ATS2825 Bluetooth Module SPEC

Latest Version: 1.1

2015-10-26

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List of Contents

Features

- 104 MHz MIPS32 Processor and 180 MHz DSP
- Internal ROM and serial flash memory interface supporting randomizer
- Internal RAM for data and program
- Built-in high performance stereo 24 bit DAC & ADC
- Supports Digital microphones, single-ended Analog microphones and full difference microphone
- Built-in stereo PA for headphone and differential audio output for speaker PA
- Bluetooth V4.2 compatible with Bluetooth V4.1,V4.1 BLE, V3.0, V2.1 systems
- Bluetooth fast AGC control to improve receiving dynamic range
- Supports AFH to dynamically detect channel quality to improve Bluetooth transmission quality
- Support SD/MMC/eMMC card interface and SPI Nor Flash interface
- Audio Interfaces: I2S, SPDIF TX
- Serial Interfaces: USB2.0, UART, TWI, SPI
- Infrared Remote controller supported
- Segment LCD panels
- Digital matrix LED panels
- Integrated PMU supports multiple low energy States
- Integrated Linear battery charger up to 600mA charging current
- PCB Dimension: 24.9mm (L) × 14mm (W) × 0.8mm (H)

ATS2825 Bluetooth Module

Bluetooth Audio Solution

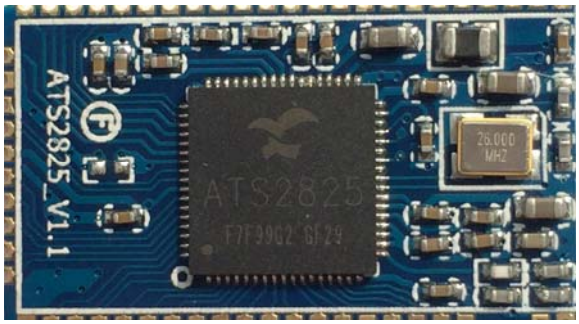
Low Power Solution for Portable&Wireless Audio Applications

Local MMC/SD Card Audio Playback

MIPS + DSP Dual-core Single-chip

Bluetooth V4.2

Revision V1.1



Applications

- Stereo headsets and headphones
- Portable stereo speakers and speakerphones
- Bluetooth car audio unit
- Bluetooth sound bar
- Bluetooth smart LED

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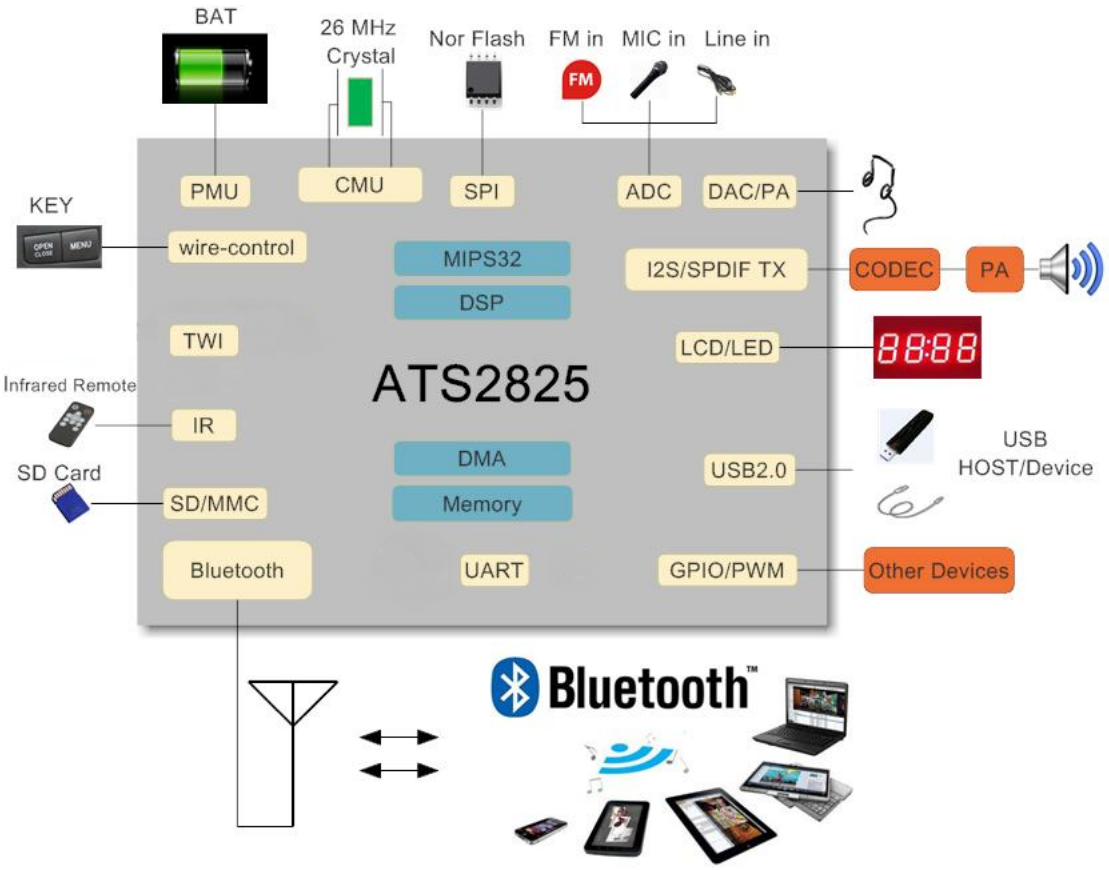
ATS2825 provides wireless and local high quality music and support wireless calls with low power and BOM, making it competitive at high-end Bluetooth audio products market. Above all, ATS2825 delivers a true “ALL-IN-ONE” solution; it is the ideal choice for Single-chip wireless and local MMC/SD card audio application

Application Diagram



Specifications

Operating Frequency Band	2.4GHz ~ 2.48GHz unlicensed ISM band
Bluetooth Specification	V2.1+EDR/V3.0/V4.0/ V4.1/V4.1 BLE/V4.2
Bluetooth Protocol	A2DP,AVRCP,HFP,SPP BAS,DIS,FMP,HRP,HRS,HTP,HTS,IAS,LLS
Output Power Class	Class 2
Operating Voltage	Core :1.2V, IO:3.3V, BAT:3.4V~4.2V
Operating temperate range	-10 ℃ ~ +70 ℃
External Interface	UART,SPI,TWI,I2S,IR,SD Card,USB,DMIC,SPDIF TX

Electrical Characteristics

Absolute Maximum Ratings				
Parameter	**Symbol**	**Min**	**Max**	**Unit**
Temperature	Storage temperature (Tstg)	-55	+150	°C
ESD Stress voltage	VESD (Human body model)	2000	-	V
Supply Voltage	DC5V	-0.3	9.0	V
	BAT	-0.3	5.0	V
	VCC/AVCC/BTVCC	-0.3	3.6	V
	VDD	-0.3	1.32	V
Input Voltage	3.3V IO	-0.3	3.6	V
	1.2V IO	-0.3	1.32	V

Recommended Power Supply				
Supply Voltage	**Min**	**Typ**	**Max**	**Unit**
BAT (Li)	3.4	3.8	4.3	V
DC5V	4.5	5.0	7.0	V
VCC/AVCC/BTVCC	2.8	3.1	3.4	V
VD15	1.0	1.5	1.7	V
VDD/RTCVDD	1.08	1.2	1.32	V
VD12	0.8	1.05	1.5	V

Regulators Maximum Output Current		
Block Name	**Output Voltage**	**Load Capacity**
VCC	2.7V ~ 3.4V	300mA
VDD	0.8V ~ 1.32V	100mA
VD15	1.0V ~ 1.7V	170mA
BTVCC	2.8V ~ 3.5V	100mA
AVCC	VCC – 0.15V	50mA@98%

Note: The output voltages are precisely within ±2%, providing large currents with a significantly small dropout voltage within ±5%.

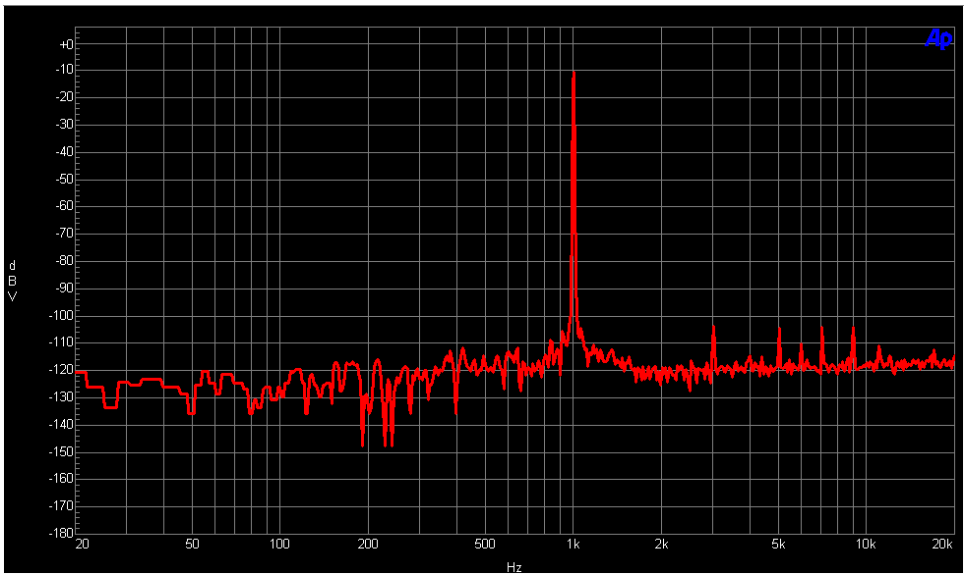
AUDIO Features

Test Condition: Power BAT=3.8V, Analog audio output AOUTL/R, Load = 10K ohm,
BW=20Hz ~ 20 KHz, A-Weight. Test equipment: AP2700.

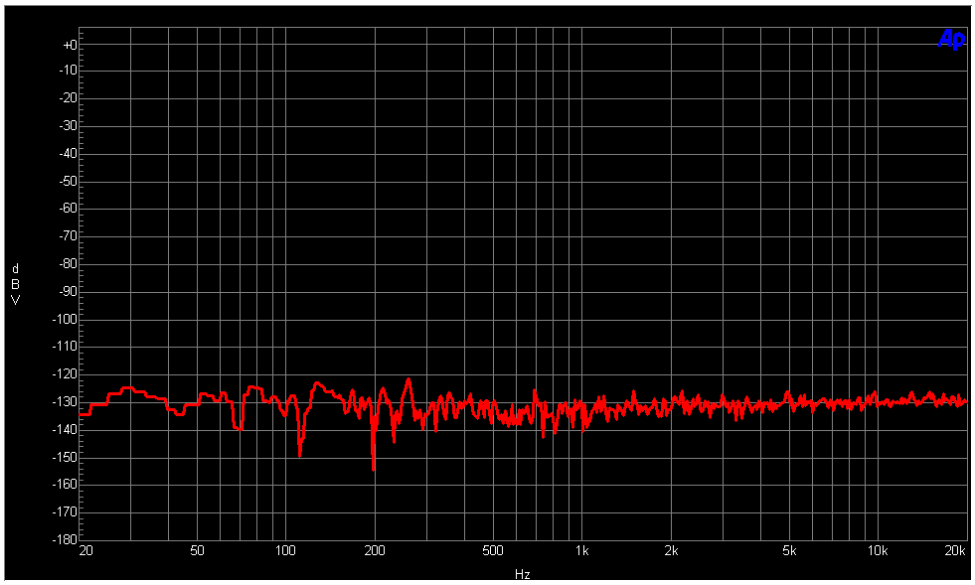
Audio Codec	DAC/ADC Sampling rate	Max : 48K Typical : 44.1K Min : 8K
Audio performance DAC (0Hz/1KHz,A weight)	Output Level	Max : 960mVrms Typical : 940 mVrms
	Ground Noise	Max : 10 uV Typical : 7 uV
	DAC SNR	Max : 101dB Typical : 98dB
	DAC THD+N	Min: -87dB Typical : -85 dB
	Dynamic Range	Max : 101 dB Typical : 98dB
	Crosstalk	Min : -100 dB Typical : -96dB
	Frequency Response	20Hz ~20KHz
Audio performance ADC (0Hz/1KHz,A weight)	Input Level THD+N <1%	Max : 980mVrms Min : --
	Ground Noise	Max : 40 uVrms Typical : 30 uVrms
	ADC SNR	Max : 90 dB Typical : 87 dB
	ADC THD+N	Min : -82dB Typical : -80 dB
	Dynamic Range	Max : 85 dB Typical : 82dB
	Crosstalk	Min : -85 dB Typical : -82dB
	Frequency Response	20Hz ~20KHz

DAC/ADC audio output performance chart:

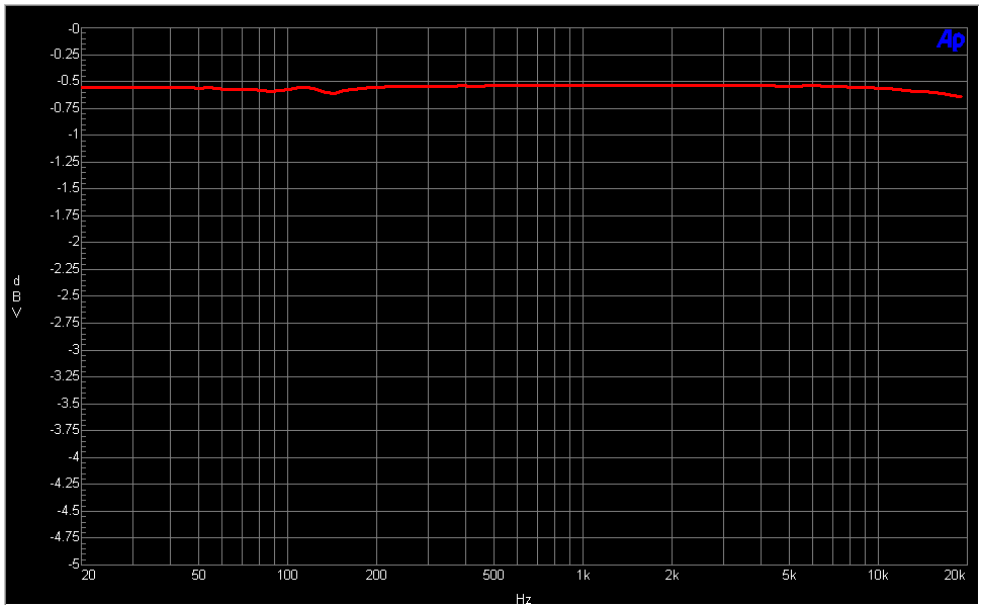
Card Player Music Mode：



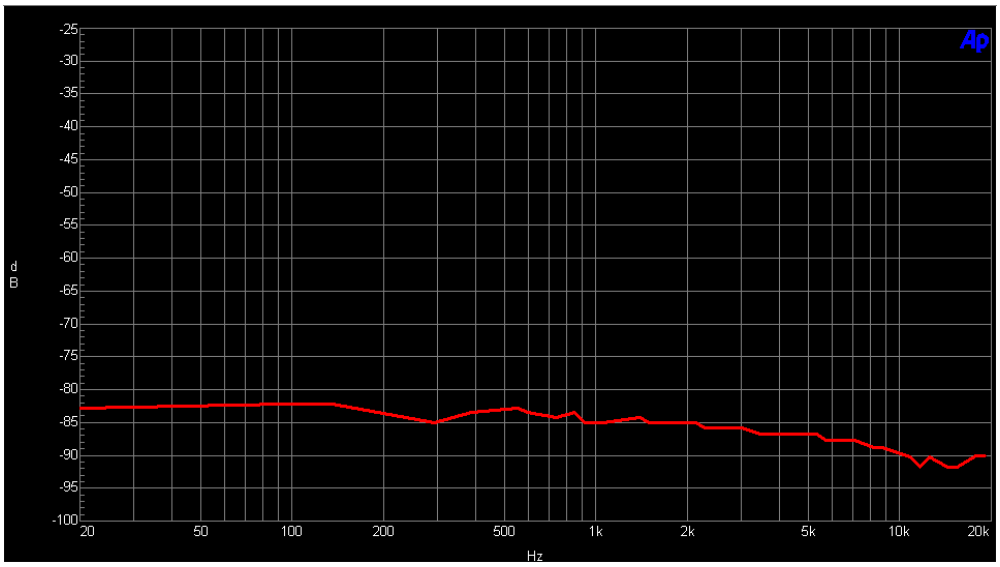
Card player: 1KHz Sin wave FFT 20Hz ~ 20 KHz



Card Player: 0Hz FFT 20Hz ~ 20 KHz

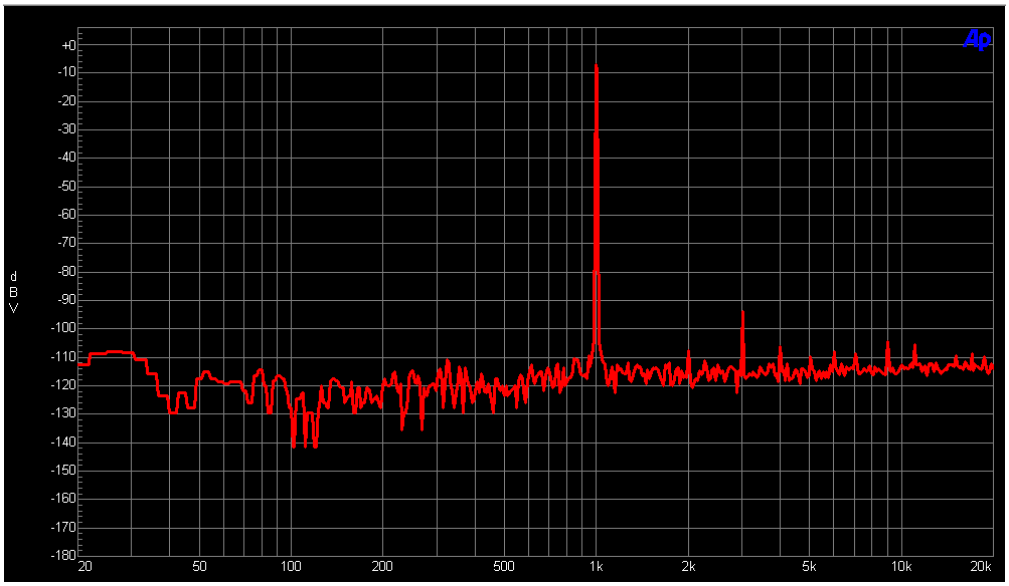


Card Player: Frequency Response 20Hz ~ 20 KHz

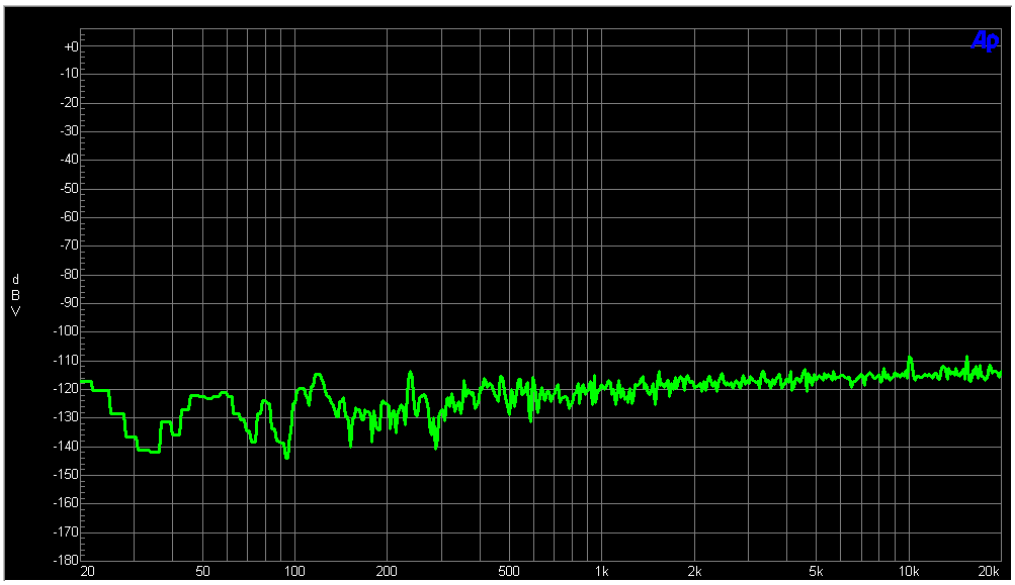


Card Player: THD+N Distortion 20Hz ~ 20 KHz

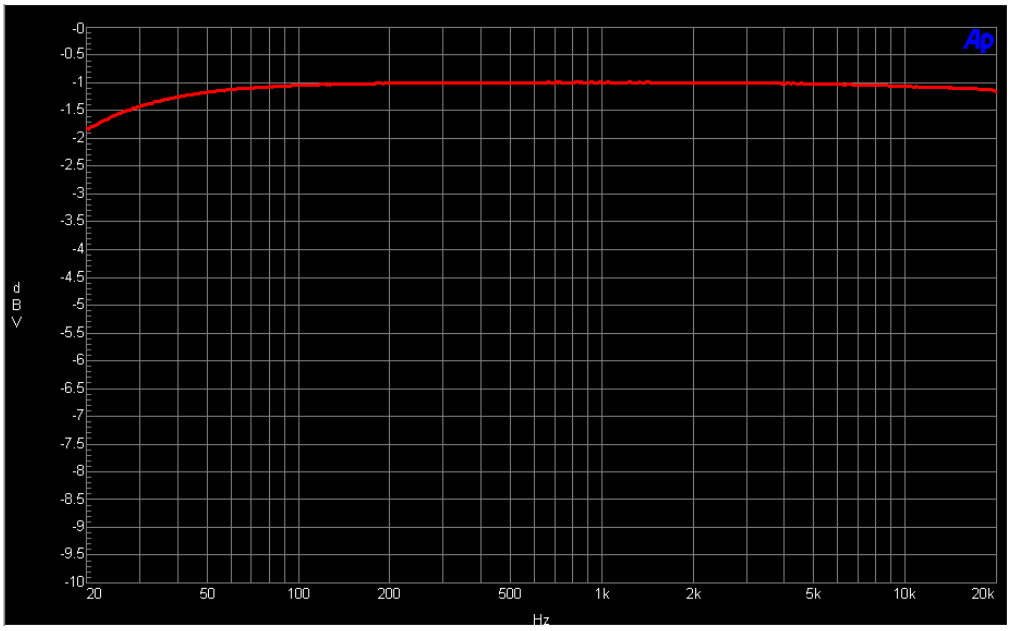
Line in Input Mode:



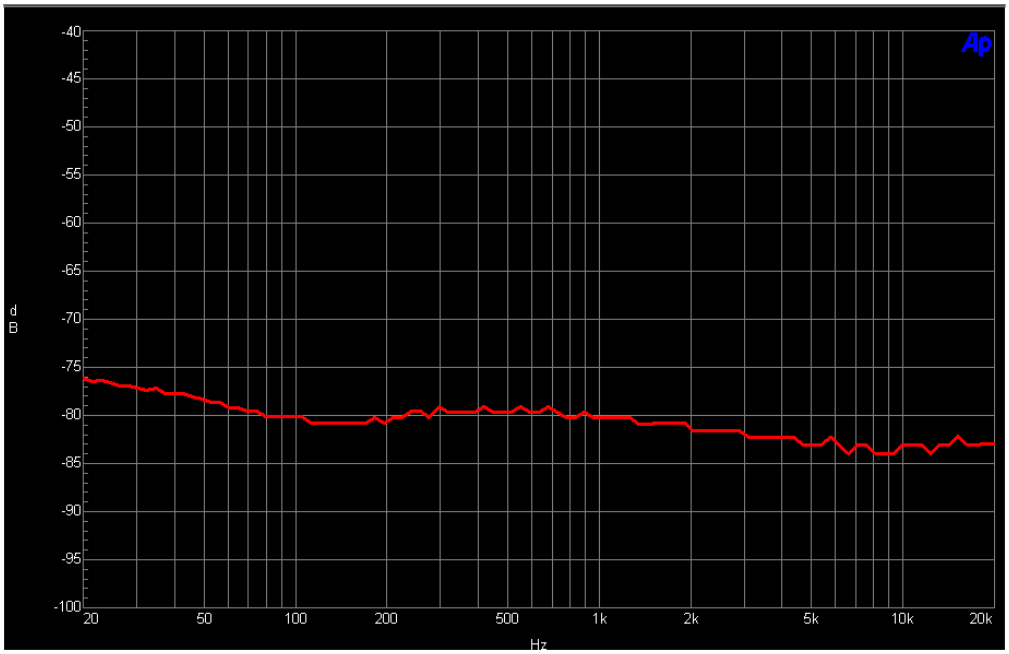
Line in Input player: 1KHz Sin wave FFT 20Hz ~ 20 KHz



Line in Input player: 0KHz FFT 20Hz ~ 20 KHz

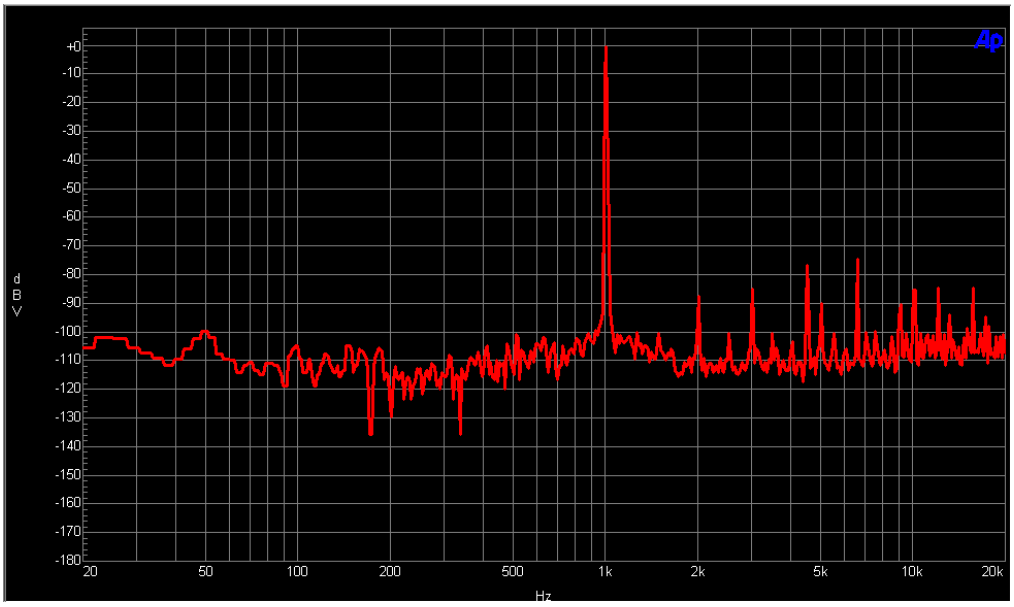


Line in Input Player: Frequency Response 20Hz ~ 20 KHz

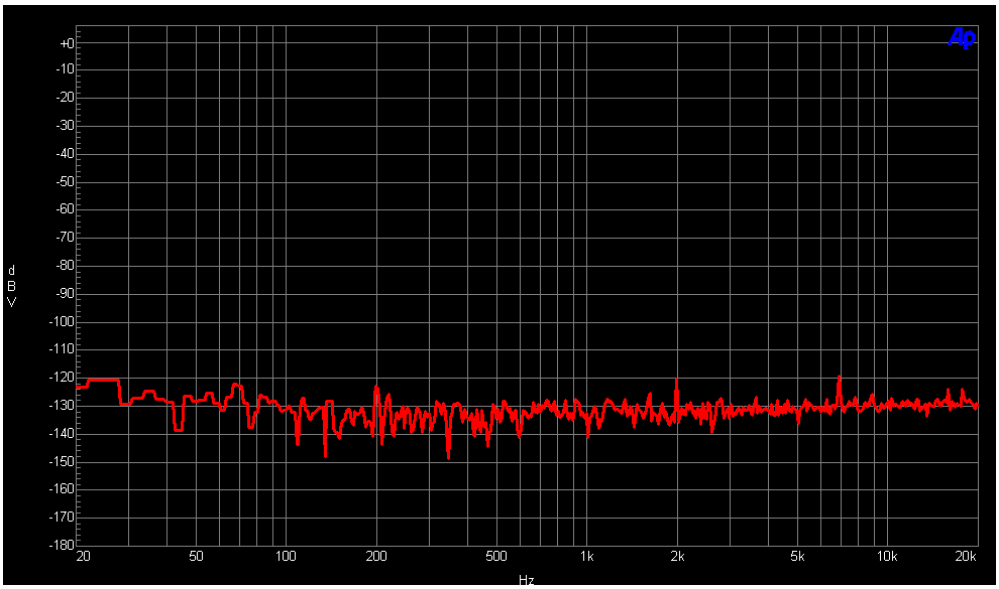


Line in Input player: THD+N Distortion 20Hz ~ 20 KHz

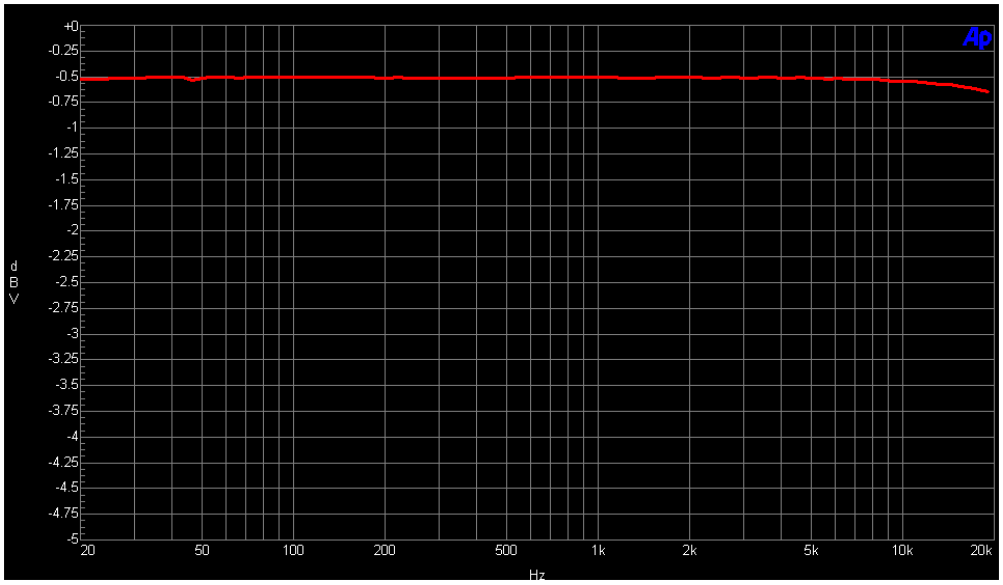
Bluetooth Player Music Mode:



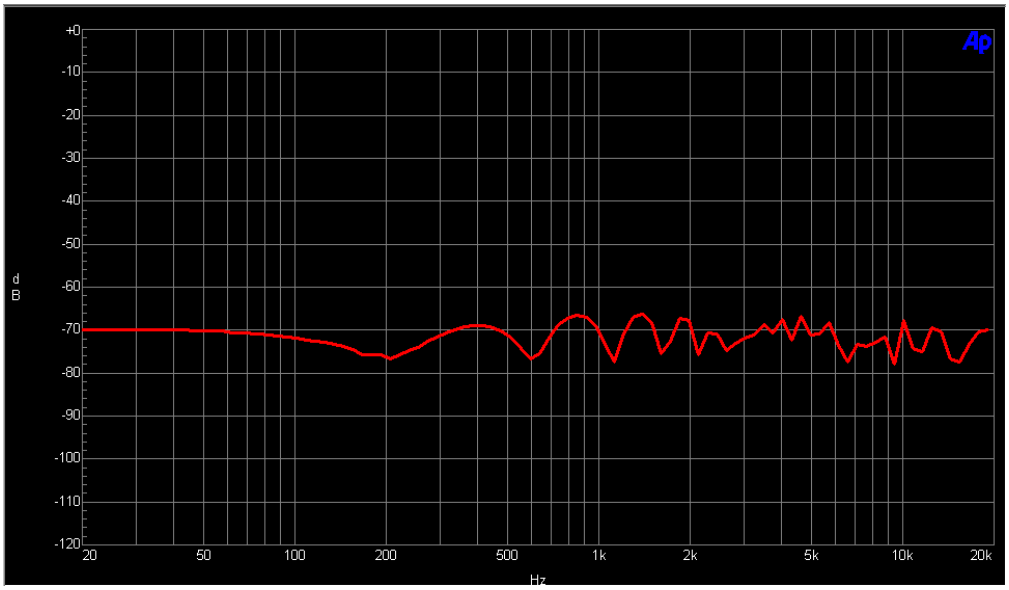
Bluetooth A2DP Player: 1KHz Sin wave FFT 20Hz ~ 20 KHz



Bluetooth A2DP Player: 0Hz FFT 20Hz ~ 20 KHz



Bluetooth A2DP Player: Frequency Response 20Hz ~ 20 KHz



Bluetooth A2DP Player: THD+N Distortion 20Hz ~ 20 KHz

RF Characteristics

Test conditions:

1. BAT=3.8V, VCC=3.1V, VDD=1.2V, Tamb=25℃.

2．BLE ON, SPP OFF, Scan time:1.28S, DAE OFF, No Load.

BT Protocols	A2DP/AVRCP/HFP /SPP	A2DP1.3
		AVRCP1.6
		HFP1.7
		SPP1.2
Power Consumption	A2DP	Typical : 21mA
	HFP	Typical : 26mA
	Sniff	Typical : 0.6mA
	Standby	Typical : 38uA
Distance	A2DP	Max:50M Typical : 20M
	HFP	Max : 20M Typical : 10M

Basic Data Rate of Transmitter
Core Supply Voltage = 1.05V @ Tamb=25℃

Parameter	Condition	Min.	Typ.	Max.	Unit
Maximum RF Transmit Power			2	4	dBm
RF Power Control Range		2	3	8	dB
20dB Bandwidth for Modulated Carrier			930	990	KHz
Adjacent Channel Transmit	+2 MHz	-47	-52		dBm
	-2 MHz	-51	-52		dBm
	+3 MHz	-40	-58		dBm
	-3 MHz	-56	-57		dBm
Frequency Deviation	Δf1avg Maximum	140	170	175	KHz
	Δf2max Maximum	100%	100%		
	Δf1avg/Δf2avg	0.89	0.9	0.91	
Initial Carrier Frequency Tolerance		3	5	6	KHz
Frequency Drift	HD1 Packet	-9	-8	8	KHz
	HD3 Packet	-8	-9	-10	KHz
	HD5 Packet	-10	-7	-6	KHz
Frequency Drift Rate		3	4	5	KHz/50us
Harmonic Content			-50		dBm

Enhanced Data Rate of Transmitter

Core Supply Voltage =1. 05V @ Tamb=25℃

Parameter	Condition	Min.	Typ.	Max.	Unit
Relative Transmit Power			-0.4		dB
π/4 DQPSK max carrier frequency stability $\|\omega_0\|$		-10		10	KHz
π/4 DQPSK max carrier frequency stability $\|\omega_i\|$		-75		75	KHz
π/4 DQPSK max carrier frequency stability $\|\omega_0+\omega_i\|$		-75		75	KHz
8DPSK max carrier frequency stability$\|\omega_0\|$		-10		10	KHz
8DPSK max carrier frequency stability$\|\omega_i\|$		-75		75	KHz
8DPSK max carrier frequency stability$\|\omega_0+\omega_i\|$		-75		75	KHz
π/4 DQPSK Modulation	RMS DEVIN		7	20	%

Accuracy	99% DEVM	99	100		%
	Peak DEVM		18	35	%
8DPSK Modulation Accuracy	RMS DEVIN		6	13	%
	99% DEVM	99	100		%
	Peak DEVM		18	25	%
In-band spurious emissions	F > F0 + 3MHz			-40	dBm
	F < F0 - 3MHz			-40	dBm
	F = F0 + 3MHz			-40	dBm
	F = F0 - 3MHz			-40	dBm
	F = F0 + 2MHz			-20	dBm
	F = F0 - 2MHz			-20	dBm
	F = F0 + 1MHz			-26	dB
	F = F0 - 1MHz			-26	dB
EDR Differential Phase Encoding		99	100		%

Basic Data Rate of Receiver

Core Supply Voltage =1. 05V@ Tamb=25℃

Parameter	Condition	Min.	Typ.	Max.	Unit
Sensitivity at 0.1% BER	2.404GHz		-90		dBm
	2.441GHz		-90		dBm
	2.480GHz		-90		dBm
Maximum Input Power at 0.1% BER		-20			dBm
Co-Channel Interface				11	dB
Adjacent Channel Selectivity C/I	$F = F_0 + 1MHz$			0	dB
	$F = F_0 - 1MHz$			0	dB
	$F = F_0 + 2MHz$			-20	dB
	$F = F_0 - 2MHz$			-20	dB
	$F = F_0 + 3MHz$			-40	dB
	$F = F_{image}$			-9	dB
Maximum Level of Intermediation Interface		-39			dBm
Blocking @ Pin = -67dBm with 0.1% BER	30-2000 MHz	-10	-8		dBm
	2000-2400 MHz	-27	-25		dBm
	2500-3000 MHz	-27	-25		dBm
	3000-12750 MHz	-10	-8		dBm

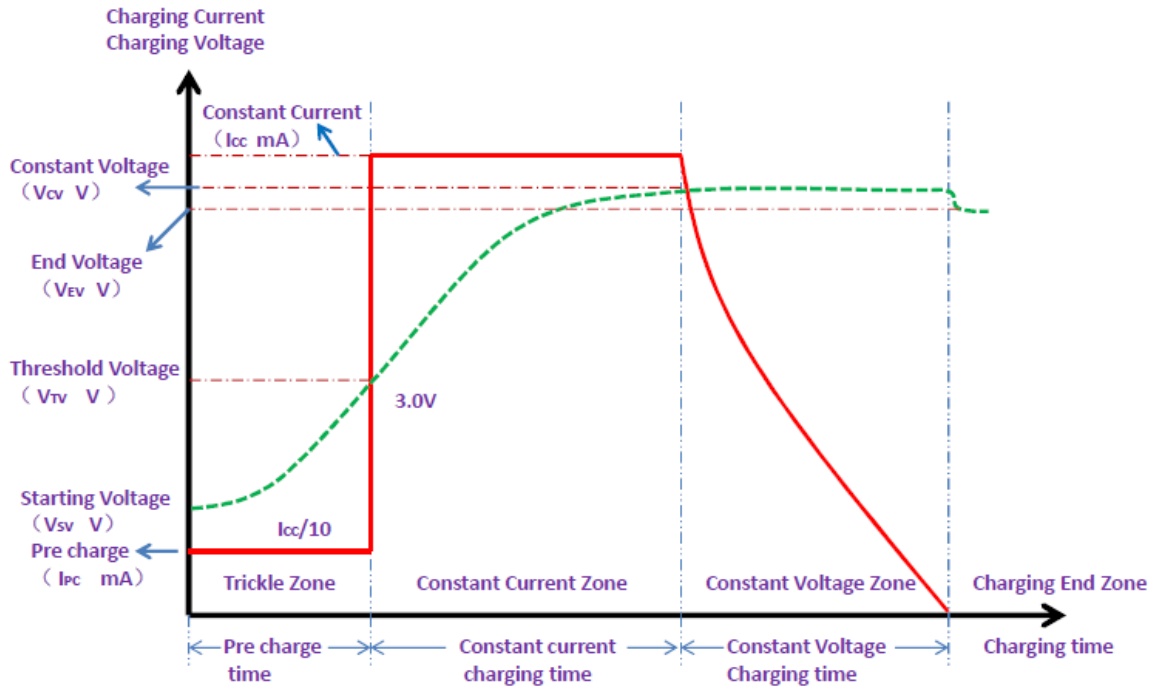
Enhanced Data Rate of Receiver						
Core Supply Voltage = 1. 05V @ Tamb=25℃						
Parameter	**Condition**		**Min.**	**Typ.**	**Max.**	**Unit**
Sensitivity at 0.01% BER	π/4 DQPSK			-88		dBm
	8DPSK			-82		dBm
Maximum Input Power at 0.1% BER	π/4 DQPSK		-20			dBm
	8DPSK		-20			dBm
Co-Channel Interference	π/4 DQPSK			13		dB
	8DPSK			21		dB
Adjacent Channel Selectivity C/I	$F = F_0 + 1MHz$	π/4 DQPSK		0		dB
		8DPSK		5		dB
	$F = F_0 - 1MHz$	π/4 DQPSK		0		dB
		8DPSK		5		dB
	$F = F_0 + 2MHz$	π/4 DQPSK		-30		dB
		8DPSK		-25		dB
	$F = F_0 - 2MHz$	π/4 DQPSK		-20		dB
		8DPSK		-13		dB
	$F = F_0 + 3MHz$	π/4 DQPSK		-40		dB
		8DPSK		-33		dB
	$F = F_{image}$	π/4 DQPSK		-7		dB
		8DPSK		0		dB

PMU Characteristics

PMU	Charging current	Max : 600mA Typical : 500mA
	Charger input voltage	Max : 7.0V Typical : 5V Min : 4.5V
Power Consumption	Test conditions: 2. BAT=3.8V, VCC=3.1V, VDD=1.2V, Tamb=25℃. 3. BLE ON, SPP OFF, Scan time:1.28S, DAE OFF, No Load.	
	Standby	38 uA (type)
	Card music play	13 mA (type)
	Line in music play	10.4 mA (type)

	Bluetooth music play	20.6mA (type)
	Bluetooth hands free	26.4 mA (type)

Charge Flow Chart and Settings：

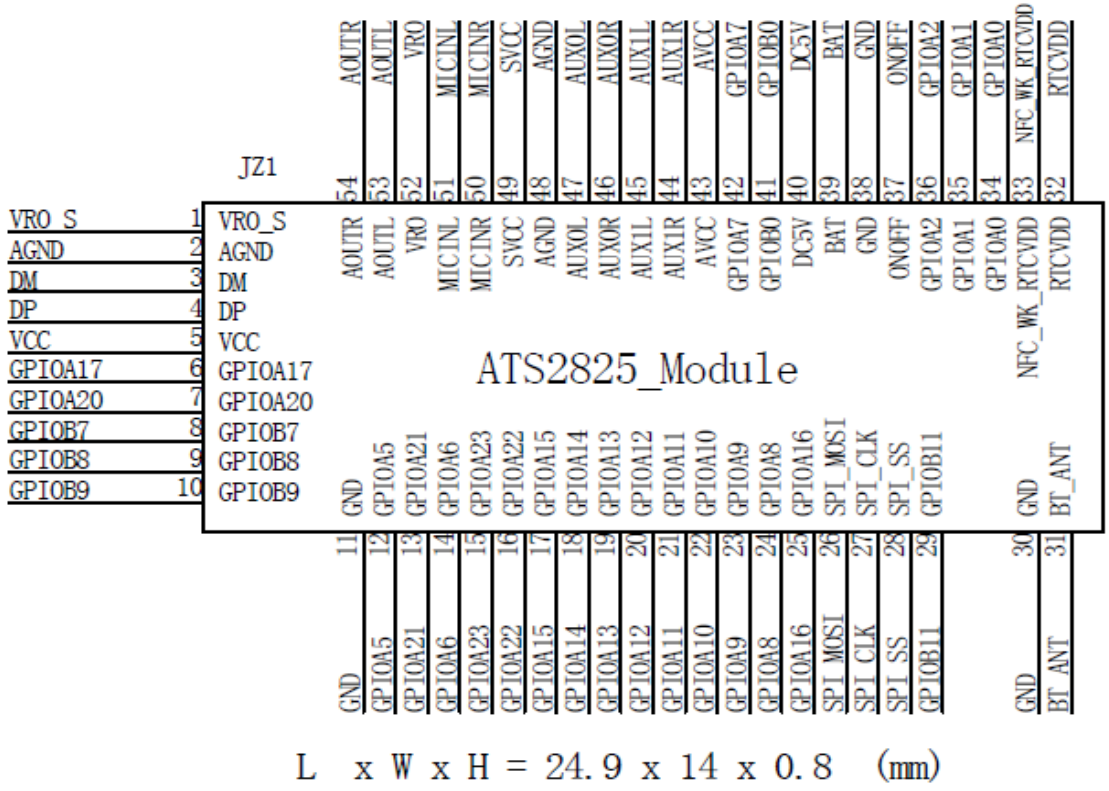


Charge Flow Chart

Note：

1. Charging process is divided into 3 stages: the pre charge process, the constant current process and the constant voltage process.
2. The pre charge current (**IPC**) is 0.1 times the constant current charge current (**ICC**). Or **IPC = 0.1 × ICC** (mA); Disable this function by set [CHG_CTL.bit14] =0, default is disable.
3. When the starting charge voltage to **3.0V** (**VTV**), the pre charging process is over, and the charging process is entered into the constant current charging process.
4. Set the constant current charging current **ICC**, constant current charge continues to the battery voltage to **VCV**, switch to the constant voltage charging process. **ICC** current can be set with 8 levels of parameters: 000:25mA, 001:50mA, 010:100mA, 011:200mA, 100:300mA, 101:400mA, **110:500mA**, 111:600mA.
5. **VCV** voltage can be set with 8 levels of parameters: 000:4.2V, 001:4.23V, 010:4.26V, 011:4.29V, 100:4.32V, 101:4.35V, 110:4.38V, 111:4.41V.
6. After the end of the charge, the Li-BAT voltage is generally **VEV**= 4.18V±0.05V.

Module Pin definitions



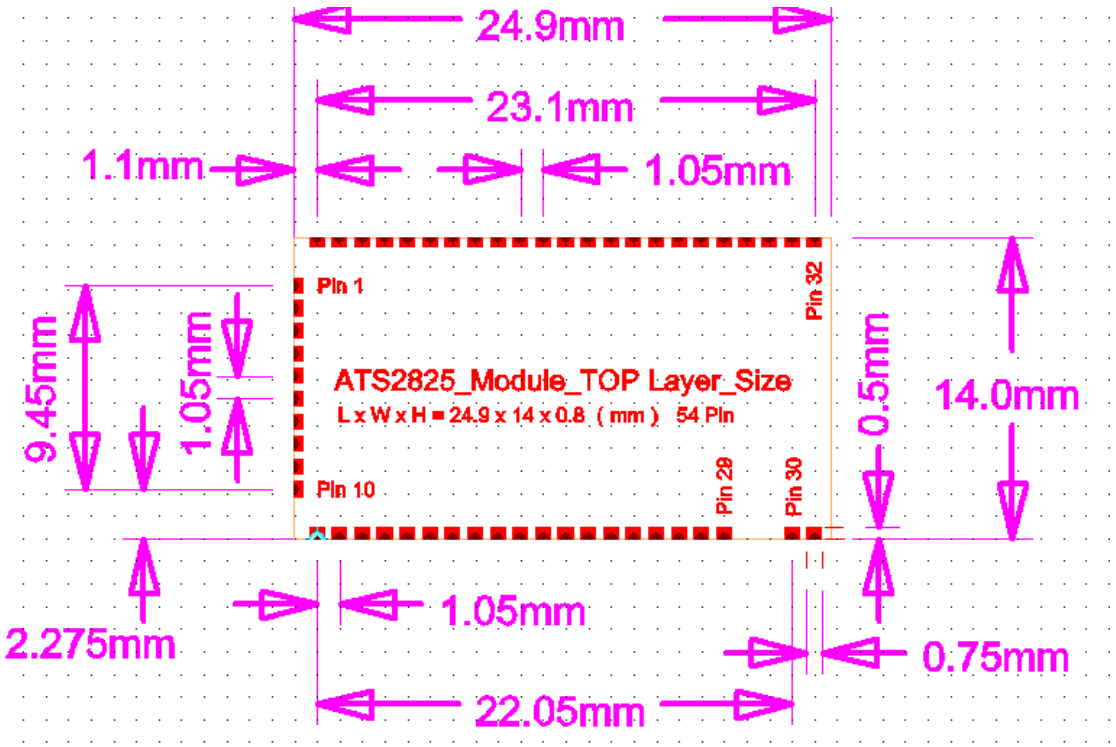
Pin Configurations

PIN NO.	NAME	TYPE	FUNCTION
1	VRO_S	Analog input	VRO Sense for PA
2	AGND	Power ground	Analog ground
3	DM	Bi-directional	USB D-
4	DP	Bi-directional	USB D+
5	VCC	Power output	3.3V power supply
6	GPIOA17	Bi-directional	General Purpose Input Output: A17

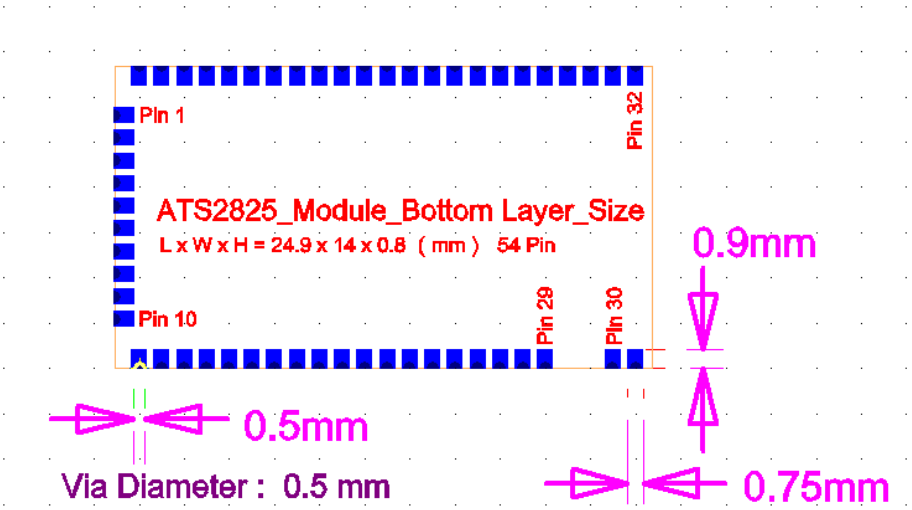
7	GPIOA20	Bi-directional	General Purpose Input Output: A20
8	GPIOB7	Bi-directional	General Purpose Input Output: B7
9	GPIOB8	Bi-directional	General Purpose Input Output: B8
10	GPIOB9	Bi-directional	General Purpose Input Output: B9
11	GND	Power ground	Ground
12	GPIOA5	Bi-directional	General Purpose Input Output: A5
13	GPIOA21	Bi-directional	General Purpose Input Output: A21
14	GPIOA6	Bi-directional	General Purpose Input Output: A6
15	GPIOA23	Bi-directional	General Purpose Input Output: A23
16	GPIOA22	Bi-directional	General Purpose Input Output: A22
17	GPIOA15	Bi-directional	General Purpose Input Output: A15
18	GPIOA14	Bi-directional	General Purpose Input Output: A14
19	GPIOA13	Bi-directional	General Purpose Input Output: A13
20	GPIOA12	Bi-directional	General Purpose Input Output: A12
21	GPIOA11	Bi-directional	General Purpose Input Output: A11
22	GPIOA10	Bi-directional	General Purpose Input Output: A10
23	GPIOA9	Bi-directional	General Purpose Input Output: A9
24	GPIOA8	Bi-directional	General Purpose Input Output: A8
25	GPIOA16	Bi-directional	General Purpose Input Output: A16
26	SPI_MOSI	Bi-directional	SPI data
27	SPI_CLK	Bi-directional	SPI clock
28	SPI_SS	Bi-directional	SPI chip enable
29	GPIOB11	Bi-directional	General Purpose Input Output: B11
30	GND	Power ground	Ground
31	BT_ANT	Bi-directional	Bluetooth antenna junction
32	RTCVDD	Power output	power for RTC Module, typical voltage:1.2V
33	NFC_WK_RTCVDD	Input	NFC wake signal input
34	GPIOA0	Bi-directional	General Purpose Input Output: A0
35	GPIOA1	Bi-directional	General Purpose Input Output: A1
36	GPIOA2	Bi-directional	General Purpose Input Output: A2
37	ONOFF	Input	Power on/off
38	GND	Power ground	Ground
39	BAT	Power input	Battery input, typical voltage range :3.4V ~ 4.2V
40	DC5V	Power input	USB power input, typical voltage range :4.5V ~ 7.0V
41	GPIOB0	Bi-directional	General Purpose Input Output: B0

42	GPIOA7	Bi-directional	General Purpose Input Output: A7
43	AVCC	Power output	Power for Analog module, typical voltage:2.95V
44	AUX1R	Analog input	AUX1 right channel input
45	AUX1L	Analog input	AUX1 left channel input
46	AUX0R	Analog input	AUX0 right channel input
47	AUX0L	Analog input	AUX0 left channel input
48	AGND	Analog ground	Analog ground
49	SVCC	Power output	Power for Standby
50	MICINR	Analog input	MIC right channel input
51	MICINL	Analog input	MIC left channel input
52	VRO	Analog output	Virtual Ground for PA
53	AOUTL	Analog output	Left channel of PA
54	AOUTR	Analog output	Right channel of PA

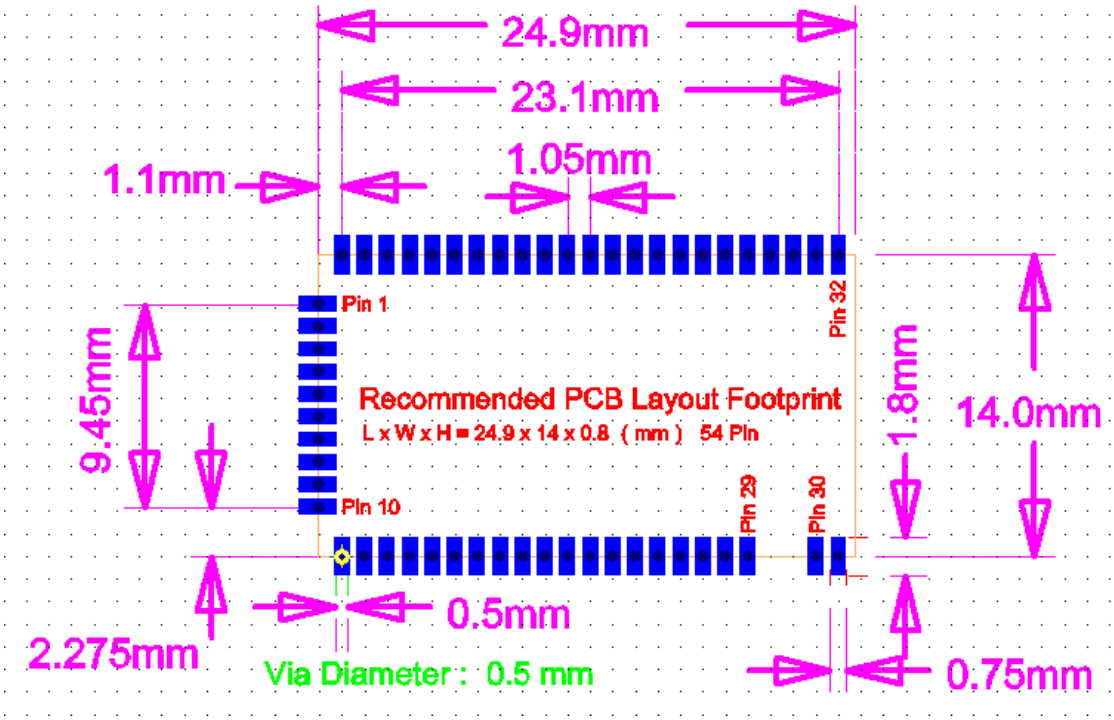
Module Package Information



Module Dimension (Top VIEW)



Module Dimension (Bottom VIEW)



Recommended PCB layout footprint

Document History

Revision	Date	History
V1.0	2015/06/09	First release
V1.1	2015/10/26	Update PMU and Audio 。

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