

aSLC

SATA III 1.8" Flash SSD

PHANES-K Series

Document No. : 100-xP8SF-PKCTMAS

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Date : September, 2020

ISO 9001 : 2015 CERTIFIED



Product Features

■ Flash IC

- TOSHIBA 15nm NAND Flash IC.
- Multi-Level Cell (MLC) management by enhance endurance technology (aSLC)

■ Compatibility

- Compliant with SATA Revision 3.2
- SATA 1.5Gbps/3.0Gbps/6.0Gbps data transfer rate.
- ATA-8 ACS4 command set

■ Additional Capabilities

- S.M.A.R.T.*1 (Self-Monitoring, Analysis and Reporting Technology) feature set support.
- Native Command Queuing (NCQ) support.
- TRIM maintenance command support.
- Both Static & Dynamic wear-leveling algorithm
- Hardware Low Density Parity Check Code, LDPC support.
- Support bad Block Management
- Support DIPM/HIPM Mode for power saving

■ Mechanical

- micro SATA 7 pins (data) + 9 pins (power connector) host Interface
- 1.8" form-factor (shorter than PCMCIA Type II form-factor)
- Dimension: 54.0 mm x 78.5 mm x 5.0 mm.
- Weight: 25g /0.88oz.

■ Power Operating Voltage 3.3V(+/-) 5%

- Read Mode: 1,650.0 mW (max.)
- Write Mode: 1,660.0 mW (max.)
- Idle Mode: 310.0 mW (max.)

■ Performance (Maximum value) *2

- Sequential Read: 550.0 MB/sec. (max.) *2
- Sequential Write: 470.0 MB/sec. (max.) *2

■ Capacity

- 16GB, 32GB, 64GB, 128GB and 256GB

■ Reliability

- **TBW:** Up to 1,510 TBW at 256GB Capacity.
(Client workload by JESD-219A)
- **ECC:** Designed with hardware LDPC ECC engine with hard-decision and soft-decision decoding.
- **Temperature:** (Operating)
Standard Grade: 0°C ~ +70°C
Wide Temp. Grade: -40°C ~ +85°C
- **Vibration:** 80 Hz to 2000 Hz, 20G, 3 axes.
- **Shock:** 0.5ms, 1500 G, 3 axes.

■ Certifications and Declarations

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


Remarks:

1. Support official S.M.A.R.T. Utility.
2. Sequential performance is based on CrystalDiskMark 5.1.2 with file size 1000MB

Order Information

I. Part Number List

◆ APRO aSLC micro SATA III SSD PHANES-K Series

| Product Picture | Grade | Standard grade (0°C ~ 70°C) | Wide Temp Grade (-40°C ~ +85°C) |
|---|-------|-----------------------------|-----------------------------------|
|  | 16GB | SP8SF016G-PKCTMAS | WP8SF016G-PKCTMAS-C |
| | 32GB | SP8SF032G-PKCTMAS | WP8SF032G-PKCTMAS-C |
| | 64GB | SP8SF064G-PKCTMAS | WP8SF064G-PKCTMAS-C |
| | 128GB | SP8SF128G-PKCTMAS | WP8SF128G-PKCTMAS-C |
| | 256GB | SP8SF256G-PKCTMAS | WP8SF256G-PKCTMAS-C |
| | | | |

Notes:

C : Special conformal coating treated on whole PCBA which may support industrial grade operating temperature -40°C ~ +85°C

II. Part Number Decoder:

X1 X2 X3 X4 X5 X6 X7 X8 X9 X11 X12 X13 X14 X15 X16 X17 -- C

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

P : Plastic frame kit

X3 X4 X5 : Product category

8SF : 1.8" micro SATA III SSD

X6 X7 X8 X9 : Capacity

016G: 16GB **128G:** 128GB

032G: 32GB **256G:** 256GB

064G: 64GB

X11 : Controller

P : PHANES Solution

X12 : Controller version

A, B, C.....

X13 : Controller Grade

C : Commercial grade

X14 : Flash IC

T : Toshiba NAND Flash IC

X15 : Flash IC grade / Type

M : 15nm aSLC -NAND Flash IC

X16 X17 : aSLC Technology

AS : aSLC Technology extends MLC product's lifespan

C : Reserved for specific requirement

C : Conformal-coating

Revision History

| Revision | Description | Date |
|----------|------------------|-----------|
| 1.0 | Initial release. | 2020/9/17 |

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1. Introduction

APRO aSLC 1.8" micro SATA III SSD PHANES-K Series provides high capacity flash memory Solid State Drive (SSD) that electrically complies with SATA Revision 3.2 standard; APRO aSLC 1.8" micro SATA III SSD PHANES-K Series support SATA 1.5Gb/s; SATA 3Gb/s & SATA 6Gb/s data transfer rate with high performance.

The available disk capacities are from 16GB up to 256GB. 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.

APRO aSLC 1.8" micro SATA III SSD PHANES-K Series is suitable to handheld device embedded system, inventory recorder and particularly for serious environment monitor recorder system. The sequential read speed is 550 MB/sec and sequential write speed is 470 MB/se which were testing based on 256GB capacity

APRO aSLC 1.8" micro SATA III SSD provides a high level interface to the host computer. This interface allows a host computer to issue commands to the APRO aSLC 1.8" micro SATA III SSD PHANES-K Series to read or write blocks of memory. A powerful hardware design is architecture multiplied LDPC (Low Density Parity Check) for Error Correcting Coding (ECC).

APRO aSLC 1.8" micro SATA III SSD PHANES-K Series intelligent controller manages interface protocols, data storage and retrieval as well as ECC, bad block management and diagnostics, power management and clock control.

Figure 1 shows a block diagram of the used high tech micro SATA III SSD controller.

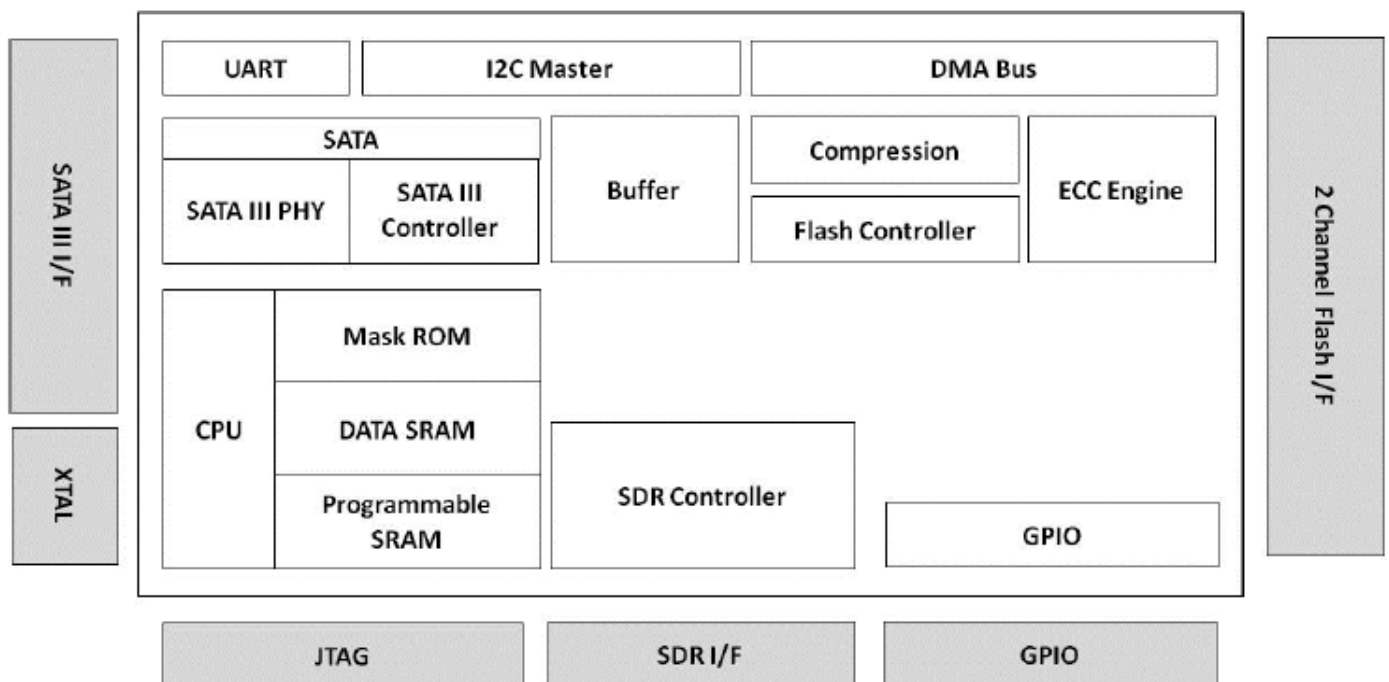


Figure 1: APRO aSLC micro SATA III SSD PHANES-K Series block diagram

1.1. Scope

This document describes features, specifications and installation guide of APRO aSLC 1.8" micro SATA III SSD PHANES-K Series. In the appendix, there provides order information, warranty policy, RMA/DOA procedure for the most convenient reference.

1.2. Flash Management Technology – Static & Dynamic Wear Leveling

NAND flash devices can only undergo a limited number of program/erase cycles, and in most cases, the flash media are not used evenly. If some areas get updated more frequently than others, the lifetime of the device would be reduced significantly. Thus, Wear Leveling is applied to extend the lifespan of NAND Flash by evenly distributing write and erase cycles across the media.

APRO aSLC 1.8" micro SATA III SSD PHANES-K Series provides advanced Wear Leveling algorithm, which can efficiently spread out the flash usage through the whole flash media area. Moreover, by implementing both dynamic and static Wear Leveling algorithms, the life expectancy of the NAND flash is greatly improved.

1.3. Bad Block Management

➤ Early Bad Block

The fault block generated during the manufacturing process of NAND Flash is called Early Bad Block.

➤ Later Bad Block

In the process of use, as the number of operations of writing and erasing increases, a fault block is gradually generated, which is called a Later Bad Block.

Bad block management is a management mechanism for a bad block to be detected by the control IC and mark bad blocks in the NAND Flash and improve the reliability of data access. The bad block management mechanism of the control IC will establish a **Bad Block Table** when the NAND Flash is started for the first time, and will also record the errors found in the process of use in the bad block table, and data is ported to new valid blocks to avoid data loss.

In order to detect the initial bad blocks to handle run time bad blocks, APRO aSLC 1.8" micro SATA III SSD PHANES-K Series provides the **Bad Block Management** scheme. It remaps a bad block to one of the reserved blocks so that the data contained in one bad block is not lost and new data writes on a bad block is avoided.

1.4. aSLC Technology

The aSLC can be considered as an extended version of the MLC. While MLC contains both fast and slow pages, aSLC only utilizes fast pages for programming. The concept of aSLC is demonstrated in the Figure 2 below. The first and second bits of a memory cell represent a fast and slow page respectively, as shown in the left table. Since only fast pages are programmed when applying aSLC, the bits highlighted in red are used, as shown in the right table. As a result, aSLC provides better performance and endurance than MLC does. Moreover, the aSLC performs similarly to the SLC, yet more cost effective.

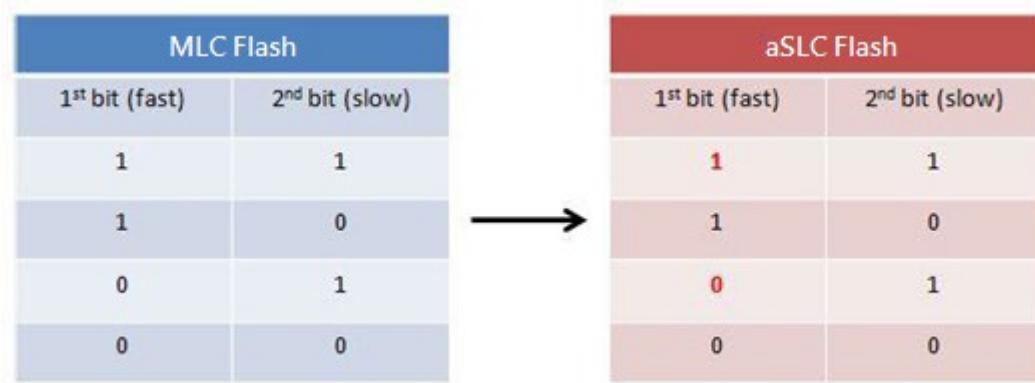


Figure 2: The concept of APRO aSLC 1.8'' micro SATA III SSD PHANES-K Series

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 aSLC 1.8'' micro SATA III SSD PHANES-K Series | | Standard Grade | Wide Temp Grade |
|---|----------------------------|---|---------------------|
| | | SP8SFxxxG-PKCTMAS | WP8SFxxxG-PKCTMAS-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 | Frequency/Acceleration: | 80 Hz to 2000 Hz, 20G, 3 axes | |
| Shock | Operating & Non-operating: | 0.5ms, 1500 G, 3 axes | |
| 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 aSLC 1.8'' micro SATA III SSD PHANES-K Series | |
|--|---|
| DC Input Voltage (VCC) | 3.3V +/- 5% (Default) 5V +/- 5% (Option) |
| Reading Mode : | 1,650.0 mW (max.) |
| Writing Mode : | 1,660.0 mW (max.) |
| Idle Mode : | 310.0 mW (max.) |

2.3. System Performance

Table 3: System Performances

| | | | | | | |
|--------------------------------------|--------------------------------|--|-------------|-------------|--------------|--------------|
| Data Transfer Mode supporting | | Serial ATA Gen-III (6.0Gb/s = 768MB/s) | | | | |
| Maximum Performance | Capacity | 16GB | 32GB | 64GB | 128GB | 256GB |
| | Sequential Read (MB/s) | 350.0 | 350.0 | 550.0 | 550.0 | 550.0 |
| | Sequential Write (MB/s) | 160.0 | 260.0 | 450.0 | 450.0 | 470.0 |

Note: The performance was measured using CrystalDiskMark by file size 1000MB (QD32).

2.4. System Reliability

Table 4: System Reliability

| | | | |
|---------------------------------|--------------|---|--|
| Wear-leveling Algorithms | | Static & Dynamic Wear-leveling | |
| Bad Block Management | | Supportive | |
| ECC Technology | | Hardware design LDPC (Low Density Parity Check) | |
| Erase counts | | NAND aSLC Flash Cell Level : 20K P/E Cycles | |
| TBW (Tera Bytes Written) | | | |
| Capacity | 16GB | 49 | |
| | 32GB | 106 | |
| | 64GB | 215 | |
| | 128GB | 649 | |
| | 256GB | 1,510 | |

Note:

- Client workload by JESD-219A.
- The endurance of SSD could be varying based on user behavior, NAND endurance cycles, and write amplification factor. It is not guaranteed by flash vendor.

2.5. Physical Specifications

Refer to Table 5 and see Figure 2 for APRO aSLC 1.8" micro SATA III SSD PHANES-K Series physical specifications and dimensions.

Table 5: Physical Specifications of APRO aSLC micro SATA III SSD PHANES-K Series

| | |
|-------------------|----------------|
| Length: | 54.0 mm |
| Width: | 78.5 mm |
| Thickness: | 5.0 mm |
| Weight: | 25g / 0.88 oz. |

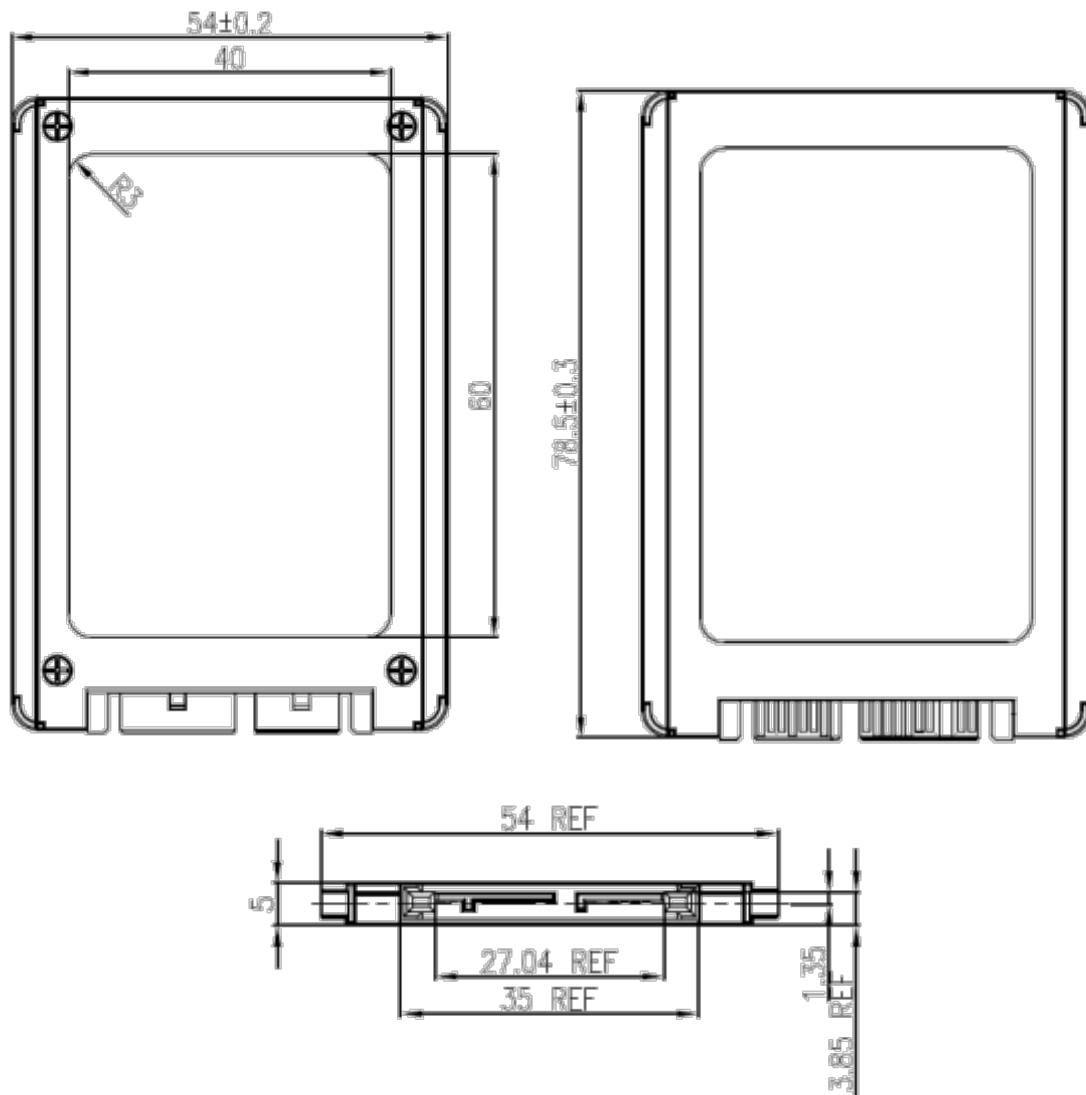


Figure 2: APRO aSLC micro SATA III SSD Dimension

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 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 use MIL-I-46058C silicon conformal coating

3. Interface Description

3.1. micro SATA III SSD interface

Refer to Table 6 and see Figure 3 for APRO 1.8" aSLC micro SATA III SSD PHANES-K Series pin assignments.

There are total of 7 pins in the signal segment and 9 pins in the power segment. The pin assignments are listed in below table 6.

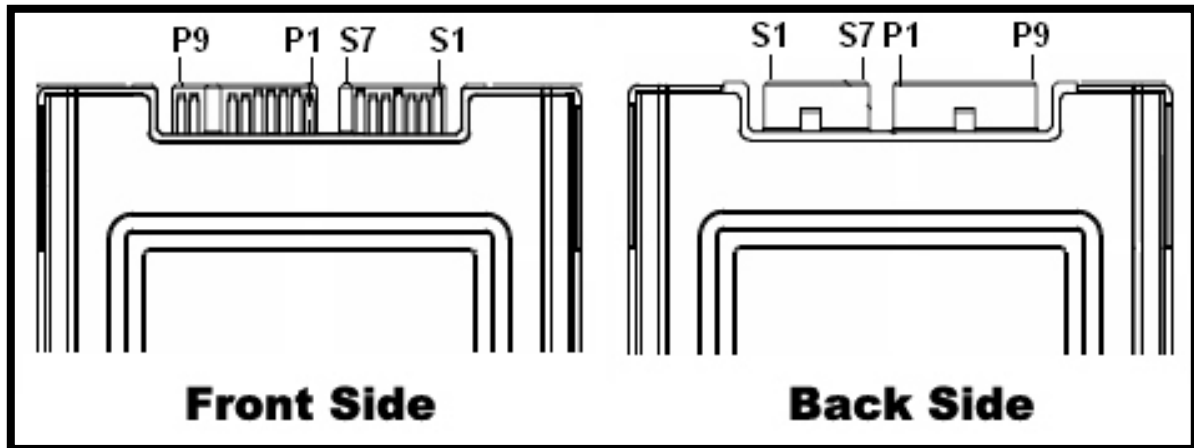


Figure 3: The connectors of SATA 7-pin (data) + 9-pin (power)

3.2. Pin Assignments

APRO aSLC 1.8" micro SATA III SSD PHANES-K Series operates with standard SATA pin-out.

The pin assignments are listed in below table 6.

| Signal Segment Pin Assignment and Descriptions | | |
|--|----------------------------------|--------------------------------------|
| Pin Number | Function | |
| S1 | GND | |
| S2 | A+ (Differential Signal Pair A) | |
| S3 | A – (Differential Signal Pair A) | |
| S4 | GND | |
| S5 | B – (Differential Signal Pair B) | |
| S6 | B+ (Differential Signal Pair B) | |
| S7 | GND | |
| Power Segment Pin Assignment and Description | | |
| Pin Number | Type | Function |
| P1 | V ₃₃ | 3.3V Power Input |
| P2 | V ₃₃ | 3.3V Power Input |
| P3 | GND | GND |
| P4 | GND | GND |
| P5 | V ₅ | Reserved for 5V Power Input (Option) |
| P6 | V ₅ | Reserved for 5V Power Input (Option) |
| P7 | Optional | Reserved for Active LED (Option) |
| Key | Key | N/C |
| P8 | Optional | Erase function (Option) |
| P9 | Optional | Reserved (Not Connected) |

Table 6 - Pin Assignments

Appendix A: Limited Warranty

APRO warrants your aSLC SATA III micro SATA III SSD PHANES-K 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:

- **aSLC (Standard grade / Wide temp. grade) 2 years / Within 20K Erasing Counts**

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