

APEX MICROTECHNOLOGY CORPORATION
RELIABILITY PREDICTION
PA95

by

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Date of prediction: 20-May-04

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 =	1	W
Supply voltage is +/-	400	V
An AC signal is applied.		
Product introduction date:	25-Nov-99	

The results of this prediction are:

24.4 failures per million hours; or,
MTBF=41 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 = 0.0001	Vs = 0.0325	Power = 8E-05	
Lb	PiT	PiR	PiS	Nc	Tj = 40.027	
0.00074	1.40571	0.6991	0.0498	1		3.62E-05

Q2		Volts = 20	Watts = 0.38	Tj = 150	'K/W= 328.95	
Usage:	Vstress = 3	Vpwr = 3	Ic = 0.0001	Vs = 0.15	Power = 0.0004	
Lb	PiT	PiR	PiS	Nc	Tj = 40.123	
0.00074	1.408643	0.6991	0.0716	1		5.22E-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 = 0.0001		Power = 0.0005	
Lb	PiT			Nc	Tj = 40.114	
0.0045	1.365887			2		0.012293

Q6,8,9,31,32		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			5		0.030664

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 = 0.0008		Power = 0.15	
Lb	PiT			Nc	Tj = 41.25	
0.012	1.396593			2		0.033518

Q12,13		Volts = 450	Watts = 4	Tj = 150	'K/W= 31.25	
Usage:		Vpwr = 397	Id = 0.0001		Power = 0.0496	
Lb	PiT			Nc	Tj = 41.551	
0.012	1.404797			2		0.033715

Q28		Volts = 450	Watts = 4	Tj = 150	'K/W= 31.25	
Usage:		Vpwr = 397	Id = 0.0003		Power = 0.0993	
Lb	PiT			Nc	Tj = 43.102	
0.012	1.447614			2		0.034743

Q5,11,25,31		Volts = 450	Watts = 25	Tj = 150	'K/W= 5	
Usage:		Fraction Output Pwr = 1/	2		Power = 0.5	
Lb	PiT			Nc	Tj = 42.5	
0.012	1.430902			4		0.068683

Q3,10,24 Volts = 450 Watts = 4 Tj = 150 'K/W= 31.25
 Usage: Vpwr = 200 Id = 0.0008 Power = 0.15
 Lb PiT Nc Tj = 44.688
 0.012 1.492299 3 0.053723

Q29 Volts = 450 Watts = 4 Tj = 150 'K/W= 31.25
 Usage: Vpwr = 5 Id = 0.0005 Power = 0.0025
 Lb PiT Nc Tj = 40.078
 0.012 1.364935 1 0.016379

Capacitors, ceramic general purpose type CK:
 $L_p = L_b * P_{iT} * P_{iC} * P_{iV}$ Lb = 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, Lb = 0.002

D1,2 Volts = 5.6 Watts = 1.35 Tj = 175 'K/W= 111.11
 Usage: Ic = 1E-06 Power = 6E-06
 Lb PiT PiS PiC Nc Tj = 40.001
 0.002 1.362858 1 2 2 0.010903

Sum of all components 0.300469

Hybrid microcircuit:
 $L_p = \sum L_c * (1 + 2 * P_{iE}) * P_{iF} * P_{iQ} * P_{iL}$
 0.300469 1.4 5.8 10 1

Total failures per million hours = 24.398
 Mean time between failures = 40987