



MLC

Mini SATA III Flash Module

HERMES-JI Series

Product Specification

APRO MLC MINI SATA III FLASH MODULE

Version 01V2

Document No. 100-xBMSM-JJICTMB

March 2016

APRO CO., LTD.

Phone: +88628226-1539

Fax: +88628226-1389

This document is for information use only and is **subject to change without prior notice**. APRO Co., Ltd. assumes no responsibility for any errors that may appear in this document, nor for incidental or consequential damages resulting from the furnishing, performance or use of this material. No part of this document may be reproduced, transmitted, transcribed, stored in a retrievable manner or translated into any language or computer language, in any form or by any means, electronic, mechanical, magnetic, optical, chemical, manual or otherwise, without the prior written consent of an officer of APRO Co., Ltd.

All parts of the APRO documentation are protected by copyright law and all rights are reserved.

APRO and the APRO logo are registered trademarks of APRO Co., Ltd.

Product names mentioned herein are for identification purposes only and may be trademarks and/or registered trademarks of their respective companies.

© 2016 APRO Corporation. All rights reserved.

Revision History

Revision	Description	Date
1.0	Initial release	2016/3/16

CONTENTS

CONTENTS.....	1
1. INTRODUCTION	2
1.1. SCOPE	3
1.2. SYSTEM FEATURES	3
1.3. FLASH MANAGEMENT TECHNOLOGY - STATIC WEAR LEVELING	3
2. PRODUCT SPECIFICATIONS	4
2.1. CAPACITY SPECIFICATIONS	4
2.2. SYSTEM ENVIRONMENTAL SPECIFICATIONS	4
2.3. SYSTEM POWER REQUIREMENTS	4
2.4. SYSTEM PERFORMANCE	5
2.5. SYSTEM RELIABILITY	5
2.6. PHYSICAL SPECIFICATIONS.....	6
2.6.1. CONFORMAL COATING	7
3. INTERFACE DESCRIPTION	7
3.1. APRO MLC MINI SATA III FLASH MODULE INTERFACE	7
3.2. PIN ASSIGNMENTS.....	7
4. S.M.A.R.T.	9
4.1. S.M.A.R.T. ATTRIBUTES.....	9
APPENDIX A: ORDERING INFORMATION	10
1. PART NUMBER LIST	10
2. PART NUMBER DECODER:	10
APPENDIX B: LIMITED WARRANTY.....	11

1. Introduction

APRO MLC mini SATA III Flash Module – HERMES-JI Series provides high capacity flash memory Solid State Drive (SSD) that electrically complies with Serial ATA 3.0 (SATA) standard. APRO MLC mini SATA III Flash Module – HERMES-JI Series support SATA Gen-III (6.0 GB/s) with high performance. The main used flash memories are MLC-NAND type flash memory chips. The available disk capacities are 4GB, 8GB, 16GB, 32GB, 64GB, 128GB, 256GB and 512GB.

The operating temperature grade is optional for Standard grade 0°C ~ 70°C and wide temp grade with conformal coating supports -40°C ~ +85°C. The data transfer performance by sequential read is up to 400 MB/sec, and sequential write is up to 200 MB/sec.

APRO MLC mini SATA III Flash Module products do not need additional driver; the disk can be configured as a boot device or data storage device. It prevents data loss caused by sudden power failure based on enhanced power cycling technology and more capacitors.

S.M.A.R.T. utility will be provided and users will be not only monitor the operation status of SSD, but also visualize Wear-Leveling status with graphics.

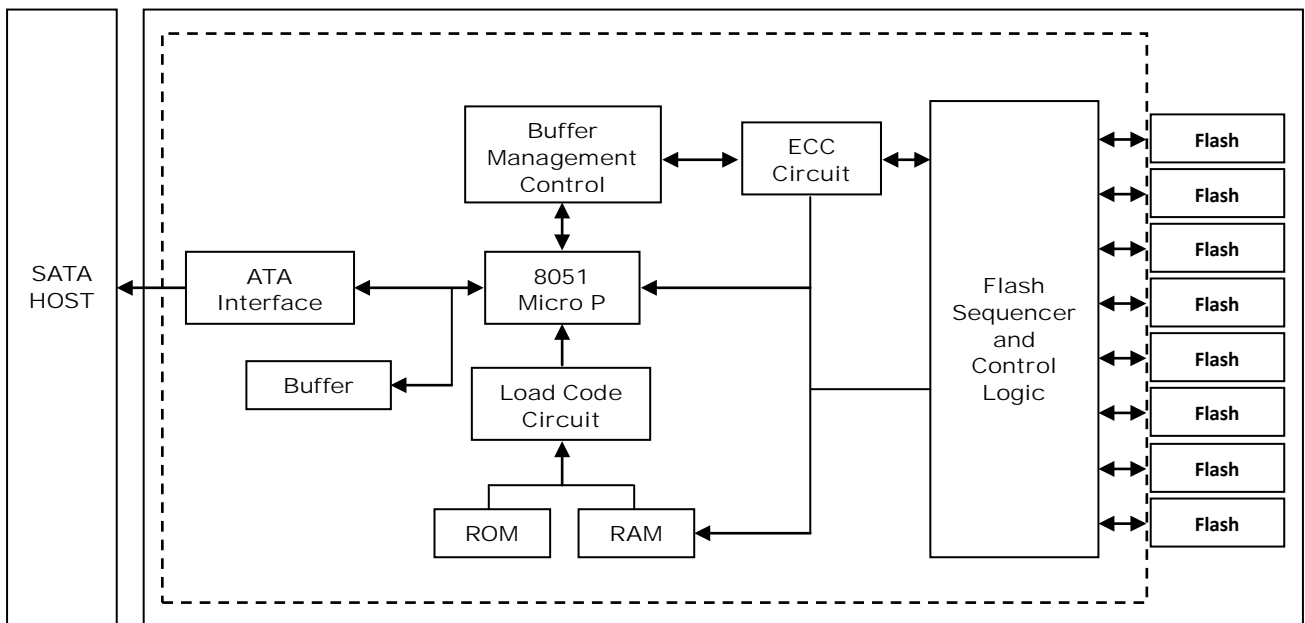


Figure 1: APRO MLC mini SATA III Flash Module HERMES-JI Series controller block diagram

1.1. Scope

This document describes features, specifications and installation guide of APRO MLC mini SATA III Flash Module – HERMES-JI Series. In the appendix, there provides order information, warranty policy, RMA/DOA procedure for the most convenient reference.

1.2. System Features

- MLC-NAND type flash technology
- Standard mSATA form-factor, compliant with JEDEC MO-300A
- Mini PCI-e connector with 52 pins SATA pin out
- SATA 1.0a, SATA 2.6 and SATA 3.0 specification compliance
- S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) function supported.
- Non-volatile memory and no moving parts
- MLC Flash SSD standard grade capacity from 4GB up to 512GB
- Sequential read performance up to 400 MB/sec
- Sequential write performance up to 200 MB/sec
- Automatic 40 bits per 1024 bytes error correction (ECC) and retry capabilities
- +3.3 V $\pm 5\%$ operation
- Shock : 0.5ms, 1500 G, 3 axes
- Vibration : 7 Hz to 2K Hz, 20G, 3 axes
- Very high performance, very low power consumption
- Low weight, Noiseless
- Standard grade supports operating temperature 0°C to +70°C, and Industrial Grade, -40°C to +85°C with special conformal coating treatment on PCBA

1.3. Flash Management Technology - Static Wear Leveling

Flash memory can be programmed and erased within a limited number of times, and the limited of the P/E cycle is defined by the flash array vendor. The P/E cycle limited applies to each individual erase block in the flash device.

In order to gain the best management for flash memory, APRO MLC mini SATA III Flash Module – HERMES-JI Series supports Static Wear-leveling technology to manage the Flash system. The life of flash memory is limited; the management is to increase the life of the flash product.

A static wear-leveling algorithm evenly distributes data over an entire Flash cell array and searches for the least used physical blocks. The identified low cycled sectors are used to write the data to those locations. If blocks are empty, the write occurs normally. If blocks contain static data, it moves that data to a more heavily used location before it moves the newly written data. The static wear leveling maximizes effective endurance Flash array compared to no wear leveling or dynamic wear leveling.

2. Product Specifications

For all the following specifications, values are defined at ambient temperature and nominal supply voltage unless otherwise stated.

2.1. Capacity Specifications

Table 1: Device Parameters

Unformatted Capacity	Cylinder	Head	Sector	LBA
4GB	7,762	16	63	7,824,096
8GB	15,525	16	63	15,649,200
16GB	16,383	16	63	31,277,232
32GB	16,383	16	63	62,533,296
64GB	16,383	16	63	125,045,424
128GB	16,383	16	63	250,069,680
256GB	16,383	16	63	500,118,192
512GB	16,383	16	63	1000,215,216

2.2. System Environmental Specifications

Table 2: Environmental Specification

APRO MLC mini SATA III Flash Module		Standard Grade	Wide Temp Grade
HERMES-JI Series		SBMSMxxxG-JJ(I)CTMB	WBMSMxxxG-JJ(I)CTMB-C
Temperature	Operating:	0°C ~ +70°C	-40°C ~ +85°C
	Non-operating:	-20°C ~ +80°C	-50°C ~ +95°C
Humidity	Operating & Non-operating:	10% ~ 95% non-condensing	
Vibration	Operating & Non-operating:	7 Hz to 2K Hz, 20G, 3 axes	
Shock	Operating & Non-operating:	0.5ms, 1500 G, 3 axes	

2.3. System Power Requirements

Table 3: Power Requirement

APRO MLC mini SATA III Flash Module		
HERMES-JI Series		
DC Input Voltage		3.3V±5%
+3.3V Current (Maximum average value)	Reading Mode :	370 (max.)
	Writing Mode :	430 (max.)
	Idle Mode :	70 (max.)

2.4. System Performance

Table 4: System Performances

Data Transfer Mode supporting		Serial ATA Gen-III (6.0Gb/s = 768MB/s)							
Average Access Time		0.2 ms (estimated)							
Maximum Performance	Capacity	4GB	8GB	16GB	32GB	64GB	128GB	256GB	512GB
	Sequential Read (MB/s)	TBC	100	100	200	220	220	400	400
	Sequential Write(MB/s)	TBC	20	20	40	80	130	200	200
	4KB Random Read IOPS (QD32)	TBC	4.0K	3.9K	6.2K	7.1K	8.3K	9.7K	9.2K
	4KB Random Write IOPS (QD32)	TBC	5.9K	5.4K	8.6K	15.0K	22.5K	30.0K	30K
The number of Flash IC		1pcs	TBC	4pcs	4pcs	4pcs	4pcs	4pcs	4pcs

Note:

(1). All values quoted are typically at 25 °C and nominal supply voltage.

(2). Testing of the MLC mini SATA III Flash Module maximum performance was performed under the following platform:

- Computer with AMD 3.0GHz processor
- Windows XP Professional operating system

2.5. System Reliability

Table 5: System Reliability

Wear-leveling Algorithms	Static Wear-leveling	
Bad Blocks Management	Supportive	
ECC Technology	40 bits per 1024 bytes	
Thermal Sensor	Supportive	
Endurance	TBW (Tera Bytes Written) ; Based on Sequential Write Test.	
Capacity	TBW(TB)	DWPD & Lifespan
4GB	10.8	DWPD=3.79 DWPD (Drive Written Per Day) Lifespan = 2 Years
8GB	21.6	
16GB	43.2	
32GB	86.4	
64GB	172.8	
128GB	345.6	
256GB	691.2	
512GB	1382.4	

2.6. Physical Specifications

Refer to Table 6 and see Figure 2 for physical specifications and dimensions.

Table 6: Physical Specifications

Length:	50.80 mm
Width:	29.80 mm
Thickness:	3.20 mm
Weight:	8.0 g / 0.3 oz

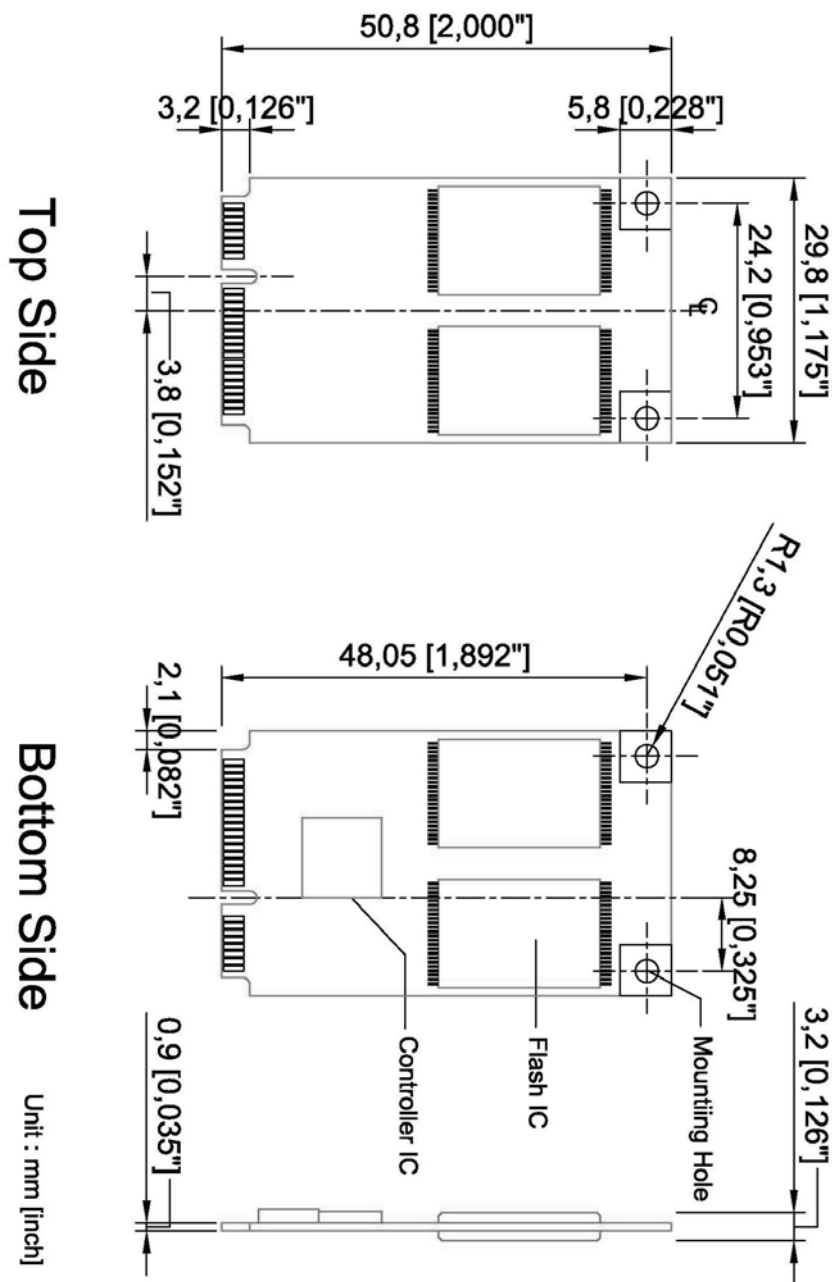


Figure 2: APRO MLC mini SATA III Flash Module Dimension

2.6.1. Conformal coating

Conformal coating is a protective, dielectric coating designed to conform to the surface of an assembled printed circuit board. Commonly used conformal coatings include silicone, acrylic, urethane and epoxy. APRO applies only silicone on APRO storage products upon requested especially by customers. The type of silicone coating features good thermal shock resistance due to flexibility. It is also easy to apply and repair.

Conformal coating offers protection of circuitry from moisture, fungus, dust and corrosion caused by extreme environments. It also prevents damage from those Flash storages handling during construction, installation and use, and reduces mechanical stress on components and protects from thermal shock. The greatest advantage of conformal coating is to allow greater component density due to increased dielectric strength between conductors.

APRO uses MIL-I-46058C silicon conformal coating

3. Interface Description

3.1. APRO MLC mini SATA III Flash Module interface

APRO Mini SATA III Flash Module is equipped with mini PCI-e 52 pins SATA pin out

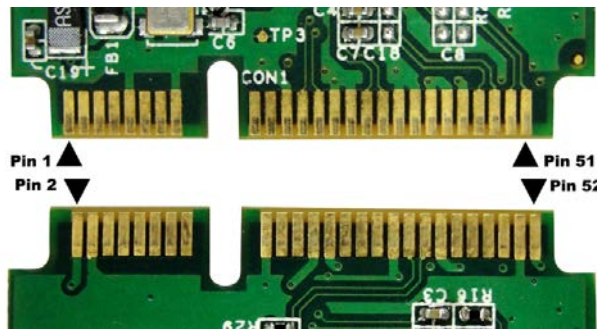


Figure 3: The connectors of mini SATA Flash Module

3.2. Pin Assignments

There are total of 7 pins in the signal segment and 15 pins in the power segment. The pin assignments are listed in below table 7.

Table 7 - Pin Assignments

Pin #	Signal Name	Pin #	Signal Name
1	NC	2	+3.3V
3	NC	4	GND
5	NC	6	NC
7	NC	8	NC
9	GND	10	NC
11	NC	12	NC
13	NC	14	NC
15	GND	16	NC
17	NC	18	GND

Product Specification

19	NC	20	NC
21	GND	22	NC
23	TX+	24	+3.3V
25	TX-	26	GND
27	GND	28	NC
29	GND	30	NC
31	RX-	32	NC
33	RX+	34	GND
35	GND	36	NC
37	GND	38	NC
39	+3.3V	40	GND
41	+3.3V	42	NC
43	NC	44	NC
45	NC	46	NC
47	NC	48	NC
49	NC	50	GND
51	GND	52	+3.3V

3.3. S.M.A.R.T.

Individual SMART commands are identified by the value placed in the Feature register.

Table 8: S.M.A.R.T. Command

Value	Command	Value	Command
D0h	SMATR Read Data	D5h	Read Log
D1h	Read Attribute Threshold	D6h	SMART Return Status
D2h	SMART Enable/Disable Attribute Auto save	D8h	Enable SMART Operations
D3h	Save Attribute Values	D9h	Disable SMART Operations
D4h	Execute OFF-LINE Immediate	DAh	Return Status

3.4. S.M.A.R.T. Attributes


Table 9: S.M.A.R.T. Attribute

Attribute ID (HEX)	Attribute Command
01	Read Error Rate
05	Later Bad
09	Power-On hours Count
0C	Drive Power Cycle Count
A3	Total Bad Block Count
A5	Max Erase count
A7	Avg. Erase count
A9	Device Life
AA	Spare Block Count
AB	Program fail count
AC	Erase fail count
C0	Unexpected Power Loss Count
C2	Temperature
E5	Flash ID
EB	Later Bad Block
F1	Total LBAs written (each write unit = 32MB)
F2	Total LBAs read (each write unit = 32MB)

Appendix A: Ordering Information

1. Part Number List

◆ APRO MLC mini SATA III Flash Module – HERMES-JI Series

Product Picture	Capacity	Standard grade (0°C ~ 70°C)	Wide Temp Grade (-40°C ~ +85°C)
	4GB	SBMSM004G-JJCTMB	WBMSM004G-JJCTMB-C
	8GB	SBMSM008G-JJCTMB	WBMSM008G-JJCTMB-C
	16GB	SBMSM016G-JJCTMB	WBMSM016G-JJCTMB-C
	32GB	SBMSM032G-JJCTMB	WBMSM032G-JJCTMB-C
	64GB	SBMSM064G-JJCTMB	WBMSM064G-JJCTMB-C
	128GB	SBMSM128G-JJCTMB	WBMSM128G-JJCTMB-C
	256GB	SBMSM256G-JJCTMB	WBMSM256G-JJCTMB-C
	512GB	SBMSM512G-JJCTMB	WBMSM512G-JJCTMB-C

Notes:

- 1) **HERMES-J Series:** 4GB ~ 128GB / **HERMES-I Series:** 256GB~512GB
- 2) **C :** Special conformal coating treated on whole PCBA which may support industrial grade operating temperature -40°C ~ +85°C

2. Part Number Decoder:

X1 X2 X3 X4 X5 X6 X7 X8 X9 — **X11 X12 X13 X14 X15 X16** — **C**

X1 : Grade

S: Standard Grade – operating temp. 0° C ~ 70 ° C

W: Wide Temp Grade- operating temp. -40° C ~ +85 ° C

(Standard grade with conformal coating)

X2 : The material of case

B : Bare (without casing)

X3 X4 X5 : Product category

MSM : mini SATA Flash Module (mSATA)

X6 X7 X8 X9 : Capacity

004G:	4GB	064G:	64GB
008G:	8GB	128G:	128GB
016G:	16GB	256G:	256GB
032G:	32GB	512G:	512GB

X11 : Controller

J : HERMES Series

X12 : Controller version

A, B, C.....

X13 : Controller Grade

C : Standard grade

X14 : Flash IC

T : Toshiba MLC-NAND Flash IC

X15 : Flash IC grade / Type

M : MLC-NAND Flash IC

X16 : Generation

B : 15 nm

C : Reserved for specific requirement

C : Conformal-coating

Appendix B: Limited Warranty

APRO warrants your MLC mini SATA III Flash Module – HERMES-JI Series against defects in material and workmanship for the life of the drive. The warranty is void in the case of misuse, accident, alteration, improper installation, misapplication or the result of unauthorized service or repair. The implied warranties of merchantability and fitness for a particular purpose, and all other warranties, expressed or implied, except as set forth in this warranty, shall not apply to the products delivered. In no event shall APRO be liable for any lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, this product.

BEFORE RETURNING PRODUCT, A RETURN MATERIAL AUTHORIZATION (RMA) MUST BE OBTAINED FROM APRO.

Product shall be returned to APRO with shipping prepaid. If the product fails to conform based on customers' purchasing orders, APRO will reimburse customers for the transportation charges incurred.

WARRANTY PERIOD:

- MLC (Standard grade / Wide temp. grade) 2 years / Within 3K Erasing Counts

The warranty period is able to extend. Please contact APRO and/or Your APRO distributors for more information.