

PSI5

Peripheral Sensor Interface

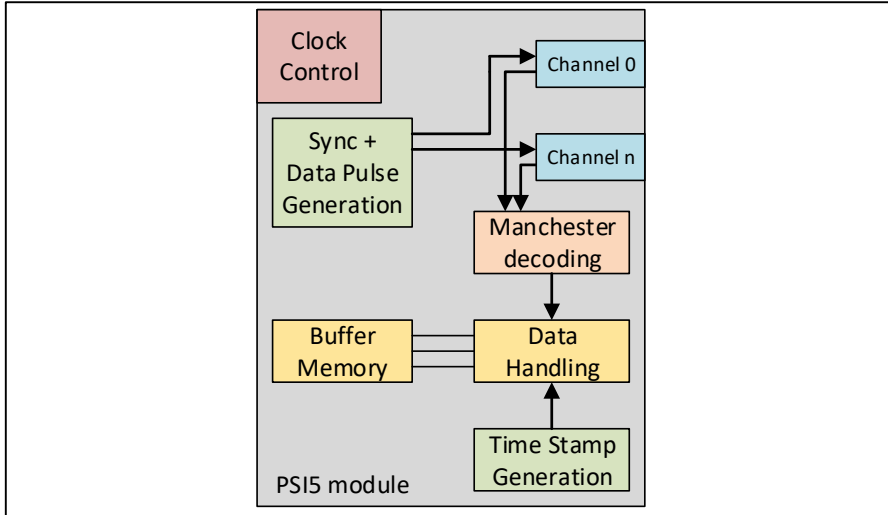
AURIX™ TC3xx Microcontroller Training
V1.0 2020-06



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PSI5

Peripheral Sensor Interface



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.

Key Features

Up to 4 independent parallel PSI5 channels

Manchester protocol decoder

Error detection and handling

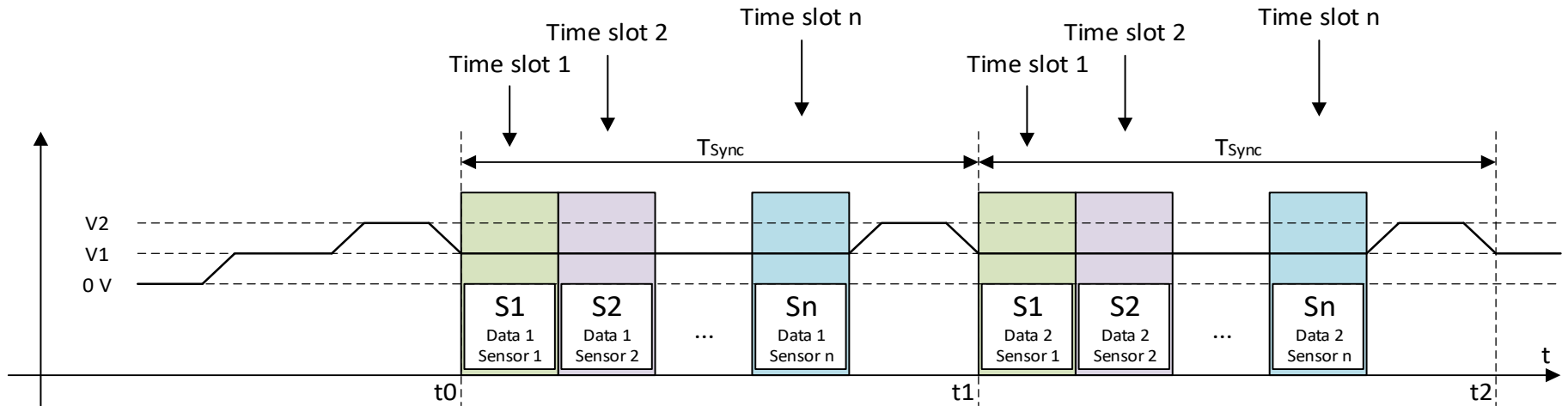
Customer Benefits

Allows greater bus topology flexibility;
applicable to variety of use cases

Simplifies implementation while the message recovery is done in HW

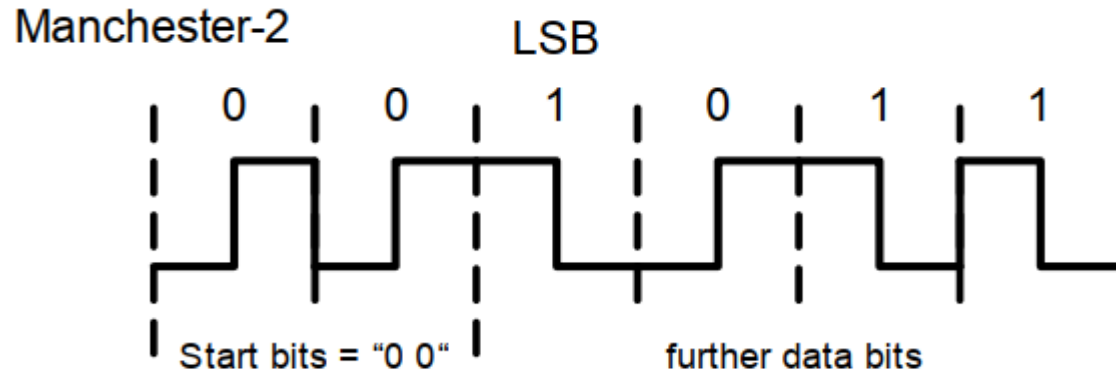
Reduces software overhead while the errors will be detected by the module itself

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 μ s)

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

Error detection and handling

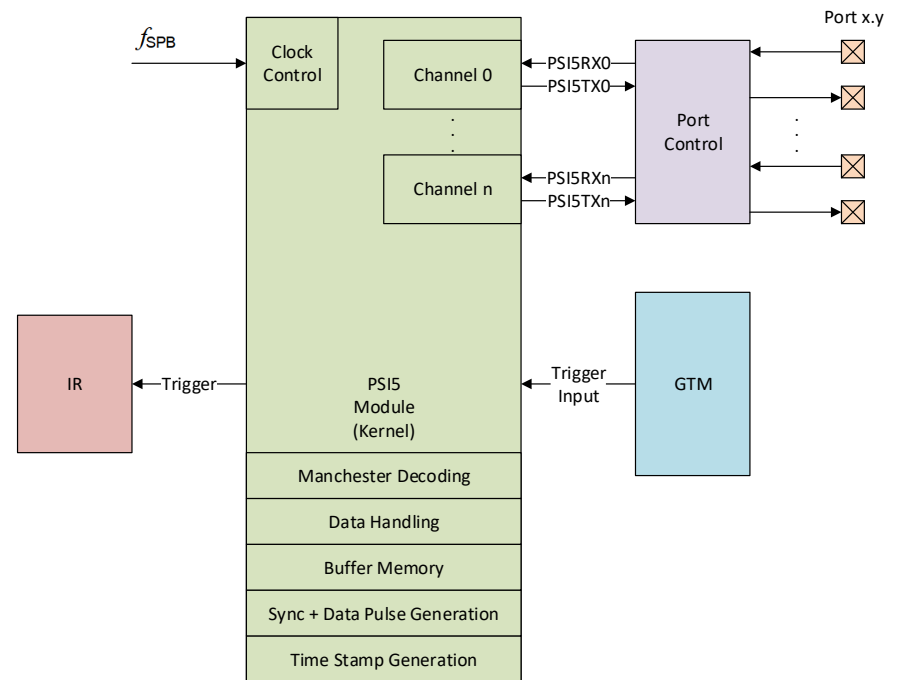
- › Error recognition in Manchester code capabilities:
 - Manchester coding error in start bits
 - Messaging bits with Manchester coding error
 - Manchester coding error but messaging bits OK
- › Error detection for the Sensor to ECU messages is realized in one of the two possible ways:
 - Single bit 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

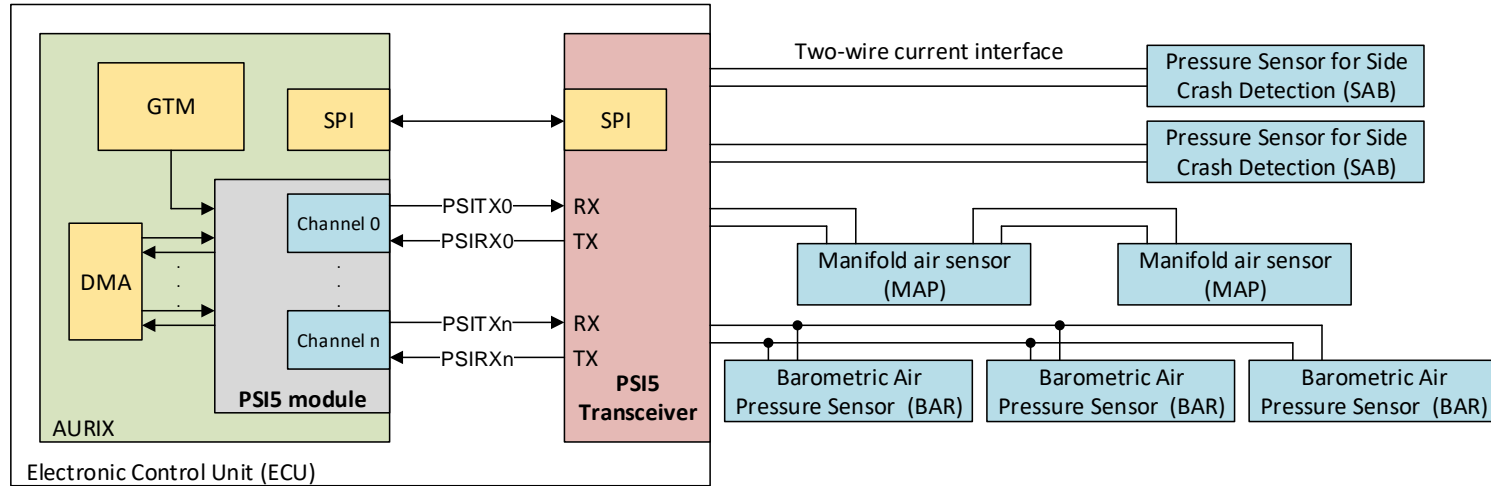
PSI5 module is connected to several external modules:

- › 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 fulfil 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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Document reference

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