CM6317A

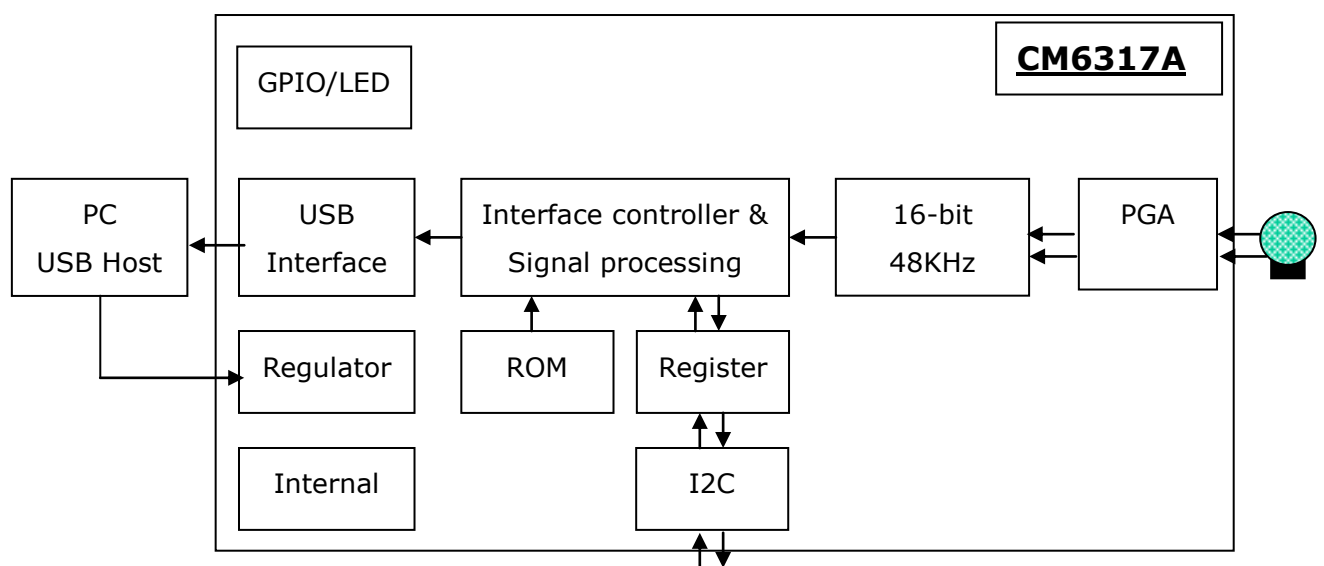USB Audio Single Chip Solution for Stereo Microphone & Line In

DESCRIPTION

CM6317A is C-Media's new Audio SOC IC. It contains high performance stereo ADC, and have various interface like I2C, allowing all kinds of Microprocessor or DSP to communicate. Especially in advanced VOIP applications. CM6317A could give you low noise and high quality speech input solution, thus, when it comes to conference or public speech, it would be wonderful choice for you. Also, CM6317A integrates all essential analog, 2CH ADC, PLL, regulator , USB transceiver, with EEPROM to customize your own product string, PID and VID. CM6317A support 8 / 11.025 / 16 / 22.05 / 32 / 44.1 / 48 KHz sampling rate and high quality 16-bit resolution and friendly General purpose inputs and outputs for customized functions.   Also there are many features could be programmable with external EEPROM and MCU. External MCU / EEPROM could be easily controlled via HID software interface.

FEATURES

■ USB spec. 2.0 Full speed compatible and USB IF certification

■ USB audio device class spec. 1.0 and USB HID class spec. 1.1 compliant

■ Supports control, interrupt and isochroous data transfers

■ USB suspend/resume and remote wake-up support

■ Embedded USB transceiver and power-on reset circuit

■ Single 12MHz Crystal Input with On-chip PLL

■ Support series number string for operation system detect

■ Serial EEPROM programming interface supports customized VID/PID/Product string/ Manufacture string

■ EEPROM interface support 24C02 data format

BLOCK DIAGRAM

TABLE OF CONTENTS

Release Note

Revision	Date	Description
1.8	2010/4/26	Updated the EEPROM Data Format Address 0x12(Bit2):reserved(0:default) Address 0x13:Reserved

CM6317A

USB Audio Single Chip Solution for Stereo Microphone & Line In

1   Description and Overview

This is a highly integrated single chip USB audio solution which comprises more USB audio controller and applications. According to coming more experiences in PC USB Audio peripheral from Vendors' recommend, C-Media aggressively design one single chip to let vendors to come more integration products, and increase more revenues.

CM6317A is C-Media's new Audio SOC IC. It contains high performance stereo ADC, and have various interface like I2C, allowing all kinds of Microprocessor or DSP to communicate. Especially in advanced VOIP applications. CM6317A could give you low noise and high quality speech input solution, thus, when it comes to conference or public speech, it would be wonderful choice for you.

Also, CM6317A integrates all essential analog, 2CH ADC, PLL, regulator , USB transceiver, with EEPROM to customize your own product string, PID and VID. CM6317A support 8 / 11.025 / 16 / 22.05 / 32 / 44.1 / 48 KHz sampling rate and high quality 16-bit resolution and friendly General purpose inputs and outputs for customized functions.   Also there are many features could be programmable with external EEPROM and MCU. External MCU / EEPROM could be easily controlled via HID software interface. 2 LED indicator pins provide more flexible behavior with device On / Off / Operation / recording mute / and controllable flash time.

2   Features

■   USB spec. 2.0 Full speed compatible and USB IF certification

■   USB audio device class spec. 1.0 and USB HID class spec. 1.1 compliant

■   Supports control, interrupt and isochroous data transfers

■   USB suspend/resume and remote wake-up support

■   Embedded USB transceiver and power-on reset circuit

■   Single 12MHz Crystal Input with On-chip PLL

■   Support series number string for operation system detect

■   Serial EEPROM programming interface supports customized VID/PID/Product string/ Manufacture string for device name changed and configuration

■   EEPROM interface support 24C02 data format

■   2CH ADC Input
     ADC sampling rate 8K / 11.025K / 16K / 22.05K / 32K / 44.1K / 48K Hz, 16-bit resolution
     Dynamic Range: 96db, THD+N: -89~96db
     Digital Linear Microphone Gain Control function (-16db~45db)
     1.0 Vrms input swing biased at 2.25V

■   Support Microsoft HID functions

- Support I2C (Master/Slave) control interface for external controller used

- I2C MCU read/write support 16 bytes data transfer bandwidth

- I2C interface support extra interrupt pin INT

- MCU / EEPROM / GPIO control via HID / Vender command interface

  USB audio topology has 1 Input Terminals, 1 Output Terminals, 1 Selector Unit, and 1 Feature Units

- Support 2 LED indicator pins:

  1. On / Off / Operation

  2. Recording mute

- Supported 8 GPIO and 2 GPI pins

- Isochronous transfer uses Adaptive Mode with Internal PLL for Synchronization

- Embedded Power-On-Reset Block

- Single 5V power supply with embedded 5V to 3.3V regulator

- Industry standard LQFP-48 Pin package

- Compatible with Win2000 / WinXP / Vista / Win7 / MAC / OSX / Linux / Wii / XBOX360 / PS2 /PS3

- Support Hardware SDK tool for third-party software development

3   Pin Descriptions

3.1   Pin Assignment by Pin Number

Pin	Signal Name	Pin	Signal Name	Pin	Signal Name	Pin	Signal Name
1	PDSW	13	N.C.	25	AVSS	37	AVDD
2	N.C.	14	HID_EN	26	MICL	38	REGV_4V5
3	TEST	15	N.C.	27	MICR	39	N.C.
4	GPIO_1	16	N.C.	28	VREF	40	GPI_1
5	GPIO_2	17	I2C_SCLK	29	VBIAS_1	41	GPI_2
6	GPIO_3	18	I2C_SDAT	30	VBIAS_2	42	GPIO_5
7	GPIO_4	19	I2C_INT	31	AVDD	43	GPIO_6
8	LED_1	20	USB_DP	32	AVDD	44	GPIO_7
9	LED_3	21	USB_DM	33	AVSS	45	GPIO_8
10	XTAL_I	22	DVSS	34	AVSS	46	MUTE_REC
11	XTAL_O	23	REGV_3V3	35	N.C.	47	RM_Wake
12	N.C.	24	DVDD5V	36	AVDD	48	DVSS

3.2   Pin-Out Diagram
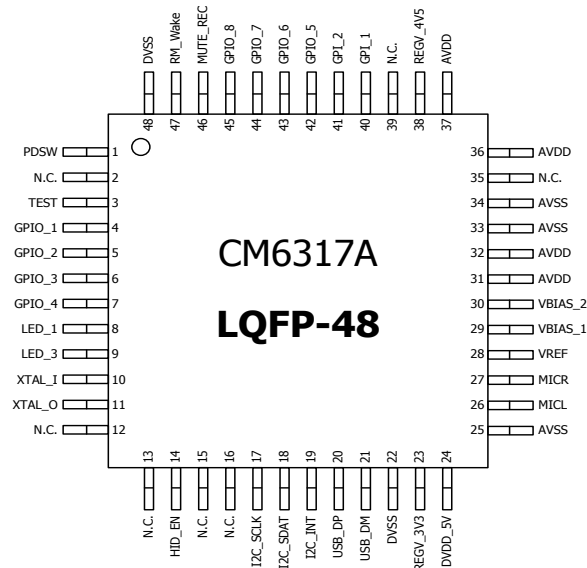
3.3 Pin Signal Descriptions

No.	Symbol	Type	Description
1	PDSW	OD, 5V	Power Down Switch Output (0:Normal Operation; 1:Suspend)
2	N.C.	N.C.	N.C.
3	TEST	DI, PD	Test Mode Select (0:Normal Mode; 1:Test Mode)
4	GPIO_1	DIO	General Purpose I/O Pin
5	GPIO_2	DIO	General Purpose I/O Pin
6	GPIO_3	DIO	General Purpose I/O Pin
7	GPIO_4	DIO	General Purpose I/O Pin
8	LED_1	DO	LED (Play or Record)
9	LED_3	DO	LED (Mute Record)
10	XTAL_I	DI	Input Pin for 12MHz Oscillator
11	XTAL_O	DO	Output Pin for 12MHz Oscillator
12	N.C.	N.C.	N.C.
13	N.C.	N.C.	N.C.
14	HID_EN	DI, PU	HID bottom function enable (0:Disable; 1:Enable)
15	N.C.	N.C.	N.C.
16	N.C.	N.C.	N.C.
17	I2C_SCLK	OD, DIO	I2C Serial Clock / EEPROM 24c02 Serial Clock
18	I2C_SDAT	OD, DIO	I2C Serial Data / EEPROM 24c02 Serial Data
19	I2C_INT	DO	I2C Interrupt output
20	USB_DP	AIO	USB D+
21	USB_DM	AIO	USB D-
22	DVSS	P	Digital Grounding
23	REGV_3V3	AO	5V->3.3V Regulator Output
24	DVDD5V	P	5V Power Supply to Internal Regulator
25	AVSS	P	Analog Ground

No.	Symbol	Type	Description
26	MICL	AI	MIC0 in left channel
27	MICR	AI	MIC0 in right channel
28	VREF	AO	2.25V reference Voltage output
29	VBIAS_1	AO	MIC bias Voltage
30	VBIAS_2	AO	MIC bias Voltage
31	AVDD	P	5V Analog Power for Analog Circuit
32	AVDD	P	5V Analog Power for Analog Circuit
33	AVSS	P	Analog Ground
34	AVSS	P	Analog Ground
35	N.C.	N.C.	N.C.
36	AVDD	P	5V Analog Power for Analog Circuit
37	AVDD	P	5V Analog Power for Analog Circuit
38	REGV_4V5	AO	4.5V regulator output
39	N.C.	N.C.	N.C.
40	GPI_1	DI, PU	General Purpose Input Pin (VU)
41	GPI_2	DI, PU	General Purpose Input Pin (VD)
42	GPIO_5	DIO	General Purpose I/O Pin
43	GPIO_6	DIO	General Purpose I/O Pin
44	GPIO_7	DIO	General Purpose I/O Pin
45	GPIO_8	DIO	General Purpose I/O Pin
46	MUTE_REC	DI, PU	HID MIC Recording Mute
47	RM_Wake	DI, PU	Remote Wakeup pin to make PC resume from suspend
48	DVSS	P	Digital Ground

4 Block Diagram

```
┌─────────────────────────────────────────────────────────────────────────┐
│                                                           ┌─────────────┐ │
│  ┌──────────────┐                                         │  CM6317A    │ │
│  │  GPIO/LED    │                                         └─────────────┘ │
│  └──────────────┘                                                         │
│                                                                           │
│┌──────────┐  ┌──────────┐  ┌──────────────────┐  ┌──────────┐ ┌────────┐│
││ PC       │◄─│  USB     │◄─│ Interface         │◄─│ 16-bit   │◄│  PGA   ││◄─●
││ USB Host │  │ Interface│  │ controller &      │  │ 48KHz    │ │        ││
││          │  │          │  │ Signal processing │  │ ADC      │ │        ││◄─
│└──────────┘  └──────────┘  └──────────────────┘  └──────────┘ └────────┘│
│     │                                                                     │
│     │        ┌──────────┐  ┌──────────┐  ┌──────────┐                    │
│     └───────►│ Regulator│  │   ROM    │  │ Register │                     │
│              └──────────┘  └──────────┘  └──────────┘                    │
│                                                                           │
│              ┌──────────┐                ┌──────────┐                     │
│              │ Internal │                │   I2C    │                     │
│              │   PLL    │                └──────────┘                     │
│              └──────────┘                                                 │
└─────────────────────────────────────────────────────────────────────────┘
```
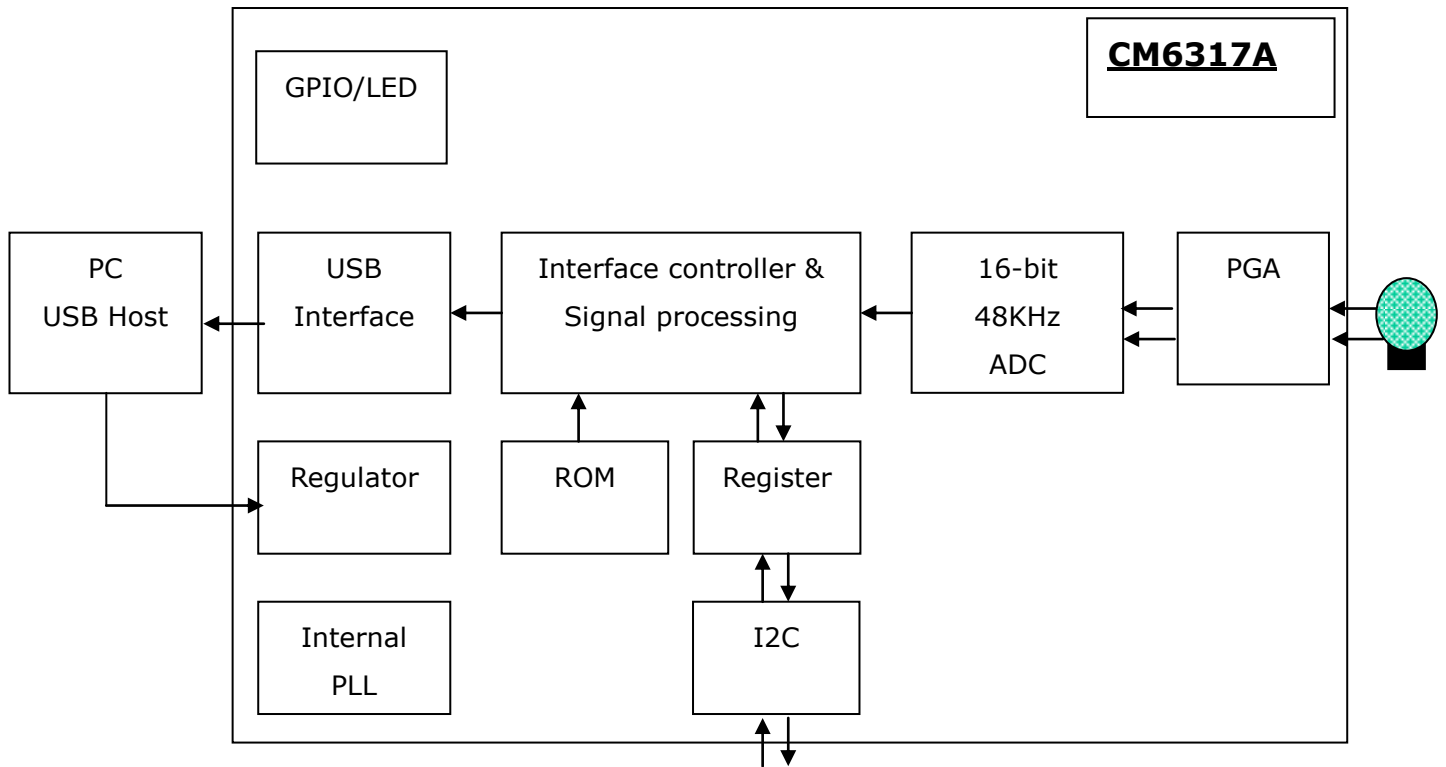
5 Ordering Information

Model Number	Package	Operating Ambient Temperature	Supply Range
CM6317A	48-Pin LQFP 7mm×7mm×1.45mm (Plastic)	0 o C to +70 o C	DVdd = 5V, AVdd = 5V
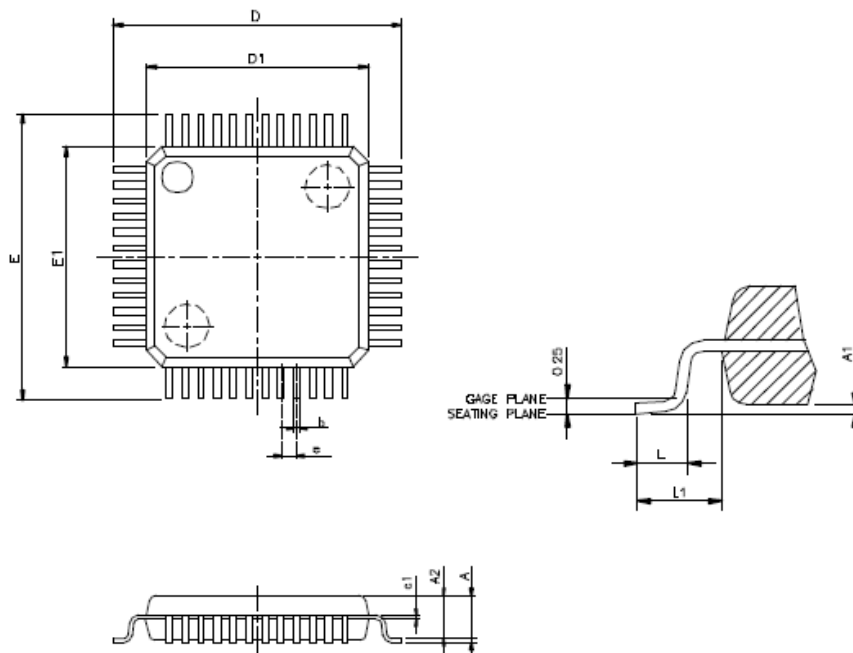
VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

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	

6   USB Audio Topology and Descriptors

6.1   USB Audio Topology
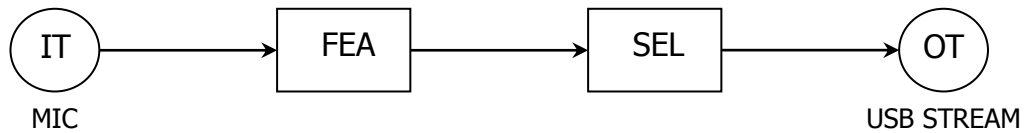
6.2   Device Descriptors

Offset	Field	Size	Value (Hex)	Description
0	bLength	1	12	Descriptor length
1	bDescriptorType	1	01	Device Descriptor
2	bcdUSB	2	0110	USB 1.1 compliant
4	bDeviceClass	1	00	Device class specified by interface
5	bDeviceSubClass	1	00	Device subclass specified by interface
6	bDeviceProtocol	1	00	Device protocol specified by interface
7	bMaxPacketSize0	1	10	Endpoint zero packet size
8	idVendor	2	0d8c	Vendor ID
10	idProduct	2	0132	Product ID
12	bcdDevice	2	0100	Device release number
14	iManufacturer	1	03	Index of string descriptor describing manufacturer
15	iProduct	1	01	Index of string descriptor describing product
16	iSerialNumber	1	00 or 03(*)	Index of string descriptor describing serial number
17	bNumConfigurations	1	01	Number of configuration

Note 1: When valid EEPROM is detected, Vendor ID and Product ID will be replaced by the content of EEPROM.
Note 2: iSerialNumber will be valid only if external EEPROM contain this info.

CM6317A
USB Audio Single Chip Solution for Stereo Microphone & Line In

6.3 Configuration Descriptors

Offset	Field	Size	Value (Hex)	Description
0	bLength	1	09	Descriptor length
1	bDescriptorType	1	02	Configuration Descriptor
2	wTotalLength	2	007f~00dd	Total length of data returned for this configuration
4	bNumInterfaces	1	03	Number of interfaces supported by this Configuration: 00: Control 02: ISO-In 03: INT-IN (HID)
5	bConfigurationValue	1	01	Configuration value
6	iConfiguration	1	00	Index of string descriptor describing this configuration
7	bmAttributes	1	a0 or 80 or e0 or c0	Bus Power and support Remote Wakeup: 8'ha0 (PWRSEL_1 = 1, HID_EN = 1) Bus Power and no Remote Wakeup: 8'h80 (PWRSEL_1 = 1, HID_EN = 0) Self Power and support Remote Wakeup: 8'he0 (PWRSEL_1 = 0, HID_EN = 1)) Self Power and no Remote Wakeup: 8'hc0 (PWRSEL_1 = 0, HID_EN = 0))
8	bMaxPower	1	32	Maximum power consumption from bus = 100mA: 8'h32 (50x2 mA) (PWRSEL_2 = 1)

6.4 Standard HID Interface Descriptor

Offset	Field	Size	Value (Hex)	Description
0	bLength	1	09	Descriptor length
1	bDescriptorType	1	04	Interface Descriptor
2	bInterfaceNumber	1	02	Interface number: 02
3	bAlternateSetting	1	00	Alternate interface
4	bNumEndpoints	1	01	Number of endpoint used by this interface
5	bInterfaceClass	1	03	HID Interface Class
6	bInterfaceSubClass	1	00	Subclass code
7	bInterfaceProtocol	1	00	Protocol code
8	iInterface	1	00	Index of string descriptor describing this interface

Class-specific HID Interface Descriptor

Offset	Field	Size	Value (Hex)	Description
0	bLength	1	09	Descriptor length
1	bDescriptorType	1	21	HID descriptor type
2	bcdHID	2	0100	HID class version
4	bCountryCode	1	00	No country code
5	bNumDescriptors	1	01	One HID class descriptor
6	bDescriptorType	1	22	Report Descriptor
7	wDescriptorLength	2	0032 / 001a	HID class descriptor length in byte: 50 / 26 bytes (Enable / Disable HID Button)

Standard HID Interrupt In Endpoint Descriptor

Offset	Field	Size	Value (Hex)	Description
0	bLength	1	07	Descriptor length
1	bDescriptorType	1	05	Endpoint Descriptor
2	bEndpointAddress	1	87	IN Endpoint, Endpoint number: 7
3	bmAttributes	1	03	Interrupt Endpoint
4	wMaxPacketSize	2	0010	Maximum packet size: 16 bytes
6	bInterval	1	01	1ms

7 Function Block Descriptions:

7.1 I²C Interface

7.1.1 Master Mode:
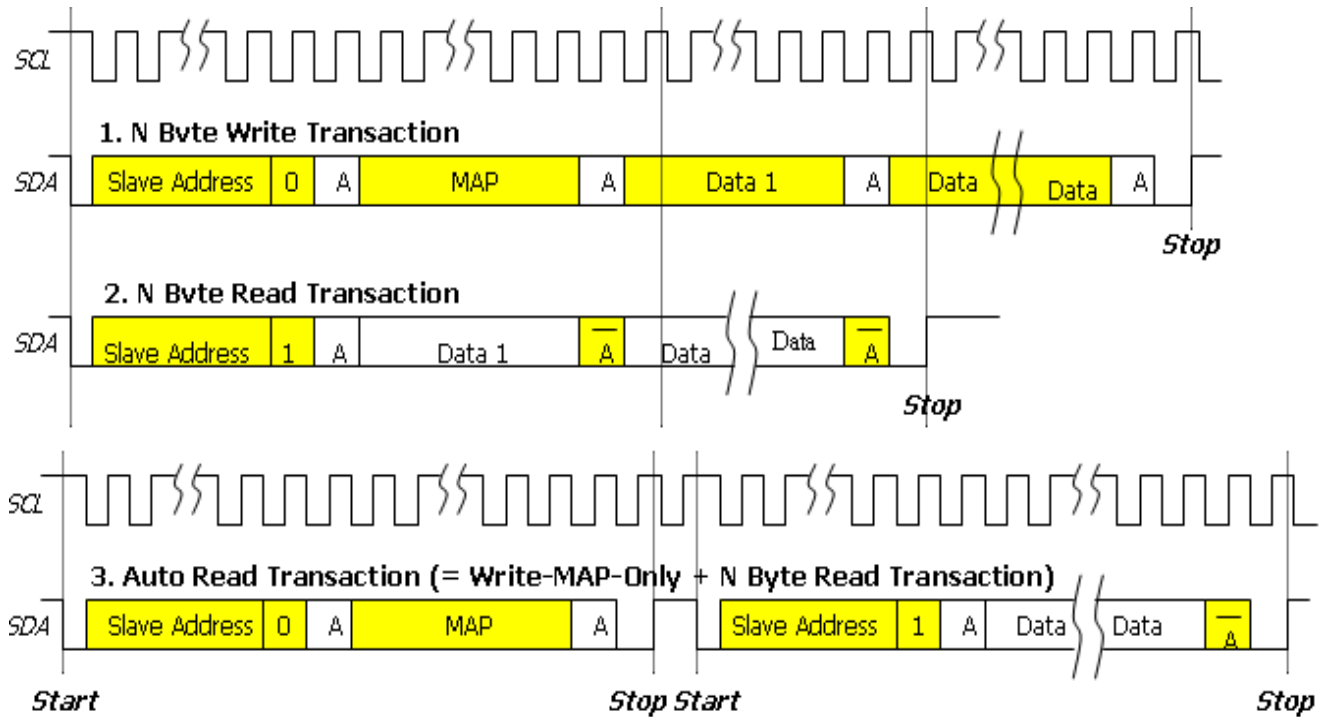
7.1.2   Slave Mode:

**"7-bit slave address = 7'b0111000"**

On the MCU serial interface, the CM6317A can serve as a slave device with bit rates up to 400Kbps (in fast mode). The MCU can write data to the CM6317A or read data from the CM6317A (No size limitations when using the I2C Interface). Since the host side and MCU can both access to the internal registers, access contention- when both host and MCU try to access the same register- should be avoided by the application. The 7-bit slave address of the CM6317A is assigned as 7'b0111000. When data is written by the MCU, the CM6317A will NOT transfer any interrupt to the PC until the INT bit of the I2C control Register has been set by the MCU.

The USB host will keep polling the upward HID report every 1ms. When any button is pressed or released, or MCU data is incoming, the CM6317A will transfer 16 bytes of HID report to the USB host. In I2C Slave Mode, the CM6317A has one open-drain input pin 'SCLK' where it receives the serial clock from the MCU, and one open-drain I/O pin 'SDAT' where it sends or receives serial signals to/from the MCU. As shown below, 'SDAT' should be stable when 'SCLK' is high, and can transition only when 'SCLK' is low.
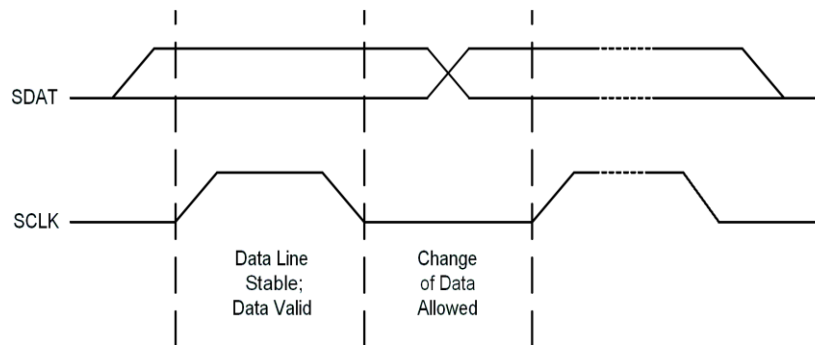
Bit Transfer on the MCU Interface

START and STOP conditions shown below are the exception. Every transaction begins from a START, and ends with a STOP, or another START (repeated START).
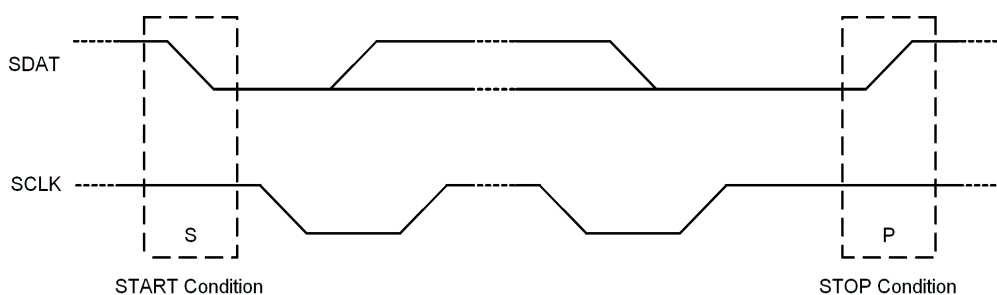
START and STOP Conditions

The figure below demonstrates a typical transaction. After every 8 bits sent by the transmitter, the receiver should send one bit low for positive acknowledgement or one bit high for negative acknowledgement. After the negative acknowledgement, a STOP or repeated START should follow. The next figure shows more details about the acknowledgement bit. Note that 'SCLK' is always driven by the master.
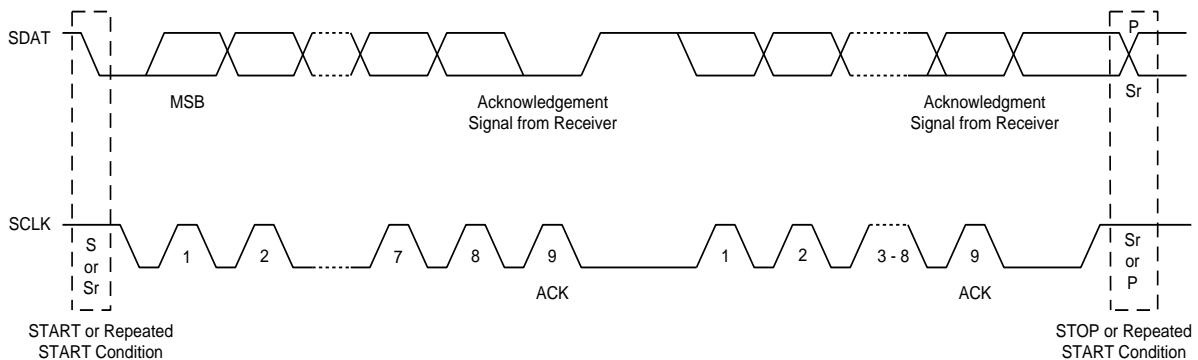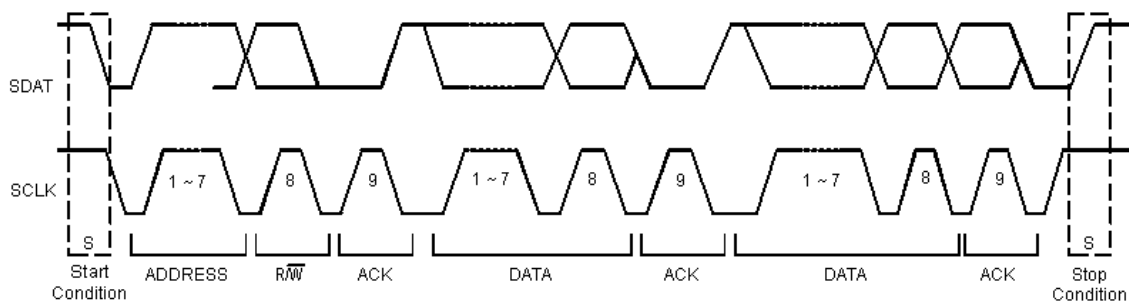
Data Transfer on the MCU Interface
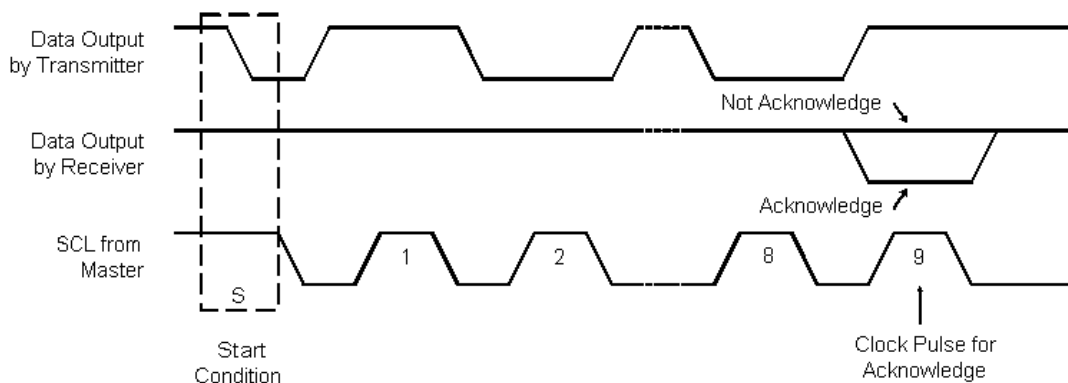
Acknowledge on the MCU Interface

The figure below shows a complete data transfer. After a START, the MCU should send 7-bit slave address (7'b0111000) first, and then the 8th bit denotes a read transfer when it's high; or a write transfer when it's low. The first acknowledgement always comes from the CM6317A.
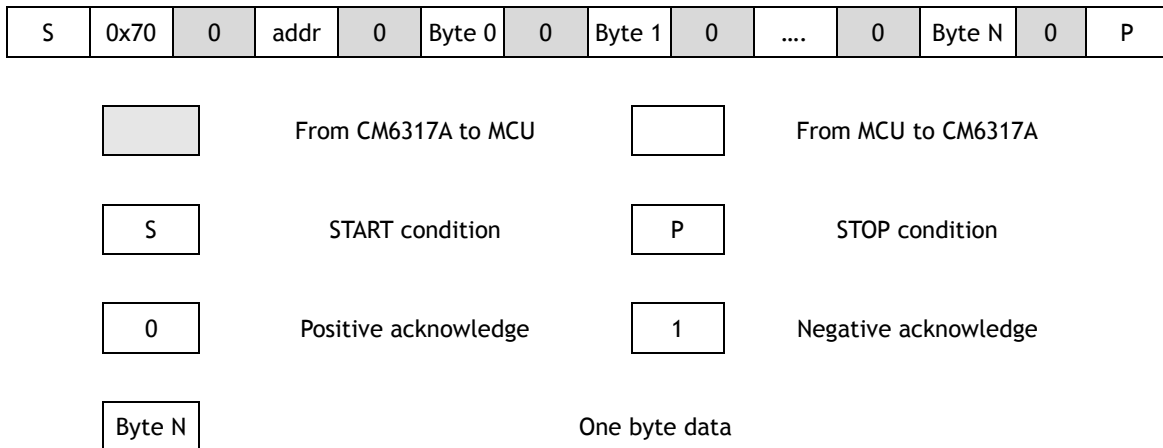
A Complete Data Transfer

CM6317A

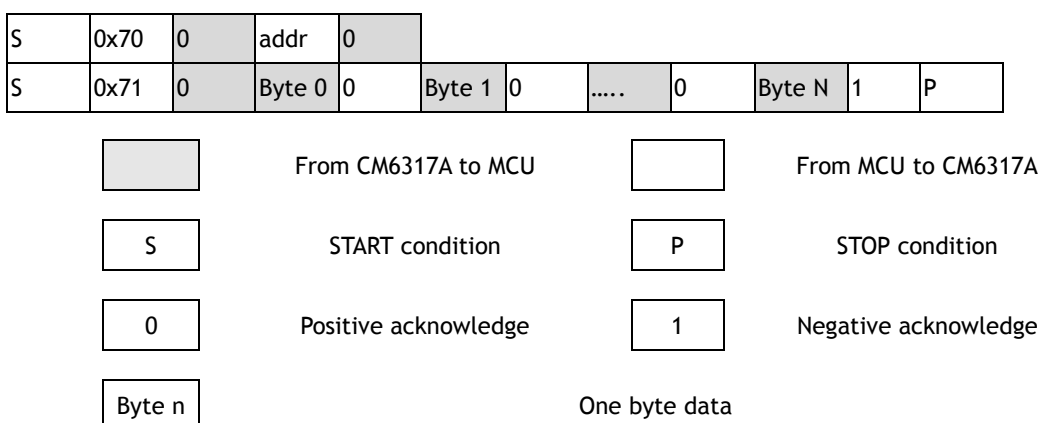USB Audio Single Chip Solution for Stereo Microphone & Line In

In the write transfer, the MCU continues to act as the master and the transfer direction is not changed. The following figure gives an example of a write transfer.

MCU write:

S	0x70	0	addr	0	Byte 0	0	Byte 1	0	….	0	Byte N	0	P

	From CM6317A to MCU		From MCU to CM6317A
S	START condition	P	STOP condition
0	Positive acknowledge	1	Negative acknowledge
Byte N		One byte data	

0x70 is the slave address of CM6317A, and it also tells CM6317A that it's receiving a write command. CM6317A regards the first coming DATA byte as the register address. The second DATA byte is the DATA content that MCU writes at the register address. CM6317A will auto-increment the register address to the next register address for the following writes DATA. The figure below shows an example of read transfer. The MCU read command can not set the register address, so the MCU may use a write command to set the register address first and then start the read command. Because the CM6317A auto-increments the register address, the second DATA byte will be the register data on the next address.

MCU read:

S	0x70	0	addr	0						
S	0x71	0	Byte 0	0	Byte 1	0	…..	0	Byte N	1	P

	From CM6317A to MCU		From MCU to CM6317A
S	START condition	P	STOP condition
0	Positive acknowledge	1	Negative acknowledge
Byte n		One byte data	

The figure below gives a complete picture of a typical transaction between the MCU and CM6317A. After a START, the MCU should send a 7-bit slave address (7'b0111000) first, and then the 8th bit denotes a read transfer when it's high; or a write transfer when it's low.

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MCU write:

S	0x70	0	addr	0	Byte 0	0	Byte 1	0	…..	0	Byte N	0	P

MCU read:

S	0x70	0	addr	0									
S	0x71	0	Byte 0	0	Byte 1	0	…..	0	Byte N	1	P		

	From CM6317A to MCU		From MCU to CM6317A
S	START condition	P	STOP condition
0	Positive acknowledge	1	Negative acknowledge
Byte N	One byte data		
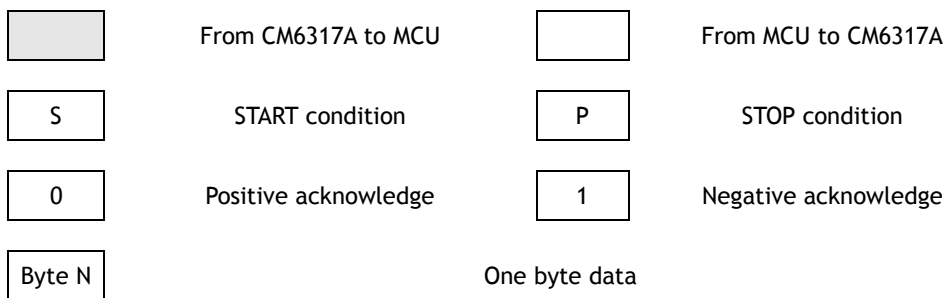
During a write transfer, the MCU continues acting as the transmitter. The CM6317A regards the first DATA byte as the start register address. The following DATA bytes are the content of the registers that the MCU requests. In a read transfer, two transactions are necessary. The MCU resets the start register address by the first transaction, then direction changes to get N of data.

7.2 EEPROM Data Format

address	description
0x00	Magic Word ("C", 8'h43)
0x01	Magic Word ("M", 8'h4D)
0x02	EEPROM Content Setting (EEPROM_OPTION_1)
	bit0: Manufacture String Valid? (0: No, 1: Yes)
	bit1: Product String Valid? (0: No, 1: Yes)
	bit2: Serial Number Valid? (0: No, 1: Yes)
	bit3: reserved
	bit4: Recording (ADC) initial control Valid? (0: No, 1: Yes)
	bit5: ADC gain range Control Valid? (0: No, 1: Yes)
	bit6: Disable Selector unit (0: No, 1: Yes)
	bit7: Enable Remote Wakeup? (0: Disable, 1: Enable)
0x03	Recording (ADC) initial-L (EEPROM_OPTION_2)
	bit[5:0]: ADC(unit Fa) initial Volume L-byte
	(6'h2E ~ 6'h00, 30~ -16dB, -1dB/step)
	bit6: Mute_fa (ADC) initial Value (0: Un-Mute, 1: Mute)
	bit7: Line-in/Mic-in claim (1: Line-in , 0 : Mic-in)
0x04	Recording (ADC) initial-H (EEPROM_OPTION_3)
	bit[3:0]: ADC (Unit Fa) initial Volume H-byte
	(4'hf ~ 4'h0, 15 ~ 0dB, -1dB/step)
	Bit[4] : control ADC HP filter by EEPROM (0 : No, 1 : Yes)
	Bit[5] : ADC HP filter enable (0 : disbale, 1 : enable)
	Bit[7 :6] : reserved
0x05	Recording (ADC) max range Control_L (EEPROM_OPTION_4)
	bit[7:0]: ADC (Unit fa) max Volume[7:0]
0x06	Recording (ADC) max range Control_H (EEPROM_OPTION_5)
	bit[7:0]: ADC (Unit fa) max Volume[15:8]
0x07	Recording (ADC) min range Control_L (EEPROM_OPTION_6)
	bit[7:0]: ADC (Unit fa) min Volume[7:0]
0x08	Recording (ADC) min range Control_H (EEPROM_OPTION_7)
	bit[7:0]: ADC (Unit fa) min Volume[15:8]
0x09	Reserved

0x0a	Reserved
0x0b	Manufacture String 1 length; this number doesn't include the first 2 bytes of string descriptor and its unit is one Unicode word (EEPROM_OPTION_A)
0x0c	Product String 2 length; this number doesn't include the first 2 bytes of string descriptor and its unit is one Unicode word (EEPROM_OPTION_B)
0x0d	serial number string 3 length; this number doesn't include the first 2 bytes of string descriptor and its unit is one Unicode word (EEPROM_OPTION_C)
0x0e	VID (Low Byte) (EEPROM_OPTION_D)
0x0f	VID (High Byte) (EEPROM_OPTION_E)
0x10	PID (Low Byte) (EEPROM_OPTION_F)
0x11	PID (High Byte) (EEPROM_OPTION_10)
0x12	misce reg (EEPROM_OPTION_11)
	Bit0 : boot gain(volume boot gain 18dB)
	Bit1: enable PLL adjustment (0: No, 1: Yes)
	Bit2 : reserved (0 :default)
0x13	Reserved
0x14 ~ 0x4f	Reserved (60 bytes)
0x50 ~0x(50+X-1)	Manufacture String (X bytes);only fill one byte of Unicode in this content, HW will add the other byte 0x00
0x(50+X)~ 0x(50+X+Y-1)	Product String (Y bytes) ;only fill one byte of Unicode in this content, HW will add the other byte 0x00
0x(50+X+Y)~ 0x(50+X+Y+Z-1)	String of Serial Number (Z bytes) ;only fill one byte of Unicode in this content, HW will add the other byte 0x00
Others	Reserved

8 Electrical Characteristics:

8.1 Absolute Maximum Rating

Symbol	Parameter	Value	Unit
Dvmin	Min Digital Supply Voltage	– 0.3	V
Dvmax	Max Digital Supply Voltage	+ 6	V
Avmin	Min Analog Supply Voltage	– 0.3	V
Avmax	Max Analog Supply Voltage	+ 6	V
Dvinout	Voltage on any Digital Input or Output Pin	–0.3 to +5.5	V
Avinout	Voltage on any Analog Input or Output Pin	–0.3 to +5.5	V
T_{stg}	Storage Temperature Range	-40 to +125	0C
Tj	Junction Operating Temperature (Commercial)	0~+115	^{0}C
ESD (HBM)	ESD Human Body Mode	4000	V
ESD (MM)	ESD Machine Mode	400	V
Latch Up	Class-3	200	mA

8.2 Operation Conditions

Operation conditions				
	Min	Typ	Max	Unit
Analog Supply Voltage	4.5	5.0	5.5	V
Digital Supply Voltage	4.5	5.0	5.5	V
Operation Power Consumption	-	33	-	mA
Standby Power Consumption	-	28	-	mA
Suspend Mode Power Consumption	-	410	-	uA
Operating ambient temperature	0	-	70	^{0}C

*Notes: Test Environment Under 25ºC, 5.0V, 48K Sample Rate,
Max Output is Playing 1K Full Scale Sin Wave, Typical Output is Playing Music.

8.3 Electrical Parameters

	Min	Typ	Max	Unit
THD + N (20 ~ 20KHz)	-89	-	-96	dB
Dynamic Range	-	96	-	dB
Frequency Response 48KHz	20	-	20K	Hz
Frequency Response 44.1KHz	20	-	20K	Hz
Input Voltage (rms)	-	1.2	-	Vrms

9 Analog Performance

9.1 ADC Frequency Response

Vista-A-D Frequency Response .at2c

9.2 ADC THD + N
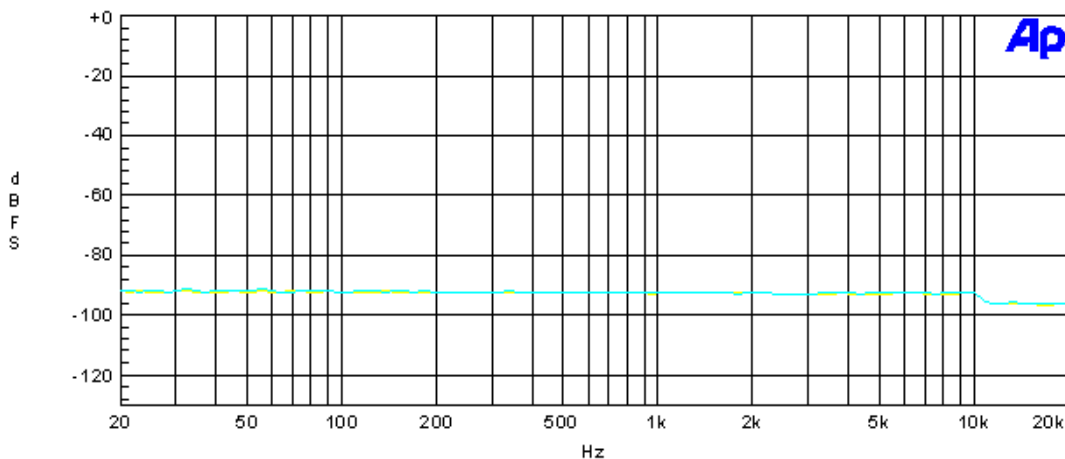
Vista-A-D THD+N .at2c

REFERENCE

USB Specification, Revision 2.0,

USB Audio Device Class Specification, Revision 1.0,

—**End of Specifications**—

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