



Test Report: HRP-600N-48

600W Single Output with PFC Function

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Control Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

■ RELIABILITY TEST

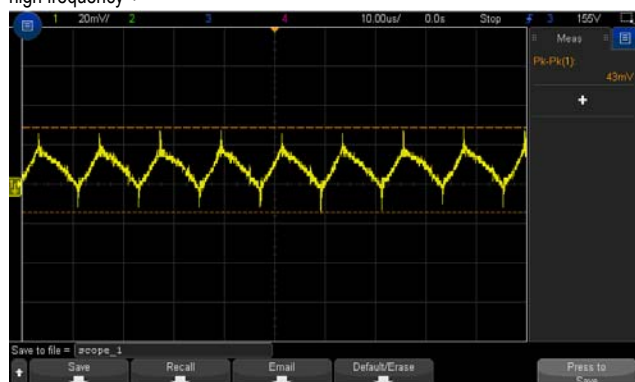
ENVIRONMENT TEST

DESIGN VERIFY TEST

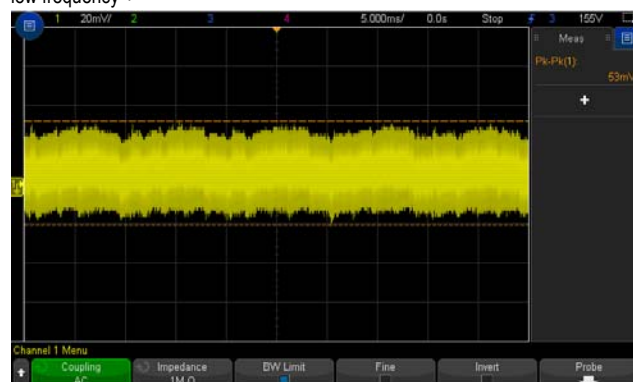
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 40.8 V~ 55.2 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	38.92V~58.41V/230VAC 38.93V~58.41V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.0 %~ +1.0 %	I/P: 85VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.01%~0.01%
3	LINE REGULATION (Max)	V1: -0.2 %~+0.2 %	I/P: 85VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: 0%~ 0.012%
4	LOAD REGULATION(Max)	V1: -0.5 %~ +0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.01%~ 0.01%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	1.2%
6	RIPPLE & NOISE(Max)	V1: 240mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 53Vp-p

high frequency :



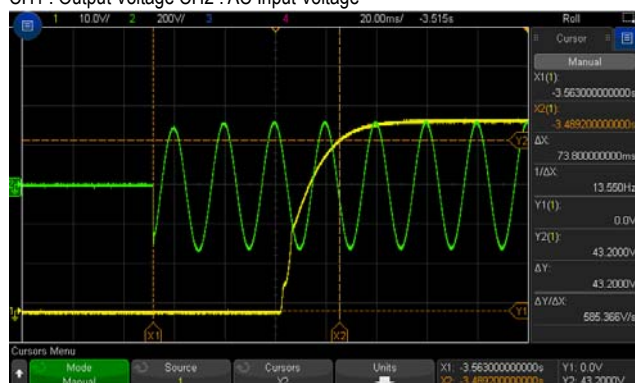
low frequency :



7	SET UP TIME(Max)	230VAC/ 1800ms 115VAC/ 3600ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 73.8 ms 115VAC/ 161 ms
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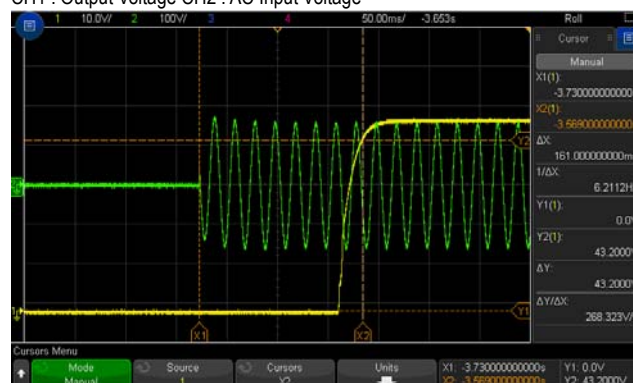
INPUT=230VAC/50HZ @ FULL LOAD

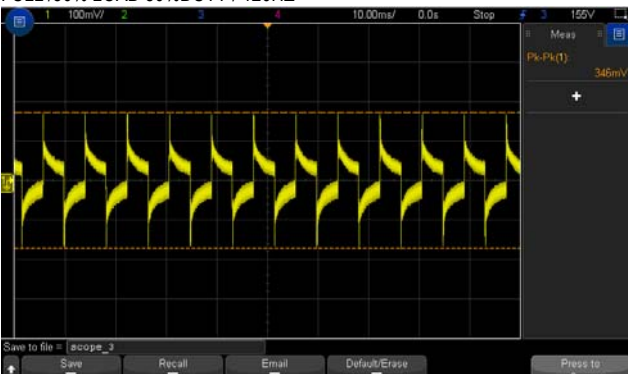
CH1 : Output Voltage CH2 : AC Input Voltage

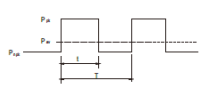
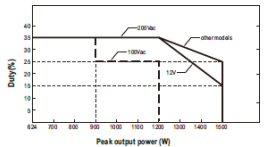


INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



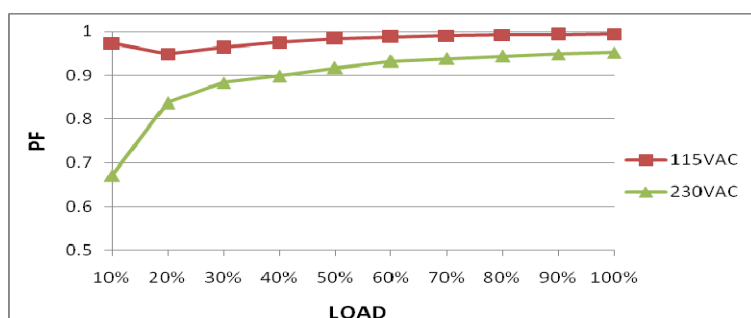
8	RISE TIME (Max)	230VAC/50ms 115VAC/50ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 21.16 ms 115VAC/ 21.22ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage 	
9	HOLD UP TIME (Typ.)	230VAC/16ms 115VAC/16ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 36.2ms 115VAC/ 34.2ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 	
10	DYNAMIC LOAD	V1: 4800 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	346mVp-p 302mVp-p
	FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 	
11	PEAK POWER	NO DAMAGE	I/P : 230 VAC O/P:TESTING Ta:25°C	TEST:OK Peak load:48.9V

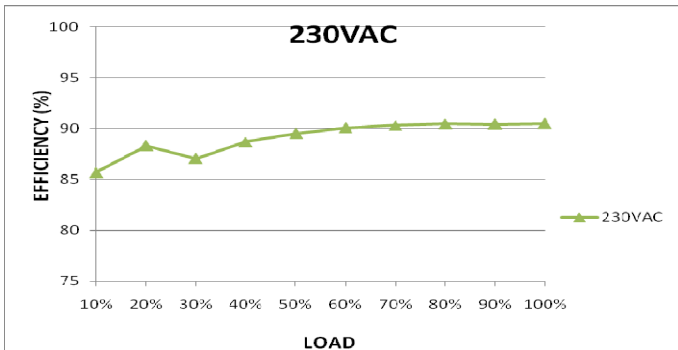
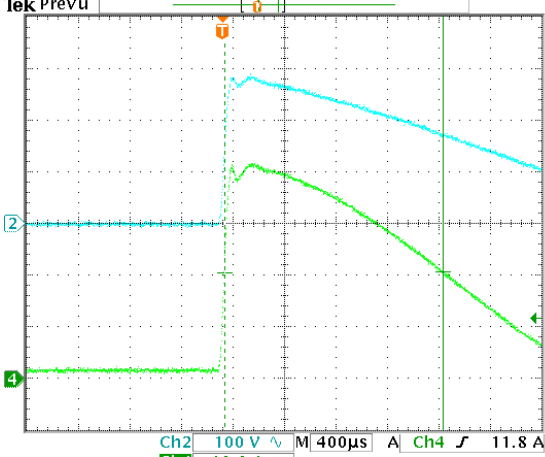
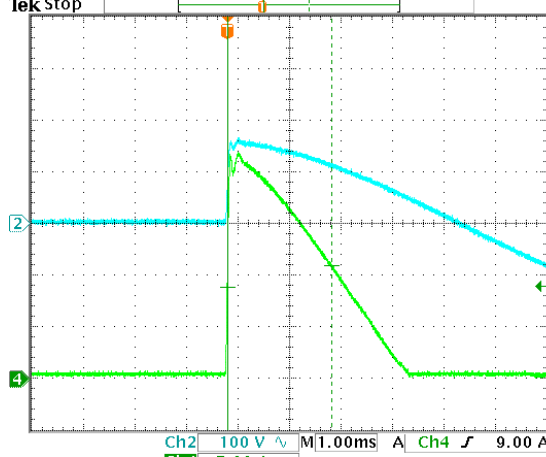
		$P_{out} = \frac{P_{pk} \times (1 - P_{pk} \times (T/t))}{T} < P_{max}$ $Duty = \frac{1}{T} \times 100\% < 35\%$ $t < 5 \text{ sec}$   For example (12V model): $V_{in} = 100V$ $Duty_{max} = 20\%$ $P_{in} = P_{rated} = 638W$ $P_{out} = 1200W$ $t < 5 \text{ sec}$ $T \geq 20 \text{ sec}$ $P_{out} = \frac{P_{in} \times (1 - P_{in} \times (T/t))}{T} = \frac{1200 \times (1 - 1200 \times (20/5))}{20} < 638W$ $P_{in} < 668W$		
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INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85VAC~264VAC 120VDC~ 370VDC	(1) I/P: TESTING O/P: FULL LOAD (2) I/P: DC TESTING (L: + N: -) O/P: FULL / 50% LOAD (3) I/P: DC TESTING (L: - N: +) O/P: FULL / 50% LOAD Ta: 25°C	(1) 78.6V~264V (2) 105.86Vdc~370Vdc/FULL LOAD 105.97Vdc~370Vdc/50% LOAD (3) 105.82Vdc~370Vdc/FULL LOAD 105.95Vdc~370Vdc/50% LOAD
			I/P: LOW-LINE-3V=82 V HIGH-LINE+15%=300 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: 85 VAC ~264 VAC O/P: FULL~MIN LOAD Ta: 25°C	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 3.6 A 115V/ 7.6A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I=3.1755A/ 230VAC I=6.361A/ 115VAC
4	LEAKAGE CURRENT	< 1.5mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	1.292 mA
6	POWER FACTOR (Typ.)	0.94/ 230VAC 0.98/115VAC	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF=0.9535/230VAC PF=0.9936/115VAC

P.F vs LOAD



7	EFFICIENCY(Typ.)	89%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	90.37%
EFFICIENCY vs LOAD 				
8	INRUSH CURRENT(Typ.)	230V/70A 115V/35A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I=41.8A/ 230VAC I=22A/ 115VAC T50= 1.9 ms/230V
INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current Tek PreVu  INPUT=115VAC/ 60HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current Tek Stop 				

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %~ 200 % /5S 280% LOAD > 5s	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P: TESTING Ta:25°C	111.77%/ 264VAC 111.85%/ 230VAC 120.08%/100VAC 5S TEST: OK PROTECTION TYPE : Normally works within 105%~200% rated power for more than 5seconds and than shut down o/p voltage, re-power on to recover ; Constant current limiting for output power >280% rated for more than 5seconds and than shut down o/p voltage, re-power on to recover

2	OVER VOLTAGE PROTECTION	57.6V~67.2V	I/P: 264VAC I/P: 230VAC I/P: 85VAC O/P: MIN LOAD Ta:25°C	66.6V / 264VAC 66.2V/ 230VAC 66.2 V/ 85VAC PROTECTION TYPE : Shut down o/p voltage , re-power on to recover .
3	OVER TEMPERATURE PROTECTION	Protection type : Shut down o/p voltage , recovers automatically after temperature goes down	I/P: 264VAC I/P: 85VAC O/P: FULL LOAD	O.T.P. Active Protection type : Shut down o/p voltage , recovers automatically after temperature goes down .
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 85VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting, and shut down after 5 seconds , re-power on to recover ..

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT						
3	REMOTE SENSE	S+ / S- >0.3V Compensate voltage drop on the load wiring up to 0.5V.	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	0.34V						
4	DC OK SIGNAL	High (3.3 ~ 5.6V) :PSU turn on Low (0 ~ 1V) : PSU turn off. I/P: 230 VAC O/P:FULL LOAD Ta:25°C Test Result : <table><tr><th>Vout</th><th>DC OK SIGNAL</th></tr><tr><td>PSU turn on</td><td>5.19V</td></tr><tr><td>PSU turn off</td><td>0V</td></tr></table>			Vout	DC OK SIGNAL	PSU turn on	5.19V	PSU turn off	0V
Vout	DC OK SIGNAL									
PSU turn on	5.19V									
PSU turn off	0V									
11	FAN ON/OFF CONTROL	Load 35±15% or RTH2≥50°C FAN ON	I/P: 230 VAC O/P:TESTING	<table><tr><td></td><td>RTH(°C)</td><td>LOAD(%)</td></tr><tr><td>FAN ON</td><td>OK</td><td>28.95%</td></tr></table>		RTH(°C)	LOAD(%)	FAN ON	OK	28.95%
	RTH(°C)	LOAD(%)								
FAN ON	OK	28.95%								

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q 3/Q4 Rated : 32 A/ 650 V VGS: ± 25 V	AC ON/OFF I/P: High-Line =300V 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	Q3 Q4 VDS: VDS: (1) 549V (1) 545V (2) 601V (2) 572V (3) 549V (3) 533V (4) 545V (4) 529V (5) 545V (5) 529V (6) 541V (6) 549V (7) 589V (7) 573V

2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : 34 A/ 600 V VGS: ± 25 V	I/P: High-Line =264V 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	Q1 VDS: (1) 452V (2) 448V (3) 456V (4) 489V (5) 456V (6) 460V (7) 472V
3	P.F.C DIODE	D1 Rated : 6A/ 650 V	I/P: High-Line =300V 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) 388V (2) 408V (3) 388V (4) 400V
4	Diode Peak Voltage	Q101 Rated : 20 A/ 400 V Q104 Rated : 20 A/ 400 V	AC ON/OFF I/P: High-Line =300V VOmax 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 VO: O/P: (1)Full Load Ta:25°C	Q101: VOmax VDS: (1) 155V (2) 169V (3) 189V (4) 167V (5) 167V (6) 185V (7) 181V (8) 183V VO: (1) 145V Q104: VOmax VDS: (1) 277V (2) 332V (3) 291V (4) 285V (5) 285V (6) 281V (7) 304V (8) 261V VO: (1) 285V
5	Input Capacitor Voltage	C5 Rated: : 680 μ / 400 V	I/P High-Line =300V 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) 398V (2) 397V (3) 398V (4) 380V
6	Control IC Voltage Test	PWM IC U1 Rated 11V~ 30 V O/P IC U202/ U203 Rated -0.3 V~ 30 V	AC ON/OFF I/P: High-Line =300V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(LOW LINE) Ta:25°C	U1 (1) 16.7V (2) 17.9V (3) 16.7V (4) 16.7V (5) 15.5V U202/ U203 (1) 11.82V

			(2) 11.90V (3) 11.82V (4) 11.82V (5) 12.22V
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SAFETY& E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG :2KVAC/min O/P-FG:0.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:0.6 KVAC/min Ta:25℃	I/P-O/P:8.07mA I/P-FG:9.11mA O/P-FG:4.54mA 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℃	I/P-O/P: 9999MΩ I/P-FG: 9999MΩ O/P-FG: 9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	6 mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	PASS
2	CONDUCTION	EN55032 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25℃	PASS Test by certified Lab
3	RADIATION	EN55032 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 AIR: 8KV / Contact: 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
5	E.F.T	EN61000-4-4 INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
6	SURGE	IEC61000-4-5 L-N : 2KV L,N-PE : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL : HRP-600N-48 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 25.0 ℃ 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 50.0℃		

NO	Position	ROOM AMBIENT Ta= 25.0 °C	HIGH AMBIENT Ta= 50.0 °C
1	ZNR1	26.2°C	52.1°C
2	C1	26.6°C	52.7°C
3	LF1	27.2°C	53.3°C
4	LF2	26.8°C	52.8°C
5	Q19	32.8°C	58.8°C
6	RTH1	26.5°C	52.5°C
7	RY1	30.6°C	56.9°C
8	C10	32.0°C	58.7°C
9	BD1	51.1°C	73.9°C
10	Q2	44.3°C	71.3°C
11	D1	50.4°C	77.2°C
12	TSW1	38.3°C	65.4°C
13	L3	39.1°C	66.3°C
14	C5	30.9°C	56.8°C
15	T1coil	52.9°C	81.8°C
16	T1core	54.5°C	82.6°C
17	TSW2	44.9°C	72.3°C
18	Q100	61.8°C	88.9°C
19	Q102	58.7°C	87.1°C
20	U1	28.7°C	54.8°C
21	T2	30.2°C	56.5°C
22	C61	27.0°C	53.0°C
23	Q3	49.3°C	78.3°C
24	Q4	43.2°C	71.4°C
25	D22	42.0°C	69.1°C
26	RTH2	36.1°C	63.4°C
27	RG1	45.6°C	72.7°C
28	U202	33.1°C	59.8°C
29	C108	33.6°C	60.4°C
30	Q103	56.0°C	82.8°C
31	Q105	54.6°C	82.2°C
32	L100	52.3°C	81.7°C
33	C109	37.2°C	64.2°C
34	J115	46.5°C	76.8°C
35	R100	58.5°C	85.5°C

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 108% LOAD Ta : 25°C	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC O/P : 100 % LOAD Ta= -45 °C	TEST : OK

4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C /95 %R.H NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	$\pm 0.03 \text{ }^{\circ}\text{C}/^{\circ}\text{C}$ (0~50°C)	I/P : 230 VAC O/P : FULL LOAD	$\pm 0.0051 \text{ }^{\circ}\text{C}/^{\circ}\text{C}$ (0~50°C)
6	STORAGE TEMPERATURE TEST	-40~85°C	1. Thermal shock Temperature : -45°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : STATIC	
7	THERMAL SHOCK TEST	-40~50°C	1. Thermal shock Temperature : -45°C~ +55°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	
8	VIBRATION TEST	10 ~ 500Hz, 5G 10min./1cycle, 60min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 6G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C	
9	CAPACITOR LIFE CYCLE	SUPPOSE C105 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= 50 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 50 °C LIFE TIME		(1) 1587555.4HRS (2) 244313.7HRS (3) 335539.3HRS (4) 416715.8HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 452.04K hrs min. Telcordia TR/SR-332 (Bellcore) ; 191.26K hrs min. MIL-HDBK-217F (25°C)		
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure :50,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ

2018.4.30 GP-A50-F010