



Test Report: HEP-100-24

100W Single Output Switching Power Supply

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

■ RELIABILITY TEST



DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|--------------------------------|---|--|--|
| 1 | RIPPLE & NOISE | V1: 150 mVp-p (Max) | I/P: 230 VAC O/P: FULL LOAD Ta: 25°C | V1: 26.4 mVp-p |
| 2 | OUTPUT VOLTAGE ADJUST RANGE | CH1: 22V~27 V | I/P: 230 VAC I/P: 115VAC O/P: MIN LOAD Ta: 25°C | 21.19 V~27.88 V /230VAC 21.19 V~27.88 V /115VAC |
| 3 | CURRENT ADJ RANGE | 2.5A~4A | I/P: 230 VAC O/P: FULL LOAD Ta: 25°C | 1.69 A~4.52 A |
| 4 | OUTPUT VOLTAGE TOLERANCE | V1: -1% ~ 1% (Max) | I/P: 100 VAC /305VAC O/P: FULL / 0% LOAD Ta: 25°C | V1: -0.2 %~0.2 % |
| 5 | LINE REGULATION | V1: -0.5% ~ 0.5% (Max) | I/P: 100 VAC ~305 VAC O/P: FULL LOAD Ta: 25°C | V1: 0 %~0 % |
| 6 | LOAD REGULATION | V1: -0.5% ~ 0.5% (Max) | I/P: 230 VAC O/P: FULL ~MIN LOAD Ta: 25°C | V1: -0.2 %~0.2 % |
| 7 | SET UP TIME | 230VAC/ 500 ms (Max) 115VAC/ 1200 ms (Max) | I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta: 25°C | 230VAC/ 394 ms 115 VAC/ 824 ms |
| 8 | RISE TIME | 230VAC/ 50 ms (Max) 115VAC/ 50 ms (Max) | I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta: 25°C | 230VAC/ 9.4 ms 115 VAC/ 9.3 ms |
| 9 | HOLD UP TIME | 230VAC/ 16 ms (Typ) 115VAC/ 16ms (Typ) | I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta: 25°C | 230VAC/ 23 ms 115 VAC/ 23 ms |
| 10 | OVER/UNDERSHOOT TEST | < ±5% | I/P: 230 VAC O/P: FULL LOAD Ta: 25°C | TEST: < 5 % |
| 11 | DYNAMIC LOAD | V1: 2400 mVp-p | I/P: 230 VAC O/P: (1) FULL /Min LOAD 90%DUTY/1KHZ (2) FULL /Min LOAD 90%DUTY/120HZ Ta: 25°C | 556 mVp-p 968 mVp-p |



INPUT FUNCTION TEST

| NO | TEST ITEM | SPECICATION | TEST CONDITION | RESULT |
|----|-----------------------|---|---|--|
| 1 | INPUT VOLTAGE RANGE | 90VAC~305 VAC | I/P:TESTING O/P:FULL LOAD Ta:25°C | 78 V~305V |
| | | | I/P: (1)LOW-LINE-3V=87 V (2)HIGH-LINE+10V=315 V O/P:FULL/MIN LOAD ON: 30 Sec . OFF: 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE) | TEST: OK |
| 2 | INPUT FREQUENCY RANGE | 47HZ ~63 HZ NO DAMAGE | I/P: 100 VAC ~305VAC O/P:FULL~MIN LOAD Ta:25°C | OK |
| 3 | POWER FACTOR | 0.95/ 230 VAC FULL LOAD (TYP) 0.98/ 115 VAC FULL LOAD (TYP) 0.93/ 277 VAC FULL LOAD (TYP) | I/P: 230 VAC I/P: 115 VAC I/P: 277 VAC O/P:FULL LOAD Ta:25°C | PF=0.960/230V/100%LOAD PF=0.997/115V/100%LOAD PF=0.935/277V/100%LOAD |
| 4 | EFFICIENCY | 93%(TYP) | I/P: 230 VAC O/P:FULL LOAD Ta:25°C | 93.76 % |
| 5 | INPUT CURRENT | 277V /0.5 A (TYP) 230 V/ 0.55 A (TYP) 115 V/ 1.2 A (TYP) | I/P: 277 VAC I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C | I = 0.42 A/ 277VAC I = 0.47 A/ 230VAC I = 0.95 A/ 115VAC |
| 6 | INRUSH CURRENT | 230 V/ 60A (Typ) COLD START | I/P: 230 VAC O/P:FULL LOAD Ta:25°C | I = 50 A/ 230VAC |

PROTECTION FUNCTION TEST

| NO | TEST ITEM | SPECICATION | TEST CONDITION | RESULT |
|----|-----------------------------|---|---|--|
| 1 | OVER LOAD PROTECTION | 105 %~125 % | I/P: 305VAC I/P: 230 VAC I/P: 100 VAC O/P:TESTING Ta:25°C | 110 %/305VAC 110 %/ 230VAC 110 %//100VAC Constant current limiting, recovers automatically after fault condition is removed |
| 2 | OVER VOLTAGE PROTECTION | V1: 28V~ 34V | I/P: 305VAC I/P: 230 VAC I/P: 90 VAC O/P:MIN LOAD Ta:25°C | 29.57 V/ 305VAC 29.56 V/ 230VAC 29.55 V/ 100VAC Shut down o/p voltage with auto recovery or re-power on to recovery |
| 3 | OVER TEMPERATURE PROTECTION | Shut down o/p voltage with auto recovery or re-power on to recovery | I/P: 230 VAC O/P:FULL LOAD | O.T.P. Active Shut down o/p voltage with auto recovery or re-power on to recovery |
| 4 | SHORT PROTECTION | SHORT EVERY OUTPUT 1 HOUR NO DAMAGE | I/P: 305VAC O/P: FULL LOAD Ta:25°C | NO DAMAGE Constant current limiting, recovers automatically after fault condition is removed |

COMPONENT STRESS TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|--|--------------------------|---|--|
| 1 | Power Transistor (D to S) or (C to E) Peak Voltage | Q5 Rated 12A/500V | I/P : High-Line +3V = 308V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C | (1) 472 V (2) 452 V (3) 454 V |
| 2 | Diode Peak Voltage | Q101 Rated 80A/75V | I/P : High-Line +3V =308V O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C | (1) 61.2 V (2) 16.4 V (3) 58.4 V |
| | | Q102 Rated 80A/75V | I/P : High-Line +3V = 308 V O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C | (1) 57.2 V (2) 29.1 V (3) 56.4 V |
| 3 | Input Capacitor Voltage | C5 Rated: 82u/450V | I/P : High-Line +3V = 308V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C | (1) 436.4 V (2) 437.5 V (3) 436.9 V |
| 4 | Control IC Voltage Test | U 900 Rated 8.85V~16V | I/P : High-Line +3V = 308V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C | (1) 13.893 V (2) 12.95 V (3) 12.89 V |
| 5 | P.F.C Transistor (D to S) or (C to E) Peak Voltage | Q1 Rated 17A/600V | I/P : High-Line +3V = 308 V O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C | (1) 494 V (2) 456 V (3) 454 V |

SAFETY & EMC TEST

SAFETY TEST

| NO | TEST ITEM | SPECICATION | TEST CONDITION | RESULT |
|----|----------------------|--|--|---|
| 1 | WITHSTAND VOLTAGE | IEC60950-1 I/P-O/P: 3.75KVAC/min I/P-FG:2 KVAC/min O/P-FG:0.5KVAC/min | I/P-O/P: 4 KVAC/min I/P-FG: 2.4KVAC/min O/P-FG: 0.6KVAC/min Ta:25°C | I/P-O/P: 2.592 mA I/P-FG: 2.348 mA O/P-FG: 3.65 mA NO DAMAGE |
| 2 | ISOLATION RESISTANCE | I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ | I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C | I/P-O/P: 30 GΩ I/P-FG: 30 GΩ O/P-FG: 30 GΩ NO DAMAGE |
| 3 | GROUNDING CONTINUITY | IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ | 40A / 2min Ta:25°C | 11 mΩ |
| 4 | LEAKAGE CURRENT | IEC60950-1 < 0.75 mA / 277VAC | I/P: 277 VAC O/P:Min LOAD Ta:25°C | L-FG: 0.27 mA N-FG: 0.27 mA |

E.M.C TEST

| NO | TEST ITEM | SPECICATION | TEST CONDITION | RESULT |
|----|------------|--|---|-------------------------------|
| 1 | HARMONIC | EN61000-3-2 CLASS A | I/P: 240VAC/50HZ O/P:100%/50% LOAD Ta:25°C | PASS |
| 2 | CONDUCTION | EN55022 CLASS B | I/P: 230 VAC (50HZ) O/P:FULL/50% LOAD Ta:25°C | PASS Test by certified Lab |
| 3 | RADIATION | EN55022 CLASS B | I/P: 230 VAC (50HZ) O/P:FULL LOAD Ta:25°C | PASS Test by certified Lab |
| 4 | E.S.D | EN61000-4-2 LIGHT INDUSTRY AIR:8KV / Contact:4KV | I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C | CRITERIA A |
| 5 | E.F.T | EN61000-4-4 LIGHT INDUSTRY INPUT : 1KV | I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C | CRITERIA A |
| 6 | SURGE | IEC61000-4-5 INDUSTRY L-N : 3KV L,N-PE:6KV | I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C | CRITERIA A |

Reliability Test

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----|---|--|---|-------------------|----------|-----------------------------|-----------------------------|---|-----|--------|--------|---|----|--------|--------|---|----|--------|--------|---|----|--------|--------|---|----|--------|--------|---|------|--------|--------|---|----|--------|--------|---|----|--------|--------|---|------|--------|--------|----|----|--------|--------|----|------|--------|--------|----|------|--------|--------|----|-----|--------|--------|----|------|--------|--------|----|----|--------|--------|--|
| 1 | TEMPERATURE RISE TEST | MODEL : HEP-100-24 1. ROOM AMBIENT BURN-IN : 2.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 30.7 °C 2. HIGH AMBIENT BURN-IN : 5.5 HRS I/P : 230VAC O/P : FULL LOAD Ta=60.7 °C | <table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 30.7 °C</th> <th>HIGH AMBIENT Ta= 60.7 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>46.8°C</td><td>74.8°C</td></tr> <tr><td>2</td><td>Q1</td><td>48.1°C</td><td>76.1°C</td></tr> <tr><td>3</td><td>L2</td><td>48.8°C</td><td>76.8°C</td></tr> <tr><td>4</td><td>Q5</td><td>48.2°C</td><td>76.2°C</td></tr> <tr><td>5</td><td>D2</td><td>48.8°C</td><td>76.8°C</td></tr> <tr><td>6</td><td>RTH2</td><td>46.3°C</td><td>74.3°C</td></tr> <tr><td>7</td><td>C5</td><td>45.5°C</td><td>73.5°C</td></tr> <tr><td>8</td><td>T1</td><td>49.3°C</td><td>77.3°C</td></tr> <tr><td>9</td><td>Q101</td><td>47.4°C</td><td>75.4°C</td></tr> <tr><td>10</td><td>D9</td><td>47.0°C</td><td>75.0°C</td></tr> <tr><td>11</td><td>C102</td><td>45.3°C</td><td>73.3°C</td></tr> <tr><td>12</td><td>C201</td><td>46.3°C</td><td>74.3°C</td></tr> <tr><td>13</td><td>C38</td><td>48.2°C</td><td>76.2°C</td></tr> <tr><td>14</td><td>U900</td><td>47.4°C</td><td>75.4°C</td></tr> <tr><td>15</td><td>U1</td><td>49.4°C</td><td>77.4°C</td></tr> </tbody> </table> | NO | Position | ROOM AMBIENT Ta= 30.7 °C | HIGH AMBIENT Ta= 60.7 °C | 1 | BD1 | 46.8°C | 74.8°C | 2 | Q1 | 48.1°C | 76.1°C | 3 | L2 | 48.8°C | 76.8°C | 4 | Q5 | 48.2°C | 76.2°C | 5 | D2 | 48.8°C | 76.8°C | 6 | RTH2 | 46.3°C | 74.3°C | 7 | C5 | 45.5°C | 73.5°C | 8 | T1 | 49.3°C | 77.3°C | 9 | Q101 | 47.4°C | 75.4°C | 10 | D9 | 47.0°C | 75.0°C | 11 | C102 | 45.3°C | 73.3°C | 12 | C201 | 46.3°C | 74.3°C | 13 | C38 | 48.2°C | 76.2°C | 14 | U900 | 47.4°C | 75.4°C | 15 | U1 | 49.4°C | 77.4°C | |
| NO | Position | ROOM AMBIENT Ta= 30.7 °C | HIGH AMBIENT Ta= 60.7 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | BD1 | 46.8°C | 74.8°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Q1 | 48.1°C | 76.1°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | L2 | 48.8°C | 76.8°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Q5 | 48.2°C | 76.2°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | D2 | 48.8°C | 76.8°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | RTH2 | 46.3°C | 74.3°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | C5 | 45.5°C | 73.5°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | T1 | 49.3°C | 77.3°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Q101 | 47.4°C | 75.4°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | D9 | 47.0°C | 75.0°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | C102 | 45.3°C | 73.3°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | C201 | 46.3°C | 74.3°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | C38 | 48.2°C | 76.2°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | U900 | 47.4°C | 75.4°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | U1 | 49.4°C | 77.4°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | OVER LOAD BURN-IN TEST | NO DAMAGE 1 HOUR (MIN) | I/P : 305 VAC O/P : O/P SHORT TEST Ta : 25°C | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | LOW TEMPERATURE TURN ON TEST | TURN ON AFTER 2 HOUR | I/P : 305VAC/230VAC/100VAC O/P : 100% LOAD Ta= -55 °C | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST | AFTER 12 HOURS IN CHAMBER ON CONTROL 60 °C NO DAMAGE | I/P : 305 VAC O/P : 100% Ta= 60 °C HUMIDITY= 95 %R.H | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | TEMPERATURE COEFFICIENT | ± 0.03 %(0~50°C) | I/P : 230 VAC O/P : FULL LOAD | ± 0.002 %(0~50°C) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | STORAGE TEMPERATURE TEST | 1. Thermal shock Temperature : -60°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 5 CYCLE 5. Input/Output condition : STATIC | | OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | THERMAL SHOCK TEST | 1. Thermal shock Temperature : -55°C~ +65°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : 230VAC/Full Load TURN ON/58 'SEC.;TURN OFF/2SEC. | | OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



100W Single Output Switching Power Supply

HEP-100 series

| | | | |
|----|-----------------------------|--|---|
| 8 | VIBRATION TEST | 1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 20~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 10G (5) Test Time : 72min in each axis (X.Y.Z) (6) Ta : 25°C | TEST : OK |
| 9 | CAPACITOR LIFE CYCLE | HEP-100-24:SUPPOSE C102 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 60 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 60 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 60 °C LIFE TIME | (1) 1144515 HRS (2) 116235 HRS (3) 133455 HRS (4) 143049 HRS |
| 10 | MTBF | MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE : 164.7K HRS | OK |
| 11 | DMTBF/Accelerated Life Test | Demonstration Mean Time Between Failure(Expected Life) : 55,000 hours @ Tcase 75°C | OK |

| TEST RESULT | TESTER | REVIEW | APPROVAL |
|-------------|------------|------------|---------------|
| PASS | DANIEL GAO | SANFORD SU | VINCENT TSENG |

2003/12/12 A50-F023