

UT8Q512 SRAM Standby/Operating Current Characterization Summary (Lot# 5EC026BA)

Abstract

Characterization data generated by analyzing a substantial number of randomly selected UT8Q512 SRAMs shows a mean standby current of 0.80mA at room temperature and mean standby current of 11.91mA at 125°C. The mean operating currents at 40MHz at room and 125°C are 112.59mA and 114.69mA, respectively.

Background

The UT8Q512 is a high performance 512Kx8 static random access memory (SRAM) which has been characterized for total dose radiation performance, single event upset (SEU), and single event latch-up (SEL). This information sheet describes the standby and operating current of the UT8Q512 SRAM.

The data summarized below includes a sample population of 53 devices. Electrical test data was collected after burn-in conditioning for standby current and during operation at both the specification frequencies of 1MHz and 40MHz.

Analysis

Table 1 lists the current consumption characterization data captured during testing of the UT8Q512 SRAM. As noted there are values for more than fifty devices in the sample. Three current parameters are looked at for each device at three different temperatures (i.e. -55°C, 25°C, and 125°C, all at the worst-case data sheet voltage of 3.6V). The three current parameters cataloged are standby power supply current (0MHz) and values for the device operating at both 1MHz and 40MHz. Several statistics are calculated for each of the test conditions listed at the bottom of each of the respective columns.

Statistics are shown for min/max and average values for each current parameter at the noted test condition. Average and standard deviations are also listed. Circumstances to note include the dominating condition by which current is consumed. In a standby condition the worst current consumption exists when the device is hot as a result of leakage currents in the devices. During device operation at 40MHz, the overwhelming condition for current consumption comes as the device is operated at colder temperatures – likely as a result of increased carrier mobility and hence faster switching speed.

Aeroflex UTMC specifies the standby current as 40mA at hot condition for the part. Characterization data shows the characterized sample to be well within this limit. At 40MHz operation the specified data sheet value is 180mA; the worst case operating current consumption based on the characterization data is 130mA (noted at the worst-case condition - while the device was cold, -55°C).

Summary

Aeroflex UTMC has provided data specifications that include considerable margin for reliability and functional reasons. As the product matures the data sheet parameters may be adjusted to better represent actual device performance. Characterization data can be obtained for any of the device AC and DC parameters listed in the data sheet. In general, data sheet parameters reflect a plus 3 σ or larger guardband over the nominal device performance.

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Table 1. UT8Q512 Current Consumption Summary Table

UT8Q512	room 25C				hot 125C				cold -55C			
	standby	40MHz	1MHz	Data Retention	standby	40MHz	1MHz	Data Retention	standby	40MHz	1MHz	Data Retention
	ISB	IDDOP	IDDOP	IDR	ISB	IDDOP	IDDOP	IDR	ISB	IDDOP	IDDOP	IDR
Test	440	406	407	450	440	406	407	450	440	406	407	450
Units	mA	mA	mA	mA	mA	mA	mA	mA	mA	mA	mA	mA
1	0.54	111	76.6	0.3	10.54	98.4	74.8	4.03	0.57	132.2	97.2	0.33
2	1.74	116.5	81.9	0.91	11.9	116.6	80.5	6.78	1.88	139.9	103.4	1
3	0.54	111.2	77.8	0.3	10.91	110	75.4	5.41	0.56	129.6	94.6	0.33
4	0.55	113.4	79.1	0.3	9.98	112.8	77	5.48	0.57	132.2	96.2	0.33
5	4.72	117.1	83.3	1.98	14.09	115.9	80.8	6.89	4.89	135.4	100.4	1.73
6	0.6	113.2	79.1	0.33	12.01	115.2	79.5	6.43	0.57	132.8	97	0.34
7	0.57	118.6	83.4	0.32	9.85	117.7	81.1	5.48	0.59	135.8	99.3	0.35
8	0.58	113.5	79.2	0.33	12.68	115	79.5	6.67	0.61	132.9	96.6	0.35
9	1.13	112.9	78.8	0.64	17.07	119.2	83.8	9.14	1.03	129.5	94.3	0.63
10	0.61	111.3	77.4	0.33	14.34	115.9	80.3	7.75	0.55	128	92.7	0.33
11	2.38	113.5	80.1	1.7	13.35	115.4	80.8	8.01	2.63	131.2	96.3	1.94
12	0.6	112.2	77.7	0.34	13.01	116.2	80.8	7.77	0.55	128.4	93.6	0.32
13	0.62	111.6	77.4	0.34	14.09	116.4	80.8	7.99	0.56	129.6	94	0.33
14	0.6	111.7	77.8	0.33	12.51	115.9	80.4	7.73	0.57	130.6	94.9	0.33
15	0.61	113.5	79.3	0.33	12.83	117.3	81.4	7.72	0.56	128.9	94.1	0.33
16	0.6	110.7	77.1	0.32	11.27	114.6	79.7	7.48	0.57	129.3	94.3	0.33
17	1.79	112.3	79.4	1.22	14.29	117.4	82.7	9.11	0.56	129.5	94.2	0.33
18	0.55	112.6	78.8	0.32	7.8	112.2	77	5.29	0.54	131	95.7	0.34
19	0.57	111.1	77.8	0.31	12.4	114.8	79.8	7.46	0.53	126.5	91.9	0.31
20	0.55	118.9	83.4	0.31	8.77	115.6	79.3	5.05	1.88	130	95.4	0.34
21	0.55	111.7	77.9	0.3	8.92	111.4	76.3	5.3	0.6	137.1	100.6	0.32
22	0.64	111.8	77.6	0.34	15.72	118.2	82.6	8.8	0.56	128.4	93.8	0.32
23	0.55	112.7	78.7	0.31	8.9	112.7	77.1	5.39	0.55	128.9	93.5	0.32
24	0.56	110.6	76.9	0.31	10.53	112.2	77	6.27	0.54	128.5	93.4	0.35
25	0.56	115.4	81.6	0.33	11.36	116.5	80.3	6.3	0.58	136.2	99.9	0.31
26	0.59	111	77.5	0.31	12.67	113.6	78.9	7.04	0.51	129.5	93.9	0.34
27	0.54	113.1	78.9	0.3	9.88	113.4	77.8	5.73	0.57	131	95.4	0.33
28	0.57	110.5	77.2	0.31	13.41	113.8	78.7	7.35	0.56	129.3	94.5	0.31
29	0.64	111.3	77.8	0.33	15.55	119.7	84.5	8.9	0.59	127.3	92.7	0.32
30	0.56	114.5	79.8	0.31	8.79	113.7	77.7	5.43	0.55	128.6	93.4	0.33
31	0.6	111.8	78.2	0.33	15.69	117.5	82.4	8.76	0.57	135	98.3	0.32
32	0.58	114.7	80.2	0.32	13.11	117.9	81.4	7.56	0.54	128.8	94	0.33
33	0.57	112.3	78.5	0.32	14.36	115.8	80.1	7.6	0.56	132.5	96.8	0.32
34	0.63	113.7	80.2	0.36	11.57	116.4	81.2	7.17	0.55	129.3	94.5	0.35
35	0.57	114	79.6	0.32	12.62	116.9	81	7.36	0.59	130.5	95.5	0.33
36	2.54	114.7	80.8	1.28	11.92	117.4	81.7	8.13	0.57	131	95.4	1.34
37	0.56	112.7	78.8	0.31	11.55	114.2	78.9	6.59	0.57	130.3	94.8	0.34
38	0.57	110.7	77.2	0.32	13.56	115.1	80.3	7.93	0.55	128.7	93.6	0.33
39	0.52	112.7	78.4	0.3	8.39	110.3	75.1	4.51	0.57	132	96.4	0.33
40	0.61	110.8	77.1	0.34	11.72	118	83.1	9.27	0.55	127.9	92.9	0.33
41	0.55	112.9	79.1	0.31	9.66	113.4	78.2	5.98	0.56	130.9	95.5	0.33
42	0.54	113.4	79.1	0.3	8.82	112.2	76.4	4.93	0.55	132.7	96.8	0.34
43	0.53	112.2	78.5	0.3	9.95	112.4	77.3	5.81	0.55	130	95	0.32
44	0.56	111.2	77.8	0.31	11.77	112.5	78.1	6.68	0.54	127.4	92.8	0.32
45	0.58	110.6	77.4	0.33	15.8	116.5	81.8	8.93	0.55	130.3	94.9	0.32
46	0.59	112.8	79.2	0.32	13.94	117	81.6	8.07	0.52	129	93.8	0.32
48	0.58	111.4	77.5	0.32	12.5	113.3	78.9	7.39	0.54	125.2	90.9	0.32
49	1.8	114.3	79.7	1	11.49	114	78.9	7.16	0.56	130.5	94.8	0.34
50	0.59	112.7	78.3	0.32	13.37	118.6	83	8.64	1.86	133.5	97.3	1.04
51	0.51	112.4	78.4	0.3	10.76	115.7	80.2	7.48	0.58	132.6	96.1	0.34
52	0.53	112.5	78.5	0.29	6.86	111.3	76	5	0.55	130.2	95	0.32
53	0.61	104.4	77.3	0.35	9.65	112.2	76.9	5.51	0.53	130.5	95.2	0.32
54	0.55	111.6	77.9	0.3	13.38	113.8	79.3	7.42	0.56	127.8	93.2	0.33
47	0.56	109.9	76.7	0.31	11.5	113.2	78.1	6.61	0.53	128.8	93.7	0.31
Min	0.51	104.4	76.6	0.29	6.86	98.4	74.8	4.03	0.51	125.2	90.9	0.31
Max	4.72	118.9	83.4	1.98	17.07	119.7	84.5	9.27	4.89	139.9	103.4	1.94
Avg	0.7970	112.5889	78.7722	0.4383	11.9141	114.6907	79.5593	6.9383	0.7589	130.6204	95.2667	0.4344
Stdev	0.7048	2.2192	1.6200	0.3518	2.2485	3.2305	2.2905	1.3259	0.7046	2.7657	2.3122	0.3373
plus 3s	2.9113	119.2464	83.6321	1.4937	18.6597	124.3822	86.4309	10.9160	2.8727	138.9173	102.2034	1.4465

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Not shown by the table above is that the current performance through the range of operating frequencies (1MHz to 40MHz) is very linear. This is important for making power calculations at other frequencies than are explicitly specified. Average power supply current over the device operating range, at all three specification temperatures, is graphed below.

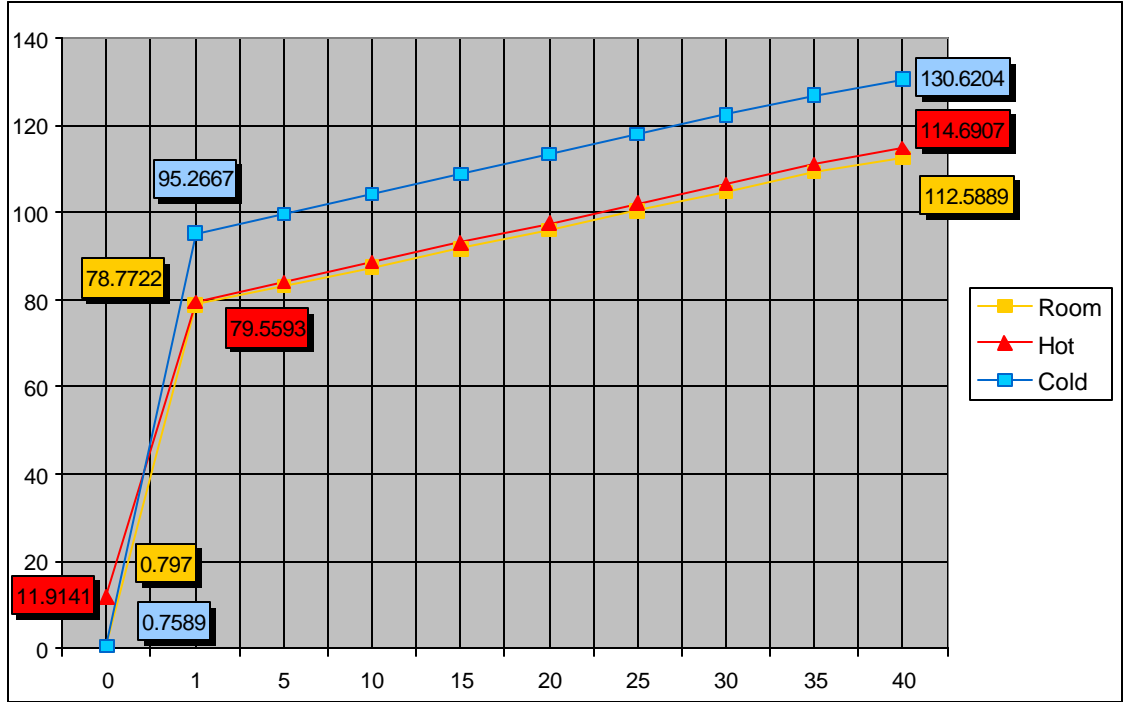


Figure 1. Current Performance (Standby to 40Mhz) from Data in Table 1