

APEX MICROTECHNOLOGY CORPORATION  
RELIABILITY PREDICTION  
PA10

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	Commercial
Environment is Gf	Ground, Fixed
Case temperature is	40 C
Internal Power Dissipation =	5 W
Supply voltage is +/-	36 V
An AC signal is applied.	
Product introduction date:	01-Aug-80

The results of this prediction are:

1.57 failures per million hours; or,  
MTBF=636 thousand hours.

## Monolithic Bipolar and MOS Linear Devices:

$$L_p = C_1 * P_i T$$

IC1		Watts = 3.14	Tj = 200	#/Qs = 56	
Usage:		Watts = 0.1		Max Tj = 45.573	
C1	PiT			Nc	
0.01	0.512782			1	0.005128

## Transistors, Low Frequency, Bipolar:

$$L_p = L_b * P_i T * P_i R * P_i S$$

Q3,5,7,8		Volts = 40	Watts = 1.2	Tj = 175	'K/W= 125
Usage:	Vstress = 0.65	Vpwr = 0.65	Ic = 0.0001	Vs = 0.0163	Power = 7E-05
Lb	PiT	PiR	PiS	Nc	Tj = 40.008
0.00074	1.405146	1.0698	0.0473	4	0.000211

Q4		Volts = 40	Watts = 1.2	Tj = 175	'K/W= 125
Usage:	Vstress = 0.65	Vpwr = 0.65	Ic = 0.0034	Vs = 0.0163	Power = 0.0022
Lb	PiT	PiR	PiS	Nc	Tj = 40.274
0.00074	1.413235	1.0698	0.0473	1	5.29E-05

Q1		Volts = 120	Watts = 1.2	Tj = 200	'K/W= 145.83
Usage:	Vstress = 66.6	Vpwr = 33	Ic = 0.005	Vs = 0.555	Power = 0.165
Lb	PiT	PiR	PiS	Nc	Tj = 64.063
0.00074	2.275332	1.0698	0.2514	1	0.000453

Q2,6		Volts = 100	Watts = 83	Tj = 200	'K/W= 2.1084
Usage:	Vstress = 69	Fraction Output Pwr = 1/	1	Vs = 0.69	Power = 5
Lb	PiT	PiR	PiS	Nc	Tj = 50.542
0.00074	1.750735	5.1293	0.3821	2	0.005078

## Capacitors, ceramic general purpose type CK:

$$L_p = L_b * P_i T * P_i C * P_i V \quad L_b = 0.00099$$

C1,2		Volts = 100	pF = 470		
Usage:	Vstress = 69			S = 0.69	
Lb	PiT	PiC	PiV	Nc	
0.00099	1.92167	0.269	2.5209	2	0.002585

C3		Volts = 45	pF = 26		
Usage:	Vstress = 2			S = 0.0444	
Lb	PiT	PiC	PiV	Nc	
0.00099	1.92167	0.208	1.0004	1	0.000395

Diodes, Low Frequency:

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

Diodes, Zener,  $L_b =$  0.002

D1,4			Volts = 3.1	Watts = 2.5	$T_j =$	175	'K/W= 60
Usage:				$I_c =$ 0.0011			Power = 0.0036
$L_b$	$P_{iT}$	$P_{iS}$	$P_{iC}$		$N_c$	$T_j =$	40.214
0.002	1.368569	1	2		1		0.005474

Sum of all components 0.019376

Hybrid microcircuit:

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

0.019376 1.4 5.8 10 1

Total failures per million hours = 1.5734

Mean time between failures = 635579