

IPS2550STKIT GETTING STARTED

20230620

RENESAS ELECTRONICS CORPORATION

CONTENT

IPS2550STKIT Content

IPS2-Comboard, Micro B USB cable

IPS2550MROT4x90001, Two 10pin ribbon cables

Renesas disclaimer document

Getting Started Index

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IPS2550 OVERVIEW: HIGH-SPEED POSITION SENSOR

AECQ100 Grade-0 Automotive Qualified

Interface: sin/cos single ended or differential

Temperature range: -40° to 160° C ambient

Functional Safety: supports ASIL-C single

Voltage Supply: 3.3V ±10% or 5.0V ±10% supply

Speed: 600.000 (el) rpm

Propagation delay: 4μs

Overvoltage, reverse polarity, short-circuit protected

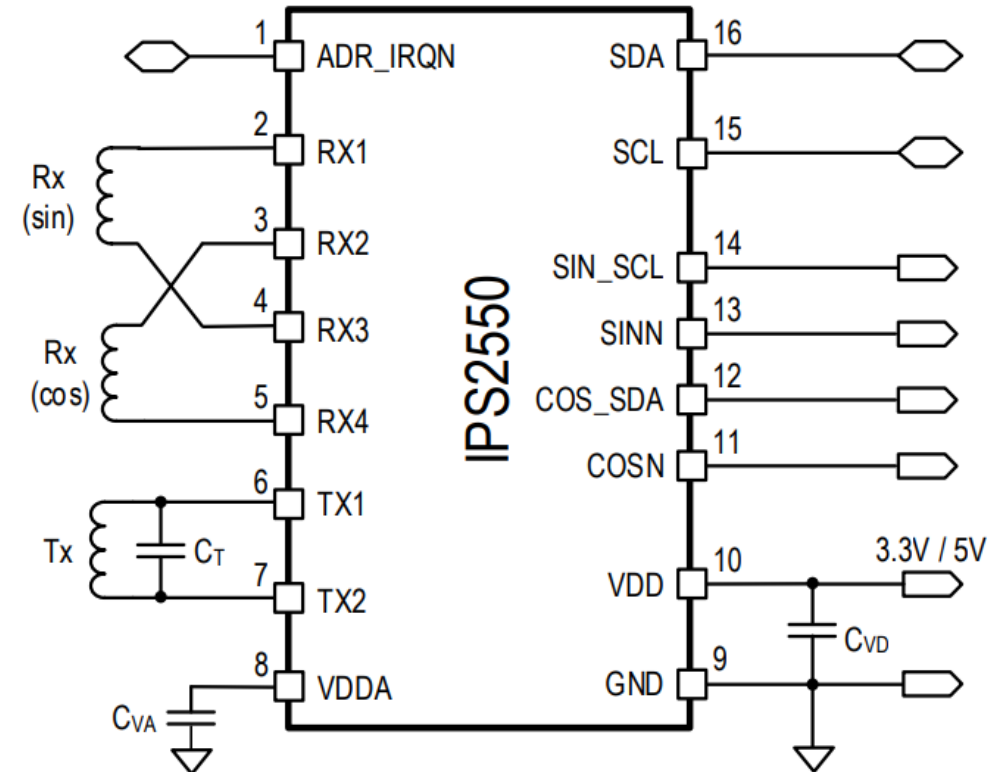
Programming interface: I²C or [over output pins](#)

Diagnostics interrupt to external MCU

[AGC to compensate air-gap variations](#)

TSSOP-16 [with exposed pad](#)

Improvement over IPS2200 in [blue](#)



IPS2550 is pin backward compatible to IPS2200 in straight pinout mode

EVALUATION KIT SETUP: STEP 1 - CONNECT BOARD

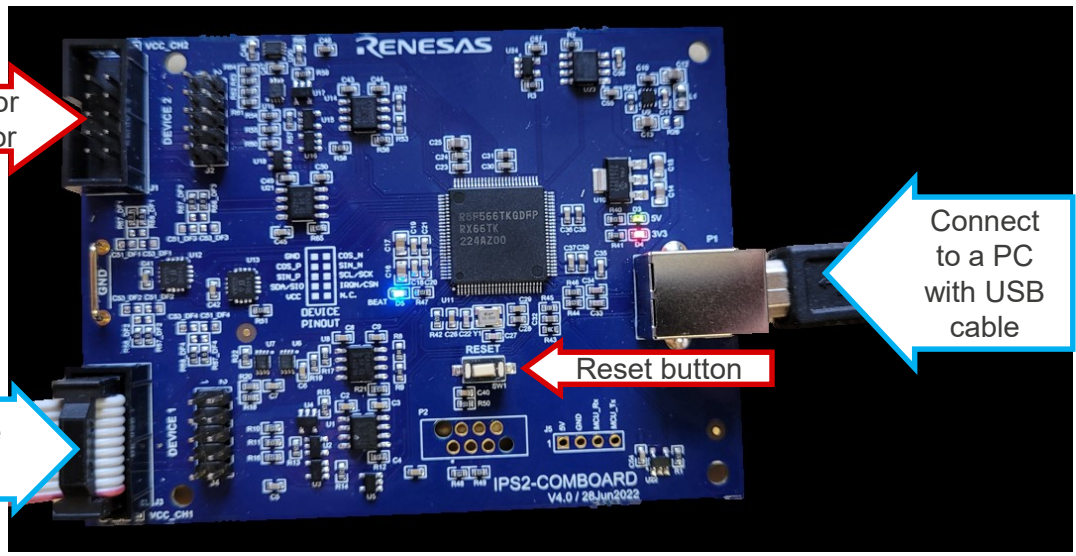
Connect the IPS2550MROT4X90001 sensor module to the IPS-COMBOARD

IPS-COMBOARD
(Same for IPS2200 and IPS 2550)



Header for 2nd sensor

Connect Sensor Module to Device1 header



Connect to a PC with USB cable

Reset button

EVALUATION KIT SETUP: STEP 2 – INSTALL GUI AND CONNECT

Download and Install the IPS2550 EVKIT Application. Open the application and click on “Connect”

(Download Link: https://www.renesas.com/eu/en/products/sensor-products/position-sensors/ips2550stkit-evaluation-kit-ips2550#design_development)

Select connection settings:

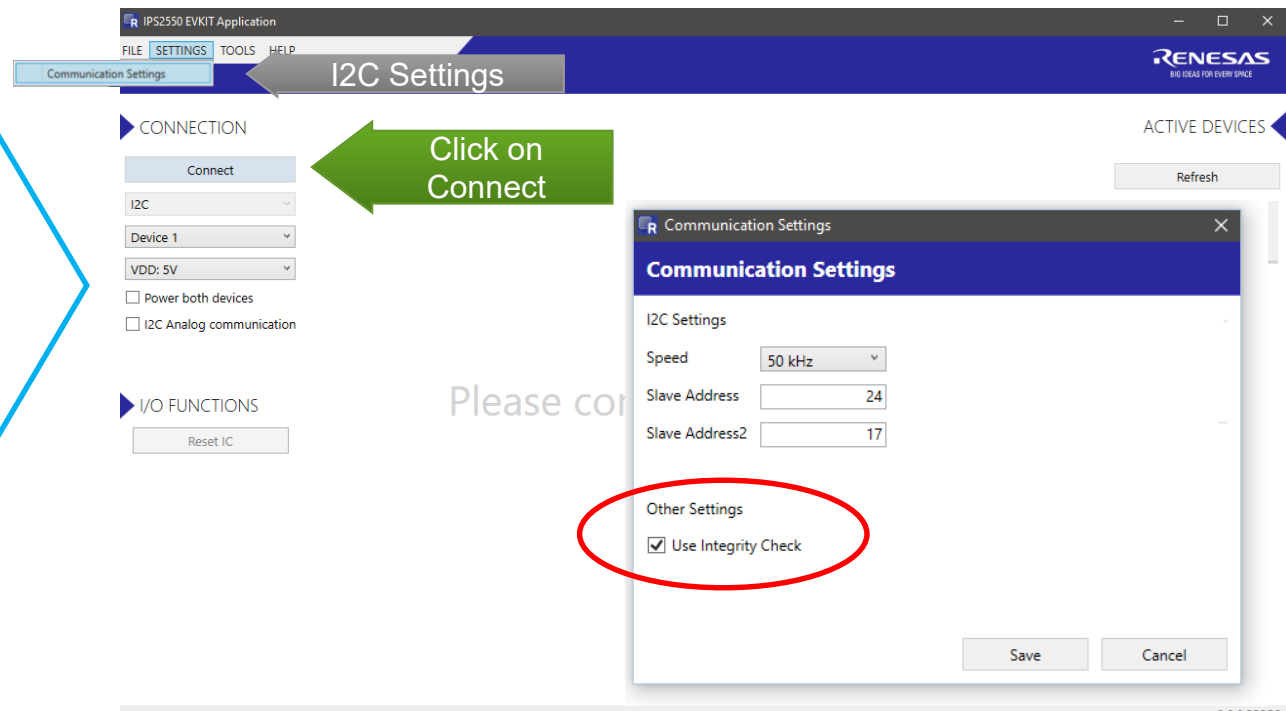
- (1) Select Device 1 (as connected)
- (2) Select VDD: 5V (IPS2550MROT4X90001 default)

Optional:

- (3) Change I2C address if needed in “Settings → Communication Settings”
- (4) Enable Integrity Check for default config

Default I2C Addresses:

- 24 dec (18h) → default + AdrPin High (IPS2550MROT4X90001)
- 17 dec (11h) → default + AdrPin Low
- 16 dec (10h) → old default



EVALUATION KIT SETUP: STEP 3 – READ OUTPUT SIGNALS

A) Place Target over the Sensor Module



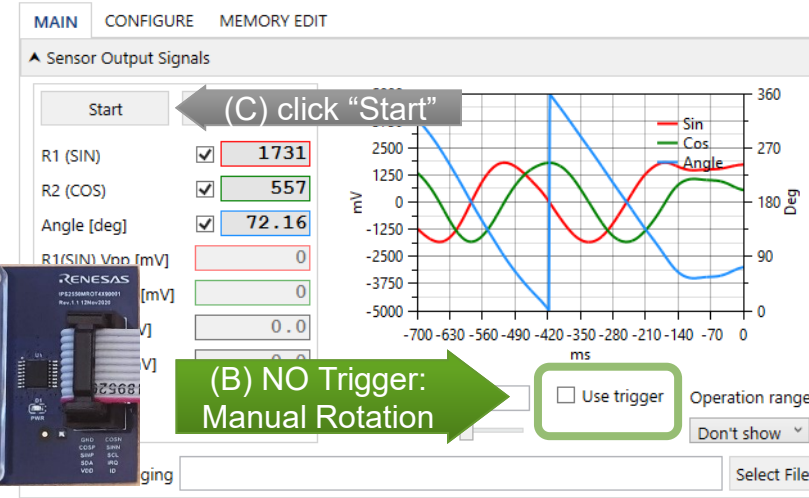
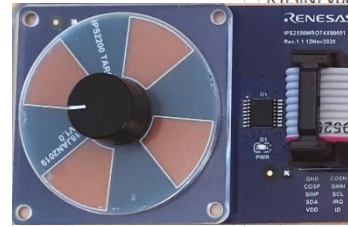
B) Decide for Automatic Trigger

Manual Rotation: NO Trigger Motor Rotation: USE Trigger



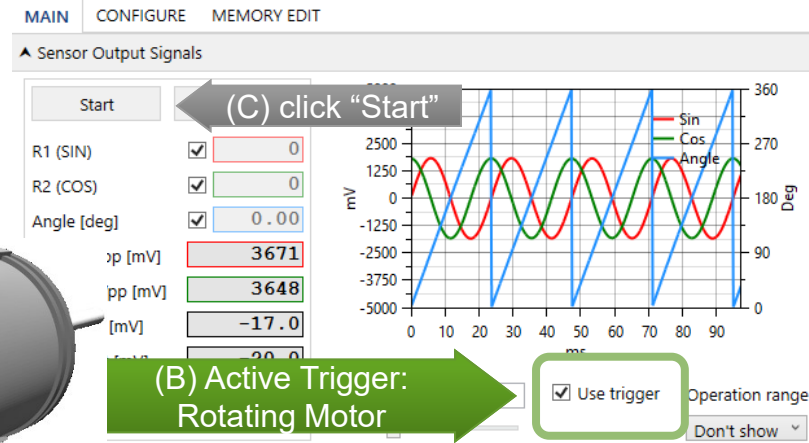
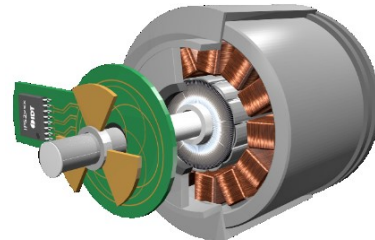
C) Click „Start“ to display data

Rotation by hand:
No trigger & configure time span



(B) NO Trigger: Manual Rotation

Motor rotating (preferred):
automatic trigger & select periods



(B) Active Trigger: Rotating Motor

ACTIVE DEVICES

Refresh
Device: EVK CommBoard
Name: IPS2550
FW: 2.5.0

ACTIVE DEVICES

Refresh
Device: EVK CommBoard
Name: IPS2550
FW: 2.5.0

EVALUATION KIT SETUP: STEP 4 – SENSOR CALIBRATION

Step 4: Sensor Configuration Options:

1. Use the Calibration Wizard



2. Alternatively configure steps A ...E manually (refer to the IPS2550 Programming Manual)

A) TX Bias Current

B) Gain

C) Offset

D) Amplitude Mismatch

E) Program to FTP

SENSOR CONFIGURATION USING THE CALIBRATION WIZARD

Select the setup and follow required steps A ...E in the wizard.

1. Select Setup

- This wizard helps to configure the device.
- The configuration steps should be performed in sequence as shown on the left side.
- Not required steps can be skipped.
- The wizard can be used in two ways:

Select Calibration Setup:

Target rotated by hand

Target rotated by motor

The wizard will ask to remove the target from sensor

Target must be rotating at constant speed between 100 and 1000rpm

E) Program to FTP

Write Calibration to NVM

Proceed with TX Current Setup

Close

MANUAL SENSOR CONFIGURATION WITH ROTATING MOTOR

Preparation:

Disable the AGC: AGC code is configured as static gain

A) TX current

Keep the default or set-up with programming manual

B) Gain

Adjust the master gain for desired output amplitudes only if AGC is not enabled after configuration

C) Offset compensation

Adjust Coil Offset Compensation until the Offset is as close as possible to „0“

D) Amplitude Mismatch compensation

Adjust Fine Gain Compensation until the Amplitude Mismatch is as close as possible to „1“

E) Enable AGC again if needed & Click on „Write FTP“

The screenshot shows the 'Sensor Output Signals' configuration window. The 'Sensor Output Signals' section includes a graph and several input fields:

- R1 (SIN)**: 0
- R2 (COS)**: 0
- Angle (deg)**: 0.00
- R1(SIN) Vpp [mV]**: 3671
- R2(COS) Vpp [mV]**: 3648
- Sin Offset [mV]**: -17.0
- Cos Offset [mV]**: -20.0
- Amplitude Mismatch**: 1.006
- Tx Current [µA]**: 496
- Master Gain**: 1.274
- R1 Fine Gain**: 0
- R1 Coil Offset**: 0
- R2 Fine Gain**: 0
- R2 Coil Offset**: 0

The graph displays three waveforms: Sin (red), Cos (green), and Angle (blue). The x-axis is labeled 'ms' and the y-axis is labeled 'mV'. The 'ACTIVE DEVICES' panel on the right shows the device name 'IPS2550' and firmware version 'FW:2.8.0'. The 'Calibration Wizard' button is also visible.

Colored arrows indicate the configuration steps:

- A) TX Bias Current** (green arrow) points to the Tx Current field.
- B) Gain** (blue arrow) points to the Master Gain field.
- C) Offset** (red arrow) points to the Sin and Cos Offset fields.
- D) Amplitude** (yellow arrow) points to the Amplitude Mismatch field.
- E) Program to FTP** (grey arrow) points to the Write FTP button.

IPS2550: CONFIGURATION TAB

All IPS2550 device settings are available in the configure tab.

It consists of 3 register blocks:

- **FTP**
 - Few Times Programmable Register
 - (1000 write cycles max.)
- **SRB**
 - Shadow Register Bank
 - Volatile
- **SFR**
 - Special Function Register
 - Contains Status and Interrupt handling

The screenshot shows the 'IPS2550STKIT Application' window with the 'CONFIGURE' tab selected. The 'CONFIGURE' tab is highlighted with a green arrow and a green box labeled 'Configure Tab'. The interface is divided into several sections:

- CONNECTION:** Includes buttons for 'Disconnect', 'I2C', 'Device 1', 'VDD: 5V', and checkboxes for 'Power both devices' and 'I2C over output pins'.
- I/O FUNCTIONS:** Includes buttons for 'Read FTP', 'Write FTP', 'Read SRB', 'Write SRB', 'Read SFR', 'Write SFR', and 'Reset IC'.
- MAIN CONFIGURE:** Includes tabs for 'INTERFACE & SUPPLY', 'AFE CONFIG', 'DIAGNOSTICS CONFIG', 'DIAGNOSTICS MASK', 'DIAGNOSTICS STATUS', and 'TRACEABILITY'.
- INTERFACE & SUPPLY:** Includes a 'Shown memory type' dropdown set to 'FTP', an 'I2C slave address' field showing '17 / 0x11 ADR pin "Low" | 24 / 0x18 ADR pin "High"', and several other configuration fields: 'i2c_slave_sub_addr' (2), 'ana_prm_dis' (enabledPrmModeEntry), 'back_end_protocol' (Differential), 'system_protocol' (I2C ADDR), 'cyber_security' (ReadWriteAllowed), 'prot_integ_check_dis' (Enabled), and 'vdda_3v_5v' (5V).

At the bottom of the configuration area, a red text note states: "Register values in red are different than actual values in chip memory. You need to write them to chip memory in order to take effect."

(For details refer to the [IPS2550 Programming Manual](#))

IPS2550: MEMORY EDIT

Default Setup:

5V Mode

I2C Interface with address pin

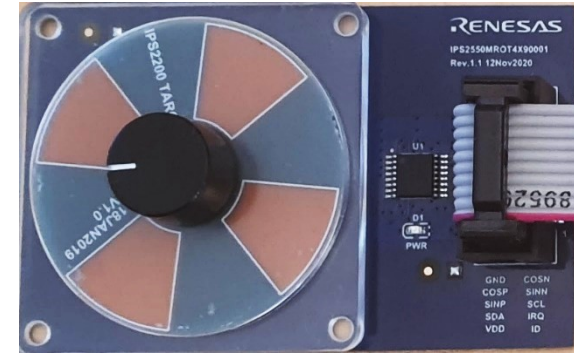
Differential Sin/Cos Output

AGC "ON"

Examples:

- System Config1 0x00 =
 - 0121h -> AGC ON (default)
 - 0321h-> AGC OFF

- System Config2 0x01 =
 - 0001h-> IPS2550 Pinout (default)
 - 0021h-> IPS2200 Pin Compatible



FTP	System Config	Gain	Coil1 Ampl.	Coil1 Offset	Coil2 Ampl.	Coil2 Offset	Emitter Current	
0h	0121	0001	0003	0000	0080	0000	0080	00BE
8h	00AF	0000	07FF	0000	0000	0000	0000	
10h		003A	02C4	0004	0644	0443		
18h	0000	0019	0009	0706	0000	002D	0041	0057

SFR	0	1	2	3	4	5	6	7
68h	0000	0000	0000	0000	0000	0000	0167	0000
70h	0000	0000	0000	0002	0000	0000	0000	0000
78h	0044	0000	0000					02A3

AGC Value

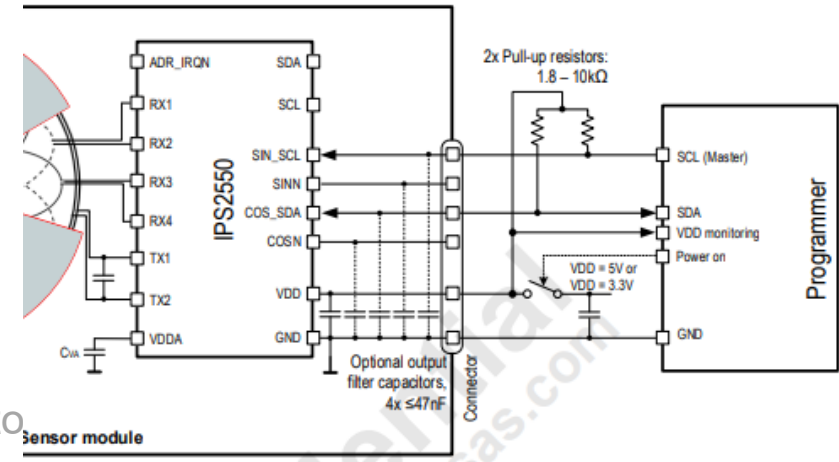
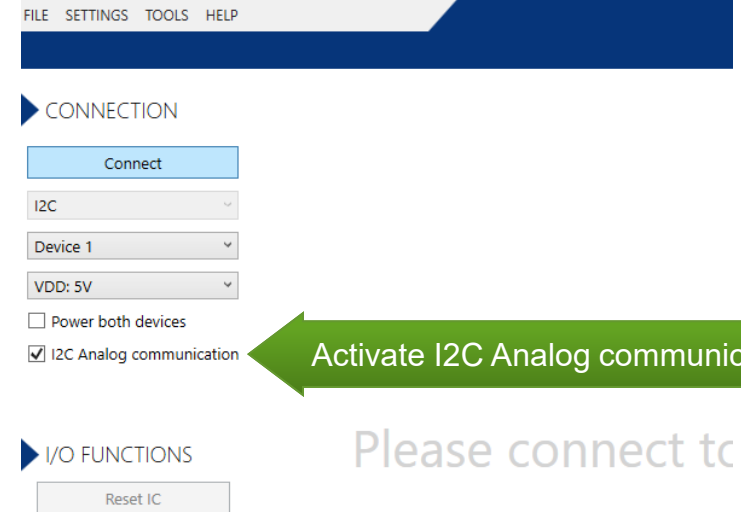
ProductID

(For details refer to the IPS2550 Programming Manual)

PROGRAMMING OVER ANALOG OUTPUT PINS

It is possible to program the IC over the analog output pins. Select “**I2C Analog communication**”.

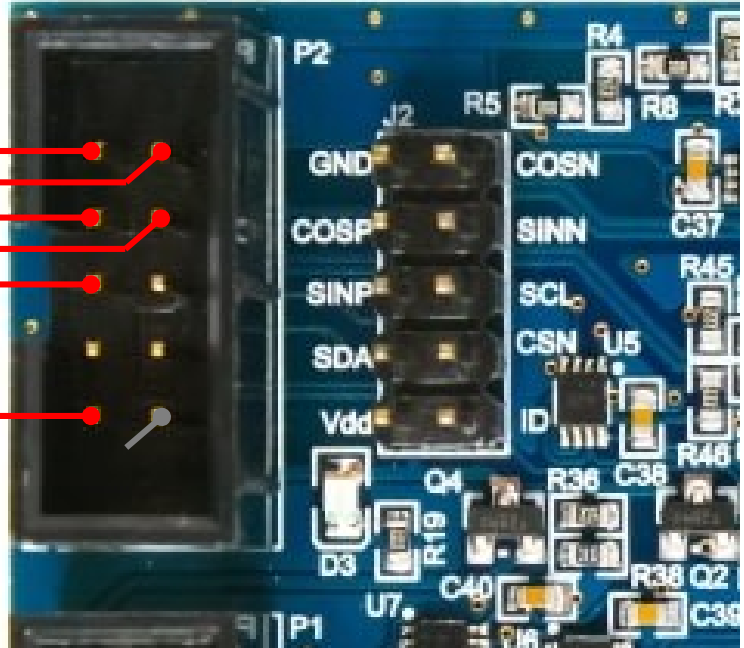
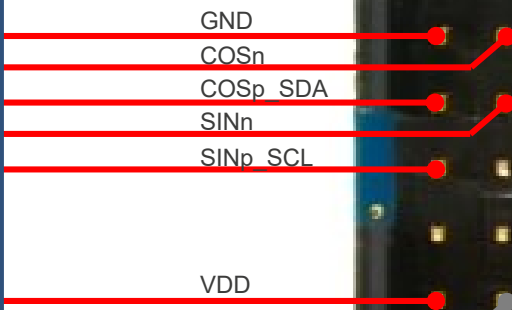
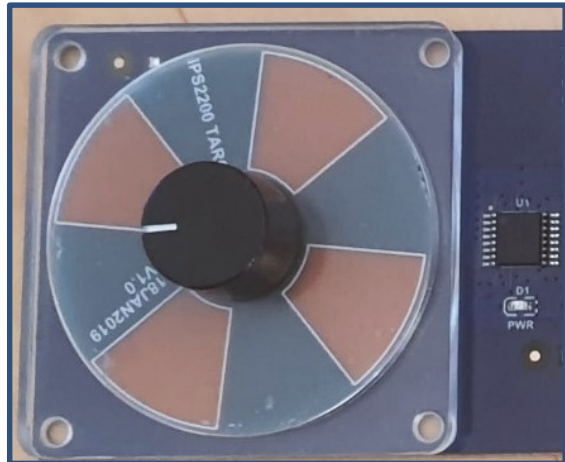
- When I2C over analog lines is selected 4KHz clock is used automatically
- If a customer programming board is used pull-ups should be 2.4K or lower.
- Filtering capacitors should be max 47nF
- If an IPS-comboard is used:
 - From Rev.2.4 and V4.0, the smaller pull-ups are activated automatically. Connect supply and output pins only.
 - Up to Rev.2.3 and FW:3.2 or newer, external 2K4 pull-ups must be added on SIN_SCL and COS_SDA pins. (Jumper wires not needed)
 - Up to Rev.2.3 and with FW:2.11 or older, analog output pins on the IPS-comboard must be connected to I2C pins of the IPS-comboard using jumper wires. As well the pull-ups on the IPS-comboard must be reduced to 2K4. (eg. add additional 4K7 resistors in parallel)



HOW TO CONNECT A SENSOR WITH 6 WIRES?

IPS-COMBOARD
(Same for IPS2200 and IPS 2550)

Sensor Module



**Software
Connection
Settings:**

▶ CONNECTION

Connect

I2C

Device 1

VDD: 5V

Power both devices

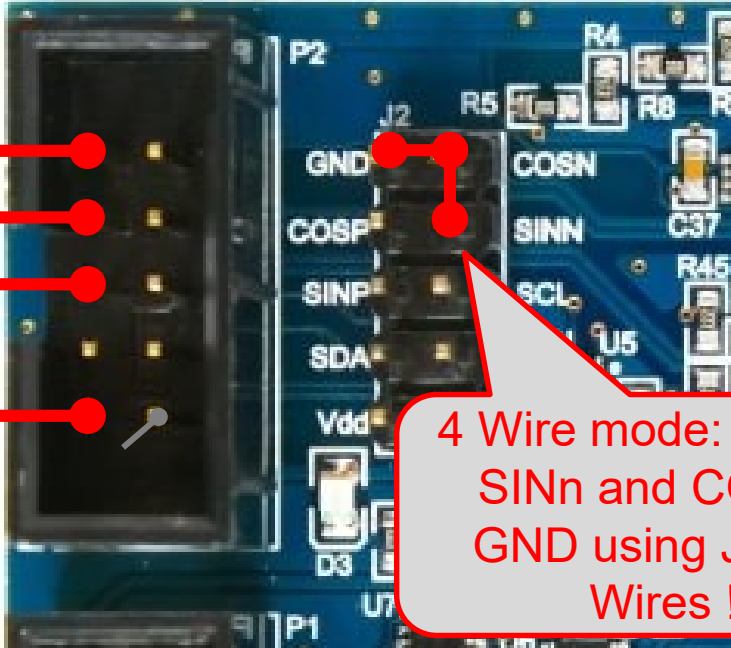
I2C over output pins

4-wire connection

HOW TO CONNECT A SENSOR WITH 4 WIRES?

IPS-COMBOARD
(Same for IPS2200 and IPS 2550)

Sensor Module



4 Wire mode: Connect SINn and COSn to GND using Jumper Wires !!!

Software Connection Settings:

CONNECTION

Connect

I2C

Device 1

VDD: 5V

Power both devices

I2C over output pins

4-wire connection

IPS2550 SUPPORT DOCUMENTS

IPS2550 Landing Page:

<https://www.renesas.com/ips2550>

IPS2550 Datasheet (secure link):

<https://www.renesas.com/us/en/document/dst/ips2550-datasheet>

IPS2550 Sensor and Coil Design Instruction Video (9min):

<https://www.renesas.com/us/en/video/how-design-inductive-position-sensor>

IPS2550 Customer Reference Board Catalog:

<https://www.renesas.com/us/en/document/oth/ips2-customer-reference-board-catalog-crb>

IPS2550 EMC Recommendations (secure link):

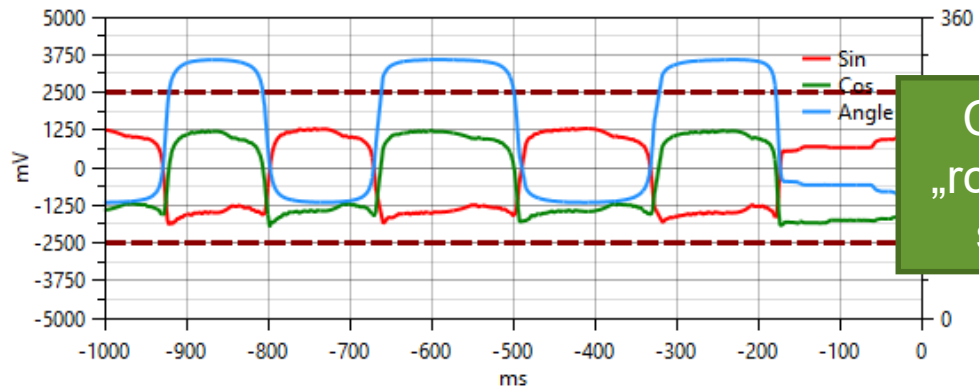
<https://www.renesas.com/document/apn/ips2550-emc-recommendations>

IPS2550 Programming Guide:

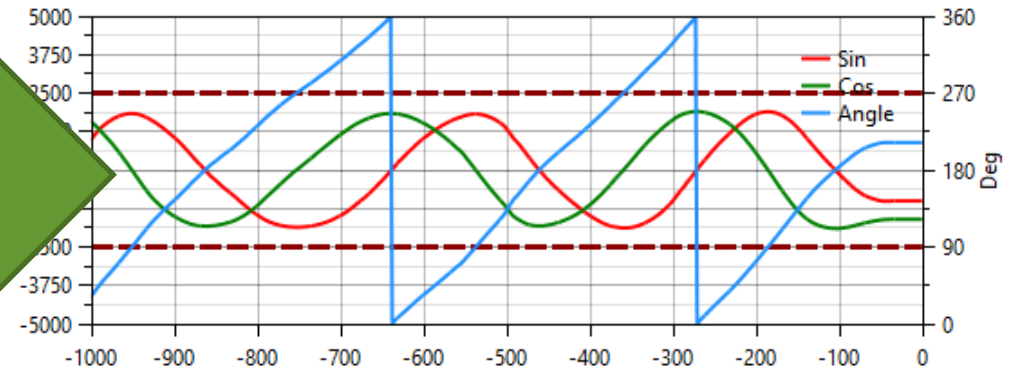
<https://www.renesas.com/document/man/ips2550-programming-guide>

FREQUENTLY ASKED QUESTIONS

WHY ARE THE OUTPUT SIGNALS SHIFTED BY 180 DEG?



Change „rc_switch“ setting



MAIN **CONFIGURE** MEMORY EDIT

INTERFACE & SUPPLY **AFE CONFIG** DIAGNOSTICS CONFIG DIAGNOSTICS MASK DIAGNOSTICS STATUS TRACEABIL

Shown memory type FTP

afe_gain_code	45	afe_r1_gain_cal	0
afe_r1_offset_cal_r	0	afe_r2_gain_cal	0
afe_r2_offset_cal_r	0	exc_current_cal_base	18
afe_agc_dis	Enabled	rc_switch	Straight
agc_mode	select0p9Vpeak	d2a_afe_boost_sel	enabled
afe_r1_offset_cal	Substraction	afe_r2_offset_cal	Substraction
exc_current_cal_mult	mult 64		

