

Cypress Semiconductor Product Qualification Report

QTP# 141603 VERSION **
January, 2014

128Kb and 256Kb F-RAM Memory Product Qualification 130nm Technology, TI Fab	
FM24V02A-G	256-Kbit (32K × 8) Serial (I2C) F-RAM
FM24V01A-G	128-Kbit (16K × 8) Serial (I2C) F-RAM
FM25V02A-G	256-Kbit (32K × 8) Serial (SPI) F-RAM
FM25V01A-G	128-Kbit (16K × 8) Serial (SPI) F-RAM
FM25V02A-DG	256-Kbit (32K × 8) Serial (SPI) F-RAM
FM25V02A-DGQ	256-Kbit (32K × 8) Serial (SPI) F-RAM

FOR ANY QUESTIONS ON THIS REPORT, PLEASE CONTACT
reliability@cypress.com or via a CYLINK CRM CASE

Prepared By:
Becky Thomas
Reliability Engineer

Reviewed By:
Zhaomin Ji
Reliability Engineer

Approved By:
Richard Oshiro
Reliability Director

PACKAGE/PRODUCT QUALIFICATION HISTORY

QTP Number	Description of Qualification Purpose	Date
02-60-5112 / 124901	TI Process Qualification 130nm F-RAM Process	Aug 2008 / Dec 2012
133705	New Product Qualification, 1Mb and 2Mb F-RAM Memory	Aug 2014
141603	New Product Qualification, 128Kb and 256Kb F-RAM Memory	Jan 2015

PRODUCT DESCRIPTION (for qualification)

Qualification Purpose: New Product Qualification, 128Kb and 256Kb F-RAM Memory

Marketing Part #: FM24V02A-G, FM24V01A-G, FM25V02A-G, FM25V01A-G, FM25V02A-DG, FM25V02A-DGQ

Device Description: 128Kb and 256Kb F-RAM Serial and Parallel Memory

Cypress Division: Cypress Semiconductor Corporation – Memory Products Division (MPD)

TECHNOLOGY/FAB PROCESS DESCRIPTION

Number of Metal Layers:	6	Metal Composition:	Metal 1: Cu 3050A Metal 2: Cu 3050A Metal 3: Cu 3050A Metal 4: Cu 3050A Metal 5: Cu 4050A Metal 6: Al 1.0um
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Passivation Type and Thickness:	4000A SiO ₂ + 3000A SiO _x N _y + 4000A SiO _x N _y +4000A Si ₃ N ₄
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Generic Process Technology/Design Rule (μ-drawn):	E035.1 F-RAM / 130nm
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Gate Oxide Material/Thickness (MOS):	1.5V 26A 3.3V 70A
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Name/Location of Die Fab (prime) Facility:	Texas Instruments / Dallas, TX
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Die Fab Line ID/Wafer Process ID:	DMOS 5 / E035.1
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PACKAGE AVAILABILITY

PACKAGE	ASSEMBLY FACILITY SITE
8-pin SOIC, 150 mils	UTAC, Thailand (UT)
8-pin SOIC, 150 mils	CML, Philippines (RA)
8-pin TDFN	UTAC, Thailand (UT)

MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION	
Package Designation:	SW815
Package Outline, Type, or Name:	8LD SOIC (150mils)
Mold Compound Name/Manufacturer:	G3000DA / Kyocera
Mold Compound Flammability Rating:	V-0 / UL94
Mold Compound Alpha Emission Rate:	<0.1
Oxygen Rating Index: >28%	50% Typical
Lead Frame Designation:	FMP
Lead Frame Material:	Cu
Substrate Material:	N/A
Lead Finish, Composition / Thickness:	NiPdAu
Die Backside Preparation Method/Metallization:	Backgrind
Die Separation Method:	Wafer Saw
Die Attach Supplier:	Henkel
Die Attach Material:	QMI 509
Bond Diagram Designation	001-87480
Wire Bond Method:	Thermosonic
Wire Material/Size:	Au / 0.8 mil
Thermal Resistance Theta JA °C/W:	146C/W
Package Cross Section Yes/No:	No
Assembly Process Flow:	001-91441/M
Name/Location of Assembly (prime) facility:	CML-RA
MSL LEVEL	3
REFLOW PROFILE	260C

ELECTRICAL TEST / FINISH DESCRIPTION	
Test Location:	CMI, USA; UTAC, Thailand; CML, Philippines / UTAC, Thailand; 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
Data Retention (Plastic)	150 C, non-biased, 1,000 Hours JESD22-A117 and JESD22-A103	P
Data Retention (Plastic)	125 C, non-biased, 1,000 Hours JESD22-A117 and JESD22-A103	P
High Temperature Operating Life Early Failure Rate	Dynamic Operating Condition, Vcc = 3.60V, 125 C, 96 Hours JESD22-A108	P
Endurance Test	MIL-STD-883, Method 883-1033, 1.1E6 cycles (full 256Kb array) + 7.5E9 (single byte), Vcc = 3.60V, followed by 168hour Data Retention at 150C.	P
High Temperature Operating Life Latent Failure Rate	Dynamic Operating Condition, Vcc = 3.60V, 125 C, 1,000 Hours JESD22-A108	P
Pressure Cooker Test	JESD22-A102: 121 C, 100%RH, 15 PSIG, 168 Hours and 288 Hours Precondition: JESD22 Moisture Sensitivity Level 3 (192 Hrs, 30 C°, 60% RH)	P
Temperature Cycle	MIL-STD-883, Method 1010, Condition C, -65 C to 150 C, 500 and 1,000 Cycles Precondition: JESD22 Moisture Sensitivity Level 3 (192 Hrs, 30 C°, 60% RH)	P
Acoustic Microscopy	J-STD-020 Precondition: JESD22 Moisture Sensitivity Level 3 (192 Hrs, 30 C°, 60% RH)	P
Electrostatic Discharge Human Body Model (ESD-HBM): FM25V02A-G, FM24V02A-G, FM25V01A-G, FM24V01A-G	(1,100V / 2,200V / 3,300V) JEDEC EIA/JESD22-A114-B	P
Electrostatic Discharge Charge Device Model (ESD-CDM): FM25V02A-G, FM24V02A-G, FM25V02A-DGQ, FM25V01A-G, FM24V01A-G	(500V / 750V / 1,000V / 1,250V / 1,500V / 1,750V / 2,000V) JESD22-C101	P
Static Latch up: FM25V02A-G, FM24V02A-G, FM25V01A-G, FM24V01A-G	85C, ±140mA, 5.4V JESD78	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	1784 Devices* 1599 Devices	0	N/A	N/A	0 PPM
High Temperature Operating Life ^{1,2} Long Term Failure Rate	547,000 DHRs** 231,000 DHRs* 188,000 DHRs	0	0.7	55	17 FITs

*Leverage EFR/LFR data from New Product Qualification, 1Mb and 2Mb F-RAM Memory QTP#133705 (SPEC#001-93908)

*Leverage HTOL data from TI 130nm F-RAM Process QTP#124901 (SPEC#001-85093)

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 = 8.62x10⁻⁵ eV/Kelvin.

T₁ is the junction temperature of the device under stress and T₂ is the junction temperature of the device at use conditions.



Reliability Test Data

QTP #: 141603

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: DATA RETENTION (125C, 1,000 hours)							
FM25V02A-G	4438076	611435736	CML-RA	500	80	0	
FM25V02A-G	4438076	611435736	CML-RA	1000	80	0	
STRESS: DATA RETENTION (150C, 1,000 hours)							
CY15B102Q-SXE	4351641	611410018	UTAC - UT	500	77	0	
CY15B102Q-SXE	4351641	611410018	UTAC - UT	1000	77	0	
STRESS: ACOUSTIC Microscopy, Before and After MSL3 Preconditioning							
FM25V02A-G	4438076	611435736	CML-RA	COMP	15	0	
STRESS: HIGH TEMPERATURE OPERATING LIFE- EARLY FAILURE RATE (125C, 96 hours, 3.60V)							
FM25V02A-G	4438076	611435736	CML-RA	96	1599	0	
STRESS: ENDURANCE (1.1E6 cycles (full 256Kb array) + 7.5E9 (single byte), 3.60V, followed by 168hour Data Retention at 150C)							
FM25V02A-G	4438076	611435736	CML-RA	168	77	0	
STRESS: HIGH TEMPERATURE OPERATING LIFE- LATENT FAILURE RATE (125C, 1,000 hours, 3.60V)							
FM25V02A-G	4438076	611435736	CML-RA	168	188	0	
FM25V02A-G	4438076	611435736	CML-RA	1000	188	0	
STRESS: ESD- CHARGED DEVICE MODEL (500V)							
FM25V02A-G	4438076	611435736	CML-RA	COMP	9	0	
FM24V02A-G	4438076	611435737	CML-RA	COMP	9	0	
FM25V02A-DGQ	4438076	611435722	UTAC - UT	COMP	9	0	
FM25V01A-G	4438076	611442260	CML-RA	COMP	9	0	
FM24V01A-G	4438076	611442261	CML-RA	COMP	9	0	



Reliability Test Data

QTP #: 141603

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: ESD- CHARGED DEVICE MODEL (750V)							
FM25V02A-G	4438076	611435736	CML-RA	COMP	3	0	
FM24V02A-G	4438076	611435737	CML-RA	COMP	3	0	
FM25V02A-DGQ	4438076	611435722	UTAC - UT	COMP	3	0	
FM25V01A-G	4438076	611442260	CML-RA	COMP	3	0	
FM24V01A-G	4438076	611442261	CML-RA	COMP	3	0	
STRESS: ESD- CHARGED DEVICE MODEL (1,000V)							
FM25V02A-G	4438076	611435736	CML-RA	COMP	3	0	
FM24V02A-G	4438076	611435737	CML-RA	COMP	3	0	
FM25V02A-DGQ	4438076	611435722	UTAC - UT	COMP	3	0	
FM25V01A-G	4438076	611442260	CML-RA	COMP	3	0	
FM24V01A-G	4438076	611442261	CML-RA	COMP	3	0	
STRESS: ESD- CHARGED DEVICE MODEL (1,250V)							
FM25V02A-G	4438076	611435736	CML-RA	COMP	3	0	
FM24V02A-G	4438076	611435737	CML-RA	COMP	3	0	
FM25V02A-DGQ	4438076	611435722	UTAC - UT	COMP	3	0	
FM25V01A-G	4438076	611442260	CML-RA	COMP	3	0	
FM24V01A-G	4438076	611442261	CML-RA	COMP	3	0	
STRESS: ESD- CHARGED DEVICE MODEL (1,500V)							
FM25V02A-G	4438076	611435736	CML-RA	COMP	3	0	
FM24V02A-G	4438076	611435737	CML-RA	COMP	3	0	
FM25V02A-DGQ	4438076	611435722	UTAC - UT	COMP	3	0	
FM25V01A-G	4438076	611442260	CML-RA	COMP	3	0	
FM24V01A-G	4438076	611442261	CML-RA	COMP	3	0	



Reliability Test Data

QTP #: 141603

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: ESD- CHARGED DEVICE MODEL (1,750V)							
FM25V02A-G	4438076	611435736	CML-RA	COMP	3	0	
FM24V02A-G	4438076	611435737	CML-RA	COMP	3	0	
FM25V02A-DGQ	4438076	611435722	UTAC - UT	COMP	3	0	
FM25V01A-G	4438076	611442260	CML-RA	COMP	3	0	
FM24V01A-G	4438076	611442261	CML-RA	COMP	3	0	
STRESS: ESD- CHARGED DEVICE MODEL (2,000V)							
FM25V02A-G	4438076	611435736	CML-RA	COMP	3	0	
FM24V02A-G	4438076	611435737	CML-RA	COMP	3	0	
FM25V02A-DGQ	4438076	611435722	UTAC - UT	COMP	3	0	
FM25V01A-G	4438076	611442260	CML-RA	COMP	3	0	
FM24V01A-G	4438076	611442261	CML-RA	COMP	3	0	
STRESS: ESD-HUMAN BODY CIRCUIT (1,100V)							
FM25V02A-G	4438076	611435736	CML-RA	COMP	3	0	
FM24V02A-G	4438076	611435737	CML-RA	COMP	3	0	
FM25V01A-G	4438076	611442260	CML-RA	COMP	3	0	
FM24V01A-G	4438076	611442261	CML-RA	COMP	3	0	
STRESS: ESD-HUMAN BODY CIRCUIT (2,200V)							
FM25V02A-G	4438076	611435736	CML-RA	COMP	8	0	
FM24V02A-G	4438076	611435737	CML-RA	COMP	8	0	
FM25V01A-G	4438076	611442260	CML-RA	COMP	8	0	
FM24V01A-G	4438076	611442261	CML-RA	COMP	8	0	
STRESS: ESD-HUMAN BODY CIRCUIT (3,300V)							
FM25V02A-G	4438076	611435736	CML-RA	COMP	3	0	
FM24V02A-G	4438076	611435737	CML-RA	COMP	3	0	
FM25V01A-G	4438076	611442260	CML-RA	COMP	3	0	
FM24V01A-G	4438076	611442261	CML-RA	COMP	3	0	



Reliability Test Data

QTP #: 141603

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
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STRESS: PRESSURE COOKER TEST (121C, 100%RH, with MSL3 Preconditioning)

FM25V02A-G	4438076	611435736	CML-RA	168	79	0	
FM25V02A-G	4438076	611435736	CML-RA	288	78	0	

STRESS: STATIC LATCH-UP TESTING (85C, $\pm 140mA$, 5.4V)

FM25V02A-G	4438076	611435736	CML-RA	COMP	6	0	
FM24V02A-G	4438076	611435737	CML-RA	COMP	6	0	
FM25V01A-G	4438076	611442260	CML-RA	COMP	6	0	
FM24V01A-G	4438076	611442261	CML-RA	COMP	6	0	

STRESS: TEMPERATURE CYCLE, CONDITION C (-65C TO 150C), with MSL3 Preconditioning

FM25V02A-G	4438076	611435736	CML-RA	500	80	0	
FM25V02A-G	4438076	611435736	CML-RA	1000	80	0	



Reliability Test Data

QTP #: 133705

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
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STRESS: ACOUSTIC Microscopy, Before and After MSL3 Preconditioning

FM25V20A-G	4346426	611343226	UTAC - UT	COMP	15	0	
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STRESS: HIGH TEMPERATURE OPERATING LIFE- EARLY FAILURE RATE (125C, 96 hours, 3.60V)

FM25V20A-G	4346426	611343226	UTAC - UT	96	1784	0	
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STRESS: HIGH TEMPERATURE OPERATING LIFE- LATENT FAILURE RATE (125C, 1,000 hours, 3.60V)

FM25V20-G	060801410	060801410	UTAC - UT	1000	77	0	
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FM25V20-G	057847882	057847882	UTAC - UT	1000	77	0	
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FM25V20-G	15199101	15199101	UTAC - UT	1000	77	0	
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STRESS: ESD- CHARGED DEVICE MODEL(500V)

FM25V20A-G	4346426	611343226	UTAC - UT	COMP	12	0	
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FM28V202-TG	4346426	611343224	UTAC - UT	COMP	12	0	
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STRESS: ESD- CHARGED DEVICE MODEL(750V)

FM25V20A-G	4346426	611343226	UTAC - UT	COMP	3	0	
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FM28V202-TG	4346426	611343224	UTAC - UT	COMP	3	0	
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STRESS: ESD- CHARGED DEVICE MODEL(1,000V)

FM25V20A-G	4346426	611343226	UTAC - UT	COMP	3	0	
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FM28V202-TG	4346426	611343224	UTAC - UT	COMP	3	0	
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STRESS: ESD- CHARGED DEVICE MODEL(1,250V)

FM25V20A-G	4346426	611343226	UTAC - UT	COMP	3	0	
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FM28V202-TG	4346426	611343224	UTAC - UT	COMP	3	0	
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STRESS: ESD-HUMAN BODY CIRCUIT (1,100V)

FM25V20A-G	4346426	611343226	UTAC - UT	COMP	3	0	
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FM28V202-TG	4346426	611343224	UTAC - UT	COMP	3	0	
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STRESS: ESD-HUMAN BODY CIRCUIT (1,500V)

FM25V20A-G	4346426	611343226	UTAC - UT	COMP	5	0	
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FM28V202-TG	4346426	611343224	UTAC - UT	COMP	5	0	
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Reliability Test Data

QTP #: 133705

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: ESD-HUMAN BODY CIRCUIT (2,200V)							
FM25V20A-G	4346426	611343226	UTAC - UT	COMP	8	0	
FM28V202-TG	4346426	611343224	UTAC - UT	COMP	8	0	
STRESS: ESD-HUMAN BODY CIRCUIT (3,300V)							
FM25V20A-G	4346426	611343226	UTAC - UT	COMP	3	0	
STRESS: PRESSURE COOKER TEST (121C, 100%RH, with MSL3 Preconditioning)							
FM25V20A-G	4346426	611343226	UTAC - UT	168	80	0	
STRESS: STATIC LATCH-UP TESTING (85C, $\pm 140mA$, 5.4V)							
FM25V20A-G	4346426	611343226	UTAC - UT	COMP	6	0	
FM28V202-TG	4346426	611343224	UTAC - UT	COMP	6	0	
STRESS: TEMPERATURE CYCLE, CONDITION C (-65C TO 150C), with MSL3 Preconditioning							
FM25V20A-G	4346426	611343226	UTAC - UT	500	80	0	
FM25V20A-G	4346426	611343226	UTAC - UT	1000	80	0	



Document History Page

Document Title: QTP #141603:128KB AND 256KB F-RAM MEMORY PRODUCT QUALIFICATION
Document Number: 001-96051

Rev.	ECN No.	Orig. of Change	Description of Change
**	4623063	BECK	Initial Release

Distribution: WEB

Posting: None