

July 29, 2010

PCN Number: 1013

PCN Change Level: Minor

Subject: RTAX-S/SL and AX Enhanced Minimum Delay (EMD)

Dear Customer,

We have recently discovered an inaccuracy in Actel's Libero® Integrated Design Environment (IDE) static timing analysis tool, SmartTime, which can cause inaccurate reporting of timing characteristics for RTAX-S/SL and Axcelerator® devices under specific circumstances. The software inaccuracy is described below along with a suggested workaround.

Description of the Issue

Enhanced Minimum Delay (EMD) is a delay calculation methodology introduced in Actel's static timing analysis to compute lower bound delays on gates and nets. This is necessary for a conservative hold check (minimum delay analysis) during which the tightest timing margin (slack) is computed.

During a hold check with EMD, SmartTime is not able to compute the tightest timing margin (slack) for the following conditions:

- A *reg-to-reg* hold analysis on paths using an opposite edge clocking scheme
- An external hold analysis with an external source register and internal sink register using an opposite edge clocking scheme

Inaccurate timing numbers are returned only for minimum delay calculation under worst case operating conditions. The other conditions (minimum delay, best case; maximum delay, best case; maximum delay, worst case) return accurate results.

It is important to note that this inaccuracy does not occur on an undetected violated timing path unless the clock is using regular routing resources (not dedicated globals) and the skew is at larger than half a period.

The following is an example illustrating the problem:

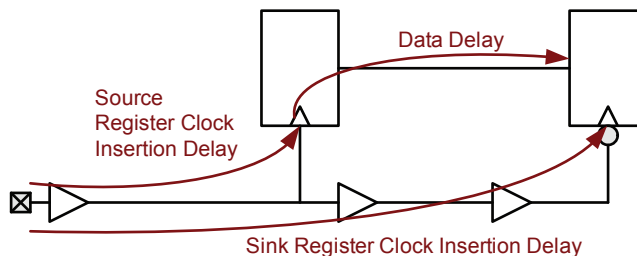


Figure 1. Sample Design

In this example, the hold time check will be the following:

- Arrival time is equal to the clock insertion delay to the source register plus data path delay.
- Required time is the clock constraint plus the clock insertion delay of the sink register plus hold time of the sink register.
- Clock constraint is the delay difference between the launching edge and the edge prior to the capturing edge. For a 50% duty cycle clock, it is equal to $T/2$ if T is the clock period.
- Slack is equal to the arrival time minus the required time.

Table 1 shows the results for different operating conditions on an implementation of this design on a RTAX250S/SL STD, with MIL operating conditions and the required clock period set to 100 MHz (delays are in ns).

Table 1. Analysis Results

Operating Conditions	EMD	Arrival	Sink Clock Insertion	Clock Constraint	Hold	Required	Slack
Best	Y	1.458	1.652	-5.000	0	-3.348	4.806
Worst	Y	2.689	2.849	-5.000	0	-2.151	4.840
Worst	N	4.713	5.038	-5.000	0	0.038	4.675

Because the clock constraint is fixed (does not change with operating conditions), higher slack results when higher delays are used; the worst slack results when there is no EMD (last row). Therefore, EMD must be turned off to obtain the worst slack.

Workaround

Actel recommends that customers perform timing analysis at all four corners – minimum delay, best case; minimum delay, worst case; maximum delay, best case; maximum delay, worst case. Using the Enhanced Min Delay tool is recommended for all of these with the exception of minimum delays, worst case. For this case, Actel recommends disabling the Enhanced Min Delay tool and performing timing analysis using SmartTime *without* the Enhanced Min Delay feature.

To turn off EMD, customers can set the **EMD_70200rts** variable to 0 in Designer by selecting **Options > Variable Console** and clicking **Set value**.

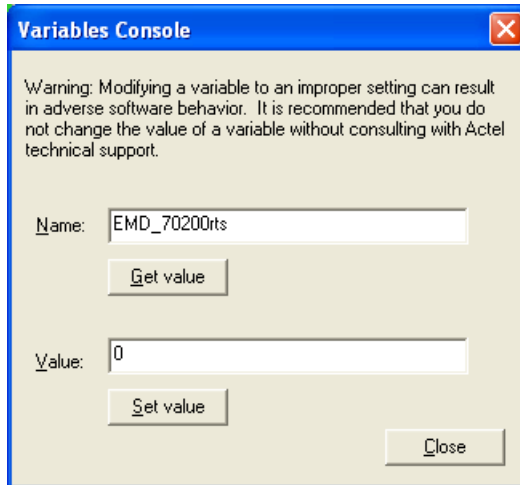


Figure 2. Variables Console in Designer

To re-enable EMD, close SmartTime and Designer, set the same variable to 1, and then restart Designer and SmartTime. This variable must be set before SmartTime is started for it to be effective. To verify whether EMD is being used, check the Summary in the GUI or the header of any report to see if "Using Enhanced Min Delay" is mentioned.

The following is a list of affected devices.

Table 2. Affected Devices

AX1000		
AX1000-1BG729	AX1000-1FGG896I	AX1000-BGG729I
AX1000-1BG729I	AX1000-1FGG896M	AX1000-BGG729M
AX1000-1BG729M	AX1000-1LG624M	AX1000-CGS624M
AX1000-1BGG729	AX1000-2BG729	AX1000-CQ352M
AX1000-1BGG729I	AX1000-2BG729I	AX1000-FG484
AX1000-1BGG729M	AX1000-2BGG729	AX1000-FG484I
AX1000-1CGS624M	AX1000-2BGG729I	AX1000-FG484M
AX1000-1CQ352M	AX1000-2FG484	AX1000-FG676
AX1000-1FG484	AX1000-2FG484I	AX1000-FG676I
AX1000-1FG484I	AX1000-2FG676	AX1000-FG676M
AX1000-1FG484M	AX1000-2FG676I	AX1000-FG896

Table 2. Affected Devices (continued)

AX1000-1FG676	AX1000-2FG896	AX1000-FG896I
AX1000-1FG676I	AX1000-2FG896I	AX1000-FG896M
AX1000-1FG676M	AX1000-2FGG484	AX1000-FGG484
AX1000-1FG896	AX1000-2FGG484I	AX1000-FGG484I
AX1000-1FG896I	AX1000-2FGG676	AX1000-FGG484M
AX1000-1FG896M	AX1000-2FGG676I	AX1000-FGG676
AX1000-1FGG484	AX1000-2FGG896	AX1000-FGG676I
AX1000-1FGG484I	AX1000-2FGG896I	AX1000-FGG676M
AX1000-1FGG484M	AX1000-BG729	AX1000-FGG896
AX1000-1FGG676	AX1000-BG729I	AX1000-FGG896I
AX1000-1FGG676I	AX1000-BG729M	AX1000-FGG896M
AX1000-1FGG676M	AX1000-BGG729	AX1000-LG624M
AX1000-1FGG896		
AX125		
AX125-1CS180	AX125-2CS180	AX125-CS180
AX125-1CS180I	AX125-2CS180I	AX125-CS180I
AX125-1CSG180	AX125-2CSG180	AX125-CSG180
AX125-1CSG180I	AX125-2CSG180I	AX125-CSG180I
AX125-1FG256	AX125-2FG256	AX125-FG256
AX125-1FG256I	AX125-2FG256I	AX125-FG256I
AX125-1FG324	AX125-2FG324	AX125-FG324
AX125-1FG324I	AX125-2FG324I	AX125-FG324I
AX125-1FGG256	AX125-2FGG256	AX125-FGG256
AX125-1FGG256I	AX125-2FGG256I	AX125-FGG256I
AX125-1FGG324	AX125-2FGG324	AX125-FGG324
AX125-1FGG324I	AX125-2FGG324I	AX125-FGG324I
AX2000		
AX2000-1CGS624M	AX2000-1FGG896M	AX2000-FG1152
AX2000-1CQ256M	AX2000-1LG624M	AX2000-FG1152I
AX2000-1CQ352M	AX2000-2FG1152	AX2000-FG1152M
AX2000-1FG1152	AX2000-2FG1152I	AX2000-FG896
AX2000-1FG1152I	AX2000-2FG896	AX2000-FG896I
AX2000-1FG1152M	AX2000-2FG896I	AX2000-FG896M
AX2000-1FG896	AX2000-2FGG1152	AX2000-FGG1152
AX2000-1FG896I	AX2000-2FGG1152I	AX2000-FGG1152I
AX2000-1FG896M	AX2000-2FGG896	AX2000-FGG1152M

Table 2. Affected Devices (continued)

AX2000-1FGG1152	AX2000-2FGG896I	AX2000-FGG896
AX2000-1FGG1152I	AX2000-CGS624M	AX2000-FGG896I
AX2000-1FGG1152M	AX2000-CQ256M	AX2000-FGG896M
AX2000-1FGG896	AX2000-CQ352M	AX2000-LG624M
AX2000-1FGG896I		
AX250		
AX250-1CQ208M	AX250-1PQG208I	AX250-FG256I
AX250-1CQ352M	AX250-1PQG208M	AX250-FG256M
AX250-1FG256	AX250-2FG256	AX250-FG484
AX250-1FG256I	AX250-2FG256I	AX250-FG484I
AX250-1FG256M	AX250-2FG484	AX250-FG484M
AX250-1FG484	AX250-2FG484I	AX250-FGG256
AX250-1FG484I	AX250-2FGG256	AX250-FGG256I
AX250-1FG484M	AX250-2FGG256I	AX250-FGG256M
AX250-1FGG256	AX250-2FGG484	AX250-FGG484
AX250-1FGG256I	AX250-2FGG484I	AX250-FGG484I
AX250-1FGG256M	AX250-2PQ208	AX250-FGG484M
AX250-1FGG484	AX250-2PQ208I	AX250-PQ208
AX250-1FGG484I	AX250-2PQG208	AX250-PQ208I
AX250-1FGG484M	AX250-2PQG208I	AX250-PQ208M
AX250-1PQ208	AX250-CQ208M	AX250-PQG208
AX250-1PQ208I	AX250-CQ352M	AX250-PQG208I
AX250-1PQ208M	AX250-FG256	AX250-PQG208M
AX250-1PQG208		
AX500		
AX500-1CQ208M	AX500-1PQG208I	AX500-FG484I
AX500-1CQ352M	AX500-1PQG208M	AX500-FG484M
AX500-1FG484	AX500-2FG484	AX500-FG676
AX500-1FG484I	AX500-2FG484I	AX500-FG676I
AX500-1FG484M	AX500-2FG676	AX500-FG676M
AX500-1FG676	AX500-2FG676I	AX500-FGG484
AX500-1FG676I	AX500-2FGG484	AX500-FGG484I
AX500-1FG676M	AX500-2FGG484I	AX500-FGG484M
AX500-1FGG484	AX500-2FGG676	AX500-FGG676
AX500-1FGG484I	AX500-2FGG676I	AX500-FGG676I
AX500-1FGG484M	AX500-2PQ208	AX500-FGG676M

Table 2. Affected Devices (continued)

AX500-1FGG676	AX500-2PQ208I	AX500-PQ208
AX500-1FGG676I	AX500-2PQG208	AX500-PQ208I
AX500-1FGG676M	AX500-2PQG208I	AX500-PQ208M
AX500-1PQ208	AX500-CQ208M	AX500-PQG208
AX500-1PQ208I	AX500-CQ352M	AX500-PQG208I
AX500-1PQ208M	AX500-FG484	AX500-PQG208M
AX500-1PQG208		
RTAX1000S		
5962-0422001QUA	5962-0422008QXC	RTAX1000SL-1CGS624B
5962-0422001QXC	5962-0422008QYC	RTAX1000SL-1CGS624E
5962-0422001QYC	RTAX1000S-1CG624PROTO	RTAX1000SL-1CGS624EV
5962-0422002QUA	RTAX1000S-1CGS624B	RTAX1000SL-1CQ352B
5962-0422002QXC	RTAX1000S-1CGS624E	RTAX1000SL-1CQ352E
5962-0422002QYC	RTAX1000S-1CGS624EV	RTAX1000SL-1CQ352EV
5962-0422003QUA	RTAX1000S-1CQ352B	RTAX1000SL-1LG624B
5962-0422003QXC	RTAX1000S-1CQ352E	RTAX1000SL-1LG624E
5962-0422003QYC	RTAX1000S-1CQ352EV	RTAX1000SL-1LG624EV
5962-0422004QUA	RTAX1000S-1CQ352PROTO	RTAX1000SL-CGS624B
5962-0422004QXC	RTAX1000S-1LG624B	RTAX1000SL-CGS624E
5962-0422004QYC	RTAX1000S-1LG624E	RTAX1000SL-CGS624EV
5962-0422005QUA	RTAX1000S-1LG624EV	RTAX1000SL-CQ352B
5962-0422005QXC	RTAX1000S-1LG624PROTO	RTAX1000SL-CQ352E
5962-0422005QYC	RTAX1000S-CG624PROTO	RTAX1000SL-CQ352EV
5962-0422006QUA	RTAX1000S-CGS624B	RTAX1000SL-LG624B
5962-0422006QXC	RTAX1000S-CGS624E	RTAX1000SL-LG624E
5962-0422006QYC	RTAX1000S-CGS624EV	RTAX1000SL-LG624EV
5962-0422007QUA	RTAX1000S-CQ352B	RTAX1000SL-LG624PROTO
5962-0422007QXC	RTAX1000S-CQ352E	RTAX1000SL-LG624B
5962-0422007QYC	RTAX1000S-CQ352EV	RTAX1000SL-LG624E
5962-0422008QUA	RTAX1000S-CQ352PROTO	RTAX1000SL-LG624EV
RTAX2000S		
5962-0422101QMC	5962-0422108QTA	RTAX2000SL-1CG1152B
5962-0422101QNA	5962-0422108QUC	RTAX2000SL-1CG1152E
5962-0422101QTA	5962-0422108QXC	RTAX2000SL-1CG1152EV
5962-0422101QUC	5962-0422108QYC	RTAX2000SL-1CGS624B
5962-0422101QXC	RTAX2000S-1CG1152B	RTAX2000SL-1CGS624E

Table 2. Affected Devices (continued)

5962-0422101QYC	RTAX2000S-1CG1152E	RTAX2000SL-1CGS624EV
5962-0422102QMC	RTAX2000S-1CG1152EV	RTAX2000SL-1CQ256B
5962-0422102QNA	RTAX2000S-1CG1152PROTO	RTAX2000SL-1CQ256E
5962-0422102QTA	RTAX2000S-1CG624PROTO	RTAX2000SL-1CQ256EV
5962-0422102QUC	RTAX2000S-1CGS624B	RTAX2000SL-1CQ352B
5962-0422102QXC	RTAX2000S-1CGS624E	RTAX2000SL-1CQ352E
5962-0422102QYC	RTAX2000S-1CGS624EV	RTAX2000SL-1CQ352EV
5962-0422103QMC	RTAX2000S-1CQ256B	RTAX2000SL-1LG1152B
5962-0422103QNA	RTAX2000S-1CQ256E	RTAX2000SL-1LG1152E
5962-0422103QTA	RTAX2000S-1CQ256EV	RTAX2000SL-1LG1152EV
5962-0422103QUC	RTAX2000S-1CQ256PROTO	RTAX2000SL-1LG624B
5962-0422103QXC	RTAX2000S-1CQ352B	RTAX2000SL-1LG624E
5962-0422103QYC	RTAX2000S-1CQ352E	RTAX2000SL-1LG624EV
5962-0422104QMC	RTAX2000S-1CQ352EV	RTAX2000SL-CG1152B
5962-0422104QNA	RTAX2000S-1CQ352PROTO	RTAX2000SL-CG1152E
5962-0422104QTA	RTAX2000S-1LG1152B	RTAX2000SL-CG1152EV
5962-0422104QUC	RTAX2000S-1LG1152E	RTAX2000SL-CGS624B
5962-0422104QXC	RTAX2000S-1LG1152EV	RTAX2000SL-CGS624E
5962-0422104QYC	RTAX2000S-1LG1152PROTO	RTAX2000SL-CGS624EV
5962-0422105QMC	RTAX2000S-1LG624B	RTAX2000SL-CQ256B
5962-0422105QNA	RTAX2000S-1LG624E	RTAX2000SL-CQ256E
5962-0422105QTA	RTAX2000S-1LG624EV	RTAX2000SL-CQ256EV
5962-0422105QUC	RTAX2000S-1LG624PROTO	RTAX2000SL-CQ352B
5962-0422105QXC	RTAX2000S-CG1152B	RTAX2000SL-CQ352E
5962-0422105QYC	RTAX2000S-CG1152E	RTAX2000SL-CQ352EV
5962-0422106QMC	RTAX2000S-CG1152EV	RTAX2000SL-LG1152B
5962-0422106QNA	RTAX2000S-CG1152PROTO	RTAX2000SL-LG1152E
5962-0422106QTA	RTAX2000S-CG624PROTO	RTAX2000SL-LG1152EV
5962-0422106QUC	RTAX2000S-CGS624B	RTAX2000SL-LG1152PROTO
5962-0422106QXC	RTAX2000S-CGS624E	RTAX2000SL-LG624B
5962-0422106QYC	RTAX2000S-CGS624EV	RTAX2000SL-LG624E
5962-0422107QMC	RTAX2000S-CQ256B	RTAX2000SL-LG624EV
5962-0422107QNA	RTAX2000S-CQ256E	RTAX2000SL-LG624PROTO
5962-0422107QTA	RTAX2000S-CQ256EV	RTAX2000SL-LG1152B
5962-0422107QUC	RTAX2000S-CQ256PROTO	RTAX2000SL-LG1152E
5962-0422107QXC	RTAX2000S-CQ352B	RTAX2000SL-LG1152EV

Table 2. Affected Devices (continued)

5962-0422107QYC	RTAX2000S-CQ352E	RTAX2000SL-LG624B
5962-0422108QMC	RTAX2000S-CQ352EV	RTAX2000SL-LG624E
5962-0422108QNA	RTAX2000S-CQ352PROTO	RTAX2000SL-LG624EV
RTAX250S		
5962-0421901QUA	5962-0421908QYC	RTAX250S-CQ352PROTO
5962-0421901QXC	5962-0421908QZC	RTAX250SL-1CG624B
5962-0421901QYC	RTAX250S-1CG624B	RTAX250SL-1CG624E
5962-0421901QZC	RTAX250S-1CG624E	RTAX250SL-1CG624EV
5962-0421902QUA	RTAX250S-1CG624EV	RTAX250SL-1CQ208B
5962-0421902QXC	RTAX250S-1CG624PROTO	RTAX250SL-1CQ208E
5962-0421902QYC	RTAX250S-1CQ208B	RTAX250SL-1CQ208EV
5962-0421902QZC	RTAX250S-1CQ208E	RTAX250SL-1CQ352B
5962-0421903QUA	RTAX250S-1CQ208EV	RTAX250SL-1CQ352E
5962-0421903QXC	RTAX250S-1CQ208PROTO	RTAX250SL-1CQ352EV
5962-0421903QYC	RTAX250S-1CQ352B	RTAX250SL-1LG624B
5962-0421903QZC	RTAX250S-1CQ352E	RTAX250SL-1LG624E
5962-0421904QUA	RTAX250S-1CQ352EV	RTAX250SL-1LG624EV
5962-0421904QXC	RTAX250S-1CQ352PROTO	RTAX250SL-CG624B
5962-0421904QYC	RTAX250S-1LG624B	RTAX250SL-CG624E
5962-0421904QZC	RTAX250S-1LG624E	RTAX250SL-CG624EV
5962-0421905QUA	RTAX250S-1LG624EV	RTAX250SL-CQ208B
5962-0421905QXC	RTAX250S-1LG624PROTO	RTAX250SL-CQ208E
5962-0421905QYC	RTAX250S-CG624B	RTAX250SL-CQ208EV
5962-0421905QZC	RTAX250S-CG624E	RTAX250SL-CQ352B
5962-0421906QUA	RTAX250S-CG624EV	RTAX250SL-CQ352E
5962-0421906QXC	RTAX250S-CG624PROTO	RTAX250SL-CQ352EV
5962-0421906QYC	RTAX250S-CQ208B	RTAX250SL-LG624B
5962-0421906QZC	RTAX250S-CQ208E	RTAX250SL-LG624E
5962-0421907QUA	RTAX250S-CQ208EV	RTAX250SL-LG624EV
5962-0421907QXC	RTAX250S-CQ208PROTO	RTAX250SL-LG624PROTO
5962-0421907QYC	RTAX250S-CQ352B	RTAX250SL-LG624B
5962-0421907QZC	RTAX250S-CQ352E	RTAX250SL-LG624E
5962-0421908QUA	RTAX250S-CQ352EV	RTAX250SL-LG624EV
5962-0421908QXC		

Table 2. Affected Devices (continued)

RTAX4000S		
RTAX4000S-1CG1272B	RTAX4000S-CG1272EV	RTAX4000SL-1LG1272EV
RTAX4000S-1CG1272E	RTAX4000S-CG1272PROTO	RTAX4000SL-CG1272B
RTAX4000S-1CG1272EV	RTAX4000S-CQ352B	RTAX4000SL-CG1272E
RTAX4000S-1CG1272PROTO	RTAX4000S-CQ352E	RTAX4000SL-CG1272EV
RTAX4000S-1CQ352B	RTAX4000S-CQ352EV	RTAX4000SL-CQ352B
RTAX4000S-1CQ352E	RTAX4000S-CQ352PROTO	RTAX4000SL-CQ352E
RTAX4000S-1CQ352EV	RTAX4000SL-1CG1272B	RTAX4000SL-CQ352EV
RTAX4000S-1CQ352PROTO	RTAX4000SL-1CG1272E	RTAX4000S-LG1272B
RTAX4000S-1LG1272B	RTAX4000SL-1CG1272EV	RTAX4000S-LG1272E
RTAX4000S-1LG1272E	RTAX4000SL-1CQ352B	RTAX4000S-LG1272EV
RTAX4000S-1LG1272EV	RTAX4000SL-1CQ352E	RTAX4000S-LG1272PROTO
RTAX4000S-1LG1272PROTO	RTAX4000SL-1CQ352EV	RTAX4000SL-LG1272B
RTAX4000S-CG1272B	RTAX4000SL-1LG1272B	RTAX4000SL-LG1272E
RTAX4000S-CG1272E	RTAX4000SL-1LG1272E	RTAX4000SL-LG1272EV

Long Term Solution

Actel is working to improve this issue of inaccurate timing results returned when Enhanced Min Delays are enabled for minimum delay, worst case conditions. We expect that accurate results will be provided in software versions beginning with Libero IDE v9.0 SP2, to be released in August 2010.

If you have any additional questions, please do not hesitate to contact Actel's ITAR Technical support at <http://www.actel.com/mycases> or tech_itar@actel.com.

Yours Sincerely,

Actel Corporation