## Description

U.2 8TB, PCIe Gen3 x4 Reference Design

The U.2, 7mm, Marvell® Reference design uses the latest high-performance enterprise SSD controller from Marvell along with the high-performance 1:4 expander/multiplexer from IDT. Together, this combination allows for maximum speeds of up to 800MT/s per channel without compromising capacity.

Each channel supports 512Gb die × 16 for a total of 1TB of flash capacity per channel. Without using the high performance 1:4 expander, the capacitive loading of 16 die would create signal integrity issues and make this level of performance prohibitive.

Figure 1.   Reference Design Block Diagram
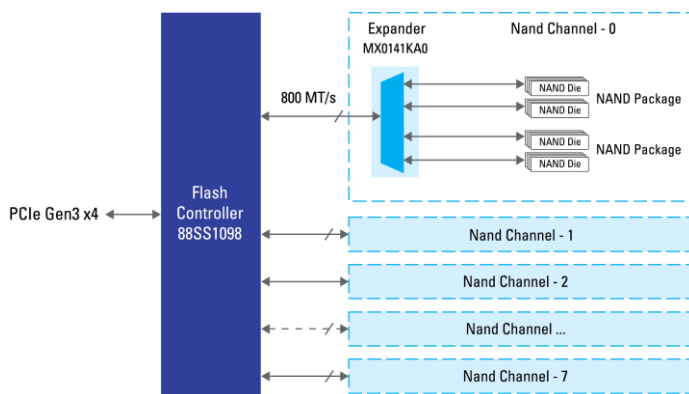
88SS1098 Controller

The Marvell 88SS1098 enables high-performance and high-capacity SSDs for use in enterprise and data center environments. Leveraging a quad-core Arm® Cortex®-R5 architecture with support for up to 8GB DRAM, these controllers can enable high-performance SSDs to meet the demands of the most challenging workloads.

For enterprise use cases, the 88SS1098 can also support PCIe Gen3 x4 dual port (active/active) to enable high availability systems. The 88SS1098 leverages the latest Marvell Gen4 NANDEdge™ LDPC engine for extracting the highest performance from MLC and TLC memories while providing the most P/E cycles. The device also supports TCG standards including an AES engine and OTP storage for secure drive configuration.

Reference Design Features

Controller Features

- Quad Cortex®-R5 CPUs
  - Dynamic Branch Prediction
  - DMA controller
  - PCIe Gen3 x4 (with dual port support)
- DDR Controller
  - Up to 8GB DDR3, DDR4, LPDDR3, LPDDR4 at speeds up to 2400MT/s with ECC support
- Flash Controller
  - 8 Channels at 800MT/s
  - ONFI 2.2/2.3/3.0/4.0, JEDEC mode and Toggle 1.0/2.0

1:4 High Performance Expander Features

Main Features

- 1:4 high bandwidth 16-bit bus multiplexer
- SSTL18 and SSTL12 signaling
- Supports ONFI 3.0, 4.0, 4.1 and Toggle NAND Flash
- 4.0 × 11 mm FCCSP package with 0.65/0.5mm ball pitch

High-Speed MUX Features

- Bidirectional passive port switches
- Pull-up/Pull-down/Tristate/bus-hold for deselected ports
- Pin-to-pin output skew < 30ps (within a port)
- Pin-to-pin output skew < 10ps (Differential pairs)
- Propagation delay < 150ps
- Insertion loss < 1dB at 800MHz

Low Speed MUX/Control Logic Features

- 4-bit in, 16-bit input/output logic targeted for Chip Enables or port selections
- Multiplexing or decoding
- Unidirectional, active multiplexing
- Multiple function selected via the CFG pins

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Figure 2.   88SS1098 Controller Block Diagram
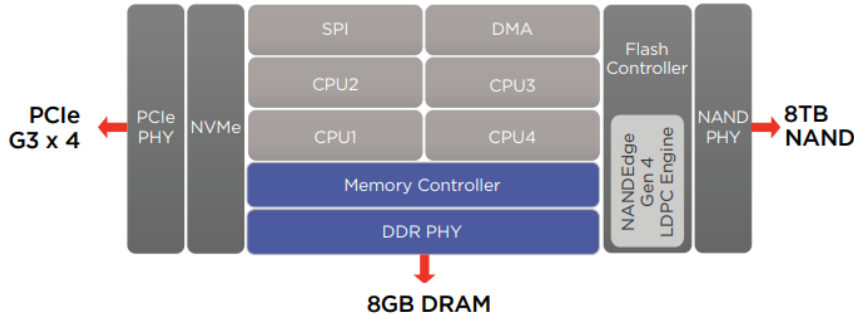
## MX0141KA0 1:4 High Performance Expander

The 1:4 high-speed MUX is comprised of a high-speed 1:4 multiplexer (mux) path and a low speed multi-function control logic path. The high-speed path consists of four passive switches that connect input port "IN" to four 16-bit output ports A, B, C, and D. The passive switches, which closed selectively, forms a bidirectional multiplexer.

The low-speed path is active multi-function IOs that can be configured in different modes. It can configured as unidirectional 1:4 mux with 4-bit port width, 4:16 decoder, or 16-bit signals for port selection. The CIO pins can be used to drive Chip Enable pins of the NAND Dies, or be used as a high-speed mux selector.

Figure 3.   MX1014KA0 Block Diagram
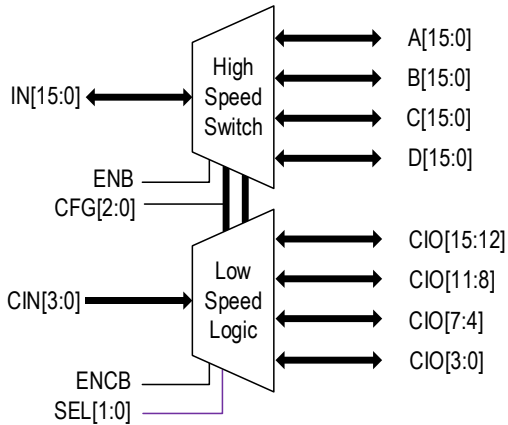
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