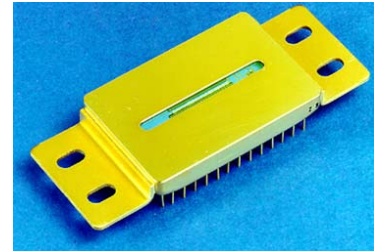


Application Note

Linear Array Integration and Video Timing



Purpose

For the linear photodiode arrays, this note describes the integration timing and video output timing as a function of the externally applied clocks. See Figure 1 for the detailed timing diagram. Further information can be found in the linear array datasheets.

Summary

- LSYNC transitions should be aligned to the rising edge of CLOCK.
- The exposure time is 3 clocks shorter than the duration of LSYNC.
- Odd video starts 3 clocks after LSYNC falls.
- Even video starts $\frac{1}{2}$ clock after odd video.

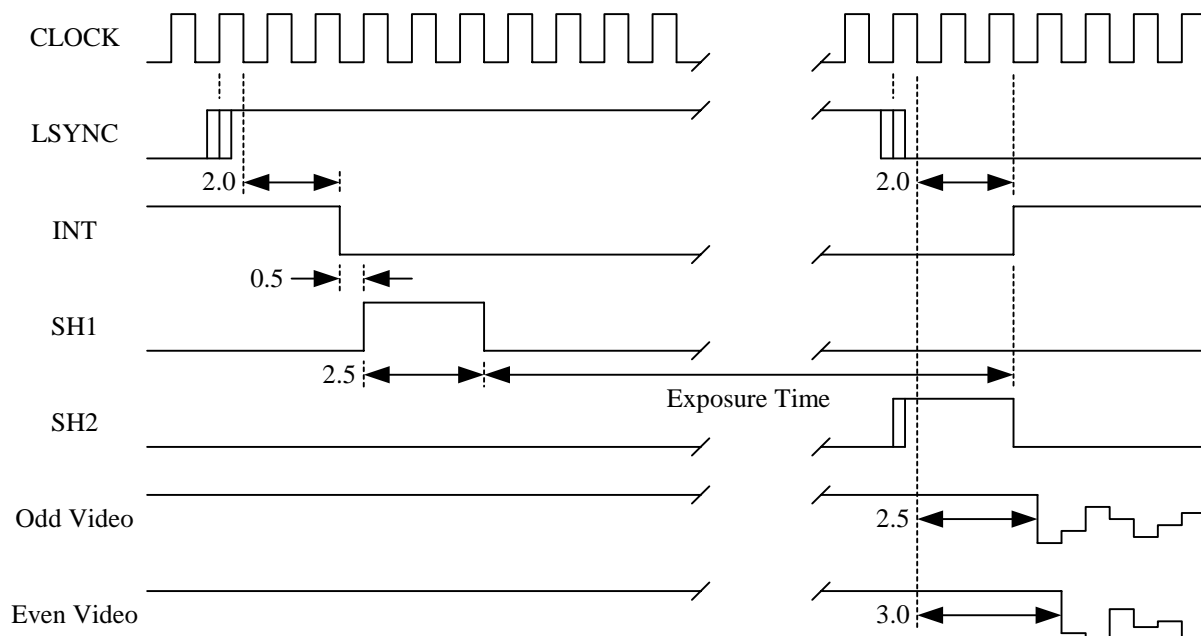


Figure 1. Summary of timing.

Explanation

The linear array devices are controlled by two input waveforms, called CLOCK and LSYNC. The timing of CLOCK and LSYNC determine the exposure time and the video output.

To show the operation of a device, the timing was varied with a programmable timing generator and the output waveforms were captured with a digital oscilloscope. Waveforms for CLOCK, LSYNC, INTB, SH1 and SH2 were captured for the integration timing, and waveforms for CLOCK, LSYNC, VIDEO1 and VIDEO2 were captured for the video timing. The meaning of the clocks is shown with the simplified pixel schematic in Figure 2.

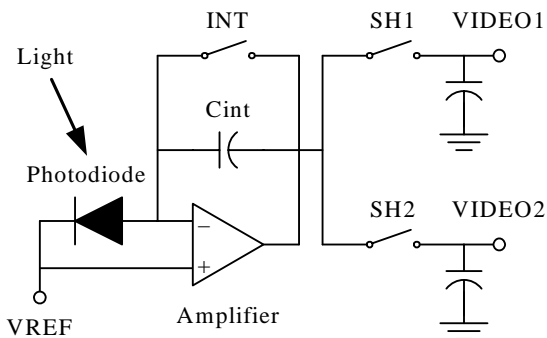


Figure 2. Single pixel of readout circuit.

The configuration for each captured waveform is in Table 1. The edges of LSYNC were shifted to show that the logic latches on the falling edge of CLOCK. The one minor exception is SH2, which changes with LSYNC when CLOCK is high, because it is the output of the first flip-flop.

Figure	LSYNC edge shift	Odd/Even	Information
Figure 3	Rising	Odd or	Integration time
Figure 4	Falling	Even	
Figure 5	Falling	Odd	Video output
Figure 6	Falling	Even	

Table 1. Configuration for each set of waveforms.

Figure 3 and Figure 4 show the internal clocks controlling the integration switch and the two sample and hold circuits. In the clock names,

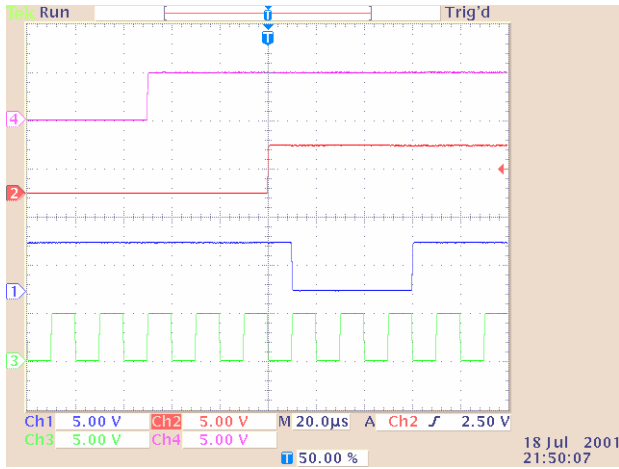
the "B" indicates that a buffer between the internal clock and the bondpad used for measurement inverts the signal.

At the beginning of the integration time, Figure 3 shows that there is a 2.0 clock delay from the falling edge of CLOCK following the rising edge of LSYNC to the start of integration. The first sample and hold starts 0.5 clocks later, and lasts for 2.5 clock. This means that the VIDEO1 output is for an integration time of 3.0 clocks. At the end of the integration time, Figure 4 shows that the integration ends 2.0 clocks after the falling edge of CLOCK following the falling edge of LSYNC. The second sample and hold ends at the same time. The conclusion is that the exposure time is $2.0 + 0.5 + 2.5 - 2.0 = 3.0$ clocks shorter than LSYNC, if both the rising and falling edges of LSYNC are at the same position in the clock cycle.

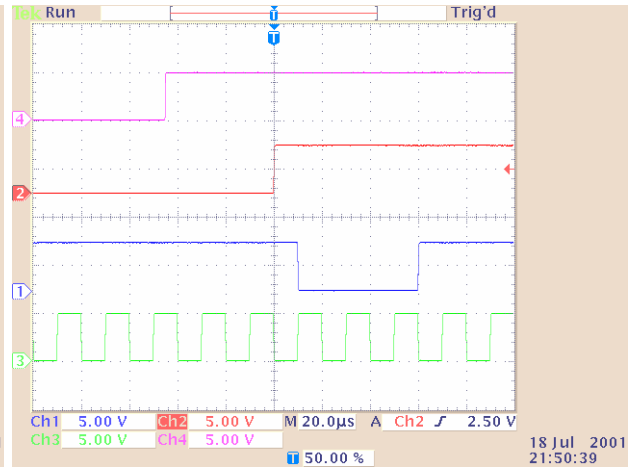
The delay from the fall of LSYNC to the output of video is shown in Figure 5 for odd video, and in Figure 6 for even video. As the falling edge of LSYNC shifts, the duration of LSYNC decreases from 9 to 8 clocks. The timing for video output is different for the "Odd" and "Even" side of the device. Each device has two multiplexers, which are identical but have different video output timing because of the readout direction.

If you need further technical support, please contact our sales department via email sui_support@goodrich.com or call us at 609-520-0610.

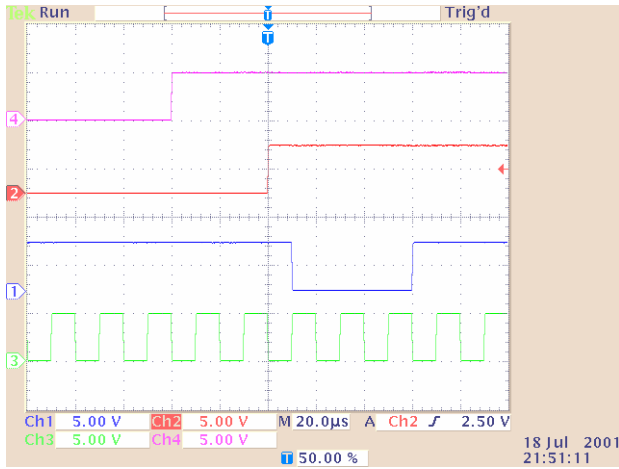
About Goodrich's SUI Team: Founded in 1991, SUI (Sensors Unlimited, Inc.) is the leading manufacturer of indium gallium arsenide (InGaAs) PIN and avalanche photodiode arrays that are used in shortwave and near infrared imaging for military, industrial, spectroscopic, machine vision, and telecommunications applications. SUI provides InGaAs photodiode array processing as a foundry service and designs custom readout integrated circuits for unique imaging applications within its ISO 9001 certified facility. For more information, visit www.oss.goodrich.com/sui.



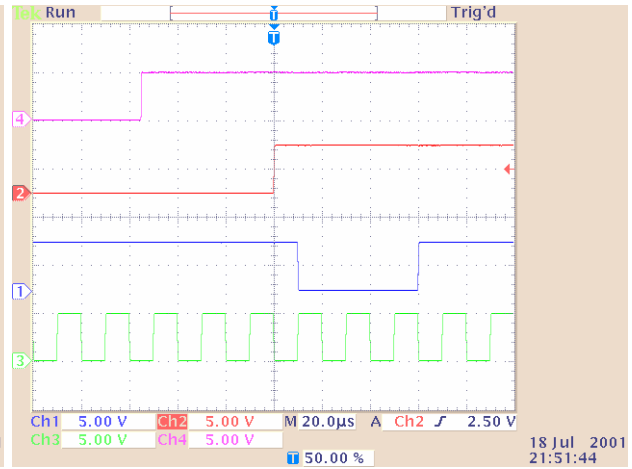
(a) LSYNC rising edge on CLOCK rising edge



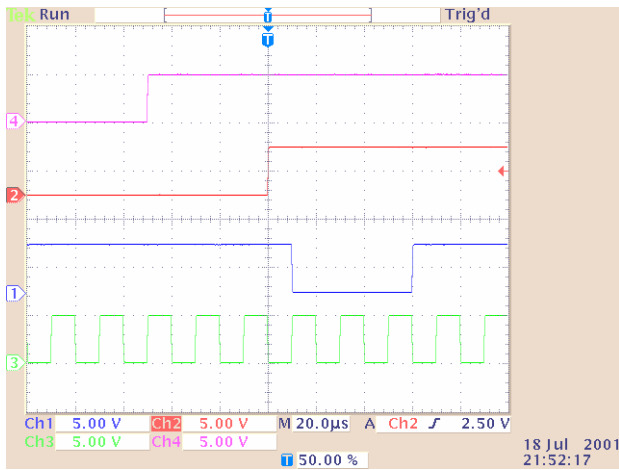
(b) LSYNC rising edge shifted 0.25 clock later



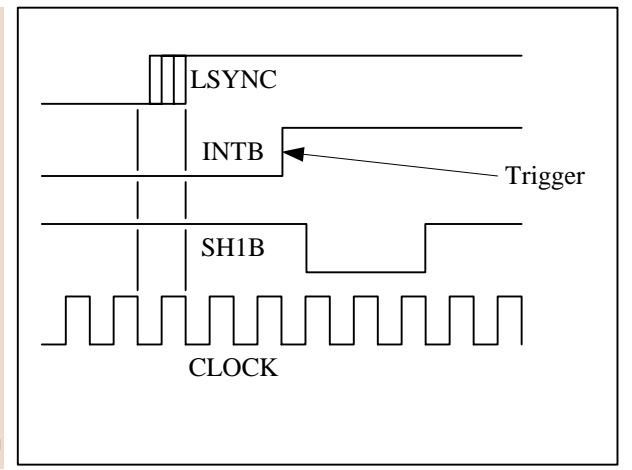
(c) LSYNC rising edge shifted 0.5 clock later



(d) LSYNC rising edge shifted 0.75 clock later

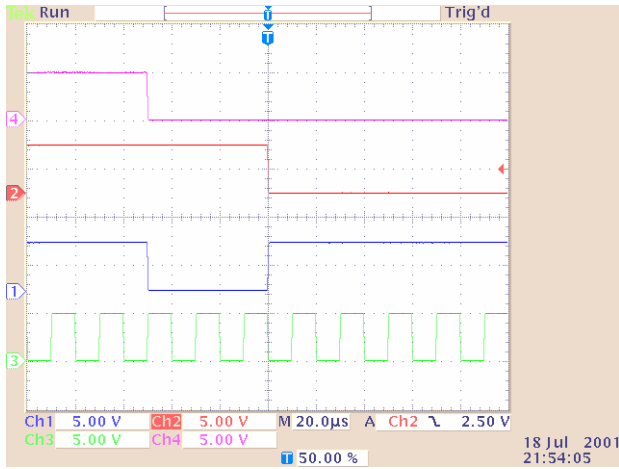


(e) LSYNC rising edge shifted 1.0 clock later

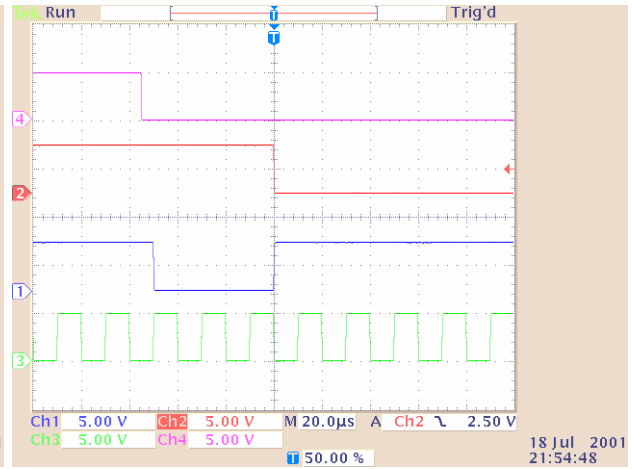


(f) Legend

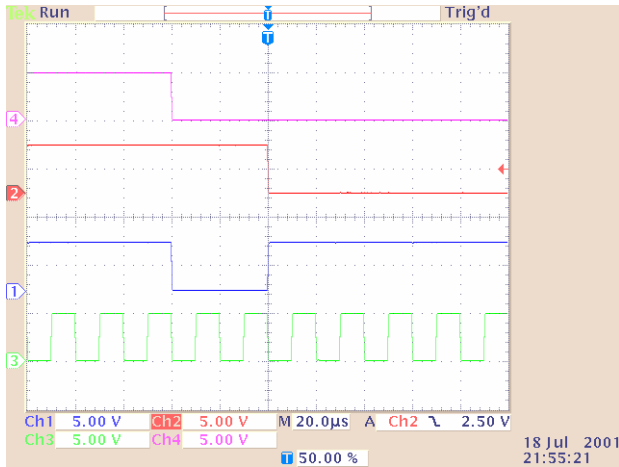
Figure 3. Start of integration with a shift in the rising edge of LSYNC.



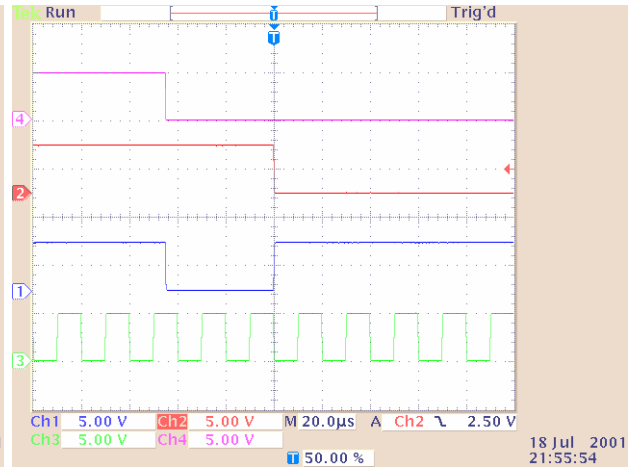
(a) LSYNC falling edge on CLOCK rising edge



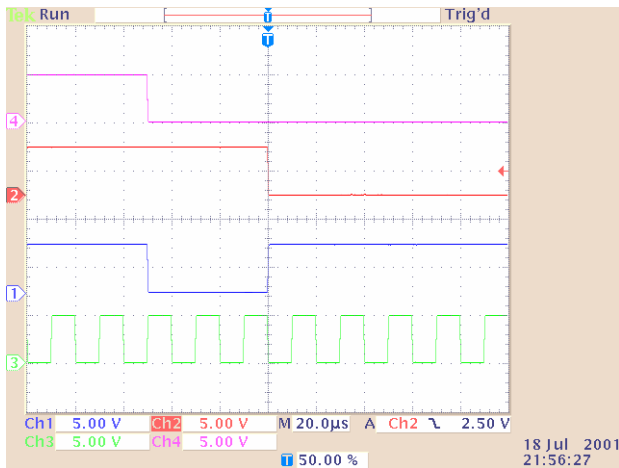
(b) LSYNC falling edge shifted 0.25 clock earlier



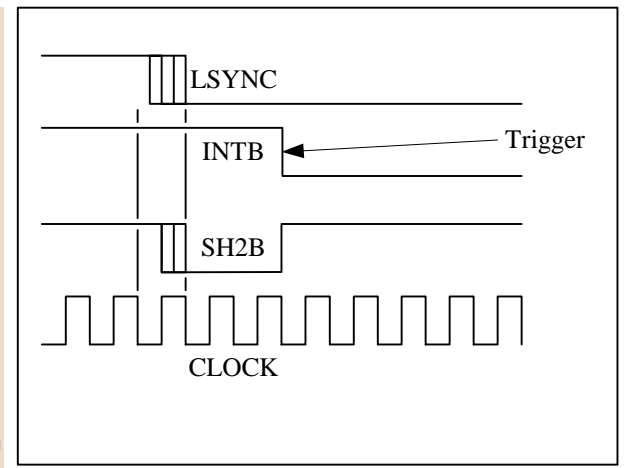
(c) LSYNC falling edge shifted 0.5 clock earlier



(d) LSYNC falling edge shifted 0.75 clock earlier

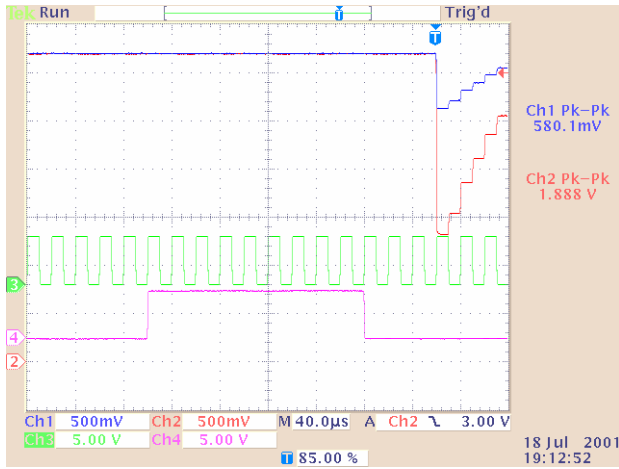


(e) LSYNC falling edge shifted 1.0 clock earlier

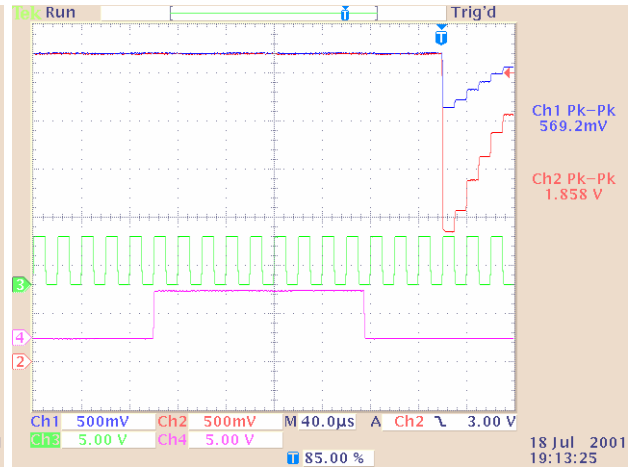


(f) Legend

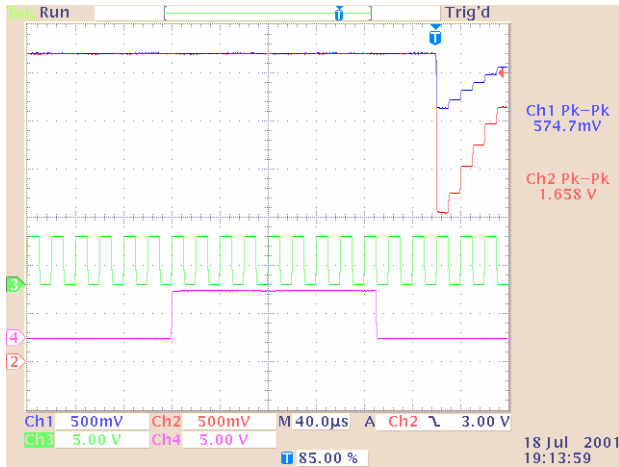
Figure 4. End of integration with a shift in the falling edge of LSYNC.



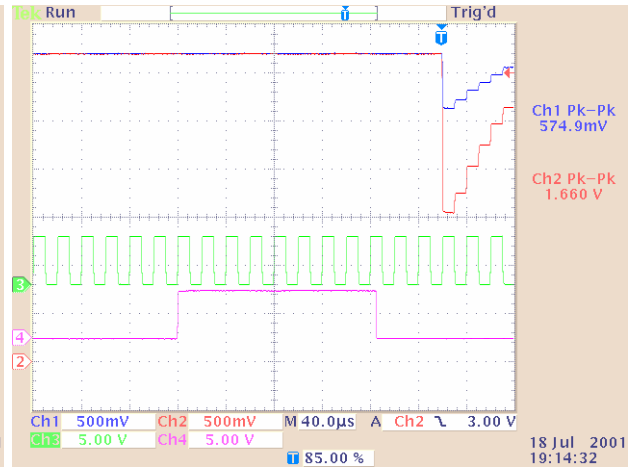
(a) LSYNC falling edge on CLOCK rising edge



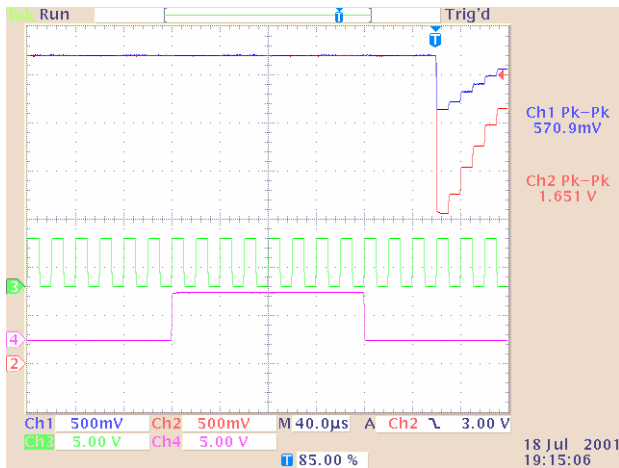
(b) LSYNC falling edge shifted 0.25 clock earlier



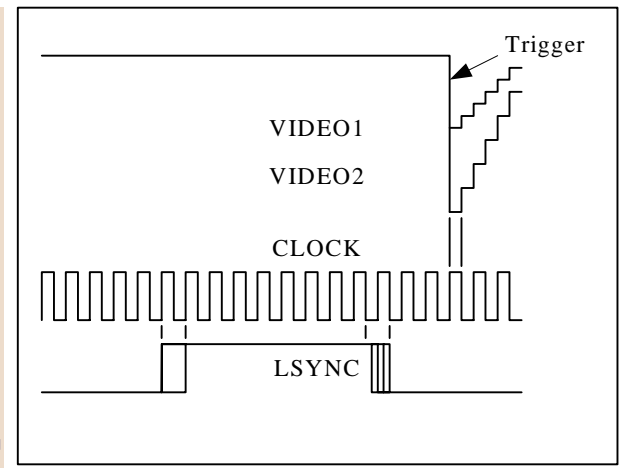
(c) LSYNC falling edge shifted 0.5 clock earlier



(d) LSYNC falling edge shifted 0.75 clock earlier

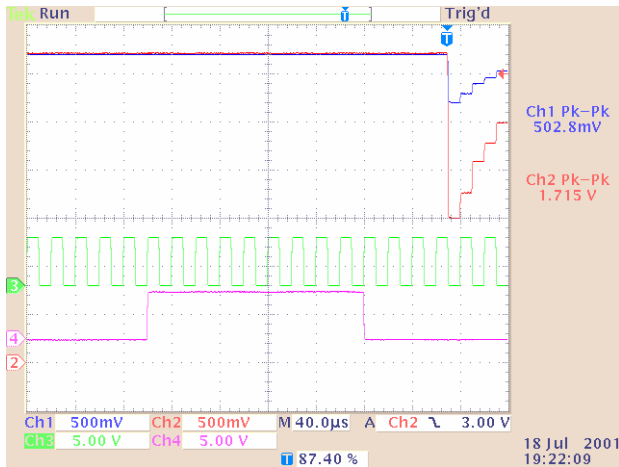


(e) LSYNC falling edge shifted 1.0 clock earlier

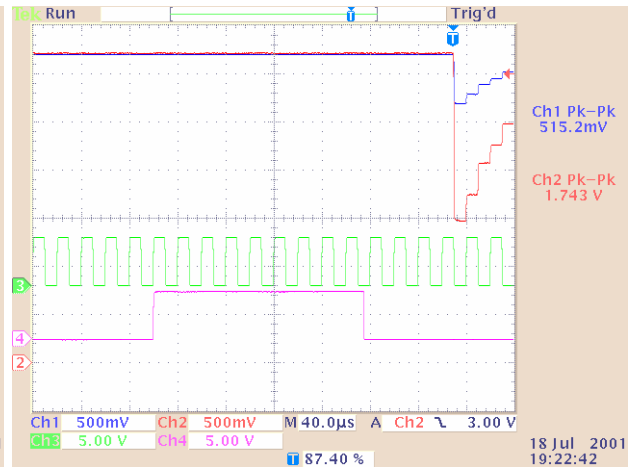


(f) Legend

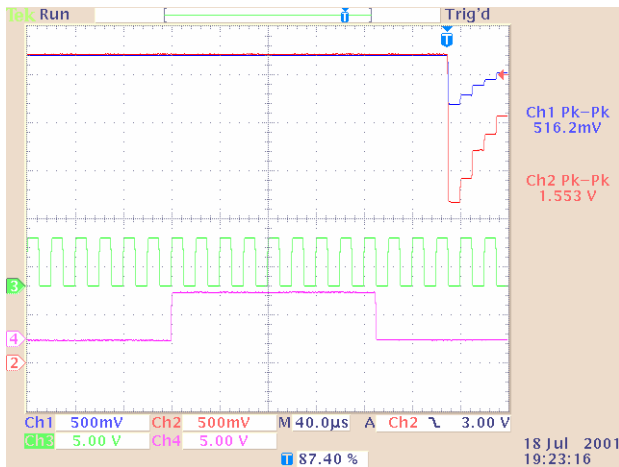
Figure 5. Odd video waveforms with a shift in the falling edge of LSYNC for a 9 to 8 clock duration.



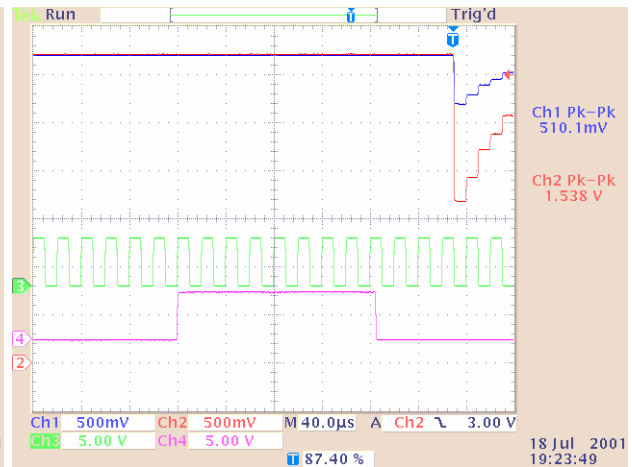
(a) LSYNC falling edge on CLOCK rising edge



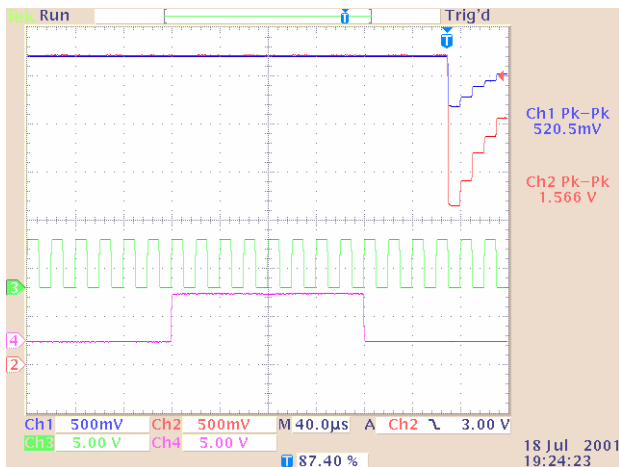
(b) LSYNC falling edge shifted 0.25 clock earlier



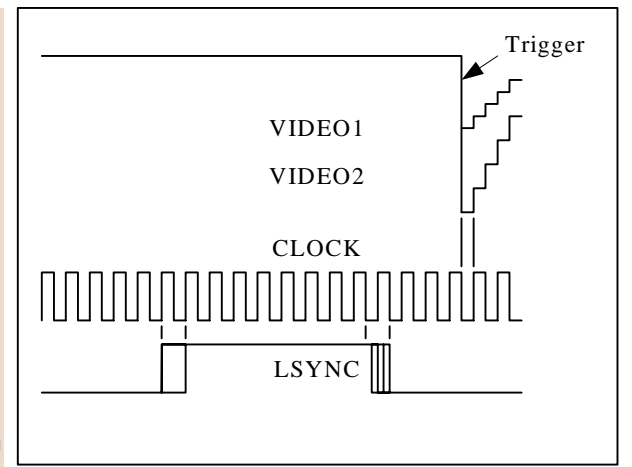
(c) LSYNC falling edge shifted 0.5 clock earlier



(d) LSYNC falling edge shifted 0.75 clock earlier



(e) LSYNC falling edge shifted 1.0 clock earlier



(f) Legend

Figure 6. Even video waveforms with a shift in the falling edge of LSYNC for a 9 to 8 clock duration.