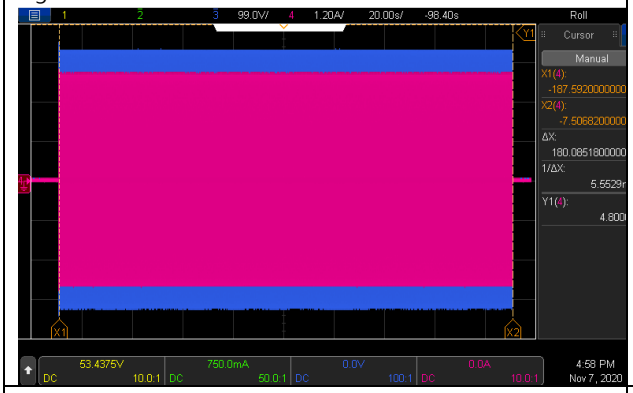
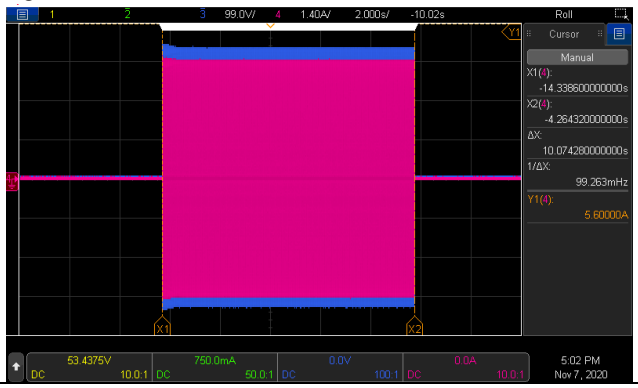
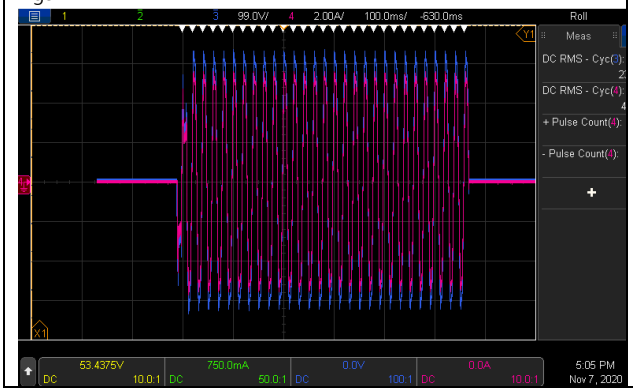
Test Report: NTS-450-212

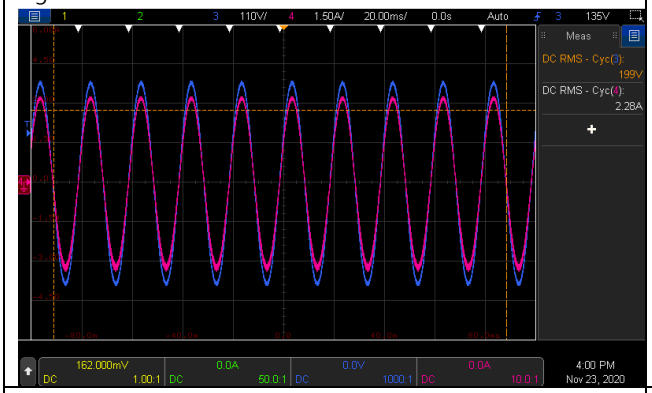
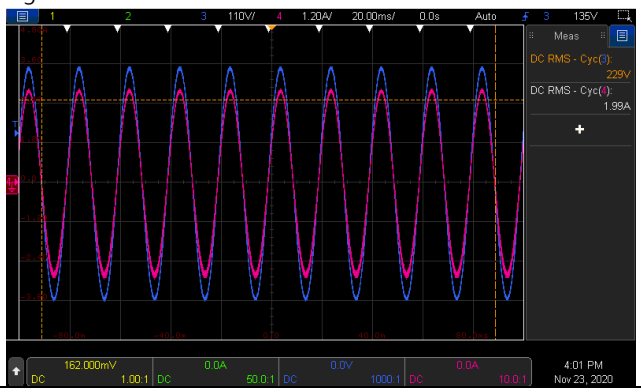
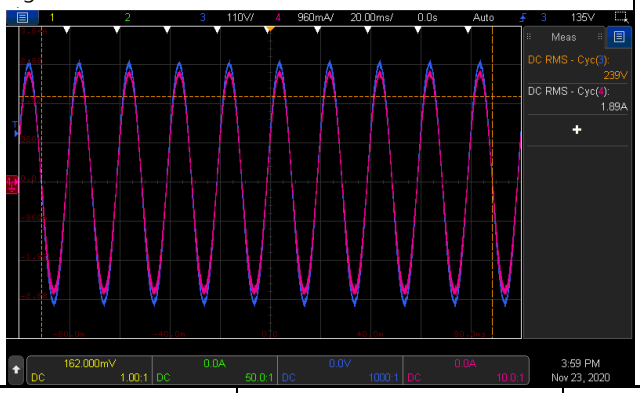
450W High Reliable Built-in Type True Sine Wave DC-AC Power Inverter

- **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℃	460 W
2	MAXIMUM OUTPUT POWER (TYP)	(1)517.5W/180sec. (2)675w/10sec (3)SURGE POWER 800W FOR 30CYCLE Vin (30±5 CYCLE)	IP: 12.5VDC OP:TESTING LOAD Ta:25℃	(1) 228.1 V/ 2.19 A/ 180.08 Sec (2) 227.5 V/ 2.96 A/ 10.07 Sec (3) 230.1 V/ 4.09 A/ 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: 12VDC OP: FULL LOAD Ta:25℃	DIP S.W 200VAC: 198.3 V DIP S.W 220VAC: 218.5 V DIP S.W 230VAC: 228.4 V DIP S.W 240VAC: 238.7 V
4	FREQUENCY	50/60Hz (±0.1HZ) selectable by DIP S.W	IP: 12VDC OP: FULL LOAD Ta:25℃	DIP S.W 50HZ: 50.04 HZ DIP S.W 60HZ: 59.95 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) 1.05 % / Vo(min) /FULL LOAD (2) 0.92 % / Vo(nor) /FULL LOAD (3) 0.87 % / 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℃	-0.66 %
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) -0.96 % (2) 1.57 % (3) 2.66 %
8	O/P voltage DC offset	Vin(nor)= 12 v · Vo <200mv · no load : 76.4mv / full load: 87.7 mv		

<table>
<tr><td>9</td><td>LED STATUS</td><td>

● 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	15.5V~12.50V ±0.3v	15.5V> Vdc>12.43V
Orange	11~12.5VDC ±0.3v	11 ~ 12.5 vdc
Red	Vdc< 11.0V · Vdc>15.5V ±0.3v	Vdc< 11.0V · Vdc> 15.4

● Load test

LED	LOAD RANGE	RESULT
Green	Min. load ~ 40%±5% LOAD	Min. load ~ 42.6%
Orange	40%±5% ~ 80%±5% LOAD	42.78 %~ 83.35%
Red	80%±5%~105%±5% LOAD	83.42%~108.39%

</td></tr>
</table>

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℃	10.1 VDC~ 16.5 VDC/NO LOAD 10.2 VDC~ 16.5 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℃	41.3 A
3	NO LOAD DISSPATION (Typ.)	≦ 1.2W @ Saving Mode ≤10W@NON-Saving Mode	IP: 12VDC OP:NO LOAD Ta:25℃	0.84 W 8.78 W
4	SAVING MODE TO NORMAL	Po≥25W	IP: 12VDC OP: TESTING LOAD Ta:25℃	≥ 21 W
5	NORMAL TO SAVING MODE	Po≦ 10W	IP: 12VDC OP: TESTING LOAD Ta:25℃	≤12 W
6	OFF MODE CURRENT DRAW (Typ.)	≦ 1mA	IP: 12VDC OP: Sw off Ta:25℃	0.46mA
7	EFFICIENCY(TYP)	450W/90%	IP: 12.5VDC OP: Po=450W 230V/50HZ (factory setting) Ta:25℃	90.8 %

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℃	10.1 V
3	BAT LOW RESTART	12.5V±0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	12.5 V
4	BAT HIGH ALARM	15.5V±0.3VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25℃	15.6 V
5	BAT HIGH SHUT DOWN	16.5V±0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	16.5 V
6	BAT HIGH RESTART	15V±0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	15.0 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: 12VDC 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). 105%~111 % 180.08 sec (2). 117%~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: 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: 209 W · turn on OK LAMP: 423.58 W · turn on OK LAMP: 526.93 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= 451.8W	1. Vin=HIGH LINE 2. O/P=230V/50Hz TEST: OK	
		NO PFC: LRS-350-36 · O/P= 323 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 : 60V /60 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) 35.8V (2) 35.0V (3) 36.2V (4) 35.4V (5) 35.4V

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) D 105 Output Short (3)O.L.P(200%) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25℃	 (1)507V (2)551V (3)507V (4)519V (5)511V
3	DC BUS Capacitor Voltage	C118/ C119 Rated : 390u/ 265V	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) 250V (3) 250V (4) 254V (5)250 V C119 (1) 250V (2) 250V (3) 250V (4) 250V (5) 245V
4	DC TO AC Power Transistor (D to S) or (C to E) Peak Voltage	Q 200 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) 535V (2) 611V (3) 563V (4) 523V (5) 531V
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℃	Q504 (1) 49.9V (2) 49.9V (3) 49.9V (4) 49.9V (5) 42.8V Q105 (1) 38.0V (2) 38.3V (3) 39.3V (4) 39.3V (5) 44.8V
6	Control IC Voltage Test	 MCU IC U303 Rated 2.4 V~ 3.6 V AUX IC U501 Rated 8.2V~30V	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	U303 (1) 3.38V (2) 3.38V (3) 3.4V (4) 3.38V (5) 3.49V

		CHARGE IC U101 Rated -0.3V~20V Gate Driver IC U200 Rated -0.3V~20V	(5) Saving mode Ta:25℃	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) 5.14V (2) 5.10V (3) 5.14V (4) 5.14V (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: 2.116 mA AC O/P-FG: 1.516 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: 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

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL：NTS-450-212
1. ROOM AMBIENT BURN-IN：2 HRS
I/P： 12.5VDC O/P： FULL LOAD Ta= 25 ℃
2. HIGH AMBIENT BURN-IN： 2 HRS
I/P： 12.5VDC O/P： FULL LOAD Ta= 40 ℃

<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=25 ℃</th><th>HIGH AMBIENT Ta= 40 ℃</th></tr>
<tr><td>1</td><td>C100</td><td>91.6℃</td><td>92.7℃</td></tr>
<tr><td>2</td><td>C101</td><td>91.1℃</td><td>91.5℃</td></tr>
<tr><td>3</td><td>Q104</td><td>69.0℃</td><td>74.8℃</td></tr>
<tr><td>4</td><td>Q103</td><td>70.5℃</td><td>76.3℃</td></tr>
<tr><td>5</td><td>RT300</td><td>63.3℃</td><td>67.6℃</td></tr>
<tr><td>6</td><td>T101</td><td>100.4℃</td><td>96.6℃</td></tr>
<tr><td>7</td><td>C112</td><td>56.4℃</td><td>58.7℃</td></tr>
<tr><td>8</td><td>D106</td><td>56.3℃</td><td>62.2℃</td></tr>
<tr><td>9</td><td>C119</td><td>54.5℃</td><td>58.2℃</td></tr>
<tr><td>10</td><td>D108</td><td>55.8℃</td><td>62.1℃</td></tr>
<tr><td>11</td><td>C118</td><td>51.4℃</td><td>55.6℃</td></tr>
<tr><td>12</td><td>Q200</td><td>62.9℃</td><td>69.5℃</td></tr>
<tr><td>13</td><td>U501</td><td>77.3℃</td><td>76.5℃</td></tr>
<tr><td>14</td><td>L201</td><td>40.4℃</td><td>48.2℃</td></tr>
<tr><td>15</td><td>C219</td><td>50.6℃</td><td>54.7℃</td></tr>
<tr><td>16</td><td>Q202</td><td>61.2℃</td><td>68.1℃</td></tr>
<tr><td>17</td><td>L200</td><td>69.7℃</td><td>70.5℃</td></tr>
<tr><td>18</td><td>TSW1</td><td>62.5℃</td><td>64.3℃</td></tr>
<tr><td>19</td><td>U101</td><td>55.2℃</td><td>57.7℃</td></tr>
<tr><td>20</td><td>ZR200</td><td>43.3℃</td><td>49.8℃</td></tr>
<tr><td>21</td><td>Q105</td><td>51.2℃</td><td>55.2℃</td></tr>
<tr><td>22</td><td>T501</td><td>64.1℃</td><td>65.3℃</td></tr>
<tr><td>23</td><td>T100</td><td>50.9℃</td><td>55.2℃</td></tr>
<tr><td>24</td><td>Q501</td><td>73.6℃</td><td>71.3℃</td></tr>
<tr><td>25</td><td>U303</td><td>59.1℃</td><td>64.2℃</td></tr>
<tr><td>26</td><td>Q504</td><td>70.3℃</td><td>69.7℃</td></tr>
<tr><td>27</td><td>U201</td><td>61.4℃</td><td>65.2℃</td></tr>
<tr><td>28</td><td>U500</td><td>60.9℃</td><td>65.0℃</td></tr>
<tr><td>29</td><td>U100</td><td>69.0℃</td><td>72.2℃</td></tr>
</table></td></tr>
<tr><td>2</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER 2
HOUR</td><td>I/P： 12.5VDC
O/P： 100%LOAD
Ta= -25 ℃</td><td>TEST：OK</td></tr>
<tr><td>3</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 40 ℃
NO DAMAGE</td><td>I/P：16.1VDC
O/P：FULL LOAD
Ta= 40 ℃
HUMIDITY= 95 %R.H</td><td>TEST：OK</td></tr>
</table>

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： 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℃	TEST：OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C100 IS THE MOST CRITICAL COMPONENT (1) I/P： 12.5VDC O/P：FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P： 12.5VDC O/P：FULL LOAD Ta= 40 ℃ LIFE TIME	 (1) 40049.3HRS (2) 37109.2HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 281.3K hrs min. Telcordia SR-332 (Bellcore) ; 85K hrs min. MIL-HDBK-217F (25℃)	
11	Ongoing Reliability Test	I/P：12.5VDC 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