



Test Report: NTU-1200-124

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) 110.62 V/ 12.41A/180.11 Sec (2) 110.44V/16.17A/10.07 Sec (3) 109.3 V/17.87A/ 35 Cycle

CH3:O/P VAC CH4:O/P IAC

Fig1



Fig2

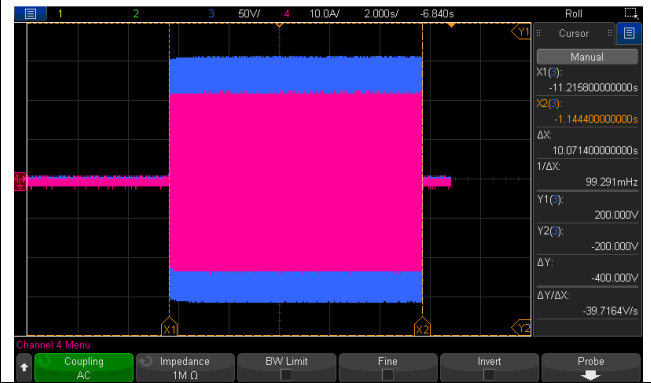
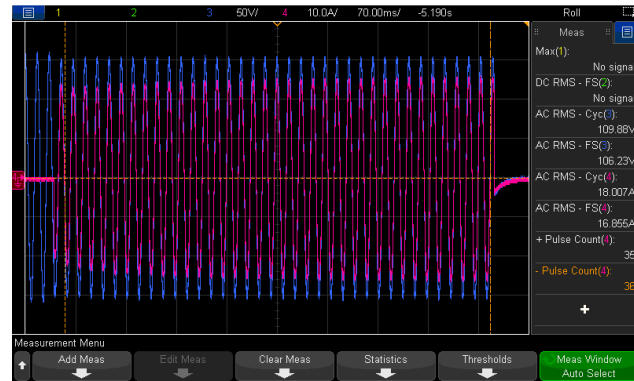


Fig3



3	AC Voltage	100 / 110 / 115 / 120Vac selectable by DIP S.W	IP: 24VDC OP: FULL LOAD Ta:25°C	DIP S.W 100VAC: <u>100.48</u> V DIP S.W 110VAC: <u>110.63</u> V DIP S.W 115VAC: <u>115.68</u> V DIP S.W120VAC: <u>120.76</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>50.038</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) 1.47 % / Vo(min)/75% LOAD (2) 1.36% / Vo(nor) /75% LOAD (3) 1.26% / Vo(max) /75% LOAD
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CH3:O/P VAC CH4:O/P IAC

Fig1

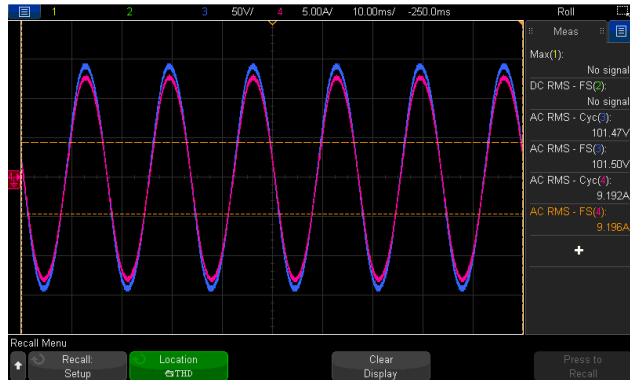


Fig2

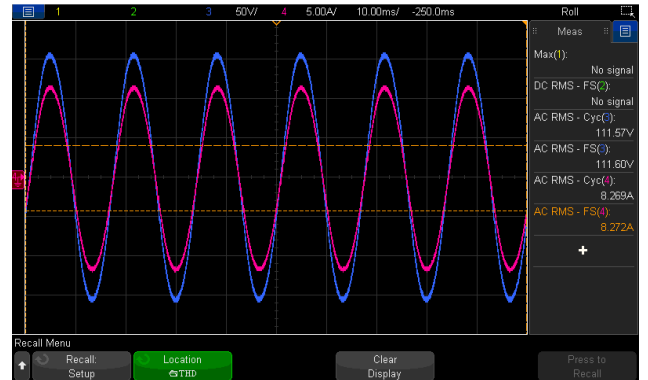
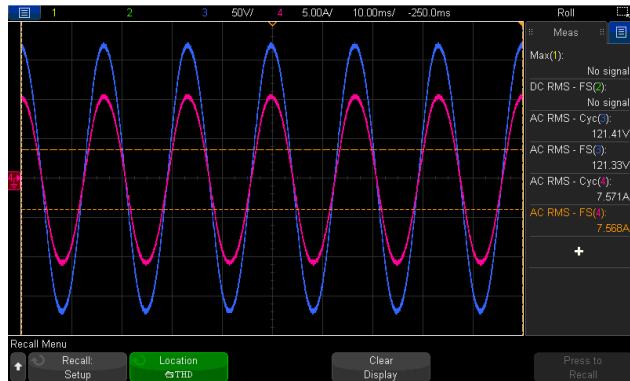









































Fig3



6	AC REGULATION	±3%	IP: 25VDC OP:75% LOAD(900W) Ta:25°C	1.09 %
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) -6.82 % (2) -3.73 % (3) -5.45 %
8	O/P voltage DC offset	$V_{in(nor)} = 24 \text{ v} \cdot V_o < 200\text{mV} \cdot \text{no load} : 63.2 \text{ mV} / \text{full load} : 64.8 \text{ mV}$		

9	LED STATUS	<ul style="list-style-type: none"> Status test <table border="1" data-bbox="424 293 1439 631"> <thead> <tr> <th>LED</th> <th>Status</th> <th>RESULT</th> </tr> </thead> <tbody> <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> </tbody> </table> Battery test <table border="1" data-bbox="424 705 1439 978"> <thead> <tr> <th>LED</th> <th>Battery RANGE</th> <th>RESULT</th> </tr> </thead> <tbody> <tr> <td>Green </td> <td>25.0~31.0 Vdc±0.5v</td> <td>25.135Vdc ~ 30.992Vdc</td> </tr> <tr> <td>Orange </td> <td>22.0~25.0Vdc ±0.5v</td> <td>22.095Vdc ~ 24.953Vdc</td> </tr> <tr> <td>Red </td> <td><22.0 Vdc ±0.5v > 31.0vdc±0.5v</td> <td>< 22.024 Vdc > 31.176 Vdc</td> </tr> </tbody> </table> Load test <table border="1" data-bbox="424 1052 1439 1323"> <thead> <tr> <th>LED</th> <th>LOAD RANGE</th> <th>RESULT</th> </tr> </thead> <tbody> <tr> <td>Green </td> <td>Min. load ~ 40%±5% LOAD</td> <td>Min. load ~ 40.79 %</td> </tr> <tr> <td>Orange </td> <td>40%±5% ~ 80%±5% LOAD</td> <td>40.88%~ 80.11 %</td> </tr> <tr> <td>Red </td> <td>≥ 80%±5% LOAD</td> <td>≥ 80.25 %</td> </tr> </tbody> </table> AC Input <table border="1" data-bbox="424 1397 1439 1664"> <thead> <tr> <th>LED</th> <th>AC INPUT</th> <th>RESULT</th> </tr> </thead> <tbody> <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> </tbody> </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	25.135Vdc ~ 30.992Vdc	Orange 	22.0~25.0Vdc ±0.5v	22.095Vdc ~ 24.953Vdc	Red 	<22.0 Vdc ±0.5v > 31.0vdc±0.5v	< 22.024 Vdc > 31.176 Vdc	LED	LOAD RANGE	RESULT	Green 	Min. load ~ 40%±5% LOAD	Min. load ~ 40.79 %	Orange 	40%±5% ~ 80%±5% LOAD	40.88%~ 80.11 %	Red 	≥ 80%±5% LOAD	≥ 80.25 %	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>20.156</u> VDC~ <u>33.045</u> VDC/NO LOAD <u>20.159</u> VDC~ <u>32.953</u> VDC/FULL LOAD
			I/P: LOW-LINE=21V 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: 48V 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>57.24</u> A
3	NO LOAD DISSIPATION (Typ.)	≤ 8W @standby saving mode ≤ 15W@NON-Saving Mode	IP: 24VDC OP:NO LOAD Ta:25°C	<u>5.41</u> W <u>13.01</u> W
4	SAVING MODE TO NORMAL	Po≥25W	IP: 24VDC OP: TESTING LOAD Ta:25°C	<u>17.4</u> W
5	NORMAL TO SAVING MODE	Po≤ 10W	IP: 24VDC OP: TESTING LOAD Ta:25°C	<u>11.5</u> W
6	OFF MODE CURRENT DRAW (Typ.)	≤ 1mA	IP: 24VDC OP: Sw off Ta:25°C	<u>0.797</u> mA
7	EFFICIENCY(TYP)	900W/90%	IP: 25VDC OP: Po=900W 110V/60HZ (factory setting) Ta:25°C	<u>91.25</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	RESULT	
		110V	High limit (To INV mode)		Vac >110V +16%±3%	<u>127.3</u> V
			Recovery to high (To AC mode)		Vac <110V+13%±3%	<u>121.62</u> V
			Low limit (To INV mode)		Vac <110V-16%±3%	<u>93.21</u> V
			Recovery to low (To AC mode)		Vac >110V-13%±3%	<u>97.55</u> V
		100V	High limit (To INV mode)		Vac >100V+16%±3%	<u>116.28</u> V
			Recovery to high (To AC mode)		Vac <100V+13%±3%	<u>112.93</u> V
			Low limit (To INV mode)		Vac <100V-16%±3%	<u>85.18</u> V
			Recovery to low (To AC mode)		Vac >100V-13%±3%	<u>88.84</u> V
		115V	High limit (To INV mode)		Vac >115V+16%±3%	<u>131.67</u> V
			Recovery to high (To AC mode)		Vac <115V+13%±3%	<u>130.41</u> V
			Low limit (To INV mode)		Vac <115V-16%±3%	<u>97.74</u> V
			Recovery to low (To AC mode)		Vac >115V-13%±3%	<u>100.79</u> V
		120V	High limit (To INV mode)		Vac >120V+16%±3%	<u>136.54</u> V
			Recovery to high (To AC mode)		Vac <120V+13%±3%	<u>135.89</u> V
			Low limit (To INV mode)		Vac <120V-16%±3%	<u>102.74</u> V
			Recovery to low (To AC mode)		Vac >120V-13%±3%	<u>105.20</u> V
		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</u> ms b. BY PASS-INVERTER <u>3.81</u> ms (2) full load c. INTER→BY PASS <u>3.58</u> ms d. BY PASS-INVERTER <u>12.7</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>22.057</u> V
2	BAT LOW SHUT DOWN	20V±0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>20.127</u> V

3	BAT LOW RESTART	25V±0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>25.116</u> V
4	BAT HIGH ALARM	31V±0.5VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25°C	<u>31.153</u> V
5	BAT HIGH SHUT DOWN	33V±0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>33.11</u> V
6	BAT HIGH RESTART	30V±0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>30.16</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>105.6%~ 114.37 %</u> <u>180.11</u> sec (2). <u>115.81%~ 148.87 %</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>316.34</u> W · turn on <u>OK</u> LAMP: <u>772.47</u> W · turn on <u>OK</u> LAMP: <u>1145.5</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>1294.6</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>657.66</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(2000W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	Q101 Q105 (1) 87.9V (1)76.7V (2) 87.9V (2)77.5V (3) 87.1V (3)79.1V (4) 87.9V (4)75.9V (5) 87.9V (5)75.9V
2	DC TO DC Diode Peak Voltage	D 151 Rated : 300V/ 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(2000W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	D151 D152 (1) 263 V (1)263V (2) 279V (2)277V (3) 263V (3)263V (4) 271V (4)267V (5) 269V (5)273V
3	DC BUS Capacitor Voltage	C161 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(2000W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	C161 (1) 265V (2) 265V (3) 265V (4) 265V (5) 267V
4	DC TO AC Power Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rated : 40A / 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(2000W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	Q1 Q3 (1) 277V (1)273V (2) 287V (2)298V (3) 275V (3)274V (4) 271V (4)270V (5) 275V (5)276V

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(2000W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	Q201 (1) 109.7V (2) 109.7V (3) 108.9V (4) 109.7V (5) 109.7V	Q105 (1) 38.3V (2) 36.7V (3) 35.9V (4) 36.7V (5) 36.3V
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(2000W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	U301 (1) 3.39V (2) 3.43V (3) 3.39V (4) 3.39V (5) 3.39V	U501 (1) 12.41V (2) 12.41V (3) 12.41V (4) 12.41V (5) 12.41V
				U201 (1) 12.17V (2) 12.17V (3) 12.17V (4) 12.17V (5) 12.17V	U81 (1) 5.04V (2) 5.04V (3) 5.04V (4) 5.04V (5) 5.04V

SAFETY & EMC TEST

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: 7.18 mA BAT I/P-AC O/P: 7.17 mA AC O/P-FG: 6.02 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	FCC (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:110VAC/60HZ O/P:FULL LOAD Ta:25°C	PASS
4	CONDUCTION	FCC (expect for Type-UN) CLASS A	I/P : 110 VAC (60HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS
5	E.F.T	EN61000-4-4 INPUT : 1KV	I/P : 110 VAC/60HZ O/P : FULL LOAD	CRITERIA A

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 C104 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) 149847.9HRS (2) 126883HRS
8	MTBF	Conducted by Parts Stress Analysis Prediction 460.5K 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