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DRF4580L

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

Complete Small Form Factor Module

- High-bandwidth data streaming
- Waveform signal generator
- Communication receiver and transmitter
- Electronic Warfare transponder
- Analog I/O for digital recording and playback
- Sensor interfaces

The DRF4580L is a high-performance, 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 DRF4580L 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 DRF4580L's sophisticated clocking section for multichannel and multiboard synchronization, a modular front end for RF input and output, 16 GBytes of DDR4, a 1 GigE interface, four gigabit serial optical interface capable of supporting four 100 GigE connections and general-purpose serial and parallel signal paths to the FPGA.

BOARD ARCHITECTURE

The DRF4580L 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.

FEATURES

- Small Form Factor Module that can be conduction-cooled or air-cooled with an optional fan

- Incorporates Intel Agilex 9 Direct RF AGRW014

- 16 GB of DDR4 SDRAM

- 1 GigE Interface

- Four 100 GigE UDP interface

- Ruggedized and conduction-cooled

- Unique system-on-module design enables migration to other form factors

- Board Support Package (BSP) for software development

- FPGA Design Kit (FDK) for custom IP development

EXTENDABLE IP DESIGN

For applications that require specialized functions, users can install their own custom IP for data processing. Mercury's 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 the Mercury's BSP and FDK to completely replace the IP provided by Mercury with their own.

DRF4580L BLOCK DIAGRAM
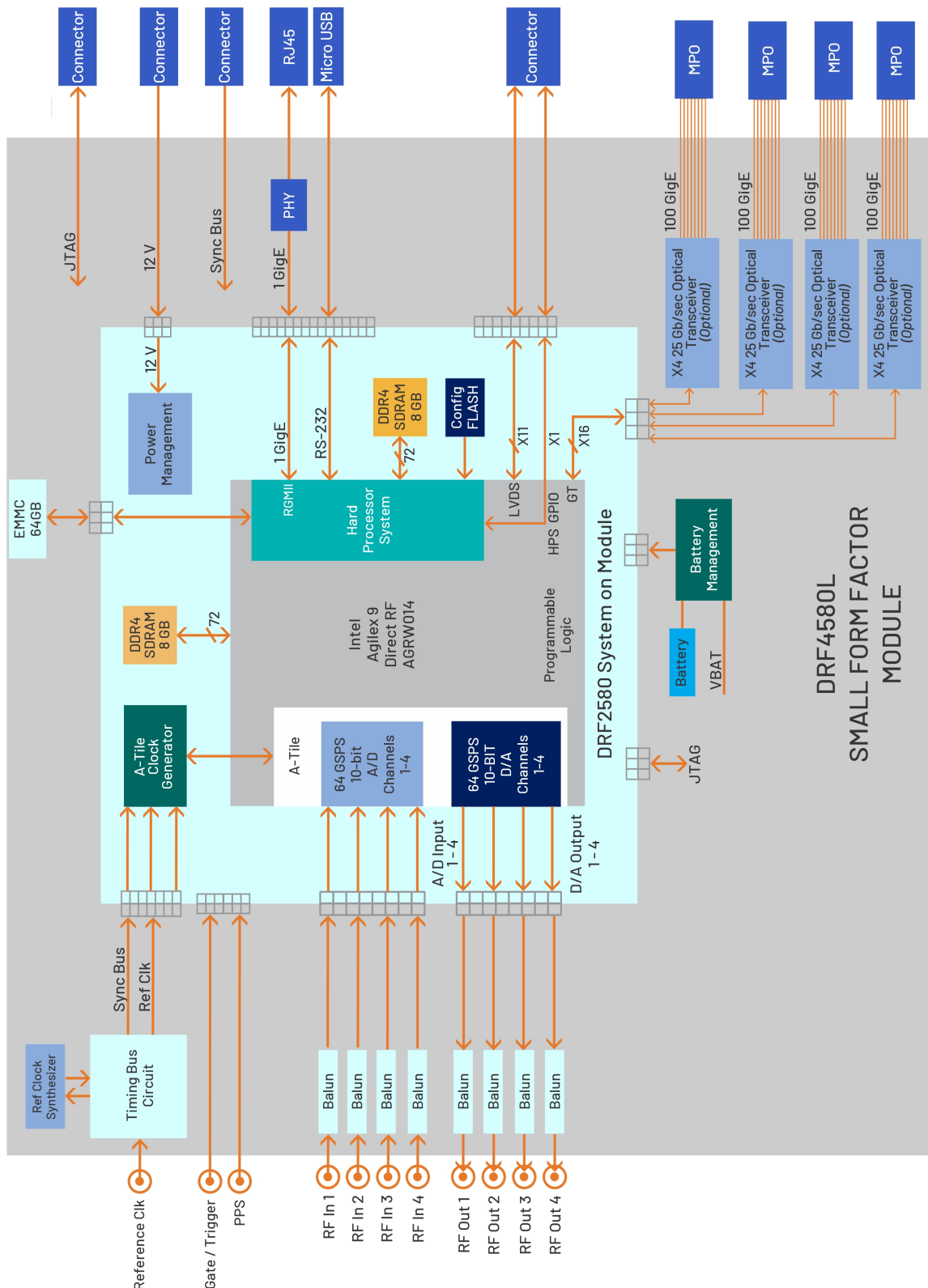
A/D CONVERTER STAGE

The analog interface accepts analog RF inputs on four coax connectors. 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.

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.

CLOCKING AND SYNCHRONIZATION

The DRF4580L'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, a front panel coax connector or from the multi-signal sync bus 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 front panel coax connector for external control of data acquisition and playback. For larger systems requiring multiboard synchronization, a multisignal sync bus interface is provided on the sync bus connector. These signals include the reference clock and all required complementary timing signals to provide synchronization across multiple modules.

MEMORY RESOURCES

The DRF4580L 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 DRF4580L includes 1 GigE interface for control and data transfers. This interface is independent of the optical 100 GigE interfaces. The 1 GigE interface provides a direct connection to the ARM processor.

EXPANDABLE I/O

The DRF4580L supports 16 25 Gb/sec full duplex lanes to 4 QSFP28 sites for optical transceivers. With the built-in quad 100 GigE UDP interface or installation of a user-provided serial protocol, this optical interface enables a high-speed gigabit data streaming path between boards.

FLEXIBLE MODULAR DESIGN

While the DRF4580L is a 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 DRF4580L, the SoM is mounted on a Small Form Factor carrier which complements the design with a timing bus circuit, analog signal conditioning, and a 16x 25 Gbps optical transceiver. As a module and carrier board set, the DRF4580L becomes a complete, ready-to-deploy module that can be conduction- or air-cooled with an optional fan.

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 a design kit for users to engineer and build their own 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.

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, sync bus (used for multiboard sync)
- 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

Interface: Optical

- Quantity: 4 full duplex 4-lane interfaces
- Connector: QSFP28
- Speed: 25 Gb/sec
- Laser: 850 nm

- Protocol: Factory-installed quad 100 GigE UDP IP cores provides greater than 48 GB/sec data transfers, other protocols supported with user installed IP

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

ORDERING INFORMATION

Model	Description
DRF4580L	Small Form Factor 4-Channel A/D and D/A Board with Intel® Agilex® 9 Direct RF

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