



Test Report: HEP-480-36

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

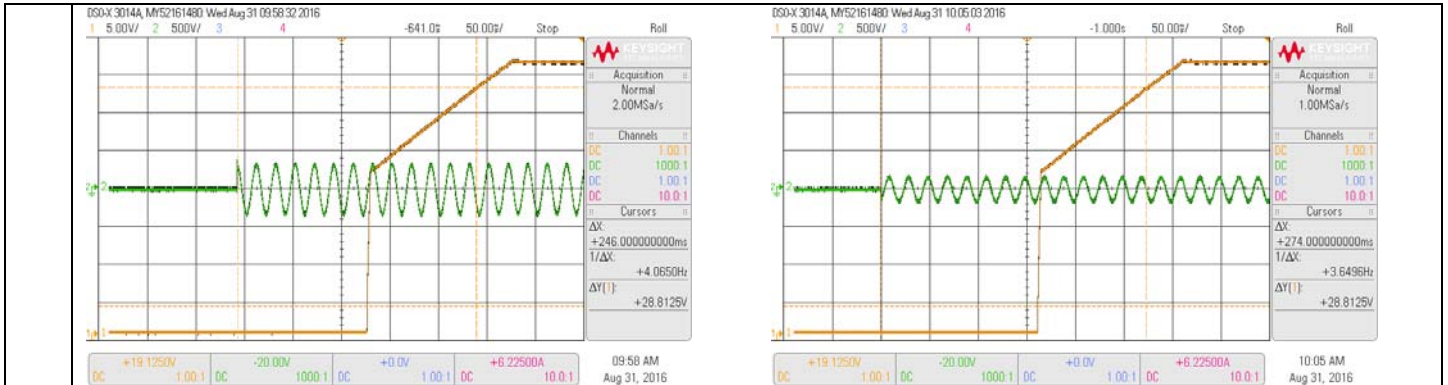
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE ADJUST RANGE	CH1: 30.6 V~ 37.8V	I/P: 230 VAC I/P:115VAC O/P:MIN LOAD Ta:25°C	27.964V~ 38.765V /230VAC 27.951V~38.768 V/115VAC
2	CURRENT ADJ. RANGE	CH1: 6.6 A~ 13.3 A	I/P: 230 VAC I/P:115VAC O/P:CV MIN & CV MAX-1V Ta:25°C	5.61A~16.06A/230VAC@CV MAX-1V 5.61A~16.06A/115VAC@CV MAX-1V
3	OUTPUT VOLTAGE TOLERANCE (Max)	V1:1% ~ -1 %	I/P:100VAC /305AC O/P:FULL/ MIN LOAD Ta:25°C	V1: 0.11%~ -0.22%
4	LINE REGULATION (Max)	V1: 0.5% ~ -0.5 %	I/P:100VAC~305AC O/P:FULL LOAD Ta:25°C	V1: 0%~ -0.027%
5	LOAD REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P: 230 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.166%~ -0.166 %
6	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	TEST: <5%
7	RIPPLE & NOISE (Max)	V1: 250 mVp-p	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	V1: 68mVp-p
<p>high frequency :</p>		<p>low frequency :</p>		
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/ 246 ms 115 VAC/ 274ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage			INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	

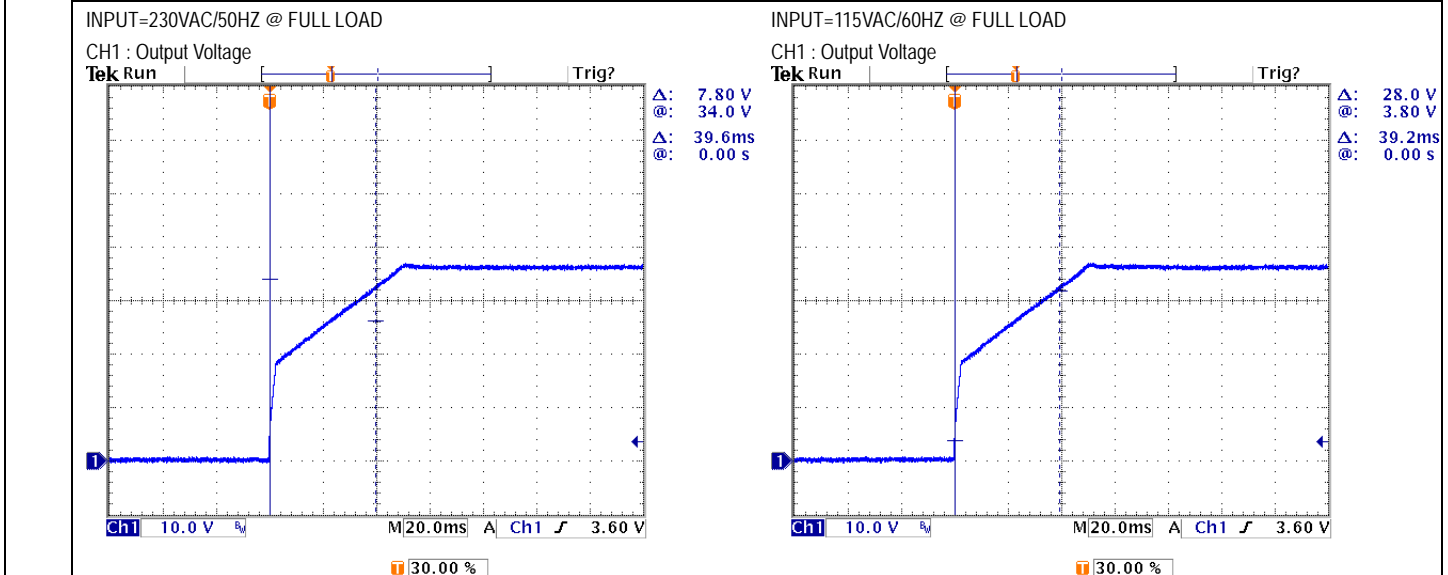


480W Single Output Switching Power Supply

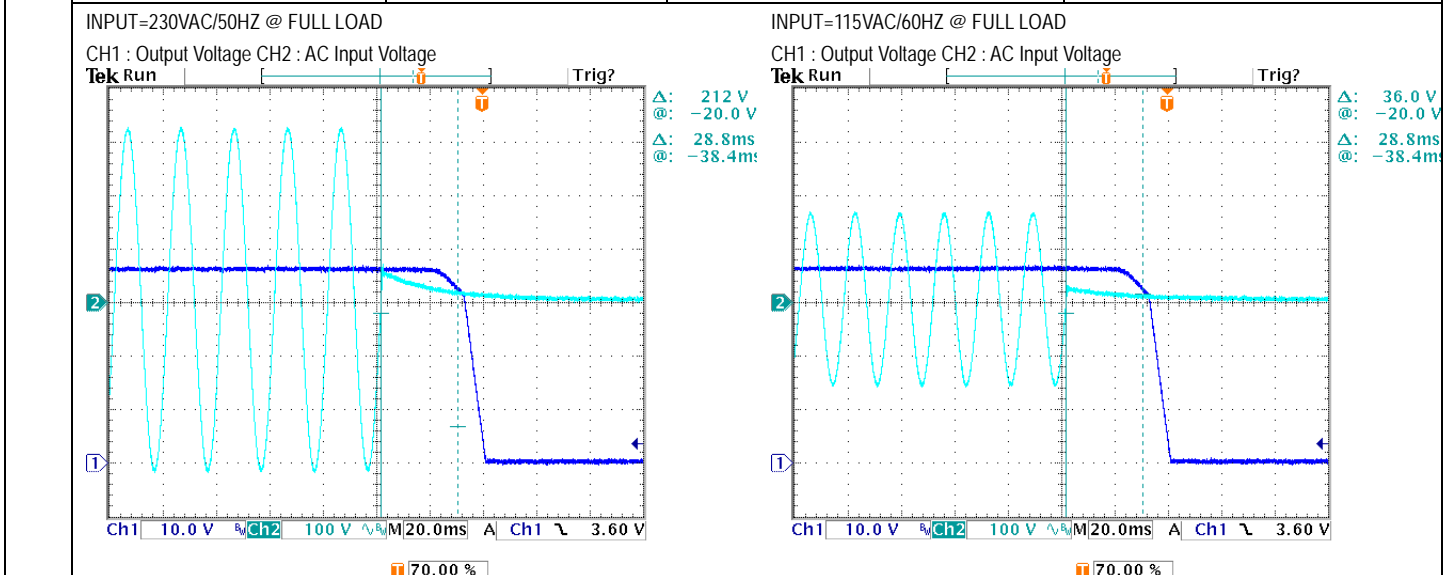
HEP-480 series

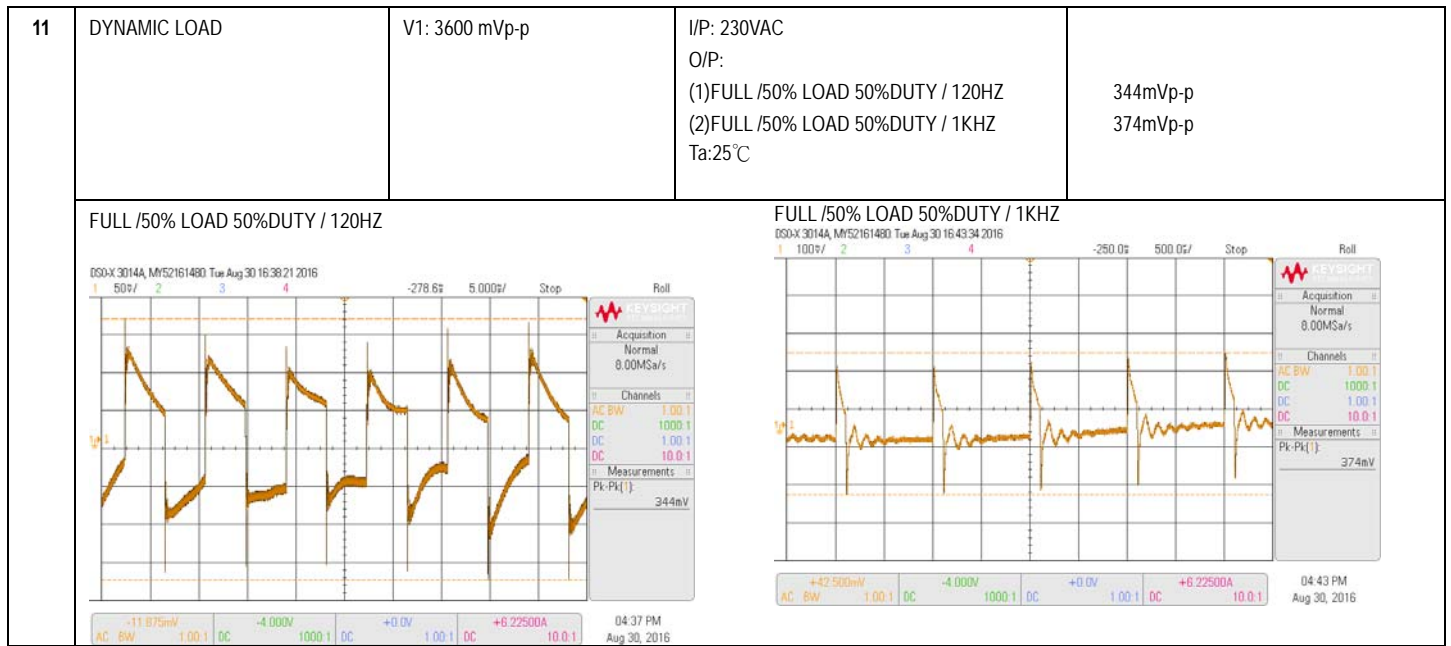


9	RISE TIME (Max)	230VAC/ 80 ms	I/P: 230 VAC	230VAC/ 39.6ms
		115VAC/ 80 ms	I/P: 115 VAC O/P: FULL LOAD Ta: 25°C	115 VAC/ 39.2ms



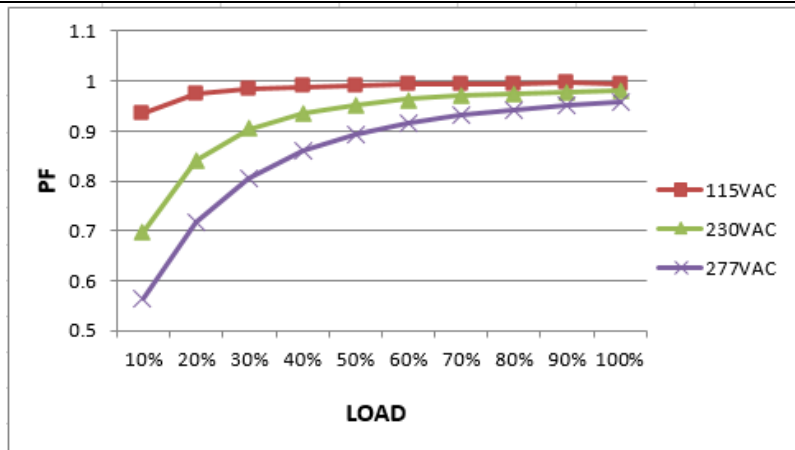
10	HOLD UP TIME (Typ.)	230VAC/ 16 ms	I/P: 230 VAC	230VAC/ 28.8ms
		115VAC/ 16 ms	I/P: 115 VAC O/P: FULL LOAD Ta: 25°C	115 VAC/ 28.8ms



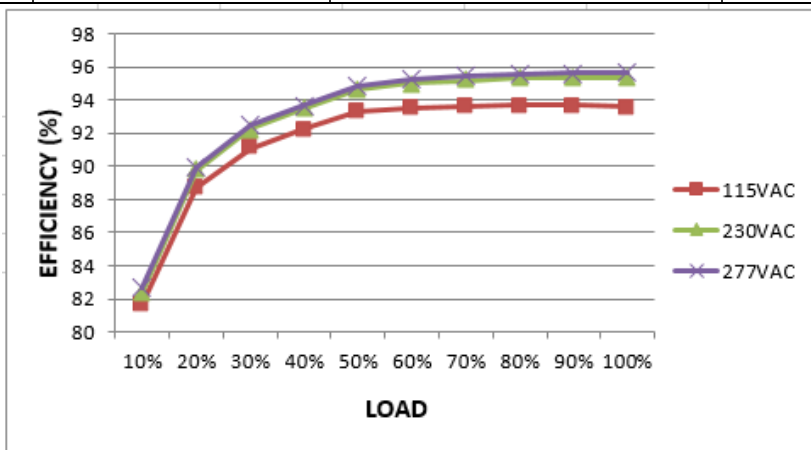


INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~305 VAC	I/P: TESTING O/P: FULL LOAD Ta: 25°C	72V~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=1.78A/277VAC I=2.11A/ 230VAC I=4.24A/ 115VAC
4	LEAKAGE CURRENT	< 0.75 mA / 277VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25°C	L-FG: 0.25mA N-FG: 0.24mA
6	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=0.981/230V/100%LOAD PF= 0.995/115V/100%LOAD PF= 0.958/277V/100%LOAD



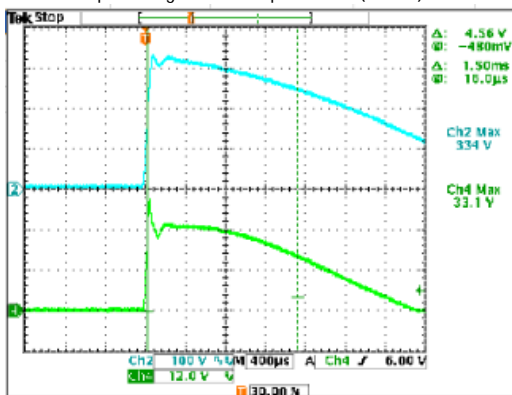
7	EFFICIENCY (TYP)	95 %	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	95.21% / 230V
---	------------------	------	--	---------------



8	INRUSH CURRENT (TYP)	230 V / 35A COLD START	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	I = 33.1A / 230VAC
---	----------------------	---------------------------	--	--------------------

INPUT=230VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : 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: 40 V- 50 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	47.708V/ 305VAC 41.72V/ 230VAC 41.65V/ 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/ 650 V Q 12 Rated 13 A/ 650 V	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.	Q10 Q13 VDS: VDS: (1) 478V (1) 526V (2) 474V (2) 514V (3) 478V (3) 534V (4) 482V (4) 526V (5) 486V (5) 530V (6) 486V (6) 522V (7) 474V (7) 506V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated 13 A/ 650 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.	VDS: (1) 522V (2) 454V (3) 526V (4) 522V (5) 534V (6) 522V (7) 478V

			Ta:25°C	
3	P.F.C DIODE	D8 Rated 12A/ 650V	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)462V (2)466V (3)462V (4)466V
4	Diode Peak Voltage	Q120 Rated 80A/100 V Q121 Rated 80A/100 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. (8).NO LOAD Ta:25°C	Q120:: VDS: (1)83.6V (2)18.5V (3)84.4V (4)86V (5)87.6V (6)85.2V (7)84.4V (8)80.4V Q121: VDS: (1)86V (2)6.1V (3)87.8V (4)87.8V (5)88.6V (6)86.1V (7)86.1V (8)82.1V
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)449V (2)449V (3)447V (4)439V
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	U2 (1) 14.49V (2) 14.89V (3) 14.33V (4) 13.37V U1 (1)15.3V (2)15.14V (3)14.57V (4)14.25V

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:5.85mA I/P-FG:5.2mA O/P-FG: 6.15mA 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:19.9 GΩ I/P-FG:13.1 G Ω O/P-FG:30G Ω NO DAMAGE
3	GROUNDING CONTINUITY	IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	25mΩ

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	EN55015 CLASS B	I/P: 230 VAC /50HZ O/P:FULL/50% LOAD Ta:25°C	PASS Test by certified Lab
3	RADIATION	EN55015 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
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT: 1KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA
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
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																																																																																																																		
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 29.4 °C</th> <th>HIGH AMBIENT Ta= 63.8 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD2</td><td>89.8°C</td><td>98.1°C</td></tr> <tr><td>2</td><td>C10</td><td>86.5°C</td><td>94.8°C</td></tr> <tr><td>3</td><td>Q1</td><td>86.4°C</td><td>97.8°C</td></tr> <tr><td>4</td><td>D8</td><td>90.1°C</td><td>99.1°C</td></tr> <tr><td>5</td><td>Q10</td><td>88.8°C</td><td>94.8°C</td></tr> <tr><td>6</td><td>Q12</td><td>89.7°C</td><td>98.7°C</td></tr> <tr><td>7</td><td>RY1</td><td>87.6°C</td><td>96.1°C</td></tr> <tr><td>8</td><td>LF2</td><td>83.3°C</td><td>90.7°C</td></tr> <tr><td>9</td><td>ZNR2</td><td>83.2°C</td><td>90.3°C</td></tr> <tr><td>10</td><td>C1</td><td>82.2°C</td><td>89.4°C</td></tr> <tr><td>11</td><td>C5</td><td>83.3°C</td><td>90.5°C</td></tr> <tr><td>12</td><td>L3</td><td>87.9°C</td><td>97.2°C</td></tr> <tr><td>13</td><td>U1</td><td>83.6°C</td><td>90.2°C</td></tr> <tr><td>14</td><td>U2</td><td>83.4°C</td><td>90.9°C</td></tr> <tr><td>15</td><td>T1 Primary side</td><td>89.7°C</td><td>100.7°C</td></tr> <tr><td>16</td><td>T2 Primary side</td><td>91.8°C</td><td>101.6°C</td></tr> <tr><td>17</td><td>Q100</td><td>84.9°C</td><td>95.7°C</td></tr> <tr><td>18</td><td>Q121</td><td>84.4°C</td><td>95.4°C</td></tr> <tr><td>19</td><td>C115</td><td>81.2°C</td><td>91.6°C</td></tr> <tr><td>20</td><td>C117</td><td>80.9°C</td><td>99.5°C</td></tr> <tr><td>21</td><td>LF100</td><td>80.1°C</td><td>91.8°C</td></tr> <tr><td>22</td><td>T500</td><td>83.1°C</td><td>91.6°C</td></tr> <tr><td>23</td><td>C511</td><td>84.3°C</td><td>92.7°C</td></tr> <tr><td>24</td><td>U501</td><td>83.4°C</td><td>90.9°C</td></tr> <tr><td>25</td><td>J101</td><td>86.3°C</td><td>97.5°C</td></tr> <tr><td>26</td><td>RTH2</td><td>84.4°C</td><td>92.6°C</td></tr> <tr><td>27</td><td>C93</td><td>86.1°C</td><td>98.7°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 29.4 °C	HIGH AMBIENT Ta= 63.8 °C	1	BD2	89.8°C	98.1°C	2	C10	86.5°C	94.8°C	3	Q1	86.4°C	97.8°C	4	D8	90.1°C	99.1°C	5	Q10	88.8°C	94.8°C	6	Q12	89.7°C	98.7°C	7	RY1	87.6°C	96.1°C	8	LF2	83.3°C	90.7°C	9	ZNR2	83.2°C	90.3°C	10	C1	82.2°C	89.4°C	11	C5	83.3°C	90.5°C	12	L3	87.9°C	97.2°C	13	U1	83.6°C	90.2°C	14	U2	83.4°C	90.9°C	15	T1 Primary side	89.7°C	100.7°C	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	19	C115	81.2°C	91.6°C	20	C117	80.9°C	99.5°C	21	LF100	80.1°C	91.8°C	22	T500	83.1°C	91.6°C	23	C511	84.3°C	92.7°C	24	U501	83.4°C	90.9°C	25	J101	86.3°C	97.5°C	26	RTH2	84.4°C	92.6°C	27	C93	86.1°C	98.7°C
NO	Position	ROOM AMBIENT Ta= 29.4 °C	HIGH AMBIENT Ta= 63.8 °C																																																																																																																	
1	BD2	89.8°C	98.1°C																																																																																																																	
2	C10	86.5°C	94.8°C																																																																																																																	
3	Q1	86.4°C	97.8°C																																																																																																																	
4	D8	90.1°C	99.1°C																																																																																																																	
5	Q10	88.8°C	94.8°C																																																																																																																	
6	Q12	89.7°C	98.7°C																																																																																																																	
7	RY1	87.6°C	96.1°C																																																																																																																	
8	LF2	83.3°C	90.7°C																																																																																																																	
9	ZNR2	83.2°C	90.3°C																																																																																																																	
10	C1	82.2°C	89.4°C																																																																																																																	
11	C5	83.3°C	90.5°C																																																																																																																	
12	L3	87.9°C	97.2°C																																																																																																																	
13	U1	83.6°C	90.2°C																																																																																																																	
14	U2	83.4°C	90.9°C																																																																																																																	
15	T1 Primary side	89.7°C	100.7°C																																																																																																																	
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																																																																																																																	
19	C115	81.2°C	91.6°C																																																																																																																	
20	C117	80.9°C	99.5°C																																																																																																																	
21	LF100	80.1°C	91.8°C																																																																																																																	
22	T500	83.1°C	91.6°C																																																																																																																	
23	C511	84.3°C	92.7°C																																																																																																																	
24	U501	83.4°C	90.9°C																																																																																																																	
25	J101	86.3°C	97.5°C																																																																																																																	
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

12.10.30 A50-F031