

Amtron Technology, Inc.

Industrial Grade USB Flash Module AA Series Product Datasheet

V1.0

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1. INTRODUCTION



1.1. General Description

Amtron industrial grade AA series flash module is designed for industrial and embedded applications. The device is fully compliant with high speed USB 2.0 specifications. These USB flash modules are available with housing and without housing options, as well as fixed disk and removable disk configurations.

Amtron AA series USB flash modules are available in a wide range from 1GB up to 8GB (SLC) and 8GB up to 64GB (MLC).

1.2. Product Features

- SLC / MLC NAND flash ICs
- RoHS compliant [Lead free]
- Compliant with USB Specification 2.0 and 1.1
- High speed:
Read: 35 MB/s max., Write: 35 MB/s max.
- Endure severe thermal and dynamic environments
 - Operation Temperature (Wide grade): -40°C to 85°C
 - Shock: 1500g
 - Vibration: 20g
- Very low power consumption
- Support S.M.A.R.T. Command
- Controlled Bill of Materials (BOM)

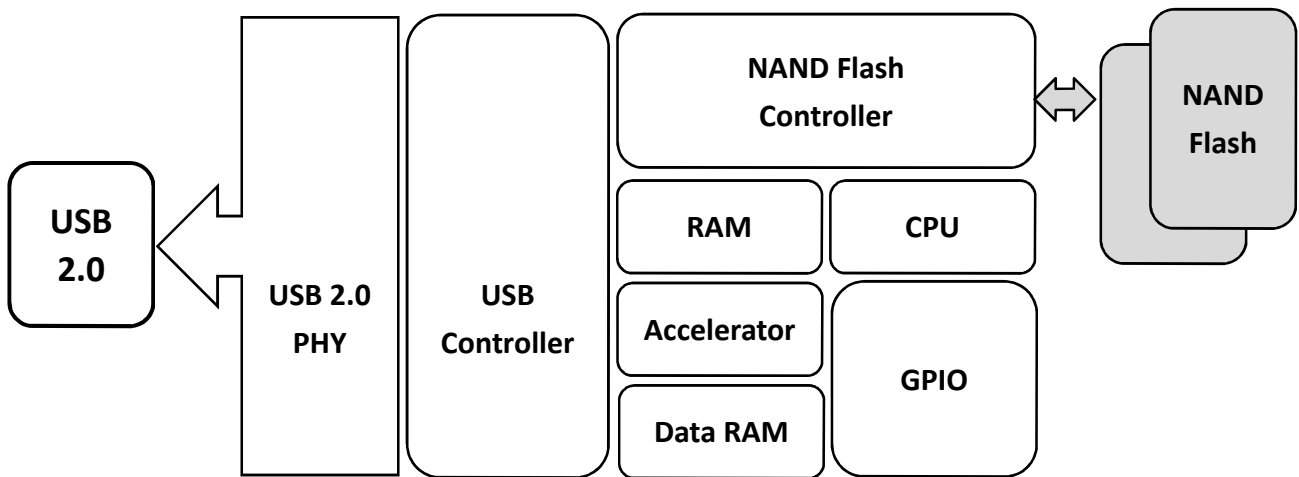
1.3. Product Overview

- **USB Interface**
 - USB Specifications 2.0 and 1.1
- **Flash Interface**
 - Flash Type: SLC, MLC
- **Capacity**
 - SLC: 1GB to 8GB
 - MLC: 8GB to 64GB
- **Performance**
 - Read up to 35 MB/s
 - Write up to 35 MB/s
- **Power Consumption**¹
 - Active mode: < 450 mW
 - Idle mode: < 300 mW
- **Advanced Flash Management**
 - Bad Block Management
 - ECC
 - Wear Leveling
- **Temperature Range**
 - Operation (Standard): 0°C to 70°C
 - Operation (Wide): -40°C to 85°C
 - Storage: -40°C to 85°C
- **Compliant**
 - RoHS
 - CE & FCC

Notes:

1. Please see Section 4.2 “Power Consumption” for details.

1.4. Block Diagram

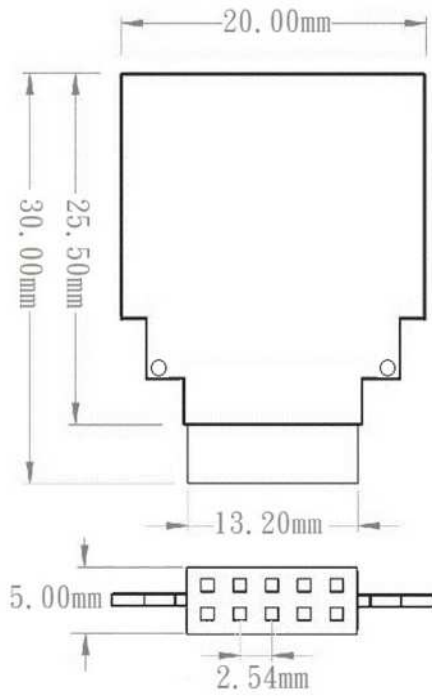


USB Flash Module Block Diagram

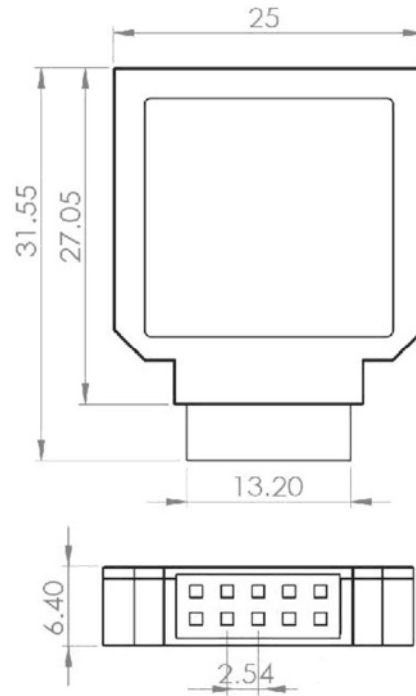
2. PRODUCT SPECIFICATIONS



2.1. Product Dimension



Without Housing



With Housing

2.2. Capacity and Performance

- **Capacity**
 - SLC: 1GB up to 8GB
 - MLC: 8GB up to 64GB
- Compatible with USB specification revision 1.1 and 2.0.
- Support Windows 2000 SP4 and Windows XP without device driver.
- Support Windows Vista and Windows 7 without device driver.
- Support MAC OS X and later without device driver (USB 1.1 speed).
- Support Linux Kernel ver 2.4.0 or above without device driver (USB 1.1 speed).
- Support Linux Kernel ver 2.4.10 or above without device driver (USB 2.0 speed).
- Durable solid-state storage – data retention up to ten 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.

- **Performance**

- **SLC**

Capacity	Flash Structure	Flash Type	Sequential	
			Read (MB/s)	Write (MB/s)
1GB	1GB x 1	24nm, TSOP	30	20
2GB	2GB x 1	32nm, TSOP	30	25
4GB	4GB x 1	24nm, TSOP	35	30
8GB	8GB x 1	24nm, TSOP	35	35

- **MLC**

Capacity	Flash Structure	Flash Type	Sequential	
			Read (MB/s)	Write (MB/s)
8GB	8GB x 1	15nm, TSOP	35	25
16GB	16GB x 1	15nm, TSOP	35	25
32GB	32GB x 1	15nm, BGA	35	30
64GB	64GB x 1	15nm, BGA	35	35

2.3. Compliance

- USB Specifications 2.0 & 1.1

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 93% 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	72 hours
Operation (Wide)	-40°C	0% RH	72 hours
Storage (Standard)	-40°C	0% RH	72 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	24 hours
Operation (Wide)	55°C	95% RH	72 hours
Storage (Standard)	40°C	95% RH	72 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
Non-Operational	1500G	0.5ms
Operational	1500G	0.5ms

Result: No abnormality is detected when power on.

3.1.3. Vibration

■ Vibration Specification

	Condition		Vibration Orientation
	Frequency/Displacement	Frequency/Acceleration	
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 1 min/5 times

Result: No abnormality is detected when power on.

3.1.6. Torque

	Force	Action
Non-operational	0.5N-m or 5 deg	Hold 1 min/5 times

Result: No abnormality is detected when power on.

3.1.7. Electrostatic Discharge (ESD)

■ Contact ESD Specification

Device	Capacity	Temperature	Relative Humidity	+/- 4KV	Result
USB Module	64GB	24.0°C	49% (RH)	Device functions are affected, but EUT will be back to its normal or operational state automatically.	PASS

3.2. Certification

- RoHS
- CE / FCC

4. ELECTRICAL SPECIFICATIONS



4.1. Absolute Maximum Rating

Item	Symbol	Parameter	MIN	MAX	Unit
1	VDD-VSS	DC Power Supply	-0.3	+5.5	V
2	VIN	Input Voltage	VSS-0.3	VDD+0.3	V
3	Ta	Operating Temperature	0	+70	°C
4	Tst	Storage Temperature	-25	+85	°C

Parameter	Symbol	Min	Typ	MAX	Unit
Operating Temperature	Ta	0	+25	+70	°C
VDD Voltage	VDD	3.0	3.3	3.6	V
		4.5	5.0	5.5	V

4.2. Power Consumption

Read (max.)	Write (max.)	Idle (max.)
450	450	300

Unit: mW

NOTES:

1. Samples are made of Toshiba 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 _{CC}	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	LVTTL		1.5		V
V _{t-}	Schmitt Trigger Negative Going threshold voltage	LVTTL	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

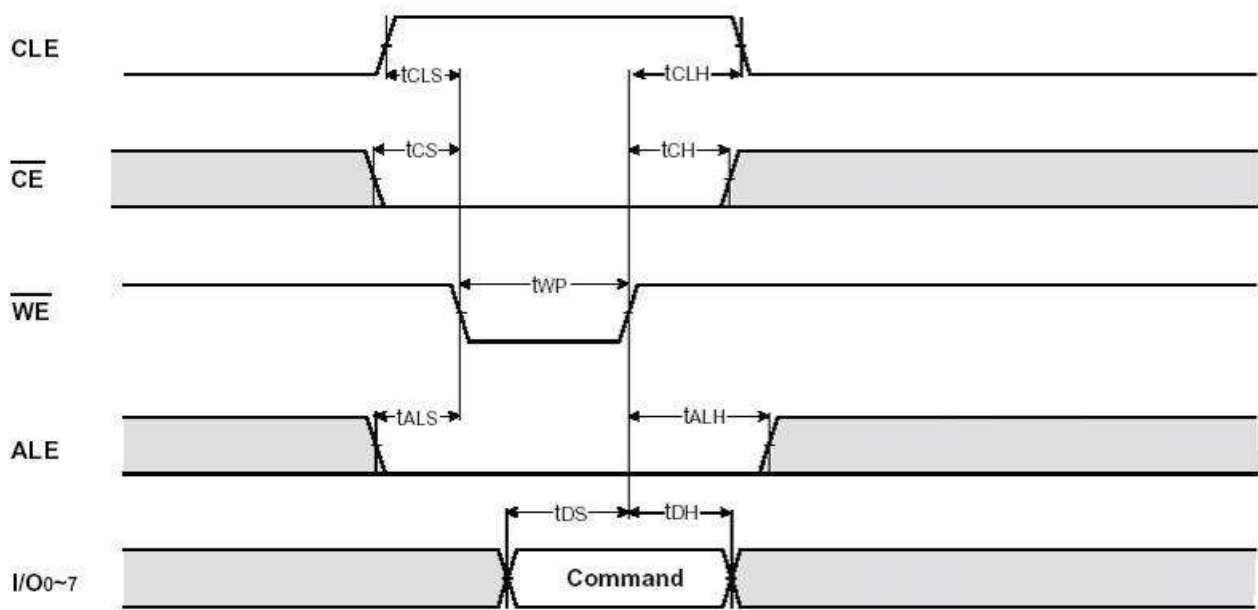
4.4. AC Characteristic

4.4.1. Flash Memory Interface Timing

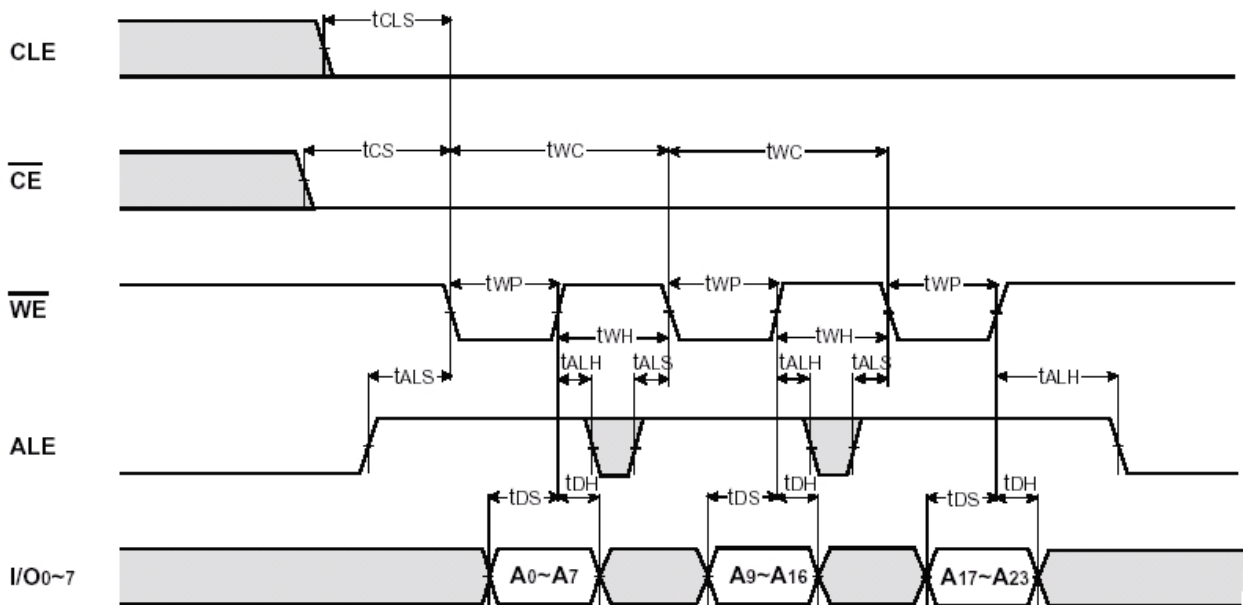
Below information are for reference and example use only. The actual timing, please refer to the related flash spec.

Parameter	Symbol	Min	Max	Unit
CLE Set-up Time	tCLS	0	-	ns
CLE Hold Time	tCLH	10	-	ns
CE Setup Time	tCS	0	-	ns
CE Hold Time	tCH	10	-	ns
WE Pulse Width	tWP	25	-	ns
ALE Setup Time	tALS	0	-	ns
ALE Hold Time	tALH	10	-	ns
Data Setup Time	tDS	20	-	ns
Data Hold Time	tDH	10	-	ns
Write Cycle Time	tWC	45	-	ns
WE High Hold Time	tWH	15	-	ns
Read Cycle Time	tRC	50	-	ns
/RE Pulse Width	tRP	25	-	ns
/RE High Hold Time	tREH	15	-	ns
Ready to /RE Low	tRR	60	-	ns

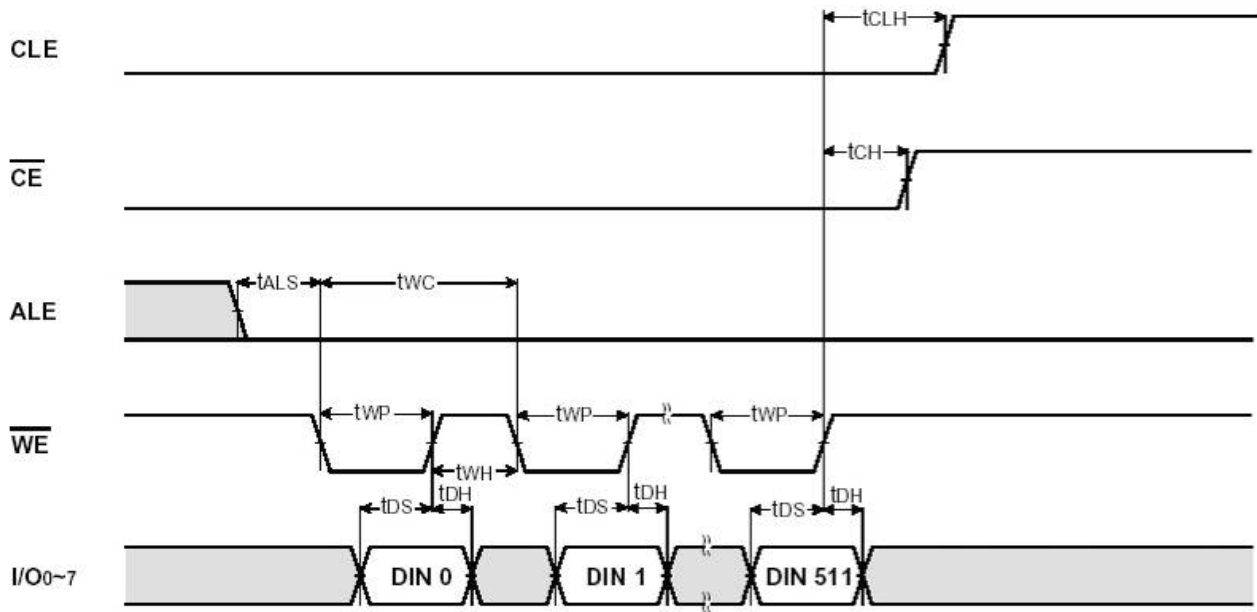
4.4.2. Command Latch Cycle



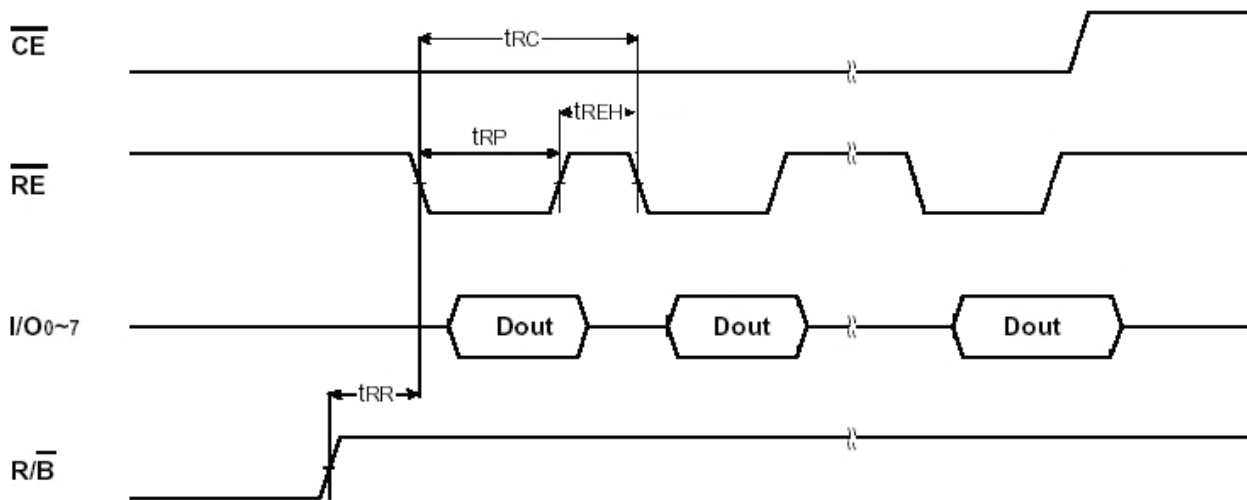
4.4.3. Address Latch Cycle



4.4.4. Input Data Latch Cycle



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



5. INTERFACE



5.1. USB Pin Header Description

USB Pin Header Description – Type D		
No.	Pin Name	Pin Description
1	VCC	5.0V USB Bus Power Input
2	NC	No Connection
3	DM	USB 2.0 data in negative pin terminal.
4	NC	No Connection
5	DP	USB 2.0 data in positive pin terminal.
6	NC	No Connection
7	GND	0V regulator ground reference input.
8	NC	No Connection
9	NC	No Connection
10	NC	No Connection

6. PART NUMBER DECODER



UFM- X¹AAX²X³X⁴X⁵X⁶X⁷

Item	Housing	Series	Capacity (Byte)	NAND Flash	Mode
	X ¹		X ² X ³ X ⁴ X ⁵	X ⁶	X ⁷
UFM	V : without housing U : with housing	AA	001G 002G 004G 008G 016G 032G 064G	C : SLC (0°C to +70°C) I : SLC (-40°C to +85°C) K : MLC (0°C to +70°C) M : MLC (-40°C to +85°C)	F : Fix Disk R : Removable Disk