Test Report: HRP-150N-24

150W 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

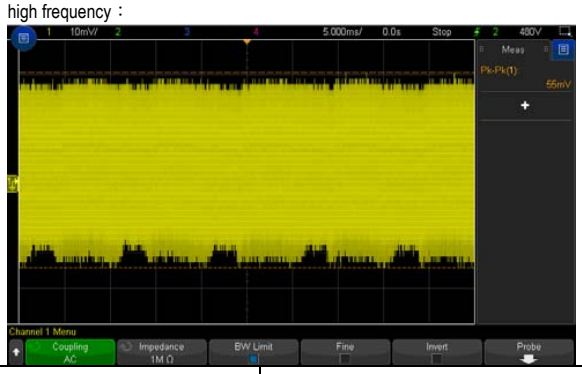
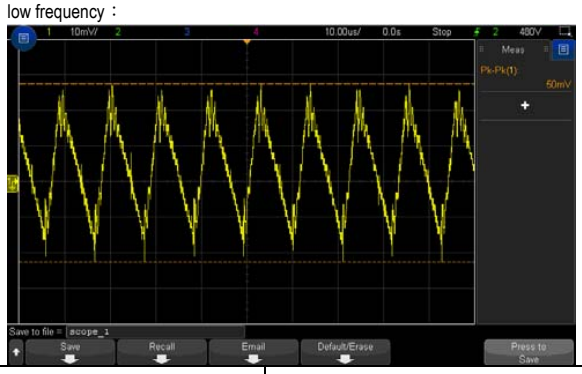
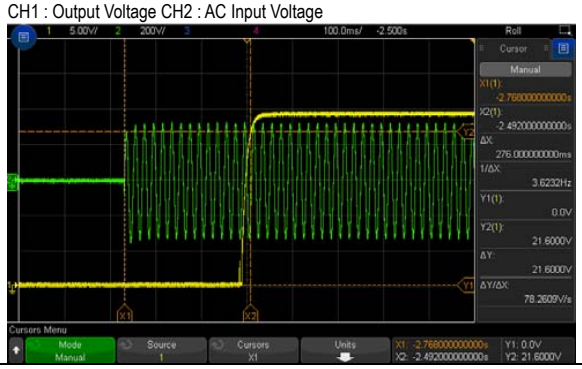
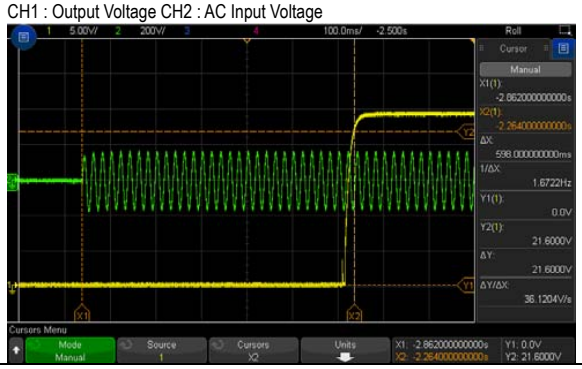
Safety Test
E.M.C. Test

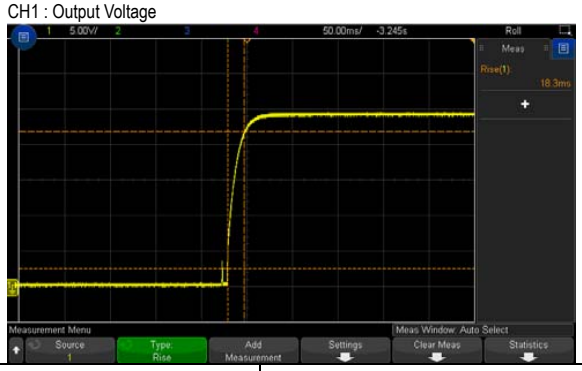
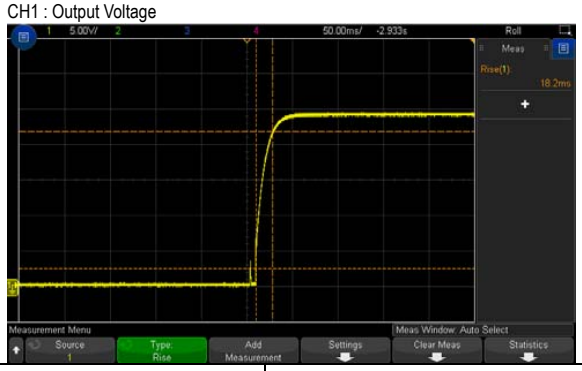
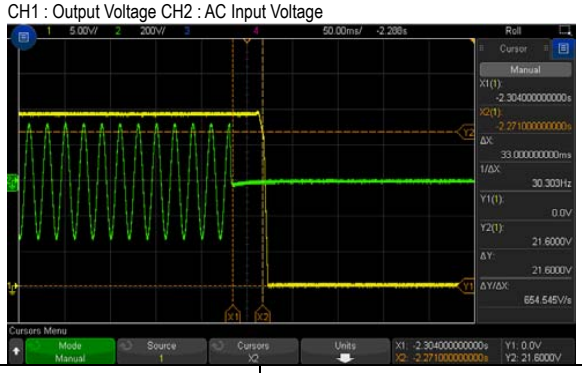
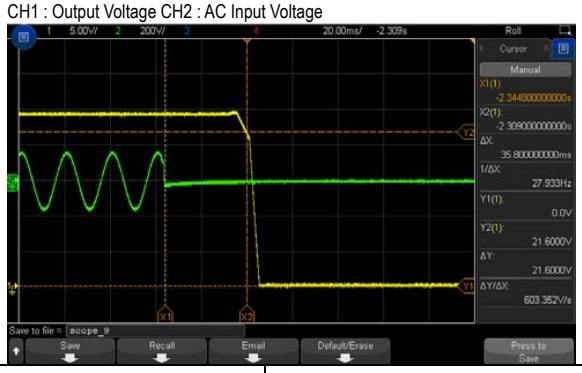
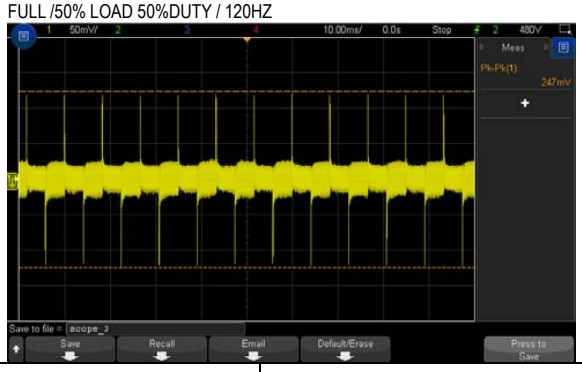
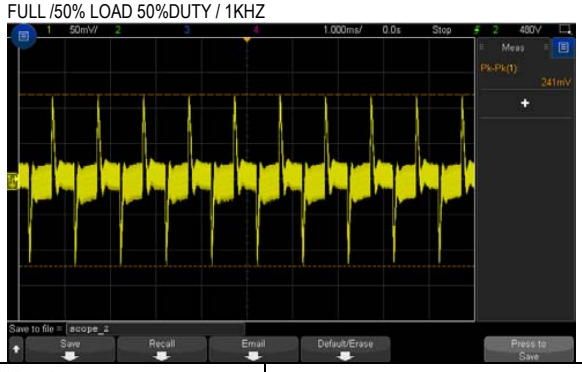
■ RELIABILITY TEST

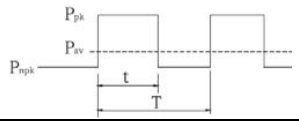
ENVIRONMENT TEST

■ DESIGN VERIFY TEST

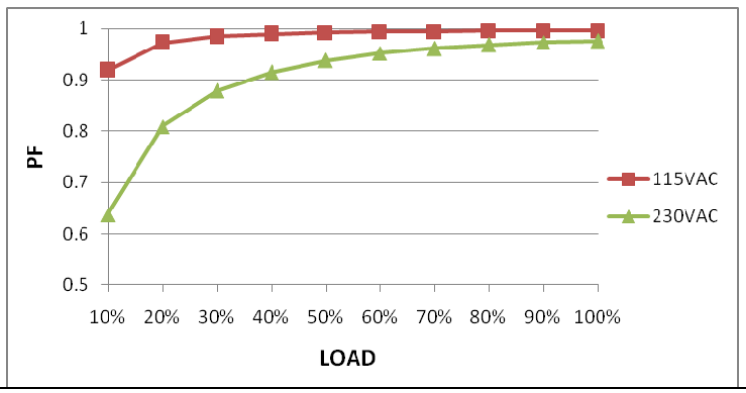
OUTPUT FUNCTION TEST

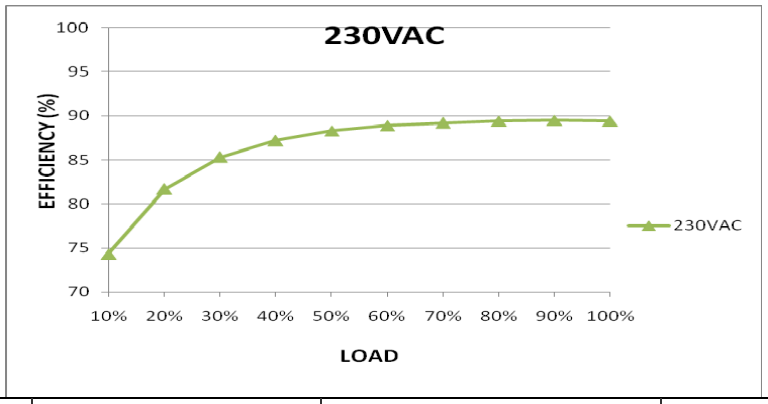
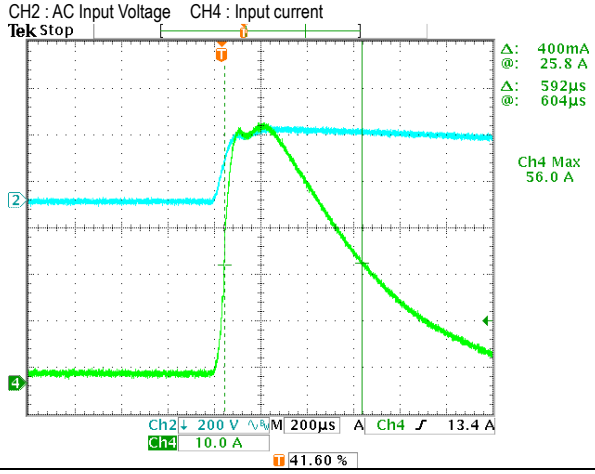
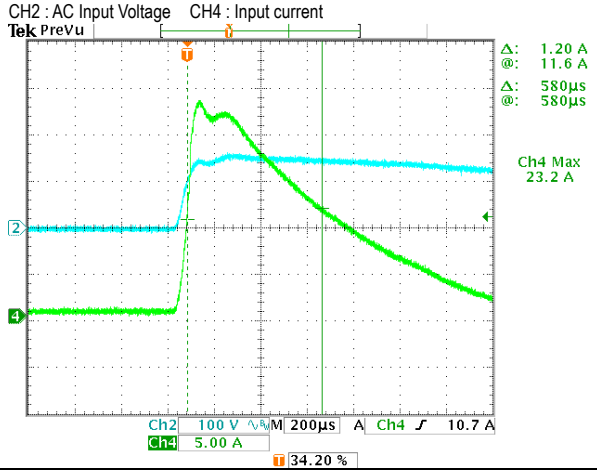
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 21.6 V~ 28.8 V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	20.948V~32.279V/230VAC 20.953V~32.277V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.5 %~ +1.5 %	I/P: 85VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: -0.03 %~ 0.03 %
3	LINE REGULATION (Max)	V1: -0.2%~ +0.2 %	I/P: 85VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1: -0.01%~ 0.03 %
4	LOAD REGULATION(Max)	V1: -0.5 %~ +0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.03 %~ 0.02 %
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	2.1%
6	RIPPLE & NOISE(Max)	V1: 150mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 55mVp-p
	high frequency： 		low frequency： 	
7	SET UP TIME(Max)	230VAC/ 3000ms 115VAC/3000ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/276ms 115VAC/ 598ms
	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℃	230VAC/ 18.3 ms 115VAC/ 18.2 ms
	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℃	230VAC/ 33 ms 115VAC/ 35.8 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 	
10	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℃	 247mVp-p 241mVp-p
	FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 	
11	PEAK POWER	1 HOUR NO DAMAGE	I/P： 230 VAC O/P:TESTING Ta:25℃	TEST:OK

		$P_{av}=\frac{P_{pk}\times t+P_{npk}\times(T-t)}{T}\leq P_{rated}$ $Duty=\frac{t}{T}\times 100\%\leq 35\%$ $t\leq 5\ sec$ 		

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℃	(1) 77.2 V~264V (2) 103.43Vdc~370Vdc/FULL LOAD 103.35Vdc~370Vdc/50% LOAD (3) 103.43Vdc~370Vdc/FULL LOAD 103.35Vdc~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℃	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 0.9 A 115V/ 1.7A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =0.7782A/ 230VAC I =1.567A/ 115VAC
4	LEAKAGE CURRENT	< 1.0mA / 240 VAC	I/P： 240 VAC O/P：Min LOAD Ta：25℃	0.672mA
5	POWER FACTOR (Typ.)	0.95/ 230VAC 0.98/115VAC	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	PF=0.976/230VAC PF=0.9926/115VAC
	P.F vs LOAD 			

6	EFFICIENCY(Typ.)	88%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	89.4 %
	EFFICIENCY vs LOAD 			
7	INRUSH CURRENT(Typ.)	230V/70A 115V/35A COLD START	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =56A/ 230VAC I =23.2A/ 115VAC
	INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current 		INPUT=115VAC/ 60HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current 	

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℃	107.94%/ 264VAC 107.85%/ 230VAC 107.94%/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	30V~34.8V	I/P: 264VAC I/P: 230VAC I/P: 85VAC O/P:MIN LOAD Ta:25℃	32.8V/264VAC 32.6V/ 230VAC 32.6V/ 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℃	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
1	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℃	0.308V

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 : 13 A/ 600 V VGS :±25V	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℃	Q3 VDS: (1) 508V (2) 516V (3) 516V (4) 516V (5) 520V (6) 504V (7) 520V Q4 VDS: (1) 492V (2) 508V (3) 500V (4) 496V (5) 496V (6) 504V (7) 504V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : 18 A/ 600 V VGS :± 25V	I/P: High-Line =267V 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/	Q1 VDS: (1) 472V (2) 432V (3) 476V (4) 476V (5) 472V (6) 476V (7) 396V

			Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. Ta:25℃	
3	P.F.C DIODE	D1 Rated : 8 A/ 600 V	I/P: High-Line =267V 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℃	(1) 396V (2) 412V (3) 408V (4) 396V
4	Diode Peak Voltage	Q101 Rated : 20 A/ 200 V Q103 Rated : 20 A/ 200 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℃	Q101: Q103: VOmax: VOmax: VDS: VDS: (1) 166V (1) 153V (2) 172V (2) 161V (3) 170V (3) 157V (4) 168V (4) 157V (5) 168V (5) 157V (6) 166V (6) 157V (7) 170V (7) 159V (8) 162V (8) 151V VO: VO: (1) 166V (1) 155V
5	Input Capacitor Voltage	C5 Rated: : 100 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 / 267V Ta:25℃	(1) 398V (2) 398V (3) 398V (4)383V
6	Control IC Voltage Test	PWM IC U1 Rated 11V~ 30 V O/P IC U101 Rated -0.3V~32V	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℃	U1 (1) 15.7V (2) 15.9V (3) 15.9V (4) 15.9V (5) 15.9V U101 (1) 7.24V (2) 7.33V (3) 7.00V (4) 7.00V (5) 7.08V

■ 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:2.549mA I/P-FG:2.743mA O/P-FG:1.660m A 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℃	6mΩ

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-150N-24 1. ROOM AMBIENT BURN-IN：2 HRS I/P： 230VAC O/P： FULL LOAD Ta= 29.1 ℃ 2. HIGH AMBIENT BURN-IN： 2 HRS I/P： 230VAC O/P： FULL LOAD Ta= 51.4 ℃		

NO	Position	ROOM AMBIENT Ta= 29.1 ℃	HIGH AMBIENT Ta= 51.4 ℃
1	LF1	47.9℃	71.5℃
2	ZNR1	48.0℃	71.3℃
3	LF2	53.6℃	77.0℃
4	C105	61.8℃	85.1℃
5	L100	73.0℃	97.8℃
6	RTH1	53.8℃	76.3℃
7	L3	57.7℃	79.2℃
8	BD1	66.0℃	87.9℃
9	RY1	73.4℃	94.4℃
10	C61	65.5℃	88.2℃
11	C5	63.7℃	86.2℃
12	TSW1	53.2℃	76.6℃
13	Q1	57.8℃	81.1℃
14	D1	56.7℃	79.3℃
15	Q4	75.4℃	97.9℃
16	T2	59.0℃	84.1℃
17	Q3	79.1℃	101.4℃
18	U1	64.5℃	86.4℃
19	T1coil	80.4℃	103.7℃
20	T1core	73.7℃	97.9℃
21	RTH2	59.1℃	82.1℃
22	Q101	76.5℃	99.3℃
23	Q103	85.0℃	108.0℃
24	J111	64.5℃	87.4℃
25	U101	64.1℃	87.8℃
26	R115	74.3℃	98.1℃
27	U2	54.2℃	77.3℃

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P： 230 VAC O/P：109 % LOAD Ta：25℃	TEST：OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P： 264VAC/100VAC O/P： 100 % LOAD Ta= -45 ℃	TEST：OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 ℃ / 95 %R.H NO DAMAGE	I/P： 272 VAC O/P：FULL LOAD Ta= 50 ℃ HUMIDITY= 95 %R.H	TEST：OK
5	TEMPERATURE COEFFICIENT	±0..04 %/℃(0~50℃)	I/P： 230 VAC O/P：FULL LOAD	±0.0089%/℃(0~50℃)
6	STORAGE TEMPERATURE TEST	-45~90℃	1. Thermal shock Temperature： -45℃~ +90℃ 2. Temperature change rate ：25℃ / 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℃	1. Thermal shock Temperature： -45℃~ +55℃ 2. Temperature change rate ：25℃ / 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℃
9	CAPACITOR LIFE CYCLE	SUPPOSE C105IS THE MOST CRITICAL COMPONENT (1) I/P： 230VAC O/P：FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P： 230VAC O/P：FULL LOAD Ta= 50 ℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 50 ℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 50 ℃ LIFE TIME	(1) 388613.3 HRS (2) 64097.3 HRS (3) 106247.8 HRS (4) 162891.1 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 578.15K hrs min. Telcordia SR-332 (Bellcore) ; 221.71K hrs min. MIL-HDBK-217F (25℃)	
11	Ongoing Reliability Test	I/P：230VAC O/P：FULL LOAD TA=50℃ Demonstration Mean Time Between Failure : 50,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ

2018.4.30 GP-A50-F010

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