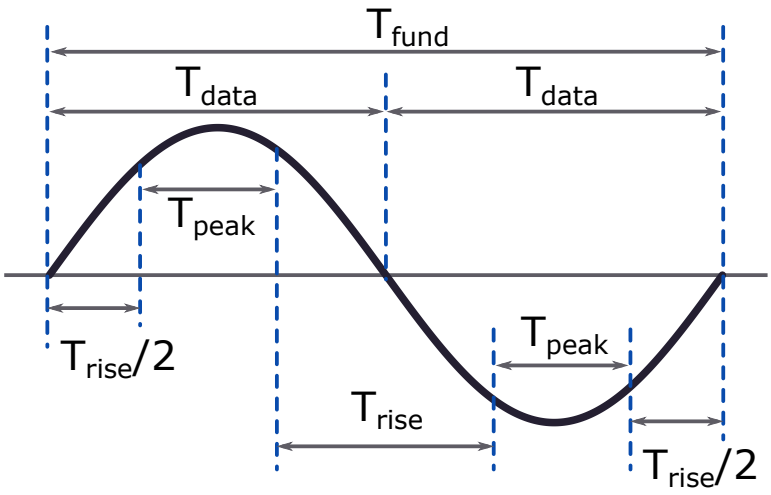
Data Rate and Clocking in OOK

Note: In the plots below I depicted data using sinusoidal, which represent the minimum required bandwidth to achieve certain data rate while avoiding ISI effects (Nyquist limit).

Relation between Gbps, GHz, and Rise Time

The illustration below shows two pulses (high and low), with following parameters:
T_{data}: Pulse duration.
T_{fund}: Period of the fundamental frequency. This is in the case when data continuously oscillate between high and low, essentially behaving like a rectangular signal.
T_{rise}: Rise time -- transition between high and low (assuming fall time being the same).
T_{peak}: Time duration in which a pulse holds its level.

From the plot we can read the following:
$T_{fund} = 2*T_{data}$
$T_{fund} = 2*(T_{rise} + T_{peak})$

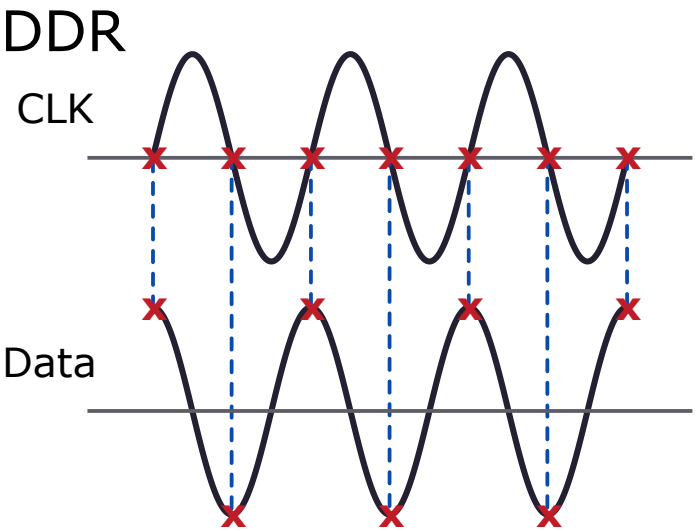


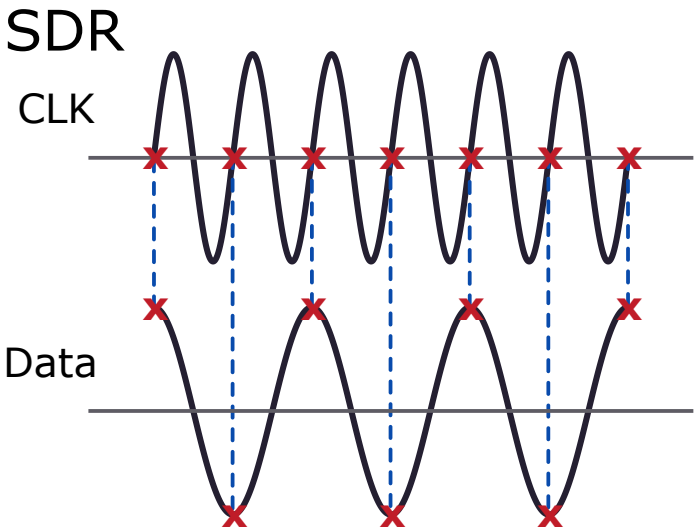
Therefore, we have:
Gbps: $f_{data} = 1/T_{data}$
GHz: $f_{fund} = 0.5*f_{data} = 0.5/(T_{rise}+T_{peak})$

If we approximate $T_{peak} \approx T_{rise}/2$, then $T_{fund} \approx 3*T_{rise} \rightarrow f_{fund} \approx 1/(3*T_{rise})$.
Of course, this approximation depends on the range definition of the rise/fall time.

Ways to clock/sample data

In the case of OOK systems, there are two ways the data can be clocked/sampled:
Double data rate (DDR) clocking: in one clock cycle two data pulses get clocked.
Single data rate (SDR) clocking: in one clock cycle one data pulse gets clocked.





Note: The shape of the output data depends on the reconstruction method, e.g., sample-and-hold. The analoge bandwidth is limited by the RF front-end.

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