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Product Specification

INDUSTRIAL micro USB (Flash Disk) Module

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RevCSCon History

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1. Introduction

APRO's Industrial micro USB (Flash Disk) Module - MUM, is specified as 2.0 High Speed Device, Mass Storage Class, USB-IF, WHQL and EMI tests certified. The MUM Flash Disk 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 as the removable mass storage solution for certain harsh Industrial applications which needs larger storages but limited space. The MUM flash disk operates like a hard drive, but has the speed and transportability of a solid state device.

APRO's MUM flash disk is an internal solution that attaches direct to a USB pin connector on motherboard. Coming in capacities of 128MB~8GB for horizontal type and 128MB~4GB for Vertical type, it improves the form-factor diversity and increase solutions of storage choosing: There are 2 types with three form-factor for APRO micro USB flash disk module for industrial embedded computing, including 2x5 2.54mm pitch pin connector horizontal type without casing, 2x5 2.00mm horizontal type without casing and also 2x5 2.54mm pitch pin connector vertical type with casing.

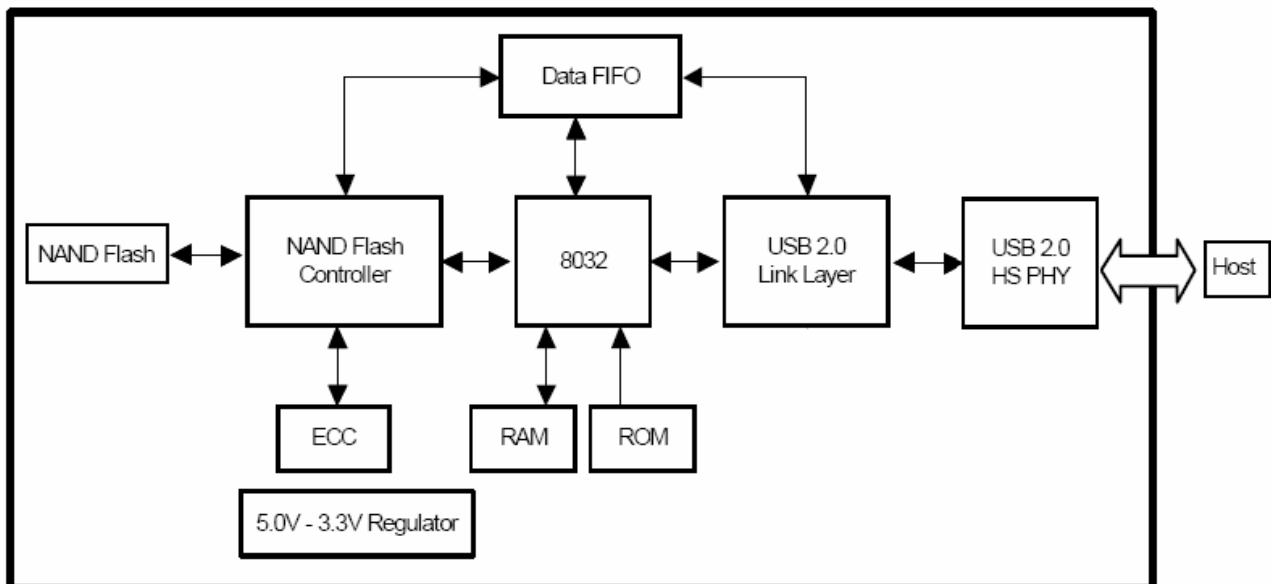


Figure 1: Industrial USB Disk Module Controller Block Diagram

1.1. **Scope**

This document describes the key features and specifications of Industrial USB (Flash Disk) Model (MUM)

1.2. **System Features**

- 2x5 header, x86 internal USB standard
- Horizontal - 2 form-factors : 2x5 2.54mm connector & 2.00mm pitch pin connector
- Vertical- 1 form-factor : 2x5 2.54mm pitch pin connector
- Complies with Microsoft Vista Ready-Boost® requirements
- Fixed disk type (not removable)
- Advanced error detection and error correction algorithms
- High-speed USB 2.0 interface; backward compatible with USB 1.1
- Horizontal: Capacities from 128MB up to 8GB
- Vertical: Capacities from 128MB up to 4GB
- Performance up to 32.0MB/sec

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

Temperature	Operating: Non-operating:	0°C ~ +70°C -20°C ~ +85°C
Humidity	Operating & Non-operating:	5% ~ 95% non-condensing
Vibration	Operating & Non-operating:	16.3G peak-to-peak maximum
Shock	Operating & Non-operating:	1,500 G maximum

2.2. System Power Requirements

Table 2: Power Requirement

DC Input Voltage (VCC) 100mV max. ripple(p-p)		Vertical (4GB)	Horizontal (8GB)
+5V Current (Maximum average value)	Sleeping Mode :	39 mA (Max.)	43 mA (Max.)
	Reading Mode :	113 mA (Max.)	114 mA (Max.)
	Writing Mode :	89 mA (Max.)	94 mA (Max.)

2.3. System Performance

Table 3: System Performances

Performance (KB/sec)	Sequent Speed (MB/Sec.)			
	Single Channel		Dual Channel	
	Read	Write	Read	Write
128MB	26.1	12.3	N/A	N/A
256MB	26.4	12.6	32.3	16.5
512MB	26.3	12.7	32.2	16.2
1GB	26.2	12.3	32.1	16.6
2GB	26.5	12.0	32.2	16.7
4GB	26.5	12.1	32.7	16.9
8GB	N/A	N/A	32.7	16.9

Note:

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

(2). The Max. Performance was tested by SiSoftware Sandra /File Benchmark

2.4. System Reliability

Table 4: System Reliability

MTBF	>1,000,000 hours
Data Reliability	<1 non-recoverable error in 10 ¹⁴ bits read <1 erroneous correction in 10 ²⁰ bits read
Wear-leveling Algorithms	Dynamic
ECC Technology	Enhanced management 8-bits per 512bytes 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 and see Figure 3 for USB Flash Disk physical specifications and dimensions.

Table 5: Physical Specifications

APRO Industrial USB Disk Module Horizontal Type – Standard Form factor (2.54mm pitch pin)	
Length:	38.0 mm
Width:	26.8 mm
Thickness:	9.1 mm
Weight:	10.0 g

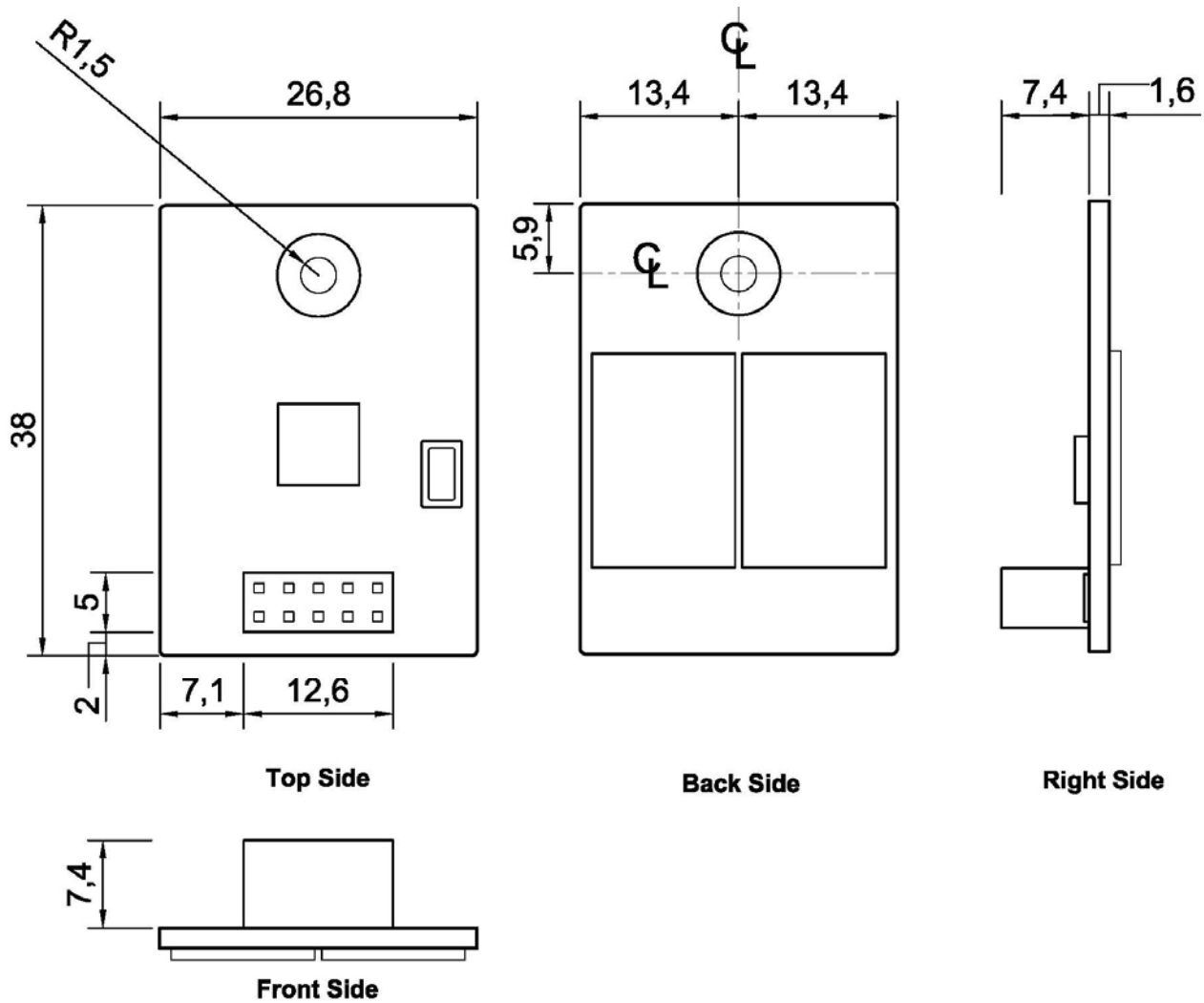


Figure 2: Industrial USB Disk Module Horizontal Type – Standard Form factor Dimension

APRO Industrial USB Disk Module Horizontal Type – Low profile Form factor (2.00mm pitch pin)

Length:	38.0 mm
Width:	26.8 mm
Thickness:	6.2 mm
Weight:	10.0 g

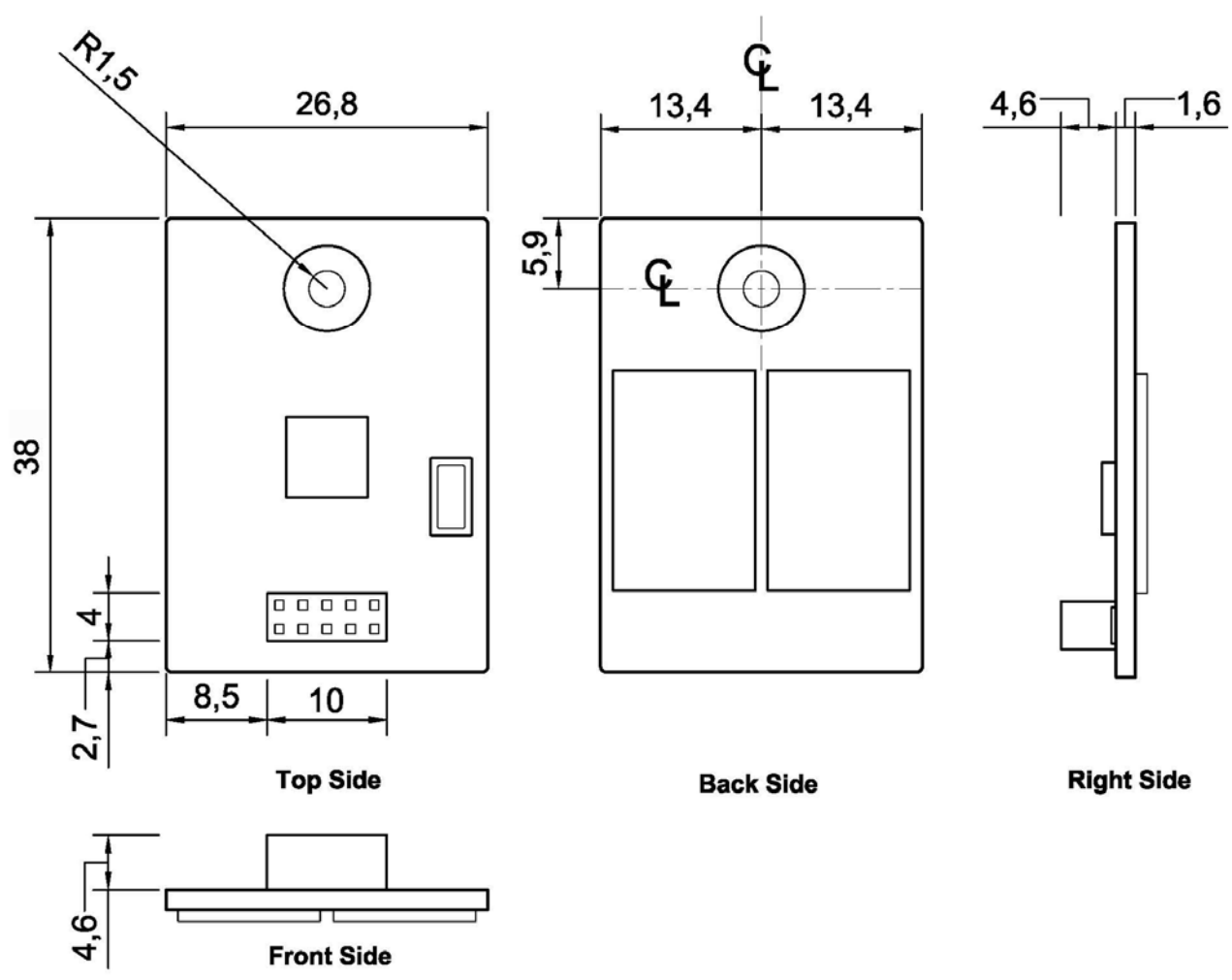


Figure 3: Industrial USB Disk Module Horizontal Type – Low Profile Form factor Dimension

APRO Industrial USB Disk Module Vertical Type Form factor (2.54mm pitch pin)

Length:	15.4 mm
Width:	34.2mm
Thickness:	6.3 mm
Weight:	15.0 g

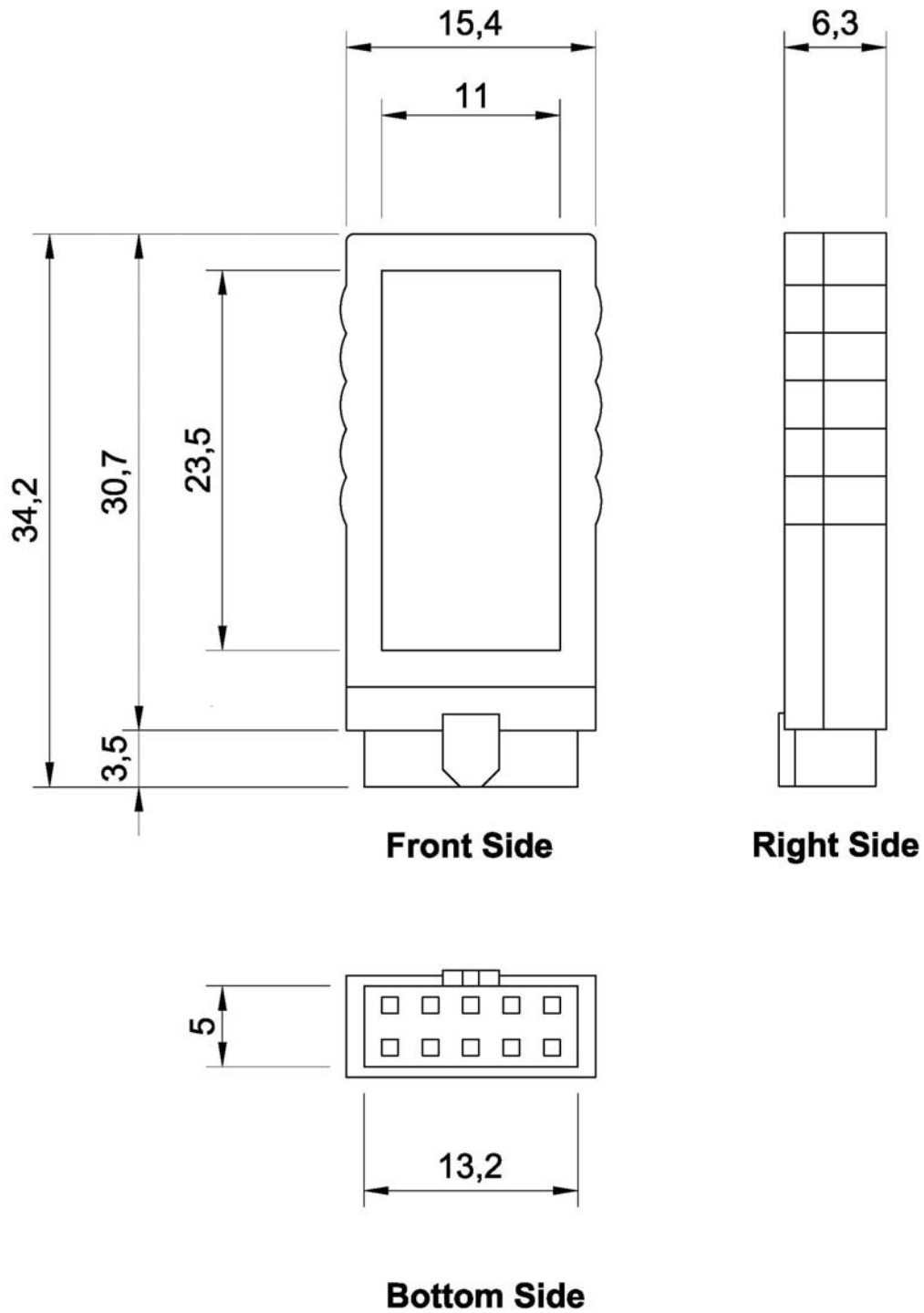


Figure 3: Industrial USB Disk Module Vertical Type Form factor Dimension

2.6. Capacity Specifications

Industrial micro USB Flash Disk Module (MUM) USB 2.0 Flash Disks built-in mainly Samsung NAND Type SLC Flash memory chips. The Table 6 shows the equipollent part number of applied Samsung Flash memory chips for each USB Flash Disk.

Table 6: USB Flash Disk Configuration vs. Samsung NAND SLC part number

Capacity	Samsung SLC Flash Memory Part Number * Q'TY	
	Vertical Type	Horizontal Type
128MB	K9F1G08U0A-PCB0 (1Gb) or equipollent * 1	K9F1G08U0A-PCB0 (1Gb) or equipollent * 1
256MB	K9F2G08U0A-PCB0 (2Gb) or equipollent * 1	K9F2G08U0A-PCB0 (2Gb) or equipollent * 1
512MB	K9F4G08U0M-PCB0 (4Gb) or equipollent * 1	K9F4G08U0M-PCB0 (4Gb) or equipollent * 1
1GB	K9K8G08U0M-PCB0 (8Gb) or equipollent * 1	K9K8G08U0M-PCB0 (8Gb) or equipollent * 1
2GB	K9WAG08U1M-PCB0 (16Gb) or equipollent *1	K9WAG08U1M-PCB0 (16Gb) or equipollent *1 K9K8G08U0M-PCB0 (8Gb) or equipollent * 2
4GB	K9WBG08U1M-PCB0 (32Gb) or equipollent *1	K9WBG08U1M-PCB0 (32Gb) or equipollent *1 K9WAG08U1M-PCB0 (16Gb) or equipollent *2
8GB	Not support 2 flashes	K9WBG08U1M-PCB0 (32Gb) or equipollent *2

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 8 Pin Assignments of USB 2.0

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

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 9 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	-55 to +95	°C
T _a	Operating Temperature	0 ~ +70	°C

4.2. Recommended Operating conditions

Table 10 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 11 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 Low-/full-speed	TBD		V	2
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 12 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 – Vertical Type			
Grade		Standard Grade 0°C ~ 70°C	Industrial Grade -40°C ~ 85°C
128MB		SPMUM128M – UBCSC–VS	WPMUMD128M – UBISI–VS
256MB		SPMUM256M – UBCSC–VS	WPMUMD256M – UBISI–VS
512MB		SPMUM512M – UBCSC–VS	WPMUMD512M – UBISI–VS
1GB		SPMUM001G – UBCSC–VS	WPMUMD001G – UBISI–VS
2GB		SPMUM002G – UBCSC–VS	WPMUMD002G – UBISI–VS
4GB		SPMUM004G – UBCSC–VS	WPMUMD004G – UBISI–VS

INDUSTRIAL micro USB Disk Module – Horizontal Type Standard Form Factor			
Grade		Standard Grade 0°C ~ 70°C	Industrial Grade -40°C ~ 85°C
128MB		SBMUM128M – UBCSC–HS	WPMUM128M – UBISI–HS
256MB		SBMUM256M – UBCSC–HS	WPMUM256M – UBISI–HS
512MB		SBMUM512M – UBCSC–HS	WPMUM512M – UBISI–HS
1GB		SBMUM001G – UBCSC–HS	WPMUM001G – UBISI–HS
2GB		SBMUM002G – UBCSC–HS	WPMUM002G – UBISI–HS
4GB		SBMUM004G – UBCSC–HS	WPMUM004G – UBISI–HS
8GB		SBMUM008G – UBCSC–HS	WPMUM008G – UBISI–HS

INDUSTRIAL micro USB Disk Module – Horizontal Type Low Profile Form Factor			
Grade		Standard Grade 0°C ~ 70°C	Industrial Grade -40°C ~ 85°C
128MB		SBMUM128M – UBCSC–HL	WPMUM128M – UBISI–HL
256MB		SBMUM256M – UBCSC–HL	WPMUM256M – UBISI–HL
512MB		SBMUM512M – UBCSC–HL	WPMUM512M – UBISI–HL
1GB		SBMUM001G – UBCSC–HL	WPMUM001G – UBISI–HL
2GB		SBMUM002G – UBCSC–HL	WPMUM002G – UBISI–HL
4GB		SBMUM004G – UBCSC–HL	WPMUM004G – UBISI–HL
8GB		SBMUM008G – UBCSC–HL	WPMUM008G – UBISI–HL

2. Part Number Decoder

X1 X2 X3 X4 X5 X6 X7 X8 X9 – **X11 X12 X13 X14 X15** – **X17 X18** – **C**
S P M U M 0 0 8 G – **U B C S C** – **V S** (–**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

P : With Plastic casing

X3 X4 X5 : Product category

MUM : micro USB 2.0 (Flash Disk) Module

X6 X7 X8 X9 : Capacity

128M: 128MB

256M: 256MB

512M: 512MB

001G: 1GB

002G: 2GB

004G: 4GB

008G: 8GB

X11 : Controller

U : USBest

X12 : Controller version

B : **UT165**

X13 : Controller Grade

C : Commercial grade

I : Industrial grade

X14 : Flash IC

S : Samsung NAND-SLC Flash IC

X15 : Flash IC grade / Type

C : Commercial grade

I : Industrial grade

X17 X18 : Product Form Factor

VS : Vertical Type Standard Form Factor

HS : Horizontal Type Standard Form Factor

HL : Horizontal Type Low Profile Form Factor

C : Reserved for specific requirement

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.

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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.