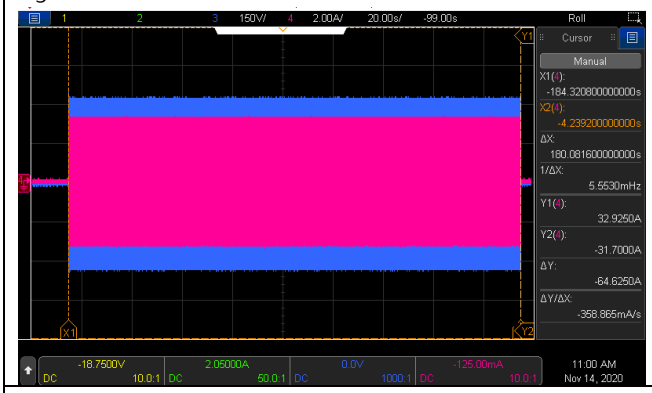
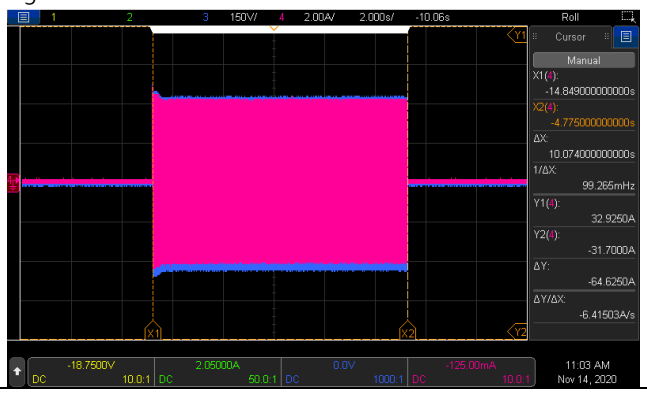
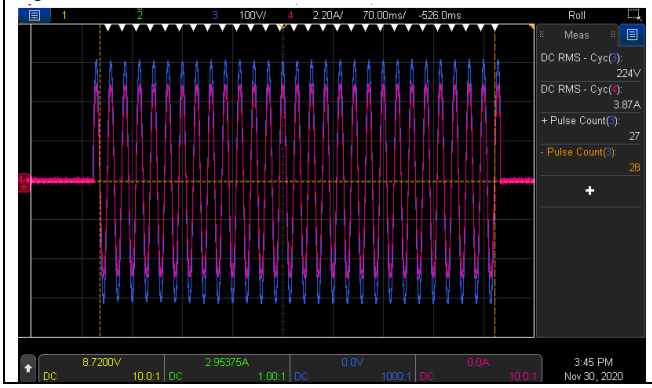
Test Report: NTS-450-224

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: 24VDC Ta:25℃	460 W
2	MAXIMUM OUTPUT POWER (TYP)	(1)517.5W/180sec. (2)675w/10sec (3)SURGE POWER 900W FOR 30CYCLE Vin (30±5 CYCLE)	IP: 25VDC OP:TESTING LOAD Ta:25℃	(1) 228.3V/ 2.19 A/180.08 Sec (2) 228.85V/ 2.86 A/ 10.07 Sec (3) 232.1 V/ 3.943A/ 28 Cycle
	CH3:O/P VAC CH4:O/P IAC			
	Fig1 			
	Fig2 			
	Fig3 			
	Fig4			
3	AC Voltage	200 / 220 / 230 / 240Vac selectable by DIP S.W	IP: 24VDC OP: FULL LOAD Ta:25℃	DIP S.W 200VAC: 198.3 V DIP S.W 220VAC: 218.3 V DIP S.W 230VAC: 228.6 V DIP S.W 240VAC: 238.8 V
4	FREQUENCY	50/60Hz (±0.1HZ) selectable by DIP S.W	IP: 24VDC OP: FULL LOAD Ta:25℃	DIP S.W 50HZ: 50.041 HZ DIP S.W 60HZ: 59.958 HZ
5	WAVEFORM	True sine wave (THD<3%)	IP: 25VDC OP: FULL LOAD (1) Vo(min) (2) Vo(nor) (3) Vo(max) Ta:25℃	(1) 0.66 % / Vo(min) /FULL LOAD (2) 0.68 % / Vo(nor) /FULL LOAD (3) 0.67 % / Vo(max) /FULL LOAD

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

Fig1

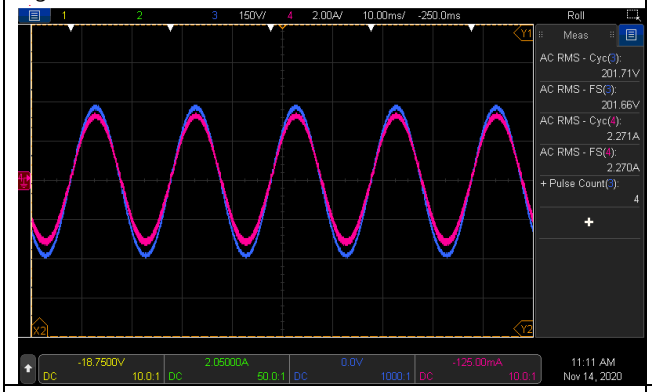


Fig2

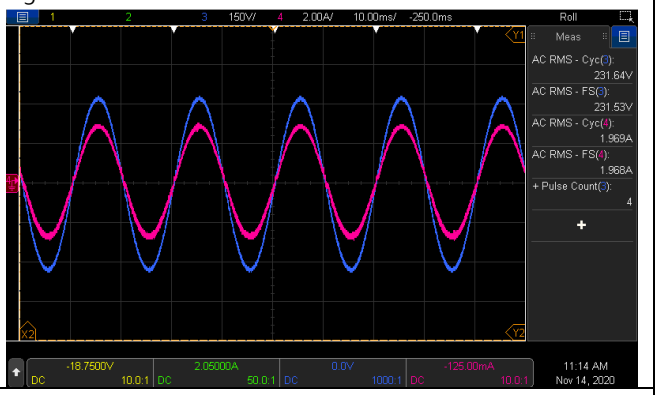
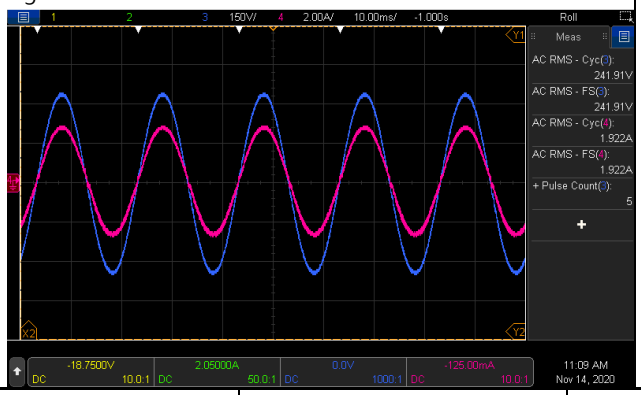


Fig3



6	AC REGULATION	±3%	IP: 25VDC OP: FULL LOAD/NO LOAD Ta:25℃	-0.61 %
7	Overshoot /Undershoot	<±10%	IP: 24VDC OP: (1) full load turn on (2) no load turn on (3) full /no load change Ta:25℃	(1) -7.9% (2) -6.5 (3) -2.7%
8	O/P voltage DC offset	Vin(nor)= 24 v · Vo <200mv · load : 92mV / full load: 77mV		

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	25VDC~31VDC±0.5v	25.11vdc ~31.02 vdc
Orange	22~ 25Vdc ±0.5v	22.313Vdc ~25.031 Vdc
Red	<22 Vdc ±0.5v > 31Vdc±0.5v	< 22.17 vdc > 31.22 Vdc

● Load test

LED	LOAD RANGE	RESULT
Green	Min. load ~ 40%±5% LOAD	Min. load ~ 39.1%
Orange	40%±5% ~ 80%±5% LOAD	40.7% ~ 78.4 %
Red	≧ 80%±5% LOAD	≧ 79.6 %

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℃	20.2 VDC~ 33.2 VDC/NO LOAD 20.2 VDC~ 33.2 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: 24V O/P:FULL LOAD ON:30ec OFF:30ec 12Hr (POWER ON/OFF NO DAMAGE)	Test: OK

2	DC CURRENT (TYP)	25A	IP: 24VDC OP:FULL LOAD Ta:25℃	19.92 A
3	NO LOAD DISSPATION (Typ.)	NON-Saving Mode=10W	IP: 24VDC OP:NO LOAD Ta:25℃	8.32 W
		SAVING MODE (1) Po： Default disable, auto detect AC output load ≦ 10W will be changed to saving mode (2) Pi ： ≦1.3 W	IP: 24VDC OP: TESTING LOAD Ta:25℃	NORMAL TO SAVING MODE: ≦ 13.2 W
			IP: 24VDC OP: TESTING LOAD Ta:25℃	0.828 W
4	OFF MODE CURRENT DRAW (Typ.)	≦ 1mA	IP: 24VDC OP: Sw off Ta:25℃	0.82 mA
5	EFFICIENCY(TYP)	450W/93%	IP: 25VDC OP: Po=450W 230V/50HZ (factory setting) Ta:25℃	93.8 %

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℃	22.1 V
2	BAT LOW SHUT DOWN	20V±0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	20.2 V
3	BAT LOW RESTART	25V±0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	25.2 V
4	BAT HIGH ALARM	31V±0.5VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25℃	31.2 V
5	BAT HIGH SHUT DOWN	33V±0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	33.2 V
6	BAT HIGH RESTART	30V±0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	30.1 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: 24VDC 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: 24VDC OP: TESTING SW:ON Ta:25℃	(1). 106 % ~111 % 180.08 sec (2). 115.8 % ~148.8 % 10.07 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: 24VDC 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: 310 W · turn on OK LAMP: 460 W · turn on OK LAMP: 604 W · turn on OK	1. Vin=HIGH LINE 2. O/P=230V/50Hz TEST: OK	
2	INDUCTION MOTOR	0.15 HP	1. Vin=HIGH LINE 2. O/P=230V/50Hz TEST: OK	
3	SWITCHING POWER SUPPLY	WITH PFC: EPP-500-48 · O/P= 455 W	1. Vin=HIGH LINE 2. O/P=230V/50Hz TEST: OK	
		NO PFC: LRS-350-36 · NNO/P= 355 W	1. Vin=HIGH LINE 2. O/P=230V/50Hz 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 : 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℃	(1) 74.8V (2) 74.0V (3) 76.5V (4) 76.5V (5) 81.3V

2	DC TO DC Diode Peak Voltage	D 105 Rated : 600V/10 A	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℃	(1)519V (2)564V (3)522V (4)528V (5)528V
3	DC BUS Capacitor Voltage	C118 Rated :330u/ 265 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℃	C118 (1) 250V (2) 254V (3) 248V (4) 250V (5)250V C119 (1) 250V (2) 254V (3) 254V (4) 250V (5) 250V
4	DC TO AC Power Transistor (D to S) or (C to E) Peak Voltage	Q 200 Rated : 650V / 15 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) 540V (2) 637V (3) 568V (4) 528V (5) 528V
5	AUX PWM MOS	Q504 Rated : 18 A/ 200 V Q105 Rated : 40 A/ 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) 66.3V (2) 66.3V (3) 66.3V (4) 65.5V (5) 65.5V Q105 (1)72.7 V (2) 70.3V (3) 72.7V (4) 71.9V (5) 71.9V
6	Control IC Voltage Test	MCU IC U303 Rated 2.4 V~ 3.6 V AUX IC U501 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	U303 (1) 3.42V (2) 3.46V (3) 3.46V (4) 3.33V

		8.2V~30V CHARGE IC U101 Rated -0.3V~20V Gate Driver IC U200 Rated -0.3V~20V	(4) NO LOAD Turn On (5) Saving mode Ta:25℃	(5) 3.33V U501 (1) 11.6V (2) 11.6V (3) 11.6V (4) 11.6V (5) 11.6V U101 (1) 12.45V (2) 12.45V (3) 12.45V (4) 12.45V (5) 12.45V U200 (1) 5.10V (2) 5.10V (3) 5.14V (4) 5.10V (5) 5.10V

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: 1.926 mA AC O/P-FG: 2.246 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	EN55032 CLASS A	I/P:24 VDC O/P: :FULL/50% LOAD Ta:25℃	CLASS A
2	E.S.D	EN61000-4-2 AIR：8KV / Contact：4KV	I/P: 24VDC 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-450-224 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 25VDC O/P : FULL LOAD Ta= 25 ℃ 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 25VDC O/P : FULL LOAD Ta= 40 ℃		
2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 25VDC O/P : 100%LOAD Ta= -25 ℃	TEST : OK

NO	Position	ROOM AMBIENT Ta=25 ℃	HIGH AMBIENT Ta= 40 ℃
1	C100	57.7℃	67.1℃
2	C101	57.5℃	67.1℃
3	Q103	49.4℃	61.4℃
4	Q104	49.6℃	61.4℃
5	RT300	48.9℃	60.3℃
6	T101	79.3℃	87.5℃
7	C112	50.4℃	61.1℃
8	L100	47.9℃	57.8℃
9	D107	50.4℃	61.9℃
10	D105	52.5℃	63.8℃
11	C119	54.3℃	63.2℃
12	C118	52.8℃	62.4℃
13	Q200	57.9℃	69.0℃
14	L201	47.3℃	58.1℃
15	C219	54.0℃	64.3℃
16	Q203	57.2℃	68.8℃
17	L200	72.5℃	80.5℃
18	RT100	51.3℃	60.3℃
19	ZR200	35.4℃	47.7℃
20	C115	41.1℃	52.2℃
21	T100	42.8℃	53.4℃
22	T501	54.8℃	63.0℃
23	T501	47.1℃	56.7℃
24	Q504	58.4℃	67.4℃
25	Q105	45.7℃	55.7℃
26	U501	66.4℃	75.3℃
27	Q501	62.2℃	71.6℃
28	U101	47.1℃	55.9℃
29	U201	57.0℃	66.0℃
30	U500	54.9℃	64.7℃
31	U100	53.1℃	64.0℃

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
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) 388630.8HRS (2) 199778.4HRS
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