

Cardinal Components Inc. Product Qualification Report

September, 2000

PLL Programmable Clock	
L28 Technology, Fab 2	
CPP 2000-1 Family CPP 2000-4 Family CPP 2000-7 Family	High Accuracy EPROM Programmable Die for CPP Family Crystal Oscillators

CARDINAL COMPONENTS INC. TECHNICAL CONTACT FOR QUALIFICATION DATA:

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PRODUCT QUALIFICATION HISTORY

Qual Report		Description of Qualification Purpose	Date
96388		New Product/Fab3 Qualification	Feb 98
97403		Technology Qualification (Generic)	Apr 98
98314		Fab transfer	Sep 98
98225		Redesign of product	Oct 98

PRODUCT DESCRIPTION (for qualification)			
Qualification Purpose: Redesign CY2037AWAF/CY5037AWAF in qualified, L28 Technology , Fab 2.			
Marketing Part #:	CPP 2000 Family		
Device Description:	3.3 or 5V, Industrial, available via Die/Wafer sale		
Timing Division:	Cardinal Components Inc. (ICD)		
Overall Die (or Mask) REV Level (pre-requisite for qualification):		Rev. A	
Die Size (stepping):	58.9 mils x 43.5 mils	What ID markings on Die:	7C80380A/7C80381A

TECHNOLOGY/FAB PROCESS DESCRIPTION - L28			
Number of Metal Layers:	2	Metal Composition:	Metal 1: 500A Ti/1,200A TiW/6,000A Al/1,200A TiW Metal 2: 1,500A TiW//10,000A Al/150A Ti
Passivation Type and Materials:	3,000A TEOS + 15,000A Si ₂ N ₄		
Free Phosphorus contents in top glass layer(%):	N/A		
Die Coating(s), if used:	N/A		
Generic Process Technology/Design Rule (μ-drawn):	CMOS, Single Poly, Double Metal /0.65 μm		
Gate Oxide Material/Thickness (MOS):	SiO ₂ / 145 Å		
Name/Location of Die Fab (prime) Facility:	Cypress Semiconductor - Bloomington, MN		
Die Fab Line ID/Wafer Process ID:	Fab2/L28		

Package used for Qualification

PLASTIC/HERMETIC PACKAGE/ASSEMBLY DESCRIPTION	
Package Designation:	CPP 2000-1, CPP 2000-4, CPP 2000-7
Package Outline, Type, or Name:	20-lead SOIC
Mold Compound Name/Manufacturer:	Sumitomo
Mold Compound Flammability Rating:	V-O per UL94
Oxygen Rating Index:	>28%
Lead Frame Designation:	S
Lead Frame Material:	Copper
Lead Finish, Composition / Thickness:	Solder Plated 85%Sn, 15%Pb
Die Backside Preparation Method/Metallization:	N/A
Die Separation Method:	Wafer Saw
Die Attach Supplier:	Ablestik
Die Attach Material:	8361H
Bond Diagram Designation	10-02947
Wire Bond Method:	Thermosonic
Wire Material/Size:	1.0mil
Thermal Resistance Theta JA °C/W:	79.5
Package Cross Section Yes/No:	N/A
Assembly Process Flow:	11-20017M
Name/Location of Assembly (prime) facility:	Cardinal, Korea

ELECTRICAL TEST / FINISH DESCRIPTION	
Test Location:	CSPI-R
Fault Coverage:	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 = 5.75V, 150C (98225) = 3.65V, 150C (97403)	P
High Temperature Operating Life Latent Failure Rate	Dynamic Operating Condition, Vcc = 5.75V, 150C (98225) = 3.65V, 150C (97403)	P
Read and Record	Dynamic Operating Condition, Vcc = 3.65V, 150C (97403)	P
High Accelerated Saturation Test (HAST)	140°C, 85%RH, 5.5V Precondition: JESD22 Moisture Sensitivity Level 1 (97403) 168 Hrs, 85°C/85%RH	P
Temperature Cycle	MIL-STD-883C, Method 1010, Condition C, -65°C to 150°C (97403) Precondition: JESD22 Moisture Sensitivity Level 1 168 Hrs, 85°C/85%RH	P
Electrostatic Discharge Human Body Model (ESD-HBM)	MIL-STD-883, Method 3015.7 (2,200V)	P
Electrostatic Discharge Charge Device Model (ESD-CDM)	MIL-STD-883, (500V)	P
High Temperature Storage	165C, no bias	P
Age Bond Pull	MIL-STD-883, Method 2011	P
Cold Life Test	-30C, 6.5V	P
Latchup Sensitivity	In accordance with JEDEC 17. (+/- 200mA)	P

RELIABILITY FAILURE RATE SUMMARY

Stress/Test	Device Tested/ Device Hours	# Fails	Activation Energy	Thermal ³ A.F	Failure Rate ⁴
High Temperature Operating Life Early Failure Rate	1,850 Devices	0	N/A	N/A	0 PPM
High Temperature Operating Life ^{1,2} Long Term Failure Rate	173,900 DHRs (97403) 58,000 DHRs (98225)	0 0	0.7	170	31 FITs 93 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.

⁴EFR based on QTP #97403 (Technology Qualification) and QTP #98225 (Redesign Product)

⁴LFR based on QTP #97403 and QTP #98225.

RELIABILITY TEST DATA

QTP#: 98314

DEVICE	ASSY-LOC	FABLOT#	ASSYLOT#	DURATION	S/S	REJ	FAIL MODE
=====							
STRESS: ESD-CHARGE DEVICE MODEL (1,000V)							
CPP-2000	CSPI-R	2827384	619809267	COMP	3	0	

STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015 (4,400V)							
CPP-2000	CSPI-R	2827384	619809267	COMP	3	0	

QTP#: 98225

DEVICE	ASSY-LOC	FABLOT#	ASSYLOT#	DURATION	S/S	REJ	FAIL MODE
=====							
STRESS:	HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE (150C, 5.75V)						

CPP 2000	CSPI-R	2825234	619808136	48	148	0	
CPP 2000	CSPI-R	2825234	619808136	48	148	0	
CPP 2000	CSPI-R	2825234	619808136	48	112	0	
CPP 2000	CSPI-R	2825234	619808136	48	148	0	
CPP 2000	CSPI-R	2825234	619808136	48	148	0	
CPP 2000	CSPI-R	2825234	619808136	48	148	0	
CPP 2000	CSPI-R	2825234	619808136	48	148	0	

STRESS:	ESD-CHARGE DEVICE MODEL (1,000V)						
CPP 2000	CSPI-R	2825234	619808136	COMP	3	0	

STRESS:	ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015 (2,200V)						
CPP 2000	CSPI-R	2825234	619808136	COMP	3	0	

STRESS:	HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE (150C, 5.75V)						
CPP 2000	CSPI-R	2825234	619808136	500	116	0	

STRESS:	STATIC LATCH-UP TESTING 125c, 12V (+/-200 mA)						
CPP 2000	CSPI-R	2825234	619808136	DATA	3	0	

RELIABILITY TEST DATA

QTP 97403

DEVICE	ASSY-LOC	FABLOT#	ASSYLOT#	DURATION	S/S	REJ	FAIL MODE
=====	=====	=====	=====	=====	=====	=====	=====
STRESS: HIGH TEMPERATURE STORAGE (165C, NO BIAS)							
CPP 2000	CSPI-R	2732995	619708289/319	168	78	0	
CPP 2000	CSPI-R	2732995	619708289/319	552	78	0	
CPP 2000	CSPI-R	2735423	619709731	168	78	0	
CPP 2000	CSPI-R	2735423	619709731	552	78	0	
CPP 2000	CSPI-R	2734307	619709732	168	78	0	
CPP 2000	CSPI-R	2734307	619709732	552	78	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE (150C, 3.65V)							
CPP 2000	CSPI-R	2732995	619708289/319	48	180	0	
CPP 2000	CSPI-R	2735423	619709731	48	340	0	
CPP 2000	CSPI-R	2734307	619709732	48	330	0	
STRESS: ESD-CHARGE DEVICE MODEL, 2000V							
CPP 2000	CSPI-R	2732995	619708289/319	COMP	3	0	
STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015, 4000V							
CPP 2000	CSPI-R	2732995	619708289/319	COMP	3	0	
STRESS: HI-ACCEL SATURATION TEST (140C, 3.63V, 85%RH), PRECOND. 168 HRS 85C/85%RH							
CPP 2000	CSPI-R	2732995	619708289/319	128	44	0	
CPP 2000	CSPI-R	2732995	619708289/319	256	44	0	
CPP 2000	CSPI-R	2734307	619709732	128	45	0	
STRESS: HIGH TEMPERATURE STORAGE (165C, NO BIAS)							
CPP 2000	CSPI-R	2732995	619708289/319	336	45	0	
CPP 2000	CSPI-R	2732995	619708289/319	500	45	0	
CPP 2000	CSPI-R	2732995	619708289/319	1000	45	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE (150C, 3.65V)							
CPP 2000	CSPI-R	2732995	619708289/319	80	116	0	
CPP 2000	CSPI-R	2732995	619708289/319	500	116	0	
CPP 2000	CSPI-R	2735423	619709731	80	120	0	
CPP 2000	CSPI-R	2735423	619709731	500	116	0	
CPP 2000	CSPI-R	2734307	619709732	80	116	0	
CPP 2000	CSPI-R	2734307	619709732	500	115	0	1 EOS
STRESS: COLD LIFE TEST (-30C, 6.5V)							
CPP 2000	CSPI-R	2732995	619708289/319	500	45	0	
CPP 2000	CSPI-R	2732995	619708289/319	1000	44	0	1 EOS
STRESS: READ & RECORD LIFE TEST (150C, 3.65V)							
CPP 2000	CSPI-R	2734307	619709732	48	10	0	
CPP 2000	CSPI-R	2734307	619709732	80	10	0	
CPP 2000	CSPI-R	2734307	619709732	500	10	0	

QTP 97403

DEVICE	ASSY-LOC	FABLOT#	ASSYLOT#	DURATION	S/S	REJ	FAIL MODE
=====	=====	=====	=====	=====	=====	=====	=====
STRESS: TC COND. C, -65 TO 150C, PRECOND. 168 HRS 85C/85%RH							
CPP 2000	CSPI-R	2732995	619708289/319	300	45	0	
CPP 2000	CSPI-R	2732995	619708289/319	1000	45	0	
CPP 2000	CSPI-R	2735423	619709731	300	48	0	
CPP 2000	CSPI-R	2735423	619709731	1000	48	0	
CPP 2000	CSPI-R	2734307	619709732	300	47	0	
CPP 2000	CSPI-R	2734307	619709732	1000	47	0	