August 12, 2011

CN Number: 1103

CN Change Level: Minor

Subject: Signal Coupling in Deeply-Cascaded SRAM Blocks in RTAX-S/SL/DSP FPGAs

Dear Customer,

This notification describes timing effects of coupling in signals driving deeply-cascaded SRAM blocks in the RTAX™-S, RTAX-SL, and RTAX-DSP families of spaceflight FPGAs. Guidance is provided here to help designers identify whether their designs are likely to be impacted by these timing effects. Recommended margins for timing are provided for designs which are affected.

Background

In rare cases, signals driving the SRAM blocks in RTAX-S/SL and RTAX-DSP devices can exhibit slower set-up time and slower clock-to-Q time than indicated in the product datasheet and in the SmartTime timing analysis software provided in the Libero® Integrated Design Environment (IDE) tool set. Both of the following conditions must be true for the slower timing to be observed in your design:

1) The SRAM blocks must be deeply cascaded (4 or more blocks deep in the case of designs placed and routed with software earlier than Libero IDE v9.0 SP2, or 8 or more blocks deep in the case of designs placed and routed with Libero IDE v9.0 SP2 or later).
2) Switching conditions for a coupling effect on timing must exist on the signal tracks (either two adjacent signals must be switching simultaneously in opposite directions, or three adjacent signals must be switching simultaneously with the middle signal switching in the opposite direction from the other two).

Suggested Action

First, designers should determine whether or not SRAM blocks are deeply cascaded in the design. To determine the depth of cascading of SRAM blocks in an RTAX-S/SL/DSP design, designers should do the following:

1. Open the *.adb file of the design with the Designer software from the Libero IDE tool suite.
2. Run the tcl script **cascadeTest.tcl** using the **File→Execute Script** command.
3. The script provides a list of the SRAM instances with the number of cascaded blocks for each instance.

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Here is an example of the script output for a design which has one SRAM instance with 14 cascaded SRAM blocks in depth:

```
Wrote to the file: D:\Test.loc
The Export command succeeded ( 00:00:03 )
Finding all RAM instances... Done!
RAM Instance Name                              |Depth Cascades
Sram_core_ctl/U_edacsram/uaxram/axram_7kx36 |     14
The Execute Script command succeeded ( 00:00:04 )
```

Second, designers should determine whether or not signal coupling exists in the design. Unless a code with a hamming distance greater than 2 (such as a Gray code) is used for both address and data in the SRAM cells, assume that coupling does exist in the design. Note that traditional static timing analysis tools assume that one signal is switching at a time and therefore do not account for coupling effects.

Third, designers should determine which version of Libero IDE software was used to place-and-route the design. In order to improve SRAM access time, Libero IDE software, starting with v9.0SP2, changed the way SRAM blocks are accessed, with the benefit that coupling between address and data signals is reduced.

Designers should then consult the following table to determine whether or not any additional timing allowance on the data setup time, address setup time, enable setup time and clock-to-Q delay needs to be made in their designs using embedded SRAM blocks.

Depth of SRAM Cascading	**Additional Timing Allowance Required (nominal temperature and voltage)**			
Software used for place-and-route	**Libero IDE v9.0 SP1 or earlier**		**Libero IDE v9.0 SP2 or later**	
Speed grade	**–1**	**Std.**	**–1**	**Std.**
0–3 SRAM blocks	No change	No change	No change	No change
4 SRAM blocks	3.0 ns	2.0 ns	No change	No change
8 SRAM blocks	16.7 ns	15.7 ns	2.9 ns	1.8 ns
16 SRAM blocks	36.3 ns	33.3 ns	5.9 ns	2.9 ns

If parts have already been programmed, a functional test of the design with an extensive test pattern should reveal the presence of any coupling related timing issues.

If you have any questions related to this topic, please contact Microsemi's ITAR Application Technical Support at soc_tech_itar@microsemi.com.

Regards,

Microsemi Corporation

Appendix

Table 1 lists the affected part numbers.

Table 1: Affected Part Numbers

RTAX250S/SL		
RTAX250S-CG624B	5962-0421904QYC	RTAX250SL-1CQ352E
5962-0421901QUA	RTAX250S-CQ208EV	5962-0421908QXC
RTAX250S-1CG624B	RTAX250S-1CQ208EV	RTAX250SL-CQ352EV
5962-0421902QUA	RTAX250SL-CQ208B	RTAX250SL-1CQ352EV
RTAX250S-CG624E	5962-0421905QYC	RTAX250S-CQ352PROTO
5962-0421903QUA	RTAX250SL-1CQ208B	RTAX250S-1CQ352PROTO
RTAX250S-1CG624E	5962-0421906QYC	RTAX250S-LG624B
5962-0421904QUA	RTAX250SL-CQ208E	5962-0421901QZC
RTAX250S-CG624EV	5962-0421907QYC	RTAX250S-1LG624B
RTAX250S-1CG624EV	RTAX250SL-1CQ208E	5962-0421902QZC
RTAX250SL-CG624B	5962-0421908QYC	RTAX250S-LG624E
5962-0421905QUA	RTAX250SL-CQ208EV	5962-0421903QZC
RTAX250SL-1CG624B	RTAX250SL-1CQ208EV	RTAX250S-1LG624E
5962-0421906QUA	RTAX250S-CQ208PROTO	5962-0421904QZC
RTAX250SL-CG624E	RTAX250S-1CQ208PROTO	RTAX250S-LG624EV
5962-0421907QUA	RTAX250S-CQ352B	RTAX250S-1LG624EV
RTAX250SL-1CG624E	5962-0421901QXC	RTAX250SL-LG624B

Table 1: Affected Part Numbers

5962-0421908QUA	RTAX250S-CQ352E	5962-0421905QZC
RTAX250SL-CG624EV	5962-0421903QXC	RTAX250SL-1LG624B
RTAX250SL-1CG624EV	RTAX250S-1CQ352E	5962-0421906QZC
RTAX250S-CG624PROTO	5962-0421904QXC	RTAX250SL-LG624E
RTAX250S-1CG624PROTO	RTAX250S-CQ352EV	5962-0421907QZC
RTAX250S-CQ208B	RTAX250S-1CQ352EV	RTAX250SL-1LG624E
5962-0421901QYC	RTAX250SL-CQ352B	5962-0421908QZC
RTAX250S-1CQ208B	5962-0421905QXC	RTAX250SL-LG624EV
5962-0421902QYC	RTAX250SL-1CQ352B	RTAX250SL-1LG624EV
RTAX250S-CQ208E	5962-0421906QXC	RTAX250S-LG624PROTO
5962-0421903QYC	RTAX250SL-CQ352E	RTAX250S-1LG624PROTO
RTAX250S-1CQ208E	5962-0421907QXC	
RTAX1000S/SL		
RTAX1000S-CGS624B	RTAX1000S-CQ352B	RTAX1000S-LG624B
5962-0422001QUA	5962-0422001QXC	5962-0422001QYC
RTAX1000S-1CGS624B	RTAX1000S-1CQ352B	RTAX1000S-1LG624B
5962-0422002QUA	5962-0422002QXC	5962-0422002QYC
RTAX1000S-CGS624E	RTAX1000S-CQ352E	RTAX1000S-LG624E
5962-0422003QUA	5962-0422003QXC	5962-0422003QYC
RTAX1000S-1CGS624E	RTAX1000S-1CQ352E	RTAX1000S-1LG624E
5962-0422004QUA	5962-0422004QXC	5962-0422004QYC
RTAX1000S-CGS624EV	RTAX1000S-CQ352EV	RTAX1000S-LG624EV
RTAX1000S-1CGS624EV	RTAX1000S-1CQ352EV	RTAX1000S-1LG624EV
RTAX1000SL-CGS624B	RTAX1000SL-CQ352B	RTAX1000SL-LG624B
5962-0422005QUA	5962-0422005QXC	5962-0422005QYC
RTAX1000SL-1CGS624B	RTAX1000SL-1CQ352B	RTAX1000SL-1LG624B
5962-0422006QUA	5962-0422006QXC	5962-0422006QYC

Table 1: Affected Part Numbers

RTAX1000SL-CGS624E	RTAX1000SL-CQ352E	RTAX1000SL-LG624E
5962-0422007QUA	5962-0422007QXC	5962-0422007QYC
RTAX1000SL-1CGS624E	RTAX1000SL-1CQ352E	RTAX1000SL-1LG624E
5962-0422008QUA	5962-0422008QXC	5962-0422008QYC
RTAX1000SL-CGS624EV	RTAX1000SL-CQ352EV	RTAX1000SL-LG624EV
RTAX1000SL-1CGS624EV	RTAX1000SL-1CQ352EV	RTAX1000SL-1LG624EV
RTAX1000S-CG624PROTO	RTAX1000S-CQ352PROTO	RTAX1000S-LG624PROTO
RTAX1000S-1CG624PROTO	RTAX1000S-1CQ352PROTO	RTAX1000S-1LG624PROTO
RTAX2000S/SL		
RTAX2000S-CG1152B	RTAX2000S-1CGS624E	RTAX2000SL-1CQ256B
5962-0422101QTA	5962-0422104QNA	5962-0422106QUC
RTAX2000S-1CG1152B	RTAX2000S-CGS624EV	RTAX2000SL-CQ256E
5962-0422102QTA	RTAX2000S-1CGS624EV	5962-0422107QUC
RTAX2000S-CG1152E	RTAX2000SL-CGS624B	RTAX2000SL-1CQ256E
5962-0422103QTA	5962-0422105QNA	5962-0422108QUC
RTAX2000S-1CG1152E	RTAX2000SL-1CGS624B	RTAX2000SL-CQ256EV
5962-0422104QTA	5962-0422106QNA	RTAX2000SL-1CQ256EV
RTAX2000S-CG1152EV	RTAX2000SL-CGS624E	RTAX2000S-CQ256PROTO
RTAX2000S-1CG1152EV	5962-0422107QNA	RTAX2000S-1CQ256PROTO
RTAX2000SL-CG1152B	RTAX2000SL-1CGS624E	RTAX2000S-CQ352B
5962-0422105QTA	5962-0422108QNA	5962-0422101QXC
RTAX2000SL-1CG1152B	RTAX2000SL-CGS624EV	RTAX2000S-1CQ352B
5962-0422106QTA	RTAX2000SL-1CGS624EV	5962-0422102QXC
RTAX2000SL-CG1152E	RTAX2000S-CG624PROTO	RTAX2000S-CQ352E
5962-0422107QTA	RTAX2000S-1CG624PROTO	5962-0422103QXC
RTAX2000SL-1CG1152E	RTAX2000S-1CQ256B	RTAX2000S-1CQ352E
5962-0422108QTA	5962-0422102QUC	5962-0422104QXC

Table 1: Affected Part Numbers

RTAX2000SL-CG1152EV	RTAX2000S-CQ256E	RTAX2000S-CQ352EV
RTAX2000SL-1CG1152EV	5962-0422103QUC	RTAX2000S-1CQ352EV
RTAX2000S-CG1152PROTO	RTAX2000S-1CQ256E	RTAX2000SL-CQ352B
RTAX2000S-1CG1152PROTO	5962-0422104QUC	5962-0422105QXC
RTAX2000S-1CGS624B	RTAX2000S-CQ256EV	RTAX2000SL-1CQ352B
5962-0422102QNA	RTAX2000S-1CQ256EV	5962-0422106QXC
RTAX2000S-CGS624E	RTAX2000SL-CQ256B	RTAX2000SL-CQ352E
5962-0422103QNA	5962-0422105QUC	5962-0422107QXC
RTAX2000SL-1CQ352E	5962-0422105QMC	RTAX2000S-1LG624E
5962-0422108QXC	RTAX2000SL-1LG1152B	5962-0422104QYC
RTAX2000SL-CQ352EV	5962-0422106QMC	RTAX2000S-LG624EV
RTAX2000SL-1CQ352EV	RTAX2000SL-LG1152E	RTAX2000S-1LG624EV
RTAX2000S-CQ352PROTO	5962-0422107QMC	RTAX2000SL-LG624B
RTAX2000S-1CQ352PROTO	RTAX2000SL-1LG1152E	5962-0422105QYC
RTAX2000S-LG1152B	5962-0422108QMC	RTAX2000SL-1LG624B
5962-0422101QMC	RTAX2000SL-LG1152EV	5962-0422106QYC
RTAX2000S-1LG1152B	RTAX2000SL-1LG1152EV	RTAX2000SL-LG624E
5962-0422102QMC	RTAX2000S-LG1152PROTO	5962-0422107QYC
RTAX2000S-LG1152E	RTAX2000S-1LG1152PROTO	RTAX2000SL-1LG624E
5962-0422103QMC	RTAX2000S-LG624B	5962-0422108QYC
RTAX2000S-1LG1152E	5962-0422101QYC	RTAX2000SL-LG624EV
5962-0422104QMC	RTAX2000S-1LG624B	RTAX2000SL-1LG624EV
RTAX2000S-LG1152EV	5962-0422102QYC	RTAX2000S-LG624PROTO
RTAX2000S-1LG1152EV	RTAX2000S-LG624E	RTAX2000S-1LG624PROTO
RTAX2000SL-LG1152B	5962-0422103QYC	
RTAX4000S/SL		
RTAX4000S-CG1272B	RTAX4000S-CQ352B	RTAX4000S-LG1272B

Table 1: Affected Part Numbers

5962-0822401QZA	5962-0822401QXC	5962-0822401QYC
RTAX4000S-1CG1272B	RTAX4000S-1CQ352B	RTAX4000S-1LG1272B
5962-0822402QZA	5962-0822402QXC	5962-0822402QYC
RTAX4000S-CG1272E	RTAX4000S-CQ352E	RTAX4000S-LG1272E
5962-0822403QZA	5962-0822403QXC	5962-0822403QYC
RTAX4000S-1CG1272E	RTAX4000S-1CQ352E	RTAX4000S-1LG1272E
5962-0822404QZA	5962-0822404QXC	5962-0822404QYC
RTAX4000S-CG1272EV	RTAX4000S-CQ352EV	RTAX4000S-LG1272EV
RTAX4000S-1CG1272EV	RTAX4000S-1CQ352EV	RTAX4000S-1LG1272EV
RTAX4000SL-CG1272B	RTAX4000SL-CQ352B	RTAX4000SL-LG1272B
5962-0822405QZA	5962-0822405QXC	5962-0822405QYC
RTAX4000SL-1CG1272B	RTAX4000SL-1CQ352B	RTAX4000SL-1LG1272B
5962-0822406QZA	5962-0822406QXC	5962-0822406QYC
RTAX4000SL-CG1272E	RTAX4000SL-CQ352E	RTAX4000SL-LG1272E
5962-0822407QZA	5962-0822407QXC	5962-0822407QYC
RTAX4000SL-1CG1272E	RTAX4000SL-1CQ352E	RTAX4000SL-1LG1272E
5962-0822408QZA	5962-0822408QXC	5962-0822408QYC
RTAX4000SL-CG1272EV	RTAX4000SL-CQ352EV	RTAX4000SL-LG1272EV
RTAX4000SL-1CG1272EV	RTAX4000SL-1CQ352EV	RTAX4000SL-1LG1272EV
RTAX4000S-CG1272PROTO	RTAX4000S-CQ352PROTO	RTAX4000S-LG1272PROTO
RTAX4000S-1CG1272PROTO	RTAX4000S-1CQ352PROTO	RTAX4000S-1LG1272PROTO
RTAX-DSP		
RTAX2000D-CGD1272B	RTAX2000D-CQ352B	RTAX4000D-LGD1272B
RTAX2000D-CGD1272E	RTAX2000D-CQ352E	RTAX4000D-LGD1272E
RTAX2000D-CGD1272EV	RTAX2000D-CQ352EV	RTAX4000D-LGD1272EV
RTAX2000D-CGD1272PROTO	RTAX2000D-CQ352PROTO	RTAX4000D-LGD1272PROTO
RTAX2000D-LGD1272B	RTAX4000D-CGD1272B	RTAX4000D-CQ352B

Table 1: Affected Part Numbers

RTAX2000D-LGD1272E	RTAX4000D-CGD1272E	RTAX4000D-CQ352E
RTAX2000D-LGD1272EV	RTAX4000D-CGD1272EV	RTAX4000D-CQ352EV
RTAX2000D-LGD1272PROTO	RTAX4000D-CGD1272PROTO	RTAX4000D-CQ352PROTO
RTAX2000D-1CGD1272B	RTAX2000D-1CQ352B	RTAX4000D-1LGD1272B
RTAX2000D-1CGD1272E	RTAX2000D-1CQ352E	RTAX4000D-1LGD1272E
RTAX2000D-1CGD1272EV	RTAX2000D-1CQ352EV	RTAX4000D-1LGD1272EV
RTAX2000D-1CGD1272PROTO	RTAX2000D-1CQ352PROTO	RTAX4000D-1LGD1272PROTO
RTAX2000D-1LGD1272B	RTAX4000D-1CGD1272B	RTAX4000D-1CQ352B
RTAX2000D-1LGD1272E	RTAX4000D-1CGD1272E	RTAX4000D-1CQ352E
RTAX2000D-1LGD1272EV	RTAX4000D-1CGD1272EV	RTAX4000D-1CQ352EV
RTAX2000D-1LGD1272PROTO	RTAX4000D-1CGD1272PROTO	RTAX4000D-1CQ352PROTO