RENESAS

USER'S MANUAL

AN1665 Rev 0.00 September 30, 2011

High-Speed ADC Evaluation Platform

- Interfaces Intersil's High-Speed ADC Evaluation PCB Family to FMC Based Evaluation Platforms
- 40MSPS to 500MSPS Operation
- SPI Access for ADC Configuration
- Compatible with all Intersil High-Speed ADC Daughter Cards

Evaluation Platform Overview

Intersil's FMC based high-speed ADC evaluation platform consists of custom designed hardware, which allows interfacing to an FMC based FPGA evaluation platform. This allows for direct FPGA processing of the ADC output data and system prototyping for a user. SPI access to the ADC is possible at the FMC connector or optionally at a separate header on the PCB (JP3).

Hardware

There are two components in the hardware portion of the evaluation platform: the daughter card and the motherboard (Figure 1). The ADC is contained on the daughter card, which routes power from the motherboard and contains the analog input circuitry, clock drive and decoupling. The daughter card interfaces to the motherboard through a mezzanine connector. The motherboard provides power to the ADCs analog and digital supply pins from separate LDOs from Intersil's High performance linear regulator family. The ADCs digital outputs are routed through the mezzanine connector to the FMC connector at the motherboard card edge.

The user must supply low-jitter RF generators for the clock and analog inputs. Recommendations of suitable generators can be found in "Appendix A: RF Generators" on page 2.

Many low-jitter RF generators exhibit high harmonic spectral content relative to the ADC performance. A band-pass filter is recommended to attenuate the harmonics. A wideband attenuator in series with the band-pass filter is also recommended for daughter cards without on-board attenuators. Current spikes from the ADCs switched capacitor sample-and-hold amplifier can create signal reflections in the coaxial cable. The attenuator reduces these reflections and improves performance.

Software

There is no software provided with the evaluation system. Data capture and ADC performance verification needs to be done at the receiving FPGA. A reset of the ADC is possible at switch S1 on the PCB.



FIGURE 1. EVALUATION PLATFORM BLOCK DIAGRAM



Initial Start-Up

Referring to Figure 1, connect the daughter card to the motherboard by aligning the two mating mezzanine connectors. Four screws on the motherboard (not shown) align with mounting holes in the daughter card. The FMC connector should be aligned and connected with an appropriate mating FMC-based FPGA evaluation system. Next, connect the RF generators to the Clock and Analog input SMA connectors. Set the clock frequency as desired with the power level at +10dBm. Similarly, set the analog input frequency with a power level of approximately +7dBm (the full-scale value will vary depending on the loss of the input path and gain of the ADC). With the RF generators on, apply +5V power supply to the motherboard. The daughter card is powered by Intersil linear regulators on the motherboard.

Daughter Cards

Each daughter card is designed to produce optimal ADC performance and simplify the evaluation process. Some boards have multiple connections for the analog input and clock. For example, low-frequency and high-frequency input paths are provided on certain boards. A high-frequency input path may have a balun interface, while a low frequency path may use a transformer or buffer amplifier (for DC-coupling).

Motherboard

The only connection required for the motherboard is +5V power at J1 (5V wall supply is supplied), JP1 is an optional connection. The data outputs are LVDS and will require 100 Ω differential termination resistors at the receiver/FPGA.



FIGURE 2. PCB TOP VIEW



FIGURE 3. JP3 PINOUT

SPI Programming

Access to the ADC SPI port is available at both the FMC connector and header JP3. The ADCs typically support both 3-wire and 4-wire SPI communication and the default mode at power-up is 3-wire mode (consult the appropriate ADC data sheet for more information). It is recommended to use 4-wire SPI communication with the FMC based ADC motherboard, requiring that the ADC first be placed in 4-wire SPI mode by writing to the appropriate ADC register (consult data sheet). A resistor on the daughter card (R4) at the CPLD will need to be removed. Logic levels for the SPI port on card is 3.3V LVCMOS (level translation to 1.8V is done on the ADC daughter cards).

Appendix A: RF Generators

Intersil uses the following RF generators as clock and signal sources when characterizing high-speed ADCs:

- Rohde & Schwarz: SMA100A
- Agilent: 8644B (with Low-Noise option)

These generators provide very low jitter to optimize the SNR performance of the ADC under test. Other generators with similar phase noise performance can also be used. Contact Intersil Technical Support for recommendations.

Appendix B: Daughter Cards

The FMC ADC Evaluation Board (KAD-FMC-EVALZ) connects data, clock, and SPI control signals to/from an ADC to an external FPGA through an LPC FMC connector and a 180 pin Molex connector. The Molex connector interfaces with any of the KAD5XXX and ISLAXXX ADC daughtercards. The schematic for the respective Intersil ADC daughtercard can be downloaded from our website for additional information and bit-ordering. Note that the MSB bit-ordering is different for the ISLA2XXX and KAD5XXX,ISL1XXP50 families. Additional information on Intersil ADC Daughter Cards can be found at the respective ADC product pages on our <u>website</u>.



TABLE 1. LPC FMC CONNECTOR PINOUT

	н	G	D	С
1	NC	GND	NC	GND
2	NC	NC	GND	NC
3	GND	NC	GND	NC
4	NC	GND	NC	GND
5	NC	GND	NC	GND
6	GND	CLKOUTP (FMC LA00_P_CC)	GND	NC
7	DIG_OUT14 (FMC LA02_P)	CLKOUTN (FMC LA00_N_CC)	GND	NC
8	DIG_OUT14N (FMC LA02_N)	GND	DIG_OUT15 (FMC LA01_P)	GND
9	GND	DIG_OUT13 (FMC LA03_P)	DIG_OUT15N (FMC LA01_N)	GND
10	DIG_OUT12 (FMC LA04_P)	DIG_OUT13N (FMC LA03_N)	GND	DIG_OUT10 (FMC LA06_P)
11	DIG_OUT12N (FMC LA04_N)	GND	DIG_OUT11 (FMC LA05_P)	DIG_OUT10N (FMC LA06_N)
12	GND	DIG_OUT9 (FMC LA08_P)	DIG_OUT11N (FMC LA05_N)	GND
13	DIG_OUT8 (FMC LA07_P)	DIG_OUT9N (FMC LA08_N)	GND	GND
14	DIG_OUT8N (FMC LA07_N)	GND	DIG_OUT7 (FMC LA09_P)	DIG_OUT6 (FMC LA10_P)
15	GND	DIG_OUT5 (FMC LA12_P)	DIG_OUT7N (FMC LA09_N)	DIG_OUT6N (FMC LA10_N)
16	DIG_OUT4 (FMC LA11_P)	DIG_OUT5N (FMC LA12_N)	GND	GND
17	DIG_OUT4N (FMC LA11_N)	GND	DIG_OUT3 (FMC LA13_P)	GND
18	GND	DIG_OUT1 (FMC LA16_P)	DIG_OUT3N (FMC LA13_N)	DIG_OUT2 (FMC LA14_P)
19	DIG_OUTO (FMC LA15_P)	DIG_OUT1N (FMC LA16_N)	GND	DIG_OUT2N (FMC LA14_N)
20	DIG_OUTON (FMC LA15_N)	GND	NC	GND
21	GND	NC	NC	GND
22	NC	NC	GND	NC
23	NC	GND	NC	NC
24	GND	NC	NC	GND
25	SCLK (LA21_P)	NC	GND	GND
26	CSB (LA21_N	GND	NC	NC
27	GND	NC	NC	NC
28	MISO (LA24_P)	NC	GND	GND



KAD-FMC-EVALZ

	TABLE 1. LPC FMC CONNECTOR PINOUT (Continued)					
	Н	G	D	C		
29	MOSI (LA24_N)	GND	NC	GND		
30	GND	NC	NC	NC		
31	NC	NC	NC	NC		
32	NC	GND	NC	GND		
33	GND	NC	NC	GND		
34	NC	NC	NC	NC		
35	NC	GND	NC	NC		
36	GND	NC	NC	GND		
37	PC2 (LA32_P)	NC	GND	NC		
38	NC	GND	NC	GND		
39	GND	NC	GND	NC		
40	NC	GND	NC	GND		



FMC PCB 180 PIN DATA CONNECTOR		ISLA2XXX DAUGHTER CARD(72pin QFN) (Note)	KAD5XXX DAUGHTER CARD (72 pin QFN) (Note)
PIN NUMBER	PIN NAME	PIN NAME	PIN NAME
14	dig_out15	lvds_0	ORP
16	dig_outn15	lvds_n0	ORN
20	dig_out14	lvds_1	D13P (MSB)
22	dig_outn14	lvds_n1	D13N (MSB)
26	dig_out13	lvds_2	D12P
28	dig_outn13	lvds_n2	D12N
32	dig_out12	lvds_3	D11P
34	dig_outn12	lvds_n3	D11N
38	dig_out11	lvds_4	D10P
40	dig_outn11	lvds_n4	D10N
44	dig_out10	lvds_5	D9P
46	dig_outn10	lvds_n5	D9N
50	dig_out9	lvds_6	D8P
52	dig_outn9	lvds_n6	D8N
62	dig_out8	lvds_7	D7P
64	dig_outn8	lvds_n7	D7N
68	dig_out7	lvds_8	D6P
70	dig_outn7	lvds_n8	D6N
74	dig_out6	lvds_9	D5P
76	dig_outn6	lvds_n9	D5N
80	dig_out5	lvds_10	D4P
82	dig_outn5	lvds_n10	D4N
86	dig_out4	lvds_11	D3P
88	dig_outn4	lvds_n11	D3N
92	dig_out3	lvds_12	D2P
94	dig_outn3	lvds_n12	D2N
98	dig_out2	lvds_13	D1P
100	dig_outn2	lvds_n13	D1N
104	dig_out1	lvds_14	DOP
106	dig_outn1	lvds_n14	DON
110	dig_out0	lvds_15 (MSB)	NC
112	dig_outn0	lvds_n15 (MSB)	NC
56	clk_out	clk_out	clkoutp
58	clk_outn	clk_outn	clkoutn
124	sclk_3v	sclk_3v	sclk_3v
126	csb_3v	csb_3v	csb_3v
128	miso_3v	miso_3v	miso_3v

TABLE 2. FMC PIN OUT DAUGHTER CARD CROSS REFERENCE



TABLE 2. FMC PIN OUT DAUGHTER CARD CROSS REFERENCE (Continued)

FMC PCB 180 PIN DATA CONNECTOR		ISLA2XXX DAUGHTER CARD(72pin QFN) (Note)	KAD5XXX DAUGHTER CARD (72 pin QFN) (Note)
PIN NUMBER	PIN NAME	PIN NAME	PIN NAME
130	mosi_3v	mosi_3v	mosi_3v
140	PORn_ExtResetn_fpga	PORn_ExtResetn_fpga	PORn_ExtResetn_fpga

NOTE: The 72 pin QFN ADC eval boards are MSB justified; J6 pins 110/112 are the MSB for 16,14, and 12-bit devices: ISLA2XXX while J6 pins 20/22 are the MSB for 14, 12, 10 and 8-bit devices: KAD5XXX, and ISL1XXP50



KAD-FMC-EVALZ

Schematics



FIGURE 4.

AN1665 Rev 0.00 September 30, 2011

RENESAS

Schematics (Continued)



AN1665 Rev 0.00 September 30, 2011

Notice

- Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for
 the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by
 you or third parties arising from the use of these circuits, software, or information.
- Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
- 3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
- 4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
- 5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
 - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.

"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; underse arepeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics data sheet, user's manual or other Renesas Electronics document.

- 6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
- 7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product or harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for agging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for valuating the safety of the final products or systems manufactured by you.
- 8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
- 9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
- 10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
- 11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
- 12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.
- (Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
- (Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

Refer to "http://www.renesas.com/" for the latest and detailed information

(Rev.4.0-1 November 2017)



SALES OFFICES

Renesas Electronics Corporation

http://www.renesas.com

Renesas Electronics America Inc. 1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A. Tel: +1-408-432-8888, Fax: +1-408-434-5351	
Renesas Electronics Canada Limited 9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3 Tel: +1-905-237-2004	
Renesas Electronics Europe Limited Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K Tel: +44-1628-651-700, Fax: +44-1628-651-804	
Renesas Electronics Europe GmbH Arcadiastrasse 10, 40472 Disseldorf, Germany Tel: +49-211-6503-0, Fax: +49-211-6503-1327	
Renesas Electronics (China) Co., Ltd. Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China Tel: +86-10-8235-1155, Fax: +86-10-8235-7679	
Renesas Electronics (Shanghai) Co., Ltd. Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China Tel: +86-21-2226-0888, Fax: +86-21-2226-0999	
Renesas Electronics Hong Kong Limited Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong Tel: +852-256-5688, Fax: +852 2886-9022	
Renesas Electronics Taiwan Co., Ltd. 13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan Tel: +886-2-8175-9600, Fax: +886 2-8175-9670	
Renesas Electronics Singapore Pte. Ltd. 80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949 Tel: +65-6213-0200, Fax: +65-6213-0300	
Renesas Electronics Malaysia Sdn.Bhd. Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia Tel: +60-3-7955-9390, Fax: +60-3-7955-9510	
Renesas Electronics India Pvt. Ltd. No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India Tel: +91-80-67208700, Fax: +91-80-67208777	
Renesas Electronics Korea Co., Ltd. 17F, KAMCO Yangiae Tower, 262, Cangnam-daero, Gangnam-gu, Seoul, 06265 Korea Tel: +82-2-558-3737, Fax: +82-2-558-5338	