

Cervoz Industrial Embedded Module

mSATA

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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1. Product Overview

1.1 Introduction

Cervoz Industrial mSATA Embedded Module T351 family is a Solid State Flash Disk product that is in compliance with the mSATA and SATA III standards. mSATA T351 family fits in any mSATA 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.

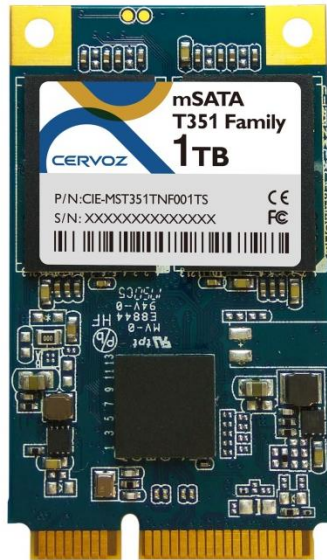
T351 family offers outstanding performance and reliability; the product family is a good cost-effective solution for semi-industrial and high-capacity storage applications.

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 mSATA Module T351



T351 Family Standard Temp. (0°C ~ 70°C) Model No.	T351 Family Wide Temp. (-40°C ~ 85°C) Model No.	Capacity
CIE-MST351TKE064GS	CIE-MST351TKE064GW	64GB
CIE-MST351TKE128GS	CIE-MST351TKE128GW	128GB
CIE-MST351TMF256GS	CIE-MST351TMF256GW	256GB
CIE-MST351TMF512GS	CIE-MST351TMF512GW	512GB
CIE-MST351TNF001TS	CIE-MST351TNF001TW	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	mSATA
Interface	SATA III 6.0Gb/s (backward compatible to 3.0Gb/s, 1.5Gb/s)
Connector	mSATA
NAND Flash Type	3D NAND
Capacity	64GB/128GB/256GB/512GB/1TB
Sequential Read	up to 560MB/s
Sequential Write	up to 510MB/s
ECC Scheme	Applies the LDPC (Low Density Parity Check) of ECC algorithm
MTBF	2,000,000 hours
TeraByte Written (TBW)	64GB : 63 128GB : 125 256GB : 250 512GB : 500 1TB : 1000
Low Power Management	DIPM/HIPM mode
Supply Voltage	+3.3V DC +/-5%
Power Consumption	Active mode: < 1720mW Idle mode: < 300mW
Dimension (LxWxH)	50.80*29.85*4.00mm

2.2 Performance

The performance was measured with below PC configuration:

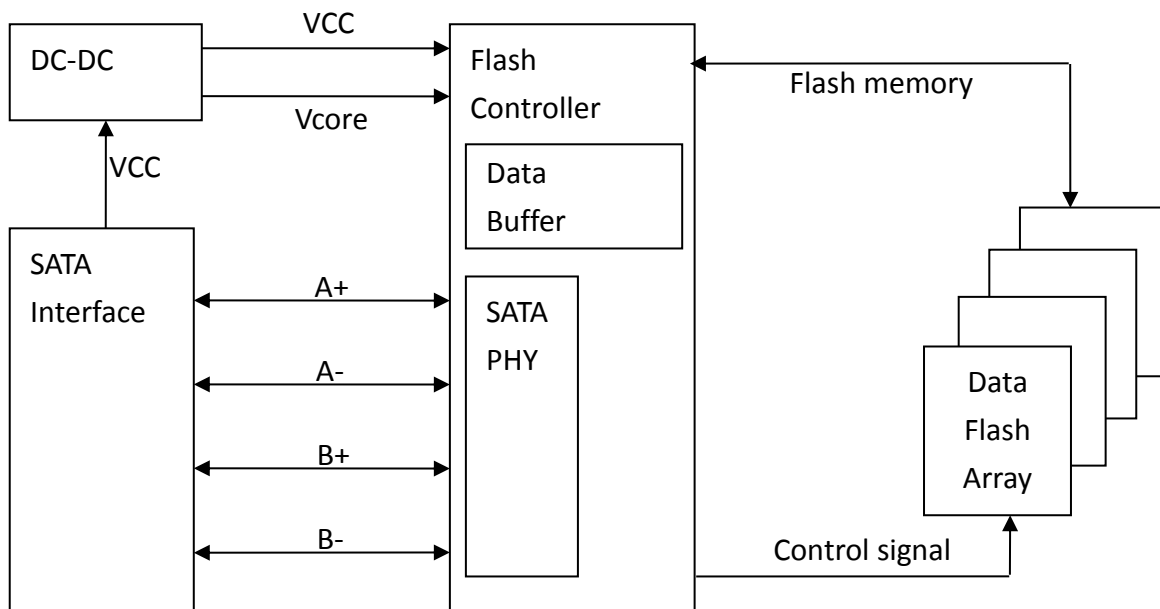
- Platform: ASUS Z97-A (Intel Z97)
- RAM: Cervoz CIR-S3DUSK1604G(DDR3 4G 1600MHz)
- Operation Systems: Windows 7
- Testing Utility: Crystal Disk Mark v5.1.0
- SATAIII port (6.0 Gb/s) performance

Capacity	64GB	128GB	256GB	512GB	1TB
Sequential Read (Q32T1)	555MB/s	560MB/s	560MB/s	545MB/s	545MB/s
Sequential Write (Q32T1)	260MB/s	460MB/s	500MB/s	510MB/s	505MB/s
4KB Random Read (Q32T1)	160MB/s	270MB/s	325MB/s	320MB/s	315MB/s
4KB Random Write (Q32T1)	250MB/s	335MB/s	350MB/s	360MB/s	360MB/s

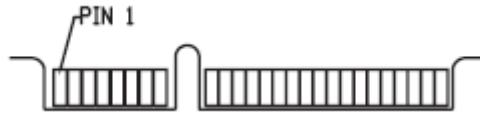
Actual performance might differ based on different using conditions and environment.

2.3 Electronic Specifications

2.3.1 Block Diagram



2.3.2 Pin Assignment



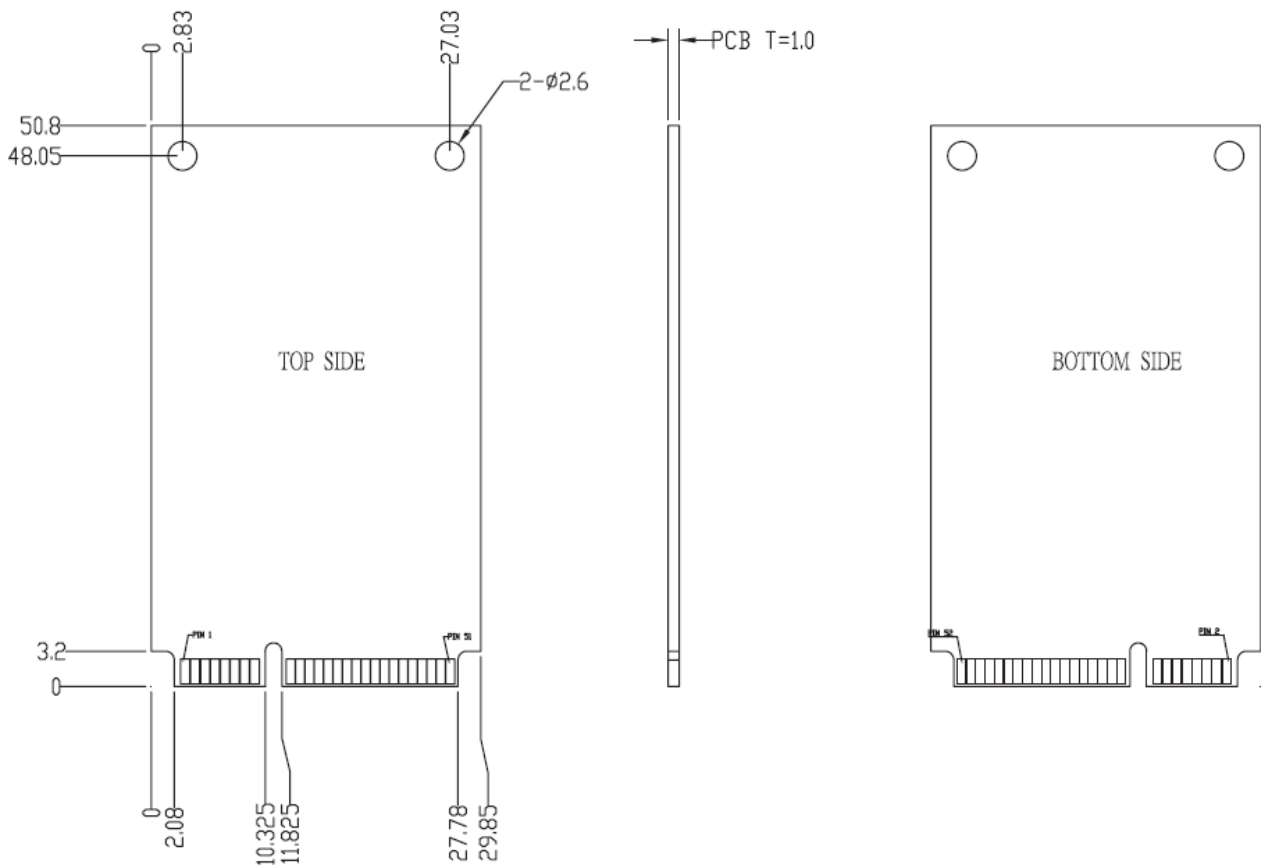
Pin #	Pin Description	Signal Name	Pin #	Pin Description	Signal Name
1	Not Used	NC	27	Ground	GND
2	3.3V power in	+3.3V	28	Not Used	NC
3	Not Used	NC	29	Ground	GND
4	Ground	GND	30	Not Used	NC
5	Not Used	NC	31	SATA Rxn	-A – RX-
6	Not Used	NC	32	Not Used	NC
7	Not Used	NC	33	SATA Rxp	+A – RX-
8	Not Used	NC	34	Ground	GND
9	Ground	GND	35	Ground	GND
10	Not Used	NC	36	Not Used	NC
11	Not Used	NC	37	Ground	GND
12	Not Used	NC	38	Not Used	NC
13	Not Used	NC	39	3.3V power in	+3.3V
14	Not Used	NC	40	Ground	GND
15	Ground	GND	41	3.3V power in	+3.3V
16	Not Used	NC	42	Not Used	NC
17	Not Used	NC	43	Not Used	NC
18	Ground	GND	44	Enter/Exit Device Sleep	DEVSLP
19	Not Used	NC	45	Not Used	NC
20	Not Used	NC	46	Not Used	NC
21	Ground	GND	47	Not Used	NC
22	Not Used	NC	48	Not Used	NC
23	SATA Txp	+B - TX+	49	Device Activity Signal	DAS
24	3.3V power in	+3.3V	50	Ground	GND
25	SATA Txn	-B - TX-	51	Default connect to GND	GND
26	Ground	GND	52	3.3V power in	+3.3V

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	mSATA
Length	50.80mm +/-0.30mm
Width	29.85mm +/-0.30mm
Thickness	4.00mm +/-0.30mm



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)