Data Book

AU6368

USB2.0 Multiple Slots Flash Memory Card Reader

Technical Reference Manual

Product Specification

Official Release

Revision 1.13W

Public

Aug 2005

Data sheet status

Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.

Revision History

Date	Revision	Description
May 2005	1.11W/C31,C33, D31,D33	Removed the schematics. Please contact our sales if you need it.
Aug 2005	1.12W/ C.D.E	To modify “4.1 Pin Description” Pin- 12
Aug 2005	1.13W/ C.D.E	1. To modify “5.2 Recommended Operating Conditions” 2. Moved “3.0 Power Switch Feature” to “5.6 Power Switch Feature”

Contact Information:

Web site: http://www.alcormicro.com/

Taiwan
Alcor Micro Corp.
4F, No 200 Kang Chien Rd., Nei Hu,
Taipei, Taiwan, R.O.C.
Phone: 886-2-8751-1984
Fax: 886-2-2659-7723

Santa Clara Office
2901 Tasman Drive, Suite 206
Santa Clara, CA 95054
USA
Phone: (408) 845-9300
Fax: (408) 845-9086

Los Angeles Office
9070 Rancho Park Court
Rancho Cucamonga, CA.91730
USA
Phone: (909) 483-9900
Fax: (909) 944-0464

Table of Contents

List of Figures

List of Tables

1.0 Introduction

1.1 Description

The AU6368 is an integrated single chip memory card reader controller specially designed for notebook, hand-held and other PC peripheral devices, which require fewer components for small PCB area. It supports a widely used flash memory card such as CF, MD, SMC, xD Picture Card, MS, MS Pro, MS Duo, SD and MMC. It can be used as removable storage disks in enormous data exchange applications between PC and PC or PC and various consumer electronic appliances.

The AU6368 reads digital content saved on memory card that user captured with the portable device such as notebook, digital camera, MP3 player, PDA and mobile phone… etc. In addition, AU6368 allows user to transfer information such as data, graphics, texts or digital images from one electronic device to another quickly and easily. Furthermore, AU6368 integrates power switch function; manufacturers can use fewer components in their product design.

With AU6368, user's experience will be also further enhanced by the Plug-and-Play nature built into latest operation systems such as Windows 2000/XP and Mac OS X.

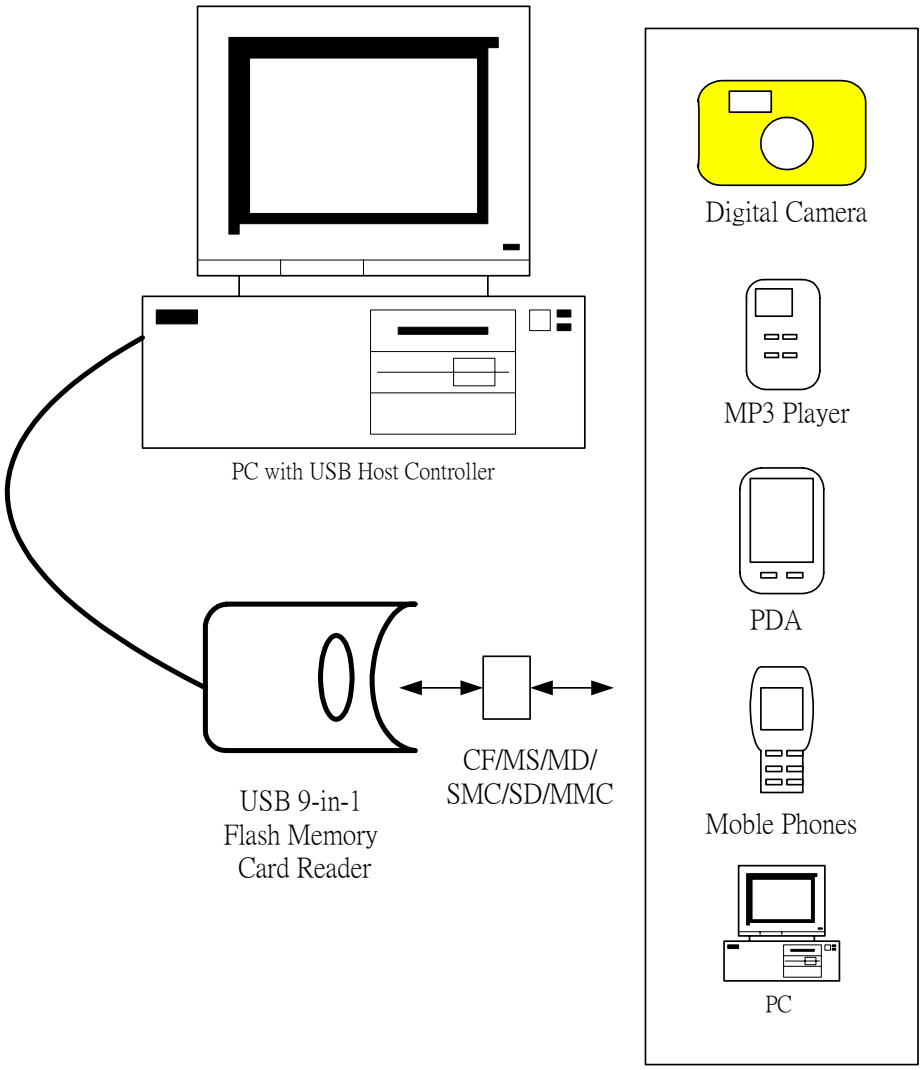
1.2 Features

- Support USB v2.0 specification and USB Device Class Definition for Mass Storage, Bulk-Transport v1.0
- Support CF/MD, SD/MMC, MS/MS PRO/MS ROM/MS Duo AND xD/SMC specification
- Work with default driver from Windows ME, Windows XP, and Mac OS X. Windows 98, Windows 2000 are supported by vendor AP (The AP included both win98 and 2000 driver) from Alcor.
- Ping-pong FIFO implementation for concurrent bus operation
- Support multiple sectors transfer optimize performance
- Support slot-to-slot read/write operation.
- Support auto-detecting slot with card inserted on Win 2000 without driver.
- Capable of handing ~~4~~ sets of built-in PID, VID and strings to minimize inventory control and improve lead production lead-time.
- Support LED for bus activity indication.
- Each slot can be enables/disabled by 5 independent pins to fit all the different card readers' combination requirement.
- Runs at 30MHz, built-in 480 MHz PLL
- Built-in 3.3V to 2.5V regulator

2.0 Application Block Diagram

Following is the application diagram of a typical card reader product with AU6368. By connecting the card reader to a desktop or notebook PC through USB bus, AU6368 is implemented as a bus-powered, high speed USB card reader, which can be used as a bridge for data transfer between Desktop PC and Notebook PC.

2.1 Block Diagram



3.0 Pin Assignment

The AU6368 is packed in 80pin-LQFP-form factor. The following figure shows signal name for each pin and the table in the following page describes each pin in detail.

Figure 3.1 Pin Assignment Diagram

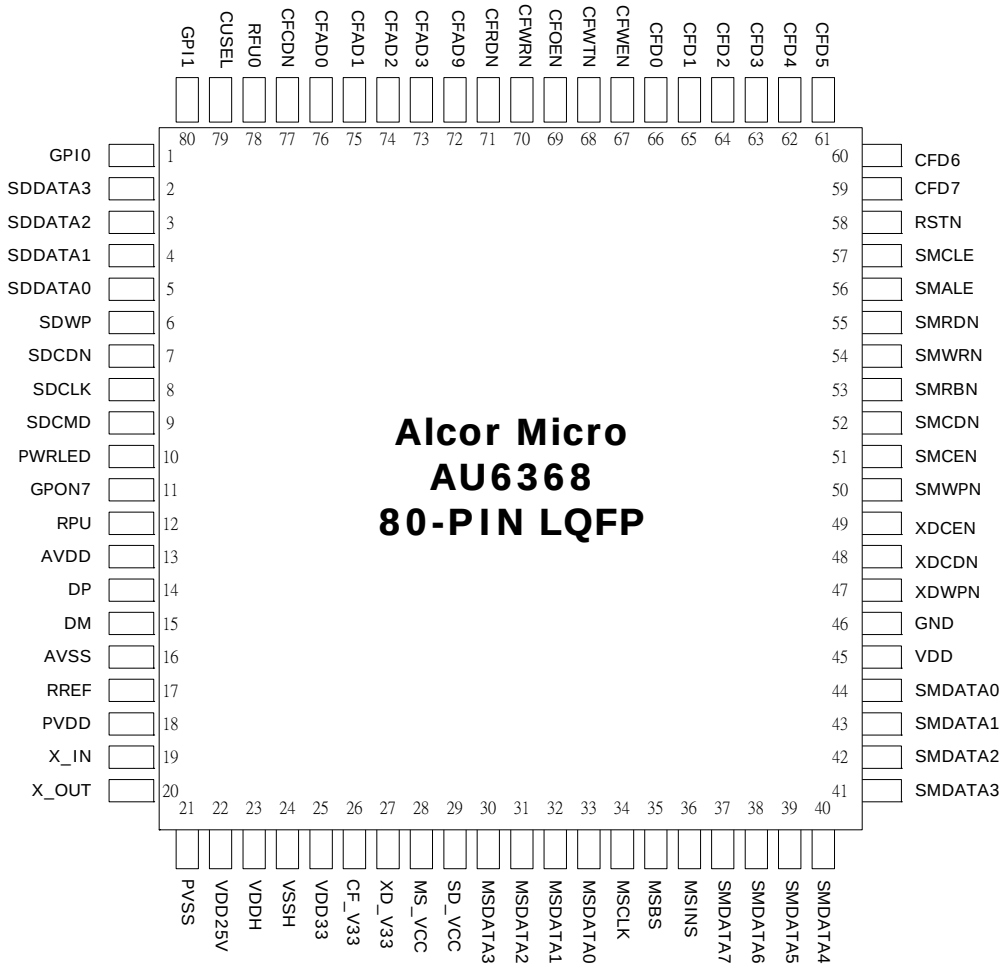


Table 3.1 Pin Descriptions

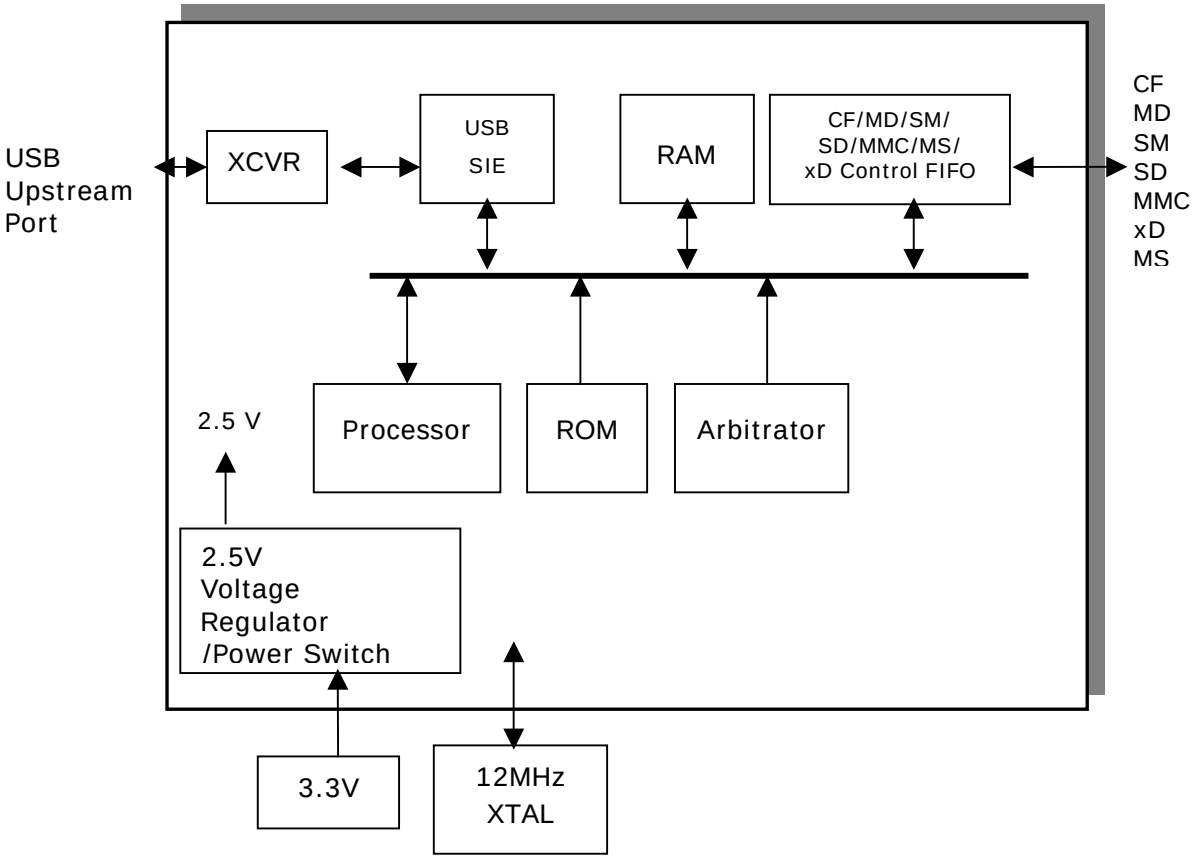
Pin #	Pin Name	I/O	Description
1	GPI0	I	Slot Mode Select (GPI1, GPI0) = (0,0) : Reserved (GPI1, GPI0) = (0,1) : 2 Luns (GPI1, GPI0) = (1,0) : 4.5 Luns (GPI1, GPI0) = (1,1) : 1 Lun
2	SDDATA3	I/O	SD Data3
3	SDDATA2	I/O	SD Data2
4	SDDATA1	I/O	SD Data1
5	SDDATA0	I/O	SD Data0
6	SDWP	I	SD Write Protect
7	SDCDN	I	SD Card Detect
8	SDCLK	O	SD CLK
9	SDCMD	I/O	SD CMD
10	PWRLED	O	Power LED; (Normal:"0"; Suspend"1")
11	GPON7	O	Card insert LED; (Card inserted:"0";
12	RPU	I	Connected with an 1.5k pull up resistor to 3.3 VDD
13	AVDD	I	Analog Power 3.3V
14	DP	I/O	USB DP
15	DM	I/O	USB DM
16	AVSS	PWR	Analog Ground
17	RREF	I	Connected an 1k resistor to GND for impedance match
18	PVDD	I	OSC Power 3.3V
19	X_IN	I	12 MHz crystal input.
20	X_OUT	O	12 MHz crystal output.
21	PVSS	PWR	OSC Ground
22	VDD25V	O	Core Power 2.5V
23	VDDH	I	IO Power 3.3V
24	VSSH	PWR	IO Ground
25	VDD33	I	Switch Power 3.3V
26	CF_V33	O	CF Card Power
27	XD_V33	O	SMC and XD share XD_V33 Power
28	MS_VCC	O	MS Card Power
29	SD_VCC	O	SD Card Power
30	MSDATA3	I/O	MS Data3
31	MSDATA2	I/O	MS Data2
32	MSDATA1	I/O	MS Data1
33	MSDATA0	I/O	MS Data0
34	MSCLK	O	MS CLK
35	MSBS	O	MS BS
36	MSINS	I	MS INS
37	SMDATA7	I/O	SMDATA7
38	SMDATA6	I/O	SMDATA6
39	SMDATA5	I/O	SMDATA5
40	SMDATA4	I/O	SMDATA4
41	SMDATA3	I/O	SMDATA3

42	SMDATA2	I/O	SMDATA2
43	SMDATA1	I/O	SMDATA1
44	SMDATA0	I/O	SMDATA0
45	VDD	I	Core power 2.5V
46	GND	PWR	Core Ground
47	XDWPN	O	XD WP
48	XDCDN	I	XD CD
49	XDCEN	O	XD CE
50	SMWPN	I	SMC WP
51	SMCEN	O	SMC CE
52	SMCDN	I	SMC CD
53	SMRBN	I	SMC read/busy. External pull up with 470K to 3.3V.
54	SMWRN	O	SM WRN
55	SMRDN	O	SMRDN
56	SMALE	O	SM ALE
57	SMCLE	O	SM CLE
58	RSTN	I	Chip Reset (Reset:"0"; Normal:"1"), pull up with RC
59	CFD7	I/O	CF Data7
60	CFD6	I/O	CF Data6
61	CFD5	I/O	CF Data5
62	CFD4	I/O	CF Data4
63	CFD3	I/O	CF Data3
64	CFD2	I/O	CF Data2
65	CFD1	I/O	CF Data1
66	CFD0	I/O	CF Data0
67	CFWEN	O	CF WEN
68	CFWTN	I	CF WAITN
69	CFOEN	O	CF OE
70	CFWRN	O	CF IOWRN
71	CFRDN	O	CF IORDN
72	CFAD9	O	CF Addr9
73	CFAD3	O	CF Addr3
74	CFAD2	O	CF Addr2
75	CFAD1	O	CF Addr1
76	CFAD0	O	CF Addr0
77	CFCDN	I	CF CD
78	RFU0	I	Always pull Low
79	CUSEL	I	Always pull High
80	GPI1	I	Slot Mode Select (GPI1, GPI0) = (0,0) : Reserved (GPI1, GPI0) = (0,1) : 2 Luns (GPI1, GPI0) = (1,0) : 4.5 Luns (GPI1, GPI0) = (1,1) : 1 Lun

4.0 System Architecture and Reference Design

4.1 AU6368 Block Diagram

Figure 4.1 AU6368 Block Diagram



5.0 Electrical Characteristics

5.1 Absolute Maximum Ratings

Table 5.1 Absolute Maximum Ratings

SYMBOL	PARAMETER	RATING	UNITS
V_{CC}	Power Supply	-0.3 to V_{CC}+0.3	V
V_{IN}	Input Voltage	-0.3 to 3.3	V
V_{OUT}	Output Voltage	-0.3 to V_{CC}+0.3	V
T_{STG}	Storage Temperature	-40 to 150	^{O}C

5.2 Recommended Operating Conditions

Table 5.2 Recommended Operating Conditions

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
V_{CC}	Power Supply	3.0	3.3	3.6	V
V_{IN}	Input Voltage	0	3.3	5.2	V
T_{OPR}	Operating Temperature	0	25	125	^{O}C

5.3 Leakage Current and Capacitance

Table 5.3 General DC Characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
I_{IN}	Input current	no pull-up or pull-down	-10	±1	10	μA
I_{OZ}	Tri-state leakage current		-10	±1	10	μA
C_{IN}	Input capacitance	Pad Limit		2.8		ρF
C_{OUT}	Output capacitance	Pad Limit		2.8		ρF
C_{BID}	Bi-directional buffer capacitance	Pad Limit		2.8		ρF

5.4 DC Electrical Characteristics of 3.3V I/O Cells

Table 5.4 DC Electrical Characteristics of 3.3V I/O Cells

SYMBOL	PARAMETER	CONDITIONS	Limits			UNIT
			MIN	TYP	MAX	
V_{CC}	Power supply	3.3V I/O	3.0	3.3	3.6	V
V_{il}	Input low voltage	LVTTL			0.8	V
V_{ih}	Input high voltage		2.0			V
V_{ol}	Output low voltage	$\lvert I_{ol} \rvert$ =2~16mA			0.4	V
V_{oh}	Output high voltage	$\lvert I_{oh} \rvert$ =2~16mA	2.4			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_{CC} or 0	-10	±1	10	μA
I_{oz}	Tri-state output leakage current		-10	±1	10	μA

5.5 USB Transceiver Characteristics

Table 5.5 Electrical characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
AVCC	Analog supply current		3.0	3.3	3.6	V
VCC	Digital supply current		2.25	2.5	2.75	V
I_{CC}	Operating supply current	High speed operating at 480 MHz			73	mA
$I_{CC(susp)}$	Suspend supply current	In suspend mode, current with 1.5kΩ pull-up resistor on pin RPU disconnected			120	μA

Table 5.6 Static characteristic：Digital pin

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Input levels						
V_{IL}	Low-level input voltage				0.8	V
V_{IH}	High-level input voltage		2.0			V
Output levels						
V_{OL}	Low-level output voltage				0.2	V
V_{OH}	High-level output voltage		VCC-0.2			V

AVCC=3.0V~3.6V；VCC=2.25V~2.75V；Temp=0℃~115℃

Table 5.7 Static characteristic：Analog I/O pins（DP/DM）

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
USB2.0 Transceiver（HS）						
Input Levels（differential receiver）						
V_{HSDIFF}	High speed differential input sensitivity	$\lvert V_{I(DP)} - V_{I(DM)} \rvert$ measured at the connection as application circuit	300			mV
V_{HSCM}	High speed data signaling common mode voltage range		-50		500	mV
V_{HSSQ}	High speed squelch detection threshold	Squelch detected			100	mV
		No squelch detected	150			mV
V_{HSDSC}	High speed disconnection detection threshold	Disconnection detected	625			mV
		Disconnection not detected			525	mV
Output Levels						
V_{HSOI}	High speed idle level output voltage(differential)		-10		10	mV
V_{HSOL}	High speed low level output voltage(differential)		-10		10	mV
V_{HSOH}	High speed high level output voltage(differential)		-360		400	mV
V_{CHIRPJ}	Chirp-J output voltage（differential）		700		1100	mV
V_{CHIRPK}	Chirp-K output voltage（differential）		-900		-500	mV
Resistance						
R_{DRV}	Driver output impedance	Equivalent resistance used as internal chip only	3	6	9	Ω
		Overall resistance including external resistor	40.5	45	49.5	
Termination						
V_{TERM}	Termination voltage for pull-up resistor on pin RPU		3.0		3.6	V
USB1.1 Transceiver（FS/LS）						
Input Levels（differential receiver）						
V_{DI}	Differential input sensitivity	$\lvert V_{I(DP)} - V_{I(DM)} \rvert$	0.2			V
V_{CM}	Differential common mode voltage		0.8		2.5	V
Input Levels（single-ended receivers）						

V_{SE}	Single ended receiver threshold		0.8		2.0	V
Output levels						
V_{OL}	Low-level output voltage		0		0.3	V
V_{OH}	High-level output voltage		2.8		3.6	V

AVCC=3.0V~3.6V；VCC=2.25V~2.75V；Temp=0℃~115℃

Table 5.8 Dynamic characteristic：Analog I/O pins（DP/DM）

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Driver Characteristics						
High-Speed Mode						
t_{HSR}	High-speed differential rise time		500			ps
t_{HSF}	High-speed differential fall time		500			ps
Full-Speed Mode						
t_{FR}	Rise time	CL=50pF；10 to 90% of $\lvert V_{OH}-V_{OL} \rvert$；	4		20	ns
t_{FF}	Fall time	CL=50pF；90 to 10% of $\lvert V_{OH}-V_{OL} \rvert$；	4		20	ns
t_{FRMA}	Differential rise/fall time matching（t_{FR} / t_{FF}）	Excluding the first transition from idle mode	90		110	%
V_{CRS}	Output signal crossover voltage	Excluding the first transition from idle mode	1.3		2.0	V
Low-Speed Mode						
t_{LR}	Rise time	CL=200pF-600pF；10 to 90% of $\lvert V_{OH}-V_{OL} \rvert$；	75		300	ns
t_{LF}	Fall time	CL=200pF-600pF；90 to 10% of $\lvert V_{OH}-V_{OL} \rvert$；	75		300	ns
t_{LRMA}	Differential rise/fall time matching（t_{LR} / t_{LF}）	Excluding the first transition from idle mode	80		125	%
V_{CRS}	Output signal crossover voltage	Excluding the first transition from idle mode	1.3		2.0	V
V_{OH}	High-level output voltage		2.8		3.6	V

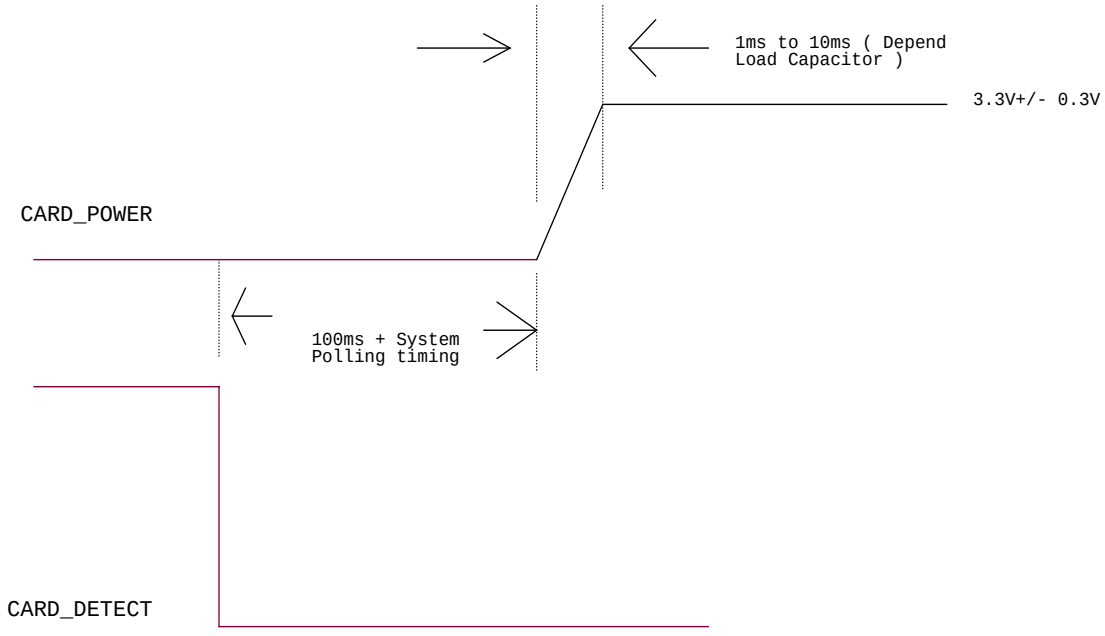
5.6 Power Switch Feature

AU6368 integrates a 3.3V to 2.5V voltage regulator and power switch to replace all MOS chips for flash card power supply.

Card Power Output Current Range

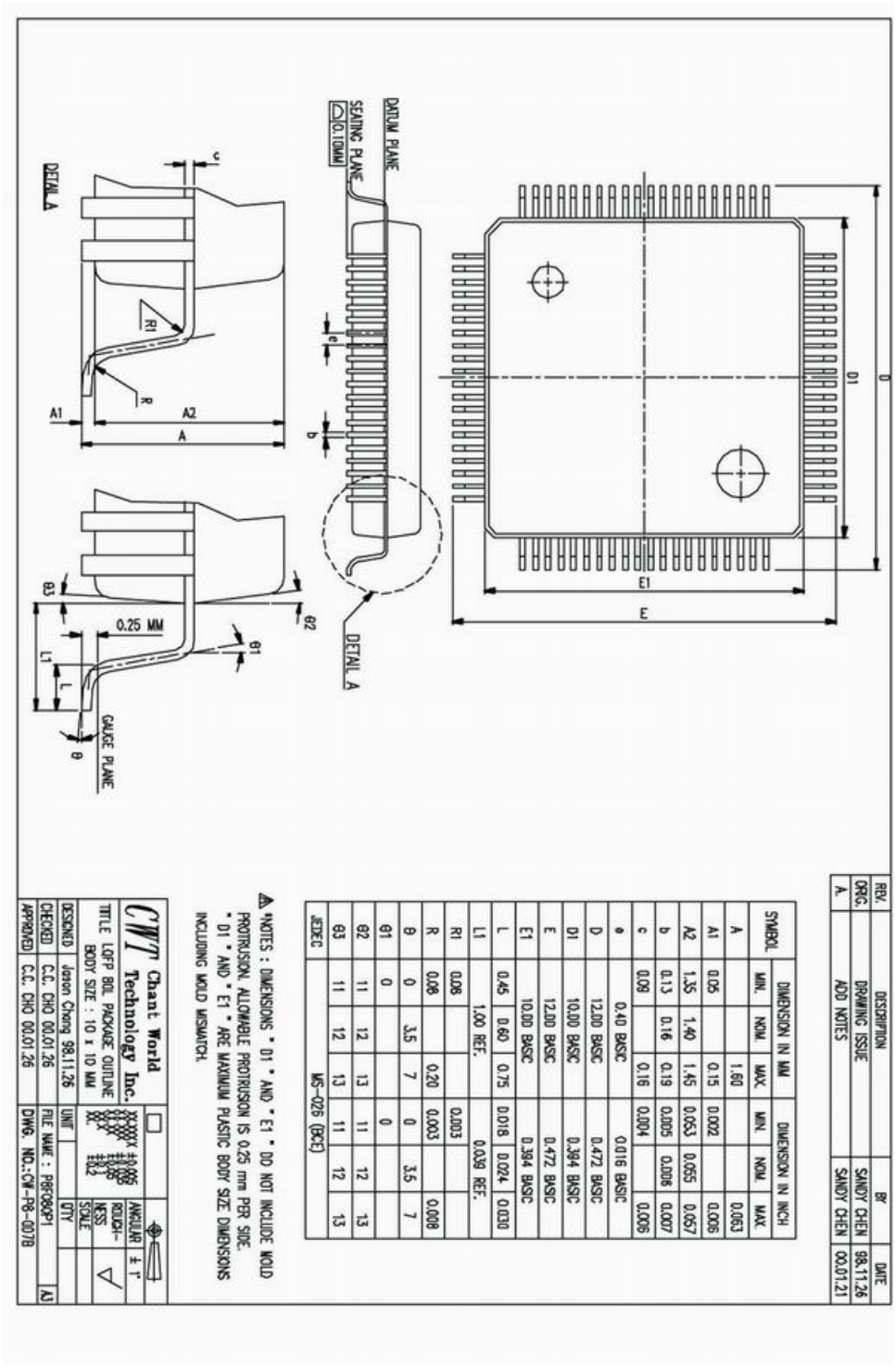
- For MS/SD
  - MAX: 100mA
- For XD/SMC
  - MAX: 70mA
- For CF
  - MAX: 250mA
- Card power output voltage range
  - MS/XD/SD/SMC/CF: 3.3V±0.3V
- AU6368 will turn off all of Card Power in suspend mode

Figure 5.1 Card Detect Power-on Timing



6.0 Mechanical Information

Figure 6.1 Mechanical Information Diagram



7.0 Abbreviations

This chapter lists and defines terms and abbreviations used throughout this specification.

SIE	Serial Interface Engine
CF	Compact Flash
MD	Micro Drive
SMC	SmartMedia Card
MS	Memory Stick
SD	Secure Digital
MMC	Multimedia Card
UTMI	USB Transceiver Macrocell Interface

【MEMO】

About Alcor Micro, Corp

Alcor Micro, Corp. designs, develops and markets highly integrated and advanced peripheral semiconductor, and software driver solutions for the personal computer and consumer electronics markets worldwide. We specialize in USB solutions and focus on emerging technology such as USB and IEEE 1394. The company offers a range of semiconductors including controllers for USB hub, integrated keyboard/USB hub and USB Flash memory card reader…etc. Alcor Micro, Corp. is based in Taipei, Taiwan, with sales offices in Taipei, Japan, Korea and California.

Alcor Micro is distinguished by its ability to provide innovative solutions for spec-driven products. Innovations like single chip solutions for traditional multiple chip products and on-board voltage regulators enable the company to provide cost-efficiency solutions for the computer peripheral device OEM customers worldwide.