

# Cypress Semiconductor Product Qualification Report

QTP# 050507 VERSION 1.0  
August 2005

<b>Programmable Clock Generator w/ VCXO</b>	
<b>Device Family</b>	
<b>S4AD-LATCH, Fab 2</b>	
<b>CY22388/89/91</b>	<b>Factory Programmable Qual PLL Clock Generator with VCXO</b>
<b>CY24378</b>	<b>Quad PLL Clock Generator with VCXO</b>
<b>CY24745</b>	<b>DTV Quad PLL Clock Generator with VCXO</b>

## CYPRESS TECHNICAL CONTACT FOR QUALIFICATION DATA:

Fredrick Whitwer  
Principal Reliability Engineer  
(408) 943-2722

Sabbas Daniel  
Quality Engineering Director  
(408) 943-2685

### PRODUCT QUALIFICATION HISTORY

<b>Qual Report</b>	<b>Description of Qualification Purpose</b>	<b>Date Comp</b>
010702	New Technology S4AD-5 / New Product, Programmable Clock Generator, CY2414ZC, its product family and bond option.	Apr 01
044105	S4ADLATCH Derivative Technology at Fab2	Mar 05
050507	7C84980A (CY22388) Device Family using S4AD-Latch Technology, Fab2	Aug 05

<b>PRODUCT DESCRIPTION (for qualification)</b>	
Qualification Purpose: Qualify CY22388 Device and its product family in Technology S4AD-LATCH in Fab 2	
Marketing Part #:	CY22388/89/91, CY24377/8, CY24745
Device Description:	3.3V Commercial, 4 PLL Programmable Clock Generator with AVCXO
Cypress Division:	Cypress Consumer & Computation Division – (CCD) WA
Overall Die (or Mask) REV Level (pre-requisite for qualification):	Rev. A
What ID markings on Die:	7C84980A

<b>TECHNOLOGY/FAB PROCESS DESCRIPTION S4AD-LATCH</b>			
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
Free Phosphorus contents in top glass layer (%):	0%		
Number of Transistors in Device:	35,000		
Number of Gates in Device	2,500		
Generic Process Technology/Design Rule (□-drawn):	1P2m, 0.35 μm		
Gate Oxide Material/Thickness (MOS):	SiO <sub>2</sub> / 70Å		
Name/Location of Die Fab (prime) Facility:	Cypress Semiconductor - Round Rock, TX		
Die Fab Line ID/Wafer Process ID:	Fab2, S4AD-LATCH Sonos		

**PACKAGE AVAILABILITY**

<b>PACKAGE</b>	<b>ASSEMBLY/TEST SITE FACILITY</b>
<b>16-Lead SSOP</b>	<b>CML-R</b>
<b>20-Lead QSOP</b>	<b>CML-R</b>
<b>20-Lead TSSOP</b>	<b>OSE-Taiwan/CML-R</b>
<b>32-Lead QFN</b>	<b>Korea-Seoul/CML-R</b>

**Note:** Package Qualification details upon request.

<b>MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION</b>	
<b>Package Designation:</b>	ZZ20
<b>Package Outline, Type, or Name:</b>	20-Lead Thin Shrink Small Outline Package (TSSOP)
<b>Mold Compound Name/Manufacturer:</b>	Hitachi CEL9200HF
<b>Mold Compound Flammability Rating:</b>	V-O per UL94
<b>Oxygen Rating Index:</b>	>28%
<b>Lead Frame Material:</b>	Copper
<b>Lead Finish, Composition / Thickness:</b>	Pure Sn
<b>Die Backside Preparation Method/Metallization:</b>	Grinding
<b>Die Separation Method:</b>	Sawing
<b>Die Attach Supplier:</b>	Ablestik
<b>Die Attach Material:</b>	8340
<b>Die Attach Method:</b>	Dispensing
<b>Bond Diagram Designation:</b>	10-06878
<b>Wire Bond Method:</b>	Thermosonic
<b>Wire Material/Size:</b>	Au, 1.0mil
<b>Thermal Resistance Theta JA °C/W:</b>	101.3 °C/W
<b>Package Cross Section Yes/No:</b>	N/A
<b>Assembly Process Flow:</b>	49-35028M
<b>Name/Location of Assembly (prime) facility:</b>	OSE-Taiwan

<b>ELECTRICAL TEST / FINISH DESCRIPTION</b>	
<b>Test Location:</b>	CML-R
<b>Fault Coverage:</b>	95%

**Note:** Please contact a Cypress Representative for other packages availability.

**RELIABILITY TESTS PERFORMED PER SPECIFICATION REQUIREMENT**

<b>Stress/Test</b>	<b>Test Condition (Temp/Bias)</b>	<b>Result P/F</b>
High Temperature Operating Life Early Failure Rate	Dynamic Operating Condition, Vcc Max=3.8V, 150°C	P
High Temperature Operating Life Latent Failure Rate	Dynamic Operating Condition, Vcc Max=3.8V, 150°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 Precondition: JESD22 Moisture Sensitivity MSL 1 168 Hrs, 85°C/85%RH+3IR-Reflow, <b>260°C</b> +0, -5°C	P
Pressure Cooker	121°C, 100%RH 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 Precondition: JESD22 Moisture Sensitivity MSL 1 168 Hrs, 85°C/85%RH+3IR-Reflow, <b>260°C</b> +0, -5°C	P
High Accelerated Saturation Test (HAST)	130°C, 3.63V, 85%RH Precondition: JESD22 Moisture Sensitivity MSL 1 168 Hrs, 85°C/85%RH+3IR-Reflow, 235°C+0, -5°C	P
Data Retention	150°C ± 5°C no bias	P
High Temperature Steady State Life	150°C, 3.63V, Vcc Max	P
Electrostatic Discharge Human Body Model (ESD-HBM)	2,000V, 2,200V MIL-STD-883, Method 3015.7	P
Electrostatic Discharge Human Body Model (ESD-HBM)	2,200V JESD22, Method A114-B	P
Electrostatic Discharge Charge Device Model (ESD-CDM)	500V Cypress Spec. 25-00020	P
Age Bond Strength	MIL-STD-883C, Method 2011	P
Acoustic Microscopy	Cypress Spec. 25-00104	P
Low Temperature Operating Life	-30°C, 4.3V, 8MHZ	P
Dynamic Latch up Sensitivity	Cypress Spec. 01-00081	P
Static Latch up Sensitivity	125°C, 9V/10V ± 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 <sup>3</sup> A.F	Failure Rate
High Temperature Operating Life Early Failure Rate	1,036 Devices	0	N/A	N/A	0 PPM
High Temperature Operating Life <sup>1,2</sup> Long Term Failure Rate	304,580 DHRs	0	0.7	170	18 FITs

<sup>1</sup> Assuming an ambient temperature of 55°C and a junction temperature rise of 15°C.

<sup>2</sup> Chi-squared 60% estimations used to calculate the failure rate.

<sup>3</sup> 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 =  $8.62 \times 10^{-5}$  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
<b>STRESS: ACOUSTIC-MSL1</b>							
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	
<b>STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE, 150C, 3.8V, Vcc Max</b>							
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	
<b>STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE, 150C, 3.8V, Vcc Max</b>							
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	
<b>STRESS: AGE BOND STRENGTH</b>							
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	
<b>STRESS: DYNAMIC LATCH-UP TESTING, 11.5V</b>							
CY2414ZC (7C841400A)	2101502	610106170/1/2	TAIWN-T	COMP	3	0	
<b>STRESS: LOW TEMPERATURE OPERATING LIFE, -30C, 4.3V</b>							
CY2414ZC (7C841400A)	2101502	610106170/1/2	TAIWN-T	500	48	0	
<b>STRESS: ESD-CHARGE DEVICE MODEL, 500V</b>							
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	

## Reliability Test Data

QTP #: 010702

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
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**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	

**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: 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	
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**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, MSL1**

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
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**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 #: 044105

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
<b>STRESS: ESD-CHARGE DEVICE MODEL, 500V</b>							
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	COMP	9	0	
<b>STRESS: ESD-HUMAN BODY CIRCUIT PER JESD22, METHOD A114-B, 2,200V</b>							
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	COMP	9	0	
<b>STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015, 2,200V</b>							
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	COMP	3	0	
<b>STRESS: STATIC LATCH-UP TESTING, 125C, 9V, ±300mA</b>							
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	COMP	3	0	
<b>STRESS: DATA RETENTION, PLASTIC, 150C</b>							
CY221V08ASC (7C842020A)	2438514	61046013/4/5	CML-RA	480	78	0	
CY221V08ASC (7C842020A)	2438514	61046013/4/5	CML-RA	1000	78	0	
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	168	80	0	
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	500	80	0	
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	1000	80	0	
CY5048SXI (7C880303A)	2438517	610458324/5/9	PHIL-M	500	90	0	
CY5048SXI (7C880303A)	2438517	610458324/5/9	PHIL-M	1000	90	0	
<b>STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE, 150C, 3.3V, Vcc Max</b>							
CY221V08ASC (7C842020A)	2438514	61046013/4/5	CML-RA	48	1010	0	
<b>STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE, 150C, 3.8V, Vcc Max</b>							
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	48	1010	0	
<b>STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE, 150C, 3.8V, Vcc Max</b>							
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	80	130	0	
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	500	129	0	
<b>STRESS: PRESSURE COOKER TEST, 121C, 100%RH, PRE COND 168 HR 85C/85%RH, MSL1</b>							
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	168	48	0	
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	288	48	0	
<b>STRESS: TC COND. C -65C TO 150C, PRE COND 168 HRS 85C/85%RH, MSL1</b>							
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	300	48	0	
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	500	48	0	
CY5048SXI (7C880303A)	2433160	610453536/7/8	PHIL-M	1000	48	0	

## Reliability Test Data

QTP #: 050507

<b>Device</b>	<b>Fab Lot #</b>	<b>Assy Lot #</b>	<b>Assy Loc</b>	<b>Duration</b>	<b>Samp</b>	<b>Rej</b>	<b>Failure Mechanism</b>
<b>STRESS: ESD-CHARGE DEVICE MODEL, 500V</b>							
CY24745OXC (7C84984A)	2510491	610520154	CML-R	COMP	9	0	
CY22389FZXC (7C84980A)	2510491	610520114/6/9	TAIWN-T	COMP	9	0	
CY22391LFXC (7C84980A)	2510491	610519725/6/7	SEOL-L	COMP	9	0	
CY22391LFXC (7C84980A)	2514077	610529632	SEOL-L	COMP	9	0	
CY22389FZXC (7C84980A)	2514077	610529631	TAIWN-T	COMP	9	0	
CY24745OXC (7C84984A)	2514077	610530589	CML-R	COMP	9	0	
<b>STRESS: ESD-HUMAN BODY CIRCUIT PER JESD22, METHOD A114-B, 2,200V</b>							
CY22389FZXC (7C84980A)	2510491	610520114/6/9	TAIWN-T	COMP	9	0	
CY22391LFXC (7C84980A)	2510491	610519725/6/7	SEOL-L	COMP	9	0	
<b>STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015, 2,200V</b>							
CY22389FZXC (7C84980A)	2510491	610520114/6/9	TAIWN-T	COMP	3	0	
CY22391LFXC (7C84980A)	2510491	610519725/6/7	SEOL-L	COMP	3	0	
<b>STRESS: STATIC LATCH-UP TESTING, 125C, 10V, ±300mA</b>							
CY22389FZXC (7C84980A)	2510491	610520114/6/9	TAIWN-T	COMP	9	0	
<b>STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE, 150C, 3.8V, Vcc Max</b>							
CY22389FZXC (7C84980A)	2510491	610520114/6/9	TAIWN-T	48	1036	0	
<b>STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE, 150C, 3.8V, Vcc Max</b>							
CY22389FZXC (7C84980A)	2510491	610520114/6/9	TAIWN-T	80	120	0	
CY22389FZXC (7C84980A)	2510491	610520114/6/9	TAIWN-T	500	120	0	