Cypress Semiconductor
Reliability Qualification Report

QTP# 163804, 164209, 164301, 164214, 164213, 173412 Version *A

S25FL128L

Qualification of: S25FL128L, 128 Megabit, 3.0-Volt Single Supply Serial Peripheral Interface Flash Non-Volatile Memory with Multi-I/O

FOR ANY QUESTIONS ON THIS REPORT, PLEASE CONTACT
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I.A. Product and Package Information

Product Description:	S25FL128L 128 Megabit, 3.0-Volt Single Supply Serial Peripheral Interface Flash Non-Volatile Memory with Multi-I/O	**Cypress Division:**	Memory Product Division

Package:	FAC024	**QTP:**	163804		
Description:	(8 x 6 x 1.2mm) 24 Ball, Fine Pitch Ball Grid Array Package (FBGA)			**Flammability:**	**O2 Index:**
Assembly:	Cypress Thailand	**Molding Compound:**	ShinEtsu KMC 3580LVA	UL-V0	>28
Electrical Test:	Cypress Thailand	**Theta Ja / Psi Jt:**	38 °C/W / 0.1 °C/W		
Substrate/Leadframe:	Laminate Substrate	**Die Attachment:**	QMI 546		
Lead Finish:	96.5Sn3.0Ag0.5Cu Spheres	**Bond Wire:**	Copper		
Comments:					

Est. Field Temperature:	55 °C	**Life Test Temperature:**	150 °C
Est. DC Field Current:	25 mA	**Life Test Dynamic Current:**	10 mA
Est. Field Voltage:	3.0 V	**Life Test Voltage:**	3.6 V
Est. Field Power Dissipation:	75 mWatts	**Est. Stress Power Dissipation:**	36 mWatts
Est. Field Tj:	57.8 °C	**Est. Stress Tj:**	151.3 °C

Die:	98SZ2A	**Die Size:**	3.47 x 3.83 mm
Process:	65nm	**Fab:**	XMC
Type:	Floating Gate	**Density:**	128M

I.B. Product and Package Information

Product Description: S25FL128L
128 Megabit, 3.0-Volt Single Supply Serial Peripheral Interface
Flash Non-Volatile Memory with Multi-I/O

Cypress Division: Memory Product Division

Package:	FAB024	**QTP:**	164209
Description:	(8 x 6 x 1.2mm) 24 Ball, Fine Pitch Ball Grid Array Package (FBGA)		
Assembly:	Cypress Thailand	**Molding Compound:**	ShinEtsu KMC 3580LVA
Electrical Test:	Cypress Thailand	**Theta Ja / Psi Jt:**	38 °C/W / 0.1 °C/W
Substrate/Leadframe:	Laminate Substrate	**Die Attachment:**	QMI 546
Lead Finish:	96.5Sn3.0Ag0.5Cu Spheres	**Bond Wire:**	Copper
Comments:			

Flammability:	**O2 Index:**
UL-V0	>28

Est. Field Temperature:	55 °C	**Life Test Temperature:**	150 °C
Est. DC Field Current:	25 mA	**Life Test Dynamic Current:**	10 mA
Est. Field Voltage:	3.0 V	**Life Test Voltage:**	3.6 V
Est. Field Power Dissipation:	75 mWatts	**Est. Stress Power Dissipation:**	36 mWatts
Est. Field Tj:	57.8 °C	**Est. Stress Tj:**	151.3 °C

Die:	98SZ2A	**Die Size:**	3.47 x 3.83 mm
Process:	65nm	**Fab:**	XMC
Type:	Floating Gate	**Density:**	128M

I.C. Product and Package Information

Product Description:	S25FL128L 128 Megabit, 3.0-Volt Single Supply Serial Peripheral Interface Flash Non-Volatile Memory with Multi-I/O	**Cypress Division:**	Memory Product Division

Package:	FAC024	**QTP:**	164301		
Description:	(8 x 6 x 1.2mm) 24 Ball, Fine Pitch Ball Grid Array Package (FBGA)			**Flammability:**	**O2 Index:**
Assembly:	Cypress Thailand	**Molding Compound:**	ShinEtsu KMC 3580LVA	UL-V0	>28
Electrical Test:	Cypress Thailand	**Theta Ja / Psi Jt:**	38 °C/W / 0.1 °C/W		
Substrate/Leadframe:	Laminate Substrate	**Die Attachment:**	QMI 546		
Lead Finish:	96.5Sn3.0Ag0.5Cu Spheres	**Bond Wire:**	Copper		
Comments:					

Est. Field Temperature:	55 °C	**Life Test Temperature:**	150 °C
Est. DC Field Current:	25 mA	**Life Test Dynamic Current:**	10 mA
Est. Field Voltage:	3.0 V	**Life Test Voltage:**	3.6 V
Est. Field Power Dissipation:	75 mWatts	**Est. Stress Power Dissipation:**	36 mWatts
Est. Field Tj:	57.8 °C	**Est. Stress Tj:**	151.3 °C

Die:	98SZ2A	**Die Size:**	3.47 x 3.83 mm
Process:	65nm	**Fab:**	XMC
Type:	Floating Gate	**Density:**	128M

I.D. Product and Package Information

Product Description:	S25FL128L 128 Megabit, 3.0-Volt Single Supply Serial Peripheral Interface Flash Non-Volatile Memory with Multi-I/O	**Cypress Division:**	Memory Product Division

Package:	SOC008	**QTP:**	164214		
Description:	(8.00 x 5.28 x 2.159mm) 8 Lead, Small Outline Integrated Circuit (SOIC)			**Flammability:**	**O2 Index:**
Assembly:	ZKT China	**Molding Compound:**	Samsung 8500HKT	UL-V0	>28
Electrical Test:	Cypress Thailand	**Theta Ja / Psi Jt:**	63 °C/W / 0.9 °C/W		
Substrate/Leadframe:	Copper Leadframe	**Die Attachment:**	Yizbond 8511		
Lead Finish:	100% Matte Sn Plating	**Bond Wire:**	Copper		
Comments:					

Est. Field Temperature:	55 °C	**Life Test Temperature:**	150 °C
Est. DC Field Current:	25 mA	**Life Test Dynamic Current:**	10 mA
Est. Field Voltage:	3.0 V	**Life Test Voltage:**	3.6 V
Est. Field Power Dissipation:	75 mWatts	**Est. Stress Power Dissipation:**	36 mWatts
Est. Field Tj:	59.7 °C	**Est. Stress Tj:**	152.2 °C

Die:	98SZ2A	**Die Size:**	3.47 x 3.83 mm
Process:	65nm	**Fab:**	XMC
Type:	Floating Gate	**Density:**	128M

I.E. Product and Package Information

Product Description: S25FL128L
128 Megabit, 3.0-Volt Single Supply Serial Peripheral Interface Flash Non-Volatile Memory with Multi-I/O

Cypress Division: Memory Product Division

Package:	WND008	**QTP:**	164213
Description:	(6 x 5 x 0.8mm) 8 Contact, Small Outline No Lead Package (WSON)		
Assembly:	ASE Taiwan	**Molding Compound:**	Sumitomo EME G700SLA
Electrical Test:	Cypress Thailand	**Theta Ja / Psi Jt:**	32 °C/W / 0.1 °C/W
Substrate/Leadframe:	Copper Leadframe	**Die Attachment:**	Hitachi EN-4900
Lead Finish:	100% Matte Sn Plating	**Bond Wire:**	Copper
Comments:			

Flammability:	**O2 Index:**
UL-V0	>28

Est. Field Temperature:	55 °C	**Life Test Temperature:**	150 °C
Est. DC Field Current:	25 mA	**Life Test Dynamic Current:**	10 mA
Est. Field Voltage:	3.0 V	**Life Test Voltage:**	3.6 V
Est. Field Power Dissipation:	75 mWatts	**Est. Stress Power Dissipation:**	36 mWatts
Est. Field Tj:	57.3 °C	**Est. Stress Tj:**	151.1 °C

Die:	98SZ2A	**Die Size:**	3.47 x 3.83 mm
Process:	65nm	**Fab:**	XMC
Type:	Floating Gate	**Density:**	128M

I.F. Product and Package Information

Product Description: S25FL128L
128 Megabit, 3.0-Volt Single Supply Serial Peripheral Interface Flash Non-Volatile Memory with Multi-I/O

Cypress Division: Memory Product Division

Package:	SO3016	**QTP:**	173412
Description:	(10.3 x 10.3 x 2.65mm) 16 Lead, Small Outline Integrated Circuit (SOIC)	**Flammability:** UL-V0	**O2 Index:** >28
Assembly:	ASE Taiwan	**Molding Compound:**	Sumitomo EME G700SLA
Electrical Test:	Cypress Thailand	**Theta Ja / Psi Jt:**	36 °C/W / 0.3 °C/W
Substrate/Leadframe:	Copper Leadframe	**Die Attachment:**	Hitachi EN-4900
Lead Finish:	100% Matte Sn Plating	**Bond Wire:**	Copper
Comments:			

Est. Field Temperature:	55 °C	**Life Test Temperature:**	150 °C
Est. DC Field Current:	25 mA	**Life Test Dynamic Current:**	10 mA
Est. Field Voltage:	3.0 V	**Life Test Voltage:**	3.6 V
Est. Field Power Dissipation:	75 mWatts	**Est. Stress Power Dissipation:**	36 mWatts
Est. Field Tj:	57.7 °C	**Est. Stress Tj:**	151.3 °C

Die:	98SZ2A	**Die Size:**	3.47 x 3.83 mm
Process:	65nm	**Fab:**	XMC
Type:	Floating Gate	**Density:**	128M

II. 65nm Floating Gate Life Test Failure Rate Calculation

HTOL Stress Temperature - 150 °C

Failure Mechanism	Read Points / Test Results				Modeling Parameters @ 55°C					Avg. Failure Rate FITS @ 55°C, 60% Conf.	
	48 hrs	168 hrs	500 hrs	1000 hrs	Ea eV	TAF	VAF	OAF	MTTF (yrs)	Early Life	Inherent Life
PLASTIC											
Sample Size	1868	1065	499	499							
Zero fails, Process ave. Ea	0 *	0	0	0	0.7	141	1	141		123	10
Totals	**0**	**0**	**0**	**0**					**11416**	**123**	**10**

* - Contributes to early life FITS

Data Retention Bake - 150 °C

Reliability Stress	Number of Rejects	Sample Size	Failure Rate %	Failure Mechanism
500 hrs	0	229	0.00	No Failures
1000 hrs	0	229	0.00	No Failures

III. Summary of Stress Test Results

Stress Test	Stress Condition	Package Type	Sample Size	Num. of Lots	Num. of Fails	Failure Rate %	Comments
Data From Qualification 163804, 164209, 164301, 164214, 164213, 173412:							
HTOL (EL)	(3.6V, 150°C)	FAC024 [1]	77	1	0	0.00	168 hours
	(3.6V, 150°C)	WND008 [5]	77	1	0	0.00	168 hours
HTOL (IL)	(3.6V, 150°C)	FAC024 [1]	77	1	0	0.00	504 hours
	(3.6V, 150°C)	WND008 [5]	77	1	0	0.00	500 hours
High Temp Bake	(200°C)	WND008 [5]	77	1	0	0.00	350 hours
	(150°C)	WND008 [5]	77	1	0	0.00	1000 hours
ESD CDM	N/A	FAC024 [1]	15	1	0	0.00	Passed 1.0kV
	N/A	FAB024 [2]	15	1	0	0.00	Passed 1.0kV
	N/A	FAC024 [3]	15	1	0	0.00	Passed 1.0kV
	N/A	SOC008 [4]	15	1	0	0.00	Passed 1.0kV
	N/A	WND008 [5]	15	1	0	0.00	Passed 1.0kV
	N/A	SO3016 [6]	24	1	0	0.00	Passed 1.0kV
ESD HBM	(100pF, 1500 Ohms)	FAC024 [1]	14	1	0	0.00	Passed 2.0kV
Latch Up	(125°C, +/- 140mA)	FAC024 [1]	9	1	0	0.00	Passed
Endurance (10k)	(125°C, 3.6V)	FAC024 [1]	64	1	0	0.00	10k cycles
	(25°C, 3.6V)	FAC024 [1]	64	1	0	0.00	10k cycles
	(-40°C, 3.6V)	FAC024 [1]	64	1	0	0.00	10k cycles
Endurance (100k)	(125°C, 3.6V)	FAC024 [1]	64	1	0	0.00	100k cycles
	(25°C, 3.6V)	FAC024 [1]	64	1	0	0.00	100k cycles
	(-40°C, 3.6V)	FAC024 [1]	64	1	0	0.00	100k cycles
Preconditioning	(PC2/260°C, +0°C/-5°C)	FAB024 [2]	77	1	Passed Jedec L3		
	(PC2/260°C, +0°C/-5°C)	FAC024 [3]	77	1	Passed Jedec L3		
	(PC2/260°C, +0°C/-5°C)	SOC008 [4]	77	1	Passed Jedec L3		
	(PC2/260°C, +0°C/-5°C)	WND008 [5]	241	1	Passed Jedec L3		
	(PC2/260°C, +0°C/-5°C)	SO3016 [6]	77	1	Passed Jedec L3		
Precon+Temp Cycle	(PC2/260°C, -40°C/150°C)	WND008 [5]	77	1	0	0.00	1000 cycles
Precon+HAST	(PC2/260°C, Biased, 130°C/85% RH)	WND008 [5]	77	1	0	0.00	192 hours
Precon+uHAST	(PC2/260°C, Unbiased, 130°C/85% RH)	WND008 [5]	77	1	0	0.00	96 hours

Generic Reference Data:

Test	Condition	Fab/Assembly					Duration
HTOL (EL)	(3.6V, 150°C)	FAB024 [7]	268	3	0	0.00	168 hours
	(3.6V, 150°C)	SOC008 [8]	231	3	0	0.00	168 hours
	(3.6V, 150°C)	SO3016 [9]	231	3	0	0.00	168 hours
HTOL (IL)	(3.6V, 150°C)	FAB024 [7]	268	3	0	0.00	500 hours
	(3.6V, 150°C)	SOC008 [8]	231	3	0	0.00	1000 hours
	(3.6V, 150°C)	SO3016 [9]	231	3	0	0.00	1000 hours
HTOL (XL)	(3.6V, 150°C)	FAB024 [7]	268	3	0	0.00	1000 hours
High Temp Bake	(200°C)	FAB024 [7]	72	1	0	0.00	350 hours
	(150°C)	FAB024 [7]	231	3	0	0.00	1000 hours
	(200°C)	SOC008 [8]	216	3	0	0.00	350 hours
	(150°C)	SOC008 [8]	231	3	0	0.00	1000 hours
	(200°C)	SO3016 [9]	50	1	0	0.00	350 hours
High Temp Bake (200°C), Extended	(200°C)	FAB024 [7]	67	1	0	0.00	500 hours
	(200°C)	SOC008 [8]	201	3	0	0.00	500 hours
	(200°C)	SO3016 [9]	45	1	0	0.00	500 hours
Preconditioning	(PC1/260°C, +0°C/-5°C)	FAB024 [7]	770	4	Passed Jedec L3		
	(PC2/260°C, +0°C/-5°C)	SOC008 [8]	723	3	Passed Jedec L3		
	(PC2/260°C, +0°C/-5°C)	SO3016 [9]	723	3	Passed Jedec L3		
Precon+Temp Cycle	(PC2/260°C, -40°C/150°C)	FAB024 [7]	230	3	0	0.00	1000 cycles
	(PC2/260°C, -65°C/150°C)	SOC008 [8]	246	3	0	0.00	500 cycles
	(PC2/260°C, -65°C/150°C)	SO3016 [9]	246	3	0	0.00	500 cycles
Precon+Temp Cycle (Ext.)	(PC2/260°C, -65°C/150°C)	SOC008 [8]	231	3	0	0.00	1000 cycles
	(PC2/260°C, -65°C/150°C)	SO3016 [9]	216	3	0	0.00	1000 cycles
Precon+HAST	(PC2/260°C, Biased, 110°C/85% RH)	FAB024 [7]	231	3	0	0.00	264 hours
	(PC2/260°C, Biased, 130°C/85% RH)	SOC008 [8]	246	3	0	0.00	96 hours
	(PC2/260°C, Biased, 130°C/85% RH)	SO3016 [9]	246	3	0	0.00	96 hours
Precon+HAST (Ext.)	(PC2/260°C, Biased, 110°C/85% RH)	FAB024 [7]	226	3	0	0.00	512 hours
	(PC2/260°C, Biased, 130°C/85% RH)	SOC008 [8]	230	3	0	0.00	192 hours
	(PC2/260°C, Biased, 130°C/85% RH)	SO3016 [9]	216	3	0	0.00	192 hours
Precon+uHAST	(PC2/260°C, Unbiased, 130°C/85% RH)	FAB024 [7]	231	3	0	0.00	96 hours
	(PC2/260°C, Unbiased, 130°C/85% RH)	SOC008 [8]	231	3	0	0.00	96 hours
	(PC2/260°C, Unbiased, 130°C/85% RH)	SO3016 [9]	231	3	0	0.00	96 hours
Precon+uHAST (Ext.)	(PC2/260°C, Unbiased, 130°C/85% RH)	FAB024 [7]	231	3	0	0.00	192 hours
High Temp Bake (Ext.)	(150°C)	SOC008 [8]	216	3	0	0.00	2000 Hours
	(150°C)	SO3016 [9]	50	1	0	0.00	2000 Hours

Notes / Justification:

1) Results from Qual 163804, S25FL128L, 65nm Floating Gate in 24 Ball FBGA (8 x 6 x 1.2mm)
2) Results from Qual 164209, S25FL128L, 65nm Floating Gate in 24 Ball FBGA (8 x 6 x 1.2mm)
3) Results from Qual 164301, S25FL128L, 65nm Floating Gate in 24 Ball FBGA (8 x 6 x 1.2mm)
4) Results from Qual 164214, S25FL128L, 65nm Floating Gate in 8 Lead SOIC (8 x 5.28 x 2.159mm)
5) Results from Qual 164213, S25FL128L, 65nm Floating Gate in 8 Contact WSON (6 x 5 x 0.8mm)
6) Results from Qual 173412, S25FL128L, 65nm Floating Gate in 16 Lead SOIC (10.3 x 10.3 x 2.65mm)
7) Results from Qual 162020, S25FL256L in 24 Ball FBGA (8 x 6 x 1.2mm) - Same Product Family in FBGA Package
8) Results from Qual 163311, S25FL064L in 8 Lead SOIC (8 x 5.28 x 2.159mm) - Same SOIC Package assembled at ZKT
9) Results from Qual 173402, S25FL064L in 16 Lead SOIC (10.3 x 10.3 x 2.65mm) - Same SO3016 Package assembled at ASE Taiwan

Preconditioning Flows:

PC1 (Exceeds JEDEC L3 and JEITA Rank E): Bake 125°C, 24hr => Soak @ 30°C/70%RH, 216hr => 3x Reflow

PC2 (JEDEC L3): Bake 125°C, 24hr => Soak @ 30°C/60%RH, 192hr => 3x Reflow

Reliability Tests Performed per Specification Requirements

Stress	Condition	Specification Reference
Endurance (100k)	(125°C, 3.6V)	JESD47 / JESD22-A117 / AEC-Q100 /AEC-Q100-005
Endurance (100k)	(25°C, 3.6V)	JESD47 / JESD22-A117 / AEC-Q100 /AEC-Q100-005
Endurance (100k)	(-40°C, 3.6V)	JESD47 / JESD22-A117 / AEC-Q100 /AEC-Q100-005
Endurance (10k)	(125°C, 3.6V)	JESD47 / JESD22-A117 / AEC-Q100 /AEC-Q100-005
Endurance (10k)	(25°C, 3.6V)	JESD47 / JESD22-A117 / AEC-Q100 /AEC-Q100-005
Endurance (10k)	(-40°C, 3.6V)	JESD47 / JESD22-A117 / AEC-Q100 /AEC-Q100-005
ESD CDM	N/A	JS002 / AEC-Q100-011
ESD HBM	(100pF, 1500 Ohms)	JS001 / AEC-Q100-002
High Temp Bake	(150°C)	JESD22-A103
High Temp Bake	(200°C)	JESD22-A103
High Temp Bake (200°C), Extended	(200°C)	JESD22-A103
High Temp Bake (Ext.)	(150°C)	JESD22-A103
HTOL (EL)	(3.6V, 150°C)	JESD22-A108
HTOL (IL)	(3.6V, 150°C)	JESD22-A108
HTOL (XL)	(3.6V, 150°C)	JESD22-A108
Latch Up	(125°C, +/- 140mA)	JESD78 / AEC Q100-004
Precon+HAST	(PC2/260°C, Biased, 110°C/85% RH)	JESD22-A110
Precon+HAST	(PC2/260°C, Biased, 130°C/85% RH)	JESD22-A110
Precon+HAST (Ext.)	(PC2/260°C, Biased, 110°C/85% RH)	JESD22-A110
Precon+HAST (Ext.)	(PC2/260°C, Biased, 130°C/85% RH)	JESD22-A110
Precon+Temp Cycle	(PC2/260°C, -40°C/150°C)	JESD22-A104
Precon+Temp Cycle	(PC2/260°C, -65°C/150°C)	JESD22-A104
Precon+Temp Cycle (Ext.)	(PC2/260°C, -65°C/150°C)	JESD22-A104
Precon+uHAST	(PC2/260°C, Unbiased, 130°C/85% RH)	JESD22-A118
Precon+uHAST (Ext.)	(PC2/260°C, Unbiased, 130°C/85% RH)	JESD22-A118
Preconditioning	(PC1/260°C, +0°C/-5°C)	J-STD-020 / EIAJ ED-4701-100 Method 104
Preconditioning	(PC2/260°C, +0°C/-5°C)	J-STD-020

IV. Revision History

Document Number: 002-19394

Document Title: QTP#163804 : Qualification of S25FL128L, 128 Megabit, 3.0-Volt Single Supply Serial Peripheral Interface Flash Non-Volatile Memory with Multi-I/O

Rev.	Issue Date	ECN#	Originator	Description
**	4/10/2017	5690361	BAKC	Initial Release.
*A	10/20/2017	5936694	BAKC	Added SO3016 package data.

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