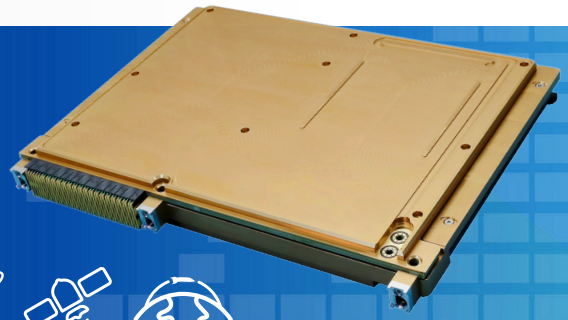
DATASHEET

TRRUST-Stor® VPX RT

2nd Generation Radiation-Tolerant Large Geometry SLC NAND SpaceDrive

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 2nd generation proprietary SpaceDrive NAND controller**
- **6U SpaceVPX form factor**
- **Radiation-tolerant solid state storage**
- **Up to 1 TB large geometry SLC NAND flash**
- **RAID0, RAID1 or cold store mirror capability**



IN DEVELOPMENT*

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.

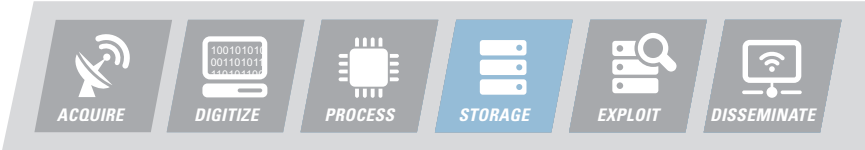
Incorporating a Mercury designed 2nd Generation SpaceDrive controller, the new devices add enhanced features and capabilities. Including all the features of the original 3U RH3440 design, Mercury's 2nd Generation SpaceDrive controller series adds over twice the media capacity, additional error correction, sector addressing support and media over-write capability. Designed for fault-tolerance, the new 2nd Generation SpaceDrives add 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
  - 3U variants in development
- Performance:
  - 1160 MB/s SRIO (9280 Mbits/sec)
  - 800 MB/s PCIe (6400 Mbits/sec)
  - Options for lower power, lower speed operation
- Smiths connectors: KUPX series
- Operating mode: Enhanced data recorder
  - Erase, write, read and overwrite in any order
  - Sector based addressing
  - Random reads and writes anytime
  - Minimum overwrite size is 1sector
  - Optional log file support: 8 files, 134 MB each, (4 SuperBlocks per file)
- 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

** This product is under development, not qualified or characterized and is subject to change or cancellation without notice.*

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.



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- Radiation-tolerant design: RTG4-based NAND processor
  - Configuration upsets immunity to LET > 103 MeV.cm^2/mg
  - Single-event latch-up (SEL) immunity to LET > 103 MeV.cm^2/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 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
- 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 +75 °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: 12V (50mA) and 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)

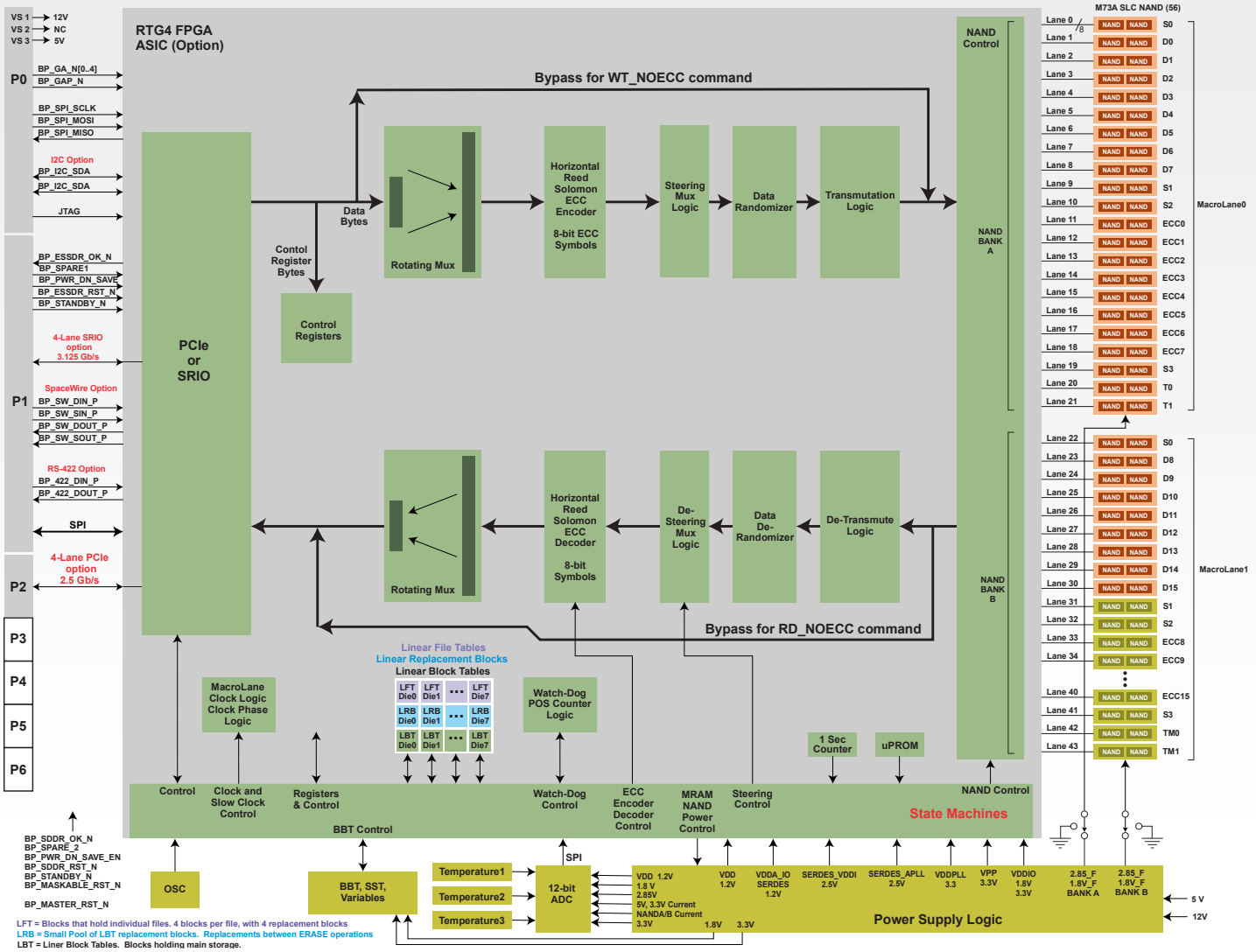
Classification
00 = Standard Product

Attribute Field

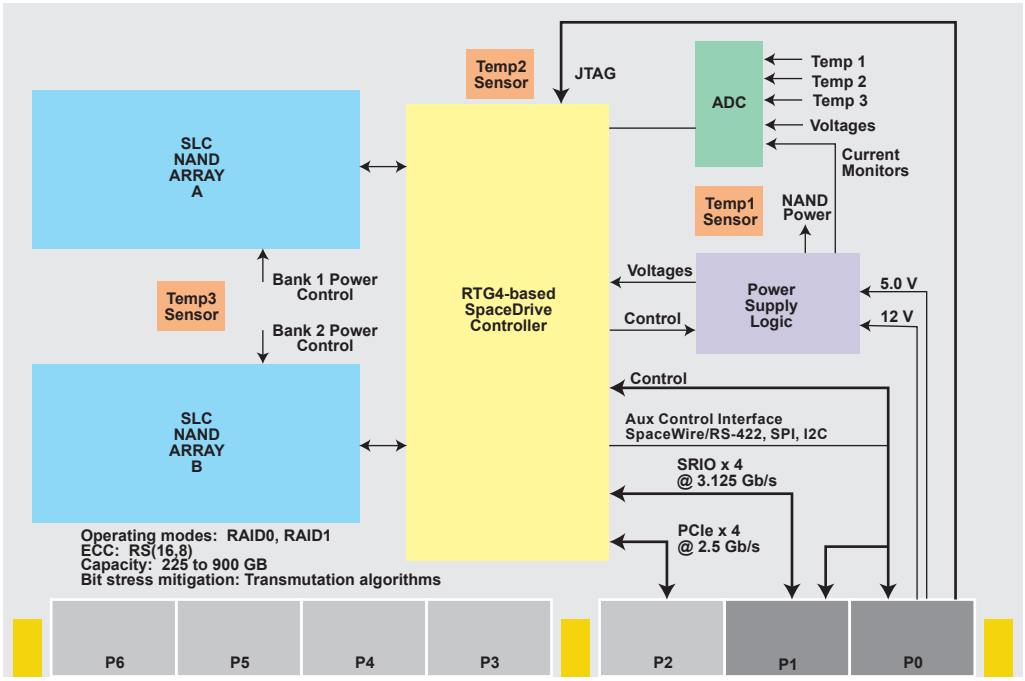
- 01	Construction:	Leaded (L)
	Interface Structure:	4 Lanes (4)
	Interface Type:	SRIO (SR)
	Grade:	Engineering Development Unit (EDU)
- 02	Construction:	Leaded (L)
	Interface Structure:	4 Lanes (4)
	Interface Type:	SRIO (SR)
	Grade:	Flight Unit (FLT)
- 03	Construction:	Leaded (L)
	Interface Structure: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