GlobTek® (Suzhou) Co., Ltd

**File No :**

# MTBF Prediction Report

**Model Name: GTM41060-2512**

**Customer:**

**Stage: EDVT1**

**PCB Rev.: A**

**Part List Rev.: 2**

**Spec Rev.: E**

**Conclusion:** ☑ **PASS** ☐ **FAIL**

**Prepared By:** Michael **Checked By:** JET **Approved By:** **JAYSON**

GlobTek (Suzhou) Co., Ltd

# GTM41060-2512 CMTBF REPORT LIST
# PART LIST REV: 0A

| COMPONENT | FAILURE RATE | | Q'TY |
|---|---|---|---|
| RESISTOR | 0.14272183 | | 25 |
| CAPACITOR ( except electrolytic ) | 0.160759096 | | 9 |
| CAPACITOR ( electrolytic ) | 2.183505497 | | 4 |
| DIODE | 0.498244092 | | 6 |
| ZENER DIODE | 0.032220559 | | 1 |
| Integrated Circuits | 0.584780694 | | 2 |
| TL431 | 0.515321814 | | 1 |
| Transistor-Power MOSFET | 0.592363442 | | 1 |
| IC-Opto-couplers | 0.124914198 | | 1 |
| Magnetic | 0.018403583 | | 2 |
| TOTAL | 4.85323480 | | 52 |
| MTBF | 206,048.14 | Hours | |
| MTBF SPEC. | 200,000 | Hours | |
| Conclusion | OK | | |

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# SUMMARY TEST REPORT


| Input Voltage | NO . | Test Item | Page |
|---|---|---|---|
| | | Cover,Report,Part list,and summary | 1~4 |
| 240V | 1 | Magnetics | 5 |
| | 2 | TL431s | 6 |
| | 3 | Integrated Circuits | 7 |
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| | 10 | Resistor | 14 |

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| CMTBF TEST REPORT | | | | Test Engineer: | Maichael |
|---|---|---|---|---|---|
| Model Name: | GTM41060-2512 | Customer: | | Test Date: | 2013-4-2 |
| Quantity: | 1 | Ser. No.: | | | |

## 1. Purpose:

Verify PSU whether or not to meet the customer CMTBF specification.

## 2. Conditions:

Input: 240V AC

Output: 12V/2.08A

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..

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**MTBF prediction worksheet - Magnetics**

Model GTM41060-2512
Conditions:Vin=240VAC; Output Load:+12V/2.08A
Amb.: 25℃

| Component description | | | Component specifications | Stress | Failure rate | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ref. Design | Part No. | Type | Tcore | Tcore | λb | πQ | πE | πc | λp |
| | | | deg.C | deg.C | | | | | |
| LF1 | 703-01192004(R) | C | 130 | 64.8 | 0.000537697 | 4 | 1 | 1 | 0.002150787 |
| T1 | 320-01951403(R) | X | 130 | 82.5 | 0.004063199 | 4 | 1 | 1 | 0.016252796 |
| TOTAL | | | | | | | | | 0.018403583 |

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**MTBF prediction worksheet - TL431s**

Model GTM41060-2512
Conditions:Vin=240VAC; Output Load:+12V/2.08A
Amb.: 25℃

| Component description | | | | Component specifications | | | | | Sress | | | | Failure rate | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ref. Design | Part No. | Type | Maker | Pin NO. | VKA | IK(rms) | Rth | Tj | VKA | IK(rms) | Ta | Tj(c) | C1 | C2 | πT | πL | πQ | πE | λp |
| | | | | | V | A | degC/W | deg.C | V | A | deg.C | deg.C | | | | | | | |
| U1 | 270-03460001(R) | AZ431 | BCD | 3 | 36 | 0.1 | 330 | 150 | 2.64 | 0.018 | 64.1 | 79.782 | 0.01 | 0.00118 | 5.09426 | 1 | 10 | 0.5 | 0.51532 |
| TOTAL | | | | | | | | | | | | | | | | | | | 0.515322 |

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**MTBF prediction worksheet - Integrated Circuits**

Model GTM41060-2512
Conditions:Vin=240VAC; Output Load:+12V/2.08A
Amb.: 25℃

| 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 | | | | | | | |
| IC1 | 261-08009001(R) | PWM | Leadtrend | 6 | 30 | 0.3 | 250 | 150 | 14.53 | 0.004 | 60 | 74.53 | 0.01 | 0.0025 | 3.6877 | 1 | 10 | 0.5 | 0.381234796 |
| U3 | 269-03190001® | COM | ST | 8 | 32 | 0.05 | 125 | 150 | 9.9 | 0.004 | 59 | 63.95 | 0.01 | 0.0034 | 1.8654 | 1 | 10 | 0.5 | 0.203545898 |
| TOTAL | | | | | | | | | | | | | | | | | | | 0.584780694 |

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**Component stress analysis worksheet - IC-Opto-couplers**

Model GTM41060-2512

Conditions:Vin=240VAC; Output Load:+12V/2.08A

Amb.: 25℃

| | | | | W | V | A | deg.C/W | deg.C | Vpeak(V) | Ratio | Irms(A) | Ratio | W | Ratio | deg.C | deg.C | π T | λ b | π Q | π E | λp |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PC1 | 251-03000002(R) | PHO | LITEON | 0.07 | 6 | 0.05 | 400 | 100 | 1.18 | 0.19667 | 0.007 | 0.14 | 0.0083 | 0.12 | 60.7 | 64.00 | 2.955248 | 0.0055 | 8 | 1 | 0.130031 |
| | | | | 0.15 | 35 | 0.05 | 425 | 100 | 3.04 | 0.08686 | 0.008 | 0.16 | 0.0243 | 0.16 | 60.7 | 71.04 | 2.72267 | 0.0055 | 8 | 1 | 0.119797 |
| TOTAL | | | | | | | | | | | | | | | | | | | | | 0.124914 |

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**MTBF prediction worksheet - Zener Diodes**

Model GTM41060-2512
Conditions:Vin=240VAC; Output Load:+12V/2.08A
Amb.: 25℃

| Component description | | | Component specifications | | | | | Stress | | | | Failure rate | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ref. Desig. | Part No. | Maker | Vz | Iz | Pd | Rth | Tj | Vz | Iz(rms) | Ta | Tj(c) | λb | πE | πQ | πt | πs | πc | λp |
| | | | V | I | W | deg.C/W | deg. C | V | A | deg.C | deg.C | | | | | | | |
| ZD1 | 211-01780001(R) | PANJIT | 15 | 0.02 | 0.5 | 300 | 175 | 12.13 | 0.007 | 59 | 84.473 | 0.002 | 1 | 5.5 | 2.92914 | 1 | 1 | 0.032221 |
| TOTAL | | | | | | | | | | | | | | | | | | 0.032221 |

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**MTBF prediction worksheet - Diodes**

Model GTM41060-2512
Conditions:Vin=240VAC; Output Load:+12V/2.08A
Amb.: 25℃

| Component description | | | | Component specifications | | | | | | Stress | | | | | Failure Rate | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ref.Design | Part No. | Type | Maker | 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 | | | | | | | |
| D2 | 218-02470001(R) | FR | PANJIT | 75 | 0.15 | 1.25 | 450 | 150 | 1 | 3.31 | 0.044 | 0.003 | 61 | 62.69 | 0.069 | 1 | 5.5 | 3.2044 | 0.05 | 1 | 0.0657 |
| D3 | 207-02107001(R) | FR | PANJIT | 400 | 1.4 | 1.15 | 150 | 150 | 1 | 134 | 0.334 | 0.004 | 60.7 | 61.39 | 0.069 | 1 | 5.5 | 3.0919 | 0.07 | 1 | 0.082 |
| D6 | 218-02470001(R) | FR | PANJIT | 75 | 0.15 | 1.25 | 450 | 150 | 1 | 0.72 | 0.01 | 0.005 | 59.2 | 62.01 | 0.069 | 1 | 5.5 | 3.1455 | 0.05 | 1 | 0.0645 |
| D1 | 206-01411005(R) | FR | LIHUI | 1000 | 1.5 | 1.3 | 25 | 175 | 1 | 418 | 0.418 | 0.004 | 60.9 | 61.03 | 0.069 | 1 | 5.5 | 3.0613 | 0.12 | 1 | 0.1395 |
| BD1 | 202-08215001(R) | BRG | POWERSI | 800 | 1 | 1.1 | 50 | 150 | 1 | 339 | 0.424 | 0.018 | 70.6 | 71.59 | 0.005 | 1 | 5.5 | 4.065 | 0.12 | 1 | 0.0139 |
| D4 | 204-04270001(R) | SCHOTTKY | PANJIT | 150 | 10 | 0.92 | 30 | 125 | 1 | 110 | 0.73 | 2.04 | 81.6 | 137.9 | 0.003 | 1 | 5.5 | 17.289 | 0.47 | 1 | 0.1328 |
| TOTAL | | | | | | | | | | | | | | | | | | | | | 0.4982 |

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**MTBF prediction worksheet - Capacitors, except electrolytic**

Model GTM41060-2512
Conditions:Vin=240VAC; Output Load:+12V/2.08A
Amb.: 25℃

| 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 | 125-08045475(R) | MPF | DAIN | 0.47 | 275 | 125 | 51.1 | 238 | 0.86545 | 1.724704 | 0.016938 | 3 | 1 | 0.0876403 |
| CY1 | 122-11044103(R) | DIS | TDK | 0.01 | 250 | 105 | 71.4 | 193 | 0.772 | 1.129234 | 0.014164 | 3 | 1 | 0.0479818 |
| C2 | 122-39131223(R) | MON | TDK | 0.0022 | 1000 | 125 | 60.9 | 137 | 0.137 | 0.955983 | 0.000835 | 3 | 1 | 0.0023947 |
| C4 | 120-26091003(R) | MON | TDK | 0.001 | 50 | 125 | 60.9 | 3.51 | 0.0702 | 0.876564 | 0.000772 | 3 | 1 | 0.0020306 |
| C12 | 120-26091003(R) | MON | TDK | 0.001 | 50 | 125 | 59.1 | 12.39 | 0.2478 | 0.876564 | 0.001186 | 3 | 1 | 0.003119 |
| C15 | 120-26091003(R) | MON | TDK | 0.001 | 50 | 125 | 58.7 | 10.66 | 0.2132 | 0.876564 | 0.00103 | 3 | 1 | 0.0027078 |
| C5 | 120-26091502(R) | MON | TDK | 0.00015 | 50 | 125 | 60.5 | 1.06 | 0.0212 | 0.711466 | 0.000762 | 3 | 1 | 0.001626 |
| C8 | 120-27091003(R) | MON | TDK | 0.001 | 200 | 125 | 60.1 | 97.14 | 0.4857 | 0.876564 | 0.003989 | 3 | 1 | 0.0104894 |
| C13 | 120-26094703(R) | MON | TDK | 0.0047 | 50 | 125 | 59.6 | 8.3 | 0.166 | 1.039237 | 0.000888 | 3 | 1 | 0.0027695 |
| TOTAL | | | | | | | | | | | | | | 0.1607591 |

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**MTBF prediction worksheet - Capacitors, electrolytic**

Model GTM41060-2512
Conditions:Vin=240VAC; Output Load:+12V/2.08A
Amb.: 25℃

| Component description | | | | Component specifications | | | | | | Stress | | | Failure rate | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ref.Design | Part No. | Type | Maker | Cap. (uF) | Vmax | Ripple current | F | T | Temp. | Tc | V | Vratio | πcv | λb | πQ | πE | λp |
| | | | | | | | | | | deg.C | Vmax | | | | | | |
| C1 | 123-03371477® | ELE | SAMXON | 47 | 400 | 0.266 | 1<br>1.4 | 2.2 | 105 | 69.5 | 314 | 0.785 | 0.6799 | 0.2769 | 3 | 1 | 0.564896 |
| C6 | 123-59047104(R) | ELE | JFD | 10 | 50 | 0.11 | 1 | 2.44 | 105 | 71 | 14.5 | 0.291 | 0.5146 | 0.0729 | 3 | 1 | 0.112498 |
| C7 | 123-21091110(R) | ELE | SAMXON | 1000 | 16 | 1.35 | 1 | 2.44 | 105 | 65.9 | 12.5 | 0.78 | 1.1789 | 0.2324 | 3 | 1 | 0.822079 |
| C9 | 123-21091111(R) | ELE | SAMXON | 1000 | 16 | 1.35 | 1 | 2.44 | 105 | 62.3 | 12.3 | 0.77 | 1.1789 | 0.1934 | 3 | 1 | 0.684032 |
| TOTAL | | | | | | | | | | | | | | | | | 2.183505 |

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**MTBF prediction worksheet - Transistor-Power MOSFET**

Model GTM41060-2512
Conditions:Vin=240VAC; Output Load:+12V/2.08A
Amb.: 25℃

| Component description | | | | Component specifications | | | | | | | Stress | | | | Failure rate | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ref. Design | Part No. | Type | Maker | Pd rated | Vds rated | Id rated | Vgs rated | Rth | Rdc(on) | Tj rated | Id(rms) | Pd | Tc | Tj(c) | πT | λb | πA | πQ | πE | λp |
| | | | | W | V | A | V | deg.C/W | Ohm | deg,C | A | W | deg.C | deg.C | | | | | | |
| Q1 | 226-08311001(R) | M | AUK | 30 | 600 | 7 | 30 | 4.16 | 1.2 | 150 | 0.207 | 0.05 | 67.4 | 67.61 | 2.244 | 0.012 | 4 | 5.5 | 1 | 0.592363 |
| TOTAL | | | | | | | | | | | | | | | | | | | | 0.592363 |

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**MTBF prediction worksheet - Resistors**

Model GTM41060-2512
Conditions:Vin=240VAC; Output Load:+12V/2.08A
Amb.: 25℃

| 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 | | | | | | |
| R3 | 102-31054704(R) | MOF | VIKMG | 47000 | 1 | 350 | 155 | 1.00 | 60.9 | 105 | 0.235 | 0.23 | 1.00 | 0.001255 | 5.00 | 1.00 | 0.006277142 |
| R12 | 102-31056809(R) | MOF | VIKMG | 0.68 | 1 | 350 | 155 | 1.00 | 67.4 | 0.056 | 0.005 | 0.00 | 1.00 | 0.001003 | 5.00 | 1.00 | 0.005017457 |
| R4 | 100-12051006(R) | R.CF | VIKMG | 1000000 | 0.25 | 200 | 155 | 1.00 | 61 | 112.25 | 0.013 | 0.05 | 1.10 | 0.001003 | 5.00 | 1.00 | 0.005517162 |
| RA | 100-12055105(R) | R.CF | VIKMG | 510000 | 0.25 | 200 | 155 | 1.00 | 60.7 | 119 | 0.028 | 0.11 | 1.10 | 0.001077 | 5.00 | 1.00 | 0.005925857 |
| RB | 100-12055105(R) | R.CF | VIKMG | 510000 | 0.25 | 200 | 155 | 1.00 | 60.9 | 118 | 0.027 | 0.11 | 1.10 | 0.001077 | 5.00 | 1.00 | 0.005923289 |
| R1 | 100-12055105(R) | R.CF | VIKMG | 510000 | 0.25 | 200 | 155 | 1.00 | 60.9 | 97 | 0.018 | 0.07 | 1.10 | 0.001031 | 5.00 | 1.00 | 0.005672220 |
| R2 | 100-12055105(R) | R.CF | VIKMG | 510000 | 0.25 | 200 | 155 | 1.00 | 60.7 | 96.1 | 0.018 | 0.07 | 1.10 | 0.001028 | 5.00 | 1.00 | 0.005652521 |
| R5 | 100-08058205(R) | R.CF | VIKMG | 820000 | 0.125 | 200 | 155 | 1.00 | 61.2 | 61.73 | 0.005 | 0.04 | 1.10 | 0.000989 | 5.00 | 1.00 | 0.005438325 |
| R6 | 100-08058205(R) | R.CF | VIKMG | 820000 | 0.125 | 200 | 155 | 1.00 | 61.1 | 62.81 | 0.005 | 0.04 | 1.10 | 0.000989 | 5.00 | 1.00 | 0.005442204 |
| R7 | 100-12051001(R) | R.CF | VIKMG | 10 | 0.25 | 200 | 155 | 1.00 | 61.1 | 0.958 | 0.092 | 0.37 | 1.00 | 0.001479 | 5.00 | 1.00 | 0.007396732 |
| R8 | 100-08054701(R) | R.CF | VIKMG | 47 | 0.125 | 200 | 155 | 1.00 | 61.2 | 0.461 | 0.005 | 0.04 | 1.00 | 0.000988 | 5.00 | 1.00 | 0.004937867 |
| R9 | 100-08015100(R) | R.CF | VIKMG | 5.1 | 0.125 | 200 | 155 | 1.00 | 60.7 | 0.265 | 0.014 | 0.11 | 1.00 | 0.001076 | 5.00 | 1.00 | 0.005381155 |
| R10 | 100-08011303(R) | R.CF | VIKMG | 1300 | 0.125 | 200 | 155 | 1.00 | 60.8 | 1.33 | 0.001 | 0.01 | 1.00 | 0.000954 | 5.00 | 1.00 | 0.004770460 |
| R13 | 100-12055601(R) | R.CF | VIKMG | 56 | 0.25 | 200 | 155 | 1.00 | 60.1 | 3.1 | 0.172 | 0.69 | 1.00 | 0.002162 | 5.00 | 1.00 | 0.010810528 |
| R14 | 100-12055601(R) | R.CF | VIKMG | 56 | 0.25 | 200 | 155 | 1.00 | 60.2 | 3.1 | 0.172 | 0.69 | 1.00 | 0.002165 | 5.00 | 1.00 | 0.010822759 |
| R15 | 100-08014704(R) | R.CF | VIKMG | 47000 | 0.125 | 200 | 155 | 1.00 | 59 | 9.64 | 0.002 | 0.02 | 1.00 | 0.000945 | 5.00 | 1.00 | 0.004723452 |
| R24 | 100-08011004(R) | R.CF | VIKMG | 10000 | 0.125 | 200 | 155 | 1.00 | 58.7 | 0.001 | 0.000 | 0.00 | 1.00 | 0.000924 | 5.00 | 1.00 | 0.004621251 |
| R25 | 100-08011004(R) | R.CF | VIKMG | 10000 | 0.125 | 200 | 155 | 1.00 | 58.6 | 0.098 | 0.000 | 0.00 | 1.00 | 0.000923 | 5.00 | 1.00 | 0.004617232 |
| R26 | 100-08011004(R) | R.CF | VIKMG | 10000 | 0.125 | 200 | 155 | 1.00 | 59.1 | 7.66 | 0.006 | 0.05 | 1.00 | 0.000982 | 5.00 | 1.00 | 0.004910056 |
| R18 | 100-08011802(R) | R.CF | VIKMG | 180 | 0.125 | 150 | 155 | 1.00 | 59.2 | 0.168 | 0.000 | 0.00 | 1.00 | 0.000930 | 5.00 | 1.00 | 0.004648706 |
| R27 | 100-08012703(R) | R.CF | VIKMG | 2700 | 0.125 | 150 | 155 | 1.00 | 58.7 | 2.063 | 0.002 | 0.01 | 1.00 | 0.000939 | 5.00 | 1.00 | 0.004692602 |
| R30 | 100-08011002(R) | R.CF | VIKMG | 100 | 0.125 | 150 | 155 | 1.00 | 58.7 | 0.11 | 0.000 | 0.00 | 1.00 | 0.000925 | 5.00 | 1.00 | 0.004626689 |
| R21 | 100-08055103(R) | R.CF | VIKMG | 5100 | 0.125 | 150 | 155 | 1.00 | 58.6 | 9.72 | 0.019 | 0.15 | 1.00 | 0.001106 | 5.00 | 1.00 | 0.005527851 |
| R28 | 100-08013323(R) | R.CF | VIKMG | 3320 | 0.125 | 150 | 155 | 1.00 | 59.2 | 2.503 | 0.002 | 0.02 | 1.00 | 0.000946 | 5.00 | 1.00 | 0.004727670 |
| R29 | 100-08019104(R) | R.MF | VIKMG | 91000 | 0.125 | 150 | 155 | 1.00 | 59.1 | 2.503 | 0.000 | 0.00 | 1.00 | 0.000928 | 5.00 | 1.00 | 0.004640643 |
| TOTAL | | | | | | | | | | | | | | | | | 0.142721830 |