

APEX MICROTECHNOLOGY CORPORATION
RELIABILITY PREDICTION
PA94

by

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Date of prediction: 05-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 =	5 W
Supply voltage is +/-	400 V
An AC signal is applied.	
Product introduction date:	25-Nov-99

The results of this prediction are:

26.8 failures per million hours; or,
MTBF=37.4 thousand hours.

Transistors, Low Frequency, Bipolar:

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

Q14,21		Volts = 40	Watts = 1.2	Tj = 175	'K/W= 125	
Usage:	Vstress = 4	Vpwr = 2	Ic = 1E-06	Vs = 0.1	Power = 2E-06	
Lb	PiT	PiR	PiS	Nc	Tj = 40	
0.00074	1.404908	1.0698	0.0614	2		0.000136

Q1		Volts = 20	Watts = 0.38	Tj = 150	'K/W= 328.95	
Usage:	Vstress = 0.65	Vpwr = 0.65	Ic = 0.0025	Vs = 0.0325	Power = 0.0016	
Lb	PiT	PiR	PiS	Nc	Tj = 40.535	
0.00074	1.421171	0.6991	0.0498	1		3.66E-05

Q2		Volts = 20	Watts = 0.38	Tj = 150	'K/W= 328.95	
Usage:	Vstress = 3	Vpwr = 3	Ic = 0.0025	Vs = 0.15	Power = 0.0075	
Lb	PiT	PiR	PiS	Nc	Tj = 42.467	
0.00074	1.481101	0.6991	0.0716	1		5.49E-05

Transistors, Low Frequency, Si JFET: Lb = 0.0045

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

Q15A,B		Volts = 25	Watts = 0.55	Tj = 150	'K/W= 227.27	
Usage:		Vpwr = 4	Id = 0.0025		Power = 0.01	
Lb	PiT			Nc	Tj = 42.273	
0.0045	1.424622			2		0.012822

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

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

Q30		Volts = 450	Watts = 15	Tj = 150	'K/W= 8.3333	
Usage:		Vpwr = 200	Id = 0.01		Power = 2	
Lb	PiT			Nc	Tj = 56.667	
0.012	1.859858			1		0.022318

Q12,13		Volts = 450	Watts = 4	Tj = 150	'K/W= 31.25	
Usage:		Vpwr = 397	Id = 0.0025		Power = 0.9846	
Lb	PiT			Nc	Tj = 70.768	
0.012	2.3632			2		0.056717

Q28		Volts = 450	Watts = 4	Tj =	150	'K/W= 31.25	
Usage:		Vpwr = 397	Id = 0.005			Power = 1.985	
Lb	PiT				Nc	Tj = 102.03	
0.012	3.769061				1		0.045229
Q5,11,25,31		Volts = 450	Watts = 25	Tj =	150	'K/W= 5	
Usage:		Fraction Output Pwr = 1/	2			Power = 2.5	
Lb	PiT				Nc	Tj = 52.5	
0.012	1.725908				4		0.082844
Q3,10,24		Volts = 450	Watts = 25	Tj =	150	'K/W= 5	
Usage:		Vpwr = 200	Id = 0.01			Power = 2	
Lb	PiT				Nc	Tj = 50	
0.012	1.648687				3		0.059353
Q29		Volts = 450	Watts = 25	Tj =	150	'K/W= 5	
Usage:		Vpwr = 5	Id = 0.005			Power = 0.025	
Lb	PiT				Nc	Tj = 40.125	
0.012	1.366192				1		0.016394

Capacitors, ceramic general purpose type CK:

$L_p = L_b * P_{iT} * P_{iC} * P_{iV}$ $L_b =$ 0.00099

C2		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

C1,3,4,5		Volts = 500	pF = 22				
Usage:	Vstress = 395			S =	0.79		
Lb	PiT	PiC	Pi V		Nc		
0.00099	1.92167	0.205	3.2826		4		0.00511

Diodes, Low Frequency:

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

Diodes, Zener, $L_b =$ 0.002

D1,2		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		2		0.010903

Sum of all components

0.318562

Hybrid microcircuit:

$$L_p = \sum L_c (1 + 2 \cdot P_i E) \cdot P_i F \cdot P_i Q \cdot P_i L$$

$$0.318562 \cdot 1.4 \cdot 5.8 \cdot 10 \cdot 1.0343$$

$$\text{Total failures per million hours} = 26.753$$

$$\text{Mean time between failures} = 37379$$