



Test Report: HEP-480-24

480W 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

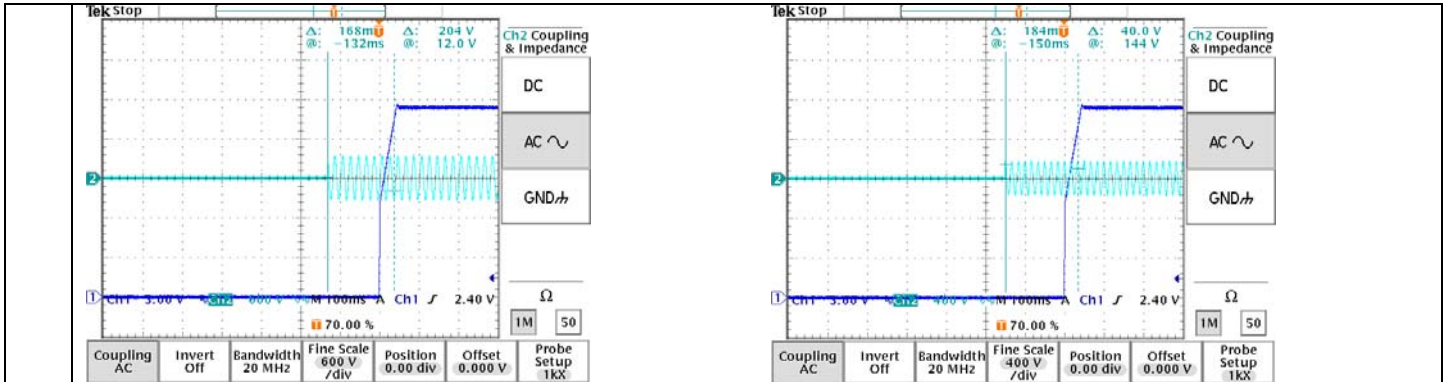
■ RELIABILITY TEST

ENVIRONMENT TEST

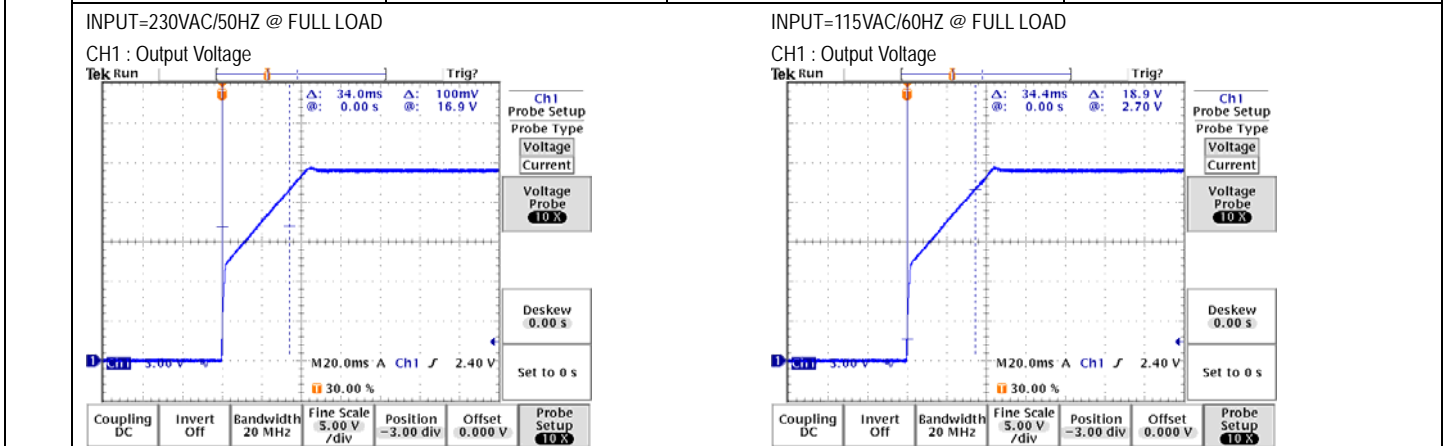
DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

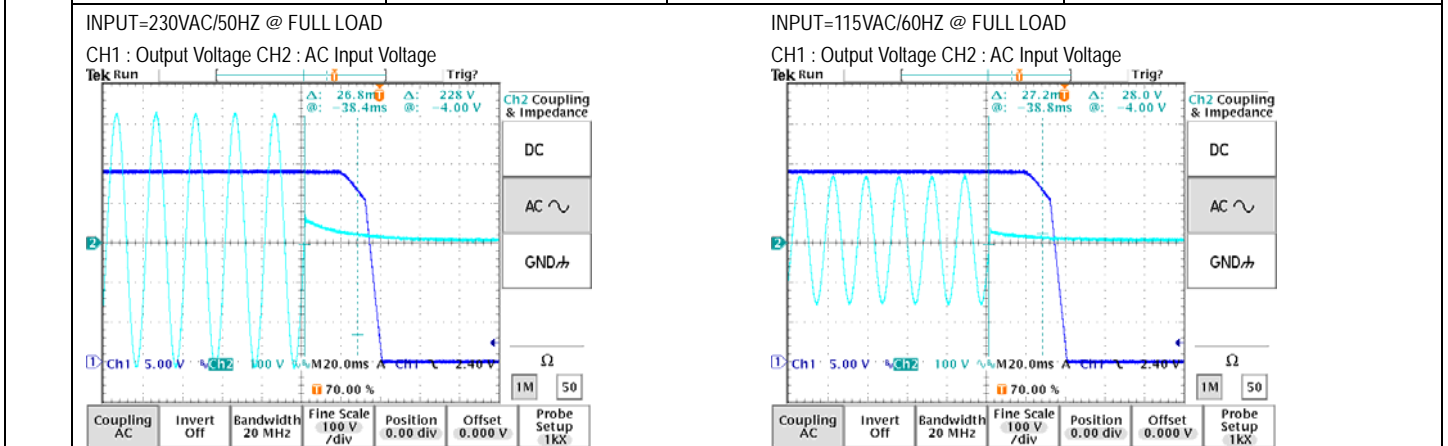
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE ADJUST RANGE	CH1: 20.4 V- 25.2V	I/P: 230 VAC I/P:115VAC O/P:MIN LOAD Ta:25°C	18.51V-25.76 V /230VAC 18.52V-25.76 V/115VAC
2	CURRENT ADJ. RANGE	CH1: 10 A- 20 A	I/P: 230 VAC I/P:115VAC O/P:CV MIN & CV MAX-1V Ta:25°C	7.84A-24.51A/230VAC@CVMAX-1V 7.84A- 24.51 A/115VAC@CV AX-1V
3	OUTPUT VOLTAGE TOLERANCE (Max)	V1:1% ~ -1 %	I/P:100VAC /305AC O/P:FULL/ MIN LOAD Ta:25°C	V1:0%~-0.62%
4	LINE REGULATION (Max)	V1: 0.5% ~ -0.5 %	I/P:100VAC-305AC O/P:FULL LOAD Ta:25°C	V1: 0 %~ 0 %
5	LOAD REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P: 230 VAC O/P:FULL -MIN LOAD Ta:25°C	V1:-0.33 %~ 0.29 %
6	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	TEST: 1.63 %
7	RIPPLE & NOISE (Max)	V1: 200 mVp-p	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	V1: 64 mVp-p
<div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p>high frequency :</p> </div> <div style="width: 45%;"> <p>low frequency :</p> </div> </div>				
8	SET UP TIME (Max)	230VAC/ 500 ms 115VAC/ 500 ms	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230VAC/ 168 ms 115 VAC/ 184 ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage			INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	



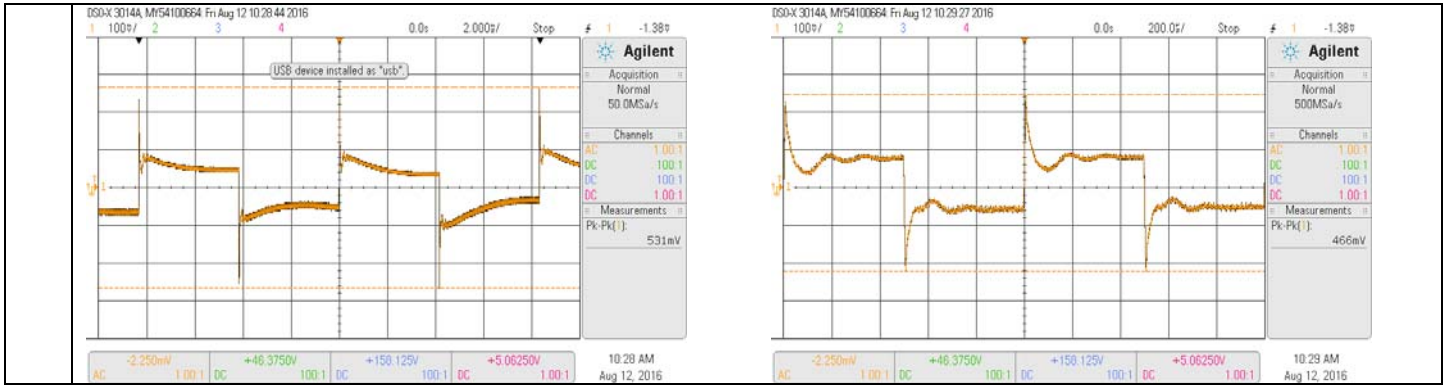
9	RISE TIME (Max)	230VAC/ 80 ms 115VAC/ 80 ms	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230VAC/ 34 ms 115 VAC/34.4 ms
	<p>INPUT=230VAC/50HZ @ FULL LOAD</p> <p>CH1 : Output Voltage</p>			



10	HOLD UP TIME (Typ.)	230VAC/ 16 ms 115VAC/ 16 ms	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230VAC/ 26.8 ms 115 VAC/27.2 ms
	<p>INPUT=115VAC/60HZ @ FULL LOAD</p> <p>CH1 : Output Voltage</p>			

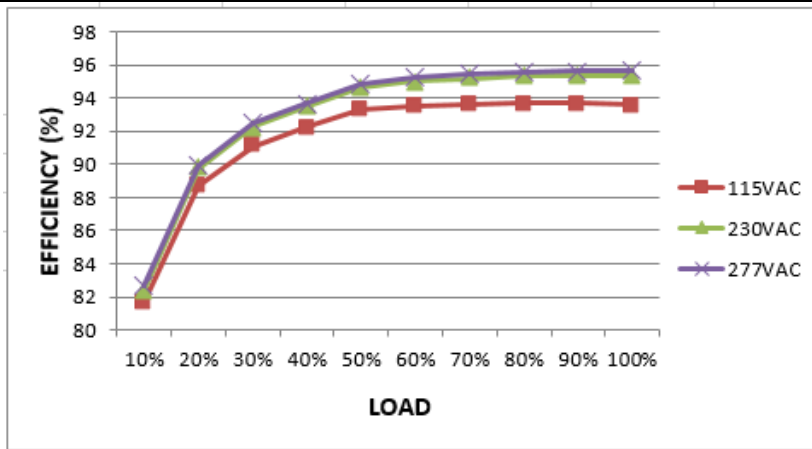


11	DYNAMIC LOAD	V1: 2400 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	531mVp-p 466mVp-p
	<p>FULL /50% LOAD 50%DUTY / 120HZ</p> <p>FULL /50% LOAD 50%DUTY / 1KHZ</p>			



INPUT FUNCTION TEST

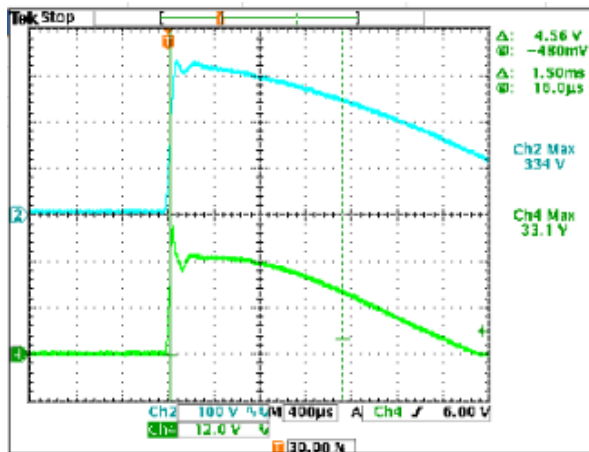
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																												
1	INPUT VOLTAGE RANGE	90VAC~305 VAC	I/P: TESTING O/P: FULL LOAD Ta: 25°C	76V~305 V																																												
			I/P: LOW-LINE-3V=87 V HIGH-LINE+10V=315 V O/P: FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (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	INPUT CURRENT (TYP)	277VAC/ 2 A 230 VAC/ 2.45 A 115 VAC/ 5 A	I/P: 277VAC/230 VAC/115 VAC O/P: FULL LOAD Ta: 25°C	I=1.80A/ 277VAC I=2.13A/ 230VAC I=4.31 A/ 115VAC																																												
4	LEAKAGE CURRENT	< 0.75 mA / 277VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25°C	L-FG: 0.32mA N-FG: 0.32 mA																																												
5	POWER FACTOR(TYP)	0.97/230 VAC FULL LOAD 0.98/115 VAC FULL LOAD 0.95/277 VAC FULL LOAD	I/P: 230 VAC/115VAC/277VAC O/P: FULL LOAD Ta: 25°C	PF=0.982 /230V/100%LOAD PF=0.994/115V/100%LOAD PF=0.958 /277V/100%LOAD																																												
<table border="1"> <caption>Power Factor vs Load Data</caption> <thead> <tr> <th>Load (%)</th> <th>115VAC PF</th> <th>230VAC PF</th> <th>277VAC PF</th> </tr> </thead> <tbody> <tr><td>10</td><td>0.95</td><td>0.70</td><td>0.55</td></tr> <tr><td>20</td><td>0.98</td><td>0.85</td><td>0.72</td></tr> <tr><td>30</td><td>0.99</td><td>0.90</td><td>0.80</td></tr> <tr><td>40</td><td>0.99</td><td>0.93</td><td>0.85</td></tr> <tr><td>50</td><td>0.99</td><td>0.95</td><td>0.88</td></tr> <tr><td>60</td><td>0.99</td><td>0.96</td><td>0.90</td></tr> <tr><td>70</td><td>0.99</td><td>0.97</td><td>0.92</td></tr> <tr><td>80</td><td>0.99</td><td>0.97</td><td>0.93</td></tr> <tr><td>90</td><td>0.99</td><td>0.98</td><td>0.94</td></tr> <tr><td>100</td><td>0.99</td><td>0.98</td><td>0.95</td></tr> </tbody> </table>					Load (%)	115VAC PF	230VAC PF	277VAC PF	10	0.95	0.70	0.55	20	0.98	0.85	0.72	30	0.99	0.90	0.80	40	0.99	0.93	0.85	50	0.99	0.95	0.88	60	0.99	0.96	0.90	70	0.99	0.97	0.92	80	0.99	0.97	0.93	90	0.99	0.98	0.94	100	0.99	0.98	0.95
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6	EFFICIENCY (TYP)	94 %	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	94.37% /230V																																												



7	INRUSH CURRENT (TYP)	230 V/35A COLD START	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	I = 33.1 A / 230VAC
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INPUT=230VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH1 : Input current (1V=1A)



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER CURRENT PROTECTION	105%~ 125 % PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed	I/P: 305VAC I/P: 230VAC I/P: 100VAC O/P: TESTING Ta: 25°C	110%/ 305VAC 110%/ 230VAC 110%/100VAC PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	V1: 27 V~ 33 V PROTECTION TYPE : Shut down output voltage, re-power on to recovery	I/P: 305VAC I/P: 230VAC I/P: 90VAC O/P: MIN LOAD Ta: 25°C	28.26V/ 305VAC 28.27V/ 230VAC 28.26V/ 90VAC PROTECTION TYPE : Shut down output voltage, re-power on to recovery

3	OVER TEMPERATURE PROTECTION	PROTECTION TYPE : Shut down output voltage, re-power on to recovery	I/P: 305 VAC I/P: 90 VAC O/P: FULL LOAD	O.T.P Active PROTECTION TYPE : Shut down output voltage, re-power on to recovery
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed	I/P: 305VAC I/P: 90 VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q 10 Rated 13 A/ 600 V Q 13 Rated 13 A/ 600V	I/P: High-Line +3V =308V AC ON/OFF VDS: O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7) 0%→400% Load. Ta:25°C	Q10 Q13 VDS: (1)504V (2)500V (3)440V (4)428V (5)432V (6)432V (7)488V VDS: (1)508V (2)500V (3)440V (4)432V (5)440V (6)432V (7)500V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rated 13 A/ 600 V	I/P: High-Line +3V =308 V AC ON/OFF O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7) 0%→400% Load. Ta:25°C	VDS: (1)499V (2) 459V (3)479V (4)483V (5)491V (6)483V (7)471V
3	P.F.C DIODE	D8 Rated 15A/ 600V	I/P: High-Line +3V =308 V AC ON/OFF O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (4) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25°C	(1)424V (2)448V (3)428V (4)440V
4	Diode Peak Voltage	Q100 Rated 100 A/ 80V Q101 Rated	I/P: High-Line +3V =308 V AC ON/OFF O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/	Q100: VDS: (1)56.3V (2)17.7V (3)53.9V Q101 VDS: (1)57.1V (2)4.1V (3)57.1V

		100 A/ 80V	Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. (8).NO LOAD Ta:25°C	(4)57.9V (5)55.5V (6)53.9V (7)12.9V (8)51.5V	(4)59.5V (5)58.7V (6)61.2V (7)8.9V (8)24.2V
5	Input Capacitor Voltage	C5 Rated: 150 μ / 450V	I/P:High-Line +3V =308V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue Ta:25°C	(1)433V (2)437V (3)449V (4)433V	
6	Control IC Voltage Test	PWM IC U2 Rated 16V- 8.85V(MIN.) PFC IC U1 Rated 20V-10.5V(MIN.)	I/P:High-Line +3V =308 V AC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. Ta:25°C	U1: (1) 13.68V (2) 13.25V (3) 13.31V (4) 13.31V U2: (1)12.375V (2)12.375V (3)12.25V (4)12.81V	

SAFETY & EMC TEST REPORT

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: 4.125 KVAC/min I/P-FG: 2.4KVAC/min O/P-FG: 1.8 KVAC/min Ta:25°C	I/P-O/P:5.59mA I/P-FG: 4.8mA O/P-FG:6.08 mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100M Ω I/P-FG: 500VDC>100M Ω O/P-FG:500VDC>100M Ω	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P: 25.1G Ω I/P-FG: 15G Ω O/P-FG:30 G Ω NO DAMAGE
3	GROUNDING CONTINUITY	IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 m Ω	40A / 2min Ta:25°C	25m Ω

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P: 230 VAC/50HZ O/P:FULL 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	I/P: 230 VAC/50HZ O/P:FULL LOAD	CRITERIA A

		AIR:8KV / Contact:4KV	Ta:25°C	
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
7	Test by certified Lab & Test Report Prepare			

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																																																
1	TEMPERATURE RISE TEST	MODEL : HEP-480-24 1. ROOM AMBIENT BURN-IN : 2.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 29.4 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 63.8 °C																																																																																																																		
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16	T2 Primary side	91.8°C	101.6°C																																																																																																																	
17	Q100	84.9°C	95.7°C																																																																																																																	
18	Q121	84.4°C	95.4°C																																																																																																																	
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22	T500	83.1°C	91.6°C																																																																																																																	
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26	RTH2	84.4°C	92.6°C																																																																																																																	
27	C93	86.1°C	98.7°C																																																																																																																	

2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : 100 % LOAD Ta= -60 °C	TEST : OK
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60 °C NO DAMAGE	I/P : 315 VAC O/P : FULL LOAD Ta= 60°C HUMIDITY= 95 %R.H	TEST : OK
4	TEMPERATURE COEFFICIENT	± 0.02 %/°C(0-60°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.006 %/°C (0-60°C)
5	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -50°C~ +125°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 100 CYCLE 5. Input/Output condition : STATIC		OK
6	THERMAL SHOCK TEST	1. Thermal shock Temperature : -60°C~ +65°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 16 CYCLE 5. Input/Output condition : 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test		OK
7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10-500Hz (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	SUPPOSE C117 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) 95027HRS (2) 19111HRS (3) 52542HRS (4) 86291HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 89.8K hrs min. MIL-HDBK-217F (25°C)		
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : Above 55,000 hours @ TA 60°C		

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

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