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# Cypress Semiconductor Product Qualification Report

QTP# 141603 VERSION \*A  
June, 2015

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

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

<b>QTP Number</b>	<b>Description of Qualification Purpose</b>	<b>Date</b>
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:	Proprietary*	Metal Composition:	Proprietary*
Passivation Type and Thickness:	Proprietary*		
Generic Process Technology/Design Rule ( $\mu$ -drawn):	CMOS / 130nm		
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.

### 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 <sup>3</sup>	Failure Rate
High Temperature Operating Life Early Failure Rate	1784 Devices* 1599 Devices	0	N/A	N/A	0 PPM
High Temperature Operating Life <sup>1,2</sup> 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)

<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.



## Reliability Test Data

### QTP #: 141603

Device	Fab Lot #	Assy Lot #	Assy Loc	Duration	Samp	Rej	Failure Mechanism
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**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	
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**STRESS: HIGH TEMPERATURE OPERATING LIFE- EARLY FAILURE RATE (125C, 96 hours, 3.60V)**

FM25V02A-G	4438076	611435736	CML-RA	96	1599	0	
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**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	
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**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
<b>STRESS: ESD- CHARGED DEVICE MODEL (750V)</b>							
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	
<b>STRESS: ESD- CHARGED DEVICE MODEL (1,000V)</b>							
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	
<b>STRESS: ESD- CHARGED DEVICE MODEL (1,250V)</b>							
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	
<b>STRESS: ESD- CHARGED DEVICE MODEL (1,500V)</b>							
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
<b>STRESS: ESD- CHARGED DEVICE MODEL (1,750V)</b>							
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	
<b>STRESS: ESD- CHARGED DEVICE MODEL (2,000V)</b>							
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	
<b>STRESS: ESD-HUMAN BODY CIRCUIT (1,100V)</b>							
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	
<b>STRESS: ESD-HUMAN BODY CIRCUIT (2,200V)</b>							
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	
<b>STRESS: ESD-HUMAN BODY CIRCUIT (3,300V)</b>							
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
<b>STRESS: ESD-HUMAN BODY CIRCUIT (2,200V)</b>							
FM25V20A-G	4346426	611343226	UTAC - UT	COMP	8	0	
FM28V202-TG	4346426	611343224	UTAC - UT	COMP	8	0	
<b>STRESS: ESD-HUMAN BODY CIRCUIT (3,300V)</b>							
FM25V20A-G	4346426	611343226	UTAC - UT	COMP	3	0	
<b>STRESS: PRESSURE COOKER TEST (121C, 100%RH, with MSL3 Preconditioning)</b>							
FM25V20A-G	4346426	611343226	UTAC - UT	168	80	0	
<b>STRESS: STATIC LATCH-UP TESTING (85C, <math>\pm 140mA</math>, 5.4V)</b>							
FM25V20A-G	4346426	611343226	UTAC - UT	COMP	6	0	
FM28V202-TG	4346426	611343224	UTAC - UT	COMP	6	0	
<b>STRESS: TEMPERATURE CYCLE, CONDITION C (-65C TO 150C), with MSL3 Preconditioning</b>							
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
*A	4803254	BECK	Indicated "Proprietary" Items on the "TECHNOLOGY/FAB PROCESS DESCRIPTION" Table, Page 4.

Distribution: WEB

Posting: None