APEX MICROTECHNOLOGY CORPORATION
RELIABILITY PREDICTION
PA03

by

Granger Scofield

Date of prediction: 15-Mar-01

This reliability prediction is based on MIL-HDBK-217F, December 2, 1991 including Notice 2, February 28, 1995.

Conditions of this prediction are as follows:

Hybrid quality level is		Commercial	
Environment is	Gf	Ground, Fixed	
Case temperature is		45	C
Internal Power Dissipation =		220	W
Supply voltage is +/-		15	V

An AC signal is applied.
Product introduction date: 15-Aug-85

The results of this prediction are:
4.18 failures per million hours; or,
MTBF=239 thousand hours.

Transistors, Low Frequency, Bipolar:

Lp = Lb * PiT * PiR * PiS

Q8,33			Volts =	40	Watts =	1.2	Tj =	175	'K/W=	125	
Usage:	Vstress =	0.65	Vpwr =	0.65	Ic =	0.025	Vs =	0.0163	Power =	0.0163	
Lb	PiT		PiR	PiS				Nc	Tj =	47.031	
0.00074	1.629633		1.0698	0.0473				2			0.000122
Q1			Volts =	40	Watts =	1.2	Tj =	175	'K/W=	125	
Usage:	Vstress =	1.3	Vpwr =	1.3	Ic =	1E-05	Vs =	0.0325	Power =	1E-05	
Lb	PiT		PiR	PiS				Nc	Tj =	45.002	
0.00074	1.562356		1.0698	0.0498				1			6.16E-05
Q38,40			Volts =	60	Watts =	1.2	Tj =	175	'K/W=	125	
Usage:	Vstress =	2	Vpwr =	2	Ic =	1E-05	Vs =	0.0333	Power =	2E-05	
Lb	PiT		PiR	PiS				Nc	Tj =	45.003	
0.00074	1.562385		1.0698	0.0499				2			0.000123
Q16,24			Volts =	350	Watts =	5	Tj =	200	'K/W=	35	
Usage:	Vstress =	26	Vpwr =	11	Ic =	0.025	Vs =	0.0743	Power =	0.275	
Lb	PiT		PiR	PiS				Nc	Tj =	54.625	
0.00074	1.899253		1.8139	0.0567				1			0.000144
Q30			Volts =	120	Watts =	1.2	Tj =	200	'K/W=	145.83	
Usage:	Vstress =	2.5	Vpwr =	2.5	Ic =	1E-05	Vs =	0.0208	Power =	3E-05	
Lb	PiT		PiR	PiS				Nc	Tj =	45.004	
0.00074	1.562422		1.0698	0.048				1			5.94E-05
Q7			Volts =	140	Watts =	1.2	Tj =	200	'K/W=	145.83	
Usage:	Vstress =	2.2	Vpwr =	2.2	Ic =	1E-05	Vs =	0.0157	Power =	2E-05	
Lb	PiT		PiR	PiS				Nc	Tj =	45.003	
0.00074	1.562408		1.0698	0.0472				1			5.84E-05
Q34			Volts =	140	Watts =	1.2	Tj =	200	'K/W=	145.83	
Usage:	Vstress =	1.3	Vpwr =	1.3	Ic =	1E-05	Vs =	0.0093	Power =	1E-05	
Lb	PiT		PiR	PiS				Nc	Tj =	45.002	
0.00074	1.562365		1.0698	0.0463				1			5.73E-05
Q19,23,34			Volts =	140	Watts =	1.2	Tj =	200	'K/W=	145.83	
Usage:	Vstress =	1.3	Vpwr =	1.3	Ic =	0.01	Vs =	0.0093	Power =	0.013	
Lb	PiT		PiR	PiS				Nc	Tj =	46.896	
0.00074	1.625082		1.0698	0.0463				3			0.000179

Q9-11,26-28			Volts =	140	Watts =	178.6	Tj =	175	'K/W=	0.8399	
Usage:	Vstress =	23	Fraction Output Pwr = 1/			3	Vs =	0.1643	Power =	73.333	
Lb	PiT		PiR	PiS				Nc	Tj =	106.59	
0.00074	4.594202		6.8108	0.0749				6			0.010404
Q13,25			Volts =	120	Watts =	59.5	Tj =	150	'K/W=	2.1008	
Usage:	Vstress =	23.5	Fraction Output Pwr = 1/			15	Vs =	0.1958	Power =	14.667	
Lb	PiT		PiR	PiS				Nc	Tj =	75.812	
0.00074	2.810589		4.5349	0.0826				2			0.001558
Q5			Volts =	300	Watts =	1.15	Tj =	150	'K/W=	108.7	
Usage:	Vstress =	14.7	Vpwr =	9.7	Ic =	0.0005	Vs =	0.049	Power =	0.0049	
Lb	PiT		PiR	PiS				Nc	Tj =	45.527	
0.00074	1.579587		1.0531	0.0524				1			6.45E-05
Q6			Volts =	300	Watts =	1.15	Tj =	150	'K/W=	108.7	
Usage:	Vstress =	27.8	Vpwr =	12.8	Ic =	0.01	Vs =	0.0927	Power =	0.128	
Lb	PiT		PiR	PiS				Nc	Tj =	58.913	
0.00074	2.064363		1.0531	0.06				1			9.65E-05
Q14,22			Volts =	300	Watts =	1.15	Tj =	150	'K/W=	108.7	
Usage:	Vstress =	15	Vpwr =	15	Ic =	1E-05	Vs =	0.05	Power =	0.0002	
Lb	PiT		PiR	PiS				Nc	Tj =	45.016	
0.00074	1.562836		1.0531	0.0525				2			0.000128
Q15			Volts =	300	Watts =	1.15	Tj =	150	'K/W=	108.7	
Usage:	Vstress =	25.95	Vpwr =	10.95	Ic =	0.005	Vs =	0.0865	Power =	0.0548	
Lb	PiT		PiR	PiS				Nc	Tj =	50.951	
0.00074	1.765234		1.0531	0.0588				1			8.09E-05
Q17,18			Volts =	300	Watts =	1.15	Tj =	150	'K/W=	108.7	
Usage:	Vstress =	9	Vpwr =	9	Ic =	0.0022	Vs =	0.03	Power =	0.0198	
Lb	PiT		PiR	PiS				Nc	Tj =	47.152	
0.00074	1.633704		1.0531	0.0494				2			0.000126
Q31			Volts =	300	Watts =	1.15	Tj =	150	'K/W=	108.7	
Usage:	Vstress =	10.9	Vpwr =	10.9	Ic =	0.0049	Vs =	0.0363	Power =	0.0534	
Lb	PiT		PiR	PiS				Nc	Tj =	50.805	
0.00074	1.76006		1.0531	0.0504				1			6.91E-05
Q29			Volts =	300	Watts =	1.15	Tj =	150	'K/W=	108.7	
Usage:	Vstress =	24	Vpwr =	12.5	Ic =	0.01	Vs =	0.08	Power =	0.125	
Lb	PiT		PiR	PiS				Nc	Tj =	58.587	
0.00074	2.051473		1.0531	0.0577				1			9.22E-05

Q35			Volts =	300	Watts =	1.15	Tj =	150	'K/W=	108.7	
Usage:	Vstress =	21.5	Vpwr =	12.5	Ic =	1E-05	Vs =	0.0717	Power =	0.0001	
Lb	PiT		PiR	PiS				Nc	Tj =	45.014	
0.00074	1.562747		1.0531	0.0562				1			6.84E-05
Q36,37			Volts =	300	Watts =	1.15	Tj =	150	'K/W=	108.7	
Usage:	Vstress =	24.4	Vpwr =	24.4	Ic =	0.0033	Vs =	0.0813	Power =	0.0805	
Lb	PiT		PiR	PiS				Nc	Tj =	53.752	
0.00074	1.866798		1.0531	0.0579				2			0.000168
Q2,3			Volts =	20	Watts =	0.38	Tj =	150	'K/W=	328.95	
Usage:	Vstress =	1.34	Vpwr =	1.34	Ic =	0.0022	Vs =	0.067	Power =	0.0029	
Lb	PiT		PiR	PiS				Nc	Tj =	45.97	
0.00074	1.5942		0.6991	0.0554				2			9.14E-05
Q12			Volts =	20	Watts =	0.38	Tj =	150	'K/W=	328.95	
Usage:	Vstress =	0.6	Vpwr =	0.6	Ic =	0.005	Vs =	0.03	Power =	0.003	
Lb	PiT		PiR	PiS				Nc	Tj =	45.987	
0.00074	1.594766		0.6991	0.0494				1			4.07E-05

Transistors, Low Frequency, Si JFET: Lb = 0.0045

Lp = Lb * PiT

Q20A,B			Volts =	25	Watts =	0.55	Tj =	150	'K/W=	227.27
Usage:			Vpwr =	4	Id =	0.0022			Power =	0.0088
Lb	PiT							Nc	Tj =	47
0.0045	1.559097							2		0.014032

Capacitors, ceramic general purpose type CK:

Lp = Lb * PiT * PiC * PiV Lb = 0.00099

C6			Volts =	100	pF =	2200				
Usage:	Vstress =	2.5					S =	0.025		
Lb	PiT	PiC	Pi V					Nc		
0.00099	2.356629	0.31	1.0001					1		0.000722
C1			Volts =	25	pF =	3300				
Usage:	Vstress =	2					S =	0.08		
Lb	PiT	PiC	Pi V					Nc		
0.00099	2.356629	0.321	1.0024					1		0.000751
C5			Volts =	200	pF =	150				
Usage:	Vstress =	4.6					S =	0.023		
Lb	PiT	PiC	Pi V					Nc		
0.00099	2.356629	0.243	1.0001					1		0.000567

C9			Volts =	100	pF =	15000				
Usage:	Vstress =	0.65					S =	0.0065		
Lb	PiT	PiC	Pi V					Nc		
0.00099	2.356629	0.368	1					1		0.000859
C4			Volts =	200	pF =	470				
Usage:	Vstress =	27.4					S =	0.137		
Lb	PiT	PiC	Pi V					Nc		
0.00099	2.356629	0.269	1.0119					1		0.000636
C8			Volts =	50	pF =	33000				
Usage:	Vstress =	2.5					S =	0.05		
Lb	PiT	PiC	Pi V					Nc		
0.00099	2.356629	0.395	1.0006					1		0.000922
C2,7			Volts =	25	pF =	47000				
Usage:	Vstress =	0.65					S =	0.026		
Lb	PiT	PiC	Pi V					Nc		
0.00099	2.356629	0.408	1.0001					2		0.001903

Diodes, Power Rectifier, Fast Recovery, Lb = 0.025

D2,3			Volts =	150	Watts =	4.29	Tj =	175	'K/W=	34.965
Usage:			Volts =	25	Ic =	0.001	Vs =	0.1667	Power =	0.0007
Lb	PiT	PiS	PiC					Nc	Tj =	45.023
0.025	1.921396	0.054	1					2		0.005188

Diodes, Zener, Lb = 0.002

D1,4			Volts =	3.1	Watts =	2.5	Tj =	175	'K/W=	60
Usage:					Ic =	0.003			Power =	0.0093
Lb	PiT	PiS	PiC					Nc	Tj =	45.558
0.002	1.517214	1	2					2		0.012138

Sum of all components 0.051511

Hybrid microcircuit:

Lp=sumLc*(1+.2*PiE)	* PiF	* PiQ	* PiL
0.051511	1.4	5.8	10	1

Total failures per million hours = 4.1827

Mean time between failures = 239082