MEAS KMA36 XPLAINED PRO BOARD

Digital Humidity
Digital Component Sensor (DCS) Development Tools

The KMA36 Xplained Pro provides the necessary hardware to interface the KMA36, A universal magnetic encoder for precise rotational measurement. To any system that utilizes Xplained Pro compatible expansion ports configurable for I²C communication. The KMA36 sensor feature a system-on chip technology that combines a magnetoresistive element along with analog to digital converter and signal processing in a standard small package. This model can operate from 3.0V to 3.6V, by using Anisotropic Magneto Resistive(AMR) technology, the KMA36 can determine contactlessly the magnetic angle of an external magnet over 360°.

Refer to the KMA36 data sheet for detailed information regarding operation of the IC:

http://www.te.com/usa-en/product-CAT-MRS0001.html

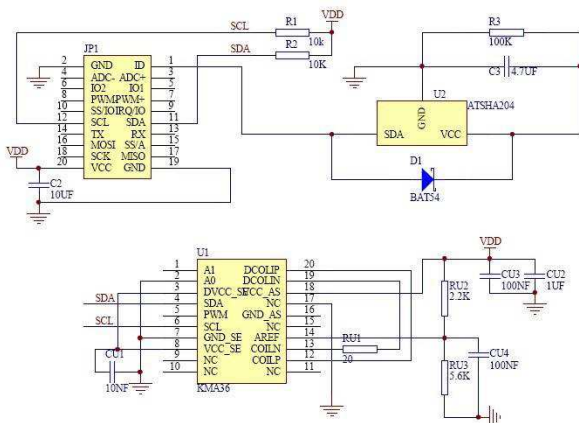## Performance
* User programmable parameters
* Low power mode
* -40°C to 125°C accuracy:1°C
* Sleep and automatic wake-up through I²C
* Programmable zero position
* Device address hardware configurable
* Operates from 3.0V to 3.6V

Features
* 20-pin Xplained Pro compatible connector
* I²C interface
* Xplained Pro Hardware identification Chip
* Atmel Studio 6 Project available for download
* µC C code available for download
* Programmable resolution up to 13 bits
* Very low hysteresis
* High accuracy mode

Specifications
* Contactless angle measurement from 0° to 360°
* Programmable resolution up to 13 bits
* I²C communication
* Very low hysteresis
* Incremental model
* Programmable zero position
* low power consumption

Schematic

Connector Pin Assignments (I²C Communications)

System Plug

Connector JP1					
Pin No.	Signal	Description	Pin No.	Signal	Description
1	ID	Hardware identification	11	SDA	TWI Serial Data
2	GND	Ground	12	SCL	TWI Serial Clock
3	N/C	Not Connected	13	N/C	Not Connected
4	N/C	Not Connected	14	N/C	Not Connected
5	N/C	Not Connected	15	N/C	Not Connected
6	N/C	Not Connected	16	N/C	Not Connected
7	N/C	Not Connected	17	N/C	Not Connected
8	N/C	Not Connected	18	N/C	Not Connected
9	N/C	Not Connected	19	GND	Ground
10	N/C	Not Connected	20	Vdd	Power Supply

Dimensions (mm)
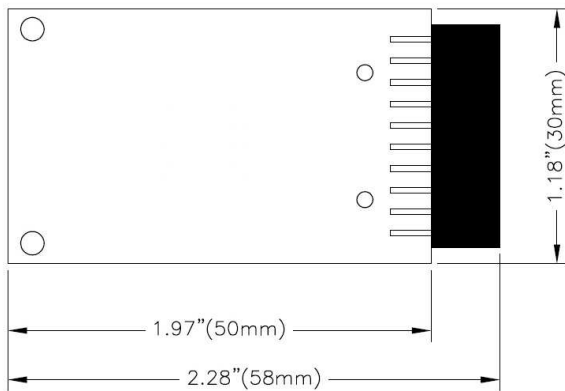
Detailed Description

I²C Interface

The peripheral module can interface to the host being plugged directly into an Xplained Pro extension port (configured for I²C) through connector JP1.

External Control Signals

The IC operates as an I²C slave using the standard 2 wire I²C connection scheme. The IC is controlled either by the host (through the Xplained Pro connector). In cases where one or more of the SCL and SDA signals are driven from an external source, 10k resistors R1, R2 provide pull-up. However, this also increases the apparent load to the external driving source. If the external source is not capable of driving these loads (10k), they should be removed.

Reference Materials

The complete software kit is available for download at: Link to KMA36_CPROJ.zip

Drivers & Software

Detailed example software and drivers are available that execute directly without modification on a number of development boards that support an integrated or synthesized microprocessor. The download contains several source files intended to accelerate customer evaluation and design. The source code is written in standard ANSI C format, and all development documentation including theory/operation, register description, and function prototypes are documented in the interface file.

Functions Summary

Enumerations	

enum	**kma36_status** {
	  kma36_status_ok, **kma36_status_no_i2c_acknowledge**,
	  kma36_status_i2c_transfer_error, **kma36_status_crc_error**
	}

enum	**kma36_i2c_address** {
	  kma36_i2c_address_GND, **kma36_i2c_address_DCOILP**, **kma36_i2c_address_DCOILN**,
	  kma36_i2c_address_DVCC_SE, **kma36_i2c_address_VCC**
	}

enum	**kma36_oversampling** {
	  kma36_oversampling_2 = 0, **kma36_oversampling_4**,
	  kma36_oversampling_8, **kma36_oversampling_32**
	}

Functions	
enum kma36_status	**kma36_read_data** (uint8_t *)
	Reads the KMA36 user register.
void	**kma36_init** (void)
	Configures the SERCOM I2C master to be used with the kma36 device.
bool	**kma36_is_connected** (void)
	Check whether KMA36 device is connected.
void	**kma36_set_i2c_address** (enum kma36_i2c_address)
	Configures KMA36 I2C address to be used depending on HW configuration The address depends on connection of one of following pins (GND, DCOILP, DCOILN, DVCC_SE, VCC) with A0 pin.
enum kma36_status	**kma36_sleep_enter** (void)
	Request KMA36 to enter sleep mode.
enum kma36_status	**kma36_sleep_exit** (void)
	Request KMA36 to exit sleep mode.
enum kma36_status	**kma36_enable_low_power_mode** (void)
	Request KMA36 to enable low power mode. In this mode, only 180° measurements are possible.
enum kma36_status	**kma36_disable_low_power_mode** (void)
	Request KMA36 to disable low power mode.
enum kma36_status	**kma36_enable_counter** (void)
	Request KMA36 to enable full turn counting.
enum kma36_status	**kma36_disable_counter** (void)
	Request KMA36 to disable full turn counting.
enum kma36_status	**kma36_enable_fast_rate** (void)
	Request KMA36 to enable fast measurement update rate In fast mode, measurement accuracy is reduced Update rate = 1 / (1.4ms x oversampling x const)
enum kma36_status	**kma36_disable_fast_rate** (void)
	Request KMA36 to disable fast measurement update rate.
enum kma36_status	**kma36_set_accuracy** (enum kma36_oversampling)
	Set KMA36 accuracy - unit is to be discussed Resolution impacts the measurement update rate. Update rate = 1 / (1.4ms x oversampling x const)
enum kma36_status	**kma36_set_resolution** (uint16_t)
	Set KMA36 resolution.
enum kma36_status	**kma36_read_angle** (float *)
	Read KMA36 current angle.

Project Setup

This project is based on ATSAMD20J18 board with Measurement Specialties Xplained Pro extension board connected to EXT1 pad as shown on figure below.
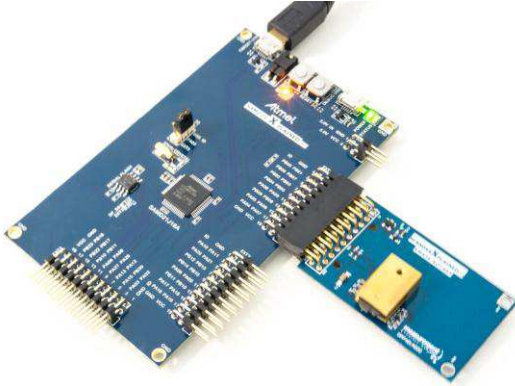
Running the Application

1. Download the KMA36 Xplained Pro example package on [TE Website](#)

1. Decompress the archive file

2. Open the .cproj project file with Atmel Studio 6

3. You will now be able to build the KMA36example project -

4. Finally, run the build result on your Xplained Pro Board -

Application Code

This section is intended to provide a basic example of functionality.

```c
/**
 * \file main.c
 *
 * \brief KMA36 Universal magnetic encoder sensor application file
 *
 * Copyright (c) 2014 Measurement Specialties. All rights reserved.
 *
 */

#include <asf.h>

float angle;
uint8_t err_cnt = 0;

int main (void)
{
        enum kma36_status status;
        float last_angle = 0;
        float variation = 0;
```

```c
uint16_t n = 0;
uint8_t read_data[7];

system_init();
delay_init();

// Configure device and enable
kma36_init();

// Set address
kma36_set_i2c_address(kma36_i2c_address_GND);

if( !kma36_is_connected() )
        return -1;

status = kma36_sleep_enter();
if( status != kma36_status_ok)
        return -1;

delay_s(2);

while( !kma36_is_connected() );

status = kma36_sleep_exit();
if( status != kma36_status_ok)
        return -1;

status = kma36_enable_counter();
if( status != kma36_status_ok)
        return -1;

status = kma36_enable_fast_rate();
if( status != kma36_status_ok)
        return -1;

status = kma36_set_accuracy(kma36_oversampling_4);
if( status != kma36_status_ok)
        return -1;

status = kma36_set_resolution(10);
if( status != kma36_status_ok)
        return -1;

status = kma36_enable_low_power_mode();
if( status != kma36_status_ok)
        return -1;

// Monitor angle every 10ms
while (1) {
```

```c
status = kma36_read_angle(&angle);

if( status != kma36_status_ok)
        return -1;


variation += angle - last_angle;
// Look for significant angle variation
if (  variation >= 1 ) {
        // Yes, so turn LED on.
        port_pin_set_output_level(LED_0_PIN, LED_0_ACTIVE);
        variation = 0;
} else if ( variation <= -1 ) {
        // No, so turn LED off.
        port_pin_set_output_level(LED_0_PIN, LED_0_INACTIVE);
        variation = 0;
}
delay_ms(10);
last_angle = angle;
n++;
if( n==50 ) n=0;
    }
}
```

Ordering Information

Description	Part Number
MEAS KMA36 XPLAINED PRO BOARD	DPP401A000

te.com/sensorsolutions

PRODUCT SHEET