



J-DEVICES ELECTRICAL CHARACTERIZATION REPORT

Lattice Manufacturing Operations
30-Sep-2014

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- Summary

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Bill of Materials



BILL OF MATERIALS

Product/Package	ASEM Copper (Control)			J-Devices Copper (New)		
	Mold Compound	Wire/Diameter	Die Attach Epoxy	Mold Compound	Wire/Diameter	Die Attach Epoxy
LFXP2-17E/256ftBGA	Sumikon G-750SE (Low Alpha)	Pd Coated Cu (PCC) / 0.8mil	Ablebond 2100A	Kyocera KE-G2250 (Low Alpha)	Pd Coated Cu (PCC) / 0.8mil	Ablebond 84-3MV
LFXP2-5E/144TQFP	Sumikon G-700SY (Low Alpha)	Cu (99.99%) / 0.8mil	Yiztech 8143	Kyocera KE-G6000 (Low Alpha)	Pd Coated Cu (PCC) / 0.8mil	Sumitomo CRM1076WA

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Yield Data



Assembly

Device	Lot	FTN256
		Relative Yield
LFXP2-17E	J-Devices Copper Lot (DK34K6235204AEL1)	1.007
	ASEM Copper Lot (control)	1.000
Device	Lot	TN144
		Relative Yield
LFXP2-5E	J-Devices Copper Lot (CT44K6379801JEL1)	0.985
	ASEM Copper Lot (control)	1.000

Test

Device	Lot	FTN256
		Relative Yield
LFXP2-17E	J-Devices Copper Lot (DK34K6235204AEL1)	1.007
	ASEM Copper Lot (control)	1.000
Device	Lot	TN144
		Relative Yield
LFXP2-5E	J-Devices Copper Lot (CT44K6379801JEL1)	0.993
	ASEM Copper Lot (control)	1.000

J-Devices has comparable assembly and test yields to the released process at ASEM

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Parametric Data Comparisons – XP2-5E



		Tpd Count (counts)					
		N	Mean	Std. Dev	LSL	USL	Cpk
LFXP2-5E	J-Devices Copper Lot	537	37,707.05	1,056.65	32,000	60,000	1.80
	ASEM Copper Lot (control)	136,828	39,450.88	1,803.53	32,000	60,000	1.38

		Icc (mA)					
		N	Mean	Std. Dev	LSL	USL	Cpk
LFXP2-5E	J-Devices Copper Lot	537	26.33	3.81	-5	342	2.74
	ASEM Copper Lot (control)	136,828	21.14	4.57	-5	342	1.91

		Pull Down Leakage (@ Vcc = 1.26V; Vcc IO = 3.465V) (uA)					
		N	Mean	Std. Dev	LSL	USL	Cpk
LFXP2-5E	J-Devices Copper Lot	537	119.76	2.68	32	205	10.62
	ASEM Copper Lot (control)	136,828	120.37	2.90	32	205	9.72

		No-Pullup Leakage Min (@ Vcc = 1.26V; Vcc IO = 3.465V) (uA)					
		N	Mean	Std. Dev	LSL	USL	Cpk
LFXP2-5E	J-Devices Copper Lot	537	-0.25	0.02	-8	8	109.43
	ASEM Copper Lot (control)	136,828	-0.12	0.03	-8	8	93.02

All XP2-5E parameters have acceptable process capability indices. J-Devices parametric process capability is equal or better than the control lot.

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Parametric Data Comparisons – XP2-17E



		Tpd Count (counts)					
		N	Mean	Std. Dev	LSL	USL	Cpk
LFXP2-17E	J-Devices Copper Lot	310	40,204.44	1,528.95	32,000	60,000	1.79
	ASEM Copper Lot (control)	69,439	40,051.13	1,607.21	32,000	60,000	1.67

		Icc (mA)					
		N	Mean	Std. Dev	LSL	USL	Cpk
LFXP2-17E	J-Devices Copper Lot	310	62.74	11.91	-5	342	1.90
	ASEM Copper Lot (control)	69,439	39.11	15.76	-5	342	0.93

		Pull Down Leakage (@ Vcc = 1.26V; Vcc IO = 3.465V) (uA)					
		N	Mean	Std. Dev	LSL	USL	Cpk
LFXP2-17E	J-Devices Copper Lot	310	118.15	2.77	32	205	10.38
	ASEM Copper Lot (control)	69,439	119.56	3.02	32	205	9.44

		No-Pullup Leakage Min (@ Vcc = 1.26V; Vcc IO = 3.465V) (uA)					
		N	Mean	Std. Dev	LSL	USL	Cpk
LFXP2-17E	J-Devices Copper Lot	310	-0.15	16.95	-8	8	154.40
	ASEM Copper Lot (control)	69,439	-0.11	0.34	-8	8	7.84

All XP2-17E parameters have acceptable process capability indices. J-Devices parametric process capability is equal or better than the control lot.

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SSO Performance Comparisons – XP2-5E



SSO or Simultaneous Switching Output data is a measure of ground bounce or Vcc droop. Larger bounce or droop figures could indicate increased inductance or other parasitics that might impact performance. The design goal was that the SSO difference between the control and J-Devices be less than 10%.

PRODUCT/PACKAGE: **FXP2-5E/TN144**

Part #	Wire Diameter	Vcc_CORE	Vcc_IO	Vcc_Aux	Vcc_PLL	CLK Frequency	# Aggressor Pins	Bank	Material (Assy Subcon)	Lot	Ground Bounce (at maximum)			Vcc Droop (at minimum)		
											Min (mV)	Mean (mV)	Max (mV)	Min (mV)	Mean (mV)	Max (mV)
S1	0.8 mil	1.2 V	3.4 V	3.4 V	3.4 V	1 MHz	17	2	Cu-Pure (ASEM)	CT44K64392012	319	326.48	335	760	849.82	930
S2											319	329.29	343	760	859.23	930
S3											327	341.50	351	760	849.89	930
S4											327	335.90	351	680	760.65	850
S5											327	334.70	343	760	870.19	930
S6											319	327.36	335	680	754.59	850
S7											335	345.28	359	850	938.48	1010
Q1									Pd Coated Cu (J-Devices)	CT44K5145801EL1	290	299.41	306	800	860.04	920
Q2											282	296.28	306	920	960.96	1000
Q3											306	313.94	322	760	818.28	880
Q4											314	326.80	338	840	888.28	960
Q5											306	316.18	330	760	839.18	880
Q6											314	326.37	338	760	807.12	840
Q7											290	298.63	314	760	820.98	880
Cu (ASEM) Material Average											334.36			840.41		
Cu (J-Devices) Material Average											311.09			856.41		
Difference (%)											6.960%			1.904%		

Sample size: 2000 counts of Ground Bounce and Vcc Droop

Performed by: Patrick, Michelle

Mean differences from 2 sets of samples show <10% delta for both Ground Bounce and Vcc Droop.

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SSO Performance Comparisons – XP2-5E (cont.)



Sample scope images for XP2-5E SSO comparisons.

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SSO Performance Comparisons – XP2-17E



PRODUCT/PACKAGE: **FXP2-17E/FTN256**

Part #	Wire Diameter	Vcc_CORE	Vcc_IO	Vcc_Aux	Vcc_PLL	CLK Frequency	# Aggressor Pins	Bank	Material (Assy Subcon)	Lot	Ground Bounce (at maximum)			Vcc Droop (at minimum)		
											Min (mV)	Mean (mV)	Max (mV)	Min (mV)	Mean (mV)	Max (mV)
S1	0.8 mil	1.2 V	3.4 V	3.4 V	3.4 V	1 MHz	9	2	Pd Coated Cu (ASEM)	DK34K54055013	270	304.74	350	960	1001.30	1040
S2											270	294.54	350	840	881.67	920
S3											270	311.24	350	960	1001.50	1040
S4											270	313.26	350	1000	1063.70	1120
S5											270	310.84	350	920	961.70	1000
S6											270	308.24	350	920	966.04	1000
S7											270	305.50	350	920	948.44	960
Q1									Pd Coated Cu (J-Devices)	CA14K5424701AEL1	250	305.88	410	890	1002.90	1050
Q2											250	294.28	410	890	961.32	1050
Q3											170	290.76	410	890	980.52	1050
Q4											170	297.88	410	890	1027.70	1140
Q5											170	293.84	410	890	1020.30	1140
Q6											170	287.12	410	890	997.49	1140
Q7											170	297.40	410	890	1038.20	1140
Cu (ASEM) Material Average											306.91			974.91		
Cu (J-Devices) Material Average											295.31			1004.06		
Difference (%)											3.78%			2.99%		

Sample size: 2000 counts of Ground Bounce and Vcc Droop

Performed by: Patrick, Michelle

Mean differences from 2 sets of samples show <10% delta for both Ground Bounce and Vcc Droop.

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SSO Performance Comparisons – XP2-17E (cont.)



Sample scope images for XP2-17E SSO comparisons.

Qualification samples from J-Devices assembly were compared to control product from the released subcontractor ASEM.

Assembly yields were comparable.

Test yields were comparable.

Electrical parametric measurements are nominal and very well controlled.

Simultaneous switching Output bench measurements are well within the design tolerance of 10%.

J-Devices assembly process is well controlled and approved for manufacturing release.