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What's the SPO technology?

SDS2000 Series digital storage oscilloscope, with bandwidth up to 300 MHz, maximum sampling rate 2GSa/s, a deep memory of 28Mpts, high capture rate of 110,000wfs/s, multi-level intensity grading and color temperature display, various trigger types, commonly used serial protocol triggering and decoding, integrated arbitrary waveform generator and other characteristics, is an advanced technology, high performance and general purpose digital storage oscilloscope.

SDS2000 Series oscilloscope uses Siglent-innovated waveform acquisition and graphics processing engine which supports up to 110,000 wfs/s capture rate, 256 levels intensity grading and color temperature display, with deep memory storage and the use of new digital trigger technology supports rich trigger types and precise trigger. All of these technologies are collectively known as SPO (Super Phosphor Oscilloscope) technology.

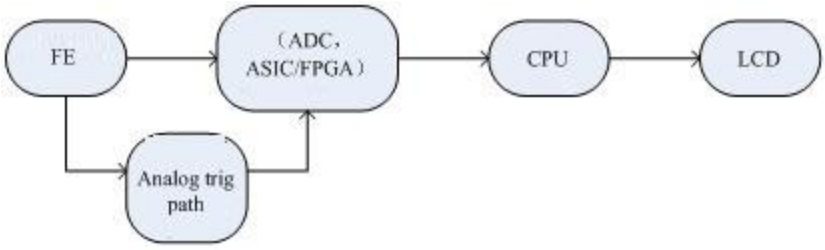

Figure 1 The architecture of traditional digital storage oscilloscope

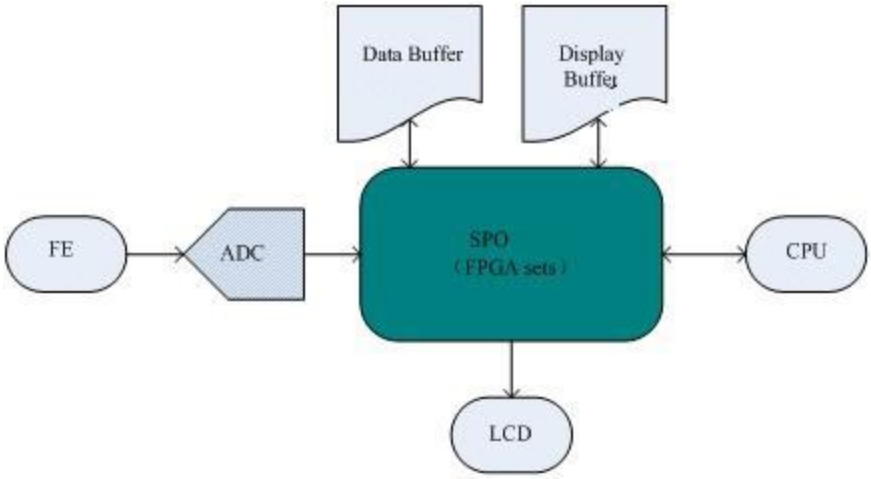

Figure 2 The architecture SPO oscilloscope

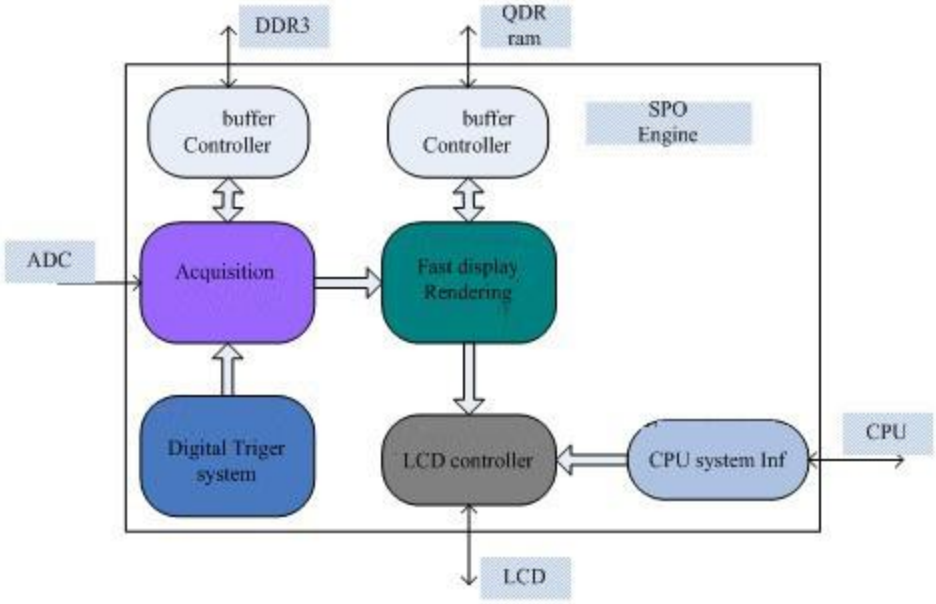

Figure 3 SPO waveform acquisition and graphics processing engine

Features of SPO technologies

1. Up to 110,000wfm/s waveform capture rate

in the traditional digital storage oscilloscope, waveform data processing and display are completed within the CPU. CPU is the bottleneck of the entire data acquisition, processing and display. To start the acquisition of next frame, there will be a large section of time between every two frames to wait for the CPU need complete the processing of the previous frame. Referring to Figure 4, the time between two

acquired frames is called oscilloscope acquisition dead time. The dead time of traditional digital storage oscilloscopes is very long. The occasional glitches are difficult to be captured by oscilloscopes as they are easily fallen into the dead time. With Siglent-innovated waveform acquisition, image processing engine, using FPGA group to complete the processing and display of waveforms, it greatly reduces the dead time between two frames in SPO oscilloscope. In SDS2000 platform, at 50ns time base, you can achieve up to 110,000 wfs/s waveform capture rate. Compared with the traditional oscilloscope in the same time base which can do about 200wfs/s, and the same level of mainstream products like 50,000 wfs/s waveform capture rate, the SPO technology of SDS2000 series oscilloscope can help you capturing the occasional glitches and abnormal signal quickly. It will greatly improve your work efficiency.

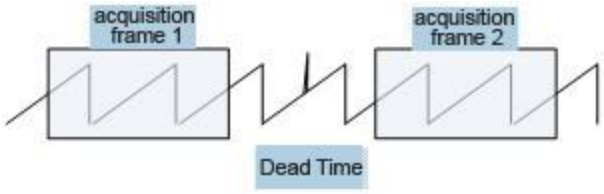

Figure 4 The oscilloscope acquisition dead time

With short dead time and high waveform capture rate, you can capture occasional glitches and abnormal signals quickly.

Figure 5 High waveform capture rate can find abnormal signal quickly

2. 256 levels intensity grading and color temperature display

With the high waveform capture rate, according to the occurrence probability of waveform points on the screen and using different intensity grading levels, SPO engine achieves an effect of chemical phosphor similar to analog oscilloscope waveform intensity gradually changing. It realizes the waveform display in three dimensions (time, amplitude and intensity).

Figure 6 The actually captured noise signal waveform, the obvious intensity of brightness and grading levels display

Or with different colors to indicate the occurrence probability of the signal, the color temperature display.

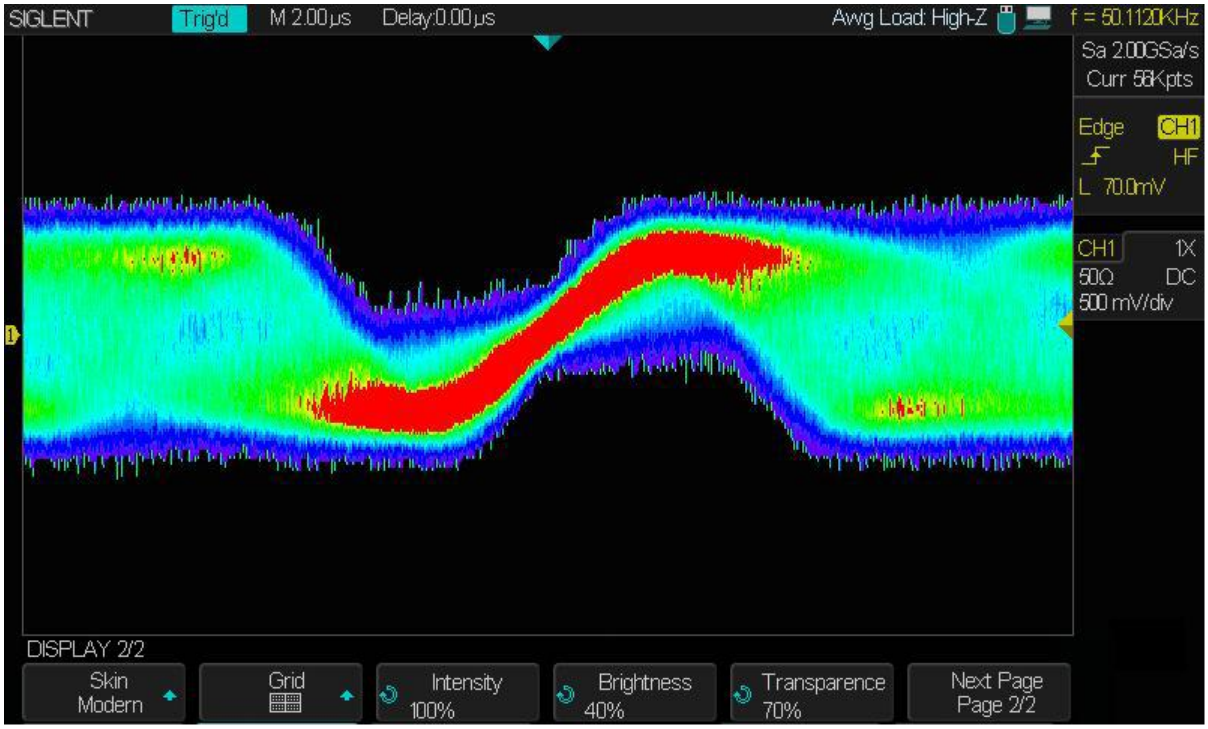

Figure 7 Color temperature display of the actually captured noise waveform

3. Deep memory depth storage

The SPO engine supports external DDR3 RAM to achieve deep memory depth storage. In SDS2000 platform, it can support single-channel 14Mpts memory depth, when operating in two-channel interleaved mode, support 28Mpts memory depth. Refer to the following figure; channel 1 is operating in interleaved mode in the main window. It can still support up to 2GSa/s sampling rate at 1ms time base because of its ability up to 28Mpts memory depth. In zoom window, you can observe stable waveform details.

Figure 8 Zoom function in deep memory depth

4. Digital trigger function

1) Precise trigger

Traditional digital storage oscilloscopes use analog trigger technology. Analog trigger system in figure 1 usually contains two parts of circuits, one analog comparator, and the second TDC circuit. Analog comparator compares the analog signal coming from the analog front-end with the trigger level to generate a trigger signal which is sent to the post-stage acquisition system. TDC circuit completes the time interval measurement from the trigger edge to the following sampling clock edge. It is used for the acquisition system to finely adjust the horizontal position of the trigger frame. Trigger sensitivity and trigger delay accuracy is poor due to the use of traditional analog trigger technology which is subjected to the frequency response differences between the acquisition channels and trigger channel. Trigger jitter is

large since the accuracy and temperature drift of TDC circuit. The waveform capture rate will be also reduced because of the slow response of TDC circuit.

The SPO engine implements digital trigger system by using of a digital comparator and digital TDC. It overcomes the above-mentioned shortcomings of the analog trigger circuit completely. It achieves a high trigger sensitivity and low trigger jitter. At the same time, you can improve waveform capture rate as the quick response of digital TDC.

The following two figures are both at 2ns time base. You can see that the trigger jitter is obviously much lower using digital trigger through the contrast of the measurement of the fast edge signal between analog and digital trigger.

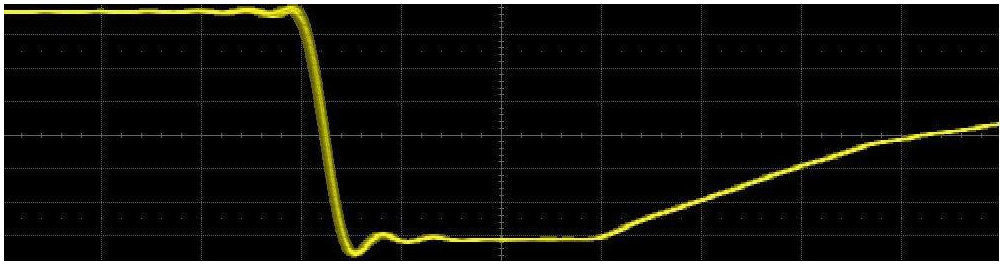

Figure 9 Analog trigger

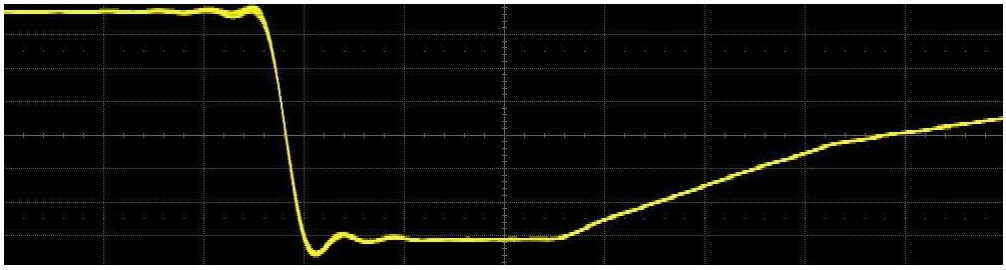

Figure 10 Digital trigger

2) Timing trigger accuracy to1ns

Digital comparator is used in digital trigger in SPO engine. The comparison accuracy can be reached as 1ns, especially for some trigger types which support

timing, such as pulse width trigger. This can not be achieved for oscilloscopes using analog trigger technology.

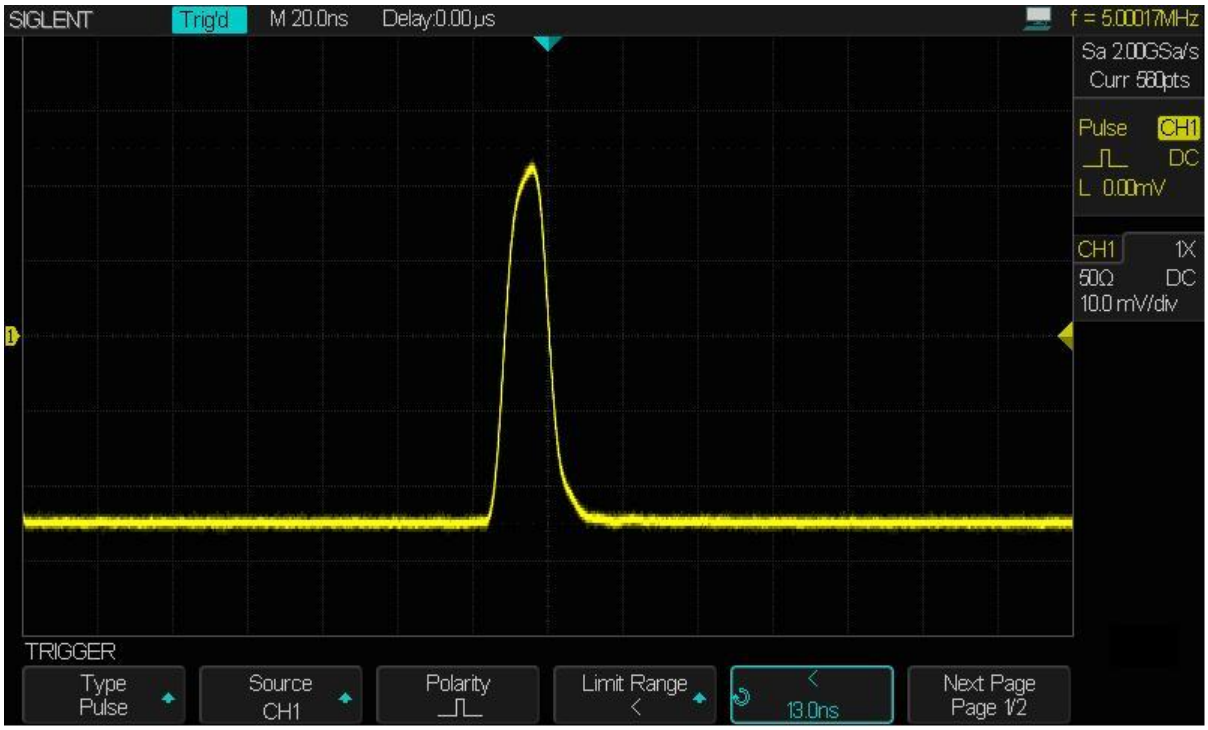

Figure 11 High precision trigger

3) Precisely set trigger delay, configurable trigger noise suppression

4) High stability trigger circuit, independent from temperature change

5. Various trigger types

SDS2000 trigger types based on SPO engine:

Edge, Pulse width, Window, Runt, Interval, Drop Out, Pattern, Video;

Figure 12 Runt trigger

Figure 13 Pattern trigger

6. Serial decode/trigger functions

Serial protocol：IIC，SPI，UART/RS232，CAN，LIN

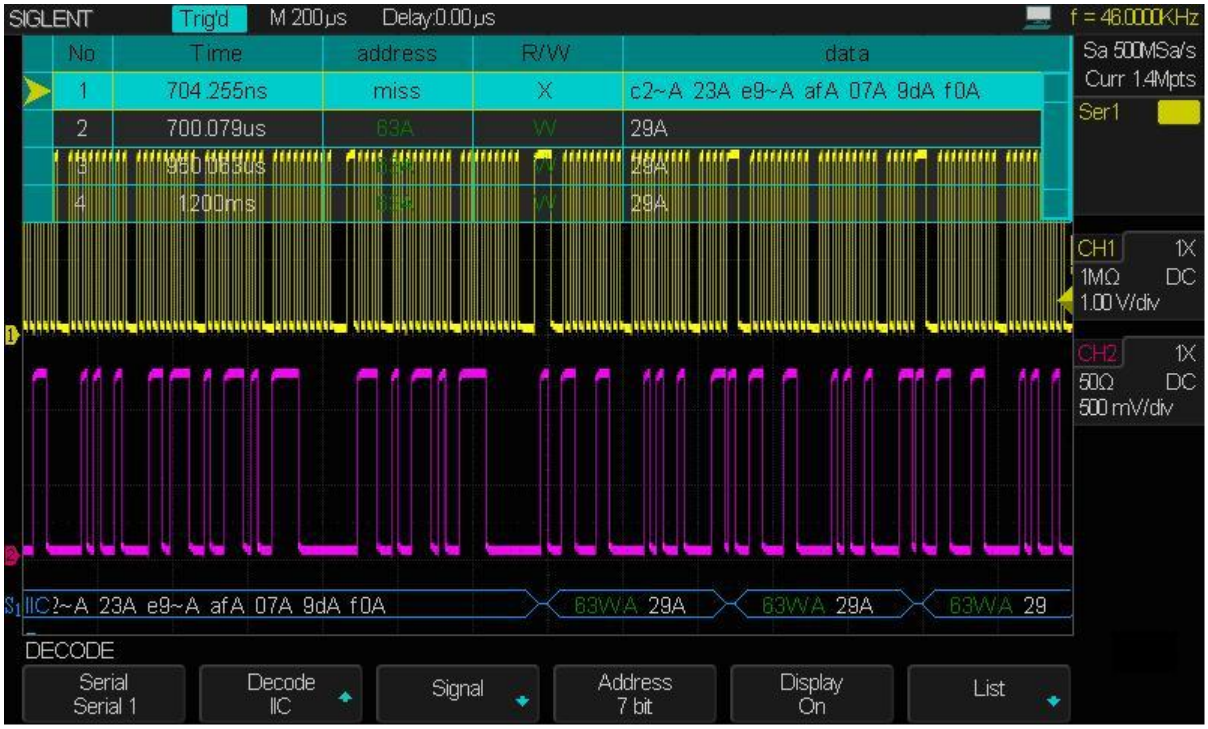

Figure 14 IIC trigger and decode

7. Hardware based Pass/Fail function

Based on hardware Pass/Fail function, you can achieve rapid detection and counting for Fail frame. You can also stop acquisition once Fail frame detected and issue Failed signal at the same time.

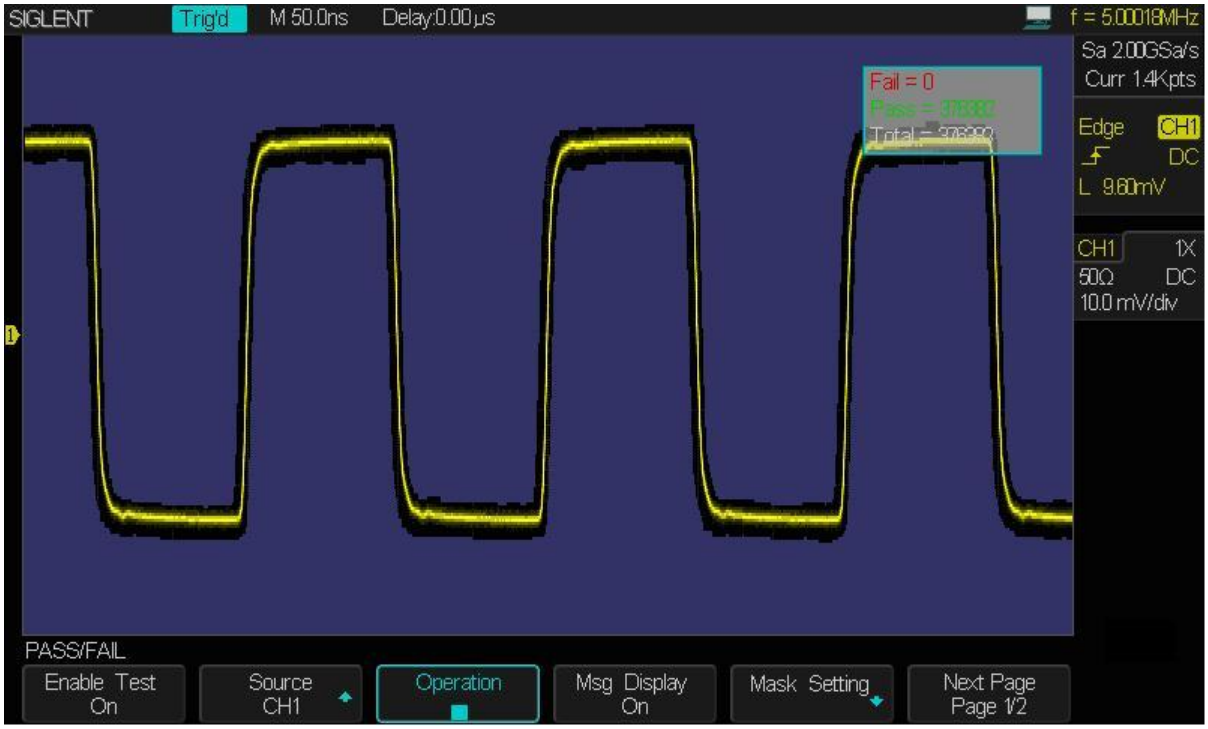

Figure 15 Fast Pass / Fail function