MPC5643L/MPC5634M CU WIRE Qualification (PCN 16188)

1. Objective

This report describes the Freescale Austin Technology Manufacturing Center (ATMC) fab site for MPC5643L/MPC5634M 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: MPC5643L/MPC5634M
Fab site: ATMC
Mask set:N89D/M35Y
Package(s): 257MBGA/208MBGA
Assembly Site: Freescale Tianjin, China

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 ATMC 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 ≤ 15%, justification will be provided if otherwise.

4. Data and Summary:

4.1. Electrical Distribution Table:

Selected Evaluation Vehicle: MPC5675K (473MBGA) N72D

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

Hot Temperature				**Au Wire**			**Cu Wire**			**Drift within +/-1 sigma or less than +/-15% to spec**	**Drift within +/-1 sigma or less than +/-15% to spec**	**Comment**
				Temp	140	C	**Temp**	140	C			
Parameter Name, as in Datasheet	**Units**	**Lower Spec Limit** (NA if no spec)	**Upper Spec Limit** (NA if no spec)	**Avg**	**Std**	**Cpk**	**Avg**	**Std**	**Cpk**			
IIL_VDDIO_HI	uA	-1.00	1.00	0.0283	0.0000	101.97	0.0343	0.0000	82.14	0.58%	0.61%	PASS
IIL_VDDIO_LO	uA	-1.00	1.00	-0.0281	0.0000	117.21	-0.0280	0.0000	116.37	0.01%	0.01%	PASS
IIL_VDDADR_LO	uA	-0.50	0.50	-0.0064	0.0000	163.44	-0.0085	0.0000	113.81	-0.42%	-0.41%	PASS
IIL_VDDADR_HI	uA	-0.50	0.50	0.0051	0.0000	165.77	0.0064	0.0000	166.85	0.25%	0.26%	PASS
IDD_VDD_CORE	mA	20.00	1000.00	507.8803	0.0140	11.58	504.9089	0.0091	17.76	-0.61%	-0.60%	PASS
IDD_VDD_IO	mA	0.50	140.00	20.4289	0.0022	3.02	20.1048	0.0031	2.10	-1.63%	-0.27%	PASS
IDD_VDD_FLA	mA	1.00	30.00	5.9789	0.0001	11.75	6.0371	0.0002	8.36	1.17%	0.24%	PASS
IDD_VDD_ADV	mA	-0.04	20.00	9.6980	0.0002	19.85	9.5404	0.0002	13.52	-1.62%	-1.53%	PASS
HVD_VDDHV	V	1.31	1.50	1.4400	0.0000	N/A	1.4400	0.0000	N/A	0.00%	0.00%	PASS, CPK=NA as Std=0
LVD_VDDHV	V	1.10	1.20	1.1150	0.0000	7379839143746.81	1.1150	0.0000	7379839143746.81	0.00%	0.00%	PASS
LVD_ADCHV	V	2.75	2.92	2.7500	0.0000	N/A	2.7500	0.0000	N/A	NA	0.00%	PASS, CPK=NA as Std=0
TUE_ADC0_P_LV	LSBs	-6.00	6.00	1.6867	0.7001	2.05	1.9433	0.4925	2.75	3.34%	5.95%	PASS
TUE_ADC0_N_LV	LSBs	-6.00	6.00	-1.8467	0.7736	1.79	-2.0900	0.3661	3.56	-5.86%	-3.10%	PASS
TUE_ADC1_P_LV	LSBs	-6.00	6.00	3.6200	0.4063	1.95	3.6533	0.2043	3.83	0.35%	1.40%	PASS
TUE_ADC1_N_LV	LSBs	-6.00	6.00	-1.5333	0.5061	2.94	-1.4100	0.3517	4.35	2.76%	1.64%	PASS
TUE_ADC2_P_LV	LSBs	-6.00	6.00	1.8000	0.5079	2.76	2.1533	0.5594	2.29	4.53%	8.41%	PASS
TUE_ADC2_N_LV	LSBs	-6.00	6.00	-2.2933	0.4370	2.83	-2.5067	0.5570	2.09	-5.76%	-2.57%	PASS
TUE_ADC3_P_LV	LSBs	-6.00	6.00	2.1767	0.5393	2.36	2.6067	0.4417	2.56	5.26%	11.25%	PASS
TUE_ADC3_N_LV	LSBs	-6.00	6.00	-2.5667	0.4205	2.72	-2.6867	0.4790	2.31	-3.50%	-1.40%	PASS
SNR_ADC0	dB	67.00	150.00	70.9302	0.0954	13.73	70.9831	0.1249	10.63	1.35%	0.07%	PASS
SNR_ADC1	dB	67.00	150.00	70.9025	0.0832	15.63	70.9726	0.1589	8.34	1.80%	0.09%	PASS
SNR_ADC2	dB	67.00	150.00	71.0955	0.1108	12.32	71.1134	0.1250	10.97	0.44%	0.02%	PASS
SNR_ADC3	dB	67.00	150.00	70.9999	0.0939	14.20	71.0558	0.1191	11.35	1.40%	0.07%	PASS
IRC	MHz	15.20	16.80	16.3183	88509.7646	1.81	16.3183	73835.4150	2.17	0.00%	0.00%	PASS
VCO_PLL0	MHz	15.80	16.20	16.0000	50.8548	1310.66	16.0001	49.0133	1359.81	0.01%	0.01%	PASS
VCO_PLL1	MHz	15.80	16.20	16.0001	49.8273	1337.62	16.0001	49.8273	1337.62	0.00%	0.00%	PASS

Cold Temperature				ATMC AU T0			ATMC Cu T0			Adjusted for Control Data if provided, **T0 Mean Drift toward LSL**	Adjusted for Control Data if provided, **T0 Mean Drift toward USL**	**Comment**
				Temp	-40	C	**Temp**	-40	C			
Parameter Name, as in Datasheet	**Units**	**Lower Spec Limit** (NA if no spec)	**Upper Spec Limit** (NA if no spec)	**Avg**	**Std**	**Cpk**	**Avg**	**Std**	**Cpk**	Drift within +/-1 sigma or less than +/-15% to spec	Drift within +/-1 sigma or less than +/-15% to spec	
IIL_VDDIO_HI	uA	-1.00	1.00	0.0005	0.0000	457.89	0.0000	0.0000	453.41	-0.05%	-0.05%	PASS
IIL_VDDIO_LO	uA	-1.00	1.00	-0.0006	0.0000	503.83	-0.0005	0.0000	375.28	0.01%	0.01%	PASS
IIL_VDDADR_LO	uA	-0.50	0.50	-0.0009	0.0000	206.53	-0.0007	0.0000	206.49	0.04%	0.04%	PASS
IIL_VDDADR_HI	uA	-0.50	0.50	0.0003	0.0000	242.73	0.0001	0.0000	177.39	-0.03%	-0.03%	PASS
IDD_VDD_CORE	mA	20.00	800.00	424.8736	0.0049	25.52	425.8988	0.0052	23.83	0.25%	0.27%	PASS
IDD_VDD_IO	mA	0.50	120.00	20.9839	0.0039	1.73	19.9707	0.0023	2.80	-4.95%	-1.02%	PASS
IDD_VDD_FLA	mA	1.00	15.00	5.7390	0.0003	5.30	5.6608	0.0002	8.12	-1.65%	-0.84%	PASS
IDD_VDD_ADV	mA	-0.04	20.00	8.5566	0.0002	13.40	8.6960	0.0001	20.44	1.62%	1.22%	PASS
HVD_VDDHV	V	1.31	1.50	1.4400	0.0000	NA	1.4400	0.0000	NA	0.00%	0.00%	PASS, CPK=NA as Std=0
LVD_VDDHV	V	1.10	1.20	1.1150	0.0000	7379839143746.81	1.1150	0.0000	7379839143746.81	0.00%	0.00%	PASS
LVD_ADCHV	V	2.75	2.92	2.7500	0.0000	NA	2.7500	0.0000	NA	NA	0.00%	PASS, CPK=NA as Std=0
TUE_ADC0_P_LV	LSBs	-6.00	6.00	2.1867	0.5389	2.36	1.7633	0.5249	2.69	-5.17%	-11.10%	PASS
TUE_ADC0_N_LV	LSBs	-6.00	6.00	-1.9633	0.5294	2.54	-1.5633	0.3337	4.43	9.91%	5.02%	PASS
TUE_ADC1_P_LV	LSBs	-6.00	6.00	2.9867	0.4493	2.24	2.7033	0.3605	3.05	-3.15%	-9.40%	PASS
TUE_ADC1_N_LV	LSBs	-6.00	6.00	-1.6000	0.6459	2.27	-1.3567	0.3919	3.95	5.53%	3.20%	PASS
TUE_ADC2_P_LV	LSBs	-6.00	6.00	2.1467	0.6367	2.02	1.7467	0.4508	3.14	-4.91%	-10.38%	PASS
TUE_ADC2_N_LV	LSBs	-6.00	6.00	-2.1100	0.6692	1.94	-1.9833	0.3086	4.34	3.26%	1.56%	PASS
TUE_ADC3_P_LV	LSBs	-6.00	6.00	1.4567	0.7118	2.13	1.9533	0.4524	2.98	6.66%	10.93%	PASS
TUE_ADC3_N_LV	LSBs	-6.00	6.00	-2.3100	0.7019	1.75	-2.0867	0.3491	3.74	6.05%	2.69%	PASS
SNR_ADC0	dB	67.00	150.00	71.5720	0.1601	9.52	71.6476	0.0947	16.37	1.65%	0.10%	PASS
SNR_ADC1	dB	67.00	150.00	71.4779	0.2069	7.21	71.6406	0.1162	13.31	3.63%	0.21%	PASS
SNR_ADC2	dB	67.00	150.00	71.5410	0.1666	9.08	71.6751	0.1077	14.47	2.95%	0.17%	PASS
SNR_ADC3	dB	67.00	150.00	71.4775	0.1649	9.05	71.5865	0.1002	15.26	2.43%	0.14%	PASS
IRC	MHz	15.20	16.80	15.9967	84158.7723	3.16	16.0130	93807.4281	2.80	2.05%	2.04%	PASS
VCO_PLL0	MHz	15.80	16.20	16.0001	46.6092	1429.90	16.0000	49.0133	1360.00	-0.02%	-0.02%	PASS
VCO_PLL1	MHz	15.80	16.20	16.0001	46.6092	1429.90	16.0000	50.7416	1313.60	-0.01%	-0.01%	PASS

Selected Evaluation Vehicle: MPC5644A (208MBGA) M14X

Hot Temperature				**Au Wire**			**Cu Wire**			**Drift within +/-1 sigma or less than +/-15% to spec**	**Drift within +/-1 sigma or less than +/-15% to spec**	**Comment**
				Temp	150	C	**Temp**	150	C			
Parameter Name, as in Datasheet	**Units**	**Lower Spec Limit** (NA if no spec)	**Upper Spec Limit** (NA if no spec)	**Avg**	**Std**	**Cpk**	**Avg**	**Std**	**Cpk**			
I/O Leak_VDDEH_HI	uA	-2.50	2.50	0.0102	0.0147	56.46	-0.0071	0.0092	90.32	-0.69%	-0.69%	PASS
I/O Leak_VDDEH_LO	uA	-2.50	2.50	0.0178	0.0071	116.54	-0.0004	0.0048	173.58	-0.72%	-0.73%	PASS
I/O Leak_VDD33_HI	uA	-2.50	2.50	0.0159	0.0103	80.39	-0.0004	0.0092	90.57	-0.65%	-0.66%	PASS
I/O Leak_VDD33_LO	uA	-2.50	2.50	0.0205	0.0104	79.47	-0.0016	0.0032	260.25	-0.88%	-0.89%	PASS
Analog Leak_VDDA_LO	nA	-150.00	150.00	15.0857	6.9990	6.43	0.0356	0.4029	124.07	-9.12%	-11.16%	PASS
Analog Leak_VDDA_HI	nA	-150.00	150.00	15.2270	7.5632	5.94	-0.2964	0.7760	64.31	-9.40%	-11.52%	PASS
VBGuncal	V	1.1337	1.2921	1.2241	0.0069	3.29	1.2264	0.0090	2.43	2.54%	3.38%	PASS
Idd_150MHZ_VDD	mA	NA	400.00	237.7037	3.4854	15.52	235.7220	2.7630	19.82	NA	-1.22%	PASS
Idd_150MHZ_VDD_CACHE_ENABLED	mA	NA	400.00	241.3486	3.5413	14.93	239.3808	2.7843	19.23	NA	-1.24%	PASS
Idd33	mA	NA	60.00	4.7681	0.1205	152.79	4.7496	0.1150	160.15	NA	-0.03%	PASS
Idda	mA	NA	30.00	4.8411	0.1927	43.52	4.8099	0.2314	36.29	NA	-0.12%	PASS
Cold Temperature				**Au Wire**			**Cu Wire**			**Drift within +/-1 sigma or less than +/-15% to spec**	**Drift within +/-1 sigma or less than +/-15% to spec**	**Comment**
				Temp	-40	C	**Temp**	-40	C			
Parameter Name, as in Datasheet	**Units**	**Lower Spec Limit** (NA if no spec)	**Upper Spec Limit** (NA if no spec)	**Avg**	**Std**	**Cpk**	**Avg**	**Std**	**Cpk**			
I/O Leak_VDDEH_HI	uA	-2.50	2.50	0.0442	0.0183	44.73	0.0293	0.0086	95.76	-0.59%	-0.61%	PASS
I/O Leak_VDDEH_LO	uA	-2.50	2.50	0.0040	0.0074	112.43	-0.0113	0.0041	202.33	-0.61%	-0.61%	PASS
I/O Leak_VDD33_HI	uA	-2.50	2.50	0.3210	0.0402	18.07	0.3167	0.0888	8.20	-0.15%	-0.20%	PASS
I/O Leak_VDD33_LO	uA	-2.50	2.50	-0.2813	0.0352	21.01	-0.2648	0.0537	13.87	0.74%	0.59%	PASS
Analog Leak_VDDA_LO	nA	-150.00	150.00	12.0975	6.4504	7.13	-3.3289	0.8011	61.03	-9.52%	-11.19%	PASS
Analog Leak_VDDA_HI	nA	-150.00	150.00	17.8352	6.9253	6.36	1.8234	1.2367	39.94	-9.54%	-12.12%	PASS
VBGuncal	V	1.1337	1.2921	1.2256	0.0073	3.04	1.2259	0.0093	2.37	0.33%	0.45%	PASS
Idd_150MHZ_VDD	mA	NA	400.00	316.9641	14.1585	1.95	300.8612	12.0205	2.75	NA	-19.39%	JUSTIFY, Cu wire Average move away from Hi Limit
Idd_150MHZ_VDD_CACHE_ENABLED	mA	NA	400.00	323.1086	14.6531	1.75	306.4801	12.3574	2.52	NA	-21.63%	JUSTIFY, Cu wire Average move away from Hi Limit
Idd33	mA	NA	60.00	5.3945	0.1547	117.66	5.4139	0.1985	91.66	NA	0.04%	PASS
Idda	mA	NA	30.00	5.4022	0.1544	53.10	5.3631	0.1870	43.92	NA	-0.16%	PASS

"Shift analysis" refers to analysis of shift of the distribution mean towards the nearest specification limit:
"% Shift (USL) = {Mean(new)-Mean(old)} / {Upper Spec Limit-Mean(old)}
% Shift (LSL) = {Mean(new)-Mean(old)} / {Mean(old)-Lower Spec Limit}

4.2. Summary:

From the above data, it was verified that the requirements and acceptance criteria was achieved.

5. Document History:

Rev	Date	Originator
O	16th Feb 2014	Chia Kenn Yong

Appendix A: Justifications for any Shifts > 15%

Not applicable as no parameter shift > 15%.