



# Test Report: NSP-1600-24

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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

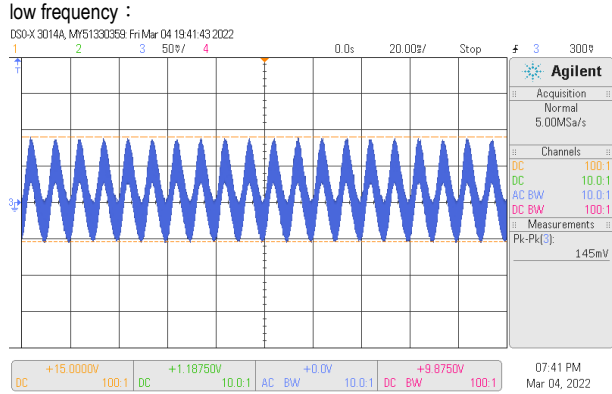
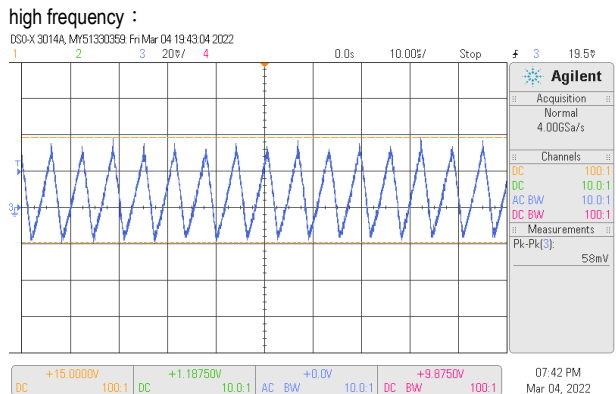
## ■ RELIABILITY TEST

ENVIRONMENT TEST

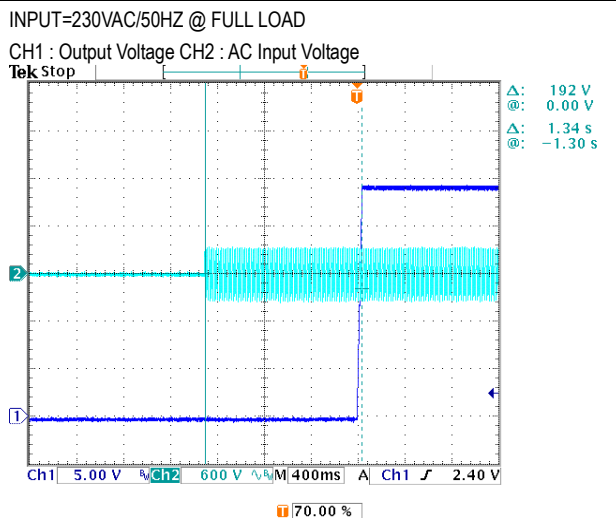
## DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 23.5 V~ 30V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	22.480V~30.663V/230VAC 22.486V~30.663V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1%~-1%	I/P: 180VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: 0.13%~ -0.13%
3	LINE REGULATION (Max)	V1: 0.5%~-0.5%	I/P: 180VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: 0.05%~-0.05%
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: 200 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 145 mVp-p



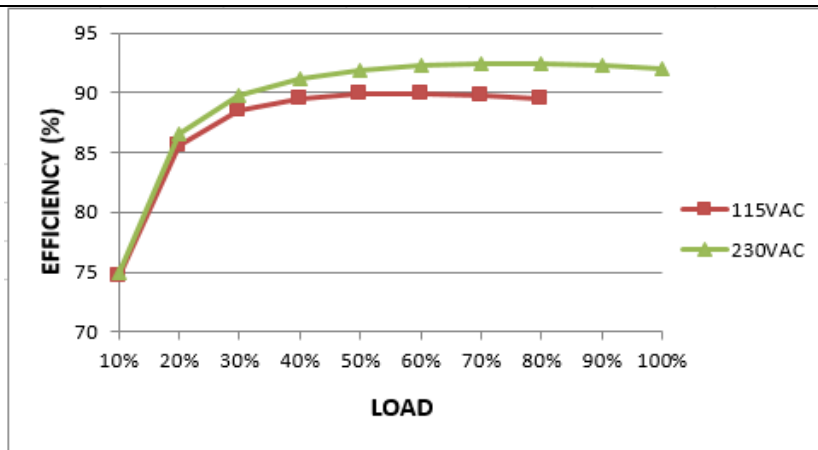
7	SET UP TIME(Max)	230VAC/1500ms	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 1336 ms
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8	RISE TIME (Max)	230VAC/60ms	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 33.8 ms
<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage</p> <p>Δ: 1.80 V @: 14.9 V Δ: 33.8ms @: 0.00 s</p> <p>Ch1 5.00 V M10.0ms A Ch1 2.40 V</p>				
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	20ms (70% load) 13.2ms (100% load)
<p>INPUT=230VAC/50HZ @ 70% LOAD INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage CH1 : Output Voltage CH2 : AC Input Voltage</p> <p>Δ: 2.60 V @: 21.6 V Δ: 20.0ms @: 52.8ms</p> <p>Ch1 Max 24.6 V Ch1 RMS 17.6 V</p> <p>Δ: 24.0 V @: 28.0 V Δ: 13.2ms @: -40.8ms</p> <p>Ch1 10.0 V Ch2 500 V M40.0ms A Ch1 200mV</p> <p>Ch1 5.00 V Ch2 100 V M10.0ms A Ch1 2.40 V</p>				
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°C	620mVp-p 592mVp-p
<p>FULL /50% LOAD 50%DUTY / 120HZ FULL /50% LOAD 50%DUTY / 1KHZ</p> <p>Δ: 620mV @: -284mV</p> <p>Ch1 Max 300mV Ch1 RMS 50.2mV Ch1 Pk-Pk 572mV</p> <p>Δ: 592mV @: -264mV</p> <p>Ch1 Max 296mV Ch1 RMS 85.9mV Ch1 Pk-Pk 544mV</p> <p>Ch1 200mV M2.00ms A Ch1 220mV</p> <p>Ch1 200mV M400µs A Ch1 296mV</p> <p>24 Mar 2016 13:43:09 24 Mar 2016 13:44:15</p>				

**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 =7.86A/ 230VAC I =12.89A/ 115VAC (80% LOAD)																																	
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=0.98/230VAC																																	
P.F vs LOAD <div style="text-align: center;"> <table border="1"> <caption>Approximate data from P.F vs LOAD graph</caption> <thead> <tr> <th>LOAD (%)</th> <th>PF (115VAC)</th> <th>PF (230VAC)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>0.98</td><td>0.86</td></tr> <tr><td>20%</td><td>0.99</td><td>0.94</td></tr> <tr><td>30%</td><td>0.99</td><td>0.96</td></tr> <tr><td>40%</td><td>0.99</td><td>0.97</td></tr> <tr><td>50%</td><td>0.99</td><td>0.975</td></tr> <tr><td>60%</td><td>0.99</td><td>0.975</td></tr> <tr><td>70%</td><td>0.99</td><td>0.975</td></tr> <tr><td>80%</td><td>0.99</td><td>0.975</td></tr> <tr><td>90%</td><td>0.99</td><td>0.975</td></tr> <tr><td>100%</td><td>0.99</td><td>0.975</td></tr> </tbody> </table> </div>					LOAD (%)	PF (115VAC)	PF (230VAC)	10%	0.98	0.86	20%	0.99	0.94	30%	0.99	0.96	40%	0.99	0.97	50%	0.99	0.975	60%	0.99	0.975	70%	0.99	0.975	80%	0.99	0.975	90%	0.99	0.975	100%	0.99	0.975
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6	EFFICIENCY(Typ.)	91%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	92.09 %																																	
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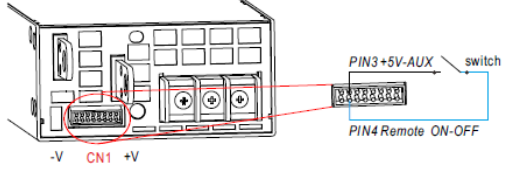
7	INRUSH CURRENT(Typ.)	230V/35 A COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I=33A/ 230VAC T50= 2450 us/230V
<p>INPUT=230VAC/50HZ @ FULL LOAD CH4 : Input current CH3: Input AC</p>				

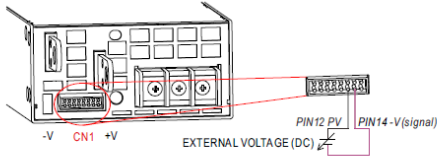
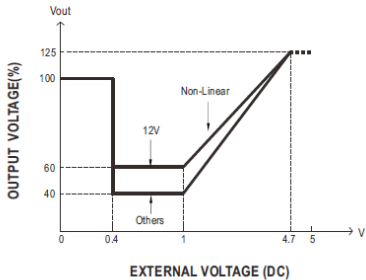
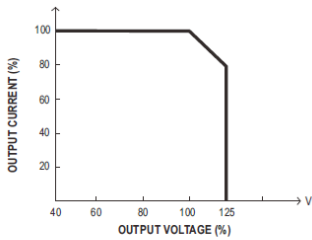
## PROTECTION FUNCTION TEST

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	108%/ 264VAC 108.2%/ 230VAC 107.9%/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	31.5 V~ 37.5 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	34.5V/ 264VAC 34.5V/ 230VAC 34.5V/ 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 on to recover	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
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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	11.6V 0.8 A ; ripple 136mvp-p												
2	REMOTE ON/OFF CONTROL	<p><b>3. Remote ON-OFF Control</b></p> <p>※ The power supply can be turned ON/OFF individually or along with other units by using the "Remote ON-OFF" function.</p>  <table border="1" data-bbox="1050 875 1485 965"> <thead> <tr> <th>Between Remote ON-OFF and +5V-AUX</th> <th>Power Supply Status</th> </tr> </thead> <tbody> <tr> <td>Switch Short</td> <td>ON</td> </tr> <tr> <td>Switch Open</td> <td>OFF</td> </tr> </tbody> </table> <p>I/P: 230 VAC            O/P:FULL LOAD            Ta:25°C            Test Result :</p> <table border="1" data-bbox="472 1144 1075 1245"> <thead> <tr> <th>Between Remote ON-OFF and +5V-AUX</th> <th>Power Supply Status</th> </tr> </thead> <tbody> <tr> <td>SW SHORT</td> <td>ON</td> </tr> <tr> <td>SW OPEN</td> <td>OFF</td> </tr> </tbody> </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 SHORT	ON															
SW OPEN	OFF															
3	REMOTE SENSE	S+ / S- 0.3V~0.5V Compensate voltage drop on the load wiring up to 0.5V.	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	0.3V~0.5V												
4	ALARM SIGNAL	<p>1. DC OK SIGNAL</p> <p>High (3.5 ~ 5.5V) : When the <math>V_{out} \leq 77\% \pm 5\%</math>.</p> <p>Low (-0.5 ~ 0.5V) : When <math>V_{out} \geq 80\% \pm 5\%</math>.</p> <p>The maximum sourcing current is 10mA and only for output. (Note.2)</p> <p>I/P: 230 VAC            O/P:FULL LOAD            Ta:25°C            Test Result :</p> <table border="1" data-bbox="525 1632 1096 1729"> <thead> <tr> <th>Vout</th> <th>DC OK SIGNAL</th> </tr> </thead> <tbody> <tr> <td><math>V_{out} \leq 72\%</math></td> <td>5V</td> </tr> <tr> <td><math>V_{out} \geq 85\%</math></td> <td>-0.09V</td> </tr> </tbody> </table>	Vout	DC OK SIGNAL	$V_{out} \leq 72\%$	5V	$V_{out} \geq 85\%$	-0.09V								
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		<p>2. T-ALARM</p> <table border="1" data-bbox="539 318 1129 398"> <tr> <th>PSU 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> <p>I/P: 230 VAC O/P:FULL LOAD Ta:25°C Test Result :</p> <table border="1" data-bbox="544 524 1115 622"> <tr> <th>P.S.U STATUS</th> <th>T-ALARM</th> </tr> <tr> <td>NORMAL</td> <td>-0.09 V</td> </tr> <tr> <td>OTP OR FAN LOCK</td> <td>4.936V</td> </tr> </table>	PSU 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	-0.09 V	OTP OR FAN LOCK	4.936V									
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5	<p>OUTPUT VOLTAGE PROGRAMMABLE(PV)</p>	<p>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.</p>  <div style="display: flex; justify-content: space-around;"> <div data-bbox="491 949 858 1227">  </div> <div data-bbox="938 958 1251 1196">  </div> </div> <p>⊙ The rated current should change with the Output Voltage Programming accordingly. ⊙ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.</p> <p>I/P: 230 VAC O/P:FULL LOAD Ta:25°C Test Result :</p> <table border="1" data-bbox="472 1429 1155 1630"> <tr> <td></td> <td>PV</td> <td>&lt;0.4V</td> <td>1V</td> <td>4.7V</td> <td>5V</td> </tr> <tr> <td>MODEL</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>SPEC</td> <td></td> <td>24V±5%</td> <td>9.6V±5%</td> <td>30V±5%</td> <td>30V±5%</td> </tr> <tr> <td>Vout</td> <td></td> <td>24.11V</td> <td>9.47V</td> <td>30.01V</td> <td>30.52V</td> </tr> </table>		PV	<0.4V	1V	4.7V	5V	MODEL						SPEC		24V±5%	9.6V±5%	30V±5%	30V±5%	Vout		24.11V	9.47V	30.01V	30.52V
	PV	<0.4V	1V	4.7V	5V																					
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SPEC		24V±5%	9.6V±5%	30V±5%	30V±5%																					
Vout		24.11V	9.47V	30.01V	30.52V																					

## COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor ( D to S) or (C to E) <b>Peak Voltage</b>	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/	VDS: (1)469V (2)441V (3)425V (4)469V (5)469V





**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:6.77mA I/P-FG:7.63mA O/P-FG:5.84m 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°C	I/P-O/P: 30GΩ I/P-FG: 30GΩ O/P-FG: 30GΩ 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		

		Temperature Measurement Data			
		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

2020.10.1 TAG-QA-009