Product Document

ams OSRAM

Application Note: AS5048B I2C Slave Address Programming

AS5048B

14-bit Rotary Position Sensor with Digital Interface

Table of Contents

Revision History

Revision	Date	Owner	Description
1.0	29.04.2013	ACH	Initial revision
1.1	18.11.2013	RPH	Added note for 3.3V programming; Added Information about burn status and gload operation; Minor changes

1. General Description

This Application Note explains how to programm the slave address for the AS5048B 14-bit Rotary Position Sensor.

If more than two AS5048B are used or if there is already a device on the I2C bus with the same adress, it might be necessary to change the slave adress of the AS5048B.

To permanently program configuration on the AS5048, an OTP block is used. First the desired values are written into the desired register. A special command described below enables the automatic programming of the OTP. After programming, the programmed bits are verified.

Note:

The programming can be performed in 5V operation mode. If the AS5048 is used in 3V operation mode, a minimum supply voltage of 3.3V and an additional capacitor with a value of 10µF is necessary on the VDD3V pin to perform the programming procedure.

Note:

The programming has to be performed at room temperature.

Note:

The status of the burning procedure can be seen by polling the Burn bit in the OTP control register. Refer to Figure 3.

Note:

After programming, it is recommended to verify the OTP block content. To load the content from the OTP block into the registers using modified comperator levels, the Verify bit in the OTP control register is used.

2. Programming the AS5048B slave address

The following programming sequence demonstrates how the AS5048B slave address can be changed.

The slave address consists of the hardware setting on pins A1, A2 and upper MSBs programmable by the user. The MSB of the slave address (yellow) is internally inverted. This

means that by default the resulting data is '1'. A read of the I²C slave address register 21 will return a '0' at the MSB.

Figure 1:
Slave address construction
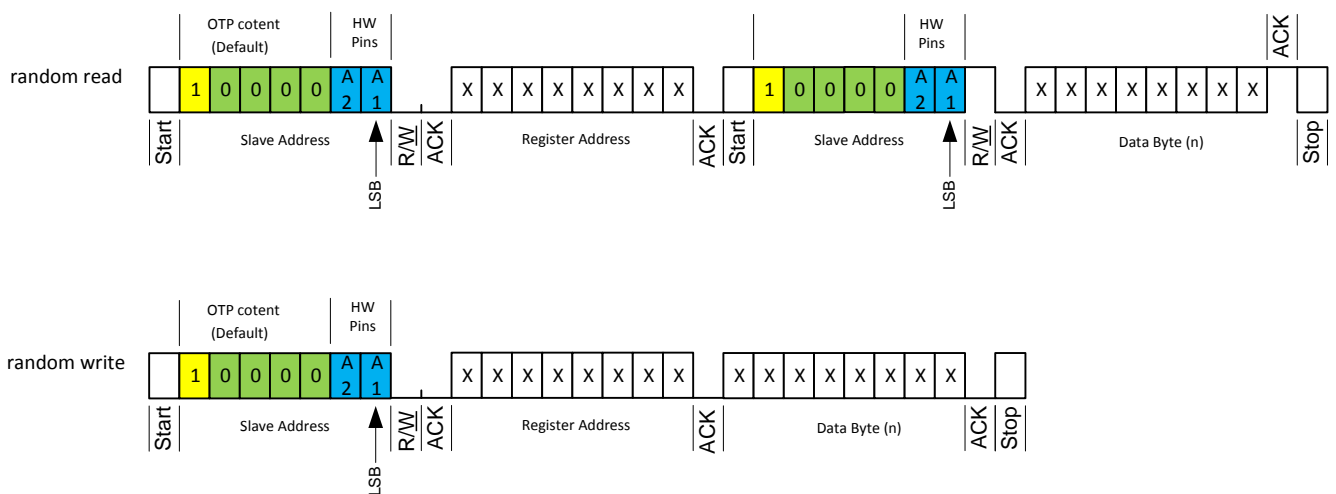
Set a new slave address:

Write new slave address into I^{2}C slave address register (dec.21)

Program the OTP bits permanently:

1. Write dec.253 into the OTP control register (dec.3) to enable the special programming mode

2. Set the Burn bit (dec.8) in the OTP control register (dec.3) to enable automatic programming procedure

3. Write dec.0 into the OTP control register (dec.3) to disable the special programming mode
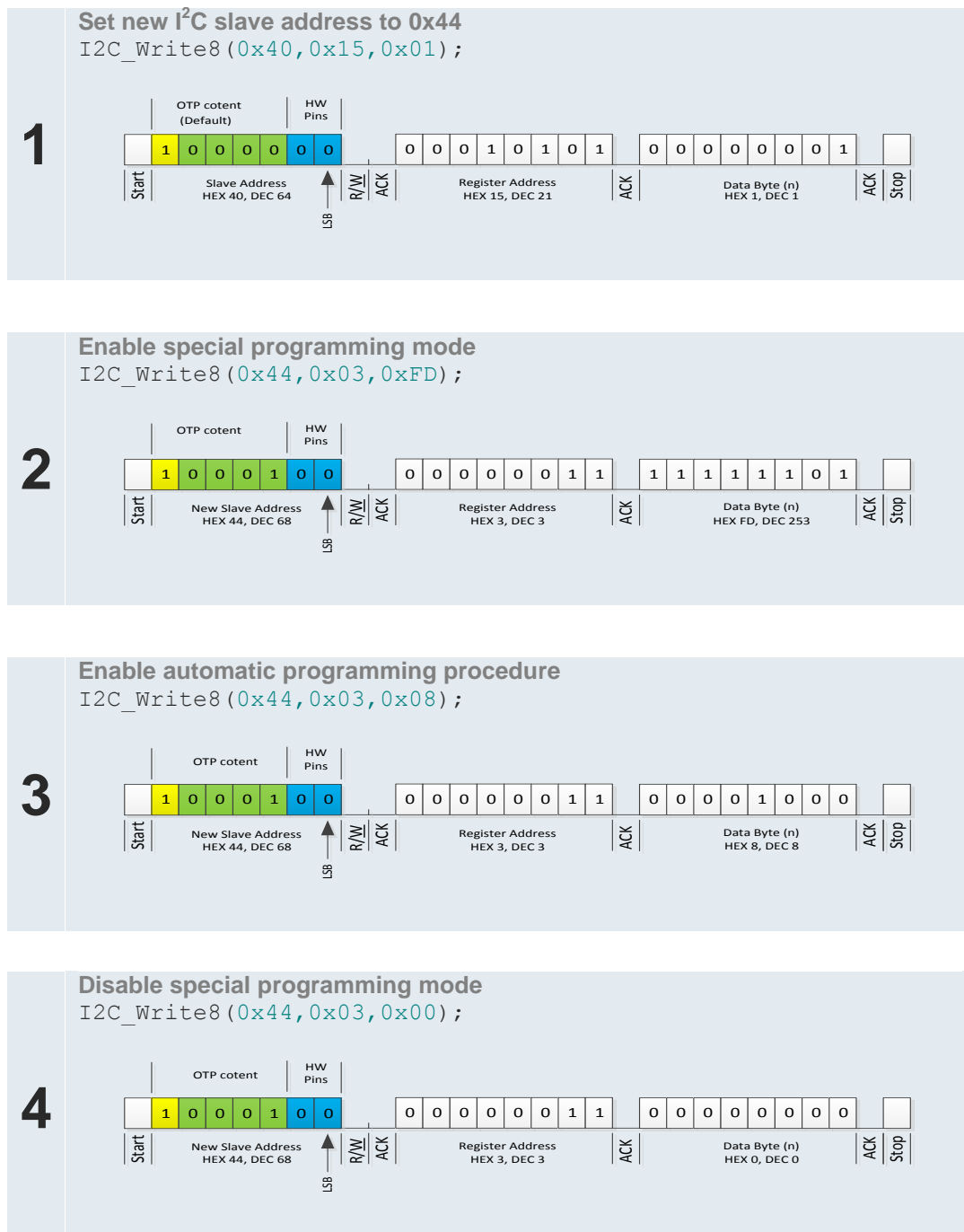
Note:

Use the special programming mode only to program the slave address!

C-Code EXAMPLE:

Figure 2:

4 Steps to program permanently a new I²C slave address

1
Set new I²C slave address to 0x44
`I2C_Write8(0x40,0x15,0x01);`

	OTP cotent (Default)	HW Pins				
Start	1 0 0 0 0	0 0	R/W ACK	0 0 0 1 0 1 0 1	ACK	0 0 0 0 0 0 0 1	ACK Stop
	Slave Address HEX 40, DEC 64			Register Address HEX 15, DEC 21		Data Byte (n) HEX 1, DEC 1	

LSB

2
Enable special programming mode
`I2C_Write8(0x44,0x03,0xFD);`

	OTP cotent	HW Pins				
Start	1 0 0 0 1	0 0	R/W ACK	0 0 0 0 0 0 1 1	ACK	1 1 1 1 1 1 0 1	ACK Stop
	New Slave Address HEX 44, DEC 68			Register Address HEX 3, DEC 3		Data Byte (n) HEX FD, DEC 253	

LSB

3
Enable automatic programming procedure
`I2C_Write8(0x44,0x03,0x08);`

	OTP cotent	HW Pins				
Start	1 0 0 0 1	0 0	R/W ACK	0 0 0 0 0 0 1 1	ACK	0 0 0 0 1 0 0 0	ACK Stop
	New Slave Address HEX 44, DEC 68			Register Address HEX 3, DEC 3		Data Byte (n) HEX 8, DEC 8	

LSB

4
Disable special programming mode
`I2C_Write8(0x44,0x03,0x00);`

	OTP cotent	HW Pins				
Start	1 0 0 0 1	0 0	R/W ACK	0 0 0 0 0 0 1 1	ACK	0 0 0 0 0 0 0 0	ACK Stop
	New Slave Address HEX 44, DEC 68			Register Address HEX 3, DEC 3		Data Byte (n) HEX 0, DEC 0	

LSB

3. AS5048B I^{2}C Register Map

The available registers for I^{2}C communication of the AS5048A are listed in Figure 3.

Figure 3:
I^{2}C Register Map

	Address dec	Name	Access Type	Bit Nr.	Symbol	Default	Description
Control OTP	3	Programming Control	R/W	7	not used	0	Programming control register. Programming must be enabled before burning the fuse(s). After programming is an verification mandatory. See programming procedure.
				6	Verify		
				5	not used		
				4			
				3	Burn		
				2	reserved		
				1			
				0	Programming Enable		
Programmable Customer settings	21	I²C slave address	R/W + Program	7	not used	n.a.	I²C slave address slave address consist of 5 programable bits (MSBs) and the hardware setting of Pins A1 and A2 I²C address <4> is by default not programmed and due to the inversion defined as '1'
				:			
				5			
				4	I²C address<4>	internally inverted	
				:	:	:	
				0	I²C address<0>	0	
	22	OTP Register Zero Position Hi	R/W + Program	7	Zero Position <13>	0	Zero Position value high byte
				:	:	:	
				0	Zero Position <6>	0	
	23	OTP Register Zero Position Low 6 LSBs	R/W + Program	7	not used	n.a.	Zero Position remaining 6 lower LSB's
				6			
				5	Zero Position <5>	0	
				:	:	:	
				0	Zero Position <0>	0	
Readout Registers	250	Automatic Gain Control	R	7	AGC value<7>	1	Automatic Gain Control value. 0 decimal represents high magnetic field 255 decimal represents low magnetic field
				:	:	:	
				0	AGC value<0>	0	
	251	Diagnostics	R	7	not used	n.a.	Diagnostic flags
				:			
				4			
				3	Comp High	0	
				2	Comp Low	0	
				1	COF	0	
				0	OCF	1	
	252	Magnitude	R	7	Magnitude<13>	0	Magnitude information afer ATAN calculation
				:	:	:	
				0	Magnitude<6>	0	
	253		R	7	not used	n.a.	
				6			
				5	Magnitude<5>	0	
				:	:	:	
				0	Magnitude<0>	0	
	254	Angle	R	7	Angle<13>	0	Angle Value afer ATAN calculation and zero position adder
				:	:	:	
				0	Angle<6>	0	
	255		R	7	not used	n.a.	
				6			
				5	Angle<5>	0	
				:	:	:	
				0	Angle<0>	0	

4. Ordering Information

Table 1:
Ordering Information

Ordering Code	Description	comments
AS5048B-HTSP	14 –Bit Programmable Magnetic Rotary Encoder with I2C-Interface	I^2C interface

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