

# **MTBF Prediction Report**

**Model Name: GTM41133-9016-4.0**

**Customer: Standard model**

**Stage: MVT**

**PCB Rev.: C**

**Part List Rev.: 1**

**Spec Rev.: E**

**Conclusion:**

|                                            |
|--------------------------------------------|
| <input checked="checked" type="checkbox"/> |
| <input type="checkbox"/>                   |

**PASS**

**FAIL**

**Prepared By:** Michael

**Approved By:** Jet



**GTM41133-9016-4.0 CMTBF REPORT LIST**  
**PART LIST REV: 01**

| COMPONENT                         | FAILURE RATE | Q'TY |
|-----------------------------------|--------------|------|
| RESISTOR                          | 0.32515739   | 50   |
| CAPACITOR ( except electrolytic ) | 0.404860802  | 29   |
| CAPACITOR ( electrolytic )        | 1.052620594  | 4    |
| Zener Diodes                      | 0.09353364   | 3    |
| DIODE                             | 0.374055819  | 12   |
| Integrated Circuits               | 0.605080988  | 2    |
| IC-Opto-couplers                  | 0.178719827  | 1    |
| Magnetic                          | 0.023669428  | 5    |
| Fuse                              | 0.02         | 2    |
| Transistor-bipolar GP or sw       | 0.017901584  | 4    |
| Transistor-Power MOSFET           | 1.795554071  | 5    |
| TOTAL                             | 4.89115414   | 117  |
| MTBF                              | 204,450.72   |      |
| MTBF SPEC.                        | 200,000      |      |
| Conclusion                        | OK           |      |

| Input Voltage | NO . | Test Item                          | Page  |
|---------------|------|------------------------------------|-------|
|               |      | Cover,Report,Part list,and summary | 1~4   |
| 240V          | 1    | Fuse                               | 5     |
|               | 2    | Magnetics                          | 6     |
|               | 3    | Integrated Circuits                | 7     |
|               | 4    | IC - Opto-couplers                 | 8     |
|               | 5    | Zener Diode                        | 9     |
|               | 6    | Diode                              | 10    |
|               | 7    | Capacitors, except electrolytic    | 11    |
|               | 8    | Capacitors, electrolytic           | 12    |
|               | 9    | Transistor-bipolar GP or sw        | 13    |
|               | 10   | Transistor-Power MOSFET            | 14    |
|               | 11   | Resistor                           | 15~16 |

|                   |                   |           |  |                |           |
|-------------------|-------------------|-----------|--|----------------|-----------|
| CMTBF TEST REPORT |                   |           |  | Test Engineer: | Maichael  |
| Model Name:       | GTM41133-9016-4.0 | Customer: |  | Test Date:     | 2015-4-24 |
| Quantity:         | 1                 | Ser. No.: |  |                |           |

**1. Purpose:**  
Verify PSU whether or not to meet the customer CMTBF specification.

**2. Conditions:**  
Input: 240V AC  
Output: 12V/7.5A  
Ambient: 25 degree C

**3. Equipment:**  
Oscilloscope: Tek3054B, AC source: HP6813A, Electronic load:Chroma6310  
Multimeter: Agilent34401A, Current Probe Amplifier:Tek TM502A

**4. Criteria:**  
The life time of the power supply component shall exceed 200,000 hours when 240vac and maximun load at 25℃ .Calculated using the formula by the MIL-HDBK-217F.

**5. REGISTER:**  
Details,please refer to the report content.

**6. Result:**  
The MTBF value meets customer spec..



**MTBF prediction worksheet - Fuse**

Model : GTM41133-9016-4.0

Conditions: Vin=240VAC; Output Load: +12V/7.5A

Amb. : 25°C

| Component description |                 |          | Component specifications | Stress   | Failure rate |         |             |
|-----------------------|-----------------|----------|--------------------------|----------|--------------|---------|-------------|
| Ref. Design           | Part No.        | Type     |                          | I(RMS) A | $\lambda_b$  | $\pi E$ | $\lambda_p$ |
| FS1                   | 160-27146315(R) | W-F-1814 | 3.15A/250V               | 0.888    | 0.01         | 1       | 0.01        |
| FS2                   | 160-27146316(R) | W-F-1814 | 3.15A/251V               | 0.886    | 0.01         | 1       | 0.01        |
| TOTAL                 |                 |          |                          |          |              |         | 0.02        |



## MTBF prediction worksheet - Magnetics

Model : GTM41133-9016-4.0

Conditions:  $V_{in}=240V_{AC}$ ; Output Load:  $+12V/7.5A$

Amb . : 25°C

| Component description |                     |      | Component specifications | Stress | Failure rate |         |         |         |             |
|-----------------------|---------------------|------|--------------------------|--------|--------------|---------|---------|---------|-------------|
| Ref. Design           | Part No.            | Type | Tcore                    | Tcore  | $\lambda b$  | $\pi Q$ | $\pi E$ | $\pi c$ | $\lambda p$ |
|                       |                     |      | deg.C                    | deg.C  |              |         |         |         |             |
| LF2                   | OSP-321-02401864®   | C    | 130                      | 63.6   | 0.000529206  | 4       | 1       | 1       | 0.002116824 |
| LF1                   | OSP-321-02403892®   | C    | 130                      | 54.3   | 0.000474318  | 4       | 1       | 1       | 0.001897273 |
| L1                    | 321-02404642®       | C    | 130                      | 65.1   | 0.000539878  | 4       | 1       | 1       | 0.002159511 |
| L2                    | 321-02402602(R)     | C    | 130                      | 66.9   | 0.000553476  | 4       | 1       | 1       | 0.002213904 |
| T1                    | OSP-320-02974502(R) | X    | 130                      | 79.3   | 0.003820479  | 4       | 1       | 1       | 0.015281916 |
| TOTAL                 |                     |      |                          |        |              |         |         |         | 0.023669428 |



## MTBF prediction worksheet - Integrated Circuits

Model : GTM41133-9016-4.0

Conditions:  $V_{in}=240VAC$ ; Output Load:  $+12V/7.5A$

Amb. : 25°C

| Component description |                 |            |       | Component specifications |          |          |         |       | Sress     |         |       |        | Failure rate |        |        |    |    |     |             |
|-----------------------|-----------------|------------|-------|--------------------------|----------|----------|---------|-------|-----------|---------|-------|--------|--------------|--------|--------|----|----|-----|-------------|
| Ref. Design           | Part No.        | Type       | Maker | Pin NO.                  | VCC(max) | Ic (rms) | Rth     | Tj    | VCC(peak) | Ic(rms) | Ta    | Tj(c)  | C1           | C2     | πT     | πL | πQ | πE  | λp          |
|                       |                 |            |       |                          | V        | A        | deg.C/W | deg.C | V         | A       | deg.C | deg.C  |              |        |        |    |    |     |             |
| US1                   | 265-07040001(R) | PWM        | NXP   | 16                       | 38       | 0.003    | 124     | 150   | 25.48     | 0.001   | 71    | 74.16  | 0.01         | 0.0072 | 2.9193 | 1  | 10 | 0.5 | 0.327878932 |
| US2                   | 269-03130001(R) | Amplifiers | ST    | 8                        | 36       | 0.002    | 175     | 125   | 12.67     | 0.001   | 70    | 72.217 | 0.01         | 0.0034 | 2.602  | 1  | 10 | 0.5 | 0.277202056 |
| TOTAL                 |                 |            |       |                          |          |          |         |       |           |         |       |        |              |        |        |    |    |     | 0.605080988 |



Component CMTBF analysis worksheet - IC-Opto-couplers  
Model :GTM41133-9016-4.0  
Conditions:Vin=240VAC; Output Load:+12V/7.5A  
Amb.:25°C

| Component description |               |      |        | Component specifications |             |             |         |       | Worse case stress in application |             |         |       |       |       |         |             | Failure rate |         |             |          |           |
|-----------------------|---------------|------|--------|--------------------------|-------------|-------------|---------|-------|----------------------------------|-------------|---------|-------|-------|-------|---------|-------------|--------------|---------|-------------|----------|-----------|
| Ref. Design           | Part No.      | Type | Maker  | P/Pc                     | VR/Vce(max) | IF/Ice(rms) | Rth     | Tj    | VR/Vce(max)                      | IF/Ice(rms) | P/Pc    |       | Ta    | Tj    | $\pi T$ | $\lambda b$ | $\pi Q$      | $\pi E$ | $\lambda p$ |          |           |
|                       |               |      |        | W                        | V           | A           | deg.C/W | deg.C | Vpeak(V)                         | Ratio       | Irms(A) | Ratio | W     | Ratio | deg.C   | deg.C       |              |         |             |          |           |
| U1                    | 260-00510001® | PHO  | LITEON | 0.07                     | 6           | 0.05        | 400     | 100   | 1.76                             | 0.293       | 0.002   | 0.04  | 0.004 | 0.05  | 79.9    | 81.31       | 4.0012       | 0.0055  | 8           | 1        | 0.176051  |
|                       |               |      |        | 0.15                     | 35          | 0.05        | 425     | 100   | 2.24                             | 0.064       | 0.003   | 0.06  | 0.007 | 0.04  | 79.9    | 82.76       | 4.1225       | 0.0055  | 8           | 1        | 0.1813886 |
| TOTAL                 |               |      |        |                          |             |             |         |       |                                  |             |         |       |       |       |         |             |              |         |             | 0.178720 |           |



### MTBF prediction worksheet - Zener Diodes

Model : GTM41133-9016-4.0

Conditions:  $V_{in}=240VAC$ ; Output Load:  $+12V/7.5A$

Amb. : 25°C

| Component description |                 |        | Component specifications |      |     |         |        | Stress |         |       |        | Failure rate |         |         |         |         |         |             |
|-----------------------|-----------------|--------|--------------------------|------|-----|---------|--------|--------|---------|-------|--------|--------------|---------|---------|---------|---------|---------|-------------|
| Ref. Desig.           | Part No.        | Maker  | Vz                       | Iz   | Pd  | Rth     | Tj     | Vz     | Iz(rms) | Ta    | Tj(c)  | $\lambda_b$  | $\pi E$ | $\pi Q$ | $\pi t$ | $\pi s$ | $\pi c$ | $\lambda_p$ |
|                       |                 |        | V                        | I    | W   | deg.C/W | deg. C | V      | A       | deg.C | deg.C  |              |         |         |         |         |         |             |
| DZ3                   | 211-02107004(R) | PANJIT | 16.8                     | 0.25 | 0.5 | 450     | 150    | 16.42  | 0.004   | 77.6  | 107.16 | 0.002        | 1       | 5.5     | 3.43099 | 1       | 1       | 0.037741    |
| DZ4                   | 211-02107004(R) | PANJIT | 16.8                     | 0.25 | 0.5 | 450     | 150    | 1.48   | 0.003   | 76.5  | 78.498 | 0.002        | 1       | 5.5     | 2.38275 | 1       | 1       | 0.02621     |
| DZ5                   | 211-02107004(R) | PANJIT | 16.8                     | 0.25 | 0.5 | 450     | 150    | 5.9    | 0.004   | 76.9  | 87.52  | 0.002        | 1       | 5.5     | 2.68932 | 1       | 1       | 0.029582    |
| TOTAL                 |                 |        |                          |      |     |         |        |        |         |       |        |              |         |         |         |         |         | 0.093534    |

**MTBF prediction worksheet - Diodes**

Model: GTM41133-9016-4.0

Conditions: Vin=240VAC; Output Load: +12V/7.5A

Amb.: 25°C

| Component description |                 |         | Maker  | Component specifications |          |      |         |          |   | Stress  |          |        |       | Failure Rate |       |    |     |        |      |        |        |
|-----------------------|-----------------|---------|--------|--------------------------|----------|------|---------|----------|---|---------|----------|--------|-------|--------------|-------|----|-----|--------|------|--------|--------|
| Ref.Design            | Part No.        | Type    |        | Vr                       | If, ave. | Vf   | Rth     | Tj rated | K | Vr.peak | Vr.ratio | If.ave | Ta    | Tj(c)        | λb    | πE | πQ  | πt     | πs   | πc     | λp     |
|                       |                 |         |        | V                        | A        | V    | deg.C/W | deg.C    |   | V       |          | A      | deg.C | deg.C        |       |    |     |        |      |        |        |
| BD1                   | 202-05890001(R) | BRG     | HY     | 600                      | 4        | 1.1  | 2.4     | 150      | 1 | 346     | 0.577    | 0.436  | 67    | 68.15        | 0.005 | 1  | 5.5 | 3.7135 | 0.26 | 1      | 0.0268 |
| D1                    | 208-00814001(R) | GENERAL | PSI    | 600                      | 4        | 1.28 | 63      | 175      | 1 | 375     | 0.625    | 0.279  | 66.5  | 89           | 0.004 | 1  | 5.5 | 6.2575 | 0.32 | 1      | 0.0417 |
| D2                    | 200-00812001(R) | GENERAL | PSI    | 1000                     | 3        | 1.2  | 20      | 150      | 1 | 458     | 0.458    | 0.295  | 66.5  | 73.58        | 0.004 | 1  | 5.5 | 4.2798 | 0.15 | 1      | 0.0134 |
| D3                    | 206-01407005(R) | FR      | PANJIT | 1000                     | 1        | 1.3  | 65      | 175      | 1 | 122     | 0.122    | 0.009  | 67.8  | 68.56        | 0.069 | 1  | 5.5 | 3.7541 | 0.05 | 1      | 0.0769 |
| DS1                   | 218-02470001(R) | GENERAL | PANJIT | 75                       | 0.15     | 1    | 450     | 150      | 1 | 4.39    | 0.059    | 0.007  | 75.6  | 78.75        | 0.004 | 1  | 5.5 | 4.8793 | 0.05 | 1      | 0.0055 |
| DS2                   | 218-02470001(R) | GENERAL | PANJIT | 75                       | 0.15     | 1    | 450     | 150      | 1 | 6.79    | 0.091    | 0.006  | 76.3  | 79           | 0.004 | 1  | 5.5 | 4.9098 | 0.05 | 1      | 0.0055 |
| DS3                   | 218-02470001(R) | GENERAL | PANJIT | 75                       | 0.15     | 1    | 450     | 150      | 1 | 6.66    | 0.089    | 0.005  | 77.3  | 79.55        | 0.004 | 1  | 5.5 | 4.9775 | 0.05 | 1      | 0.0056 |
| DS4                   | 218-02470001(R) | GENERAL | PANJIT | 75                       | 0.15     | 1    | 450     | 150      | 1 | 3.85    | 0.051    | 0.007  | 77.6  | 80.75        | 0.004 | 1  | 5.5 | 5.1278 | 0.05 | 1      | 0.0058 |
| DS5                   | 218-02470001(R) | GENERAL | PANJIT | 75                       | 0.15     | 1    | 450     | 150      | 1 | 72.3    | 0.963    | 0.008  | 75.4  | 79           | 0.004 | 1  | 5.5 | 4.9098 | 0.91 | 1      | 0.0937 |
| DS7                   | 218-02470001(R) | GENERAL | PANJIT | 75                       | 0.15     | 1    | 450     | 150      | 1 | 50.5    | 0.673    | 0.006  | 74.5  | 77.2         | 0.004 | 1  | 5.5 | 4.6931 | 0.38 | 1      | 0.0375 |
| DS8                   | 218-02470001(R) | GENERAL | PANJIT | 75                       | 0.15     | 1    | 450     | 150      | 1 | 34.9    | 0.465    | 0.005  | 76.3  | 78.55        | 0.004 | 1  | 5.5 | 4.8549 | 0.16 | 1      | 0.0158 |
| DS9                   | 218-02470001(R) | GENERAL | PANJIT | 75                       | 0.15     | 1    | 450     | 150      | 1 | 54.2    | 0.723    | 0.007  | 75.1  | 78.25        | 0.004 | 1  | 5.5 | 4.8186 | 0.45 | 1      | 0.0457 |
| TOTAL                 |                 |         |        |                          |          |      |         |          |   |         |          |        |       |              |       |    |     |        |      | 0.3741 |        |

### MTBF prediction worksheet - Capacitors, except electrolytic

Model : GTM41133-9016-4.0

Conditions:  $V_{in}=240VAC$ ; Output Load:  $+12V/7.5A$

Amb. : 25°C

| Component description |                 |      |          | Component specifications |            |             | Stress |       |         | Failure rate |          |    |    |           |
|-----------------------|-----------------|------|----------|--------------------------|------------|-------------|--------|-------|---------|--------------|----------|----|----|-----------|
| Ref. Design           | Part No.        | Type | Maker    | Cap.                     | Vmax rated | temp. rated | Tc     | V     | V ratio | πcv          | λb       | πQ | πE | λp        |
|                       |                 |      |          | uF                       | V          | deg C       | deg.C  | V     |         |              |          |    |    |           |
| CX1                   | 125-08305475(R) | MPF  | DAIN     | 0.47                     | 275        | 125         | 55.7   | 240   | 0.87273 | 1.724704     | 0.017553 | 3  | 1  | 0.0908229 |
| C1                    | 125-07074705(R) | MPP  | ARATRONI | 0.47                     | 400        | 125         | 66.4   | 346   | 0.865   | 1.724704     | 0.017575 | 3  | 1  | 0.0909373 |
| C2                    | 125-07074705(R) | MPP  | ARATRONI | 0.47                     | 400        | 125         | 67.6   | 350   | 0.875   | 1.724704     | 0.018222 | 3  | 1  | 0.0942839 |
| C3                    | 122-12101102(R) | MON  | SUCCESS  | 0.0001                   | 1000       | 85          | 70.3   | 395   | 0.395   | 0.680431     | 0.002569 | 3  | 1  | 0.0052445 |
| C7                    | 122-12101102(R) | MON  | SUCCESS  | 0.0001                   | 1000       | 85          | 73.3   | 577   | 0.577   | 0.680431     | 0.006405 | 3  | 1  | 0.0130739 |
| C8                    | 122-12101102(R) | MON  | SUCCESS  | 0.0001                   | 1000       | 85          | 74.2   | 65.53 | 0.06553 | 0.680431     | 0.000799 | 3  | 1  | 0.001632  |
| C5                    | 122-07101333(R) | MON  | SUCCESS  | 0.0033                   | 630        | 85          | 72.3   | 205   | 0.3254  | 0.999587     | 0.001791 | 3  | 1  | 0.005372  |
| CY1                   | 122-11044103(R) | MON  | TDK      | 0.01                     | 250        | 100         | 73.4   | 30    | 0.12    | 1.129234     | 0.00084  | 3  | 1  | 0.0028457 |
| CY2                   | 122-11044103(R) | MON  | TDK      | 0.01                     | 250        | 100         | 71.9   | 75    | 0.3     | 1.129234     | 0.001572 | 3  | 1  | 0.0053267 |
| CS2                   | 120-24092203(R) | MON  | TDK      | 2.2                      | 25         | 125         | 77.8   | 5.28  | 0.2112  | 2.043856     | 0.001078 | 3  | 1  | 0.0066105 |
| CS3                   | 120-26093305(R) | MON  | TDK      | 0.33                     | 50         | 125         | 76.9   | 2.42  | 0.0484  | 1.658901     | 0.000801 | 3  | 1  | 0.0039843 |
| CS15                  | 120-26093305(R) | MON  | TDK      | 0.33                     | 50         | 125         | 77.3   | 2.97  | 0.0594  | 1.658901     | 0.000804 | 3  | 1  | 0.0040029 |
| CS1                   | 120-26091006(R) | MON  | TDK      | 1                        | 50         | 125         | 77.5   | 5.28  | 0.1056  | 1.874062     | 0.000833 | 3  | 1  | 0.0046856 |
| CS22                  | 120-26091006(R) | MON  | TDK      | 1                        | 50         | 125         | 76.1   | 12.67 | 0.2534  | 1.874062     | 0.001275 | 3  | 1  | 0.0071674 |
| CS5                   | 120-26091002(R) | MON  | TDK      | 0.0001                   | 50         | 125         | 75.9   | 0.026 | 0.00052 | 0.680431     | 0.000795 | 3  | 1  | 0.0016229 |
| CS24                  | 120-26091002(R) | MON  | TDK      | 0.001                    | 50         | 125         | 76.9   | 12.96 | 0.2592  | 0.876564     | 0.001311 | 3  | 1  | 0.0034487 |
| CS10                  | 120-06081005(R) | MON  | TDK      | 0.1                      | 50         | 125         | 77.8   | 1.02  | 0.0204  | 1.454735     | 0.000799 | 3  | 1  | 0.0034892 |
| CS16                  | 120-06081005(R) | MON  | TDK      | 0.1                      | 50         | 125         | 77.1   | 25.48 | 0.5096  | 1.454735     | 0.004708 | 3  | 1  | 0.0205445 |
| CS18                  | 120-26071003(R) | MON  | TDK      | 0.001                    | 50         | 125         | 76.9   | 13.24 | 0.2648  | 0.876564     | 0.001345 | 3  | 1  | 0.0035382 |
| CS6                   | 120-26091004(R) | MON  | TDK      | 0.01                     | 50         | 125         | 76.2   | 2.51  | 0.0502  | 1.129234     | 0.000799 | 3  | 1  | 0.0027082 |
| CS12                  | 120-26091004(R) | MON  | TDK      | 0.01                     | 50         | 125         | 77.3   | 3.83  | 0.0766  | 1.129234     | 0.000811 | 3  | 1  | 0.0027488 |
| CS14                  | 120-26091004(R) | MON  | TDK      | 0.01                     | 50         | 125         | 76.8   | 2.65  | 0.053   | 1.129234     | 0.000801 | 3  | 1  | 0.0027149 |
| CS11                  | 120-26092202(R) | MON  | TDK      | 0.00022                  | 50         | 125         | 77.6   | 1.36  | 0.0272  | 0.742079     | 0.000799 | 3  | 1  | 0.0017796 |
| CS9                   | 120-26092205(R) | MON  | TDK      | 0.22                     | 50         | 125         | 77.9   | 3.86  | 0.0772  | 1.586538     | 0.000813 | 3  | 1  | 0.00387   |
| CS4                   | 120-26093302(R) | MON  | TDK      | 0.00033                  | 50         | 125         | 76.5   | 10.42 | 0.2084  | 0.775926     | 0.001063 | 3  | 1  | 0.0024751 |
| CS21                  | 120-26071005(R) | MON  | TDK      | 0.1                      | 50         | 125         | 75.9   | 8.95  | 0.179   | 1.454735     | 0.000964 | 3  | 1  | 0.0042066 |
| CS8                   | 120-26094704(R) | MON  | TDK      | 0.047                    | 50         | 125         | 76.3   | 1.12  | 0.0224  | 1.338797     | 0.000796 | 3  | 1  | 0.003198  |
| CS7                   | 120-26094705(R) | MON  | TDK      | 0.47                     | 50         | 125         | 77.8   | 3.54  | 0.0708  | 1.724704     | 0.00081  | 3  | 1  | 0.0041898 |
| CS23                  | 120-26091003(R) | MON  | TDK      | 0.001                    | 50         | 125         | 77.9   | 21.55 | 0.431   | 0.876564     | 0.00317  | 3  | 1  | 0.0083365 |
| TOTAL                 |                 |      |          |                          |            |             |        |       |         |              |          |    |    | 0.4048608 |



| Component description |                 |      |        | Component specifications |            |          |         |          | Stress    |         |       |         | Failure rate |             |         |         |         |         |         |             |
|-----------------------|-----------------|------|--------|--------------------------|------------|----------|---------|----------|-----------|---------|-------|---------|--------------|-------------|---------|---------|---------|---------|---------|-------------|
| Ref.Design            | Part No.        | Type | Maker  | Pd rated                 | Vceo rated | Ic rated | Rth     | Tj rated | Vce, peak | Ic(ave) | Ta    | Tj(c)   | $\pi$ T      | $\lambda$ b | $\pi$ S | $\pi$ R | $\pi$ A | $\pi$ Q | $\pi$ E | $\lambda$ p |
|                       |                 |      |        | W                        | V          | A        | deg.C/W | deg.C    | V         | A       | deg.C | deg.C   |              |             |         |         |         |         |         |             |
| QS1                   | 227-03412001(R) | PNP  | JCST   | 0.25                     | 60         | 0.6      | 500     | 150      | 8.23      | 0.005   | 77.8  | 98.375  | 4.0617       | 0.00074     | 0.05    | 4.549   | 0.7     | 5.5     | 1       | 0.002632    |
| QS2                   | 227-03412001(R) | PNP  | JCST   | 0.25                     | 60         | 0.6      | 500     | 150      | 20.58     | 0.004   | 76.9  | 118.06  | 5.4094       | 0.00074     | 0.05    | 4.549   | 0.7     | 5.5     | 1       | 0.003505    |
| QS4                   | 227-03412001(R) | PNP  | JCST   | 0.25                     | 60         | 0.6      | 500     | 150      | 7.5       | 0.005   | 77.5  | 96.25   | 3.9308       | 0.00074     | 0.05    | 4.549   | 0.7     | 5.5     | 1       | 0.002547    |
| QS3                   | 224-03470003(R) | NPN  | PANJIT | 0.3                      | 65         | 0.1      | 375     | 150      | 54.61     | 0.006   | 77.2  | 200.073 | 13.809       | 0.00074     | 0.05    | 4.686   | 0.7     | 5.5     | 1       | 0.009217    |
| TOTAL                 |                 |      |        |                          |            |          |         |          |           |         |       |         |              |             |         |         |         |         |         | 0.017902    |



## MTBF prediction worksheet - Resistors

Model : GTM41133-9016-4.0

Conditions:  $V_{in}=240VAC$ ; Output Load:  $+12V/7.5A$

Amb. : 25°C

| Component description |                 |      |       | Component specifications |       |             |       |      | Stress |       |              |            | Failure Rate |          |      |      |             |
|-----------------------|-----------------|------|-------|--------------------------|-------|-------------|-------|------|--------|-------|--------------|------------|--------------|----------|------|------|-------------|
| Ref. Design           | Part No.        | Type | Maker | Resistance               | Power | V rms rated | temp. | K    | Tc     | Vrms  | Power actual | Watt ratio | πR           | λb       | πQ   | πE   | λp          |
|                       |                 |      |       | Ohm                      | W     | V           | deg.C |      | deg.C  | V     | W            |            |              |          |      |      |             |
| R1                    | 102-32051009(R) | MOF  | YAGEO | 0.1                      | 2     | 350         | 200   | 1.00 | 75.2   | 0.005 | 0.000        | 0.00       | 1.00         | 0.001069 | 5.00 | 1.00 | 0.005343738 |
| R2                    | 102-32051509(R) | MOF  | YAGEO | 0.15                     | 2     | 350         | 200   | 1.00 | 74.9   | 0.027 | 0.005        | 0.00       | 1.00         | 0.001069 | 5.00 | 1.00 | 0.005345336 |
| R1A                   | 100-25013309(R) | MOF  | YAGEO | 0.33                     | 1     | 350         | 200   | 1.00 | 77.8   | 0.005 | 0.000        | 0.00       | 1.00         | 0.001093 | 5.00 | 1.00 | 0.005466987 |
| R2A                   | 100-25013309(R) | MOF  | YAGEO | 0.33                     | 1     | 350         | 200   | 1.00 | 77.5   | 0.027 | 0.002        | 0.00       | 1.00         | 0.001094 | 5.00 | 1.00 | 0.005467537 |
| RS37                  | 100-12057500(R) | R.CF | YAGEO | 7.5                      | 0.25  | 200         | 155   | 1.00 | 78.2   | 0.996 | 0.132        | 0.53       | 1.00         | 0.002167 | 5.00 | 1.00 | 0.010834928 |
| RS20                  | 100-08051003(R) | R.CF | YAGEO | 1000                     | 0.125 | 150         | 155   | 1.00 | 77.9   | 0.006 | 0.000        | 0.00       | 1.00         | 0.001094 | 5.00 | 1.00 | 0.005471266 |
| RS22                  | 100-08051003(R) | R.CF | YAGEO | 1000                     | 0.125 | 150         | 155   | 1.00 | 76.4   | 0.094 | 0.000        | 0.00       | 1.00         | 0.001080 | 5.00 | 1.00 | 0.005400055 |
| RS23                  | 100-08057502(R) | R.CF | YAGEO | 750                      | 0.125 | 150         | 155   | 1.00 | 78.2   | 0.127 | 0.000        | 0.00       | 1.00         | 0.001097 | 5.00 | 1.00 | 0.005486931 |
| RS4                   | 100-08054706(R) | R.CF | YAGEO | 4700000                  | 0.125 | 150         | 155   | 1.00 | 77.6   | 133.9 | 0.004        | 0.03       | 1.60         | 0.001135 | 5.00 | 1.00 | 0.009079940 |
| RS6                   | 100-08054706(R) | R.CF | YAGEO | 4700000                  | 0.125 | 150         | 155   | 1.00 | 77.4   | 133.8 | 0.004        | 0.03       | 1.60         | 0.001133 | 5.00 | 1.00 | 0.009063251 |
| RS1                   | 100-12054705(R) | R.CF | YAGEO | 470000                   | 0.25  | 200         | 155   | 1.00 | 77.9   | 121.6 | 0.031        | 0.13       | 1.10         | 0.001286 | 5.00 | 1.00 | 0.007075032 |
| RS2                   | 100-12054705(R) | R.CF | YAGEO | 470000                   | 0.25  | 200         | 155   | 1.00 | 78.1   | 124.3 | 0.033        | 0.13       | 1.10         | 0.001298 | 5.00 | 1.00 | 0.007139837 |
| RS44                  | 100-08014643(R) | R.CF | YAGEO | 4640                     | 0.125 | 150         | 155   | 1.00 | 76.9   | 2.57  | 0.001        | 0.01       | 1.00         | 0.001101 | 5.00 | 1.00 | 0.005503098 |
| RS8                   | 100-08055103(R) | R.CF | YAGEO | 5100                     | 0.125 | 150         | 155   | 1.00 | 78.3   | 1.92  | 0.001        | 0.01       | 1.00         | 0.001106 | 5.00 | 1.00 | 0.005531552 |
| RS16                  | 100-08051004(R) | R.CF | YAGEO | 10000                    | 0.125 | 150         | 155   | 1.00 | 77.5   | 2.17  | 0.000        | 0.00       | 1.00         | 0.001096 | 5.00 | 1.00 | 0.005478485 |
| RS36                  | 100-08051004(R) | MOF  | YAGEO | 10000                    | 0.125 | 150         | 200   | 1.00 | 76.9   | 3.15  | 0.001        | 0.01       | 1.00         | 0.001096 | 5.00 | 1.00 | 0.005478820 |
| RS48                  | 100-08051004(R) | R.CF | YAGEO | 10000                    | 0.125 | 150         | 155   | 1.00 | 77.5   | 0.256 | 0.000        | 0.00       | 1.00         | 0.001090 | 5.00 | 1.00 | 0.005452419 |
| RS55                  | 100-08051004(R) | R.CF | YAGEO | 10000                    | 0.125 | 150         | 155   | 1.00 | 78.2   | 10.29 | 0.011        | 0.08       | 1.00         | 0.001223 | 5.00 | 1.00 | 0.006117290 |
| RS31                  | 100-12051004(R) | R.CF | YAGEO | 10000                    | 0.25  | 200         | 155   | 1.00 | 78.1   | 8.85  | 0.008        | 0.03       | 1.00         | 0.001141 | 5.00 | 1.00 | 0.005706239 |
| RS14                  | 100-08051001(R) | R.CF | YAGEO | 10                       | 0.125 | 150         | 155   | 1.00 | 76.7   | 0.294 | 0.009        | 0.07       | 1.00         | 0.001183 | 5.00 | 1.00 | 0.005915247 |
| RS47                  | 100-08011804(R) | R.CF | YAGEO | 18000                    | 0.125 | 150         | 155   | 1.00 | 77.6   | 9.84  | 0.005        | 0.04       | 1.00         | 0.001153 | 5.00 | 1.00 | 0.005766915 |
| RS60                  | 100-12011503(R) | R.CF | YAGEO | 1500                     | 0.25  | 200         | 155   | 1.00 | 77.2   | 12.17 | 0.099        | 0.39       | 1.00         | 0.001805 | 5.00 | 1.00 | 0.009024999 |
| RS61                  | 100-12011503(R) | R.CF | YAGEO | 1500                     | 0.25  | 200         | 155   | 1.00 | 76.9   | 12.17 | 0.099        | 0.39       | 1.00         | 0.001799 | 5.00 | 1.00 | 0.008997315 |
| TOTAL                 |                 |      |       |                          |       |             |       |      |        |       |              |            |              |          |      |      | 0.150147218 |

## MTBF prediction worksheet - Resistors

Model : GTM41133-9016-4.0

Conditions:  $V_{in}=240VAC$ ; Output Load:  $+12V/7.5A$

Amb. : 25°C

| Component description |                 |      |       | Component specifications |       |             |       |      | Stress |       |              |            | Failure Rate |          |      |      |             |
|-----------------------|-----------------|------|-------|--------------------------|-------|-------------|-------|------|--------|-------|--------------|------------|--------------|----------|------|------|-------------|
| Ref. Design           | Part No.        | Type | Maker | Resistance               | Power | V rms rated | temp. | K    | Tc     | Vrms  | Power actual | Watt ratio | πR           | λb       | πQ   | πE   | λp          |
|                       |                 |      |       | Ohm                      | W     | V           | deg.C |      | deg.C  | V     | W            |            |              |          |      |      |             |
| RS27                  | 100-08051001(R) | R.CF | YAGEO | 10                       | 0.125 | 150         | 155   | 1.00 | 78.2   | 0.247 | 0.006        | 0.05       | 1.00         | 0.001168 | 5.00 | 1.00 | 0.005841197 |
| RS34                  | 100-08011545(R) | R.CF | YAGEO | 154000                   | 0.125 | 150         | 155   | 1.00 | 77.9   | 21.8  | 0.003        | 0.02       | 1.10         | 0.001130 | 5.00 | 1.00 | 0.006212431 |
| RS33                  | 100-08054701(R) | R.CF | YAGEO | 47                       | 0.125 | 150         | 155   | 1.00 | 76.6   | 0.488 | 0.005        | 0.04       | 1.00         | 0.001139 | 5.00 | 1.00 | 0.005697265 |
| RS32                  | 100-08051305(R) | R.CF | YAGEO | 130000                   | 0.125 | 150         | 155   | 1.00 | 77.9   | 21.67 | 0.004        | 0.03       | 1.10         | 0.001136 | 5.00 | 1.00 | 0.006246139 |
| RS17                  | 100-08053005(R) | R.CF | YAGEO | 300000                   | 0.125 | 150         | 155   | 1.00 | 77.2   | 1.02  | 0.000        | 0.00       | 1.10         | 0.001088 | 5.00 | 1.00 | 0.005981669 |
| RS3                   | 100-12051106(R) | R.CF | YAGEO | 1100000                  | 0.125 | 150         | 155   | 1.00 | 76.9   | 95.67 | 0.008        | 0.07       | 1.60         | 0.001181 | 5.00 | 1.00 | 0.009450194 |
| RS19                  | 100-08051204(R) | R.CF | YAGEO | 12000                    | 0.125 | 150         | 155   | 1.00 | 78.2   | 0.345 | 0.000        | 0.00       | 1.00         | 0.001097 | 5.00 | 1.00 | 0.005486277 |
| RS24                  | 100-08052004(R) | R.CF | YAGEO | 20000                    | 0.125 | 150         | 155   | 1.00 | 78.4   | 0.16  | 0.000        | 0.00       | 1.00         | 0.001099 | 5.00 | 1.00 | 0.005495446 |
| RS21                  | 100-08053304(R) | R.CF | YAGEO | 33000                    | 0.125 | 150         | 155   | 1.00 | 77.9   | 0.562 | 0.000        | 0.00       | 1.00         | 0.001094 | 5.00 | 1.00 | 0.005471802 |
| RS5                   | 100-08053301(R) | R.CF | YAGEO | 33                       | 0.125 | 150         | 155   | 1.00 | 77.7   | 0.525 | 0.008        | 0.07       | 1.00         | 0.001190 | 5.00 | 1.00 | 0.005951162 |
| RS35                  | 100-08053904(R) | R.CF | YAGEO | 39000                    | 0.125 | 150         | 155   | 1.00 | 76.8   | 0.229 | 0.000        | 0.00       | 1.00         | 0.001084 | 5.00 | 1.00 | 0.005418668 |
| RS13                  | 100-08015104(R) | R.CF | YAGEO | 51000                    | 0.125 | 150         | 155   | 1.00 | 77.6   | 4.23  | 0.000        | 0.00       | 1.00         | 0.001095 | 5.00 | 1.00 | 0.005476554 |
| RS45                  | 100-12054701(R) | R.CF | YAGEO | 47                       | 0.25  | 200         | 155   | 1.00 | 78.2   | 0.203 | 0.001        | 0.00       | 1.00         | 0.001102 | 5.00 | 1.00 | 0.005510523 |
| RS46                  | 100-12054701(R) | R.CF | YAGEO | 47                       | 0.25  | 200         | 155   | 1.00 | 76.9   | 0.203 | 0.001        | 0.00       | 1.00         | 0.001090 | 5.00 | 1.00 | 0.005447794 |
| RS18                  | 100-08016204(R) | R.CF | YAGEO | 62000                    | 0.125 | 150         | 155   | 1.00 | 77.4   | 2.61  | 0.000        | 0.00       | 1.00         | 0.001091 | 5.00 | 1.00 | 0.005453409 |
| RS29                  | 100-12054704(R) | R.CF | YAGEO | 47000                    | 0.25  | 200         | 155   | 1.00 | 78.3   | 45.49 | 0.044        | 0.18       | 1.00         | 0.001377 | 5.00 | 1.00 | 0.006887121 |
| RS26                  | 100-12054704(R) | R.CF | YAGEO | 47000                    | 0.25  | 200         | 155   | 1.00 | 76.8   | 43.79 | 0.041        | 0.16       | 1.00         | 0.001336 | 5.00 | 1.00 | 0.006678835 |
| RS30                  | 100-12054704(R) | R.CF | YAGEO | 47000                    | 0.25  | 200         | 155   | 1.00 | 77.9   | 45.49 | 0.044        | 0.18       | 1.00         | 0.001372 | 5.00 | 1.00 | 0.006861167 |
| RS28                  | 100-12054704(R) | R.CF | YAGEO | 47000                    | 0.25  | 200         | 155   | 1.00 | 77.4   | 43.79 | 0.041        | 0.16       | 1.00         | 0.001343 | 5.00 | 1.00 | 0.006716577 |
| RS41                  | 100-08058202(R) | R.CF | YAGEO | 820                      | 0.125 | 150         | 155   | 1.00 | 78.2   | 0.969 | 0.001        | 0.01       | 1.00         | 0.001110 | 5.00 | 1.00 | 0.005550747 |
| RS54                  | 100-08052201(R) | R.CF | YAGEO | 22                       | 0.125 | 150         | 155   | 1.00 | 78.6   | 1.25  | 0.071        | 0.57       | 1.00         | 0.002289 | 5.00 | 1.00 | 0.011443635 |
| RS51                  | 100-06011203(R) | R.CF | YAGEO | 1200                     | 0.1   | 50          | 155   | 1.00 | 77.6   | 6.06  | 0.031        | 0.31       | 1.00         | 0.001617 | 5.00 | 1.00 | 0.008084028 |
| RS57                  | 100-06011203(R) | R.CF | YAGEO | 1200                     | 0.1   | 50          | 155   | 1.00 | 76.7   | 1.05  | 0.001        | 0.01       | 1.00         | 0.001096 | 5.00 | 1.00 | 0.005477921 |
| RS50                  | 100-06011004(R) | R.CF | YAGEO | 10000                    | 0.1   | 50          | 155   | 1.00 | 76.3   | 6.78  | 0.005        | 0.05       | 1.00         | 0.001144 | 5.00 | 1.00 | 0.005721639 |
| RS56                  | 100-06011004(R) | R.CF | YAGEO | 10000                    | 0.1   | 50          | 155   | 1.00 | 77.8   | 13.51 | 0.018        | 0.18       | 1.00         | 0.001382 | 5.00 | 1.00 | 0.006911352 |
| RS53                  | 100-06051001(R) | R.CF | YAGEO | 10                       | 0.1   | 50          | 155   | 1.00 | 78.3   | 0.667 | 0.044        | 0.44       | 1.00         | 0.001947 | 5.00 | 1.00 | 0.009732943 |
| RS40                  | 100-06012004(R) | R.CF | YAGEO | 20000                    | 0.1   | 50          | 155   | 1.00 | 77.9   | 9.58  | 0.005        | 0.05       | 1.00         | 0.001161 | 5.00 | 1.00 | 0.005803679 |
| TOTAL                 |                 |      |       |                          |       |             |       |      |        |       |              |            |              |          |      |      | 0.175010173 |