Cypress Semiconductor
Product Qualification Report

QTP# 032508 VERSION 4.0
January 2008

PSoC ™ Mixed Signal Array Product Family S4AD-5 Technology, Fab 2	
CY8C22113 CY8C22213	PSoC ™ Mixed Signal Microcontroller
CY8C22113A CY8C22213A	PSoC ™ Mixed Signal Microcontroller
CY8C24123 CY8C24223 CY8C24423	PSoC ™ Mixed Signal Microcontroller
CY8C24123A CY8C24223A CY8C24423A	PSoC ™ Mixed Signal Microcontroller

CYPRESS TECHNICAL CONTACT FOR QUALIFICATION DATA:

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PRODUCT QUALIFICATION HISTORY

Qual Report	Description of Qualification Purpose	Date Comp
010702	New Technology S4AD-5 / New Product, Programmable Clock Generator, CY2414ZC, its product family and bond option.	Apr 01
032508	PSoC 8C22XX/8C24XXX Product Family on **Industrial** SONOS S4AD-5 Technology	Mar 04
043104	PSoC 8C24XXXB (New Die Revision) to fix know errata and improve silicon performance	Jul 04
073901	New Metal 2 (MM2) masks on Lithium Device (8C24001BT) on S4AD-5 Technology, Fab 2	Jan 08

PRODUCT DESCRIPTION (for qualification)	
Qualification Purpose: Qualify CY8C22xxx/CY8C24xxx Product Family on Industrial SONOS S4AD-5 Technology, Fab 2	
Marketing Part #:	CY8C22113, CY8C22213, CY8C22113A, CY8C22213A, CY8C24123, CY8C24223, CY8C24423, CY8C24123A, CY8C24223A, CY8C24423A
Device Description:	3.3V & 5V Industrial 24MHz Programmable System on a Chip available in 8/20/28-Lead PDIP, 8/20/28-Lead SOIC, 20/28-Lead SSOP and 32-Lead MLF
Cypress Division:	Cypress Semiconductor Corporation – Consumer and Computation Division (CCD)

TECHNOLOGY/FAB PROCESS DESCRIPTION S4AD-5			
Number of Metal Layers:	2	Metal Composition:	Metal 1: 500A Ti/6,000A Al 0.5% Cu /1,200A TiW Metal 2: 500A Ti/8,000A Al 0.5% Cu/300A TiW
Passivation Type and Materials:	3,000A TeOs / 6,000A Si_3N_4		
Free Phosphorus contents in top glass layer(%):	0%		
Number of Transistors in Device:	150,000		
Number of Gates in Device	25,000		
Generic Process Technology/Design Rule (µ-drawn):	1P2M/0.35um		
Gate Oxide Material/Thickness (MOS):	SiO_2 / 110°A		
Name/Location of Die Fab (prime) Facility:	Cypress Semiconductor – CTI Round Rock, TX		
Die Fab Line ID/Wafer Process ID:	Fab2, S4AD-5CTI SONOS		

ELECTRICAL TEST / FINISH DESCRIPTION	
Test Location:	Cypress Philippines (CML-R), Omedata-Indonesia
Fault Coverage:	100%

MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION	
Package Designation:	P8/20/28
Package Outline, Type, or Name:	8/20/28-Lead Plastic Dual-In-Line Package (PDIP)
Mold Compound Name/Manufacturer:	Nitto MP8000CH
Mold Compound Flammability Rating:	V-O per UL94
Oxygen Rating Index:	>28%
Lead Frame Material:	Copper
Lead Finish, Composition / Thickness:	Solder Plated Sn 85%, 15% Pb
Die Backside Preparation Method/Metallization:	Grinding
Die Separation Method:	Sawing 100%
Die Attach Supplier:	Ablestik
Die Attach Material:	8361H
Die Attach Method:	Epoxy
Bond Diagram Designation:	10-05192, 10-05195, 10-05197
Wire Bond Method:	Thermosonic
Wire Material/Size:	Au, 1.0mil
Thermal Resistance Theta JA °C/W:	123°C/W, 108°C/W, 69°C/W
Package Cross Section Yes/No:	N/A
Assembly Process Flow:	49-70027
Name/Location of Assembly (prime) facility:	Omedata-Indonesia

PACKAGE AVAILABILITY

PACKAGE	ASSEMBLY SITE FACILITY
8/20/28 Lead PDIP	INDNS-O
8-Lead SOIC	PHIL-M
20/28-Lead SOIC	CML-R
20/28-Lead SSOP	CML-RA , PHIL-M, TAIWAN-T
32-Lead MLF	MALAYSIA-CA, SEOL-L

RELIABILITY TESTS PERFORMED PER SPECIFICATION REQUIREMENT

Stress/Test	Test Condition (Temp/Bias)	Result P/F
High Temperature Operating Life Early Failure Rate	Dynamic Operating Condition, Vcc Max=5.75V, 125°C Dynamic Operating Condition, Vcc Max=3.8V, 150°C	P
High Temperature Operating Life Latent Failure Rate	Dynamic Operating Condition, Vcc Max=5.75V, 125°C Dynamic Operating Condition, Vcc Max=3.8V, 150°C	P
High Temperature Steady State life	150°C, 3.63V, Vcc Max	P
Low Temperature Operating Life	-30C, 4.3V, 8MHZ	P
High Accelerated Saturation Test (HAST)	130C, 5.75V/3.63V, 85%RH, Precondition: JESD22 Moisture Sensitivity MSL1 168 Hrs, 85°C/85%RH+3IR-Reflow, 235°C+0, -5°C	P
Temperature Cycle	MIL-STD-883C, Method 1010, Condition C, -65°C to 150°C Precondition: JESD22 Moisture Sensitivity MSL 1 168 Hrs, 85°C/85%RH+3IR-Reflow, 235°C+0, -5°C	P
Pressure Cooker	121°C, 100%RH Precondition: JESD22 Moisture Sensitivity MSL 1 168 Hrs, 85°C/85%RH+3IR-Reflow, 235°C+0, -5°C	P
Age Bond Strength	200C, 4hrs MIL-STD-883, Method 883-2011	P
Endurance Test	MIL-STD-883, Method 883-1033	P
Data Retention	150°C ± 5°C No Bias	P
Dynamic Latch up	Cypress Spec. 01-00081	P
Electrostatic Discharge Human Body Model (ESD-HBM)	2,200V JESD22, Method A114-B	P
Electrostatic Discharge Human Body Model (ESD-HBM)	2,200V/2,200V MIL-STD-883, Method 3015.7	P
Electrostatic Discharge Charge Device Model (ESD-CDM)	500V Cypress Spec. 25-00020	P
Latch up Sensitivity	125°C, 11/11.5V, ± 300mA In accordance with JEDEC 17. Cypress Spec. 01-00081	P

RELIABILITY FAILURE RATE SUMMARY

Stress/Test	Device Tested/ Device Hours	# Fails	Activation Energy	Thermal[3] A.F	Failure Rate
High Temperature Operating Life Early Failure Rate[1]	1,005 Devices	0	N/A	N/A	0 PPM
High Temperature Operating Life[1,2] Long Term Failure Rate	283,794 DHRs	0	0 .7	55	19 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 #: 010702

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: ACOUSTIC-MSL1							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	COMP	15	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	COMP	15	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	COMP	15	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE (150C, 3.8V, Vcc Max)							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	48	1005	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	48	1004	1	NON VISUAL
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	48	1005	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE (150C, 3.8V, Vcc Max)							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	80	120	0	
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	500	120	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	80	120	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	500	120	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	80	120	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	500	120	0	
STRESS: AGE BOND STRENGTH							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	COMP	15	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	COMP	15	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	COMP	15	0	
STRESS: LOW TEMPERATURE OPERATING LIFE (-30C, 4.3V)							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	500	48	0	
STRESS: ESD-CHARGE DEVICE MODEL (500V)							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	COMP	9	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	COMP	9	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	COMP	9	0	
STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015 (2,000V)							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	COMP	9	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	COMP	9	0	
CY2414ZC (7C841400A)	2103764	*610106177*	TAIWN-T	COMP	10	0	

Reliability Test Data

QTP #: 010702

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: STATIC LATCH-UP TESTING (125C, 10V, ±300mA)							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	COMP	3	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	COMP	3	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	COMP	3	0	
STRESS: DYNAMIC LATCH-UP TESTING (11.5V)							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	COMP	3	0	
STRESS: HI-ACCEL SATURATION TEST (130C, 85%RH, 3.63V), PRE COND 168 HR 85C/85%RH, MSL1							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	128	50	0	
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	256	50	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	128	48	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	128	48	0	
STRESS: HIGH TEMP STEADY STATE LIFE TEST (150C, 3.63V)							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	80	80	0	
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	168	80	0	
STRESS: ENDURANCE TEST							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	COMP	45	0	
STRESS: DATA RETENTION, PLASTIC, 150C							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	168	80	0	
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	552	80	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	168	80	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	552	80	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	168	80	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	552	80	0	
STRESS: PRESSURE COOKER TEST (121C, 100%RH), PRE COND 168 HR 85C/85%RH, MLS1							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	168	50	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	168	49	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	168	51	0	

Reliability Test Data

QTP #: 010702

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							
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	300	50	0	
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	500	50	0	
CY2414ZC (7C841400A)	2101502	*610106170/1/2*	TAIWN-T	1000	50	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	300	50	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	500	50	0	
CY2414ZC (7C841400A)	2052404	*610106173/4/5*	TAIWN-T	1000	50	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	300	50	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	500	50	0	
CY2414ZC (7C841400A)	2103764	*610106176/7/8*	TAIWN-T	1000	49	0	

Reliability Test Data

QTP #: 032508

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE, 125C, 5.75V, Vcc Max							
CY8C24423 (8C24423A)	2340016	*510400896*	INDNS-O	96	681	0	
CY8C24423 (8C24423A)	2344365	*510400385*	INDNS-O	96	700	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE, 125C, 5.75V, Vcc Max							
CY8C24423 (8C24423A)	2332416	*510307853*	INDNS-O	250	429	0	
CY8C24423 (8C24423A)	2332416	*510307853*	INDNS-O	500	429	0	
STRESS: ESD-CHARGE DEVICE MODEL, 500V							
CY8C24423 (8C24423A)	2332416	*510307815*	INDNS-O	COMP	9	0	
STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015, 2,200V							
CY8C24423 (8C24423A)	2332416	*510307815*	INDNS-O	COMP	9	0	
STRESS: STATIC LATCH-UP TESTING, 125C, 11V, ±300mA							
CY8C24423 (8C24423A)	2332416	*510307815*	INDNS-O	COMP	3	0	
STRESS: DATA RETENTION, 150°C, No Bias							
CY8C24423 (8C24423A)	2332416	*510307814/5*	INDNS-O	250	158	0	
CY8C24423 (8C24423A)	2332416	*510307814/5*	INDNS-O	500	158	0	
CY8C24223 (8C24223A)	2344365	*510400385*	INDNS-O	250	160	0	
CY8C24223 (8C24223A)	2344365	*510400385*	INDNS-O	500	159	0	
STRESS: HI-ACCEL SATURATION TEST, 130C, 85%RH, 5.75V							
CY8C22213 (8C22213A)	2332416	*510308327*	INDNS-O	128	47	0	
STRESS PRESSURE COOKER TEST, 121C, 100%RH							
CY8C24423 (8C24423A)	2332416	*510307814/5*	INDNS-O	168	44	0	
CY8C24423 (8C24423A)	2332416	*510307814/5*	INDNS-O	288	44	0	
CY8C24223 (8C24223A)	2344365	*510400385*	INDNS-O	168	50	0	
CY8C24223 (8C24223A)	2344365	*510400385*	INDNS-O	288	49	0	
STRESS: TC COND. C -65C TO 150C							
CY8C24423 (8C24423A)	2332416	*510307814/5*	INDNS-O	300	45	0	
CY8C24223 (8C24223A)	2333449	*510309073*	INDNS-O	300	45	0	
CY8C24223 (8C24223A)	2333449	*510309073*	INDNS-O	500	45	0	
CY8C24223 (8C24223A)	2333449	*510309073*	INDNS-O	1000	45	0	
CY8C24223 (8C24223A)	2344365	*510400385*	INDNS-O	300	50	0	
CY8C24223 (8C24223A)	2344365	*510400385*	INDNS-O	500	49	0	

Reliability Test Data

QTP #: 043104

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE, 125C, 5.75V, Vcc Max							
CY8C24423A (8C24423B)	2419761	510406293	INDNS-O	96	1005	0	
STRESS: ESD-CHARGE DEVICE MODEL, 500V							
CY8C24423A (8C24423B)	2419761	510405650	INDNS-O	COMP	9	0	
STRESS: ESD-HUMAN BODY CIRCUIT PER JESD22, METHOD A114-B, 2,200V							
CY8C24423A (8C24423B)	2419761	510405650	INDNS-O	COMP	9	0	
STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015, 2,200V							
CY8C24423A (8C24423B)	2419761	510405650	INDNS-O	COMP	3	0	
STRESS: STATIC LATCH-UP TESTING, 125C, 11.5V, ±300mA							
CY8C24423A (8C24423B)	2419761	510405650	INDNS-O	COMP	3	0	

Reliability Test Data

QTP #: 073901

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: SORT YIELD							
CY8C24423A (8C24423E)	2728024			COMP			COMPARABLE
STRESS: ETEST YIELD							
CY8C24423A (8C24423E)	2728024			COMP			COMPARABLE