# APEX MICROTECHNOLOGY CORPORATION RELIABILITY PREDICTION PA02

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 Commercial
Environment is Gf Ground, Fixed

Case temperature is 40 C
Internal Power Dissipation = 12 W
Supply voltage is +/- 15 V

An AC signal is applied.

Product introduction date: 01-Jul-83

The results of this prediction are:
1.09 failures per million hours; or,
MTBF=920 thousand hours.

### Monolithic Bipolar and MOS Linear Devices:

Lp = C1 \* PiT

IC1		Watts = 1.68	Tj =	200	#/Qs =	28	
Usage:		Watts = 0.08			Max Tj =	48.333	
C1	PiT					Nc	
0.01	0.628435					1	0.006284

### Transistors, Low Frequency, Bipolar:

Lp = Lb \* PiT \* PiR \* PiS

	Volts = 40	Watts =	1.2	Tj =	175	'K/W=	125	
Vstress = 0.99	Vpwr = 0.99	Ic =	0.0025	Vs =	0.0248	Power =	0.0025	
PiT	PiR PiS				Nc	Tj =	40.309	
1.414301	1.0698 0.0486				2			0.000109
	Volte = 40	Watte -	1.2	Ti -	175	'\ <i>\</i> /\\/-	125	
Vetroes = 20.0				•				
		PWI = 1/	25	VS =				
PiT	PiR PiS				Nc	Tj =	100	
4.16368	1.0698 0.4193				2			0.002764
			4.0	-	475	114044	405	
	Volts = 40	vvatts =	1.2	1 j =	1/5	'K/VV=	125	
Vstress = 1.3	Vpwr = 1.3	Ic =	1E-05	Vs =	0.0325	Power =	1E-05	
PiT	PiR PiS				Nc	Tj =	40.002	
1.404949	1.0698 0.0498				2			0.000111
	Volts = 120	Watts =	59.5	Ti =	150	'K/W=	2.1008	
Vetroce = 29.9				•				
	•	-WI - 1/	1	VS -				
PiT	PiR PiS				Nc	Tj =	65.21	
2.324272	4.5349 0.0947				2			0.001477
	PiT 1.414301  Vstress = 28.8 PiT 4.16368  Vstress = 1.3 PiT 1.404949  Vstress = 28.8 PiT	Vstress =       0.99       Vpwr =       0.99         PiT       PiR       PiS         1.414301       1.0698       0.0486         Volts =       40         Vstress =       28.8       Fraction Output         PiT       PiR       PiS         4.16368       1.0698       0.4193         Volts =       40         Vstress =       1.3       Vpwr =       1.3         PiT       PiR       PiS         1.404949       1.0698       0.0498         Vstress =       28.8       Fraction Output         PiT       PiR       PiS	Vstress =         0.99         Vpwr =         0.99         Ic =           PiT         PiR         PiS           1.414301         1.0698         0.0486           Volts =         40         Watts =           Vstress =         28.8         Fraction Output Pwr = 1/           PiT         PiR         PiS           4.16368         1.0698         0.4193           Volts =         40         Watts =           Vstress =         1.3         Ic =           PiT         PiR         PiS           1.404949         1.0698         0.0498           Volts =         120         Watts =           Vstress =         28.8         Fraction Output Pwr =         1/           PiT         PiR         PiS	Vstress = 0.99       Vpwr = 0.99       Ic = 0.0025         PiT PiR PiS       1.414301       1.0698 0.0486         Volts = 40 Watts = 1.2       Vstress = 28.8 Fraction Output Pwr = 1/ 25       25         PiT PiR PiS 4.16368       1.0698 0.4193       0.4193         Volts = 40 Watts = 1.2       Vstress = 1.3 Vpwr = 1.3 Ic = 1E-05         PiT PiR PiS 1.404949       1.0698 0.0498         Volts = 120 Watts = 59.5       Vstress = 28.8 Fraction Output Pwr = 1/ 1         PiT PiR PiS       PiS	Vstress = 0.99       Vpwr = 0.99       Ic = 0.0025       Vs = PiT         PiT       PiR       PiS         1.414301       1.0698       0.0486         Volts = 40       Watts = 1.2       Tj = Vstress = 28.8         PiT       PiR       PiS         4.16368       1.0698       0.4193         Volts = 40       Watts = 1.2       Tj = Vstress = 1.3         Vpwr = 1.3       Ic = 1E-05       Vs =	Vstress = 0.99         Vpwr = 0.99         lc = 0.0025         Vs = 0.0248           PiT	Vstress = 0.99         Vpwr = 0.99         Ic = 0.0025         Vs = 0.0248         Power = 0.0248 </td <td>Vstress = 0.99       Vpwr = 0.99       Ic = 0.0025       Vs = 0.00248       Power = 0.0025         PiT PiR PiR PiS</td>	Vstress = 0.99       Vpwr = 0.99       Ic = 0.0025       Vs = 0.00248       Power = 0.0025         PiT PiR PiR PiS

## Capacitors, ceramic general purpose type CK:

Lp = Lb \* PiT \* PiC \* PiV Lb = 0.00099

 Usage:
 Vstress =
 2.5
 S =
 0.0556

 Lb
 PiT
 PiC
 Pi V
 Nc

 0.00099
 1.92167
 0.219
 1.0008
 1

# Diodes, Low Frequency:

Lp = Lb \* PiT \* PiS \* PiC

0.000417

Diodes, Power Rectifier, Fast Recovery, Lb = 0.025

D2			Volts =	150	Watts =	4.29	Tj =	175	'K/W=	34.965	
Usage:			Volts =	15	Ic =	0.001	Vs =	0.1	Power =	0.0007	
Lb	PiT	PiS	PiC					Nc	Tj =	40.023	
0.025	1.6451	0.054	1					1			0.002221

Sum of all components 0.013383

Hybrid microcircuit:

Lp=sumLc\*(1+.2\*PiE) \* PiF \* PiQ \* PiL 0.013383 1.4 5.8 10 1

Total failures per million hours = 1.0867 Mean time between failures = 920194