



KC705 Used to Interface to a ADC and ADC is a Virtual Device.

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FMC connections (1)

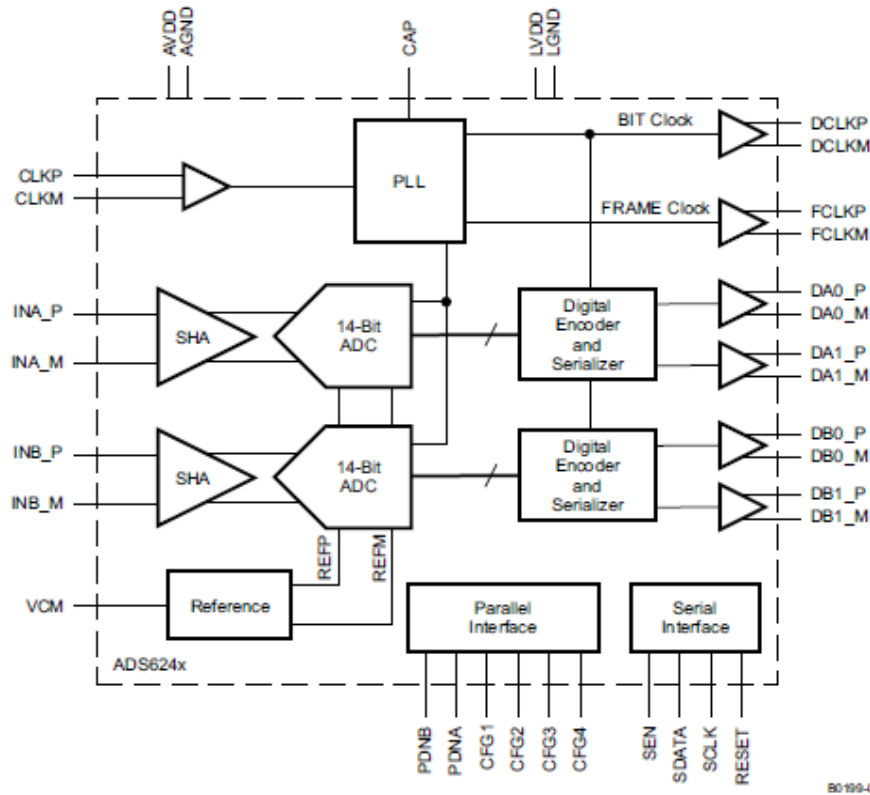
- Only the FMC-LPC connector is used.
- The connector must be used for the ADC interface (Receiver) and for the virtual ADC (transmitter).
- The pinout fits also whenever hardware for ADC and DAC is created.
- The FMC-LPC connector is populated with IO from IO-Bank 12 and 13 on the KC705 board..
- **FPGA implementation ADC interface (receiver) and Virtual ADC (transmitter) or DAC interface.**
 - IO-Bank 12 is used as virtual ADC or transmitter interface.
 - IO-Bank 13 is used as ADC interface or receiver.
- IO-Bank 12 gets a clock from a high-speed programmable oscillator on the mezzanine board.
 - In reality, if there is a DAC, this will be the high-speed clock coming from the DAC.
- What is pinning is needed:
 - IO-Bank 12
 - A high-speed clock input ← Clock from the transmitter, in this case a clock from a programmable oscillator.
 - A high speed bit clock output.
 - A low speed, word or frame clock output.
 - LVDS lanes for data transmitter . (Most popular 8, 12, 14, or 16-bit).
 - IO-Bank 13
 - A high speed bit clock input.
 - A low speed, word or frame clock input.
 - LVDS lanes for data receiver. (Most popular 8, 12, 14, or 16-bit).

FMC Connections (2)

Virtual ADC.

- IO-Bank 12 is used as implementation of the digital part of an ADC (transmitter).
- Typical connections of an ADC are:
 - High speed clock (Bit clock)
 - Low speed clock (Sync or frame clock), can be seen as data.
 - A number of data channels. For ADC devices it is the number of LVDS data channels that counts.
 - Example:
 - A Dual, 2-wire ADC needs 4 LVDS data channels (+ Bit_Clk + Sync).
 - A Quad, 2-wire ADC needs 8 LVDS channels (+ Bit_Clk + Sync).
- IO-bank 12 allows to connect:
 - Two Dual channel, 2-wire ADC
 - One Quad channel, 2-wire ADC
- For real ADC testing the FMC-HPC connector should be used to connect ADC devices.
- Because then ADC devices with different sorts of interfaces can be connected.
 - Serial LVDS ADC.
 - Full Parallel ADC
 - JESD204A multi-channels ADC.

ADC: Example for the test ADS6245



The plan is to use the Texas Instruments ADS6245 ADC device as example with the conversion of the Virtex-5 ADC interface. This Texas Instruments ADC is used because it has a small set of data channels and this makes it easier to debug the conversion of the design. The goal is to interface to the more popular Quad channel ADC of this family.

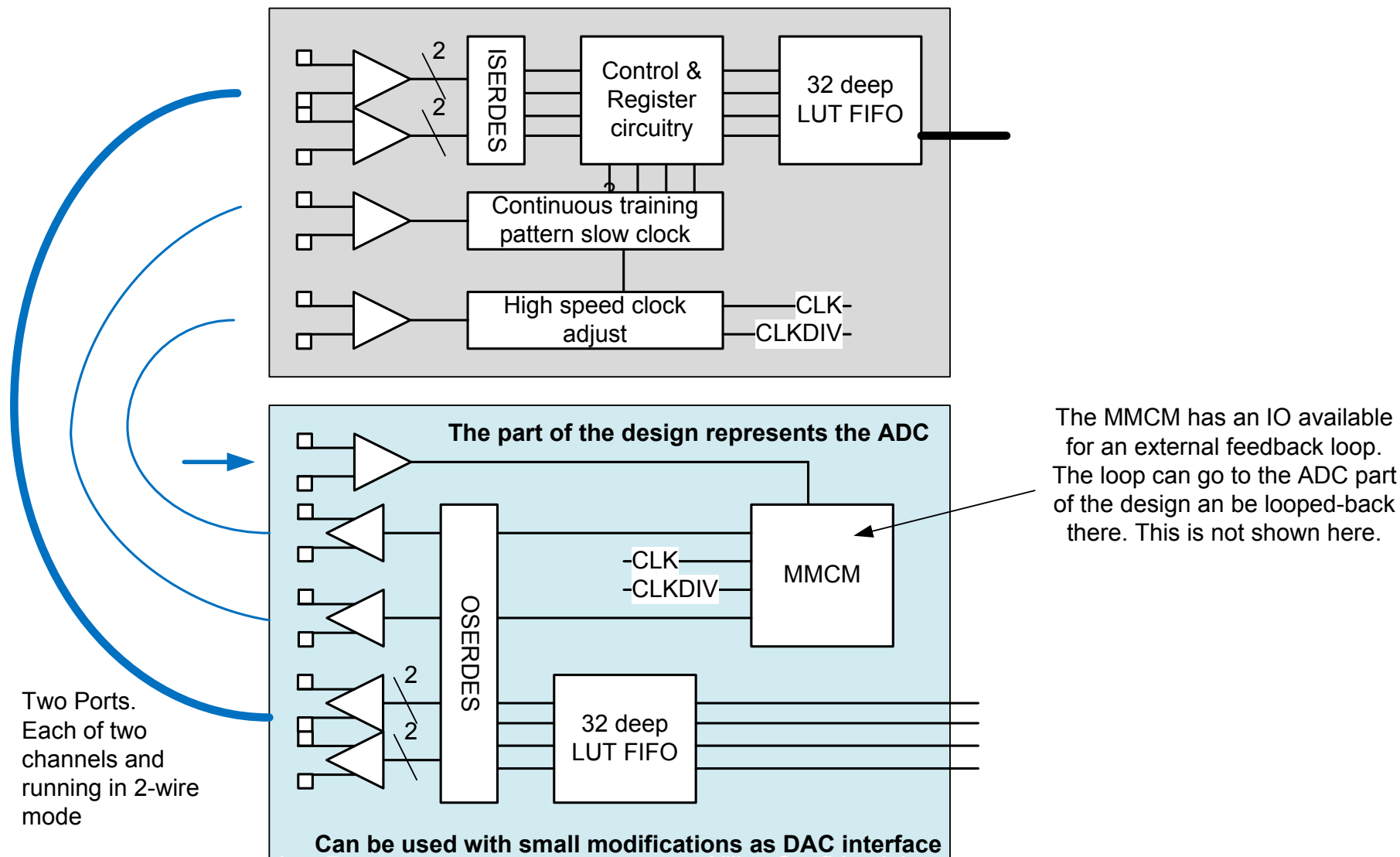
Dual 14-bit, 125 MSPS ADC with serial LVDS outputs.

The ADC is used in:

- 2-wire
- Byte wise
- MSB first
- DDR bit clock
- 16x serialisation

Mode.

RX and TX Interfaces



FMC – LPC connector pinout

| | K | J | H | G | F | E | D | C | B | A |
|----|----|----|-------------|------------|----|----|---------------|-----------|----|----|
| 1 | NC | NC | VREF A M2C | GND | NC | NC | PG C2M | GND | NC | NC |
| 2 | NC | NC | PRSNT M2C L | CLK1 M2C P | NC | NC | GND | DP0 C2M P | NC | NC |
| 3 | NC | NC | GND | CLK1 M2C N | NC | NC | GND | DP0 C2M N | NC | NC |
| 4 | NC | NC | CLK0 M2C P | GND | NC | NC | GBTCLK0 M2C P | GND | NC | NC |
| 5 | NC | NC | CLK0 M2C N | GND | NC | NC | GBTCLK0 M2C N | GND | NC | NC |
| 6 | NC | NC | GND | LA00 P CC | NC | NC | GND | DP0 M2C P | NC | NC |
| 7 | NC | NC | LA02 P | LA00 N CC | NC | NC | GND | DP0 M2C N | NC | NC |
| 8 | NC | NC | LA02 N | GND | NC | NC | LA01 P CC | GND | NC | NC |
| 9 | NC | NC | GND | LA03 P | NC | NC | LA01 N CC | GND | NC | NC |
| 10 | NC | NC | LA04 P | LA03 N | NC | NC | GND | LA06 P | NC | NC |
| 11 | NC | NC | LA04 N | GND | NC | NC | LA05 P | LA06 N | NC | NC |
| 12 | NC | NC | GND | LA08 P | NC | NC | LA05 N | GND | NC | NC |
| 13 | NC | NC | LA07 P | LA08 N | NC | NC | GND | GND | NC | NC |
| 14 | NC | NC | LA07 N | GND | NC | NC | LA09 P | LA10 P | NC | NC |
| 15 | NC | NC | GND | LA12 P | NC | NC | LA09 N | LA10 N | NC | NC |
| 16 | NC | NC | LA11 P | LA12 N | NC | NC | GND | GND | NC | NC |
| 17 | NC | NC | LA11 N | GND | NC | NC | LA13 P | GND | NC | NC |
| 18 | NC | NC | GND | LA16 P | NC | NC | LA13 N | LA14 P | NC | NC |
| 19 | NC | NC | LA15 P | LA16 N | NC | NC | GND | LA14 N | NC | NC |
| 20 | NC | NC | LA15 N | GND | NC | NC | LA17 P CC | GND | NC | NC |
| 21 | NC | NC | GND | LA20 P | NC | NC | LA17 N CC | GND | NC | NC |
| 22 | NC | NC | LA19 P | LA20 N | NC | NC | GND | LA18 P CC | NC | NC |
| 23 | NC | NC | LA19 N | GND | NC | NC | LA23 P | LA18 N CC | NC | NC |
| 24 | NC | NC | GND | LA22 P | NC | NC | LA23 N | GND | NC | NC |
| 25 | NC | NC | LA21 P | LA22 N | NC | NC | GND | GND | NC | NC |
| 26 | NC | NC | LA21 N | GND | NC | NC | LA26 P | LA27 P | NC | NC |
| 27 | NC | NC | GND | LA25 P | NC | NC | LA26 N | LA27 N | NC | NC |
| 28 | NC | NC | LA24 P | LA25 N | NC | NC | GND | GND | NC | NC |
| 29 | NC | NC | LA24 N | GND | NC | NC | TCK | GND | NC | NC |
| 30 | NC | NC | GND | LA29 P | NC | NC | TDI | SCL | NC | NC |
| 31 | NC | NC | LA28 P | LA29 N | NC | NC | TDO | SDA | NC | NC |
| 32 | NC | NC | LA28 N | GND | NC | NC | 3P3VAUX | GND | NC | NC |
| 33 | NC | NC | GND | LA31 P | NC | NC | TMS | GND | NC | NC |
| 34 | NC | NC | LA30 P | LA31 N | NC | NC | TRST L | GA0 | NC | NC |
| 35 | NC | NC | LA30 N | GND | NC | NC | GA1 | 12P0V | NC | NC |
| 36 | NC | NC | GND | LA33 P | NC | NC | 3P3V | GND | NC | NC |
| 37 | NC | NC | LA32 P | LA33 N | NC | NC | GND | 12P0V | NC | NC |
| 38 | NC | NC | LA32 N | GND | NC | NC | 3P3V | GND | NC | NC |
| 39 | NC | NC | GND | VADJ | NC | NC | GND | 3P3V | NC | NC |
| 40 | NC | NC | VADJ | GND | NC | NC | 3P3V | GND | NC | NC |

LPC Connector

LPC Connector

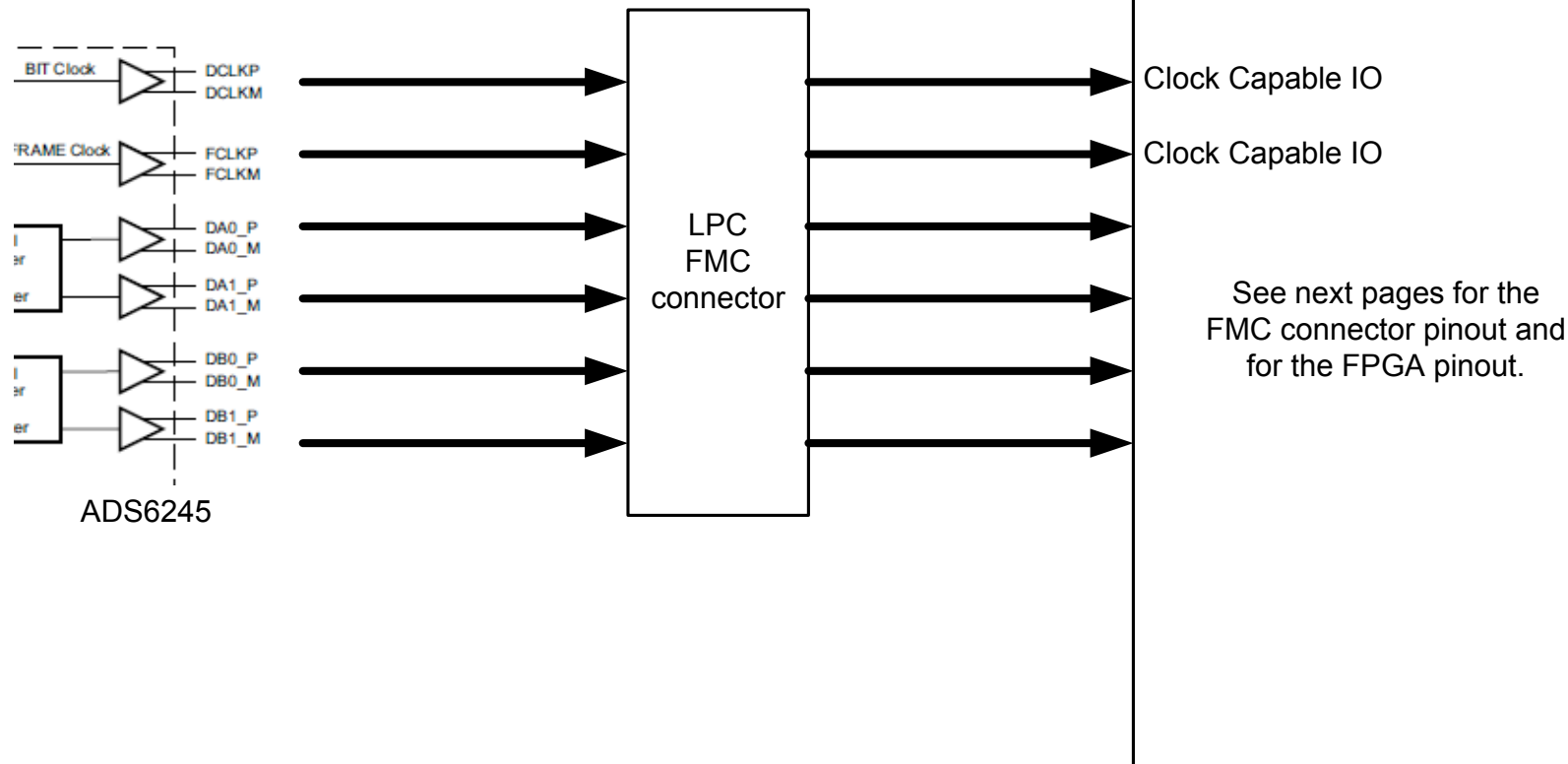
LPC Connector

LPC Connector

ADC (ADS6245) interface (receiver).

The ADS6245 is cooked into the FPGA and functions as Virtual ADC

The FPGA on the KC705 board is a 7KC325T-2-FFG900.






ADC Interface

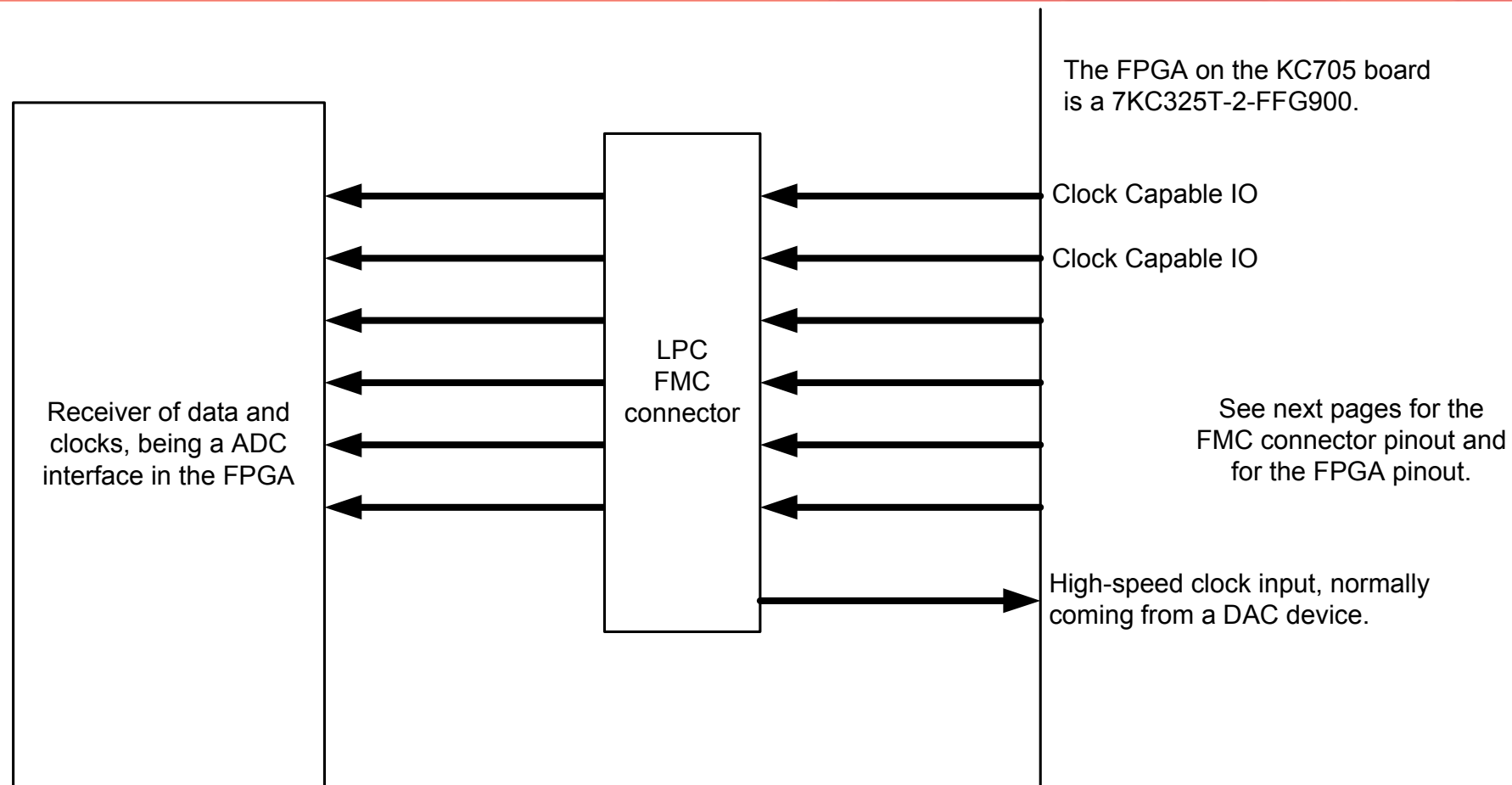
| | | | |
|-------------------------|------|--------------------|--|
| IO_25_13_AE26 | AE26 | GPIO LED 4 LS | |
| IO_L24N_T3_13_AK26 | AK26 | FMC LPC LA19 N | |
| IO_L24P_T3_13_AJ26 | AJ26 | FMC LPC LA19 P | |
| IO_L23N_T3_13_AF27 | AF27 | FMC LPC LA20 N | |
| IO_L23P_T3_13_AF26 | AF26 | FMC LPC LA20 P | |
| IO_L22N_T3_13_AH27 | AH27 | FMC LPC LA23 N | |
| IO_L22P_T3_13_AH26 | AH26 | FMC LPC LA23 P | |
| IO_L21N_T3_DQS_13_AG28 | AG28 | FMC LPC LA21 N | |
| IO_L21P_T3_DQS_13_AG27 | AG27 | FMC LPC LA21 P | |
| IO_L20N_T3_13_AK28 | AK28 | FMC LPC LA22 N | |
| IO_L20P_T3_13_AJ27 | AJ27 | FMC LPC LA22 P | |
| IO_L19N_T3_VREF_13_AD26 | AD26 | FMC LPC LA25 N | |
| IO_L19P_T3_13_AC26 | AC26 | FMC LPC LA25 P | |
| IO_L18N_T2_13_AH30 | AH30 | FMC LPC LA24 N | |
| IO_L18P_T2_13_AG30 | AG30 | FMC LPC LA24 P | |
| IO_L17N_T2_13_AJ29 | AJ29 | FMC LPC LA27 N | |
| IO_L17P_T2_13_AJ28 | AJ28 | FMC LPC LA27 P | |
| IO_L16N_T2_13_AF30 | AF30 | FMC LPC LA28 N | |
| IO_L16P_T2_13_AE30 | AE30 | FMC LPC LA28 P | |
| IO_L15N_T2_DQS_13_AK30 | AK30 | FMC LPC LA26 N | |
| IO_L15P_T2_DQS_13_AK29 | AK29 | FMC LPC LA26 P | |
| IO_L14N_T2_SRCC_13_AF28 | AF28 | FMC LPC LA29 N | |
| IO_L14P_T2_SRCC_13_AE28 | AE28 | FMC LPC LA29 P | |
| IO_L13N_T2_MRCC_13_AH29 | AH29 | FMC LPC CLK1 M2C N | |
| IO_L13P_T2_MRCC_13_AG29 | AG29 | FMC LPC CLK1 M2C P | |
| IO_L12N_T1_MRCC_13_AC27 | AC27 | FMC LPC LA17 CC N | |
| IO_L12P_T1_MRCC_13_AB27 | AB27 | FMC LPC LA17 CC P | |
| IO_L11N_T1_SRCC_13_AD28 | AD28 | FMC LPC LA18 CC N | |
| IO_L11P_T1_SRCC_13_AD27 | AD27 | FMC LPC LA18 CC P | |
| IO_L10N_T1_13_AB30 | AB30 | FMC LPC LA30 N | |
| IO_L10P_T1_13_AB29 | AB29 | FMC LPC LA30 P | |
| IO_L9N_T1_DQS_13_AE29 | AE29 | FMC LPC LA31 N | |
| IO_L9P_T1_DQS_13_AD29 | AD29 | FMC LPC LA31 P | |
| IO_L8N_T1_13_AA30 | AA30 | FMC LPC LA32 N | |
| IO_L8P_T1_13_Y30 | Y30 | FMC LPC LA32 P | |
| IO_L7N_T1_13_AC30 | AC30 | FMC LPC LA33 N | |
| IO_L7P_T1_13_AC29 | AC29 | FMC LPC LA33 P | |
| IO_L6N_T0_VREF_13_AB25 | AB25 | XADC GPIO 0 | |
| IO_L6P_T0_13_AA25 | AA25 | XADC GPIO 1 | |
| IO_L5N_T0_13_AB28 | AB28 | XADC GPIO 2 | |
| IO_L5P_T0_13_AA27 | AA27 | XADC GPIO 3 | |
| IO_L4N_T0_13_Y29 | Y29 | GPIO DIP SW0 | |
| IO_L4P_T0_13_W29 | W29 | GPIO DIP SW1 | |
| IO_L3N_T0_DQS_13_AA28 | AA28 | GPIO DIP SW2 | |
| IO_L3P_T0_DQS_13_Y28 | Y28 | GPIO DIP SW3 | |
| IO_L2N_T0_13_W28 | W28 | REC CLOCK C N | |
| IO_L2P_T0_13_W27 | W27 | REC CLOCK C P | |
| IO_L1N_T0_13_AA26 | AA26 | ROTARY PUSH | |
| IO_L1P_T0_13_Y26 | Y26 | ROTARY INCA | |
| IO_0_13_Y25 | Y25 | ROTARY INCB | |

By design of the KC705 board the FPGA (7KC325T-FFG900) IO-Bank 12 and IO-Bank 13 are used for the LPC FMC connector.

The FMC-LPC connector setup of the KC705 board dictates that for IO-Bank 12 this setup is possible:

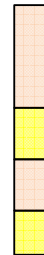
-  - High-speed clock output.
-  - Bit clock (High Speed) and Frame/Sync (Low Speed) clock inputs.
-  - Data inputs.

FPGA Virtual ADC






Virtual ADC pinout.

| | | | |
|-------------------------|------|--------------------|--|
| 25_12_AE20 | AE20 | SI5326 RST LS | |
| -----F3_12_AK21 | AK21 | FMC LPC LA06 N | |
| IO_L24P_T3_12_AK20 | AK20 | FMC LPC LA06 P | |
| IO_L23N_T3_12_AJ21 | AJ21 | FMC LPC LA04 N | |
| IO_L23P_T3_12_AH21 | AH21 | FMC LPC LA04 P | |
| IO_L22N_T3_12_AH20 | AH20 | FMC LPC LA03 N | |
| IO_L22P_T3_12_AG20 | AG20 | FMC LPC LA03 P | |
| IO_L21N_T3_DQS_12_AJ23 | AJ23 | FMC LPC LA08 N | |
| IO_L21P_T3_DQS_12_AJ22 | AJ22 | FMC LPC LA08 P | |
| IO_L20N_T3_12_AH22 | AH22 | FMC LPC LA05 N | |
| IO_L20P_T3_12_AG22 | AG22 | FMC LPC LA05 P | |
| IO_L19N_T3_VREF_12_AF21 | AF21 | FMC LPC LA02 N | |
| IO_L19P_T3_12_AF20 | AF20 | FMC LPC LA02 P | |
| IO_L18N_T2_12_AH25 | AH25 | FMC LPC LA07 N | |
| IO_L18P_T2_12_AG25 | AG25 | FMC LPC LA07 P | |
| IO_L17N_T2_12_AK24 | AK24 | FMC LPC LA09 N | |
| IO_L17P_T2_12_AK23 | AK23 | FMC LPC LA09 P | |
| IO_L16N_T2_12_AF25 | AF25 | FMC LPC LA11 N | |
| IO_L16P_T2_12_AE25 | AE25 | FMC LPC LA11 P | |
| IO_L15N_T2_DQS_12_AK25 | AK25 | FMC LPC LA10 N | |
| IO_L15P_T2_DQS_12_AJ24 | AJ24 | FMC LPC LA10 P | |
| IO_L14N_T2_SRCC_12_AH24 | AH24 | HDMI INT | |
| IO_L14P_T2_SRCC_12_AG24 | AG24 | SI5326 INT ALM LS | |
| IO_L13N_T2_MRCC_12_AG23 | AG23 | FMC LPC CLK0 M2C N | |
| IO_L13P_T2_MRCC_12_AF22 | AF22 | FMC LPC CLK0 M2C P | |
| IO_L12N_T1_MRCC_12_AE24 | AE24 | FMC LPC LA00 CC N | |
| IO_L12P_T1_MRCC_12_AD23 | AD23 | FMC LPC LA00 CC P | |
| IO_L11N_T1_SRCC_12_AF23 | AF23 | FMC LPC LA01 CC N | |
| IO_L11P_T1_SRCC_12_AE23 | AE23 | FMC LPC LA01 CC P | |
| IO_L10N_T1_12_AE21 | AE21 | FMC LPC LA14 N | |
| IO_L10P_T1_12_AD21 | AD21 | FMC LPC LA14 P | |
| IO_L9N_T1_DQS_12_AD24 | AD24 | FMC LPC LA15 N | |
| IO_L9P_T1_DQS_12_AC24 | AC24 | FMC LPC LA15 P | |
| IO_L8N_T1_12_AD22 | AD22 | FMC LPC LA16 N | |
| IO_L8P_T1_12_AC22 | AC22 | FMC LPC LA16 P | |
| IO_L7N_T1_12_AC25 | AC25 | FMC LPC LA13 N | |
| IO_L7P_T1_12_AB24 | AB24 | FMC LPC LA13 P | |
| IO_L6N_T0_VREF_12_AB20 | AB20 | FMC LPC LA12 N | |
| IO_L6P_T0_12_AA20 | AA20 | FMC LPC LA12 P | |
| IO_L5N_T0_12_AC21 | AC21 | SDIO CD DAT3 LS | |
| IO_L5P_T0_12_AC20 | AC20 | SDIO DAT0 LS | |
| IO_L4N_T0_12_AA23 | AA23 | SDIO DAT1 LS | |
| IO_L4P_T0_12_AA22 | AA22 | SDIO DAT2 LS | |
| IO_L3N_T0_DQS_12_AB23 | AB23 | SDIO CLK LS | |
| IO_L3P_T0_DQS_12_AB22 | AB22 | SDIO CMD LS | |
| IO_L2N_T0_12_AA21 | AA21 | SDIO SDDDET | |
| IO_L2P_T0_12_Y21 | Y21 | SDIO SDWP | |
| IO_L1N_T0_12_Y24 | Y24 | USER SMA GPIO N | |
| IO_L1P_T0_12_Y23 | Y23 | USER SMA GPIO P | |
| IO_0_12_Y20 | Y20 | SFP_TX DISABLE | |



By design of the KC705 board the FPGA (7KC325T-FFG900) IO-Bank 12 and IO-Bank 13 are used for the LPC FMC connector.

The FMC-LPC connector setup of the KC705 board dictates that for IO-Bank 13 this setup is possible:

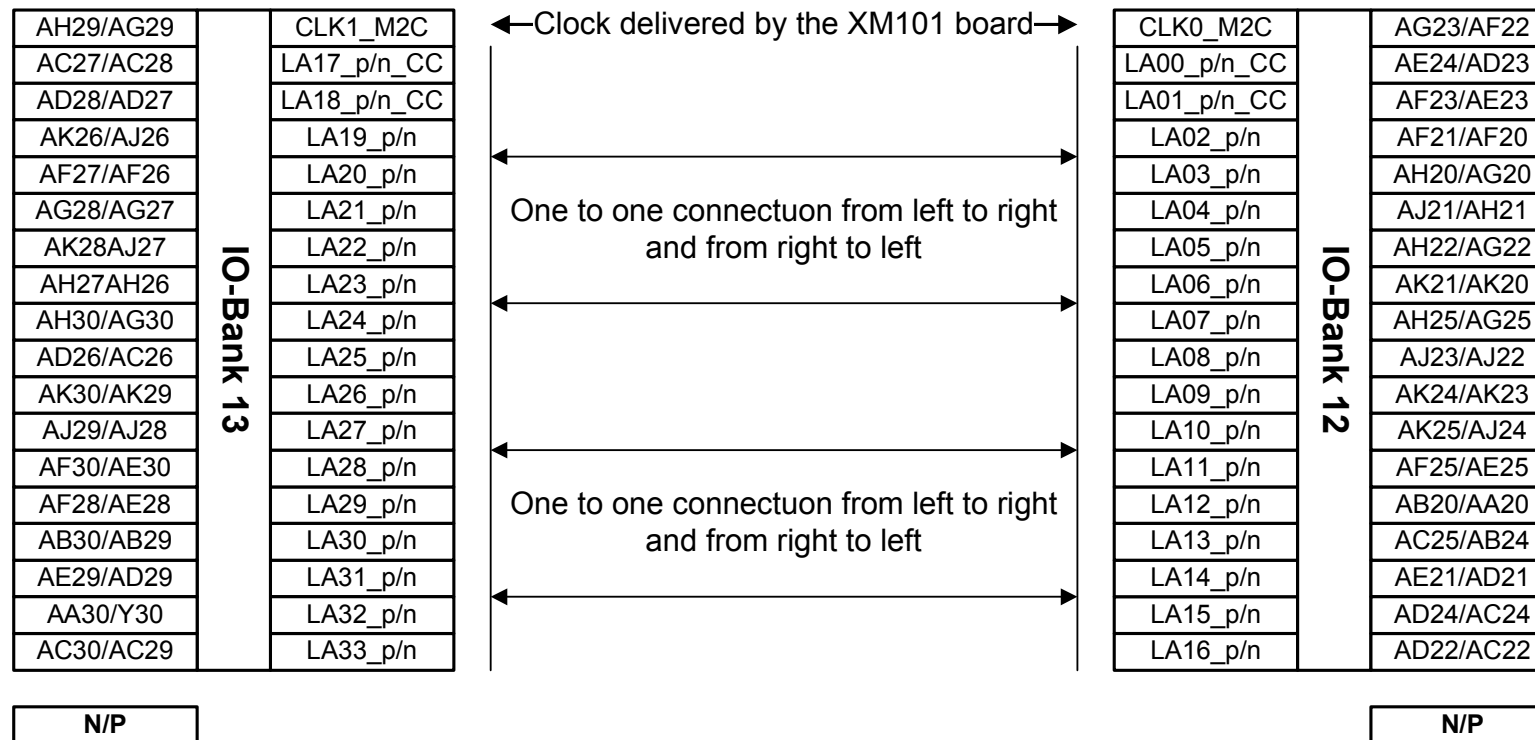
-  - High-speed clock input.
-  - Bit clock (High Speed) and Frame/Sync (Low Speed) clock outputs.
-  - Data outputs.

FPGA LPC IO-Banks 12 and 13 connected via cable

As shown on page 7 the transmitter, Virtual ADC, will be connected to the receiver, ADC interface in the FPGA.

This holds that IO-Bank 12 is connected to IO-Bank 13 by means of a XM101 board plugged into the LPC FMC connector of the KC705 board.

This slide shows the interconnections via the XM101 board between the IO-Banks.



The DAC (Transmitter)

