Additional Test Site for Xilinx Automotive Spartan-3 FPGA Families

Qualification Report

RPT111 (v1.0) March 1, 2010

XILINX®

Revision History

The following table shows the revision history for this document.

Date	Version	Revision
03/01/10	1.0	Initial Xilinx release.

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Additional Test Site for Xilinx Automotive Spartan-3 FPGA Families

Overview

This qualification report provides a data summary for Amkor Technology Philippines (ATP) qualification as an additional test site for Xilinx® Automotive (XA) Spartan®-3 FPGA families. (The Spartan-3 FPGA families consist of the Spartan-3, Spartan-3E, Spartan-3A, and Spartan-3A DSP FPGAs.) For more information regarding this change, refer to XCN10001, *Additional Test Site for Xilinx Automotive (XA) Spartan-3/-3E/-3A/-3A DSP Devices* released on March 1, 2010.

Qualification Data

Test Purposes

The purposes of this test are:

- To qualify Amkor Technology Philippines (ATP) as a test site for XA Spartan-3 FPGA families
- To provide an additional test site to the existing Siliconware Precision Industries Co., Ltd. (SPIL) test site in Taiwan and Xilinx Singapore (XAP) for XA Spartan-3 FPGA families to allow supply continuity

The devices affected by this qualification are the XA Spartan-3, Spartan-3E, Spartan-3A, and Spartan-3A DSP families including all subsequent versions under specification control document (SCD) numbers.

Qualifications Plan and Results

Qualifications Plan

The qualification requirements for automotive devices are:

- Site-to-site comparison:
  - Ten devices from one lot are needed to compare the performance of the site to be qualified with the reference test sites. (The XC3S500E device is selected for this assessment.)

- Qualification run:
  - Three lots are needed (one each of the Spartan-3E, Spartan-3A, and Spartan-3A DSP devices) to complete the qualification:
    - Bin-to-bin correlation is performed
    - Parametric comparison is performed
  - The Spartan-3 device is covered by the Spartan-3E device for qualification purposes. The Spartan-3 and Spartan-3E device product designs and processes are similar. The Spartan-3E device is a superset of the Spartan-3 device in terms of product features.

Additional data points are:

- ATP was also qualified to test commercial/industrial XC Spartan-3 FPGA families in 2008.
- Testers and test programs in ATP are correlated to the same tester platforms and programs with XAP.

The criterion for qualification is:

- Critical parametric performance should be within ±5%.

Qualification Results

Correlation of 10 units at 100°C between XAP and ATP using XA3S500E devices showed that the critical parameters are between ±5% and meet Xilinx specifications (see Table 1 and Table 2).

Table 1: **Correlation Data between XAP and ATP Using XA3S500E Devices (Units 1 through 5)**

Parameter	Unit 1			Unit 2			Unit 3			Unit 4			Unit 5		
	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)
$I_{CCSTDBY}$ (mA)	33.07	33.09	–0.07	26.25	26.55	1.14	33.88	35.38	–4.44	35.00	35.60	–1.71	37.58	37.50	0.22
$I_{CCOSTDBY}$ (µA)	178.70	174.43	2.39	156.22	159.34	1.96	166.52	172.80	–3.77	187.95	181.18	3.61	163.21	156.03	4.40
$I_{CCAUXSTDBY}$ (mA)	18.94	18.90	0.18	17.75	17.81	0.35	19.13	19.32	–1.02	18.97	19.01	–0.25	19.12	19.05	0.35
TILO_NW_f (ns)	18.22	18.19	0.16	19.66	19.62	–0.20	18.29	18.21	0.44	17.76	17.80	–0.23	18.30	18.27	0.16
TILO_NW_r (ns)	14.52	14.49	0.21	15.92	15.89	–0.19	14.74	14.68	0.41	14.21	14.23	–0.14	14.80	14.78	0.14

Table 2: **Correlation Data between XAP and ATP Using XA3S500E Devices (Units 6 through 10)**

Parameter	Unit 6			Unit 7			Unit 8			Unit 9			Unit 10		
	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)
$I_{CCSTDBY}$ (mA)	32.07	32.71	–2.01	34.09	34.33	–0.70	35.70	36.62	–2.57	38.10	39.51	–3.71	22.44	22.90	–2.06
$I_{CCOSTDBY}$ (µA)	168.78	162.89	3.49	178.80	171.89	3.87	192.04	189.71	1.21	172.14	172.39	–0.14	165.55	169.85	–2.60

Table 2: **Correlation Data between XAP and ATP Using XA3S500E Devices (Units 6 through 10) *(Cont'd)***

Parameter	Unit 6			Unit 7			Unit 8			Unit 9			Unit 10		
	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)	ATP	XAP	Delta (%)
$I_{CCAUXSTDBY}$ (mA)	18.88	18.92	–0.19	18.95	18.92	0.13	19.40	19.45	–0.25	19.37	19.50	–0.69	17.11	17.14	–0.15
TILO_NW_f (ns)	18.88	18.89	–0.05	17.91	17.92	–0.06	18.16	18.11	0.28	18.45	18.41	0.22	19.57	19.54	0.15
TILO_NW_r (ns)	15.24	15.24	0.00	14.46	14.47	–0.07	14.54	14.52	0.14	14.84	14.81	0.20	16.16	16.14	0.12

In the correlation of three lots tested in XAP and ATP, all units passed at both facilities. No bin switching was observed.

Table 3 shows the correlation results for the XA3S500E device tested with the XA I-grade requirement at 100°C T_J.

Table 3: **XA3S500E Device Tested with XA I-Grade at 100°C T_J**

Facility	$I_{CCAUXSTDBY}$ (mA)		$I_{CCOSTDBY}$ (µA)		$I_{CCSTDBY}$ (mA)		TILO_NW_f (ns)		TILO_NW_r (ns)	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
XAP	18.61576	0.81227	171.64873	12.03975	32.07115	5.63803	18.46173	1.78074	14.91323	1.48244
ATP	18.64651	0.83043	173.70376	14.17660	32.07205	5.74599	18.50150	1.78281	14.93843	1.48332

Table 4 shows the correlation results for the XA3S400A device tested with the XA Q-grade requirement at 125°C T_J.

Table 4: **XA3S400A Device Tested with XA Q-Grade at 125°C T_J**

Facility	$I_{CCAUXSTDBY}$ (mA)		$I_{CCOSTDBY}$ (µA)		$I_{CCSTDBY}$ (mA)		TILO_NW_f (ns)		TILO_NW_r (ns)	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
XAP	16.63743	1.46137	196.68327	27.11353	64.50923	10.81282	18.58621	0.50745	14.90545	0.48498
ATP	16.62562	1.46297	195.94699	26.97062	64.40917	10.76042	18.58549	0.50738	14.90431	0.48458

Table 5 shows the correlation results for the XA3SD3400A device tested with the XA I-grade requirement at 100°C T_J.

Table 5: **XA3SD3400A Device Tested with XA I-Grade at 100°C T_J**

Facility	$I_{CCAUXSTDBY}$ (mA)		$I_{CCOSTDBY}$ (µA)		$I_{CCSTDBY}$ (mA)		TILO_NW_f (ns)		TILO_NW_r (ns)	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
XAP	83.40157	6.17789	238.58365	25.66676	251.54851	55.52225	18.49430	0.55128	14.85874	0.54100
ATP	84.89981	6.45197	242.88595	22.81469	263.44079	58.10100	18.34491	0.55164	14.72137	0.53845

Comparison with Results of SPIL-XAP Qualification

Correlation of 10 units at 125°C between SPIL and XAP using the XA3S1000-4FGG456Q device showed that the critical parameters are between ±5% and meet Xilinx specifications (see Table 6 and Table 7).

Table 6: **Correlation Data between SPIL and XAP Using XA3S1000 Devices (Units 1 through 5)**

Parameter	Unit 1			Unit 2			Unit 3			Unit 4			Unit 5		
	SPIL	XAP	Delta (%)	SPIL	XAP	Delta (%)	SPIL	XAP	Delta (%)	SPIL	XAP	Delta (%)	SPIL	XAP	Delta (%)
I_{BYCO} (mA)	90.12	89.51	0.67	71.19	70.75	0.61	54.71	56.49	–3.27	84.71	83.79	1.09	124.45	125.86	–1.13
I_{BYIO1} (mA)	1.10	1.12	–1.95	0.99	1.00	–0.82	1.00	1.03	–3.07	1.01	1.02	–1.11	1.09	1.11	–2.01
I_{BYIO2} (mA)	1.11	1.12	–1.25	0.99	1.00	–0.74	0.99	1.03	–4.32	1.01	1.01	0.13	1.08	1.11	–2.51
I_{BYAUX} (mA)	37.53	37.30	0.62	36.30	36.37	–0.19	32.99	33.39	–1.22	36.89	36.70	0.52	42.49	42.96	–1.10
TILO_NW_f (ns)	16.90	16.97	–0.41	17.81	17.85	–0.22	18.28	18.36	–0.44	16.94	16.99	–0.30	16.16	16.16	0.00
TILO_NW_r (ns)	13.33	13.39	–0.45	14.27	14.34	–0.49	14.81	14.87	–0.41	13.52	13.56	–0.30	12.67	12.68	–0.08

Table 7: **Correlation Data between SPIL and XAP Using XA3S1000 Devices (Units 6 through 10)**

Parameter	Unit 6			Unit 7			Unit 8			Unit 9			Unit 10		
	SPIL	XAP	Delta (%)	SPIL	XAP	Delta (%)	SPIL	XAP	Delta (%)	SPIL	XAP	Delta (%)	SPIL	XAP	Delta (%)
I_{BYCO} (mA)	72.57	74.18	–2.22	67.45	66.50	1.41	108.22	106.45	1.64	67.66	69.94	–3.37	77.53	78.47	–1.21
I_{BYIO1} (mA)	1.03	1.07	–3.98	0.98	0.99	–1.61	1.14	1.13	0.77	1.00	1.04	–3.97	1.02	1.04	–1.94
I_{BYIO2} (mA)	1.04	1.07	–2.37	0.99	0.99	–0.16	1.13	1.13	0.44	1.01	1.05	–3.64	1.05	1.05	–0.21
I_{BYAUX} (mA)	36.17	36.70	–1.46	34.69	34.79	–0.29	40.65	40.52	0.32	35.68	36.29	–1.73	36.32	36.57	–0.70
TILO_NW_f (ns)	17.90	17.99	–0.50	18.10	18.12	–0.11	16.80	16.81	–0.06	18.38	18.44	–0.33	17.26	17.32	–0.35
TILO_NW_r (ns)	14.36	14.43	–0.49	14.53	14.58	–0.34	13.21	13.24	–0.23	14.83	14.89	–0.40	13.78	13.83	–0.36

In the correlation of one lot of the XA3S1000-4FGG456Q device tested with 729 units in SPIL and XAP:

- All units passed in SPIL and XAP. No bin switching was observed.
- Testing was also done at 125°C, confirming a good correlation.

Table 8 shows the results of this correlation.

Table 8: **Correlation Data between SPIL and XAP on 729 Units**

Facility	Sample Size	I_{BYCO} (mA)		I_{BYIO1} (mA)		I_{BYIO2} (mA)		I_{BYAUX} (mA)		TILO_NW_f (ns)		TILO_NW_r (ns)	
		Average	Std Dev	Average	Std Dev	Average	Std Dev	Average	Std Dev	Average	Std Dev	Average	Std Dev
SPIL	729	86.61835	21.01389	1.182572	0.076339	1.183172	0.075966	39.3819	3.015889	18.01424	0.634906	14.43786	0.617998
XAP	729	88.56504	20.37708	1.213315	0.069256	1.210915	0.070205	39.79102	2.922177	18.10211	0.637978	14.49989	0.619295

Conclusion

All tests pass the correlation criteria for qualification of the ATP test facility for XA Spartan-3 FPGA families. ATP is thus qualified as an additional test site for XA Spartan-3 FPGA families.