Data Book

AU6333

USB2.0 SD/MMC/MS Single/Dual LUN Card Reader Controller Technical Reference Manual

Product Specification

Official Release

Revision 1.04W

Public

Aug 2006

Alcor Micro Corp.

Data book status

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

Revision History

Date	Revision	Description
Jun 2005	1.00W	Official release
Jul 2005	1.01W	1. To modify "4.1 Pin Descriptions - pin 37" 2. Removed the schematics. Please contact our sales if you need it.
Sep 2005	1.02W	Moved "3.0 Power Switch Feature" to "5.6 Power Switch Feature"
Jan 2006	1.03W	Add "Support SD 2.0 specification" feature
Aug 2006	1.04W	Update new address of Los Angeles Office

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

China ShenZhen Office
Rm.2407-08 ,Industrial Bank Building
No.4013, Shennan Road ,ShenZhen,China.
518026
Phone: (0755) 8366-9039
Fax: (0755) 8366-9101

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

AU6333 USB 2.0 SD/MMC/MS Single/Dual LUN Flash Memory Card Reader V1.04W
Official release _ Public

1.0 Introduction

1.1 Description

AU6333 is an USB2.0 high-speed transmission controller, which is designed as a bridge between USB and SD/MS compatible flash card interface, such as SD, HS-SD, MMC, HS-MMC, RS-MMC, MMCmicro, MS, MS Pro and MS Duo…etc. AU6333 can read digital contents stored on memory card designed to cover a wide area of applications such as digital cameras, PDAs, MP3 players and smart phones…etc.
With the AU6333, users can transfer digital data between flash memory card and PC or other electronic devices.

AU6333 inherits the high-performance and cost-efficiency character from Alcor's products, included power switch integration, dynamic icon utility support, and DMA engine integration.

1.2 Features

- Support USB V2.0 specification and USB Device Class Definition for Mass Storage, Bulk-Transport V1.0
- Support SD/MMC/MS compatible flash card
- Support the latest flash card specification: SD1.1 (HS-SD), MMC4.0 (8-bit), MSPro parallel mode (4-bit)
- Support SD 2.0 specification
- Alcor DMA engine integrated for performance enhancement
- Work with default driver from Windows ME/2000/XP and Mac OS X; Windows 98/2000(SP1/SP2) and Mac OS 9 are supported by vendor driver from Alcor.
- Ping-pong FIFO implementation for concurrent bus operation
- Support multiple sectors transfer optimize performance
- Support slot-to-slot read/write operation (Dual LUN)
- Support Dynamic Icon Utility
- Support LED for bus operating indication
- Power switch integrated to reduce production BOM cost
- Built in 2.5V regulator

2.0 Application Block Diagram

Following is the application diagram of a typical card reader product with AU6333. By connecting the card reader to a desktop or notebook PC through USB bus, AU6333 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

PC with USB Host Controller

Digital Camera

MP3 Player

PDA

Moble Phones

PC

USB
Flash Memory Card
Reader

SD/MMC/MS

AU6333 USB 2.0 SD/MMC/MS Single/Dual LUN Flash Memory Card Reader V1.04W
Official release _ Public
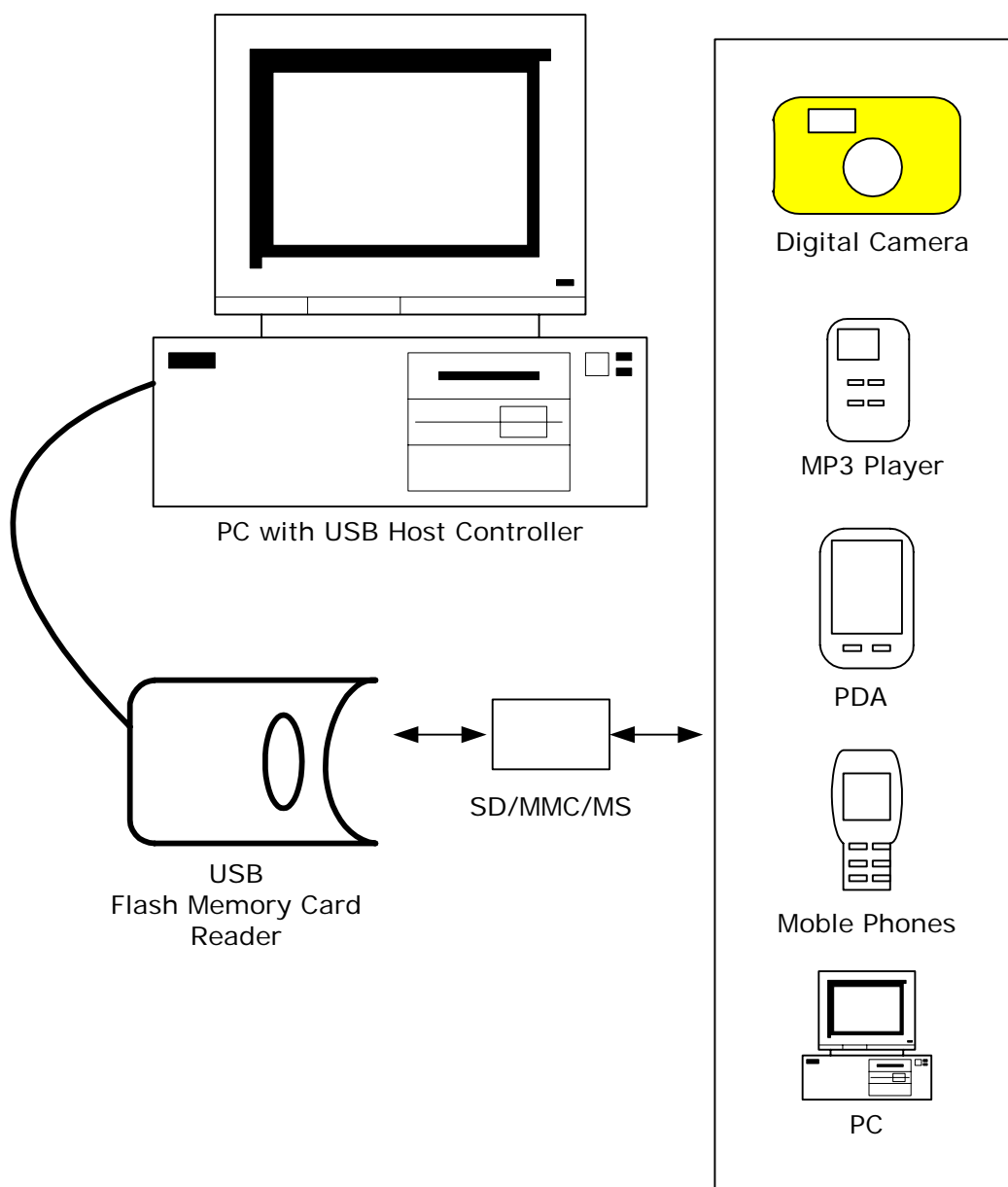
3.0 Pin Assignment

The AU6333 is packed in 48pin-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

AU6333 USB 2.0 SD/MMC/MS Single/Dual LUN Flash Memory Card Reader V1.04W
Official release _ Public

Alcor Micro Corp.

Http://www.alcormicro.com/

Table 3.1 Pin Descriptions

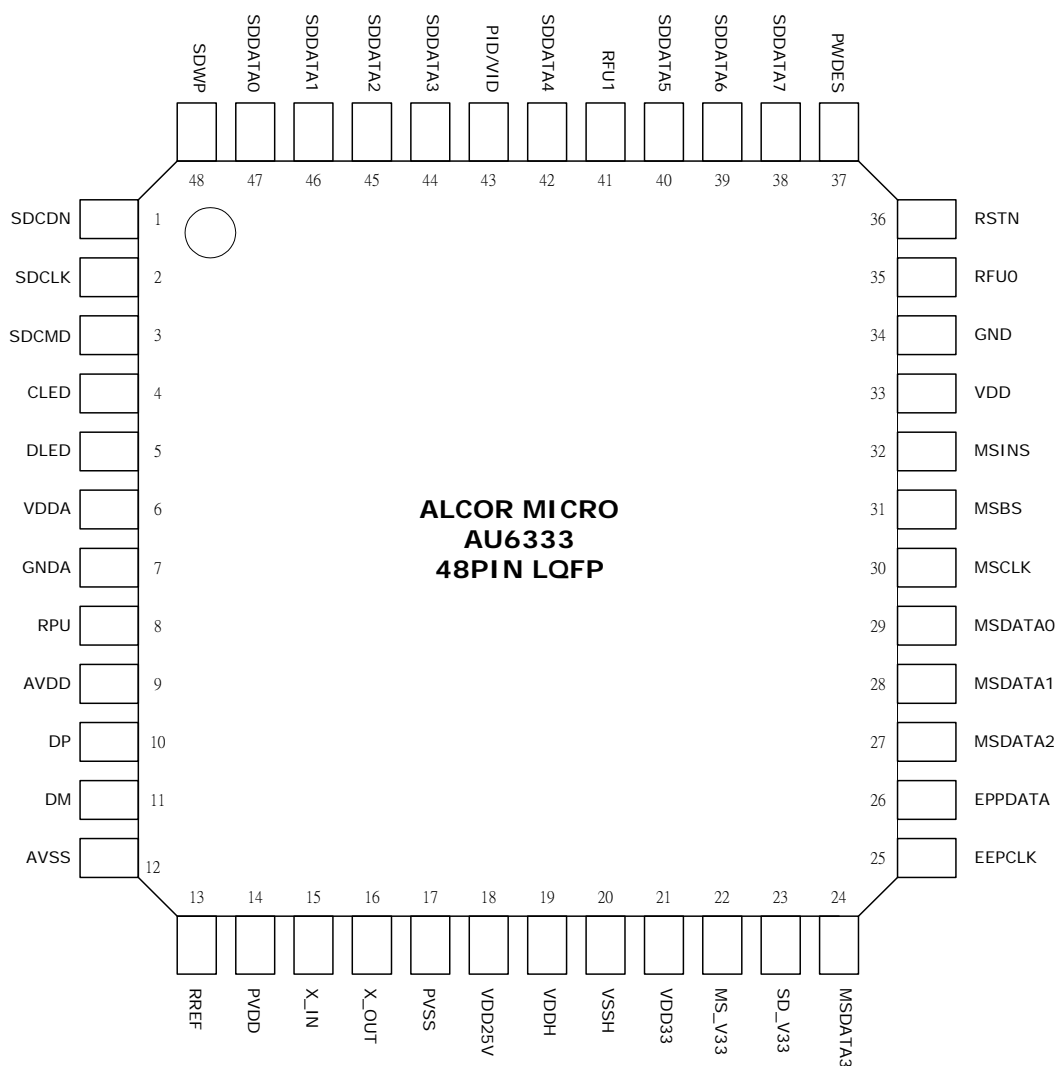| Pin #	Pin Name	I/O	Description
1	SDCDN	I	SD card detect; ("0":Detected; "1":unDetected[Default])
2	SDCLK	O	SD CLK
3	SDCMD	I/O	SD CMD
4	CLED	O	Card activity LED
5	DLED	O	Device LED
6	VDDA	I	2.5V Analog power
7	GNDA	I	Analog GND
8	RPU	I	Connect 1.5K pull up resistor to 3.3V VDD
9	AVDD	I	3.3V Analog power
10	DP	I/O	DP
11	DM	I/O	DM
12	AVSS	I	Analog GND
13	RREF	I	Connect 1K resistor to AVSS for impedance match
14	PVDD	I	OSC power 3.3V
15	X_IN	I	12MHz crystal input
16	X_OUT	O	12MHz crystal output
17	PVSS	I	OSC GND
18	VDD25V	O	2.5V output connect to core power VDD
19	VDDH	I	I/O power 3.3V
20	VSSH	I	I/O GND
21	VDD33	I	3.3V for card power
22	MS_V33	O	3.3V for MS card
23	SD_V33	O	3.3V for SD card
24	MSDATA3	I/O	MS data3
25	EEPCLK	O	EEPROM CLK
26	EPPDATA	I/O	EEPROM Data
27	MSDATA2	I/O	MS data2
28	MSDATA1	I/O	MS data1
29	MSDATA0	I/O	MS data0
30	MSCLK	O	MS CLK
31	MSBS	O	MS BS
32	MSINS	I	MS INS
33	VDD	I	Core power 2.5V
34	GND	I	Core GND
35	RFU0	I	Always pull low
36	RSTN	I	Chip reset, pull up with RC.
37	PWDES	I	Operating power in confiscation Descriptor ;("0":100mA[Default];"1":250mA)

AU6333 USB 2.0 SD/MMC/MS Single/Dual LUN Flash Memory Card Reader V1.04W
Official release _ Public

Pin #	Pin Name	I/O	Description
38	SDDATA7	I/O	SD data7
39	SDDATA6	I/O	SD data6
40	SDDATA5	I/O	SD data5
41	RFU1	I	Always pull low
42	SDDATA4	I/O	SD data4
43	PID/VID	I	LUN Mode Selection ("0": 2-LUN; "1": 1-LUN)
44	SDDATA3	I/O	SD data3
45	SDDATA2	I/O	SD data2
46	SDDATA1	I/O	SD data1
47	SDDATA0	I/O	SD data0
48	SDWP	I	SD write protect

AU6333 USB 2.0 SD/MMC/MS Single/Dual LUN Flash Memory Card Reader V1.04W
Official release _ Public

4.0 System Architecture and Reference Design

4.1 AU6333 Block Diagram

Figure 4.1 AU6333 Block Diagram

AU6333 USB 2.0 SD/MMC/MS Single/Dual LUN Flash Memory Card Reader V1.04W
Official release _ Public
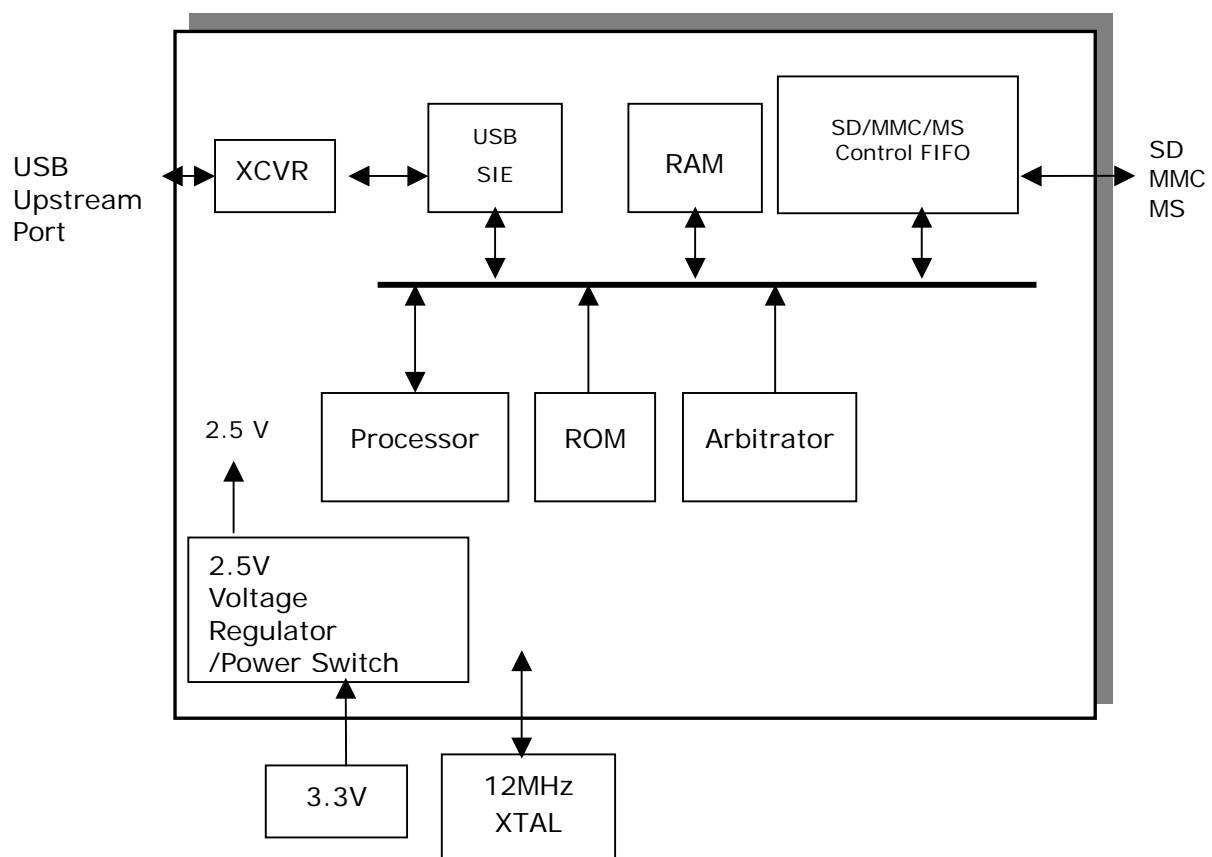
5.0 Electrical Characteristics

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 3.6	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_{DD}	Digital Supply	2.25	2.5	2.75	V
V_{IN}	Input Voltage	0	3.3	5.2	V
T_{OPR}	Operating Temperature	0		85	^{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

AU6333 USB 2.0 SD/MMC/MS Single/Dual LUN Flash Memory Card Reader V1.04W
Official release _ Public

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	$\mid I_{ol} \mid = 2 \sim 16mA$			0.4	V
V_{oh}	Output high voltage	$\mid I_{oh} \mid = 2 \sim 16mA$	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 Voltage		3.0	3.3	3.6	V
VCC	Digital supply Voltage		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℃~85℃

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	∣$V_{I (DP)}$-$V_{I (DM)}$∣ 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	∣$V_{I (DP)}$-$V_{I (DM)}$∣	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℃~85℃

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

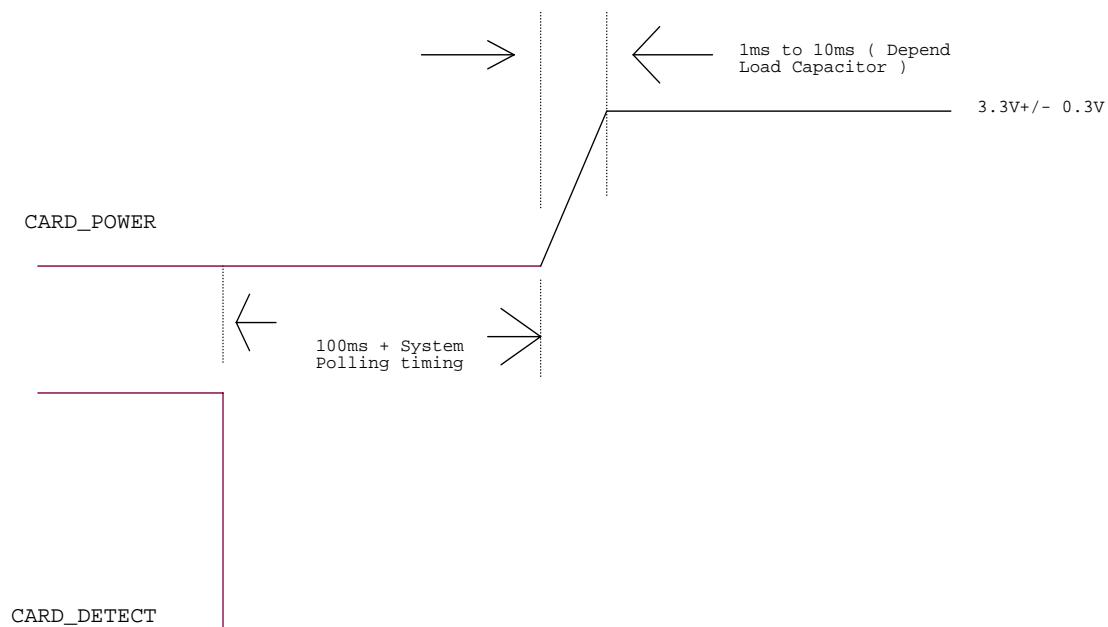| Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Driver Characteristics						
High-Speed Mode						
t$_{HSR}$	High-speed differential rise time		500			ps
t$_{HSF}$	High-speed differential fall time		500			ps
Full-Speed Mode						
t$_{FR}$	Rise time	CL=50pF；10 to 90% of ｜V$_{OH}$-V$_{OL}$｜；	4		20	ns
t$_{FF}$	Fall time	CL=50pF；90 to 10% of ｜V$_{OH}$-V$_{OL}$｜；	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 ｜V$_{OH}$-V$_{OL}$｜；	75		300	ns
t$_{LF}$	Fall time	CL=200pF-600pF；90 to 10% of ｜V$_{OH}$-V$_{OL}$｜；	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

AU6333 integrates a 3.3V to 2.5V voltage regulator and power switch to replace all MOS chips for flash card power supply.
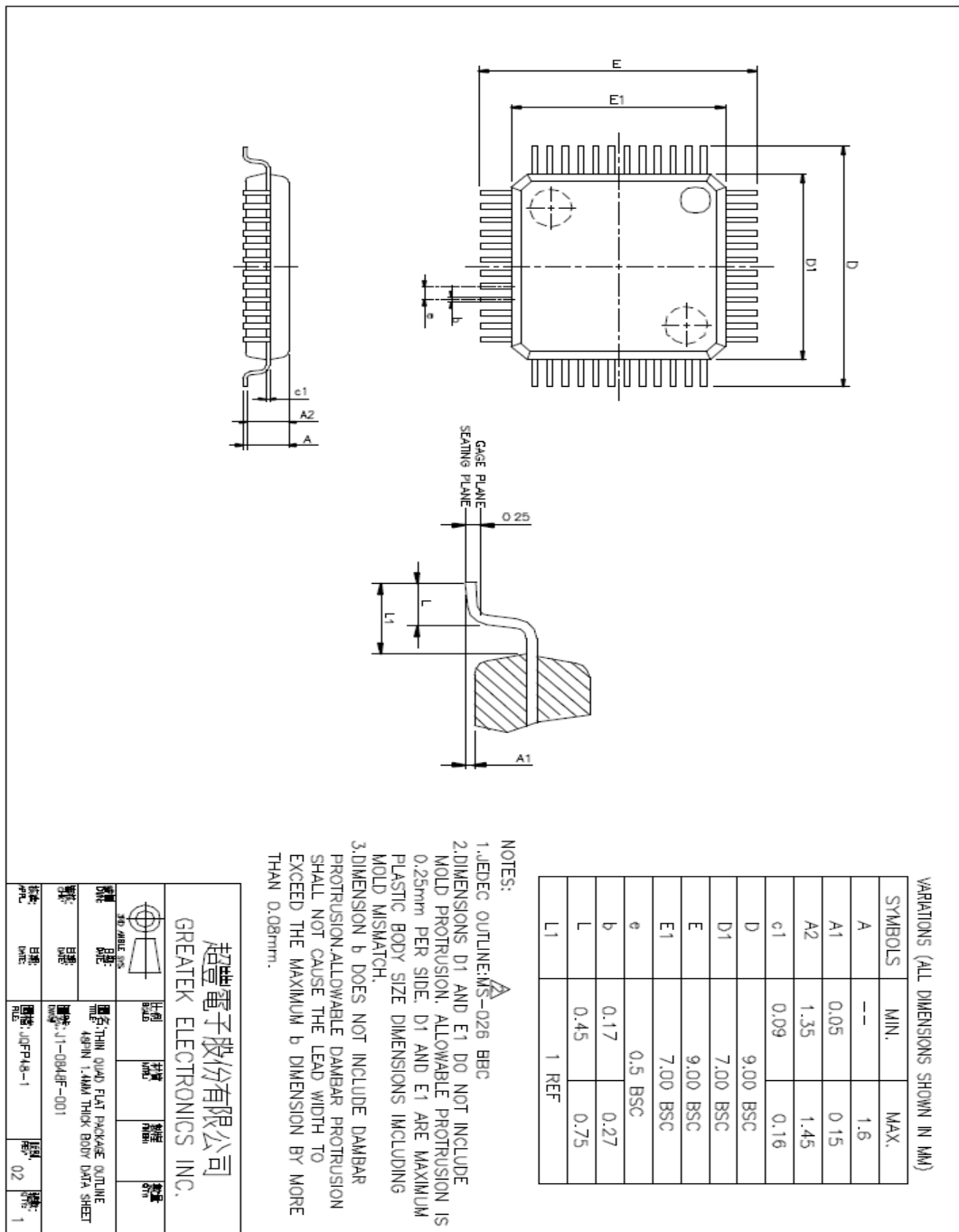
Card Power Output Current Range

- For SD/MMC
  - MAX: 200mA
- For MS
  - MAX: 100mA
- Card power output voltage range
  - SD/MMC/MS: 3.3V±0.3V

- AU6333 will turn off all of Card Power in suspend mode

Figure 5.1 Card Detect Power-on Timing

```
                                            1ms to 10ms ( Depend
                                            Load Capacitor )
                                                                3.3V+/- 0.3V

   CARD_POWER


                 100ms + System
                 Polling timing




   CARD_DETECT
```

AU6333 USB 2.0 SD/MMC/MS Single/Dual LUN Flash Memory Card Reader V1.04W
Official release _ Public

Alcor Micro Corp. Http://www.alcormicro.com/

6.0 Mechanical Information

Figure 6.1 Mechanical Information Diagram

AU6333 USB 2.0 SD/MMC/MS Single/Dual LUN Flash Memory Card Reader V1.04W
Official release _ Public

7.0 Abbreviations

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

SIE   Serial Interface Engine
SD   Secure Digital
MMC   Multimedia Card
MS   Memory Stick Card
UTMI   USB Transceiver Macrocell Interface

AU6333 USB 2.0 SD/MMC/MS Single/Dual LUN Flash Memory Card Reader V1.04W
Official release _ Public

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.

AU6333 USB 2.0 SD/MMC/MS Single/Dual LUN Flash Memory Card Reader V1.04W
Official release _ Public