



MLC  
Semi Metal USB  
Generation 5  
HERCULES-P Series

**Product Specification**

MLC

Semi Metal USB Flash Disk Generation 5

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#### Revision History

| <b>Revision</b> | <b>Description</b> | <b>Date</b> |
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## **1. Introduction**

APRO MLC Semi Metal USB Flash Disk Generation 5 – HERCULES-P Series, is specified as 2.0 High Speed Device, Mass Storage Class; USB-IF (USB Implementers Forum), WHQL (Window Hardware Quality Labs), EMI tests certified. In addition to being as a removable storage device, MUFD - Generation 5 can also be configured as a bootable disk for system recovery. Also, its random access performance exceed the minimum requirement of Read Boost feature found in Microsoft Vista operating system, in which randomly access blocks of information are saved into MUFD - Generation 5 for boosting up the average performance. Capacities are available for 4GB, 8GB, 16GB and 32GB.

Semi Metal USB - Generation 5 – HERCULES-P Series also offers unique customization for OEM customers by laser carvings.

### **1.1. Scope**

This document describes the key features and specifications of Semi Metal USB – Generation 5 – HERCULES-P Series.

### **1.2. System Features**

- USB 2.0 interface downwards compatible to USB 1.1
- USB 2.0 Mass Storage compliant
- LED indicator for the usage status of USB Flash Disk
- Standard grade supports 0°C to 70°C, and Wide temp grade with conformal coating supports -40°C to +85°C
- Support partition management for Disk Lock and Password Protection
- Supports Ready Boost for Microsoft Vista O.S.
- Capacities from 4GB to 32GB

### **1.3. Flash Management Technology - Static Wear Leveling**

In order to gain the best management for flash memory, APRO Semi Metal USB HERCULES-P 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. System Environmental Specifications

**Table 1: Environmental Specification**

| APRO Semi Metal USB Flash Disk<br>HERCULES-P Series |                            | Standard Grade<br>SMUFDxxxG-MPCTM-5 | Wide Temp. Grade<br>WMUFDxxxG-MPCTM-5C |
|---|----------------------------|-------------------------------------|--|
| 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 Semi Metal USB Flash Disk<br>HERCULES-P Series |                | Standard Grade<br>SMUFDxxxG-MPCTM-5 |
|---|----------------|-------------------------------------|
| DC Input Voltage (VCC) 100mV max. ripple(p-p)       |                | 5V±10%                              |
| +5V Current<br>(Maximum average value)              | Reading Mode : | 122 (max.)                          |
|   | Writing Mode : | 139 (max.)                          |
|   | Idle Mode :    | 76 (max.)                           |

### 2.3. System Performance

**Table 3: System Performances**

|                               |                        |                    |      |      |      |
|-------------------------------|------------------------|--------------------|------|------|------|
| Data Transfer Mode supporting |                        | USB 2.0            |      |      |      |
| Average Access Time           |                        | 0.6 ms (estimated) |      |      |      |
| Maximum Performance           | Capacity               | 4GB                | 8GB  | 16GB | 32GB |
|                               | Sequential Read (MB/s) | 26.1               | 26.6 | 26.4 | 26.3 |
|                               | Sequential Write(MB/s) | 11.6               | 16.9 | 19.2 | 19.8 |

Note:

- (1). All values quoted are typically at 25°C and nominal supply voltage.
- (2). Testing of the Semi Metal USB Flash Disk maximum performance was performed under the following platform:
  - Computer with Intel i5 3.5GHz processor
  - Windows 7 Professional operating system

## 2.4. System Reliability

**Table 4: System Reliability**

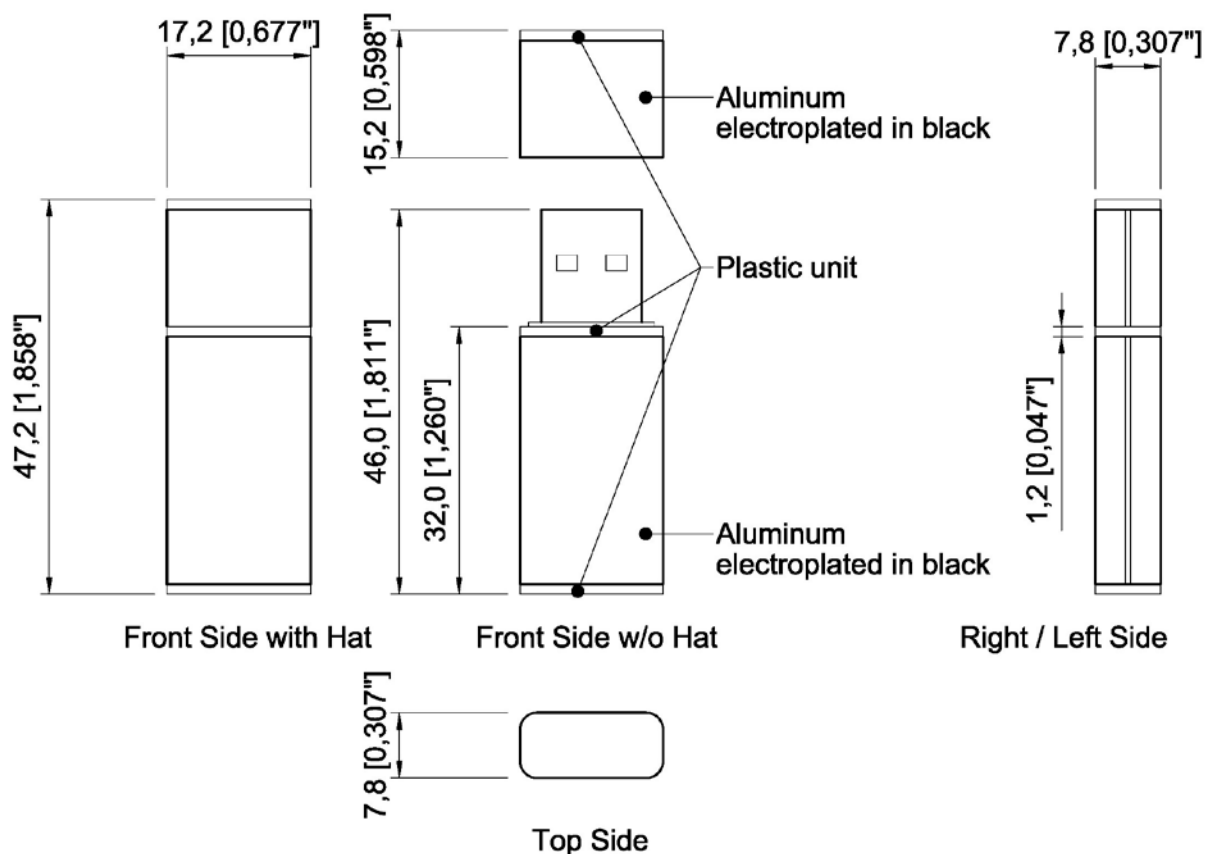
|                                 |   |
|---------------------------------|---|
| <b>Wear-leveling Algorithms</b> | Static Wear-leveling  |
| <b>Bad Blocks Management</b>    | Supportive  |
| <b>ECC Technology</b>           | 72 bits per 1024 bytes  |
| <b>Endurance</b>                | Un-limited Read Cycles<br>Endurance Management enables five years minimal useful life |
| <b>Data Retention</b>           | 10 years  |

## 2.5. Physical Specifications

Refer to Table 5 and see Figure 1 for Semi Metal USB Flash Disk HERCULES-P Series physical specifications and dimensions.

**Table 5: Physical Specifications of APRO Semi Metal USB Flash Disk HERCULES-P Series**

|                   |                |
|-------------------|----------------|
| <b>Length:</b>    | 47.20 mm       |
| <b>Width:</b>     | 17.20 mm       |
| <b>Thickness:</b> | 7.80 mm        |
| <b>Weight:</b>    | 15 g / 0.53 oz |



**Figure 1: APRO Semi Metal USB Flash Disk Generation 5 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 uses MIL-I-46058C silicon conformal coating

## 3. Interface Description

### 3.1. APRO Semi Metal USB Flash Disk interface

APRO Semi Metal USB Flash Disk is equipped with standard USB Type A connector.

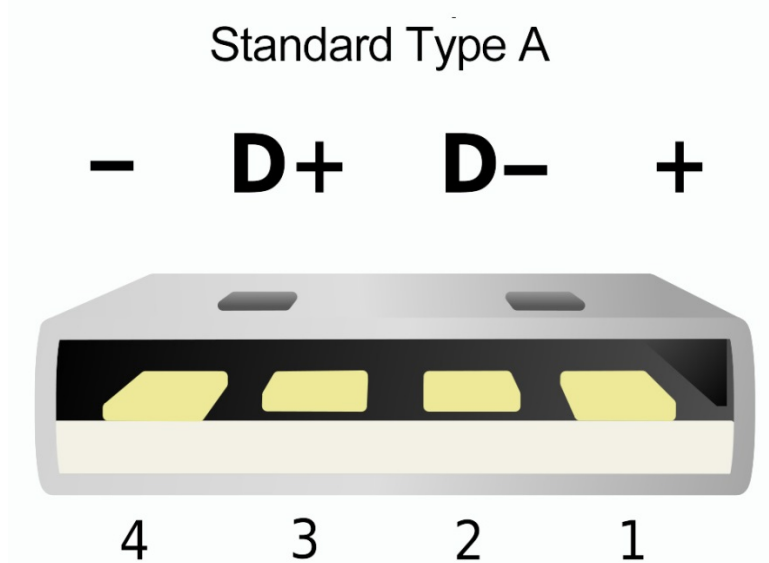


Figure 2: USB Type A Connector

### 3.2. Pin Assignments

There are total of 4 pins in the USB Type A Connector. The pin assignments are listed in below table 6.


Table 6 - Pin Assignments

| Pin Number | Pin Name | Function  |
|------------|----------|---|
| Pin 1      | Vcc      | Power   |
| Pin 2      | USB -    | The pairs are used to transmit Address, Data and Command. |
| Pin 3      | USB +    |   |
| Pin 4      | Vss      | Ground  |

**Appendix A: Ordering Information**

**1. Part Number List**

◆ **APRO Semi Metal USB Flash Disk Generation 5 – HERCULES-P Series**

| Product Picture   | Grade       | Standard grade (0°C ~ 70°C) | Wide Temp. Grade (-40°C ~ +85°C) |
|---|-------------|-----------------------------|----------------------------------|
|  | <b>4GB</b>  | SMUFD004G-MPCTM-5           | WMUFD004G-MPCTM-5C               |
|   | <b>8GB</b>  | SMUFD008G-MPCTM-5           | WMUFD008G-MPCTM-5C               |
|   | <b>16GB</b> | SMUFD016G-MPCTM-5           | WMUFD016G-MPCTM-5C               |
|   | <b>32GB</b> | SMUFD032G-MPCTM-5           | WMUFD032G-MPCTM-5C               |
|   |             |                             |                                  |
|   |             |                             |                                  |
|   |             |                             |                                  |

**2. Part Number Decoder:**

**X1 X2 X3 X4 X5 X6 X7 X8 X9 – X11 X12 X13 X14 X15 – Z1 – 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**

**M:** Semi Metal

**X3 X4 X5 : Product category**

**UFD:** USB Flash Disk

**X6 X7 X8 X9 : Capacity**

**004G:** 4GB  
**008G:** 8GB  
**016G:** 16GB  
**032G:** 32GB

**X11 : Controller**

**M:** SMI (HERCULES-P Series)

**X12 : Controller version**

**A, B, C.....**

**X13 : Controller Grade**

**C:** Commercial grade

**X14 : Flash IC**

**T:** Toshiba MLC-NAND Flash IC

**X15 : Flash IC grade / Type**

**M:** MLC-NAND Flash IC

**Z1 : Housing Generation**

**5:** Generation 5 Housing

**C : Reserved for specific requirement**

**C:** Conformal-coating



**Appendix B: Limited Warranty**

APRO warrants your Semi Metal USB Flash Disk 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:**

- SMUFDxxxG-MPCTM-5                      2 years
- WMUFDxxxG-MPCTM-5C                    2 years



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