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Cypress Semiconductor Automotive Product Qualification Report

QTP# 154103 VERSION *B
November, 2016

Evans 4M nvSRAM Product Family S8TNV1-5, Fab 4	
CY14B104NA	**256K x 16 Automotive nvSRAM**

FOR ANY QUESTIONS ON THIS REPORT, PLEASE CONTACT
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PRODUCT QUALIFICATION HISTORY

QTP Number	Description of Qualification Purpose	Date
154103	New Automotive Product Qualification of Evans 4M nvSRAM, using S8TNV1-5 Process Technology	Feb 2016

PRODUCT DESCRIPTION (for qualification)	
Qualification Purpose: New Automotive Product Qualification of Evans 4M nvSRAM, using S8TNV1-5 Process Technology	
Automotive Marketing Part #:	CY14B104NA
Device Description:	4M (256K x 16) Automotive nvSRAM
Cypress Division:	MPD

TECHNOLOGY/FAB PROCESS DESCRIPTION			
Number of Metal Layers:	3	Metal Composition:	Metal 1: 300Å TiW / 3,200Å Al / 100Å Ti Metal 2: 300Å TiW / 3,200Å Al / 100Å Ti Metal 3: 300Å TiW / 8,000Å Al / 150Å Ti
Passivation Type and Thickness:			Si2N3 9000Å & SiO2 700Å
Generic Process Technology/Design Rule (µ-drawn):			S8TNV1-5/0.13µm
Gate Oxide Material/Thickness (MOS):			32Å (LV) & 110Å (HV)
Name/Location of Die Fab (prime) Facility:			Cypress Semiconductor -- Bloomington, MN
Die Fab Line ID/Wafer Process ID:			Fab4 / S8TNV1-5

PACKAGE AVAILABILITY

PACKAGE	ASSEMBLY FACILITY SITE
48 FBGA	**ASEK-Taiwan (G)**
44 TSOP II	**JCET-China (JT)**

MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION	
Package Designation:	BK48C
Package Outline, Type, or Name:	48 FBGA
Mold Compound Name/Manufacturer:	KE G2270 / KYOCERA
Mold Compound Flammability Rating:	V-0
Mold Compound Alpha Emission Rate:	0.001C/CM2-H
Oxygen Rating Index: >28%	52%
Substrate Material:	BT Resin / UMTC
Lead Finish, Composition / Thickness:	SnAgCu 0.3
Die Backside Preparation Method/Metallization:	Backgrind
Die Separation Method:	100% Saw
Die Attach Supplier:	Henkel
Die Attach Material:	2025D
Bond Diagram Designation	001-97797
Wire Bond Method:	Thermosonic
Wire Material/Size:	1.0 mil Au
Thermal Resistance Theta JA °C/W:	46.09 °C/W
Package Cross Section Yes/No:	No
Assembly Process Flow:	49-41040
Name/Location of Assembly (prime) facility:	ASE-G
MSL LEVEL	3
REFLOW PROFILE	260C

ELECTRICAL TEST / FINISH DESCRIPTION	
Test Location:	Sort Test: CMI, USA / Class Test and Finish: CML, Philippines

Note: Please contact a Cypress Representative for other package availability.

RELIABILITY TESTS PERFORMED PER SPECIFICATION REQUIREMENTS

Stress/Test	Test Condition (Temp/Bias)	Result P/F
Electrostatic Discharge Human Body Model (ESD-HBM)	AEC-Q100-002, 500V, 1,000V, 2,000V	P
Electrostatic Discharge Charge Device Model (ESD-CDM)	AEC-Q100-011, 250V, 500V, 750V (corner pins)	P
Latchup Sensitivity	AEC-Q100-004, +/- 140mA at 125C, 5.4V	P
NVM Endurance /Data Retention (Plastic)	AEC-Q100-005, Endurance at 25C with Retention at 25C and Endurance at 125C with Retention at 150 C, non-biased	P
NVM Endurance / High Temperature Operating Life	AEC-Q100-005 and JESD22-A108, Endurance at 125C with Life Test at 150 C, Dynamic Operating Condition, Vcc = 3.60V	P
High Temperature Operating Life Early Failure Rate	AEC-Q100-008 and JESD22-A108, 150 C Dynamic Operating Condition, Vcc = 3.60V	P
High Temperature Operating Life Latent Failure Rate	JESD22-A108, 150 C Dynamic Operating Condition, Vcc = 3.60V	P
High Accelerated Saturation Test (HAST)	JESD22-A110,130 C, 85%RH, nnV Precondition: JESD22-A113 Moisture Sensitivity Level (192 Hrs., 30 C°, 60% RH)	P
Temperature Cycle	JESD22- A104, -65 C to 150 C Precondition: JESD22-A113 Moisture Sensitivity Level (192 Hrs., 30 C°, 60% RH)	P
Post Temperature Cycle Wire Bond Pull	Mil-Std 883, Method 2011	P
Pressure Cooker Test	JESD22-A102, 121 C, 100%RH, 15 PSIG Precondition: JESD22-A113 Moisture Sensitivity Level (192 Hrs., 30 C°, 60% RH)	P
Wire Bond Shear	AEC Q100-001	P
Wire Bond Pull	Mil-Std 883, Method 2011	P
Solderability	JESD22-B102	P
Physical Dimensions	JESD22B100 and B108	P
Solder Ball Shear	AEC Q100-010	P
Electrical Distributions	AEC Q100-009	P

RELIABILITY FAILURE RATE SUMMARY

Stress/Test	Device Tested/ Device Hours	# Fails	Activation Energy	Thermal AF[3]	Failure Rate
High Temperature Operating Life Early Failure Rate	10,340 Devices Tested / 496,320 Device Hours	0	N/A	N/A	0 PPM
High Temperature Operating Life[1,2] Long Term Failure Rate	10,819 Devices Tested/ 680,232 Device Hours	0	0.7	170	8 FIT

3 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 #: 154103

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: Electrostatic Discharge- Human Body Model (ESD-HBM): 500V							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	500V	3	0	
STRESS: Electrostatic Discharge- Human Body Model (ESD-HBM): 1,000V							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	1000V	3	0	
STRESS: Electrostatic Discharge- Human Body Model (ESD-HBM): 2,000V							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	2000V	3	0	
STRESS: Electrostatic Discharge- Charge Device Model (ESD-CDM): 48 BGA- 250V							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	250V	3	0	
STRESS: Electrostatic Discharge- Charge Device Model (ESD-CDM): 48 BGA- 500V							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	500V	3	0	
STRESS: Electrostatic Discharge- Charge Device Model (ESD-CDM): 48 BGA- 750V (corner pins)							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	750V	3	0	
STRESS: Static Latch up, ±140mA 125C, and Overvoltage Test at 5.4V							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	COMP	6	0	
STRESS: 125C Endurance Test (1.4 Million Cycles) + 150C, 1000 hour Data Retention							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	1000	80	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	1000	80	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	1000	80	0	
STRESS: 25C Endurance Test (1.4 Million Cycles) + 25C, 1000 hour Data Retention							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	1000	80	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	1000	80	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	1000	80	0	
STRESS: 125C Endurance Test (1.4 Million Cycles) + High Temperature Operating Life, 150C, 3.6V, 408 Hrs							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	408	79	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	408	80	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	408	80	0	
STRESS: High Temperature Operating Life- Early Failure Rate, 150C, 3.6V, 48 Hrs							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	48	3446	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	48	3446	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	48	3448	0	
STRESS: High Temperature Operating Life- Latent Failure Rate, 150C, 3.6V, 408 Hrs							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	408	80	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	408	80	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	408	80	0	

Reliability Test Data

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Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: Highly Accelerated Saturation Test (HAST), 130C, 85%RH, 3.6V (MSL 3 Preconditioning)							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	96	80	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	96	80	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	96	80	0	
STRESS: Temperature Cycling Test (TCT), Condition C, -65 C to 150 C (MSL 3 Preconditioning)							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	500	80	0	
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	1000	80	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	96	80	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	1000	80	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	96	80	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	1000	80	0	
STRESS: Post Temperature Cycling Test (TCT) Bond Pull							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	500	5	0	
STRESS: Pressure Cooker Test (PCT), 121 C, 100%RH, 15 PSIG (MSL 3 Preconditioning)							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	96	80	0	
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	168	80	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	96	80	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	168	80	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	96	80	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	168	80	0	
STRESS: Wire Bond Shear							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	COMP	150	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	COMP	150	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	COMP	150	0	
STRESS: Wire Bond Pull							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	COMP	150	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	COMP	150	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	COMP	150	0	
STRESS: Solderability							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	COMP	15	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	COMP	15	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	COMP	15	0	
STRESS: Physical Dimensions							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	COMP	30	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	COMP	30	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	COMP	30	0	
STRESS: BGA Solder Ball Shear							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	COMP	15	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	COMP	15	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	COMP	15	0	

Reliability Test Data

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Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: Electrical Distributions							
CY14B104NA-BA45XE	4520595	*611530604*	*ASE-G*	COMP	30	0	
CY14B104NA-BA45XE	4504243	*611530606*	*ASE-G*	COMP	30	0	
CY14B104NA-BA45XE	*4519953*	*611530603*	*ASE-G*	COMP	30	0	

Document History Page

Document Title: QTP# 154103: New Automotive Product Qualification of Evans 4M nvSRAM, using S8TNV1-5 Process Technology
Document Number: 002-11402

Rev.	ECN No.	Orig. of Change	Description of Change
**	5153831	BECK	Initial Release
*A	5506324	HSTO	Update contact person on Reliability Engineer and Reliability Director Add 44-TSOP II as package option
*B	5535711	HSTO	Update MPN list