Test Report: HEP-100-48

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	SPECICATION	TEST CONDITION	RESULT
1	RIPPLE & NOISE	V1: 200 mVp-p (Max)	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	V1: 40.8 mVp-p
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 43V~53 V	I/P: 230 VAC I/P:115VAC O/P:MIN LOAD Ta:25℃	41.68 V~ 54.24 V /230VAC 41.68 V~ 51.24 V/115VAC
3	CURRENT ADJ RANGE	1.25A~2A	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	0.682 A~ 2.987 A
4	OUTPUT VOLTAGE TOLERANCE	V1: -1 % ~ 1 % (Max)	I/P: 100 VAC /305VAC O/P:FULL/ 0 % LOAD Ta:25℃	V1: -0.02 %~ 0.02 %
5	LINE REGULATION	V1: - 0.5% ~ 0.5 % (Max)	I/P:100 VAC ~305 VAC O/P:FULL LOAD Ta:25℃	V1: 0 %~ 0 %
6	LOAD REGULATION	V1: - 0.5% ~ 0.5 % (Max)	I/P: 230 VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.02 %~ 0.02 %
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℃	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℃	230VAC/ 9.7 ms 115 VAC/ 9.7 ms
9	HOLD UP TIME	230VAC/ 16 ms (Typ) 115VAC/ 16 ms (Typ)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25℃	230VAC/ 24 ms 115 VAC/ 26 ms
10	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	TEST:< 5 %
11	DYNAMIC LOAD	V1: 4800 mVp-p	I/P: 230 VAC O/P:(1)FULL /Min LOAD 90%DUTY/1KHZ (2)FULL /Min LOAD 90%DUTY/120HZ Ta:25℃	368 mVp-p 2280 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℃	79 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℃	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℃	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℃	93.1 %
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℃	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℃	I = 46 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℃	110 %/305VAC 110 %/ 230VAC 110 %//100VAC Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	V1: 54V~60V	I/P: 305VAC I/P: 230 VAC I/P: 90 VAC O/P:MIN LOAD Ta:25℃	57.04 V/ 305VAC 57.04 V/ 230VAC 57.04V/ 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℃	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℃	(1) 474 V (2) 456 V (3) 456 V
2	Diode Peak Voltage	Q101 Rated 30A/150V	I/P：High-Line +3V =308V O/P： (1)Full Load Turn on (2)Output Short (3)Full load continue Ta：25℃	(1) 112 V (2) 10.8 V (3) 108 V
		Q102 Rated 30A/150V	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on (2)Output Short (3)Full load continue Ta：25℃	(1) 114 V (2) 11.8 V (3) 110 V
3	Input Capacitor Voltage	C5 Rated: 82u/450V 105℃	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℃	(1) 436.8 V (2) 437.7 V (3) 437.2 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℃	(1) 12.652 V (2) 12.563 V (3) 12.366 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℃	(1) 502 V (2) 460 V (3) 458 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:1.5KVAC/min	I/P-O/P: 4 KVAC/min I/P-FG: 2.4KVAC/min O/P-FG: 1.8KVAC/min Ta:25℃	I/P-O/P: 2.723 mA I/P-FG: 2.452 mA O/P-FG:3.67 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℃	I/P-O/P: 30 GΩ I/P-FG: 30 G Ω O/P-FG: 30 G Ω NO DAMAGE
3	GROUNDING CONTINUITY	IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	11 mΩ
4	LEAKAGE CURRENT	IEC60950-1 < 0.75 mA / 277VAC	I/P: 277 VAC O/P:Min LOAD Ta:25℃	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℃	PASS
2	CONDUCTION	EN55022 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL/50% LOAD Ta:25℃	PASS Test by certified Lab
3	RADIATION	EN55022 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL LOAD Ta:25℃	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℃	CRITERIA A
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT： 1KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	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℃	CRITERIA A

Reliability Test

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

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℃	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 ℃ LIFE TIME (2) I/P： 230VAC O/P：FULL LOAD Ta= 60 ℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 60 ℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 60 ℃ LIFE TIME	(1) 1380862 HRS (2) 140238 HRS (3) 161122 HRS (4) 172705 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 80℃	OK

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

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