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Cypress Semiconductor
Product Qualification Report

QTP# 142501 VERSION*C
July 2019

130nm F-RAM Device Family 130nm Technology, TI Fab	
FM22L16-55-TG	**4-Mbit (256 K × 16) Parallel F-RAM Memory**
FM22LD16-55-BG	**4-Mbit (256 K × 16) Parallel F-RAM Memory**
FM22L16-55-TGTR	**4-Mbit (256 K × 16) Parallel F-RAM Memory**
FM22LD16-55-BGTR	**4-Mbit (256 K × 16) Parallel F-RAM Memory**

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

QTP Number	Description of Qualification Purpose	Date
143801	Qualification of Additional Passivation Layers on F-RAM Products	Nov 2014
142501	Qualification of Additional PO2 Passivation Layer on FM22L16 (Largest F-RAM Die) at TI DM5 Dallas Fab	Dec 2014

PRODUCT DESCRIPTION (for qualification)	
Qualification Purpose: Qualify Additional PO2 Passivation Layer on FM22L16 (Largest F-RAM Die) at TI DM5 Dallas Fab	
Marketing Part #:	FM22L16-55-TG, FM22LD16-55-BG, FM22L16-55-TGTR, FM22LD16-55-BGTR
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):	Proprietary*		
Gate Oxide Material/Thickness (MOS):	Proprietary*		
Name/Location of Die Fab (prime) Facility:	Texas Instruments / Dallas		
Die Fab Line ID/Wafer Process ID:	DMOS 5 / E035.1		

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

ALTERNATIVE PACKAGE AVAILABILITY

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

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

MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION	
Package Designation:	ZW44B
Package Outline, Type, or Name:	44L TSOP II
Mold Compound Name/Manufacturer:	G631H / Sumitomo
Mold Compound Flammability Rating:	V-0
Mold Compound Alpha Emission Rate:	<0.1
Oxygen Rating Index: >28%	53%
Lead Frame Designation:	FMP
Lead Frame Material:	Al 42
Substrate Material:	N/A
Lead Finish, Composition / Thickness:	Matte Sn
Die Backside Preparation Method/Metallization:	Backgrind
Die Separation Method:	Wafer Saw
Die Attach Supplier:	Sumitomo
Die Attach Material:	CRM1076WA
Bond Diagram Designation	001-85443
Wire Bond Method:	Thermosonic
Wire Material/Size:	Au / 0.8 mil (20um)
Package Cross Section Yes/No:	No
Assembly Process Flow:	49-41999
Name/Location of Assembly (prime) facility:	ASEK-Taiwan (G)
MSL Level	3
Reflow Profile	260C

ELECTRICAL TEST / FINISH DESCRIPTION	
Test Location:	**KYEC-Taiwan**

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
Acoustic Microscopy	J-STD-020 Precondition: JESD22 Moisture Sensitivity Level (192 Hrs., 30°C, 60% RH, 260°C Reflow)	P
Aged Bond Strength	200°C, 4HRS MIL-STD-883, Method 883-2011	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 (192 Hrs., 30°C, 60% RH, 260°C Reflow)	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 (192 Hrs., 30°C, 60% RH, 260°C Reflow)	P
Temperature Cycle	MIL-STD-883, Method 1010, Condition C, -65 °C to 150°C Precondition: JESD22 Moisture Sensitivity Level (192 Hrs., 30°C, 60% RH, 260°C Reflow)	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	1,499 Devices	0	N/A	N/A	0 PPM (1)
High Temperature Operating Life Long Term Failure Rate	1,009,000 DHRs	0	0.7	55	16 FIT (2)

[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.

(1) Early Failure Rate was computed from QTP#142501
(2) Long Term Failure Rate was computed from QTP#143801

Reliability Test Data

QTP #: 143801

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: ACOUSTIC, MSL3							
CY15B102Q-SXE	4351641	611410018	UTAC	COMP	22	0	
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	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	COMP	15	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	COMP	15	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	COMP	15	0	
STRESS: BALL SHEAR							
CY15B102Q-SXE	4351641	611410018	UTAC	COMP	30	0	
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	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	COMP	5	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	COMP	5	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	COMP	5	0	
STRESS: BOND PULL							
CY15B102Q-SXE	4351641	611410018	UTAC	COMP	30	0	
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	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	COMP	5	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	COMP	5	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	COMP	5	0	
STRESS: AGED BOND PULL (200C, 4 Hours)							
CY15B102Q-SXE	4351641	611410018	UTAC	COMP	5	0	
STRESS: CLASS YIELD							
CY15B102Q-SXE	4351641	611410018	UTAC	COMP	EQUIVALENT		
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	COMP	EQUIVALENT		
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	COMP	EQUIVALENT		
FM25V01-G (FM25V01A)	2329041	611340037	LINGSEN	COMP	EQUIVALENT		
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	COMP	EQUIVALENT		
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	COMP	EQUIVALENT		
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	COMP	EQUIVALENT		

Reliability Test Data

QTP #: 143801

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: CONSTRUCTIONAL ANALYSIS							
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	COMP	5	0	
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	COMP	5	0	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	COMP	5	0	
FM25V02-G (FM25V02A)	2329042	611340083	UTAC	COMP	5	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	COMP	5	0	
STRESS: DATA RETENTION, 125C							
CY15B102Q-SXE	4351641	611410018	UTAC	500	77	0	
CY15B102Q-SXE	4351641	611410018	UTAC	1000	77	0	
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	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	500	77	0	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	500	77	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	1000	77	0	
STRESS: HI-ACCEL SATURATION TEST (130C, 85%RH, 3.6V), PRE COND 128 HR 30C/60%RH (MSL3)							
CY15B102Q-SXE	4351641	611410018	UTAC	96	77	0	
CY15B102Q-SXE	4351641	611410018	UTAC	128	77	0	
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	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	128	63	0	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	128	63	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	128	77	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	128	77	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	128	66	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	128	66	0	

Reliability Test Data

QTP #: 143801

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE (125C, 3.6V, Vcc Max)							
CY15B102Q-SXE	4351641	611410018	UTAC	96	500	0	
CY15B102Q-SXE	4351641	611410018	UTAC	96	1200	0	
CY15B102Q-SXE	4351641	611410018	UTAC	96	1800	0	
CY15B102Q-SXE	4351641	611410018	UTAC	96	100	0	
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	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	96	800	0	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	96	800	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	96	800	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	96	800	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	96	798	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	96	798	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	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	168	77	0	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	168	57	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	168	77	0	

Reliability Test Data

QTP #: 143801

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE (125C, 3.6V, Vcc Max)							
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	1000	77	0	
STRESS: PRESSURE COOKER TEST (121C, 100%RH, 15 Psig), PRE COND 192 HR 30C/60%RH (MSL3)							
CY15B102Q-SXE	4351641	611410018	UTAC	96	77	0	
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	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	168	77	0	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	288	77	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	168	77	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	288	77	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	168	77	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	288	77	0	
STRESS: SORT YIELD							
CY15B102Q-SXE	4351641	611410018	UTAC	COMP	EQUIVALENT		
FM25V01-G (FM25V01A)	2327007	611340032	LINGSEN	COMP	EQUIVALENT		
FM25V01-G (FM25V01A)	2329042	611340033	LINGSEN	COMP	EQUIVALENT		
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	COMP	EQUIVALENT		
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	COMP	EQUIVALENT		
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	COMP	EQUIVALENT		
STRESS: TEMPERATURE CYCLE (COND. C, -65C TO 150C), PRE COND 192 HR 30C/60%RH (MSL3							
CY15B102Q-SXE	4351641	611410018	UTAC	500	77	0	
CY15B102Q-SXE	4351641	611410018	UTAC	1000	77	0	
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	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	500	77	0	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2327007	611339585	UTAC	1000	77	0	

Reliability Test Data

QTP #: 143801

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: TEMPERATURE CYCLE (COND. C, -65C TO 150C), PRE COND 192 HR 30C/60%RH (MSL3							
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	500	77	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2329042	611339583	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	500	77	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	1000	77	0	
FM25V02-G (FM25V02A)	2329041	611339581	UTAC	1000	77	0	

Reliability Test Data

QTP #: 142501

Device	Fab Lot #	Assy Lot #	Ass Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: ACOUSTIC, MSL3							
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	COMP	15	0	
STRESS: AGED BOND STRENGTH							
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	COMP	5	0	
STRESS: BALL SHEAR							
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	COMP	10	0	
STRESS: BOND PULL							
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	COMP	12	0	
STRESS: DATA RETENTION, 125C							
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	500	80	0	
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	1000	80	0	
STRESS: HI-ACCEL SATURATION TEST, 130C, 85%RH, 3.6V, PRE COND 192 HR 30C/60%RH, MSL3							
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	96	77	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE, 125C, 3.6V							
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	96	1499	0	
STRESS: PRESSURE COOKER TEST, 121C, 100%RH, 15 Psig, PRE COND 192 HR 30C/60%RH, MSL3							
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	168	80	0	
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	288	80	0	
STRESS: TEMPERATURE CYCLE COND. C -65C TO 150C, PRE COND 192 HRS 30C/60%RH, MSL3							
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	500	80	0	
FM22L16 (FP22L16A)	2443003	611440903	G-Taiwan	1000	80	0	

Document History Page

Document Title: QTP#142501: 130NM F-RAM DEVICE FAMILY, 130NM TECHNOLOGY, TI FAB
Document Number: 001-95767

Rev.	ECN No.	Orig. of Change	Description of Change
**	4602939	JYF	Initial spec release.
*A	4804514	BECK	Indicated “Proprietary” Items on the “TECHNOLOGY/FAB PROCESS DESCRIPTION” Table, Page 3, and removed proprietary items from Page 2 (Qualification History).
*B	5342519	JYF	Updated Cy Logo; Updated Thermal AF in Reliability Failure Rate Summary table from 170 to 55.
*C	6621165	JYF	Updated the following: -Cypress Logo -Reliability Contact Person in Qual Report Title Page -Technology/Fab Process Description and Major Package Information Tables