

Why command setup/hold time should be considered....

Introduction

Mobile applications even in cellular phone requires high bandwidth memory solution to cover users' multimedia requirement. This trend will go on evolving from the smaller display size to the large size and from the low frame rate to the high rate also. For this, Mobile-SDRAM is being used in the mobile applications.

General Features of Mobile-SDRAM/ Mobile-DDR.

Mobile-SDRAM comes from Normal SDRAM which has been used in the desktop, notebook, and the server application. But, Mobile-SDRAM has some extra features which are low power consumption, low standby current with PASR(Partial Array Self Refresh), TCSR(Temperature Compensated Self Refresh). Clearly, Mobile-application is different from the other applications in strict low power requirement, which is DC characteristics.

Another different point is the loading related part which is AC characteristics. Basically, Mobile-SDRAM doesn't use any termination scheme which comes from various reasons. Of course, the most important factor is to reduce the interface power consumption. The fact(Mobile-SDRAM uses no termination) means any signal should swing with the wide range like from Vss to Vdd. Also, Mobile-SDRAM doesn't use source synchronous scheme to deliver its signal to the receiver.

Not using source synchronous scheme in Mobile-SDRAM is

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one factor to limit to support high frequency, but Mobile application is point to point net, which is the positive factor to overcome supporting high frequency problems. Normally, point to point net has the small loading condition which can make the signal transition fast.

Why time compensation of any input signal considering over 1ns of tR/tF is needed...

Any logic chip accepts its high and low state with its Vih/Vil(Input Voltage High/Input Voltage Low) level and each level can be different according to Voltage and interface method. Mobile-SDRAM uses LVCMOS(Low Voltage CMOS) interface which doesn't have any termination scheme in the driver and the receiver side.

In LVCMOS interface, the output loading condition is very important due to voltage swing and slew rate which can be expressed with tR/tF.(Rising Time and Falling Time). Mobile-SDRAM defined its tR/tF with 1ns, which means every input/output signal should reach to the Vih level from the Vil Level under 1ns.[See Figure 1 at the next page].

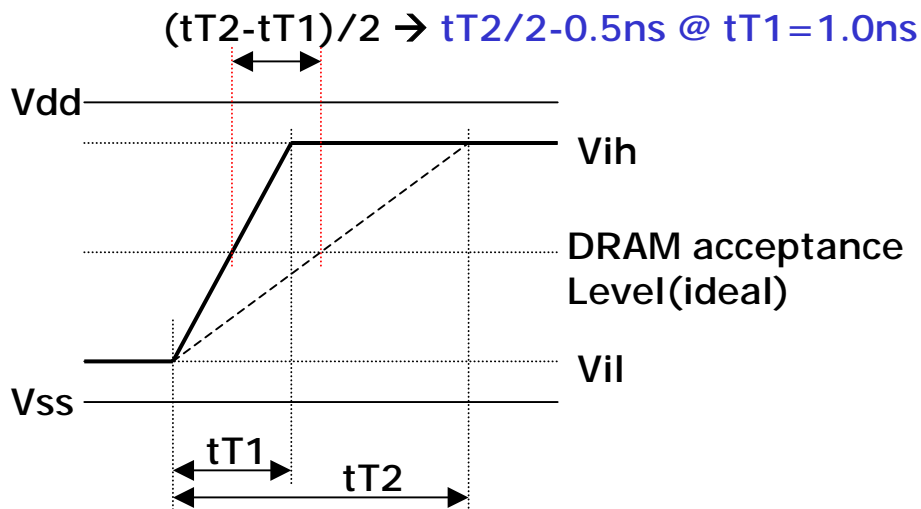
But, if the tR/tF of the actual command/address input signal may be over 1ns, what is the effect to the Mobile-SDRAM ? Any input signal has the window which consists of setup and hold time window. Normally, the longer setup time window, the shorter hold time window and the reverse case is true also. The tR/tF of any input signal delay over 1ns can make the signal window small, specially to the setup time window.

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If this happens in the actual system, the system should consider time compensation which is described in the datasheet with $t_{T2/2-0.5ns}$.



Where, t_{T1} is data book recommended signal transition time
 t_{T2} is real system level signal transition time
[Figure 1 – Input V_{ih}/V_{il} of Mobile-SDRAM]

The datasheet comments this case with the following;
“If clock /any input rising time is longer than 1ns, ($t_{R/2-0.5ns}$) should be added to the parameters”. Of course, this case should be applied to the output parameters of Mobile-SDRAM like t_{SAC} , t_{OH} , t_{SHZ} . For more detailed information, please refer to the datasheet.

Why $t_{R/2} - 0.5ns$?

The reason is that every CMOS buffer modeling range is from

10% to 90% of voltage swing like from V_{ss} to V_{dd} . LVCMOS interface can have internal V_{ref} which is $V_{dd}/2$ and the input buffer accepts its signal high and low level from this point, which is the ideal case. The good device has lower V_{ih} and upper V_{il} level and the actual level can be different device by device and vendor by vendor.

Conclusion.

Samsung datasheet describes the time compensation of any input signal considering the abnormal situation like over 1ns of $t_{R/tF}$ (1ns of $t_{R/tF}$ is the standard of Mobile-SDRAM). Even though $t_{R/tF}$ of any input signal can be delayed over 1ns (Some output signals also), the time compensation should be considered for guaranteeing the proper operation.

For more information

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