Data Book

AU6367

USB2.0 SD / MMC Flash Card Reader with UFD Controller

Technical Reference Manual

Product Specification

Preliminary Release

Revision 0.9W

Confidential **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
Aug 2005	0.9W	Preliminary release

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

This AU6367 is a highly integrated single chip for USB SD/MMC flash card reader and UFD controller. It supports USB2.0 high-speed transmission to SD/MMC card and SLC flash memory interface in one chip. The characteristic of high integration let AU6367 can be easily produced as the multi-feature (Flash card reader/UFD) device.

The AU6367 supports USB2.0 high-speed specification and USB Storage Class V1.0 specification. It 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 AU6367, users can transfer digital data between storage memory and PC or these electronic devices.

Especially, AU6367 is designed with the high performance characteristic in flash card I/O speed. Users can easy and fast transfer the digital content to PCs or the other electronic devices.

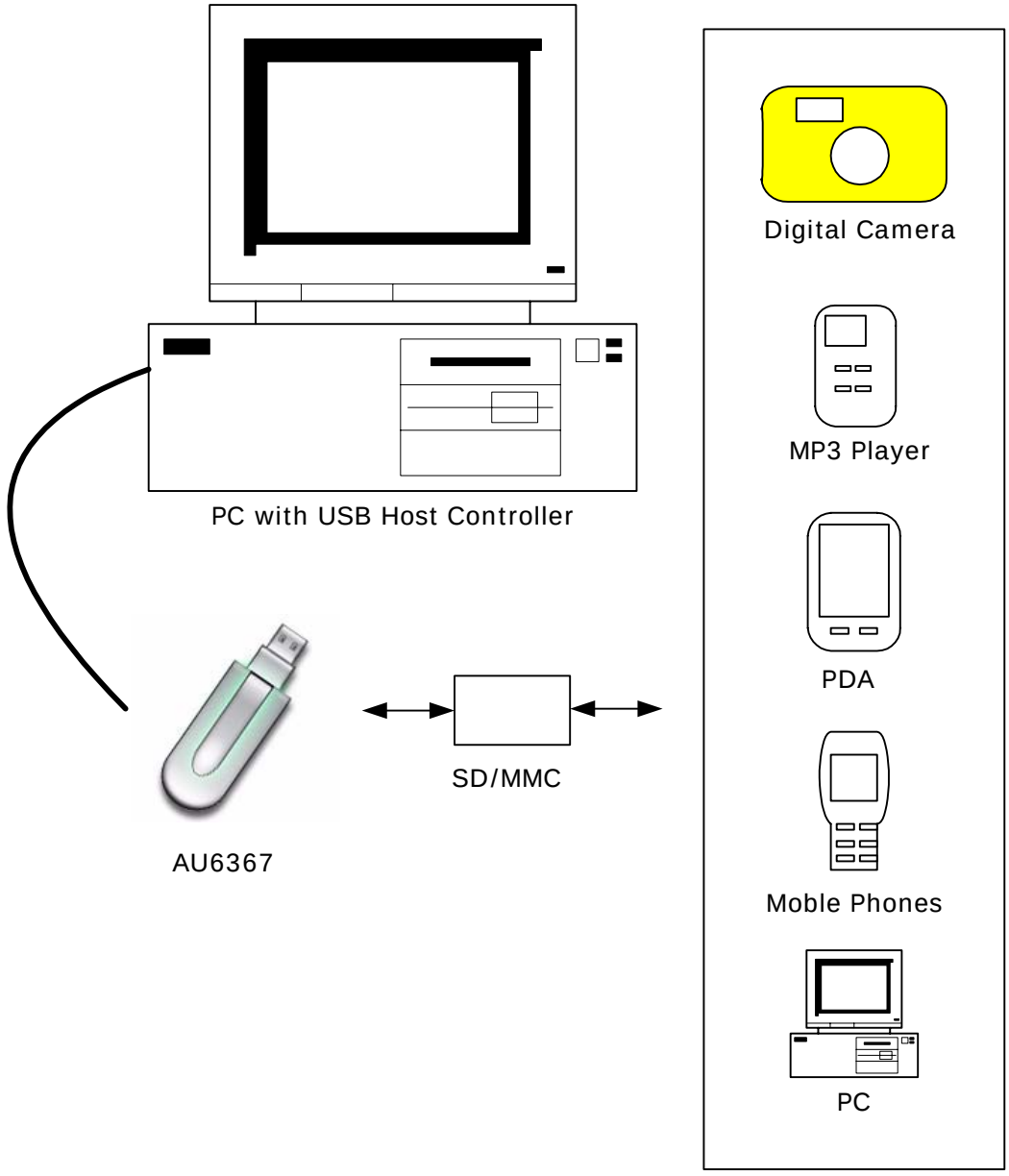
1.2 Features

- Support USB V2.0 specification and USB Device Class Definition for Mass Storage, Bulk-Transport V1.0
- Support SD/MMC compatible flash card
- Support the latest flash card specification: SD1.1 (HS-SD), MMC4.1 (8-bit)
- Support SLC flash memory
- Alcor speed-up engine integrated for data transmission 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 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

2.0 Application Block Diagram

Following is the application diagram of a typical card reader product with AU6367. By connecting the card reader to a desktop or notebook PC through USB bus, AU6367 is implemented as a bus-powered, full 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 Power Switch Feature

AU6367 integrates a 3.3V to 2.5V voltage regulator and power switch to replace all MOS chips for flash card power supply.

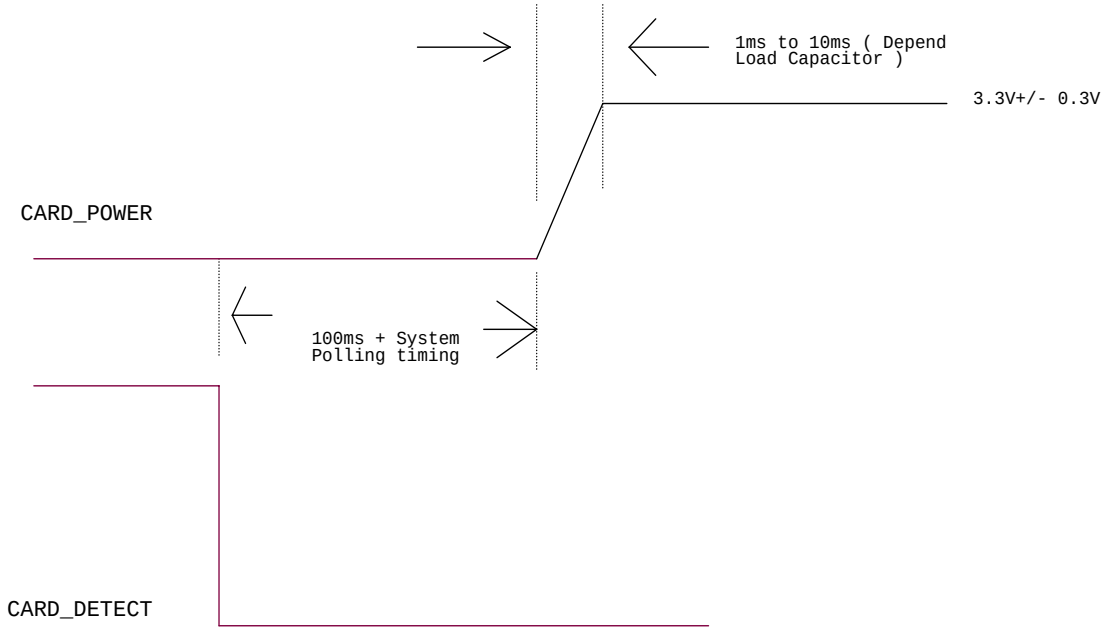
3.1 Card Power Output Current Range

- For MMC/SD
  - MAX: 100mA

- Card power output voltage range
  - MMC/SD: 3.3V±0.3V

- AU6367 will turn off all of Card Power in suspend mode

3.2 Card Detect Power-on Timing



4.0 Pin Assignment

The AU6367 is packed in 64pin-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 4.1 Pin Assignment Diagram

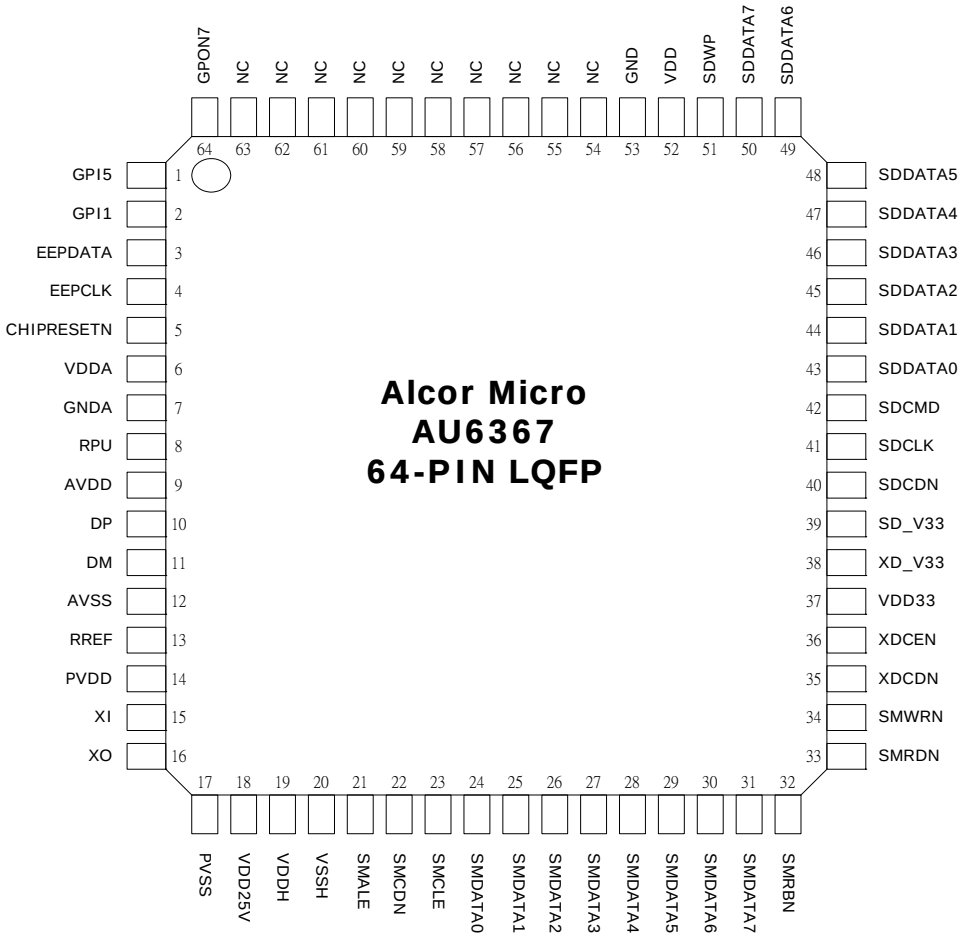


Table 4.1 Pin Descriptions

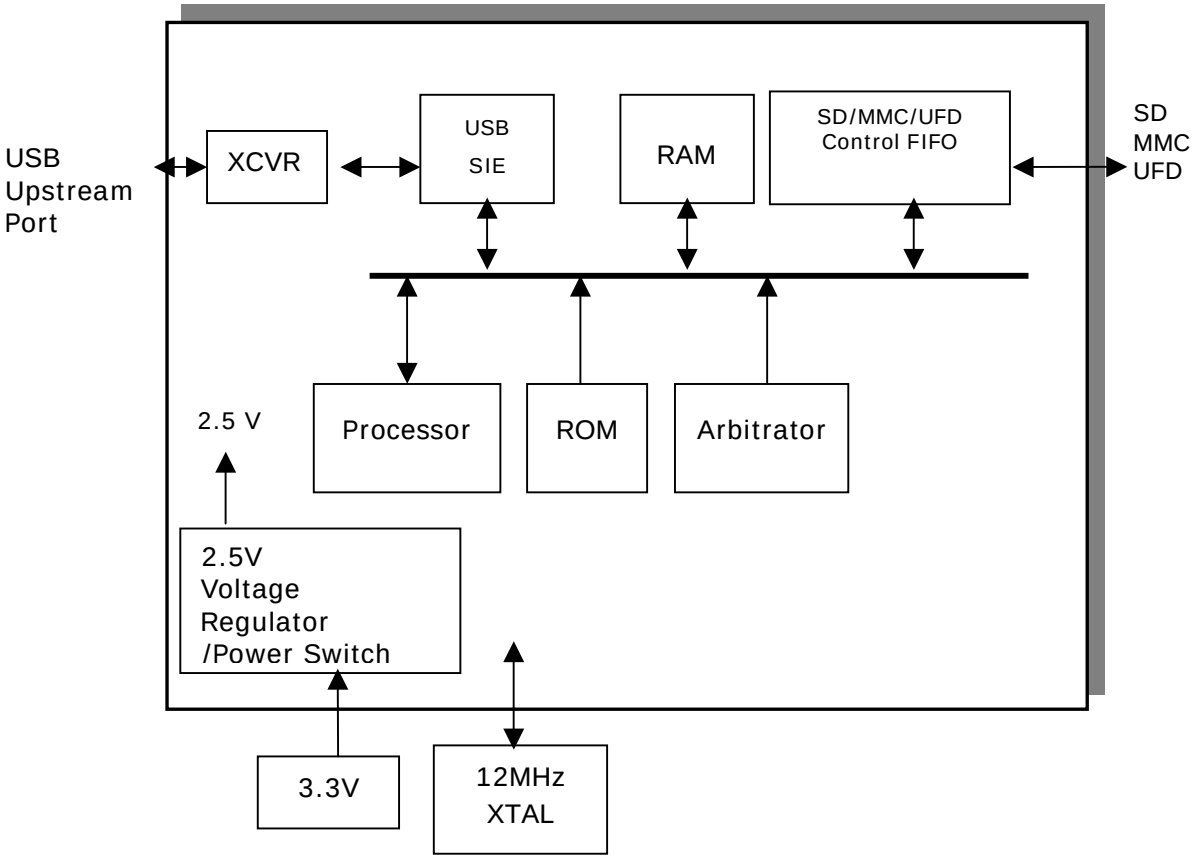
Pin #	Pin Name	I/O	Description
1	GPI5	I	Device current value. ('0':Low power[Default]; '1':High power)
2	GPI1	I	Pull low
3	EEPDATA	IO	EEPDATA
4	EEPCLK	O	EEPCLK
5	CHIPRESETN	I	Chip Reset
6	VDDA	A	Analog 2.5V VDD
7	GNDA	A	Analog 2.5V GND
8	RPU	IO	Connect 1.5K pull up Res. to 3.3V VDD
9	AVDD		Analog Power 3.3V
10	DP	IO	DP
11	DM	IO	DM
12	AVSS		Analog GND
13	RREF	IO	Connect 1K Res. to GND for impedance match
14	PVDD		OSC Power 3.3V
15	XI	I	12MHz Crystal Input
16	XO	O	12MHz Crystal Output
17	PVSS		OSC GND
18	VDD25V	O	2.5V Power Output for Core Power
19	VDDH	I	IO Power 3.3V
20	VSSH	I	IO GND
21	SMALE	O	SMC ALE
22	SMCDN	I	SMC Card Detect
23	SMCLE	O	SMC CLE
24	SMDATA0	IO	xD/SMC Data0
25	SMDATA1	IO	xD/SMC Data1
26	SMDATA2	IO	xD/SMC Data2
27	SMDATA3	IO	xD/SMC Data3
28	SMDATA4	IO	xD/SMC Data4
29	SMDATA5	IO	xD/SMC Data5
30	SMDATA6	IO	xD/SMC Data6
31	SMDATA7	IO	xD/SMC Data7
32	SMRBN	I	SMC RBN
33	SMRDN	O	SMC RDN
34	SMWRN	O	SMC WRN
35	XDCDN	I	XD Card Detect
36	XDCEN	O	XD CEN
37	VDD33	I	Power Switch 3.3V
38	XD_V33	O	XD Power
39	SD_V33	O	SD Power
40	SDCDN	I	SD Card Detect
41	SDCLK	O	SD CLK
42	SDCMD	IO	SD CMD
43	SDDATA0	IO	SD/MMC Data0
44	SDDATA1	IO	SD/MMC Data1

45	SDDATA2	IO	SD/MMC Data2
46	SDDATA3	IO	SD/MMC Data3
47	SDDATA4	IO	MMC Data4
48	SDDATA5	IO	MMC Data5
49	SDDATA6	IO	MMC Data6
50	SDDATA7	IO	MMC Data7
51	SDWP	I	SD Write Protect
52	VDD	I	Core Power 2.5V Input
53	GND	I	Core GND
54	NC		
55	NC		
56	NC		
57	NC		
58	NC		
59	NC		
60	NC		
61	NC		
62	NC		
63	NC		
64	GPON7	O	LED indicator for flash card operating

5.0 System Architecture and Reference Design

5.1 AU6367 Block Diagram

Figure 5.1 AU6367 Block Diagram



6.0 Electrical Characteristics

6.1 Absolute Maximum Ratings

Table 6.1 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

6.2 Recommended Operating Conditions

Table 6.2 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	25	125	^{O}C

6.3 Leakage Current and Capacitance

Table 6.3 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

6.4 DC Electrical Characteristics of 3.3V I/O Cells

Table 6.4 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

6.5 USB Transceiver Characteristics

Table 6.5 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 6.6 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 6.7 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

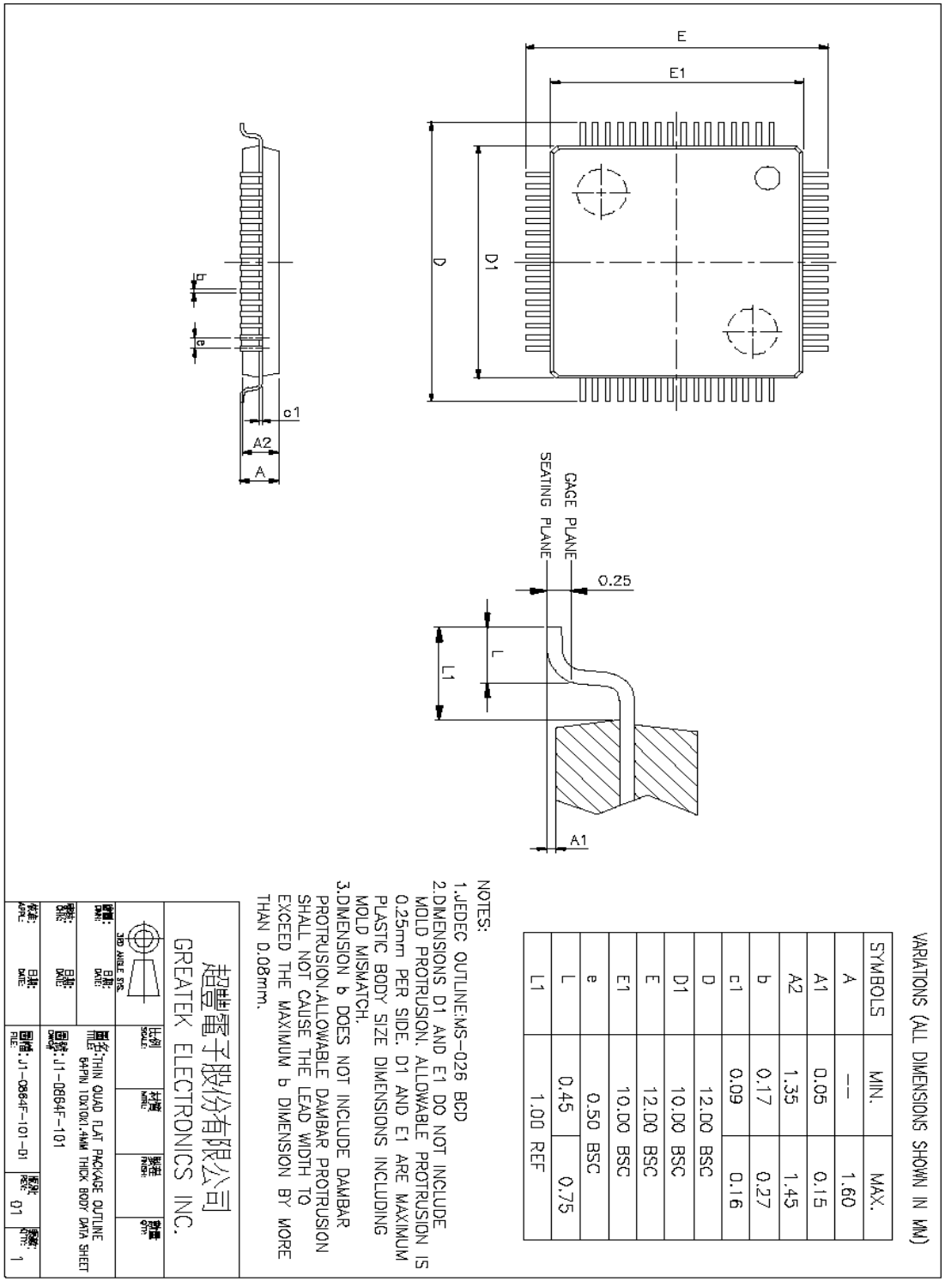
AVCC=3.0V~3.6V；VCC=2.25V~2.75V；Temp=0℃~115℃

Table 6.8 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

7.0 Mechanical Information

Figure 7.1 Mechanical Information Diagram



8.0 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.