AU6366

USB2.0 Single LUN

Multiple Flash Card Reader Controller

Technical Reference Manual

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Revision History

Date	Revision	Description
Jan 2006	1.00W	Official Release
Aug 2006	1.01W	Update new address of Los Angeles Office
Nov 2006	1.02W	Modify “1.2 Features”
July 2007	1.03W	Modify “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

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

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

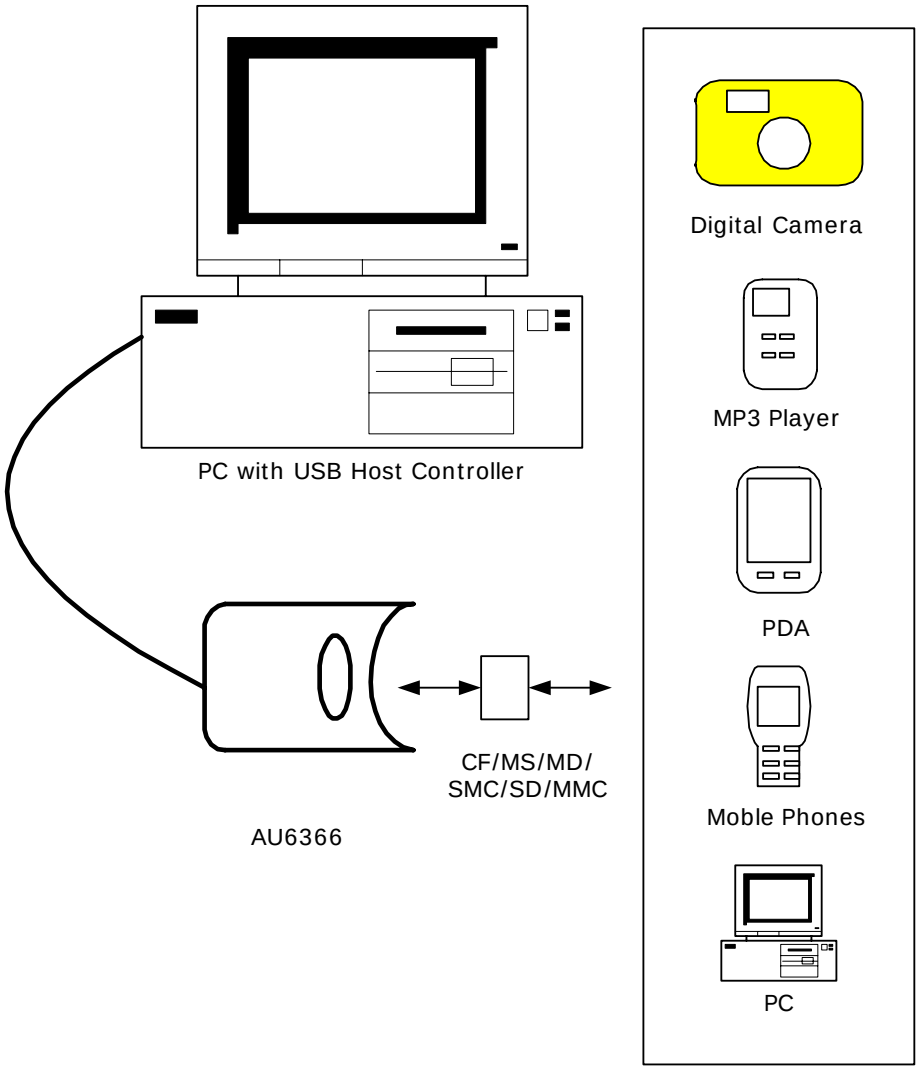
1.2 Features

- 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

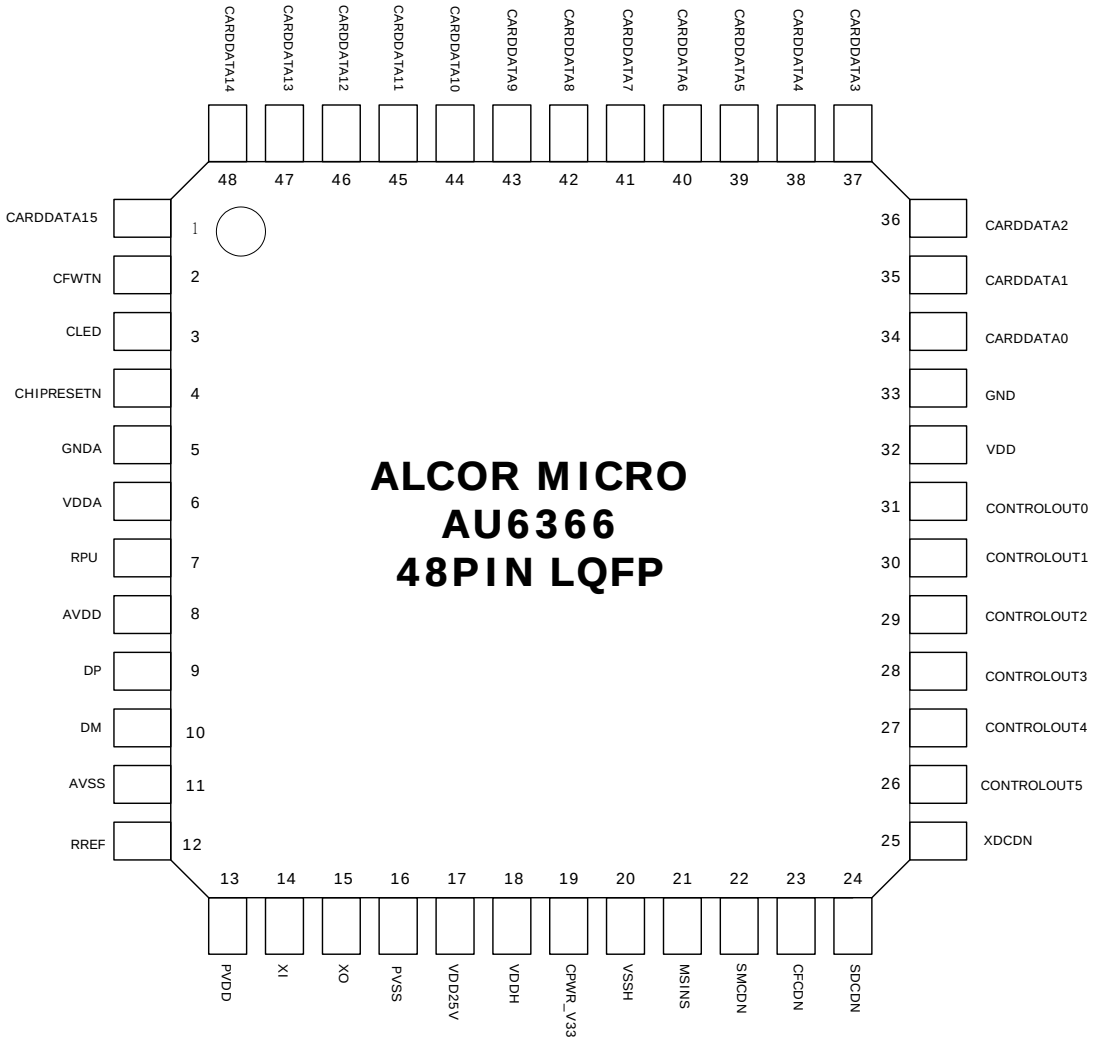


Table 3.1 Pin Descriptions

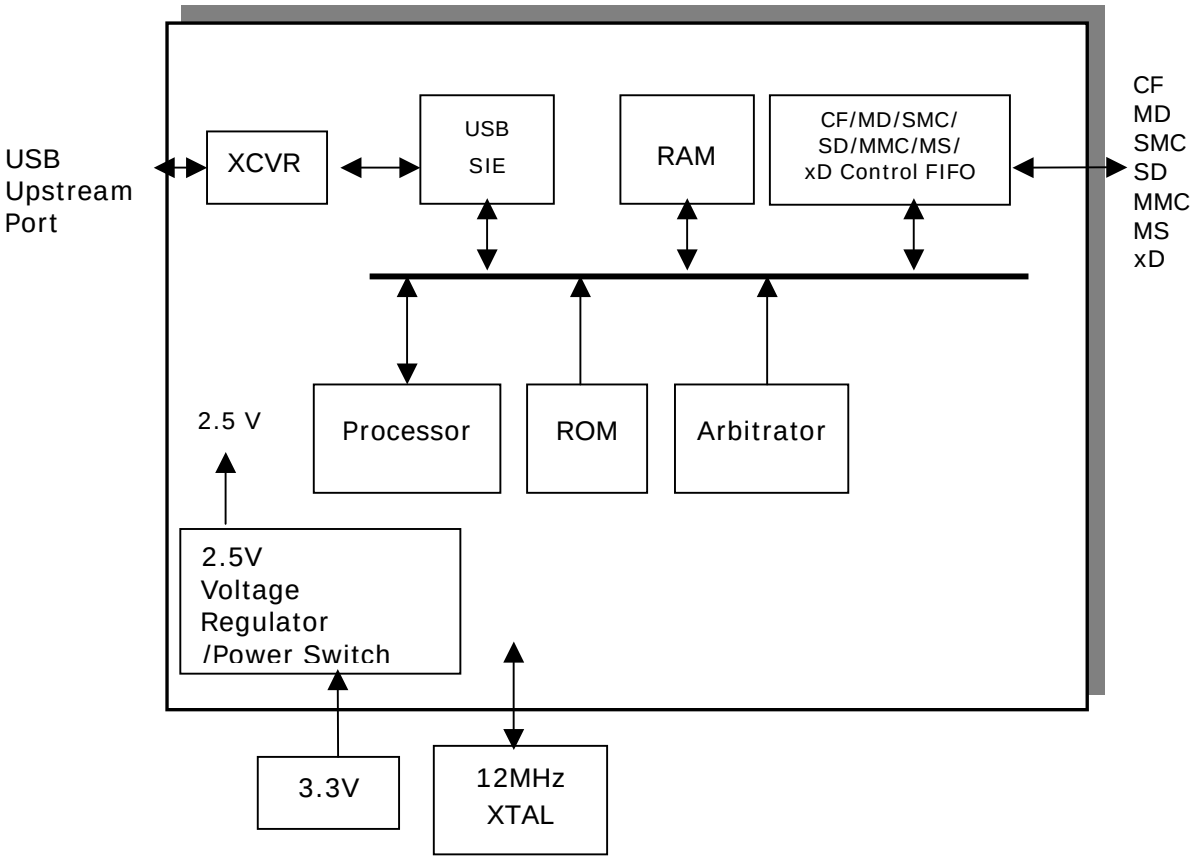
Pin #	Pin Name	I/O	Description
1	CARDDATA15	I/O	CF Data15/xD Data7
2	CFWTN	I	CF WAITN
3	CLED	O	Card Operating LED
4	CHIPRESETN	I	Chip Reset, Pull up with RC
5	GNDA		PLL Ground
6	VDDA	I	PLL VDD 2.5V
7	RPU	I	Connected with an 1.5k pull up resistor to 3.3 VDD
8	AVDD	I	Analog Power 3.3V
9	DP	I/O	DP
10	DM	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	^{O}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	^{O}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	$\lvert I_{ol} \rvert$ =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	55	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_{DDH} 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
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 1.5kΩ 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		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_{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

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

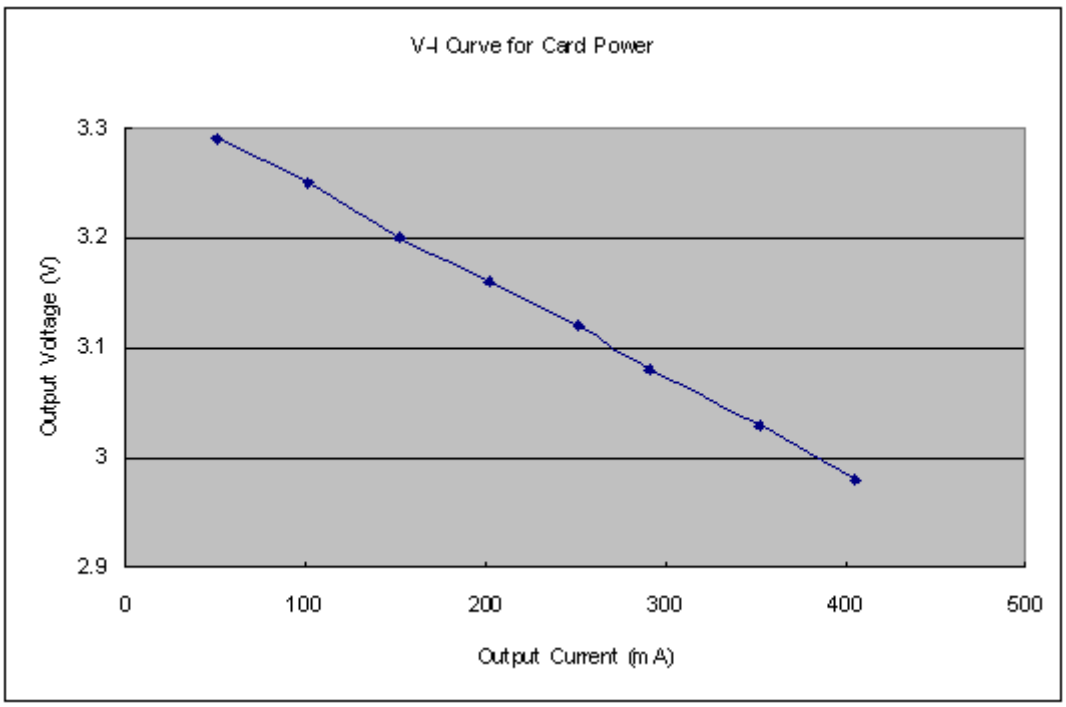


Figure 5.1 Built-in card power switch I-V curve

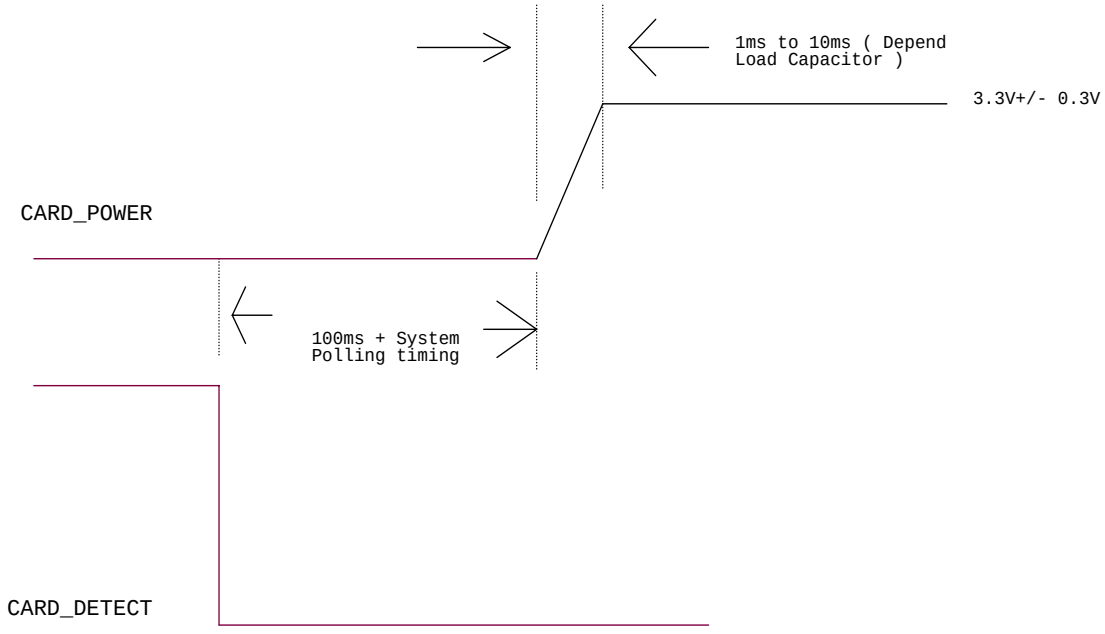
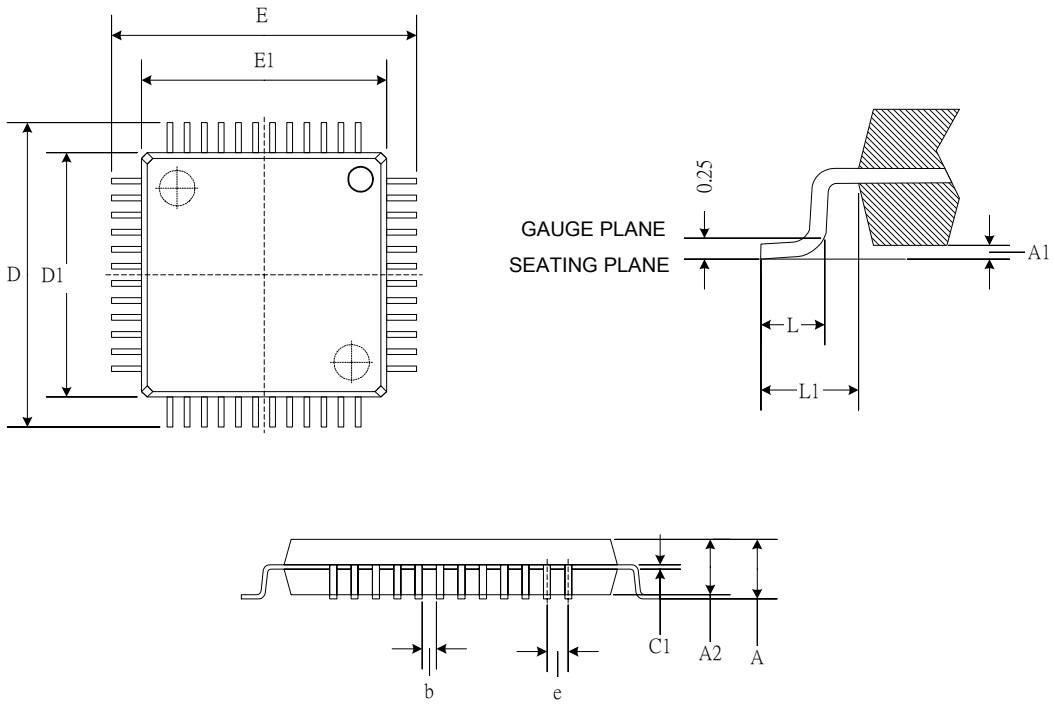


Figure 5.2 Card Detect Power-on Timing

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 IMCLUDING 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.

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

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