

Q4, 2022 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 125C, Zero fails, Process ave. Ea	500 0	150 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 125C, Zero fails, Process ave. Ea	500 0	150 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 125C, Zero fails, Process ave. Ea	500 0	150 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 125C, Zero fails, Process ave. Ea	231	231	231	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 63 (Ball Grid Array)

Reliability Stress		Sample Size	Reject	Failure Rate PPM
HAST	96hrs	1608	0	0
	264hrs	5232	0	0
HIGH TEMP STORAGE	1000hrs	6967	0	0
TEMP CYCLE	500cycle	5297	0	0
	1000cycle	2602	0	0
UNBIASED HAST TEST	96hrs	4488	0	0
	264hrs	2637	0	0

TSOP 48 (Thin Small Outline Package)

Reliability Stress		Sample Size	Reject	Failure Rate PPM
HAST	96hrs	4966	0	0
	264hrs	80	0	0
HIGH TEMP STORAGE	1000hrs	5422	0	0
PRESSURE COOKER TEST	96hrs	1028	0	0
	168hrs	4231	0	0
TEMP CYCLE	500cycle	8209	0	0
UNBIASED HAST TEST	96hrs	1455	0	0

BGA 153 (Ball Grid Array)

Reliability Stress		Sample Size	Reject	Failure Rate PPM
PC	192hrs	100	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