



ATMEL CORPORATION

Tel: (408) 441-0311

Fax: (408) 436-4200

AT-89C52 CMOS FLASH MICRO CONTROLLER RELIABILITY DATA*

- 125°C DYNAMIC OPERATING LIFE TEST
- 200°C RETENTION BAKE
- 125°C DYNAMIC OPERATING LIFE TEST (PLASTIC)
- 125°C RETENTION BAKE (PLASTIC)
- 15 PSIG PRESSURE POT
- 85°C/85% RELATIVE HUMIDITY OPERATING LIFE TEST
- EXTENDED TEMPERATURE CYCLING
- EXTENDED THERMAL SHOCK
- 131°C/85% RELATIVE HUMIDITY HAST TEST

*This report was generated from AT-89C52 reliability testing. This data is applicable to the following device types due to same technology grouping as defined on MIL-M-38535 Appendix A:

AT-89C51

OCTOBER 2006

2325 Orchard Parkway San Jose CA. 95131

AT-89C52

125°C DYNAMIC OPERATING LIFE TEST

<u>LOT NUMBER</u>	<u>DATE CODE</u>	<u>SAMPLE SIZE</u>	<u>TOTAL CKT-HRS (K)</u>	<u>NUMBER OF FAILURES</u>
4D1707	4B9441	115	287.5	0
4D1707A	4D9505	164	410.0	0
5A1634	5A9517	143	357.5	0

FAILURE RATETOAL DEVICE HOURS

1,055,000 DEVICE HOURS

BEST ESTIMATE λ = 0.07% PER 1,000 HOURS50°C AMBIENTEXTRAPOLATION TO 50°C.VIA
ARREHENNIUS EQUATION AND
ACTIVATION ENERGY OF 0.5eV λ = 0.002% PER 1,000 HOURS (23 FITS)CONFIDENCE ESTIMATE
 λ 60 = 0.003% PER 1,000 HOURS
60% CONFIDENCE (30 FITS)
 λ 90 = 0.007% PER 1,000 HOURS
90% CONFIDENCE (74 FITS)

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200°C DATA RETENTION BAKE

<u>LOT NUMBER</u>	<u>DATE CODE</u>	<u>SAMPLE SIZE</u>	<u>TOTAL CKT-HRS (K)</u>	<u>NUMBER OF FAILURES</u>
5C2822	5C9547	393	393.0	0

FAILURE RATETOTAL DEVICE HOURS

393,000 DEVICE HOURS

BEST ESTIMATE $\lambda = 0.18\%$ PER 1000 HOURS50°C AMBIENTEXTRAPOLATION TO 50°C VIA
ARRHENNIUS EQUATION AND
ACTIVATION ENERGY OF 0.5eV $\lambda = 0.0006\%$ PER 1,000 HOURS (6 FITS)CONFIDENCE ESTIMATE

λ 60 = 0.0008% PER 1000 HOURS
60% CONFIDENCE (8 FITS)

λ 90 = 0.002% PER 1000 HOURS
90% CONFIDENCE (20 FITS)

AT-89C52

PLASTIC PACKAGE

125°C DYNAMIC OPERATING LIFE TEST

<u>LOT NUMBER</u>	<u>DATE CODE</u>	<u>SAMPLE SIZE</u>	<u>TOTAL CKT-HRS (K)</u>	<u>NUMBER OF FAILURES</u>
4C1407	4C9441	80	80.0	0
4D1707	4D9441	115	115.0	0
4C1521	4C9445	90	90.0	0
4D1047	4D9502	90	90.0	0
5C1951	5C9547	112	112.0	0
5C2822	5C9549	143	143.0	0
7D2904-3	7D9811	100	100.0	0
7D2904-1	7D9809	100	100.0	0
7D2857	7D9827	100	100.0	0
1G0215	1G0136	100	100.0	0
3H5470-1	3H0346	160	160.0	0
3H4406-1	3H0346	160	160.0	0
5H2255A	5H0544	100	100.0	0
5J3756-1	5J0603	100	100.0	0
5J3757-1	5J0603	80	80.0	0

FAILURE RATETOTAL DEVICE HOURS

1,630,000 DEVICE HOURS

BEST ESTIMATE λ = 0.04% PER 1000 HOURS50°C AMBIENT

EXTRAPOLATION TO 50°C VIA
ARRHENNIUS EQUATION AND
ACTIVATION ENERGY OF 0.5eV
 λ = 0.001% PER 1,000 HOURS (14 FITS)

CONFIDENCE ESTIMATE

λ 60 = 0.002% PER 1000 HOURS
60% CONFIDENCE (19 FITS)
 λ 90 = 0.005% PER 1000 HOURS
90% CONFIDENCE (48 FITS)

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PLASTIC PACKAGE

150°C RETENTION BAKE

<u>LOT</u> <u>NUMBER</u>	<u>DATE</u> <u>CODE</u>	<u>PKG</u>	<u>SAMPLE</u> <u>SIZE</u>	<u>TOTAL</u> <u>CKT-HRS (K)</u>	<u>NUMBER</u> <u>OF FAILURES</u>
4C1521	4C9445	40 PDIP	90	90.0	0
4C1471	4C9441	40 PDIP	180	180.0	0
5C0873	5C9539	44 PLCC	90	90.0	0
5B2672	5C9549	44 PQFP	98	98.0	0
5C2232	5C9547	40 PDIP	78	78.0	0
E5N0011	5N9609	40 PDIP	198	198.0	0
E5N0012	5N9609	40 PDIP	204	204.0	0
6B0606	6B9629	44 PQFP	97	97.0	0
7L6199	7L9728	40 PDIP	90	90.0	0
7M7419	7M9747	40 PDIP	100	100.0	0
7D2904-1	7D9809	40 PDIP	300	300.0	0
7D2904-3	7D9811	44 PLCC	300	300.0	0
7D0457	7D9816	44 PLCC	100	100.0	0
7N8211-2	7N9819	40 PDIP	100	100.0	0
7N8211-1A	7N9820	44 PLCC	100	100.0	0
7D2857	7D9827	44 PLCC	100	100.0	0
9B0302N2	9B9926	44 PLCC	100	100.0	0
0E2704A	0E0019	40 PDIP	98	98.0	0
1E4922-1	1E0122	40 PDIP	50	50.0	0
1E4928-1	1E0121	40 PDIP	50	50.0	0
1E5508	1E0122	40 PDIP	50	50.0	0
1G0215	1G0136	40 PDIP	50	50.0	0
1J3032	1J0208	40 PDIP	120	120.0	0
2H0645	2H0235	40 PDIP	50	50.0	0
3E1871	3E0311	40 PDIP	50	50.0	0
3G2215-1	3G0329	44 PLCC	100	100.0	0
3H5470-1	3H0346	40 PDIP	206	206.0	0
3H4406-1	3H0346	40 PDIP	209	209.0	0
3H3137-1	3H0329	40 PDIP	200	200.0	0
5H2255A	5H0544	40 PDIP	100	100.0	0

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PLASTIC PACKAGE

150°C RETENTION BAKE

<u>LOT NUMBER</u>	<u>DATE CODE</u>	<u>PKG</u>	<u>SAMPLE SIZE</u>	<u>TOTAL CKT-HRS (K)</u>	<u>NUMBER OF FAILURES</u>
5J3756-1	5J0603	44 PLCC	100	100.0	0
5J3757-1	5J0603	44 PLCC	100	100.0	0

FAILURE RATETOTAL DEVICE HOURS

3,867,000 DEVICE HOURS

BEST ESTIMATE λ = 0.02% PER 1000 HOURS50°C AMBIENTEXTRAPOLATION TO 50°C VIA
ARRHENNIUS EQUATION AND
ACTIVATION ENERGY OF 0.5eV λ = 0.0003% PER 1,000 HOURS (3 FITS)CONFIDENCE ESTIMATE λ 60 = 0.0004% PER 1000 HOURS
60% CONFIDENCE (3 FITS) λ 90 = 0.001% PER 1000 HOURS
90% CONFIDENCE (9 FITS)

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PLASTIC PACKAGE

PRESSURE POT TEST

<u>DATE CODE</u>	<u>PACKAGE TYPE</u>	<u>SAMPLE SIZE</u>	<u>NUMBER OF FAILURE AT INDICATED HOURS</u>			
			(24)	(48)	(72)	(96)
5B9538	44 PLCC	154	0	0	0	0
5C9539	44 PLCC	154	0	0	0	0
5C9547	40 PDIP	127	0	0	0	0
5C9549	44 PQFP	90	0	0	0	0
5C9551	44 PDIP	50	0	0	0	0
5D9614	44 PLCC	154	0	0	0	0
6B9629	44 PQFP	45	0	0	0	0
7L9728	40 PDIP	77	0	0	0	0
7M9747	40 PDIP	154	0	0	0	0
7D9809	40 PDIP	50	0	0	0	0
7D9811	40 PDIP	100	0	0	0	0
7N9816	44 PLCC	50	0	0	0	0
7N9819	40 PDIP	50	0	0	0	0
7N9820	44 PLCC	50	0	0	0	0
7D9827	44 PLCC	50	0	0	0	0
9B9926	44 PLCC	50	0	0	0	0
0A0019	40 PDIP	50	0	0	0	0
1G0121	40 PDIP	50	0	0	0	0
1E0122	40 PDIP	50	0	0	0	0
1G0136	40 PDIP	50	0	0	0	0
1J0208	40 PDIP	50	0	0	0	0
2E0214	44 PLCC	50	0	0	0	0
2H0235	40 PDIP	50	0	0	0	0
3E0311	40 PDIP	50	0	0	0	0
3G0329	44 PLCC	100	0	0	0	0
3H0329	40 PDIP	77	0	0	0	0
3H0346	40 PDIP	154	0	0	0	0
5J0602	40 PDIP	77	0	0	0	0
5J0603	44 PLCC	154	0	0	0	0

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PLASTIC PACKAGE

85°C/85% RELATIVE HUMIDITY OPERATING LIFE TEST

<u>LOT</u> <u>NUMBER</u>	<u>DATE</u> <u>CODE</u>	<u>PACKAGE</u> <u>TYPE</u>	<u>SAMPLE</u> <u>SIZE</u>	<u>NUMBER OF FAILURE</u> <u>AT INDICATED HOURS</u>		
				(168)	(500)	(1000)
5C0873	5C9539	44 PLCC	54	0	0	0

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PLASTIC PACKAGE

EXTENDED TEMPERATURE CYCLING

-65°C to +150°C PLCC/TSOP/SOIC/PDIP
-55°C to +125°C CBGA

<u>DATE</u> <u>CODE</u>	<u>PKG</u> <u>TYPE</u>	<u>SAMPLE</u> <u>SIZE</u>	<u>NUMBER</u> <u>OF CYCLES</u>	<u>NUMBER</u> <u>OF FAILURES</u>
5B9538	44 PLCC	77	1000	0
7D9816	44 PLCC	50	1000	0
7D9827	44 PLCC	50	1000	0
9B9926	44 PLCC	50	1000	0
0A0019	40 PDIP	50	1000	0
1G0121	40 PDIP	50	1000	0
3G0320	44 PLCC	100	1000	0
3H0346	40 PDIP	77	1000	0
5J0602	40 PDIP	77	1000	0
5J0603	44 PLCC	77	1000	0

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PLASTIC PACKAGE

EXTENDED THERMAL SHOCK

-55°C TO +125°C

<u>DATE CODE</u>	<u>PKG TYPE</u>	<u>SAMPLE SIZE</u>	<u>NUMBER OF CYCLES</u>	<u>NUMBER OF FAILURES</u>
5C9539	44 PLCC	77	1000	0
5B2672	44 PQFP	44	1000	0
6A9621	44 PQFP	77	1000	0
6B9629	44 PQFP	77	1000	0
7L9728	40 PDIP	77	1000	0
7M9747	40 PDIP	77	1000	0

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PLASTIC PACKAGE

131°C/85% RELATIVE HUMIDITY HAST TEST

<u>LOT NUMBER</u>	<u>DATE CODE</u>	<u>PKG TYPE</u>	<u>SAMPLE SIZE</u>	<u>NUMBER OF FAILURES AT INDICATED HOURS</u>
				<u>(100)</u>
7D2904-3	7D9811	40 PLCC	50	0
7D0457	7D9816	44 PLCC	50	0
7D2857	7D9827	44 PLCC	50	0
9B0302N2	9B9926	44 PLCC	50	0
1E5508	1E0122	40 PDIP	50	0
1J3032	1J0208	40 PDIP	50	0
2H0645	2H0235	40 PDIP	50	0
3E1871	3E0311	40 PDIP	50	0
3H3137-1	3H0329	40 PDIP	77	0
3H4406-1	3H0346	40 PDIP	77	0
3H5470-1	3H0346	40 PDIP	77	0
5J3756-1	5J0603	44 PLCC	77	0
5J3757-1	5J0603	44 PLCC	77	0