

# Cervoz Industrial Embedded Module

M.2 2280

Titan Series (3D NAND)

T351 Family

*Product Datasheet*



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## Revision History

Date	Revision	Description
2018.11.30	1.0	First Released
2019.03.15	1.1	Wide Temperature Solution Information Added



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## Table of Contents

<b>1. Product Overview</b> .....	<b>4</b>
1.1 Introduction.....	4
1.2 Feature.....	4
1.3 Product Appearance & Models.....	5
<b>2. Product Specifications</b> .....	<b>6</b>
2.1 General Specifications.....	6
2.2 Performance.....	7
2.3 Electronic Specifications.....	7
2.3.1 Block Diagram.....	7
2.3.2 Pin Assignment.....	8-9
2.4 Environmental Specifications.....	10
2.5 Mechanical Specifications.....	10
<b>3. Supported Command</b> .....	<b>11</b>
3.1 List of Command Sets.....	11~12
<b>4. Part No. Decoder</b> .....	<b>13</b>
4.1 Part No. Decoder.....	13~14

## 1. Product Overview

### 1.1 Introduction

Cervoz Industrial M.2 2280 Embedded Module T351 family is a Solid State Flash Disk product that is in compliance with the M.2 and SATA III standards. M.2 2280 T351 family fits in any M.2 2280 sockets in a PC or motherboard; it can be used for both booting and storage purposes.

T351 family uses SSD grade quality 3D NAND flash memory from the industry leading manufacturer Toshiba. 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.

T351 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 NAND flash memory
- 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 2280 Module T351



T351 Family Standard Temp. (0°C ~ 70°C) Model No.	T351 Family Wide Temp. (-40°C ~ 85°C) Model No.	Capacity
CIE-M8T351TKE064GS	CIE-M8T351TKE064GW	64GB
CIE-M8T351TLF128GS	CIE-M8T351TLF128GW	128GB
CIE-M8T351TMF256GS	CIE-M8T351TMF256GW	256GB
CIE-M8T351TMF512GS	CIE-M8T351TMF512GW	512GB
CIE-M8T351TNF001TS	CIE-M8T351TNF001TW	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

<b>Form Factor</b>	M.2 2280
<b>Interface</b>	SATA III 6.0Gb/s (backward compatible to 3.0Gb/s, 1.5Gb/s)
<b>Connector</b>	M.2
<b>NAND Flash Type</b>	3D NAND
<b>Capacity</b>	64GB/128GB/256GB/512GB/1TB
<b>Sequential Read</b>	up to 555MB/s
<b>Sequential Write</b>	up to 505MB/s
<b>ECC Scheme</b>	Applies the LDPC (Low Density Parity Check) of ECC algorithm
<b>MTBF</b>	2,000,000 hours
<b>TeraByte Written (TBW)</b>	64GB : 63 128GB : 125 256GB : 250 512GB : 500 1TB : 1000
<b>Low Power Management</b>	DIPM/HIPM mode
<b>Supply Voltage</b>	+3.3V DC +/-5%
<b>Power Consumption</b>	Active mode: < 1720mW Idle mode: < 300mW
<b>Dimension (LxWxH)</b>	80.00*22.00*3.90mm

## 2.2 Performance

The performance was measured with below PC configuration:

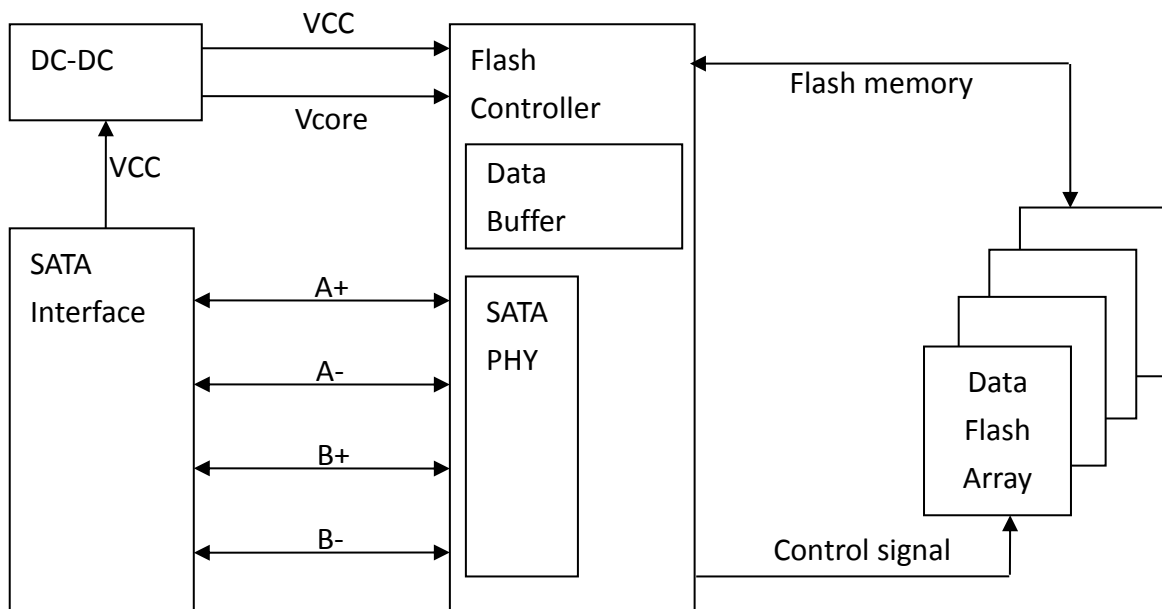
- Platform: ASUS Z97-A (Intel Z97)
- RAM: Cervoz CIR-S3DUSK1604G(DDR3 4G 1600MHz)
- Operation Systems: Windows 7
- Testing Utility: Crystal Disk Mark v5.1.0 X64
- SATAIII port (6.0 Gb/s) performance

Capacity	64GB	128GB	256GB	512GB	1TB
Sequential Read (Q32T1)	550MB/s	545MB/s	555MB/s	545MB/s	540MB/s
Sequential Write (Q32T1)	255MB/s	455MB/s	480MB/s	490MB/s	505MB/s
4KB Random Read (Q32T1)	160MB/s	220MB/s	220MB/s	220MB/s	315MB/s
4KB Random Write (Q32T1)	250MB/s	200MB/s	205MB/s	200MB/s	360MB/s

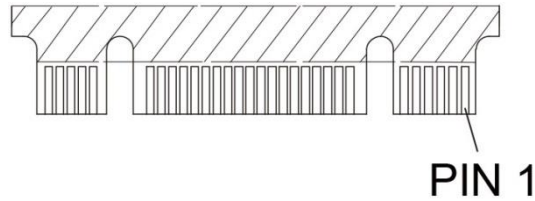
Actual performance might differ based on different using conditions and environment.

## 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 <sup>Note</sup>	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+			

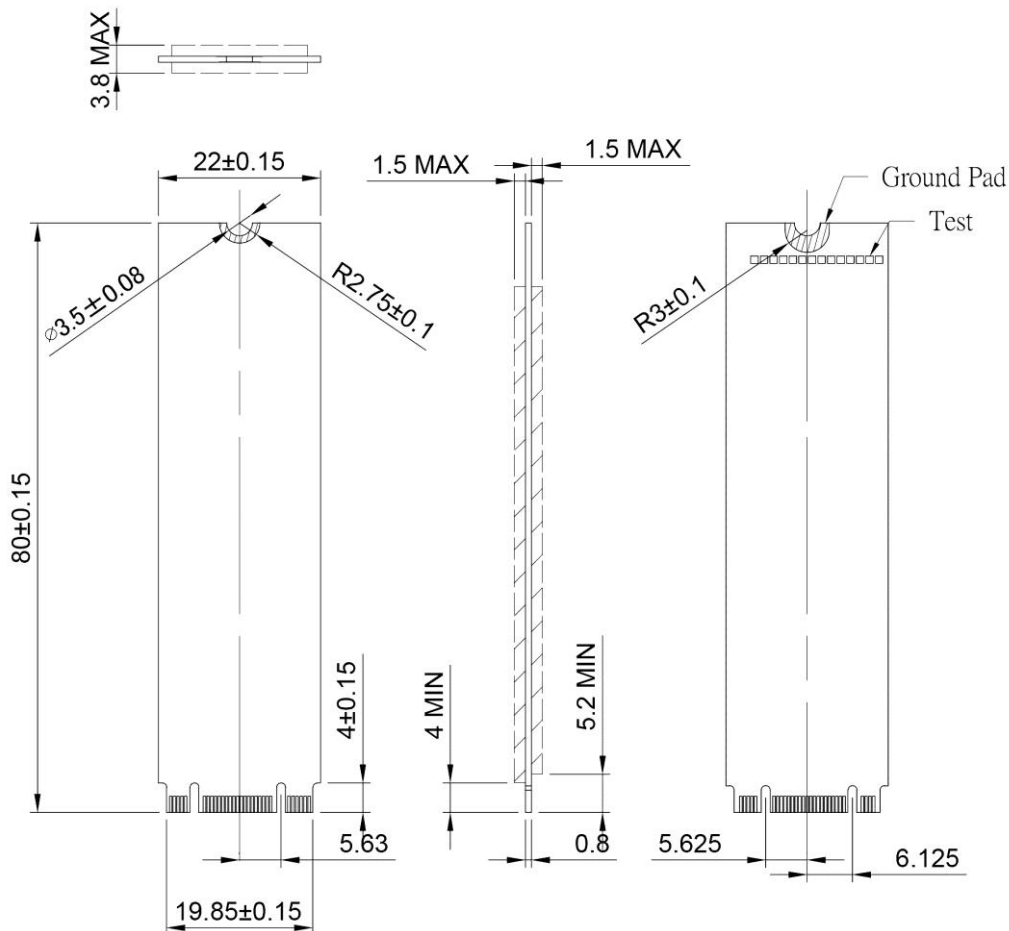
**Note:** NC for Socket 2, and GND for Socket 3.

## 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 2280
Length	80.00mm +/-0.15mm
Width	22.00mm +/-0.15mm
Thickness	3.90mm +/-0.08mm



### 3. Supported Command

#### 3.1 List of Command Sets

Code	Description	Code	Description
00h	NOP	C9h	Read DMA without Retry
06h	Data Set Management	CAh	Write DMA
10h-1Fh	Recalibrate	CBh	Write DMA without Retry
20h	Read Sectors	CEh	Write Multiple FUA EXT
21h	Read Sectors without Retry	E0h	Standby Immediate
24h	Read Sectors EXT	E1h	Idle Immediate
25h	Read DMA EXT	E2h	Standby
27h	Read Native Max Address EXT	E3h	Idle
29h	Read Multiple EXT	E4h	Read Buffer
2Fh	Read Log EXT	E5h	Check Power Mode
30h	Write Sectors	E6h	Sleep
31h	Write Sectors without Retry	E7h	Flush Cache
34h	Write Sectors EXT	E8h	Write Buffer
35h	Write DMA EXT	E9h	READ BUFFER DMA
37h	Set Native Max Address EXT	EAh	Flush Cache EXT
38h	CFA Write Sectors Without Erase	EBh	Write Buffer DMA
39h	Write Multiple EXT	ECh	Identify Device
3Dh	Write DMA FUA EXT	EFh	Set Features
3Fh	Write Long EXT	Efh/02h	Enable volatile write cache
40h	Read Verify Sectors	Efh/03h	Set transfer mode
41h	Read Verify Sectors without Retry	Efh/05h	Enable the APM feature set
42h	Read Verify Sectors EXT	Efh/10h	Enable use of SATA features et
44h	Zero EXT	Efh/10h/02h	Enable DMA Setup FIS Auto-Activate optimization
45h	Write Uncorrectable EXT	Efh/10h/03h	Enable Device-initiated interface power state (DIPM) transitions
47h	Read Log DMA EXT	Efh/10h/06h	Enable Software Settings Preservation (SSP)
57h	Write Log DMA EXT	Efh/10h/07h	Enable Device Automatic Partial to Slumber transitions
60h	Read FPDMA Queued	Efh/10h/09h	Enable Device Sleep
61h	Write FPDMA Queued	Efh/55h	Disable read look-ahead
70h-7Fh	Seek	Efh/66h	Disable reverting to power-on defaults
90h	Execute Device Diagnostic	Efh/82h	Disable volatile write cache

Code	Description	Code	Description
91h	Initialize Device Parameters	Efh/85h	Disable the APM feature set
92h	Download Microcode	Efh/90h	Disable use of SATA feature set
93h	Download Microcode DMA	Efh/90h/02h	Disable DMA Setup FIS Auto-Activate optimization
B0h	SMART	Efh/90h/03h	Disable Device-initiated interface power state (DIPM) transitions
B0h/D0h	SMART READ DATA	Efh/90h/06h	Disable Software Settings Preservation (SSP)
B0h/D1h	SMART READ ATTRIBUTE THRESHOLDS	Efh/90h/07h	Disable Device Automatic Partial to Slumber transitions
B0h/D2h	SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE	Efh/90h/09h	Disable Device Sleep
B0h/D3h	SMART SAVE ATTRIBUTE VALUES	Efh/Aah	Enable read look-ahead
B0h/D4h	SMART EXECUTE OFF-LINE IMMEDIATE	Efh/CCh	Enable reverting to power-on defaults
B0h/D5h	SMART READ LOG	F1h	Security Set Password
B0h/D6h	SMART WRITE LOG	F2h	Security Unlock
B0h/D8h	SMART ENABLE OPERATIONS	F3h	Security Erase Prepare
B0h/D9h	SMART DISABLE OPERATIONS	F4h	Security Erase Unit
B0h/Dah	SMART RETURN STATUS	F5h	Security Freeze Lock
B0h/DBh	SMART ENABLE/DISABLE AUTOMATIC OFF-LINE	F6h	Security Disable Password
B1h	Device Configuration	F8h	Read Native Max Address
B4h	Sanitize	F9h	Set Max Address
C4h	Read Multiple	F9h/01h	SET MAX SET PASSWORD
C5h	Write Multiple	F9h/02h	SET MAXLOCK
C6h	Set Multiple Mode	F9h/03h	SET MAX UNLOCK
C8h	Read DMA	F9h/04h	SET MAX FREEZE LOCIK

#### 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)	Flash Brand	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. Flash Brand

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

## 9. Operating Temperature

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