



ANM005 - USING MULTIPLE SENSORS ON SINGLE I²C BUS

Description	Order code
3-axis Acceleration Sensor	2533020201601 / 25330202016011
6-axis Inertial Measurement Unit	2536030320001 / 25360303200011
Absolute Pressure Sensor	2511020213301 / 25110202133011
Differential Pressure Sensor	25131308xxx01
Humidity Sensor	2525020210001
Temperature Sesnsor	2521020222501

VERSION 1.1

FEBRUARY 7, 2023

Revision history

App note version	Notes	Date
1.0	Initial release of the app note	June 2022
1.1	- Added 6 Axis inertial measurement unit WSEN-ISDS: 2536030320001 & 25360303200011 - Updated figures in section 2.2	February 2023

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1 Introduction

Current Würth Elektronik eiSos sensor portfolio consists of semiconductor based digital sensors. These sensors have either digital I²C or SPI (or both) interfaces through which the host controller communicates with the sensors. On an I²C bus each device has an unique 7-bit address through which the Microcontroller (Master) identifies a particular device. So a single I²C bus theoretically supports up to 128 slave devices with unique I²C device. Würth Elektronik eiSos sensors have following 7-bit slave addresses available.

Sensor	Available I ² C address	Address-1 (hex)	Address-2 (hex)
WSEN-HIDS	1	0x5F	-
WSEN-ITDS	2	0x18	0x19
WSEN-PADS	2	0x5C	0x5D
WSEN-PDUS	1	0x78	-
WSEN-TIDS	2	0x38	0x3F
WSEN-ISDS	2	0x6B	0x6A

Two of each WSEN-PADS, WSEN-TIDS, WSEN-ISDS and WSEN-ITDS could be connected to the same I²C bus since, two I²C slave addresses (based on the SAO pin connection) are available for these sensors. Only one of each WSEN-HIDS and WSEN-PDUS could be connected to a single I²C bus since only one I²C slave address is available.

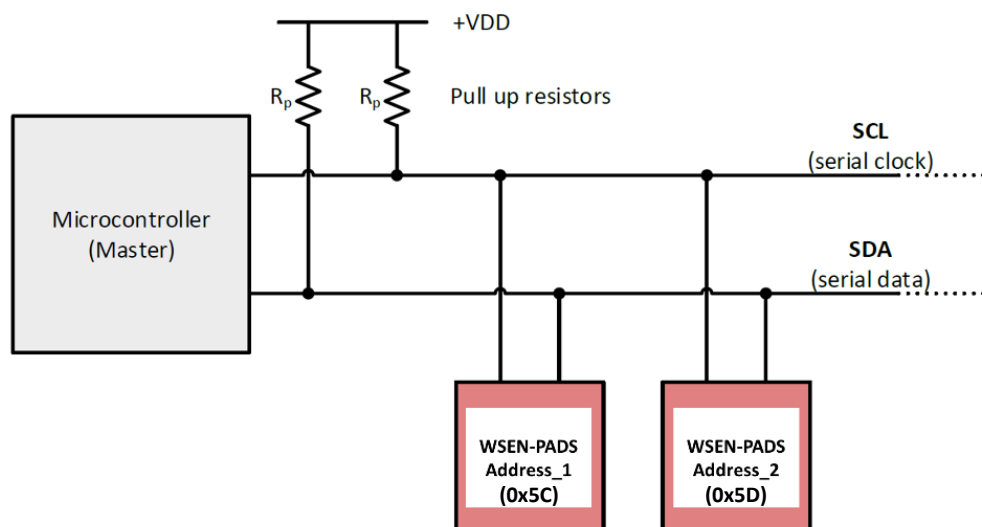


Figure 1: Two WSEN-PADS with separate slave address on an I²C bus

However, some applications require the use of same sensors multiple times on a single I²C bus. For example, to have more than two pressure sensors on a single I²C bus. In these cases, the maximum number of devices that could be connected to the I²C bus depends on the available slave addresses of that particular device.

2 How to implement multiple sensors with same I²C Address?

Two ways are described below on how one can use multiple sensors with the same I²C address on a single communication bus and avoid address conflicts.

2.1 Multiplexers

Multiple sensors are connected to the microcontroller (master) through a multiplexer. The master communicates with the multiplexer through one I²C address and selects whichever channel the user wants to enable. In this way the I²C address conflicts can be resolved and one or more sensors with the same I²C address could be enabled.

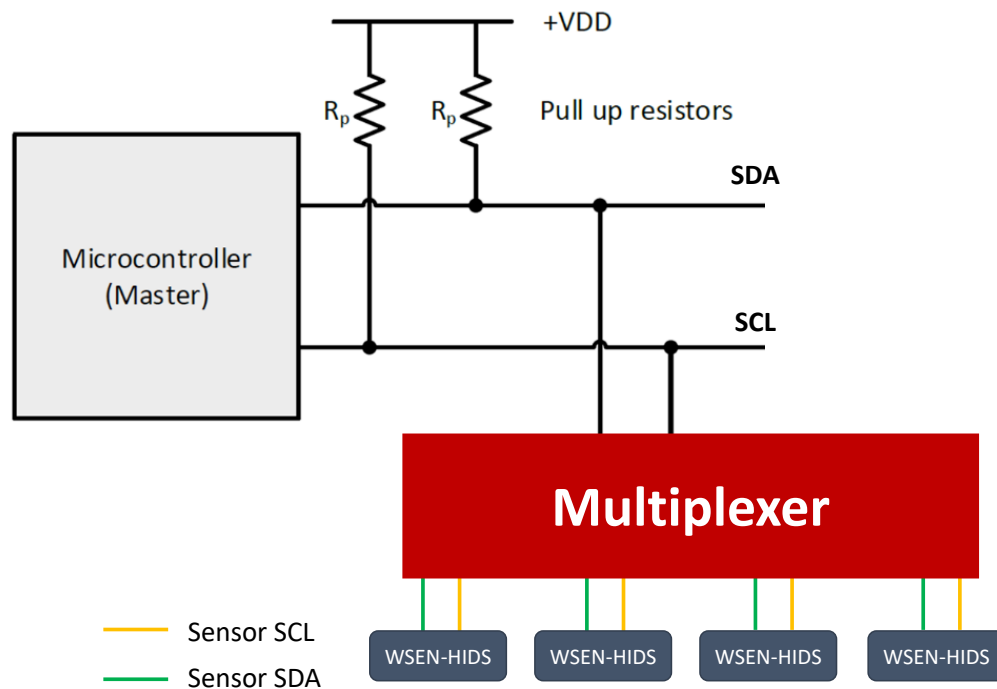


Figure 2: Multiple sensors with one I²C address connected through multiplexer

For example TCA9548A from Texas Instruments is an 8-Channel I²C multiplexer and can support up to 8-devices. The Multiplexer has 8 bidirectional translating switches that can be controlled through the I²C bus from the master. Each channel consists of a pair of data and clock line and any individual channel or combination of channels can be selected through the programmable registers.

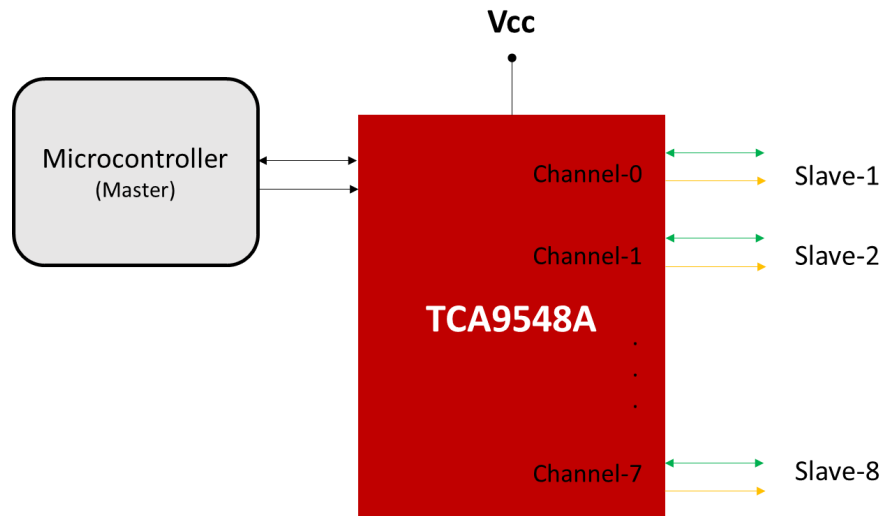


Figure 3: Application diagram of Multiplexer TCA9548A

2.2 De-selecting not required sensors through GPIO pins of microcontroller

Using microcontroller GPIO pins, each sensor can be taken into operation (GPIO Pin logic HIGH) one by one, and keeping rest of the sensors de-selected (GPIO logic LOW). Hence, at a time, only one sensor is in working state. This set-up requires use of multiple GPIO pins on the microcontroller side.

For example, WSEN-TIDS SAO pin can be connected to the GPIO pins of microcontroller. By switching the SAO pins of each sensor high one by one, each TIDS sensor can be addressed through one I²C address (SAO= High = 0x38). Rest of the TIDS sensors have their SAO pins at logic LOW with I²C address 0x3F and hence they are de-selected.

Number of sensors that can be attached to the microcontroller in this way also depends upon the number of available GPIO pins.



This is possible only for the sensors with two I²C address. (WSEN-ITDS, WSEN-ISDS, WSEN-PADS and WSEN-TIDS).

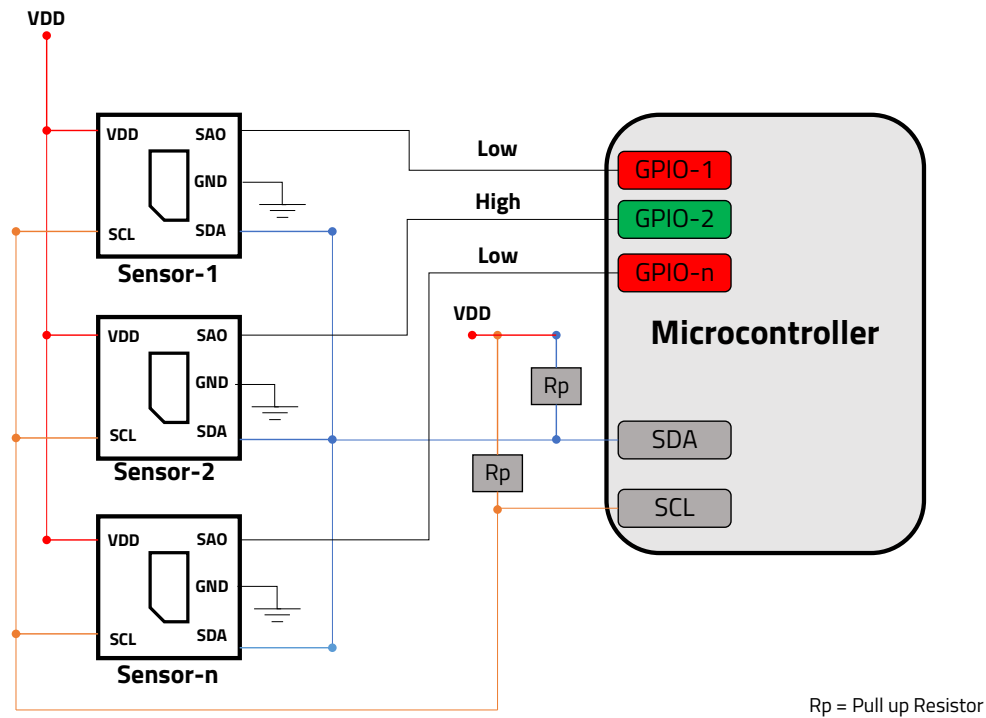


Figure 4: Sensor-1 in operation with I²C address 0x38 because GPIO-1 is high

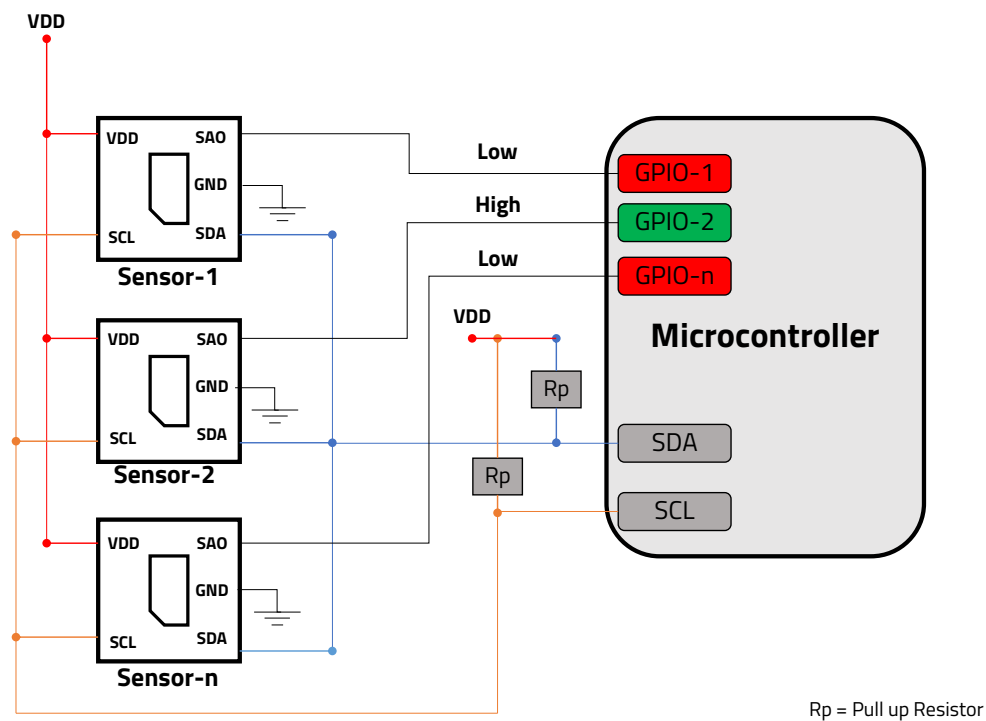


Figure 5: Sensor-2 in operation with I²C address 0x38 because GPIO-2 is high



For more information about the sensors please refer to the sensor user manuals [here](#)

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References

- [1] International Organization for Standardization; *Standard Atmosphere*; 1975; ISO 2533:1975.
- [2] Manual of the ICAO Standard Atmosphere (extended to 80 kilometres) (3rd edition); *International Civil Aviation Organization*; 1993; ISBN 978-92-9194-004-2. Doc 7488-CD.



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