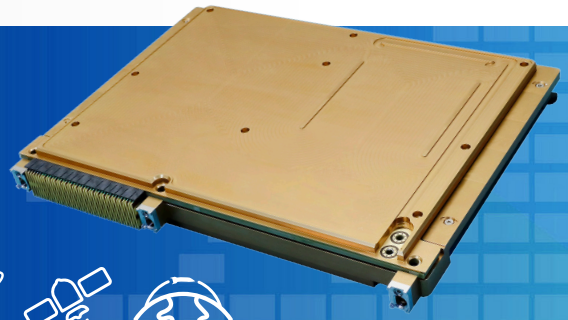
DATASHEET

TRRUST-Stor® VPX RT

6U VPX Radiation-Tolerant Large Geometry SLC NAND SpaceDrive PCIe/SRIO

SRIO models: RH6470NM2S-000I00-01, RH6940NM2S-000I00-01 (EDU), RH6470NM2S-000I00-02, RH6940NM2S-000I00-02 (FLT)
PCIe models: RH6470NM2S-000I00-03, RH6940NM2S-000I00-03 (EDU), RH6470NM2S-000I00-04, RH6940NM2S-000I00-04 (FLT)
Contact sales for information on 3U variants

- **Mercury's proprietary SpaceDrive NAND controller**
- **6U VPX form factor**
- **Radiation-tolerant solid state storage**
- **Up to 1 TB large geometry SLC NAND flash**
- **RAID0, RAID1 or cold store mirror capability**



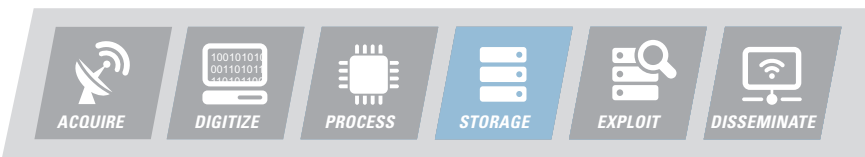
Mercury's TRRUST-Stor series of radiation-tolerant solid state drives represent the world's first commercially available, customizable SSDs precision-engineered for the harshest operating environments on Earth and beyond. Although designed for commercial satellite applications, these blazingly fast, high reliability drives are a perfect fit for applications with potential for radiation exposure, including high-altitude aircraft, air-borne weapons and mission-critical ground computing systems.

Incorporating a Mercury designed SpaceDrive controller, the 6U model adds enhanced features and capabilities. Including all the features of the original 3U RH3440 design, Mercury's SpaceDrive controller series adds over twice the media capacity, additional error correction and NAND device hot swap capability. Designed for fault-tolerance, the 6U SpaceDrive adds additional redundant NAND devices and the ability to partition the NAND flash into two identical arrays to support RAID0, RAID1 as well as a powered-off and grounded mirrored array. Recognizing that no two mission requirements are identical, power consumption, ECC, capacity and spare devices are tunable against performance to create the perfect set of features as required by each unique mission.

Standard Features

- All devices except the large geometry SLC NAND: Radiation-tolerant to 100K rad
  - NAND flash 30K rad minimum
- 6U SpaceVPX form factor
- Performance:
  - 1160 MB/s SRIO (9280 Mbits/sec)
  - 800 MB/s PCIe (6400 Mbits/sec)
  - Options for lower power, lower speed operation
- VPX connectors:
  - Smiths KVPX Series
    500 mate/unmated cycles
  - TE connectivity MultiGig RT 2-R Series
    500 mate/unmated cycles
- Operating mode: Linear and Host Addressable
  - Linear Mode: Sequential data recording (Data recorder mode)
  - Host Addressable: Random RW to any of 3502 UltraBlocks (470GB model) 7004 for 940GB model (134 MB each)
  - Random sector read operations: At any time, both modes.)
- Storage modes:
  - RAID0 (fast)
  - RAID1 (mirrored)
  - Hardened (Grounded) cold spare
- Capacity to host:
  - 940 GB RAID0
  - 470 GB RAID1 and mirrored Hardened mode
  - Host capacity is constant over entire life
- Error correction:
  - Ultra strong horizontal Reed Solomon ECC algorithm
  - Corrects bit errors, defects and several failing devices
  - Extends NAND endurance
  - Automatically replaces worn out blocks with spare blocks
- Four on-the-fly hot-swap devices
- Bad block table
  - Supports field upgrades
  - Allows replacement of failing devices with spare devices
- Multi-device defect mitigation
- Nuclear event detector input

Mercury Systems is a leading commercial provider of secure sensor and safety-critical processing subsystems. Optimized for customer and mission success, Mercury's solutions power a wide variety of critical defense and intelligence programs.



- Radiation-tolerant design:
  - RTG4-based NAND processor/controller
    - Configuration upsets immunity to LET > 103 MeV.cm2/mg
    - Single-event latch-up (SEL) immunity to LET > 103 MeV.cm²/mg
    - Registers SEU rate < 10-12 errors/bit-day (GEO Solar Min)
    - Single-event transient (SET) upset rate < 10-8 errors/bit-day (GEO Solar Min)
    - Total ionizing dose (TID) > 100 Krad
  - NAND flash: Micron M73A die. TID > 30K rad
  - All other devices: Radiation tolerant by design to >100K rad
- NAND endurance:
  - Minimum 50,000 drive over writes
  - Up to 15 drive over-writes/day for 7 years
  - 55 PB in RAID0, > 30 PB in (1TB model)
  - Minimum 6 month retention at EOL
- 6U VPX Board size: 233 mm x 160 mm
- Reliability:
  - Microprocessor-free design
  - State machine driven, no software
  - Automatic block retirement
  - Abrupt power interruption protection
  - Corruption free design
  - UBER: Better than 1E-19
- Erase operation: < 30 seconds
- Auxiliary control interface
  - Option for SPI or SpaceWire, RS-422 or I2C
- Status data:
  - All voltages and rail current
  - 3 temperature sensors
  - Wear level counts
  - Spares remaining
  - Power cycle and power on time counts
  - Erase cycle count
  - ECC error counts
  - Total Bytes written
- 100% dynamic burn-in
- Ruggedized construction and assembly.
- Rail temperature: -40 °C to +71 °C
- Storage temperature: -55 °C to +105 °C
- Vibration: 3 axis 15 min/axis
  - Random: 10-2000 Hz, 0.16 G^2/Hz
  - Sine: 15 Grms, 10-2000 Hz
- Shock: (3+, 3- per axis) 18 total
  - 15 G, 40 ms, ½ sine
  - 100 G, 6 ms, ½ sine
- Weight: < 3.5 lbs.
- Power: 10.8V to 12.3V (50mA), 4.5V to 5.5V
- BOM, schematics and design document available on request

Applications include:

- Low Earth Orbit (LEO) satellites; Contact Mercury for other orbit solutions
- Missiles
- Launch vehicles
- Scientific payloads
- Terrestrial applications with radiation exposure

Part Numbering *(dashes in the part number are required)*

R H6 XXX N M 2 S - 0 0 0 I 00 - 01

Product Series
R = Mercury Systems, (Rad-Tolerant series)

Form Factor
H6 = 6U VPX

Host-accessible NAND Capacity
940 = 940 GB host capacity
470 = 470 GB capacity

Encryption
N = None

Media Manufacturer
M = Standard Product

Media Type
2 = 1 bit SLC NAND 32 Gb

Mode
S = SLC mode

Customizable Features Field One
0 = Standard product

Customizable Features Field Two
0 = Standard product

Customizable Features Field Three
0 = Standard product

Operating Temperature
I = Industrial (-40 °C to +85 °C)

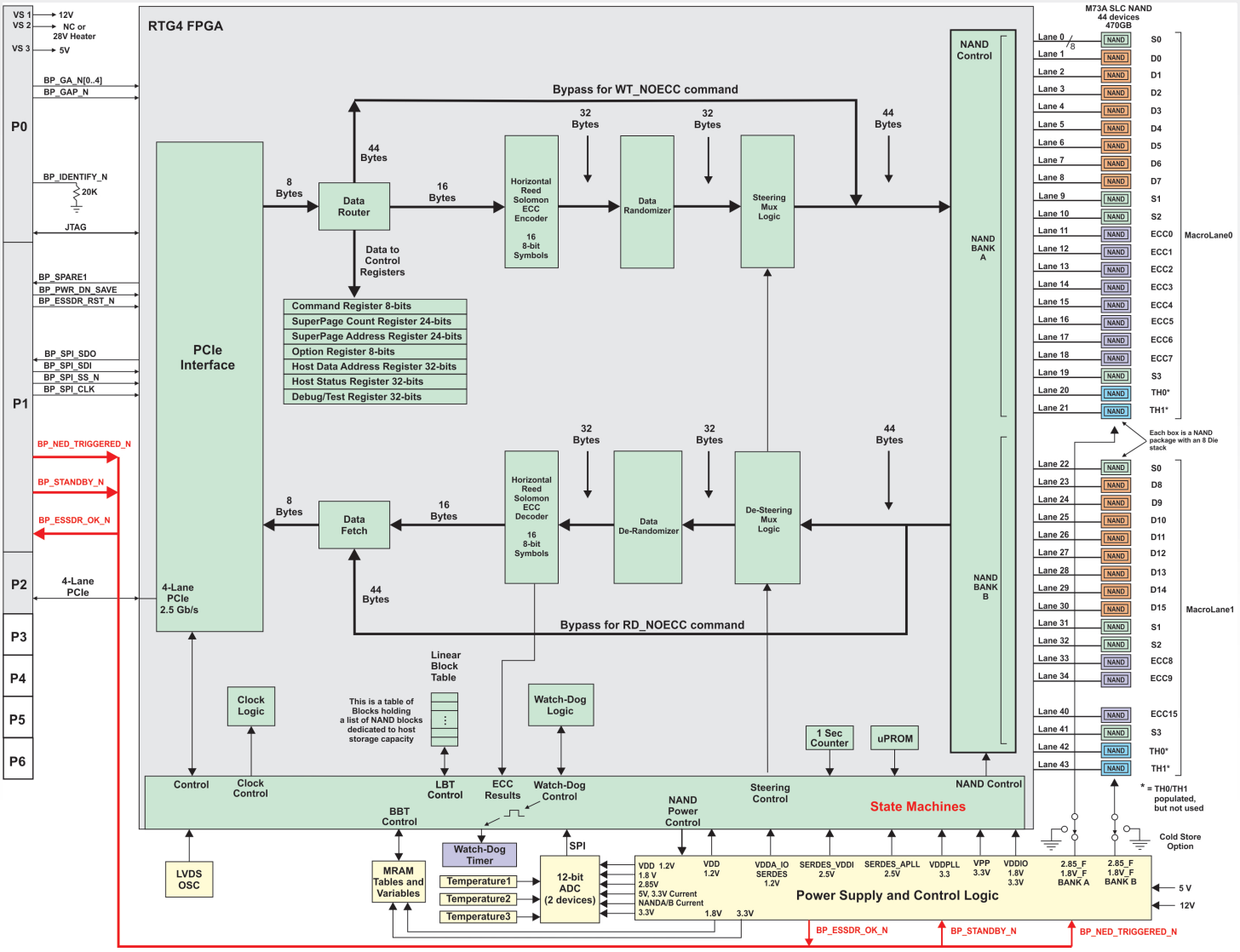
Classification
00 = Standard Product

Attribute Field

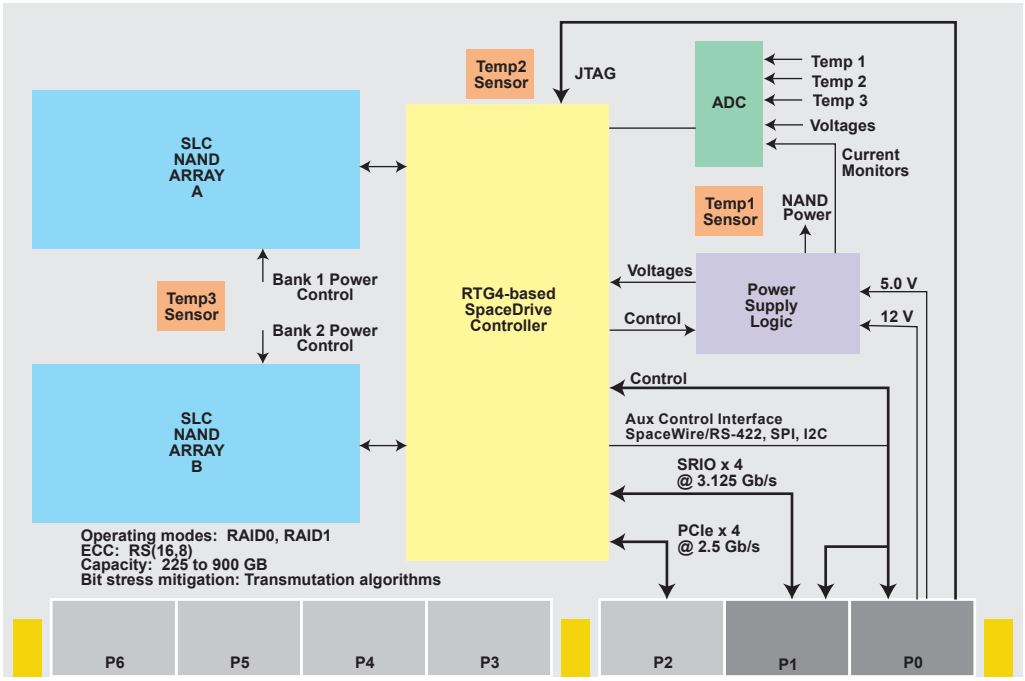
- 01	Construction:	Leaded (L)
	Interface Structure:	4 Lanes (4)
	Interface Type:	SRIO (SR)
	Grade:	Engineering Development Unit (EDU)
- 02	Construction:	Leaded (L)
	Interface Structure:	4 Lanes (4)
	Interface Type:	SRIO (SR)
	Grade:	Flight Unit (FLT)
- 03	Construction:	Leaded (L)
	Interface Structure:	4 Lanes (4)
	Interface Type:	PCIe (PC)
	Grade:	Engineering Development Unit (EDU)
- 04	Construction:	Leaded (L)
	Interface Structure:	4 Lanes (4)
	Interface Type:	PCIe (PC)
	Grade:	Flight Unit (FLT)

Example part Number: RH6470NM2S-000I00-01 (EDU)

Architectural Block Diagram



Simplified Block Diagram



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5031.09E 0540 2nd Gen TRRUST-Stor VPX RT Rad-Tolerant Large Geometry SLC NAND SSD

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