



# PSI5

## Peripheral Sensor Interface

AURIX™ TC4xx Microcontroller

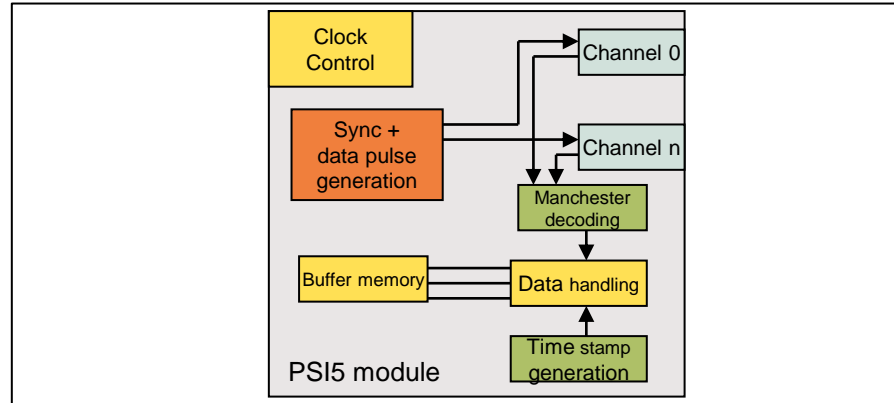
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# PSI5

## 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 V2.1 powertrain substandard
- › Data rates of 125 kbit/s and 189 kbit/s are supported

### Key Features

Up to 2 independent parallel PSI5 channels

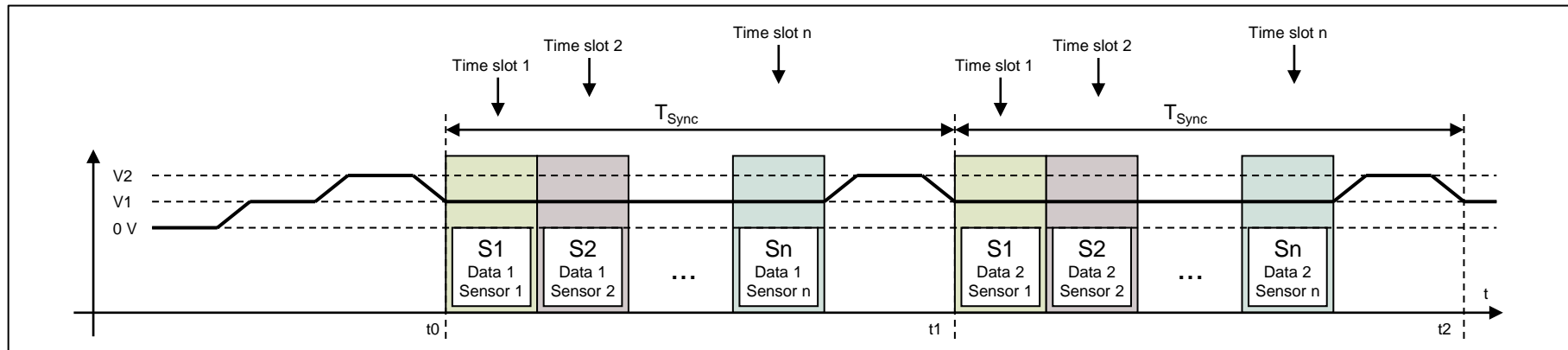
Manchester protocol decoder

Error detection and handling

### Customer Benefits

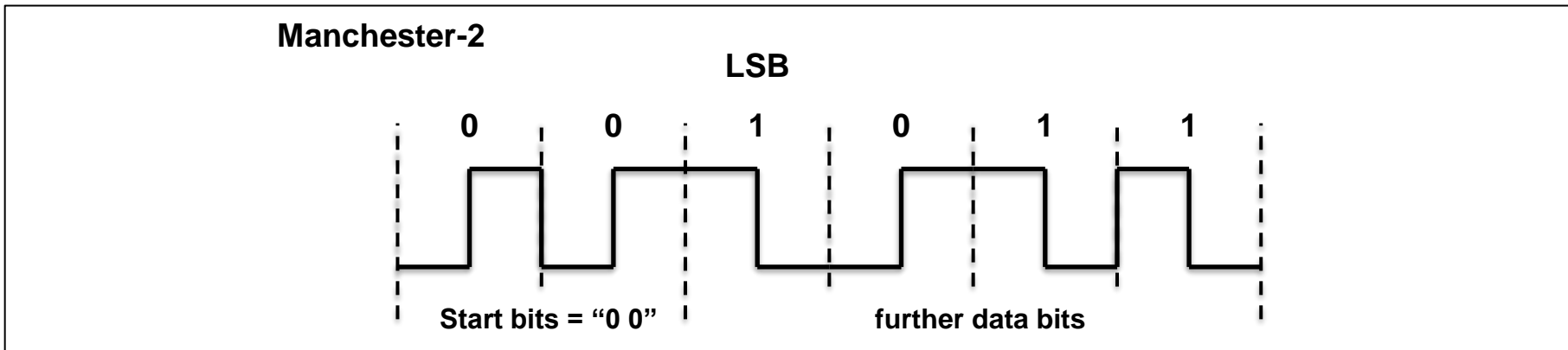
- › Allows greater bus topology flexibility; applicable to variety of use cases
- › Simplifies implementation while the message recovery is done in HW
- › Reduces software overhead while the errors will be detected by the module itself

## 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  $\mu$ 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

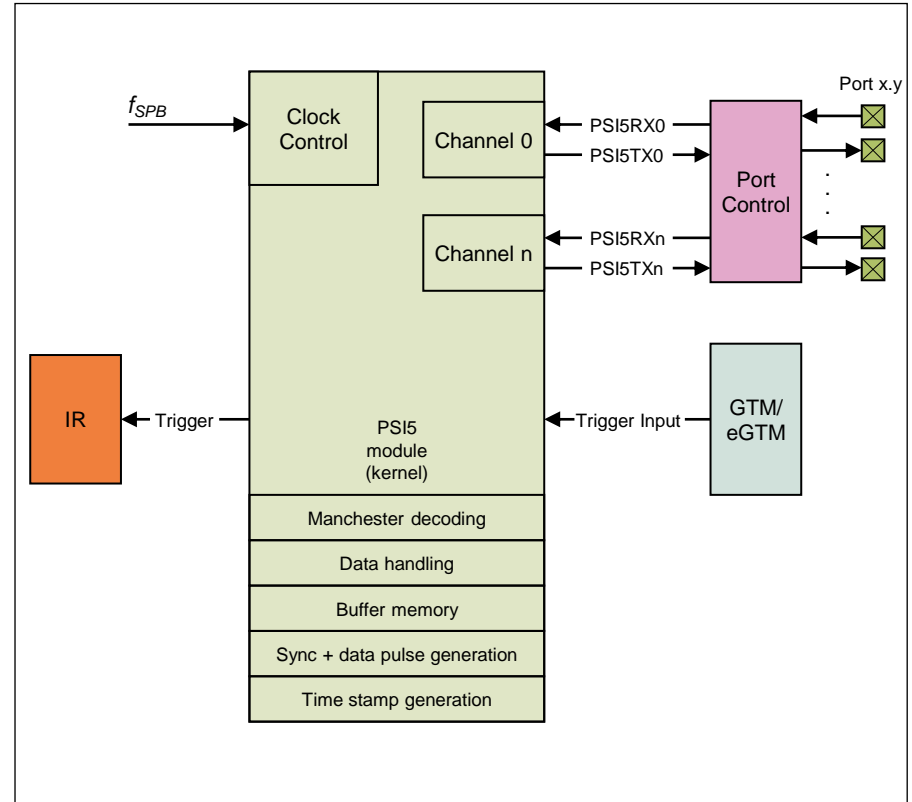
- › Error recognition in Manchester code capabilities:
  - Manchester coding error in start bits
  - Messaging bits with Manchester coding error
  - Manchester coding error but messaging bits OK
- › Error detection for the Sensor to ECU messages is realized in one of the two possible ways:
  - Single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

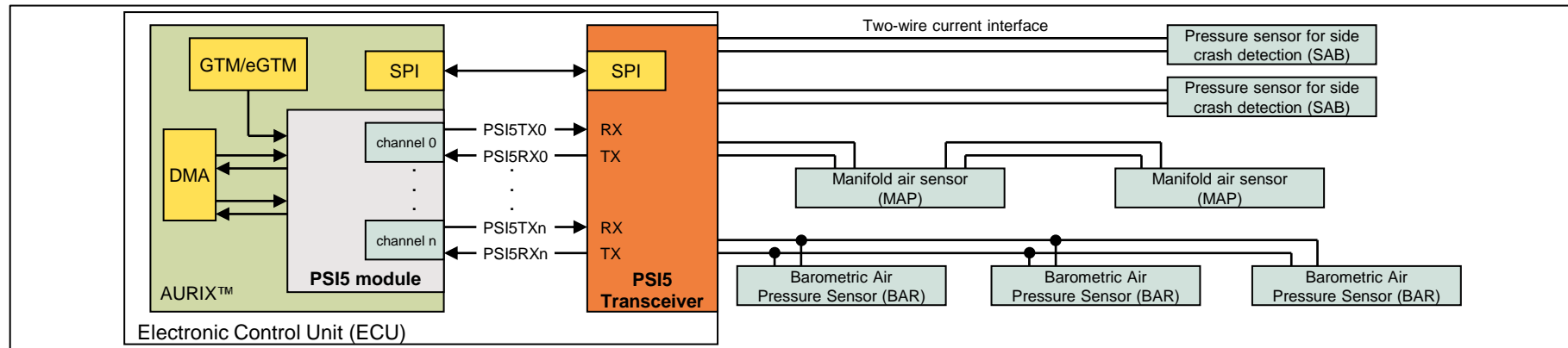
PSI5 module is connected to several external modules:

- › 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/eGTM: 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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AURIX\_3\_Peripheral\_  
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