



Test Report: NTU-1200-224

1200W High Reliable True Sine Wave with UPS DC-AC Power Inverter

- **DESIGN VERIFY TEST**

- Output Function Test

- Input Function Test

- Protection Function Test

- Control Function Test

- APPLICATION Test

- Component Stress Test

- **SAFETY & E.M.C. TEST**

- Safety Test

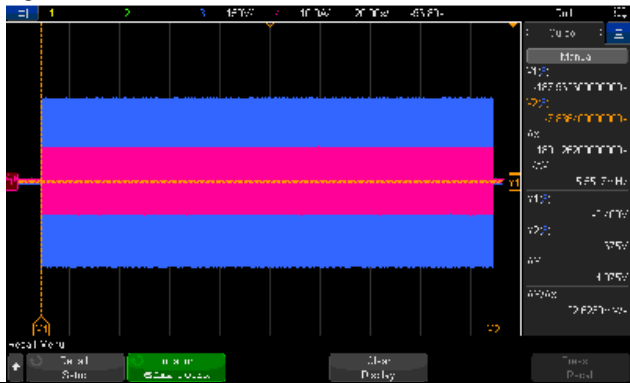
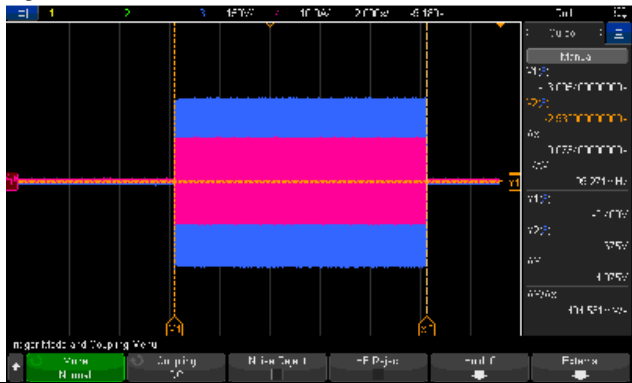
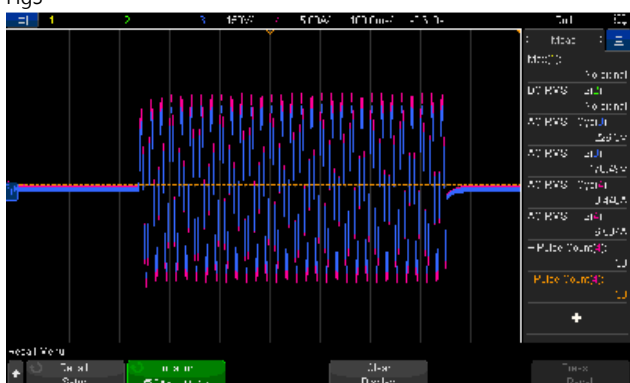
- E.M.C. Test

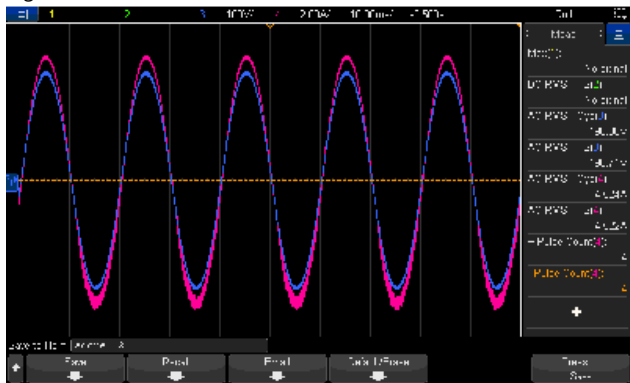
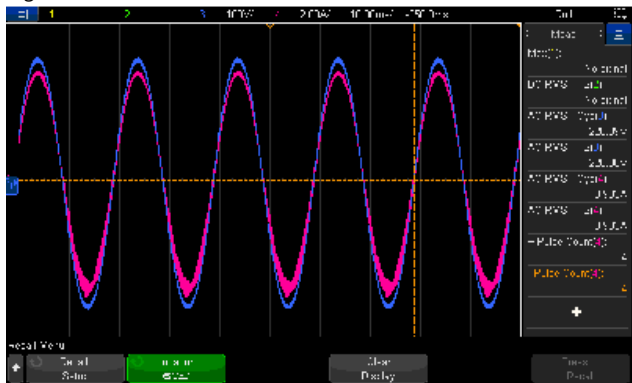
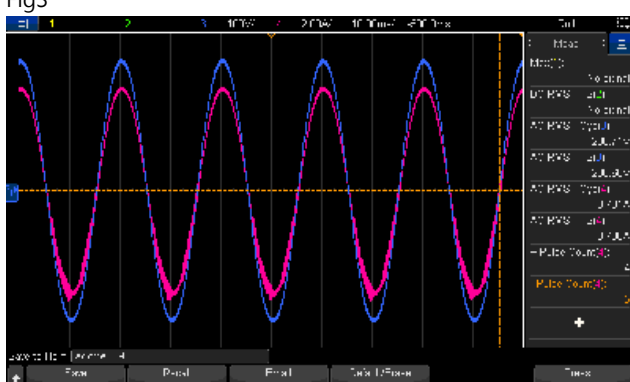
- **RELIABILITY TEST**

- ENVIRONMENT TEST

DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RATED POWER	1200W	IP: 24VDC Ta:25°C	<u>1224</u> W
2	MAXIMUM OUTPUT POWER (TYP)	(1)1380W/180sec. (2)1800w/10sec (3)SURGE POWER 2000W FOR 30CYCLE Vin (30 ± 5 CYCLE)	IP: 25VDC OP:TESTING LOAD Ta:25°C	(1) 229.2 V/ 5.96 A/ 180.12 Sec (2) 228.8 V/ 7.75 A/ 10.07 Sec (3) 226.1 V/ 8.440 A/ 30 Cycle
CH3:O/P VAC CH4:O/P IAC				
Fig1  Fig2  Fig3 				
3	AC Voltage	200 / 220 / 230 / 240Vac selectable by DIP S.W	IP: 24VDC OP: FULL LOAD Ta:25°C	DIP S.W 200VAC: <u>199.5</u> V DIP S.W 220VAC: <u>219.3</u> V DIP S.W 230VAC: <u>229.2</u> V DIP S.W 240VAC: <u>239.2</u> V
4	FREQUENCY	50/60Hz (±0.1HZ) selectable by DIP S.W	IP: 24VDC OP: FULL LOAD Ta:25°C	DIP S.W 50HZ: <u>50.041</u> HZ DIP S.W 60HZ: <u>59.958</u> HZ

5	WAVEFORM	True sine wave (THD<3%)	IP:25VDC OP:75% LOAD(900W) (1) Vo(min) (2) Vo(nor) (3) Vo(max) Ta:25°C	(1) 1.33 % / Vo(min)/75% LOAD (2) 1.73 % / Vo(nor) /75% LOAD (3) 1.11 % / Vo(max) /75% LOAD
CH3:O/P VAC CH4:O/P IAC				
Fig1				
Fig2				
Fig3				
6	AC REGULATION	±3%	IP: 25VDC OP:75% LOAD(900W) Ta:25°C	-0.27 %
7	Overshoot /Undershoot	<±10%	IP: 24VDC OP: (1) full load turn on (2) no load turn on (3) full /no load change Ta:25°C	(1) -8.91 % (2) -6.26 % (3) -3.13 %
8	O/P voltage DC offset	Vin(nor)= 24 v · Vo< 200mV · no load : 86.3 mV / full load: 76 mV		

9	LED STATUS	Status test <table> <tr> <th>LED</th><th>Status</th><th>RESULT</th></tr> <tr> <td>Green</td><td> Inverter OK</td><td>OK</td></tr> <tr> <td>Orange</td><td> Remote off  Saving mode</td><td>OK</td></tr> <tr> <td>Red</td><td> Abnormal Status (See SPEC)</td><td>OK</td></tr> </table> Battery test <table> <tr> <th>LED</th><th>Battery RANGE</th><th>RESULT</th></tr> <tr> <td>Green </td><td>25.0~31.0 Vdc±0.5v</td><td>25.05Vdc ~ 30.86 Vdc</td></tr> <tr> <td>Orange </td><td>22.0~25.0Vdc ±0.5v</td><td>22.04Vdc ~ 25.68 Vdc</td></tr> <tr> <td>Red </td><td><22.0 Vdc ±0.5v > 31.0vdc±0.5v</td><td>< 21.98 Vdc > 30.97 Vdc</td></tr> </table> Load test <table> <tr> <th>LED</th><th>LOAD RANGE</th><th>RESULT</th></tr> <tr> <td>Green </td><td>Min. load ~ 40%±5% LOAD</td><td>Min. load ~ 40.2 %</td></tr> <tr> <td>Orange </td><td>40%±5% ~ 80%±5% LOAD</td><td>42.5%~ 80.7 %</td></tr> <tr> <td>Red </td><td>≥ 80%±5% LOAD</td><td>≥ 82.5 %</td></tr> </table> AC Input <table> <tr> <th>LED</th><th>AC INPUT</th><th>RESULT</th></tr> <tr> <td>Green </td><td>Utility OK</td><td>OK</td></tr> <tr> <td>Green </td><td>Utility error</td><td>OK</td></tr> <tr> <td>Colorless </td><td>Utility disconnected</td><td>OK</td></tr> </table>	LED	Status	RESULT	Green	 Inverter OK	OK	Orange	 Remote off  Saving mode	OK	Red	 Abnormal Status (See SPEC)	OK	LED	Battery RANGE	RESULT	Green 	25.0~31.0 Vdc±0.5v	25.05Vdc ~ 30.86 Vdc	Orange 	22.0~25.0Vdc ±0.5v	22.04Vdc ~ 25.68 Vdc	Red 	<22.0 Vdc ±0.5v > 31.0vdc±0.5v	< 21.98 Vdc > 30.97 Vdc	LED	LOAD RANGE	RESULT	Green 	Min. load ~ 40%±5% LOAD	Min. load ~ 40.2 %	Orange 	40%±5% ~ 80%±5% LOAD	42.5%~ 80.7 %	Red 	≥ 80%±5% LOAD	≥ 82.5 %	LED	AC INPUT	RESULT	Green 	Utility OK	OK	Green 	Utility error	OK	Colorless 	Utility disconnected	OK
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INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE RANGE (TYP)	20VDC~33VDC	IP: TESTING OP:NO LOAD/FULL LOAD Ta:25°C	<u>20.07</u> VDC~ <u>32.8</u> VDC/NO LOAD <u>20.2</u> VDC~ <u>32.9</u> VDC/FULL LOAD
			I/P: LOW-LINE=20.5V HIGH-LINE=32.5V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON:30Sec OFF:30Sec 10MIN (POWER ON/OFF NO DAMAGE) I/P: 24V O/P:FULL LOAD ON:30ec OFF:30ec 12Hr (POWER ON/OFF NO DAMAGE)	Test: <u>OK</u>
2	DC CURRENT (TYP)	60A	IP: 24VDC OP:FULL LOAD Ta:25°C	<u>54.44</u> A
3	NO LOAD DISSIPATION (Typ.)	$\leq 8W$ @standby saving mode $\leq 25W$ @NON-Saving Mode	IP: 24VDC OP:NO LOAD Ta:25°C	<u>5.33</u> W <u>22.94</u> W
4	SAVING MODE TO NORMAL	$P_o \geq 25W$	IP: 24VDC OP: TESTING LOAD Ta:25°C	<u>21</u> W
5	NORMAL TO SAVING MODE	$P_o \leq 10W$	IP: 24VDC OP: TESTING LOAD Ta:25°C	<u>15</u> W
6	OFF MODE CURRENT DRAW (Typ.)	$\leq 1mA$	IP: 24VDC OP: Sw off Ta:25°C	<u>0.75</u> mA
7	EFFICIENCY(TYP)	900W/92%	IP: 25VDC OP: $P_o=900W$ 230V/50HZ (factory setting) Ta:25°C	<u>92.5</u> %

AC UPS MODE

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	AC Taper Voltage RANGE	AC input high / low line limit:No Load		
		AC Voltage	limit	Voltage RANGE
		230V	High limit (To INV mode)	$V_{ac} > 230V + 16\% \pm 3\%$
			Recovery to high (To AC mode)	$V_{ac} < 230V + 13\% \pm 3\%$
			Low limit (To INV mode)	$V_{ac} < 230V - 16\% \pm 3\%$
			Recovery to low (To AC mode)	$V_{ac} > 230V - 13\% \pm 3\%$
		AC Voltage	limit	Voltage RANGE
		200V	High limit (To INV mode)	$V_{ac} > 200V + 16\% \pm 3\%$
			Recovery to high (To AC mode)	$V_{ac} < 200V + 13\% \pm 3\%$
			Low limit (To INV mode)	$V_{ac} < 200V - 16\% \pm 3\%$
			Recovery to low (To AC mode)	$V_{ac} > 200V - 13\% \pm 3\%$
		AC Voltage	limit	Voltage RANGE
		220V	High limit (To INV mode)	$V_{ac} > 220V + 16\% \pm 3\%$
			Recovery to high (To AC mode)	$V_{ac} < 220V + 13\% \pm 3\%$
			Low limit (To INV mode)	$V_{ac} < 220V - 16\% \pm 3\%$
			Recovery to low (To AC mode)	$V_{ac} > 220V - 13\% \pm 3\%$
		AC Voltage	limit	Voltage RANGE
		240V	High limit (To INV mode)	$V_{ac} > 240V + 16\% \pm 3\%$
			Recovery to high (To AC mode)	$V_{ac} < 240V + 13\% \pm 3\%$
			Low limit (To INV mode)	$V_{ac} < 240V - 16\% \pm 3\%$
			Recovery to low (To AC mode)	$V_{ac} > 240V - 13\% \pm 3\%$
2	FREQUENCY RANGE	45 ~ 65Hz	IP: 24VDC OP: FULL LOAD Ta:25°C	TEST: <u>OK</u>
3	TRANSFER TIME (TYP)	t<10ms±3ms inverter→by pass	IP: 24VDC OP: (1) no load (2) full load Ta:25°C	(1) no load a. INTER→BY PASS <u>2.4</u> ms b. BY PASS→INVERTER <u>12.1</u> ms (2) full load c. INTER→BY PASS <u>3.6</u> ms d. BY PASS→INVERTER <u>11.2</u> ms

PROTECTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BAT LOW ALARM	22V±0.5VDC	IP: TESTING OP: FULL LOAD SW: ON Ta:25°C	<u>21.97</u> V
2	BAT LOW SHUT DOWN	20V±0.5VDC	IP: TESTING OP: FULL LOAD SW: ON Ta:25°C	<u>20.14</u> V

3	BAT LOW RESTART	25V±0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>25.04</u> V
4	BAT HIGH ALARM	31V±0.5VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25°C	<u>30.96</u> V
5	BAT HIGH SHUT DOWN	33V±0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>33.07</u> V
6	BAT HIGH RESTART	30V±0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>29.97</u> V
7	OVER TEMPERATURE	Shut down o/p voltage: re-power on	IP: HI LINE/LOW-LINE OP: FULL LOAD SW:ON Ta:25°C	Shut down o/p voltage, re-power on to recover LED DISPLAY: <u>OK</u>
8	OUTPUT SHORT	Shut down o/p voltage: re-power on	IP: 24VDC O/P: FULL LOAD SW:ON Ta:25°C	Shut down o/p voltage, re-power on to recover LED DISPLAY: <u>OK</u> (1).TEST: <u>OK</u>
9	OVER LOAD (typ.)	105%~115%LOAD 180sec 115%~150%LOAD 10 sec Shut down o/p voltage, re-power on to recover	IP: 24VDC OP: TESTING SW:ON Ta:25°C	(1). <u>107 %</u> ~ <u>114 %</u> <u>180.12</u> sec (2). <u>116 %</u> ~ <u>147 %</u> <u>10.07</u> sec Shut down o/p voltage, re-power on to recover

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	REMOTE CONTROL	(1).Power ON-OFF remote control by front panel dry contact connector (by RELAY) Open : Normal work Short : Remote off (2). IRC3	IP: 24VDC OP: FULL LOAD Ta:25°C	Open : Normal work Short : Remote off (1).TEST: <u>OK</u> (2).TEST: <u>OK</u>

APPLICATION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	LAMP	LAMP: <u>618</u> W · turn on <u>OK</u> LAMP: <u>1037</u> W · turn on <u>OK</u> LAMP: <u>1400</u> W · turn on <u>OK</u>	1. Vin=HIGH LINE 2. O/P=110V/60Hz TEST: <u>OK</u>	
2	INDUCTION MOTOR	<u>0.5</u> HP	1. Vin=HIGH LINE 2. O/P=110V/60Hz TEST: <u>OK</u>	

3	SWITCHING POWER SUPPLY	WITH PFC: <u>RSP-1600-48</u> O/P= <u>1245.4</u> W	1. Vin=HIGH LINE 2. O/P=110V/60Hz TEST: <u>OK</u>
		NO PFC: <u>SE-1000-48</u> O/P= <u>643.5</u> W	1. Vin=HIGH LINE 2. O/P=110V/60Hz TEST: <u>OK</u>

COMPONENT WEAFORM TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	
1	DC TO DC Power Transistor (D to S) or (C to E) Peak Voltage	Q101 Rated : 100V /80 A	I/P: high line O/P:V(max)/Freq 60HZ VDS: O/P: (1)Full Load Turn On (2) Output Short (3)O.L.P(200%) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	Q101 (1) 75.4V (2) 76.2V (3) 79.4V (4) 75.4V (5) 76.2V	Q105 (1) 76.6V (2) 77.4V (3) 79.8V (4) 77.4V (5) 77.4V
2	DC TO DC Diode Peak Voltage	D 151 Rated : 600V/ 20A	I/P: high line O/P:V(max) /Freq 60HZ O/P: (1)Full Load Turn On (2) Output Short (3)O.L.P(200%) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	D151 (1) 524V (2) 560V (3) 548V (4) 544V (5) 524V	D152 (1) 520V (2) 548V (3) 548V (4) 544V (5) 524V
3	DC BUS Capacitor Voltage	C161/C162 Rated : 680 u/ 315 V	I/P: high line O/P:V(max) /Freq 60HZ O/P: (1)Full Load Turn On (2) Output Short (3)O.L.P(200%) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	C161 (1) 258V (2) 258V (3) 256V (4) 258V (5) 256V	C162 (1) 262V (2) 262V (3) 262V (4) 262V (5) 262V
4	DC TO AC Power Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rated : 30A / 650 V	I/P: high line O/P:V(max) /Freq 60HZ VDS: O/P: (1)Full Load Turn On (2) Output Short (3)O.L.P(200%) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	Q1 (1) 536V (2) 540V (3) 552V (4) 536V (5) 544V	Q4 (1) 540V (2) 540V (3) 540V (4) 544V (5) 548V

5	AUX PWM MOS	Q201 Rated : 65 A/ 200 V Q501 Rated : 120 A/ 60 V	I/P: high line O/P:V(max) /Freq 60HZ O/P: (1)Full Load Turn On (2) Output Short (5)O.L.P(200%) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	Q201 (1) 109.2V (2) 109.2V (3) 109.2V (4) 109.2V (5) 109.2V	Q105 (1) 49.0 V (2) 49.0V (3) 49.0V (4) 49.0V (5) 49.0V
6	Control IC Voltage Test	MCU IC U301 Rated 2.4 V~ 3.6 V AUX IC U201 Rated 8.2V~30V CHARGE IC U501 Rated -0.3V~20V Gate Driver IC U81 Rated -0.3V~20V	I/P: high line O/P:V(max) /Freq 60HZ O/P: (1)Full Load Turn On (2) Output Short (3)O.L.P(200%) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	U301 (1) 3.50V (2) 3.42V (3) 3.46V (4) 3.50V (5) 3.46V U201 (1) 12.22V (2) 12.22V (3) 12.22V (4) 12.22V (5) 12.22V	U501 (1) 12.30V (2) 12.30V (3) 12.03V (4) 12.30V (5) 12.30V U81 (1) 5.07V (2) 5.07V (3) 5.07V (4) 5.07V (5) 5.07V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	BAT I/P-AC I/P: 3 KVAC/min BAT I/P-AC O/P: 3 KVAC/min AC O/P-FG: 1.5 KVAC/min	BAT I/P-AC I/P: 3.6 KVAC/min BAT I/P-AC O/P: 3.6 KVAC/min AC O/P-FG:1.8 KVAC/min Ta:25°C	BAT I/P-AC I/P: 7.21 mA BAT I/P-AC O/P: 7.08 mA AC O/P-FG: 5.95 mA NO DAMAGE
2	GROUNDING CONTINUITY	IEC62368 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta:25°C	3mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	EN55032 CISPR32 (expect for Type-UN) CLASS A	I/P:24 VDC O/P: :FULL/50% LOAD Ta:25°C	CLASS A
2	E.S.D	EN61000-4-2 AIR : 8KV / Contact : 4KV	I/P: 24VDC O/P:FULL LOAD Ta:25°C	PASS
3	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25°C	PASS
4	CONDUCTION	EN55032 CISPR32 (expect for Type-UN) CLASS A	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS
5	E.F.T	EN61000-4-4 INPUT : 1KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 L-N : 1KV	I/P : 230 VAC/50HZ O/P : FULL LOAD	CRITERIA A

		L,N-PE : 2KV	Ta : 25°C	
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

Reliability Test

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	
1	TEMPERATURE RISE TEST	MODEL : NTU-1200-224			
		1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 25VDC O/P : FULL LOAD Ta= 25.0 °C			
		2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 25VDC O/P : FULL LOAD Ta= 35.0 °C			
		NO	Position	ROOM AMBIENT Ta=25.0 °C	HIGH AMBIENT Ta= 35.0 °C
		1	C101	60.8°C	68.9°C
		2	T101	78.6°C	87.6°C
		3	D151	56.9°C	65.6°C
		4	RTH6	52.1°C	61.6°C
		5	Q105	47.3°C	56.4°C
		6	Q104	53.6°C	63.1°C
		7	C531	29.2°C	41.0°C
		8	T501	27.8°C	39.3°C
		9	Q501	31.3°C	42.4°C
		10	U301	34.0°C	45.3°C
		11	U361	31.5°C	42.9°C
		12	TSW1	42.0°C	52.4°C
		13	Q141	31.1°C	42.2°C
		14	Q1	62.4°C	73.0°C
		15	Q4	54.9°C	65.7°C
		16	R223	41.1°C	52.5°C
		17	C222	35.9°C	47.4°C
		18	Q201	35.6°C	48.2°C
		19	D154	56.6°C	65.1°C
		20	C161	38.0°C	48.2°C
		21	L10	48.6°C	58.7°C
		22	C222	30.5°C	41.3°C
		23	T202	27.9°C	39.7°C
		24	RY1	34.6°C	45.5°C
		25	ZNR1	27.4°C	38.2°C
		26	LF1	34.2°C	43.8°C
		27	R213	46.4°C	60.1°C
		28	U501	31.8°C	42.7°C
		29	R24	61.3°C	70.7°C
		30	U81	35.6°C	46.1°C
		31	D501	31.4°C	42.3°C
		32	R501	33.5°C	44.4°C
		33	U201	43.6°C	55.0°C
		34	Q203	37.0°C	48.6°C
35	TC1	34.5°C	44.4°C		
36	TC2	34.0°C	44.5°C		
37	C104	58.9°C	67.1°C		

2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 25VDC O/P : 100%LOAD Ta= -25 °C	TEST : OK
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 35 °C NO DAMAGE	I/P : 32.5VDC O/P : FULL LOAD Ta= 35 °C HUMIDITY= 95 %R.H	TEST : OK
4	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		TEST : OK
5	THERMAL SHOCK TEST	1. Thermal shock Temperature : -25°C~ +40°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 : 25VDC/Full Load		TEST : OK
6	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 4G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C		TEST : OK
7	CAPACITOR LIFE CYCLE	SUPPOSE C101 IS THE MOST CRITICAL COMPONENT (1) I/P : 25VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 25VDC O/P : FULL LOAD Ta= 35 °C LIFE TIME		(1) 302931HRS (2) 172786.3HRS
8	MTBF	Conducted by Parts Stress Analysis Prediction 166.3K hrs min. Telcordia TR/SR-332 (Bellcore) ; 58.3K hrs min. MIL-HDBK-217F (25°C)		
9	Ongoing Reliability Test	I/P : 25VDC O/P : 80% LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ

2018.4.30 GP-A50-F010