



# Test Report: HEP-185-24

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185W 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: 29.4 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	21.40 V~27.57 V /230VAC 21.45 V~27.57 V/115VAC
3	CURRENT ADJ RANGE	3.9A~7.8A	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	3.13 A~ 8.81 A
	OUTPUT VOLTAGE TOLERANCE	V1: -1% ~ 1% (Max)	I/P: 100 VAC /305VAC O/P:FULL/ 0% LOAD Ta:25°C	V1: -0.18 %~ 0.18 %
	LINE REGULATION	V1: -0.5% ~ 0.5% (Max)	I/P:100 VAC ~305 VAC O/P:FULL LOAD Ta:25°C	V1: 0 %~ 0 %
	LOAD REGULATION	V1: -0.5% ~ 0.5% (Max)	I/P: 230 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.18 %~ 0.18 %
	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/ 342 ms 115 VAC/ 706 ms
	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/ 7 ms 115 VAC/ 7 ms
	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°C	230VAC/ 21 ms 115 VAC/ 21 ms
	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	TEST:< 5 %
	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	712 mVp-p 1300 mVp-p

**INPUT FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~305 VAC	I/P:TESTING O/P:FULL LOAD Ta:25°C	71 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) 0.92/ 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=0.968 /230V/100%LOAD PF= 0.998 /115V/100%LOAD PF= 0.93 /277V/100%LOAD
4	EFFICIENCY	93.5% (TYP)	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	93.83 %
5	INPUT CURRENT	277V/ 0.8 A (TYP) 230 V/ 0.9 A (TYP) 115 V/ 2.1 A (TYP)	I/P: 277 VAC I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	I = 0.75 A/ 277VAC I = 0.89 A/ 230VAC I = 1.76 A/ 115VAC
6	INRUSH CURRENT	230 V/ 65A (Typ) COLD START	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	I = 59 A/ 230VAC

**PROTECTION FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	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	29.90 V/ 305VAC 30.25 V/ 230VAC 30.29 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, 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, 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) 478 V (2) 450 V (3) 456 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) 62.4 V (2) 13.6 V (3) 58.8 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) 62.4 V (2) 28.6 V (3) 58.4 V
3	Input Capacitor Voltage	C5 Rated: 100u/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) 437 V (2) 437.3 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°C	(1) 12.709 V (2) 12.637 V (3) 12.632 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) 486 V (2) 454 V (3) 460 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:2KVAC/min 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: 2.617 mA I/P-FG: 2.315 mA O/P-FG: 3.36 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	9 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

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																
1	TEMPERATURE RISE TEST	MODEL : HEP-185-24 1. ROOM AMBIENT BURN-IN : 15.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 29 °C 2. HIGH AMBIENT BURN-IN : 7 HRS I/P : 230VAC O/P : FULL LOAD Ta= 61.1 °C	<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 29 °C</th> <th>HIGH AMBIENT Ta= 61.1 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>V1</td><td>24.05V</td><td>23.96V</td></tr> <tr><td>6</td><td>BD1</td><td>59.0°C</td><td>81.6°C</td></tr> <tr><td>7</td><td>Q1</td><td>64.6°C</td><td>85.9°C</td></tr> <tr><td>8</td><td>L2</td><td>66.5°C</td><td>87.4°C</td></tr> <tr><td>9</td><td>Q5</td><td>67.3°C</td><td>87.7°C</td></tr> <tr><td>10</td><td>D2</td><td>70.1°C</td><td>89.7°C</td></tr> <tr><td>11</td><td>RTH2</td><td>61.9°C</td><td>83.0°C</td></tr> <tr><td>12</td><td>T1</td><td>74.9°C</td><td>94.8°C</td></tr> <tr><td>13</td><td>Q101</td><td>65.8°C</td><td>87.9°C</td></tr> <tr><td>14</td><td>D9</td><td>64.3°C</td><td>84.9°C</td></tr> <tr><td>15</td><td>C102</td><td>60.7°C</td><td>83.3°C</td></tr> <tr><td>16</td><td>C201</td><td>61.1°C</td><td>83.5°C</td></tr> <tr><td>17</td><td>C16</td><td>63.0°C</td><td>84.3°C</td></tr> <tr><td>18</td><td>C106</td><td>55.3°C</td><td>78.9°C</td></tr> <tr><td>19</td><td>C38</td><td>66.5°C</td><td>87.0°C</td></tr> <tr><td>20</td><td>LF100</td><td>57.6°C</td><td>80.8°C</td></tr> <tr><td>21</td><td>U900</td><td>62.1°C</td><td>83.4°C</td></tr> <tr><td>22</td><td>U1</td><td>60.8°C</td><td>83.7°C</td></tr> <tr><td>23</td><td>C5</td><td>46.4°C</td><td>78.5°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 29 °C	HIGH AMBIENT Ta= 61.1 °C	1	V1	24.05V	23.96V	6	BD1	59.0°C	81.6°C	7	Q1	64.6°C	85.9°C	8	L2	66.5°C	87.4°C	9	Q5	67.3°C	87.7°C	10	D2	70.1°C	89.7°C	11	RTH2	61.9°C	83.0°C	12	T1	74.9°C	94.8°C	13	Q101	65.8°C	87.9°C	14	D9	64.3°C	84.9°C	15	C102	60.7°C	83.3°C	16	C201	61.1°C	83.5°C	17	C16	63.0°C	84.3°C	18	C106	55.3°C	78.9°C	19	C38	66.5°C	87.0°C	20	LF100	57.6°C	80.8°C	21	U900	62.1°C	83.4°C	22	U1	60.8°C	83.7°C	23	C5	46.4°C	78.5°C	
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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 : 305 VAC/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% LOAD Ta= 60 °C HUMIDITY= 95 %R.H	TEST : OK																																																																																
5	TEMPERATURE COEFFICIENT	± 0.03 %(0~60°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.012 %(0~60°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	<p>1. Thermal shock Temperature : -55°C~ +65°C</p> <p>2. Temperature change rate : 25°C / MIN</p> <p>3. Dwell time low and high temperature : 30 MIN/EACH</p> <p>4. Total test cycle : 10 CYCLE</p> <p>5. Input/Output condition : 230VAC/Full Load AC ON/OFF TEST turn on 58sec ; turn off 2sec</p>	OK
8	VIBRATION TEST	<p>1 Carton &amp; 1 Set</p> <p>(1) Waveform : Sine Wave</p> <p>(2) Frequency : 20~500Hz</p> <p>(3) Sweep Time : 12min/sweep cycle</p> <p>(4) Acceleration : 10G</p> <p>(5) Test Time : 72min in each axis (X.Y.Z)</p> <p>(6) Ta : 25°C</p>	TEST : OK
9	CAPACITOR LIFE CYCLE	<p>HEP-185-24:SUPPOSE C102 IS THE MOST CRITICAL COMPONENT</p> <p>(1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME</p> <p>(2) I/P : 230VAC O/P : FULL LOAD Ta= 60 °C LIFE TIME</p> <p>(3) I/P : 230VAC O/P : 75% LOAD Ta= 60 °C LIFE TIME</p> <p>(4) I/P : 230VAC O/P : 50% LOAD Ta= 60 °C LIFE TIME</p>	<p>(1) 420912 HRS</p> <p>(2) 71928 HRS</p> <p>(3) 103147 HRS</p> <p>(4) 125546 HRS</p>
10	MTBF	<p>Conducted by Parts Stress Analysis Prediction</p> <p>164.1K hrs min. MIL-HDBK-217F (25°C)</p>	OK
11	DMTBF/Accelerated Life Test	<p>Demonstration Mean Time Between Failure(Expected Life) :</p> <p>55,000 hours @ Tcase 75°C</p>	OK

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

2003/12/12 A50-F023