A Look At COMWAKE For Use In SNW3

Steve Finch

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STMicroelectronics
The Transmitter

Transmitters send COMWAKEs with precise timing

A COMWAKE is

- Gap 160 OOB (106.666 ns)
- Burst 160 OOB (106.666 ns)
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- Burst 160 OOB (106.666 ns)
- Negation Gap 280 OOB (186.666 ns)

TOTAL 2200 OOB (1466.666 ns)

For each “bit window” the transmitter either sends this sequence
These could be Important!
Receiver COMWAKE Requirement

Detection of a COMWAKE requires detection of 4 consecutive Idle time/Burst time pairs. (Idle first, then Burst)
COMWAKE Detection

A receiver “may detect” a Burst with as little as one transition.
- No minimum detected Burst time specified
- Shall at 100 ns
- No maximum Burst time specified
  • But transmitter must send it right!

A receiver must wait for the next Burst to start to determine if an Idle time is of the proper size.
- There is a maximum Idle Time that must be met to declare the Idle time a valid COMWAKE Idle time.
COMWAKE Detection Uncertainty

From the time that the beginning of a COMWAKE appears at the input of the Receiver to the time that the Receiver signals the detection of the COMWAKE is:

Earliest: 1280 OOBI (746.66 ns)
   4 Idle times plus 4 Burst times

Latest: 1920 OOBI (1280.00 ns)
   Detect at the end of the last Burst.

Uncertainty: 640 OOBI (426.66 ns)
These could be Important!

Points of possible detection
Not Quite So Uncertain

- If the COMWAKE is preceded by more 68.67 ns of idle time, then the first Idle time/Burst time pair are disqualified because the Idle time exceeds the “shall not detect” time.

  Shall not detect: 175.00 ns
  Transmitted time - 106.66 ns

  Maximum “pre-idle” 68.67 ns

- This WILL occur for each “bit time” other than the first.
  - The COMWAKE negation time insures it.

- We can require it before the first COMWAKE
Not Quite So Uncertain

1st COMWAKE

Long Pre-Idle

No Longer a possible point of detection

Points of possible detection
COMWAKE Detection Uncertainty With Long Pre-Idle

From the time that the beginning of a COMWAKE appears at the input of the Receiver to the time that the Receiver signals the detection of the COMWAKE is:

Earliest: 1600 OOOBI (960.00 ns)
5 Idle times plus 5 Burst times.

Latest: 1920 OOOBI (1280.00 ns)
Detect at the end of the last Burst.

Uncertainty: 320 OOOBI (213.33 ns)
Sampling Is Easy And Accurate

- Detect the first COMWAKE.
- Use this as the time reference
- Generate a Strobe 640 OOBI after the first detect and every 2200 OOBI after that.
- Generate a Clear 1280 OOBI after the first detect and every 2200 OOBI after that.
- Set a flop every time a COMWAKE is detected.
- Sample the flop on every Strobe
- Clear the flop on every Clear.
Sampling Is Easy And Accurate

Detect (early)

Strobe (early)

Clear (early)

Latched Detect (early strobe)

Detect (late)

Strobe (late)

Clear (late)

Latched Detect (late strobe)
We will have to consider the Reference Clock tolerance (+/- 100 ppm).

If the transmissions are limited to the 109 usec SNTT time, and we use 2 times the clock tolerance as the difference between the transmitters frequency and the receivers frequency, then the maximum clock delta is less than 33 OOB1.

We have nearly 10 times that in window opening.
Conclusions

- It can be done, easily.
- One simple solution can be shown. Many other implementations are possible.
- The only requirement is that the transmitter keep the bus Idle for a minimum of 68.67 ns before sending the sequence of bits.
- If we keep the requirements for RCDT field, this requirement is met.
A Look At The Effect Of SSC

- Assume SSC is at the slowest modulation rate
  - 30KHz =
  - 33.33 usec =
  - 50,000 OOBIs (33.33 us / .666 ps)
- Assume a worst case modulation technique of a square wave
  - Modulation must be balanced, so only
  - 16.66 usec at one extreme, 16.66 at the opposite extreme
  - Gives 25,000 OOBIs during the extreme period
- Assume both sides have worst case in opposite directions
- Assume one side is +2500 ppm, the other -2500 ppm
  - 5000 ppm total difference
- 25,000 OOBI * 5000/1000000 = 250 OOBI maximum drift
A Look At The Effect Of SSC

- We have a 320 OOBI margin built in using the described solution
  - Without trying to optimize the Strobe and Clear positions
- The selection of the Strobe point was arbitrary
  - It could be moved to one clock before the Clear
  - And would improve margin
- Conclusion: NO ISSUES
Another Look At The Effect Of SSC

- Assume worst case clock difference for the entire 32 bit sequence: 5000 ppm clock difference
- One COMWAKE is 2200 OOBIs
- 32 COMWAKES is 70,400 OOBIs
- 5000 ppm on 70,400 = 352 OOBIs
- We have a built in 640 OOBIs optimal margin
- Results: Over a 200 OOBIs actual margin
For The Non-Believers

I ran a simulation with two clocks
- Base frequency 1.5GHz
- Transmitter +2500 ppm fixed
- Receiver -2500 ppm fixed
- And a second simulation with the clocks reversed

Generating the Strobe and Clear signals as defined

Using a range of initial clock phase relationships
- All relationships in 1 fs steps

With All 1’s, All 0’s and alternating 1’s and 0’s patterns.
- The exception is that the start bit was 1 in all patterns

Verifying the data.
Simulation passed.
- Measurement of window margin on 32nd bit confirms that margin is over 200 OObI