APEX MICROTECHNOLOGY CORPORATION
RELIABILITY PREDICTION
SA50

by

Granger Scofield

Date of prediction: 15-Mar-01

This reliability prediction is based on MIL-HDBK-217F,

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 28 V
An AC signal is applied.
Product introduction date: 01-Jun-94

The results of this prediction are:
9.33 failures per million hours; or,
MTBF=107 thousand hours.
Monolithic MOS Digital Devices:
\[ L_p = C_1 * \pi T \]

Monolithic Bipolar and MOS Linear Devices:
\[ L_p = C_1 * \pi T \]

<table>
<thead>
<tr>
<th>IC1</th>
<th>Watts</th>
<th>Tj</th>
<th>#/Qs</th>
<th>Usage: Watts</th>
<th>Max Tj</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001</td>
<td>3.26747</td>
<td>1</td>
<td>0.032675</td>
<td>72.604</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IC1</th>
<th>Watts</th>
<th>Tj</th>
<th>#/Qs</th>
<th>Usage: Watts</th>
<th>Max Tj</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001</td>
<td>3.350636</td>
<td>1</td>
<td>0.003506</td>
<td>40.54</td>
<td></td>
</tr>
</tbody>
</table>

Transistors, Low Frequency, Si MOSFET: \( L_b = 0.012 \)
\[ L_p = L_b * \pi T \]

<table>
<thead>
<tr>
<th>Q10,13</th>
<th>Volts</th>
<th>Watts</th>
<th>Tj</th>
<th>#/Qs</th>
<th>Usage: Fraction Output Pwr = 1/2</th>
<th>Power = 2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.012</td>
<td>1.537218</td>
<td>2</td>
<td>0.036893</td>
<td>46.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q11,12</th>
<th>Volts</th>
<th>Watts</th>
<th>Tj</th>
<th>#/Qs</th>
<th>Usage: Fraction Output Pwr = 1/20</th>
<th>Power = 0.25</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.012</td>
<td>1.379647</td>
<td>2</td>
<td>0.033112</td>
<td>40.625</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Capacitors, ceramic general purpose type CK:
\[ L_p = L_b * \pi T * \pi C * \pi V \]
\[ L_b = 0.00099 \]

<table>
<thead>
<tr>
<th>C1</th>
<th>Volts</th>
<th>pF</th>
<th>Usage: Vstress</th>
<th>S</th>
<th>Lb</th>
<th>Pi T</th>
<th>Pi C</th>
<th>Pi V</th>
<th>Nr</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>10000</td>
<td>0.24</td>
<td>12</td>
<td>0.00099</td>
<td>1.92167</td>
<td>0.355</td>
<td>1.064</td>
<td>1</td>
<td>0.000718</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C2,3</th>
<th>Volts</th>
<th>pF</th>
<th>Usage: Vstress</th>
<th>S</th>
<th>Lb</th>
<th>Pi T</th>
<th>Pi C</th>
<th>Pi V</th>
<th>Nr</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>100000</td>
<td>0.456</td>
<td>11.4</td>
<td>0.00099</td>
<td>1.92167</td>
<td>0.437</td>
<td>1.439</td>
<td>2</td>
<td>0.00239</td>
</tr>
</tbody>
</table>
C4

Volts = 50  pF = 270
Usage: Vstress = 8  S = 0.16
Lb  PiT  PiC  PiV  Nc
0.00099 1.92167 0.256 1.019 1 0.000497

Diodes, Low Frequency:
Lp = Lb * PiT * PiS * PiC

Diodes, Switching, Lb = 0.001

D3-6
Volts = 100  Watts = 0.38  Tj = 175  °K/W = 394.74
Usage: Volts = 11  Ic = 0.001  Vs = 0.11  Power = 0.0007
Lb  PiT  PiS  PiC  Nc  Tj = 40.257
0.001 1.657271 0.054 2 4 0.000716

Diodes, Power Rectifier, Fast Recovery, Lb = 0.025

D1.2
Volts = 100  Watts = 4.29  Tj = 175  °K/W = 34.965
Usage: Volts = 28  Ic = 0.001  Vs = 0.28  Power = 0.0007
Lb  PiT  PiS  PiC  Nc  Tj = 40.023
0.025 1.6451 0.054 1 2 0.004442

Sum of all components 0.114949

Hybrid microcircuit:
Lp = sumLc*(1+.2*PiE) * PiF * PiQ * PiL
0.114949 1.4 5.8 10 1

Total failures per million hours = 9.3338
Mean time between failures = 107137