

# **Cypress Semiconductor Product Qualification Report**

**QTP# 053103 VERSION 1.0  
November 2005**

## **Nitride Seal Mask (NSM) Qualification**

**R9T and R9Q Technology, Fab 4**

**All R9 Devices**

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

Mira Ben-Tzur  
Reliability Engineer, Principal  
(408) 943-2675

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>
033302	New Technology R9T-3R, Fab 4, and New Device CY7C137*/138*E (18Meg) Synchronous product family	Sept 04
053103	R9T Technology, Nitride Seal Mask Process at Fab 4 for Die Edge Delamination Fix	Nov 05

**Cypress products are manufactured using qualified processes. The technology qualification for this product is referenced above and must be considered to get a complete and thorough evaluation of the reliability of the product.**

<b>PRODUCT DESCRIPTION (for qualification)</b>	
<b>Qualification Purpose:</b>	Qualify R9 Technology, Nitride Seal Mask Process at Fab 4 for Die Edge Delamination Fix
<b>Marketing Part #:</b>	ALL R9 DEVICES
<b>Device Description:</b>	2.5V/3.3V, Commercial and Industrial
<b>Cypress Division:</b>	Cypress Semiconductor Corporation – Memory and Image Division (MID)
<b>Overall Die (or Mask) REV Level (pre-requisite for qualification):</b>	N/A
<b>What ID markings on Die:</b>	N/A

<b>TECHNOLOGY/FAB PROCESS DESCRIPTION – R9</b>			
<b>Number of Metal Layers:</b>	3 or 4	<b>Metal Composition:</b>	<b>Three metal layers Process:</b> Metal 1: 150Å Ti / 3200Å Al / 300Å TiW Metal 2: 150Å Ti / 6000Å Al / 300Å TiW Metal 3: 150Å Ti / 8000Å Al / 300Å TiW <b>Four Metal Layers Process:</b> Metal 1: 150Å Ti / 3200Å Al / 300Å TiW Metal 2: 150Å Ti / 6000Å Al / 300Å TiW Metal 2: 150Å Ti / 6000Å Al / 300Å TiW Metal 4: 150Å Ti / 8000Å Al / 300Å TiW
<b>Passivation Type and Materials:</b>	1000Å Oxide TEOS / 9000Å Nitride		
<b>Free Phosphorus contents in top glass layer (%):</b>	0%		
<b>Number of Transistors in Device</b>	N/A		
<b>Number of Logic Gates in Device</b>	N/A		
<b>Generic Process Technology/Design Rule (μ-drawn):</b>	CMOS 90 nm		
<b>Gate Oxide Material/Thickness (MOS):</b>	Nitridized SiO <sub>2</sub> , 23Å		
<b>Name/Location of Die Fab (prime) Facility:</b>	Cypress Semiconductor - Bloomington, MN		
<b>Die Fab Line ID/Wafer Process ID:</b>	Fab4/R9 Technology		

**PACKAGE AVAILABILITY**

<b>PACKAGE</b>	<b>ASSEMBLY SITE FACILITY</b>
All	All Qualified Assembly Sites

Note: Package Qualification details available upon request.

**RELIABILITY TESTS PERFORMED PER SPECIFICATION REQUIREMENTS**

<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 = 2.25V, 150°C	P
High Temperature Operating Life Latent Failure Rate	Dynamic Operating Condition, Vcc Max = 2.25V, 150°C	P
High Accelerated Saturation Test (HAST)	130°C, 3.3V, 85%RH Precondition: JESD22 Moisture Sensitivity MSL3 192 Hrs 30°C/60%RH+3IR-Reflow, 260°C+0, -5°C	P
Pressure Cooker Test	121°C, 100% Precondition: JESD22 Moisture Sensitivity MSL3 192 Hrs 30°C/60%RH+3IR-Reflow, 260°C+0, -5°C	P
Temperature Cycle	MIL-STD-883C, Method 1010, Condition C, -65°C to 150C Precondition: JESD22 Moisture Sensitivity MSL3 192 Hrs 30°C/60%RH+3IR-Reflow, 260°C+0, -5°C	P
Acoustic Microscopy Test	Cypress Spec. 25-00104	P
Electrostatic Discharge Human Body Model (ESD-HBM)	2,200V JEDEC EIA/JESD22-A114-B	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 Cypress Spec. 25-00020	P
Glass Integrity	Cypress Spec. 25-00064	P

**RELIABILITY FAILURE RATE SUMMARY**

Stress/Test	Device Tested / Device Hours	# Fails	Activation Energy	Thermal AF3	Failure Rate
High Temperature Operating Life Early Failure Rate	1,598 Devices	0	N/A	N/A	0 PPM
High Temperature Operating Life <sup>1,2</sup> Long Term Failure Rate	594,000 DHRs	0	0.7	170	11 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<sub>A</sub>=The Activation Energy of the defect mechanism.

k = Boltzmann's constant = 8.62x10<sup>-5</sup> eV/Kelvin.

T<sub>1</sub> is the junction temperature of the device under stress and T<sub>2</sub> is the junction temperature of the device at use conditions.

\*\*FITs Rate calculation based on the Technology Qual # 033302.

## Reliability Test Data

**QTP #: 033302**

<b>Device</b>	<b>Fab Lot #</b>	<b>Assy Lot #</b>	<b>Ass Loc</b>	<b>Duration</b>	<b>Samp</b>	<b>Rej</b>	<b>Failure Mechanism</b>
<b>STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE, 150C, 2.25V, Vcc Core</b>							
CY7C1370DV33 (7C1370E)	4345377	610424939	CML-R	500	170	0	
CY7C1370DV33 (7C1370E)	4406200	610435906	CML-R	500	400	0	
CY7C1370DV33 (7C1370E)	4410258	610437891	CML-R	500	400	0	

## Reliability Test Data

**QTP #: 053103**

<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: ACOUSTIC, MSL3</b>							
CY7C1360C (7C13600CC-RAZC)	4512466	610526368	CML-R	COMP	50	0	
CY1370EC (7C1370EC-RAZC)	4522514	610540659	CML-R	COMP	15	0	
CY7C1470A (7C1470AC-RAZC)	4518300	610542723	CML-R	COMP	15	0	
<b>GLASS INTEGRITY (Pre &amp; Post TCT-300CY)</b>							
CY7C1360C (7C13600CC-RAZC)	4512466	610526368	CML-R	COMP	1	0	
CY1370EC (7C1370EC-RAZC)	4522514	610540659	CML-R	COMP	2	0	
CY7C1470A (7C1470AC-RAZC)	4518300	610542723	CML-R	COMP	2	0	
<b>STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE, 150C, 2.25V, Vcc Core</b>							
CY7C1360C (7C13600CC-RAZC)	4512466	610526368	CML-R	48	542	0	
CY1370EC (7C1370EC-RAZC)	4522514	610540664	CML-R	48	515	0	
CY1370EC (7C1370EC-RAZC)	4522514	610547207	CML-R	48	86	0	
CY1370EC (7C1370EC-RAZC)	4522514	610547208	CML-R	48	455	0	
<b>STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE, 150C, 2.25V, Vcc Core</b>							
CY1370EC (7C1370EC-RAZC)	4522514	610540664	CML-R	80	399	0	
<b>STRESS: HI-ACCEL SATURATION TEST, 130C, 85%RH, 3.3V, PRE COND 192 HR 30C/60%RH, MSL3</b>							
CY7C1360C (7C13600CC-RAZC)	4512466	610526371	CML-R	128	48	0	
CY1370EC (7C1370EC-RAZC)	4522514	610540665	CML-R128	49	0		
CY7C1470A (7C1470AC-RAZC)	4518300	610542723	CML-R	128	49	0	
<b>STRESS: ESD-HUMAN BODY CIRCUIT PER JEDEC EIA/JESD22-A114-B, 2,200V</b>							
CY7C1360C (7C13600CC-RAZC)	4512466	610526369	CML-R	COMP	9	0	
<b>ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015, 2,200V</b>							
CY7C1360C (7C13600CC-RAZC)	4512466	610526369	CML-R	COMP	3	0	
<b>STRESS: ESD-CHARGE DEVICE MODEL, 500V</b>							
CY7C1360C (7C13600CC-RAZC)	4512466	610526369	CML-R	COMP	9	0	

## Reliability Test Data

**QTP #: 053103**

<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: PRESSURE COOKER TEST, 121C, 100%RH, PRE COND 192 HR 30C/60%RH, MSL3</b>							
CY7C1360C (7C13600CC-RAZC)	4512466	610526368	CML-R	168	50	0	
CY7C1360C (7C13600CC-RAZC)	4512466	610526368	CML-R	288	145	0	
CY7C1360C (7C13600CC-RAZC)	4512466	610526368	CML-R	336	140	0	
CY7C1360C (7C13600CC-RAZC)	4512466	610526368	CML-R	504	135	0	
CY7C1360C (7C13600CC-RAZC)	4512466	610526371	CML-R	168	49	0	
CY7C1360C (7C13600CC-RAZC)	4512466	610526371	CML-R	288	145	0	
CY7C1360C (7C13600CC-RAZC)	4512466	610526371	CML-R	336	139	0	
CY7C1360C (7C13600CC-RAZC)	4512466	610526371	CML-R	504	134	0	
CY1370EC (7C1370EC-RAZC)	4522514	610540664	CML-R	168	50	0	
CY1370EC (7C1370EC-RAZC)	4522514	610540664	CML-R	288	50	0	
CY7C1470A (7C1470AC-RAZC)	4518300	610542723	CML-R	168	50	0	
<b>STRESS: TC COND. C -65C TO 150C, PRE COND 192 HR 30C/60%RH, MSL3</b>							
CY7C1360C (7C13600CC-RAZC)	4512466	610526368	CML-R	300	50	0	
CY7C1360C (7C13600CC-RAZC)	4512466	610526368	CML-R	500	50	0	
CY7C1360C (7C13600CC-RAZC)	4512466	610526368	CML-R	1000	50	0	
CY1370EC (7C1370EC-RAZC)	4522514	610540659	CML-R	300	50	0	
CY1370EC (7C1370EC-RAZC)	4522514	610540659	CML-R	500	49	0	
CY7C1470A (7C1470AC-RAZC)	4518300	610542723	CML-R	300	50	0	