Cypress Semiconductor
Product Qualification Report

QTP# 052004
July 2013

<table>
<tr><td colspan="2">PSoC Mixed Signal Array
Neutron Device Family, S4AD-5, Fab4</td></tr>
<tr><td>CY8C21234
CY8C21334
CY8C21434
CY8C21534
CY8C21634</td><td>PsoC™ Mixed Signal Array with On-Chip Controller</td></tr>
<tr><td>CY8C9520</td><td>20 - Bit I/O Expander with EEPROM</td></tr>
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CYPRESS TECHNICAL CONTACT FOR QUALIFICATION DATA:

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Principal Reliability Engineer
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TABLE I

PACKAGE/PRODUCT QUALIFICATION HISTORY

QTP Number	Description of Qualification Purpose	Date
052004	PsoC 8C21001A Neutron Product Family on SONOS S4AD	Aug 05
070301	14 Layer Mask Change on Neutron Device Family, S4AD	Feb 07
072602	Minor Changes to Poly (P1M) and Metal 2 (MM) masks on Neutron (8C21001AC), , S4AD	Sep 07

Table II

PRODUCT DESCRIPTION (for qualification)	
Qualification Purpose: Qualification Purpose: Qualify Device PsoC 8C21001A Neutron Device Family on S4AD-5 Technology, Fab4	
Marketing Part #:	CY8C21234, CY8C21334, CY8C21434, CY8C21534, CY8C21634
Device Description:	3.3V and 5V Industrial 24MHz Programmable System on Chip
Cypress Division:	Cypress Semiconductor Corporation – Consumer and Computation Division

Table III

TECHNOLOGY/FAB PROCESS DESCRIPTION			
Number of Metal Layers:	2	Metal Composition:	Metal 1: 500A Ti/6,000A Al /300A TiW Metal 2: 500A Ti/8,000A Al /300A TiW
Passivation Type and Thickness:		7,000A TEOS / 6,000A Si3N4	
Generic Process Technology/Design Rule (µ-drawn):		Single Poly, Double Metal, 0.35 m	
Gate Oxide Material/Thickness (MOS):		SiO2 / 110A	
Name/Location of Die Fab (prime) Facility:		Cypress Semiconductor – Minnesota	
Die Fab Line ID/Wafer Process ID:		Fab 4, S4AD-5, SONOS	

Table IV

PACKAGE AVAILABILITY

PACKAGE	ASSEMBLY FACILITY SITE
16 lead SOIC	TAIWAN-T
20 lead SSOP	CML-RA, PHIL-M, TAIWAN-T
28 lead SSOP	CML-RA, PHIL-M, TAIWAN-T
32 lead MLF	SEOUL-L

Table V

MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION	
Package Designation:	SP28
Package Outline, Type, or Name:	28-Lead Shrunk Small Outline Package (SSOP)
Mold Compound Name/Manufacturer:	Hitachi CEL9220HF
Mold Compound Flammability Rating:	V-O per UL94
Oxygen Rating Index:	>28%
Lead Frame Material:	Copper
Lead Finish, Composition / Thickness:	100% Pure Sn
Die Backside Preparation Method/Metallization:	Backgrind
Die Separation Method:	100% Saw
Die Attach Supplier:	Ablestik
Die Attach Material:	8340
Die Attach Method:	Dispensing
Bond Diagram Designation:	10-06220
Wire Bond Method:	Thermosonic
Wire Material/Size:	Au, 1.0mil
Thermal Resistance Theta JA °C/W:	96°C/W
Package Cross Section Yes/No:	No
Assembly Process Flow:	49-35032
Name/Location of Assembly (prime) facility:	Taiwan- T
MSL Level	3
Reflow Profile	260C

Table VI

ELECTRICAL TEST / FINISH DESCRIPTION	
Test Location:	CML-R

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

Table VII

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=5.5V, 125°C JESD22-A108	P
High Temperature Operating Life Latent Failure Rate	Dynamic Operating Condition, Vcc Max=5.5V, 125°C JESD22-A108	P
High Accelerated Saturation Test (HAST)	JEDEC STD 22-A110: 130°C, 5.25V, 85%RH Precondition: JESD22 Moisture Sensitivity Level 1 168 Hrs, 85C/85%RH+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 1 168 Hrs, 85C/85%RH+Reflow, **260°C**+0, -5°C	P
Pressure Cooker	JESD22-A102: 121°C, 100%RH, 15 Psig Precondition: JESD22 Moisture Sensitivity Level 1 168 Hrs, 85C/85%RH+Reflow**, 260°C**+0, -5°C	P
Data Retention	JESD22-A117 and JESD22-A103: 150°C ± 5°C No Bias	P
High Temperature Steady State life	JESD22-A108: 125°C, 5.5V, Vcc Max	P
Electrostatic Discharge Human Body Model (ESD-HBM)	2,200V JESD22, Method A114	P
Electrostatic Discharge Human Body Model (ESD-HBM)	2,200V MIL-STD-883, Method 3015.7	P
Electrostatic Discharge Charge Device Model (ESD-CDM)	500V JESD22-C101	P
Electrostatic Discharge Machine Model (ESD-MM)	200V JESD22, Method A115	P
Endurance Test	MIL-STD-883, Method 883-1033	P
Age Bond Strength	200C, 4hrs MIL-STD-883, Method 883-2011	P
Low Temperature Operating Life	-30C, 5.5V, 8MHZ	P
SEM Analysis	MIL-STD-883, Method 883-2018-2	P
Acoustic Microscopy	J-STD-020 Precondition: JESD22 Moisture Sensitivity Level 1 168 Hrs, 85C/85%RH+Reflow**, 260°C**+0, -5°C	P
Dynamic Latch up	125C, 8.3V	P
Latch up Sensitivity	125C, ± 200mA, ± 300mA JESD78	P

Table VIII

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	1.098 Devices	0	N/A	N/A	0 PPM
High Temperature Operating Life[1,2] Long Term Failure Rate	528,750 DHRs	0	0.7	55	31 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 = 8.62×10^{-5} eV/Kelvin.
T_1 is the junction temperature of the device under stress and T_2 is the junction temperature of the device at use conditions.

Reliability Test Data

QTP #: 052004

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: ACOUSTIC, MSL1							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	COMP	15	0	
CY8C21234 (8C21234A)	4516674	*610521849*	PHIL-M	COMP	15	0	
CY8C21234 (8C21234A)	4517851	*610522407*	PHIL-M	COMP	15	0	
STRESS: AGE BOND STRENGTH							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	COMP	10	0	
CY8C21234 (8C21234A)	4516674	*610521849*	PHIL-M	COMP	10	0	
CY8C21234 (8C21234A)	4517851	*610522407*	PHIL-M	COMP	10	0	
STRESS: DATA RETENTION, PLASTIC, 150C							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	500	256	0	
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	1000	256	0	
CY8C21234 (8C21234A)	4516674	*610521849*	PHIL-M	500	256	0	
CY8C21234 (8C21234A)	4516674	*610521849*	PHIL-M	1000	254	0	
CY8C21234 (8C21234A)	4517851	*610522407*	PHIL-M	500	252	0	
CY8C21234 (8C21234A)	4517851	*610522407*	PHIL-M	1000	252	0	
STRESS : ENDURANCE							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	COMP	45	0	
STRESS : ESD-CHARGE DEVICE MODEL, (500V)							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	COMP	9	0	
CY8C21534 (8C21534A)	4516674	*610522255*	TAIWAN-T	COMP	9	0	
CY8C21534 (8C21534A)	4517851	*610522404*	TAIWAN-T	COMP	9	0	
STRESS: ESD-HUMAN BODY CIRCUIT PER JESD22, METHOD A114-B, (2,200V)							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	COMP	9	0	
CY8C21534 (8C21534A)	4516674	*610522255*	TAIWAN-T	COMP	9	0	
CY8C21534 (8C21534A)	4517851	*610522404*	TAIWAN-T	COMP	9	0	
STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015, (2,200V)							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	COMP	3	0	
CY8C21534 (8C21534A)	4516674	*610522255*	TAIWAN-T	COMP	3	0	
CY8C21534 (8C21534A)	4517851	*610522404*	TAIWAN-T	COMP	3	0	

Reliability Test Data

QTP #: 052004

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE (125C, 5.5V, Vcc Max)							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	120	1002	0	
CY8C21234 (8C21234A)	4516674	*610521849*	PHIL-M	120	1002	0	
CY8C21234 (8C21234A)	4517851	*610522407*	PHIL-M	120	1002	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE (125C, 5.5V, Vcc Max)							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	750	235	0	
CY8C21534 (8C21534A)	4517851	*610522404*	TAIWAN-T	750	235	0	
CY8C21534 (8C21534A)	4516674	*610522255*	TAIWAN-T	750	235	0	
STRESS: HIGH TEMP STEADY STATE LIFE TEST (125C, 5.5V)							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	168	76	0	
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	336	76	0	
STRESS: HI-ACCEL SATURATION TEST (130C, 85%RH, 5.25V), PRE COND 168 HR 85C/85%RH (MSL1)							
CY8C21234 (8C21234A)	4516647	*610527569*	PHIL-M	128	49	0	
CY8C21234 (8C21234A)	4516674	*610521849*	PHIL-M	128	44	0	
CY8C21234 (8C21234A)	4517851	*610522407*	PHIL-M	128	44	0	
STRESS: LOW TEMPERATURE OPERATING LIFE (-30C, 5.5V)							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	500	45	0	
STRESS: PRESSURE COOKER TEST (121C, 100%RH), 15 Psig, PRE COND 168 HR 85C/85%RH (MSL1)							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	168	45	0	
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	336	45	0	
CY8C21234 (8C21234A)	4516674	*610521849*	PHIL-M	168	45	0	
CY8C21234 (8C21234A)	4516674	*610521849*	PHIL-M	336	45	0	
CY8C21234 (8C21234A)	4517851	*610522407*	PHIL-M	168	45	0	
CY8C21234 (8C21234A)	4517851	*610522407*	PHIL-M	336	45	0	
STRESS: STATIC LATCH-UP TESTING (125C, 11V, ±300mA)							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	COMP	3	0	
CY8C21534 (8C21534A)	4516674	*610522255*	TAIWAN-T	COMP	3	0	
CY8C21534 (8C21534A)	4517851	*610522404*	TAIWAN-T	COMP	3	0	
STRESS: DYNAMIC LATCH-UP (8.3V)							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	COMP	3	0	

Reliability Test Data

QTP #: 052004

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: TC COND. C -65C TO 150C, PRE COND 168 HRS 85C/85%RH (MSL1)							
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	300	50	0	
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	500	50	0	
CY8C21534 (8C21534A)	4516647	*610521157*	TAIWAN-T	1000	50	0	
CY8C21234 (8C21234A)	4516674	*610521849*	PHIL-M	300	45	0	
CY8C21234 (8C21234A)	4516674	*610521849*	PHIL-M	1000	45	0	
CY8C21234 (8C21234A)	4517851	*610522407*	PHIL-M	300	45	0	

Reliability Test Data

QTP #: 070301

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE (125C, 5.5V, Vcc Max)							
CY8C21534 (8C21534A)	4652654	*610704326*	TAIWAN-T	96	400	0	
CY8C21534 (8C21534A)	4652654	*610704327*	TAIWAN-T	96	298	0	
CY8C21534 (8C21534A)	4652654	*610704328*	TAIWAN-T	96	400	0	
STRESS: ESD-CHARGE DEVICE MODEL, (500V)							
CY8C21434 (8C21434A)	4652654	*610704305*	TAIWAN-T	COMP	9	0	
CY8C21534 (8C21534A)	4652654	*610704325*	TAIWAN-T	COMP	9	0	
STRESS: ESD-HUMAN BODY CIRCUIT PER JESD22, METHOD A114-B, (2,200V)							
CY8C21434 (8C21434A)	4652654	*610704305*	TAIWAN-T	COMP	8	0	
CY8C21534 (8C21534A)	4652654	*610704325*	TAIWAN-T	COMP	8	0	
STRESS: STATIC LATCH-UP TESTING (125C, 8.30V, ±200mA)							
CY8C21534 (8C21534A)	4652654	*610704325*	TAIWAN-T	COMP	3	0	

Reliability Test Data

QTP #: 072602

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: DATA RETENTION, PLASTIC, 150C							
CY8C21534 (8C21534A)	4723791	610742720	CML-RA	500	30	0	
CY8C21534 (8C21534A)	4723791	610742720	CML-RA	1000	30	0	
CY8C21534 (8C21534A)	4723791	610742721	CML-RA	500	19	0	
CY8C21534 (8C21534A)	4723791	610742721	CML-RA	1000	19	0	
CY8C21534 (8C21534A)	4723791	610742722	CML-RA	500	30	0	
CY8C21534 (8C21534A)	4723791	610742722	CML-RA	1000	30	0	
STRESS: ENDURANCE							
CY8C21534 (8C21534A)	4723791	610742720	CML-RA	COMP	23	0	
CY8C21534 (8C21534A)	4723791	610742721	CML-RA	COMP	30	0	
CY8C21534 (8C21534A)	4723791	610742722	CML-RA	COMP	28	0	
STRESS: SORT YIELD							
CY8C21534 (8C21534A)	4723791			COMP		SAME YIELD	

Reliability Test Data

QTP #: ER112029

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: ESD-MACHINE MODEL, (200V)							
CY8C21434 (8C21434A)	4038430	611110887	CHINA-AE	COMP	5	0	

Document History Page

Document Title: QTP#052004: CY8C21X34 FAMILY S4AD-5, AT FAB-4 CMI PRODUCT QUALIFICATION REPORT
Document Number: 001-69539

Rev.	ECN No.	Orig. of Change	Description of Change
**	3253826	FDW	Added machine model ESD data
*A	4005168	NSR	Changed the contact reliability engineer. Removed the reference Cypress Specs in reliability tests performed table and replaced with industry standard. Removed 3X IR in MSL precondition.
*B	4048815	HSTO	Added CY8C9520 20 - Bit I/O Expander with EEPROM.

Distribution: WEB

Posting: None