

APEX MICROTECHNOLOGY CORPORATION  
RELIABILITY PREDICTION  
PA83M/883

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	B
Environment is Gf	Ground, Fixed
Case temperature is	40 C
Internal Power Dissipation =	5 W
Supply voltage is +/-	120 V
An AC signal is applied.	
Product introduction date:	01-May-81

The results of this prediction are:

0.44 failures per million hours; or,  
MTBF=2255 thousand hours.

## Transistors, Low Frequency, Bipolar:

$$L_p = L_b * P_{iT} * P_{iR} * P_{iS}$$

Q7		Volts = 40	Watts = 1.2	Tj = 175	'K/W= 125	
Usage:	Vstress = 1.3	Vpwr = 1.3	Ic = 1E-06	Vs = 0.0325	Power = 1E-06	
Lb	PiT	PiR	PiS	Nc	Tj = 40	
0.00074	1.404905	1.0698	0.04977	1		5.54E-05
Q11		Volts = 40	Watts = 1.2	Tj = 175	'K/W= 125	
Usage:	Vstress = 1.13	Vpwr = 1.13	Ic = 0.003	Vs = 0.0283	Power = 0.0034	
Lb	PiT	PiR	PiS	Nc	Tj = 40.424	
0.00074	1.417787	1.0698	0.049119	1		5.51E-05
Q6,17		Volts = 300	Watts = 26	Tj = 150	'K/W= 4.8077	
Usage:	Vstress = 235	Fraction Output Pwr = 1/	1	Vs = 0.7833	Power = 5	
Lb	PiT	PiR	PiS	Nc	Tj = 64.038	
0.00074	2.274314	3.3384	0.510298	2		0.005734
Q8,9		Volts = 300	Watts = 1.15	Tj = 150	'K/W= 108.7	
Usage:	Vstress = 110.3	Vpwr = 110.3	Ic = 0.0005	Vs = 0.3677	Power = 0.0552	
Lb	PiT	PiR	PiS	Nc	Tj = 45.995	
0.00074	1.595022	1.0531	0.140672	1		0.000175
Q15		Volts = 300	Watts = 1.15	Tj = 150	'K/W= 108.7	
Usage:	Vstress = 111.6	Vpwr = 111.6	Ic = 0.0012	Vs = 0.372	Power = 0.1295	
Lb	PiT	PiR	PiS	Nc	Tj = 54.071	
0.00074	1.87862	1.0531	0.142574	1		0.000209
Q3,16		Volts = 300	Watts = 1.15	Tj = 150	'K/W= 108.7	
Usage:	Vstress = 232.9	Vpwr = 118.3	Ic = 4E-09	Vs = 0.7763	Power = 5E-07	
Lb	PiT	PiR	PiS	Nc	Tj = 40	
0.00074	1.404902	1.0531	0.499344	2		0.001093
Q5		Volts = 300	Watts = 1.15	Tj = 150	'K/W= 108.7	
Usage:	Vstress = 110.2	Vpwr = 110.2	Ic = 0.0002	Vs = 0.3673	Power = 0.0176	
Lb	PiT	PiR	PiS	Nc	Tj = 41.917	
0.00074	1.46385	1.0531	0.140526	1		0.00016
Q1		Volts = 20	Watts = 0.38	Tj = 150	'K/W= 328.95	
Usage:	Vstress = 0.65	Vpwr = 0.65	Ic = 0.0005	Vs = 0.0325	Power = 0.0003	
Lb	PiT	PiR	PiS	Nc	Tj = 40.107	
0.00074	1.408144	0.6991	0.04977	1		3.63E-05

Q2,4                                   Volts = 20           Watts = 0.38   Tj =                   150   'K/W= 328.95  
 Usage:   Vstress = 3   Vpwr = 1.55   Ic =           0.0005   Vs =                   0.15   Power = 0.0008  
 Lb       PiT                   PiR   PiS                                   Nc   Tj =           40.255  
 0.00074   1.412643           0.6991   0.071641                                   2                                   0.000105

Transistors, Low Frequency, Si JFET:   Lb =           0.0045  
 Lp = Lb \* PiT

Q12                                   Volts = 50           Watts = 4       Tj =                   150   'K/W= 31.25  
 Usage:                   Vpwr = 5.4       Id =           0.0005                                   Power = 0.0027  
 Lb       PiT   Nc   Tj =           40.084  
 0.0045   1.365102   2                                   0.012286

Q13,14                               Volts = 30           Watts = 0.8     Tj =                   150   'K/W= 156.25  
 Usage:                   Vpwr = 5.03       Id =           2E-09                                   Power = 1E-08  
 Lb       PiT   Nc   Tj =           40  
 0.0045   1.362841   2                                   0.012266

Q10                                   Volts = 300         Watts = 3       Tj =                   150   'K/W= 41.667  
 Usage:                   Vpwr = 231.6       Id =           0.0014                                   Power = 0.3312  
 Lb       PiT   Nc   Tj =           53.8  
 0.0045   1.766976   1                                   0.007951

Capacitors, ceramic general purpose type CK:  
 Lp = Lb \* PiT \* PiC \* PiV           Lb =           0.00099

C2                                   Volts = 100         pF =           1000  
 Usage:   Vstress = 1   S =                   0.01  
 Lb       PiT       PiC   Pi V   Nc  
 0.00099   1.92167   0.288   1   1                                   0.000549

C5,6                               Volts = 200         pF =           100  
 Usage:   Vstress = 1   S =                   0.005  
 Lb       PiT       PiC   Pi V   Nc  
 0.00099   1.92167   0.234   1   2                                   0.000892

C4                                   Volts = 200         pF =           150  
 Usage:   Vstress = 6.4   S =                   0.032  
 Lb       PiT       PiC   Pi V   Nc  
 0.00099   1.92167   0.243   1.0002   1                                   0.000463

C3                                   Volts = 300         pF =           18  
 Usage:   Vstress = 232.7   S =                   0.7757  
 Lb       PiT       PiC   Pi V   Nc  
 0.00099   1.92167   0.201   3.1606   1                                   0.001208

C1			Volts = 45	pF = 47			
Usage:	Vstress = 1.05				S =	0.0233	
Lb	PiT	PiC	Pi V			Nc	
0.00099	1.92167	0.219	1.0001			1	0.000417

Diodes, Low Frequency:

$Lp = Lb * PiT * PiS * PiC$

Diodes, Zener, Lb = 0.002

D1			Volts = 3.1	Watts = 2.5	Tj = 175	'K/W= 60	
Usage:				lc = 0.001		Power = 0.0031	
Lb	PiT	PiS	PiC			Nc	Tj = 40.186
0.002	1.367828	1	2			1	0.005471

D2			Volts = 3.1	Watts = 2.5	Tj = 175	'K/W= 60	
Usage:				lc = 0.0014		Power = 0.0044	
Lb	PiT	PiS	PiC			Nc	Tj = 40.266
0.002	1.369977	1	2			1	0.00548

Sum of all components 0.054605

Hybrid microcircuit:

$Lp = \text{sum} Lc * (1 + .2 * PiE) * PiF * PiQ * PiL$

0.054605 1.4 5.8 1 1

Total failures per million hours = 0.443392

Mean time between failures = 2255339