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AT-28C256 CMOS EEPROM RELIABILITY DATA

- 150°C DYNAMIC OPERATING LIFE TEST
- CYCLE TEST
- 200°C RETENTION BAKE
- 125°C DYNAMIC OPERATING LIFE TEST (PLASTIC)
- 150°C RETENTION BAKE (PLASTIC)
- 15 PSIG PRESSURE POT
- 85°C/85% RELATIVE HUMIDITY OPERATING LIFE TEST
- EXTENDED TEMPERATURE CYCLING
- 131°C/85% RELATIVE HUMIDITY HAST TEST

This report was generated from AT-28C256 reliability testing.
This data is applicable to the following device types due to same
technology grouping as defined in MIL-M38535 Appendix A:

AT-28C010

AT-28C040

OCTOBER 2006

2325 Orchard Parkway San Jose CA. 95131

AT-28C256

150°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>
345-1	8737	77	77.0	0
81077	8830	77	77.0	0
81846	8C8832	78	78.0	0
81411	8831	77	77.0	0
83474	8C8845	78	78.0	0
81442	8C8830	77	77.0	0
83029	8C8841	78	78.0	0
84130-2	8850	94	94.0	0
82307	8840	78	78.0	0
82624	8837	77	77.0	0 (6.5V)
84285	8D8908	78	78.0	0
85663	9A8922	77	77.0	0
97673	9C8948	77	77.0	0
04692	0D9043	77	77.0	0
05940	1A9117	77	77.0	0
130909	1C9142	27	27.0	0
133028	1D9150	78	78.0	0
133382-2	1D9151	78	78.0	0
232139B2	2C9230	77	77.0	0
232139B	2C9232	27	27.0	0
139420-2	2C9234	77	77.0	0
3A0258-4	3A9310	80	80.0	0
3A0258-1	3B9323	77	77.0	0
3B0680	3B9329	157	157.0	0
4A1283	4A9420	80	200.0	0
4B1973	4B9431	80	80.0	0
4C1251	4C9442	320	800.0	0
5B0106	5B9526	79	79.0	0
6C1587	6C9638	79	79.0	0
6D1789	6D9701	80	80.0	0
6D1660	6D9701	79	79.0	0
6G3784	6G9708	155	155.0	0
7L1517	7L9740	59	59.0	0
7L6329	7L9732	80	80.0	0
7B2000	7B9729	80	80.0	0
7L6263	7L9729	80	80.0	0

FAILURE RATE

TOTAL DEVICE HOURS
BEST ESTIMATE
50°C AMBIENT

3,706,000 DEVICE HOURS
 λ = 0.02% PER 1,000 HOURS
 EXTRAPOLATION TO 50°C VIA ARRHENNIUS
 EQUATION AND ACTIVATION ENERGY OF 0.5eV
 λ = 0.0002% PER 1,000 HOURS (3 FITS)
 λ 60 = 0.0004% PER 1,000 HOURS
 60% CONFIDENCE (4 FITS)
 λ 90 = 0.001% PER 1,000 HOURS
 90% CONFIDENCE (9 FITS)

CONFIDENCE ESTIMATE

AT-28C256

200°C RETENTION BAKE

200°C BAKE DEVICES WITH ALL ZEROES OR WITH ALL ONES

<u>LOT</u> <u>NUMBER</u>	<u>DATE</u> <u>CODE</u>	<u>SAMPLE</u> <u>SIZE</u>	<u>@24</u>	<u>NUMBER OF FAILURES</u>		
				<u>@168</u>	<u>@500</u>	<u>@1000Hrs</u>
82624	8837	77	0	0	0	0
81845	8836	77	0	0	0	0
83991	8D8904	45	0	0	0	0
92490	9C8933	79	0	0	0	0
97878	9D9006	77	0	0	0	0
131374-1	1B9128	77	0	0	0	0
130909	1C9142	34	0	0	0	0
3B0680	3B9329	124	0	0	0	0
4A1283	4A9420	79	0	0	0	0
5A2526	5A9523	78	0	0	0	0
5B0106	5B9526	80	0	0	0	0
5B2247	5B9531	80	0	0	0	0
6C1587	6C9638	80	0	0	0	0
6D1789	6D9701	80	0	0	0	0
6D1660	6D9701	80	0	0	0	0
6D3784-1	6D9708	79	0	0	0	0
7B2000	7B9729	80	0	0	0	0
7L6329	7L9732	80	0	0	0	0
7L6263	7L9729	80	0	0	0	0

FAILURE RATETOTAL DEVICE HOURS

1,466,000 DEVICE HOURS

BEST ESTIMATE $\lambda = 0.05\%$ PER 1000 HOURS50°C AMBIENTEXTRAPOLATION TO 50°C VIA ARRHENNIUS
EQUATION AND ACTIVATION ENERGY OF 0.5eV $\lambda = 0.0002\%$ 1000 HOURS (2 FITS)CONFIDENCE ESTIMATE
 λ 60 = 0.0003% PER 1000 HOURS
60% CONFIDENCE (2 FITS)
 λ 90 = 0.0006% PER 1000 HOURS
90% CONFIDENCE (5 FITS)

Data cycling followed by 200°C bakes were performed to determine the device endurance. Each address was byte cycled through all addresses. The parts were baked and then verified. The results of the cycling tests are shown below. No device failures have been found.

CYCLE TEST RESULTS OF AT-28C256

<u>LOT NUMBER</u>	<u>DATE CODE</u>	<u>SAMPLE SIZE</u>	<u>NO. OF BYTE CYCLE</u>	<u>NO. OF FAILURES</u>	<u>BAKE TEMP</u>	<u>BAKE TIME</u>
80844	8831	80	10,000	0	200°C	24 Hrs
81077	8830	77	10,000	0	200°C	176 Hrs
84285	8D8908	77	100,000	0	200°C	176 Hrs
81900	9B8930	77	100,000	0	200°C	176 Hrs
97673	9C8948	73	100,000	0	200°C	176 Hrs
03134	0D9046	77	100,000	0	200°C	176 Hrs
6D1789	6D9701	86	100,000	0	150°C	176 Hrs
7D2729	7D9816	64	10,000	0	150°C	176 Hrs
8B0847L	8B9908	50	10,000	0	150°C	176 Hrs

AT-28C256

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>
	9A8940	350	350.0	0
92750	9C8933	77	77.0	0
94738	9C9001	75	75.0	0
97964	9D9004	77	77.0	0
90961	0A9013	77	77.0	0
3A0258	3A9315	620	720.0	0
4B2335	4C9440	80	80.0	0
6D1549	6D9703	499	499.0	0
6D3784	6D9709	613	613.0	0
7D1856	7D9814	300	300.0	0
7D2729	7D9816	100	100.0	0
8A3027-1	8A9832	100	100.0	0
8H0730-3	8H9839	200	200.0	0
8B0847	8B9908	100	100.0	0
8B0844-1	8B9901	100	100.0	0
9J1925	9J0002	100	100.0	0
1G4848	1G0136	100	100.0	0
2E2987	2E0232	100	100.0	0
1C0960-3	1C0302	100	100.0	0
3E5909	3E0323	100	100.0	0
3G2705-1	3G0338	100	100.0	0
3H0193	3H0336	100	100.0	0
3H1593	3H0424	100	100.0	0
4E7098	4E0423	100	100.0	0
6F6500A	6F0618	77	77.0	0

FAILURES RATETOTAL DEVICE HOURS

5,445,000 DEVICE HOURS

BEST ESTIMATE $\lambda = 0.01\%$ PER 1,000 HOURS50°C AMBIENTEXTRAPOLATION TO 50°C VIA ARRHENNIUS
EQUATION AND ACTIVATION ENERGY OF 0.5eV
 $\lambda = 0.0005\%$ PER 1,000 HOURS (4 FITS)CONFIDENCE ESTIMATE λ 60 = 0.001% PER 1,000 HOURS
60 CONFIDENCE (6 FITS)
 λ 90 = 0.002% PER 1,000 HOURS
90% CONFIDENCE (14 FITS)

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PLASTIC PACKAGE

150°C RETENTION BAKE

<u>LOT NUMBER</u>	<u>DATE CODE</u>	<u>PACKAGE TYPE</u>	<u>SAMPLE SIZE</u>	<u>TOTAL CKT-HRS(K)</u>	<u>NUMBER OF FAILURES</u>
3A0258	3A9315	28 PDIP	148	148.0	0
4B2335	4C9440	28 TSOP	77	77.0	0
7C2459A	7C9746	28 TSOP	80	80.0	0
7D1856	7D9814	28 TSOP	50	50.0	0
7D2729	7D9816	32 PLCC	100	100.0	0
8A3027-1	8A9832	32 PLCC	100	100.0	0
8H0730-3	8H9839	28 PDIP	300	300.0	0
8B0844-1	8B9901	28 TSOP	100	100.0	0
8B0847	8B9908	32 PLCC	50	50.0	0
9J1925	9J0002	28 TSOP	50	50.0	0
1G4848	1G0136	28 TSOP	50	50.0	0
2E2987	2E0232	32 PLCC	50	50.0	0
1C0960-3	1C0302	28 SOIC	200	200.0	0
3E5905	3E0323	32 PLCC	50	50.0	0
3G2705-1	3G0338	28 SOIC	100	100.0	0
3H0193	3H0336	32 PLCC	100	100.0	0
3H1593	3H0424	28 SOIC	50	50.0	0
4E7098-12	4E0423	32 PLCC	50	50.0	0
6F6500A	6F0618	28 PDIP	77	77.0	0

FAILURE RATETOTAL DEVICE HOURS

1,782,000 DEVICE HOURS

BEST ESTIMATE $\lambda = 0.04\%$ PER 1,000 HOURS50°C AMBIENT

EXTRAPOLATION TO 50°C VIA ARRHENNIUS
EQUATION AND ACTIVATION ENERGY OF 0.5eV
 $\lambda = 0.0006\%$ PER 1,000 HOURS (6 FITS)

CONFIDENCE ESTIMATE

$\lambda_{60} = 0.0008\%$ PER 1,000 HOURS
60% CONFIDENCE (7 FITS)
 $\lambda_{90} = 0.002\%$ PER 1,000 HOURS
90% CONFIDENCE (18 FITS)

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PLASTIC PACKAGE

PRESSURE POT TEST

<u>DATE</u> <u>CODE</u>	<u>PKG</u> <u>TYPE</u>	<u>SAMPLE</u> <u>SIZE</u>	<u>NUMBER OF FAILURES</u> <u>AT INDICATED HOURS</u>			
			(24)	(48)	(72)	(96)
8828	32 PLCC	50	0	0	0	0
8C8839	28 PDIP	42	0	0	0	0
9D9002	32 PLCC	45	1	0	0	0 (LEAKAGE)
0A9013	28 PDIP	45	0	0	0	0
1A9117	32 PLCC	45	0	0	0	0
3A9314	32 PLCC	45	0	0	0	0
3A9315	28 PDIP	45	0	0	0	0
3B9336	32 PLCC	45	0	0	0	0
4B9436	28 TSOP	123	0	0	0	0
7C9746	28 TSOP	150	0	0	0	0
7D9814	28 TSOP	50	0	0	0	0
7D9816	32 PLCC	50	0	0	0	0
8A9832	32 PLCC	50	0	0	0	0
8B0844-1	28 TSOP	49	0	0	0	0
8B0847	32 PLCC	50	0	0	0	0
9J0002	28 TSOP	50	0	0	0	0
1G0136	28 TSOP	50	0	0	0	0
2E0232	32 PLCC	50	0	0	0	0
1C0302	28 SOIC	50	0	0	0	0
3E0319	32 PLCC	44	0	0	0	0
3E0320	32 PLCC	50	0	0	0	0
3E0323	32 PLCC	50	0	0	0	0
3G0338	28 SOIC	77	0	0	0	0
3H0336	32 PLCC	77	0	0	0	0
3H0424	28 SOIC	50	0	0	0	0
4E0423	32 PLCC	50	0	0	0	0

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PLASTIC PACKAGE

85°C/85% RELATIVE HUMIDITY OPERATING LIFE 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>		
				(168)	(500)	(1000)
3A0258	3B9323	32 PLCC	45	0	0	0
4B2335	4B9436	28 TSOP	77	0	0	0
6D2033	6D9703	32 PLCC	100	0	0	0

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PLASTIC PACKAGE

EXTENDED TEMPERATURE CYCLE

-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>
6D9703	32 PLCC	80	1000	0
7D9814	28 TSOP	50	1000	0
7D9816	32 PLCC	50	1000	0
8A9832	32 PLCC	50	1000	0
9J0002	28 TSOP	50	1000	0
1J0136	28 TSOP	50	1000	0
2E0232	32 PLCC	50	1000	0
1C0302	28 SOIC	50	1000	0
3E0319	32 PLCC	100	1000	0
3E0323	32 PLCC	100	1000	0
3G0338	28 SOIC	77	1000	0
3H0336	32 PLCC	77	1000	0
3H0424	28 SOIC	50	1000	0
4E0423	32 PLCC	50	1000	0

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PLASTIC PACKAGE

131°C/85% RELATVIE HUMIDITY HAST TEST

<u>DATE CODE</u>	<u>PKG TYPE</u>	<u>SAMPLE SIZE</u>	<u>NUMBER OF HOURS</u>	<u>NUMBER OF FAILURES</u>
1G0136	28 TSOP	50	100	0
2E0232	32 PLCC	50	100	0
1C0302	28 SOIC	50	100	0
3E0323	32 PLCC	50	100	0
3H0336	32 PLCC	77	100	0
3H0424	28 SOIC	50	100	0
4E0423	32 PLCC	50	100	0