

# U.2 8TB, PCIE GEN3 X4 SSD REFERENCE DESIGN

1:4 ONFI expander boosts SSD performance



This innovative SSD reference design creates a U.2, 7 mm solution to maximize capacity and performance without expanding design footprint. The 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 800 MT/s per channel without compromising capacity.

Each channel supports 512 Gb 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.

## Key features

- IDT® MX0141K 1:4 expander
- Marvell® 88SS1098 controller
- 800 MT/s per channel
- 1 TB flash capacity per channel

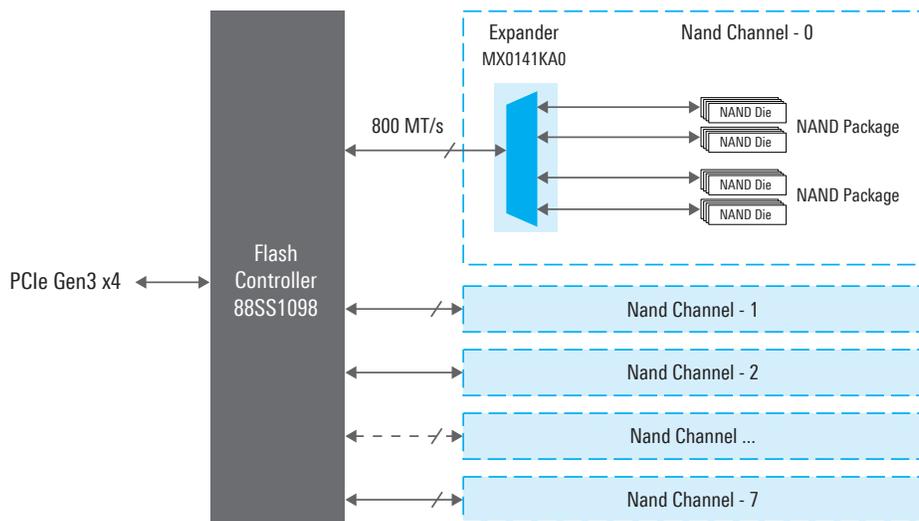


Figure 1. SSD reference design block diagram



## U.2 8TB, PCIe GEN3 X4 SSD REFERENCE DESIGN

### Reference design features

#### 1:4 High Performance Expander 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 0.65/0.5 mm ball pitch

#### High-Speed MUX Features

- Bi-directional 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 800 MHz

#### 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

#### 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 2400 MT/s with ECC support
- Flash controller
  - 8 Channels at 800 MT/s
  - ONFI 2.2/2.3/3.0/4.0, JEDEC mode and toggle 1.0/2.0

### MX0141KA0 1:4 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 close selectively, form a bi-directional multiplexer.

The low-speed path is active multi-function IOs that can be configured in different modes. It can be configured as uni-directional 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.

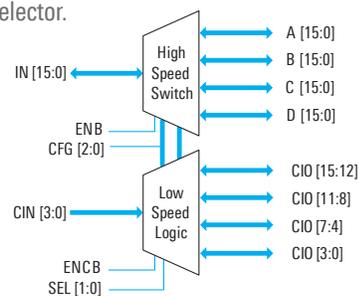


Figure 2. MX0141KA0 Block Diagram

### 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.

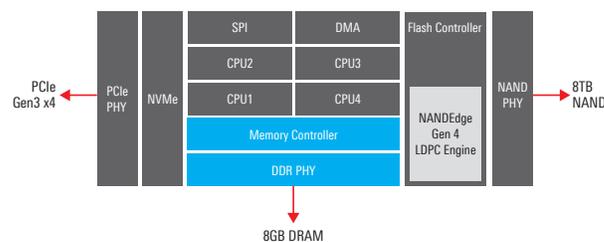


Figure 3. 88SS1098 controller block diagram



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