Application Note 001

Simultaneous Pulse-Echo / Through-Transmission Imaging

Introduction

Traditional ultrasonic imaging can be performed either in pulse-echo mode or in through- transmission mode. The advantage of pulse-echo imaging is high resolution at different depth in the sample. However, it may be necessary to scan the sample from both sides to inspect all interfaces. Through transmission imaging is capable of detecting delaminations within the sample. However, it is impossible to know the depth of the delaminations since the entire sample thickness is evaluated at once.

Simultaneous pulse-echo and through-transmission (PE/TT) imaging offers combined benefits of two methods, which makes the explanation of the inspection results more accurate and reliable. In this mode, the main pulser/receiver provides a PE mode signal from the top of the device under test, and the secondary receiver simultaneously provides a TT mode signal from the bottom of the device. The two signals are combined into a single composite signal so that images of both modes can be created.

Hardware Configuration

Generally, the low frequency remote pulser receiver (L1/L2) is connected to channel A and the high frequency remote pulser receiver (H1/H2) is connected to channel B.

For low frequency (<35 MHz) imaging, L1/L2 (channel A) is used for sending out the pulse and receiving the reflections back. H1/H2 (channel B) is used for receiving the transmitted signal. The connection of cables is demonstrated in **Figure 1**.

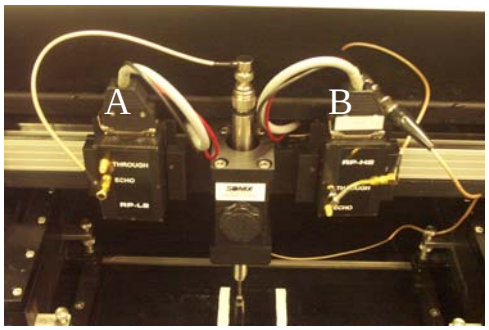

Figure 1: Low frequency PE/TT configuration

For high frequency (>=35 MHz) imaging, H1/H2 (channel B) is used for sending out the pulse and receiving the reflections back. L1/L2 (channel A) is used for receiving the transmitted signal. The connection of cables is demonstrated in **Figure 2**.

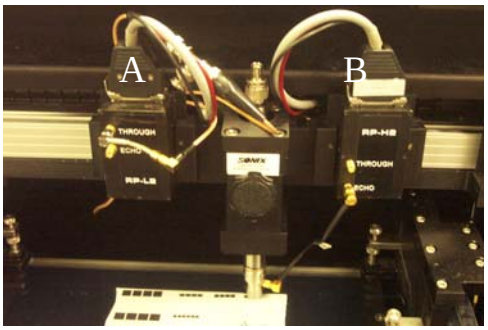

Figure 2: High frequency PE/TT configuration

Software Configuration

-- Low frequency imaging
As shown in **Figure 3**, in the tab of “Instrument”, choose channel A and select its mode as “Reflected”. The reflected signal will show up in the oscilloscope. Set up gates and focus transducer properly to generate optimum C-Scan images in pulse-echo mode.

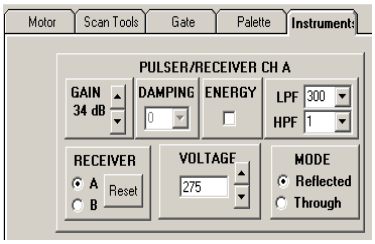

Figure 3: Channel A set up

Next, choose channel B and click “Slave” to activate it, select its mode as “Through” (**Figure 4**). Raise the gain enough so that the transmitted signal can be seen in the oscilloscope (**Figure 5**). Place another gate (green) on the transmitted signal and make sure its position is fixed rather than following the FSF.

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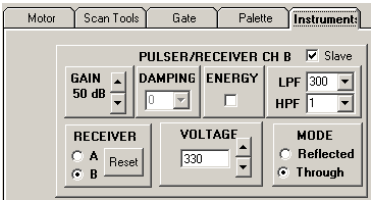

Figure 4: Channel B set up

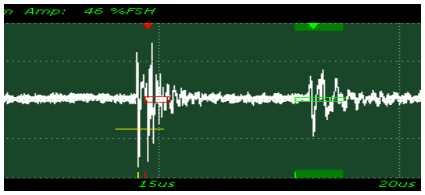

Figure 5: The combined pulse-echo (red gate) and through-transmission signal (green gate)

Run the scan to generate simultaneous pulse-echo and through -transmission images as shown in **Figure 6 and Figure 7**. The die top delaminations were found as bright spots in the pulse-echo image and as corresponding dark areas in the through transmission image.

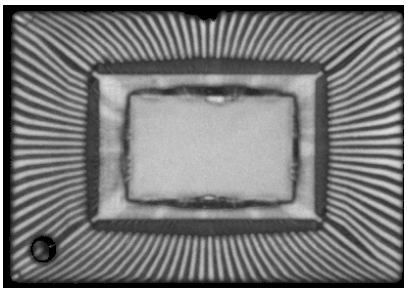

Figure 6: Pulse echo image

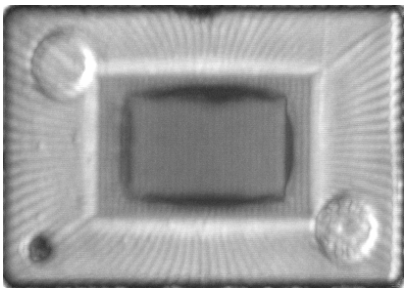

Figure 7: Through transmission image

-- High frequency imaging

As shown in **Figure 8**, in the tab of "Instrument", choose channel B and click "Slave" to activate it. Select its mode as "Reflected". The reflected signal will show up in the oscilloscope. Set up gates and focus transducer properly to generate optimum C-Scan images in pulse-echo mode.

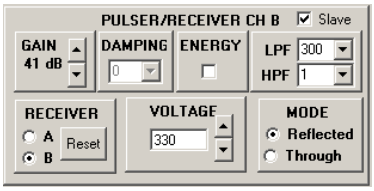

Figure 8: Channel B set up

Next, choose channel A and select its mode as "Through". Boost the gain enough so that the transmitted signal can be seen in the oscilloscope. Place another gate on the transmitted signal and make sure its position is fixed rather than following the FSF.

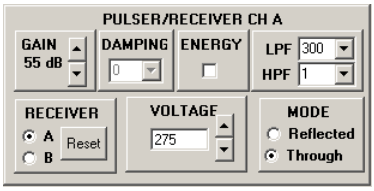

Figure 9: Channel A set up

Run the scan to generate simultaneous pulse-echo and through -transmission images.

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