

APEX MICROTECHNOLOGY CORPORATION
RELIABILITY PREDICTION
PB58

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 =	22 W
Supply voltage is +/-	132 V
An AC signal is applied.	
Product introduction date:	01-Nov-89

The results of this prediction are:

11 failures per million hours; or,
MTBF=90.8 thousand hours.

Transistors, Low Frequency, Bipolar:

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

Q5		Volts = 40	Watts = 1.2	Tj = 175	'K/W= 125
Usage:	Vstress = 2.5	Vpwr = 0.65	Ic = 1E-05	Vs = 0.0625	Power = 6.5E-06
Lb	PiT	PiR	PiS	Nc	Tj = 40.0008
0.00074	1.404925	1.0698	0.05462	1	6.07E-05

Q1		Volts = 40	Watts = 1.2	Tj = 175	'K/W= 125
Usage:	Vstress = 7.1	Vpwr = 4.7	Ic = 1E-05	Vs = 0.1775	Power = 4.7E-05
Lb	PiT	PiR	PiS	Nc	Tj = 40.0059
0.00074	1.405078	1.0698	0.07802	1	8.68E-05

Q7		Volts = 40	Watts = 1.2	Tj = 175	'K/W= 125
Usage:	Vstress = 2.5	Vpwr = 0.65	Ic = 1E-05	Vs = 0.0625	Power = 6.5E-06
Lb	PiT	PiR	PiS	Nc	Tj = 40.0008
0.00074	1.404925	1.0698	0.05462	1	6.07E-05

Q10		Volts = 350	Watts = 5	Tj = 200	'K/W= 35
Usage:	Vstress = 259	Vpwr = 127.5	Ic = 0.005	Vs = 0.74	Power = 0.6375
Lb	PiT	PiR	PiS	Nc	Tj = 62.3125
0.00074	2.20206	1.8139	0.44615	1	0.001319

Q4		Volts = 300	Watts = 20	Tj = 150	'K/W= 6.25
Usage:	Vstress = 144	Vpwr = 127.3	Ic = 0.001	Vs = 0.48	Power = 0.1273
Lb	PiT	PiR	PiS	Nc	Tj = 40.7956
0.00074	1.429166	3.0296	0.19927	1	0.000638

Q9		Volts = 300	Watts = 20	Tj = 150	'K/W= 6.25
Usage:	Vstress = 145	Vpwr = 129.5	Ic = 0.0015	Vs = 0.4833	Power = 0.19425
Lb	PiT	PiR	PiS	Nc	Tj = 41.2141
0.00074	1.442045	3.0296	0.20134	1	0.000651

Transistors, Low Frequency, Si JFET: Lb = 0.0045

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

Q11		Volts = 300	Watts = 3	Tj = 150	'K/W= 41.6667
Usage:		Vpwr = 258	Id = 0.001		Power = 0.258
Lb	PiT			Nc	Tj = 50.75
0.0045	1.671607			1	0.007522

Transistors, Low Frequency, Si MOSFET: Lb = 0.012

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

Q3,8		Volts = 350	Watts = 115.4	Tj = 175	'K/W= 1.29983
Usage:		Fraction Output Pwr = 1/	1		Power = 22
Lb	PiT			Nc	Tj = 68.5962

0.012

2.280564

2

0.054734

Q6	Volts = 450	Watts = 4	Tj =	150	'K/W= 31.25
Usage:	Vpwr = 4.5	Id = 0.0037			Power = 0.01652
Lb	PiT			Nc	Tj = 40.5161
0.012	1.376709			1	0.016521

Q2	Volts = 450	Watts = 4	Tj =	150	'K/W= 31.25
Usage:	Vpwr = 128.5	Id = 0.005			Power = 0.6425
Lb	PiT			Nc	Tj = 60.0781
0.012	1.974483			2	0.047388

Capacitors, ceramic general purpose type CK:

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

C1	Volts = 50	pF = 68			
Usage:	Vstress = 1.5		S =	0.03	
Lb	PiT	PiC	PiV	Nc	
0.00099	1.92167	0.226	1.0001	1	0.000431

C2	Volts = 50	pF = 15000			
Usage:	Vstress = 4.5		S =	0.09	
Lb	PiT	PiC	PiV	Nc	
0.00099	1.92167	0.368	1.0034	1	0.000702

Diodes, Low Frequency:

$L_p = L_b * PiT * PiS * PiC$

Diodes, Zener, Lb = 0.002

D1	Volts = 3.1	Watts = 2.5	Tj =	175	'K/W= 60
Usage:		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 0.135585

Hybrid microcircuit:

$L_p = \sum L_c * (1 + 2 * PiE) * PiF * PiQ * PiL$

0.135585 1.4 5.8 10 1

Total failures per million hours = 11.0095

Mean time between failures = 90830.7