

APEX MICROTECHNOLOGY CORPORATION
RELIABILITY PREDICTION
PA97

by

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Date of prediction: 06-Dec-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	40 C
Internal Power Dissipation =	2 W
Supply voltage is +/-	400 V
An AC signal is applied.	
Product introduction date:	25-May-00

The results of this prediction are:

31.1 failures per million hours; or,
MTBF=32.1 thousand hours.

Transistors, Low Frequency, Bipolar:

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

Q1		Volts = 20	Watts = 0.38	Tj = 150	'K/W= 328.95	
Usage:	Vstress = 0.65	Vpwr = 0.65	Ic = 0.001	Vs = 0.0325	Power = 0.0007	
Lb	PiT	PiR	PiS	Nc	Tj = 40.214	
0.00074	1.411392	0.6991	0.0498	1		3.63E-05

Q2		Volts = 20	Watts = 0.38	Tj = 150	'K/W= 328.95	
Usage:	Vstress = 3	Vpwr = 3	Ic = 0.001	Vs = 0.15	Power = 0.003	
Lb	PiT	PiR	PiS	Nc	Tj = 40.987	
0.00074	1.435041	0.6991	0.0716	1		5.32E-05

Transistors, Low Frequency, Si JFET: Lb = 0.0045

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

Q10A,B		Volts = 25	Watts = 0.55	Tj = 150	'K/W= 227.27	
Usage:		Vpwr = 4	Id = 0.001		Power = 0.004	
Lb	PiT			Nc	Tj = 40.909	
0.0045	1.387333			2		0.012486

Q6		Volts = 450	Watts = 0.38	Tj = 150	'K/W= 328.95	
Usage:		Vpwr = 0.7	Id = 1E-07		Power = 7E-08	
Lb	PiT			Nc	Tj = 40	
0.0045	1.362842			1		0.006133

Transistors, Low Frequency, Si MOSFET: Lb = 0.012

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

Q15		Volts = 450	Watts = 4	Tj = 150	'K/W= 31.25	
Usage:		Vpwr = 200	Id = 0.01		Power = 2	
Lb	PiT			Nc	Tj = 102.5	
0.012	3.793289			1		0.045519

Q7,8		Volts = 450	Watts = 4	Tj = 150	'K/W= 31.25	
Usage:		Vpwr = 397	Id = 0.001		Power = 0.397	
Lb	PiT			Nc	Tj = 52.406	
0.012	1.722969			2		0.041351

217F

Q14	Volts = 450	Watts = 4	Tj =	150	'K/W= 31.25	
Usage:	Vpwr = 397	Id = 0.0002			Power = 0.0794	
Lb	PiT			Nc	Tj = 42.481	
0.012	1.430384			1		0.017165

Q4,11,12,16	Volts = 450	Watts = 3.125	Tj =	150	'K/W= 40	
Usage:	Fraction Output Pwr = 1/ 2				Power = 1	
Lb	PiT			Nc	Tj = 80	
0.012	2.735936			4		0.131325

Q3,6,13	Volts = 450	Watts = 3.125	Tj =	150	'K/W= 40	
Usage:	Vpwr = 200	Id = 0.0003			Power = 0.06	
Lb	PiT			Nc	Tj = 42.4	
0.012	1.428137			3		0.051413

Capacitors, ceramic general purpose type CK:

$L_p = L_b * P_iT * P_iC * P_iV$ $L_b = 0.00099$

C1	Volts = 50	pF = 470				
Usage:	Vstress = 1.5		S =	0.03		
Lb	PiT	PiC	Pi V	Nc		
0.00099	1.92167	0.269	1.0001	1		0.000513

Diodes, Low Frequency:

$L_p = L_b * P_iT * P_iS * P_iC$

Diodes, Zener, $L_b = 0.002$

D1	Volts = 8.7	Watts = 1.35	Tj =	175	'K/W= 111.11	
Usage:		Ic = 1E-06			Power = 9E-06	
Lb	PiT	PiS	PiC	Nc	Tj = 40.001	
0.002	1.362867	1	2	1		0.005451

Sum of all components 0.311446

Hybrid microcircuit:

$L_p = \text{sum} L_c * (1 + 2 * P_iE) * P_iF * P_iQ * P_iL$
 0.311446 1.4 5.8 10 1.2307

Total failures per million hours = 31.123

Mean time between failures = 32130