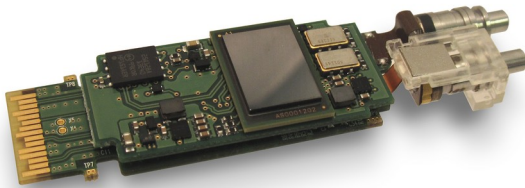


Customer

Several Tier 1 & Tier 2 Network Equipment Manufacturers, that provide switches, routers, and packet-optical products, required an easy way to add TDM/SONET/SDH/OTN circuit emulation to their products in order to support Telecom Service Providers networks.

To fulfill this need AimValley created SFP modules (Small Form-Factor Pluggable), to create connections via fiber optics, in cooperation with OE Solutions.

These SFP modules translate the electrical signals from the switch to optical signals on the fiber. The applications mentioned require extra processing functions inside the SFP module itself, but the standard size leaves very little space for extra components.



Customer Objectives

- > Build SFP modules with a large programmable FPGA inside to support additional protocol processing, to handle Ethernet and other protocols at 1 Gb/s or 10 Gb/s, along with T1, E1, DS-3, SONET, SDH, OTN, CPRI, and OAM.
- > The power consumption needed to be limited and the design needed to support a temperature range of -40°C to +85°C.
- > Also required was a modular approach that enabled reuse of the hardware device across multiple customer products and variants.

AimValley Solution

Standard packaged FPGA devices do not fit inside the small SFP module; so our solution is to use a bare die design. A bare die is a silicon chip without its normal package with the die itself then wire bonded or connected via flip-chip to a proprietary board, packaged and sealed to fit within the SFP module.

We developed 2 separate solutions:

- > a bare die with wire bonding for protocols up to 1 Gb/s
- > and another with flip-chip interconnect for higher bitrate protocols up to 10 Gb/s.

Key Technologies

- > Wire bonding 400 wires with >95% yield per device (95% of all boards with wire bonded devices met the connection and quality standards of AimValley).
- > Patented algorithm to limit power.
- > Special test program to verify bare die.
- > [Bare Die](#)
- > [SONET/SDH, Circuit Emulation](#)
- > [Thermal Management](#)

Results and Added Value**✓ Efficient**

4 platforms for more than 50 products variants. Rapid solution for adding new functionality to an existing or new switch, router or packet optical network element.

**Partnership**

AimValley worked with [AMD](#) to obtain bare die chips. AimValley's partner [OE Solutions](#) adds various flavors of optics and manufactures the Smart SFP.

★ Successful

Shipment of more than 50 000 Smart SFPs.

**Innovation**

The alternative to AimValley SmartSFPs is to add the functionality directly into the network element itself. Typically, that requires a full multiport board design with integrated software development which does not help in situations where one or just a small number of ports need to be added. AimValley SmartSFPs can be plug and play and can support integration into the switch/router management software.