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# MPC5643L TSMC14 PRIMARY WAFER FAB SITE TRANSFER (PCN 16247)

## 1. Objective

This report describes the Taiwan Semiconductor Manufacturing Company Fab 14 (TSMC14) fab site for SPC5643L 100/144LQFP devices electrical distribution data on 20um PdCu wire versus baseline on 23um Au wire.

***Current Wire:***

23um Au wire

***Proposed New Wire:***

20um PdCu wire

## 2. General Information

Product Family: SPC5643L

Fab site: TSMC14

Mask set: N18H

Package(s): 100/144LQFP

Assembly Site: Freescale Kuala Lumpur, Kuala Lumpur, Malaysia

## 3. Method

Two data sets taken from selected key product, 30 units in each set at T0 analysis:

1. 30 units from 20um PdCu wire diameter qual lot from TSMC14 fab site
2. 30 units from 23um Au wire diameter control lot from ATMC fab site

Both qualification and control lots are tested to standard production final test flow. Electrical distribution data generated from the selected key parametric tests with Freescale standard criteria  $CPK > 1.67$  and  $shift \leq 15\%$ , justification will be provided if otherwise.

## 4. Data and Summary:

### 4.1. Electrical Distribution Table:

Selected Evaluation Vehicle: SPC5643L (144LQFP) N18H

The ED data from Selected Evaluation Vehicle will be representing the parts stated in section 2 General Information

Parameter Name, as in Datasheet	Units	Lower Spec Limit (NA if no spec)	Upper Spec Limit (NA if no spec)	ATMC Au			TSMC Cu			Shift within +/-1 sigma or less than 15% to spec	Shift within +/-1 sigma or less than 15% to spec	Comment
				Temp	145	C	Temp	145	C			
				Avg	Std	Cpk	Avg	Std	Cpk			
Input leakage current PB6	uA	-1	1	-0.1016	0.0142	21.14	-0.1028	0.0163	18.33	0.13%	0.11%	PASS
Input leakage current PB3	uA	-1	1	-0.0198	0.0036	91.41	-0.0200	0.0045	72.67	0.01%	0.01%	PASS
Input leakage current PB2	uA	-1	1	-0.0196	0.0037	88.14	-0.0201	0.0045	71.95	0.06%	0.06%	PASS
Input leakage current PB1	uA	-1	1	-0.0194	0.0034	95.70	-0.0197	0.0045	72.65	0.03%	0.03%	PASS
Input leakage current PC12	uA	-1	1	-0.0342	0.0043	75.43	-0.0301	0.0050	64.35	0.42%	0.40%	PASS
Input leakage current PC11	uA	-1	1	-0.0339	0.0043	74.60	-0.0304	0.0050	64.44	0.36%	0.34%	PASS
Input leakage current PE5	uA	-1	1	-0.0045	0.0006	588.37	-0.0044	0.0006	537.67	0.01%	0.01%	PASS
Input leakage current PE6	uA	-1	1	-0.0047	0.0007	453.45	-0.0045	0.0006	585.30	0.02%	0.02%	PASS
Input leakage current PE10	uA	-1	1	-0.0045	0.0004	740.45	-0.0042	0.0007	460.06	0.03%	0.03%	PASS
Input leakage current PA13	uA	-1	1	0.0168	0.0031	106.26	0.0107	0.0041	79.78	0.60%	0.62%	PASS
Input leakage current PA12	uA	-1	1	0.0361	0.0046	70.60	0.0306	0.0056	57.38	0.53%	0.57%	PASS
Input leakage current PA11	uA	-1	1	0.0376	0.0048	66.48	0.0313	0.0062	52.38	0.60%	0.65%	PASS
Input leakage current PB14	uA	-1	1	0.0024	0.0008	440.89	0.0050	0.0010	317.89	0.26%	0.26%	PASS
Input leakage current PB15	uA	-1	1	0.0026	0.0007	477.68	0.0049	0.0012	270.38	0.23%	0.23%	PASS
Input leakage current PC0	uA	-1	1	0.0020	0.0008	435.15	0.0051	0.0012	277.11	0.32%	0.32%	PASS
Input leakage current PC1	uA	-1	1	0.0027	0.0007	473.96	0.0054	0.0010	342.22	0.27%	0.27%	PASS
Input leakage current XTAL	uA	-1	1	-0.0162	0.0040	82.13	-0.0210	0.0074	44.02	0.48%	0.47%	PASS
Input leakage current XTAL	uA	-1	1	0.0061	0.0010	347.74	0.0050	0.0010	335.93	0.11%	0.11%	PASS
Input leakage current XTAL	uA	-1	1	0.0443	0.0044	71.74	0.0362	0.0086	37.21	0.77%	0.84%	PASS
Input leakage current XTAL	uA	-1	1	0.0275	0.0035	93.81	0.0220	0.0032	103.15	0.54%	0.58%	PASS
Slow, low level output voltage PB4_TDO	V	NA	0.5	0.2335	0.0020	44.26	0.2338	0.0021	41.53	NA	0.12%	PASS
Slow, low level output voltage PB5_TDI	V	NA	0.5	0.2359	0.0020	43.99	0.2371	0.0022	40.00	NA	0.46%	PASS
Medium, low level output voltage PB5_TDI	V	NA	0.5	0.1425	0.0013	88.81	0.1433	0.0014	83.22	NA	0.22%	PASS
Fast, high level output voltage PB4_TDO	V	NA	0.5	0.0443	0.0009	178.37	0.0441	0.0005	304.96	NA	0.05%	PASS
Slow, high level output voltage PB4_TDO	V	2.500	NA	2.6810	0.0028	21.23	2.6643	0.0019	29.42	9.22%	NA	PASS
Slow, high level output voltage PB5_TDI	V	2.500	NA	2.6760	0.0028	20.89	2.6581	0.0018	30.08	10.17%	NA	PASS
Medium, high level output voltage PB5_TDI	V	2.500	NA	2.7362	0.0020	39.06	2.7240	0.0013	59.17	5.19%	NA	PASS
Fast, high level output voltage PB4_TDO	V	2.500	NA	2.8419	0.0012	92.67	2.8391	0.0005	226.65	0.81%	NA	PASS
Slow, low level output voltage PB4_TDO	V	NA	0.5	0.2711	0.0022	34.95	0.2733	0.0023	33.16	NA	0.93%	PASS

Parameter Name, as in Datasheet	Units	Lower Spec Limit (NA if no spec)	Upper Spec Limit (NA if no spec)	ATMC Au			TSMC Cu			Shift within +/-1 sigma or less than 15% to spec	Shift within +/-1 sigma or less than 15% to spec	Comment
				Temp 145 C			Temp 145 C					
				Avg	Std	Cpk	Avg	Std	Cpk			
Slow, low level output voltage PB5_TDI	V	NA	0.5	0.2734	0.0023	33.16	0.2766	0.0024	31.64	NA	1.41%	PASS
Medium, low level output voltage PB5_TDI	V	NA	0.5	0.1643	0.0160	7.01	0.1554	0.0015	76.06	NA	2.65%	PASS
Fast, high level output voltage PB4_TDO	V	NA	0.5	0.0501	0.0042	35.86	0.0474	0.0004	336.50	NA	0.59%	PASS
Slow, high level output voltage PB4_TDO	V	2.500	NA	3.4729	0.0031	105.46	3.4531	0.0019	163.40	2.03%	NA	PASS
Slow, high level output voltage PB5_TDI	V	2.500	NA	3.4673	0.0030	106.19	3.4465	0.0020	159.02	2.16%	NA	PASS
Medium, high level output voltage PB5_TDI	V	2.500	NA	3.5415	0.0168	20.60	3.5391	0.0014	244.31	0.23%	NA	PASS
Fast, high level output voltage PB4_TDO	V	2.500	NA	3.4094	0.0303	9.99	3.4128	0.0033	92.96	0.37%	NA	PASS
Equivalent pull-up current PC10	uA	-130	NA	-27.4459	0.4438	77.03	-26.1326	0.6145	56.34	1.28%	NA	PASS
Equivalent pull-up current PC11	uA	-130	NA	-27.6362	0.5832	58.50	-25.6044	0.4355	79.90	1.98%	NA	PASS
Equivalent pull-up current PA13	uA	NA	-10	-45.8432	0.6601	18.10	-43.6504	0.5537	20.26	NA	6.12%	PASS
Equivalent pull-up current PA12	uA	NA	-10	-45.6181	0.8579	13.84	-42.8613	0.4504	24.32	NA	7.74%	PASS
Equivalent pull-up current PA11	uA	NA	-10	-45.4569	0.5576	21.20	-42.9262	0.5731	19.15	NA	7.14%	PASS
Equivalent pull-down current PA9	uA	10	NA	30.5519	0.5488	12.48	30.0040	0.4010	16.63	2.67%	NA	PASS
Equivalent pull-down current PA8	uA	10	NA	30.5108	0.4143	16.50	30.5157	0.4381	15.61	0.02%	NA	PASS
Equivalent pull-down current PA7	uA	10	NA	30.6089	0.4918	13.97	30.3814	0.4901	13.86	1.10%	NA	PASS
Equivalent pull-down current PG6	uA	NA	130	50.9519	0.5247	50.22	49.8355	0.4863	54.95	NA	1.41%	PASS
Equivalent pull-down current PG5	uA	NA	130	50.7052	0.5349	49.41	48.9510	0.7025	38.46	NA	2.21%	PASS
Equivalent pull-down current PG4	uA	NA	130	50.5064	0.6661	39.78	50.0302	0.4588	58.10	NA	0.60%	PASS
Input leakage current AN3_PC2	uA	-1	1	0.0944	0.0154	19.61	0.1593	0.0167	16.79	5.94%	7.18%	PASS
Input leakage current AN6_PE7	uA	-1	1	0.0936	0.0155	19.51	0.1594	0.0165	16.96	6.02%	7.26%	PASS
Input leakage current AN11_PB9	uA	-1	1	0.0959	0.0159	18.96	0.1640	0.0170	16.40	6.22%	7.54%	PASS
Input leakage current AN7_PE9	uA	-1	1	0.0933	0.0152	19.95	0.1613	0.0181	15.49	6.22%	7.50%	PASS
Input leakage current AN12_PB10	uA	-1	1	0.0957	0.0153	19.64	0.1663	0.0183	15.21	6.45%	7.81%	PASS
Input leakage current AN13_PB11	uA	-1	1	0.0953	0.0154	19.62	0.1661	0.0185	15.06	6.47%	7.83%	PASS
Offset error	LSB	-6	6	1.3263	0.8564	1.82	1.2922	0.3433	4.57	0.46%	0.73%	PASS
Total unadjusted error ADC0 neg test	LSB	-10	10	-0.7288	0.4370	7.07	-0.7870	0.3544	8.66	0.63%	0.54%	PASS
Total unadjusted error ADC0 pos test	LSB	-10	10	2.0900	0.8765	3.01	1.8169	0.3397	8.03	2.26%	3.45%	PASS
Total unadjusted error ADC1 neg test	LSB	-10	10	-0.7338	0.5553	5.56	-0.7961	0.2409	12.74	0.67%	0.58%	PASS
Total unadjusted error ADC1 pos test	LSB	-10	10	2.1463	0.8433	3.10	2.0247	0.3253	8.17	1.00%	1.55%	PASS
Signal-to-noise ratio	dB	67	NA	70.0190	0.1951	5.16	70.2163	0.1702	6.30	6.53%	NA	PASS
Operating current	mA	NA	318	234.0658	3.4861	8.03	250.1139	6.6704	3.39	NA	19.12%	Justify, TSMC14
Operating current in VDD STOP mode	mA	NA	105	27.2369	2.7463	9.44	41.2043	6.5698	3.24	NA	17.96%	avg is well within
Operating current in VDD HALT mode	mA	NA	115	34.6184	2.8091	9.54	49.8313	6.9494	3.13	NA	18.93%	limit
RC oscillator frequency (target 16MHz) LV	ns	58.75	66.25	62.5202	0.3014	4.12	63.1576	0.3053	3.38	16.91%	17.09%	Justify, avg different insignificant, < 1ns
RC oscillator frequency (target 16MHz) HV	ns	58.75	66.25	60.9179	0.3068	2.36	61.5681	0.3003	3.13	29.99%	12.20%	Justify, TSMC14 avg move towards center of limit

Parameter Name, as in Datasheet	Units	Lower Spec Limit (NA if no spec)	Upper Spec Limit (NA if no spec)	ATMC Au			TSMC Cu			Shift within +/-1 sigma or less than 15% to spec	Shift within +/-1 sigma or less than 15% to spec	Comment
				Temp	-40	C	Temp	-40	C			
				Avg	Std	Cpk	Avg	Std	Cpk			
Input leakage current PB6	uA	-1	1	-0.0001	0.0004	837.41	-0.0001	0.0003	1054.04	0.00%	0.00%	PASS
Input leakage current PB3	uA	-1	1	0.0001	0.0003	1006.51	-0.0001	0.0003	1093.78	0.02%	0.02%	PASS
Input leakage current PB2	uA	-1	1	0.0000	0.0004	939.19	0.0001	0.0004	869.65	0.01%	0.01%	PASS
Input leakage current PB1	uA	-1	1	-0.0002	0.0003	1186.16	-0.0001	0.0003	1086.35	0.01%	0.01%	PASS
Input leakage current PC12	uA	-1	1	0.0001	0.0003	987.99	0.0000	0.0003	983.32	0.01%	0.01%	PASS
Input leakage current PC11	uA	-1	1	0.0000	0.0003	1309.41	0.0000	0.0004	912.96	0.00%	0.00%	PASS
Input leakage current PE5	uA	-1	1	0.0001	0.0004	937.24	0.0000	0.0004	889.87	0.00%	0.00%	PASS
Input leakage current PE6	uA	-1	1	0.0002	0.0004	773.25	0.0001	0.0004	758.60	0.01%	0.01%	PASS
Input leakage current PE10	uA	-1	1	-0.0001	0.0003	1129.05	0.0001	0.0004	751.60	0.01%	0.01%	PASS
Input leakage current PA13	uA	-1	1	-0.0001	0.0004	919.88	0.0001	0.0005	622.05	0.01%	0.01%	PASS
Input leakage current PA12	uA	-1	1	0.0000	0.0007	483.20	-0.0001	0.0003	1075.01	0.01%	0.01%	PASS
Input leakage current PA11	uA	-1	1	-0.0002	0.0004	839.56	0.0001	0.0005	717.48	0.03%	0.03%	PASS
Input leakage current PB14	uA	-1	1	0.0001	0.0004	812.80	-0.0002	0.0005	678.37	0.03%	0.03%	PASS
Input leakage current PB15	uA	-1	1	0.0005	0.0008	400.75	-0.0001	0.0005	613.92	0.05%	0.05%	PASS
Input leakage current PC0	uA	-1	1	-0.0002	0.0004	779.60	-0.0001	0.0003	1038.81	0.01%	0.01%	PASS
Input leakage current PC1	uA	-1	1	0.0000	0.0005	738.88	-0.0001	0.0003	1154.27	0.00%	0.00%	PASS
Input leakage current EXTAL	uA	-1	1	0.0003	0.0004	890.59	-0.0001	0.0003	993.91	0.04%	0.04%	PASS
Input leakage current XTAL	uA	-1	1	0.0005	0.0003	1027.21	0.0002	0.0003	996.87	0.03%	0.03%	PASS
Input leakage current EXTAL	uA	-1	1	0.0003	0.0007	470.41	-0.0002	0.0005	627.74	0.05%	0.05%	PASS
Input leakage current XTAL	uA	-1	1	0.0005	0.0007	484.58	-0.0002	0.0005	731.85	0.07%	0.07%	PASS
Slow, low level output voltage PB4_TDO	V	NA	0.5	0.1375	0.0016	76.77	0.1310	0.0013	97.86	NA	1.79%	PASS
Slow, low level output voltage PB5_TDI	V	NA	0.5	0.1423	0.0037	31.92	0.1350	0.0014	89.12	NA	2.04%	PASS
Medium, low level output voltage PB5_TDI	V	NA	0.5	0.1109	0.0052	24.71	0.1043	0.0010	133.74	NA	1.69%	PASS
Fast, high level output voltage PB4_TDO	V	NA	0.5	0.0354	0.0011	139.68	0.0334	0.0007	220.34	NA	0.44%	PASS
Slow, high level output voltage PB4_TDO	V	2.500	NA	2.7579	0.0022	39.37	2.7515	0.0022	38.34	2.49%	NA	PASS
Slow, high level output voltage PB5_TDI	V	2.500	NA	2.7513	0.0035	23.72	2.7461	0.0020	41.43	2.07%	NA	PASS
Medium, high level output voltage PB5_TDI	V	2.500	NA	2.7661	0.0052	16.90	2.7627	0.0017	52.59	1.26%	NA	PASS
Fast, high level output voltage PB4_TDO	V	2.500	NA	2.8507	0.0016	71.81	2.8509	0.0009	131.48	0.04%	NA	PASS
Slow, low level output voltage PB4_TDO	V	NA	0.5	0.1677	0.0019	57.81	0.1614	0.0014	78.25	NA	1.91%	PASS
Slow, low level output voltage PB5_TDI	V	NA	0.5	0.1729	0.0049	22.36	0.1655	0.0015	71.99	NA	2.25%	PASS
Medium, low level output voltage PB5_TDI	V	NA	0.5	0.1433	0.0047	25.23	0.1310	0.0097	12.74	NA	3.45%	PASS
Fast, high level output voltage PB4_TDO	V	NA	0.5	0.0440	0.0010	155.45	0.0405	0.0025	60.47	NA	0.77%	PASS
Slow, high level output voltage PB4_TDO	V	2.500	NA	3.5533	0.0026	134.84	3.5441	0.0023	152.90	0.87%	NA	PASS
Slow, high level output voltage PB5_TDI	V	2.500	NA	3.5454	0.0046	76.43	3.5379	0.0023	147.48	0.71%	NA	PASS
Medium, high level output voltage PB5_TDI	V	2.500	NA	3.5472	0.0045	78.04	3.5483	0.0143	24.40	0.10%	NA	PASS
Fast, high level output voltage PB4_TDO	V	2.500	NA	3.4213	0.0080	38.61	3.4306	0.0237	13.09	1.01%	NA	PASS

				ATMC Au			TSMC Cu			Shift within +/-1 sigma or less than 15% to spec	Shift within +/-1 sigma or less than 15% to spec	Comment
Parameter Name, as in Datasheet	Units	Lower Spec Limit (NA if no spec)	Upper Spec Limit (NA if no spec)	Temp	-40	C	Temp	-40	C			
				Avg	Std	Cpk	Avg	Std	Cpk			
Equivalent pull-up current PC10	uA	-130	NA	-43.0167	0.8516	34.05	-42.6799	0.7055	41.26	0.39%	NA	PASS
Equivalent pull-up current PC11	uA	-130	NA	-44.0399	1.0085	28.41	-42.4028	0.6435	45.37	1.90%	NA	PASS
Equivalent pull-up current PA13	uA	NA	-10	-70.6560	1.1793	17.14	-68.7112	1.0019	19.53	NA	3.21%	PASS
Equivalent pull-up current PA12	uA	NA	-10	-71.7161	1.1932	17.24	-68.7628	0.8898	22.01	NA	4.79%	PASS
Equivalent pull-up current PA11	uA	NA	-10	-71.2744	1.1490	17.78	-69.0004	0.9033	21.77	NA	3.71%	PASS
Equivalent pull-down current PA9	uA	10	NA	54.4042	0.9694	15.27	53.9625	0.7394	19.82	0.99%	NA	PASS
Equivalent pull-down current PA8	uA	10	NA	54.8985	1.0113	14.80	54.2773	0.6700	22.03	1.38%	NA	PASS
Equivalent pull-down current PA7	uA	10	NA	55.3565	1.1101	13.62	54.1463	0.7578	19.42	2.67%	NA	PASS
Equivalent pull-down current PG6	uA	NA	130	90.7754	1.3861	9.43	89.2603	1.0439	13.01	NA	3.86%	PASS
Equivalent pull-down current PG5	uA	NA	130	91.1421	1.1916	10.87	88.6405	1.1431	12.06	NA	6.44%	PASS
Equivalent pull-down current PG4	uA	NA	130	90.9799	1.1702	11.11	89.1587	0.9763	13.94	NA	4.67%	PASS
Input leakage current AN3_PC2	uA	-1	1	-0.0003	0.0005	615.71	-0.0004	0.0003	1015.85	0.01%	0.01%	PASS
Input leakage current AN6_PE7	uA	-1	1	-0.0002	0.0010	333.89	-0.0001	0.0006	551.62	0.01%	0.01%	PASS
Input leakage current AN11_PB9	uA	-1	1	0.0000	0.0005	612.15	-0.0002	0.0007	472.25	0.02%	0.02%	PASS
Input leakage current AN7_PE9	uA	-1	1	0.0002	0.0010	317.46	-0.0002	0.0004	808.13	0.04%	0.04%	PASS
Input leakage current AN12_PB10	uA	-1	1	-0.0001	0.0008	440.60	-0.0003	0.0006	558.77	0.02%	0.02%	PASS
Input leakage current AN13_PB11	uA	-1	1	0.0001	0.0007	487.58	-0.0004	0.0006	589.42	0.05%	0.05%	PASS
Offset error	LSB	-6	6	1.8188	0.5049	2.76	1.3000	0.2095	7.48	6.63%	12.41%	PASS
Total unadjusted error ADC0 neg test	LSB	-10	10	-0.4025	0.8443	3.79	-0.4808	0.3272	9.70	0.82%	0.75%	PASS
Total unadjusted error ADC0 pos test	LSB	-10	10	2.4238	0.4667	5.41	1.7603	0.2218	12.39	5.34%	8.76%	PASS
Total unadjusted error ADC1 neg test	LSB	-10	10	-0.4288	0.5085	6.27	-0.3295	0.2423	13.30	1.04%	0.95%	PASS
Total unadjusted error ADC1 pos test	LSB	-10	10	2.4788	0.5486	4.57	1.9897	0.2631	10.15	3.92%	6.50%	PASS
Signal-to-noise ratio	dB	67	NA	70.3047	0.1840	5.99	70.7125	0.1565	7.91	12.34%	NA	PASS
Operating current	mA	NA	279	202.7459	3.8550	6.59	206.8069	1.9654	12.24	NA	5.33%	PASS
Operating current in VDD STOP mode	mA	NA	20	3.1164	0.0276	203.72	3.0055	0.0263	215.48	NA	0.66%	PASS
Operating current in VDD HALT mode	mA	NA	25	9.2991	0.0848	61.68	8.9659	0.0622	85.99	NA	2.12%	PASS
RC oscillator frequency (target 16MHz) LV	ns	58.75	66.25	64.4197	0.3280	1.86	64.0239	0.3522	2.11	6.98%	21.63%	Justify, TSMC14 avg move towards center of limit
RC oscillator frequency (target 16MHz) HV	ns	58.75	66.25	62.7324	0.3269	3.59	62.5029	0.3451	3.62	5.76%	6.53%	PASS

Parameter Name, as in Datasheet	Units	Lower Spec Limit (NA if no spec)	Upper Spec Limit (NA if no spec)	ATMC Au			TSMC Cu			Shift within +/-1 sigma or less than 15% to spec	Shift within +/-1 sigma or less than 15% to spec	Comment
				Temp	25	C	Temp	25	C			
				Avg	Std	Cpk	Avg	Std	Cpk			
Input leakage current PB6	uA	-1	1	-0.0003	0.0004	874.99	-0.0004	0.0004	865.65	0.01%	0.01%	PASS
Input leakage current PB3	uA	-1	1	0.0001	0.0004	909.82	0.0000	0.0003	1083.45	0.01%	0.01%	PASS
Input leakage current PB2	uA	-1	1	0.0000	0.0003	954.64	0.0001	0.0003	1041.09	0.01%	0.01%	PASS
Input leakage current PB1	uA	-1	1	-0.0002	0.0004	947.59	0.0000	0.0004	909.20	0.02%	0.02%	PASS
Input leakage current PC12	uA	-1	1	0.0000	0.0003	991.71	0.0000	0.0005	633.30	0.00%	0.00%	PASS
Input leakage current PC11	uA	-1	1	0.0000	0.0003	967.62	0.0001	0.0005	706.41	0.01%	0.01%	PASS
Input leakage current PE5	uA	-1	1	0.0001	0.0004	857.04	-0.0001	0.0004	834.90	0.02%	0.02%	PASS
Input leakage current PE6	uA	-1	1	0.0002	0.0004	777.81	-0.0001	0.0004	877.84	0.03%	0.03%	PASS
Input leakage current PE10	uA	-1	1	-0.0002	0.0003	1019.25	0.0002	0.0004	848.41	0.04%	0.04%	PASS
Input leakage current PA13	uA	-1	1	0.0000	0.0004	856.77	0.0001	0.0004	789.70	0.00%	0.00%	PASS
Input leakage current PA12	uA	-1	1	0.0000	0.0005	636.96	0.0000	0.0003	1042.29	0.01%	0.01%	PASS
Input leakage current PA11	uA	-1	1	0.0000	0.0004	951.45	0.0001	0.0004	834.90	0.02%	0.02%	PASS
Input leakage current PB14	uA	-1	1	0.0000	0.0004	770.24	-0.0001	0.0004	811.62	0.01%	0.01%	PASS
Input leakage current PB15	uA	-1	1	0.0002	0.0007	506.20	0.0001	0.0005	717.34	0.01%	0.01%	PASS
Input leakage current PC0	uA	-1	1	-0.0002	0.0004	859.82	-0.0001	0.0003	962.43	0.01%	0.01%	PASS
Input leakage current PC1	uA	-1	1	0.0001	0.0005	649.38	0.0002	0.0003	1049.25	0.01%	0.01%	PASS
Input leakage current EXTAL	uA	-1	1	0.0000	0.0004	885.21	-0.0008	0.0004	858.89	0.08%	0.08%	PASS
Input leakage current XTAL	uA	-1	1	0.0004	0.0003	977.32	0.0002	0.0003	1124.39	0.03%	0.03%	PASS
Input leakage current EXTAL	uA	-1	1	0.0002	0.0006	518.42	-0.0002	0.0005	724.57	0.04%	0.04%	PASS
Input leakage current XTAL	uA	-1	1	0.0003	0.0007	507.92	0.0000	0.0003	1014.18	0.03%	0.03%	PASS
Slow, low level output voltage PB4_TDO	V	NA	0.5	0.1619	0.0019	60.39	0.1622	0.0014	82.54	NA	0.08%	PASS
Slow, low level output voltage PB5_TDI	V	NA	0.5	0.1650	0.0020	57.01	0.1659	0.0014	79.94	NA	0.27%	PASS
Medium, low level output voltage PB5_TDI	V	NA	0.5	0.1259	0.0017	71.39	0.1254	0.0053	23.52	NA	0.13%	PASS
Fast, high level output voltage PB4_TDO	V	NA	0.5	0.0394	0.0012	129.16	0.0390	0.0014	111.61	NA	0.09%	PASS
Slow, high level output voltage PB4_TDO	V	2.500	NA	2.7946	0.0019	51.72	2.7803	0.0019	50.22	4.85%	NA	PASS
Slow, high level output voltage PB5_TDI	V	2.500	NA	2.7892	0.0020	47.36	2.7746	0.0018	51.72	5.05%	NA	PASS
Medium, high level output voltage PB5_TDI	V	2.500	NA	2.8082	0.0019	53.81	2.7969	0.0063	15.67	3.65%	NA	PASS
Fast, high level output voltage PB4_TDO	V	2.500	NA	2.9052	0.0015	88.19	2.9024	0.0018	73.26	0.68%	NA	PASS
Slow, low level output voltage PB4_TDO	V	NA	0.5	0.1973	0.0023	43.41	0.1988	0.0016	62.29	NA	0.52%	PASS
Slow, low level output voltage PB5_TDI	V	NA	0.5	0.2005	0.0024	41.45	0.2028	0.0016	61.31	NA	0.76%	PASS
Medium, low level output voltage PB5_TDI	V	NA	0.5	0.1395	0.0018	66.42	0.1410	0.0011	108.17	NA	0.44%	PASS
Fast, high level output voltage PB4_TDO	V	NA	0.5	0.0432	0.0012	126.47	0.0432	0.0007	229.74	NA	0.01%	PASS
Slow, high level output voltage PB4_TDO	V	2.500	NA	3.4529	0.0023	135.60	3.4356	0.0023	137.23	1.81%	NA	PASS
Slow, high level output voltage PB5_TDI	V	2.500	NA	3.4465	0.0025	124.11	3.4288	0.0022	143.93	1.87%	NA	PASS
Medium, high level output voltage PB5_TDI	V	2.500	NA	3.4844	0.0022	150.10	3.4700	0.0017	188.48	1.46%	NA	PASS
Fast, high level output voltage PB4_TDO	V	2.500	NA	3.3628	0.0077	37.55	3.3454	0.0041	68.36	2.02%	NA	PASS

Parameter Name, as in Datasheet	Units	Lower Spec Limit (NA if no spec)	Upper Spec Limit (NA if no spec)	ATMC Au			TSMC Cu			Shift within +/-1 sigma or less than 15% to spec	Shift within +/-1 sigma or less than 15% to spec	Comment
				Temp	25	C	Temp	25	C			
				Avg	Std	Cpk	Avg	Std	Cpk			
Equivalent pull-up current PC10	uA	-130	NA	-37.4053	0.6562	47.03	-35.7480	0.6643	47.29	1.79%	NA	PASS
Equivalent pull-up current PC11	uA	-130	NA	-38.0126	0.7906	38.78	-35.4716	0.4493	70.13	2.76%	NA	PASS
Equivalent pull-up current PA13	uA	NA	-10	-57.5543	0.7651	20.72	-54.4180	0.6815	21.73	NA	6.60%	PASS
Equivalent pull-up current PA12	uA	NA	-10	-58.3595	1.0804	14.92	-53.9964	0.5841	25.11	NA	9.02%	PASS
Equivalent pull-up current PA11	uA	NA	-10	-57.9302	0.7082	22.56	-54.2652	0.5804	25.42	NA	7.65%	PASS
Equivalent pull-down current PA9	uA	10	NA	46.1521	0.6361	18.95	44.2850	0.5261	21.72	5.16%	NA	PASS
Equivalent pull-down current PA8	uA	10	NA	46.6883	0.9305	13.14	44.6882	0.4720	24.50	5.45%	NA	PASS
Equivalent pull-down current PA7	uA	10	NA	47.0103	0.8349	14.78	44.5666	0.5400	21.34	6.60%	NA	PASS
Equivalent pull-down current PG6	uA	NA	130	71.8523	1.2147	15.96	67.8068	0.6351	32.64	NA	6.96%	PASS
Equivalent pull-down current PG5	uA	NA	130	72.1405	1.2530	15.39	67.0097	0.7188	29.21	NA	8.87%	PASS
Equivalent pull-down current PG4	uA	NA	130	71.7412	0.8796	22.08	67.8284	0.6711	30.88	NA	6.72%	PASS
Input leakage current AN3_PC2	uA	-1	1	0.0000	0.0009	364.70	0.0001	0.0003	1081.18	0.01%	0.01%	PASS
Input leakage current AN6_PE7	uA	-1	1	0.0001	0.0011	304.00	0.0003	0.0005	642.36	0.02%	0.02%	PASS
Input leakage current AN11_PB9	uA	-1	1	0.0000	0.0005	721.17	0.0004	0.0006	557.74	0.04%	0.04%	PASS
Input leakage current AN7_PE9	uA	-1	1	0.0001	0.0007	444.40	0.0001	0.0004	742.14	0.00%	0.00%	PASS
Input leakage current AN12_PB10	uA	-1	1	0.0000	0.0006	517.80	0.0004	0.0005	617.15	0.03%	0.03%	PASS
Input leakage current AN13_PB11	uA	-1	1	-0.0001	0.0007	465.74	0.0001	0.0006	563.66	0.02%	0.02%	PASS
Offset error	LSB	-6	6	1.5375	0.2383	6.24	1.3597	0.2178	7.10	2.36%	3.98%	PASS
Total unadjusted error ADC0 neg test	LSB	-10	10	-0.4788	0.3467	9.16	-0.7260	0.2215	13.96	2.60%	2.36%	PASS
Total unadjusted error ADC0 pos test	LSB	-10	10	2.0488	0.2152	12.31	1.7468	0.2094	13.14	2.51%	3.80%	PASS
Total unadjusted error ADC1 neg test	LSB	-10	10	-0.3713	0.3123	10.28	-0.7857	0.2506	12.25	4.30%	4.00%	PASS
Total unadjusted error ADC1 pos test	LSB	-10	10	2.1775	0.2418	10.78	1.8714	0.3056	8.87	2.51%	3.91%	PASS
Signal-to-noise ratio	dB	67	NA	70.1217	0.1951	5.33	70.6084	0.1635	7.36	15.59%	NA	Justify, TSMC14 avg move away from limit
Operating current	mA	NA	279	209.3092	3.1840	7.30	209.4243	1.5573	14.89	NA	0.17%	PASS
Operating current in VDD STOP mode	mA	NA	20	3.4178	0.0421	131.41	3.6761	0.1748	31.13	NA	1.56%	PASS
Operating current in VDD HALT mode	mA	NA	25	9.6169	0.0782	65.55	9.6851	0.1928	26.47	NA	0.44%	PASS

“Shift analysis” refers to analysis of shift of the distribution mean towards the nearest specification limit:

$$\% \text{ Shift (USL)} = \frac{\{\text{Mean}(\text{new}) - \text{Mean}(\text{old})\}}{\{\text{Upper Spec Limit} - \text{Mean}(\text{old})\}}$$

$$\% \text{ Shift (LSL)} = \frac{\{\text{Mean}(\text{new}) - \text{Mean}(\text{old})\}}{\{\text{Mean}(\text{old}) - \text{Lower Spec Limit}\}}$$

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## 4.2. Summary:

From the above data, it was verified that the requirements and acceptance criteria was achieved. Justifications were provided for shift of > 15%.

## 5. Document History:

Rev	Date	Originator
0	4 <sup>th</sup> Jun 2014	Ismail Ikmal

## Appendix A: Justifications for any Shifts > 15%

Justification as provided in the table.