



# Test Report: HEP-240-12

---

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: 150 mVp-p (Max)	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	V1: 37 mVp-p (Max)
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 11.2 V~12.8 V	I/P: 230 VAC I/P:115VAC O/P:MIN LOAD Ta:25°C	10.07V~ 13.28 V /230VAC 10.07V~ 13.28 V/115VAC
3	CURRENT ADJ RANGE	8A~16A	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	0.35A~16.83 A
4	OUTPUT VOLTAGE TOLERANCE	V1: -2.5 % ~ 2.5 % (Max)	I/P: 100 VAC /305VAC O/P:FULL/ 0 % LOAD Ta:25°C	V1: 0.9 %~ -0.9 %
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: -2% ~ 2 % (Max)	I/P: 230 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.9 %~ -0.9 %
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°C	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°C	230VAC/ 35 ms 115 VAC/ 35 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°C	230VAC/ 26 ms 115 VAC/ 26 ms
10	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	TEST:< 5 %
11	DYNAMIC LOAD	V1: 1200 mVp-p	I/P: 230 VAC O/P:(1)FULL /Min LOAD 90%DUTY/1KHZ Ta:25°C	360mVp-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	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°C	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°C	PF= 0.95 /230V/100%LOAD PF=0.994/115V/100%LOAD PF= 0.953 /277V/100%LOAD
4	EFFICIENCY	90% (TYP)	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	90.7 %
5	INPUT CURRENT	230 V/ 1.05 A (Typ) 115 V/ 2 A (Typ) 277V/ 0.9 A(Typ)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	I = 0.96 A/ 230VAC I = 1.85 A/ 115VAC I =0.8A/ 277VAC
6	INRUSH CURRENT	230 V/ 75A (Typ) COLD START	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	I = 67 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°C	113 %/305VAC 113 %/ 230VAC 113 %//100VAC Constant Current Limiting
2	OVER VOLTAGE PROTECTION	V1: 13.5V~ 18V	I/P: 305 VAC I/P: 230 VAC I/P: 90 VAC O/P:MIN LOAD Ta:25°C	14.15 V/305VAC 14.18 V/ 230VAC 14.15V/ 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°C	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°C	(1) 462 V (2) 462 V (3) 450 V
2	Diode Peak Voltage	Q101 Rated 162A/40V	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) 40 V (2) 17.4 V (3) 40 V
		Q102 Rated 162A/40V	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) 40 V (2) 38.2 V (3) 40 V
3	Input Capacitor Voltage	C5 Rated: 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°C	(1) 427.8 V (2) 430.9 V (3) 432.4 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°C	(1) 12.98 V (2) 13.01 V (3) 13.03 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°C	(1) 550 V (2) 450 V (3) 508 V

## SAFETY & EMC TEST

### SAFETY TEST

NO	TEST ITEM	SPECIFICATION	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-FG: 1.5KVAC/min	I/P-O/P: 4 KVAC/min I/P-FG: 2.4KVAC/min O/P-FG: 1.8 KVAC/min Ta: 25°C	I/P-O/P: 4.26 mA I/P-FG: 3.47 mA O/P-FG: 4.95 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: 21 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	13 mΩ
4	LEAKAGE CURRENT	IEC60950-1 < 0.75 mA / 277VAC	I/P: 277 VAC O/P: Min LOAD Ta: 25°C	L-FG: 0.38 mA N-FG: 0.38 mA

### E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P: 230VAC/50HZ LOAD:FULL LOAD O/P:100% 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 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 INDUSTRY INPUT: 2KV	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-240-12 1. ROOM AMBIENT BURN-IN : 1.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 26.5 °C 2. HIGH AMBIENT BURN-IN : 12 HRS I/P : 230VAC O/P : FULL LOAD Ta= 61.7 °C																																																																						
			<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 26.5 °C</th> <th>HIGH AMBIENT Ta= 61.7 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>62.7°C</td><td>89.2°C</td></tr> <tr><td>2</td><td>C1</td><td>59.8°C</td><td>88.0°C</td></tr> <tr><td>3</td><td>LF2</td><td>59.7°C</td><td>87.8°C</td></tr> <tr><td>4</td><td>BD1</td><td>60.5°C</td><td>89.2°C</td></tr> <tr><td>5</td><td>L2</td><td>59.3°C</td><td>87.7°C</td></tr> <tr><td>6</td><td>L1</td><td>59.6°C</td><td>88.1°C</td></tr> <tr><td>7</td><td>Q1</td><td>60.9°C</td><td>89.6°C</td></tr> <tr><td>8</td><td>C5</td><td>61.0°C</td><td>89.4°C</td></tr> <tr><td>9</td><td>U1</td><td>59.0°C</td><td>87.2°C</td></tr> <tr><td>10</td><td>TSW1</td><td>59.9°C</td><td>88.9°C</td></tr> <tr><td>11</td><td>C35</td><td>63.8°C</td><td>92.2°C</td></tr> <tr><td>12</td><td>Q3</td><td>60.8°C</td><td>89.5°C</td></tr> <tr><td>13</td><td>T1</td><td>78.2°C</td><td>106.1°C</td></tr> <tr><td>14</td><td>Q101</td><td>67.4°C</td><td>96.5°C</td></tr> <tr><td>15</td><td>C102</td><td>69.9°C</td><td>98.3°C</td></tr> <tr><td>16</td><td>LF101</td><td>77.9°C</td><td>106.5°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 26.5 °C	HIGH AMBIENT Ta= 61.7 °C	1	LF1	62.7°C	89.2°C	2	C1	59.8°C	88.0°C	3	LF2	59.7°C	87.8°C	4	BD1	60.5°C	89.2°C	5	L2	59.3°C	87.7°C	6	L1	59.6°C	88.1°C	7	Q1	60.9°C	89.6°C	8	C5	61.0°C	89.4°C	9	U1	59.0°C	87.2°C	10	TSW1	59.9°C	88.9°C	11	C35	63.8°C	92.2°C	12	Q3	60.8°C	89.5°C	13	T1	78.2°C	106.1°C	14	Q101	67.4°C	96.5°C	15	C102	69.9°C	98.3°C	16	LF101	77.9°C	106.5°C	
NO	Position	ROOM AMBIENT Ta= 26.5 °C	HIGH AMBIENT Ta= 61.7 °C																																																																					
1	LF1	62.7°C	89.2°C																																																																					
2	C1	59.8°C	88.0°C																																																																					
3	LF2	59.7°C	87.8°C																																																																					
4	BD1	60.5°C	89.2°C																																																																					
5	L2	59.3°C	87.7°C																																																																					
6	L1	59.6°C	88.1°C																																																																					
7	Q1	60.9°C	89.6°C																																																																					
8	C5	61.0°C	89.4°C																																																																					
9	U1	59.0°C	87.2°C																																																																					
10	TSW1	59.9°C	88.9°C																																																																					
11	C35	63.8°C	92.2°C																																																																					
12	Q3	60.8°C	89.5°C																																																																					
13	T1	78.2°C	106.1°C																																																																					
14	Q101	67.4°C	96.5°C																																																																					
15	C102	69.9°C	98.3°C																																																																					
16	LF101	77.9°C	106.5°C																																																																					



2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 112% Ta : 25°C	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305 VAC/100VAC O/P : 100% 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	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
6	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/2 SEC		OK
7	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
8	CAPACITOR LIFE CYCLE	HEP-240-12: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		(1) 186060 HRS (2) 26348 HRS (3) 76412 HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 171.3K hrs min. MIL-HDBK-217F (25°C)		
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 55,000 hours @ Tcase 75°C		

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

2003/12/12 A50-F023