

Amtron Technology, Inc.

Industrial USB 2.0 Flash Drive UA Series Product Datasheet

Revision History

Revision	Description	Date
1.0	Initial release	2018-June-08
1.1	Revise Section 1.3.4 Block Diagram	2019-Feb-25

Table of Contents

1.	Introduction	5
1.1.	Description.....	5
1.2.	Product Features	5
1.3.	Flash Management.....	6
1.3.1.	Error Correction Code (ECC).....	6
1.3.2.	Wear Leveling.....	6
1.3.3.	Bad Block Management	6
1.3.4.	Block Diagram.....	6
2.	Product Specifications.....	7
3.	Environmental Specifications	8
3.1.	Environmental Conditions	8
3.1.1.	Temperature and Humidity	8
3.1.2.	Shock	9
3.1.3.	Vibration	9
3.1.4.	Drop	9
3.1.5.	Bending.....	9
3.1.6.	Torque	10
3.1.7.	Electrostatic Discharge (ESD).....	10
3.2.	Certification	10
4.	Electrical Specifications	11
4.1.	Absolute Maximum Rating.....	11
4.2.	Power Consumption.....	11
4.3.	DC Characteristic.....	12
4.4.	AC Characteristic.....	12
4.4.1.	Flash Memory Interface Timing	12
4.4.2.	Command Latch Cycle	13
4.4.3.	Address Latch Cycle.....	14
4.4.4.	Input Data Latch Cycle.....	14
4.4.5.	Sequential Out Cycle after Read (CLE=L, /WE=H, ALE=L).....	15
5.	Interface.....	16

5.1. Pin Assignment and Descriptions 16

6. Physical Dimension 16

7. Part Number Decoder..... 17

1. INTRODUCTION



1.1. Description

Amtron industrial grade UA series USB 2.0 flash drive (UFD2) is compatible with USB 1.1 / USB 2.0 specifications. In addition to being a removable and bootable flash disk, it can also be configured as a fixed drive for system recovery.

UA Series USB 2.0 SLC NAND flash drives are available in 128MB, 256MB, 512MB, 1GB, 2GB, 4GB and 8GB capacities.

1.2. Product Features

- **Capacity**
 - SLC: 128MB up to 8GB
- **Flash Interface**
 - Flash Type: SLC
- **Performance**
 - Read: up to 30 MB/s
 - Write: up to 27 MB/s
- **Power Consumption**¹
 - Read: 100mA
 - Write: 120mA
 - Idle mode: 30mA
 - Standby: 2.5mA
- **Other**
 - Metal housing
 - Disk usage status LED indicator
- **Advanced Flash Management**
 - Wear Leveling
 - Bad Block Management
 - ECC
 - SMART
- **MTBF:**
 - 3,000,000 hours (SLC)
- **Temperature Range**
 - Operation (Standard): 0°C ~ 70°C
 - Operation (Wide): -40°C ~ 85°C
 - Storage: -40°C ~ 85°C
- **Dynamics**
 - Vibration: 20G
 - Shock: 1500G
- **Compliant**
 - RoHS
 - CE & FCC

Notes:

1. Please see Section 4.2 Power Consumption for details.

1.3. Flash Management

1.3.1. Error Correction Code (ECC)

Flash memory cells deteriorate with use, which might generate random bit errors in the stored data. By applying the BCH ECC algorithm, the drive can detect and correct errors that occurred during the read process, ensuring that data have been read correctly and protecting data from corruption.

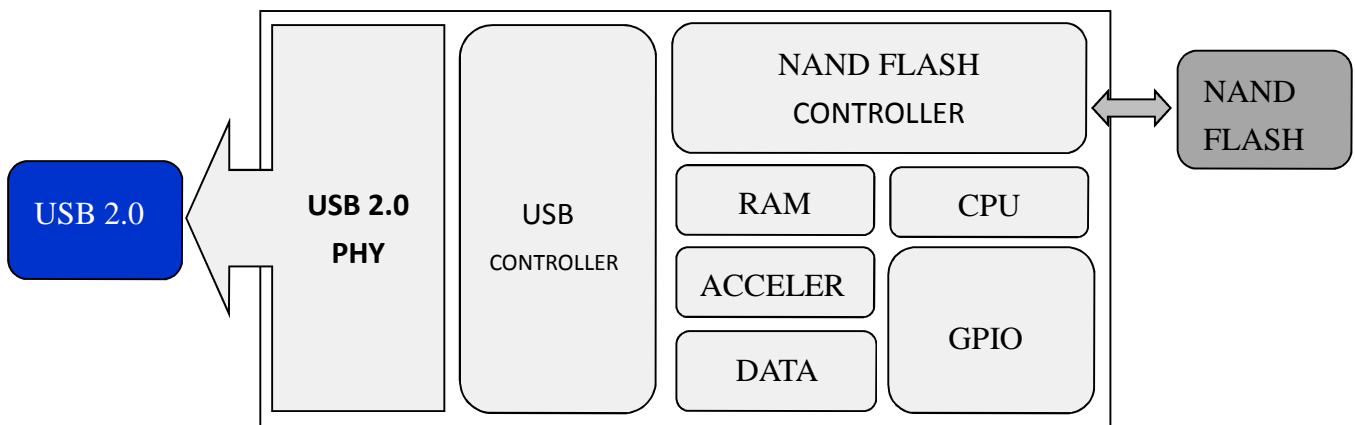
1.3.2. Wear Leveling

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 certain areas are updated more frequently than others, then the lifetime of the device would be reduced significantly. To address this problem, wear leveling technique is applied to extend the lifespan of NAND flash by evenly distributing write and erase cycles across the media. The Amtron UA Series USB Drives utilize advanced dynamic and static wear leveling algorithms that efficiently spreads out the flash usage, thus greatly improving the life expectancy of the NAND flash.

1.3.3. Bad Block Management

Bad blocks are flash memory blocks that contain one or more invalid bits, which undermine their reliability. Blocks identified and marked as bad by the factory are referred to as “initial bad blocks”, and bad blocks that are developed during the lifespan of the flash are named “later bad blocks”. Amtron implements an efficient bad block management algorithm to detect and manage both the “initial” and “later” bad blocks. This prevents data from being stored in these locations, thereby improving data reliability.

1.3.4. Block Diagram



2. PRODUCT SPECIFICATIONS



- **Capacity**
 - SLC: 128MB up to 8GB
- **Compatible with USB specification revision 1.1 and 2.0.**
- **Supports Windows 2000 SP4 and Windows XP without device driver.**
- **Supports Windows Vista and Windows 7 without device driver.**
- **Supports MAC OS X and later without device driver (USB 1.1 speed).**
- **Supports Linux Kernel ver 2.4.0 or above without device driver (USB 1.1 speed).**
- **Supports Linux Kernel ver 2.4.10 or above without device driver (USB 2.0 speed).**
- **Durable solid-state storage – data retention up to 10 years.**
- **No external power is required – DC 4.5V – 5.5V from USB port.**
- **Transfer rate for USB interface:**
 - High speed up to 480Mbits/sec for USB 2.0.
 - Full speed up to 12Mbits/sec for USB 1.1.
- **Low power consumption.**
- **Performance (MB/s):**

Capacity	Flash Structure	Sequential Read	Sequential Write
128MB	TSB TSOP SLC 24nm 1Gb*1	30 MB/s	5 MB/s
256MB	TSB TSOP SLC 24nm 2Gb*1	30 MB/s	10 MB/s
512MB	TSB TSOP SLC 24nm 4Gb*1	30 MB/s	20 MB/s
1GB	TSB TSOP SLC 24nm 8Gb*1	30 MB/s	20 MB/s
2GB	TSB TSOP SLC 24nm 16Gb*1	30 MB/s	20 MB/s
4GB	TSB TSOP SLC 24nm 32Gb*1	30 MB/s	25 MB/s
8GB	TSB TSOP SLC 24nm 64Gb*1	30 MB/s	27 MB/s

Notes:

- 1 The table above is for reference only. Performance may vary from flash configuration, DDR configuration, and platform.
- 2 Samples are made of Toshiba SLC NAND Flash.
- 3 The performance is obtained from CrystalDiskMark 5.0.2 x64 (C) (1000 MB).

3. ENVIRONMENTAL SPECIFICATIONS



3.1. Environmental Conditions

3.1.1. Temperature and Humidity

- Temperature:
 - ◆ Storage: -40°C to 85°C
 - ◆ Operational (Standard grade): 0°C to 70°C
 - ◆ Operational (Wide grade): -40°C to 85°C
- Humidity:
 - ◆ Standard grade: RH 90% under 40°C (operational)
 - ◆ Wide grade: RH 95% under 55°C (operational)

■ High Temperature Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	70°C	0% RH	72 hours
Operation (Wide)	85°C	0% RH	72 hours
Storage (Standard)	85°C	0% RH	72 hours
Storage (Wide)	85°C	0% RH	168 hours

Result: No abnormality is detected.

■ Low Temperature Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	0°C	0% RH	24 hours
Operation (Wide)	-40°C	0% RH	72 hours
Storage (Standard)	-40°C	0% RH	24 hours
Storage (Wide)	-40°C	0% RH	168 hours

Result: No abnormality is detected.

■ High Humidity Test Condition

	Temperature	Humidity	Test Time
Operation (Standard)	40°C	93% RH	4 hours
Operation (Wide)	55°C	95% RH	24 hours
Storage (Standard)	40°C	95% RH	48 hours
Storage (Wide)	55°C	95% RH	96 hours

Result: No abnormality is detected.

■ Temperature Cycle Test

	Temperature	Test Time	Cycle
Operation (Standard)	0°C	30 min	10 cycles
	70°C	30 min	
Operation (Wide)	-40°C	30 min	20 cycles
	85°C	30 min	
Storage (Standard)	-40°C	30 min	10 cycles
	85°C	30 min	
Storage (Wide)	-40°C	30 min	50 cycles
	85°C	30 min	

Result: No abnormality is detected.

3.1.2. Shock

■ Shock Specification

	Acceleration Force	Half Sin Pulse Duration	Number of Shocks
Non-operational	1500G	0.5ms	6 faces, 5 times each

Result: No abnormality is detected when power on.

3.1.3. Vibration

■ Vibration Specification

	Condition		Vibration Orientation
	Frequency/Displacement	Frequency/Acceleration	
Non-operational	20Hz~80Hz/1.52mm	80Hz~2000Hz/20G	X, Y, Z axis/30 min for each

Result: No abnormality is detected when power on.

3.1.4. Drop

■ Drop Specification

	Height of Drop	Number of Drop
Non-operational	110cm free fall	6 face of each unit

Result: No abnormality is detected when power on.

3.1.5. Bending

■ Bending Specification

	Force	Action
Non-operational	≥ 10N	Hold 1min/5 times

Result: No abnormality is detected when power on.

3.1.6. Torque

■ **Torque Specification**

	Force	Action
Non-operational	0.5 N-m or ±5 deg	Hold 30s/5times

Result: No abnormality is detected when power on.

3.1.7. Electrostatic Discharge (ESD)

■ **Contact ESD Specification**

Device	Capacity	Temperature	Relative Humidity	+/- 8KV	Result
UFD2-UA	1GB	24.0°C	49% (RH)	No degradation of performance or loss of function.	PASS

3.2. Certification

- RoHS
- CE / FCC

4. ELECTRICAL SPECIFICATIONS



4.1. Absolute Maximum Rating

Symbol	Parameter	MIN	MAX	Unit
V_{DD}, V_{SS}	DC Power Supply	-0.3	+5.5	V
V_{in}	Input Voltage	$V_{SS} - 0.3$	$V_{DD} + 0.3$	V
T_a	Operating Temperature	0	+70	°C
T_{st}	Storage Temperature	-25	+85	°C

Parameter	Symbol	MIN	Typ	MAX	Unit
Operating Temperature	T_a	0	+25	+70	°C
V_{DD}	V_{DD}	3.0	3.3	3.6	V
Voltage		4.5	5.0	5.5	V

4.2. Power Consumption

Capacity	Flash Structure	Power Consumption (mA)			
		Read	Write	Idle	Standby
128MB	TSB TSOP SLC 24nm 1Gb*1	80	90	25	2.5
256MB	TSB TSOP SLC 24nm 2Gb*1	85	95	25	2.5
512MB	TSB TSOP SLC 24nm 4Gb*1	85	95	25	2.5
1GB	TSB TSOP SLC 24nm 8Gb*1	85	95	25	2.5
2GB	TSB TSOP SLC 24nm 16Gb*1	90	100	25	2.5
4GB	TSB TSOP SLC 24nm 32Gb*1	90	100	30	2.5
8GB	TSB TSOP SLC 24nm 64Gb*1	100	120	30	2.5

Unit: mA

NOTES:

1. Samples are made of Toshiba SLC NAND Flash.
2. Power Consumption may vary from flash configuration, DDR configuration, or platform.

4.3. DC Characteristic

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
V _{CCK}	Core Power Supply	Core Area	1.16	1.23	1.30	V
V _{CC3IO}	Power Supply	3.3V I/O	3.15	3.30	3.45	V
Temp	Junction Temperature		-40	25	125	°C
V _t	Switching threshold	LVTTTL		1.5		V
V _{t-}	Schmitt Trigger Negative Going threshold voltage	LVTTTL	0.8	1.1		V
V _{t+}	Schmitt Trigger Positive Going threshold voltage			1.6	2.0	V
V _{ol}	Output Low voltage	I _{ol} = 2 ~ 16 mA			0.4	V
V _{oh}	Output High voltage	I _{oh} = 2 ~ 16 mA	V _{CC3IO} - 0.4			V
R _{pu}	Input Pull-Up Resistance	PU=high, PD=low	40	75	190	KΩ
R _{pd}	Input Pull-Down Resistance	PU=low, PD=high	40	75	190	KΩ
I _{in}	Input Leakage Current	V _{in} = V _{CC3I} or 0			10	μA
I _{oz}	Tri-state Output Leakage Current		-10	±1	10	μA

4.4. AC Characteristic

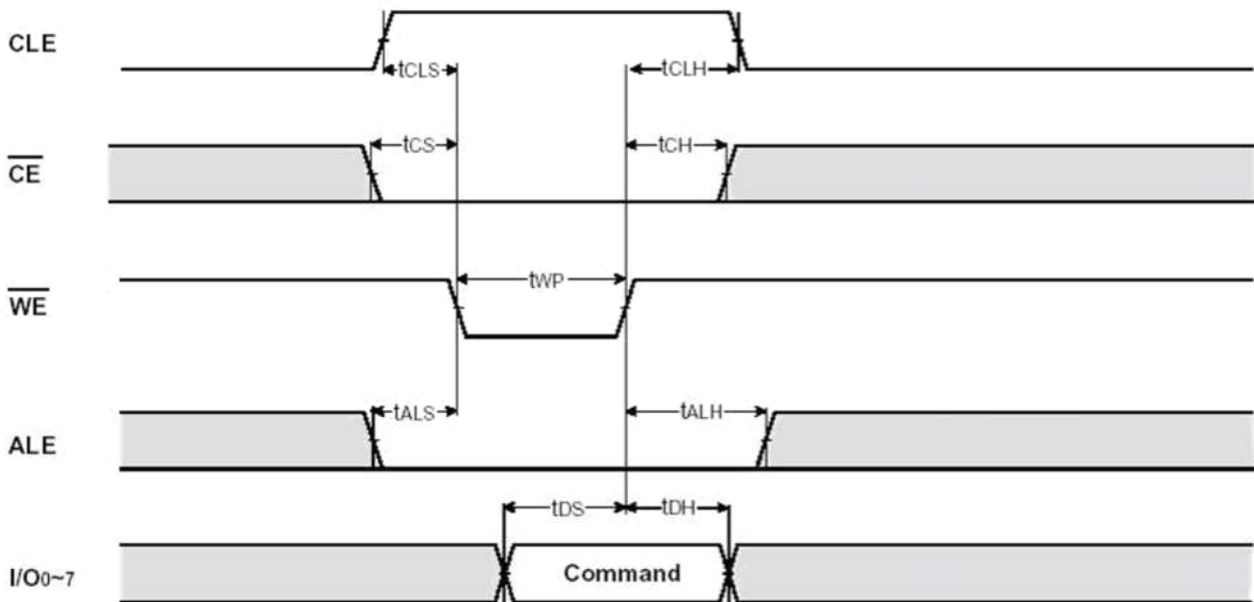
4.4.1. Flash Memory Interface Timing

Information below is for reference and example use only. For the actual timing, please refer to the related flash spec.

Parameter	Symbol	Min	Max	Unit
CLE Set-up Time	t _{CLS}	0	-	ns
CLE Hold Time	t _{CLH}	10	-	ns
CE Setup Time	t _{CS}	0	-	ns
CE Hold Time	t _{CH}	10	-	ns
WE Pulse Width	t _{WP}	25	-	ns

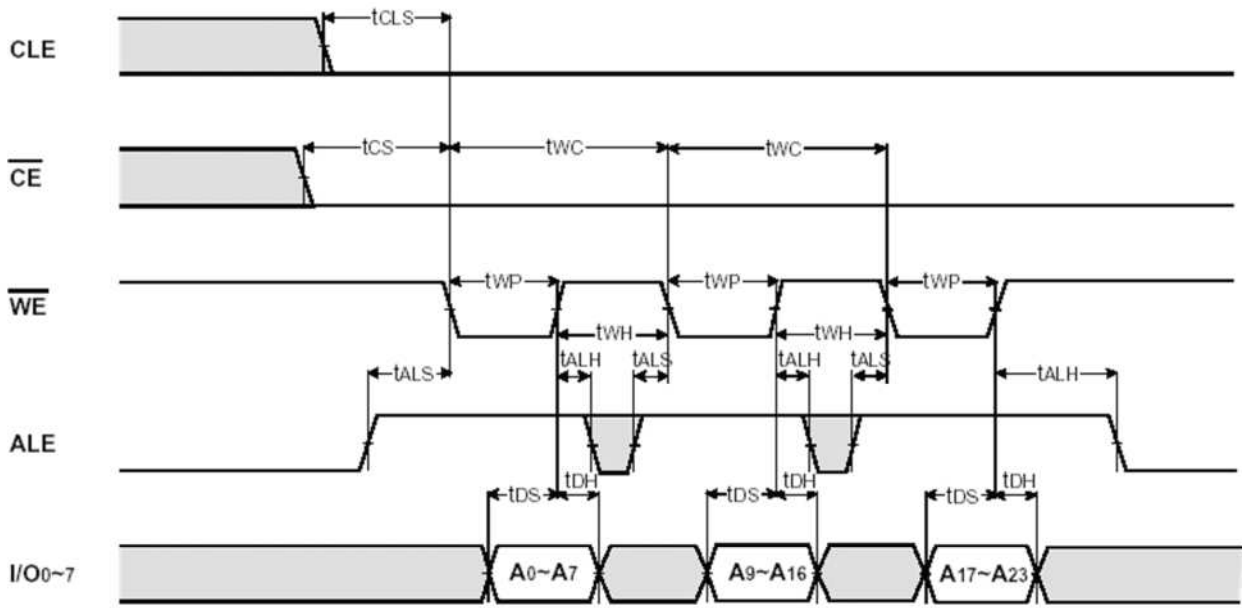
ALE Setup Time	t_{ALS}	0	-	ns
ALE Hold Time	t_{ALH}	10	-	ns
Data Setup Time	t_{DS}	20	-	ns
Data Hold Time	t_{DH}	10	-	ns
Write Cycle Time	t_{WC}	45	-	ns
WE High Hold Time	t_{WH}	15	-	ns
Read Cycle Time	t_{RC}	50	-	ns
/RE Pulse Width	t_{RP}	25	-	ns
/RE High Hold Time	t_{REH}	15	-	ns
Ready to /RE Low	t_{RR}	60	-	ns

4.4.2. Command Latch Cycle



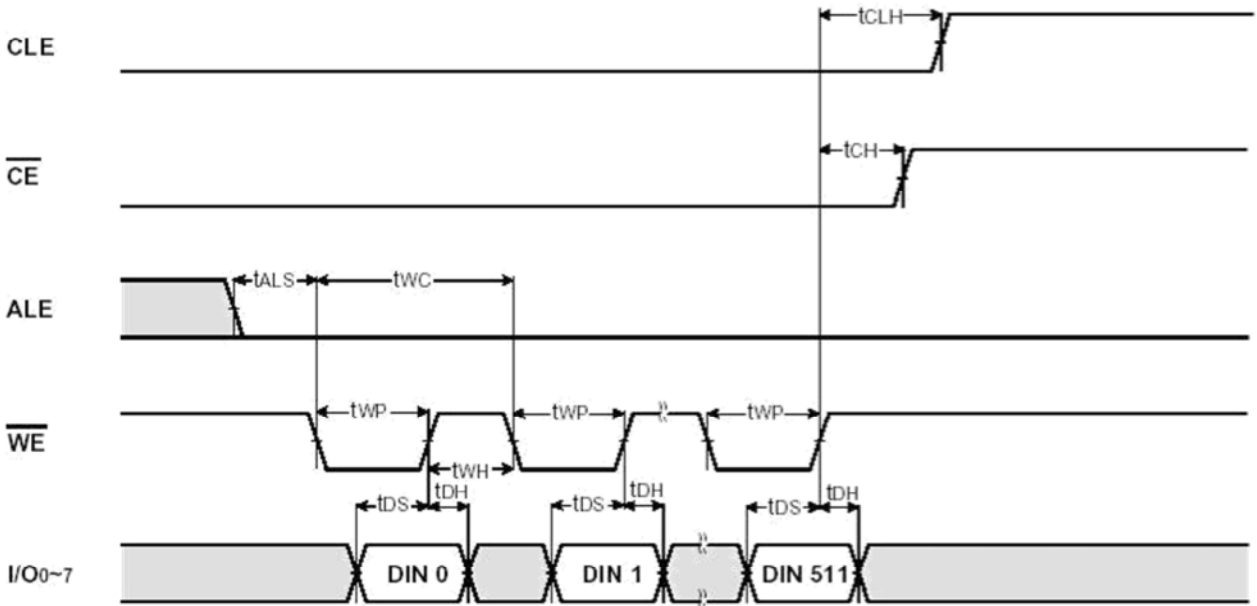
Command Latch Cycle

4.4.3. Address Latch Cycle



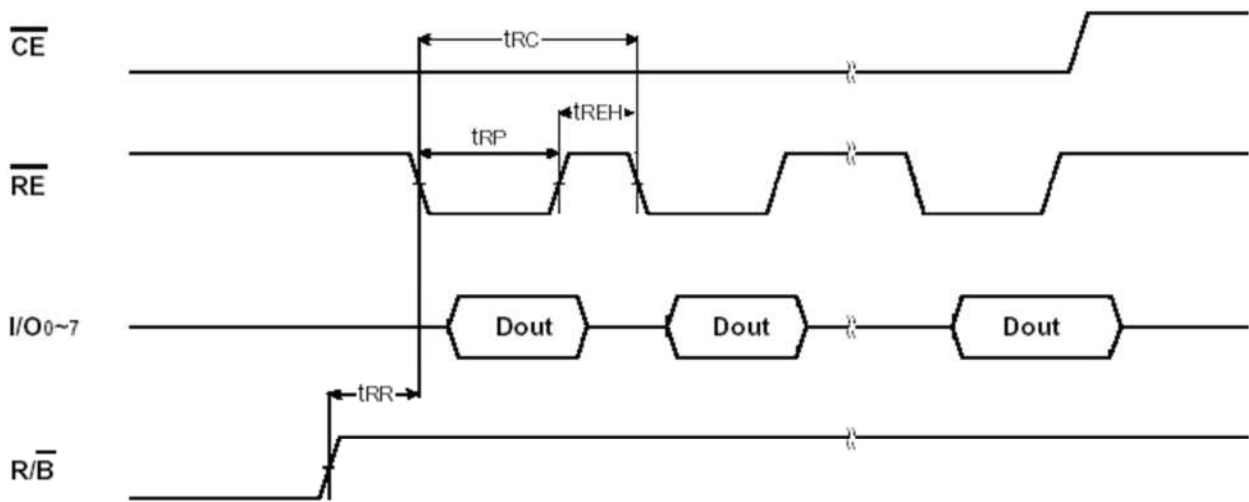
Address Latch Cycle

4.4.4. Input Data Latch Cycle



Input Data Latch Cycle

4.4.5. Sequential Out Cycle after Read (CLE=L, /WE=H, ALE=L)

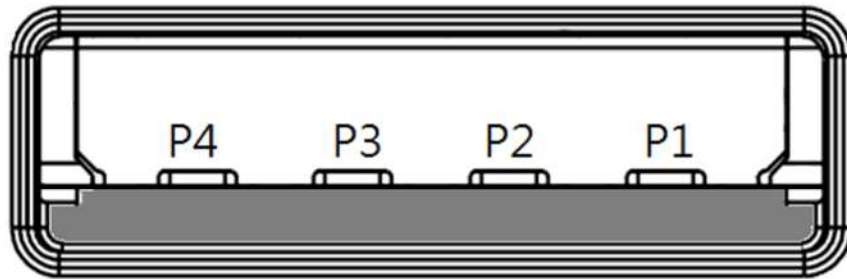


Sequential Out Cycle after Read (CLE=L, /WE=H, ALE=L)

5. INTERFACE

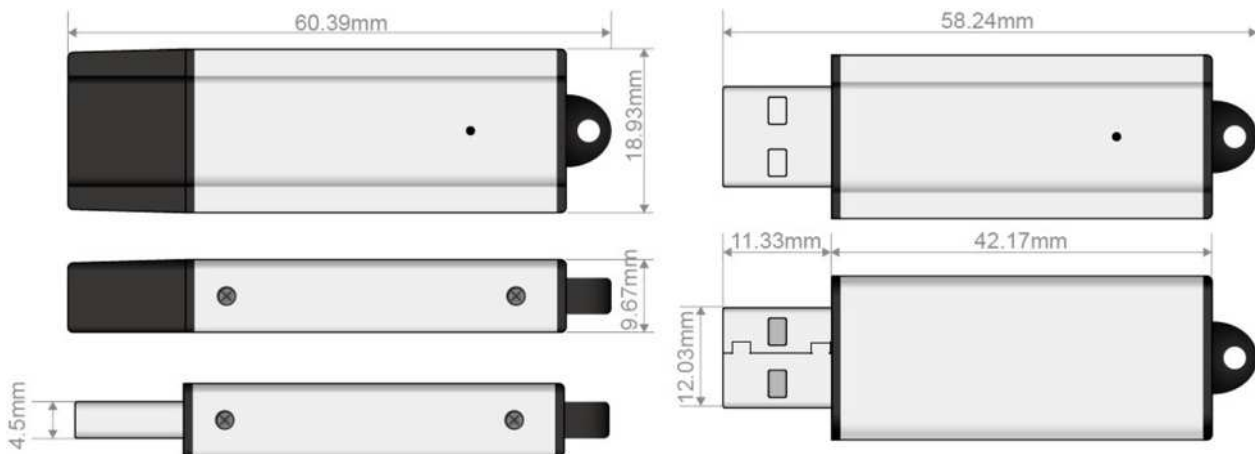


5.1. Pin Assignment and Descriptions



Pin Number	Type	Function
P1	V _{BUS}	5.0V USB Bus Power Input
P2	D-	USB 2.0 data in negative pin terminal.
P3	D+	USB 2.0 data in positive pin terminal.
P4	GND	Ground

6. PHYSICAL DIMENSION



7. PART NUMBER DECODER



U F D 2 - U A X¹ X² X³ X⁴ X⁵ X⁶ X⁷

		X ¹ X ² X ³ X ⁴ X ⁵	X ⁶	X ⁷
UFD2	UA	128MB 256MB 512MB 001GB 002GB 004GB 008GB	C: SLC (0°C ~ +70°C) I: SLC (-40°C ~ +85°C)	F: Fixed R: Removable