

STAR-Dundee

Supporting SpaceWire Applications

SpW-10X Router ASIC Evaluation Kit

The SpW-10X Router ASIC, designed using STAR-Dundee SpaceWire router technology and available from Atmel/Microchip as the AT7910E, is the most versatile, configurable, and easiest to use, radiation tolerant SpaceWire routing device on the market (see overleaf for more details on the Router ASIC device).

The STAR-Dundee SpW-10X Evaluation Kit allows rapid evaluation of the SpW-10X Router ASIC and easy prototyping of SpaceWire networks, which can be readily transformed into systems suitable for spaceflight. This can save several months of development effort and substantially reduces development risk. The kit is ready to use straight out of the box: just plug in the power adaptor provided and you have an extremely capable, high performance, SpaceWire router unit with a direct path to a flight system.

The STAR-Dundee SpW-10X Evaluation Kit can be used in a lab environment to explore using the SpW-10X as a stand-alone router, as an instrument interface possibly connected to an FPGA, or as a router embedded in a processing system.

Overview

A block diagram of the SpW-10X Evaluation Kit is shown in Figure 1, along with photographs in Figure 2 and Figure 3.

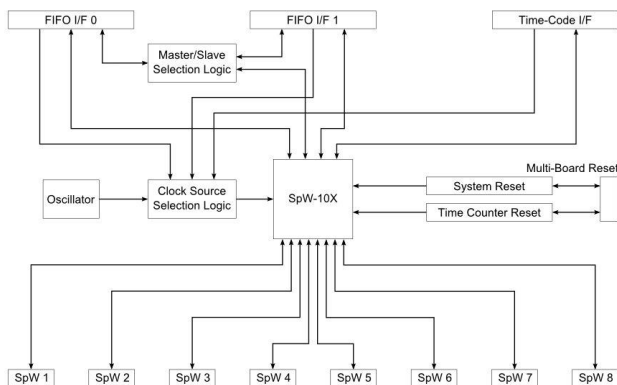


Figure 1: SpW-10X Radiation Tolerant SpaceWire Router Evaluation Kit

At the heart of the SpW-10X Evaluation Kit is the AT7910E radiation tolerant SpaceWire router. The eight SpaceWire ports of the router are passed to eight micro-miniature D-type SpaceWire connectors on the front panel of the unit. SpaceWire equipment can be directly coupled to these connectors using a SpaceWire cable. On the back panel two external ports are available on two 25-pin sub-D connectors and a time-code port is available on a third connector. The unit is powered by a 5V power brick which is supplied with the Evaluation Kit. The major interconnections to the SpW-10X ASIC device are all available on external connectors on the unit. For most applications all development work can be done without opening the unit.

Inside the unit, every signal from the ASIC is brought out to a standard 0.1" pitch header to permit easy interfacing to a logic analyser or oscilloscope. All inputs can be controlled using the onboard DIL switches, permitting evaluation of the complete functionality of the router without external components. Dedicated logic has been included on the board to facilitate the

interconnection of parallel external ports. Whilst this logic may be switched out, its inclusion allows a port to be looped back on itself; or looped onto another external port, either on the same evaluation kit, or a second unit.

The various inputs and outputs to and from the ASIC device are not buffered, to allow the electrical characteristics of the router to be observed and studied.

A comprehensive user manual details the various test points and switches of the kit, providing examples of how to interface to the external data and time-code ports.



Figure 2: Front view of SpW-10X Evaluation Kit



Figure 3: Rear view of SpW-10X Evaluation Kit

Specifications

Size: 110 x 170 x 35 mm approx.

Power: +5V DC, mains power brick supplied

SpaceWire Ports:

- Compliant to ECSS-E50-12A (ECSS-E-ST-50-12C)
- Number of SpaceWire Ports: 8
- Maximum Speed: 200 Mbit/s
- Connectors: 9-pin micro-miniature D-type
- LVDS: Built-in LVDS drivers and receivers

External ports:

- Synchronous parallel FIFO interface
- Number of external ports: 2
- Operating speed: 30MHz
- Optional interface logic provided
- External time-code port also provided
- Connectors: 25-pin Sub-D

EMC: CE/FCC certified.

Rack Mounting: 19" rack mounting kit is available which is able to take two units on a 1U high shelf.

SpW-10X Radiation Tolerant Router

The SpW-10X ASIC (Microchip AT7910E) is a radiation tolerant SpaceWire router with eight SpaceWire ports and two external parallel ports, sufficient to meet the requirements of many space applications. The SpW-10X is easy to use, requiring only a single 3.3V power supply and a 30MHz clock. Fully compliant LVDS drivers are built into the ASIC so that a typical application requires only a handful of external components.

Overview

A block diagram of the SpW-10X Router ASIC is shown in Figure 4.

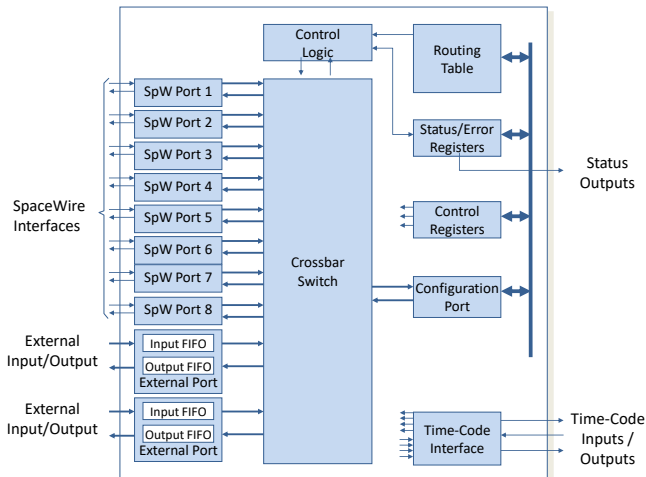


Figure 4: SpW-10 (AT7910E) Router Block Diagram

At the heart of the SpW-10X device is a cross-bar switch that connects the various input/output ports together. Packets arriving at one port can be rapidly switched to any output port according to the leading byte of the packet. Both path and logical addressing are supported, along with group adaptive routing. The routing table is accessed via the router configuration port (port 0) which is also used to configure the router and to read status and error information. A time-code interface on the device can be used to send or receive time-codes.

Key Features

Eight SpaceWire ports (ports 1 to 8): Each fully compatible with the SpaceWire standard and able to operate at up to 200 Mbit/s.

Two external ports (ports 9 and 10): Used to connect the router to an external host system. Each external port comprises an input FIFO and an output FIFO. The FIFOs have eight data bits and a control bit for indicating EOPs/EEPs. They operate synchronously to the 30MHz system clock.

Internal configuration port (port 0): Used to configure the router, setup the routing tables, and read its status registers. The configuration port provides access to the internal registers of the router using the RMAP protocol.

Non-blocking cross-bar switch: The cross-bar switch routes packets from any input port to any output port. It is non-blocking so that, provided an output port is not already being used to route a packet, the switch is guaranteed to be able to route the packet to its destination.

Versatile routing capabilities: Supports path and logical address, group adaptive routing across any number of ports, and priority arbitration for logical addressing.

Time-codes: Can act as a time-code master or slave device. A time-code port is provided for sending or receiving time-codes.

Watchdog timers: Each port has a programmable watchdog timer for detecting packet stalling on a SpaceWire link. The router will automatically recover from a stall condition on a SpaceWire network.

Power down on silence and start on request: The SpW-10X can automatically power down a link when there is nothing being sent across it, and then power it up again when there is data to send. This is very useful for saving power when there is only occasional SpaceWire traffic flowing across some links.

Clock tree disable: When all the SpaceWire ports are not needed in a specific application, the clock-tree of the unused ports can be halted to save power.

LVDS drivers/receivers on-chip: The SpW-10X includes all the LVDS drivers and receivers on-chip, saving substantial board area and cost.

General purpose outputs: 8-bits of a general purpose register are available on the output pins of the SpW-10X. These pins can be programmed using an RMAP command.

Plug and Play support: Network discovery and router identity registers are included on the SpW-10X to support plug-and-play applications that require the ability to automatically discover the structure of a SpaceWire network.

Sticky error registers: Status registers accessible using the RMAP configuration port (port 0) are available for each SpaceWire and external port and for the SpW-10X router core. Error registers are sticky and only reset when they are read.

Complete single chip SpaceWire routing device: All that is needed is a 3.3V power supply, a 30 MHz clock, a few passive devices and connectors to form a complete SpaceWire router.

Suitable for spaceflight applications: The SpW-10X is radiation tolerant and available from Microchip in various flight qualification grades.

Specifications

Power:

- Single 3.3 V supply
- Power consumption typically 4W with all interfaces running at 200 Mbit/s

Link speed:

- Transmit programmable up to 200 Mbit/s
- Receive up to 200 Mbit/s

Packet switching time:

- ~0.5 μ s

Radiation tolerant:

- 300 krad total dose

Availability

The SpW-10X radiation tolerant router ASIC is available from Microchip as the AT7910E in prototype and flight quality grades (<https://www.microchip.com/wwwproducts/en/AT7910E>).

The SpW-10X router technology is also available as a Router IP core from STAR-Dundee.



STAR-Dundee

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