

Cypress Semiconductor Fab Process Qualification Report

**QTP # 123907, 132302, 132301
March 2014**

Metal Stack Change S8 Technology, Fab 4 CMI

Prepared By:
Honesto Sintos
Reliability Engineer

Reviewed By:
Zhaomin Ji
Reliability Manager

Approved By:
Richard Oshiro
Reliability Director

PRODUCT QUALIFICATION HISTORY

QTP Number	Description of Qualification Purpose	Date
123907	Qualification of S8DI Technology Metal Stack Change from Ti/AlCu/TiW to Ti/TiN/AlCu/Ti/TiN in CMI Fab 4	June 2013
132302	Qualification of S8TNV Technology Metal Stack Change from Ti/AlCu/TiW to Ti/TiN/AlCu/Ti/TiN in CMI Fab 4	July 2013
132301	Qualification of S8P Metal Stack Change from Ti/AlCu/TiW to Ti/TiN/AlCu/Ti/TiN, excluding top metal layers	Feb 2014

PRODUCT DESCRIPTION (for qualification)	
Qualification Purpose: To qualify SONOS S8DI Technology Metal Stack Change from Ti/AlCu/TiW to Ti/TiN/AlCu/Ti/TiN in CMI Fab 4	
Marketing Part #:	Various
Device Description:	Commercial/Industrial Programmable System on a Chip
Cypress Division:	Cypress Semiconductor – Programmable System Division (PSD) & Data Communications Division (DCD)

TECHNOLOGY/FAB PROCESS DESCRIPTION			
Number of Metal Layers:	3	Metal Composition:	Metal 1: 150A Ti/250A TiN/3200A Al 0.5% Cu/90A Ti/500A TiN Metal 2: 150A Ti/250A TiN/3200A Al 0.5% Cu/90A Ti/500A TiN Metal 3: 500A TiW/21,250A Al 0.5% Cu/300A TiW
Passivation Type and Thickness:		1000A TEOS/9000A Si ₃ N ₄	
Generic Process Technology/Design Rule (μ-drawn):		1P3M, 0.15 μm	
Gate Oxide Material/Thickness (MOS):		SiO ₂ / 110A & SiO ₂ / 32A	
Name/Location of Die Fab (prime) Facility:		Fab 4, CMI-Minnesota	
Die Fab Line ID/Wafer Process ID:		S8DIN-5R	

MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION	
Package Designation:	LQ32
Package Outline, Type, or Name:	32 Saw Quad Flat No Lead (QFN)
Mold Compound Name/Manufacturer:	CEL9220/ Hitachi
Mold Compound Flammability Rating:	V-O per UL94
Oxygen Rating Index:	None
Lead Frame Material:	Copper
Lead Finish, Composition / Thickness:	NiPdAu
Die Backside Preparation Method/Metallization:	Backgrind
Die Separation Method:	Sawing
Die Attach Supplier:	Henkel
Die Attach Material:	QMI509
Die Attach Method:	Die Attach Epoxy
Bond Diagram Designation:	001-57086
Wire Bond Method:	Thermosonic
Wire Material/Size:	Au / 0.8 mil
Thermal Resistance Theta JA °C/W:	22.17°C/W
Package Cross Section Yes/No:	N/A
Assembly Process Flow:	001-60425M
Name/Location of Assembly (prime) facility:	CML-RA
MSL Level	3
Reflow Profile	260C

ELECTRICAL TEST / FINISH DESCRIPTION	
Test Location:	CML-RA, KYEC-TAIWAN, ASE-TAIWAN

Note: Please contact a Cypress Representative for other package availability.

RELIABILITY TESTS PERFORMED PER SPECIFICATION REQUIREMENTS

Stress/Test	Test Condition (Temp/Bias)	Result P/F
High Temperature Operating Life Early Failure Rate	Dynamic Operating Condition, Vcc Max= 2.07V, 150°C	P
High Temperature Operating Life Latent Failure Rate	Dynamic Operating Condition, Vcc Max= 2.07V 150°C	P
High Accelerated Saturation Test (HAST)	130°C, 5.25V, 85%RH Precondition: JESD22 Moisture Sensitivity Level 3 192 Hrs, 30C/60%RH+3IR-Reflow, 260°C+0, -5°C	P
Temperature Cycle	MIL-STD-883C, Method 1010, Condition C, -65°C to 150°C Precondition: JESD22 Moisture Sensitivity Level 3 192 Hrs, 30C/60%RH+3IR-Reflow, 260°C+0, -5°C	P
Pressure Cooker	121°C, 100%RH, 15 Psig Precondition: JESD22 Moisture Sensitivity Level 3 192 Hrs, 30C/60%RH+3IR-Reflow, 260°C+0, -5°C	P
Electrostatic Discharge Human Body Model (ESD-HBM)	2200V , 3300V JESD22, Method A114-B	P
Electrostatic Discharge Charge Device Model (ESD-CDM)	500V JESD22-C101	P
Electrostatic Discharge Machine Model (ESD-MM)	200V JESD22-A155	P
High Temp Storage	JESD22-A103: 150 C, no bias	P
High Temperature Steady State Life	Static Operating Condition, Vcc = 5.75V, 150 C/125 C JESD22-A108	P
SEM Analysis	MIL-STD-883, Method 2018	P

RELIABILITY FAILURE RATE SUMMARY

Stress/Test	Device Tested/ Device Hours	# Fails	Activation Energy	Thermal AF ³	Failure Rate
High Temperature Operating Life Early Failure Rate	9,169 Devices	0	N/A	N/A	0 PPM
High Temperature Operating Life ^{1,2} Long Term Failure Rate	429,000 DHRs	0	0.7	170	13 FIT

¹ Assuming an ambient temperature of 55°C and a junction temperature rise of 15°C.

² Chi-squared 60% estimations used to calculate the failure rate.

³ Thermal Acceleration Factor is calculated from the Arrhenius equation

$$AF = \exp \left[\frac{E_A}{k} \left[\frac{1}{T_2} - \frac{1}{T_1} \right] \right]$$

where:

E_A = The Activation Energy of the defect mechanism.

K = Boltzmann's constant = 8.62x10⁻⁵ eV/Kelvin.

T₁ is the junction temperature of the device under stress and T₂ is the junction temperature of the device at use conditions.

Reliability Test Data

QTP #: 123907

<i>Device</i>	<i>Fab Lot #</i>	<i>Assy Lot #</i>	<i>Assy Lot</i>	<i>Duration</i>	<i>Samp</i>	<i>Rej</i>	<i>Failure Mechanism</i>
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE (150, 2.07V)							
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	48	1530	0	
CY8C20446A (8C204662A)	4231821	611307649	CML-RA	48	1527	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE (150C, 2.07V)							
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	80	130	0	
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	452	130	0	
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	500	130	0	
STRESS: ESD-CHARGE DEVICE MODEL (500V)							
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	COMP	9	0	
STRESS: ESD-HUMAN BODY CIRCUIT PER JESD22, METHOD A114-B, (2,200V)							
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	COMP	8	0	
STRESS: ESD-CHARGE MACHINE MODEL (200V)							
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	COMP	5	0	
STRESS: HI-ACCEL SATURATION TEST (130C, 85%RH, 5.25V), PRE COND 192 HR 30C/60%RH (MSL3)							
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	128	80	0	
STRESS: HIGH TEMP STEADY STATE LIFE TEST (150C, 5.75V)							
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	80	55	0	
STRESS: HIGH TEMPERATURE STORAGE (150C, no Bias)							
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	500	80	0	
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	1000	80	0	
STRESS: PRESSURE COOKER TEST (121C, 100%RH), 15 Psig, PRE COND 192 HR 30C/60%RH (MSL3)							
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	168	80	0	
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	288	80	0	
STRESS: TC COND. C -65C TO 150C, PRE COND 192 HRS 30C/60%RH (MSL3)							
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	500	80	0	
CY8C20446A (8C204662A)	4230590	611237848	CML-RA	1000	80	0	
STRESS: SEM CROSS SECTION							
CY8C20446A (8C204662A)	4230590	N/A	N/A	COMP	1	0	

Reliability Test Data

QTP #: 132302

<i>Device</i>	<i>Fab Lot #</i>	<i>Assy Lot #</i>	<i>Assy Lot</i>	<i>Duration</i>	<i>Samp</i>	<i>Rej</i>	<i>Failure Mechanism</i>
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	96	1575	0		
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	168	198	0		
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	1000	192	0		
STRESS: ESD-CHARGE DEVICE MODEL (500V)							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	COMP	9	0		
STRESS: ESD-CHARGE DEVICE MODEL (1000V)							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	COMP	3	0		
STRESS: ESD-CHARGE DEVICE MODEL (1250V)							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	COMP	3	0		
STRESS: ESD-HUMAN BODY CIRCUIT PER JESD22, METHOD A114-B, (1100V)							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	COMP	3	0		
STRESS: ESD-HUMAN BODY CIRCUIT PER JESD22, METHOD A114-B, (2200V)							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	COMP	8	0		
STRESS: ESD-HUMAN BODY CIRCUIT PER JESD22, METHOD A114-B, (3300V)							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	COMP	3	0		
STRESS: ESD-CHARGE MACHINE MODEL (200V)							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	COMP	5	0		
STRESS: HI-ACCEL SATURATION TEST (130C, 85%RH), PRE COND 192 HR 30C/60%RH (MSL3)							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	128	76	0		
STRESS: HIGH TEMPERATURE STORAGE (150C, no Bias)							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	500	77	0		
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	1000	77	0		
STRESS: PRESSURE COOKER TEST (121C, 100%RH), 15 Psig, PRE COND 192 HR 30C/60%RH (MSL3)							
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	168	74	0		
CY14B101LA- (7C1401B8CC) 4248781	611310788	CML-RA	288	74	0		



Reliability Test Data

QTP #: 132302

<i>Device</i>	<i>Fab Lot #</i>	<i>Assy Lot #</i>	<i>Assy Lot</i>	<i>Duration</i>	<i>Samp</i>	<i>Rej</i>	<i>Failure Mechanism</i>
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STRESS: SEM CROSS SECTION

CY14B101LA- (7C1401B8CC)	N/A	N/A	CML-RA	COMP	1	0	
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STRESS: TC COND. C -65C TO 150C, PRE COND 192 HRS 30C/60%RH (MSL3)

CY14B101LA- (7C1401B8CC)	4248781	611310788	CML-RA	500	77	0	
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CY14B101LA- (7C1401B8CC)	4248781	611310788	CML-RA	1000	73	0	
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Reliability Test Data

QTP #: 132301

<i>Device</i>	<i>Fab Lot #</i>	<i>Assy Lot #</i>	<i>Assy Lot</i>	<i>Duration</i>	<i>Samp</i>	<i>Rej</i>	<i>Failure Mechanism</i>
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE							
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	48	1506	0		
CY8C5468AXI (8C561001AC) 4303722	611322201	CML-RA	48	1509	0		
CY8CTMA443 (8C20401FC) 4325500	611332472	CML-RA	48	1522	0		
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE							
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	80	120	0		
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	500	120	0		
STRESS: ESD-CHARGE DEVICE MODEL (500V)							
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	COMP	9	0		
STRESS: ESD-CHARGE DEVICE MODEL (1000V)							
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	COMP	3	0		
STRESS: ESD-CHARGE DEVICE MODEL (1250V)							
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	COMP	3	0		
STRESS: ESD-CHARGE MACHINE MODEL (200V)							
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	COMP	5	0		
STRESS: HI-ACCEL SATURATION TEST (130C, 85%RH, 5.25V), PRE COND 192 HR 30C/60%RH (MSL3)							
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	128	80	0		
STRESS: HIGH TEMPERATURE STORAGE (150C, no Bias)							
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	500	80	0		
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	1000	80	0		
STRESS: PRESSURE COOKER TEST (121C, 100%RH), 15 Psig, PRE COND 192 HR 30C/60%RH (MSL3)							
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	168	80	0		
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	1288	79	0		
STRESS: SEM CROSS SECTION							
CY8C3446AXI (8C34461CC) 4232622	N/A	N/A	COMP	1	0		
STRESS: TC COND. C -65C TO 150C, PRE COND 192 HRS 30C/60%RH (MSL3)							
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	500	80	0		
CY8C3446AXI (8C34461CC) 4232622	611310881	CML-RA	1000	80	0		



Document History Page

Document Title: QTP 123907: METAL STACK CHANGE, S8DIN TECHNOLOGY, FAB 4 CMI
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Rev.	ECN No.	Orig. of Change	Description of Change
**	4292184	HSTO	Initial spec release.

Distribution: WEB

Posting: None