Maxim TWS Solution

MAXREFDES01263

Design Verification Testing

Introduction

MAXREFDES01263 is a Maxim's TWS reference design, including cradle and earbuds. It uses total Maxim solution. MAXREFDES01263 is a high accuracy, low power, small size, and is easy implanted design.

Test Equipment Used

- Equipment PC
- MAXREFDES01263 board
- Multi-meter
- Li-battery(125mHA,3.7V)
- I2S Audio Output

Tests Conducted

The tests listed below were completed on the MAXREFDES01263 board.

- Cradle and earbuds PLC communication correction
- Cradle and earbuds battery SOC and CAP
- Cradle power rails(5V/3.3V/1.8V/1.2V/Vplc)
- Earbuds power rails (Vplc/3.7V/3.3V/1.8V/Vldo)
- Audio Codec Max98090 working with I2S audio input

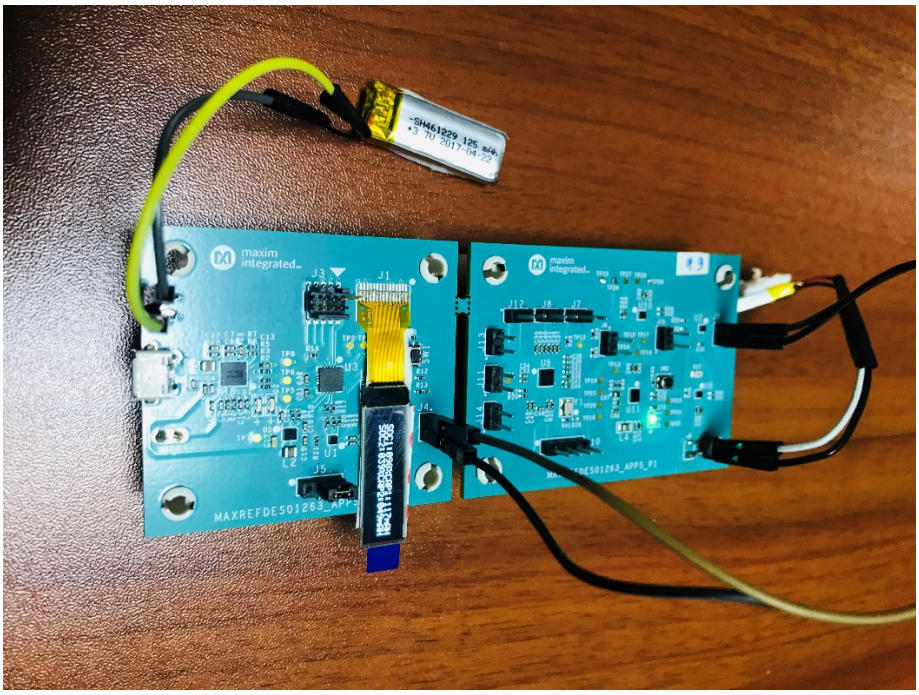

Figure 1. Test MAXREFDES01263

Test Results

1. PLC communication

Master/cradle send 3 bytes data to slave/earbuds, and the slave send back 3 bytes data as response, with each data plus 1. This verify the PLC communication is successful between master and slave.

	Master transmit data	Master received data
Test1	0x01,0x02,0x03	0x02,0x03,0x04
Test2	0x11,0x22,0x55	0x12,0x23,0x56
Test3	0x7B,0x6C,0x5D	0x7C,0x6D,0x5E

2. Cradle and Earbuds SOC&CAP

Connect cradle board and earbuds board with 2 wires (PLC and GND), both boards assembled battery (125mAH,3.7V single cell Li-battery). Measure the two battery's SOC and CAP when charging and discharging, show the measured values on OLED (just keep the integer part).

The earbuds SOC and CAP is transferred to cradle through the PLC. The communication protocol is a simple 3 bytes package shown as below.

Handshake	SOC byte	CAP byte

The handshake byte records the number of data transferred. Start with zero and will be cleared to zero when the count reaches 0x7FF.

The SOC output is 0% to 100% with step is 1%.

The CAP output is 0mAH to max 255mAH with step 1mAH, which can meet most application.

Note: For accuracy measurement, it requires to build the battery characterization model for the battery used in this design and config the fuel gauge accordingly in the firmware.

The test result for cradle charging and discharging is shown as Table1

Table 1. Cradle SOC/CAP

	Cradle SOC/CAP	requirement
Continue charging	20%, 25mAH	1% step SOC
	21%, 26mAH	
	22%, 28mAH	
	23%, 29mAH	
	24%, 30mAH	
	25%, 31mAH	
	26%, 33mAH	
	27%, 34mAH	
	28%, 35mAH	
	29%, 36mAH	
discharging	66%,83mAH	1% step SOC
	65%,82mAH	
	64%,80mAH	
	63%,79mAH	
	62%,78mAH	
	61%,76mAH	
	60%,75mAH	
	59%,74mAH	
	58%,73mAH	
	57%,71mAH	

The test result for earbuds charging is shown as Table2

Table2. Earbuds SOC/CAP

	Earbuds SOC/CAP	requirement
Continue charging	5%, 6mAH	1% step SOC
	6%, 7mAH	
	7%, 9mAH	
	8%, 10mAH	
	9%, 11mAH	
	10%, 13mAH	

	11%, 14mAH	
	12%, 15mAH	
	13%, 16mAH	
	14%, 17mAH	
	16%, 20mAH	
	17%, 21mAH	
	18%, 22mAH	

3. Cradle power rails

Use multimeter to measure output voltage for all rails.

Power rail	Test results	requirement
5V	4.94	4.8~5.2V
3.3V	3.32	3~3.6V
1.8V	1.9	1.7~2.0V
1.2V	1.23	1.1~1.3V
Vplc	4.94	4.5~5.2V

4. Earbuds power rails

Use multimeter to measure output voltage for all rails.

Power rail	Test results	requirement
3.7V	3.71	3.6~3.9V
3.3V	3.30	3~3.6V
1.8V	1.82	1.7~2.0V
Vldo	1.79	1.79~1.81V
Vplc	4.94	4.5~5.2V

5. Max98090 test

This is a basic test to check if max98090 can work with I2S audio input. In the test, we use Max98090 evkit and its GUI to generate the I2S signal, then route this signal from JU15 on MAX98090 evkit board to MAXREFDES01263 earbuds boards on J10. Then connect one headphone to the earbuds board HP(J14) connector. After this, if we play one audio from PC, we can clearly hear this audio.

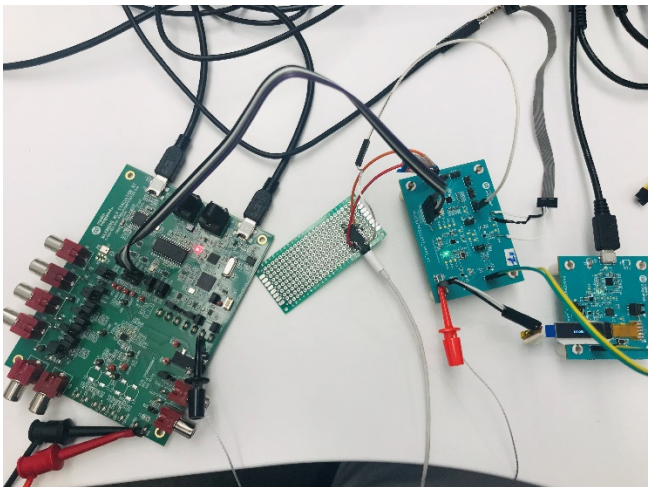

Figure 2. Earbuds board Max98090 codec working test picture.