Solid State System Co., Ltd.

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Table of Contents

SSS1629A4 USB Headset/Line-in Controller Datasheet

1. Product Overview

SSS1629 is 3S highly integrated single chip USB audio controller with on chip oscillator to save the external 12MHz crystal component for headset application. SSS1629 features have stereo 16 bits ADC, stereo 16 bits DAC, earphone driver, five-band hardware EQ, audio PLL, USB clock oscillator, and USB FS controller plus PHY. External 24C02~24C16 EEPROM connection provides flexibility for USB VID/PID/product string, default gain settings, and other customized demands. SSS1629 provides a minimum BOM solution for featured USB audio solutions.

2. Product Features

- Compliant with USB specification v2.0 full speed operation
- Compliant with USB audio device class specification v1.1
- Embedded USB 48MHz on chip oscillator without external crystal component
- Embedded 5V to 3.3V and 1.8V output regulator from single external 5V USB bus power
- Embedded 16-Bit Delta-Sigma ADC and DAC
- Support sampling rate are 8KHz, 11.025KHz, 12KHz, 16KHz, 22.05KHz, 24KHz, 32KHz, 44.1KHz and 48KHz (default).
- Embedded I2S (master mode)/SPDIF interface for DAC/ADC
- Embedded rotary encoder interface for volume control
- Earphone amplifier with variable gain adjustment
- Built-in sound equalizer with five-band segments setting in playback channels
- Volume up, volume down, playback mute, recording mute, next track, previous track, stop, play/pause and EQ pin for direct user control
- Volume up, volume down, playback mute, next track, previous track, stop and play/pause are designed for Microsoft multimedia key
- Embedded LED breathing lights mode and audio wave gradient mode
- Initial setting with I2C interface for external 24bit Codec (as xx8988)
- Support EEPROM programming interface for USB VID/PID, Product string, Manufacturer string, recording AGC function, sound EQ, LYNC description, multi-function key, 3D effect, SPDIF in/out interface, I2S in/out interface, LED flash, infrared remote control (NEC IR) and so on.
- External EEPROM register access optional by MCU (I2C interface) or USB HID interface
- Provide EEPROM code generator and burner from host-end application program
- Embedded 8x8 e-Fuse for function option
- Support mask ROM service for customized requirement
- Compatible with Win XP/Vista/7/8/8.1 and Mac system with OS's USB Audio driver

- 1.8 V power for digital core, POR and audio PLL operation
- 3.3 V power for IO, oscillator, USB PLL, and ADC/DAC operation
- Shipping in Die, 48 LQFP, or 64 LQFP package

3. Electric Characteristics

● Absolute Maximum Rating

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	VCC5A	-0.3 to +5.5	V
DC Input Voltage	Vin	-0.3 to +3.6	V
Operating Temperature	T_{opr}	0 to 80	^{0}C
Storage Temperature	T_{stg}	-20 to +120	^{0}C
Human Body Model ESD	HBM	4000	V
Machine Model ESD	MM	200	V

● DC Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Regulation Supply Voltage	VCC5A	4	5	5.5	V
Regulation Output Voltage	VCC33	3.0	3.3	3.6	V
	VCC23	2.07	2.3	2.53	V
	VCC18	1.62	1.8	1.98	V
Regulation Driving Capability	REGdrv33			250	mA
	REGdrv23			1	mA
	REGdrv18			70	mA
Audio PLL Supply Voltage	APLL_VCCP3	3.0	3.3	3.6	V
	APLL_VCCPD	1.62	1.8	1.98	V
Audio PLL output Voltage	APLL_VCCP18	1.62	1.8	1.98	V
CODEC Supply Voltage	PWRPD	3.0	3.3	3.6	V
	PWRP	3.0	3.3	3.6	V
	PWRP_LPF	3.0	3.3	3.6	V
Earphone Driver Supply Voltage	NVDD	3.0	3.3	3.6	V
eFuse Program Power input	FSOURCE	3.42	3.8	4.18	V
IO Supply Voltage	VCCIO	3.0	3.3	3.6	V

IO Input Voltage	Vin	-0.3	3.3	3.6	V
Core Supply Voltage	VCCK	1.62	1.8	1.98	V

- **AC Characteristics**

Headphone Output (A-Weighted)

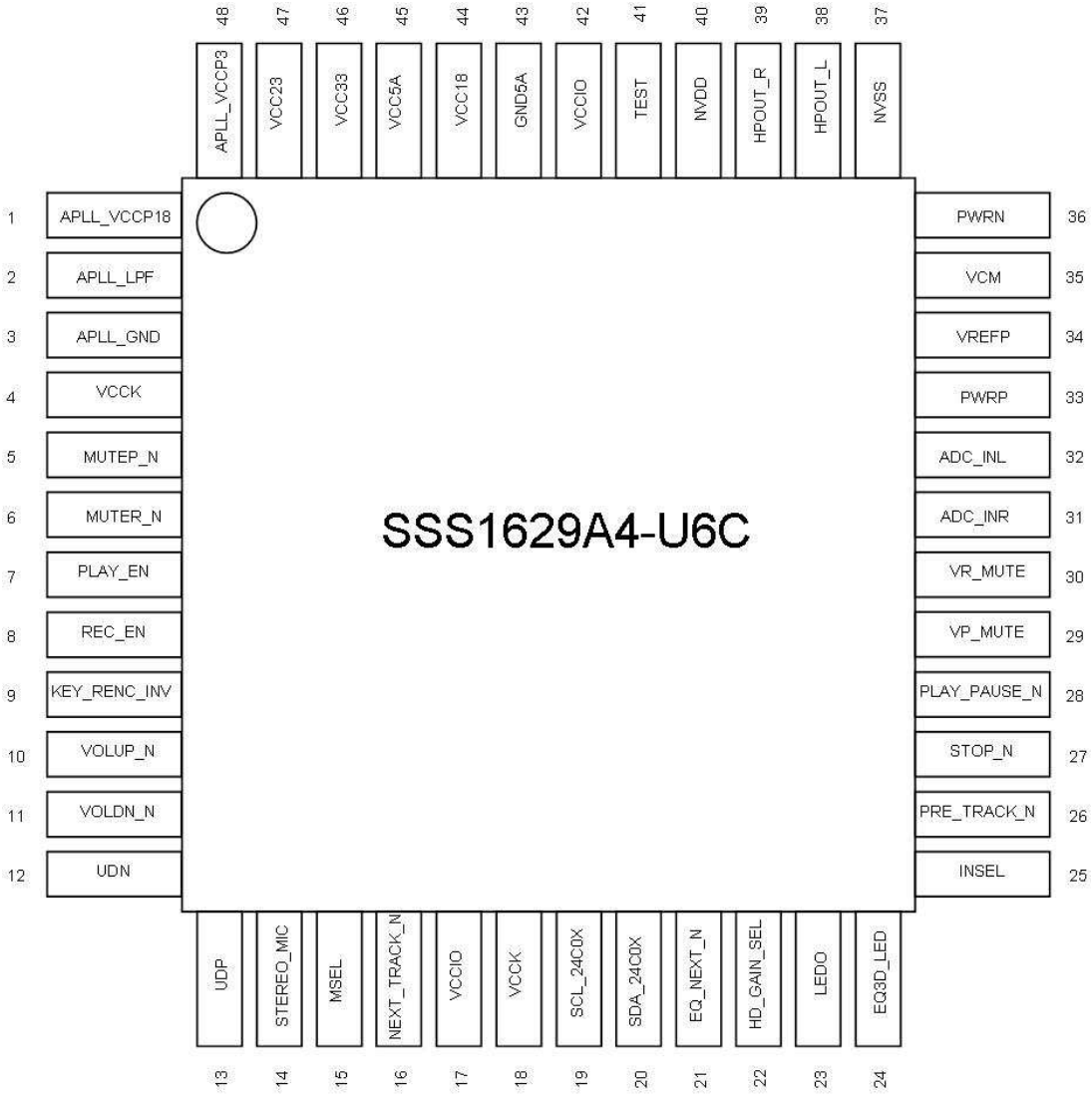
PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT
Pmax Output power @1% THD+N	RL = 32 Ω, VCC33A = 3.3 V	--	14	--	mW
	RL = 16 Ω, VCC33A = 3.3 V	--	28	--	mW
SNR (Signal-to-noise ratio)	Idle channel	--	-86	--	dB
	mute	--	-94		dB
THD+N Total harmonic distortion	1KHz @ -3dB; 32Ω load	--	-75	--	dB
	1KHz @ -3dB; 16Ω load	--	-74	--	dB

Microphone Input Characteristics

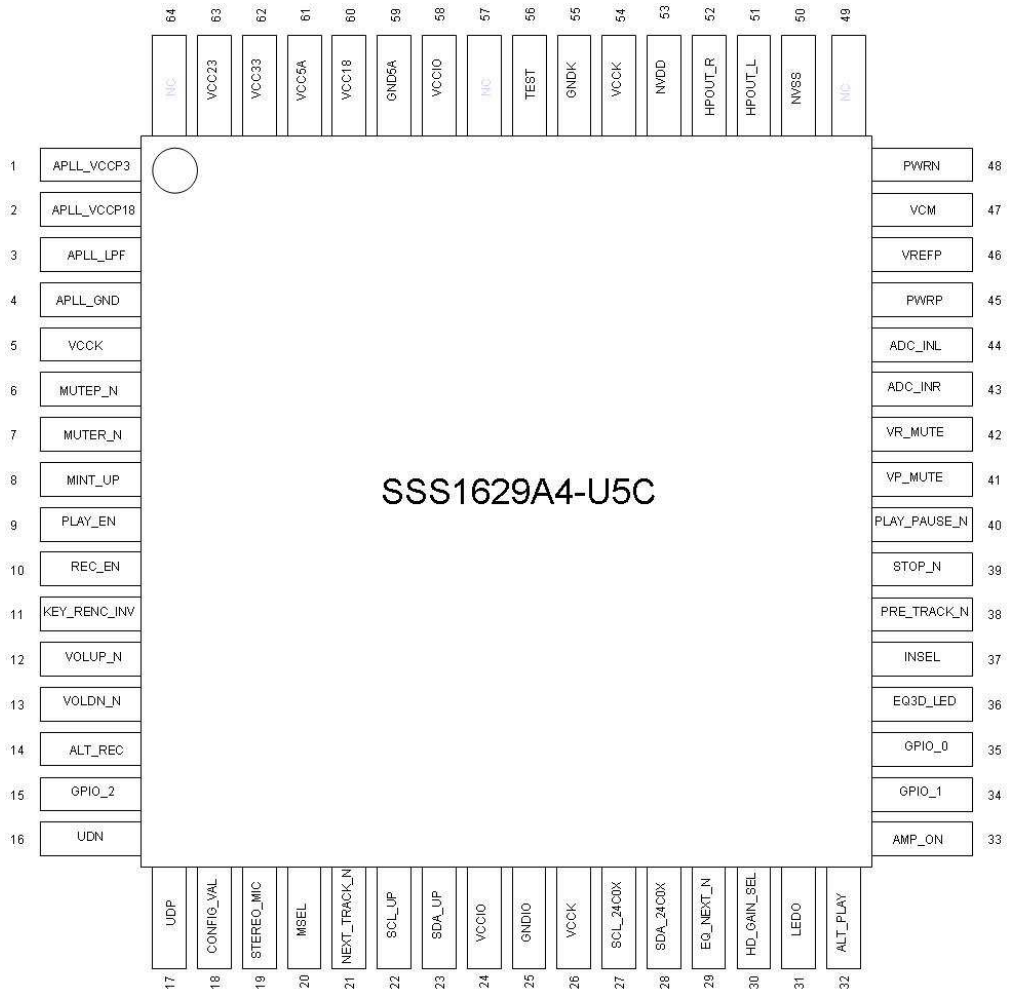
SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
AMP	Microphone gain amplification	-7.5		+39	dB
GSTEP	ADC gain step		1.5		dB
DR	Dynamic range @ 997Hz -60dB FS gain = 0dB		83		dB
SNR	SNR @ idle channel gain = 0dB		82		dB
THD+N	THD+N @ 997Hz -3dB FS gain = 0dB		-77		dB
FS	Signal full scale input gain = 0dB		0.95*VCC33A		V
OFF	DC offset @gain = 0dB			±14	mV
RIN	Input impedance	15K	20K		ohm

4. Pin Description

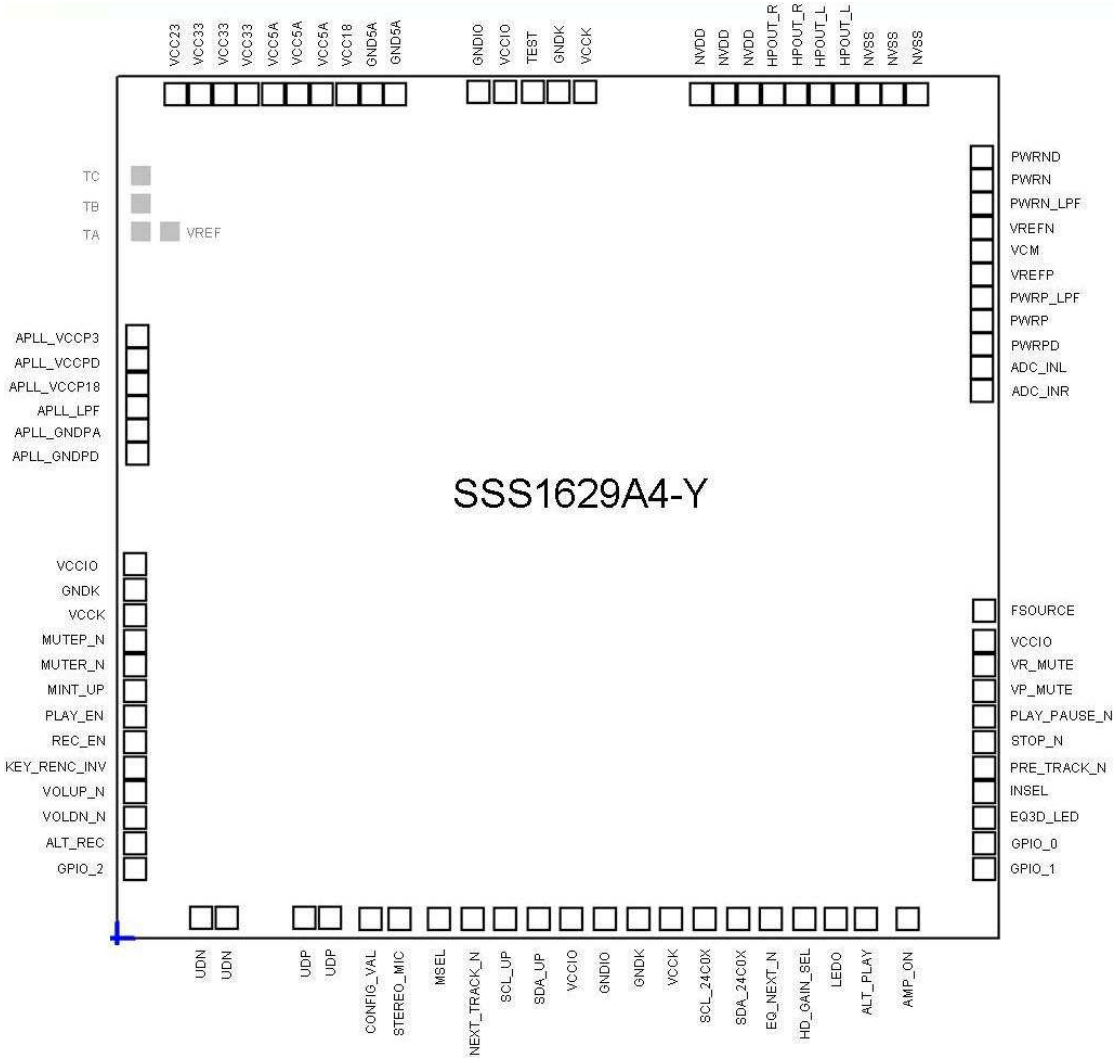
- **Pin Out Chart for 48 Pin LQFP**



- **Pin Out Chart for 64 Pin LQFP**



- **Pin Out Chart for Die form**



Pin List Table

DIE PAD#	LQFP 64	LQFP 48	PAD# SYMBOL	NORMAL MODE	PD MODE	DESCRIPTION
1	1	48	APLL_VCCP3	PI	PI	3.3V power for audio PLL
2	2	1	APLL_VCCPD	PI	PI	1.8V power for audio PLL (Digital)
3	2	1	APLL_VCCP18	PO	PO	1.8V output from PLL regulator
4	3	2	APLL_LPF	AIO	AIO	Low pass filter for audio PLL
5	4	3	APLL_GND	PI	PI	Audio PLL ground
6	4	3	APLL_GND	PI	PI	Audio PLL ground (Digital)
7			VCCIO	PI	PI	3.3V power
8	4	3	GNDK	PI	PI	Ground
9	5	4	VCCK	PI	PI	1.8V power
10	6	5	MUTEP_N	I	I	Playback Mute
11	7	6	MUTER_N	I	I	Record Mute
12	8		MINT_UP	O	I	External MCU interrupt pin
13	9	7	PLAY_EN	I	I	Bonding option, different PID, and PLAY Enable 0 : disable 1 : enable
14	10	8	REC_EN	I	I	Bonding option, different PID, and REC Enable 0:disable 1:enable
15	11	9	KEY_RENC_INV	I	I	Volume control mode 1 : volume up/down buttons control the digital gain with HID 0 : volume up/down buttons control the analog gain without HID *Note: definition of this pin can be changed by EEPROM
16	12	10	VOLUP_N	I	I	Volume up
17	13	11	VOLDN_N	I	I	Volume down
18	14		ALT_REC	O	I	USB REC Alternate state
19	15		GPIO_2	IO	I	GPIO 2
20	16	12	UDN	AIO	AIO	USB data D-
21	16	12	UDN	AIO	AIO	USB data D-
22	17	13	UDP	AIO	AIO	USB data D+
23	17	13	UDP	AIO	AIO	USB data D+
24	18		CONFIG_VAL	O	I	USB Configuration state
25	19	14	STEREO_MIC	I	I	MIC Select 1: stereo 0: mono
26	20	15	MSEL	I	I	Mixer enable 1: enable mixer 0: disable mixer

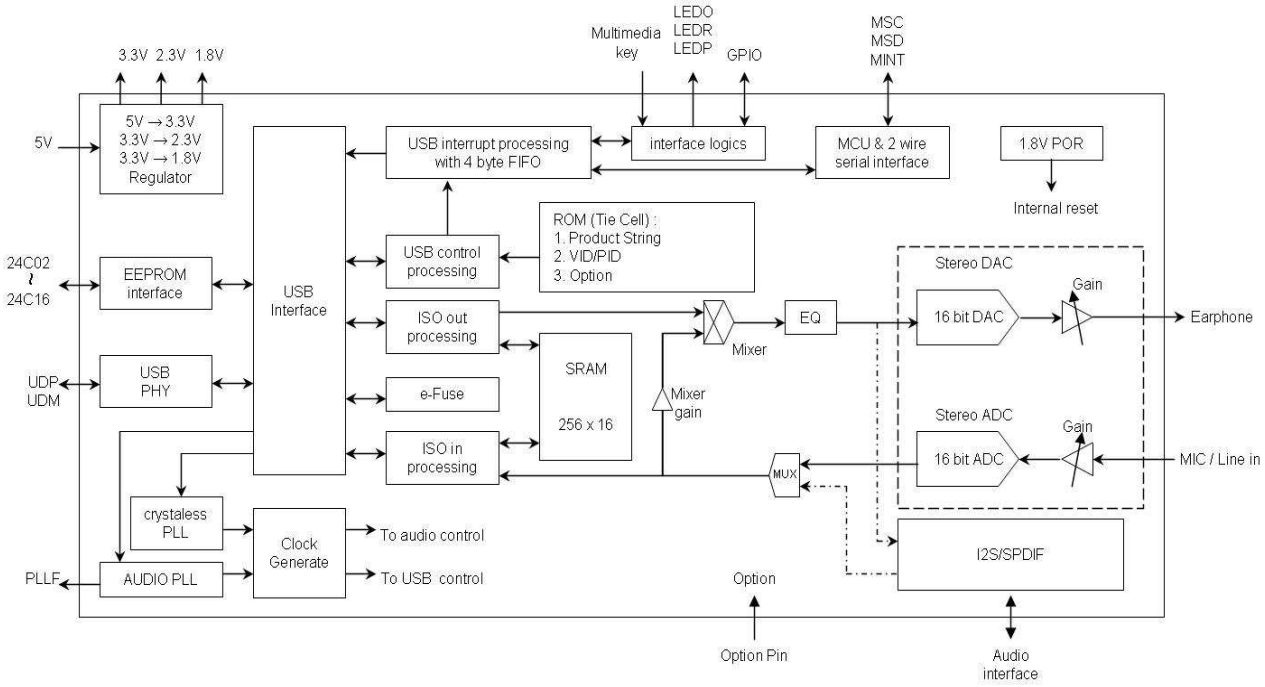
27	21	16	NEXT_TRACK_N	I	I	Next Track
28	22		SCL_UP	I	I	External MCU serial bus clock pin
29	23		SDA_UP	IO	I	External MCU serial bus data pin
30	24	17	VCCIO	PI	PI	3.3V power
31	25		GNDIO	PI	PI	Ground
32	25		GNDK	PI	PI	Ground
33	26	18	VCCK	PI	PI	1.8V power
34	27	19	SCL_24C0X	O	I	External (24C0X) NOR serial bus clock pin
35	28	20	SDA_24C0X	IO	I	External (24C0X) NOR serial bus data pin
36	29	21	EQ_NEXT_N	I	I	EQ select button
37	30	22	HD_GAIN_SEL	I	I	Head Phone Driver default select (**1:** 14mW **0:** 24mW)
38	31	23	LEDO	O	I	LED Out (toggling for data transmit)
39	32		ALT_PLAY	O	I	USB PLAY Alternate state
40	33		AMP_ON	O	I	DAC operation state
41	34		GPIO_1	IO	I	GPIO 1
42	35		GPIO_0	IO	I	GPIO 0
43	36	24	EQ3D_LED	O	I	EQ&3D LED Out
44	37	25	INSEL	I	I	Line in mode select 0: Line_in mode 1:USB mode
45	38	26	PRE_TRACK_N	I	I	Previous Track
46	39	27	STOP_N	I	I	stop
47	40	28	PLAY_PAUSE_N	I	I	Play/pause
48	41	29	VP_MUTE	O	I	Play mute indicator
49	42	30	VR_MUTE	O	I	Record mute indicator
50			VCCIO	PI	PI	3.3V power
51			FSOURCE	PI	PI	extra power pad for testing purpose
52	43	31	ADC_INR	AI	AI	Right channel inputs of Audio
53	44	32	ADC_INL	AI	AI	Left channel inputs of Audio
54	45	33	PWRPD	PI	PI	Digital power (3.3V)
55	45	33	PWRP	PI	PI	Analog power (3.3V)
56	45	33	PWRP_LPF	AI	AI	LPF Analog power (3.3V)
57	46	34	VREFP	AI	AI	Codec reference high voltage
58	47	35	VCM	AI	AI	Codec reference middle voltage
59	48	36	VREFN	AI	AI	Codec reference low voltage
60	48	36	PWRN_LPF	AI	AI	LPF Analog Ground
61	48	36	PWRN	PI	PI	Analog Ground

62	48	36	PWRND	PI	PI	Digital Ground
63	50	37	NVSS	PI	PI	Earphone driver ground
64	50	37	NVSS	PI	PI	Earphone driver ground
65	50	37	NVSS	PI	PI	Earphone driver ground
66	51	38	HPOUT_L	AO	Z	Earphone driver output
67	51	38	HPOUT_L	AO	Z	Earphone driver output
68	52	39	HPOUT_R	AO	Z	Earphone driver output
69	52	39	HPOUT_R	AO	Z	Earphone driver output
70	53	40	NVDD	PI	PI	Earphone driver power
71	53	40	NVDD	PI	PI	Earphone driver power
72	53	40	NVDD	PI	PI	Earphone driver power
73	54		VCCK	PI	PI	1.8V power
74	55		GNDK	PI	PI	Ground
75	56	41	TEST	I	I	Test mode pin; NC in normal mode
76	58	42	VCCIO	PI	PI	3.3V power
77	59	43	GNDIO	PI	PI	Ground
78	59	43	GND5A	PI	PI	Analog ground for regulator
79	59	43	GND5A	PI	PI	Analog ground for regulator
80	60	44	VCC18	PO	PO	1.8V output for regulator
81	61	45	VCC5A	PI	PI	5V input for regulator
82	61	45	VCC5A	PI	PI	5V input for regulator
83	61	45	VCC5A	PI	PI	5V input for regulator
84	62	46	VCC33	PO	PO	3.3V output for regulator
85	62	46	VCC33	PO	PO	3.3V output for regulator
86	62	46	VCC33	PO	PO	3.3V output for regulator
87	63	47	VCC23	PO	PO	2.3V output for regulator

※ PLAY_EN & REC_EN Function Option

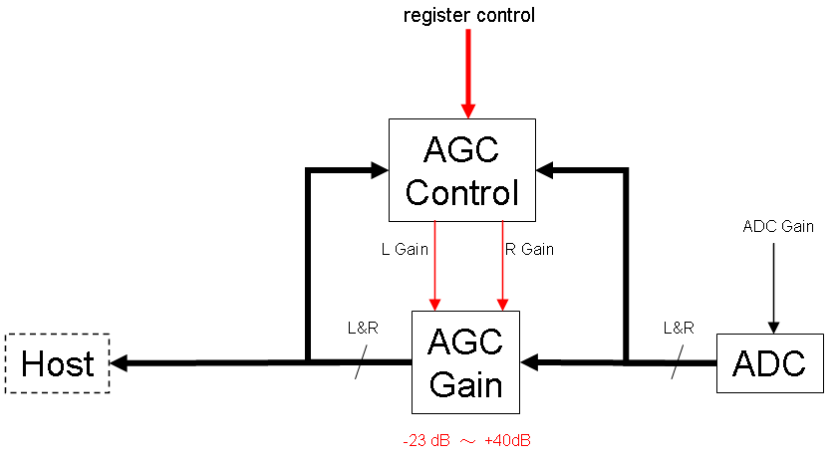
PLAY_EN	*REC_EN*	*function*
0	0	Reserved for test
1	0	Play only
0	1	Record only
1	1	Play & Record (default)

5. Block Diagram And Descriptions



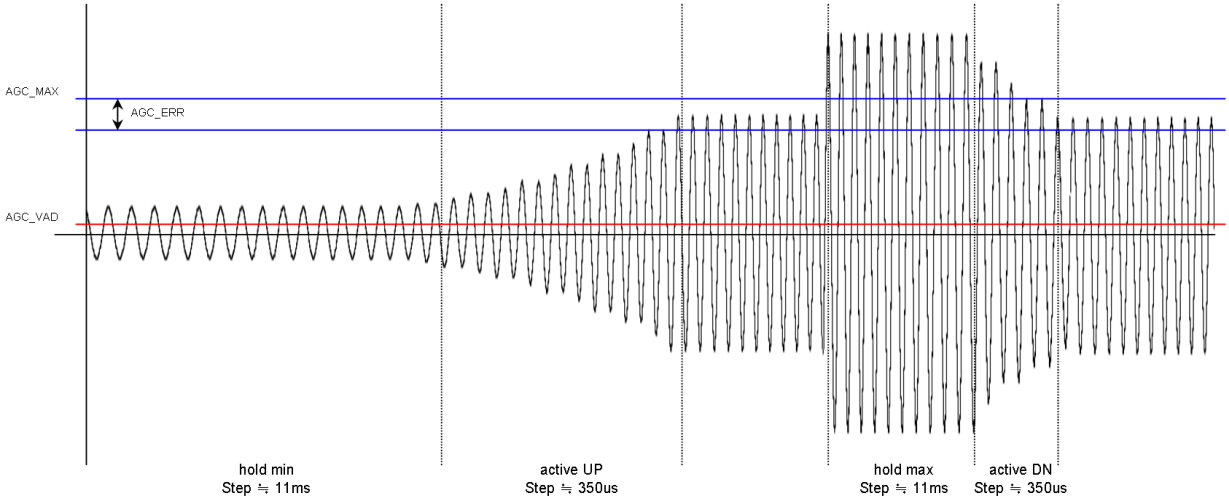
Automatic Gain Control (AGC)

SSS1629A4 has AGC (Automatic Gain Control) function. It can be used to automatically adjust the output range of ADC, which can let ADC outputs remain in a stable range. AGC control schematic diagram as below, the gain adjustable range is -23dB ~ + 40dB, with each step 1dB adjusted.



AGC parameter setting can be set in EEPROM. The control features include stability of time, error range, active manner, hold time, speed adjusting and son on, these parameters need for individual settings. Its operational diagram refers as below:

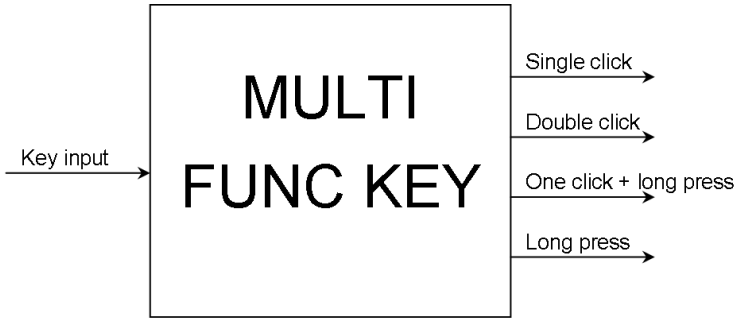
AGC tuning is targeted at within two blue lines. Shown in front of diagram, signal is below the blue line interval, then AGC amplifier the signal to the blue range. Similarly in the illustration, the signal is over the blue interval, and then AGC will down the signal to the blue range.



Ps : AGC function is only valid for built-in ADC of SSS1629A4

- **MULTI FUNCTION KEY** (4 Key)

SSS1629A4 support maximum 4 multifunction keys. By EEPROM settings, each multifunction key can have up to four different button operation manners. Four kinds of different button operation are "a short press", "consecutive two short press", "a short and a long press" and "a long press". Each multifunction key corresponds to different control manner for different function demand, so that can achieve the purpose of streamlining the key number of requirements. Setting diagram is as follows:



Key input can be set from :

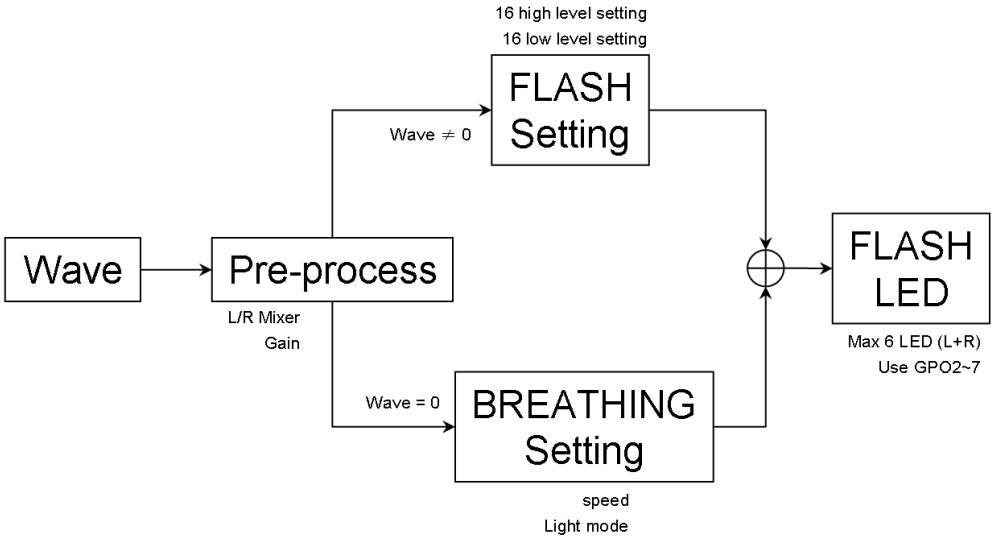
ON.	Key input
1	VOLUP_IN
2	VOLDN_IN
3	MUTEP_IN
4	MUTER_IN
5	NEXT_TRACK_IN
6	PRE_TRACK_IN
7	STOP_IN
8	PLAY_PAUSE_IN
9	EQ_NEXT_IN
10	USER_KEY_IN
11	GPI5
12	GPI6
13	GPI7
14	GPI8
15	GPI9

Function output can be assign to :

ON.	Function output
1	VOLUP
2	VOLDN
3	MUTEP
4	MUTER
5	NEXT_TRACK
6	PRE_TRACK
7	STOP
8	PLAY_PAUSE
9	EQ_NEXT
10	USER_KEY
11	S3D_NEXT
12	GPO9
13	GPO8
14	GPO7
15	GPO6
16	GPO5

LED FLASH

SSS1629A4 has the function of stereo audio wave gradient indicator. By EEPROM settings, can provide up to six indication signals (the difference between L/R, for each channel share three indication signals). Indication signal is shared with GPO (GPO7 ~ GPO2), can be connected to LED to be audio output gradient indicator. When the audio signal is zero, the LEDs can be set for as breathing lights to increase product diversity.
The following is a functional diagram:



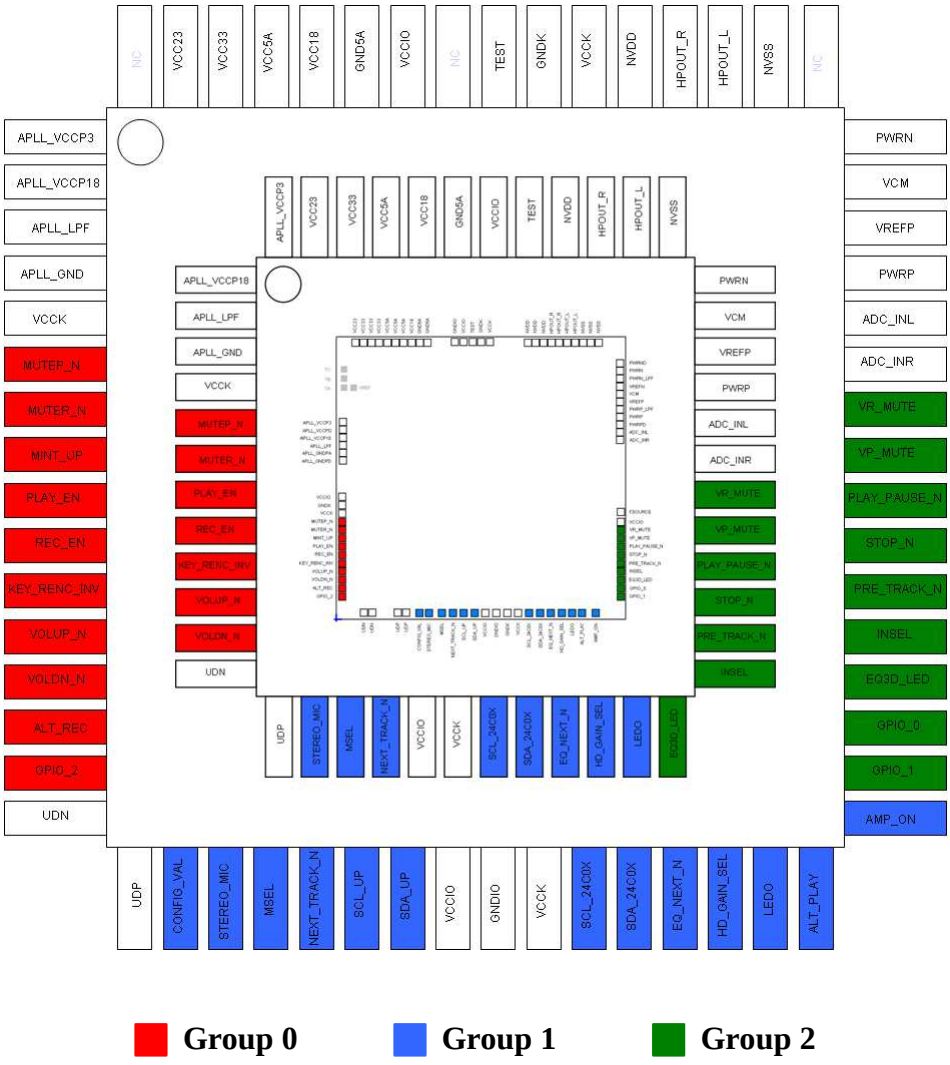
When setting for audio output indicator, it can be adjusted in accordance with the desired output range; each indicator signals can have 16 levels to do proposed audio settings.

IO Setting

SSS1629A4 has total of 32 multi-purpose IO pads. These IO pads can follow the demand for functional setting from EEPROM. Proposed IOs are divided into three groups, and each group can be individually set output driver ability. The setting range is 2mA ~ 16mA, with each step 2mA adjusted.

IO Group Distinction as Follows:

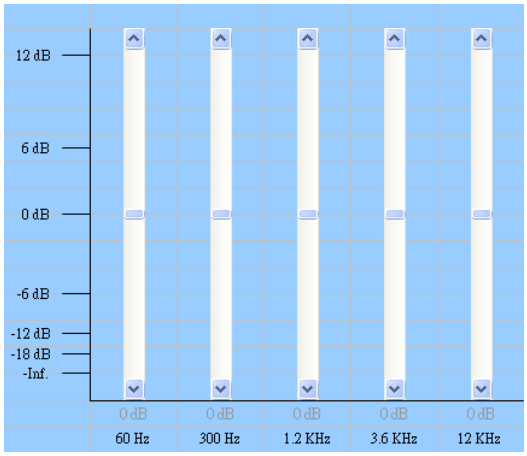
Group	IO pad
0	PLAY_EN, REC_EN, KEY_RENC_INV, VOLUP_N, VOLDN_N, MUTEP_N, MUTER_N, MINT_UP, ALT_REC, GPIO_2
1	STEREO_MIC, MSEL, SCL_24C0X, SDA_24C0X, NEXT_TRACK_N, LEDO, EQ_NEXT_N, HD_GAIN_SEL, SCL_UP SDA_UP, ALT_PLAY, CONFIG_VAL, AMP_ON
2	EQ3D_LED, INSEL, PRE_TRACK_N, STOP_N, PLAY_PAUSE_N, VP_MUTE, VR_MUTE, GPIO_0, GPIO_1



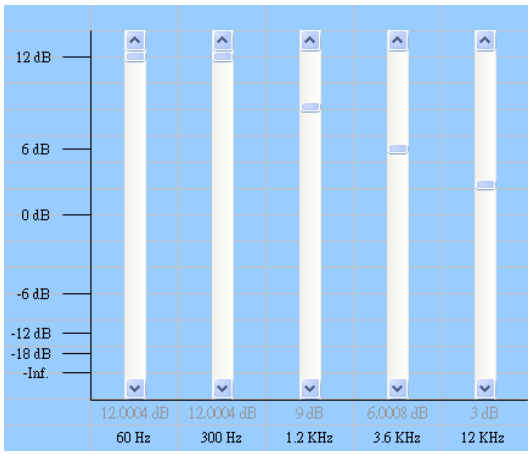
Group 0 **Group 1** **Group 2**

● Five-band Equalizer

SSS1629A4 on playback path built 5 Band EQ functions to provide user to make sound effect adjustment. These frequencies of five-band EQ are fixed at 60Hz, 300Hz, 1.2KHz, 3.6KHz and 12KHz, respectively. Gain can be set for each band is + 12dB ~ -∞dB, as follows:



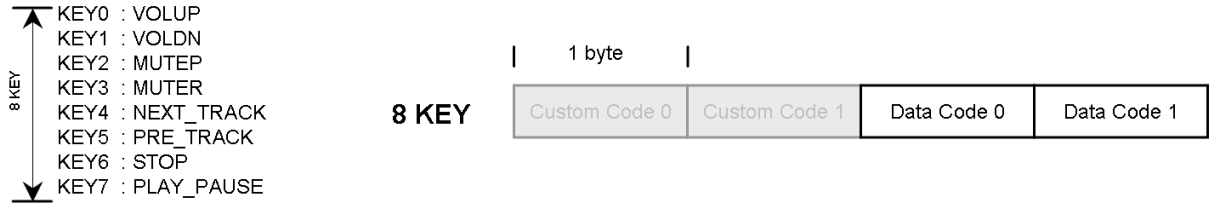
User can adjust a variety of sound effects according to requirement; the results will be stored in EEPROM after adjustment, and it can use single button to change different sound effect in cycle approach, simultaneously, also provide a single LED for indication of ON/OFF sound effect. By default, SSS1629A4 built-in a subwoofer sound settings, therefore, under no external EEPROM case, there is still an EQ sound transformation for user. Preset bass (SUBWOOFER) sound settings are as follows:



Infrared Remote Control (NEC IR)

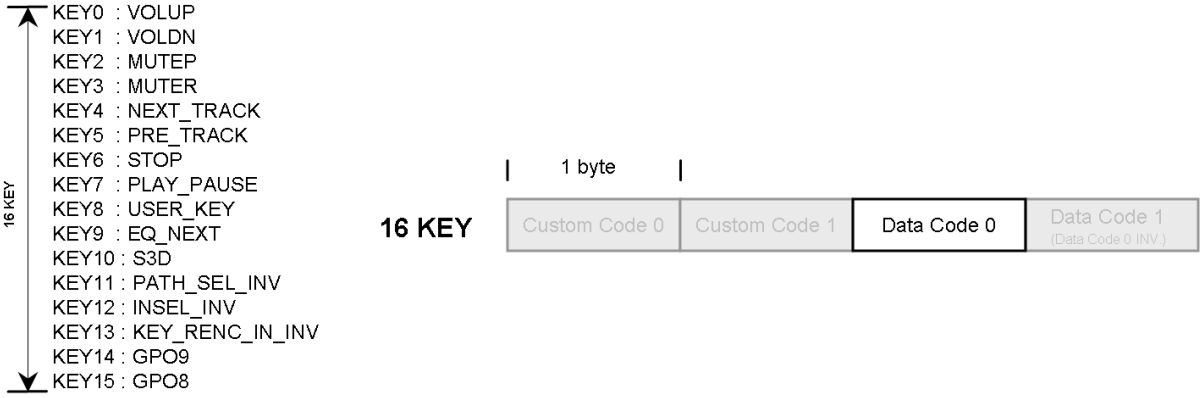
SSS1629A4 has Infrared Remote Control (NEC IR) function. The control codes can be set in EEPROM, and in accordance with the control code setting can be divided into two different ways to set as 8 Key and 16 Key, shown below:

8 Key



In 8 Key mode, ***Data Code 0*** and ***Data Code 1*** can be set by user definition

16 Key

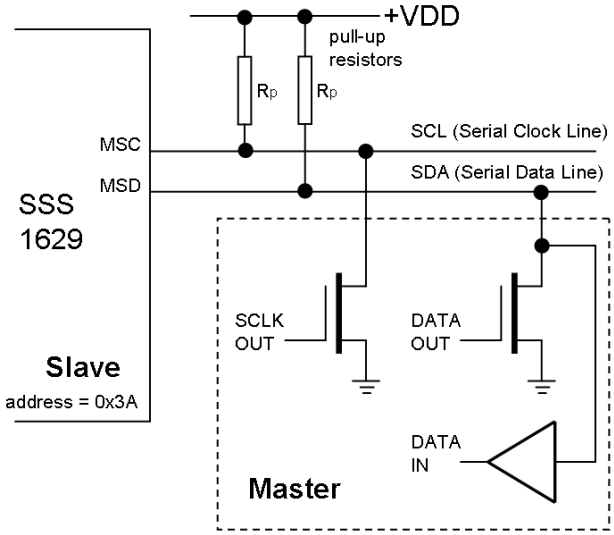


In 16 Key mode, ***Data Code 0*** can be set by user definition, and ***Data Code 1*** will be automatically inverted according to the ***Data Code 0*** setting

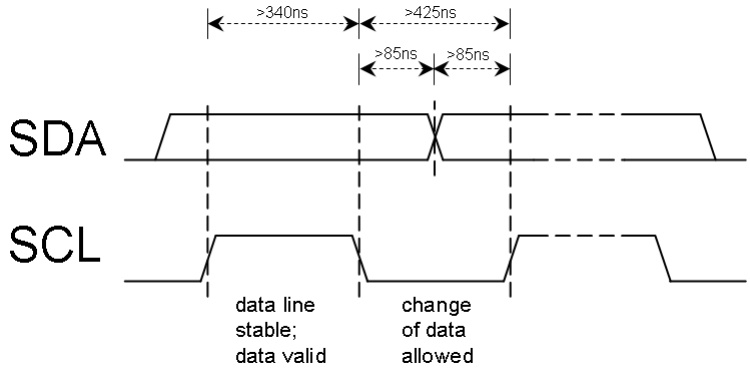
- **SSS1629 A4 Register Control by Two-wire Serial Bus**

MCU Two-wire Serial Bus

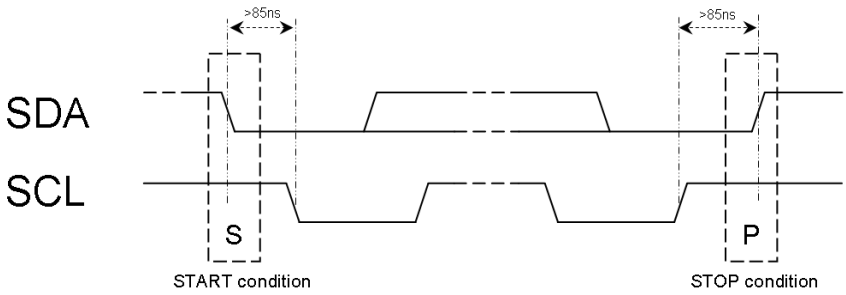
Connection of the devices to the 2 wire serial bus



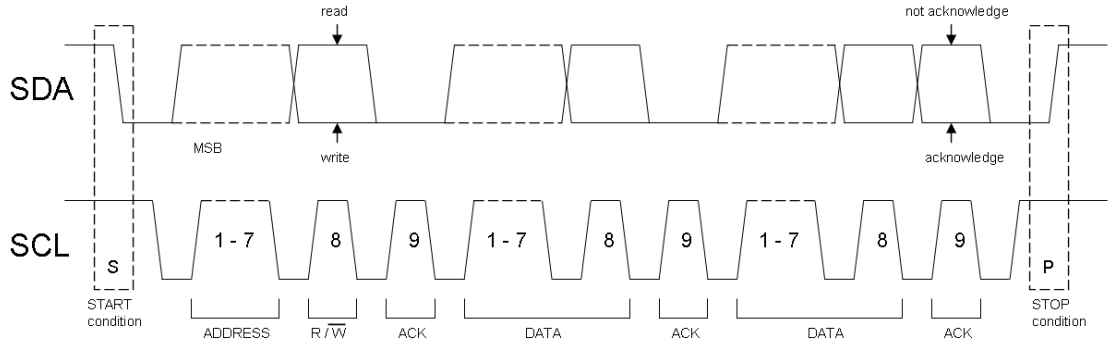
Bit transfer on the SSS1629 2 wire serial bus



START and STOP conditions



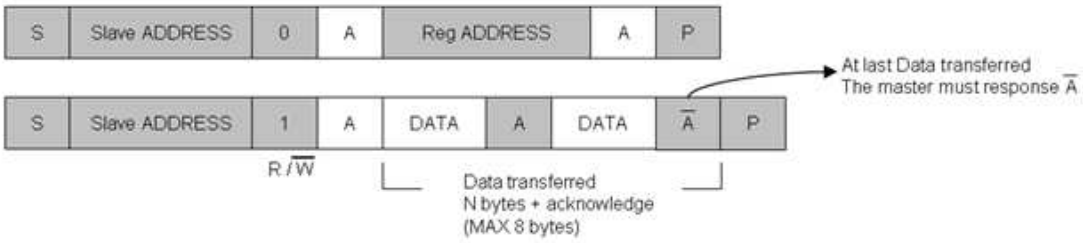
Two wire serial bus data transfer

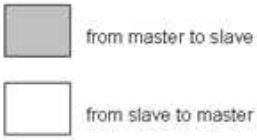


MCU Two-wire Serial Bus Read/Write

Set Data (Master write data to SSS1629)

Get Data (Master Read data from SSS1629)





A = acknowledge (SDA LOW)
Ā = not acknowledge (SDA HIGH)
S = START condition
P = STOP condition
Slave ADDRESS = SSS1629 address : 3A (it can be modify by eeprom)
Reg ADDRESS = SSS1629 internal register address (0 - 7)
When Set MAX 4 bytes (0 - 3)
When Get MAX 8 bytes (0 - 7)

Two-wire Serial Bus Device Address

SSS1629 Device Address: 0x3A

Two-wire Serial Bus Register Description

REG_0 (Multi-Media Key)-Register address: 0x00

Bits	Read/Write	Description	Default
7	R/W	User define Key	0x0
6	R/W	0: No activity on Play/Pause button 1: Play/Pause button pressed then released	0x0
5	R/W	0: No activity on Stop button 1: Stop button pressed then released	0x0
4	R/W	0: No activity on Play Mute button 1: Play Mute button pressed then released	0x0
3	R/W	0: Scan Previous Track button released 1: Scan Previous Track button pressed	0x0
2	R/W	0: Scan Next Track button released 1: Scan Next Track button pressed	0x0
1	R/W	0: Volume-Down button released 1: Volume-Down button pressed	0x0
0	R/W	0: Volume-Up button released 1: Volume-Up button pressed	0x0

REG_1 (Control Byte 1)-Register address: 0x01

Bits	Read/Write	Description	Default
7-0	R/W	Write : Control mode = 001 Mapped to Internal register address[7:0] Control mode = 010 Mapped to Internal register write data Control mode = 011 Mapped to GPO[7:0] Other Reserved Read : Control mode = 011 Mapped to GPI[7:0] Other Mapped to Internal register read data	0x0

REG_2 (Control Byte 2)-Register address : 0x02

Bits	Read/Write	Description	Default
7-0	R/W	Write : Control mode = 001 Mapped to Internal register address[15:8] Control mode = 011 Mapped to GPOE[7:0] (1: output 0: input) Other Reserved Read : Control mode = 011 Bit7 : Mapped to MUTE_R Bit6-2 : 0 Bit1-0 : Mapped to GPI[9:8] Other Internal register address[7:0]	0x0

REG_3 (Control Byte 3) -Register address: 0x03

When data is written to *REG_3* then the control will be executed

Bits	Read/Write	Description	Default
7	R/W	Write : Reserved Read : Control mode = 011 Output Report 3 [7] Other Internal register address [15]	0x0
6-4	R/W	Write : Control mode select (Command ID CODE) 000: Generic register 001: set internal register address 010: write data to internal registers 011: write data to GPIO Other Reserved Read : Control mode = 011 Output Report 3 [6:4] Other Internal register address [14:12]	0x0
3-0	R/W	Write : Control mode = 011	0x0

		Bit1-0: Mapped to GPO[9:8] Bit3-2: Mapped to GPOE[9:8] (1: output 0: input) Other Reserved Read : Control mode = 011 REG_3 [7:4] Other Internal register address [11:8]	

REG_4 (HID Output Report 0)-Register address: 0x04

Bits	Read/Write	Description	Default
7-0	R	HID Output Report 0	0x0

REG_5 (HID Output Report 1)-Register address: 0x05

Bits	Read/Write	Description	Default
7-0	R	HID Output Report 1	0x0

REG_6 (HID Output Report 2)-Register address: 0x06

Bits	Read/Write	Description	Default
7-0	R	HID Output Report 2	0x0

REG_7 (HID Output Report 3)-Register address: 0x07

Bits	Read/Write	Description	Default
7-0	R	HID Output Report 3	0x0

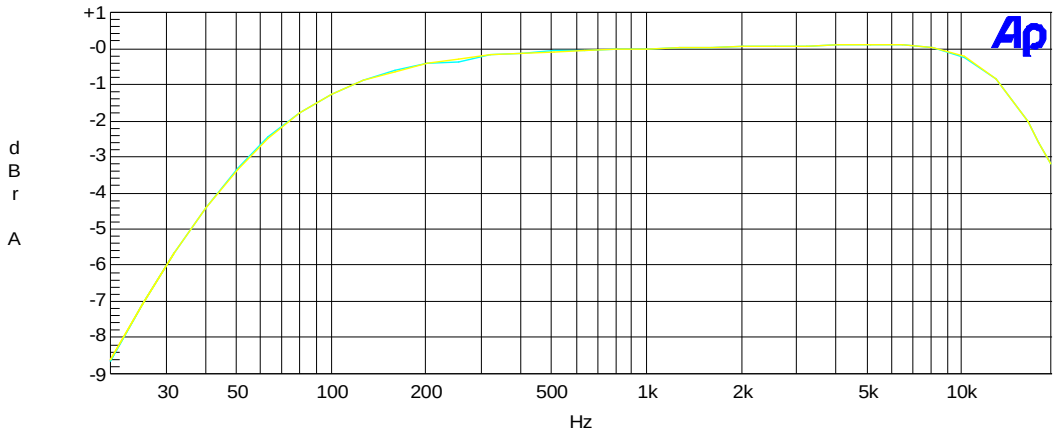
6. Typical Performance Curves

● SSS1629 A4 LQFP48 DAC Measurement

(HP driver Gain=-1dB,Vrefp=3v,play sample rate 44.1k)

Frequency Response(32Ω)

sss1629D Frequency Response 08/12/14 16:51:02



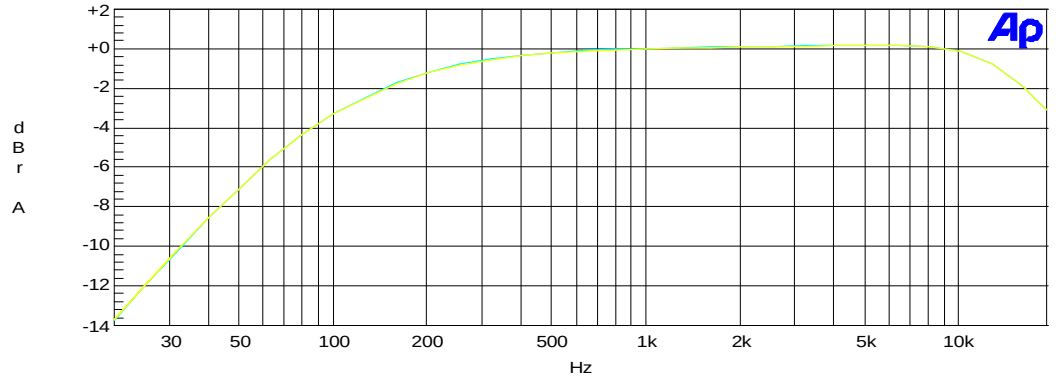
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Cyan	Solid	1	Analyzer.Level A!Normalize	Left	
1	2	Yellow	Solid	1	Analyzer.Level B!Normalize	Left	

dBrA=698.7mVrms
dBrB=700.6mVrms

XA-Frequency Response.ats2

Frequency Response(16Ω)

sss1629D Frequency Response 08/12/14 15:49:44

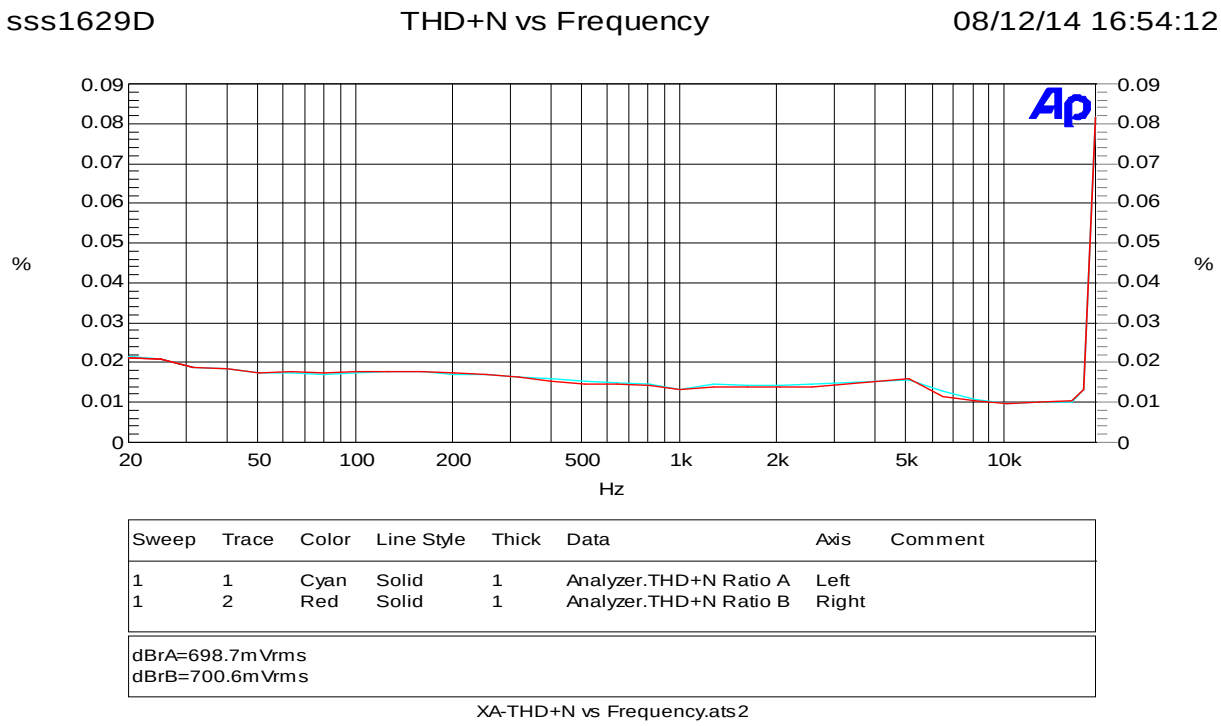


Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Cyan	Solid	1	Analyzer.Level A!Normalize	Left	
1	2	Yellow	Solid	1	Analyzer.Level B!Normalize	Left	

dBrA=675.6mVrms
dBrB=677.7mVrms

XA-Frequency Response.ats2

Thd+N V.S. Frequency(-3dB input signal)(with “A” weighting) (32Ω)

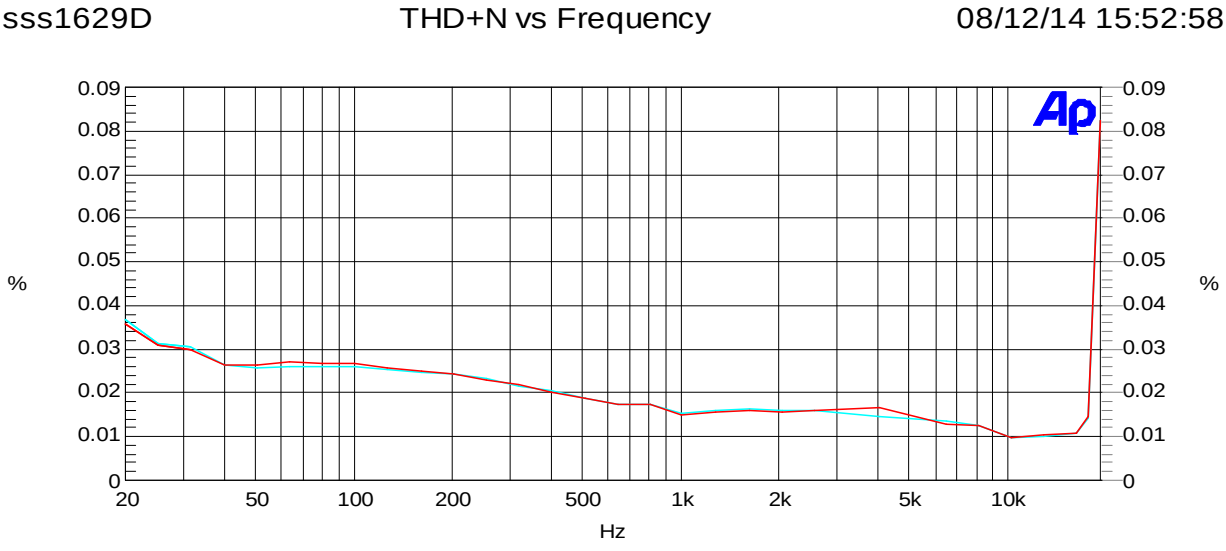


Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Cyan	Solid	1	Analyzer.THD+N Ratio A	Left	
1	2	Red	Solid	1	Analyzer.THD+N Ratio B	Right	

dBrA=698.7mVrms
dBrB=700.6mVrms

XA-THD+N vs Frequency.ats2

Thd+N V.S. Frequency(-3dB input signal)(with “A” weighting) (16Ω)



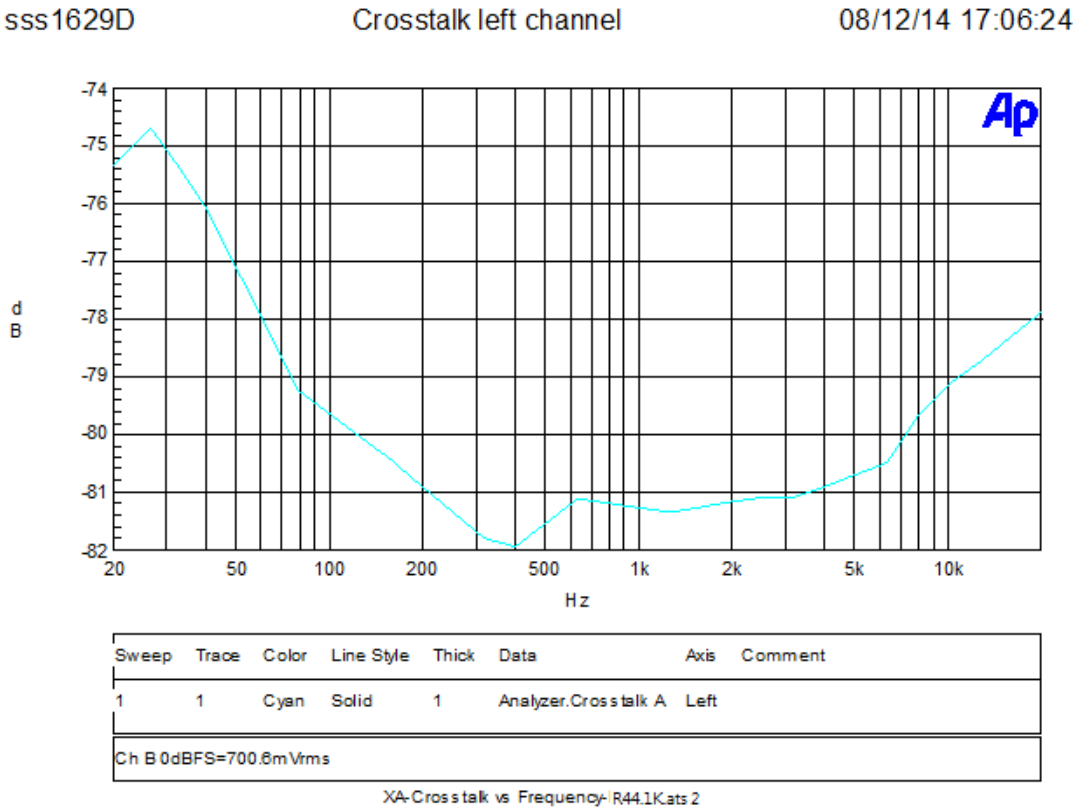
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Cyan	Solid	1	Analyzer.THD+N Ratio A	Left	
1	2	Red	Solid	1	Analyzer.THD+N Ratio B	Right	

dBrA=675.6mVrms
dBrB=677.7mVrms

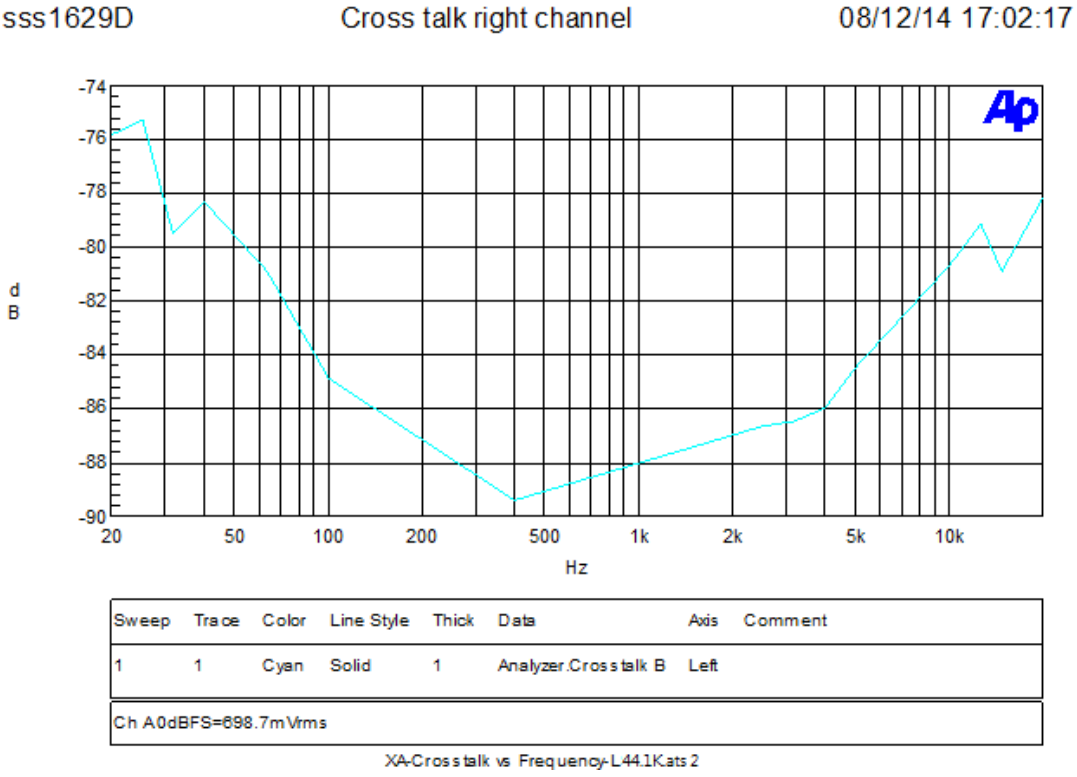
XA-THD+N vs Frequency.ats2

Crosstalk (32Ω)

-Left channel

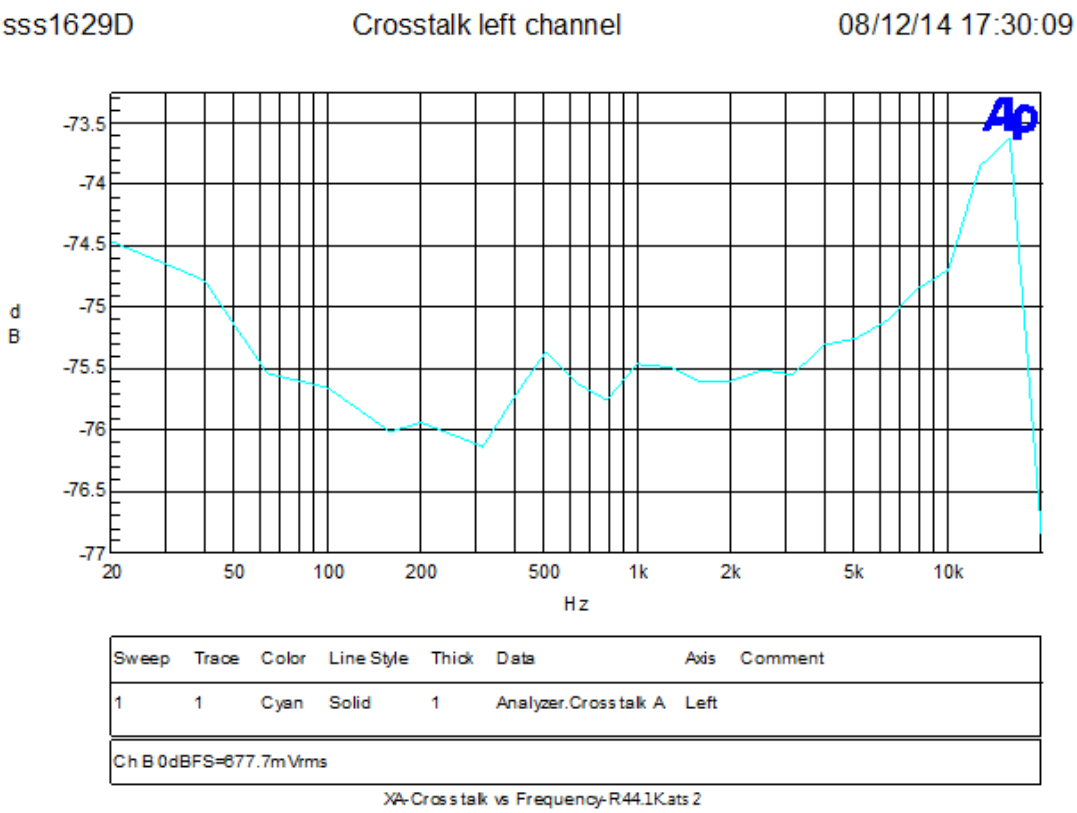


-Right channel

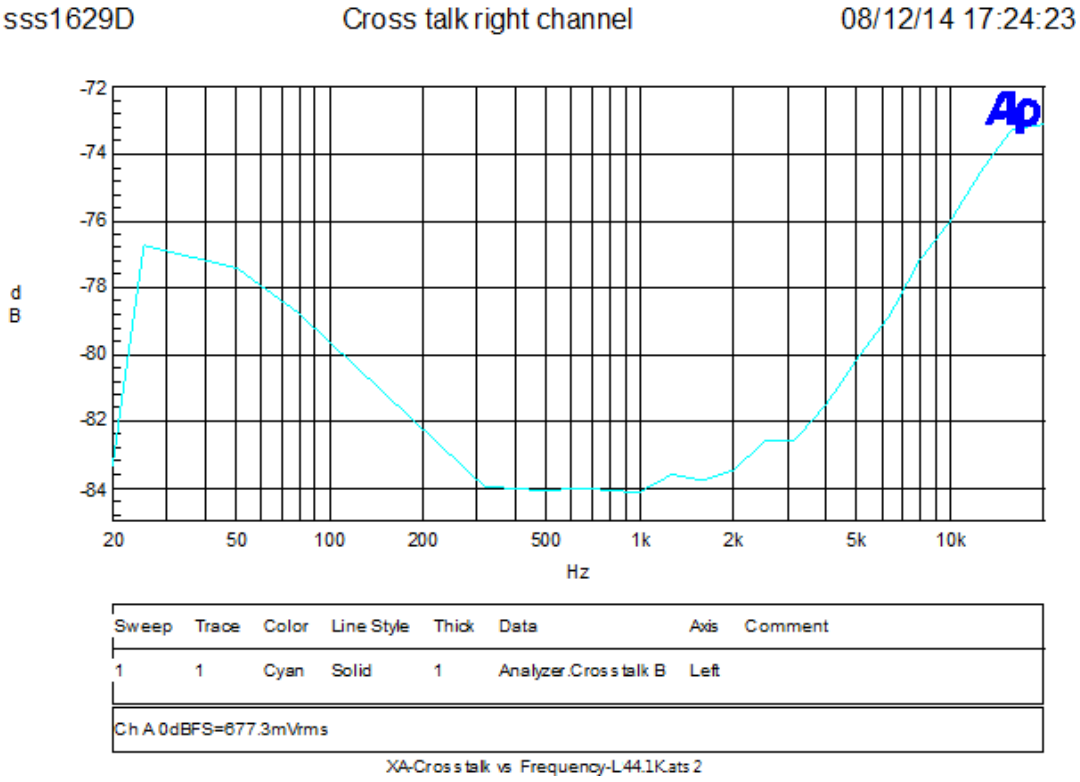


Crosstalk (16Ω)

-Left channel



-Right channel

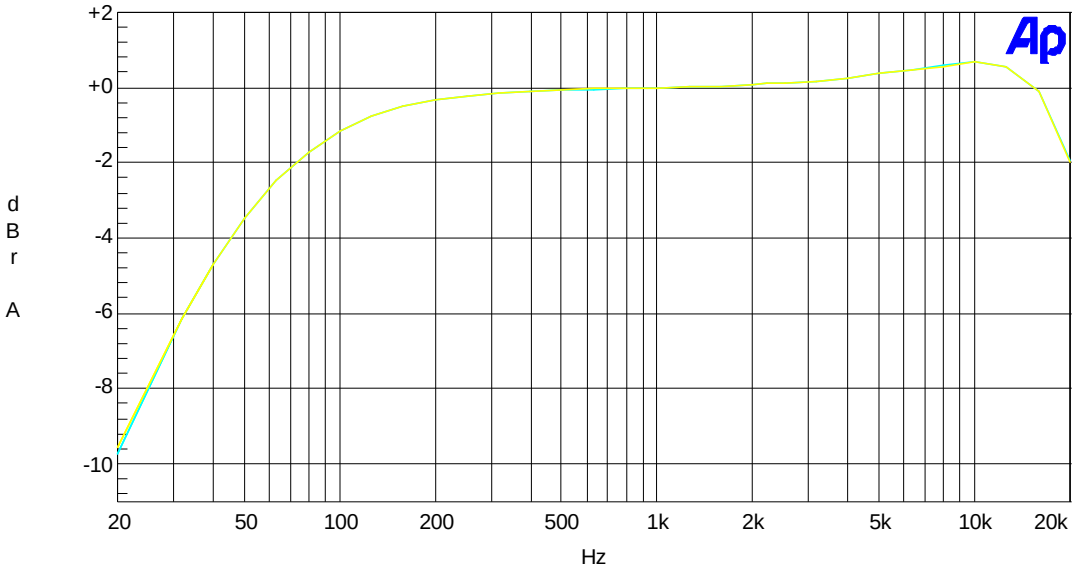


- **SSS1629 A4 LQFP48 ADC measurement**

(vrefp=3v,record sample rate=44.1k)

Frequency response

sss1629D A-D-PC Recording Frequency Response 06/10/14 15:54:13

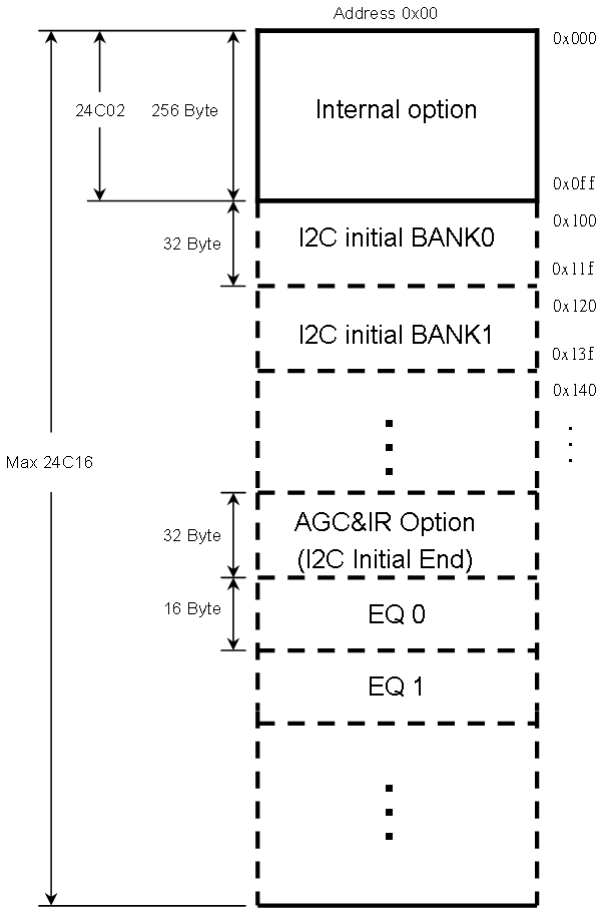


Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Cyan	Solid	1	Analyzer.Level A!Normalize	Left	
1	2	Yellow	Solid	1	Analyzer.Level B!Normalize	Left	

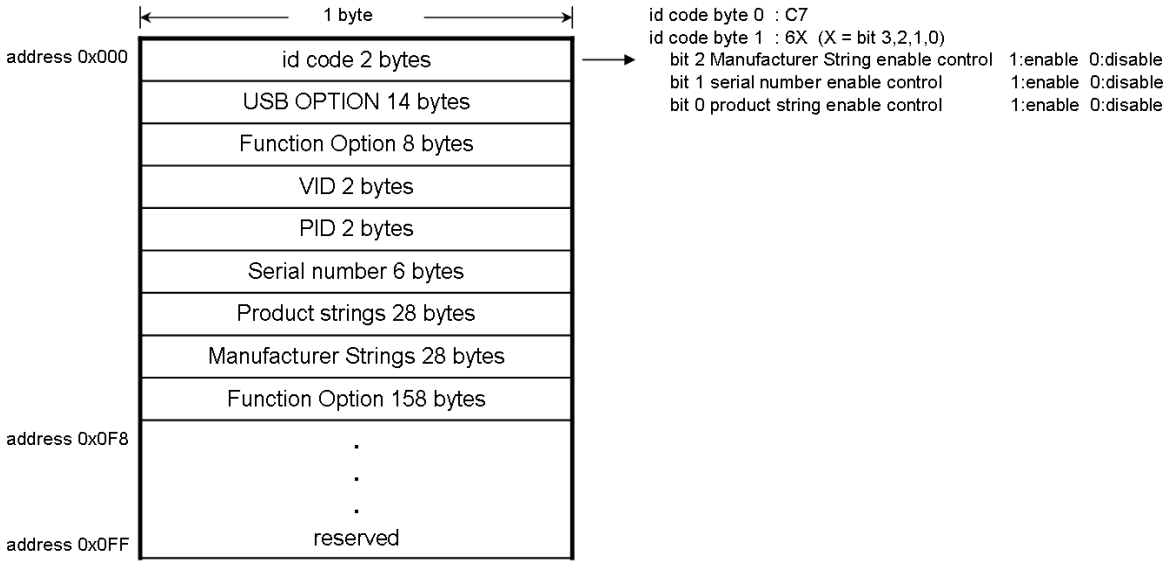
AD-PC Frequency Response.ats2

7. EEPROM Content And Descriptors

● EEPROM Space Partition

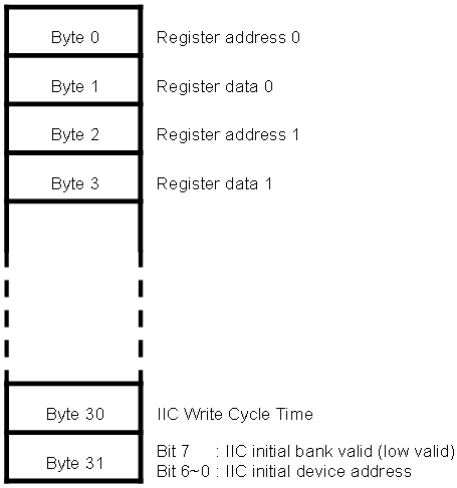


Internal Option

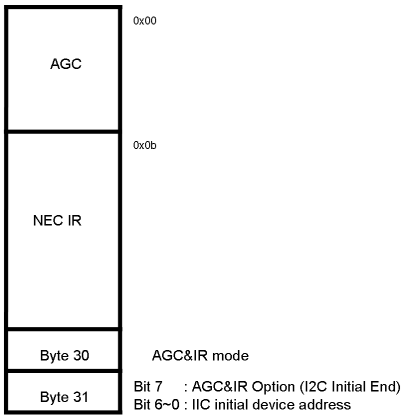


External Initial

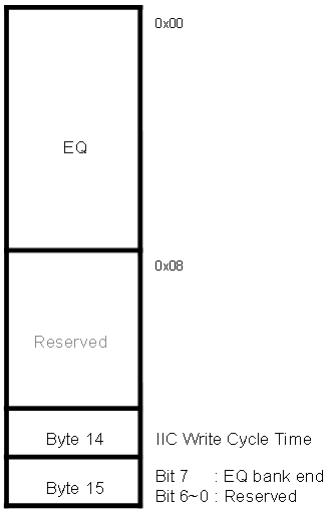
I2C initial BANK (32 Byte)(after 0xff)



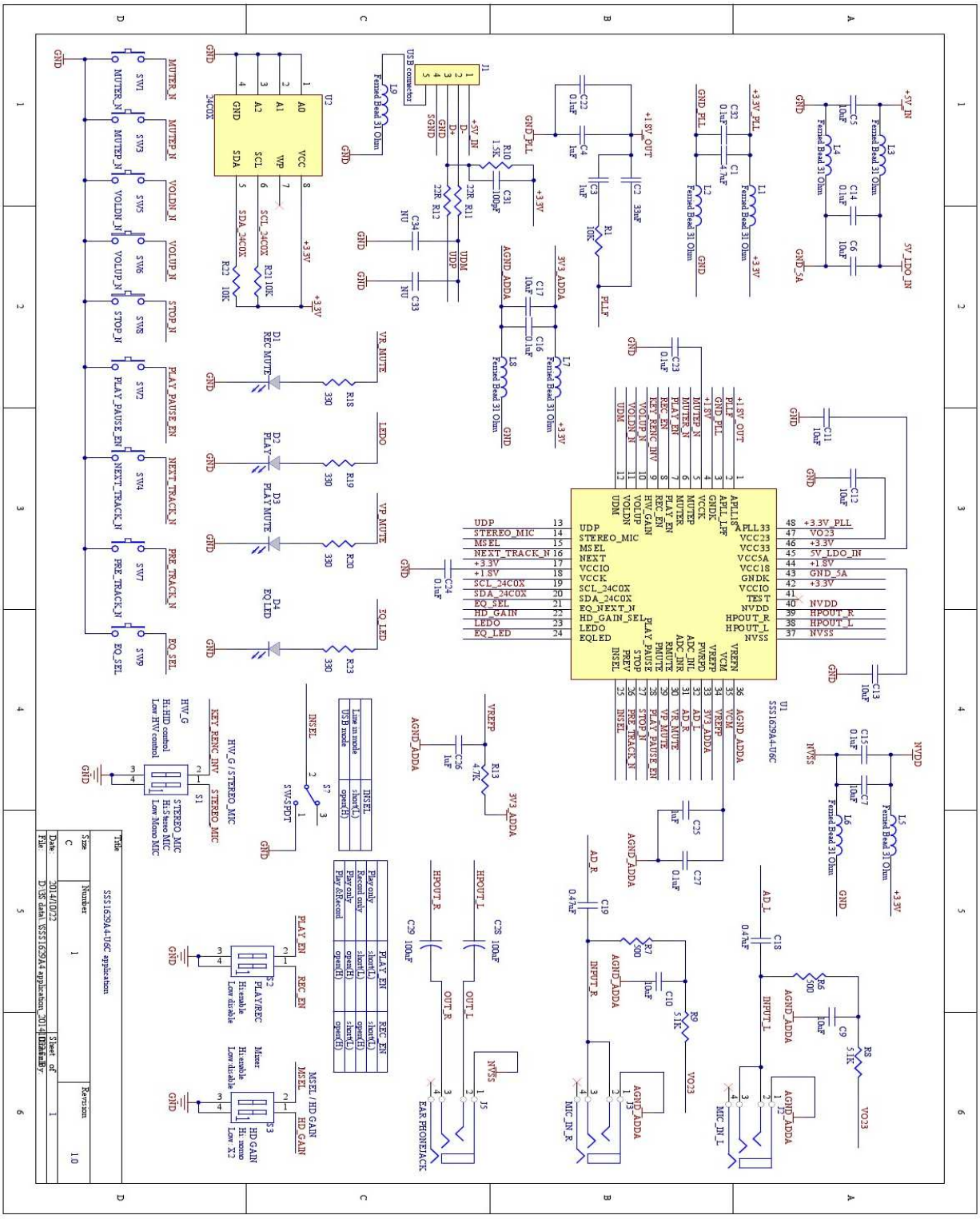
AGC&IR Option (I2C Initial End)



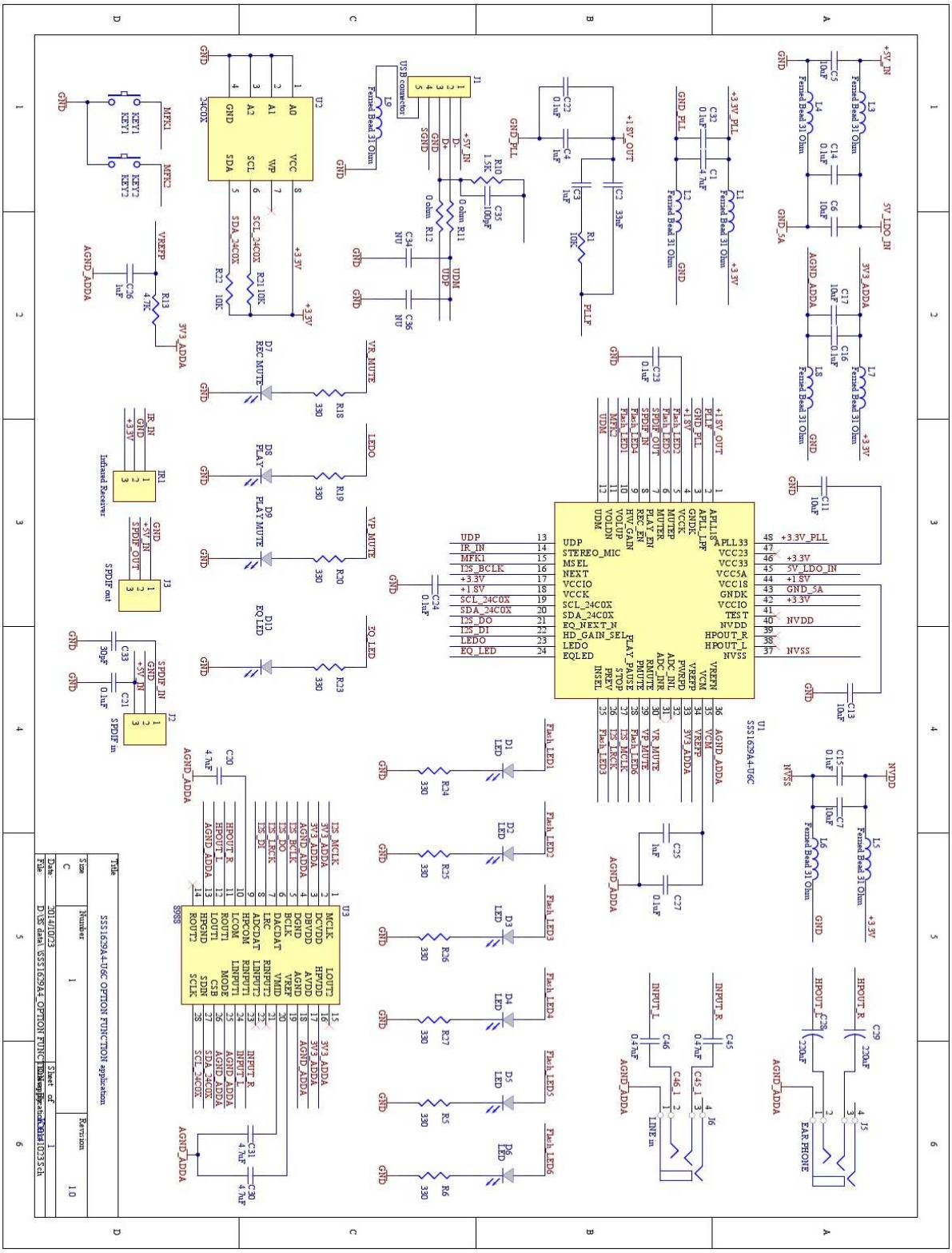
EQ Extend Bank (16 Byte)(after External I2C Interface Initial Bank)



8. Reference Application Circuit

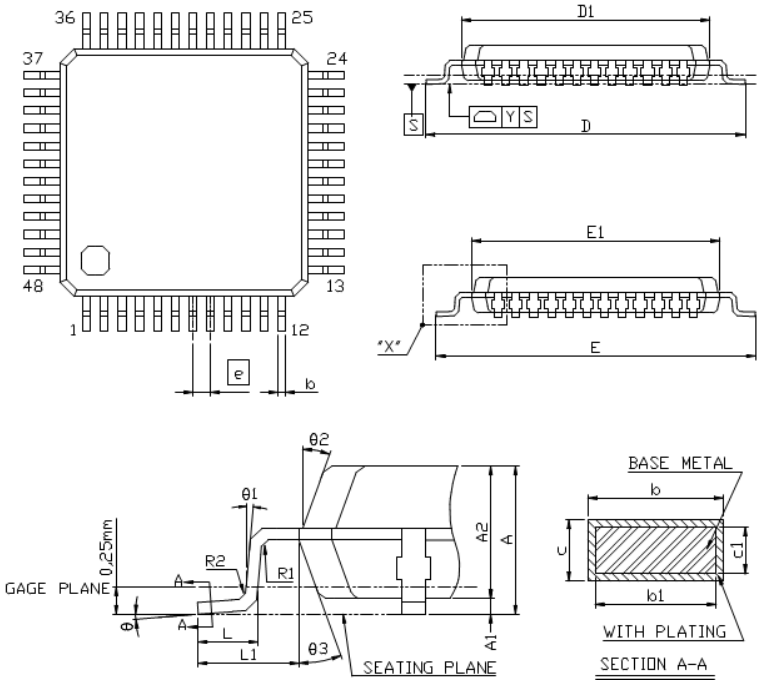


- **Reference Application Circuit for Add on Function**



9. Package Information

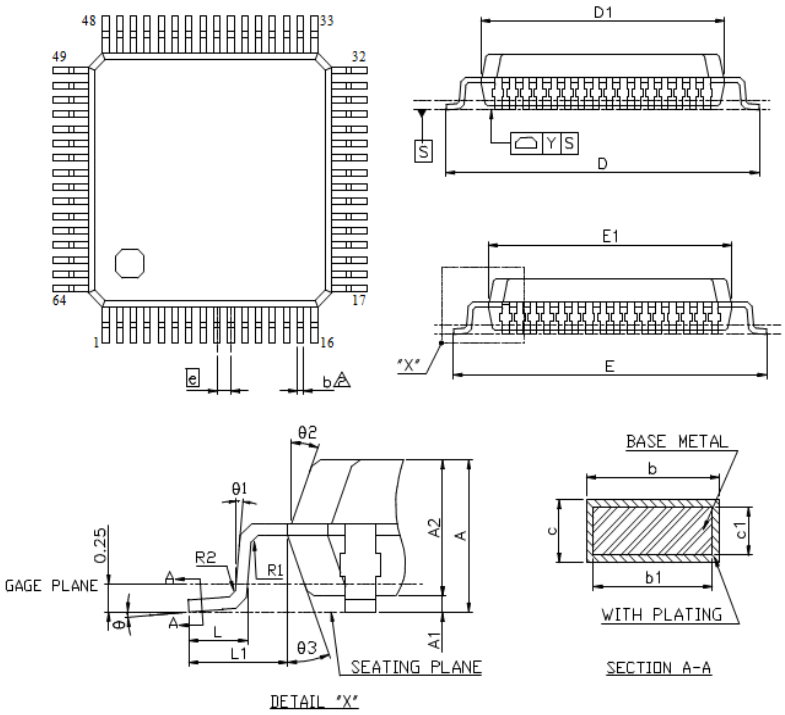
- **LQFP48**



SYMBOL	DIMENSION (MM)			DIMENSION (MIL)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A			1.60			63.0
A1	0.05	0.10	0.15	2.0	3.9	5.9
A2	1.35	1.40	1.45	53.1	55.1	57.1
b	0.17	0.22	0.27	6.7	8.7	10.6
b1	0.17	0.20	0.23	6.7	7.9	9.1
c	0.09		0.20	3.5		7.9
c1	0.09		0.16	3.5		6.3
D	8.90	9.00	9.10	350.4	354.3	358.3
D1	6.90	7.00	7.10	271.7	275.6	279.5
E	8.90	9.00	9.10	350.4	354.3	358.3
E1	6.90	7.00	7.10	271.7	275.6	279.5
e	0.45	0.50	0.55	17.7	19.7	21.7
L	0.50	0.60	0.70	19.7	23.6	27.6
L1	0.85	1.00	1.15	33.5	39.4	45.3
R1	0.08			3.1		
R2	0.08		0.20	3.1		7.9
Y			0.08			3.1
θ	0°	3.5°	7°	0°	3.5°	7°
θ1	0°			0°		
θ2	11°	12°	13°	11°	12°	13°
θ3	11°	12°	13°	11°	12°	13°

NOTE:
1.REFER TO JEDEC MS-026 (ISSUE D) / BBC
2.DIMENSION D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION.
ALLOWABLE PROTRUSION IS 0.25mm PER SIDE D1 AND E1 ARE
MAXIMUM PLASTIC BODY SIZE DIMENSION 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.
4.ALL DIMENSIONS ARE IN MILLIMETERS.
5.DIMENSION CONVERSION FACTOR : 1mm=39.37mil

- **LQFP64**



SYMBOL	DIMENSION (MM)			DIMENSION (MIL)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A			1.60			63.0
A1	0.05	0.10	0.15	2.0	3.9	5.9
A2	1.35	1.40	1.45	53.1	55.1	57.1
b	0.13	0.18	0.23	5.1	7.1	9.1
b1	0.13	0.16	0.19	5.1	6.3	7.5
c	0.09		0.20	3.5		7.9
c1	0.09		0.16	3.5		6.3
D	8.85	9.00	9.15	348.4	354.3	360.2
D1	6.90	7.00	7.10	271.7	275.6	279.5
E	8.85	9.00	9.15	348.4	354.3	360.2
E1	6.90	7.00	7.10	271.7	275.6	279.5
e	0.35	0.40	0.45	13.8	15.7	17.7
L	0.45	0.60	0.75	17.7	23.6	29.5
L1	0.85	1.00	1.15	33.5	39.4	45.3
R1	0.08			3.1		
R2	0.08		0.20	3.1		7.9
Y			0.08			3.1
θ	0°	3.5°	7°	0°	3.5°	7°
θ1	0°			0°		
θ2	11°	12°	13°	11°	12°	13°
θ3	11°	12°	13°	11°	12°	13°

NOTE:
1.REFER TO JEDEC MS-026(ISSUE D)/BBD
2.DIMENSION D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION.
ALLOWABLE PROTRUSION IS 0.25mm PER SIDE D1 AND E1 ARE
MAXIMUM PLASTIC BODY SIZE DIMENSION 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.
4.ALL DIMENSIONS ARE IN MILLIMETERS.
5.DIMENSION CONVERSION FACTOR : 1mm=39.37mil

10. Revision History

Revision	Date	Description
1.0	2014/08/20	Initial Specification
1.1	2014/09/04	Fixed Incorrect Text. Add Package Information
1.2	2014/09/29	Changed 1629A4 (44.1k sampling rate default) to 1629A5 (48k sampling rate default)
1.3	2014/10/23	Changed Reference Application Circuit & Reference Application Circuit for Add on Function