Q3, 2021 Quarterly Reliability Report

1. S34ML-1 product family, 41nm SLC NAND

41 nm SLC NAND were introduced in Jun 2012 and utilize tunnel Oxide, Polysilicon floating gate and interconnections are three metal layers with contact plugs and barrier metals. The 1st Metal layer for 41 nm SLC NAND is using Copper.

Data Summary and Failure Rate Estimation using Exponential Model HTOL Stress Temperature - 125°C

Failure Mechanisms	Read Point / Test Result		Modeling Parameters @ 55°C					Average Failure Rate	
	Early Life (hrs)	Inherent Life (hrs)	Ea eV	TAF	VAF	OAF	MTTF (yrs)	Early Life (PPM)	Inherent Life (FITS)
	96	1000							
Sample Size	500	150							
125C, Zero fails, Process ave. Ea	0	0	0.7	74	1	74	9259	0	12

Data Retention Bake - 150°C

Reliability Stress	Sample Size	Reject	PPM	FITS
1000	77	0	0	<1

Endurance - 90°C

Reliability Stress	Sample Size	Reject	PPM	FITS
10000	60	0	0	2
100000(Decade)	64	0	0	

2. S34ML-2 product family, 32nm SLC NAND

32 nm SLC NAND were introduced in October 2012 and utilize tunnel Oxide, Polysilicon floating gate and interconnections are three metal layers with contact plugs and barrier metals. The 1st Metal layer for 32 nm SLC NAND is using Copper

Data Summary and Failure Rate Estimation using Exponential Model HTOL Stress Temperature - 125°C

Failure Mechanisms	Read Point / Test Result		Modeling Parameters @ 55°C					Average Failure Rate	
	Early Life (hrs)	Inherent Life (hrs)	Ea eV	TAF	VAF	OAF	MTTF (yrs)	Early Life (PPM)	Inherent Life (FITS)
	96	1000							
Sample Size	500	150							
125C, Zero fails, Process ave. Ea	0	0	0.7	74	1	74	12198	0	9

Data Retention Bake - 150°C

Reliability Stress	Sample Size	Reject	PPM	FITS
1000	77	0	0	<1

Endurance - 90°C

Reliability Stress	Sample Size	Reject	PPM	FITS
10000	60	0	0	2
100000(Decade)	64	0	0	

3. S34ML-3 product family, 16nm SLC NAND

16 nm SLC NAND were introduced in November 2019 and utilize tunnel Oxide, Polysilicon floating gate and interconnections are three metal layers with contact plugs and barrier metals. The 1st Metal layer for 16 nm SLC NAND is using Copper

Data Summary and Failure Rate Estimation using Exponential Model HTOL Stress Temperature - 125°C

Failure Mechanisms	Read Point / Test Result		Modeling Parameters @ 55°C					Average Failure Rate	
	Early Life (hrs)	Inherent Life (hrs)	Ea eV	TAF	VAF	OAF	MTTF (yrs)	Early Life (PPM)	Inherent Life (FITS)
	96	1000							
Sample Size	500	150							
125C, Zero fails, Process ave. Ea	0	0	0.66	61	1	62	5708	79	20

Data Retention Bake - 150°C

Reliability Stress	Sample Size	Reject	PPM	FITS
1000	77	0	0	<1

Endurance - 90°C

Reliability Stress	Sample Size	Reject	PPM	FITS
10000	60	0	0	2
100000(Decade)	64	0	0	

4. S40FC004 product family, 4GB eMMC

4GB eMMC were introduced in November 2020 and utilize tunnel Oxide, Polysilicon floating gate and interconnections are three metal layers with contact plugs and barrier metals. The 1st Metal layer for 16 nm MLC NAND is using Copper

Data Summary and Failure Rate Estimation using Exponential Model HTOL Stress Temperature - 125°C

Failure Mechanisms	Read Point / Test Result			Modeling Parameters @ 55°C					Average Failure Rate	
	Early Life (hrs)	Inherent Life (hrs)		Ea eV	TAF	VAF	OAF	MTTF (yrs)	Early Life (PPM)	Inherent Life (FITS)
	168	504	1000							
Sample Size	231	231	231							
125C, Zero fails, Process ave. Ea		0	0	0.7	61	1	62	3747	58.51	23.26

Data Retention Bake - 150°C

Reliability Stress	Sample Size	Reject	PPM	FITS
1000	77	0	0	<1

Endurance - 90°C

Reliability Stress	Sample Size	Reject	PPM	FITS
10000	60	0	0	2
100000(Decade)	64	0	0	

5. Data Summaries by Package Family

BGA (Ball Grid Array)

Reliability Stress		Sample Size	Reject	Failure Rate PPM
HAST	96hrs	727	0	0
	264hrs	2125	0	0
HIGHTEMP STORAGE	1000hrs	4528	0	0
Pressure Cooker Test	168hrs	80	0	0
TEMP CYCLE	500cycle	2074	0	0
	1000cycle	3460	0	0
UNBIASED HAST TEST	96hrs	4059	0	0
	264hrs	481	0	0

TSOP (Thin Small Outline Package)

Reliability Stress		Sample Size	Reject	Failure Rate PPM
HAST	96hrs	5436	0	0
	264hrs	644	0	0
HIGHTEMP STORAGE	1000hrs	5842	0	0
Pressure Cooker Test	96hrs	730	0	0
	168hrs	2532	0	0
TEMP CYCLE	500cycle	5528	0	0
	1000cycle	2242	0	0
UNBIASED HAST TEST	96hrs	3106	0	0

BGA 153 (Ball Grid Array)

Reliability Stress		Sample Size	Reject	Failure Rate PPM
PC	192hrs	99	0	0
HAST	164hrs	25	0	0
HIGH TEMP STORAGE	1000hrs	25	0	0
TEMP CYCLE	500cycle	25	0	0
UNBIASED HAST TEST	96hrs	25	0	0