

# RT-SPW-ROUTER

Radiation-Tolerant 10x SpaceWire Router

Radiation-Tolerant 6x SpaceWire Router with PCI



## Introduction

The Radiation-Tolerant SpaceWire Router family is available as standard components using the Actel RTAX and RT ProASIC3 Field Programmable Gate Arrays. The fault tolerant design of the router in combination with the radiation tolerant FPGA makes it ideally suited for space and other high-rel applications.

The router implements a routing switch as defined in the ECSS-E-ST-50-12C standard, supporting all mandatory and optional features. It implements up to ten external routing ports and a mandatory configuration port. The configuration port provides access to configuration and status registers and the routing table using the Remote Memory Access Protocol (RMAP) defined in ECSS-E-ST-50-52C.

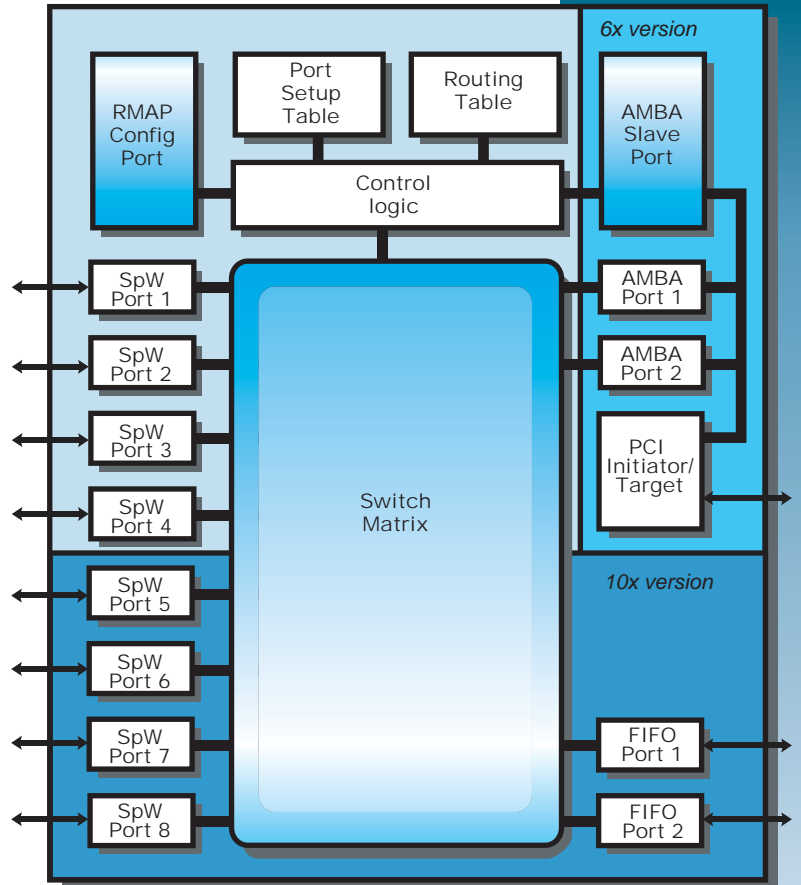
The router implements a non-blocking switch matrix which can connect any input port to any output port. All the addressing modes such as path, logical and regional logical are supported. Group adaptive routing is fully supported, meaning that both path and logical addresses can be individually configured to use from one up to all ports. A unique feature is the support for packet distribution, which can be used to implement multicast and broadcast addresses.

## Main Features

- Compliant with ECSS-E-ST-50-12C
- Routing
  - Non-blocking switch-matrix connecting any input port to any output port
  - Path, Logical and Regional Logical addressing
  - Group Adaptive Routing
  - Packet Distribution
  - Two priority levels for output port arbitration
- Configuration port using the RMAP protocol (ECSS-E-ST-50-52C)
- SpaceWire ports, up to 8 external
  - Up to 200 MBPS in both directions per link
  - Support for on-chip or off-chip LVDS transceivers
- FIFO ports, 2 external
  - 9-bit wide data paths
  - Read/write, full and empty signals
  - Possible to cascade two routers without glue logic



Figure: Block diagram of 10x and 6x SpaceWire Routers



- AMBA ports, 2 internal
  - AMBA AHB master interface with DMA and RMAP, and AMBA APB interface for control and status
  - AMBA AHB slave interface for access to the configuration space and routing table
- PCI initiator and target with DMA, 32-bit, 33 MHz
- System-time distribution via all ports
  - Can be enabled/disabled per port or globally
  - Programmable checking of control flags
- Timers on all ports to prevent deadlock

## Availability

The Radiation-Tolerant SpaceWire Routers implemented using the Actel RTAX2000S/SL and RT ProASIC3 RT3PE3000L devices are directly available in standard configurations.

The standard 10x SpaceWire router implements 8 external SpaceWire ports and 2 external FIFO ports. The standard 6x SpaceWire router implements 4 external SpaceWire ports and a PCI initiator and target interface accessed via two internal AMBA ports with DMA and RMAP. Other configurations can be offered on request.

The components are pre-programmed and are shipped with a complete data sheet and user's manual. For evaluation and prototyping the commercial version Axcelerator AX2000 and ProASIC3L A3PE3000L devices are available. For price and ordering please contact Aeroflex Gaisler.

### Standard Configurations

Product name	RT-SPW-ROUTER-10X	RT-SPW-ROUTER-6X
Configuration ID (CID)	1	2
Description	10x SpaceWire Router	6x SpaceWire Router with PCI
SpaceWire ports	8	4
FIFO ports	2	
AMBA ports with RMAP		2
Configuration port with RMAP	Yes	Yes
Configuration port with AMBA		Yes
PCI Initiator/Target		Yes
PCI Interrupt Controller		Yes
UART Debug Link		Yes
FPGA and package	RTAX2000S/SL CCGA624 RTAX2000S/SL CQFP352 RT3PE3000L CCGA484	RTAX2000S/SL CCGA624 RTAX2000S/SL CQFP352
SpaceWire Physical Layer	LVTTTL / LVDS (on-chip)	LVTTTL / LVDS (on-chip)

### Specifications

Technology	RT Axcelerator	RT ProASIC3
Device	RTAX2000S/SL	RT3PE3000L
Link speed	200 MBPS	100 MBPS
Receiver clock	200 MHz	100 MHz
Transmitter clock	100 MHz (DDR)	50 MHz (DDR)
System clock	25 MHz / 33 MHz	25 MHz
PCI clock	33 MHz	N/A
Power consumption	500 mW (TBD)	500 mW (TBD)
Package	CQFP352, CCGA624	CCGA484
Total Ionizing Dose	300 krad (Si)	15 krad (Si)
Single-Event Latch-Up Immunity (SEL)	$LET_{TH} > 117 \text{ MeV-cm}^2/\text{mg}$	$LET_{TH} > 68 \text{ MeV-cm}^2/\text{mg}$
Single-Event Upsets (SEU)	$LET_{TH} > 37 \text{ MeV-cm}^2/\text{mg}$	$LET_{TH} > 6 \text{ MeV-cm}^2/\text{mg}$ (before TMR)
Supply Voltage	1.5V, 2.5V & 3.3V	1.2V – 1.5V, 2.5V & 3.3V

### CONTACT INFORMATION

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