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AN INFINEON TECHNOLOGIES COMPANY

Cypress Semiconductor
Product Qualification Report

QTP# 133202 VERSION*C
March, 2021

130nm F-RAM Device Family 130nm Technology, TI and Global Foundries Fab	
FM1608B	64Kb Parallel (8192x8bits) 5V F-RAM Memory
FM16W08	64Kb Parallel (8192x8bits) Wide Voltage F-RAM Memory
FM1808B	256kb Parallel (32,768x8bits) 5V F-RAM Memory
FM18W08	256kb Parallel (32,768x8bits) Wide Voltage F-RAM Memory
FM24C04B	4Kb I2C (512Kx8bits) 5V Serial F-RAM Memory
FM24C16B	16Kb I2C (2,048Kx8bits) 5V Serial F-RAM Memory
FM24C64B	64Kb I2C (8,192Kx8bits) 5V Serial F-RAM Memory
FM24CL04B	4Kb I2C (512Kx8bits) 3V Serial F-RAM Memory
FM24CL16B	16Kb I2C (2,048Kx8bits) 3V Serial F-RAM Memory
FM24CL64B	64Kb I2C (8,192Kx8bits) 3V Serial F-RAM Memory
FM24V01	128Kb (16,384Kx8bits) Serial 3V F-RAM Memory
FM24V02	256Kb (32,768Kx8bits) Serial 3V F-RAM Memory
FM24W256	256Kb I2C (32,768Kx8bits) Serial Wide Voltage F-RAM Memory
FM25040B	4Kb I2C (512Kx8bits) 5V Serial F-RAM Memory
FM25640B	64Kb SPI (8,192Kx8bits) 5V Serial F-RAM Memory
FM25C160B	16Kb SPI (2,048Kx8bits) 5V Serial F-RAM Memory
FM25CL64B	64Kb SPI (8,192Kx8bits) 3V Serial F-RAM Memory
FM25L04B	4Kb I2C (512Kx8bits) 3V Serial F-RAM Memory
FM25L16B	16Kb SPI (2,048Kx8bits) 3V Serial F-RAM Memory
FM25V01	128Kb (16,384Kx8bits) Serial 3V F-RAM Memory
FM25V02	256Kb (32,768Kx8bits) Serial 3V F-RAM Memory
FM25W256	256Kb SPI (32,768Kx8bits) Serial Wide Voltage F-RAM Memory

130nm F-RAM Device Family 130nm Technology, TI and Global Foundries Fab	
FM28V020	**256Kb (32Kx8bits) Bytewide F-RAM Memory**
FM31256	**256Kb Integrated Processor Companion with F-RAM Memory**
FM31276	**64Kb 5V Integrated Processor Companion with F-RAM Memory**
FM31278	**256Kb 5V Integrated Processor Companion with F-RAM Memory**
FM3164	**64Kb Integrated Processor Companion with F-RAM Memory**
FM31L276	**64Kb 3V Integrated Processor Companion with F-RAM Memory**
FM31L278	**256Kb 3V Integrated Processor Companion with F-RAM Memory**
FM33256B	**256Kb 3V Serial F-RAM Memory**

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

QTP Number	Description of Qualification Purpose	Date
133202	Qualification of Additional Passivation Layers on F-RAM Products	March 2014

PRODUCT DESCRIPTION (for qualification)	
Qualification Purpose: Qualification of Additional Passivation Layers on F-RAM Products	
Marketing Part #:	FM1608B, FM16W08, FM1808B, FM18W08, FM24C04B, FM24C16B, FM24C64B, FM24CL04B, FM24CL16B, FM24CL64B, FM24V01, FM24V02, FM24W256, FM25040B, FM25640B, FM25C160B, FM25CL64B, FM25L04B, FM25L16B, FM25V01, FM25V02, FM25W256, FM28V020 FM31256, FM31276, FM31278, FM3164, FM31L276, FM31L278, FM33256B
Device Description:	F-RAM
Cypress Division:	Cypress Semiconductor Corporation – Memory Product Division (MPD)

TECHNOLOGY/FAB PROCESS DESCRIPTION			
Number of Metal Layers:	Proprietary*	Metal Composition:	Proprietary*
Passivation Type and Thickness:	Proprietary*		
Generic Process Technology/Design Rule (μ-drawn):	CMOS / 130nm		
Gate Oxide Material/Thickness (MOS):	Proprietary*		
Name/Location of Die Fab (prime) Facility:	Texas Instruments / Dallas (Tile die), Global Foundries / Essex, Vermont (Base die)		
Die Fab Line ID/Wafer Process ID:	DMOS 5 / E035.1 (Tile die), GF CMRF7TG (Base die)		

*Texas Instruments' proprietary information is available with signed NDA.

ALTERNATIVE PACKAGE AVAILABILITY

PACKAGE	ASSEMBLY FACILITY SITE	QTP REFERENCE
8-Lead SOIC	**UTAC, Thailand**	**QTP#133203**

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

MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION	
Package Designation:	(SZ815)
Package Outline, Type, or Name:	8-Lead SOIC
Mold Compound Name/Manufacturer:	G600/Sumitomo
Mold Compound Flammability Rating:	UL-97 – V0
Oxygen Rating Index:	N/A
Lead Frame Material:	Copper
Lead Finish, Composition / Thickness:	Pure Sn
Die Backside Preparation Method/Metallization:	Backgrind
Die Separation Method:	100% Saw
Die Attach Supplier:	Ablebond
Die Attach Material:	8200T
Die Attach Method:	Epoxy
Bond Diagram Designation:	001-85674
Wire Bond Method:	Thermosonic
Package Cross Section Yes/No:	N/A
Assembly Process Flow:	001-85816
Name/Location of Assembly (prime) facility:	Lingsen, Taiwan
MSL Level	3
Reflow Profile	260C

ELECTRICAL TEST / FINISH DESCRIPTION	
Test Location:	**Lingsen, Taiwan**

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

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RELIABILITY TESTS PERFORMED PER SPECIFICATION REQUIREMENTS

Stress/Test	Test Condition (Temp/Bias)	Result P/F
Acoustic Microscopy	J-STD-020 Precondition: JESD22 Moisture Sensitivity Level 3 192 Hrs, 30C/60%RH+ Reflow, 260°C+0, -5°C	P
Ball Shear	JESD22-B116	P
Bond Pull	MIL-STD-883 – Method 2011, Cpk : 1.33, Ppk : 1.66	P
Constructional Analysis	Criteria: Meet external and internal characteristics of Cypress package	P
Data Retention	125°C, 1000 Hours JESD22-A117 and JESD22-A103	P
High Accelerated Saturation Test (HAST)	JEDEC STD 22-A110: 130°C, 85%RH, 3.6V, Precondition: JESD22 Moisture Sensitivity Level 3 192 Hrs, 30C/60%RH+ Reflow, 260°C+0, -5°C	P
High Temperature Operating Life Early Failure Rate (EFR)	Dynamic Operating Condition, 125°C, 3.6V, 96 Hours JESD22-A-108	P
High Temperature Operating Life Latent Failure Rate (LFR)	Dynamic Operating Condition, 125°C, 3.6V, 168,1000 Hours JESD22-A-108	P
Pressure Cooker	JESD22-A102:121°C /100%RH, 15 PSIG Precondition: JESD22 Moisture Sensitivity Level 3 192 Hrs, 30C/60%RH+ Reflow, 260°C+0, -5°C	P
Temperature Cycle	MIL-STD-883, Method 1010, Condition C, -65 °C to 150°C Precondition: JESD22 Moisture Sensitivity Level 3 192 Hrs, 30C/60%RH+ Reflow, 260°C+0, -5°C	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	2,390 Devices	0	N/A	N/A	0 PPM
High Temperature Operating Life Long Term Failure Rate	1,009,000 DHRs	0	0.7	170	16 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.

*LFR data leveraged from QTP# 124901 (TI 130nm F-RAM Process) and QTP# 125003 (128KB/256KB F-RAM AEC-Q100)

Reliability Test Data

QTP #: 133202

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej
STRESS: ACOUSTIC, MSL3						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	COMP	15	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	COMP	15	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	COMP	15	0
STRESS: BALL SHEAR						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	COMP	5	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	COMP	5	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	COMP	5	0
STRESS: BOND PULL						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	COMP	5	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	COMP	5	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	COMP	5	0
STRESS: CLASS YIELD						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	COMP	EQUIVALENT	
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	COMP	EQUIVALENT	
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	COMP	EQUIVALENT	
STRESS: CONSTRUCTIONAL ANALYSIS						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	COMP	5	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	COMP	5	0
STRESS: DATA RETENTION, 125C						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	500	77	0
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	1000	75	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	500	77	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	1000	77	0

Reliability Test Data

QTP #: 133202

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej
STRESS: HI-ACCEL SATURATION TEST (130C, 85%RH, 3.6V), PRE COND 192 HR 30C/60%RH (MSL3)						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	128	77	0
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	256	72	0
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	256	72	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	128	77	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	256	73	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	256	73	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	128	77	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	256	72	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	256	72	0
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE (125C, 3.6V, Vcc Max)						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	96	800	0
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	96	792	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	96	799	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	96	799	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	96	800	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	96	799	0
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE (125C, 3.6V, Vcc Max)						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	168	77	0
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	168	77	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	168	77	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	1000	77	0

Reliability Test Data

QTP #: 133202

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej
STRESS: PRESSURE COOKER TEST (121C, 100%RH, 15 Psig), PRE COND 192 HR 30C/60%RH (MSL3)						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	168	77	0
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	288	77	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	168	77	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	288	77	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	168	77	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	288	77	0
STRESS: SORT YIELD						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	COMP	EQUIVALENT	
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	COMP	EQUIVALENT	
STRESS: TEMPERATURE CYCLE (COND. C, -65C TO 150C), PRE COND 192 HR 30C/60%RH (MSL3)						
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	500	77	0
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	500	77	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	500	77	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	1000	77	0
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	1000	77	0

Document History Page

Document Title: QTP#133202: 130NM F-RAM DEVICE FAMILY, 130NM TECHNOLOGY, TI FAB
Document Number: 001-91526

Rev.	ECN No.	Orig. of Change	Description of Change
**	4308820	JYF	Initial release.
*A	4315968	BECK	Standardized format, corrected typos
*B	4803184	BECK	Indicated “Proprietary” Items on the “TECHNOLOGY/FAB PROCESS DESCRIPTION” Table, Page 4, and removed proprietary items from Page 3 (Qualification History) and Page 4 (Product Description).
*C	7106403	JUMI SLLO	Clarified Global Foundries Fab site on title and page 4 (Technology/Fab Process Description). and aligned Qualification Report with current requirements. Removed Distribution and Posting from document history page.