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# Cypress Semiconductor Reliability Qualification Report

QTP# Q99992, Q99990a, Q100182a, Q100333 Version \*\*

## S29GL512S

**Qualification of: S29GL512S, 512Mb, 3.0 Volt-only Page Mode Flash Memory featuring 65 nm MirrorBit® Eclipse process technology in LAE064, LAA064, TSOP056 and VBU056 Packages**

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

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**Product Description:** S29GL512S**Cypress Division:** Memory Product Division

512Mb, 3.0 Volt-only Page Mode Flash Memory featuring 65 nm MirrorBit® Eclipse process technology

**Package:** LAE064**QTP:** Q99992**Description:** (9 x 9 x 1.4mm) 64 Ball, Fortified Ball Grid Array Package (fBGA)**Flammability: O2 Index:****Assembly:** Cypress Thailand**Molding Compound:** ShinEtsu KMC 3580LVA

UL-V0 &gt;28

**Electrical Test:** Cypress Thailand**Theta Ja / Psi Jt:** 39 °C/W / 17 °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:** 125 °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:** 57.9 °C**Est. Stress Tj:** 126.4 °C**Die:** 98290A**Die Size:** 6.80 x 5.02 mm**Process:** CS239LS (65nm)**Fab:** Cypress Fab25**Type:** MirrorBit Eclipse**Density:** 512M

## I.B. Product and Package Information

**Product Description:** S29GL512S **Cypress Division:** Memory Product Division  
512Mb, 3.0 Volt-only Page Mode Flash Memory featuring 65 nm MirrorBit® Eclipse process technology

<b>Package:</b> TS056	<b>QTP:</b> Q99990a	<b>Flammability:</b> O2 Index:
<b>Description:</b> (20.0 x 14.0 x 1.2mm) 56 Lead, Thin Small Outline Package (TSOP)		UL-V0 >28
<b>Assembly:</b> Cypress Thailand	<b>Molding Compound:</b> Hitachi CEL 9200HF10-U	
<b>Electrical Test:</b> Cypress Thailand	<b>Theta Ja / Psi Jt:</b> 40 °C/W / 17 °C/W	
<b>Substrate/Leadframe:</b> Copper Leadframe	<b>Die Attachment:</b> Ablebond 8340	
<b>Lead Finish:</b> 100% Matte Sn Plating	<b>Bond Wire:</b> Copper	
<b>Comments:</b>		

<b>Est. Field Temperature:</b> 55 °C	<b>Life Test Temperature:</b> 125 °C
<b>Est. DC Field Current:</b> 25 mA	<b>Life Test Dynamic Current:</b> 10 mA
<b>Est. Field Voltage:</b> 3.0 V	<b>Life Test Voltage:</b> 3.6 V
<b>Est. Field Power Dissipation:</b> 75 mWatts	<b>Est. Stress Power Dissipation:</b> 36 mWatts
<b>Est. Field Tj:</b> 58.0 °C	<b>Est. Stress Tj:</b> 126.4 °C

<b>Die:</b> 98290A	<b>Die Size:</b> 6.80 x 5.02 mm
<b>Process:</b> CS239LS (65nm)	<b>Fab:</b> Cypress Fab25
<b>Type:</b> MirrorBit Eclipse	<b>Density:</b> 512M

## I.C. Product and Package Information

**Product Description:** S29GL512S  
512M, 3.0 Volt-only Page Mode Flash Memory featuring 65nm MirrorBit Eclipse Process Technology

**Cypress Division:** Memory Product Division

<b>Package:</b> LAA064	<b>QTP:</b> Q100182a	
<b>Description:</b> (13.0 x 11.0 x 1.4mm) 64 Ball, Fortified Ball Grid Array Package (FBGA)		<b>Flammability: O2 Index:</b>
<b>Assembly:</b> Cypress Thailand	<b>Molding Compound:</b> ShinEtsu KMC 3580LVA	UL-V0 >28
<b>Electrical Test:</b> Cypress Thailand	<b>Theta Ja / Psi Jt:</b> 39 °C/W / 11 °C/W	
<b>Substrate/Leadframe:</b> Laminate Substrate	<b>Die Attachment:</b> QMI 546	
<b>Lead Finish:</b> 96.5Sn3.0Ag0.5Cu Spheres	<b>Bond Wire:</b> Copper	
<b>Comments:</b>		

<b>Est. Field Temperature:</b> 55 °C	<b>Life Test Temperature:</b> 125 °C
<b>Est. DC Field Current:</b> 25 mA	<b>Life Test Dynamic Current:</b> 10 mA
<b>Est. Field Voltage:</b> 3.0 V	<b>Life Test Voltage:</b> 3.6 V
<b>Est. Field Power Dissipation:</b> 75 mWatts	<b>Est. Stress Power Dissipation:</b> 36 mWatts
<b>Est. Field Tj:</b> 57.9 °C	<b>Est. Stress Tj:</b> 126.4 °C

<b>Die:</b> 98290A	<b>Die Size:</b> 6.80 x 5.02 mm
<b>Process:</b> CS239LS (65nm)	<b>Fab:</b> Cypress Fab25
<b>Type:</b> MirrorBit Eclipse	<b>Density:</b> 512M

## I.D. Product and Package Information

**Product Description:** S29GL512S  
512Mb, 3.0 Volt-only Page Mode Flash Memory Featuring 65nm MirrorBit Eclipse Process Technology

**Cypress Division:** Memory Product Division

<b>Package:</b> VBU056	<b>QTP:</b> Q100333	
<b>Description:</b> (9.0 x 7.0 x 1.0mm) 56 Ball, Very Thin Fine Pitch Ball Grid Array Package (FBGA)		<b>Flammability: O2 Index:</b>
<b>Assembly:</b> Cypress Thailand	<b>Molding Compound:</b> ShinEtsu KMC 3580LVA	UL-V0 >28
<b>Electrical Test:</b> Cypress Thailand	<b>Theta Ja / Psi Jt:</b> 39 °C/W / 11 °C/W	
<b>Substrate/Leadframe:</b> Laminate Substrate	<b>Die Attachment:</b> Hitachi EN4310	
<b>Lead Finish:</b> 98.5Sn1.0Ag0.5Cu Spheres	<b>Bond Wire:</b> Copper	
<b>Comments:</b>		

<b>Est. Field Temperature:</b> 55 °C	<b>Life Test Temperature:</b> 125 °C
<b>Est. DC Field Current:</b> 25 mA	<b>Life Test Dynamic Current:</b> 10 mA
<b>Est. Field Voltage:</b> 3.0 V	<b>Life Test Voltage:</b> 3.6 V
<b>Est. Field Power Dissipation:</b> 75 mWatts	<b>Est. Stress Power Dissipation:</b> 36 mWatts
<b>Est. Field Tj:</b> 57.9 °C	<b>Est. Stress Tj:</b> 126.4 °C

<b>Die:</b> 98290A	<b>Die Size:</b> 6.80 x 5.02 mm
<b>Process:</b> CS239LS (65nm)	<b>Fab:</b> Cypress Fab25
<b>Type:</b> MirrorBit Eclipse	<b>Density:</b> 512M

## II. CS239LS Life Test Failure Rate Calculation

### HTOL Stress Temperature - 125 °C

Failure Mechanism	Read Points / Test Results					Modeling Parameters @ 55°C					Avg. Failure Rate FITS @ 55°C, 60% Conf.	
	24 hrs	48 hrs	168 hrs	1000 hrs	2000 hrs	Ea eV	TAF	VAF	OAF	MTTF (yrs)	PPM	FIT
<b>PLASTIC</b>												
Sample Size	2770	2970	5744	1504	135							
Zero fails, Process ave. Ea	0	0	0	0	0	0.7	69	1	69			
<b>Totals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>					<b>19026</b>	<b>0</b>	<b>6</b>

\* Contributes to early life FITS

### Data Retention Bake - 150 °C

Reliability Stress	Number of Rejects	Sample Size	Failure Rate %	Failure Mechanism
500 hrs	0	3765	0.00	No Failures
1000 hrs	0	3473	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
<b>Data From Qualification Q99992, Q100182a, Q100333:</b>							
<b>HTOL (EL)</b>	(3.6V, 125°C)	LAE064 <sup>1</sup>	77	1	0	0.00	168 hours
<b>HTOL (IL)</b>	(3.6V, 125°C)	LAE064 <sup>1</sup>	77	1	0	0.00	504 hours
<b>HTOL (XL)</b>	(3.6V, 125°C)	LAE064 <sup>1</sup>	77	1	0	0.00	1000 hours
<b>ESD CDM</b>	N/A	LAE064 <sup>1</sup>	15	1	Passed 1.0kV		
	N/A	LAA064 <sup>2</sup>	15	1	Passed 1.0kV		
	N/A	VBU056 <sup>3</sup>	15	1	Passed 1.0kV		
<b>ESD HBM</b>	(100pF, 1500 Ohms)	LAE064 <sup>1</sup>	84	1	Passed 2.0kV		
<b>Latch Up</b>	(125°C, +/- 100mA)	LAE064 <sup>1</sup>	6	1	Passed		
<b>Endurance (10k)</b>	(-40°C, 3.6V)	LAE064 <sup>1</sup>	64	1	0	0.00	10K cycles
	(90°C, 3.6V)	LAE064 <sup>1</sup>	128	1	0	0.00	10K cycles
<b>Preconditioning</b>	(PC1/260°C, +0°C/-5°C)	LAE064 <sup>1</sup>	231	2	Passed Jedec L3 / Jeita Rank E		
	(PC9/260°C, +0°C/-5°C)	VBU056 <sup>3</sup>	77	1	Passed Jedec L3 / Jeita Rank E		
<b>Precon+Temp Cycle</b>	(PC1/260°C, -40°C/150°C)	LAE064 <sup>1</sup>	77	1	0	0.00	1000 cycles
	(PC9/260°C, -40°C/150°C)	VBU056 <sup>3</sup>	77	1	0	0.00	1000 cycles
<b>Precon+HAST</b>	(PC1/260°C, Biased, 110°C/85% RH)	LAE064 <sup>1</sup>	77	1	0	0.00	264 hours
<b>Precon+uHAST</b>	(PC1/260°C, Unbiased, 130°C/85% RH)	LAE064 <sup>1</sup>	77	1	0	0.00	96 hours



### Generic Reference Data:

<b>ELFR</b>	(1.95V, 150°C)	TS048 <sup>8</sup>	2416	3	0	0.00	48 hours
<b>HTOL (EL)</b>	(3.6V, 125°C)	LAE064 <sup>5</sup>	77	1	0	0.00	168 hours
	(3.6V, 125°C)	LAE064 <sup>6</sup>	288	4	0	0.00	168 hours
<b>HTOL (IL)</b>	(3.6V, 125°C)	LAE064 <sup>6</sup>	192	3	0	0.00	504 hours
<b>Data Retention Bake</b>	(150°C)	LAE064 <sup>6</sup>	120	1	0	0.00	168 hours
<b>ESD CDM</b>	N/A	TS056 <sup>9</sup>	15	1	Passed 1.0kV		
<b>Endurance (10k)</b>	(90°C, 3.6V)	LAE064 <sup>5</sup>	64	1	0	0.00	10K cycles
<b>Endurance (100k)</b>	(90°C, 3.6V)	LAE064 <sup>6</sup>	42	2	0	0.00	100k cycles
<b>Preconditioning</b>	(PC9/260°C, +0°C/-5°C)	TS056 <sup>4</sup>	693	3	Passed Jedec L3 / Jeita Rank E		
	(PC1/260°C, +0°C/-5°C)	LAE064 <sup>6</sup>	385	2	Passed Jedec L3 / Jeita Rank E		
	(PC1/260°C, +0°C/-5°C)	LAA064 <sup>7</sup>	693	3	Passed Jedec L3 / Jeita Rank E		
<b>Precon+Temp Cycle</b>	(PC9/260°C, -40°C/150°C)	TS056 <sup>4</sup>	231	3	0	0.00	1000 cycles
	(PC1/260°C, -40°C/150°C)	LAE064 <sup>6</sup>	154	2	0	0.00	1000 cycles
	(PC1/260°C, -40°C/150°C)	LAA064 <sup>7</sup>	231	3	0	0.00	1000 cycles
<b>Precon+HAST</b>	(PC9/260°C, Biased, 130°C/85% RH)	TS056 <sup>4</sup>	231	3	0	0.00	96 hours
	(PC1/260°C, Biased, 110°C/85% RH)	LAE064 <sup>6</sup>	154	2	0	0.00	264 hours
	(PC1/260°C, Biased, 110°C/85% RH)	LAA064 <sup>7</sup>	231	3	0	0.00	264 hours
<b>Precon+uHAST</b>	(PC9/260°C, Unbiased, 130°C/85% RH)	TS056 <sup>4</sup>	231	3	0	0.00	96 hours
	(PC1/260°C, Unbiased, 130°C/85% RH)	LAE064 <sup>6</sup>	77	1	0	0.00	96 hours
	(PC1/260°C, Unbiased, 130°C/85% RH)	LAA064 <sup>7</sup>	231	3	0	0.00	96 hours

- Notes / Justification:**
- 1) Results from Qual Q99992, S29GL512S, CS239LS (65nm) MirrorBit Eclipse in 64 Ball fFBGA (9 x 9 x 1.4mm)
  - 2) Results from Qual Q100182a, S29GL512S, CS239LS (65nm) MirrorBit Eclipse in 64 Ball fFBGA (13 x 11 x 1.4mm)
  - 3) Results from Qual Q100333, S29GL512S, CS239LS (65nm) MirrorBit Eclipse in 56 Ball vFBGA (9 x 7 x 1mm)
  - 4) Results from Qual Q100420, S29GL01GS in 56 Lead TSOP (20 x 14 x 1.2mm) - Same TSOP package and Flash
  - 5) Results from Qual Q100108, S29GL512S in 64 Ball fFBGA (9 x 9 x 1.4mm) - Same LAE package and Flash with MS3 Die
  - 6) Results from Qual Q99891, S29GL01GS in 64 Ball fFBGA (9 x 9 x 1.4mm) - Same LAE package and Flash Technology
  - 7) Results from Qual Q99832, S29GL01GR in 64 Ball fFBGA (13 x 11 x 1.4mm) - Same LAA package and similar process Technology nod
  - 8) Results from Qual 81324, S30MS02GR in 48 Lead TSOP (20 x 12 x 1.2mm) - Similar Flash Technology in TSOP Package
  - 9) Results from Qual Q99990, S29GL512S in 56 Lead TSOP (20 x 14 x 1.2mm) - TSOP Package and Same Flash Device

- Preconditioning Flows:**
- PC1 (Exceeds JEDEC L3 and JEITA Rank E): Bake 125°C, 24hr => Soak @ 30°C/70%RH, 216hr => 3x Reflow
- PC9 (Accelerated JEDEC L3 / JEITA Rank E): Bake 125°C, 24hr => Soak @ 60°C/70%RH, 72hr => 3x Reflow

### Reliability Tests Performed per Specification Requirements

Stress	Condition	Specification Reference
Data Retention Bake	(150°C)	JESD47 / JESD22-A117 / AEC-Q100 /AEC-Q100-005
ELFR	(1.95V, 150°C)	JESD47 / JESD22-A117 / AEC-Q100 /AEC-Q100-005
Endurance (100k)	(90°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
Endurance (10k)	(90°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
HTOL (EL)	(3.6V, 125°C)	JESD22-A108
HTOL (IL)	(3.6V, 125°C)	JESD22-A108
HTOL (XL)	(3.6V, 125°C)	JESD22-A108
Latch Up	(125°C, +/- 100mA)	JESD78 / AEC Q100-004
Precon+HAST	(PC1/260°C, Biased, 110°C/85% RH)	JESD22-A110
Precon+HAST	(PC9/260°C, Biased, 130°C/85% RH)	JESD22-A110
Precon+Temp Cycle	(PC1/260°C, -40°C/150°C)	JESD22-A104
Precon+Temp Cycle	(PC9/260°C, -40°C/150°C)	JESD22-A104
Precon+uHAST	(PC1/260°C, Unbiased, 130°C/85% RH)	JESD22-A118
Precon+uHAST	(PC9/260°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	(PC9/260°C, +0°C/-5°C)	J-STD-020 / EIAJ ED-4701-100 Method 104

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## IV. Revision History

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**Document Number:** 002-21933**Document Title:** Qualification of S29GL512S

Rev.	Issue Date	ECN#	Originator	Description
**	11/2/2017	5954913	EKNG	Initial Release.

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