Test Report: HEP-240-54

240W Single Output Switching Power Supply

■ DESIGN VERIFY TEST

Output Function Test
Input Function Test
Protection Function Test
Other 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: 350 mVp-p (Max)	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	V1: 275 mVp-p (Max)
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 50 V~ 57 V	I/P: 230 VAC I/P:115VAC O/P:MIN LOAD Ta:25℃	40.28V~60.26 V /230VAC 40.28V~60.26 V/115VAC
3	CURRENT ADJ RANGE	2.23 A~ 4.45 A	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	0.45A~ 5.1 A
4	OUTPUT VOLTAGE TOLERANCE	V1: -1 % ~ 1 % (Max)	I/P: 100 VAC /305VAC O/P:FULL/ 0 % LOAD Ta:25℃	V1: 0.05 %~ -0.05 %
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: 0.05 %~ -0.05 %
7	SET UP TIME	230VAC/ 500 ms (Max) 115VAC/ 1000 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25℃	230VAC/ 362 ms 115 VAC/ 704 ms
8	RISE TIME	230VAC/ 80 ms (Max) 115VAC/ 80 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25℃	230VAC/ 45.8 ms 115 VAC/46.3 ms
9	HOLD UP TIME	230VAC/ 15 ms (Typ) 115VAC/ 15 ms (Typ)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25℃	230VAC/ 16 ms 115 VAC/ 16 ms
10	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	TEST:< 5 %
11	DYNAMIC LOAD	V1: 5400 mVp-p	I/P: 230 VAC O/P:(1)FULL /Min LOAD 90%DUTY/1KHZ Ta:25℃	233mVp-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℃	68V~305V
			I/P: (1)LOW-LINE-3V=87 V (2)HIGH-LINE=305 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) 0.92/ 277 VAC FULL LOAD (TYP)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25℃	PF= 0.957 /230V/100%LOAD PF= 0.99 /115V/100%LOAD PF= 0.946 /277V/100%LOAD
4	EFFICIENCY	93.5 % (TYP)	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	94.2 %
5	INPUT CURRENT	230 V/ 1.3 A (Typ) 115 V/ 2.5 A (Typ) 277 V/ 1.1 A (Typ)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25℃	I = 1.14 A/ 230VAC I = 2.3 A/ 115VAC I = 0.97 A/ 277VAC
6	INRUSH CURRENT	230 V/ 75A (Typ) COLD START	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	I = 65 A/ 230VAC

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %~125 %	I/P: 305 VAC I/P: 230 VAC I/P: 100 VAC O/P:TESTING Ta:25℃	116.4 %/305VAC 116.4 %/ 230VAC 116.4 %//100VAC Constant Current Limiting
2	OVER VOLTAGE PROTECTION	V1: 60 V~ 67V	I/P: 305 VAC I/P: 230 VAC I/P: 90 VAC O/P:MIN LOAD Ta:25℃	62.35V/305VAC 62.13V/ 230VAC 62.12V/ 90VAC Shut down Re- power ON
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 230 VAC O/P:FULL LOAD	O.T.P. Active Shut down o/p volotage，recovers automatically after temperature goes down
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 305VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE Constant Current Limiting

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q4 Rated 16A/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) 464 V (2) 464 V (3) 460 V
2	Diode Peak Voltage	Q101 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) 123 V (2) 123 V (3) 123 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) 124 V (2) 27 V (3) 123 V
3	Input Capacitor Voltage	C5 Rated: NCC: 150μ/450 V	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta：25℃	(1) 427.7 V (2) 432 V (3) 440 V
4	Control IC Voltage Test	U 70 Rated 8.85V~16 V	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta：25℃	(1) 13.13 V (2) 13.11 V (3) 13.13 V
5	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated 20.7A/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) 560 V (2) 490 V (3) 480 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<4.5mA O/P-FG1.5KVAC/min	I/P-O/P: 4 KVAC/min I/P-FG: 2.4KVAC/min O/P-FG:1.8/KVAC/min Ta:25℃	I/P-O/P: 4.87 mA I/P-FG: 4.03 mA O/P-FG: 5.02 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: 21.7 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℃	13 mΩ
4	LEAKAGE CURRENT	IEC60950-1 < 0.75 mA / 277VAC	I/P: 277 VAC O/P:Min LOAD Ta:25℃	L-FG: 0.34 mA N-FG: 0.34 mA

E.M.C TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P: 230VAC/50HZ LOAD:FULL LOAD O/P:100% 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 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 INDUSTRY INPUT: 2KV	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-240-24
1. ROOM AMBIENT BURN-IN：1.5 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 26.5 ℃
2. HIGH AMBIENT BURN-IN： 12 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 61.7 ℃
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 26.5 ℃</th><th>HIGH AMBIENT Ta= 61.7 ℃</th></tr>
<tr><td>1</td><td>LF1</td><td>64.0℃</td><td>91.1℃</td></tr>
<tr><td>2</td><td>C1</td><td>61.3℃</td><td>89.3℃</td></tr>
<tr><td>3</td><td>LF2</td><td>63.4℃</td><td>91.2℃</td></tr>
<tr><td>4</td><td>BD1</td><td>64.0℃</td><td>92.7℃</td></tr>
<tr><td>5</td><td>L2</td><td>62.7℃</td><td>90.9℃</td></tr>
<tr><td>6</td><td>L1</td><td>61.5℃</td><td>89.9℃</td></tr>
<tr><td>7</td><td>Q1</td><td>64.7℃</td><td>93.2℃</td></tr>
<tr><td>8</td><td>U1</td><td>61.5℃</td><td>90.2℃</td></tr>
<tr><td>9</td><td>TSW1</td><td>64.1℃</td><td>92.7℃</td></tr>
<tr><td>10</td><td>Q3</td><td>65.1℃</td><td>93.3℃</td></tr>
<tr><td>11</td><td>T1</td><td>79.0℃</td><td>106.6℃</td></tr>
<tr><td>12</td><td>Q101</td><td>69.6℃</td><td>98.3℃</td></tr>
<tr><td>13</td><td>C102</td><td>66.5℃</td><td>94.9℃</td></tr>
<tr><td>14</td><td>LF101</td><td>71.8℃</td><td>100.1℃</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： 230 VAC
O/P：115%
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： 305 VAC/100VAC
O/P：100%
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>± 0.003 %(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： -60℃~ +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</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-240-24: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	(1) 477984 HRS (2) 42248 HRS (3) 66755 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 171.3K hrs min. MIL-HDBK-217F (25℃)	
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 55,000 hours @ Tcase 75℃	

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

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