



MLC

2.5" SATA III SSD

Supports Fast & Secure Erase

BON-III Series

## **Product Specification**

APRO RUGGED METAL 2.5" SATA III MLC SSD

SUPPORTS FAST / SECURE ERASE

Version 01V0

Document No. 100-xR2SR-MSTMB

September 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	2016/09/14

# CONTENTS

<b>1.</b>	<b>INTRODUCTION</b> .....	<b>- 2 -</b>
1.1.	SCOPE.....	- 3 -
1.2.	SYSTEM FEATURES .....	- 3 -
1.3.	FLASH MANAGEMENT TECHNOLOGY - GLOBAL WEAR LEVELING .....	- 3 -
1.4.	DRAM BUFFER .....	- 4 -
1.5.	POWER INTERRUPT DATA PROTECTION TECHNOLOGY .....	- 4 -
<b>2.</b>	<b>PRODUCT SPECIFICATIONS</b> .....	<b>- 5 -</b>
2.1.	SYSTEM ENVIRONMENTAL SPECIFICATIONS.....	- 5 -
2.2.	SYSTEM POWER REQUIREMENTS .....	- 5 -
2.3.	SYSTEM PERFORMANCE.....	- 5 -
2.4.	SYSTEM RELIABILITY .....	- 6 -
2.5.	PHYSICAL SPECIFICATIONS .....	- 6 -
2.5.1.	Conformal coating.....	- 8 -
<b>3.</b>	<b>INTERFACE DESCRIPTION</b> .....	<b>- 8 -</b>
3.1.	APRO RUGGED METAL 2.5" SATA III MLC SSD INTERFACE .....	- 8 -
3.2.	PIN ASSIGNMENTS .....	- 9 -
<b>4.</b>	<b>CONFIGURATION OF BON-III SERIES 2.5" SATA III MLC SSD</b> .....	<b>- 10 -</b>
4.1.	FAST / SECURE ERASE JUMPER.....	- 10 -
4.1.1.	Default Setting .....	- 10 -
4.1.2.	Write Protect Function .....	- 10 -
4.1.3.	Fast Erase.....	- 11 -
4.1.4.	Secure Erase.....	- 11 -
4.1.5.	Secure Erase Standards .....	- 12 -
4.2.	AUTO-RESUME FEATURES.....	- 12 -
4.3.	RANDOM DATA WRITTEN DURING THE SANITIZE PROCEDURE.....	- 12 -
4.4.	PROTECTION MECHANISM .....	- 12 -
4.5.	USING THE SSD AFTER SANITIZING PROCEDURE .....	- 12 -
4.6.	REQUIRED TIME FOR SECURE ERASE FUNCTION .....	- 12 -
	<b>APPENDIX A: ORDERING INFORMATION</b> .....	<b>- 14 -</b>
1.	PART NUMBER LIST.....	- 14 -
2.	PART NUMBER DECODER:.....	- 14 -
	<b>APPENDIX B: LIMITED WARRANTY</b> .....	<b>15</b>

**1. Introduction**

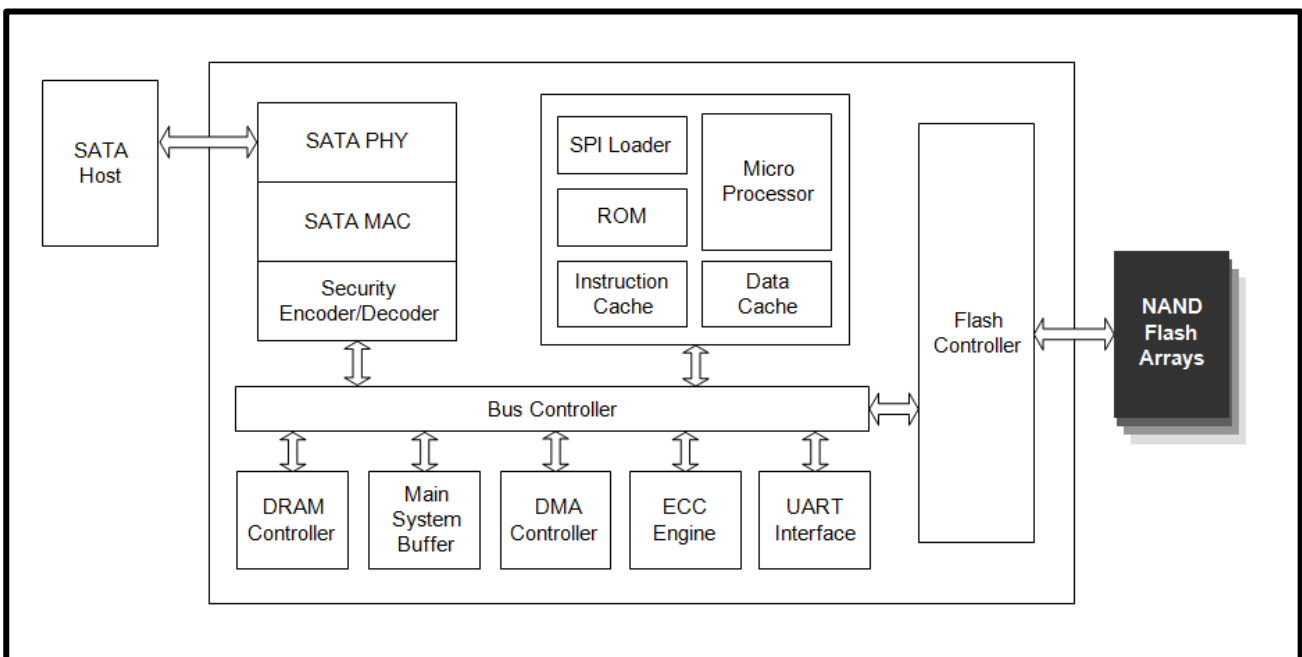
APRO rugged metal 2.5” SATA III MLC SSD – BON-III series provides high capacity flash memory Solid State Drive (SSD) that electrically complies with Serial ATA 3.0 (SATA) standard. APRO Rugged Metal 2.5” SATA III MLC SSD – BON-III series support SATA Gen-III (6.0 GB/s) with high performance. The main used flash memories are MLC-NAND type flash memory chips. The available disk capacities are 32GB, 64GB, 128GB, 256GB, 512GB and 1TB.

The operating temperature grade is optional for Standard grade 0°C ~ 70°C and wide temp grade supports -40°C ~ +85°C. The data transfer performance by sequential read is up to 561.0 MB/sec, and sequential write is up to 350.3 MB/sec.

APRO Rugged Metal 2.5” SATA III MLC SSD – BON-III series supports Fast Erase/Secure Erase which initiates by hardware design and software vendor commands. Fast Erase Procedure is one of the defaults sanitizing procedure in BON-III series. Fast Erase enables users to erase entire disk contents within seconds; 32GB SSD needs about 11.2 seconds, and 1TB needs about 70 seconds to run the fast erase procedure for whole disk completely.

APRO Rugged Metal 2.5” SATA III MLC SSD built-in DDRIII 4Gbits SDRAM (1TB built-in 8Gbit) products provide a high level interface to the host computer. This interface allows a host computer to issue commands to the Rugged Metal 2.5” SATA III MLC SSD to read or write blocks of memory. Hardware BCH ECC capable of correcting errors up to 66-bit/1KB (ECC). APRO Rugged Metal 2.5” SATA III MLC SSD BON-III series intelligent controller manages interface protocols, data storage and retrieval as well as ECC, defect handling and diagnostics, power management and clock control.

Figure 1 shows a block diagram of the used high tech Rugged Metal 2.5” SATA III MLC SSD controller.



**Figure 1: APRO Rugged Metal 2.5” SATA III MLC SSD BON-III series controller block diagram**

## 1.1. Scope

This document describes features, specifications and installation guide of APRO's Rugged Metal 2.5" SATA III MLC SSDs BON-III 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 2.5" SATA Flash Disk form-factor (9.2mm height).
- SATA 7-pin (data) + 15-pin (power connector) SATA Interface.
- Extremely Rugged Metal casing to endure harsh environments.
- Power interrupts data protection technology by Tantalum Capacitors.
- Fast Erase by Hardware jumper setting by JP1+JP2, which located on the front side of SSD.
- Secure Erase by Hardware jumper setting by JP3+JP4, which located on the front side of SSD.
- Compliance with Existing Sanitize (Purge) Standards by software vendor commands.
- Supports hardware jumper setting by JP5+JP6 for Write Protect function.
- SATA 1.0a, SATA 2.6 and SATA 3.0 specification compliance.
- SMART (Self-Monitoring, Analysis and Reporting Technology) function supported.
- Supports Window-7 TRIM Command.
- Non-volatile memory and no moving parts.
- MLC Flash SSD standard grade capacity are 32GB, 64GB, 128GB, 256GB, 512GB and 1TB
- 32GB to 512GB Supports 4GBits DDRIII SDRAM Cache ; 1TB Supports 8GBits DDRIII SDRAM Cache
- Sequential read performance up to 561.0 MB/sec.
- Sequential write performance up to 350.3 MB/sec.
- Hardware BCH ECC capable of correcting errors up to 66-bit/1KB (ECC).
- +5 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.

## 1.3. Flash Management Technology - Global Wear Leveling

In order to gain the best management for flash memory, APRO's Rugged Metal 2.5" SATA III MLC SSDs BON-III series applies Global 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. The objective of global wear leveling is to prevent any frequently updated data from staying at the static area so that wear leveling could be evenly applied to all blocks. Static areas contain any data that does not change, and are ignored by dynamic wear leveling. Such static data may include operating system files, table look-ups, executable files, and etc. Global wear leveling frequently replaces blocks in this area with block in the hot area, and thus each block in all areas has the same probability to be used.

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 data, it moves that data to a more heavily used location before it moves the newly written data. Wear leveling maximizes effective endurance Flash array compared to no wear leveling products.

### **1.4. DRAM Buffer**

SSDs designed with a DDRIII SDRAM buffer which is support high transfer rate as a data buffer for the SSD; SSD with SDRAM buffer is able to deliver excellent random data transfer speed.

- 32GB to 512GB Supports 4GBits DDRIII SDRAM Cache
- 1TB Supports 8GBits DDRIII SDRAM Cache

### **1.5. Power Interrupt Data Protection Technology**

In the event of an unstable power supply, SSD loses power before it can finish programming process from host to flash, this may cause data being written to the incorrect block and further leads to data corruption.

Power Interrupt Data Protection Technology is applied with several tantalum capacitors to provide power buffering after host power interruption. The Data Protection Technology provides enough time for the SSD controller can write all DRAM buffer data to flash, all data will be protected and without data loss.

The ability of Power Interrupt Data Protection Technology is able to write 1.28MB of data within 60ms.

This ensures all data in the DRAM buffer can be successfully written into flash.

Traditionally, super capacitors were applied in most SSD products, the advantages of tantalum capacitors over super capacitors are:

- **Tantalum capacitors are electrolyte free.**  
It is able to maintain its designed capacitance for several years when used within design limits.
- **Wide operating temperature range.**  
Tantalum capacitors can operate from temperature range of -55C to +125C, which is very suitable for Wide Temp. and military usage.
- **Tantalum capacitors have an ultimate high volumetric efficiency (CV/cc).**  
For example, a 50-microfarad tantalum capacitor can be equal and to properly replace a 500-microfarad aluminum capacitor.

## 2. Product Specifications

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

### 2.1. System Environmental Specifications

**Table 1: Environmental Specification**

APRO Rugged Metal 2.5" SATA III MLC SSD		Standard Grade	Wide Temp. Grade
BON-III series		SR2SRxxxG-MSCTMB-UFE(USE)	WR2SRxxxG-MSCTMBUFE(USE)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	

### 2.2. System Power Requirements

**Table 2: Power Requirement**

APRO Rugged Metal 2.5" SATA III MLC SSD BON-III series		
DC Input Voltage (VCC)		5V±5%
+5V Current (Maximum average value)	Reading Mode :	350mA. (max.)
	Writing Mode :	580mA. (max.)
	During FE/SE :	330mA. (max.)
	Idle Mode :	120mA. (max.)

### 2.3. System Performance

**Table 3: System Performances**

Data Transfer Mode supporting		Serial ATA Gen-III (6.0Gb/s = 768MB/s)					
Average Access Time		0.1 ms (estimated)					
Maximum Performance	Capacity	32GB	64GB	128GB	256GB	512GB	1TB
	Sequential Read (MB/s)	566.0	546.0	559.7	560.3	561.0	561.0
	Sequential Write(MB/s)	101.2	89.7	320.4	320.3	350.3	349.0

Note:

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

(2). Testing base on CrystalDiskMark 3.01 with file size 1000MB

## 2.4. System Reliability

**Table 4: System Reliability**

<b>Wear-leveling Algorithms</b>	Global wear leveling algorithm evens program/erase count and maximizes SSD lifespan
<b>Bad Blocks Management</b>	Supportive
<b>ECC Technology</b>	Hardware BCH ECC capable of correcting errors up to 66-bit/1KB (ECC).
<b>Endurance</b>	Un-limited Read Cycles Endurance Management enables five years minimal useful life

## 2.5. Physical Specifications

Refer to Table 5 and see Figure 2 for Rugged Metal 2.5" SATA III MLC SSD BON-III series physical specifications and dimensions.

**Table 5: Physical Specifications**

<b>Length:</b>	100.0 mm / 3.93 in
<b>Width:</b>	70.00 mm / 2.75 in
<b>Thickness:</b>	9.20 mm / 0.36 in
<b>Net Weight:</b>	95.00 g / 3.35 oz



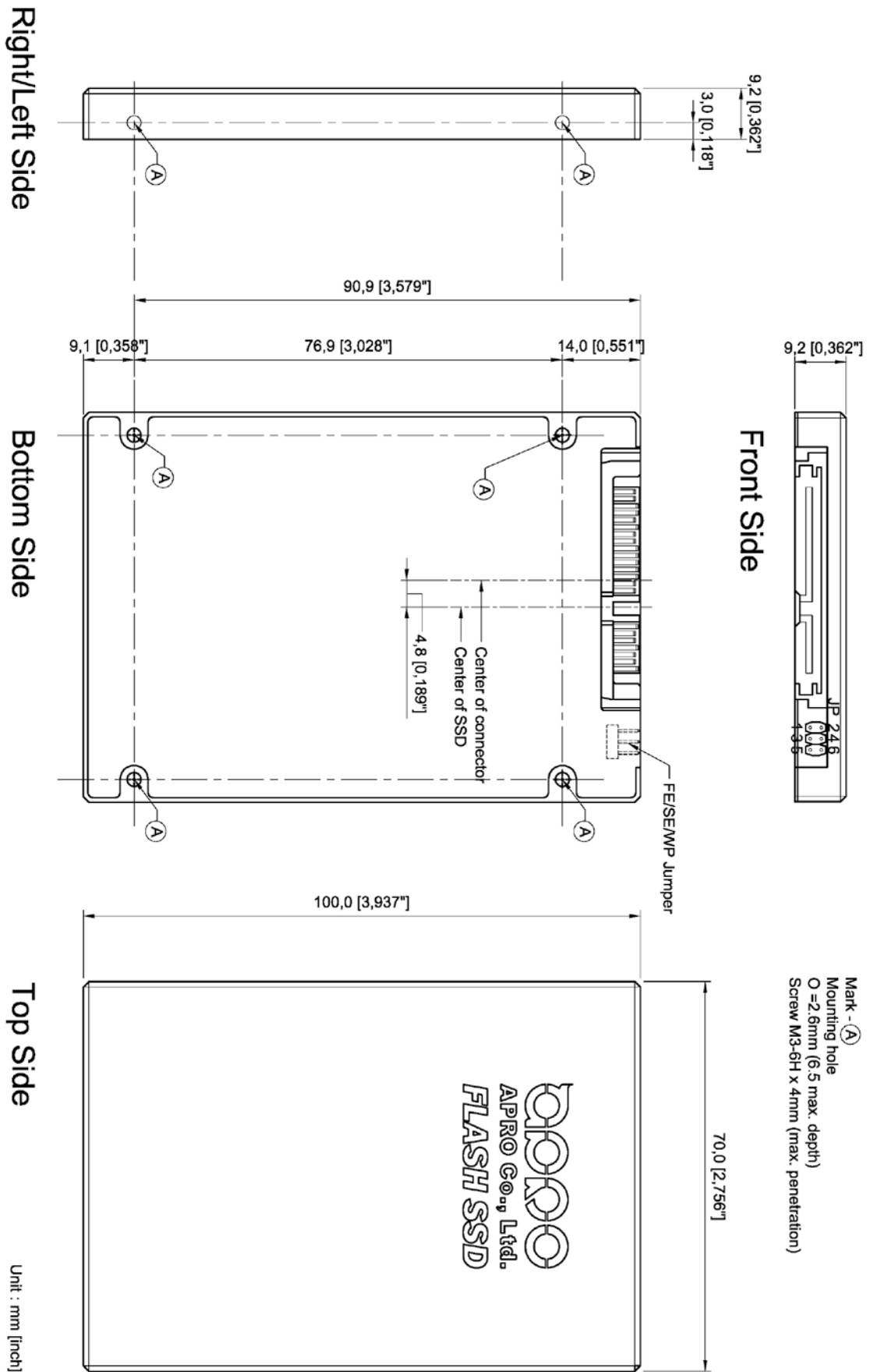


Figure 2: APRO Rugged Metal 2.5" SATA III MLC SSD Dimension

### 2.5.1. 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 storages 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.

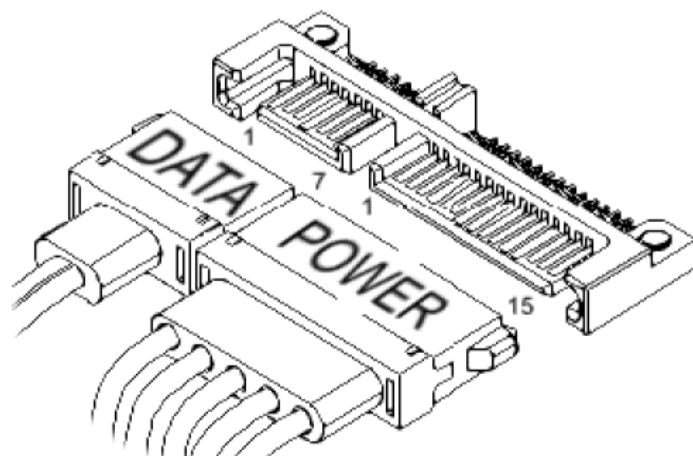
Conformal coating offers protection of circuitry from moisture, fungus, dust and corrosion caused by extreme environments. It also prevents damage from those Flash storages handling during construction, installation and use, and reduces mechanical stress on components and protects from thermal shock. 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 Rugged Metal 2.5" SATA III MLC SSD interface

APRO Rugged Metal 2.5" SATA III MLC SSD is equipped with standard 7 pins + 15 pins Serial ATA connector.



**Figure 3 : The connectors of 2.5" SATA III MLC SSD**

### 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 6.

**Table 6 - Pin Assignments**

Name	Type	Description
S1	GND	NA
S2	A+	Differential Signal Pair A
S3	A-	
S4	GND	NA
S5	B-	Differential Signal Pair B
S6	B+	
S7	GND	NA

Key and Spacing separate signal and power segments		
P1	NC	NA
P2	NC	NA
P3	NC	NA
P4	GND	NA
P5	GND	NA
P6	GND	NA
P7	V5	5V Power, Pre-Charge
P8	V5	5V Power
P9	V5	5V Power
P10	GND	NA
P11	DAS/DSS	Device Activity Signal / Disable Staggered Spin up
P12	GND	NA
P13	NC	NA
P14	NC	NA
P15	NC	NA

Notes:

1. All pins are in a signal row with a 1.27 mm (0.050" pitch).
2. The commands on the mating sequence in forward table apply to the case of backplane blind mate connector only. In this case, the mating sequences are:
  - (1) The pre-charge power pins and other ground pins.
  - (2) The signal pins and the rest of the power pins.

#### 4. Configuration of BON-III series 2.5" SATA III MLC SSD

##### 4.1. Fast / Secure Erase Jumper

BON-III series 2.5" SATA III SSD has several security features, such as fast erase, secure erase and a newly added write-protect function. These functions can be triggered by different hardware jumper settings or by ATA commands.

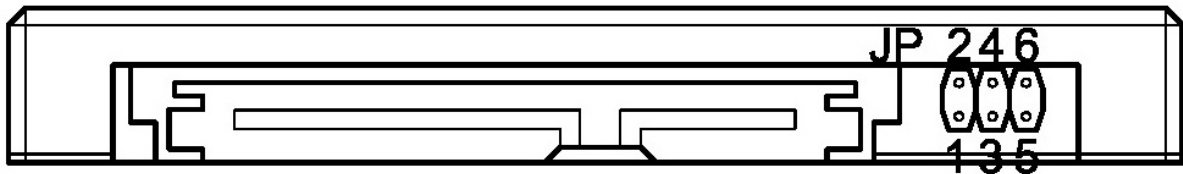


Figure 4 : The jumper configuration of 2.5" SATA III MLC SSD

##### 4.1.1. Default Setting

When security function is not required, jumper head should be placed on Pin-3 and Pin-5, SSD will not take any actions, it can be used as a normal storage device.

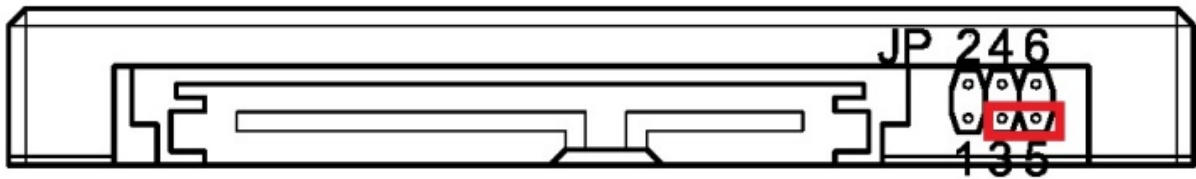


Figure 5 : Default Setting

##### 4.1.2. Write Protect Function

Write-Protect function can be enabled by setting the jumper head on Pin-5 and Pin-6, once it's enabled, it will abort any writing commands sent to the SSD. At this stage, SSD will become Read-Only and user will not be able to write or delete any data on the SSD.

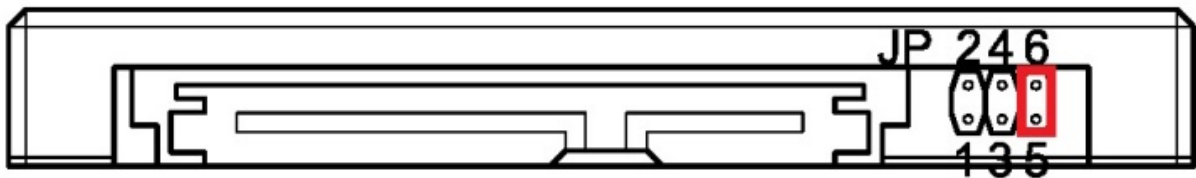
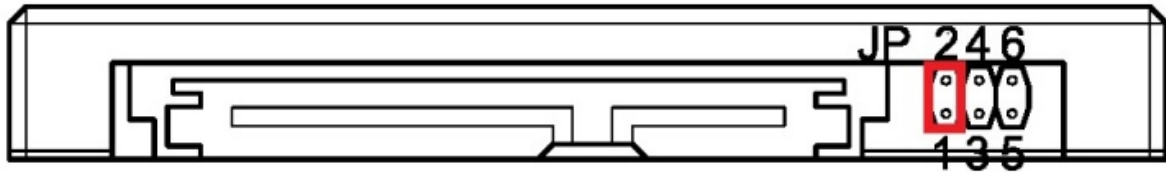


Figure 6 : Write-Protect Function Jumper Setting

**4.1.3. Fast Erase**

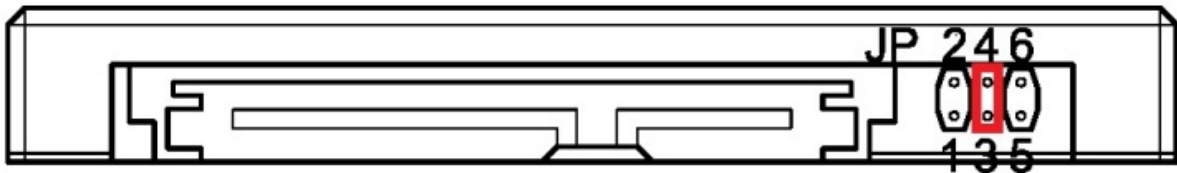
Fast Erase Procedure is one of the default sanitizing procedure in APRO Secure Erase SSD Series, it is trigger by placing jumper head on Pin-1 and Pin-2, SSD will be then become fully erased and filled with 0xFF and random data.



**Figure 7 : Fast Erase Jumper Setting**

**4.1.4. Secure Erase**

To execute Secure Erase function, jumper must be set on Pin-3 and Pin-4. APRO provide varieties of Secure Erase standard as options, customer may choose whichever is suitable for their application.



**Figure 8 : Secure Erase Jumper Setting**

#### 4.1.5. Secure Erase Standards

**Table 7 – Secure Erase Procedures**

Standard	Description
Fast Erase	<ol style="list-style-type: none"> <li>Erase all media</li> <li>fill with 0xFF and random data</li> </ol>
NSA Manual 130-2	<ol style="list-style-type: none"> <li>Erase the media</li> <li>Overwrite with random data twice</li> <li>Erase again</li> <li>Overwrite with 0x55</li> </ol>
USA-AF AFSSI 5020	<ol style="list-style-type: none"> <li>Erase the media</li> <li>Overwrite with random data</li> </ol>
DoD 5220.22-M	<ol style="list-style-type: none"> <li>Erase the media</li> <li>Overwrite with single character</li> <li>erase again</li> </ol>
IRIG 106	<ol style="list-style-type: none"> <li>Erase the media</li> <li>Overwrite with 0x55</li> <li>Erase</li> <li>Overwrite with 0xAA, erase</li> </ol>
USA Navy NAVSO P-5239-26	<ol style="list-style-type: none"> <li>Erase the media</li> <li>Overwrite with random data</li> <li>Erase again</li> </ol>
USA-Army 380-19	<ol style="list-style-type: none"> <li>Erase the media</li> <li>Overwrite with random data</li> <li>Fill with 0x55</li> <li>Overwrite again with 0xAA</li> </ol>
NISPOMSUP Chap 8, Sect. 8-501	<ol style="list-style-type: none"> <li>Filled with 0x55</li> <li>Overwrite with 0Xaa</li> <li>Overwrite again with random data</li> </ol>
NSA Manual 9-12	<ol style="list-style-type: none"> <li>Erase the media</li> <li>Overwrite with unclassified pattern</li> </ol>

#### 4.2. Auto-Resume Features

APRO rugged metal 2.5" SATA III SSD – BON-III series supports auto-resume features. When encounter power interruption during sanitizing procedure, it will automatically resume sanitizing at the next power-on until the whole procedure is finished.

#### 4.3. Random Data Written During the Sanitize Procedure

The random data used to overwrite user data is a digest of pseudo-random generation and real random data. The pseudo-random generation is seeded in such a manner that even if the SSD launches the Sanitize command under identical external conditions (for example, if the unit is powered on with Sanitize Interrupt active), it will produce different seeds and different pseudo-random data.

#### 4.4. Protection Mechanism

The protection mechanism only allows customer to activate Fast Erase and Secure Erase once for each power-on cycle.

This is to protect APRO's SSD from being erased continuously and can indirectly extend the lifetime of flash. If user wishes to activate erase function again, power must be disconnect and then reconnect again.

#### 4.5. Using the SSD After Sanitizing Procedure

After Fast Erase or Secure Erase is finished, storage must be reinitialized and partition should be rebuilt in order to be used again.

#### 4.6. Required Time for Secure Erase Function

**Table 8 – Erase time for all standard and capacities**


Capacity	32GB	64GB	128GB	256GB	512GB	1TB
Fast Erase	11.2 secs	22.5 secs	27.6 secs	27.6 secs	49.3 secs	70 secs

*Note: Erase time by other Secure Erase Standard must test by customer's own system.*

**Appendix A: Ordering Information**

**1. Part Number List**

◆ **APRO Rugged Metal 2.5" SATA III MLC SSD – BON-III series**

Product Picture	Grade	Standard grade (0°C ~ 70°C)	Wide Temp. Grade (-40°C ~ +85°C)
	<b>32GB</b>	SR2SR032G-MSCTMB-UFE(USE)	WR2SR032G-MSCTMBUFE(USE)C
	<b>64GB</b>	SR2SR064G-MSCTMB-UFE(USE)	WR2SR064G-MSCTMB-UFE(USE)C
	<b>128GB</b>	SR2SR128G-MSCTMB-UFE(USE)	WR2SR128G-MSCTMBUFE(USE)C
	<b>256GB</b>	SR2SR256G-MSCTMB-UFE(USE)	WR2SR256G-MSCTMBUFE(USE)C
	<b>512GB</b>	SR2SR512G-MSCTMB-UFE(USE)	WR2SR512G-MSCTMBUFE(USE)C
	<b>1TB</b>	SR2SR001T-MSCTMB-UFE(USE)	WR2SR001T-MSCTMBUFE(USE)C

**2. Part Number Decoder:**



**X1 : Grade**

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

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

**X2 : The material of case**

R : 2.5" Rugged Metal Casing

**X3 X4 X5 : Product category**

2SR : 2.5" SATA SSD w/SDRAM cache

**X6 X7 X8 X9 : Capacity**

<b>032G:</b>	32GB	<b>256G:</b>	256GB
<b>064G:</b>	64GB	<b>512G:</b>	512GB
<b>128G:</b>	128GB	<b>001T:</b>	1TB

**X11 : Controller**

M : BON-III Series

**X12 : Controller version**

A, B, C.....

**X13 : Controller Grade**

C : Commercial grade

**X14 : Flash IC**

T : Toshiba MLC-NAND Flash IC

**X15 X16 : Flash IC grade / Type**

M : MLC grade

B : 15nm

**X17 X18 X19 : Special function**

UFE : Fast Erase function only

USE: Secure Erase function (supported by special firmware) & Fast Erase function

**C : Reserved for specific requirement**

C : Conformal-coating



### ***Appendix B: Limited Warranty***

APRO warrants your Rugged Metal 2.5" SATA III MLC SSD 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.***