



May 2014

Product Specification

HERCULES-P Series

Industrial micro USB Flash (MUM) Module

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Revision History

<i>Rev.</i>	<i>Description</i>	<i>Update</i>
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1. Introduction

APRO's Industrial micro USB Flash (MUM) Module, is specified as 2.0 High Speed Device, Mass Storage Class, USB-IF, WHQL and EMI tests certified. The MUM Flash Module supports optional standard operating temperature 0°C ~ +70°C and wide operating temperature -40°C ~ +85°C, is designed to meet the special demand of USB Flash Disks which replace the traditional floppy disks for certain harsh Industrial applications which needs larger storages but smaller form-factor. The MUM Flash Module operates like a hard drive, but has the speed and transportability of a solid state device.

APRO's Industrial micro USB Flash (MUM) Module is an internal solution that attaches direct to a USB pin connector on motherboard. Coming in capacities of 512MB ~ 32GB, it improves the form-factor diversity and increase solutions of storage choosing: There are 2 form factors for APRO's Industrial micro USB Flash (MUM) Module, which are 1) 2x5 2.54mm pitch pin connector horizontal type without casing and, 2) 2x5 2.00mm horizontal type without casing

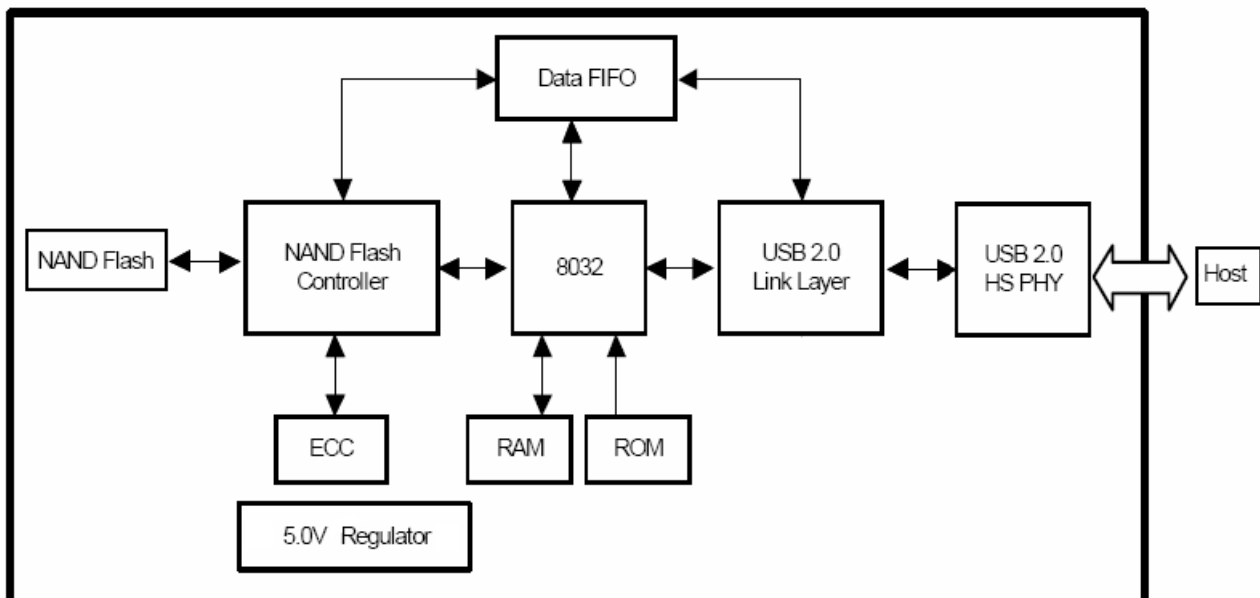


Figure 1: Industrial micro USB Flash (MUM) Module Block Diagram

1.1. Scope

This document describes the key features and specifications of APRO's Industrial micro USB Flash (MUM) Module.

1.2. System Features

- 2x5 header, x86 internal USB standard
- Horizontal - 2 form-factors : 2x5 2.54mm connector & 2.00mm pitch pin connector
- Complies with Microsoft Vista Ready-Boost® requirements
- BCH ECC: 72 bits per 1024 Bytes
- Defaulted as Fixed disk type (Removable disk type optional)
- High-speed USB 2.0 interface; backward compatible with USB 1.1
- Horizontal: Capacities from 512MB up to 32GB (Dual Channel)
- Performance up to 29.4 MB/sec max.

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

Industrial micro USB Module (MUM) – HERCULES-P Series		Commercial Grade	Industrial Grade
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, 3axes	
Shock	Operating & Non-operating:	0.5ms, 1500G, 3 axes	

2.2. System Power Requirements

Table 2: Power Requirement

DC Input Voltage (VCC) 100mV max. ripple(p-p)		Horizontal (8GB)
+5V Current (Maximum average value)	Reading Mode :	130 mA (Max.)
	Writing Mode :	145 mA (Max.)
	Idle Mode :	75 mA (Max.)

2.3. System Performance

Table 3: System Performances

Performance (KB/sec)	Sequential Speed (MB/Sec.)	
	Dual Channel	
	Read	Write
512MB	26.6	20.9
1GB	26.5	21.3
2GB	26.7	22.0
4GB	29.2	25.6
8GB	29.4	24.8
16GB	29.0	26.2
32GB	28.9	23.7

Note:

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

(2). The Max. Performance was tested by ATTODISK Benchmark

2.4. System Reliability

Table 4: System Reliability

MTBF	>3,000,000 hours
Wear-leveling Algorithms	Static
ECC Technology	Enhanced management 72 bits per 1024 bytes block
Endurance	Greater than 2,000,000 cycles Logically contributed by Wear-leveling and advanced bad sector management
Data Retention	10 years

2.5. Physical Specifications

Refer to Table 5 ~ 7 and see Figure 2 ~ 4 for USB Flash Disk physical specifications and dimensions.

Table 5: Physical Specifications of MUM Horizontal Type – Standard Form-factor (2.54mm pitch pin)

Length:	37.00 mm
Width:	26.60 mm
Thickness:	0.95 mm
Weight:	10.0 g / 0.35 oz.
Interface Pin pitch:	2.54mm
Available Capacity:	512MB, 1GB, 2GB, 4GB, 8GB, 16GB and 32GB

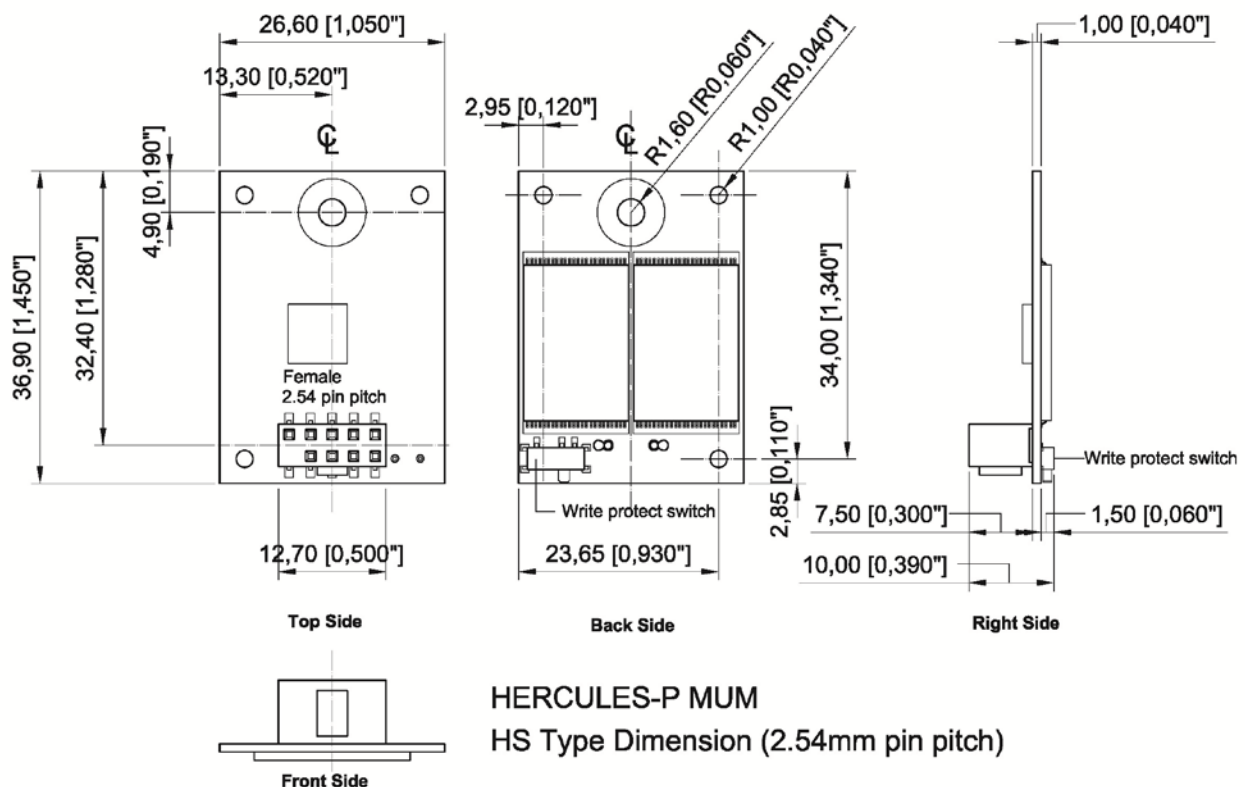


Figure 2: Industrial USB Disk Module Horizontal Type – Standard Form factor Dimension

Table 6: Physical Specifications of MUM Horizontal Type – Low Profile Form-factor (2.00mm pitch pin)

APRO Industrial USB Disk Module Horizontal Type – Low profile Form factor (2.00mm pitch pin)	
Length:	37.00 mm
Width:	26.60 mm
Thickness:	0.95 mm
Weight:	10.0 g / 0.35 oz.
Interface Pin pitch:	2.00mm
Available Capacity:	512MB, 1GB, 2GB, 4GB, 8GB, 16GB and 32GB

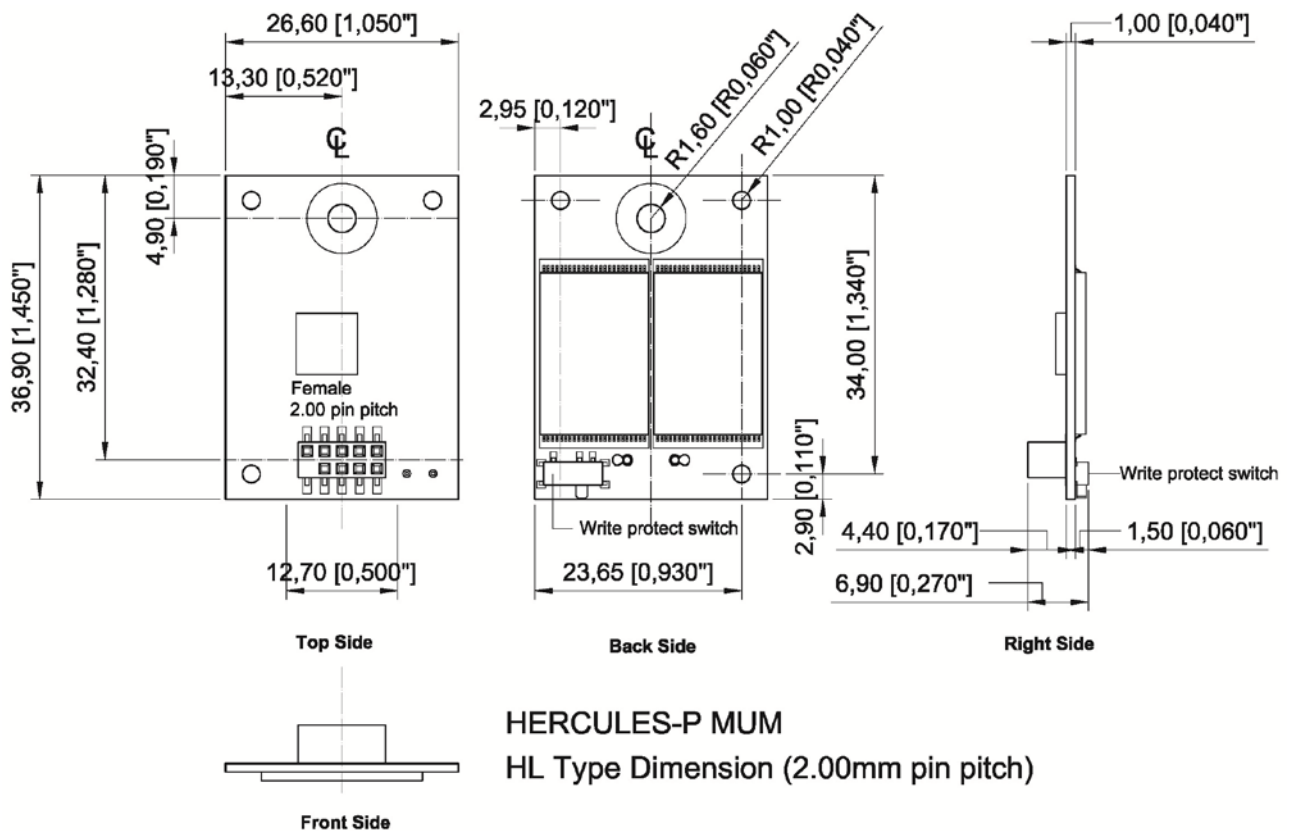


Figure 3: Industrial USB Disk Module Horizontal Type – Low Profile Form factor Dimension

3. Interface Description

3.1. Physical Description

The host is connected to the Industrial micro USB Flash Disk Module (MUM) using a Type A female USB connector.

3.2. Pin Assignments

Table 7 Pin Assignments of USB 2.0

Horizontal Type			
Pin Number	Signal	Pin Number	Signal
Pin 1	+5VDC	Pin 2	NC
Pin 3	USB -	Pin 4	NC
Pin 5	USB +	Pin 6	NC
Pin 7	GND	Pin 8	NC
Pin 9	NC	Pin 10	NC

4. Electrical Characteristics

4.1. Absolute Maximum Ratings

Table 8 Absolute Maximum Ratings

SYMBOL	PARAMETER	RAITING	UNITS
V _{CC33}	3.3V supply voltage	-0.3 to 3.6	V
V _{CC18}	1.8V supply voltage	-0.3 to 2	V
V _{IN33}	3.3V buffer input voltage	-0.3 to 3.6	V
V _{IN335}	3.3V/5V buffer input voltage	-0.3 to 5.5	V
V _{IN18}	1.8V buffer input voltage	-0.3 to 2	V
T _{STG}	Storage Temperature	Standard grade : -20 ~ +80 Industrial grade : -50 to +95	°C
T _a	Operating Temperature	Standard grade : 0 ~ 70 Industrial grade : -40 ~ +85	°C

4.2. Recommended Operating conditions

Table 9 Recommended Operating Conditions

SYMBOL	PARAMETER	MIN	TYPE	MAX	UNITS
USB _{Vin}	5V Power Supply	3.2	5.0	5.5	V
V _{DD33}	3.3V Power Supply	3.0	3.3	3.6	V
V _{DD18}	1.8V Power Supply	1.6	1.8	2	V

4.3. General DC Characteristics

Table 10 DC CHARACTERISTICS OF I/O INTERFACE

Symbol	Parameter	Min	Max	Unit	Notes
V _{IH_TTL}	TTL Input High Voltage	2	V _{cc3} +0.3	V	1
V _{IL_TTL}	TTL Input Low Voltage	-0.3	0.8	V	1
V _{OH_TTL}	TTL Output High Voltage	0.9V _{cc3}		V	1
V _{OL_TTL}	TTL Output Low Voltage		0.45	V	1
I _{OH_TTL}	TTL Output High Current	-4		mA	1
I _{OL_TTL}	TTL Output Low Current		4	mA	1
V _{IH_USB}	USB Input High Voltage for Low-/full-speed	2.0		V	2
V _{IL_USB}	USB Input Low Voltage for Low-/full-speed		0.8	V	2
V _{I_USB_DIFF}	Differential Input Sensitivity for	TBD		V	2

	Low-/full-speed				
V _{I_USB_CM}	Differential Common Mode Input Range for Low-/full-speed	0.8	2.5	V	2
V _{I_USB_HSSQ}	USB High-speed squelch Input detection threshold	0.1	0.15	V	2
V _{I_USB_HSDSC}	USB High-speed disconnect Input detection threshold	0.525	0.625	V	2
V _{I_USB_HSCM}	USB High-speed Signaling Common Mode Range	-0.05	0.5	V	2
V _{OH_USB}	USB Output High Voltage for Low-/full-speed	2.8	3.6	V	2
V _{OL_USB}	USB Output Low Voltage for Low-/full-speed	0	0.3	V	2
V _{OH_USB_HS}	USB Output High Voltage for High-speed	0.36	0.44	V	2
V _{OL_USB_HS}	USB Output Low Voltage for High-speed	-0.01	0.01	V	2
I _{OH_USB}	USB Output High Current for Low-/full-speed	-10		mA	2
I _{OL_USB}	USB Output Low Current for Low-/full-speed		10	mA	2
I _{OH_USB_HS}	USB Output High Current for High-speed	-40		mA	2
I _{OL_USB_HS}	USB Output Low Current for High-speed		40	mA	2

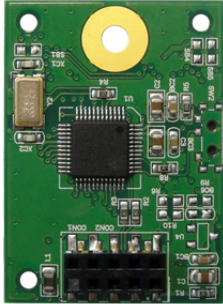
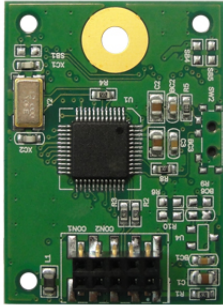
4.4. General AC Characteristics

Table 11 AC CHARACTERISTICS OF I/O INTERFACE

Symbol	Parameter	Min.	Typ.	Max.	Unit
TP _{ILH}	Input Rising Delay	0.61 (0.8pF)	0.72 (2.4pF)	0.92 (4.8pF)	ns
TP _{IHL}	Input falling Delay	0.88 (0.8pF)	1.03 (2.4pF)	1.24 (4.8pF)	ns
TP _{OLH}	Output Rising Delay	2.40 (10pF)	3.42 (30pF)	4.88 (60pF)	ns
TP _{OHL}	Output falling Delay	2.61 (10pF)	3.62 (30pF)	5.03 (60pF)	ns
TR	Output Rising Time	2.26 (10pF)	4.45 (30pF)	7.83 (60pF)	ns
TF	Output falling Time	1.90 (10pF)	3.63 (30pF)	6.23 (60pF)	ns

Appendix A. Ordering Information

1. Part Number List

INDUSTRIAL micro USB Disk Module – Horizontal Type Standard Form Factor			
512MB		SBMUM512M-MPCTC-HS(/C)	WBMUM512M-MPITI-HS(/C)
1GB		SBMUM001G-MPCTC-HS(/C)	WBMUM001G-MPITI-HS(/C)
2GB		SBMUM002G-MPCTC-HS(/C)	WBMUM002G-MPITI-HS(/C)
4GB		SBMUM004G-MPCTC-HS(/C)	WBMUM004G-MPITI-HS(/C)
8GB		SBMUM008G-MPCTC-HS(/C)	WBMUM008G-MPITI-HS(/C)
16GB		SBMUM016G-MPCTC-HS(/C)	WBMUM016G-MPITI-HS(/C)
32GB		SBMUM032G-MPCTC-HS(/C)	WBMUM032G-MPITI-HS(/C)
INDUSTRIAL micro USB Disk Module – Horizontal Type Low Profile Form Factor			
512MB		SBMUM512M-MPCTC-HL(/C)	WBMUM512M-MPITI-HL(/C)
1GB		SBMUM001G-MPCTC-HL(/C)	WBMUM001G-MPITI-HL(/C)
2GB		SBMUM002G-MPCTC-HL(/C)	WBMUM002G-MPITI-HL(/C)
4GB		SBMUM004G-MPCTC-HL(/C)	WBMUM004G-MPITI-HL(/C)
8GB		SBMUM008G-MPCTC-HL(/C)	WBMUM008G-MPITI-HL(/C)
16GB		SBMUM016G-MPCTC-HL(/C)	WBMUM016G-MPITI-HL(/C)
32GB		SBMUM032G-MPCTC-HL(/C)	WBMUM032G-MPITI-HL(/C)

2. Part Number Decoder

X1 X2 X3 X4 X5 X6 X7 X8 X9 – **X11 X12 X13 X14 X15** – **Y1 Y2** – **C**

X1 : Grade

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

W : Industrial Grade – operating temperature -40° C ~ +85 °C

X2 : The material of case

B : Bare board without casing

X3 X4 X5 : Product category

MUM : micro USB 2.0 Flash Module

X6 X7 X8 X9 : Capacity

512M: 512MB

001G: 1GB

002G: 2GB

004G: 4GB

008G: 8GB

016G: 16GB

032G: 32GB

X11 : Controller

M : SMI (HERCULES Series)

X12 : Controller version

A, B, C...

X13 : Controller Grade

C : Commercial grade

I : Industrial grade

X14 : Flash IC

T : Toshiba NAND-SLC Flash IC

X15 : Flash IC grade / Type

C : Commercial grade

I : Industrial grade

Y1 Y2 : Product Form Factor

HS : Horizontal Type Standard Form Factor

HL : Horizontal Type Low Profile Form Factor

C : Reserved for specific requirement

C: Conformal Coating

Appendix B. Limited Warranty

APRO warrants your 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:

- ***SxMUMxxxx-MPCTC-YY*** ***3 years***
- ***WxMUMxxxx-MPITI-YY*** ***5 years***



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