



# AU6366

**USB2.0 Single LUN  
Multiple Flash Card Reader Controller**

Technical Reference Manual



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**Multiple Flash Card Reader Controller**



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**<Memo>**



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# 1. Introduction

## 1.1 Description

The AU6366 is a single chip integrated USB 2.0 multimedia card reader controller that enables PC/DVD/Printer to read/write various type of flash media cards. Flash media cards such as CF, SMC, XD, SD, MMC, Memory Stick are widely used in digital camera, cell phone, PDA and MP3 player to store digital photos and compressed music.

Performance of AU6366 is maximized by implementing the latest and fastest card specification available from the industry.

The AU6366 is designed in shared pin architecture to meet cost and space regulate for Notebook end reunite.

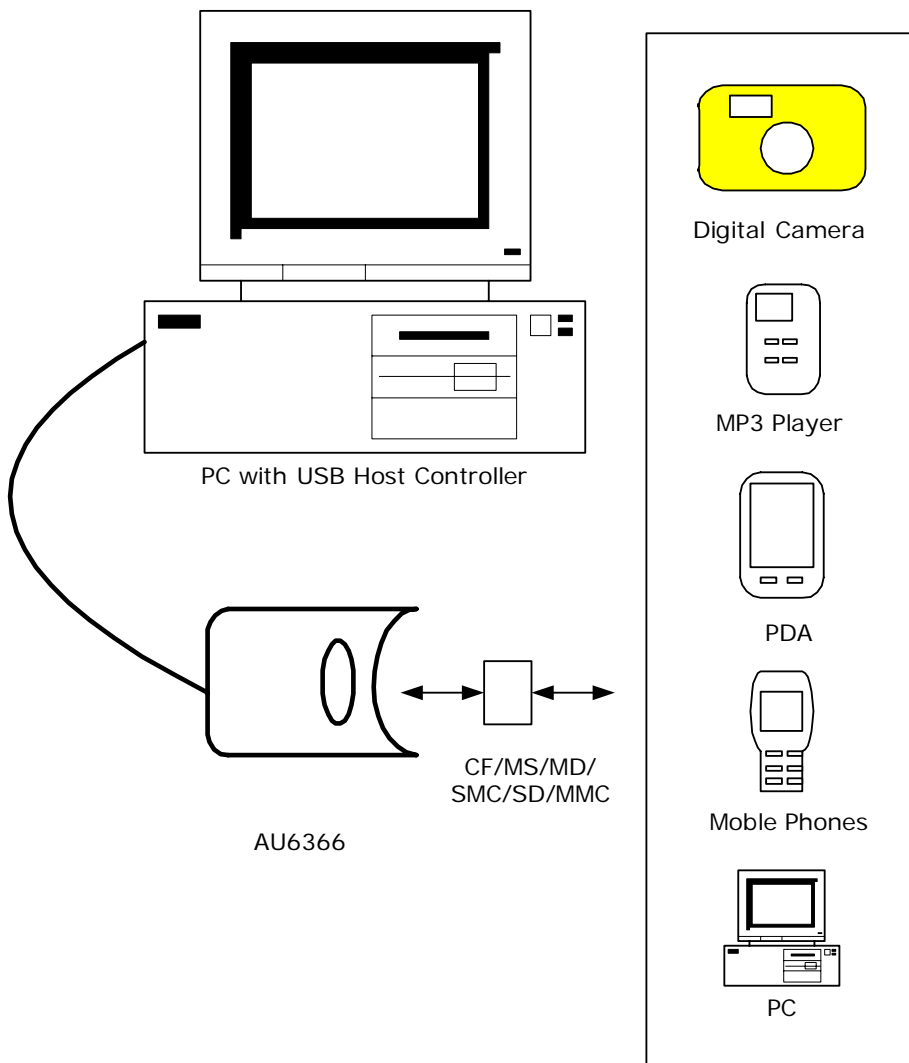
## 1.2 Features

- 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\_Duo/xD/SMC compatible flash card
- Support the latest flash card specification: CF 3.0 (16-bit IDE mode), SD1.1 (HS-SD), MMC4.0 (8-bit), MSPro parallel mode (4-bit), xD 1.2
- Hardware 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
- Support Dynamic Icon Utility
- Support LED for bus operating indication
- Power switch integrated to reduce production BOM cost
- 30MHz 8051 CPU
- Built in 3.3V to 2.5V regulator
- Run at 12MHz crystal
- Available in 48-pin LQFP package

## 2. Application Block Diagram

The following application drawing demonstrates a typical card reader block diagram using AU6366. By connecting one card reader to a desktop or notebook PC through USB bus, the AU6366 becomes a bus-powered, high speed USB card reader, which can be used as a bridge for data transfer between Desktop PC and Notebook PC.

Figure 2.1 Block Diagram



### 3. Pin Assignment

The AU6366 is delivered in 48pin LQFP form factor. Documented below is a figure shows signal names of each pin and a table in the following page describes each pin in more details.

**Figure 3.1 Pin Assignment Diagram**

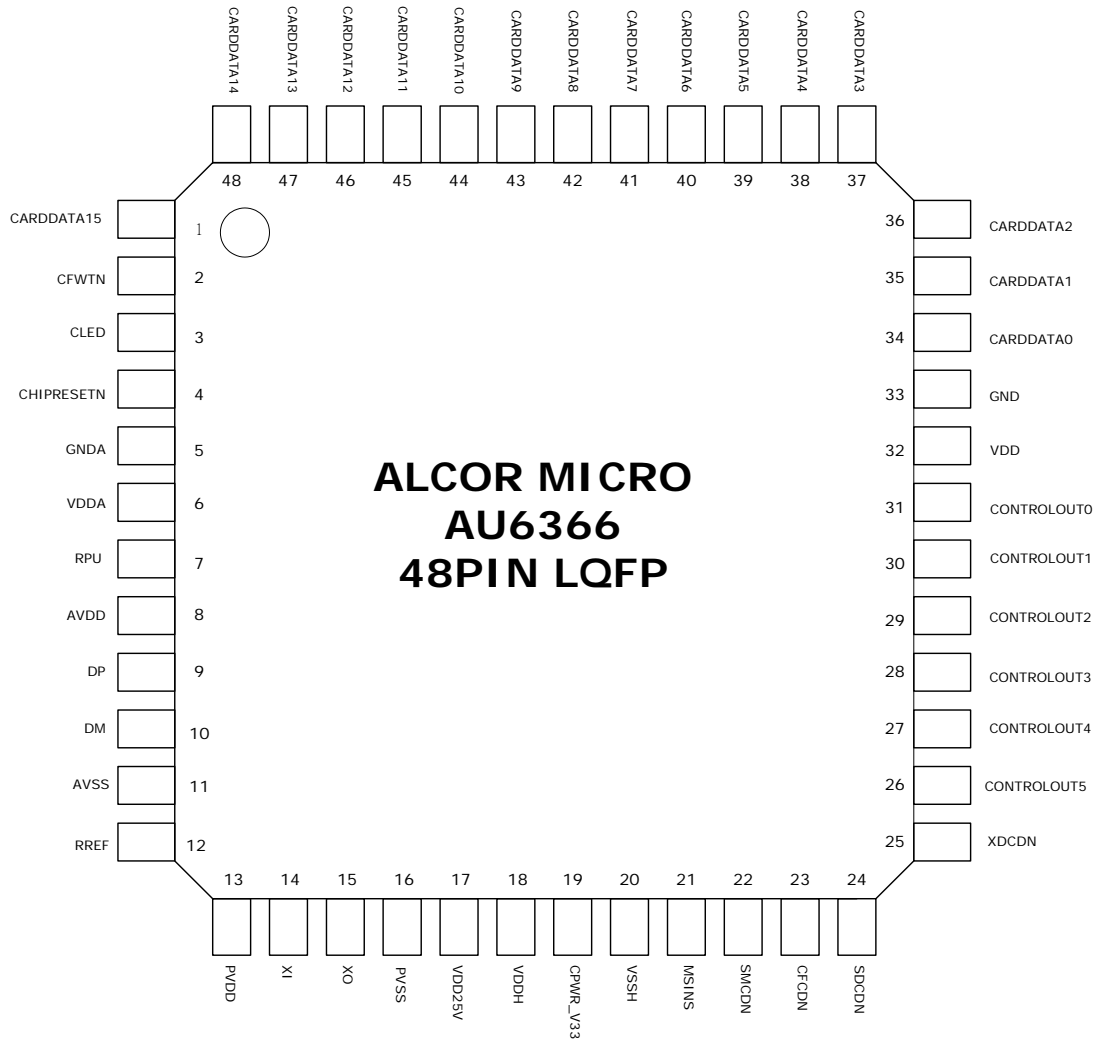




Table 3.1 Pin Descriptions

Pin #	Pin Name	I/O	Description
1	CARDDATA15	I/O	CF Data15/xD Data7
2	CFWTN	I	CF WAITN
3	CLED	O	Card Operating LED
4	CHIPRESETN	I	Chip Reset, Pull up with RC
5	GNDA		PLL Ground
6	VDDA	I	PLL VDD 2.5V
7	RPU	I	Connected with an 1.5k pull up resistor to 3.3 VDD
8	AVDD	I	Analog Power 3.3V
9	DP	I/O	DP
10	DM	I/O	DM
11	AVSS		Analog Ground
12	RREF	I	Connected an 1k resistor to GND for impedance match
13	PVDD	I	OSC Power 3.3V
14	XI	I	12 MHz crystal input.
15	XO	O	12 MHz crystal output.
16	PVSS		OSC Ground
17	VDD25V	O	Core Power 2.5V
18	VDDH	I	3.3V for IO pad
19	CPWR_V33	O	Card Power 3.3V
20	VSSH		Power Ground
21	MSINS	I	MS INS
22	SMCDN	I	SMC Card Detect
23	CFCDN	I	CF Card Detect
24	SDCDN	I	SD Card Detect
25	XDCDN	I	xD Card Detect
26	CONTROLOUT5	O	CFRESETN and SMWRN/XDWRN
27	CONTROLOUT4	O	CFWRN and SMRDN/XDRDN
28	CONTROLOUT3	O	CFRDN and XDCEN/SMCEN
29	CONTROLOUT2	O	CFAD2 and SMALE/XDALE

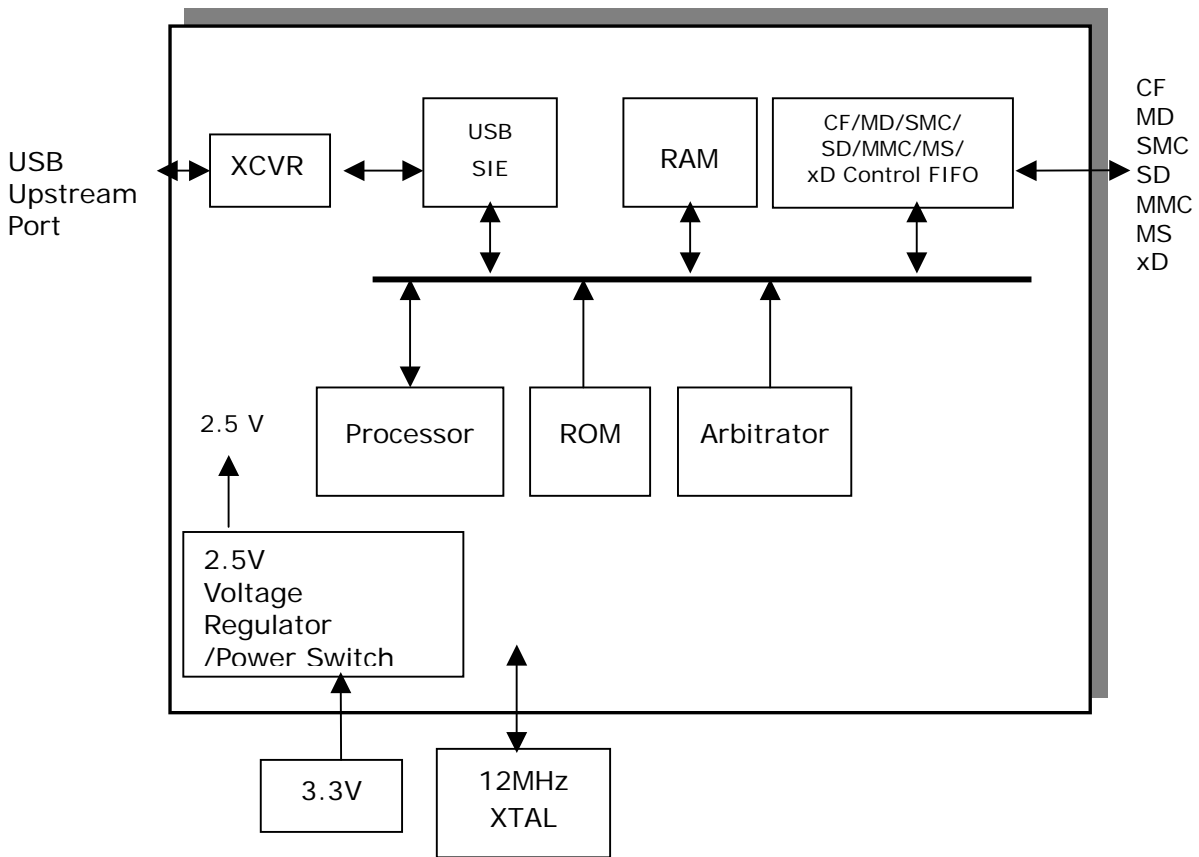


Pin #	Pin Name	I/O	Description
30	CONTROLOUT1	O	CFAD1, MSCLK and SMCLE/XDCLE
31	CONTROLOUT0	O	CFAD0, SDCLK and MSBS
32	VDD	I	Core power 2.5V
33	GND		Core Ground
34	CARDDATA0	I/O	CFDATA0, MSDATA0, and SDCMD
35	CARDDATA1	I/O	CFDATA1, MSDATA1, XDWPN, and SMWPN
36	CARDDATA2	I/O	CFDATA2, MSDATA2, and SDWP
37	CARDDATA3	I/O	CFDATA3, MSDATA3, SMRBN, and XDRBN
38	CARDDATA4	I/O	CFDATA4 and SDDATA0
39	CARDDATA5	I/O	CFDATA5 and SDDATA1
40	CARDDATA6	I/O	CFDATA6 and SDDATA2
41	CARDDATA7	I/O	CFDATA7 and SDDATA3
42	CARDDATA8	I/O	CFDATA8, XDDATA0, and SDDATA4
43	CARDDATA9	I/O	CFDATA9, XDDATA1, and SDDATA5
44	CARDDATA10	I/O	CFDATA10, XDDATA2, and SDDATA6
45	CARDDATA11	I/O	CFDATA11, XDDATA3, and SDDATA7
46	CARDDATA12	I/O	CFDATA12 and XDDATA4
47	CARDDATA13	I/O	CFDADA13 and XDDATA5
48	CARDDATA14	I/O	CFDATA14 and XDDATA6

# 4. System Architecture and Reference Design

## 4.1 AU6366 Block Diagram

Figure 4.1 AU6366 Block Diagram





## 5. Electrical Characteristics

### 5.1 Absolute Maximum Ratings

Table 5.1 Absolute Maximum Ratings

SYMBOL	PARAMETER	RATING	UNITS
$V_{DDH}$	Power Supply	-0.3 to $V_{DDH} + 0.3$	V
$V_{IN}$	Input Signal Voltage	-0.3 to 3.6	V
$V_{OUT}$	Output Signal Voltage	-0.3 to $V_{DDH} + 0.3$	V
$T_{STG}$	Storage Temperature	-40 to 150	°C

### 5.2 Recommended Operating Conditions

Table 5.2 Recommended Operating Conditions

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
$V_{DDH}$	Power Supply	3.0	3.3	3.6	V
$V_{DD}$	Digital Supply	2.25	2.5	2.75	V
$V_{IN}$	Input Signal Voltage	0	3.3	3.6	V
$T_{OPR}$	Operating Temperature	0		70	°C

### 5.3 General DC Characteristics

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	
$V_{DDH}$	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	$ I_{ol}  = 2\sim 16\text{mA}$			0.4	V
$V_{oh}$	Output high voltage	$ I_{oh}  = 2\sim 16\text{mA}$	2.4			V
$R_{pu}$	Input pull-up resistance	PU=high, PD=low	55	75	190	$K\Omega$
$R_{pd}$	Input pull-down resistance	PU=low, PD=high	40	75	190	$K\Omega$
$I_{in}$	Input leakage current	$V_{in} = V_{DDH}$ or 0	-10	$\pm 1$	10	$\mu A$
$I_{oz}$	Tri-state output leakage current		-10	$\pm 1$	10	$\mu A$

## 5.5 USB Transceiver Characteristics

**Table 5.5 Electrical characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
VD33	Analog supply Voltage		3.0	3.3	3.6	V
VDDU VDDA	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 $1.5k\Omega$ pull-up resistor on pin RPU disconnected			120	$\mu A$

**Table 5.6 Static characteristic : Digital pin**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Input levels						
V <sub>IL</sub>	Low-level input voltage				0.8	V
V <sub>IH</sub>	High-level input voltage		2.0			V
Output levels						
V <sub>OL</sub>	Low-level output voltage				0.2	V
V <sub>OH</sub>	High-level output voltage		VDDH-0.2			V

**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 <sub>HSDIFF</sub>	High speed differential input sensitivity	$ V_{I(DP)} - V_{I(DM)} $ measured at the connection as application circuit	300			mV
V <sub>HSCM</sub>	High speed data signaling common mode voltage range		-50		500	mV
V <sub>HSSQ</sub>	High speed squelch detection threshold	Squelch detected			100	mV
		No squelch detected	150			mV
V <sub>HSDSC</sub>	High speed disconnection detection threshold	Disconnection detected	625			mV
		Disconnection not detected			525	mV
Output Levels						
V <sub>HSOI</sub>	High speed idle level output voltage(differential)		-10		10	mV
V <sub>HSOL</sub>	High speed low level output voltage(differential)		-10		10	mV
V <sub>HSOH</sub>	High speed high level output voltage(differential)		-360		400	mV
V <sub>CHIRPJ</sub>	Chirp-J output voltage ( differential )		700		1100	mV
V <sub>CHIRPK</sub>	Chirp-K output voltage ( differential )		-900		-500	mV
Resistance						
R <sub>DRV</sub>	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

**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

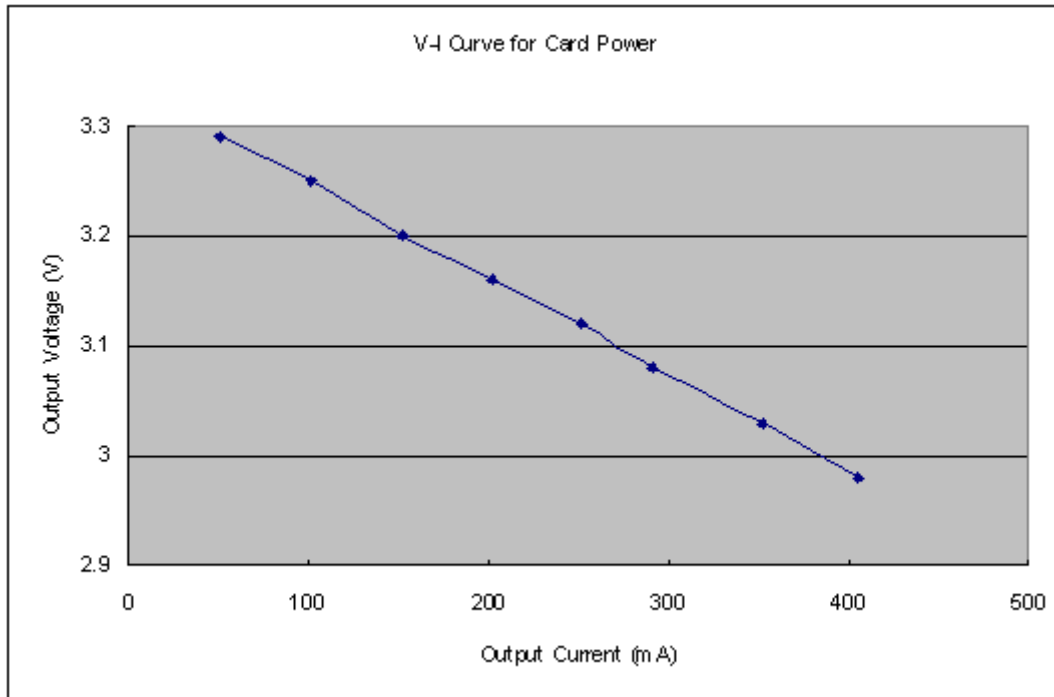


Figure 5.1 Built-in card power switch I-V curve

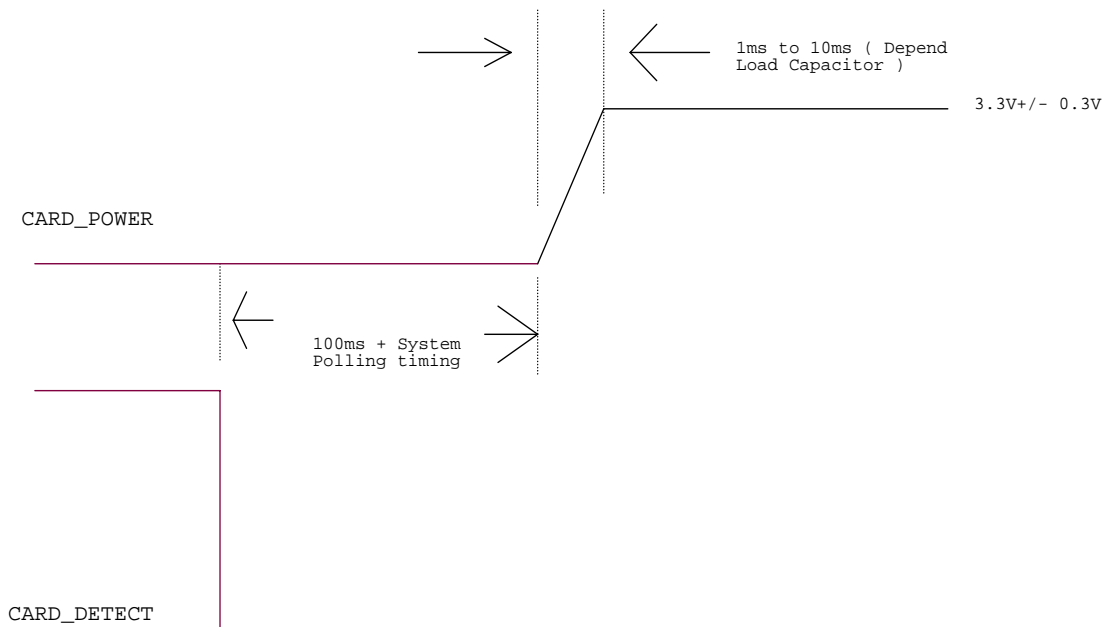
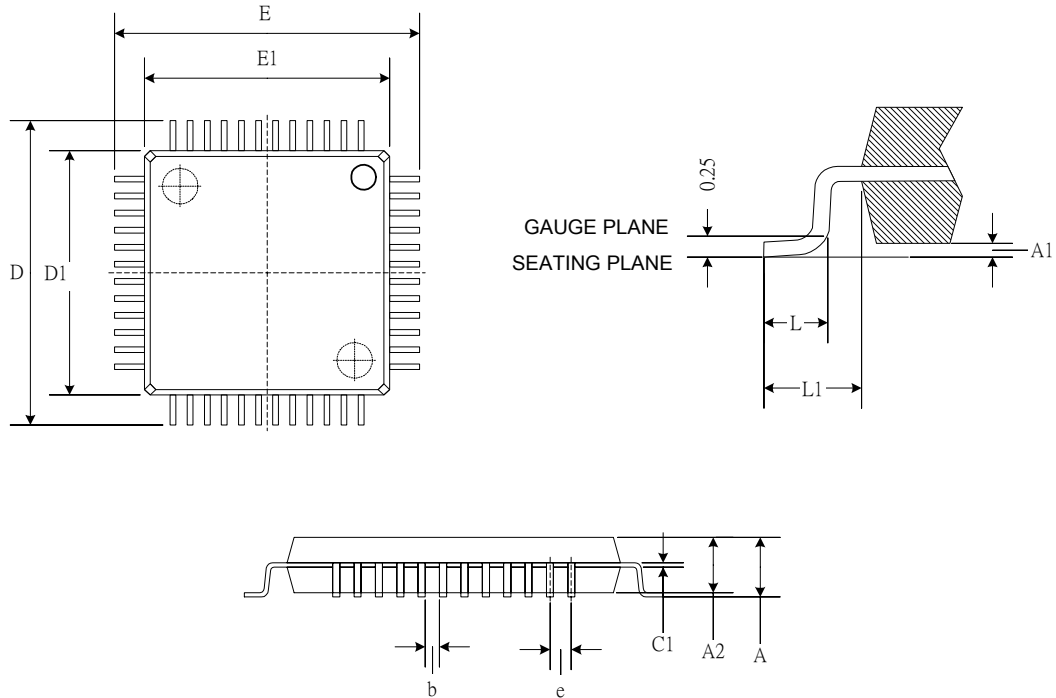


Figure 5.2 Card Detect Power-on Timing

## 6. Mechanical Information

Figure 6.1 Mechanical Information Diagram



SYMBOLS	MIN.	MAX.
A	--	1.6
A1	0.05	0.15
A2	1.35	1.45
c1	0.09	0.16
D	9.00 BSC	
D1	7.00 BSC	
E	9.00 BSC	
E1	7.00 BSC	
e	0.5 BSC	
b	0.17	0.27
L	0.45	0.75
L1	1 REF	

1. JEDEC OUTLINE: MS-026 BBC
2. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25mm PER SIDE. D1 AND E1 ARE MAXIMUM PLASTIC BODY SIZE DIMENSIONS INCLUDING MOLD MISMATCH.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL NOT CAUSE THE LEAD WIDTH TO EXCEED THE MAXIMUM b DIMENSION BY MORE THAN 0.08mm



## 7. Abbreviations

In this chapter some of the terms and abbreviations used throughout the technical reference manual are listed as follows.

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

## 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.