

# **Cypress Semiconductor Product Qualification Report**

**QTP# 020305 VERSION 2.0  
August, 2003**

**CY22312ZC Two-PLL Clock Generator with Direct Rambus (Lite) Support  
S4AD-5 Technology, Fab 2 / R42LDHA, Fab 4**

## **CYPRESS TECHNICAL CONTACT FOR QUALIFICATION DATA:**

Ed Russell  
Reliability Director  
(408) 432-7069

Bill Stevenson  
Reliability Engineering  
(408) 456-1926

### PRODUCT QUALIFICATION HISTORY

<b>Qual Report</b>	<b>Description of Qualification Purpose</b>	<b>Date Comp</b>
98357	R42 with Hot Aluminum / 4 Meg, 128K x 36 Pipelined SRAM CY1350	Sep 98
010702	New Technology S4AD-5 / New Programmable Clock Generator CY2414ZC and Bond Option	Apr 01
021011	New Two-PLL Clock Generator with Direct Rambus (Lite) Support CY22312ZC	Apr 02
020305	Metal Change to 7C83900	May 02

<b>PRODUCT DESCRIPTION (for qualification)</b>	
Qualification Purpose: Qualify CY22312ZC in S4AD-5 Technology, Fab 2	
Marketing Part #:	CY22312ZC
Device Description:	3.3V, Commercial, available in 16-lead TSSOP and 8-lead SOIC package
Cypress Division:	Cypress Semiconductor Corporation – Timing Technology Division (TTD) WA
Overall Die (or Mask) REV Level (pre-requisite for qualification):	Rev. A
What ID markings on Die:	7C83910A, 7C80803A

<b>TECHNOLOGY/FAB PROCESS DESCRIPTION S4AD-5</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
Passivation Type and Materials:	3,000A TeOs / 6,000A Si <sub>3</sub> N <sub>4</sub>		
Free Phosphorus contents in top glass layer(%):	0%		
Number of Transistors in Device:	50,000		
Number of Gates in Device	2,500		
Generic Process Technology/Design Rule (μ-drawn):	Single Poly, Double Metal, 0.35 μm		
Gate Oxide Material/Thickness (MOS):	SiO <sub>2</sub> / 110A		
Name/Location of Die Fab (prime) Facility:	Cypress Semiconductor - Round Rock, TX		
Die Fab Line ID/Wafer Process ID:	Fab2, S4AD-5		

<b>TECHNOLOGY/FAB PROCESS DESCRIPTION - R42LDHA</b>			
Number of Metal Layers:	2	Metal Composition:	Metal 1: 500Å TiW/6000Å Al/.5%Cu/1200Å TiW Metal 2: 500Å TiW/8000Å Al/.5%Cu/300Å TiW
Passivation Type and Materials:	3,000 TEOS + 6,000Å Si <sub>3</sub> N <sub>4</sub>		
Free Phosphorus contents in top glass layer(%):	0%		
Number of Transistors in Device:	8,000		
Number of Gates in Device	1,400		
Generic Process Technology/Design Rule (μ-drawn):	CMOS, Double Metal /0.35 μm		
Gate Oxide Material/Thickness (MOS):	SiO <sub>2</sub> / 70Å		
Name/Location of Die Fab (prime) Facility:	Cypress Semiconductor - Bloomington, MN		
Die Fab Line ID/Wafer Process ID:	Fab4/R42LDHA		

**PACKAGE AVAILABILITY**

<b>PACKAGE</b>	<b>ASSEMBLY SITE FACILITY</b>
28-lead TSSOP	OSE Taiwan (TAIWN-T)

<b>MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION</b>	
<b>Package Designation:</b>	Z2815
<b>Package Outline, Type, or Name:</b>	28-lead TSSOP
<b>Mold Compound Name/Manufacturer:</b>	SHINETSU KMC – 184-2
<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>	Solder Plated 85% +10/-5Sn, 15% +5/-10Pb, 300-800u”
<b>Die Backside Preparation Method/Metallization:</b>	Grinding / 10 mils
<b>Die Separation Method:</b>	Wafer Saw
<b>Die Attach Supplier:</b>	ASM
<b>Die Attach Material:</b>	84-1LMIS
<b>Die Attach Method:</b>	Dispensing
<b>Bond Diagram Designation:</b>	10-04706
<b>Wire Bond Method:</b>	Thermosonic
<b>Wire Material/Size:</b>	Au, 1.0mil
<b>Thermal Resistance Theta JA °C/W:</b>	94.2°C/W
<b>Package Cross Section Yes/No:</b>	N/A
<b>Assembly Process Flow:</b>	49-35003
<b>Name/Location of Assembly (prime) facility:</b>	OSE Taiwan (TAIWN-T)

<b>ELECTRICAL TEST / FINISH DESCRIPTION</b>	
<b>Test Location:</b>	OSE Taiwan (TAIWN-T)
<b>Fault Coverage:</b>	100%

**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=3.8V, 150°C	P
High Temperature Operating Life Latent Failure Rate	Dynamic Operating Condition, Vcc Max=3.8V, 150°C	P
High Temperature Steady State Life	Static Operating Condition, Vcc Max=3.8V, 150°C	P
High Accelerated Saturation Test (HAST)	130°C, 3.63V,85%RH Precondition: JESD22 Moisture Sensitivity MSL 1 168 Hrs, 85C/85%RH+3IR-Reflow, 235°C+5, 0°C Precondition: JESD22 Moisture Sensitivity MSL 3 192 Hrs., 30°C/60%RH+3IR-Reflow, 220°C+5, -0°C	P
Temperature Cycle	Precondition: JESD22 Moisture Sensitivity MSL 1 168 Hrs, 85C/85%RH+3IR-Reflow, 235°C+5, 0°C Precondition: JESD22 Moisture Sensitivity MSL 3 192 Hrs., 30°C/60%RH+3IR-Reflow, 220°C+5, -0°C MIL-STD-883C, Method 1010, Condition C, -65°C to 150°C	P
Pressure Cooker	Precondition: JESD22 Moisture Sensitivity MSL 1 168 Hrs, 85C/85%RH+3IR-Reflow, 235°C+5, 0°C Precondition: JESD22 Moisture Sensitivity MSL 3 192 Hrs., 30°C/60%RH+3IR-Reflow, 220°C+5, -0°C 121°C, 100%RH	P
Data Retention	150°C ± 5°C no bias	P
Electrostatic Discharge Human Body Model (ESD-HBM)	2,200V 2,000V MIL-STD-883, Method 3015.7	P

**RELIABILITY TESTS PERFORMED PER SPECIFICATION REQUIREMENT (continuation)**

Stress/Test	Test Condition (Temp/Bias)	Result P/F
Electrostatic Discharge Charge Device Model (ESD-CDM)	500V Cypress Spec. 25-00020	P
Endurance Test	MIL-STD-883, Method 883-1033	P
Age Bond Strength	200C, 4hrs MIL-STD-883, Method 883-2011	P
Current Density	Cypress Spec 22-00029	P
Low Temperature Operating Life	-30C, 4.3V, 8MHZ	P
SEM X-Sections	MIL-STD-883, Method 883-2018-2	P
Acoustic Microscopy	MSL1, MSL3 Cypress Spec. 25-00104	P
Latchup Sensitivity	125C, 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 <sup>4</sup>
High Temperature Operating Life Early Failure Rate <sup>1</sup>	4,514	1	N/A	N/A	222 PPM
High Temperature Operating Life <sup>1,2</sup> Long Term Failure Rate	592,168 DHRs	1	0.7	170	10 FIT

<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.

<sup>4</sup> LFR failure rate based on QTP 010702 and QTP #98357.

**RELIABILITY TEST DATA**

**QTP#: 98357**

DEVICE	ASSY-LOC	FABLOT#	ASSYLOT#	DURATION	S/S	REJ	FAIL MODE
STRESS: ACOUSTIC, MSL3							
CY7C1350-AC	CSPI-R	4815594	619807192	COMP	15	0	
CY7C1352-AC	CSPI-R	4812385	619805289	COMP	15	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE, 150C, 3.8V							
CY7C1350-AC	CSPI-R	4812418	619805770	48	750	0	
CY7C1350-AC	CSPI-R	4815594	619807192	48	288	0	
CY7C1350-AC	CSPI-R	4815594	619807192	48	396	0	
CY7C1352-AC	CSPI-R	4824383	619809153	48	66	0	
STRESS: ESD-CHARGE DEVICE MODEL, 500V							
CY7C1352-AC	CSPI-R	4824383	619809153	COMP	3	0	
STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015, 4,400V							
CY7C1352-AC	CSPI-R	4824383	619809153	COMP	3	0	
STRESS: STATIC LATCH-UP TESTING, 125C, 10V, +/-300mA							
CY7C1352-AC	CSPI-R	4824383	619809153	COMP	3	0	
STRESS: HI-ACCEL SATURATION TEST (130C, 3.63V), PRECOND. 192 HRS 30C/60%RH, MSL3							
CY7C1350-AC	CSPI-R	4816713	619808643	128	48	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE, 150C, 3.8V							
CY7C1350-AC	CSPI-R	4812418	619805770	80	392	1	1 UNKNOWN CAUSE
CY7C1350-AC	CSPI-R	4812418	619805770	500	390	0	
CY7C1350-AC	CSPI-R	4815594	619807192	80	396	0	
CY7C1350-AC	CSPI-R	4815594	619807192	548	396	0	
STRESS: PRESSURE COOKER TEST, 121C, 100%RH, MSL3							
CY7C1352-AC	CSPI-R	4816713	619808642	168	45	0	
CY7C1352-AC	CSPI-R	4816713	619808642	288	45	0	
STRESS: TC COND. C, -65 TO 150C, PRECOND. 192 HRS 30C/60%RH, MSL3							
CY7C1350-AC	CSPI-R	4812418	619805769	300	45	0	
CY7C1350-AC	CSPI-R	4812418	619805770	300	45	0	
CY7C1350-AC	CSPI-R	4815594	619807192	300	45	0	



## Reliability Test Data

QTP #: 010702

<i>Device</i>	<i>Fab Lot #</i>	<i>Assy Lot #</i>	<i>Assy Loc</i>	<i>Duration</i>	<i>Samp</i>	<i>Rej</i>	<i>Failure Mechanism</i>
<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	
<b>STRESS: ENDURANCE TEST</b>							
CY2414ZC (7C841400A)	2101502	610106170/1/2	TAIWN-T	COMP	45	0	

## Reliability Test Data

QTP #: 010702

<i>Device</i>	<i>Fab Lot #</i>	<i>Assy Lot #</i>	<i>Assy Loc</i>	<i>Duration</i>	<i>Samp</i>	<i>Rej</i>	<i>Failure Mechanism</i>
<b>STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015, 2,000</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	610106177	TAIWN-T	COMP	10	0	
<b>STRESS: STATIC LATCH-UP TESTING, 125C, 10V, ±300mA</b>							
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	
<b>STRESS: HI-ACCEL SATURATION TEST, 130C, 85%RH, 3.63V, PRE COND 168 HR 85C/85%RH, MSL1</b>							
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	
<b>STRESS: HIGH TEMP STEADY STATE LIFE TEST, 150C, 3.63V</b>							
CY2414ZC (7C841400A)	2101502	610106170/1/2	TAIWN-T	80	80	0	
CY2414ZC (7C841400A)	2101502	610106170/1/2	TAIWN-T	168	80	0	
<b>STRESS: DATA RETENTION, PLASTIC, 150C</b>							
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	
<b>STRESS: PRESSURE COOKER TEST, 121C, 100%RH, PRE COND 168 HR 85C/85%RH, MSL1</b>							
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

<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: TC COND. C -65C TO 150C, PRECONDITION 168 HRS 85C/85%RH, MSL1, MSL1</b>							
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 #: 020305

<i>Device</i>	<i>Fab Lot #</i>	<i>Assy Lot #</i>	<i>Assy Loc</i>	<i>Duration</i>	<i>Samp</i>	<i>Rej</i>	<i>Failure Mechanism</i>
<b>STRESS: ACOUSTIC,-MSL1</b>							
CY22312ZC (7C83910A)	2151724	610204740	TAIWN-T	COMP	15	0	
CY22312ZC (7C83910A)	2151724	610204739	TAIWN-T	COMP	15	0	
CY22312ZC (7C83910A)	2151724	610204741	TAIWN-T	COMP	15	0	
<b>STRESS: ESD-CHARGE DEVICE MODEL, 500V</b>							
CY22312ZC (7C83910A)	2151724	610204740	TAIWN-T	COMP	9	0	
<b>STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015, 2,200V</b>							
CY22312ZC (7C83910A)	2151724	610204740	TAIWN-T	COMP	9	0	
<b>STRESS: STATIC LATCH-UP TESTING, 125C, 10V, ±300mA</b>							
CY22312ZC (7C83910A)	2151724	610204740	TAIWN-T	COMP	3	0	
<b>STRESS PRESSURE COOKER TEST, 121C, 100%RH, PRE COND 168 HRS., 85C/85%RH, MSL1</b>							
CY22312ZC (7C83910A)	2151724	610204740	TAIWN-T	168	48	0	
CY22312ZC (7C83910A)	2151724	610204739	TAIWN-T	168	48	0	
CY22312ZC (7C83910A)	2151724	610204741	TAIWN-T	168	48	0	
<b>STRESS: TC COND. C -65C TO 150C, PRECONDITION 168 HRS 85C/85%RH, MSL1</b>							
CY22312ZC (7C83910A)	2151724	610204740	TAIWN-T	300	48	0	
CY22312ZC (7C83910A)	2151724	610204740	TAIWN-T	500	48	0	
CY22312ZC (7C83910A)	2151724	610204740	TAIWN-T	1000	48	0	
CY22312ZC (7C83910A)	2151724	610204739	TAIWN-T	300	48	0	
CY22312ZC (7C83910A)	2151724	610204739	TAIWN-T	500	48	0	
CY22312ZC (7C83910A)	2151724	610204741	TAIWN-T	300	48	0	
CY22312ZC (7C83910A)	2151724	610204741	TAIWN-T	500	48	0	