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AU6320

USB2.0 CF Card Reader Controller

Technical Reference Manual



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1. Introduction

1.1 Description

The AU6320 is a single chip integrated USB 2.0 multimedia card reader controller that enables PC/DVD/Printer to read/write CF (Compact Flash) widely used in digital camera, cell phone, PDA and MP3 player to store digital photos and compressed music. Performance of AU6320 is maximized by implementing the latest and fastest card specification available from the industry.

The AU6320 is designed in shared pin architecture to meet cost and space regulate for Notebook end reunite.

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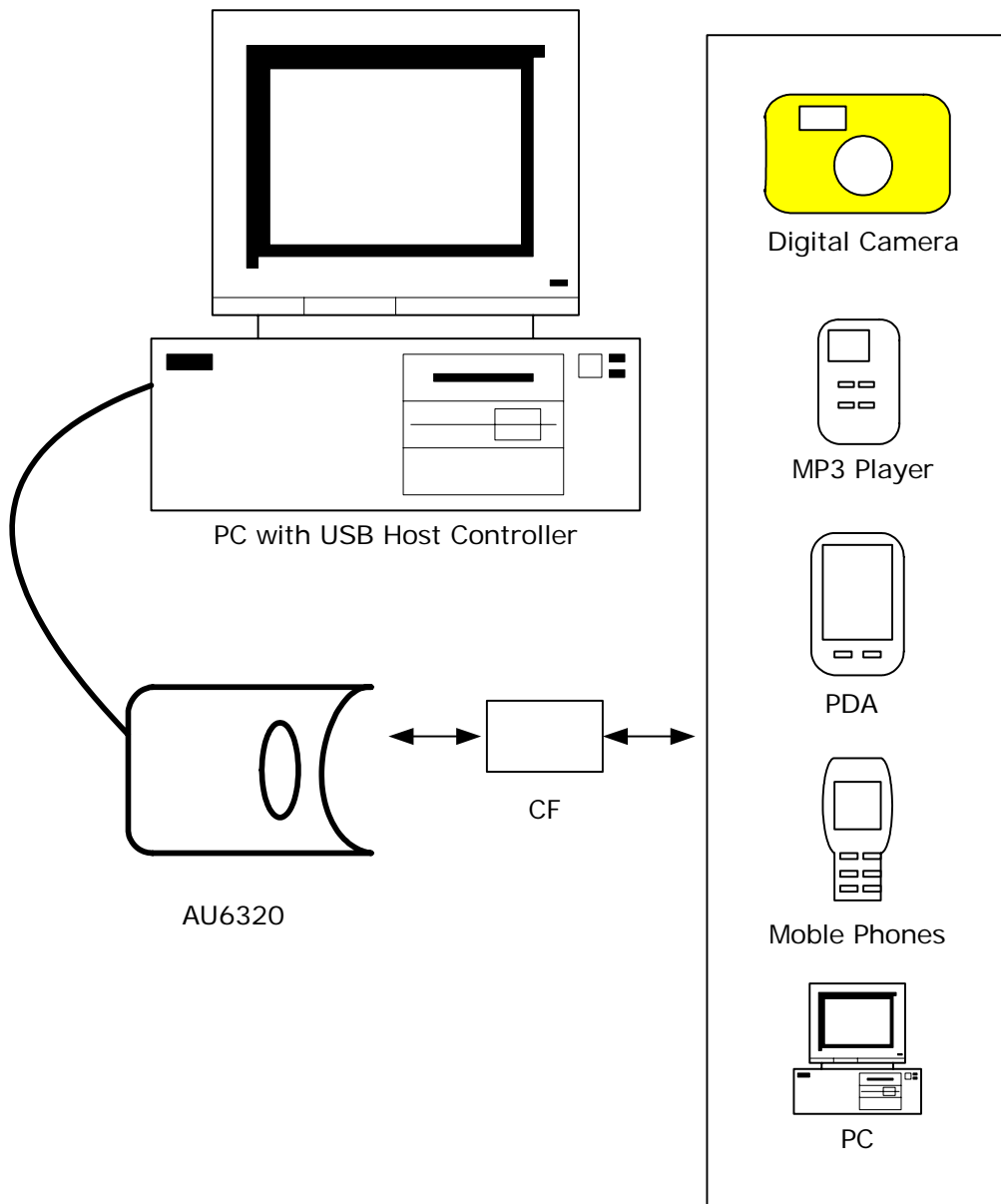
1.2 Features

- Support USB V2.0 specification and USB Device Class Definition for Mass Storage, Bulk-Transport V1.0
- Support CF compatible flash card, including Micro Drive (CF type II).
- Support CF 4.0 Ultra DMA mode.
- Hardware DMA engine integrated for performance enhancement.
- Work with default driver from Windows ME/2000/XP/Vista 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 1.8V regulator
- Runs at 12MHz crystal
- Available in 48-pin LQFP package

2. Application Block Diagram

Following application diagram demonstrates a typical card reader using the AU6320 chip. By connecting the card reader to a desktop or notebook PC through USB bus, the AU6320 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

AU6320 is available in 48-pin LQFP package. Below diagram shows signal name of each pin and table in the following page describes each pin in detail.

Figure 3.1 AU6320 Pin Assignment Diagram

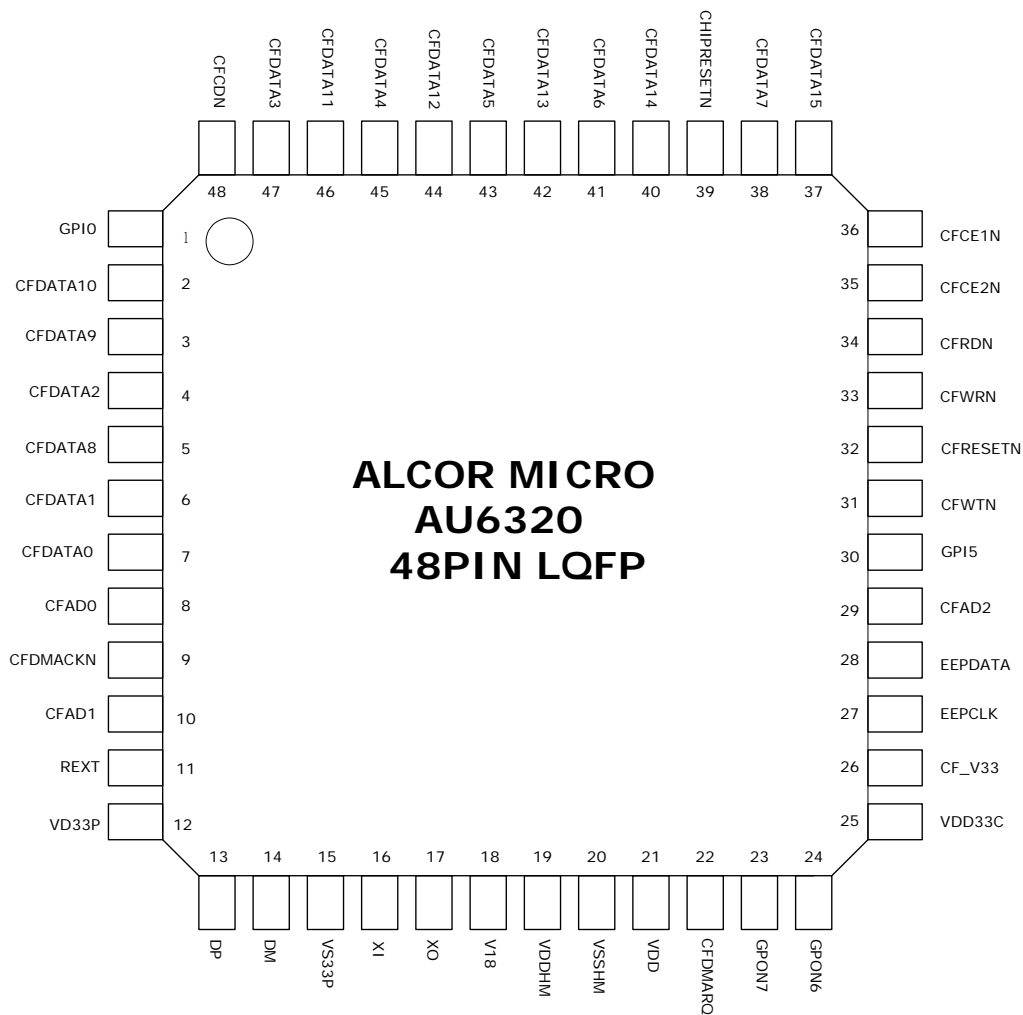




Table 3.1 AU6320 Pin Descriptions

Pin #	Pin Name	I/O	Description
1	GPI0	I	Slot Mode Select. '0' for 4 LUN [Default]. '1' for 1 LUN.
2	CFDATA10	IO	CF Data10
3	CFDATA9	IO	CF Data9
4	CFDATA2	IO	CF Data2
5	CFDATA8	IO	CF Data8
6	CFDATA1	IO	CF Data1
7	CFDATA0	IO	CF Data0
8	CFAD0	O	CF Address0
9	CFDMACKN	O	
10	CFAD1	O	CF Address1
11	REXT	IO	External Resistor 330 to Ground
12	VD33P	PWR	3.3V Power Source for UTMI
13	DP	IO	DP
14	DM	IO	DM
15	VS33P	GND	Ground Power
16	XI	I	12MHz Crystal Input
17	XO	O	12MHz Crystal Output
18	V18	PWR	Core Power 1.8V
19	VDDHM	PWR	3.3V Power Source for IO pad
20	VSSHM	GND	3.3V ground for IO pad
21	VDD	PWR	Core Power 1.8V Input
22	CFDMARQ	I	
23	GPON7	O	Card access LED.
24	GPON6	O	CF power indicator. '0' for on. '1' for off. Reserved for external PMOS for CF card power.
25	VDD33C	PWR	3.3V power for PMOS
26	CF_V33	PWR	CF Power
27	EEPCLK	O	EEPCLK
28	EEPDATA	IO	EEPDATA
29	CFAD2	O	CF Address2
30	GPI5	I	Device current consumption value. "1":250mA for WHQL; "0":100mA for normal mode
31	CFWTN	I	CF WTN

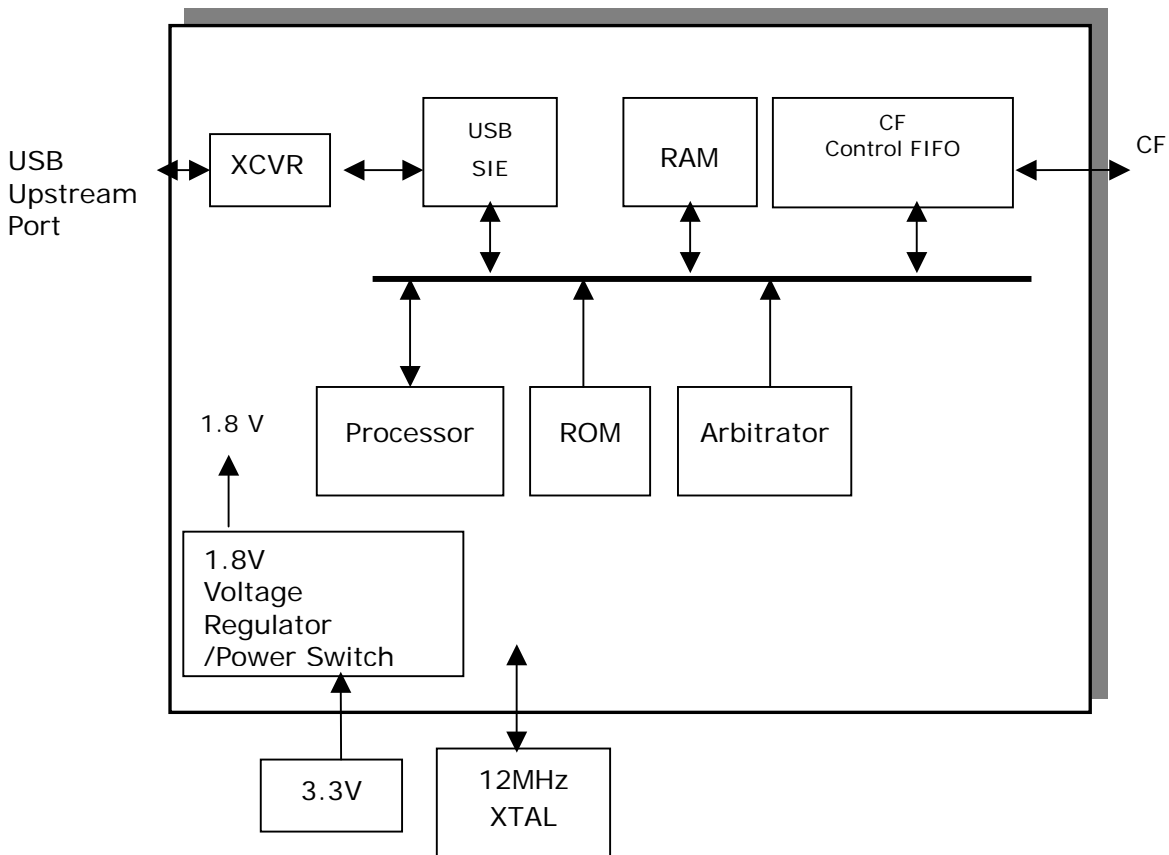


Pin #	Pin Name	I/O	Description
32	CFRESETN	O	CF Reset
33	CFWRN	O	CF WRN
34	CFRDN	O	CF RDN
35	CFCE2N	O	CFCE2N
36	CFCE1N	O	CFCE1N
37	CFDATA15	IO	CF Data15
38	CFDATA7	IO	CF Data7
39	CHIPRESETN	I	Chip Reset
40	CFDATA14	IO	CF Data14
41	CFDATA6	IO	CF Data6
42	CFDATA13	IO	CF Data13
43	CFDATA5	IO	CF Data5
44	CFDATA12	IO	CF Data12
45	CFDATA4	IO	CF Data4
46	CFDATA11	IO	CF Data11
47	CFDATA3	IO	CF Data3
48	CFCDN	I	CF Card Detect ("0":Detected; "1":Undetected)

4. System Architecture and Reference Design

4.1 AU6320 Block Diagram

Figure 4.1 AU6320 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 3.6	V
V _{IN}	Input 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} V ₁₈	Digital Supply	1.62	1.8	1.98	V
V _{IN}	Input Signal Voltage	0	3.3	3.6	V
T _{OPR}	Operating Temperature	0		85	°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	110	$K\Omega$
R_{pd}	Input pull-down resistance	PU=low, PD=high	40	75	150	$K\Omega$
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
VD33P	Analog supply Voltage		3.0	3.3	3.6	V
VDD V18	Digital supply Voltage		1.62	1.8	1.98	V
I_{CC}	Operating supply current	High speed operating at 480 MHz			55	mA

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	$ 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)						
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

5.6 Power Switch Feature

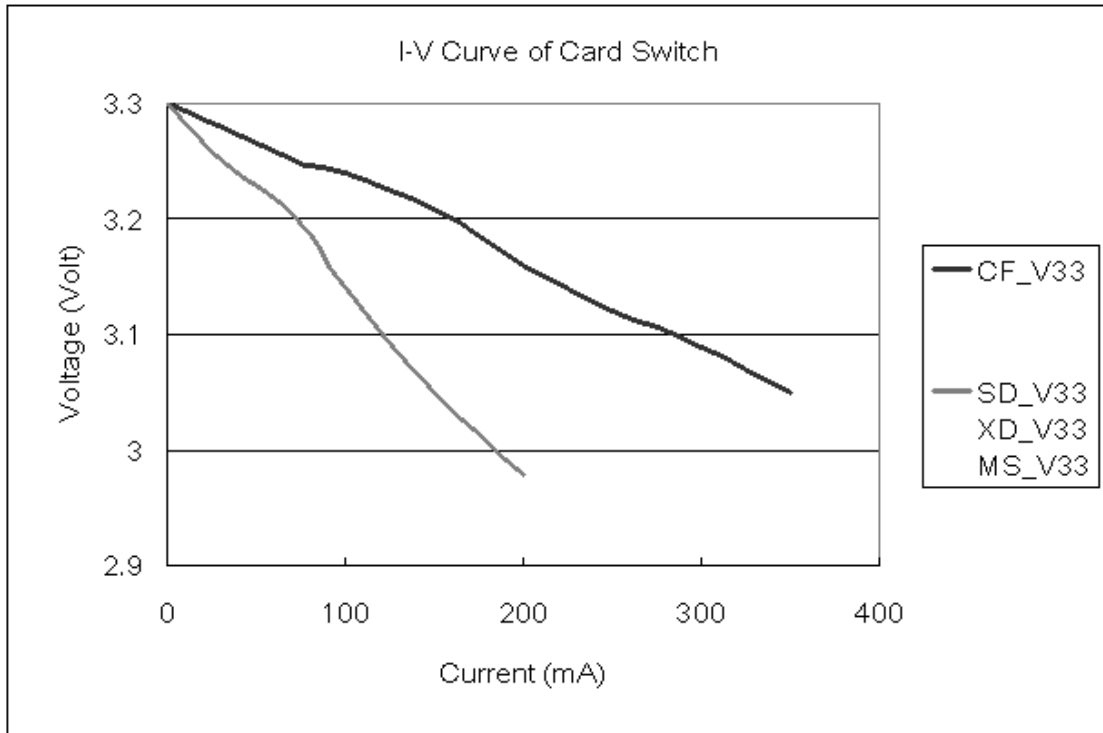


Figure 5.1 Built-in card power switch I-V curve

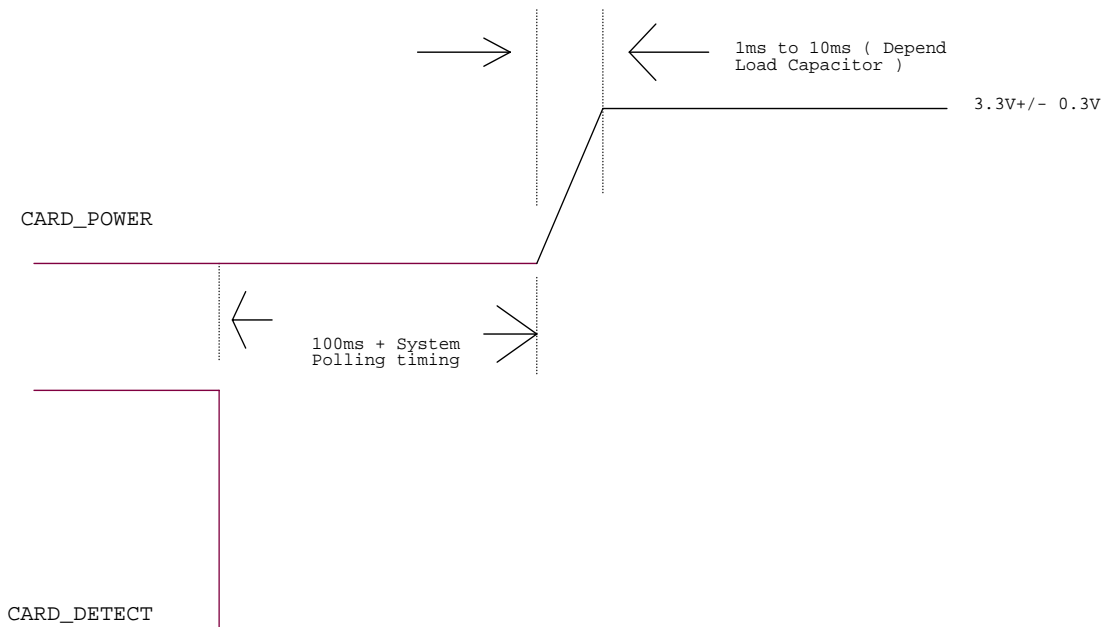
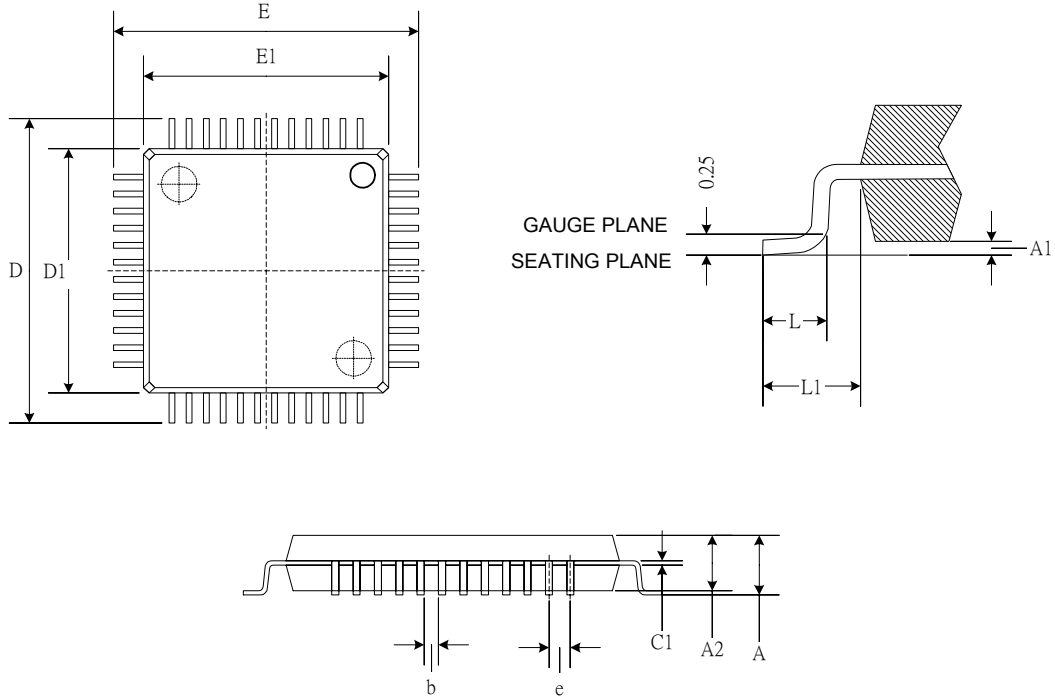


Figure 5.2 Card Detect Power-in Timing

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.

SIE	Serial Interface Engine
CF	Compact Flash
UTMI	USB Transceiver Macrocell Interface

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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.