



Test Report: HEP-185-48

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: 200 mVp-p (Max)	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	V1: 47.2 mVp-p
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 43V~53 V	I/P: 230 VAC I/P:115VAC O/P:MIN LOAD Ta:25°C	41.89 V~54.15 V /230VAC 41.89 V~54.15V/115VAC
3	CURRENT ADJ RANGE	1.95A~3.9A	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	1.612 A~ 4.270 A
4	OUTPUT VOLTAGE TOLERANCE	V1: -1 % ~ 1 % (Max)	I/P: 100 VAC /305VAC O/P:FULL/ 0 % LOAD Ta:25°C	V1: -0.04 %~0.04 %
5	LINE REGULATION	V1: - 0.5% ~ 0.5 % (Max)	I/P:100 VAC ~305 VAC O/P:FULL LOAD Ta:25°C	V1: -0.02 %~-0.02 %
6	LOAD REGULATION	V1: - 0.5% ~ 0.5 % (Max)	I/P: 230 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.04 %~ 0.04 %
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/ 342 ms 115 VAC/ 706 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/ 6 ms 115 VAC/ 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°C	230VAC/ 21 ms 115 VAC/ 21 ms
10	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	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°C	460 mVp-p 1910 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	82 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	94% (TYP)	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	94.03 %
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 = 0.67 A/ 277VAC I = 0.79 A/ 230VAC I = 1.56 A/ 115VAC
6	INRUSH CURRENT	230 V/ 65A (Typ) COLD START	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	I = 56 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: 54V~60V	I/P: 305VAC I/P: 230 VAC I/P: 90 VAC O/P: MIN LOAD Ta: 25°C	55.29 V/ 305VAC 55.31V/ 230VAC 55.30 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
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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) 466 V (2) 446 V (3) 450 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°C	(1) 111 V (2) 12.8 V (3) 109 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°C	(1) 111 V (2) 11.5 V (3) 109 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) 435.8 V (2) 436.1 V (3) 436 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) 12.652 V (2) 12.582 V (3) 12.582 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) 452 V (3) 458 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 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°C	I/P-O/P: 2.589 mA I/P-FG: 2.297 mA O/P-FG: 3.41 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	SPECIFICATION	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 ℃ 2. HIGH AMBIENT BURN-IN : 7 HRS I/P : 230VAC O/P : FULL LOAD Ta= 61.1 ℃ <table><thead><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 29 ℃</th><th>HIGH AMBIENT Ta= 61.1 ℃</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℃</td><td>81.6℃</td></tr><tr><td>7</td><td>Q1</td><td>64.6℃</td><td>85.9℃</td></tr><tr><td>8</td><td>L2</td><td>66.5℃</td><td>87.4℃</td></tr><tr><td>9</td><td>Q5</td><td>67.3℃</td><td>87.7℃</td></tr><tr><td>10</td><td>D2</td><td>70.1℃</td><td>89.7℃</td></tr><tr><td>11</td><td>RTH2</td><td>61.9℃</td><td>83.0℃</td></tr><tr><td>12</td><td>T1</td><td>74.9℃</td><td>94.8℃</td></tr><tr><td>13</td><td>Q101</td><td>65.8℃</td><td>87.9℃</td></tr><tr><td>14</td><td>D9</td><td>64.3℃</td><td>84.9℃</td></tr><tr><td>15</td><td>C102</td><td>60.7℃</td><td>83.3℃</td></tr><tr><td>16</td><td>C201</td><td>61.1℃</td><td>83.5℃</td></tr><tr><td>17</td><td>C16</td><td>63.0℃</td><td>84.3℃</td></tr><tr><td>18</td><td>C106</td><td>55.3℃</td><td>78.9℃</td></tr><tr><td>19</td><td>C38</td><td>66.5℃</td><td>87.0℃</td></tr><tr><td>20</td><td>LF100</td><td>57.6℃</td><td>80.8℃</td></tr><tr><td>21</td><td>U900</td><td>62.1℃</td><td>83.4℃</td></tr><tr><td>22</td><td>U1</td><td>60.8℃</td><td>83.7℃</td></tr><tr><td>23</td><td>C5</td><td>46.4℃</td><td>78.5℃</td></tr></tbody></table>			NO	Position	ROOM AMBIENT Ta= 29 ℃	HIGH AMBIENT Ta= 61.1 ℃	1	V1	24.05V	23.96V	6	BD1	59.0℃	81.6℃	7	Q1	64.6℃	85.9℃	8	L2	66.5℃	87.4℃	9	Q5	67.3℃	87.7℃	10	D2	70.1℃	89.7℃	11	RTH2	61.9℃	83.0℃	12	T1	74.9℃	94.8℃	13	Q101	65.8℃	87.9℃	14	D9	64.3℃	84.9℃	15	C102	60.7℃	83.3℃	16	C201	61.1℃	83.5℃	17	C16	63.0℃	84.3℃	18	C106	55.3℃	78.9℃	19	C38	66.5℃	87.0℃	20	LF100	57.6℃	80.8℃	21	U900	62.1℃	83.4℃	22	U1	60.8℃	83.7℃	23	C5	46.4℃	78.5℃
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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℃	TEST : OK																																																																																
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305 VAC/100VAC O/P : 100% LOAD Ta= -55 ℃	TEST : OK																																																																																
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60 ℃ NO DAMAGE	I/P : 305 VAC O/P : 100% LOAD Ta= 60 ℃ HUMIDITY= 95 %R.H	TEST : OK																																																																																
5	TEMPERATURE COEFFICIENT	± 0.03 %(0~60℃)	I/P : 230 VAC O/P : FULL LOAD	± 0.012 %(0~60℃)																																																																																
6	STORAGE TEMPERATURE TEST	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		OK																																																																																

7	THERMAL SHOCK TEST	1. Thermal shock Temperature : $-55^{\circ}\text{C} \sim +65^{\circ}\text{C}$ 2. Temperature change rate : $25^{\circ}\text{C} / \text{MIN}$ 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : 230VAC/Full Load AC ON/OFF TEST turn on 58sec ; turn off 2sec	OK
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-185-24: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) 420912 HRS (2) 71928 HRS (3) 103147 HRS (4) 125546 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 164.1K hrs min. MIL-HDBK-217F (25°C)	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

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