Medical Device Measurement - Heart Rate Meter

Market trend:

With the advent of the Internet of Things (IoT) era, wearable devices have come to you and me with the 5G communications. The world's major consumer electronics manufacturers, such as Apple, Samsung, Huawei, etc. have stepped into related fields. Low-power, high-performance electrical products are also constantly introduced, such as glasses, watches, electrical clothes ... and so on. In addition, health care is also using high-tech intelligent health monitoring, the most common methods are heart rate, blood pressure and pace monitoring.

Measuring challenge

For the manufacturers of wearable devices, the challenge is not only making advanced and practical devices to get the love of customers, but also how to minimize the size of wearable devices and keep them long time working. The key to have a long battery life is not only to enlarge the battery's capacity, but more importantly is the wearable device can save power, which is the most critical problem that need to be settled in the product testing measurement -- the power measurement.

➢ Power off, with very low leakage current, usually a few micro-amps (μA), or even a few hundred nano-amps (nA)
➢ Standby, with standby current, usually tens of microamperes (μA)
➢ Working, with working current, hundreds of milliamperes (mA), depending on the mode of operation and change.

The features of IT6400 series for testing wearable device

IT6400 high speed linear DC source provides bipolar output, the maximum output voltage of single channel can reach up to ± 60 V, and current up to ± 10 A. With multi-function and high-performance, IT6400 meets various test requirements. IT6412 is a dual-channel bipolar DC source. one set of IT6412 can finish the test of both mobile electronics and batteries.

➤ Ultrafast transient response time < 20 μs
➤ Ultrafast voltage rising time up to 150 μs (full load)
➤ Read-back current resolution up to 1 nA
➤ Ultra-small current ripple up to 2 μArms
➤ Oscilloscope waveform display (DSO)
➤ Built-in DVM of high accuracy

Application: Heart rate tester

For wearable devices, in addition to product performance, the most important thing is the power consumption. The DUT is a heart rate tester module, which has a Bluetooth to monitor records timely. Using accurate voltage source IT6412 power supply and a high precision meter connected in series as a current measurement comparison.
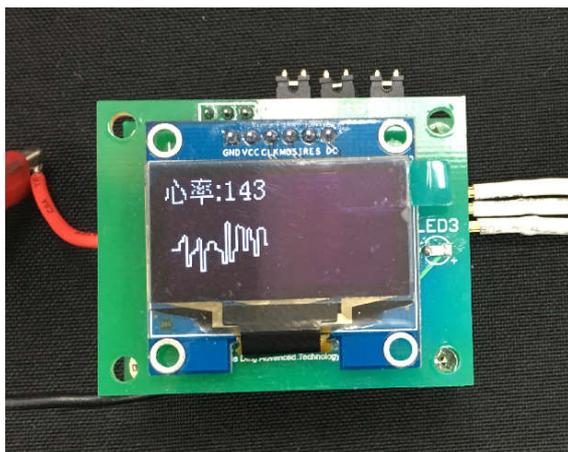
DUT: a heart rate tester module
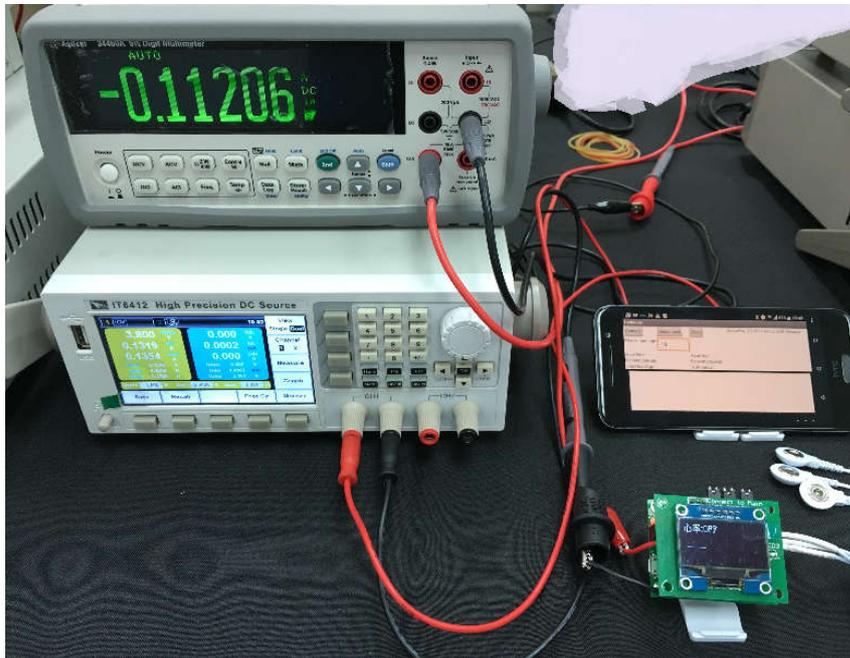
The wiring diagram.

Powered by IT6412, which is connected with an ammeter in series. Transmitting data to the phone in time via the Bluetooth for monitoring.

Testing Measurement - Shutdown Leakage current and standby power consumption.

Using IT6412 to simulate a 4.8V battery of this module, to test its current when the module is shut down and the leakage current turns out to be 247uA. As the heart rate meter is in module, so when it's powered on, it's in the working mode. Thus there's no standby power consumption. For wearable module, it will be in standby mode (when no function is working) after power on, and then the tested current is standby current.

Measurement——working current and consumption

Turn on the heart rate meter to enter the working mode. The average working current is approx. 134mA read by IT6412 using a high resolution current meter. Then switch from meter mode to waveform display mode. Now it is clearer to observe the real current curves fluctuating between 100mA and

150mA with period 300ms. With time scale adjusted under waveform display mode, the current details or the overall waveform can be easily observed.
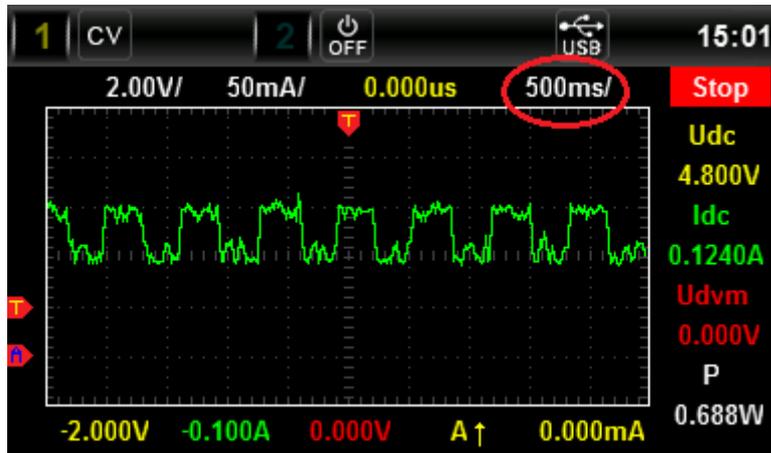

The overall waveform under 500ms/div setting
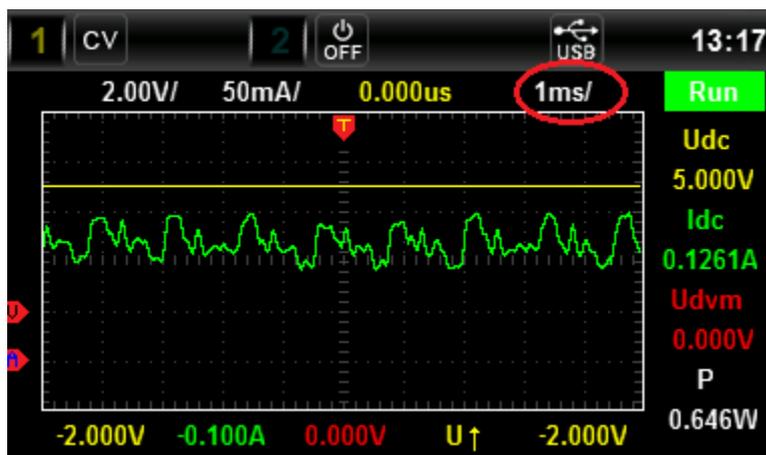
the details of the waveform under 1ms/dvi setting

IT6400's screenshot function works under both meter display mode and waveform display mode. Once the USB disk is plugged in, the front panel display can be quickly captured for further analysis. Because the Bluetooth will automatically turn on when the heart rate meter module is turned on, the amount of current consumed by the Bluetooth cannot be measured separately. The different power consumption of each mode and function of a wearable device can be measured by the IT6400 which simulates a battery, in which way, IT6412 can greatly help the engineers R&D of the products.

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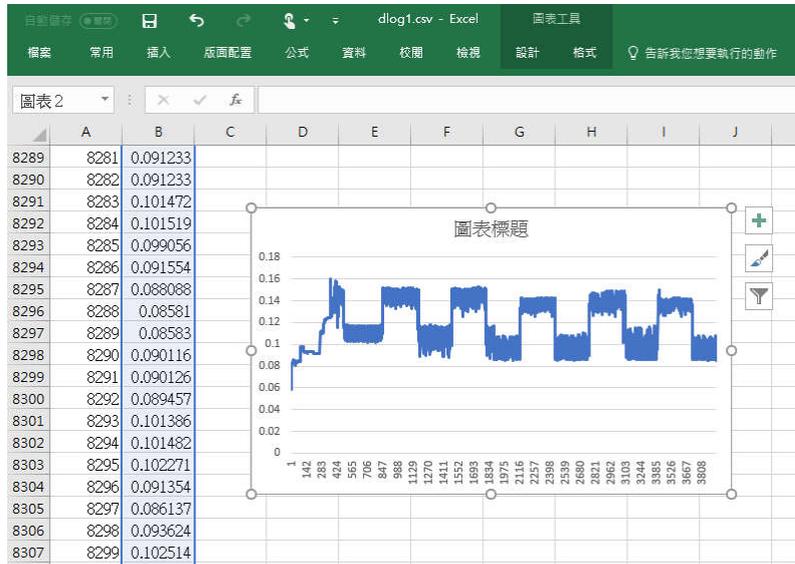
Data collected by a high precision ampere meter connected in series with IT6400

With High CP Power - Verification Comparison

In this test, in order to confirm the accuracy of the data measurement, we use the K brand manufacturers' equipment with high-accuracy and high-price for comparison and verification. There is little difference on the digital meter display, almost the same and the trend of the waveform is also true. This is enough to prove that IT6400 is not only a high-accuracy power supply, but also has high-resolution measurement capability. IT6412 is a power supply with a fairly high CP value.
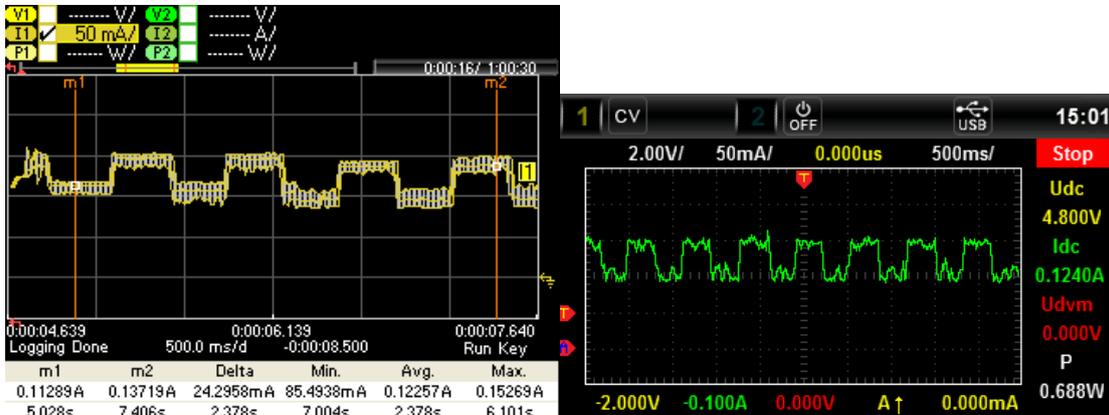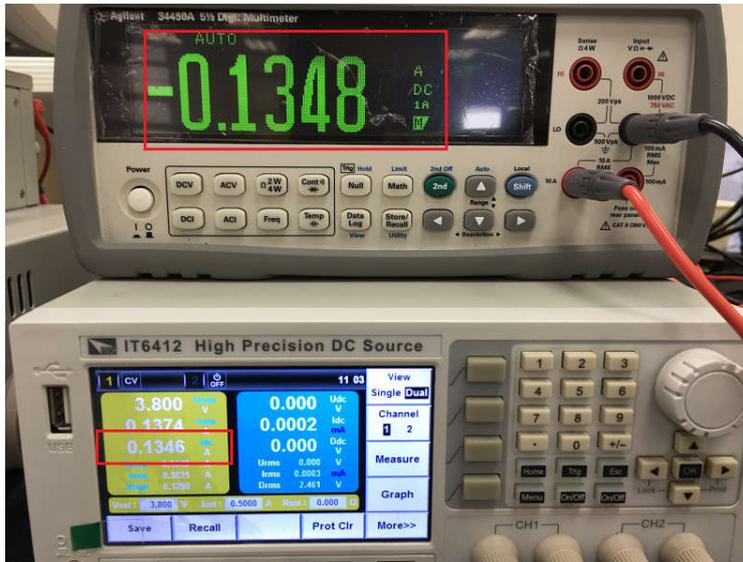
IT6400 Series High Speed Linear DC Power Supply:

◆ Maximum output power of single channel up to 150 W, output voltage max. ±60 V, output current max. ±10A
◆ Bipolar dual-range output
◆ Battery characteristics simulation
◆ Oscilloscope waveform display (DSO)
◆ Ultrafast transient response time < 20 us
◆ Ultrafast voltage rising time up to 150us
◆ Current readback resolution up to 1nA
◆ Ultra-small current ripple up to 2uArms
◆ Built-in high accuracy DVM
◆ Applicable to portable battery power supplies test

Model	Voltage	Current	Power	channel
IT6411	±15V/±9V	±3A/±5A	45W	1
IT6411S	-15V~0V, 0~15V	±0.1A	1.5 W	1
IT6412	CH1:±15V/±9V	CH1:±3A/±5A	CH1:45W	2
	CH2:0~15V/0~9V	CH2:±3A/±5A	CH2:45W	
IT6431	-15V~ 0V, 0~ 15V	±10 A	150W	1
IT6432	-30V~0V, 0~30V	±5A	150W	1
IT6433	-60V-0V,0-60V	±2.5 A	150W	1
IT6432H	-30V-0V,0-30V	±5A	150W	1
IT6433H	-60V-0V,0-60V	±2.5 A	150W	1