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AT-28C010 CMOS EEPROM RELIABILITY DATA*

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

*This report was generated from AT-28C010 reliability testing.
This data is applicable to the following device types due to
same technology grouping as defined in MIL-M-38535 Appendix A:

AT-28C256

AT-28C040

APRIL 2008

2325 Orchard Parkway San Jose CA. 95131

AT-28C010

150°C DYNAMIC LIFE TEST

<u>LOT</u> <u>NUMBER</u>	<u>DATE</u> <u>CODE</u>	<u>SAMPLE</u> <u>SIZE</u>	<u>TOTAL</u> <u>CKT-HRS(K)</u>	<u>NUMBER</u> <u>OF FAILURES</u>
03307	OD9051	77	77.0	0
11158	1A9111	53	53.0	0
04329-1	1A9112	77	77.0	0
132106-2	1B9129	76	76.0	0
131571	1C9131	55	55.0	0
133345-3	1D9150	78	78.0	0
2322700A	2C9230	45	45.0	0
234337	2D9306	79	79.0	0
3C3089	3C9341	79	79.0	0
4A0594	4A9412	80	80.0	0
4A0083	4A9414	49	49.0	0
A4A0083	4A9421	79	79.0	0
4A1406	4A9427	77	77.0	0
4B2397	4B9432	77	77.0	0
4C0168	4C9436	60	150.0	0
4B1469	4B9435	75	187.5	0
4B1968	4B9436	81	202.5	0
4B1967	4B9438	68	170.0	0
4C2585	4C9447	78	195.0	0
4H5229	4H9506	249	622.5	0
4H5789	4H9508	176	440.0	0
4H5247	4H9508	113	282.5	0
5A0544	5A9519	79	197.5	0
5F0116	5F9527	80	240.0	0
5H1115A	5H9604	80	80.0	0
6F0122A	6F9630	80	80.0	0
6C0494-1	6C9638	45	45.0	0
6H1224	6H9701	80	80.0	0
7J0975	7J9806	80	80.0	0

FAILURE RATETOTAL DEVICE HOURS

3,953,500 DEVICE HOURS

BEST ESTIMATE $\lambda = 0.02\%$ PER 1,000 HOURS50°C AMBIENT

EXTRAPOLATION TO 50°C VIA
ARRHENNIUS EQUATION AND ACTIVATION
ENERGY OF 0.5eV

$\lambda = 0.0003\%$ PER 1,000 HOURS (3 FITS)

CONFIDENCE ESTIMATE

λ 60 = 0.0003% PER 1,000 HOURS
60% CONFIDENCE (3 FITS)

λ 90 = 0.0009% PER 1,000 HOURS
90% CONFIDENCE (9 FITS)

AT-28C010

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>
132106-2	1B9129	77	77.0	0
131571	1C9131	64	64.0	0
232270A-1	2C9230	45	45.0	0
4A0083	4A9421	79	79.0	0
4B2397	4B9432	48	48.0	0
4C0168	4C9435	59	59.0	0
4B2397	4B9432	48	48.0	0
4C0168	4C9436	59	59.0	0
4H5187	4H9508	190	190.0	0
4H5247	4H9508	338	338.0	0
5A0544	5A9519	79	79.0	0
5F0116	5F9527	80	80.0	0
6E0122A	6F9630	80	80.0	0
6C0494-1	6C9638	45	45.0	0
6H1224	6H9702	80	80.0	0
7J0975A2	7J9806	80	80.0	0

FAILURE RATETOTAL DEVICE HOURS λ 1,342,000 DEVICE HOURSBEST ESTIMATE λ = 0.06% PER 1,000 HOURS50°C AMBIENTEXTRAPOLATION TO 50°C VIA
ARRHENNIUS EQUATION AND ACTIVATION
ENERGY OF 0.5eV λ = 0.0002% PER 1,000 HOURS (2 FITS)CONFIDENCE ESTIMATE λ 60 = 0.0002% PER 1,000 HOURS
60% CONFIDENCE (2 FITS) λ 90 = 0.0006% PER 1,000 HOURS
90% CONFIDENCE (6 FITS)

Data cycling followed by 200°C bakes were performed to determine the device endurance. All addresses were cycled the specified number of times. 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-28C010

<u>LOT NUMBER</u>	<u>DATE CODE</u>	<u>SAMPLE SIZE</u>	<u>NO. OF CYCLES</u>	<u>NO. OF FAILURES</u>	<u>BAKE TEMP</u>	<u>BAKE TEMP</u>
03307	OD9051	77	10,000	0	200°C	176 HRS
04329-1	1A9112	77	100,000	0	200°C	176 HRS
132106-2	1B9129	77	10,000	0	200°C	176 HRS
4A0594	4A9412	80	10,000	0	200°C	176 HRS
4A0083	4A9414	49	10,000	0	200°C	176 HRS
A4A0083	4A9421	79	10,000	0	200°C	176 HRS
4B2397	4B9432	77	10,000	0	200°C	176 HRS
4C0168	4C9436	59	10,000	0	200°C	176 HRS
4C2585	4C9447	78	10,000	0	200°C	176 HRS
4C2586	4C9449	100	10,000	0	200°C	176 HRS
4H5229	4H9506	89	10,000	0	200°C	176 HRS
6H3159-1	6H9708	64	10,000	0	200°C	176 HRS

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PLASTIC PACKAGE

125°C DYNAMIC OPERATING LIFE TEST

<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>
4A1243	4A9422	32 PLCC	76	76.0	0
4C5253	4C9517	32 PLCC	77	77.0	0
4H5249	4H9524	32 PDIP	219	219.0	0
4H5187	4H9525	32 PDIP	112	112.0	0
5E0344	5E9536	32 PLCC	210	210.0	0
5E0344	5E9536	32 PDIP	249	249.0	0
6C3006	6C9649	32 PDIP	80	80.0	0
7G1008	7G9822	32 PDIP	100	100.0	0
9G5407	9G9937	32 TSOP	100	100.0	0
9G5412	9G9939	32 TSOP	100	100.0	0
4H4250	4H0452	32 TSOP	100	100.0	0
5F0575	5F0513	32 TSOP	160	160.0	0
5F0576	5F0513	32 TSOP	160	160.0	0
7H2476-2	7H0747	32 PLCC	77	77.0	0

FAILURE RATETOTAL DEVICE HOURS

1,820,000 DEVICE HOURS

BEST ESTIMATE $\lambda = 0.03\%$ PER 1,000 HOURS50°C AMBIENTEXTRAPOLATION TO 50°C VIA
ARRHENNIUS EQUATION AND ACTIVATION
ENERGY OF 0.5eV $\lambda = 0.001\%$ PER 1,000 HOURS (12 FITS)CONFIDENCE ESTIMATE $\lambda = 60 = 0.002\%$ PER 1,000 HOURS
60% CONFIDENCE (17 FITS) $\lambda = 90 = 0.004\%$ PER 1,000 HOURS
90% CONFIDENCE (43 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>
4A1243	4A9422	32 PLCC	39	39.0	0
4C2523	4C9517	32 PLCC	94	94.0	0
4H5249	4H9524	32 PDIP	150	150.0	0
5E0344	5E9536	32 PLCC	84	84.0	0
5E0344	5E9536	32 PDIP	254	254.0	0
6C3006	6C9649	32 PDIP	80	80.0	0
7G1008	7G9822	32 PDIP	100	100.0	0
6H3159-1	6H9708	32 TSOP	50	50.0	0
9G5407	9G9937	32 TSOP	50	50.0	0
9G5412	9G9939	32 TSOP	50	50.0	0
4H4250	4H0452	32 TSOP	50	50.0	0
5F0575	5F0513	32 TSOP	200	200.0	0
5F0576	5F0513	32 TSOP	200	200.0	0
7H2476-2	7H0747	32 PLCC	77	77.0	0

FAILURE RATETOTAL DEVICE HOURS

1,478,000 DEVICE HOURS

BEST ESTIMATE λ = 0.05% PER 1,000 HOURS50°C AMBIENTEXTRAPOLATION TO 50°C VIA
ARRHENNIUS EQUATION AND ACTIVATION
ENERGY OF 0.5eV λ = 0.0007% PER 1,000 HOURS (7 FITS)CONFIDENCE ESTIMATE λ 60 = 0.0009% PER 1,000 HOURS
60% CONFIDENCE (9 FITS) λ 90 = 0.002% PER 1,000 HOURS
90% CONFIDENCE (22 FITS)

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PLASTIC PACKAGE

85°C/85% RELATIVE HUMIDITY OPERATIVE LIFE TEST

<u>LOT NUMBER</u>	<u>DATE CODE</u>	<u>PACKAGE TYPE</u>	<u>SAMPLE SIZE</u>	<u>NUMBER OF FAILURES AT INDICATED HOURS</u>		
				(168)	(500)	(1000)
4B1469	4B9435	32 PLCC	45	0	0	0

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PLASTIC PACKAGE

PRESSURE POT TEST

<u>DATE CODE</u>	<u>PKG TYPE</u>	<u>SAMPLE SIZE</u>	<u>NUMBER OF FAILURES AT INDICATED HOURS</u>			
			(24)	(48)	(72)	(96)
4A9422	32 PLCC	44	0	0	0	0
4B9426	32 PLCC	47	0	0	0	0
4C9517	32 PLCC	77	0	0	0	0
5E9536	32 PLCC	77	0	0	0	0
7G9822	32 PDIP	50	0	0	0	0
6H9708	32 TSOP	50	0	0	0	0
9G9937	32 TSOP	50	0	0	0	0
9G9939	32 TSOP	50	0	0	0	0
4H0452	32 TSOP	50	0	0	0	0
7H0747	32 PLCC	77	0	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 CODE</u>	<u>PACKAGE TYPE</u>	<u>SAMPLE SIZE</u>	<u>NUMBER OF CYCLES</u>	<u>NUMBER OF FAILURES</u>
9G9937	32 TSOP	50	1000	0
9G9939	32 TSOP	50	1000	0
4H0452	32 TSOP	50	1000	0
7H0747	32 PLCC	77	1000	0

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PLASTIC PACKAGE

131°C/85% RELATIVE HUMIDITY HAST 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 FAILURES</u> <u>AT INDICATED HOURS</u>
				(96)
9G5407	9G9937	32 TSOP	50	0
4H4250	4H0452	32 TSOP	50	0
7H2476-2	7H0747	32 PLCC	77	0