kHz).

Figure 2. Measurement & Read Data Fetch Sequence, Standard Configuration



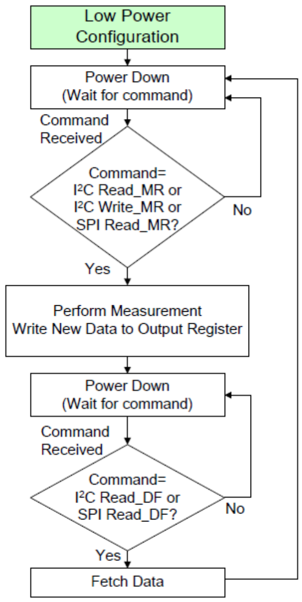
Using "interrupt polling", the INT/SS pin will assume the INT (interrupt) function. Instead of polling until a "valid" response is received, the application can look for a rise on the INT pin. This will indicate that the measurement and calculations are complete and new valid data is ready to be read on the I2C interface. Interrupt polling works the same with both standard and low power configurations; however it cannot be used with the SPI protocol.

In Figure 2, take note that the interval for valid data on the output bus varies with the Temperature Auto Zero measurement that take place every 255 measurement cycles. Secondly, the SCC clock frequency can vary up to ±15% adding more variability. These two factor make using "interrupt polling" a more efficient method for obtaining valid data.

Low Power Configuration

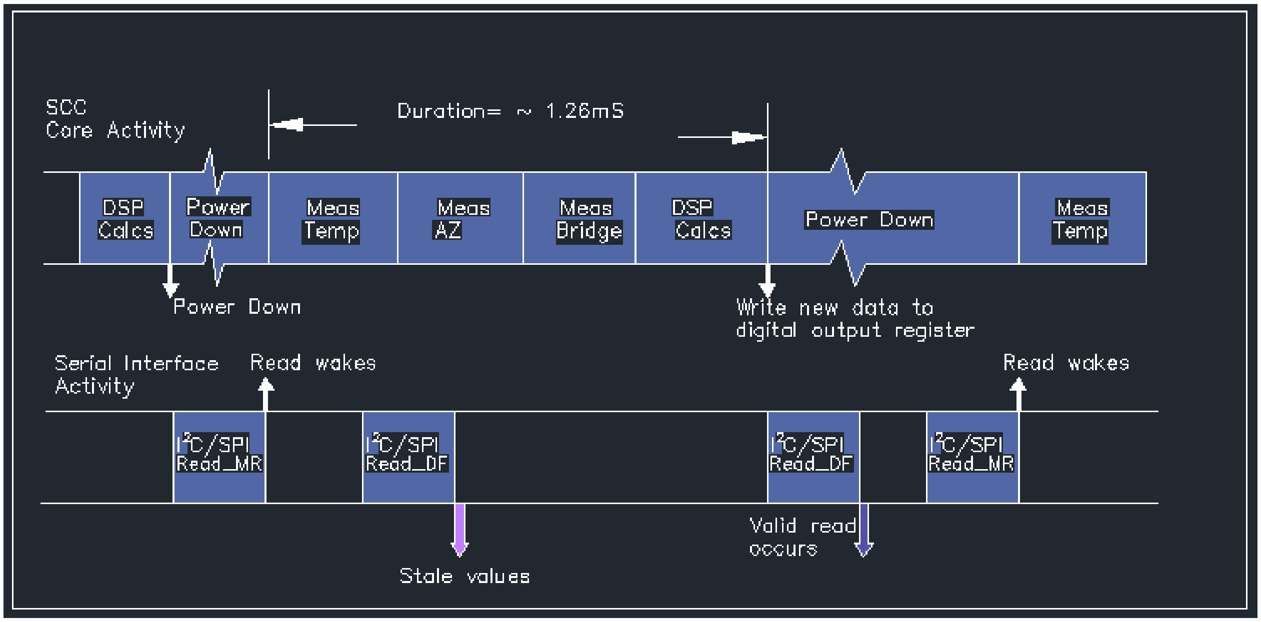
In a Low Power Configuration, after the power-on sequence, the SCC will power down until the master sends a Read_MR (either I2C or SPI) or a Write_MR (I2C only) which wakes the SCC and starts a measurement cycle.

Figure 3. Flow Diagram of Low Power Configuration



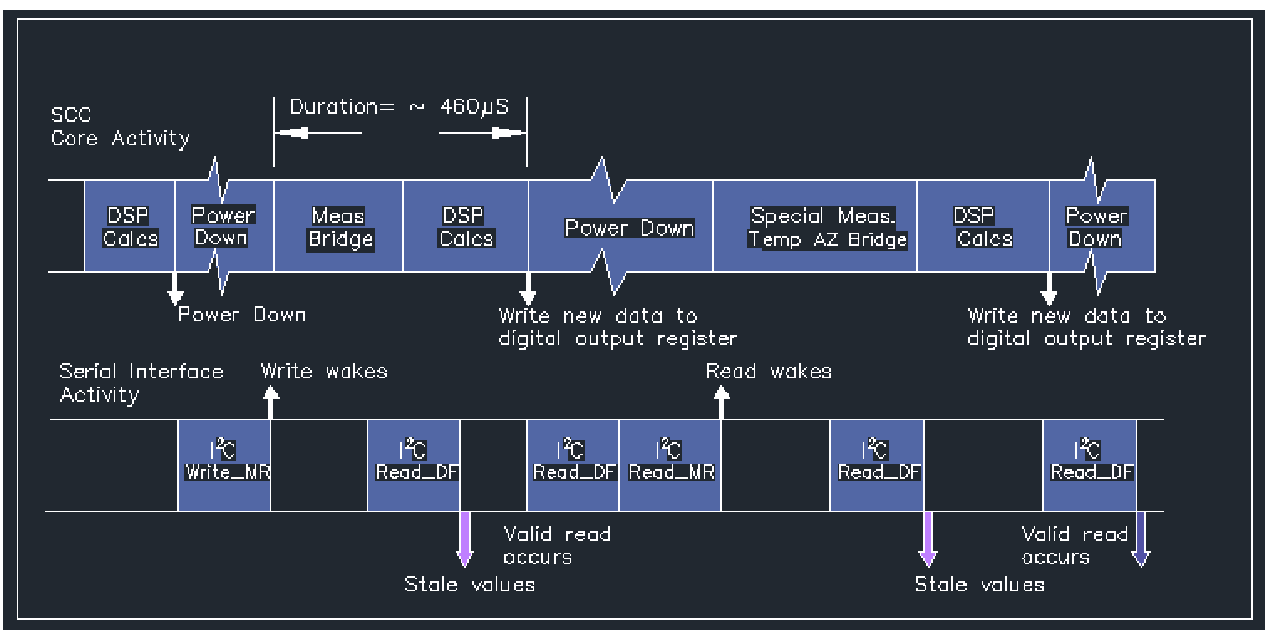
If the command is Read_MR, temperature, auto-zero (AZ), and bridge measurement are implemented followed by the DSP correction calculations. Figure 3 above, depicts the general flow of the low power option, while Figure 4 below shows the Measurement Request (MR) fetch actions, relevant bus activity and status bits results.

Figure 4. Read MR& Read Data Fetch Sequence, Low Power Configuration



If the command is Write MR, only the bridge measurement is performed with correction calculations used from previously measured temperature and auto-zero data. Valid values are then written to the digital output register and the SCC powers down again. (Figure 5)

Figure 5. Write MR & Read MR, and Read DF Sequence, Low Power Configuration



Following a measurement sequence and before the next measurement can be performed, the master must send a Read_DF command, which will fetch the data as 2, 3 or 4 bytes without waking the SCC. When a Read_DF is performed, the data packet returned will be the last measurement made with the status bits set to “valid.” After the Read_DF is completed, the status bits will be set to “stale.” The next Read_MR or Write_MR will wake the part again and start a new measurement cycle. If a Read_DF is sent while the measurement cycle is still in progress, then the status bits of the packet will read as “stale.” The chip should be polled at a frequency slower than 20% more than the update time. (Read MR= 1.26*1.20=1.512mS 661Hz OR Write MR=0.460*1.2= .552mS 1.811kHz)

POWER ON RESET

Power On Reset (POR) and Start Time to Data Ready, Standard Configuration

Upon a POR, the SCC will go immediately into its configured programmed digital protocol output mode and start performing temperature and pressure A2D conversions. The time required for data to appear on the output bus is given by the "Start Time to Data Ready" product specification.

Power On Reset (POR), Low Power Configuration

Data is considered invalid from system power-on reset (POR) until the first measured data is written to the digital register. Sending an I2C Write_MR as the first command after power-on delivers invalid data; even though the status bits report it as "valid". This is due to the correction calculations being performed with an uninitialized temperature and Auto-Zero value. To obtain valid data with valid status bit, perform I2C Read_MR so that temperature measurements and valid DSP corrections are made.

POWER CONSUMPITON, -L OPTION

Power Consumption

Power consumption is a function of sampling rate and the type of MR command. During the measurements periods described in Figures 4 & 5, power is applied to the sensor with typical power consumption of 2-3mA. After conversion, the SSC sleeps and consumes typically 0.6uA at room temperatures. As temperature increases, the sleep values will increase ~5x at 85°C and ~10x at 125°C. In Table 1, the typical room temperature current consumptions are indicated.

Table 1. Current Consumption by Sampling Rate (25°C)

	Sampling Rate			
Command	**10 Hz**	**100Hz**	**500Hz**	**1000Hz**
Write MR	0.0135 mA	0.135 mA	0.675 mA	1.35 mA
Read MR	0.045 mA	0.45 mA	2.25 mA	--

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