Combatting Signal Integrity Issues
# with FLXDrive^{TM} SRAMs

Introduction

Until recently, hardware designers were forced to use SRAMs with set output driver strength even if their application called for multi-drop bus or point-to-point applications. GSI's FLXDrive^{TM} RAMs allow designers the ability to choose the driver strength according to their system needs.

How It Works

Today's networking/telecom systems use SRAMs in one of two ways, multi-drop buses or point-to-point. This can become a problem if the SRAMs output impedance is designed for one application, but used in the other.

When designing a high speed system that eliminates signal integrity issues, the goal is to match the source impedance to the impedance of the trace. This optimizes the stair step delay and ringing. This application note assumes a 50 ohm Z_O and 1K ohm or greater load termination.

Z_O and Source Impedance = 50 ohm, Load Impedance = 1K ohm

X ns = propagation delay of the transmission line

| Source | Load |
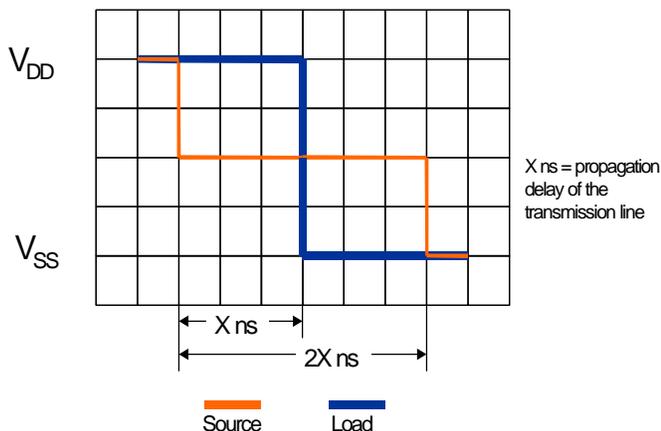
All IC output drivers demonstrate characteristic output impedance, which is generally described by a shorthand reference to the driver's V-I curve slope at mid-rail voltage. FLXDrive^{TM} RAMs enable you to switch from a 25 ohm drive to a 50 ohm drive and back with only one logic control pin (ZQ). This allows you to purchase the same SRAM for multiple systems and configure the driver to your specific needs.

Multi-drop busses, otherwise known as common busses, have two or more SRAMs hanging off the same trace. Usually, common bus traces are considerably longer than their counterpart in order to accommodate multiple devices. This causes signal integrity issues including increased propagation delay (the time it takes a signal to go from one end of the trace to the other) due to the added length, inductance, and capacitance from multiple devices. It also decreases the characteristic impedance (Z_O) of the trace.

FLXDrive^{TM} SRAMs combat these effects by allowing the user to select a 25 ohm driver (ZQ = 0). Initially this seems counterproductive since faster rise and fall times ensure that transmission line effects are not hidden during switching; however, a closer look indicates this is not the case. Common bus traces characteristically have a lower Z_O. The greater the ratio between the trace impedance and the
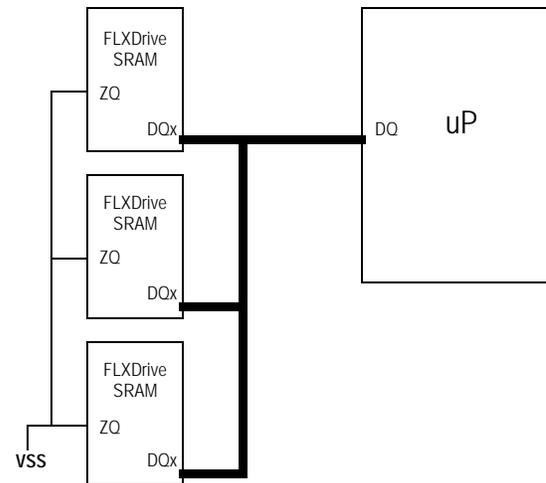
FLXDrive^{TM} SRAM in multi-drop bus system
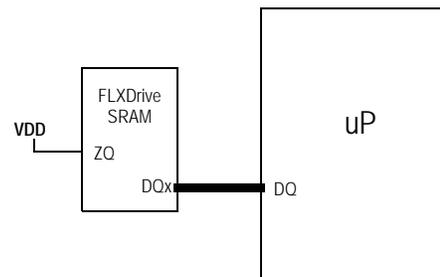
FLXDrive^{TM} SRAM in point-to-point system

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driver's output impedance, the more extreme the reflected ringing and stair-stepped switch delays. Selecting a 25 ohm driver lessens these adverse effects and makes it easier for the designer to meet tight timing margins with faster rise and fall times.

Point-to-point applications have one SRAM positioned as close to the processor or ASIC as possible in order to reduce propagation delay. Switching to the 50 ohm driver (ZQ = 1) on a FLXDrive^{TM} SRAM improves the integrity of the signal in these applications by increasing both rise and fall times and the output driver impedance. Since we have increased the output driver impedance in hopes of matching Z_0, ringing and stair-stepped switch delays will be optimized as seen in the graph on page one, as well as masked by the longer rise and fall times and shorter propagation delay.

GSI Technology offers FLXDrive^{TM} technology only on standard JEDEC 8M and 16M BGA pinouts. When choosing FLXDrive^{TM} make sure you select a SRAM part number that starts with 882xx (8M) or 8162xx (16M).

Conclusion

Until now, few tools for dealing with signal integrity have been available from RAM vendors. With the introduction of FLXDrive, GSI Technology has made it easier for you to combat signal integrity issues by reducing the need for complex termination techniques.

DISCLAIMER

When designing a printed circuit board, you must account for transmission line effects in traces as well as the load effects of devices added to the end of each trace. This application note is not designed to recommend PCB techniques or make you aware of the factors affecting PCB design, but to introduce FLXDrive^{TM} and its usefulness. GSI Technology recommends consulting a tutorial on transmission line theory and in-depth computer simulation before building prototype PCBs.

FLXDrive Output Driver Characteristics

GSI 0.3u Sync SRAM
FLXDrive Output Driver I/V Characteristics

Specifications cited are subject to change without notice. For latest documentation see http://www.gsitechnology.com
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