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DRF4581L

Very Small Form Factor 4-Channel A/D and D/A Board based on the Intel® Agilex™ 9 Direct RF-Series

Complete Data Conversion and Processing Solution in a Very Small Form Factor Module

- Ideal for SWAP-constrained environments
- Waveform signal generator
- Communication receiver and transmitter
- Electronic Warfare transponder
- Sensor interfaces

The DRF4581L is a high-performance, Very Small Form Factor module based on the Intel Agilex 9 Direct RF-Series. Four 64 GSPS A/D and D/A converters are integrated into the Agilex 9's multiprocessor architecture, creating a multichannel data conversion and processing solution on a single chip. The DRF4581L brings Agilex 9 performance to a range of environments that can't be satisfied with traditional board/chassis deployment.

Complementing the Agilex 9's on-chip resources are the DRF4581L's modular front end for RF input and output, 16 GBytes of DDR4, a 1 GigE interface, and general-purpose serial and parallel signal paths to the FPGA.

FEATURES

- Very Small Form Factor ruggedized and conduction-cooled module
- Incorporates Intel Agilex 9 Direct RF AGRW014
- 16 GB of DDR4 SDRAM
- 1 GigE Interface
- Unique system-on-module design enables migration to other form factors
- Navigator MA Board Support Package (BSP) for software development
- Navigator MA FPGA Design Kit (FDK) for custom IP development

Innovation that matters®

DRF4581L BLOCK DIAGRAM
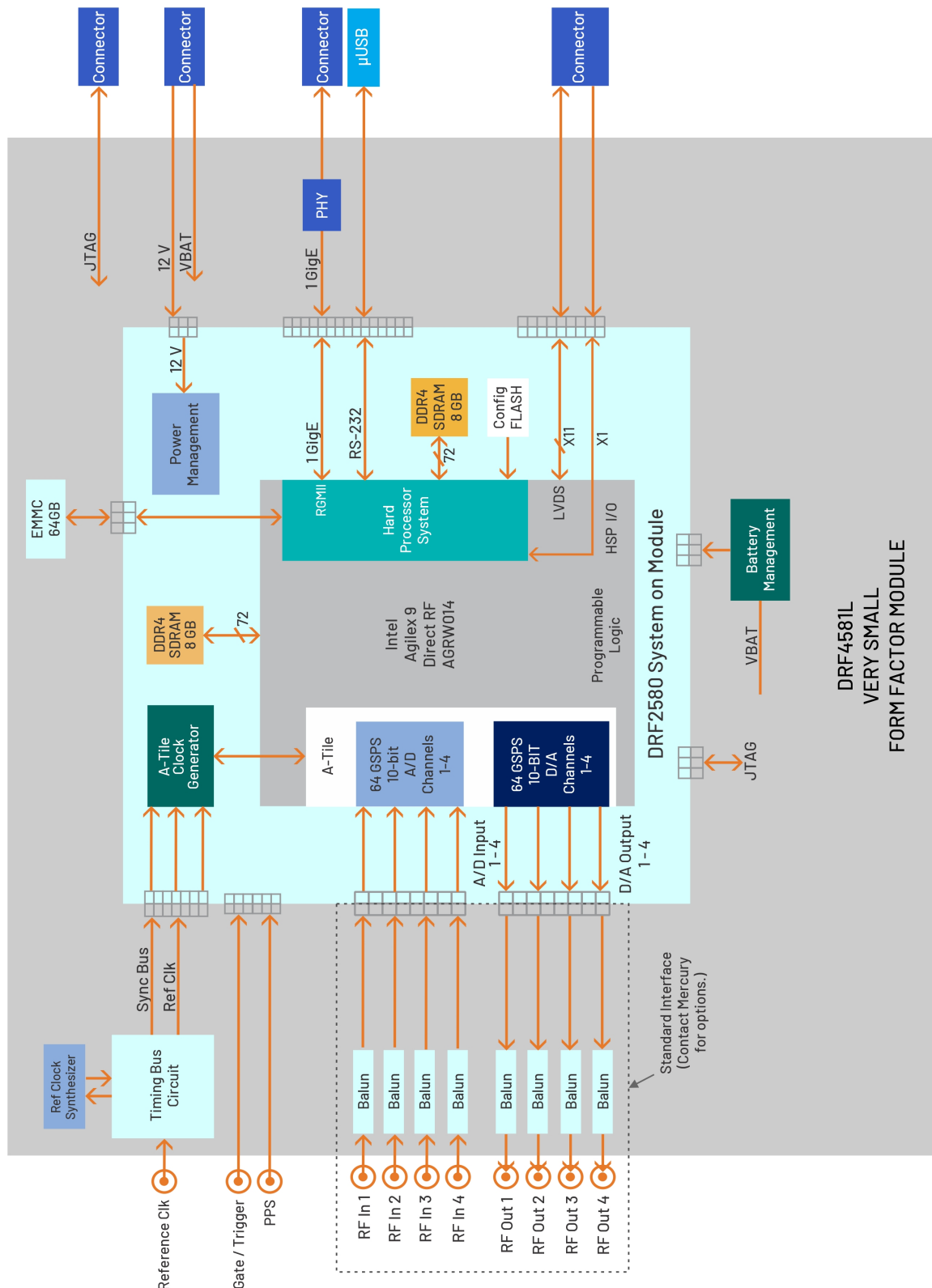
BOARD ARCHITECTURE

The DRF4581L board design places the Agilex 9 as the cornerstone of the architecture. All control and data paths are accessible by the programmable logic and processing system. A full suite of Mercury-developed IP and software functions utilize this architecture to provide data capture, waveform generation, and interface solutions for many of the most common application requirements.

A/D CONVERTER STAGE

The analog interface accepts analog RF inputs on four coax connectors. On the standard configuration, these inputs are transformer-coupled into the Agilex 9's A-Tile. Inside the Agilex 9, the analog signals are routed to four 64 GSPS, 10-bit A/D converters.

The A/D digital outputs are delivered into the programmable logic and processor system for signal processing, data capture or for routing to other resources.

The DRF4581L modular RF interface allows alternative RF conditioning prior to the A/D inputs with optional RF Interface Modules for custom requirements.

D/A CONVERTER STAGE

The Agilex 9's four D/A converters accept baseband real or complex data streams from the FPGA's programmable logic. The analog output of each of the 64 GSPS, 10-bit D/As is transformer-coupled to a coax connection in the standard configuration. The DRF4581L's modular RF interface allows alternative RF conditioning at the D/A's outputs with optional RF Interface Modules for custom requirements.

CLOCKING AND SYNCHRONIZATION

The DRF4581L's Timing Bus Circuit can generate all required clocking needed to operate all features of the board. In addition it can receive a 10 to 100 MHz reference clock from either an on-board synthesizer or a coax connector. The Timing Bus Circuit includes a jitter cleaner and provides the reference clock and sync signals to the A-Tile Clock Generator. A multifunction gate/trigger input is also available on a coax connector for external control of data acquisition and playback.

MEMORY RESOURCES

The DRF4581L architecture supports 8 GBytes of DDR4 SDRAM memory accessible from the Programmable Logic. User-installed IP, together with the Mercury-supplied DDR4 controller core within the FPGA, can take advantage of the memory for custom applications. An additional 8 GByte bank of DDR4 SDRAM is available to the Quad-core ARM Cortex-A53 processor as program memory and storage.

1 GIGE INTERFACE

The DRF4581L includes 1 GigE interface for control and data transfers. The interface provides a direct connection to the ARM processor.

FLEXIBLE MODULAR DESIGN

While the DRF4581L is a Very Small Form Factor module, the unique modular design of the DRF2580 System on Module (SoM) provides the flexibility to deploy this solution in many different situations. The DRF2580 SoM contains all of the key components including the Agilex 9 FPGA, DDR4 SDRAM, and power and clock management.

In the case of the DRF4581L, the SoM is mounted on a Very Small Form Factor carrier which complements the design with a timing bus circuit and analog signal conditioning. As a module and carrier board set, the DRF4581L becomes a complete, ready-to-deploy module that can be conduction-cooled.

The DRF2580 can also be mounted on other carriers available from Mercury to support standard form factors; or for applications that require a non-standard footprint, Mercury supports the module with the Mercury Model 4806 Custom Carrier Design Kit for the DRF2580 SoM, which enables users to engineer and build a custom carrier. As a complete and tested module, the DRF2580 encapsulates best-in-class electrical and mechanical design, eliminating some of the most challenging aspects of embedded circuit design and allowing the user to focus on the application-specific carrier design.

EXTENDABLE IP DESIGN

For applications that require specialized functions, users can install their own custom IP for data processing. Mercury's Navigator MA FPGA Design Kit (FDK) includes the board's entire FPGA design that can be edited using Intel's Quartus® Prime Software. For all supplied IP, all source code and complete IP core documentation is included. Developers can integrate their own IP along with the factory-installed functions or use Mercury's Navigator MA BSP and FDK to completely replace the IP provided by Mercury with their own.

SPECIFICATIONS

Field Programmable Gate Array

Type: Intel Agilex 9 SoC FPGA AGRW014

Agilex 9 RF Signal Chain

Analog Inputs

- Quantity: 4
- Connector: SMPM
- Input Type: Transformer-coupled

A/D Converters

- Quantity: 4
- Sampling Rate: 64 GSPS
- Resolution: 10 bits

Analog Outputs

- Quantity: 4
- Connector: SMPM
- Output Type: Transformer-coupled

D/A Converters

- Quantity: 4
- Sampling Rate: 64 GSPS
- Resolution: 10 bits

Reference Clock

- Source: Switchable between on-board synthesizer, external source
- Connector Type: MMCX

Gate/Trigger

- Source: Programmable through software or external source
- Connector Type: MMCX
- Level: LVCMOS

Hard Processing System

ARM Cortex-A53:

- Quantity: 4
- Speed: Up to 1.5 GHz

Processor I/O:

- Interface: 1 GigE
- Location: Front panel
- Connector: RJ45

FPGA I/O

Interface: GPIO

- Quantity: 11 Pairs
- Type: LVDS
- Location: Front panel

JTAG

Location: Front panel

Memory

- Type: DDR4 SDRAM
- Quantity: 2 banks
- Size: (each bank) 8 GB; 72-bit

FPGA Configuration FLASH:

- Type: QSPI NOR Flash
- Size: 2 x 1 Gbit

Physical

Dimensions:

- Depth: 6.4 in
- Height: 1.0 in
- Width: 2.8"

ORDERING INFORMATION

Model	Description
DRF4581L	Very Small Form Factor 4-Channel A/D and D/A Board with Intel® Agilex™ 9 Direct RF

Model	Description
4821.04	Navigator MA FPGA Design Kit for DRF4581L
4824.04	Navigator MA Board Support Package for DRF4581L

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