APEX MICROTECHNOLOGY CORPORATION
RELIABILITY PREDICTION
PB58

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 = 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:

\[ L_p = L_b \cdot \pi T \cdot \pi R \cdot \pi S \]

<table>
<thead>
<tr>
<th>Transistor</th>
<th>Volts</th>
<th>Watts</th>
<th>Tj (°C)</th>
<th>K/W</th>
<th>Usage</th>
<th>Vstress</th>
<th>Vpwr</th>
<th>Ic (A)</th>
<th>Vs (A)</th>
<th>Power (W)</th>
<th>Lb, πT, πR, πS, Nc, Tj</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q5</td>
<td>40</td>
<td>1.2</td>
<td>175</td>
<td>125</td>
<td>2.5</td>
<td>0.65</td>
<td>1E-05</td>
<td>0.0625</td>
<td>6.5E-06</td>
<td>40.0008</td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>40</td>
<td>1.2</td>
<td>175</td>
<td>125</td>
<td>7.1</td>
<td>4.7</td>
<td>1E-05</td>
<td>0.1775</td>
<td>4.7E-05</td>
<td>40.0059</td>
<td></td>
</tr>
<tr>
<td>Q7</td>
<td>40</td>
<td>1.2</td>
<td>175</td>
<td>125</td>
<td>2.5</td>
<td>0.65</td>
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<td>40.0008</td>
<td></td>
</tr>
<tr>
<td>Q10</td>
<td>350</td>
<td>5</td>
<td>200</td>
<td>35</td>
<td>259</td>
<td>127.5</td>
<td>0.005</td>
<td>0.74</td>
<td>0.6375</td>
<td>62.3125</td>
<td></td>
</tr>
<tr>
<td>Q4</td>
<td>300</td>
<td>20</td>
<td>150</td>
<td>6.25</td>
<td>144</td>
<td>127.3</td>
<td>0.001</td>
<td>0.48</td>
<td>0.1273</td>
<td>40.7956</td>
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<tr>
<td>Q9</td>
<td>300</td>
<td>20</td>
<td>150</td>
<td>6.25</td>
<td>145</td>
<td>129.5</td>
<td>0.0015</td>
<td>0.4833</td>
<td>0.19425</td>
<td>41.2141</td>
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Transistors, Low Frequency, Si JFET:

\[ L_p = L_b \cdot \pi T \]

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<td>Q11</td>
<td>300</td>
<td>3</td>
<td>150</td>
<td>6.25</td>
<td>258</td>
<td>0.001</td>
<td>0.258</td>
<td>41.6667</td>
<td>1.671607</td>
</tr>
<tr>
<td>Q3,8</td>
<td>350</td>
<td>115.4</td>
<td>175</td>
<td>1.29983</td>
<td>Fraction Output Pwr = 1</td>
<td>22</td>
<td>68.5962</td>
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Transistors, Low Frequency, Si MOSFET:

\[ L_p = L_b \cdot \pi T \]

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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:  
Lp = Lb * PIT * PIC * PV  
Lb = 0.00099  

C1  
Volts = 50  pF = 68  
Usage: Vstress = 1.5  S = 0.03  
Lb  PIT  PIC  PI V  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  PI V  Nc  
0.00099  1.92167  0.368  1.0034  1  0.000702  

Diodes, Low Frequency:  
Lp = Lb * 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:  
Lp=sumLc*(1+.2*PJE) * PIF * PIQ * PiL  
0.135585  1.4  5.8  10  1  

Total failures per million hours = 11.0095  
Mean time between failures = 90830.7