

Cervoz Industrial Embedded Module

M.2 2242

Titan Series (3D TLC)

T380 Family

Product Datasheet



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Revision History

| Date | Revision | Description |
|------------|----------|----------------------|
| 2020.03.01 | 1.0 | First Released |
| 2022.12.30 | 1.1 | MTBF and TBW Updated |

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1. Product Overview

1.1 Introduction

Cervoz Industrial M.2 2242 Embedded Module T380 family is a Solid State Flash Disk product that is in compliance with the M.2 and SATA III standards. M.2 2242 T380 family fits in any M.2 2242 sockets in a PC or motherboard; it can be used for both booting and storage purposes.

T380 family uses SSD grade quality 3D TLC NAND 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. This product includes various capacities to choose from.

T380 family offers outstanding performance and reliability; the product family is a good cost-effective solution for semi-industrial and high-capacity storage applications.

1.2 Feature

- Compliant with SATA III 6.0Gb/s
- 3D TLC NAND Flash
- Capacity: 64GB ~ 1TB
- End-to-End data protection
- SLC write cache technology
- Operating as boot disk
- Static and dynamic wear leveling
- Bad block management
- S.M.A.R.T. & TRIM command

1.3 Product Appearance & Models

Cervoz Industrial M.2 2242 Module T380



| T380 Family Standard Temp. (0°C ~ 70°C) Model No. | T380 Family Wide Temp. (-40°C ~ 85°C) Model No. | Capacity |
|---|---|----------|
| CIE-M4T380MLF064GS | CIE-M4T380MLF064GW | 64GB |
| CIE-M4T380MMF128GS | CIE-M4T380MMF128GW | 128GB |
| CIE-M4T380MMF256GS | CIE-M4T380MMF256GW | 256GB |
| CIE-M4T380MOF512GS | CIE-M4T380MOF512GW | 512GB |
| CIE-M4T380MOF001TS | CIE-M4T380MOF001TW | 1TB |

Please Note:

Since certain storage capacity has to be reserved for firmware and controller management purposes; the physical capacity of the SATA flash module will be approximately 92.5% 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 2242 |
| Interface | SATA III 6.0Gb/s (backward compatible to 3.0Gb/s, 1.5Gb/s) |
| Connector | M.2 (B+M) |
| NAND Flash Type | 3D TLC |
| Capacity | 64GB/128GB/256GB/512GB/1TB |
| Sequential Read | up to 550MB/s |
| Sequential Write | up to 510MB/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 256GB : 438 512GB : 875 1TB : 1750 |
| Low Power Management | DIPM/HIPM mode |
| Supply Voltage | 3.3V DC +/-5% |
| Power Consumption | Active mode: < 1475mW Idle mode: < 290mW |
| Dimension (LxWxH) | 42.00*22.00*3.75mm |

2.2 Performance

The performance was measured with below PC configuration:

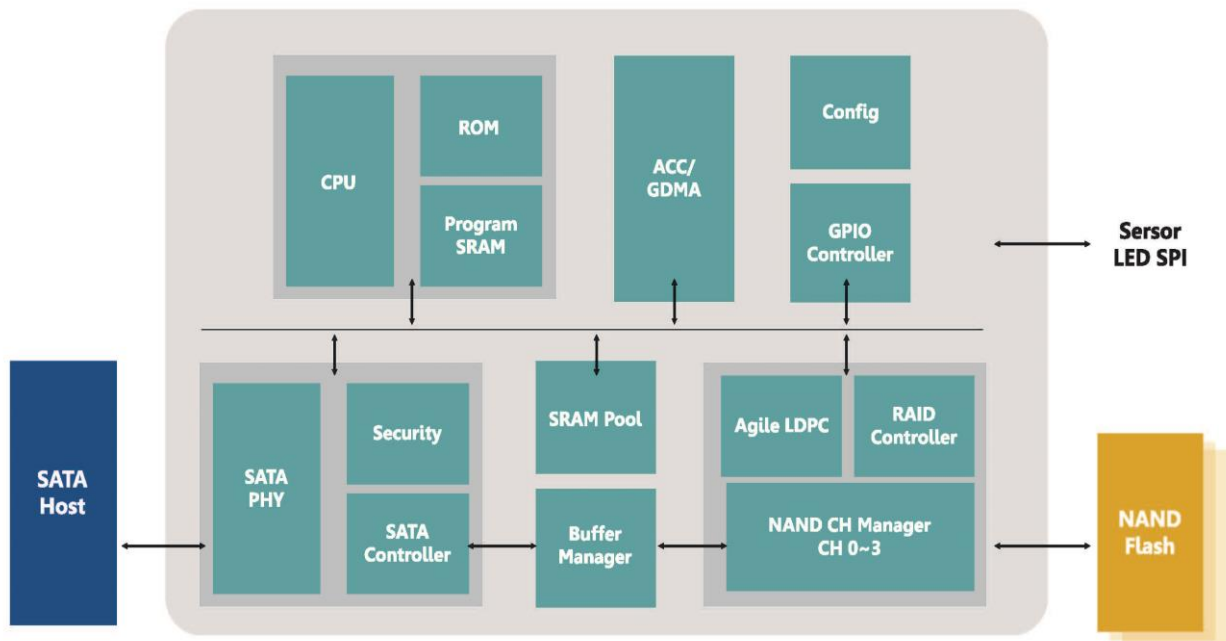
- Platform: ASUS Z97-A (Intel Z97)
- RAM: Cervoz CIR-S3DUSK1604G(DDR3 4G 1600MHz)
- Operation Systems: Windows 10
- Testing Utility: Crystal Disk Mark v5.1.0 X64
- SATAIII port (6.0 Gb/s) performance

| Capacity | 64GB | 128GB | 256GB | 512GB | 1TB |
|--------------------------|---------|---------|---------|---------|---------|
| Sequential Read (Q32T1) | 290MB/s | 470MB/s | 550MB/s | 550MB/s | 550MB/s |
| Sequential Write (Q32T1) | 240MB/s | 480MB/s | 505MB/s | 510MB/s | 510MB/s |
| 4KB Random Read (Q32T1) | 90MB/s | 180MB/s | 270MB/s | 270MB/s | 270MB/s |
| 4KB Random Write (Q32T1) | 210MB/s | 235MB/s | 235MB/s | 235MB/s | 235MB/s |

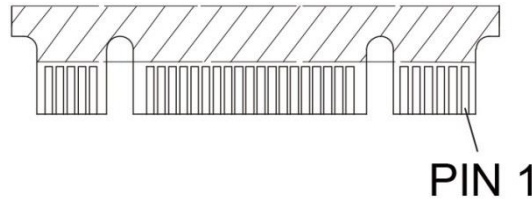
Actual performance might differ based on different using conditions and environment.

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 | CONFIG_3 = GND | 12 | Module Key | Key |
| 2 | 3.3V power in | +3.3V | 13 | Module Key | Key |
| 3 | Ground | GND | 14 | Module Key | Key |
| 4 | 3.3V power in | +3.3V | 15 | Module Key | Key |
| 5 | Not Used | NC | 16 | Module Key | Key |
| 6 | Not Used | NC | 17 | Module Key | Key |
| 7 | Not Used | NC | 18 | Module Key | Key |
| 8 | Not Used | NC | 19 | Module Key | Key |
| 9 | Not Used or Ground | NC or GND ^{Note} | 20 | Not Used | NC |
| 10 | LED/DAS/DSS | DAS/DSS# (O) (OD) | 21 | Ground | CONFIG_0 = GND |
| 11 | Not Used | NC | 22 | Not Used | NC |
| Pin # | Pin Description | Signal Name | Pin # | Pin Description | Signal Name |
| 23 | Not Used | NC | 50 | Not Used | NC |
| 24 | Not Used | NC | 51 | Ground | GND |
| 25 | Not Used | NC | 52 | Not Used | NC |
| 26 | Not Used | NC | 53 | Not Used | NC |
| 27 | Ground | GND | 54 | Not Used | NC |
| 28 | Not Used | NC | 55 | Not Used | NC |
| 29 | Not Used | NC | 56 | MFG Data | NC |
| 30 | Not Used | NC | 57 | Ground | GND |
| 31 | Not Used | NC | 58 | MFG Clock | NC |
| 32 | Not Used | NC | 59 | Module Key | Key |
| 33 | Ground | GND | 60 | Module Key | Key |
| 34 | Not Used | NC | 61 | Module Key | Key |
| 35 | Not Used | NC | 62 | Module Key | Key |
| 36 | Not Used | NC | 63 | Module Key | Key |
| 37 | Not Used | NC | 64 | Module Key | Key |
| 38 | Enter/Exit Device Sleep | DEVSLP (I) (0/3.3V) | 65 | Module Key | Key |

| | | | | | |
|----|----------|----------|----|---------------------|---------------------|
| 39 | Ground | GND | 66 | Module Key | Key |
| 40 | Not Used | NC | 67 | Not Used | NC |
| 41 | SATA Txp | +B – TX+ | 68 | 32kHz clock supply | SUSCLK (I) (0/3.3V) |
| 42 | Not Used | NC | 69 | Defines module type | CONFIG_1 = GND |
| 43 | SATA Txn | -B – TX- | 70 | 3.3V power in | +3.3V |
| 44 | Not Used | NC | 71 | Ground | GND |
| 45 | Ground | GND | 72 | 3.3V power in | +3.3V |
| 46 | Not Used | NC | 73 | Ground | GND |
| 47 | SATA Rxn | -A – RX- | 74 | 3.3V power in | +3.3V |
| 48 | Not Used | NC | 75 | Ground | CONFIG_2 = GND |
| 49 | SATA Rxp | +A – RX+ | | | |

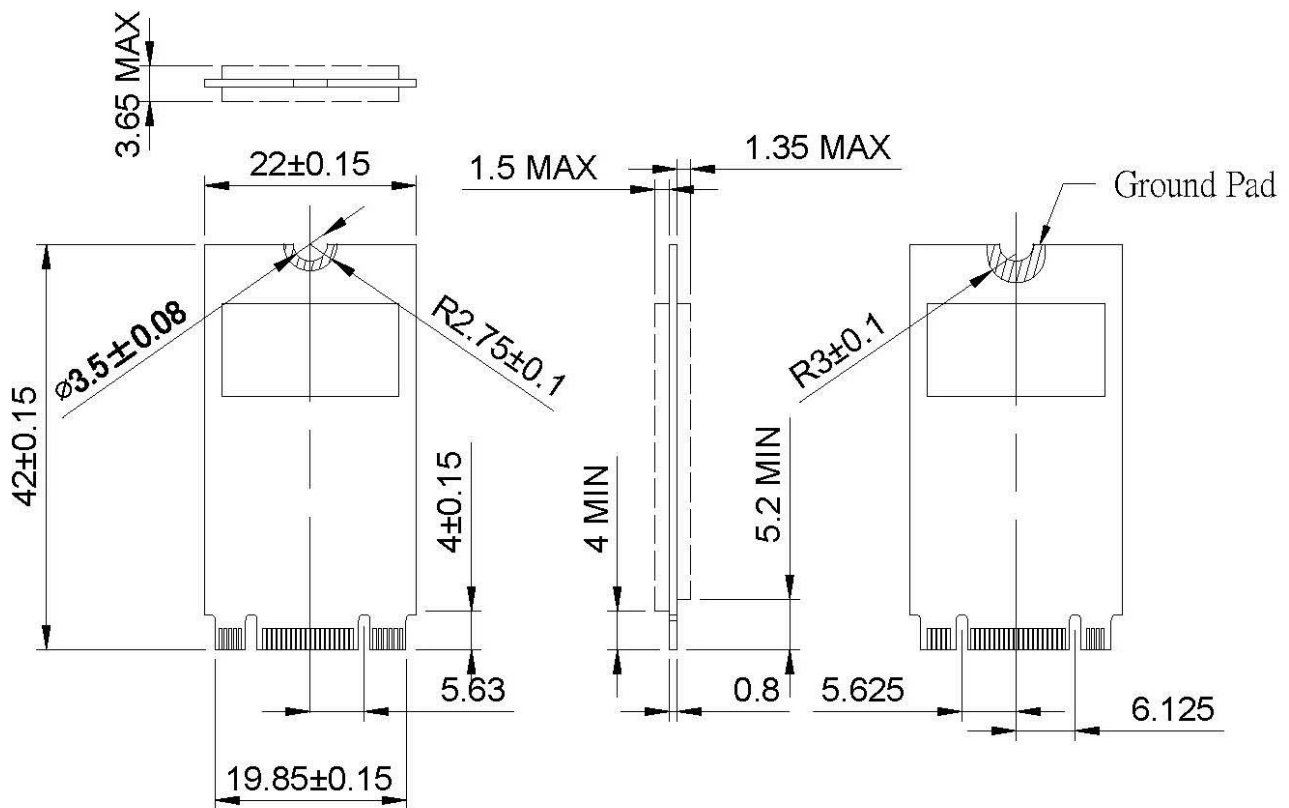
Note: NC for Socket 2, and GND for Socket 3.

2.4 Environmental Specifications

| Type | | Value |
|-------------|---------------------------------|------------------------|
| Temperature | Standard Temperature Operating: | 0°C~70°C |
| | Standard Temperature Storage: | -40°C~85°C |
| | Wide Temperature Operating: | -40°C~85°C |
| | Wide Temperature Storage: | -50°C~95°C |
| Humidity | Operating & Storage | 10~95%, Non-Condensing |
| Vibration | Non-Operating | 20G, 10Hz~2000Hz |
| Shock | Non-Operating | 1500G, 0.5ms |

2.5 Mechanical Specifications

| Type | Value |
|-------------|-------------------|
| Form Factor | M.2 2242 |
| Length | 42.00mm +/-0.15mm |
| Width | 22.00mm +/-0.15mm |
| Thickness | 3.75mm +/-0.08mm |



3. Supported Command

3.1 List of Command Sets

| Code | Description | Code | Description |
|----------|-----------------------------------|----------|---|
| 00h | NOP | B0h, D1h | SMART READ DATA ATTRIBUTE THRESHOLD |
| 06h | Data Set Management | B0h, D2h | SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE |
| 10h | Recalibrate | B0h, D3h | SMART SAVE ATTRIBUTE VALUES |
| 20h | Read Sectors | B0h, D4h | SMART EXECUTE OFF-LINE IMMEDIATE |
| 21h | Read Sectors without Retry | B0h, D5h | SMART READ LOG |
| 24h | Read Sectors EXT | B0h, D6h | SMART WRITE LOG |
| 25h | Read DMA EXT | B0h, D8h | SMART ENABLE OPERATIONS |
| 27h | Read Native Max Address EXT | B0h, D9h | SMART DISABLE OPERATIONS |
| 29h | Read Multiple EXT | B0h, DAh | SMART RETURN STATUS |
| 2Fh | Read Log EXT | B0h, DBh | SMART ENABLE/DISABLE AUTOMATIC OFF-LINE |
| 30h | Write Sectors | B1h | DEVICE CONFIGURATION OVERLAY |
| 31h | Write Sectors without Retry | B1h, C0h | DEVICE CONFIGURATION RESTORE |
| 34h | Write Sectors EXT | B1h, C1h | DEVICE CONFIGURATION FREEZE LOCK |
| 35h | Write DMA EXT | B1h, C2h | DEVICE CONFIGURATION IDENTIFY |
| 37h | Set Native Max Address EXT | B1h, C3h | DEVICE CONFIGURATION SET |
| 39h | Write Multiple EXT | B1h, C4h | DEVICE CONFIGURATION IDENTIFY DMA |
| 3Dh | Write DMA FUA EXT | B1h, C5h | DEVICE CONFIGURATION SET DMA |
| 3Fh | Write Long EXT | C4h | Read Multiple |
| 40h | Read Verify Sectors | C5h | Write Multiple |
| 41h | Read Verify Sectors without Retry | C6h | Set Multiple Mode |
| 42h | Read Verify Sectors EXT | C8h | Read DMA |
| 45h | Write Uncorrectable EXT | C9h | Read DMA without Retry |
| 47h | Read Log DMA EXT | CAh | Write DMA |
| 57h | Write Log DMA EXT | CBh | Write DMA without Retry |
| 60h | Read FPDMA Queued | CEh | Write Multiple FUA EXT |
| 61h | Write FPDMA Queued | E0h | Standby Immediate |
| 70h | Seek | E1h | Idle Immediate |
| 90h | Execute Device Diagnostic | E2h | Standby |
| 91h | Initialize Device Parameters | E3h | Idle |
| 92h | Download Microcode | E4h | Read Buffer |
| 93h | Download Microcode DMA | E5h | Check Power Mode |
| B0h | SMART | E6h | Sleep |
| B0h, D0h | SMART READ DATA | E7h | Flush Cache |

| Code | Description | Code | Description |
|---------------|--|------------------|---|
| E8h | Write Buffer | Efh, 82h | Disable write cache |
| E9h | Read Buffer DMA | Efh, 85h | Disable advanced power management |
| EAh | Flush Cache EXT | Efh, 90h | Disable use of Serial ATA feature set |
| EBh | Write Buffer DMA | Efh, 90h, 02h | Disable DMA Setup FIS Auto-Activate optimization |
| ECh | Identify Device | Efh, 90h, 03h | Disable Device-initiated interface power state (DIPM) transitions |
| EFh | Set Features | Efh, 90h, 06h | Disable Software Settings Preservation (SSP) |
| Efh, 02h | Enable 8-bit PIO transfer mode | Efh, 90h, 07h | Disable Device Automatic Partial to Slumber transitions |
| Efh, 03h | Set transfer mode based on value in Count field | Efh, 90h, 09h | Disable Device Sleep |
| Efh, 05h | Enable advanced power management | Efh, AAh | Enable read look-ahead feature |
| Efh, 10h | Enable use of Serial ATA feature | Efh, CCh | Enable reverting to power-on defaults |
| Efh, 10h, 02h | Enable DMA Setup FIS Auto-Activate optimization | F1h | Security Set Password |
| Efh, 10h, 03h | Enable Device-initiated interface power state (DIPM) transitions | F2h | Security Unlock |
| Efh, 10h, 06h | Enable Software Settings Preservation (SSP) | F3h | Security Erase Prepare |
| Efh, 10h, 07h | Enable Device Automatic Partial to Slumber transitions | F4h | Security Erase Unit |
| Efh, 10h, 09h | Enable Device Sleep | F5h | Security Freeze Lock |
| Efh, 55h | Disable read look-ahead feature | F6h | Security Disable Password |
| Efh, 66h | Disable reverting to power-on defaults | F8h | Read Native Max Address |

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 |
| 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 |
| T | Toshiba |

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 |
| 128G | 128GB |
| 256G | 256GB |
| 512G | 512GB |
| 001T | 1TB |
| 002T | 2TB |

9. Operating Temperature

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