

APEX MICROTECHNOLOGY CORPORATION  
RELIABILITY PREDICTION  
PA85M

by

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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	Non-Compliant
Environment is Gf	Ground, Fixed
Case temperature is	40 C
Internal Power Dissipation =	5 W
Supply voltage is +/-	175 V
An AC signal is applied.	
Product introduction date:	01-Nov-87

The results of this prediction are:

8.18 failures per million hours; or,  
MTBF=122 thousand hours.

## Transistors, Low Frequency, Bipolar:

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

Q12,17		Volts = 40	Watts = 1.2	Tj = 175	'K/W= 125	
Usage:	Vstress = 2.15	Vpwr = 2.15	Ic = 1E-05	Vs = 0.0538	Power = 2E-05	
Lb	PiT	PiR	PiS	Nc	Tj = 40.003	
0.00074	1.404981	1.0698	0.0532	2		0.000118

Q1		Volts = 120	Watts = 1.2	Tj = 200	'K/W= 145.83	
Usage:	Vstress = 0.65	Vpwr = 0.65	Ic = 0.0024	Vs = 0.0054	Power = 0.0016	
Lb	PiT	PiR	PiS	Nc	Tj = 40.23	
0.00074	1.411895	1.0698	0.0458	1		5.11E-05

Q2		Volts = 120	Watts = 1.2	Tj = 200	'K/W= 145.83	
Usage:	Vstress = 5.22	Vpwr = 5.22	Ic = 0.0025	Vs = 0.0435	Power = 0.0129	
Lb	PiT	PiR	PiS	Nc	Tj = 41.888	
0.00074	1.462957	1.0698	0.0515	1		5.96E-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 = 3.285	Id = 0.0025		Power = 0.0082	
Lb	PiT			Nc	Tj = 41.859	
0.0045	1.413239			2		0.012719

## Transistors, Low Frequency, Si MOSFET: Lb = 0.012

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

Q6,7		Volts = 450	Watts = 4	Tj = 150	'K/W= 31.25	
Usage:		Vpwr = 167	Id = 0.0025		Power = 0.4142	
Lb	PiT			Nc	Tj = 52.943	
0.012	1.73982			2		0.041756

Q13		Volts = 450	Watts = 4	Tj = 150	'K/W= 31.25	
Usage:		Vpwr = 170	Id = 0.0051		Power = 0.8687	
Lb	PiT			Nc	Tj = 67.147	
0.012	2.226457			1		0.026717

Q5,14		Volts = 450	Watts = 4	Tj = 150	'K/W= 31.25	
Usage:		Vpwr = 2.7	Id = 0.001		Power = 0.0027	
Lb	PiT			Nc	Tj = 40.084	
0.012	1.365102			2		0.032762

Q4,15		Volts = 450	Watts = 4	Tj =	150	'K/W= 31.25	
Usage:		Vpwr = 340.7	Id = 0.001			Power = 0.3407	
Lb	PiT				Nc	Tj = 50.647	
0.012	1.668443				2		0.040043
Q16		Volts = 450	Watts = 4	Tj =	150	'K/W= 31.25	
Usage:		Vpwr = 166.5	Id = 0.013			Power = 2.1645	
Lb	PiT				Nc	Tj = 107.64	
0.012	4.06522				1		0.048783
Q3		Volts = 450	Watts = 4	Tj =	150	'K/W= 31.25	
Usage:		Vpwr = 166.5	Id = 0.0002			Power = 0.025	
Lb	PiT				Nc	Tj = 40.78	
0.012	1.38385				1		0.016606
Q8		Volts = 450	Watts = 4	Tj =	150	'K/W= 31.25	
Usage:		Vpwr = 171	Id = 0.013			Power = 2.223	
Lb	PiT				Nc	Tj = 109.47	
0.012	4.164685				1		0.049976
Q11		Volts = 450	Watts = 4	Tj =	150	'K/W= 31.25	
Usage:		Vpwr = 5	Id = 0.0126			Power = 0.063	
Lb	PiT				Nc	Tj = 41.969	
0.012	1.416252				1		0.016995
Q9,18		Volts = 450	Watts = 50	Tj =	150	'K/W= 2.5	
Usage:		Fraction Output Pwr = 1/	1			Power = 5	
Lb	PiT				Nc	Tj = 52.5	
0.012	1.725908				2		0.041422

Capacitors, ceramic general purpose type CK:

$L_p = L_b * PiT * PiC * PiV$        $L_b = 0.00099$

C6		Volts = 100	pF = 15000				
Usage:	Vstress = 4.6			S =		0.046	
Lb	PiT	PiC	Pi V		Nc		
0.00099	1.92167	0.368	1.0005		1		0.0007

C4		Volts = 100	pF = 15000				
Usage:	Vstress = 5.7			S =		0.057	
Lb	PiT	PiC	Pi V		Nc		
0.00099	1.92167	0.368	1.0009		1		0.000701

C1  
 Usage: Vstress = 6 S = 0.06  
 Lb PiT PiC Pi V Nc  
 0.00099 1.92167 0.269 1.001 1 0.000513

C2  
 Usage: Vstress = 1.6 S = 0.016  
 Lb PiT PiC Pi V Nc  
 0.00099 1.92167 0.269 1 1 0.000513

Diodes, Low Frequency:

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

Diodes, Zener, Lb = 0.002

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

Sum of all components 0.335907

Hybrid microcircuit:

$$L_p = \text{sum}L_c * (1 + .2 * P_{iE}) * P_{iF} * P_{iQ} * P_{iL}$$

0.335907 1.4 5.8 3 1

Total failures per million hours = 8.1827

Mean time between failures = 122209