

Amtron Technology, Inc.

PCMCIA ATA Flash Card

Product Specification

Version 3.2

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A. Product Information

The ATA Card is solid-state design and IDE compatible.

It is an ideal replacement for standard IDE hard disks.

It's a solid-state design offers no seek errors even under extreme shock and vibration conditions. The ATA Card is extremely small and highly suitable for rugged environments, thus providing an excellent solution for mobile applications with space limitations.

It is fully compatible with all consumer applications designed for data storage PC card, PDA, and Smart Cellular Phones, allowing simple use for the end user. The ATA Card is O/S independent, thus offering an optimal solution for embedded systems operating in non-standard computing environments. The ATA Card is IDE compatible and offering various capacities. It has low power consumption and can operate from a single 3.3/5.0 Volt power supply. The ATA Card provides memory storage for mobile computing applications, consumer electronics and embedded systems. It is fully compatible with existing systems.

B. System Features

- ATA/True IDE Mode compatible.
- High reliability assured based on the internal Error Correcting Code (ECC) function.
- Operating modes supports PC Card Memory Mode, PC Card I/O Mode and True-IDE Mode
- Reliable Wear-leveling algorithm to ensure the best of flash endurance.
- Auto Standby and Sleep Mode Supported.
- Excellent performance Supporting Ultra DMA Mode.
- Very low power consumption.
- Very high performance and high reliability.
- Rugged environment is working well.
- Automatic error correction and retry capabilities.
- +5 Volts or +3.3 Volts $\pm 5\%$ operation.
- Supports power down commands and Auto Stand-by / Sleep Mode.
- Capacity supported: 128MB, 256MB, 512MB, 1GB, 2GB, 4GB, 8GB, 16GB and 32GB

C. Specifications

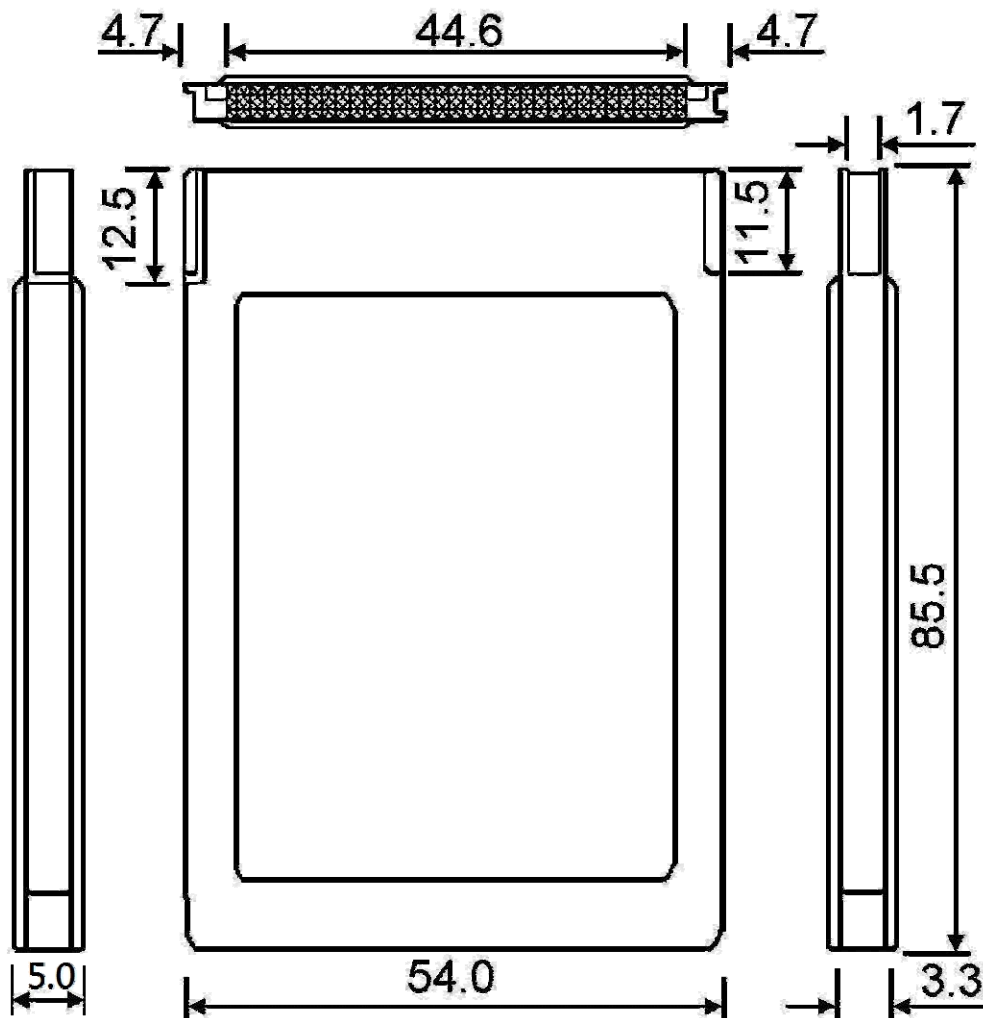
System Performance		
Data Transfer Mode	PIO Mode 4 or UDMA Mode 4	
Sequential Read	20Mbytes / sec Max.	
Sequential Write	19Mbytes / sec Max.	
Average Access Time	2ms (estimated)	
Environmental Specification		
Standard Temperature	Operation	0°C ~ +70°C
	Non-operation	-20°C ~ +80°C
Wide Temperature	Operation	-40°C ~ +85°C
	Non-operation	-50°C ~ +95°C
Vibration	Operation max	20 G
	Non-operation max	20 G
Humidity	Operation max	5~95% non-condensing
	Non-operation max	5~95% non-condensing
Shock	Operation max	1500 G
	Non-operation max	1500 G
Reliability		
MainTimeBetweenFailure	> 2,000,000 hours	
Error Code Correction	8 bits ECC Code	
Endurance	Greater than 2,000,000 cycles logically contributed by Wear-leveling and advanced bad sector management algorithms	
Data Reliability	< 1 non-recoverable error 10 ¹⁴ bits read	
Data Retention	10 years	
Power Consumption		
Power Voltage	+3.3V ± 5%	+5V ± 10%
Read	57.7mA(Typ.)	57.7mA(Typ.)
Write	60mA(Typ.)	60mA(Typ.)
Sleep Mode	2.3mA(Typ.)	2.3mA(Typ.)

D. Physical Specifications

D.1 Physical Specifications

<i>PCMCIA-ATA Flash Card</i>	
Length:	85.5 ± 0.1 mm
Width:	54.4 ± 0.1 mm
Thickness:	5.0 ± 0.1 mm
Weight:	28.6 g (1.00 oz) maximum

D.2 Dimension



E. Pin Assignments and Signal Descriptions

E.1 Pin Assignments

PC Card Memory Mode			PC Card I/O Mode			True IDE Mode		
Pin No.	Signal Name	Pin Type	Pin No.	Signal Name	Pin Type	Pin No.	Signal Name	Pin Type
1	GND	Ground	1	GND	Ground	1	GND	Ground
2	D3	I/O	2	D3	I/O	2	D3	I/O
3	D4	I/O	3	D4	I/O	3	D4	I/O
4	D5	I/O	4	D5	I/O	4	D5	I/O
5	D6	I/O	5	D6	I/O	5	D6	I/O
6	D7	I/O	6	D7	I/O	6	D7	I/O
7	CE1#	I	7	CE1#	I	7	CS0#	I
8	A10	I	8	A10	I	8	A10 ²	I
9	OE#	I	9	OE#	I	9	OE#	I
10	NC	-	10	NC	-	10	NC	-
11	A9	I	11	A9	I	11	A9 ²	I
12	A8	I	12	A8	I	12	A8 ²	I
13	NC	-	13	NC	-	13	NC	-
14	NC	-	14	NC	-	14	NC	-
15	WE#	I	15	WE#	I	15	WE# ³	I
16	RDY/BSY#	O	16	IREQ#	O	16	INTRQ	O
17	VCC	Power	17	VCC	Power	17	VCC	Power
18	NC	-	18	NC	-	18	NC	-
19	NC	-	19	NC	-	19	NC	-
20	NC	-	20	NC	-	20	NC	-
21	NC	-	21	NC	-	21	NC	-
22	A7	I	22	A7	I	22	A7 ²	I
23	A6	I	23	A6	I	23	A6 ²	I
24	A5	I	24	A5	I	24	A5 ²	I
25	A4	I	25	A4	I	25	A4 ²	I
26	A3	I	26	A3	I	26	A3 ²	I
27	A2	I	27	A2	I	27	A2	I
28	A1	I	28	A1	I	28	A1	I
29	A0	I	29	A0	I	29	A0	I
30	D0	I/O	30	D0	I/O	30	D0	I/O
31	D1	I/O	31	D1	I/O	31	D1	I/O
32	D2	I/O	32	D2	I/O	32	D2	I/O
33	WP	O	33	IOIS16#	O	33	IOCS16#	O
34	GND	Ground	34	GND	Ground	34	GND	Ground
35	GND	Ground	35	GND	Ground	35	GND	Ground
Pin	Signal	Pin	Pin	Signal	Pin	Pin	Signal	Pin

No.	Name	Type	No.	Name	Type	No.	Name	Type
36	CD1#	O	36	CD1#	O	36	CD1#	O
37	D11 ¹	I/O	37	D11 ¹	I/O	37	D11 ¹	I/O
38	D12 ¹	I/O	38	D12 ¹	I/O	38	D12 ¹	I/O
39	D13 ¹	I/O	39	D13 ¹	I/O	39	D13 ¹	I/O
40	D14 ¹	I/O	40	D14 ¹	I/O	40	D14 ¹	I/O
41	D15 ¹	I/O	41	D15 ¹	I/O	41	D15 ¹	I/O
42	CE2# ¹	I	42	CE2# ¹	I	42	CS1# ¹	I
43	VS1#	O	43	VS1#	O	43	VS1#	O
44	IORD#	I	44	IORD#	I	44	IORD	I
45	IOWR#	I	45	IOWR#	I	45	IOWR	I
46	NC	-	46	NC	-	46	NC	-
47	NC	-	47	NC	-	47	NC	-
48	NC	-	48	NC	-	48	NC	-
49	NC	-	49	NC	-	49	NC	-
50	NC	-	50	NC	-	50	NC	-
51	VCC	Power	51	VCC	Power	51	VCC	Power
52	NC	-	52	NC	-	52	VPP	-
53	NC	-	53	NC	-	53	NC	-
54	NC	-	54	NC	-	54	NC	-
55	NC	-	55	NC	-	55	NC	-
56	NC	-	56	NC	-	56	CSEL#	-
57	VS2#	O	57	VS2#	O	57	VS2#	O
58	RESET	I	58	RESET	I	58	RESET#	I
59	WAIT#	O	59	WAIT#	O	59	IORDY	O
60	INPACK#	O	60	INPACK#	O	60	DREQ	O
61	REG#	I	61	REG#	I	61	DMACK	I
62	BVD2	I/O	62	SPKR#	I/O	62	DASP#	I/O
63	BVD1	I/O	63	STSCHG#	I/O	63	PDIAG#	I/O
64	D8 ¹	I/O	64	D8 ¹	I/O	64	D8 ¹	I/O
65	D9 ¹	I/O	65	D9 ¹	I/O	65	D9 ¹	I/O
66	D10 ¹	I/O	66	D10 ¹	I/O	66	D10 ¹	I/O
67	CD2#	O	67	CD2#	O	67	CD2#	O
68	GND	Ground	68	GND	Ground	68	GND	Ground

Note:

1. Signals marked with an asterisk are required for 16-bit access, not required when installed in 8-bit systems.
2. Should be grounded by the host.

E.2 Signal Descriptions

Signal Name	Mode of operation	Pin Type	Pin No(s).	Description
CD1#, CD2#		O	36, 67	Card Detect Outputs
	PC Card Memory Mode			These Card Detect pins are connected to ground on the PC Card. They are used by the host to determine that the PC Card is fully inserted into the socket.
	PC Card I/O Mode			This signal is same in this mode.
	True IDE Mode			This signal is same in this mode.
IOWR#		I	45	I/O Write Input
	PC Card Memory Mode			This signal is not used in this mode.
	PC Card I/O Mode			The I/O Write strobe pulse is used to clock I/O data on the Card Data bus into the PC Card controller registers. The clocking will occur on the negative to positive going edge of the signal.
	True IDE Mode			This signal has the same function as in PC Card I/O Mode.
IORD#		I	44	I/O Read Input
	PC Card Memory Mode			This signal is not used in this mode.
	PC Card I/O Mode			This is an I/O Read strobe generated by the host. This signal gates I/O data onto the bus from the PC Card.
	True IDE Mode			This signal has the same function as in PC Card I/O Mode.
WE#		I	15	Write Enable Input
	PC Card Memory Mode			This is a signal driven by the host and used for strobing memory write data to the registers of the PC Card. It is also used for writing the configuration registers.
	PC Card I/O Mode			In this mode, this signal is used to write the CIS and configuration registers.
	True IDE Mode			In this mode, this input signal is not used and should be connected to VCC by the host.

Signal Name	Mode of operation	Pin Type	Pin No(s).	Description
OE#		I	9	Output Enable Input
	PC Card Memory Mode			This is a strobe generated by the host interface. It is used to read data from the PC Card and to read the CIS and configuration registers.
	PC Card I/O Mode			This signal is used to read the CIS and configuration registers.
	True IDE Mode			To enable the True IDE Mode, this input should be grounded by the host.
		I	7, 42	Card Enable Inputs
CE1#, CE2#	PC Card Memory Mode			These input signals are used both to select the card and to indicate to the card whether a byte or a word operation is being performed. CE2# always accesses the odd byte of the word. CE1# accesses the even byte or the odd byte of the word depending on A0 and CE2#. A multiplexing scheme based on A0, CE1#, CE2# allows 8 bit hosts to access all data on D0~D7.
	PC Card I/O Mode			This signal has the same function as in PC Card Memory Mode.
CS0#, CS1#	True IDE Mode			In the True IDE Mode, CS0# is the chip select for the task file registers while CS1# is used to select the Alternate Status Register and the Device Control Register.
		O	33	Write Protect / I/O Port 16 Output
WP	PC Card Memory Mode			The card does not have a WP switch. This signal is held low after reset initialization sequence.
IOIS16#	PC Card I/O Mode			A low signal indicated that a 16 bit or odd byte only operation can be performed.
IOCS16#	True IDE Mode			This signal is asserted low when the card is expecting a word data transfer cycle.
GND		Power	1,34,35, 68	Ground Pin
Vcc		Power	17, 51	Power Supply Pin (5.0V/3.3V)

Signal Name	Mode of operation	Pin Type	Pin No(s).	Description
		I	58	Card Reset Input
RESET	PC Card Memory Mode			When this pin is high, this signal resets the Flash Card. The card Reset is only at power up if this pin is left high or open from power-up. The card is also reset when the Soft Reset bit in the Card Configuration Option Register is set.
	PC Card I/O Mode			This signal has the same function as in PC Card Memory Mode.
RESET#	True IDE Mode			In this mode, this input pin is the active low from the host.
		I	61	Attribute Memory Select Input
REG#	PC Card Memory Mode			This signal is used to select between Register/ Attribute Memory (REG# = low) and Common Memory (REG# = high).
REG#	PC Card I/O Mode			Active Low on this signal will allow accesses to I/O space
DMACK#	True IDE Mode			This is a DMA Acknowledge signal that is asserted by the host in response to DREQ to initiate DMA transfers.
		O	16	Ready/Interrupt Request Output
RDY/BSY#	PC Card Memory Mode			This signal is set high when the card is ready to accept a new data transfer operation and held low when the card is busy. The host must have a pullup resistor on this signal. When powering-up and when reset
IREQ#	PC Card I/O Mode			In this mode, this signal is used as for interrupt request. This line is strobed low to generate a pulse mode interrupt or held low for a level mode interrupt. This is set using Configuration Option Register.
INTRQ	True IDE Mode			In this mode, the signal is active high request to the host.

Signal Name	Mode of operation	Pin Type	Pin No(s).	Description
		O	60	Input Port Acknowledge Output
INPACK#	PC Card Memory Mode			This signal is not used in this mode.
INPACK#	PC Card I/O Mode			This signal is asserted by the card when the card is selected and is responding to an I/O read cycle. This signal is used by the host to enable the input data buffers between the host and the card.
DREQ	True IDE Mode			This signal is a DMA Request that is used for DMA data transfers between host and device. It shall be asserted by the device when it is ready to transfer data to or from the host.
CSEL#		I	56	Cable Select Input
	PC Card Memory Mode			This signal is not used in this mode.
	PC Card I/O Mode			This signal is not used in this mode.
	True IDE Mode			This signal is used to configure this device as Master or Slave. When this pin is grounded, this device is configured as Master. When this pin is tied to VCC this card is configured as Slave.
		O	59	Extend Bus Cycle/I/O Channel Ready Output
WAIT#	PC Card Memory Mode			This signal is driven low by the card to inform the host to delay completion of the cycle in progress.
	PC Card I/O Mode			This signal has the same function as in PC Card Memory Mode.
WAIT#	True IDE Mode			This signal is negated to extend the host transfer cycle of any host register access (read or write) when the card is not ready to respond to a data transfer request. When not negated, the signal is in high-impedance state.

Signal Name	Mode of operation	Pin Type	Pin No(s).	Description
VS1#, VS2#		O	43, 57	Voltage Sense Outputs
	All Modes			VS1# is grounded so that the Card's CIS can be read at 3.3V and VS2# is left open.
D15~D0		I/O	41,40,39,38,37,66,65,64,6,5,4,3,2,32,31, 30	16-bit Data Input/output Bus
	PC Card Memory Mode			These lines carry the Data, Commands, and Status Information between the host and the controller. D15 is the MSB of odd byte and D7 the MSB of even byte in a Word Access.
	PC Card I/O Mode			This signal has the same function as in PC Card Memory Mode.
	True IDE Mode			All task file operations occur in byte mode on D7~D0, while all data transfers are word (16-bit) accesses.
A10~A0		I	8,11,12,22,23,24,25,26,27,28,29	Card Address Input Bus
	PC Card Memory Mode			These addresses along with the REG# signal are used to select the following: the I/O port address registers within the card, the memory mapped port address registers, a byte in the CIS and Configuration Control and Status registers.
	PC Card I/O Mode			This signal has the same function as in PC Card Memory Mode.
A2~A0	True IDE Mode	I	27,28,29	In this mode, only A2~A0 are used to select one of the eight Task File registers. All the remaining unused addresses should be grounded by the host.

Signal Name	Mode of operation	Pin Type	Pin No(s).	Description
		O	63	Battery Voltage Detect Output / Card Status Changed Output / Passed Diagnostics Input/output
BVD1	PC Card Memory Mode			This signal is asserted high since the card does not contain a battery.
STSCHG#	PC Card I/O Mode			This signal is asserted low to alert the host to changes in the RDY/BSY# and Write Protect states. Its use is controlled through the Card Configuration and Status Registers.
PDIAG#	True IDE Mode	I/O		This signal is asserted by slave drive to indicate to master drive that it has completed diagnostics and is ready to provide status.
		O	62	Battery Voltage Detect Output / Audio Waveform Output / Drive Active/Drive 1 Preset Output
BVD2	PC Card Memory Mode			This signal is asserted high since the card does not contain a battery.
SPKR#	PC Card I/O Mode			This signal is asserted high since the card does not support audio.
DASP#	True IDE Mode	I/O		This signal indicates that a drive is active or that a slave drive (Drive 1) is present.

F. Power Management

AFAYA PCMCIA-ATA Flash Card provides automatic Power saving Mode.

1. **Standby Mode:** When PCMCIA-ATA Flash Card finished initialization after power reset or hardware reset, it goes into Standby Mode to wait for Command In or Soft Reset.
2. **Active Mode:** If PCMCIA-ATA Flash Card received any Command In or Soft Reset, it goes into Active Mode. In Active Mode, it is capable of executing any ATA commands. The power consumption is the greatest in this mode.
3. **Sleep Mode:** The PCMCIA-ATA Flash Card will enter Sleep Mode if there is no Command In or Soft Reset from the host for about 4ms or sleep command is asserted. This time interval can be modified by firmware if necessary. Sleep Mode provides the lowest power consumption. During Sleep Mode, the system main clock is stopped. This mode can be waked up from hardware reset, software reset or any ATA command asserted.

G. Electrical Specifications

Symbol	Parameter	Rating	Units
V _{CC}	Power Supply	-0.3 to 3.6	V
V _{IN}	Input Voltage	-0.3 to V _{CC} +0.3	V
V _{OUT}	Output Voltage	-0.3 to V _{CC} +0.3	V
V _{CCQ}	Power supply for host I/O and embedded regulator	-0.6 to 6.0	V
V _{IN5}	Input voltage for host I/O	-0.3 to V _{CC} +0.3	V
V _{OUT5}	Output voltage for host I/O	-0.3 to V _{CC} +0.3	V
T _{OPR-I}	Operating temperature for wide Temperature	-40° to +85°	°C
T _{OPR}	Operating temperature for standard Temperature	0° to +70°	°C
T _{STG}	Storage temperature	-55° to 150°	°C

H. DC Characters

H.1. DC Characteristics (T_{OPRi} = -40°C ~ +85°C, V_{CC} = 3.3V ~ 3.6V)

Symbol	Parameter	Condition	MIN.	TYP.	MAX.	Units
V _{IL}	Input low voltage	CMOS			0.2*V _{cc}	V
V _{IH}	Input high voltage	CMOS	2.3			V
V _{t-}	Schmitt trigger negative going threshold voltage	CMOS	0.9			V
V _{t+}	Schmitt trigger positive going threshold voltage	CMOS			2.5	V
V _{OL}	Output low voltage	I _{OL} =4,8mA			0.4	V
V _{OH}	Output high voltage	I _{OH} =4,8mA	V _{cc} -0.8			V
R _t	Input Pull-up/down resistance	V _{IL} =0V or V _{IH} =V _{cc}		75		KΩ

H.2. DC Characteristics ($T_{OPRi} = -40^{\circ}\text{C} \sim +85^{\circ}\text{C}$, $V_{CC} = 4.5\text{V} \sim 5.5\text{V}$)

Symbol	Parameter	Condition	MIN.	TYP.	MAX.	Units
VIL	Input low voltage	COMS(*1)			0.2*Vcc	V
VIH	Input low voltage	COMS(*1)	20.			V
VILQ	Host I/F pin input low voltage	TTL(*2)			0.8	V
VIHQ	Host I/F pin input high voltage	TTL(*2)	20			V
Vt-	Schmitt trigger negative going threshold voltage	VCCQ(*2)	0.8			V
Vt+	Schmitt trigger negative going threshold voltage	VCCQ(2)			2.0	V
Vt-	Schmitt trigger negative going threshold voltage	Vcc(*1)	0.9			V
Vt+	Schmitt trigger negative going threshold voltage	Vcc(*1)			2.5	V
VOL	Output low voltage	IOL=4.8mA			0.4	V
VOH	Output high voltage	IOH=4.8mA	Vcc-0.8			V
VOLQ	Host I/F pin output low voltage	IOL=4.8mA			0.4	V
VOHQ	Host I/F pin output high voltage	IOH=4.8mA	V _{CCQ} -0.8			V
Rt	Input Pull-up / down resistance	VIL=0V or VIH=VCC		75		KΩ

Note:

1. For the pins, which were driven by Vcc.
2. For the host interface pins only, which were driven by Vcc.

I. AC Characters

AC Characteristics (Ta = -40°C ~ +85°C, Vcc = 5V ±10%, Vcc = 3.3V±5%)

I.1 The IDE Mode Access Read AC Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Data delay after IORD	td(IORD)	-	-	50	ns
Data hold following IORD	th(IORD)	5	-	-	ns
IORD width time	tw(IORD)	70	-	-	ns
Address setup before IORD	tsuA(IORD)	25	-	-	ns
Address hold following IORD	ThA(IORD)	10	-	-	ns
CE setup before IORD	tsuCE(IORD)	25	-	-	ns
CE hold following IORD	thCE(IORD)	10	-	-	ns
IOCS16 delay falling from address	tdfIOCS16(ADR)	-	-	n/a(*3)	ns
IOCS16 delay rising from address	tSIOCS16(ADR)	-	-	n/a(*3)	ns

I.2 True IDE Mode Access Write AC Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Data delay after IOWR	td(IOWR)	20	-	-	ns
Data hold following IOWR	th(IOWR)	10	-	-	ns
IORD width time	tw(IOWR)	70	-	-	ns
Address setup before IOWR	tsuA(IOWR)	15	-	-	ns
Address hold following IOWR	thA(IOWR)	10	-	-	ns
CE setup before IOWR	tsuCE(IOWR)	5	-	-	ns
CE hold following IOWR	thCE(IOWR)	10	-	-	ns
IOCS16 delay falling from address	tdfIOCS16(ADR)	-	-	35	ns
IOCS16 delay rising from address	tSIOCS16(ADR)	-	-	35	ns

J. Product Model

J.1 Part number Decoder

Item	Controller	Capacity	Temperature range	Disk mode	Data Transfer mode
X ¹ X ² X ³	X ⁴ X ⁵	X ⁶ X ⁷ X ⁸ X ⁹	X ¹⁰	X ¹¹	X ¹²
ATA	SU	016M: 16M Byte	C/I	F/R/A	U/P
		032M: 32M Byte	C: standard temp. I: wide temp.	F: Fixed Disk Mode R: Removable Disk Mode A: Auto Detect Mode (supports both F and R)	U:UDMA 4 Mode P: PIO 4 Mode
		064M: 64M Byte			
		128M: 128M Byte			
		256M: 256M Byte			
		512M: 512M Byte			
		001G: 1G Byte			
		002G: 2G Byte			
		004G: 4G Byte			
		008G: 8G Byte			
016G: 16G Byte					
032G: 32G Byte					

J.2 Part number – PCMCIA ATA Card

Capacity	Standard Temp.	Wide Temp.
128MB	ATA-SU128MCX ¹¹ X ¹²	ATA-SU128MIX ¹¹ X ¹²
256MB	ATA-SU256MCX ¹¹ X ¹²	ATA-SU256MI X ¹¹ X ¹²
512MB	ATA-SU512MCX ¹¹ X ¹²	ATA-SU512MI X ¹¹ X ¹²
1GB	ATA-SU001GCX ¹¹ X ¹²	ATA-SU001GI X ¹¹ X ¹²
2GB	ATA-SU002GCX ¹¹ X ¹²	ATA-SU002GI X ¹¹ X ¹²
4GB	ATA-SU008GCX ¹¹ X ¹²	ATA-SU004GI X ¹¹ X ¹²
8GB	ATA-SU008GCX ¹¹ X ¹²	ATA-SU008GI X ¹¹ X ¹²
16GB	ATA-SU016GCX ¹¹ X ¹²	ATA-SU016GI X ¹¹ X ¹²
32GB	ATA-SU032GCX ¹¹ X ¹²	

Note:

X¹¹ Disk mode

F: Fixed Disk Mode

R: Removable Disk Mode

A: Auto Detect Mode (supports both Fixed disk and Removable disk modes)

X¹² Data Transfer mode

U:UDMA 4 Mode

P: PIO 4 Mode