

The CX3300 Unveils Current Waveform Never Seen by Conventional Current Probes



Introduction

Computing technology and the Internet have dramatically change our lives and the boom of new technology, the Internet of Things (IoT), continues to expand the range of Internet connected devices including wearable devices, sensors, wireless networks, home appliances, electric vehicles and so on. These new devices and applications require long life operations with low signals and limited power supplies from batteries or other harvested energy supplies. With this ever-expanding range of devices comes an increasing demand in the need to analyze the current profile for research, development and the debugging of low power devices and circuits.

A current probe with an oscilloscope has been commonly used for measuring such dynamic current behavior. However, it is becoming difficult to measure the low current of μA or less flowing in the next generation low power devices.

The CX3300 Device Current Waveform Analyzer is a new solution for measuring a current waveform more precisely. Its low noise design and unique ultra-wideband low current sensing technology allow you to quickly and interactively visualize never before seen current waveform. The CX3300 supports the current sensors covering a wide range from 150 pA to 100 A with 1 GSa/s sampling rate, 200 MHz bandwidth, 14/16 bit dynamic range and 256 Mpts memory depth capabilities on a 2 channel or 4 channel mainframe.

The CX3300A enables a wide range of precision current waveform measurements that have been difficult to obtain using a conventional current probe. It enables you to accelerate the research, development, debugging and current profiling for a wide range of applications as follows.

- Battery powered mobile and wearable devices
- Low power wireless/communication/IoT chip
- MCU/ SoC/IP core
- ESD (Electro-Static-Discharge) test
- Non-volatile memory (NVM) characterization
- Time varied parameter characterization of materials and devices etc.



Figure 1: CX3300A Device Current Waveform Analyzer

Requirements for a Precision Current Waveform Measurement

Many recent electronic devices consist of a range of chips as shown in the example in Figure 2 below. Electronic devices are becoming more powerful, but their power is supplied from a limited power source such as a battery. Power saving and efficient power management are important and low power devices typically support intermittent operation between sleep and active mode. The current profile will depend on the operation mode and it is necessary to analyze a current profile that can be less than mA at sleep mode.

A current probe with an oscilloscope is commonly used for a dynamic current measurement, however, with the increase in the number of low power devices, there is a demand for an analyzer that can undertake the following:

- High sensitivity to measure the current even at sleep mode
- Dynamic range to measure the sleep and active mode transition
- Wide frequency range starting from DC
- Accurate and reliable measurement without the core saturation effect of a current probe.
- Visualization of current waveform, not an averaged current

The CX3300A is designed for precision current waveform measurement for these highly demanded needs. The CX3300A enables you to analyze the real current waveform and improve the power management. Current waveform visualization unveils the phenomena that is not possible to obtain with only a voltage measurement, and accelerates the development, evaluation and debugging of new generation devices.

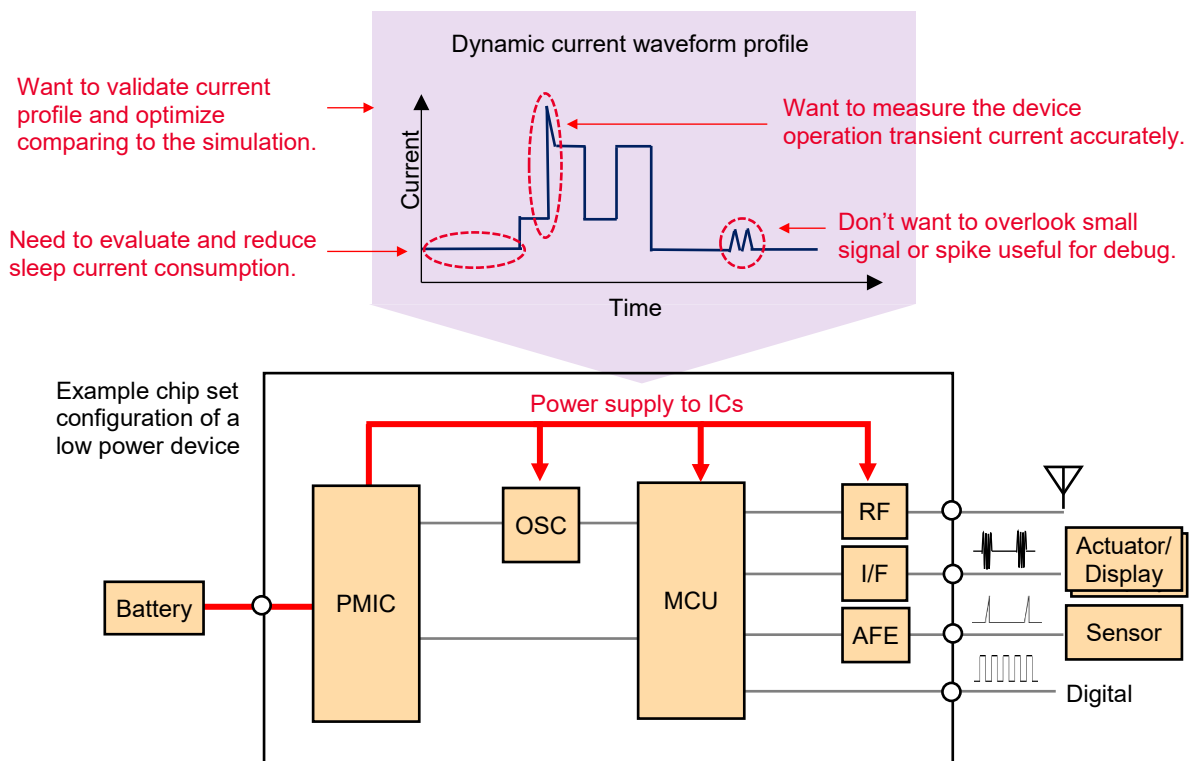


Figure 2: Example of a low power device and measurement requirements

The CX3300 Unveils Never Before Seen Current Waveform

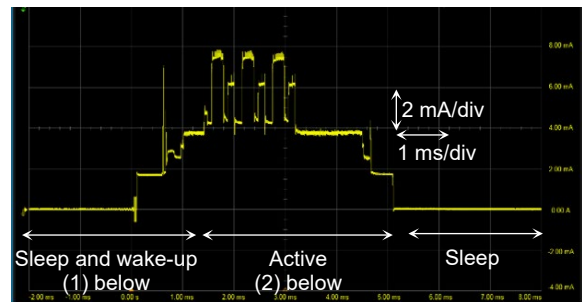
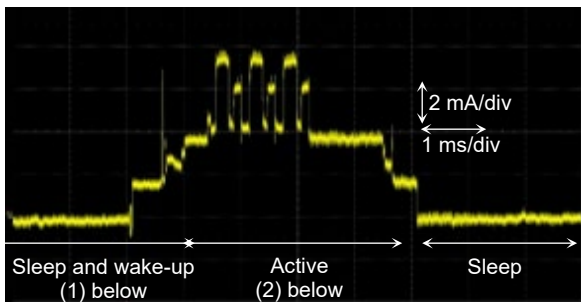
The followings are some examples measured by the CX3300A. In comparison with a current probe, the CX3300A can more clearly and precisely visualize current waveform measurements.

Example-1: Low power device measurement

This is an example of a BLE (Bluetooth Low Energy) device advertising event measurement. Although a conventional current probe allows you to observe the current waveform shape, the CX3300 unveils more precise never before seen current waveform in the circuit. For the CX3300, the CX1101A sensor is selected, because it has similar bandwidth to the current probe.

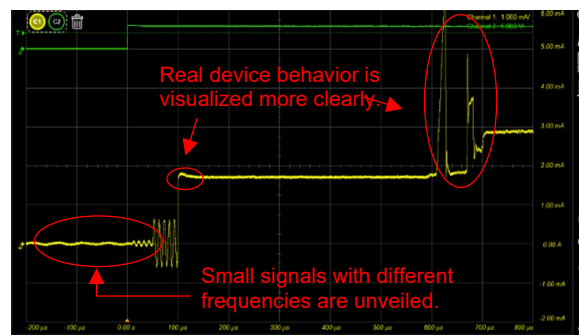
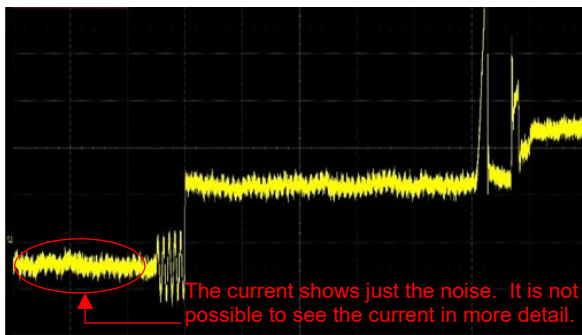
Current probe (DC - 100 MHz, 1 mA lowest measurable current)
with Oscilloscope (12 bit, 350 MHz BW, 2.5 GSa/s)
at 100 MSa/s

CX1101A (20 mA range)
with CX3324A
at 100 MSa/s



(1) Zoom into sleep and wake-up mode

(1) Zoom into sleep and wake-up mode



(1) Zoom into active mode

(2) Zoom into active mode

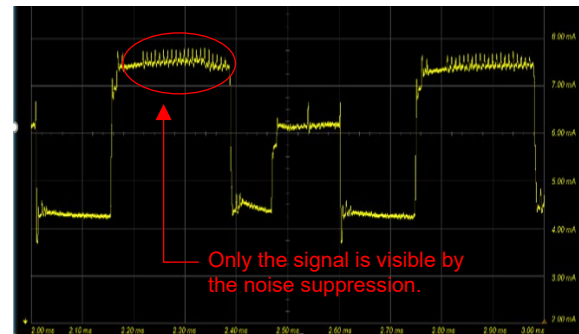
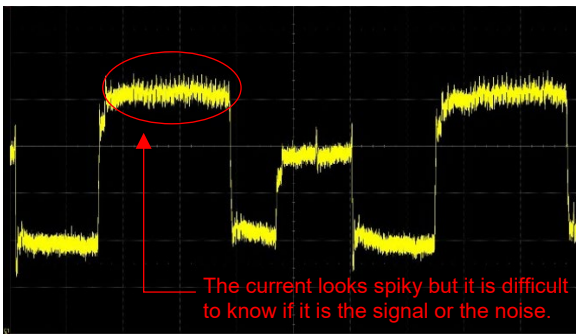


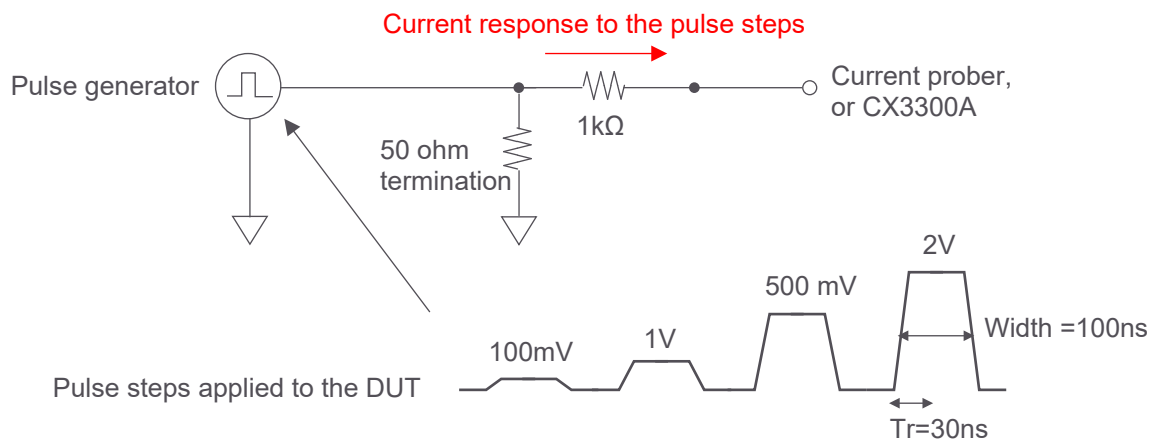
Figure 3: Example of a low power device measurement

Example-2: Pulsed I/V measurement

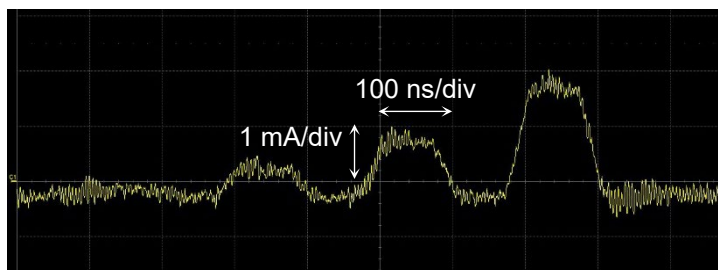
The CX3300A's current measurement capability is not limited to circuit board applications, but also available for any current waveform measurement applications.

An example application is a pulsed I/V measurement. It is important to prevent self-heating, study non-volatile memory behavior, or characterize time varied device parameters for material and device characterization. The semiconductor technology evolution demands higher speeds and higher levels of sensitivity.

In this pulsed I/V measurement example, the pulse steps are applied to 1 k Ω , and the current waveform is measured as follows.



Current probe (DC – 100 MHz, 1 mA lowest measurable current) with Oscilloscope (12 bit, 350 MHz BW, 2.5 GSa/s) at 2.5 GSa/s



CX1103A (2 mA range) with CX3324A at 1 GSa/s

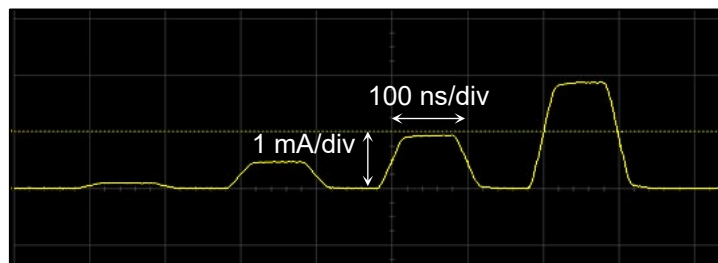


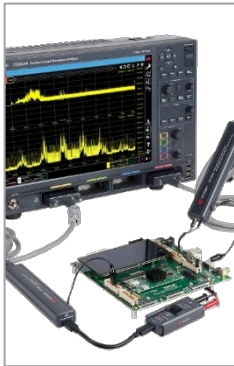
Figure 4: Pulsed I/V measurement setup and measurement result comparison

A Breakthrough Solution for Precision Current Waveform Measurement

As shown in the measurement examples, the CX3300A's low noise design and ultra-wideband low current sensing technology enables you to precisely and accurately visualize never before seen current waveform. The CX3300A's measurement capabilities can complement and enhance existing measurement solutions and benefit a broad range of applications.

Benefits:

- The ability to precisely visualize never before seen current waveform
- Accurate and reliable measurement without the core saturation effect of a current probe
- No maximum current and frequency derating limitation
- No time loss for degauss operation
- Enabling explorative measurements and debugging in a similar way as using an oscilloscope



Key features

- 14/16-bit high resolution
- 5 current sensors covering from 150 pA to 100 A
- Maximum 200 MHz bandwidth and 1 GSa/s
- Maximum 256 Mpts/ch memory depth
- Quick and intuitive dynamic measurement
- Current profiler and analysis capabilities
- Precision voltage and current measurement
- 8-bit digital channels (available for the 4-ch model)

Sensor	Feature
CX1101A Single channel current sensor	<ul style="list-style-type: none"> • 40 nA to 10 A • 100 MHz
CX1102A Dual channel current sensor	<ul style="list-style-type: none"> • 40 nA to 1 A • 100 MHz
CX1103A Low side current sensor	<ul style="list-style-type: none"> • 150 pA to 20 mA • 200 MHz
CX1104A Selectable shunt current sensor	<ul style="list-style-type: none"> • 22 μA to 15 A • 20 MHz
CX1105A Ultra-low noise differential sensor	<ul style="list-style-type: none"> • 20 μV to 2.5 V (1 μA to 100 A depending on your shunt resistor) • 100 MHz

Figure 5: CX3300 Product Overview

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