



CERVOZ

Revision History

| Date | Revision | Description |
|------------|----------|----------------|
| 2023.07.31 | 1.0 | First Released |



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1. Product Overview

1.1 Introduction

Cervoz Industrial M.2 2230 Embedded Module T425 family is a Solid State Flash Disk product that is in compliance with the M.2 and PCIe Gen3x2 standards. M.2 2230 T425 family fits in any M.2 2230 (A+E) sockets in a PC or motherboard; it can be used for both booting and storage purposes.

T425 family uses SSD grade quality 3D TLC flash memory from the industry leading manufacturer Micron. Cervoz's firmware builds in a powerful ECC algorithm call Low-Density Parity Check (LDPC) decoding to improve data reliability.

T425 family offers stable performance and reliability; the product family is an ideal choice for an ultra-compact fanless PC that demands exceptional computational capabilities. Moreover, it offers an effective solution for expanding storage capacity when storage falls short.

1.2 Feature

- Compliant with PCIe Gen3x2 interface (backward compatible to PCIe Gen 1)
- Compliance:
 - NVMe 1.3
 - PCI Express Base 3.1
- 3D TLC flash memory
- Capacity: 64GB/128GB/512GB
- End-to-End data protection
- SLC write cache technology
- Thermal throttling
- Operating as boot disk
- Static and dynamic wear leveling
- Bad block management
- S.M.A.R.T. & TRIM command
- Power Saving Modes:
 - Support APST
 - Support ASPM
 - Support L1.2
- Fully compatible with Windows 8.1, Windows 10, Mac OS, and Linux*
- RoHS compliant

*Microsoft recommends when use the M.2 NVMe SSD the driver for windows 8.1 and above is required. Mac and Linux system users need to make sure whether there is a driver support M.2 NVMe SSD or not.

1.3 Product Appearance & Models

Cervoz Industrial M.2 2230 Module T425

Standard Temperature



| T425 Family Standard Temp. (0°C ~ 70°C) Model No. | Capacity |
|---|----------|
| CIE-M3T425MLF064GS | 64GB |
| CIE-M3T425MMF128GS | 128GB |
| CIE-M3T425MOF512GS | 512GB |

Please Note:

Since certain storage capacity has to be reserved for firmware and controller management purposes; the physical capacity of the flash module will be approximately 93.1% of the indicated capacity. If you need to install an image that has the exact (or close to) the indicated size of the flash module, please choose your flash module with a greater capacity.

2. Product Specifications

2.1 General Specifications

| | |
|-------------------------------|--|
| Form Factor | M.2 PCIe 2230 |
| Interface | PCIe Gen3x2 (backward compatible to PCIe Gen 1) |
| Connector | M.2 2230 (A+E) |
| NAND Flash Type | 3D TLC |
| Capacity | 64GB/128GB/512GB |
| Sequential Read | up to 815MB/s |
| Sequential Write | up to 760MB/s |
| ECC Scheme | Applies the LDPC (Low Density Parity Check) of ECC algorithm |
| MTBF | >3,000,000 hours |
| TeraByte Written (TBW) | 64GB : 109 128GB : 219 512GB : 875 |
| Supply Voltage | 3.3V DC +/-5% |
| Power Consumption | Active mode: < 2500mW Idle mode: < 530mW |
| Dimension (LxWxH) | 30.00*22.00*3.50mm |

2.2 Performance

The performance was measured with below PC configuration:

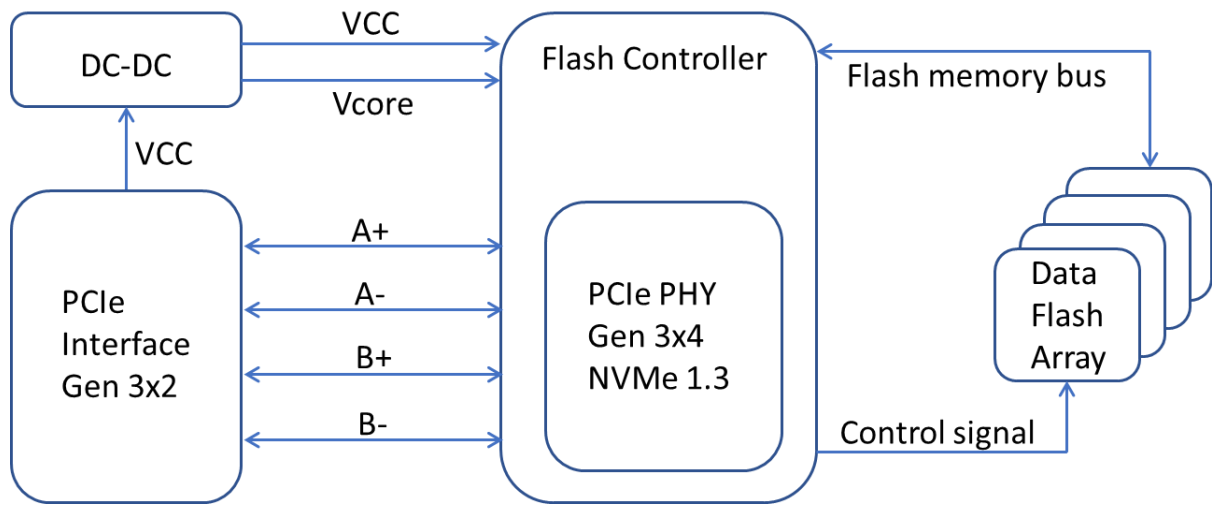
- Platform: Intel NUC i7-1165G7
- RAM: Cervoz CIR-S4SUSA3232G (DDR4 4G 3200MHz)
- Operation Systems: Win10 64bit
- Testing Utility: Crystal Disk Mark v8.0.4 x64 and IOMeter, 1GB range
- PCIe Gen3 performance

| Capacity | 64GB | 128GB | 512GB |
|-----------------------------------|----------|-----------|-----------|
| Sequential Read (Q32T1) | 495MB/s | 810MB/s | 815MB/s |
| Sequential Write (Q32T1) | 110MB/s | 515MB/s | 760MB/s |
| 4KB Random Read (Q128T16) | 30K IOPS | 50K IOPS | 120K IOPS |
| 4KB Random Write (Q128T16) | 30K IOPS | 100K IOPS | 120K IOPS |

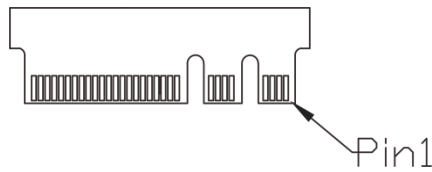
Actual performance might differ based on different using conditions and environment.

2.3 Electronic Specifications

2.3.1 Block Diagram



2.3.2 Pin Assignment



| Pin # | Pin Description | Signal Name | Pin # | Pin Description | Signal Name |
|-------|-----------------|-------------|-------|-----------------|-------------|
| 1 | Ground | GND | 15 | Module Key | Key |
| 2 | 3.3V power in | +3.3V | 16 | Not Used | NC |
| 3 | Not Used | NC | 17 | Not Used | NC |
| 4 | 3.3V power in | +3.3V | 18 | Ground | GND |
| 5 | Not Used | NC | 19 | Not Used | NC |
| 6 | Not Used | NC | 20 | Not Used | NC |
| 7 | Ground | GND | 21 | Not Used | NC |
| 8 | Module Key | Key | 22 | Not Used | NC |
| 9 | Module Key | Key | 23 | Not Used | NC |
| 10 | Module Key | Key | 24 | Module Key | Key |
| 11 | Module Key | Key | 25 | Module Key | Key |
| 12 | Module Key | Key | 26 | Module Key | Key |
| 13 | Module Key | Key | 27 | Module Key | Key |
| 14 | Module Key | Key | 28 | Module Key | Key |



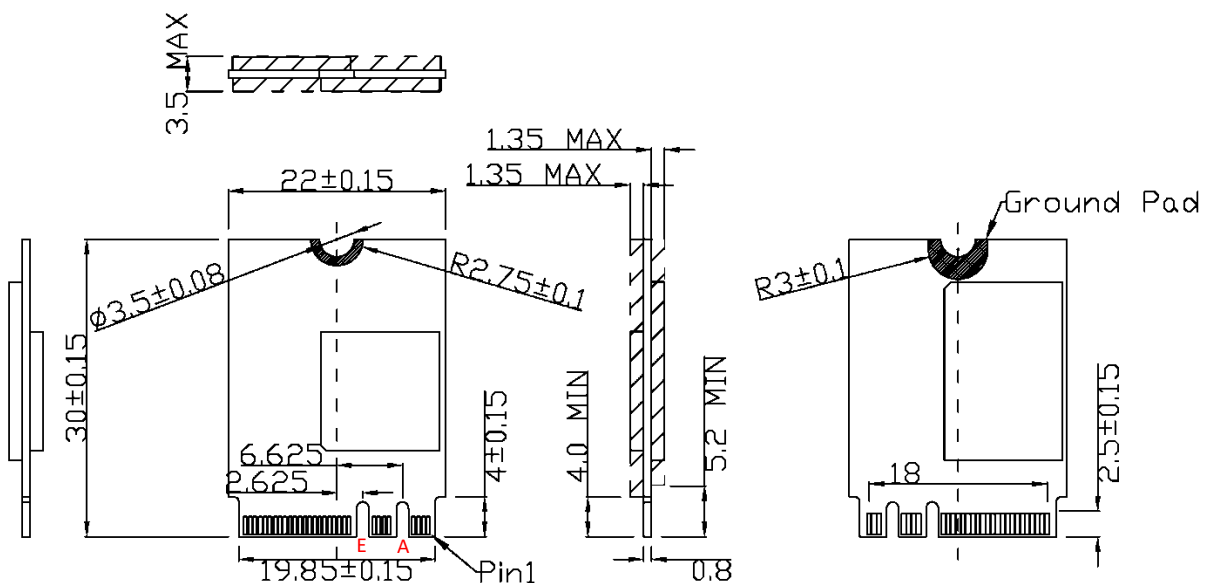
| Pin # | Pin Description | Signal Name | Pin # | Pin Description | Signal Name |
|-------|---|-------------|-------|--|----------------------|
| 29 | Module Key | Key | 45 | Ground | GND |
| 30 | Module Key | Key | 46 | Not Used | NC |
| 31 | Module Key | Key | 47 | PCIe Reference Clock signals (100 MHz) defined by the PCI Express M.2 spec. | REFCLKp |
| 32 | Not Used | NC | 48 | Not Used | NC |
| 33 | Ground | GND | 49 | PCIe Reference Clock signals (100 MHz) defined by the PCI Express M.2 spec. | REFCLKn |
| 34 | Not Used | NC | 50 | Not Used | NC |
| 35 | PCIe RX Differential signal defined by the PCI Express M.2 spec | PERp0 | 51 | Ground | GND |
| 36 | Not Used | NC | 52 | PE-Reset is a functional reset to the card as defined by the PCIe Mini CEM specification. | PERST#(I)(O/3.3V) |
| 37 | PCIe RX Differential signal defined by the PCI Express M.2 spec | PERn0 | 53 | Clock Request is a reference clock request signal as defined by the PCIe Mini CEM specification; Also used by L1 PM Substates. | CLKREQ#(I/O)(O/3.3V) |
| 38 | Not Used | NC | 54 | Not Used | NC |
| 39 | Ground | GND | 55 | Not Used | NC |
| 40 | Not Used | NC | 56 | Not Used | NC |
| 41 | PCIe TX Differential signal defined by the PCI Express M.2 spec | PETp0 | 57 | Ground | GND |
| 42 | Not Used | NC | 58 | Not Used | NC |
| 43 | PCIe TX Differential signal defined by the PCI Express M.2 spec | PETn0 | 59 | PCIe RX Differential signal defined by the PCI Express M.2 spec | PERp1 |
| 44 | Not Used | NC | 60 | Not Used | NC |

| Pin # | Pin Description | Signal Name | Pin # | Pin Description | Signal Name |
|-------|---|-------------|-------|-----------------|-------------|
| 61 | PCIe RX Differential signal defined by the PCI Express M.2 spec | PERn1 | 69 | Ground | GND |
| 62 | Not Used | NC | 70 | Not Used | NC |
| 63 | Ground | GND | 71 | Not Used | NC |
| 64 | Not Used | NC | 72 | 3.3V power in | +3.3V |
| 65 | PCIe TX Differential signal defined by the PCI Express M.2 spec | PETp1 | 73 | Not Used | NC |
| 66 | Not Used | NC | 74 | 3.3V power in | +3.3V |
| 67 | PCIe TX Differential signal defined by the PCI Express M.2 spec | PETn1 | 75 | Ground | GND |
| 68 | Not Used | NC | | | |

2.4 Environmental Specifications

| Type | | Value |
|--------------------|---------------------------------|------------------------|
| Temperature | Standard Temperature Operating: | 0°C~70°C |
| | Standard Temperature Storage: | -40°C~85°C |
| Humidity | Operating & Storage | 10~95%, Non-Condensing |
| Vibration | Non-Operating | 20G, 10Hz~2000Hz |
| Shock | Non-Operating | 1500G, 0.5ms |

2.5 Mechanical Specifications



3. Supported Command

3.1 List of Command Sets

| Admin Commands | |
|---|-----------------------------|
| Code | Description |
| 00h | Delete I/O Submission Queue |
| 01h | Create I/O Submission Queue |
| 02h | Get Log Page |
| 04h | Delete I/O Completion Queue |
| 05h | Create I/O Completion Queue |
| 06h | Identify |
| 08h | Abort |
| 09h | Set Features |
| 0Ah | Get Features |
| 0Ch | Asynchronous Event Request |
| 10h | Firmware Activate |
| 11h | Firmware Image Download |
| Admin Commands – NVM Command Set Specific | |
| Code | Description |
| 80h | Format NVM |
| 81h | Security Send |
| 82h | Security Receive |
| NVM Commands | |
| Code | Description |
| 00h | Flush |
| 01h | Write |
| 02h | Read |
| 04h | Write Uncorrectable |
| 08h | Write Zeroes |
| 09h | Dataset Management |

4. Part No. Decoder

4.1 Part No. Decoder

| 1 | - | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------------|---|-------------|----------------|---|------------|----------------|------------|-----------------|-----------------|
| Product Line | - | Form Factor | Product Series | Cervoz Family Code (Bus / Internal Control) | NAND Flash | Flash Capacity | Flash Mode | Module Capacity | Operating Temp. |
| XXX | - | XX | X | XXX | X | X | X | XXXX | X |

1. Product Line

| | |
|-----|-----------------------------------|
| CIS | Cervoz Industrial SSD |
| CIM | Cervoz Industrial Memory Card |
| CIE | Cervoz Industrial Embedded Module |

2. Form Factor

| | |
|----|---------------------------------|
| 2S | 2.5" SATA |
| 2P | 2.5" PATA |
| CF | CompactFlash |
| CA | CFast |
| MS | mSATA |
| HM | Half Size mSATA |
| HS | Half Slim |
| M3 | M.2 2230 |
| M4 | M.2 2242 |
| M6 | M.2 2260 |
| M8 | M.2 2280 |
| 0V | PATA Disk 40pin Vertical |
| 4V | PATA Disk 44pin Vertical |
| 4L | PATA Disk 44pin Horizontal Left |
| 7T | SATA Disk 7pin Vertical Tall |
| 7S | SATA Disk 7pin Vertical Short |
| 7L | SATA Disk 7pin Horizontal Left |
| 7R | SATA Disk 7pin Horizontal Right |

3. Product Series

| | |
|---|--------------------------|
| S | Supreme Series (SLC) |
| R | Reliance Series (RO-MLC) |
| M | Momentum Series (MLC) |
| T | Titan Series (TLC) |

4. Cervoz Family Code

Bus and Internal Control for Cervoz Product Families

5. NAND Flash

| | |
|---|----------------|
| M | Micron |
| K | Kioxia |
| O | OEM NAND Flash |

6. Flash Capacity

| | |
|---|-------|
| A | 256Mb |
| B | 512Mb |
| C | 1Gb |
| D | 2Gb |
| E | 4Gb |
| F | 8Gb |
| G | 16Gb |
| H | 32Gb |
| I | 64Gb |
| J | 128Gb |
| K | 256Gb |
| L | 512Gb |
| M | 1Tb |
| N | 2Tb |
| O | 4Tb |

7. Flash Mode

Internal Control for Flash Mode

8. Module Capacity

| | |
|------|--------|
| 128M | 128MB |
| 256M | 256MB |
| 512M | 512MB |
| 001G | 1GB |
| 002G | 2GB |
| 004G | 4GB |
| 008G | 8GB |
| 016G | 16GB |
| 032G | 32GB |
| 064G | 64GB |
| 120G | 120GB |
| 128G | 128GB |
| 240G | 240GB |
| 256G | 256GB |
| 480G | 480GB |
| 512G | 512GB |
| 960G | 960GB |
| 001T | 1TB |
| 1920 | 1.92TB |
| 002T | 2TB |

9. Operating Temperature

| | |
|---|--------------------------------------|
| S | Standard Grade (0~ +70°C) |
| W | Wide Temperature Grade (-40 ~ +85°C) |