

APEX MICROTECHNOLOGY CORPORATION  
RELIABILITY PREDICTION  
SA01

by

Granger Scofield

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	55 C
Internal power dissipation=	5 W
Supply voltage is +	78 V
An AC signal is applied.	
Product introduction date:	15-Nov-96

The results of this prediction are:

29.5 failures per million hours; or,  
MTBF=34 thousand hours.

## Monolithic Bipolar and MOS Linear Devices:

$$L_p = C_1 * P_i T$$

IC1	#/Pins = 7	Watts = 1	Tj = 150	#/Qs = 96	
Usage:	Vstress = 12	Watts = 0.018		Max Tj = 57.25	
C1	PiT			Nc	
0.01	1.184462			1	0.011845
IC2	#/Pins = 20	Watts = 2	Tj = 150	#/Qs = 96	
Usage:	Vstress = 11.3	Watts = 0.274		Max Tj = 72.127	
C1	PiT			Nc	
0.01	3.170333			1	0.031703

## Transistors, Low Frequency, Bipolar:

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

Q5,6		Volts = 40	Watts = 1.2	Tj = 175	'K/W= 125
Usage:	Vstress = 12	Vpwr = 6	Ic = 0.002	Vs = 0.3	Power = 0.012
Lb	PiT	PiR	PiS	Nc	Tj = 56.5
0.00074	1.970285	1.0698	0.1141	2	0.000356
Q22		Volts = 40	Watts = 1.2	Tj = 175	'K/W= 125
Usage:	Vstress = 12	Vpwr = 12	Ic = 1E-06	Vs = 0.3	Power = 1E-05
Lb	PiT	PiR	PiS	Nc	Tj = 55.002
0.00074	1.913372	1.0698	0.1141	1	0.000173
Q17,18,20,21		Volts = 60	Watts = 1.2	Tj = 175	'K/W= 125
Usage:	Vstress = 12	Vpwr = 12	Ic = 1E-06	Vs = 0.2	Power = 1E-05
Lb	PiT	PiR	PiS	Nc	Tj = 55.002
0.00074	1.913372	1.0698	0.0837	4	0.000507
Q3		Volts = 100	Watts = 3.9	Tj = 175	'K/W= 38.462
Usage:	Vstress = 66.7	Vpwr = 66.7	Ic = 0.01	Vs = 0.667	Power = 0.667
Lb	PiT	PiR	PiS	Nc	Tj = 80.654
0.00074	3.053728	1.6546	0.3558	1	0.00133
Q11,12		Volts = 300	Watts = 1.15	Tj = 150	'K/W= 108.7
Usage:	Vstress = 66	Vpwr = 66	Ic = 0.002	Vs = 0.22	Power = 0.132
Lb	PiT	PiR	PiS	Nc	Tj = 69.348
0.00074	2.506665	1.0531	0.089	2	0.000348
Q19		Volts = 300	Watts = 1.15	Tj = 150	'K/W= 108.7
Usage:	Vstress = 78	Vpwr = 78	Ic = 1E-06	Vs = 0.26	Power = 8E-05
Lb	PiT	PiR	PiS	Nc	Tj = 55.008
0.00074	1.913635	1.0531	0.1008	1	0.00015



C6			Volts = 50	pF = 10000				
Usage:	Vstress = 7.5				S =	0.15		
Lb	PiT	PiC	Pi V			Nc		
0.00099	3.478655	0.355	1.0156			1		0.001241
C3			Volts = 100	pF = 680				
Usage:	Vstress = 7.5				S =	0.075		
Lb	PiT	PiC	Pi V			Nc		
0.00099	3.478655	0.279	1.002			1		0.000961
C2			Volts = 25	pF = 100000				
Usage:	Vstress = 12				S =	0.48		
Lb	PiT	PiC	Pi V			Nc		
0.00099	3.478655	0.437	1.512			1		0.002273
C1			Volts = 25	pF = 470000				
Usage:	Vstress = 11.3				S =	0.452		
Lb	PiT	PiC	Pi V			Nc		
0.00099	3.478655	0.502	1.4275			1		0.002467

Diodes, Low Frequency:

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

Diodes, Switching,  $L_b = 0.001$

D6,7			Volts = 100	Watts = 0.38	Tj = 175	'K/W= 394.74		
Usage:			Volts = 0.65	Ic = 0.002	Vs = 0.0065			
Lb	PiT	PiS	PiC			Nc	Tj = 55	
0.001	2.582357	0.054	2			2		0.000558

Diodes, Zener,  $L_b = 0.002$

D4,5			Volts = 5.6	Watts = 1.35	Tj = 175	'K/W= 111.11		
Usage:				Ic = 0.002		Power = 0.0112		
Lb	PiT	PiS	PiC			Nc	Tj = 56.244	
0.002	1.845983	1	2			2		0.014768

D2,3			Volts = 12	Watts = 1.39	Tj = 175	'K/W= 107.91		
Usage:				Ic = 0.0143		Power = 0.171		
Lb	PiT	PiS	PiC			Nc	Tj = 73.453	
0.002	2.468044	1	2			2		0.019744

Diodes, Schottky:

$L_p = L_b * P_{iT} * P_{iR}$        $L_b = 0.027$

D8,9      Watts = 6.9444     $T_j = 150$     'K/W= 18

Usage:      Power = 0.03

$L_b$	$P_{iT}$	$P_{iR}$	$N_c$	$T_j =$	55.54
0.027	1.925266	1	2		0.103964

Sum of all components      0.362745

Hybrid microcircuit:

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

0.362745    1.4      5.8      10      1

Total failures per million hours = 29.455

Mean time between failures = 33950