



# Test Report: NTS-400P-112

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400W High Reliable Built-in Type True Sine Wave DC-AC Power Inverter

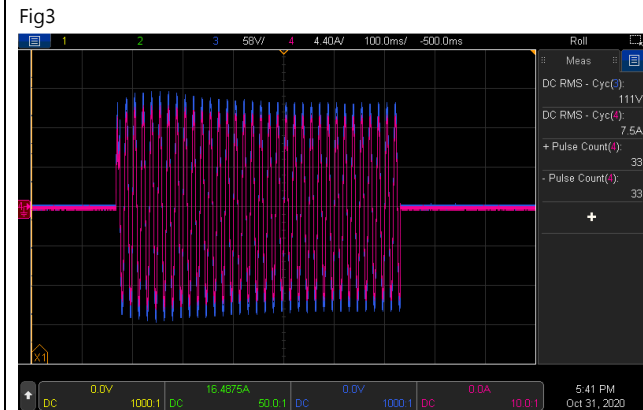
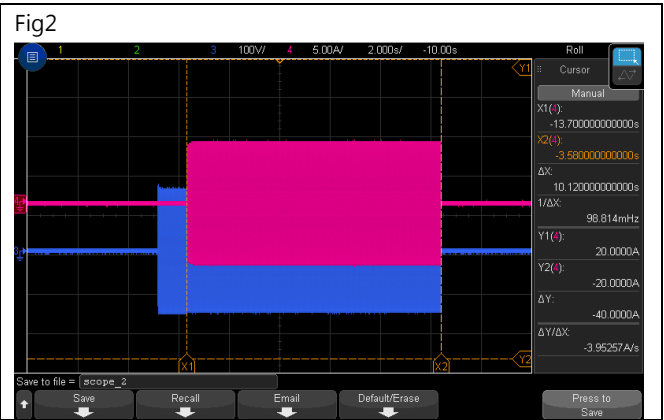
- **DESIGN VERIFY TEST**
  - Output Function Test
  - Input Function Test
  - Protection Function Test
  - Control Function Test
  - APPLICATION Test
  - Component Stress Test
- **SAFETY & E.M.C. TEST**
  - Safety Test
  - E.M.C. Test
- **RELIABILITY TEST**
  - ENVIRONMENT TEST

DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RATED POWER	400W	IP: 12VDC Ta:25°C	408 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) 109.5 V/ 4.23 A/ 180.6 Sec (2) 109.6 V/ 5.51 A/ 10.12 Sec (3) 109.9 V/ 7.5 A/ 33 Cycle

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



3	AC Voltage	100 / 110 / 115 / 120Vac selectable by DIP S.W	IP: 12VDC OP: FULL LOAD Ta:25°C	DIP S.W 100VAC: <u>99.6 V</u> DIP S.W 110VAC: <u>109.8 V</u> DIP S.W 115VAC: <u>114.2 V</u> DIP S.W 120VAC: <u>119.9 V</u>
4	FREQUENCY	50/60Hz (±0.1HZ) selectable by DIP S.W	IP: 12VDC OP: FULL LOAD Ta:25°C	DIP S.W 50HZ: <u>50.04 HZ</u> DIP S.W 60HZ: <u>59.958 HZ</u>

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) 1.29% / Vo(min) /FULL LOAD (2) 1.22% / Vo(nor) /FULL LOAD (3) 1.30% / Vo(max) /FULL LOAD
CH3:O/P VAC CH4:O/P IAC				
<p>Fig1</p>		<p>Fig2</p>		
<p>Fig3</p>				
6	AC REGULATION	±3%	IP: 12.5VDC OP: FULL LOAD/NO LOAD Ta:25°C	<u>1.09</u> %
7	Overshoot /Undershoot	<±10%	IP: 12VDC OP: (1) full load turn on (2) no load turn on (3) full /no load change Ta:25°C	(1) <u>4.91</u> % (2) <u>3.55</u> % (3) <u>1.18</u> %
8	O/P voltage DC offset	Vin(nor)= <u>12</u> v · Vo<200mv · no load : <u>78.6mv</u> / full load: <u>83.2mv</u>		

9	LED STATUS	<ul style="list-style-type: none"> <li> <b>Status test</b> <table border="1"> <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> </li> <li> <b>Battery test</b> <table border="1"> <thead> <tr> <th>LED</th> <th>Battery RANGE</th> <th>RESULT</th> </tr> </thead> <tbody> <tr> <td> Green</td> <td>12.5~15.5Vdc ±0.3v</td> <td>12.52~15.41 Vdc</td> </tr> <tr> <td> Orange</td> <td>11~12.5Vdc ±0.3v</td> <td>10.95~12.51 Vdc</td> </tr> <tr> <td> Red</td> <td>&lt;11Vdc or &gt;15.5Vdc ±0.3v</td> <td>&lt;10.94Vdc or &gt; 15.59Vdc</td> </tr> </tbody> </table> </li> <li> <b>Load test</b> <table border="1"> <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 ~ 43.5%</td> </tr> <tr> <td> Orange</td> <td>40%±5% ~ 80%±5% LOAD</td> <td>43.74%~ 82.5%</td> </tr> <tr> <td> Red</td> <td>≥ 80%±5% LOAD</td> <td>≥ 82.75 %</td> </tr> </tbody> </table> </li> </ul>			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	12.52~15.41 Vdc	Orange	11~12.5Vdc ±0.3v	10.95~12.51 Vdc	Red	<11Vdc or >15.5Vdc ±0.3v	<10.94Vdc or > 15.59Vdc	LED	LOAD RANGE	RESULT	Green	Min. load ~ 40%±5% LOAD	Min. load ~ 43.5%	Orange	40%±5% ~ 80%±5% LOAD	43.74%~ 82.5%	Red	≥ 80%±5% LOAD	≥ 82.75 %
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**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°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 VDC~ 16.51 VDC/NO LOAD</u> <u>10.13 VDC~ 16.38 VDC/FULL LOAD</u>  Test: <u>OK</u>

2	DC CURRENT (TYP)	40A	IP: 12VDC OP:FULL LOAD Ta:25°C	<u>38.59</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	$\geq 24.15$ W
5	NORMAL TO SAVING MODE	$P_o \leq 10W$	IP: 12VDC OP: TESTING LOAD Ta:25°C	$\leq 17.33$ W
6	OFF MODE CURRENT DRAW (Typ.)	$\leq 1mA$	IP: 12VDC OP: Sw off Ta:25°C	0mA
7	EFFICIENCY(TYP)	400W/89%	IP: 12.5VDC OP: $P_o=400W$ 110V/60HZ (factory setting) Ta:25°C	90.94%

**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>10.13</u> V
3	BAT LOW RESTART	12.5V $\pm$ 0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>12.45</u> V
4	BAT HIGH ALARM	15.5V $\pm$ 0.3VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25°C	<u>15.53</u> V
5	BAT HIGH SHUT DOWN	16.5V $\pm$ 0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>16.51</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>107.25%~115.75%</u> <u>180.6 sec</u> (2). <u>116%~149%</u> <u>10.12 sec</u> 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 W</u> · turn on <u>OK</u> LAMP: <u>399.64 W</u> · turn on <u>OK</u> LAMP: <u>239.22 W</u> · turn on <u>OK</u>	1. Vin=HIGH LINE 2. O/P=110V/60Hz TEST: <u>OK</u>	
2	INDUCTION MOTOR	<u>0.34 HP</u>	1. Vin=HIGH LINE 2. O/P=110V/60Hz TEST: <u>OK</u>	
3	SWITCHING POWER SUPPLY	WITH PFC: <u>EPP-500-48</u> · O/P= <u>399.83</u>	1. Vin=HIGH LINE 2. O/P=110V/60Hz TEST: <u>OK</u>	
		NO PFC: <u>LRS-350-36</u> · O/P= <u>380.22 W</u>	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	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) 37.1V (2) 37.9V (3)38.3 V (4) 37.9V (5) 37.9V

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(第 3 段) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	(1)297V (2)297V (3)298V (4)301V (5)293V
3	DC BUS Capacitor Voltage	C118 Rated : 180u/ 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	C118 (1) 289V (2) 285V (3) 293V (4) 293V (5) 289V
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)309V (2) 361V (3) 361V (4) 309V (5) 309V
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) 38.0V (2) 38.0V (3) 38.0V (4) 38.0V (5) 38.0V  Q105 (1) 65.3V (2) 65.3V (3) 65.3V (4) 65.3V (5) 65.3V
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	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)3.35 V (2) 3.35V (3) 3.35V (4) 3.35V (5) 3.35V  U501 (1) 11.69V

		Gate Driver IC U200 Rated -0.3V~20V		(2) 11.69V (3) 11.69V (4) 11.61V (5) 11.69V  U101 (1) 12.50V (2) 12.50V (3) 12.50V (4) 12.50V (5) 12.50V  U200 (1) 5.18V (2) 5.10V (3) 5.18V (4) 5.10V (5) 5.10V
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**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°C	BAT I/P-ACO/P: 1.86mA AC O/P-FG: 2.07mA 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	FCC CLASS A	I/P:24 VDC O/P: :FULL/50% LOAD Ta:25°C	CLASS A
2	E.S.D	EN61000-4-2 AIR : 15KV / Contact : 8KV	I/P: 12VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> 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-112 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 12.5VDC O/P : FULL LOAD Ta= 25.0 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 12.5VDC O/P : FULL LOAD Ta= 40.0 °C																																																																																																																														
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30	U500	57.0	61.2°C																																																																																																																													
2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 12.5VDC 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 : 16.1VDC 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 : 12VDC/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: 12.5VDC O/P: FULL LOAD Ta= 25 °C LIFE TIME (2) I/P: 12.5VDC O/P: FULL LOAD Ta= 40 °C LIFE TIME	(1) 240678.5HRS (2) 198220.6HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 836.2K hrs min. Telcordia SR-332 (Bellcore) ; 84.0K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 12.5VDC 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