Cypress Semiconductor Corporation, 198 Champion Court, San Jose, CA 95134. Tel: (408) 943-2600

PRODUCT CHANGE NOTIFICATION

PCN: PCN201502 **Date:** April 08, 2020

Subject: Qualification of Fab 25 as an Alternate Wafer Fab Site and a Bond Wire Change for Industrial-Grade 4Kb, 16Kb and 64Kb F-RAM Products

To: FUTURE ELECTRONICS
FUTURE ELE
pcn.system2@future.ca

Change Type: Major

Description of Change:
Cypress announces the qualification of Fab 25 (5204 East Ben White Boulevard, Austin, TX78741, USA) as an alternate wafer fab site for industrial-grade 4Kb, 16Kb and 64Kb F-RAM products. The new industrial-grade 4Kb, 16Kb and 64Kb F-RAM products are form, fit and function compatible with the current industrial-grade 4Kb, 16Kb and 64Kb F-RAM products manufactured at Global Foundries. Additionally, for products in the DFN package, the wire material is changed from Au to CuPdAu. There will be no change to the existing marketing part numbers.

Benefit of Change:
Qualification of alternate manufacturing sites and technologies is part of Cypress' ongoing flexible manufacturing initiative. The goal of the flexible manufacturing initiative is to provide the means for Cypress to continue to meet delivery commitments through dynamic, changing market conditions.

Part Numbers Affected: 17
See the attached 'Affected Parts List' file for a list of all part numbers affected by this change. Note that any new parts that are introduced after the publication of this PCN will include all changes outlined in this

Qualification Status:
This wafer fab site has been qualified through a series of tests documented in the Qualification Test Plan QTP#192810. This qualification report can be found as an attachment to this PCN or by visiting www.cypress.com and typing the QTP number in the keyword search window.

Sample Status:
Please review the attached 'Affected Parts List' file for a list of affected part numbers with their associated Wafer Fab site sample ordering part numbers. Samples are available now unless there is an indication that the sample ordering part numbers are subject to lead times. If you

require qualification samples, please contact your local Cypress sales representative as soon as possible, preferably within 30 days of the date of this PCN, to place any sample orders.

Approximate Implementation Date:
Effective 90 days from the date of this notification or upon customer approval, whichever comes first, all shipments Industrial part numbers in the attached file will be supplied from Fab25 or other approved wafer fabrication sites.

Anticipated Impact:
Products fabricated at the new site are completely compatible with existing products from form, fit, functional, parametric and quality performance perspectives.

Cypress also recommends that customers take this opportunity to review these changes against current application notes, system design considerations and customer environment conditions to assess impact (if any) to their application.

Method of Identification:
Cypress maintains traceability of product to wafer level, including wafer fabrication location, through the lot number marked on the package.

Response Required:
No response is required.

For additional information regarding this change, contact your local sales representative or contact the PCN Administrator at pcn_adm@cypress.com.

Sincerely,

Cypress PCN Administration

Cypress Semiconductor Corporation

64-Kbit (8 K × 8), 16-Kbit (2 K x 8), and 4-Kbit (512 x 8) Serial (SPI/I2C) F-RAM Characterization Report

Design Engineering Director or Manager
David Still
dstl@cypress.com

Product Engineering Director
Jesse Siman
zsj@cypress.com

Product Engineer
Justin Beavers
jbev@cypress.com

Applications Engineer
Shivendra Singh
zsk@cypress.com

Marketing Engineer
Pramodh Prakash
tup@cypress.com

www.cypress.com
198 Champion Ct.
San Jose, CA 95134 USA

Tel: (408) 943 2600
Fax: (408) 943 4730

1.0 Table of Contents

2.0 Introduction

2.1 General Description

The 64-Kbit (8 K × 8), 16-Kbit (2 K x 8), and 4-Kbit (512 x 8) Serial (SPI/I2C) F-RAM is a nonvolatile memory employing an advanced ferroelectric process offered in Industrial (-40°C to 85°C) grade. A ferroelectric random-access memory or F-RAM is nonvolatile and performs reads and writes similar to a RAM. It provides reliable data retention up to 151 years while eliminating the complexities, overheads, and system-level reliability problems caused by EEPROM and other nonvolatile memories.

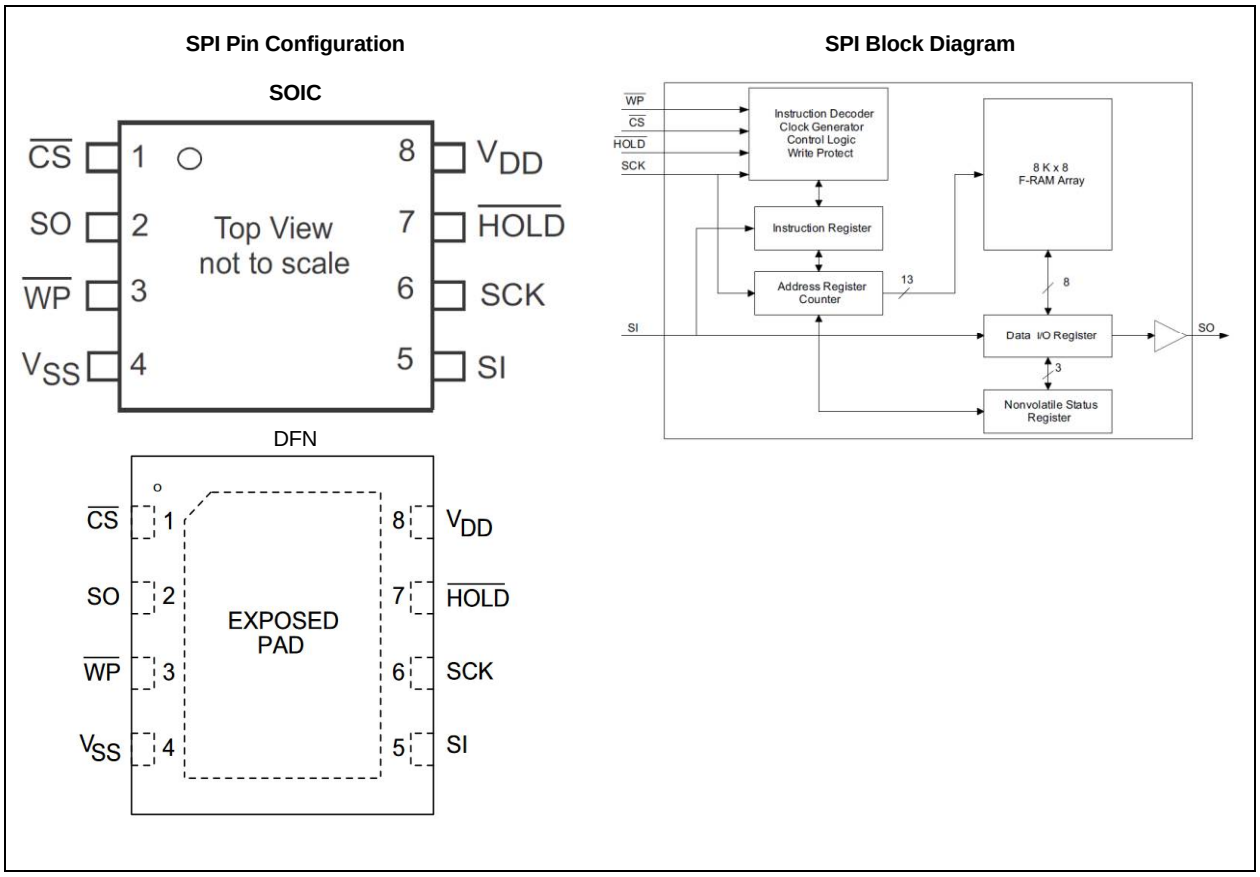

Figure 1. 64-Kbit (8 K × 8), 16-Kbit (2 K x 8), and 4-Kbit (512 x 8) Serial SPI F-RAM Pin Configuration and Logic Block Diagram

2.2 Datasheet

The 64-Kbit (8 K × 8), 16-Kbit (2 K x 8), and 4-Kbit (512 x 8) Serial (SPI/I2C) F-RAM meets all datasheet specifications. The datasheets are available from the Cypress Website at:

Industrial datasheets are available from the Cypress Website at:

Grade	Interface	V_{DD}	Density	Part Number	Datasheet
Industrial	SPI	3V	64K	FM25CL64B	http://www.cypress.com/file/125071/download
			16K	FM25L16B	http://www.cypress.com/file/136516/download
			4K	FM25L04B	http://www.cypress.com/file/136461/download
		5V	64K	FM25640B	http://www.cypress.com/file/41671/download
			16K	FM25C160B	http://www.cypress.com/file/136496/download
			4K	FM25040B	http://www.cypress.com/file/136471/download
	I2C	3V	64K	FM24CL64B	http://www.cypress.com/file/41656/download
			16K	FM24CL16B	http://www.cypress.com/file/136491/download
			4K	FM24CL04B	http://www.cypress.com/file/136466/download
		5V	64K	FM24C64B	http://www.cypress.com/file/41651/download
			16K	FM24C16B	http://www.cypress.com/file/136501/download
			4K	FM24C04B	http://www.cypress.com/file/136661/download

2.3 Application Notes

Please refer to the following Application Notes on the Cypress Website.
SPI Guide for F-RAM – http://www.cypress.com/?rID=82691

2.4 White Papers

The following F-RAM specific White Papers are available on the Cypress Website:
F-RAM™, nvSRAM, and MRAM Magnetic Field Immunity - http://www.cypress.com/file/46731/download
Energy Comparison of Cypress F-RAM and EEPROM - http://www.cypress.com/file/46746/download
Enhanced Endurance Performance of 0.13 um Nonvolatile F-RAM Products - http://www.cypress.com/file/46181/download
F-RAM Technology Brief - http://www.cypress.com/file/46186/download

2.5 Qualification Report

The 64-Kbit (8 K × 8), 16-Kbit (2 K x 8), and 4-Kbit (512 x 8) Serial (SPI/I2C) F-RAM is qualified under QTP 192810 for Industrial devices. The qualification reports are available from the Cypress Website at: http://www.cypress.com (Specific webpage URL is TBD).

3.0 Characterization Conditions

AC and DC parameters were characterized on Nextest Magnum 1 tester. Characterization was performed using 8-pin SOIC hand test boards along with the general purpose Nextest load board. The capacitance and inductance introduced by the package and the char board have an insignificant impact on these DC and AC parameters. All units were tested across datasheet V_{DD} values in addition to a +/-100 mV guardband as shown in the table below. The datasheet values are highlighted in blue. The data recorded in the tables below are for datasheet V_{DD} values only.

Characterization Voltage							
Industrial 3V VDD	**2.6V**	**2.7V**	**3.0V**	**3.3V**	**3.6V**	**3.65V**	**3.75V**
Industrial 5V VDD	**4.4V**	**4.5V**	**5.0V**	**5.5V**	**5.6V**		

A Thermonics Precision Temperature Forcing System was used to force the temperature ranges of -40°C to 85°C for Industrial grade parts. A temperature guard band of +/-5°C was used. Characterization was performed across datasheet temperature and voltage range plus guardbands to ensure that all parameters have enough margin to spec and meet the required yield criteria for mass production. Char samples were assembled in 8SOIC package and taken from three different fablots.

4.0 SPI Characterization

4.1 3V (2.7V-3.65V) SPI Industrial Characterization Summary

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
I_{DD}	Average V_{DD} current at 1 MHz	-	200	69.63	121	51.25	105	µA
I_{DD}	Average V_{DD} current at 20 MHz	-	3000	851.5	1077	818.8	1070	µA
I_{SB}	V_{DD} standby current	-	6	1.03	4.81	1.35	3.9	µA
I_{LI}	Input leakage current	-1	1	-0.01	0	0	0.01	µA
I_{LO}	Output leakage current (SO)	-1	1	-0.01	0.01	0	0.01	µA
V_{IH}	Input HIGH Voltage (V_{DD} = 2.7V)	1.89	-	1.54	1.6	1.56	1.62	V
V_{IH}	Input HIGH Voltage (V_{DD} = 3.3V)	2.31	-	1.86	1.93	1.85	1.89	V
V_{IH}	Input HIGH Voltage (V_{DD} = 3.65V)	2.555	-	2.04	2.12	2.03	2.07	V
V_{IL}	Input LOW Voltage (V_{DD} = 2.7V)	-	0.81	1.21	1.25	1.22	1.24	V
V_{IL}	Input LOW Voltage (V_{DD} = 3.3V)	-	0.99	1.47	1.52	1.49	1.52	V
V_{IL}	Input LOW Voltage (V_{DD} = 3.65V)	-	1.095	1.62	1.68	1.64	1.68	V
V_{OH}	Output HIGH Voltage (I_{OH} = -2 mA, V_{DD} = 2.7V)	1.9	-	2.53	2.61	2.58	2.64	V
V_{OH}	Output HIGH Voltage (I_{OH} = -2 mA, V_{DD} = 3.3V)	2.5	-	3.15	3.22	3.20	3.25	V
V_{OH}	Output HIGH Voltage (I_{OH} = -2 mA, V_{DD} = 3.65V)	2.85	-	3.5	3.57	3.56	3.60	V
V_{OL}	Output LOW Voltage (I_{OL} = 2 mA)	-	0.4	0.06	0.14	0.05	0.10	V

Table 1. DC Characterization Results

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
t_{CH}	Clock HIGH time	22	-	2.9	3.2	2.3	3	ns
t_{CL}	Clock LOW time	22	-	4	5.5	5.9	6.3	ns
t_{CSU}	Chip select setup	10	-	-1.4	0.04	0.8	1.3	ns
t_{CSH}	Chip select hold	10	-	-16.8	-14.38	-16.2	-13.6	ns
t_{ODV}	Output data valid time	-	20	5.2	11	5.7	12	ns
t_{OH}	Output hold time	0	-	4.5	9.5	5.1	10.6	ns
t_D	Deselect time	60	-	2.1	3.1	2.1	2.1	ns

Table 2. AC Characterization Results

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
t_{PU}	Power up to first access time	1	-	0.13	0.36	0.29	0.5	ms

Table 3. Power Cycle Timing Characterization Results

4.2 5V (4.5V-5.5V) SPI Industrial Characterization Summary

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
I_{DD}	Average V_{DD} current at 1 MHz	-	250	82.87	130.1	62.5	96.25	µA
I_{DD}	Average V_{DD} current at 20 MHz	-	4000	1093	1346	1029	1301	µA
I_{SB}	V_{DD} standby current	-	10	0.96	4.69	1.38	4.75	µA
I_{LI}	Input leakage current	-1	1	-0.19	0.25	0	0.02	µA
I_{LO}	Output leakage current (SO)	-1	1	-0.1	0.32	0	0.01	µA
V_{IH}	Input HIGH Voltage (V_{DD} = 4.5V)	3.375	-	2.51	2.56	2.48	2.52	V
V_{IH}	Input HIGH Voltage (V_{DD} = 5.0V)	3.75	-	2.78	2.85	2.75	2.80	V
V_{IH}	Input HIGH Voltage (V_{DD} = 5.5V)	4.125	-	3.04	3.15	3.02	3.08	V
V_{IL}	Input LOW Voltage (V_{DD} = 4.5V)	-	1.125	1.97	2.04	2.01	2.06	V
V_{IL}	Input LOW Voltage (V_{DD} = 5.0V)	-	1.25	2.18	2.26	2.22	2.29	V
V_{IL}	Input LOW Voltage (V_{DD} = 5.5V)	-	1.375	2.4	2.5	2.45	2.54	V
V_{OH}	Output HIGH Voltage (I_{OH} = -2 mA, V_{DD} = 4.5V)	3.7	-	4.38	4.43	4.42	4.46	V
V_{OH}	Output HIGH Voltage (I_{OH} = -2 mA, V_{DD} = 5.0V)	4.2	-	4.88	4.93	4.92	4.96	V
V_{OH}	Output HIGH Voltage (I_{OH} = -2 mA, V_{DD} = 5.5V)	4.7	-	5.39	5.43	5.42	5.46	V
V_{OL}	Output LOW Voltage (I_{OL} = 2 mA)	-	0.4	0.05	0.1	0.04	0.07	V

Table 4. DC Characterization Results

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
t_{CH}	Clock HIGH time	22	-	2.4	3	2.2	2.9	ns
t_{CL}	Clock LOW time	22	-	4.4	5.42	6.1	6.4	ns
t_{CSU}	Chip select setup	10	-	-0.7	0.7	1	1.3	ns
t_{CSH}	Chip select hold	10	-	-17.3	-14.8	-16.5	-14.9	ns
t_{ODV}	Output data valid time	-	20	4.1	7.5	4.3	6.9	ns
t_{OH}	Output hold time	0	-	3.6	6.9	4	6.2	ns
t_{D}	Deselect time	60	-	2.1	2.1	2.1	2.1	ns
t_{SU}	Data setup time	5	-	0.8	1.5	0.6	1.1	ns
t_{H}	Data hold time	5	-	-0.2	0.7	0	0.4	ns
t_{HS}	/HOLD setup time	10	-	-19.3	-18	-18.8	-18.2	ns
t_{HH}	/HOLD hold time	10	-	-1.6	-0.4	-0.9	-0.4	ns

Table 5. AC Characterization Results

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
t_{PU}	Power up to first access time	1	-	0.02	0.36	0.28	0.54	ms

Table 6. Power Cycle Timing Characterization Results

5.0 I²C Characterization

5.1 3V (2.7V-3.65V) I²C Industrial Characterization Summary

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
I_{DD}	Average V_{DD} current at 100 kHz	-	100	4.65	9.51	2.5	11.25	µA
I_{DD}	Average V_{DD} current at 400 kHz	-	170	53.64	94.24	17.5	72.5	µA
I_{DD}	Average V_{DD} current at 1 MHz	-	300	89.25	143	62.5	108.8	µA
I_{SB}	V_{DD} standby current	-	6	0.93	4.41	1.13	4.35	µA
I_{LI}	Input leakage current LOW (Except WP and A2-A0)	-1	1	-0.05	0.1	-0.14	0.08	µA

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
I_{LI}	Input leakage current (for WP and A2-A0)	-1	100	-0.11	0.09	-0.01	0.75	µA
I_{LO}	Output leakage current	-1	1	-0.08	0.1	-0.07	0.08	µA
V_{IH}	Input HIGH Voltage (V_{DD} = 2.7V)	2.25	-	1.53	1.58	1.53	1.62	V
V_{IH}	Input HIGH Voltage (V_{DD} = 3.3V)	2.475	-	1.85	1.89	1.83	1.89	V
V_{IH}	Input HIGH Voltage (V_{DD} = 3.65V)	2.7	-	2.04	2.08	2.01	2.07	V
V_{IL}	Input LOW Voltage (V_{DD} = 2.7V)	-	0.75	1.18	1.27	1.16	1.26	V
V_{IL}	Input LOW Voltage (V_{DD} = 3.3V)	-	0.825	1.44	1.51	1.42	1.53	V
V_{IL}	Input LOW Voltage (V_{DD} = 3.65V)	-	0.9	1.6	1.7	1.57	1.7	V
V_{OL}	Output LOW Voltage (I_{OL} = 2 mA)	-	0.4	0.07	0.1	0.07	0.16	V
R_{in}	Input resistance (WP, A2-A0) For $V_{IN} = V_{IL\ (MAX)}$	40	-	73.74	85.57	75.12	89.42	kΩ
R_{in}	Input resistance (WP, A2-A0) For $V_{IN} = V_{IH\ (MIN)}$	1	-	1.31	1.63	1.49	1.83	MΩ

Table 7. DC Characterization Results

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
$t_{SU;\ STA}$	Start condition setup for repeated Start	0.25	-	0.1	0.1	0.09	0.09	µs
$t_{HD;\ STA}$	Start condition hold time	0.25	-	0.01	0.02	0.01	0.01	µs
t_{LOW}	Clock LOW period	0.6	-	0.29	0.35	0.27	0.34	µs
t_{HIGH}	Clock HIGH period	0.4	-	0.07	0.08	0.06	0.08	µs
$t_{SU;\ DAT}$	Data in setup	100	-	9.5	17	9	16	ns
$t_{HD;\ DAT}$	Data in hold	0	-	-14	-7.5	-13	-7	ns
t_{DH}	Data in hold (from SCL @ V_{IL})	0	-	10	16	9	11	ns
$t_{SU;\ STO}$	STOP condition setup	0.25	-	0.09	0.09	0.09	0.09	µs
t_{AA}	SCL LOW to SDA Data Out Valid	-	0.55	0.29	0.35	0.26	0.32	µs
t_{BUF}	Bus free before new transmission	0.5	-	0.07	0.09	0.06	0.08	µs
t_{SP}	Noise suppression time constant on SCL, SDA	-	50	65	81	60	79	ns

Table 8. AC Characterization Results

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
t_{PU}	Power up to first access time	1	-	0.12	0.31	0.26	0.48	ms

Table 9. Power Cycle Timing Characterization Results

5.2 5V (4.5V-5.5V) I²C Industrial Characterization Summary

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
I_{DD}	Average V_{DD} current at 100 kHz	-	100	8.66	14.45	5	13.75	µA
I_{DD}	Average V_{DD} current at 400 kHz	-	200	76.39	119.7	46.25	86.25	µA
I_{DD}	Average V_{DD} current at 1 MHz	-	450	143.8	202.9	105	161.3	µA
I_{SB}	V_{DD} standy current	-	10	1.05	4.22	1.38	4.38	µA
I_{LI}	Input leakage current (Except WP)	-1	1	-0.08	0.13	-0.05	0.05	µA
I_{LI}	Input leakage current (for WP)	-1	100	-0.09	4.16	-0.08	3.3	µA
I_{LO}	Output leakage current low	-1	1	-0.09	0.14	-0.05	0.04	µA
V_{IH}	Input HIGH Voltage (V_{DD} = 4.5V)	3.375	-	2.5	2.55	2.45	2.5	V
V_{IH}	Input HIGH Voltage (V_{DD} = 5.0V)	3.75	-	2.76	2.84	2.72	2.77	V
V_{IH}	Input HIGH Voltage (V_{DD} = 5.5V)	4.125	-	3.02	3.13	3	3.05	V
V_{IL}	Input LOW Voltage (V_{DD} = 4.5V)	-	1.125	1.97	2.04	2.01	2.07	V
V_{IL}	Input LOW Voltage (V_{DD} = 5.0V)	-	1.25	2.2	2.26	2.23	2.29	V
V_{IL}	Input LOW Voltage (V_{DD} = 5.5V)	-	1.375	2.4	2.5	2.45	2.52	V
V_{OL}	Output LOW Voltage (I_{OL} = 2 mA)	-	0.4	0.07	0.11	0.08	0.11	V
R_{in}	Input resistance (WP, A2-A0) For $V_{IN} = V_{IL\ (MAX)}$	40	-	70.1	80.58	76.37	85.4	kΩ
R_{in}	Input resistance (WP, A2-A0) For $V_{IN} = V_{IL\ (MIN)}$	1	-	1.27	1.57	1.55	1.77	MΩ

Table 10. DC Characterization Results

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
$t_{SU; STA}$	Start condition setup for repeated Start	0.25	-	0.09	0.1	0.09	0.09	µs
$t_{HD; STA}$	Start condition hold time	0.25	-	0.01	0.01	0.01	0.01	µs
t_{LOW}	Clock LOW period	0.6	-	0.27	0.32	0.24	0.32	µs
t_{HIGH}	Clock HIGH period	0.4	-	0.07	0.08	0.07	0.08	µs
$t_{SU; DAT}$	Data in setup	100	-	8	13.5	9	13	ns
$t_{HD; DAT}$	Data in hold	0	-	-11.5	-6	-10	-6	ns
t_{DH}	Data in hold (from SCL @ V_{IL})	0	-	11	14.5	9.5	11.5	ns
$t_{SU; STO}$	STOP condition setup	0.25	-	0.09	0.09	0.09	0.09	µs
t_{AA}	SCL LOW to SDA Data Out Valid	-	0.55	0.27	0.32	0.28	0.31	µs
t_{BUF}	Bus free before new transmission	0.5	-	0.07	0.09	0.07	0.09	µs
t_{SP}	Noise suppression time constant on SCL, SDA	-	50	75	82	69	85	ns

Table 11. AC Characterization Results

Parameter	Description	Datasheet		Global Foundries		FAB25		Units
		Min	Max	Min	Max	Min	Max	
t_{PU}	Power up to first access time	1	-	0.228	0.505	0.259	0.529	ms

Table 12. Power Cycle Timing Characterization Results

Document History Page

Rev.	ECN No.	Orig. of Change	Submission Date	Description of Change
**	6834777	JBEV	3/19/2020	New Characterization Report.

Sales, Solutions, and Legal Information

Worldwide Sales and Design Support

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Cypress Semiconductor
Product Qualification Report

**QTP# 192810 VERSION **
March, 2020**

7C50003 FRAM Controller 130nm S8 Technology, Fab25	
FM24CL64B	**3V 64-KBIT (16K X 8) SERIAL (I2C) F-RAM**
FM24CL16B*	**3V 16-KBIT (2K X 8) SERIAL (I2C) F-RAM**
FM24CL04B*	**3V 4-KBIT (512 X 8) SERIAL (I2C) F-RAM**
FM24C64B*	**5V 64-KBIT (16K X 8) SERIAL (I2C) F-RAM**
FM24C16B*	**5V 16-KBIT (2K X 8) SERIAL (I2C) F-RAM**
FM24C04B*	**5V 4-KBIT (512 X 8) SERIAL (I2C) F-RAM**
FM25CL64B*	**3V 64-KBIT (16K X 8) SERIAL (SPI) F-RAM**
FM25L16B*	**3V 16-KBIT (2K X 8) SERIAL (SPI) F-RAM**
FM25L04B*	**3V 4-KBIT (512 X 8) SERIAL (SPI) F-RAM**
FM25640B*	**5V 64-KBIT (16K X 8) SERIAL (SPI) F-RAM**
FM25C160B*	**5V 16-KBIT (2K X 8) SERIAL (SPI) F-RAM**
FM25040B*	**5V 4-KBIT (512 X 8) SERIAL (SPI) F-RAM**

FOR ANY QUESTIONS ON THIS REPORT, PLEASE CONTACT
reliability@cypress.com

Prepared By:
Jun Mitani (JUMI)
Reliability Engineer

Reviewed By:
Yusaku Ohta (YUOH)
Reliability Manager

Approved By:
David Hoffman (DHH)
Reliability Director

TABLE I

PACKAGE/PRODUCT QUALIFICATION HISTORY

QTP Number	Description of Qualification Purpose	Date
192810	To qualify Industrial option of the 7C50003 F-RAM controller die at FAB25 in the 130nm S8 process.	March 2020

Table II

PRODUCT DESCRIPTION (for qualification)	
Qualification Purpose: To qualify Industrial option of the 7C50003 F-RAM controller die at FAB25 in the 130nm S8 process.	
Marketing Part #:	FM25CL64B*, FM24CL64B*, FM25640B*
Device Description:	64 KBIT (512 X 8) SERIAL (I2C / SPI) F-RAM
Cypress Division:	Memory Products Division (MPD)

Table III

TECHNOLOGY/FAB PROCESS DESCRIPTION			
Number of Metal Layers:	Proprietary	Metal Composition:	Proprietary
Passivation Type and Thickness:		Proprietary	
Generic Process Technology/Design Rule (μ-drawn):		130nm	
Gate Oxide Material/Thickness (MOS):		Proprietary	
Name/Location of Die Fab (prime) Facility:		Fab25 / Austin	
Die Fab Line ID/Wafer Process ID:		S8	

Table IV

PACKAGE AVAILABILITY

PACKAGE	ASSEMBLY FACILITY SITE
8-pin SOIC	UTAC, Thailand (UT)
8-pin TDFN	UTAC, Thailand (UT)

Table V

MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION	
Package Designation:	8 SOIC / 8 TDFN
Package Outline, Type, or Name:	SW815 (4.9x3.9 mm) / LH08F (4.0x4.5x0.8 mm)
Mold Compound Name/Manufacturer:	8 SOIC: Sumitomo EME-G600 / 8 TDFN: Sumitomo EME-G770HCD
Mold Compound Flammability Rating:	V-0 UL94
Mold Compound Alpha Emission Rate:	Standard
Oxygen Rating Index: >28%	No Data
Lead Frame Designation:	Full Metal Paddle (FMP)
Lead Frame Material:	Cu
Substrate Material:	N/A
Lead Finish, Composition / Thickness:	Matte Sn
Die Backside Preparation Method/Metallization:	Backgrind
Die Separation Method:	Laser + Wafer Saw
Die Attach Supplier:	Henkel
Die Attach Material:	8 SOIC: 8600 / 8 TDFN: 8200T
Bond Diagram Designation	8 SOIC: 002-27489 / 8 TDFN: 002-27491
Wire Bond Method:	Thermosonic
Package Cross Section Yes/No:	Yes
Assembly Process Flow:	8 SOIC: 002-13257 / 8 TDFN: 002-29769
Name/Location of Assembly (prime) facility:	UTAC, Thailand (UT)
MSL LEVEL	3
REFLOW PROFILE	260C

Table VI

ELECTRICAL TEST / FINISH DESCRIPTION	
Test Location:	Sort Test: KYEC, Taiwan / Class Test and Finish: UTAC, Thailand

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

Table VII

RELIABILITY TESTS PERFORMED PER SPECIFICATION REQUIREMENTS

Stress/Test	Test Condition (Temp/Bias)	Result P/F
Data Retention (Plastic)	125 C, non-biased JESD22-A117 and JESD22-A103	P
Endurance / Data Retention	MIL-STD-883, Method 883-1033	P
High Temperature Operating Life Early Failure Rate	Dynamic Operating Condition, Vcc = 3.6V, 125 C JESD22-A108	P
High Temperature Operating Life Latent Failure Rate	Dynamic Operating Condition, Vcc = 3.6V, 125 C JESD22-A108	P
Low Temperature Operating Life Cold Life Test	Dynamic Operating Condition, -40 C JESD22-A108	P
High Accelerated Saturation Test (HAST)	JEDEC STD 22-A110: 130C, 85%RH, 3.6V Precondition: JESD22 Moisture Sensitivity Level (192 Hrs., 30 °C, 60% RH, 260 °C Reflow)	P
Pressure Cooker Test	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-883C, Method 1010, Condition C, -65 C to 150 C Precondition: JESD22 Moisture Sensitivity Level (192 Hrs., 30 °C, 60% RH, 260 °C Reflow)	P
Electrostatic Discharge Human Body Model (ESD-HBM)	JEDEC EIA/JESD22-A114-B 1100V/2200V/3300V/4000V	P
Electrostatic Discharge Charge Device Model (ESD-CDM)	JESD22-C101 500V/750V/1000V/1250V/1500V/1750V/2000V	P
Static Latch up	JESD78B +/-100mA; +/-140mA, 125°C +/-140mA; +/-200mA; +/-300mA, 85°C	P
Acoustic Microscopy	J-STD-020 Precondition: JESD22 Moisture Sensitivity Level (192 Hrs., 30 °C, 60% RH)	P

Table VIII

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	3084	0	N/A	N/A	0 PPM
High Temperature Operating Life[1,2] Long Term Failure Rate	120000	0	0.7	55	** FIT

** Insufficient samples to calculate FIT Rate

[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.

Reliability Test Data

QTP #: 192810

Device	Fab Lot#	Assy Lot#	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: ACOUSTIC, MSL3							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	COMP	22	0	
STRESS: TEMPERATURE CYCLE COND. C -65C TO 150C, PRE COND 192 HRS 30C/60%RH, MSL3							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	500	80	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	1000	80	0	
STRESS: PRESSURE COOKER TEST, 121C,100%RH, PRE COND 192 HRS 30C/60%RH, MSL3							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	168	80	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	268	80	0	
STRESS: HIGH ACCELERATED SATURATION TEST 130C, 85%RH, 3.6V, PRE COND 192 HRS 30C/60%RH, MSL3							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	96	25	0	
STRESS: DATA RETENTION, 125C							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	500	80	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	1000	80	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	1500	80	0	
STRESS: ESD-CHARGE DEVICE MODEL							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	500	9	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	750	3	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	1000	3	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	1250	3	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	1500	3	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	1750	3	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	2000	3	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	500	9	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	750	3	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	1000	3	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	1250	3	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	1500	3	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	1750	3	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	2000	3	0	
STRESS: ESD-HUMAN BODY MODEL PER JESD22, METHOD A114							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	1100	3	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	2200	8	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	3300	3	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	4000	3	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	5000	3	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	1100	3	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	2200	8	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	3300	3	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	4000	3	0	
FM24CL64B8-G	2911000	611933572	UTL-Thailand	5000	3	0	

Device	Fab Lot#	Assy Lot#	Assy Loc	Duration	Samp	Rej	Failure Mechanism
STRESS: STATIC LATCH-UP (125C, 100mA)							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	COMP	3	0	
FM25CL64B8-G	2911000	611933572	UTL-Thailand	COMP	3	0	
STRESS: STATIC LATCH-UP (125C, 140mA)							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	COMP	3	0	
FM25CL64B8-G	2911000	611933572	UTL-Thailand	COMP	3	0	
STRESS: STATIC LATCH-UP (85C, 140mA)							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	COMP	3	0	
FM25CL64B8-G	2911000	611933572	UTL-Thailand	COMP	3	0	
STRESS: STATIC LATCH-UP (85C, 200mA)							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	COMP	3	0	
FM25CL64B8-G	2911000	611933572	UTL-Thailand	COMP	3	0	
STRESS: STATIC LATCH-UP (85C, 300mA)							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	COMP	3	0	
FM25CL64B8-G	2911000	611933572	UTL-Thailand	COMP	3	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE (125C, 3.6V, Vcc Max)							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	96	1155	0	
FM25CL64B8-G	2911000	611933572	UTL-Thailand	96	1929	0	
STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE (125C, 3.6V, Vcc Max)							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	500	120	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	1000	120	0	
STRESS: PRE/POST LFR PARAMETER ASSESSMENT							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	COMP	10+2	0	
STRESS: ENDURANCE + DATA RETENTION, 125C							
FM25CL64B8-G	2911000	611933571	UTL-Thailand	CYCLING	100	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	500	100	0	
FM25CL64B8-G	2911000	611933571	UTL-Thailand	1000	100	0	
STRESS: LOW TEMPERATURE OPERATING LIFE, -40C							
CYTT214032	4539372	611534008	CML-RA	160	40	0	
CYTT214032	4539372	611534008	CML-RA	380	40	0	

Document History Page

Document Title: QTP#192810: 7C50003 FRAM Controller 130nm S8 Technology, Fab25
Document Number: 002-30083

Rev.	ECN No.	Orig. of Change	Description of Change
**	6841087	JUMI	Initial release.

Material Composition Declaration

This document is a declaration of the substances within the manufacturer listed item. Note: if the item is an assembly with lower level parts, the declaration encompasses all lower level materials for which the manufacturer has engineering responsibility.

Adobe Reader version 7.0.5 is required to complete this declaration.

1752-2 1.1	IPC Web Site for Information on IPC-1752 Standard **http://www.ipc.org/IPC-175x**	**Form Type *** **Distribute**	**Declaration Class *** **Class 6 - RoHS Yes/No, Homogeneous Materials and Mfg Informat**

Supplier Information

Company Name *	Company Unique ID	Unique ID Authority	**Response Date ***	Response Document ID	
Cypress Semiconductor Corp	CYPRESS		**2020-04-06**		
Contact Name *	Title - Contact	**Phone - Contact ***	**Email - Contact ***	Duplicate Contact -> Authorized Representative	
Quality Customer Support Gr	Quality Customer Support Grou	**6328497500**	**qacs_team@cypress.com**		
Authorized Representative *	Title - Representative	**Phone - Representative ***	**Email - Representative** *	Supplier Comments or URL for Additional Information	
Jeff Gary Ballesca	EH&S Engineer	**6328497500**	**jgtb@cypress.com**		

Requester Item Number	Mfr Item Number	Mfr Item Name	Effective Date	Version	Manufacturing Site	**Weight ***	UOM	Unit Type
DFN8_LH08_4.0x4.5x0.80	DFN8_LH08_4.0x4.5x0.80 mm	DFN8_LH08_4.0x4.5x0.80 mm	2020-04-06		UTAC THAILAND	45	mg	Each
Alternate Recommendation				Alternate Item Comments	Package QTP No. 194521			

Manufacturing Process Information

Terminal Plating / Grid Array Material	Terminal Base Alloy	J-STD-020 MSL Rating	Peak Process Body Temperature	Max Time at Peak Temperature	Number of Reflow Cycles
Matte Tin (Sn)	**CU Alloy**	**3**	**260** C	**30** seconds	**3**

Comments

Test Report: MC (001-79658); DA (001-86460); PLATING (001-86463, 001-89436) ; BW (002-28019); LF (002-25751)

*** Required Field**

Form enabled by Adobe

Save the fields in this form to a file	Export Data	Import fields from a file into this form	Import Data	Clear all of the fields on this form	Reset Form	Lock the fields on this form to prevent changes	Lock Supplier Fields

RoHS Material Composition Declaration

Declaration Type * **Detailed**

RoHS Directive 2002/95/EC	**RoHS Definition:** Quantity limit of 0.1% by mass (1000 PPM) in homogeneous material for: Lead (Pb), Mercury, Hexavalent Chromium, Polybrominated Biphenyls (PBB), Polybrominated Diphenyl Ethers (PBDE) and quantity limit of 0.01% by mass (100 PPM) of homogeneous material for Cadmium

Please indicate whether any homogeneous material (as defined by the RoHS Directive, EU 2002/95/EC and implemented by the laws of the European Union member states) of the part identified on this form contains lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls and/or polybrominated diphenyl ethers (each a "RoHS restricted substance") in excess of the applicable quantity limit identified above. If a homogeneous material within the part contains a RoHS restricted substance in excess of an applicable quantity limit, please indicate below which, if any, RoHS exemption you believe may apply. If the part is an assembly with lower level components, the declaration shall encompass all such components. Supplier certifies that it gathered the information it provides in this form using appropriate methods to ensure its accuracy and that such information is true and correct to the best of its knowledge and belief, as of the date that Supplier completes this form. Supplier acknowledges that Company will rely on this certification in determining the compliance of its products with European Union member state laws that implement the RoHS Directive. Company acknowledges that Supplier may have relied on information provided by others in completing this form, and that Supplier may not have independently verified such information. However, in situations where Supplier has not independently verified information provided by others, Supplier agrees that, at a minimum, its suppliers have provided certifications regarding their contributions to the part, and those certifications are at least as comprehensive as the certification in this paragraph. If the Company and the Supplier enter into a written agreement with respect to the identified part,the terms and conditions of that agreement, including any warranty rights and/or remedies provided as part of that agreement, will be the sole and exclusive source of the Supplier's liability and the Company's remedies for issues that arise regarding information the Supplier provides in this form. In the absence of such written agreement, the warranty rights and/or remedies of Supplier's Standard Terms and Conditions of Sale applicable to such part shall apply.

RoHS Declaration *	1 - Item(s) does not contain RoHS restricted substances per the definition above	**Supplier Acceptance ***	**Accepted**

Exemptions: If the declared item does not contain RoHS restricted substances per the definition above except for defined RoHS exemptions, then select the corresponding response in the RoHS Declaration above and choose all applicable exemptions.

Declaration Signature

Instructions: Complete all of the required fields on all pages of this form. Select the "Accepted" on the Supplier Acceptance drop-down. This will display the signature area. Digitally sign the declaration (if required by the Requester) and click on Submit Form to have the form returned to the Requester.

Supplier Digital Signature	Jeff Gary Ballesca	Digitally signed by Jeff Gary Ballesca Date: 2020.02.12 11:29:45 -08'00'

*** Required Field**

Homogeneous Material Composition Declaration for Electronic Products

SubItem Instructions: The presence of any JIG Level A or B substances must be declared. [1] indicate the subpart in which the substance is located, [2] provide a description of the homogeneous material [3], enter the weight of the homogeneous material.

Substance Instructions: [A] select the Level (JIG A, JIG B, Requester or Supplier) [B] select the substance category (JIG or Requester) or enter a value (Supplier). [C] select the substance (JIG) or enter the substance and CAS (Other). [D] select a RoHS exemption, if applicable [E] enter the weight of the substance or the PPM concentration [F] Optionally enter the positive (+) and negative (-) tolerance in percent (Note: percent tolerance values are expected to cover a 3 sigma range of distribution unless otherwise noted).

Line Functions: +I Inserts a New Item /SubItem +M Inserts a new Material +C Inserts a new Substance Category +S Inserts a new Substance - Deletes the element line

	Item/SubItem Name		Homogeneous Material	Weight	Unit of Measure		Level	Substance Category		Substance	CAS	Exempt	Weight	Unit of Measure	Tolerance -	Tolerance +	PPM
+I -I	Leadframe	+M -M	Base Material	16.7291	mg	+C -C	Supplier	Cu	+S -S	Cu	7440-50-8		15.9784	mg			355,07
						+C -C	Supplier	Fe	+S -S	Fe	7439-89-6		0.365	mg			8,111
						+C -C	Supplier	P	+S -S	P	7723-14-0		0.0054	mg			120
						+C -C	Supplier	Zn	+S -S	Zn	7440-66-6		0.0224	mg			498
						+C -C	Supplier	Ag	+S -S	Ag	7440-22-4		0.3579	mg			7,953
+I -I	Leadfinish	+M -M	External Plating	2.0576	mg	+C -C	Supplier	Sn	+S -S	Sn	7440-31-5		2.0572	mg			45,716
						+C -C	A	Lead/Lead Compound	+S -S	Lead	7439-92-1		0.0004	mg			9
+I -I	Die Attach	+M -M	Adhesive	0.4473	mg	+C -C	Supplier	Ag	+S -S	Ag	7440-22-4		0.3579	mg			7,953
						+C -C	Supplier	Acrylate Resin	+S -S	Acrylate Resin	Trade Secret		0.0716	mg			1,591
						+C -C	Supplier	Heterocyclic organic	+S -S	Heterocyclic organic	Trade Secret		0.0089	mg			198
						+C -C	Supplier	Treated Silica	+S -S	Treated Silica	Trade Secret		0.0089	mg			198
+I -I	Die 1	+M -M	Silicon Die	4.6522	mg	+C -C	Supplier	Silicon	+S -S	Silicon	7440-21-3		4.6522	mg			103,28
+I -I	Die 2	+M -M	Silicon Die	2.7734	mg	+C -C	Supplier	Silicon	+S -S	Silicon	7440-21-3		2.7734	mg			61,621
+I -I	Wire	+M -M	Interconnect	0.0895	mg	+C -C	Supplier	Cu	+S -S	Cu	7440-50-8		0.0865	mg			1,922
						+C -C	Supplier	Pd	+S -S	Pd	7440-05-3		0.0026	mg			58
						+C -C	Supplier	Au	+S -S	Au	7440-57-5		0.0004	mg			9
+I -I	Mold Compound	+M -M	Encapsulation	18.2509	mg	+C -C	Supplier	Silica Fused	+S -S	Silica Fused	60676-86-0		16.5152	mg			367,00
						+C -C	Supplier	Carbon Black	+S -S	Carbon Black	1333-86-4		0.0179	mg			398
						+C -C	Supplier	Epoxy Resin	+S -S	Epoxy Resin	Trade Secret		0.8589	mg			19,087
						+C -C	Supplier	Phenol Resin	+S -S	Phenol Resin	Trade Secret		0.8589	mg			19,087

*** Required Field**

Test Report

No. : CE/2019/A0797 Date : 2019/10/14

MK ELECTRON CO., LTD.
405, GEUMEO-RO, POGOK-EUP, CHEOIN-GU, YONGIN-SI, GYEONGGI-DO, KOREA

The following samples was/were submitted and identified by/on behalf of the applicant as :

Sample Submitted By	:	MK ELECTRON CO., LTD.
Sample Description	:	Au FLASHED Pd COATING Cu WIRE
Sample Receiving Date	:	2019/10/04
Testing Period	:	2019/10/04 to 2019/10/14

==========

Test Requested :

(1) As specified by client, with reference to RoHS 2011/65/EU Annex II and amending Directive (EU) 2015/863 to determine Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP contents in the submitted sample(s).

(2) Please refer to next pages for the other item(s).

Test Result(s) : Please refer to following pages.

Conclusion : (1) Based on the performed tests on submitted sample(s), the test results of Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP comply with the limits as set by RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU.

Troy Chang / Manager -Tec
Signed for and behalf of
SGS TAIWAN LTD.
Chemical Laboratory - Taipei

MK ELECTRON CO., LTD.
405, GEUMEO-RO, POGOK-EUP, CHEOIN-GU, YONGIN-SI, GYEONGGI-DO, KOREA

Test Result(s)

PART NAME No.1 : SILVER COLORED METAL WIRE

Test Item(s)	Unit	Method	MDL	Result No.1	Limit
Cadmium (Cd)	mg/kg	With reference to IEC 62321-5 (2013) and performed by ICP-OES.	2	n.d.	100
Lead (Pb)	mg/kg	With reference to IEC 62321-5 (2013) and performed by ICP-OES.	2	n.d.	1000
Mercury (Hg)	mg/kg	With reference to IEC 62321-4:2013+ AMD1:2017 and performed by ICP-OES.	2	n.d.	1000
Hexavalent Chromium Cr(VI)(#2)	µg/cm²	With reference to IEC 62321-7-1 (2015) and performed by UV-VIS.	0.10	n.d.	-
Sum of PBBs	mg/kg	With reference to IEC 62321-6 (2015) and performed by GC/MS.	-	n.d.	1000
Monobromobiphenyl	mg/kg		5	n.d.	-
Dibromobiphenyl	mg/kg		5	n.d.	-
Tribromobiphenyl	mg/kg		5	n.d.	-
Tetrabromobiphenyl	mg/kg		5	n.d.	-
Pentabromobiphenyl	mg/kg		5	n.d.	-
Hexabromobiphenyl	mg/kg		5	n.d.	-
Heptabromobiphenyl	mg/kg		5	n.d.	-
Octabromobiphenyl	mg/kg		5	n.d.	-
Nonabromobiphenyl	mg/kg		5	n.d.	-
Decabromobiphenyl	mg/kg		5	n.d.	-
Sum of PBDEs	mg/kg		-	n.d.	1000
Monobromodiphenyl ether	mg/kg		5	n.d.	-
Dibromodiphenyl ether	mg/kg		5	n.d.	-
Tribromodiphenyl ether	mg/kg		5	n.d.	-
Tetrabromodiphenyl ether	mg/kg		5	n.d.	-
Pentabromodiphenyl ether	mg/kg		5	n.d.	-
Hexabromodiphenyl ether	mg/kg		5	n.d.	-
Heptabromodiphenyl ether	mg/kg		5	n.d.	-
Octabromodiphenyl ether	mg/kg		5	n.d.	-
Nonabromodiphenyl ether	mg/kg		5	n.d.	-
Decabromodiphenyl ether	mg/kg		5	n.d.	-

MK ELECTRON CO., LTD.
405, GEUMEO-RO, POGOK-EUP, CHEOIN-GU, YONGIN-SI, GYEONGGI-DO, KOREA

Test Item(s)	Unit	Method	MDL	Result	Limit
				No.1	
DEHP (Di- (2-ethylhexyl) phthalate) (CAS No.: 117-81-7)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	1000
BBP (Butyl Benzyl phthalate) (CAS No.: 85-68-7)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	1000
DBP (Dibutyl phthalate) (CAS No.: 84-74-2)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	1000
DIBP (Di-isobutyl phthalate) (CAS No.: 84-69-5)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	1000
DIDP (Di-isodecyl phthalate) (CAS No.: 26761-40-0; 68515-49-1)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	-
DINP (Di-isononyl phthalate) (CAS No.: 28553-12-0; 68515-48-0)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	-
DNOP (Di-n-octyl phthalate) (CAS No.: 117-84-0)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	-
DNHP (Di-n-hexyl phthalate) (CAS No.: 84-75-3)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	-
DIHP (1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich) (CAS No.: 71888-89-6)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	-
DHNUP (1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters) (CAS No.: 68515-42-4)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	-
DMEP (Bis (2-methoxyethyl) phthalate) (CAS No.: 117-82-8)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	-
DNPP (Di-n-pentyl phthalate) (CAS No.: 131-18-0)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.	-
PVC	**	Analysis was performed by FTIR and FLAME Test.	-	Negative	-
Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified (α-HBCDD, β- HBCDD, γ- HBCDD) (CAS No.: 25637-99-4 and 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8))	mg/kg	With reference to IEC 62321 (2008). Analysis was performed by GC/MS.	5	n.d.	-

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Test Item(s)	Unit	Method	MDL	Result No.1	Limit
Polychlorinated Biphenyls (PCBs) (CAS No.: 1336-36-3)	mg/kg	With reference to US EPA 3550C (2007). Analysis was performed by GC/MS.	0.5	n.d.	-
Polychlorinated Naphthalene (PCNs)	mg/kg	With reference to US EPA 3550C (2007). Analysis was performed by GC/MS.	5	n.d.	-
Polychlorinated Terphenyls (PCTs)	mg/kg	With reference to US EPA 3550C (2007). Analysis was performed by GC/MS.	0.5	n.d.	-
Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins) (CAS No.: 85535-84-8)	mg/kg	With reference to US EPA 3550C (2007). Analysis was performed by GC/MS.	100	n.d.	-
Tributyl Tin (TBT)	mg/kg	With reference to ISO 17353 (2004). Analysis was performed by GC/FPD.	0.03	n.d.	-
Triphenyl Tin (TphT)	mg/kg		0.03	n.d.	-
Dibutyl Tin (DBT)	mg/kg		0.03	n.d.	-
Dioctyl Tin (DOT)	mg/kg		0.03	n.d.	-
Bis(tributyltin)oxide (TBTO) (CAS No.: 56-35-9)	mg/kg	With reference to ISO 17353 (2004). Analysis was performed by GC/FPD. Calculated from the result of Tributyl Tin (TBT).	0.03 (▲)	n.d.	-
Halogen					
Halogen-Fluorine (F) (CAS No.: 14762-94-8)	mg/kg	With reference to BS EN 14582 (2016). Analysis was performed by IC.	50	n.d.	-
Halogen-Chlorine (Cl) (CAS No.: 22537-15-1)	mg/kg		50	n.d.	-
Halogen-Bromine (Br) (CAS No.: 10097-32-2)	mg/kg		50	n.d.	-
Halogen-Iodine (I) (CAS No.: 14362-44-8)	mg/kg		50	n.d.	-
Antimony (Sb)	mg/kg	With reference to US EPA 3052 (1996). Analysis was performed by ICP-OES.	2	n.d.	-
Beryllium (Be)	mg/kg	With reference to US EPA 3052 (1996). Analysis was performed by ICP-OES.	2	n.d.	-
Perfluorooctane sulfonates (PFOS-Acid, Metal Salt, Amide)	mg/kg	With reference to CEN/TS 15968 (2010). Analysis was performed by LC/MS.	0.01	n.d.	-
PFOA (CAS No.: 335-67-1)	mg/kg	With reference to CEN/TS 15968 (2010). Analysis was performed by LC/MS.	0.01	n.d.	-

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Test Item(s)	Unit	Method	MDL	Result	Limit
				No.1	
Arsenic (As)	mg/kg	With reference to US EPA 3052 (1996). Analysis was performed by ICP-OES.	2	n.d.	-
Red phosphorus	**	Analysis was performed by Pyrolyzer-GC/MS.	-	Negative	-

Note：

1. mg/kg = ppm ；0.1wt% = 1000ppm
2. MDL = Method Detection Limit
3. n.d. = Not Detected = less than MDL
4. " - " = Not Regulated
5. ** = Qualitative analysis (No Unit)
6. Negative = Undetectable / Positive = Detectable
7. (#2) =
   a. The sample is positive for Cr(VI) if the Cr(VI) concentration is greater than 0.13 µg/cm². The sample coating is considered to contain Cr(VI)
   b. The sample is negative for Cr(VI) if Cr(VI) is n.d. (concentration less than 0.10 µg/cm²). The coating is considered a non-Cr(VI) based coating
   c. The result between 0.10 µg/cm² and 0.13 µg/cm² is considered to be inconclusive - unavoidable coating variations may influence the determination.
8. (▲)：The MDL was evaluated for element / tested substance.
   Conversion Formula：AX ＝ A × F

AX	A	F
Bis(tributyltin)oxide (TBTO)	Tributyl Tin (TBT)	1.024

9. Parameter Conversion Table： http://twap.sgs.com/sgsrsts/chn/download-REACH_tw.asp

PFOS Reference Information : POPs - (EU) 2019/1021

Outlawing PFOS as substances or preparations in concentrations above 0.001% (10ppm), in semi-finished products or articles or parts at a level above 0.1%(1000ppm), in textiles or other coated materials above 1µg/m².

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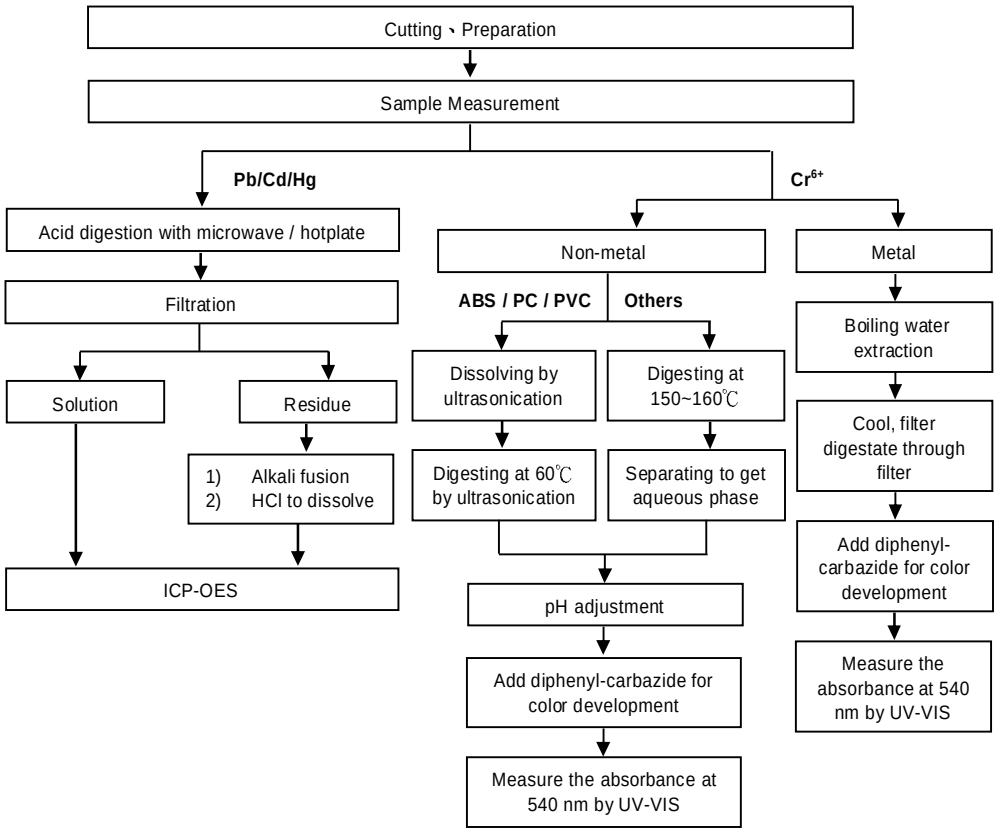
Analytical flow chart of Heavy Metal

These samples were dissolved totally by pre-conditioning method according to below flow chart. (Cr^{6+} test method excluded)

- Technician : Rita Chen
- Supervisor: Troy Chang



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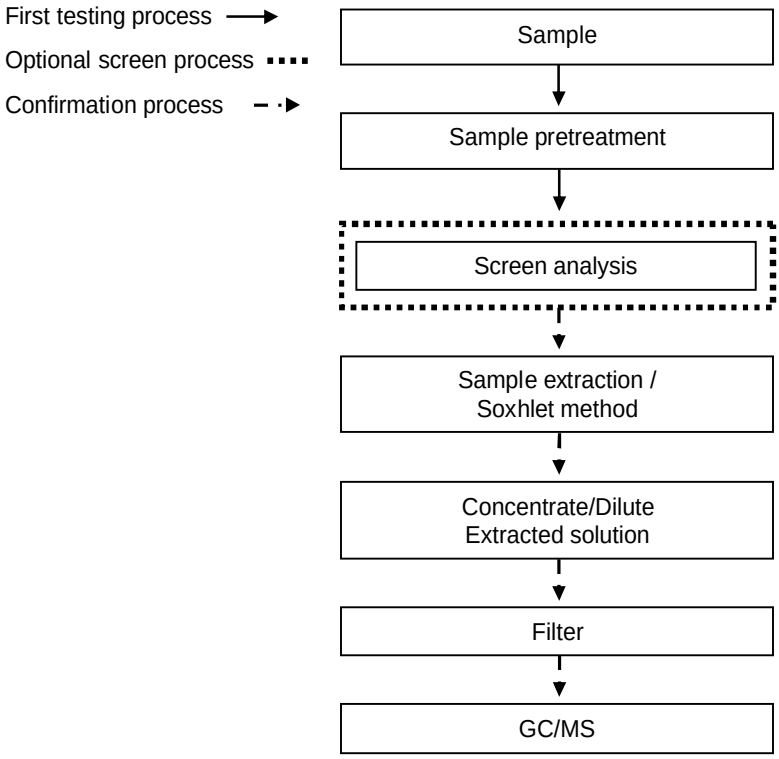
Analytical flow chart – PBB / PBDE

- Technician : Yaling Tu
- Supervisor: Troy Chang



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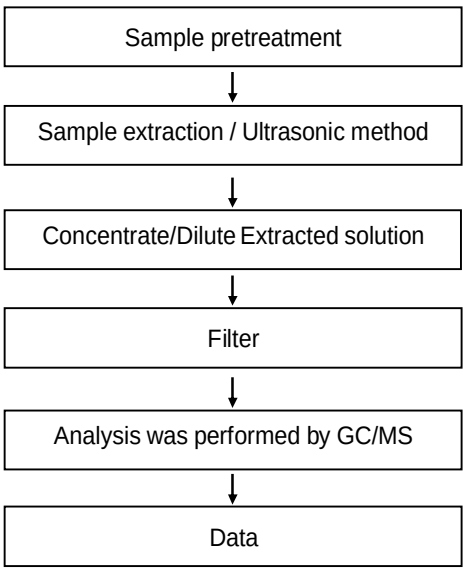
Analytical flow chart - PCBs

- Technician: Yaling Tu
- Supervisor: Troy Chang



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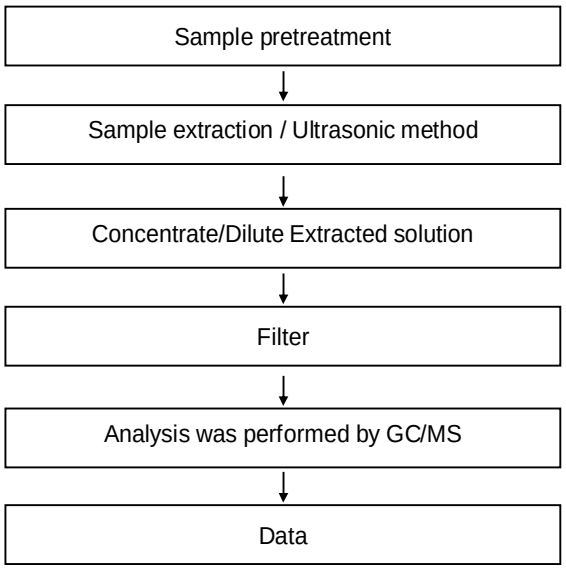
Analytical flow chart - PCNs

- Technician: Yaling Tu
- Supervisor: Troy Chang



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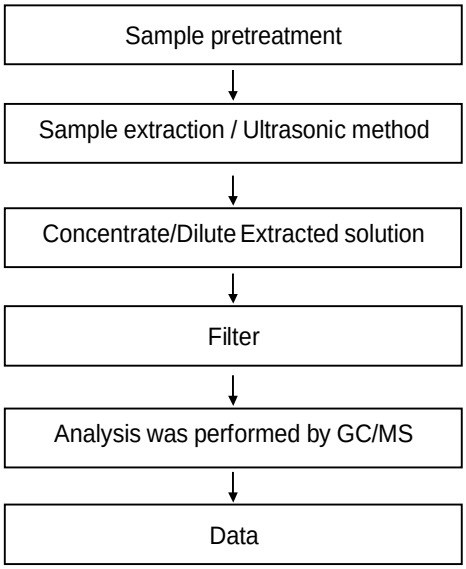
Analytical flow chart - PCTs

- Technician: Yaling Tu
- Supervisor: Troy Chang



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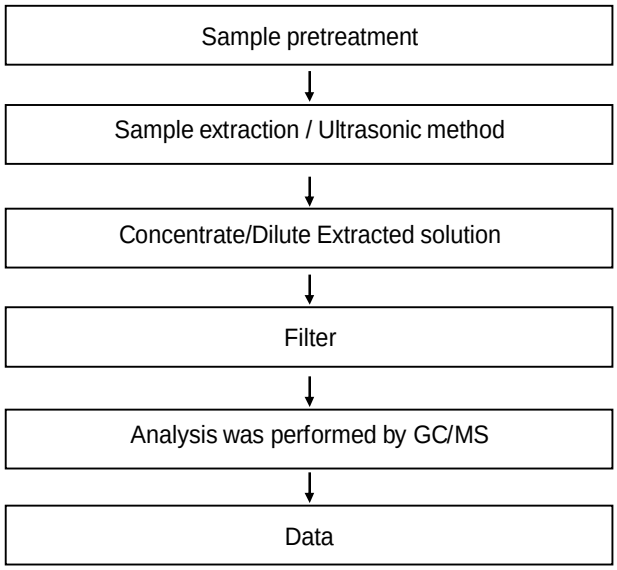
Analytical flow chart - Chlorinated Paraffins

- Technician: Yaling Tu
- Supervisor: Troy Chang



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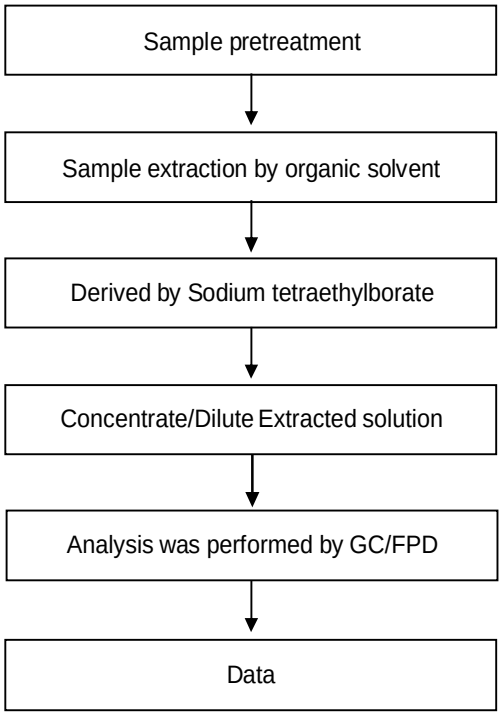
Analytical flow chart - Organic-Tin

- Technician: Yaling Tu
- Supervisor: Troy Chang



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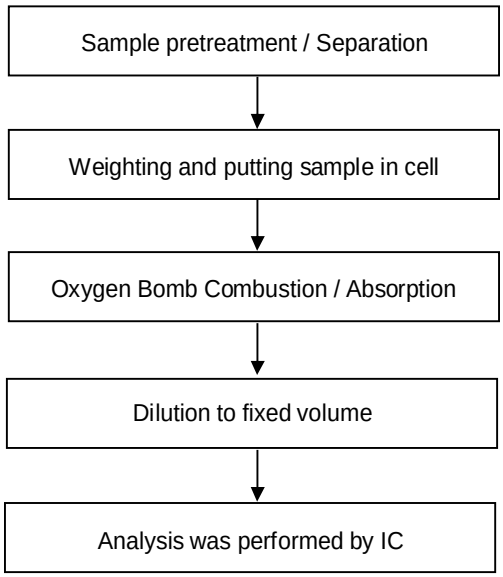
Analytical flow chart - Halogen

- Technician: Rita Chen
- Supervisor: Troy Chang



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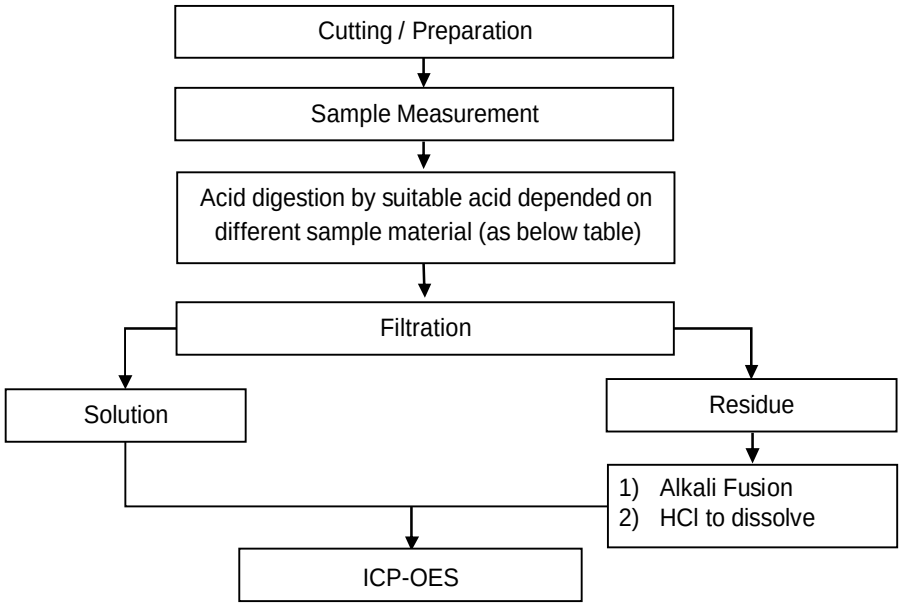
These samples were dissolved totally by pre-conditioning method according to below flow chart.

- Technician: Rita Chen
- Supervisor: Troy Chang

Flow Chart of digestion for the elements analysis performed by ICP-OES



Steel, copper, aluminum, solder	Aqua regia, HNO_3, HCl, HF, H_2O_2
Glass	HNO_3/HF
Gold, platinum, palladium, ceramic	Aqua regia
Silver	HNO_3
Plastic	H_2SO_4, H_2O_2, HNO_3, HCl
Others	Added appropriate reagent to total digestion

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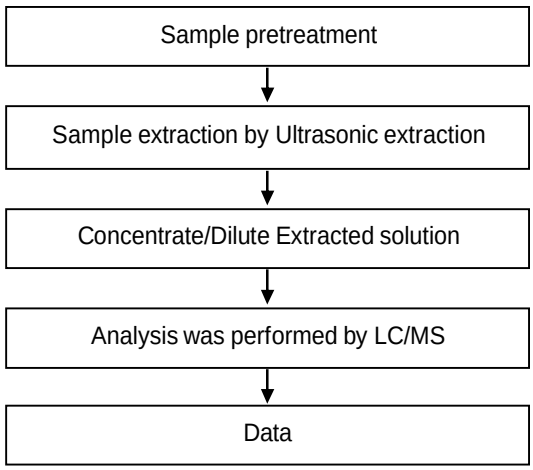
Analytical flow chart - PFOA/PFOS

- Technician: Yaling Tu
- Supervisor: Troy Chang



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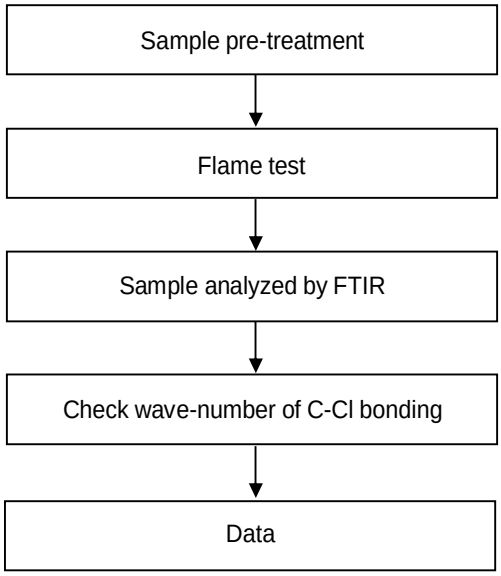
Analysis flow chart - PVC

- Technician: Yaling Tu
- Supervisor: Troy Chang



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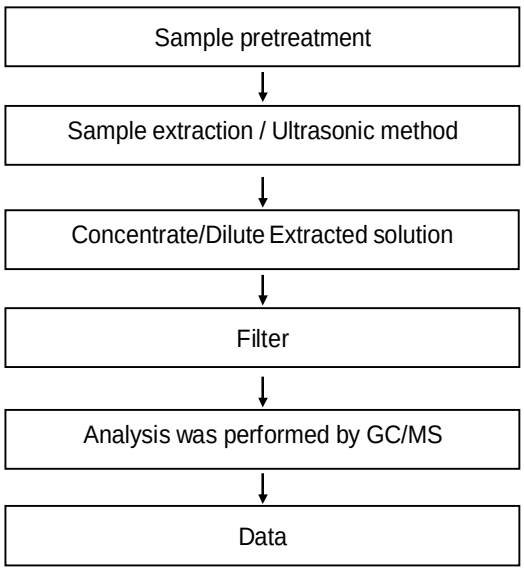
Analytical flow chart - HBCDD

- Technician: Yaling Tu
- Supervisor: Troy Chang



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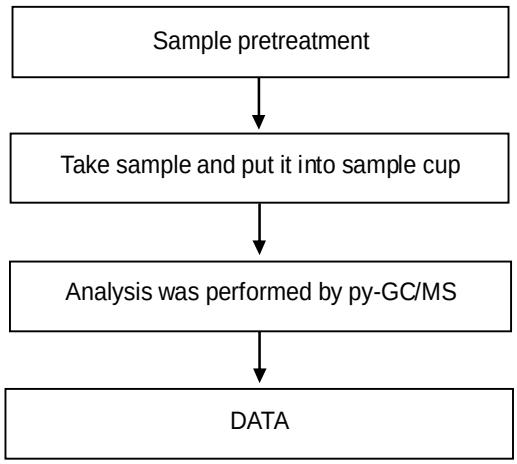
Analytical flow chart - Red phosphorus

- Technician: Yaling Tu
- Supervisor: Troy Chang



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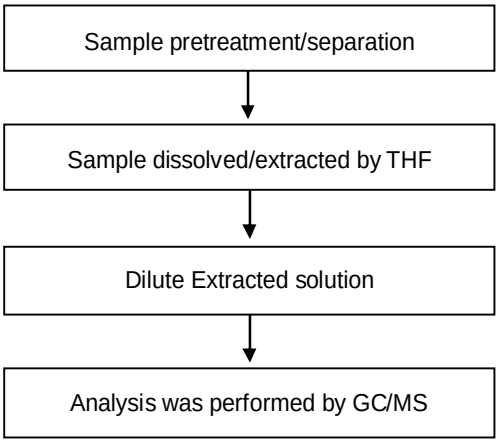
Analytical flow chart - Phthalate

- Technician: Yaling Tu
- Supervisor: Troy Chang

【Test method: IEC 62321-8】



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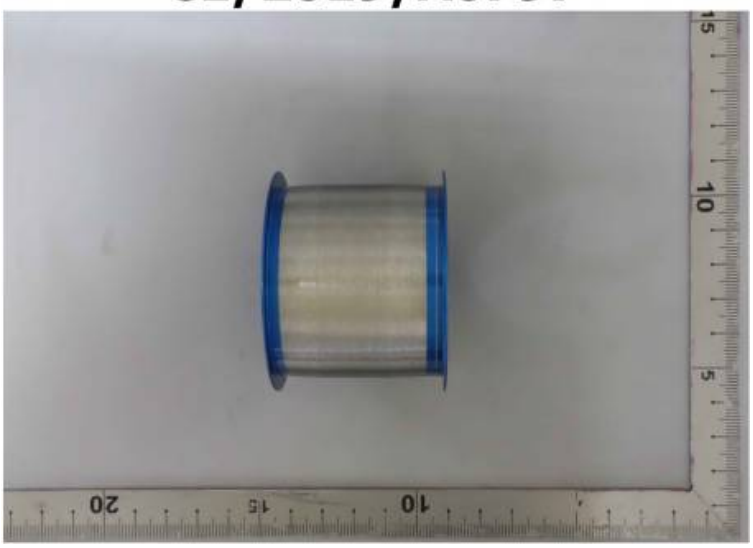
*** The tested sample / part is marked by an arrow if it's shown on the photo. ***

CE/2019/A0797



** End of Report **

Marketing Part Number	Sample Ordering Part Number	Sample Availability
FM24C04B-G	FM24C04B8-G	WW1520
FM24C16B-G	FM24C16B8-G	WW1520
FM24C64B-G	FM24C64B8-G	WW1520
FM24CL04B-G	FM24CL04B8-G	WW1520
FM24CL16B-DG	FM24CL16B8-DG	WW1520
FM24CL16B-G	FM24CL16B8-G	WW1520
FM24CL64B-DG	FM24CL64B8-DG	WW1520
FM24CL64B-G	FM24CL64B8-G	WW1520
FM25040B-G	FM25040B8-G	WW1520
FM25640B-G	FM25640B8-G	WW1520
FM25C160B-G	FM25C160B8-G	WW1520
FM25CL64B-DG	FM25CL64B8-DG	WW1520
FM25CL64B-G	FM25CL64B8-G	WW1520
FM25L04B-DG	FM25L04B8-DG	WW1520
FM25L04B-G	FM25L04B8-G	WW1520
FM25L16B-DG	FM25L16B8-DG	WW1520
FM25L16B-G	FM25L16B8-G	WW1520