



Test Report: NSP-1600-48

1600W Power Supply with Single Output

■ 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

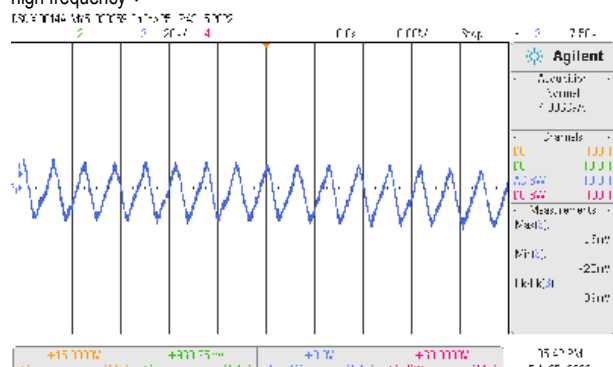
ENVIRONMENT TEST

DESIGN VERIFY TEST

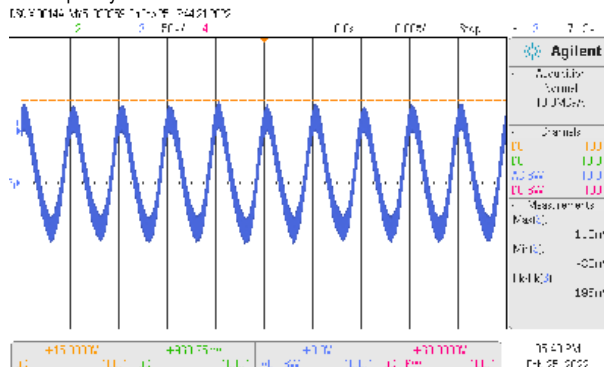
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 47.5 V~ 58.8V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	45.62V~60.1V/230VAC 45.62V~60.1V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1 %~ -1 %	I/P: 180VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: 0.2 %~ -0.2 %
3	LINE REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 180VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: 0.07 %~ -0.07 %
4	LOAD REGULATION(Max)	V1: 0.5 %~ -0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.05 %~ -0.05 %
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	<5 %
6	RIPPLE & NOISE(Max)	V1: 300 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 195 mVp-p

high frequency :



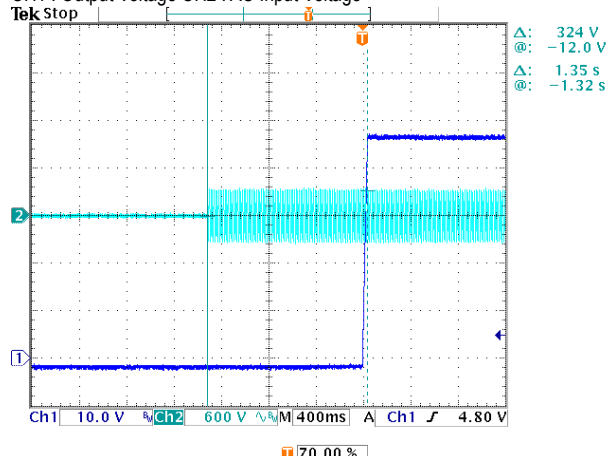
low frequency :

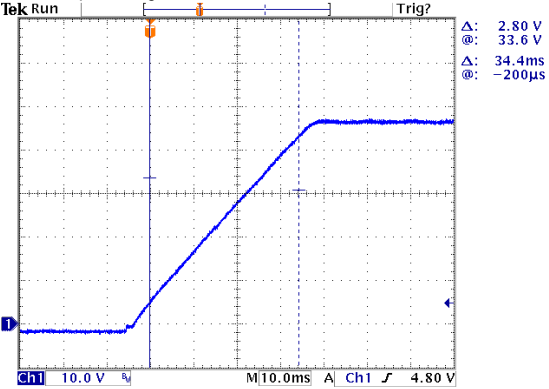
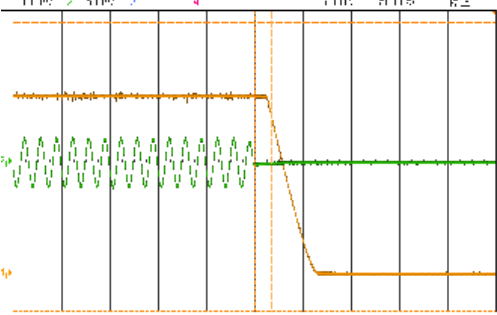
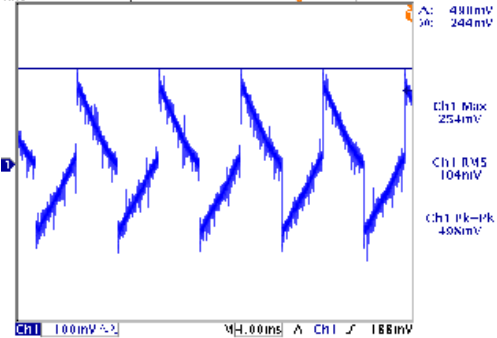
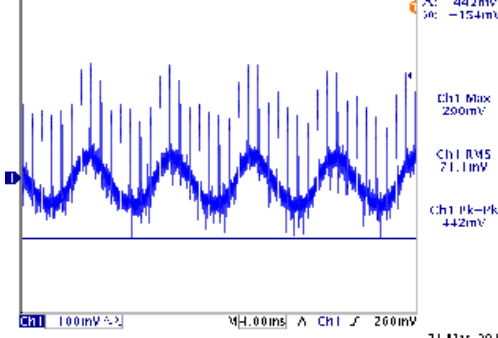


7	SET UP TIME(Max)	230VAC/1500ms	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 1352ms
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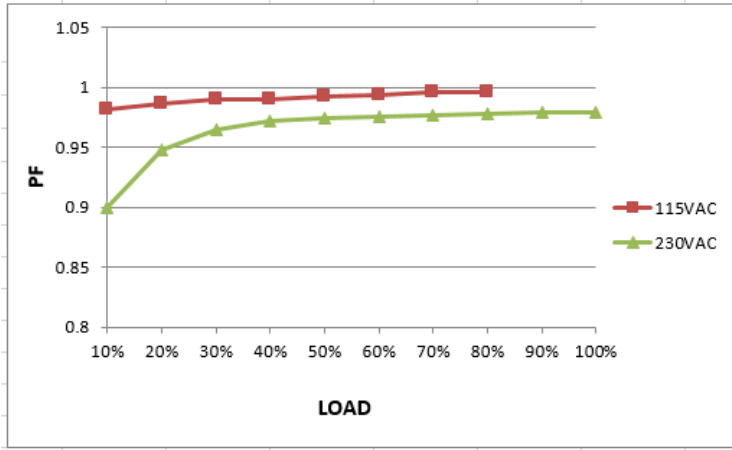
INPUT=230VAC/50HZ @ FULL LOAD

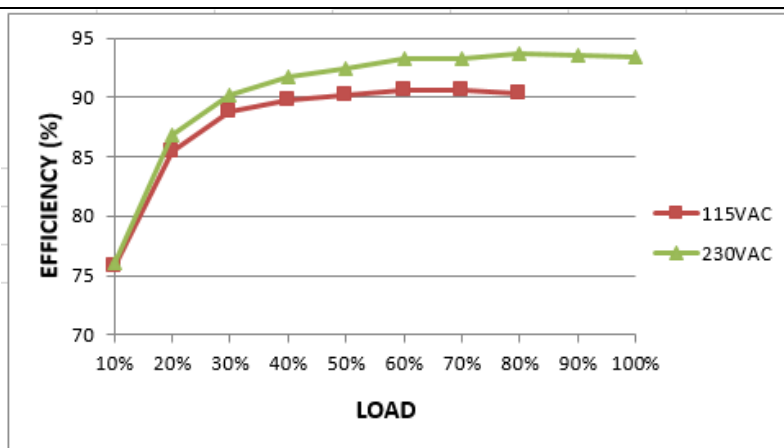
CH1 : Output Voltage CH2 : AC Input Voltage

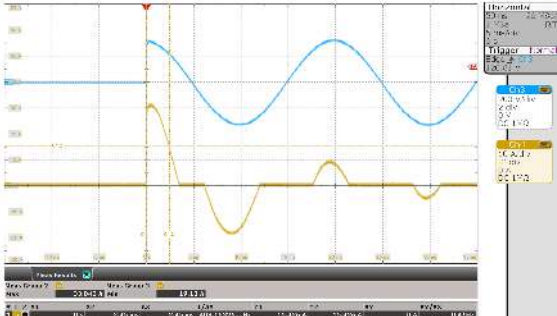


8	RISE TIME (Max)	230VAC/60ms	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 34.4 ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 			
9	HOLD UP TIME (Typ.)	230VAC 70%/ 16ms 230VAC 100%/10ms	I/P : 230 VAC O/P : 70% LOAD O/P : 100% LOAD Ta : 25°C	17 ms (70% load) 12ms (100% load)
	INPUT=230VAC/50HZ @ 70% 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	498mVp-p 442mVp-p
	FULL /50% LOAD 50%DUTY / 120HZ 			
	FULL /50% LOAD 50%DUTY / 1KHZ 			

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																	
1	INPUT VOLTAGE RANGE	90VAC~264VAC 127VDC~ 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 (PLEASE CHECK DERATING CURVE) Ta:25°C	(1) 170 V~ 264 V 87V~264V (2) 127VDC~370VDC (3) 127VDC~370VDC																																	
			I/P: LOW-LINE-3V=87 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:90 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK																																	
3	INPUT CURRENT (Typ.)	230V/ 8.5 A 115V/ 15 A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD (PLEASE CHECK DERATING CURVE) Ta : 25°C	I =7.72A/ 230VAC I =12.7A/ 115VAC																																	
4	LEAKAGE CURRENT	<2 mA / 230 VAC	I/P : 230 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.6 mA N-FG : 0.6 mA																																	
5	POWER FACTOR (Typ.)	0.97 / 230VAC	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	PF=0.978/230VAC																																	
P.F vs LOAD  <table><caption>Approximate data points from P.F vs LOAD graph</caption><thead><tr><th>Load (%)</th><th>115VAC PF</th><th>230VAC PF</th></tr></thead><tbody><tr><td>10</td><td>0.98</td><td>0.90</td></tr><tr><td>20</td><td>0.985</td><td>0.95</td></tr><tr><td>30</td><td>0.99</td><td>0.97</td></tr><tr><td>40</td><td>0.99</td><td>0.975</td></tr><tr><td>50</td><td>0.995</td><td>0.975</td></tr><tr><td>60</td><td>0.995</td><td>0.975</td></tr><tr><td>70</td><td>0.995</td><td>0.975</td></tr><tr><td>80</td><td>0.995</td><td>0.975</td></tr><tr><td>90</td><td>0.995</td><td>0.975</td></tr><tr><td>100</td><td>1.00</td><td>0.98</td></tr></tbody></table>					Load (%)	115VAC PF	230VAC PF	10	0.98	0.90	20	0.985	0.95	30	0.99	0.97	40	0.99	0.975	50	0.995	0.975	60	0.995	0.975	70	0.995	0.975	80	0.995	0.975	90	0.995	0.975	100	1.00	0.98
Load (%)	115VAC PF	230VAC PF																																			
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100	1.00	0.98																																			
6	EFFICIENCY(Typ.)	92.5%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	93.35%																																	
EFFICIENCY vs LOAD																																					



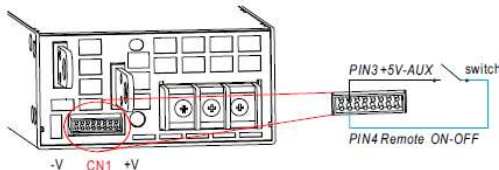
7	INRUSH CURRENT(Typ.)	230V/35 A COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I=33A/ 230VAC T50= 2450 us/230V
INPUT=230VAC/50HZ @ FULL LOAD CH4 : Input current CH3: Input AC 				

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %~ 115 % PROTECTION TYPE : Constant current limiting, unit will shut down o/p voltage after 5 sec. re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 180VAC O/P: TESTING Ta:25°C	111%/ 264VAC 111%/ 230VAC 111%/180VAC PROTECTION TYPE : Constant current limiting, unit will shut down o/p voltage after 5 sec. re-power on to recover
2	OVER VOLTAGE PROTECTION	63 V~ 75 V PROTECTION TYPE : Shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 90VAC O/P: MIN LOAD Ta:25°C	69V/ 264VAC 69V/ 230VAC 69V/ 90VAC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE PROTECTION TYPE : Shut down o/p voltage, recovers automatically after temperature goes down	I/P: 264VAC I/P: 90VAC 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 PROTECTION TYPE : Constant current limiting, unit will shut down o/p voltage after 5 sec. re-power	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting, unit will shut down o/p voltage after 5 sec. re-power on to recover

		on to recover		
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CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																					
1	AUXILIARY POWER (AUX)	12V±10%@0.8A ripple:250mVp-p	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	11.12V/ 0.8 A /150 mVp-p																					
2	REMOTE ON/OFF CONTROL	3. Remote ON-OFF Control ※ The power supply can be turned ON/OFF individually or along with other units by using the "Remote ON-OFF" function.  <table><tr><th>Between Remote ON-OFF and +5V-AUX</th><th>Power Supply Status</th></tr><tr><td>Switch Short</td><td>ON</td></tr><tr><td>Switch Open</td><td>OFF</td></tr></table> I/P: 230 VAC O/P:FULL LOAD Ta:25°C Test Result : <table><tr><th>Between Remote ON-OFF and +5V-AUX</th><th>Power Supply Status</th></tr><tr><td>SW SHORT</td><td>ON</td></tr><tr><td>SW OPEN</td><td>OFF</td></tr></table>			Between Remote ON-OFF and +5V-AUX	Power Supply Status	Switch Short	ON	Switch Open	OFF	Between Remote ON-OFF and +5V-AUX	Power Supply Status	SW SHORT	ON	SW OPEN	OFF									
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SW OPEN	OFF																								
3	REMOTE SENSE	S+ / S- >0.5V Compensate voltage drop on the load wiring up to 0.5V.	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	> 0.5 V																					
4	ALARM SIGNAL	1. DC OK SIGNAL High (3.5 ~ 5.5V) : When the $V_{out} \leq 77\% \pm 5\%$. Low (-0.5 ~ 0.5V) : When $V_{out} \geq 80\% \pm 5\%$. The maximum sourcing current is 10mA and only for output. (Note.2) 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>$V_{out} \leq 72\%$</td><td>5V</td></tr><tr><td>$V_{out} \geq 85\%$</td><td>-0.09V</td></tr></table> 2. T-ALARM <table><tr><th>P.S.U STATUS</th><th>Vo</th><th>T-ALARM</th></tr><tr><td>NORMAL</td><td>100%±2%</td><td>-0.5 ~0.5V</td></tr><tr><td>OTP OR FAN LOCK</td><td>0V</td><td>3.5~5.5V</td></tr></table> I/P: 230 VAC O/P:FULL LOAD Ta:25°C Test Result : <table><tr><th>P.S.U STATUS</th><th>T-ALARM</th></tr><tr><td>NORMAL</td><td>-0.09V</td></tr><tr><td>OTP OR FAN LOCK</td><td>4.998V</td></tr></table>			Vout	DC OK SIGNAL	$V_{out} \leq 72\%$	5V	$V_{out} \geq 85\%$	-0.09V	P.S.U STATUS	Vo	T-ALARM	NORMAL	100%±2%	-0.5 ~0.5V	OTP OR FAN LOCK	0V	3.5~5.5V	P.S.U STATUS	T-ALARM	NORMAL	-0.09V	OTP OR FAN LOCK	4.998V
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5 OUTPUT VOLTAGE PROGRAMMABLE(PV)

2. Output Voltage Programming (or, PV / remote voltage programming / remote adjust / margin programming / dynamic voltage trim)
※ In addition to the adjustment via the built-in potentiometer, the output voltage can be trimmed by applying EXTERNAL VOLTAGE.

Diagram illustrating the connection of an external voltage source to the power supply unit. The external voltage (DC) is connected to the -V and +V terminals of the CN1 connector. The output voltage is labeled as Vout. The diagram also shows the connection of the external voltage to the PV pin (PIN12) and the signal pin (PIN14 - V(signal)).

Graph showing Output Voltage (%) versus External Voltage (DC). The output voltage is 100% at 0V, drops to 40% at 0.4V, and then rises to 125% at 4.7V. The region between 0.4V and 1V is labeled "Others" and the region between 1V and 4.7V is labeled "Non-Linear".

Graph showing Output Current (%) versus Output Voltage (%). The output current is 100% for output voltages up to 100%, and then drops to 0% at 125% output voltage.

- ⊙ The rated current should change with the Output Voltage Programming accordingly.
- ⊙ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.

I/P: 230 VAC
O/P:FULL LOAD
Ta:25°C
Test Result :

MODEL \ PV	<0.4V	1V	4.7V	5V
SPEC	48V±5%	19.2V±5%	60V±5%	60V±5%
Vout	48.1V	19.21V	59.7V	61.01V

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q901 Rated 37A/600V	I/P:High-Line +3V =267V 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	VDS: (1)566V (2)546V (3)512V (4)568V (5)568V (6)488V (7)550V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q52 Rated 52A/600V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/	VDS: (1)480V (2)472V (3)464V

			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	(4)472V (5)456V (6)440V (7)423V
3	Diode Peak Voltage	Q101 Rated 65A/200 V Q104 Rated 65A/200 V	I/P:High-Line +3V =267 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	Q101: VDS: (1)187V (2)181V (3)185V (4)185V (5)183V (6)183V (7)187V (8)177V Q104: VDS: (1)189V (2)195V (3)195V (4)197V (5)195V (6)197V (7)189V (8)177V
4	Input Capacitor Voltage	C5 Rated: 680μ/400V SURGE VOLTAGE:450V	I/P:High-Line +3V =267 V O/P: (1)Full Load Ta:25°C	(1)395V
5	Control IC Voltage Test	PFC IC U51 Rated 4.5V~ 15V PWM IC U901 Rated 6.5V~ 24V	I/P:High-Line +3V =267 V AC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. Ta:25°C	U51 (1) 11.68V (2) 11.68V (3) 11.68V (4) 11.68V U901 (1)12.56V (2)12.56V (3)12.56V (4)12.56V

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:1.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.8 KVAC/min Ta:25°C	I/P-O/P:6.9mA I/P-FG:8.04mA O/P-FG:6.28mA 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: 8.16GΩ I/P-FG: 9.35GΩ O/P-FG: 9.4GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	17 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:100% 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 A	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 INDUSTRY AIR : 8KV / Contact : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N : 2KV L,N-PE : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	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 : NSP-1600-24 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta= 25°C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 50°C		

			NO	Position	ROOM AMBIENT Ta= 25 °C	HIGH AMBIENT Ta= 50 °C
			1	BD1	44.7°C	71.0°C
			2	Q52	56.9°C	84.6°C
			3	D50	60.6°C	88.9°C
			4	Q904	55.6°C	84.7°C
			5	T1	71.4°C	103.7°C
			6	Q101	66.7°C	97.7°C
			7	T301	52.8°C	81.6°C
			8	D321	58.6°C	88.9°C
			9	U82	65.8°C	89.1°C
			10	RTH21	52.6°C	79.0°C
			11	C5	39.4°C	64.0°C
			12	L100	78.0°C	102.3°C
			13	RTH9	41.6°C	66.8°C
			14	L900	64.6°C	90.0°C
			15	RG301	23.7°C	50.0°C
			16	L2	45.4°C	73.0°C
			17	C104	32.3°C	59.1°C
			18	D952	53.8°C	83.1°C
			19	D301	71.1°C	99.0°C
			20	U602	27.1°C	53.3°C
			21	U901	46.3°C	72.7°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 109% LOAD Ta : 25°C		TEST : OK	
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 230VAC/180VAC O/P : 100 % LOAD Ta= -25°C		TEST : OK	
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H		TEST : OK	
5	TEMPERATURE COEFFICIENT	± 0.03 %/°C (0~50°C)	I/P : 230 VAC O/P : FULL LOAD		± 0.002 %/°C (0~50°C)	
6	STORAGE TEMPERATURE TEST	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 : 5 CYCLE 5. Input/Output condition : STATIC			OK	
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -25°C ~ +55°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 : 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST(13500 TIMES) 1cycle:230V/ FULL LOAD Burn In Test			OK	

8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 2G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C101 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) 2128159HRS (2) 332080HRS (3) 465662HRS (4) 543665HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 684.7K hrs min. Telcordia SR-332 (Bellcore) ; 69.2K 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	DANIEL GAO	SANFORD SU	VINCENT TSENG

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