



Test Report: HEP-480-48

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

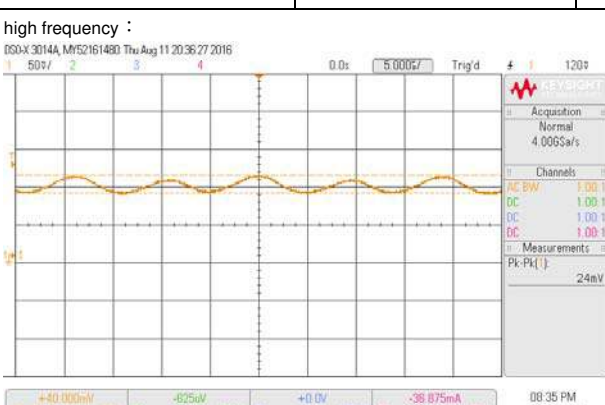
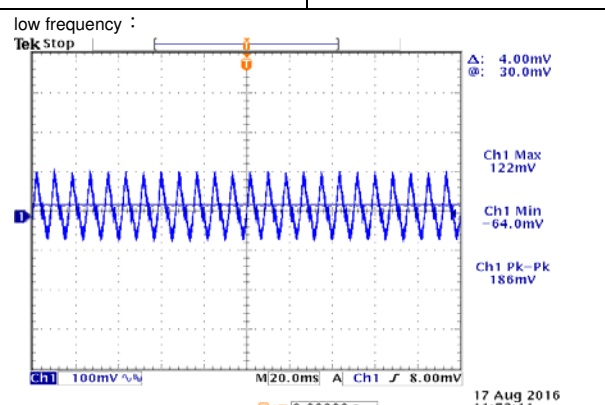
E.M.C. Test

■ RELIABILITY TEST

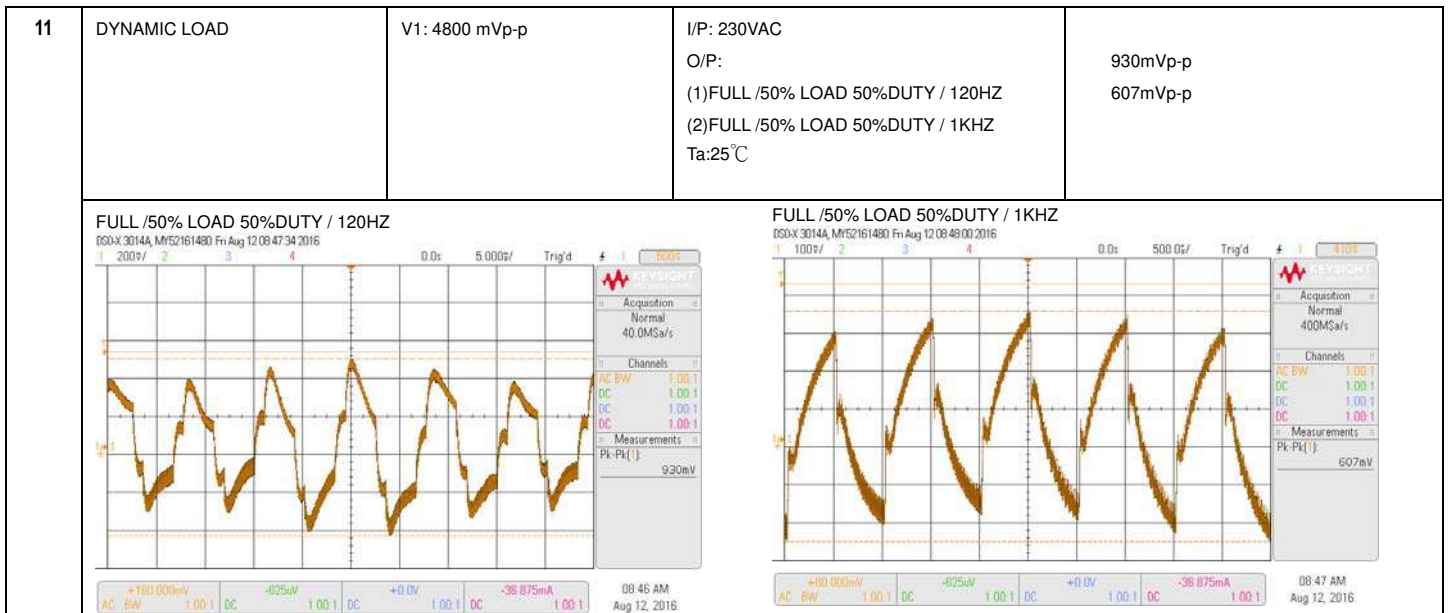
ENVIRONMENT TEST

DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

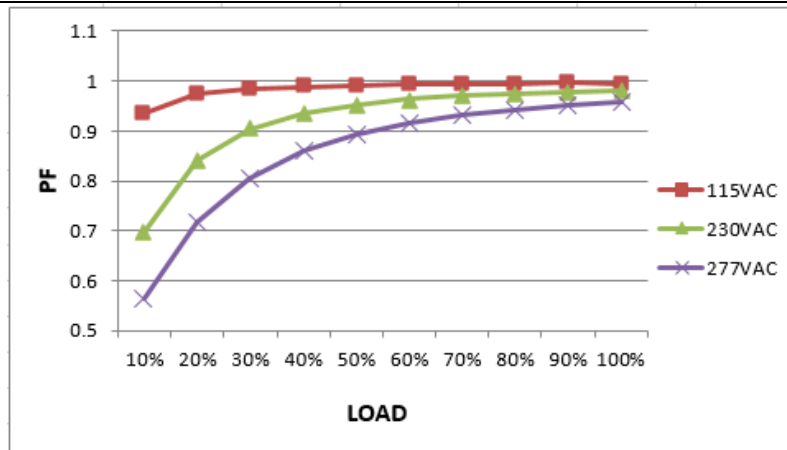
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE ADJUST RANGE	CH1: 40.8 V ~ 50.4V	I/P: 230 VAC I/P:115VAC O/P:MIN LOAD Ta:25°C	37.269V~51.698V /230VAC 37.251V~51.693 V/115VAC
2	CURRENT ADJ. RANGE	CH1: 5 A ~ 10 A	I/P: 230 VAC I/P:115VAC O/P:CV MIN & CV MAX-1V Ta:25°C	3.93A~12.16A /230VAC@CV MAX-1V 3.93A~12.16A /230VAC@CV MIN 3.93A~12.16A /115VAC@CV MAX-1V 3.93A~12.16A /115VAC@CV MIN
3	OUTPUT VOLTAGE TOLERANCE (Max)	V1:1% ~ -1 %	I/P:100VAC /305AC O/P:FULL/ MIN LOAD Ta:25°C	V1: 0.187 %~-0.375%
4	LINE REGULATION (Max)	V1: 0.5% ~ -0.5 %	I/P:100VAC~305AC O/P:FULL LOAD Ta:25°C	V1: 0.04%~-0.02%
5	LOAD REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P: 230 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.166%~-0.333%
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: 186mVp-p
high frequency :  low frequency : 				
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/199ms 115 VAC/232ms
INPUT=230VAC/50HZ @ FULL LOAD			INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	

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/ 38.4ms 115 VAC/ 38.8ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage				
INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage				
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/ 29.2ms 115 VAC/ 29.2ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage				
INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage				

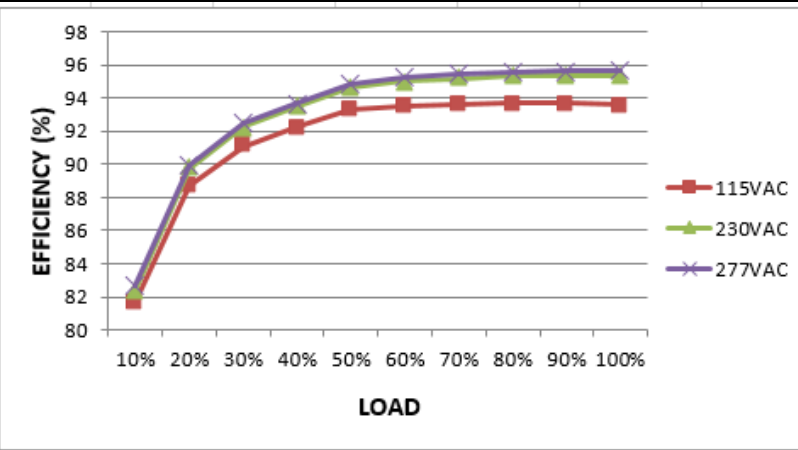


INPUT FUNCTION TEST

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= 1.79A/277VAC I= 2.12A/ 230VAC I= 4.28A/ 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: 0.3mA
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= 0.978 /230V/100%LOAD PF= 0.993/115V/100%LOAD PF= 0.958/277V/100%LOAD



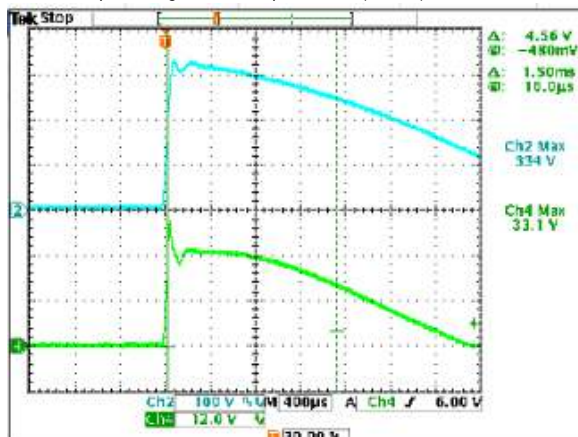
6	EFFICIENCY (TYP)	94.5 %	I/P: 230 VAC O/P: FULL LOAD Ta:25°C	94.77% /230V
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7	INRUSH CURRENT (TYP)	230 V/35A COLD START (twidh=1800us measured at 50% Ipeak) COLD START	I/P: 230 VAC O/P: FULL LOAD Ta:25°C	I = 33.1A/ 230VAC T50= 1500 us
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INPUT=230VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current (1V=1A)



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD 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℃	110%/ 305VAC 110%/ 230VAC 110%/100VAC PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	V1: 53 V~ 63 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℃	54.61V/ 305VAC 54.64V/ 230VAC 54.54V/ 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℃	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 13Rated 13 A/ 650V	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℃	Q10 Q13 VDS: VDS: (1) 490V (1) 534V (2) 478V (2) 522V (3) 494V (3) 534V (4) 490V (4) 530V (5) 494V (5) 530V (6) 490V (6) 530V (7) 474V (7) 518V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated 13 A/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/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	Q1 VDS: (1) 482V (2) 462V (3) 470V (4) 466V (5) 458V (6) 462V (7) 474V

			(7)0%→400% Load. Ta:25℃	
3	P.F.C DIODE	D8 Rated 12A/ 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℃	D8: 308V (1) 454V (2) 470V (3) 458V (4) 478V
4	Diode Peak Voltage	Q100 Rated 43A/150V Q101 Rated 43A/150V	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℃	Q100: VDS: (1) 107.7V (2) 56.2V (3)108.5V (4)111.7V (5) 112.5V (6)112.5V (7)116.5V (8) 115.7V Q101: VDS: (1) 110.1V (2) 31.3V (3) 109.3V (4) 115.7V (5) 110.9V (6) 110.9V (7)134V (8) 135.4V
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℃	(1) 448V (2) 448V (3) 448V (4) 440V
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℃	U2 U1 (1) 13.45V (1) 14.42V (2) 13.37V (2)14.5V (3) 13.21V (3) 14.58V (4) 13.29V (4) 14.1V

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℃	I/P-O/P: 5.54mA I/P-FG: 4.99mA O/P-FG: 5.77mA 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℃	I/P-O/P: 27.7G Ω I/P-FG: 17.9G Ω O/P-FG: 30G Ω NO DAMAGE
3	GROUNDING CONTINUITY	IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 m Ω	40A / 2min Ta:25℃	26m 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℃	PASS
2	CONDUCTION	EN55015 CLASS B	I/P: 230 VAC /50HZ O/P:FULL/50% LOAD Ta:25℃	PASS Test by certified Lab
3	RADIATION	EN55015 CLASS B	I/P: 230 VAC /50HZ O/P:FULL LOAD Ta:25℃	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℃	CRITERIA A
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT: 1KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	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℃	CRITERIA A
7	Test by certified Lab & Test Report Prepare			

RELIABILITY TEST

ENVIRONMENT TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																																												
1	TEMPERATURE RISE TEST	MODEL : HEP-480-48 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><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 29.4 °C</th><th>HIGH AMBIENT Ta= 63.8 °C</th></tr><tr><td>1</td><td>BD2</td><td>84.4°C</td><td>97.6°C</td></tr><tr><td>2</td><td>C10</td><td>81.5°C</td><td>94.7°C</td></tr><tr><td>3</td><td>Q1</td><td>82.4°C</td><td>95.6°C</td></tr><tr><td>4</td><td>D8</td><td>84.6°C</td><td>97.6°C</td></tr><tr><td>5</td><td>Q10</td><td>83.0°C</td><td>96.2°C</td></tr><tr><td>6</td><td>Q12</td><td>83.7°C</td><td>96.9°C</td></tr><tr><td>7</td><td>RY1</td><td>83.1°C</td><td>95.9°C</td></tr><tr><td>8</td><td>ZNR2</td><td>77.8°C</td><td>89.2°C</td></tr><tr><td>9</td><td>C1</td><td>76.8°C</td><td>88.2°C</td></tr><tr><td>10</td><td>C5</td><td>77.8°C</td><td>89.8°C</td></tr><tr><td>11</td><td>L3</td><td>83.0°C</td><td>96.5°C</td></tr><tr><td>12</td><td>U1</td><td>78.4°C</td><td>89.9°C</td></tr><tr><td>13</td><td>U2</td><td>79.1°C</td><td>91.1°C</td></tr><tr><td>14</td><td>T1 Primary side</td><td>83.2°C</td><td>98.0°C</td></tr><tr><td>15</td><td>T2 Primary side</td><td>85.1°C</td><td>99.2°C</td></tr><tr><td>16</td><td>Q100</td><td>82.9°C</td><td>98.0°C</td></tr><tr><td>17</td><td>Q121</td><td>83.0°C</td><td>98.2°C</td></tr><tr><td>18</td><td>C115</td><td>77.6°C</td><td>91.8°C</td></tr><tr><td>19</td><td>C117</td><td>75.1°C</td><td>89.2°C</td></tr><tr><td>20</td><td>LF100</td><td>74.5°C</td><td>88.9°C</td></tr><tr><td>21</td><td>T500</td><td>78.6°C</td><td>91.6°C</td></tr><tr><td>22</td><td>C511</td><td>78.8°C</td><td>91.8°C</td></tr><tr><td>23</td><td>U501</td><td>78.0°C</td><td>91.1°C</td></tr><tr><td>24</td><td>J101</td><td>77.9°C</td><td>92.5°C</td></tr><tr><td>25</td><td>RTH2</td><td>79.3°C</td><td>91.8°C</td></tr><tr><td>26</td><td>C93</td><td>80.6°C</td><td>93.4°C</td></tr></table>			NO	Position	ROOM AMBIENT Ta= 29.4 °C	HIGH AMBIENT Ta= 63.8 °C	1	BD2	84.4°C	97.6°C	2	C10	81.5°C	94.7°C	3	Q1	82.4°C	95.6°C	4	D8	84.6°C	97.6°C	5	Q10	83.0°C	96.2°C	6	Q12	83.7°C	96.9°C	7	RY1	83.1°C	95.9°C	8	ZNR2	77.8°C	89.2°C	9	C1	76.8°C	88.2°C	10	C5	77.8°C	89.8°C	11	L3	83.0°C	96.5°C	12	U1	78.4°C	89.9°C	13	U2	79.1°C	91.1°C	14	T1 Primary side	83.2°C	98.0°C	15	T2 Primary side	85.1°C	99.2°C	16	Q100	82.9°C	98.0°C	17	Q121	83.0°C	98.2°C	18	C115	77.6°C	91.8°C	19	C117	75.1°C	89.2°C	20	LF100	74.5°C	88.9°C	21	T500	78.6°C	91.6°C	22	C511	78.8°C	91.8°C	23	U501	78.0°C	91.1°C	24	J101	77.9°C	92.5°C	25	RTH2	79.3°C	91.8°C	26	C93	80.6°C	93.4°C
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25	RTH2	79.3°C	91.8°C																																																																																																													
26	C93	80.6°C	93.4°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	± 0.004 %/°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 : -45°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 : 10 G (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) 132638HRS (2) 47580HRS (3) 58920HRS (4) 89096HRS
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