

SLC / MLC

USB 3.0 Flash Disk

PHANES-D Series



G5



G4SB

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ISO 9001 : 2015 CERTIFIED



Product Features

■ Flash IC

- TOSHIBA NAND Flash IC.
- 24nm Single-Level Cell (SLC) management.
- 15nm Multi-Level Cell (MLC) management.

■ Compatibility

- Fully compatible with USB Specification Version 3.0, and backward compatible with USB 2.0 & 1.1
- Support Windows Vista, Windows XP, Windows 7, Windows 8 and Windows 10 without device driver.
- Support MAC OS X and Linux Kernel without device driver.

■ Additional Capabilities

- S.M.A.R.T.*¹ (Self-Monitoring, Analysis and Reporting Technology) feature set support.
- Hot Plug & Play without driver installation.
- Low power consumption.
- Supper speed 5Gbit/second for USB 3.0.
- High speed 480Mbit/second for USB 2.0
- Full speed 12Mbit/second for USB 1.1.
- Support Global Wear-Leveling algorithm.

■ Mechanical

- USB 3.0 standard A interface
- **Dimension/ Weight:**
- **G5:** 17.20 x 47.20 x 7.80 (mm)./ 10g.
- **G4SB:** 15.95 x 54.82 x 15.95 (mm)./22g.

■ Capacity

SLC: 128MB, 256MB, 512MB, 1GB, 2GB, 4GB, 8GB.

MLC: 4GB, 8GB, 16GB 32GB.

■ Power (Operating Voltage 5V (+/-) 10%)

SLC Solution:

- Read Mode: 127.0 mA (8GB.)
- Write Mode: 141.0 mA (8GB.)
- Idle Mode: 99.4 mA (8GB.)

MLC Solution:

- Read Mode: 154.1 mA (32GB.)
- Write Mode: 173.7 mA (32GB.)
- Idle Mode: 102.1 mA (32GB.)

■ Performance (Maximum value)

SLC Solution:

Seq. Read/Write: 41.0/36.6 (MB/sec.) (8GB.)

MLC Solution:

Seq. Read/Write: 98.0/51.2 (MB/sec.) (32GB.)

■ Reliability

- **ECC:** Up to 72 bits/1KB data by BCH ECC engine.
- **Temperature:** (Operating)
Standard grade: 0°C ~ +70°C
Wide Temp. Grade: -40°C ~ +85°C

■ Certifications and Declarations

- **Certifications:** CE & FCC
- **Declarations:** RoHS2 & REACH


Remarks:

1. Sequential performance is based on CrystalDiskMark with file size 500MB


Order Information

I. Part Number List


◆ SLC Solution APRO Rugged-Metal USB 3.0 Flash Disk_ **G4SB** – PHANES-D Series

Product Picture	Grade	Std. grade (0°C ~ 70°C)	Ind. Grade (-40°C ~ +85°C)
	128MB	SRUFD128M-PDCTC-4SB	WRUFD128M-PDITI-4SB
	256MB	SRUFD256M-PDCTC-4SB	WRUFD256M-PDITI-4SB
	512MB	SRUFD512M-PDCTC-4SB	WRUFD512M-PDITI-4SB
	1GB	SRUFD001G-PDCTC-4SB	WRUFD001G-PDITI-4SB
	2GB	SRUFD002G-PDCTC-4SB	WRUFD002G-PDITI-4SB
	4GB	SRUFD004G-PDCTC-4SB	WRUFD004G-PDITI-4SB
	8GB	SRUFD008G-PDCTC-4SB	WRUFD008G-PDITI-4SB


◆ MLC Solution APRO Rugged-Metal USB 3.0 Flash Disk_ **G4SB** – PHANES-D Series

Product Picture	Grade	Std. grade (0°C ~ 70°C)	Ind. Grade (-40°C ~ +85°C)
	4GB	SRUFD004G-PDCTM-4SB	WRUFD004G-PDCTM-4SBC
	8GB	SRUFD008G-PDCTM-4SB	WRUFD008G-PDCTM-4SBC
	16GB	SRUFD016G-PDCTM-4SB	WRUFD016G-PDCTM-4SBC
	32GB	SRUFD032G-PDCTM-4SB	WRUFD032G-PDCTM-4SBC

◆ SLC Solution APRO Semi-Metal USB 3.0 Flash Disk_ **G5** – PHANES-D Series

Product Picture	Grade	Std. grade (0°C ~ 70°C)	Ind. Grade (-40°C ~ +85°C)
	128MB	SMUFD128M-PDCTC-5	WMUFD128M-PDITI-5
	256MB	SMUFD256M-PDCTC-5	WMUFD256M-PDITI-5
	512MB	SMUFD512M-PDCTC-5	WMUFD512M-PDITI-5
	1GB	SMUFD001G-PDCTC-5	WMUFD001G-PDITI-5
	2GB	SMUFD002G-PDCTC-5	WMUFD002G-PDITI-5
	4GB	SMUFD004G-PDCTC-5	WMUFD004G-PDITI-5
	8GB	SMUFD008G-PDCTC-5	WMUFD008G-PDITI-5

◆ MLC Solution APRO Semi-Metal USB 3.0 Flash Disk_ **G5** – PHANES-D Series

Product Picture	Grade	Std. grade (0°C ~ 70°C)	Ind. Grade (-40°C ~ +85°C)
	4GB	SMUFD004G-PDCTM-5	WMUFD004G-PDCTM-5C
	8GB	SMUFD008G-PDCTM-5	WMUFD008G-PDCTM-5C
	16GB	SMUFD016G-PDCTM-5	WMUFD016G-PDCTM-5C
	32GB	SMUFD032G-PDCTM-5	WMUFD032G-PDCTM-5C

II. Part Number Decoder:

X1 X2 X3 X4 X5 X6 X7 X8 X9 — **X11 X12 X13 X14 X15** — **X17 X18 X19 X20**

X1 : Grade

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

W: Ind. Grade/ Wide – operating temp. -40° C ~ +85 ° C

X2 : The material of case

M : Semi-metal

R : Rugged-metal

X3 X4 X5 : Product category

UFD : USB Flash Disk

X6 X7 X8 X9 : Capacity

128M: 128MB **001G:** 1GB **008G:** 8GB

256M: 256MB **002G:** 2GB **016G:** 16GB

512M: 512MB **004G:** 4GB **032G:** 32GB

X11 : Controller

P : PHANES Series

X12 : Controller version

A, B, C.....

X13 : Controller Grade

C : Commercial grade

I : Industrial grade

X14 : Flash IC

T : **Kioxia** NAND Flash IC

X15 : Flash IC grade / Type

C : Standard grade

I : Industrial grade

M : 15-nm MLC

X17 X18 X19 : Housing

4SB : Generation 4 housing , Screw Thread Black

5 : Generation 5 housing

X20 : Reserved for specific requirement

C : Conformal Coating

Revision History

Revision	Description	Date
1.0	Initial release.	2023/01/06
1.1	Add. 4GB Capacity	2023/02/07
2.0	Add. TBW Value.	2023/02/22
2.1	Add. ECC information	2023/03/10
2.2	Temperature descript correction	2023/10/19

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1. Introduction

APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series supports USB 3.0 interface and backward complies with USB 2.0 & 1.1 host interface specification. The seq. read/write performance are 41.0/36.6 (MB/sec.) for SLC 8GB capacity and the seq. read/write performance are 98.0/51.2 (MB/sec.) for MLC 32GB capacity.

APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series are specially designed for portable storage device or build-in to the PC / Notebook / IA system. They are available in 128MB, 256MB, 512MB, 1GB, 2GB, 4GB, 8GB for **SLC Solution**; 4GB, 8GB, 16GB, 32GB for **MLC Solution**

APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series also offers unique customization for OEM customers by laser carvings.

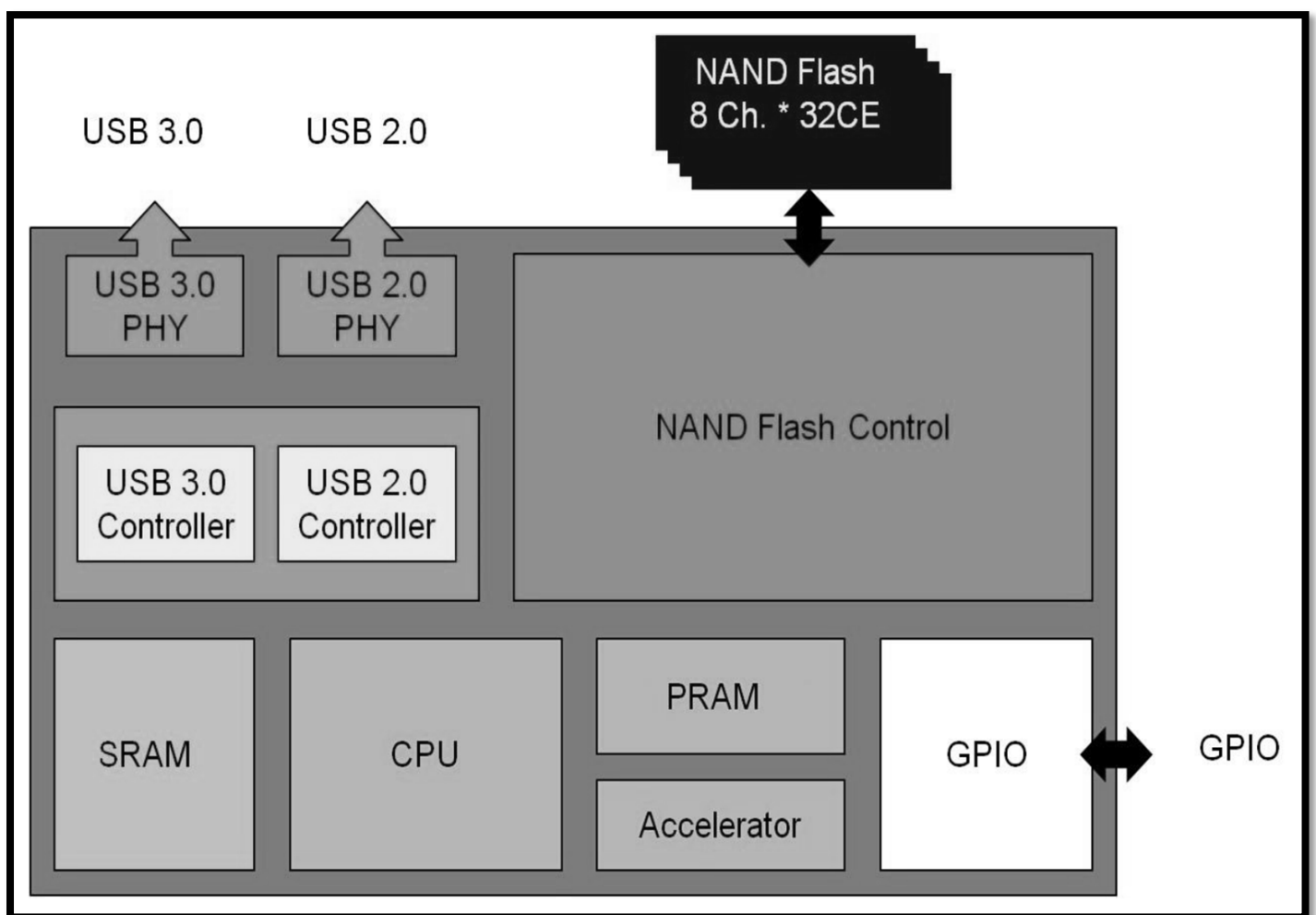


Figure 1: APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series controller block diagram

1.1. Scope

This document describes features, specifications and installation guide of APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series. In the appendix, there provides order information, warranty policy, RMA/DOA procedure for the most convenient reference.

1.2. Flash Management Technology – Global Wear Leveling

In order to gain the best management for flash memory, APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series apply 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.

1.3. Host Operating System support ability

- Support Windows Vista, Windows XP, Windows 7, Windows 8 and Windows 10 without device driver.
- Support MAC OS 10.2.8 and later without device driver. (USB 2.0 speed)
- Support MAC OS 10.8 and later without device driver. (USB 3.0 speed)
- Support Linux Kernel ver 2.4.0 or above without device driver. (USB 1.1 speed)
- Support Linux Kernel ver 2.4.10 or above without device driver. (USB 2.0 speed)

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 SLC / MLC USB 3.0 Flash Disk PHANES-D Series			
Temperature	Operating:	0°C ~ +70°C	-40°C ~ +85°C
	Non-operating:	-20°C ~ +80°C	-50°C ~ +95°C
Humidity	Operating & Non-operating:	85 °C / 95% RH Non-Operating	
Vibration	Frequency/Displacement:	20Hz~80Hz/1.52mm	
	Frequency/Acceleration:	80Hz~2000Hz/20G.	
Shock	Operating & Non-operating:	0.5ms, 1500 G, 3 axis.	
Electrostatic Discharge (ESD)	Temperature:	24°C	
	Relative Humidity:	49% (RH)	
	+/-4KV:	Device functions are affected, but EUT will be back to its normal or operational state automatically.	

2.2. System Power Requirements

Table 2: Power Requirement

APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series			
DC Input Voltage (VCC) 5V±10%		SLC	MLC
Maximum average value	Reading Mode :	127.0 mA (8GB)	154.1 mA (32GB)
	Writing Mode :	141.0 mA (8GB)	173.7 mA (32GB)
	Suspend Mode :	99.4 mA (8GB)	102.1 mA (32GB)

2.3. System Performance

Table 3: System Performances

Capacity	Read (MB/s)	Write (MB/s)
	SLC Solution	
128MB	30.0	5.0
256MB	30.0	10.0
512MB	30.0	20.0
1GB	30.0	20.0
2GB	30.0	20.0
4GB	41.2	31.9
8GB	41.0	36.6

Capacity	MLC Solution	
4GB	98.6	28.5
8GB	98.6	28.5
16GB	99.3	24.9
32GB	98.0	51.2

Note: The performance was measured using CrystalDiskMark by file size 500MB (QD32).

2.4. System Reliability

Table 6: System Reliability

Wear-leveling Algorithms	Global Wear-Leveling algorithm		
Bad Block Management	Supportive		
ECC Technology	Up to 72 bits/1KB data by BCH ECC engine.		
Erase counts	KIOXIA SLC NAND Flash: 60K P/E Cycles	KIOXIA MLC NAND Flash: 3K P/E Cycles	
TBW (Tera Bytes Written)	SLC	MLC	
Capacity	128MB	6.6	N/A
	256MB	13.2	N/A
	512MB	26.63	N/A
	1GB	54.76	N/A
	2GB	108.51	N/A
	4GB	219.04	11.16
	8GB	438.08	22.32
	16GB	N/A	44.64
	32GB	N/A	88.44

Remark:

* The estimated values are based on sequential write behavior.

*1. Flash vendor guaranteed: SLC P/E cycle: 60K; MLC P/E cycle: 3K

*2. WAF may vary from capacity, flash configuration and writing behavior on each platform.

*3. 1 Terabyte = 1,024GB

*4. DWPD (Drive Write per Day) is calculated the number of times that user can overwrite the entire capacity of an SSD per day of its lifetime during the warranty period. (SLC warranty: 5 years) (MLC warranty: 2 years)

2.5. Physical Specifications

Refer to Table 5 and see Figure 2 for APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series physical specifications and dimensions.

Table 4: Physical Specifications

Generation	G4SB	G5
Length:	54.82 mm	47.20 mm
Width:	15.95 mm	17.20 mm
Thickness:	15.95 mm	7.80 mm
Weight:	22.0g / 0.77 oz.	10 g / 0.35 oz.

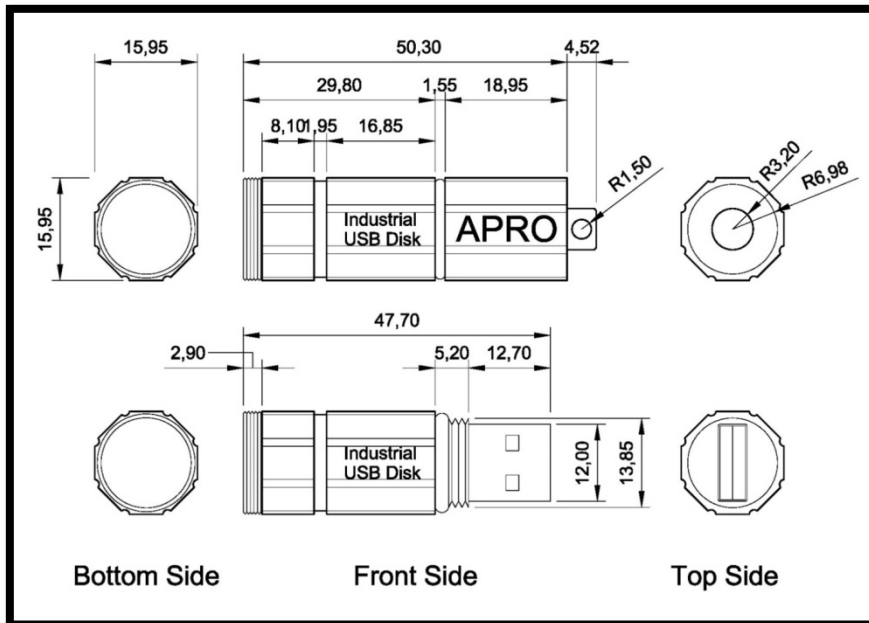


Figure 2: G4SB Dimension of APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series

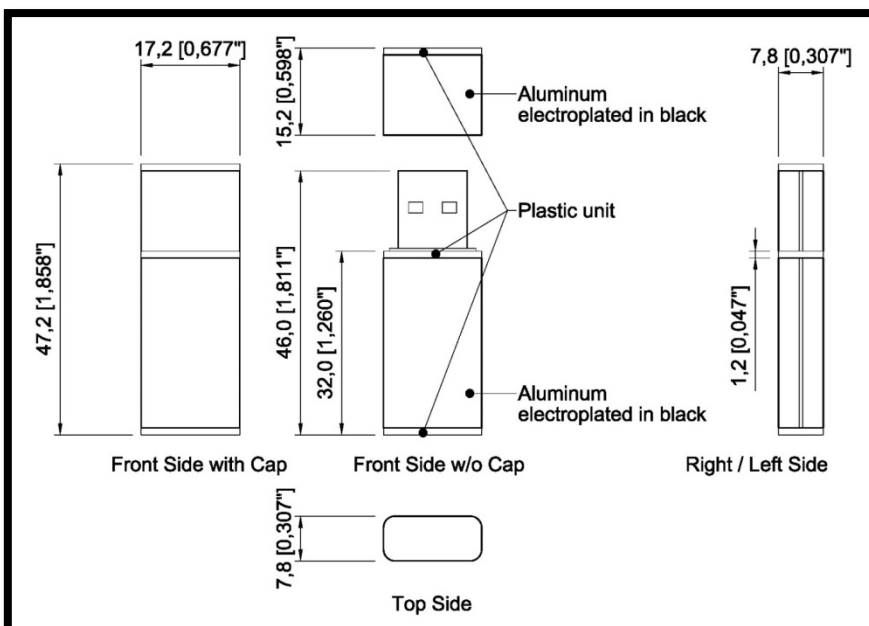


Figure 3: G5 Dimension of APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series

3. Interface Description

3.1. USB 3.0 Flash Disk PHANES-D Series Type A male interface

APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series is equipped with standard 9 pins USB 3.0 Type A male connector.

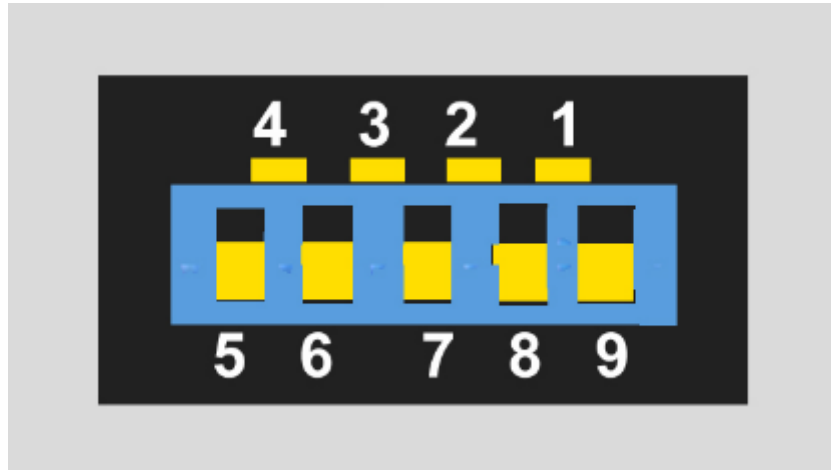


Figure 4: The Type A male connector of APRO SLC / MLC USB 3.0 Flash Disk PHANES-D Series

3.2. Pin Assignments

There are total of 9 pins in the signal segment. The pin assignments are listed in below table 6.

Table 5 - Pin Assignments

Name	Type	Description
1	VBUS	Power
2	D-	USB2.0 Differential Pair
3	D+	
4	GND	Ground for power return
5	StdA_SSRX-	Super-speed receiver differential pair
6	StdA_SSRX+	
7	GND_DRAIN	Ground for signal return
8	StdA_SSTX-	Super-speed transmitter differential pair
9	StdA_SSTX+	

Appendix A: Limited Warranty

APRO warrants your MLC USB 3.0 Flash Disk PHANES-D 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:

- **SLC STD. Grade 3 years / Within 60K Erasing Counts**
- **SLC IND. Grade 5 years / Within 60K Erasing Counts**
- **MLC (Wide temp. grade) 2 years / Within 3K Erasing Counts**

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