Test Report: NTS-450-112

450W High Reliable Built-in Type True Sine Wave 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	450W	IP: 12VDC Ta:25℃	459 W
2	MAXIMUM OUTPUT POWER (TYP)	(1)517.5W/180sec. (2)675w/10sec (3)SURGE POWER 900W FOR 30CYCLE Vin (30±5 CYCLE)	IP: 12.5VDC OP:TESTING LOAD Ta:25℃	(1) 108.9 V/ 4.63 A/ 180.07 Sec (2) 108.6 V/ 6.0 A/ 10.06 Sec (3) 109.04 V/ 8.13 A / 33 Cycle

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

Fig1

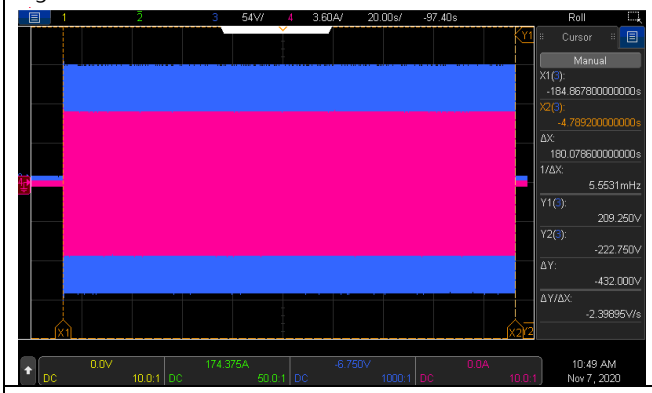


Fig2

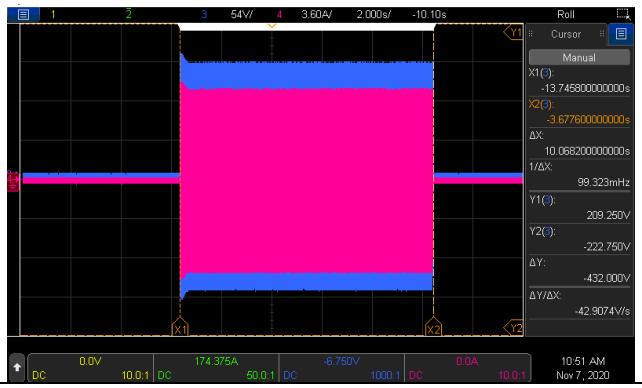


Fig3

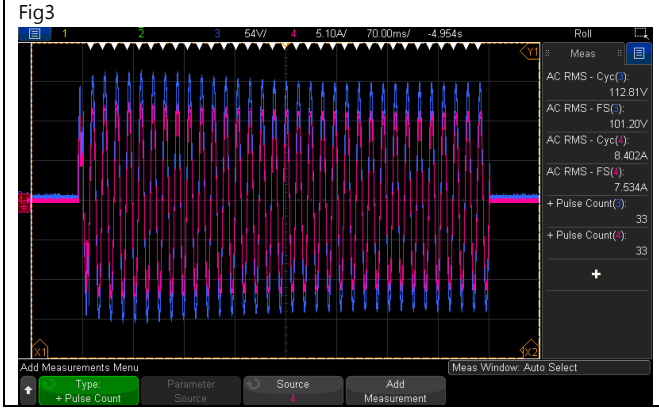


Fig4

3	AC Voltage	100 / 110 / 115 / 120Vac selectable by DIP S.W	IP: 12VDC OP: FULL LOAD Ta:25℃	DIP S.W 100VAC: 99.02 V DIP S.W 110VAC: 109.04 V DIP S.W 115VAC: 113.53 V DIP S.W 120VAC: 119.19 V
4	FREQUENCY	50/60Hz (±0.1HZ) selectable by DIP S.W	IP: 12VDC OP: FULL LOAD Ta:25℃	DIP S.W 50HZ: 50.042 HZ DIP S.W 60HZ: 59.959 HZ
5	WAVEFORM	True sine wave (THD<3%)	IP: 12.5VDC OP: FULL LOAD (1) Vo(min) (2) Vo(nor) (3) Vo(max) Ta:25℃	(1) 1.35 % / Vo(min) /FULL LOAD (2) 1.22 % / Vo(nor) /FULL LOAD (3) 1.12 % / Vo(max) /FULL LOAD

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

Fig1

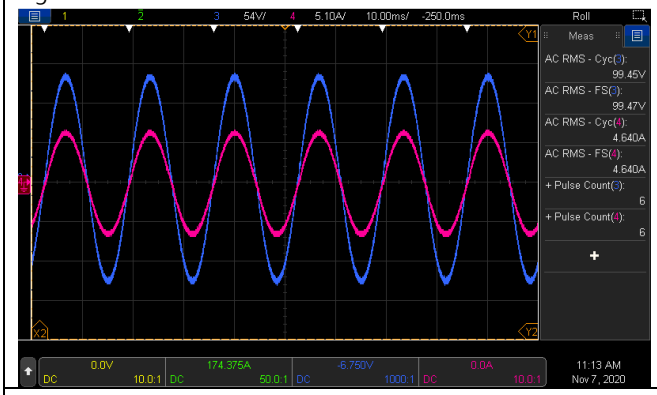


Fig2

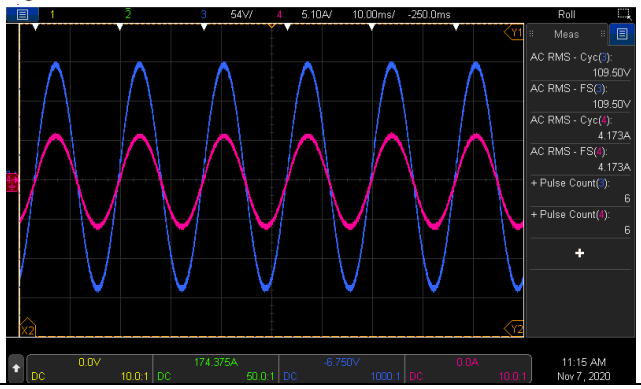
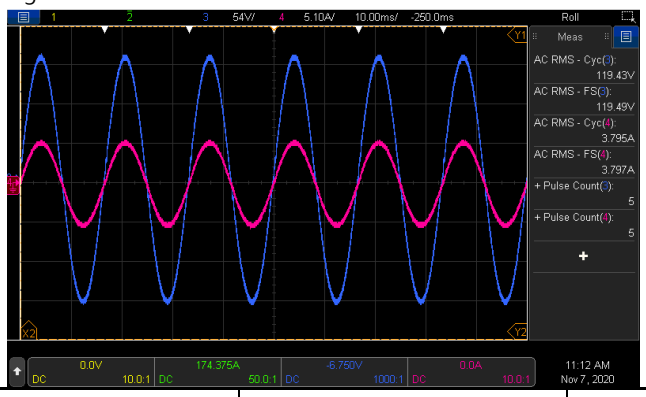


Fig3



6	AC REGULATION	±3%	IP: 12.5VDC OP: FULL LOAD/NO LOAD Ta:25℃	-0.45 %
7	Overshoot /Undershoot	<±10%	IP: 12VDC OP: (1) full load turn on (2) no load turn on (3) full /no load change Ta:25℃	(1) -1.36 % (2) -0.98.7 % (3) -3.25 %
8	O/P voltage DC offset	Vin(nor)= 12 v · Vo<200mv · no load : 90 mV / full load: 60 mV		

9	LED STATUS	● Statas test

LED	Statas	RESULT
Green	Inverter OK	OK
Orange	Remote off Saving mode	OK
Red	Abnormal Status (See SPEC)	OK

● Battery test

LED	Battery RANGE	RESULT
Green	12.5Vdc±0.3v~15.5±0.3v	12.54 Vdc~15.59
Orange	11~ 12.5Vdc ±0.3v	11.218Vdc ~ 12.429Vdc
Red	<11 Vdc ±0.3v or >15.5 Vdc ±0.3v	<11.012 Vdc or >15.064 Vdc

● Load test

LED	LOAD RANGE	RESULT
Green	Min. load ~ 40%±5% LOAD	Min. load ~ 42.2%
Orange	40%±5% ~ 80%±5% LOAD	41.8% ~ 78.8 %
Red	≧ 80%±5% LOAD	≧ 81.6%

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE RANGE (TYP)	10VDC~16.5VDC	IP: TESTING OP:NO LOAD/FULL LOAD Ta:25℃	9.95 VDC~ 16.49 VDC/NO LOAD 10.25 VDC~ 16.36 VDC/FULL LOAD
			I/P: LOW-LINE=10.5V HIGH-LINE=16.2V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON:30Sec OFF:30Sec 10MIN (POWER ON/OFF NO DAMAGE) I/P: 12V O/P:FULL LOAD ON:30ec OFF:30ec 12Hr (POWER ON/OFF NO DAMAGE)	Test: OK

2	DC CURRENT (TYP)	50A	IP: 12VDC OP:FULL LOAD Ta:25℃	42.9 A
3	NO LOAD DISSPATION (Typ.)	NON-Saving Mode=10W	IP: 12VDC OP:NO LOAD Ta:25℃	7.2 W
		SAVING MODE (1) Po： Default disable, auto detect AC output load ≦ 10W will be changed to saving mode (2) Pi ： ≦1.2 W	IP: 12VDC OP: TESTING LOAD Ta:25℃	NORMAL TO SAVING MODE: ≦ 12.7 W
			IP: 12VDC OP: TESTING LOAD Ta:25℃	0.785 W
4	OFF MODE CURRENT DRAW (Typ.)	≦ 1mA	IP: 12VDC OP: Sw off Ta:25℃	0.4 mA
5	EFFICIENCY(TYP)	450W/88%	IP: 12.5VDC OP: Po=450W 110V/60HZ (factory setting) Ta:25℃	89.1 %

PROTECTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BAT LOW ALARM	11V±0.3VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25℃	11.1 V
2	BAT LOW SHUT DOWN	10V±0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	10.26 V
3	BAT LOW RESTART	12.5V±0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	12.525 V
4	BAT HIGH ALARM	15.5V±0.3VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25℃	15.57 V
5	BAT HIGH SHUT DOWN	16.5V±0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	16.62 V
6	BAT HIGH RESTART	15V±0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	14.89 V

7	OVER TEMPERATURE	Shut down o/p voltage: re-power on	IP: HI LINE/LOW-LINE OP: FULL LOAD SW:ON Ta:25℃	Shut down o/p voltage, re-power on to recover LED DISPLAY: OK
8	OUTPUT SHORT	Shut down o/p voltage: re-power on	IP: 10.3VDC/16.2 VDC O/P: FULL LOAD SW:ON Ta:25℃	Shut down o/p voltage, re-power on to recover LED DISPLAY: OK (1).TEST: OK
9	OVER LOAD (typ.)	105%~115%LOAD 180sec 115%~150%LOAD 10 sec Shut down o/p voltage, re-power on to recover	IP: 12VDC OP: TESTING SW:ON Ta:25℃	(1). 107% ~112 % 180.07 sec (2). 117 % ~146 % 10.06 sec Shut down o/p voltage, re-power on to recover

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	REMOTE CONTROL	Power ON-OFF remote control by front panel dry contact connector (by RELAY) Open : Normal work Short : Remote off	IP: 12VDC OP: FULL LOAD Ta:25℃	Open : Normal work Short : Remote off TEST: OK

APPLICATION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	LAMP	LAMP: 242 W · turn on OK LAMP: 472 W · turn on OK LAMP: 399 W · turn on OK	1. Vin=HIGH LINE 2. O/P=110V/60Hz TEST: OK	
2	INDUCTION MOTOR	0.15 HP	1. Vin=HIGH LINE 2. O/P=110V/60Hz TEST: OK	
3	SWITCHING POWER SUPPLY	WITH PFC: EPP-500-48 · O/P= 447 W	1. Vin=HIGH LINE 2. O/P=110V/60Hz TEST: OK	
		NO PFC: LRS-350-36 · O/P= 143 W	1. Vin=HIGH LINE 2. O/P=110V/60Hz TEST: OK	

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	Q102 Rated :200 V /18 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℃	(1) 37.3V (2) 36.5V (3) 38.1V (4) 38.1V (5) 34.1V

2	DC TO DC Diode Peak **Voltage**	D 105 Rated : 600V/ 10A	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℃	 (1)301V (2)303V (3)295V (4)297V (5)303V
3	DC BUS Capacitor Voltage	C119 Rated : 330 u/ 315V	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℃	 C119 (1)290 V (2) 290V (3) 290V (4) 290V (5) 290V
4	DC TO AC Power Transistor (D to S) or (C to E) Peak Voltage	Q 200 IKP15N65H5 Rated : 650V / 20 A	I/P: high line O/P:V(min)/Freq 50HZ 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℃	 (1) 329V (2) 390V (3) 358V (4) 306V (5) 306V
5	AUX PWM MOS	Q504 Rated : 40 A/ 200 V Q105 Rated : 18A/ 200 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℃	Q504 (1) 49.9V (2) 49.9V (3) 49.9V (4) 49.5V (5) 49.9V Q105 (1) 36.2V (2) 36.2V (3) 35.8V (4) 35.8V (5) 35.8V
6	Control IC Voltage Test	 MCU IC U303 Rated 2.4 V~ 3.6 V AUX IC U501 Rated 8.2V~30V CHARGE IC U101 Rated -0.3V~20V Gate Driver IC U200 Rated	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℃	 U303 (1)3.33 V (2) 3.33V (3) 3.31V (4) 3.31V (5) 3.31V U501 (1) 11.55V (2) 11.55V

		-0.3V~20V		(3) 11.56V (4) 11.56V (5) 11.55V U101 (1) 12.9V (2) 12.9V (3) 12.9V (4) 12.9V (5) 12.9V U200 (1) 5.05V (2) 5.05V (3) 5.05V (4) 5.05V (5) 5.05V

SAFETY &EMC TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	BAT I/P-ACO/P: 3 KVAC/min AC O/P-FG: 1.5 KVAC/min	BATI/P-ACO/P 3.6 KVAC/min AC O/P-FG:1.8 KVAC/min Ta:25℃	BAT I/P-ACO/P: 1.674 mA AC O/P-FG: 2.139 mA NO DAMAGE
2	GROUNDING CONTINUITY	IEC62368 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta:25℃	3mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	▓ FCC CLASS A	I/P:12 VDC O/P: :FULL/50% LOAD Ta:25℃	CLASS A
2	E.S.D	EN61000-4-2 AIR：8KV / Contact：4KV	I/P: 12VDC O/P:FULL LOAD Ta:25℃	■CRITERIA A □ CRITERIA B
3	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：NTS-450-124 1. ROOM AMBIENT BURN-IN：2 HRS I/P： 25VDC O/P： FULL LOAD Ta= 25.0 ℃ 2. HIGH AMBIENT BURN-IN： 2 HRS I/P： 25VDC O/P： FULL LOAD Ta= 40.0 ℃		
2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P： 25VDC O/P： 100%LOAD Ta= -25 ℃	TEST：OK
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 40 ℃ NO DAMAGE	I/P：32.5VDC O/P：FULL LOAD Ta= 40 ℃ HUMIDITY= 95 %R.H	TEST：OK

NO	Position	ROOM AMBIENT Ta=25.0 ℃	HIGH AMBIENT Ta= 40.0 ℃
1	C100	51.3℃	60.9℃
2	C101	53.1℃	62.3℃
3	Q103	53.9℃	64.5℃
4	T101	67.8℃	76.0℃
5	L100	61.1℃	67.6℃
6	C112	53.2℃	60.3℃
7	D107	62.4℃	72.1℃
8	C119	52.3℃	59.6℃
9	D105	62.9℃	72.5℃
10	C118	51.8℃	57.8℃
11	Q200	75.7℃	86.0℃
12	U501	66.9℃	73.0℃
13	L201	47.5℃	56.0℃
14	C219	53.3℃	57.8℃
15	L200	84.7℃	86.4℃
16	Q203	69.4℃	78.7℃
17	TSW1	70.2℃	75.6℃
18	ZR200	40.4℃	50.4℃
19	C114	44.5℃	53.7℃
20	T100	46.0℃	55.8℃
21	T501	57.8℃	65.4℃
22	U101	48.1℃	57.2℃
23	Q501	60.0℃	67.1℃
24	Q105	46.4℃	55.8℃
25	RT300	53.1℃	62.5℃
26	Q504	60.0℃	68.7℃
27	U303	55.0℃	64.6℃
28	U100	56.9℃	67.0℃
29	U500	56.1℃	66.0℃
30	U201	56.5℃	65.6℃

5	STORAGE TEMPERATURE TEST	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：5 CYCLE 5. Input/Output condition： STATIC	TEST：OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature： -25℃~ +45℃ 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： 24VDC/Full Load	TEST：OK
8	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℃	TEST：OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C101 IS THE MOST CRITICAL COMPONENT (1) I/P： 25VDC O/P：FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P： 25VDC O/P：FULL LOAD Ta= 40 ℃ LIFE TIME	(1) 526723.6HRS (2) 378378.2HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 843.9K hrs min. Telcordia SR-332 (Bellcore) ; 85.0K hrs min. MIL-HDBK-217F (25℃)	
11	Ongoing Reliability Test	I/P：25VDC O/P：80% LOAD TA=50℃ Demonstration Mean Time Between Failure：30,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ

2018.4.30 GP-A50-F010