

HSPDM

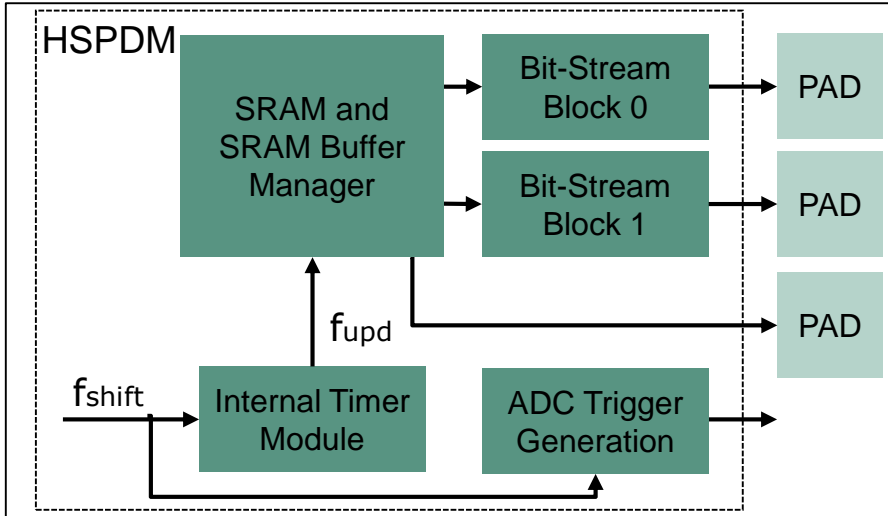
High Speed Pulse Density Modulation Module

AURIX™ TC3xx Microcontroller Training
V1.0 2020-12



[Please read the Important Notice and Warnings at the end of this document](#)

High Speed Pulse Density Modulation Module



Highlights

- > The High Speed Pulse Density Modulation (HSPDM) module is used to generate either a Pulse Density Modulated (PDM) bit-stream or a Pulse Width Modulated (PWM) bit-stream with a fixed data rate up to 160 Mbps.
- > Up to two independent synchronous bit-streams.

Key Features

Shift register generated bit-stream

$\Delta\Sigma$ modulator generated bit-stream

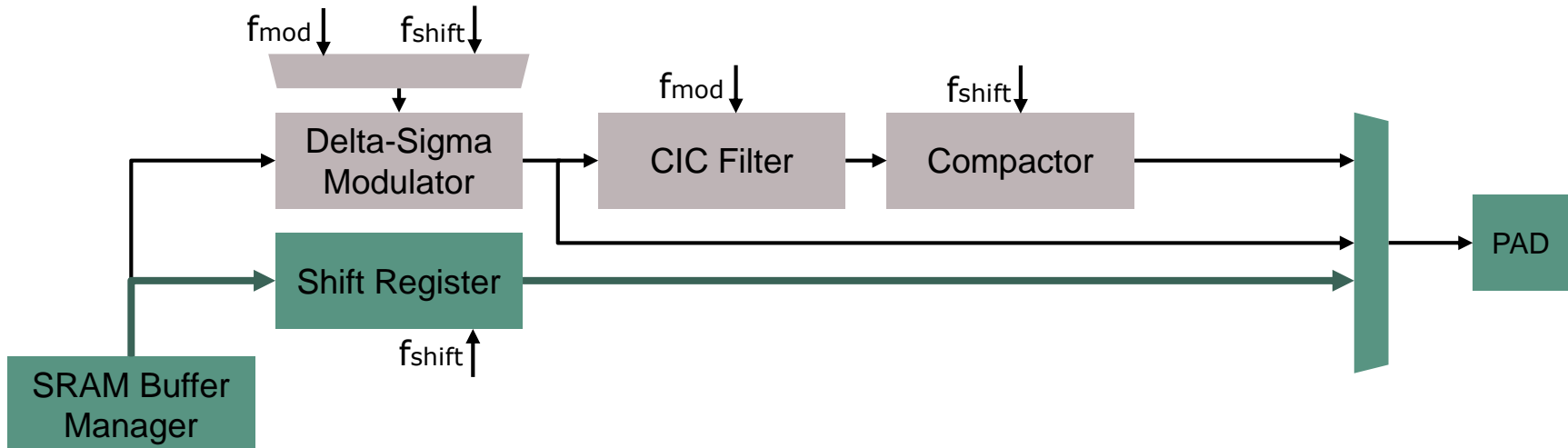
ADC Trigger Generation

Customer Benefits

- > PDM and PWM bit-stream generation
- > Arbitrary waveform generation
- > Ability to control an MMIC

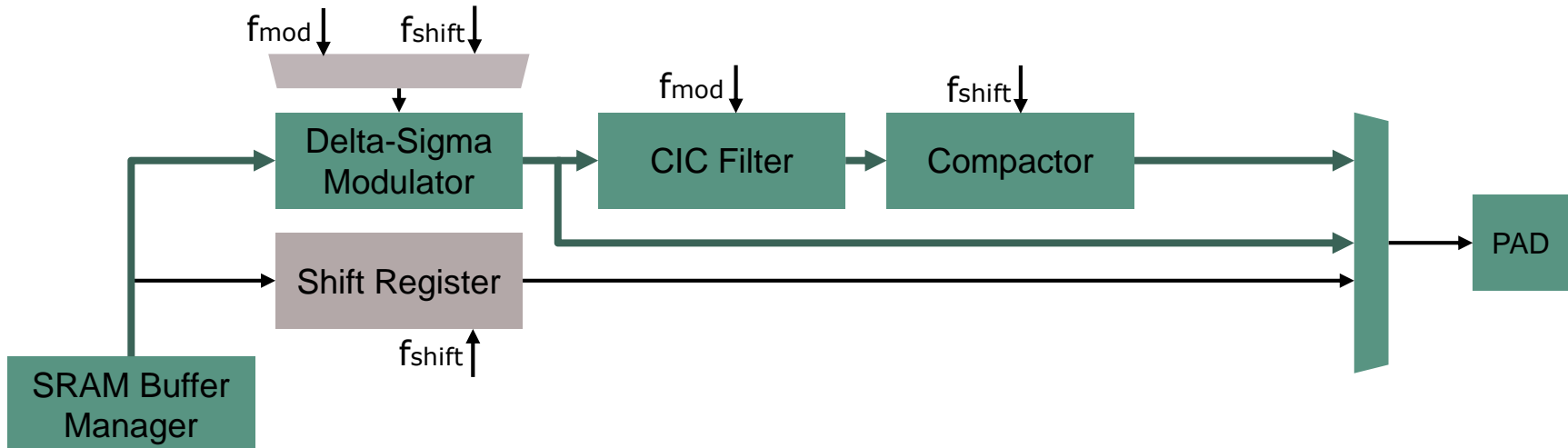
Shift register generated bit-stream

- > In this mode, a 16-bit digital word is loaded by the bit-stream loader (inside the SRAM and SRAM buffer manager block).
- > The shift register serializes the 16-bit word and sends it bit-wise (LSB first) on the rising edge of the clock.
- > At the output, a 1-bit bit-stream at 160 Mbps is generated which can be pushed out of the microcontroller through the multiplexer.
- > The Delta-Sigma modulator, the CIC filter and the Compactor are disabled in this mode of operation.
- > PWM signals with a resolution step of 6.25 ns can be generated in this mode.



$\Delta\Sigma$ modulator generated bit-stream

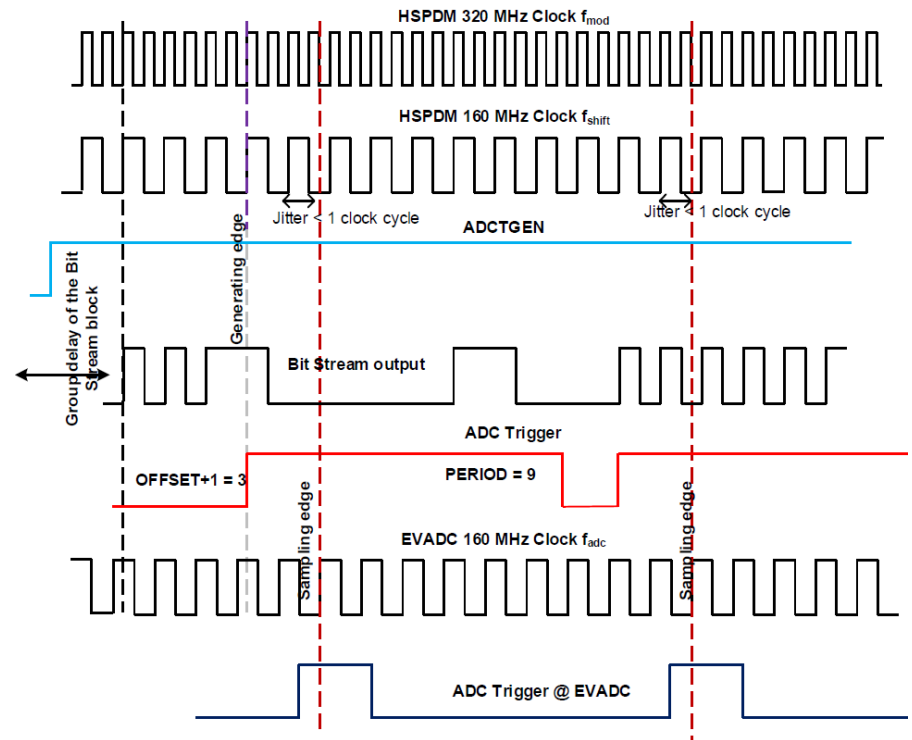
- › Two modes can be chosen here:
 - $\Delta\Sigma$ modulator generated bit-stream with the CIC filter and the Compactor enabled:
 - A 16-bit digital word is loaded by the bit-stream loader at the input of the $\Delta\Sigma$ modulator. The $\Delta\Sigma$ modulator runs at 320 MHz, generating a PDM bit-stream at 320 Mbps. The data rates higher than 160 Mbps are not supported by the microcontroller pads, therefore, the output of the modulator is decimated.
 - $\Delta\Sigma$ modulator generated bit-stream with the CIC filter and the Compactor disabled:
 - This mode is very similar with the above one, with the difference that the $\Delta\Sigma$ modulator is run at 160 MHz. The CIC filter and the Compactor are bypassed in this mode.



HSPDM

ADC Trigger Generation

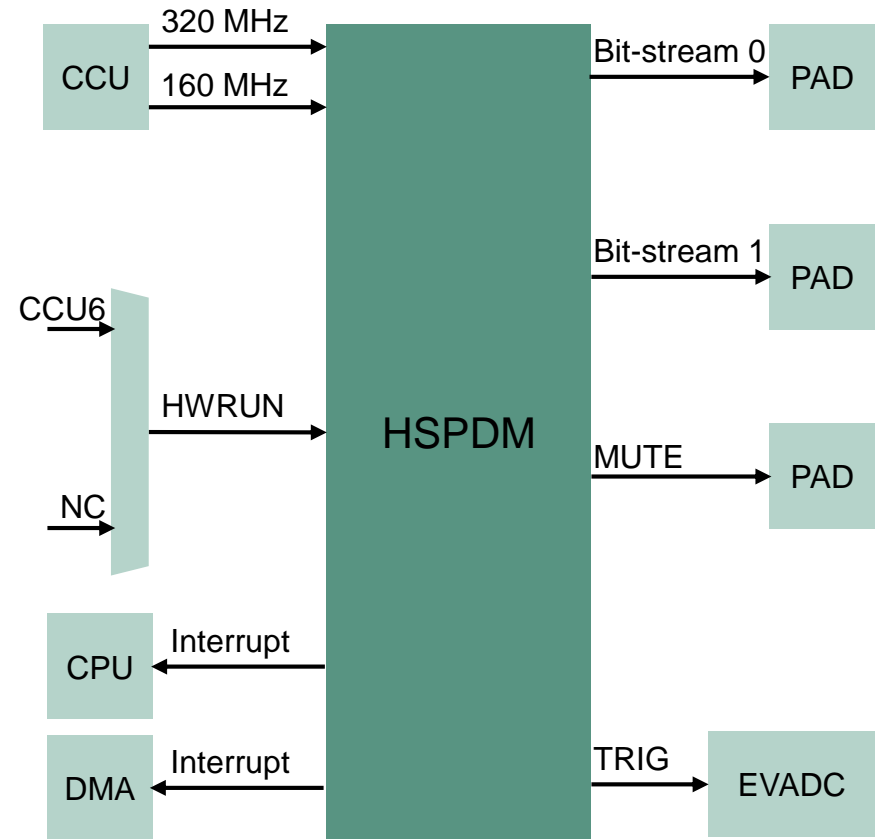
- > The ADC Trigger Generation block inside of HSPDM generates a signal to trigger a group of Enhanced Versatile Analog-to-Digital Converters (EVADCs) to start the conversion.
- > The user can easily enable/disable the ADC trigger generation or configure the trigger signal based on offset and period.



HSPDM

System integration

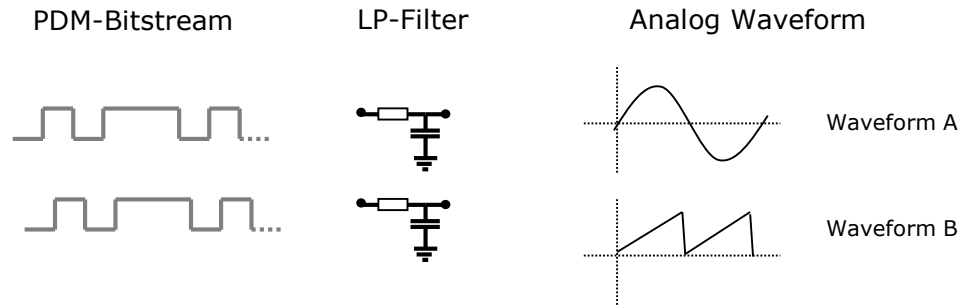
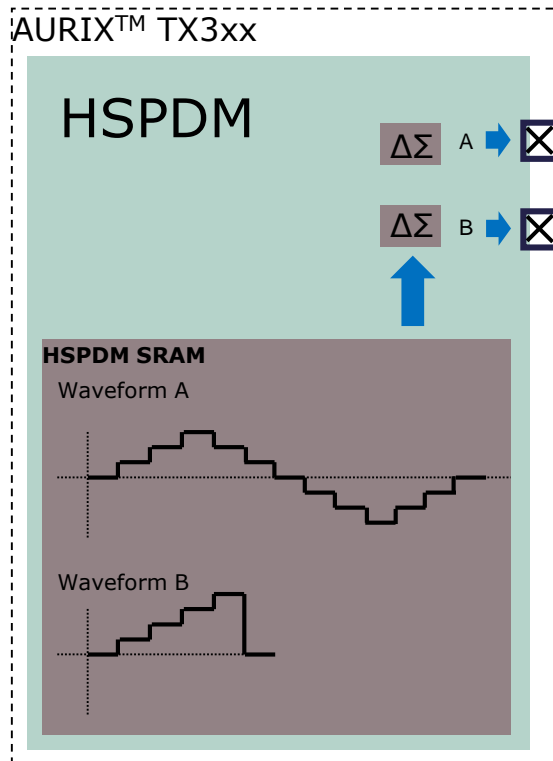
- > The HSPDM can generate up to two independent 1-bit bit-streams. The bit-stream is a pulse-density modulated (PDM) bit-stream, which can be averaged outside the microcontroller using a low pass filter (LPF) to generate the analog voltage.
- > The MUTE signal output from the microcontroller can be used to control external electronics (e.g. turn on or turn off an external transmitter).
- > The clock signals are received from the Clocking Unit (CCU).
- > HSPDM as many other peripherals can trigger interrupts which can be serviced by CPU or DMA.



Application example

Digital-to-Analog (DAC) Conversion

- > The main application of HSPDM is to create a DAC using the low frequency band up to 100 kHz.



- > The waveform is stored as a set of digital datapoints (16-Bit) within the in-built SRAM of 8kB.
- > The $\Delta\Sigma$ -Modulators can generate two independent 1-Bit pulse density modulated output bitstreams.
- > An external low pass filter averages a bitstream to generate the analog voltage.
- > The HSPDM together with external low pass filter may be used to control any analog interface device.

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2020-12

Published by

Infineon Technologies AG
81726 Munich, Germany

© 2020 Infineon Technologies AG.
All Rights Reserved.

Do you have a question about this document?

Email: erratum@infineon.com

Document reference

AURIX_Training_2_High_Speed_Pulse_Density_Modulation_Module

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics (“Beschaffenheitsgarantie”).

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer’s compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer’s products and any use of the product of Infineon Technologies in customer’s applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer’s technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies’ products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.