



Test Report: NTS-400P-212

400W 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

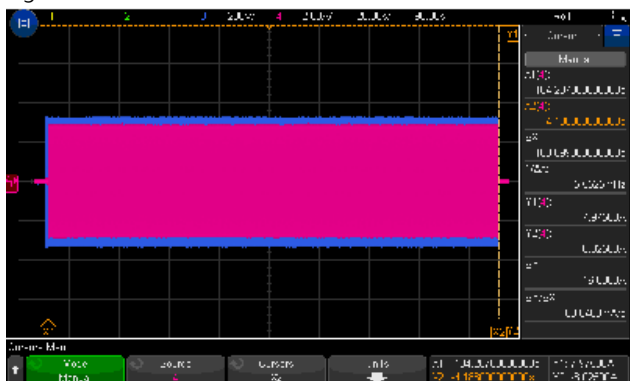
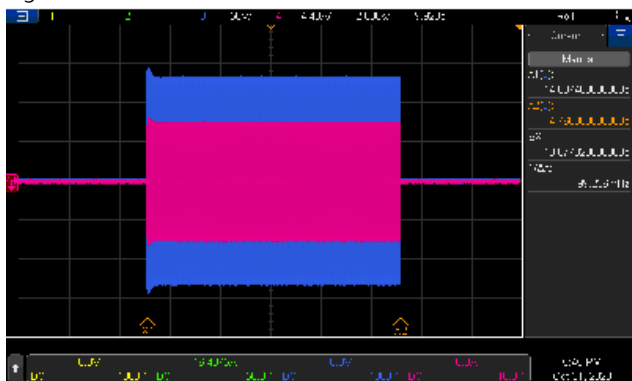
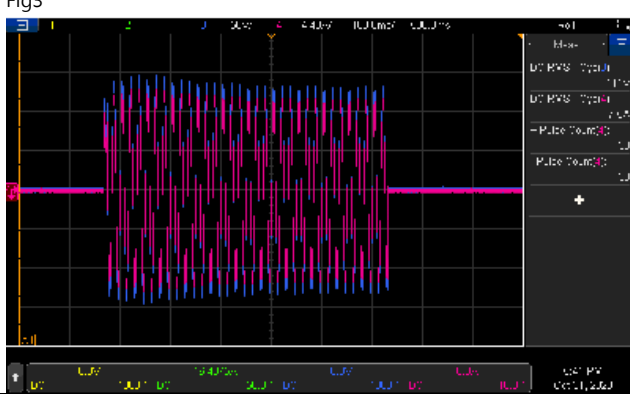
- E.M.C. Test

- **RELIABILITY TEST**

- ENVIRONMENT TEST

DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RATED POWER	400W	IP: 12VDC Ta:25°C	<u>408</u> W —
2	MAXIMUM OUTPUT POWER (TYP)	(1)460W/180sec. (2)600w/10sec (3)SURGE POWER 800W FOR 30CYCLE Vin (30±5 CYCLE)	IP: 12.5VDC OP: TESTING LOAD Ta:25°C	(1) 230.8 V/ 1.94 A/ 180.099 Sec (2) 230.8 V/ 2.62 A/ 10.078 Sec (3) 230.8 V/ 3.482 A/ 33 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: 12VDC OP: FULL LOAD Ta:25°C	DIP S.W 200VAC: <u>200.4</u> V DIP S.W 220VAC: <u>220.7</u> V DIP S.W 230VAC: <u>230.8</u> V DIP S.W 240VAC: <u>241.7</u> V
4	FREQUENCY	50/60Hz (±0.1HZ) selectable by DIP S.W	IP: 12VDC OP: FULL LOAD Ta:25°C	DIP S.W 50HZ: <u>50.042</u> HZ DIP S.W 60HZ: <u>59.959</u> 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°C	(1) 1.16% / Vo(min) /FULL LOAD (2) 1.44% / Vo(nor) /FULL LOAD (3) 1.66% / Vo(max) /FULL LOAD

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

Fig1

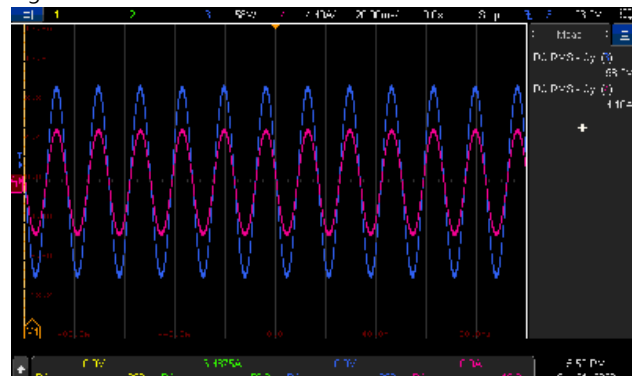


Fig2

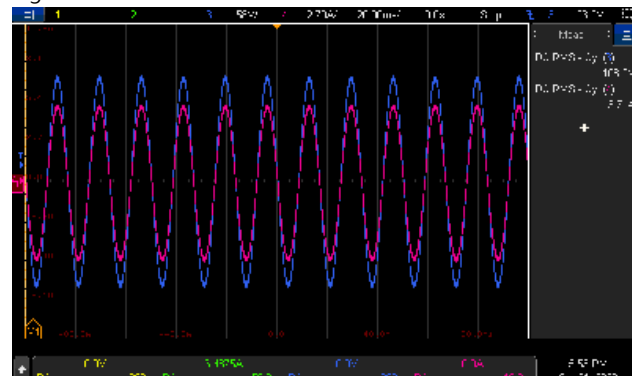
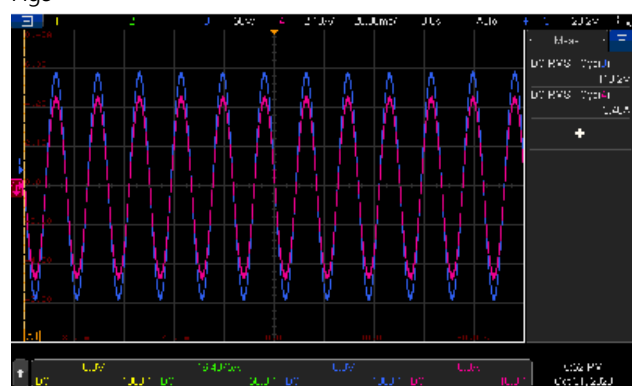


Fig3



6	AC REGULATION	$\pm 3\%$	IP: 12.5VDC OP: FULL LOAD/NO LOAD Ta:25°C	<u>0.22</u> %
7	Overshoot /Undershoot	$< \pm 10\%$	IP: 12VDC OP: (1) full load turn on (2) no load turn on (3) full /no load change Ta:25°C	(1) <u>1.74</u> % (2) <u>0.87</u> % (3) <u>1.35</u> %
8	O/P voltage DC offset	Vin(nor)= <u>12</u> v · Vo<200mv · no load : <u>76.5mv</u> / full load: <u>83.2</u> mv		

10	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>12.5~15.5Vdc±0.3v</td><td>12.52vdc ~15.58V</td></tr> <tr> <td>Orange </td><td>11~12.5Vdc ±0.3v</td><td>10.95~12.51 V</td></tr> <tr> <td>Red </td><td><11Vdc or > 15.5Vdc ±0.3v</td><td>< 10.94 V Vdc>15.59V</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 ~ 42.4%</td></tr> <tr> <td>Orange </td><td>40%±5% ~ 80%±5% LOAD</td><td>42.5%~ 82%</td></tr> <tr> <td>Red </td><td>≥ 80%±5% LOAD</td><td>≥ 82.725%</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 	12.5~15.5Vdc±0.3v	12.52vdc ~15.58V	Orange 	11~12.5Vdc ±0.3v	10.95~12.51 V	Red 	<11Vdc or > 15.5Vdc ±0.3v	< 10.94 V Vdc>15.59V	LED	LOAD RANGE	RESULT	Green 	Min. load ~ 40%±5% LOAD	Min. load ~ 42.4%	Orange 	40%±5% ~ 80%±5% LOAD	42.5%~ 82%	Red 	≥ 80%±5% LOAD	≥ 82.725%
LED	Status	RESULT																																				
Green	 Inverter OK	OK																																				
Orange	 Remote off  Saving mode	OK																																				
Red	 Abnormal Status (See SPEC)	OK																																				
LED	Battery RANGE	RESULT																																				
Green 	12.5~15.5Vdc±0.3v	12.52vdc ~15.58V																																				
Orange 	11~12.5Vdc ±0.3v	10.95~12.51 V																																				
Red 	<11Vdc or > 15.5Vdc ±0.3v	< 10.94 V Vdc>15.59V																																				
LED	LOAD RANGE	RESULT																																				
Green 	Min. load ~ 40%±5% LOAD	Min. load ~ 42.4%																																				
Orange 	40%±5% ~ 80%±5% LOAD	42.5%~ 82%																																				
Red 	≥ 80%±5% LOAD	≥ 82.725%																																				

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE RANGE (TYP)	10VDC~16.2VDC	IP: TESTING OP:NO LOAD/FULL LOAD Ta:25°C 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)	<u>10.06</u> VDC~ <u>16.49</u> VDC/NO LOAD <u>10.11</u> VDC~ <u>16.45</u> VDC/FULL LOAD Test: <u>OK</u> -

2	DC CURRENT (TYP)	40A	IP: 12VDC OP:FULL LOAD Ta:25°C	<u>36.6</u> A
3	NO LOAD DISSIPATION (Typ.)	$\leq 1.2W$ @ saving mode $\leq 10W$ @NON-Saving Mode	IP: 12VDC OP:NO LOAD Ta:25°C	<u>0.848</u> W <u>6.3</u> W
4	SAVING MODE TO NORMAL	$P_o \geq 25W$	IP: 12VDC OP: TESTING LOAD Ta:25°C	<u>≥ 21.13</u> W
5	NORMAL TO SAVING MODE	$P_o \leq 10W$	IP: 12VDC OP: TESTING LOAD Ta:25°C	<u>≤ 16.65</u> W
6	OFF MODE CURRENT DRAW (Typ.)	$\leq 1mA$	IP: 12VDC OP: Sw off Ta:25°C	0mA
7	EFFICIENCY(TYP)	400W/91%	IP: 12.5VDC OP: $P_o=400W$ 110V/60HZ (factory setting) Ta:25°C	91.7%

PROTECTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BAT LOW ALARM	11V $\pm$ 0.3VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25°C	<u>11.03</u> V
2	BAT LOW SHUT DOWN	10V $\pm$ 0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>10.11</u> V
3	BAT LOW RESTART	12.5V $\pm$ 0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>12.52</u> V
4	BAT HIGH ALARM	15.5V $\pm$ 0.3VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25°C	<u>15.52</u> V
5	BAT HIGH SHUT DOWN	16.5V $\pm$ 0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>16.50</u> V
6	BAT HIGH RESTART	15V $\pm$ 0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>15.02</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: 10.3VDC/16.2V 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: 12VDC OP: TESTING SW:ON Ta:25°C	(1). <u>107.5%~116.75%</u> <u>180.24</u> sec (2). <u>117%~150.5%</u> <u>10.59</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	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°C	Open : Normal work Short : Remote off TEST: <u>OK</u>

APPLICATION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	LAMP	LAMP: <u>308</u> W · turn on <u>OK</u> LAMP: <u>399.64</u> W · turn on <u>OK</u> LAMP: <u>239.22</u> W · turn on <u>OK</u>	1. Vin=HIGH LINE 2. O/P= 230V/50Hz TEST: <u>OK</u>	
2	INDUCTION MOTOR	<u>0.15</u> HP	1. Vin=HIGH LINE 2. O/P= 230V/50Hz TEST: <u>OK</u>	
3	SWITCHING POWER SUPPLY	WITH PFC: <u>EPP-500-48</u> · O/P= <u>400.85</u>	1. Vin=HIGH LINE 2. O/P= 230V/50Hz TEST: <u>OK</u>	
		NO PFC: <u>LRS-350-36</u> · O/P= <u>364.04</u> W	1. Vin=HIGH LINE 2. O/P= 230V/50Hz 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	Q102 Rated : 60V /60A	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	(1)37.5V (2) 35.5V (3)37.9 V (4) 36.3V (5) 37.5V

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 (3)O.L.P(200%) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	(1)507V (2)507V (3)507V (4)507V (5)503V
3	DC BUS Capacitor Voltage	C118 Rated : 220u/ 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°C	C118 (1) 256V (2) 256V (3) 251V (4) 247V (5) 247V
4	DC TO AC Power Transistor (D to S) or (C to E) Peak Voltage	Q 200 Rated : 600V / 20A	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	(1)491V (2) 523V (3) 515V (4) 499V (5) 495V
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 (3)O.L.P(200%) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	Q504 (1) 38.1V (2) 38.1V (3) 38.1V (4) 38.1V (5) 38.1V Q105 (1) 65.0V (2) 65.0V (3) 65.0V (4) 65.0V (5) 65.0V
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°C	U303 (1)3.33 V (2) 3.33V (3) 3.33V (4) 3.33V (5) 3.33V U501 (1) 11.49V (2) 11.57V

		-0.3V~20V		(3) 11.57V (4) 11.49V (5) 11.57V U101 (1) 12.45V (2) 12.45V (3) 12.45V (4) 12.45V (5) 12.45V U200 (1) 5.06V (2) 5.14V (3) 5.06V (4) 5.06V (5) 5.06V
--	--	-----------	--	---

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	BAT I/P-ACO/P 3.6 KVAC/min AC O/P-FG:1.8 KVAC/min Ta:25°C	BAT I/P-ACO/P: 1.893mA AC O/P-FG: 6.02mA NO DAMAGE
2	GROUNDING CONTINUITY	IEC62368 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta:25°C	4mΩ

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°C	CLASSA
2	E.S.D	EN61000-4-2 AIR : 15KV / Contact : 8KV	I/P: 12VDC O/P:FULL LOAD Ta:25°C	☒ 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-400P-248			
		1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 50VDC O/P : FULL LOAD Ta= 31.1 °C			
		2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 50VDC O/P : FULL LOAD Ta= 41.1 °C			
		NO	Position	ROOM AMBIENT Ta=31.1 °C	HIGH AMBIENT Ta= 41.1 °C
		1	Q103	50.9°C	59.8°C
		2	Q101	48.1°C	56.9°C
		3	C100	41.4°C	49.6°C
		4	TB1	32.3°C	42.5°C
		5	C101	44.9°C	53.0°C
		6	T101	62.7°C	70.4°C
		7	RT300	45.6°C	54.1°C
		8	L100	34.2°C	43.3°C
		9	L201	54.5°C	60.7°C
		10	ZR200	47.7°C	54.5°C
		11	C219	45.4°C	51.6°C
		12	Q203	55.0°C	61.7°C
		13	L200	49.1°C	56.0°C
		14	C112	38.2°C	46.3°C
		15	D107	44.2°C	51.6°C
		16	D105	47.2°C	54.3°C
		17	C119	44.3°C	50.8°C
		18	Q200	54.3°C	61.2°C
		19	C118	43.9°C	50.4°C
		20	U201	50.8°C	56.5°C
		21	U500	60.1°C	66.3°C
		22	TSW1	50.2°C	56.9°C
		23	U303	51.1°C	59.2°C
		24	Q105	44.3°C	52.2°C
		25	U100	51.2°C	59.4°C
		26	T100	48.6°C	55.5°C
		27	U501	63.4°C	70.2°C
		28	Q501	56.6°C	63.8°C
29	Q504	57.2°C	64.0°C		
30	T501	50.6°C	57.3°C		
2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 50VDC 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 40 °C NO DAMAGE	I/P : 65VDC O/P : FULL LOAD Ta= 40 °C HUMIDITY= 95 %R.H	TEST : OK	

5	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
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -25°C~ +45°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 : 48VDC/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°C	TEST : OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C101 IS THE MOST CRITICAL COMPONENT (1) I/P : 50VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 50VDC O/P : FULL LOAD Ta= 40 °C LIFE TIME	(1) 1424805.8HRS (2) 574653.9HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 278.7K hrs min. Telcordia SR-332 (Bellcore) ; 84K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 50VDC 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