### Key Features

- Up to 4 independent parallel PSI5 channels
- Manchester protocol decoder
- Error detection and handling

### Highlights

The Peripheral Sensor Interface is an interface for automotive sensor applications.

PSI5 module supports PSI5 protocol specification V1.3 and extended V2.0 Powertrain substandard.

Data rates of 125 kbit/s and 189 kbit/s are supported.

### Customer Benefits

- Allows greater bus topology flexibility; applicable to variety of use cases
- Simplifies implementation while the message recovery is done in HW
- Reduces software overhead while the errors will be detected by the module itself
PSI5
Up to 4 independent parallel PSI5 channels

- Each channel supports 6 sensor slots
- Allows a greater flexibility from bus topology point of view
- PSI5-A (asynchronous), PSI5-P (synchronous parallel), PSI5-U (synchronous universal), PSI5-D (synchronous daisy chain) bus topologies supported
- Each channel consists of two pins (PSI5TX and PSI5RX)
- PSI5TX is used in synchronous transmission mode for sync pulse that will trigger a data frame for data acquisition from a sensor
- PSI5RX carries Manchester coded messages from a sensor back to the ECU
- Storage of up to 32 frames per channel with 24 bit timestamp (resolution: 1 µs)
PSI5
Manchester protocol decoder

› Allows message recovery from a sensor without any CPU or software intervention
› Simplifies design between AURIX™ and PHY while only one pin is sufficient for message recovery
› Manchester-2 (convention as per G.E. Thomas) is used by PSI5 module
› The Manchester decoder uses a nominal 4 MHz / 6.048 MHz (depending which PSI5 data rate is selected) ➔ 32 samples per bit
PSI5
Error detection and handling

› Error recognition in Manchester code capabilities:
  - Manchester coding error in start bits
  - Messaging bits with Manchester coding error
  - Manchester coding error but messaging bits OK

› Error detection for the Sensor to ECU messages is realized in one of the two possible ways:
  - Single bit even parity (recommended for 10 or less bits)
  - Three bit CRC (recommended for long data words)
    - The applied generator polynomial of the CRC is $g(x) = x^3 + x + 1$ with a binary initial value (seed) of “111”

› Error detection capabilities regarding to parity/CRC:
  - Checksum error (wrong parity/CRC)
  - CRC error during serial communication
PSI5 System integration

PSI5 module is connected to several external modules:

› As an input clock source for the Clock Control module, $f_{SPB}$ is used

› Interrupt Router: Schedules service requests coming from 8 interrupt sources available for the PSI5 module

› Port Control: Connects the PSI5TX and PSI5RX pins to the external GPIO pins

› GTM: Enables timestamp generation
Application example
Connection of sensors to an ECU

Overview

▶ This application example shows typical usage of PSI5 module in airbag or powertrain domain

▶ PSI5 module is connect to the external PSI5 transceiver module (PHY) whose role is to fulfill physical layer requirement that cannot be achieved with MCU alone

Advantages

▶ The sensors are connected to the ECU by just two wires, using same lines for power supply and data transmission

▶ This allows high reliability data transfer at lowest possible implementation overhead and cost
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