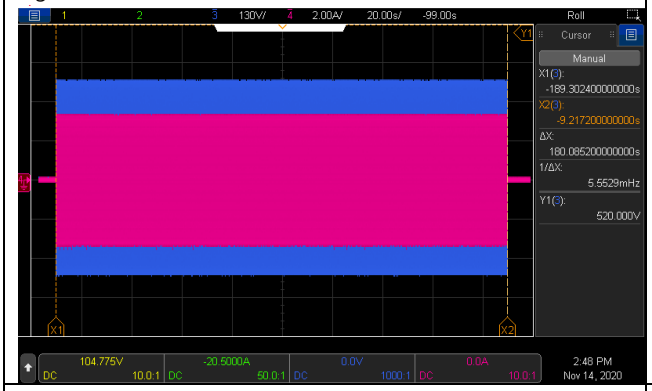
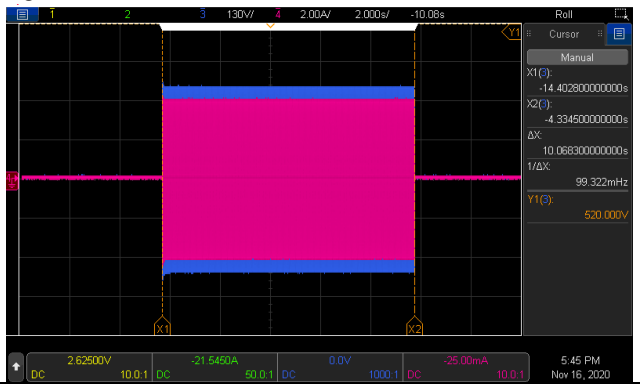
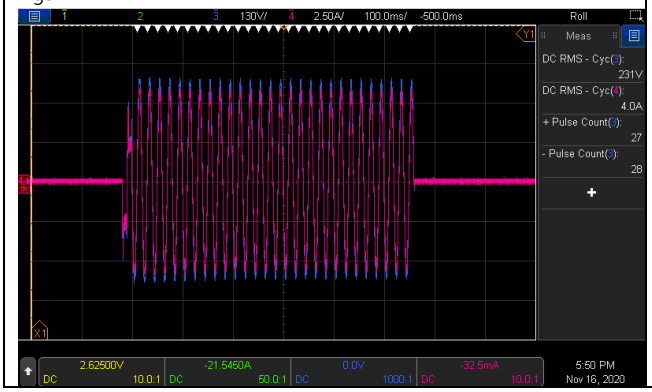
Test Report: NTS-450-248

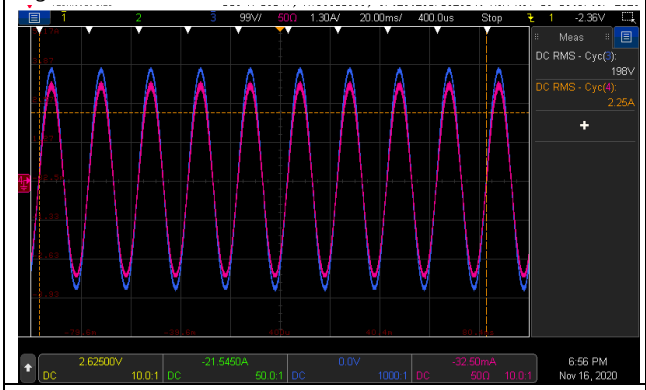
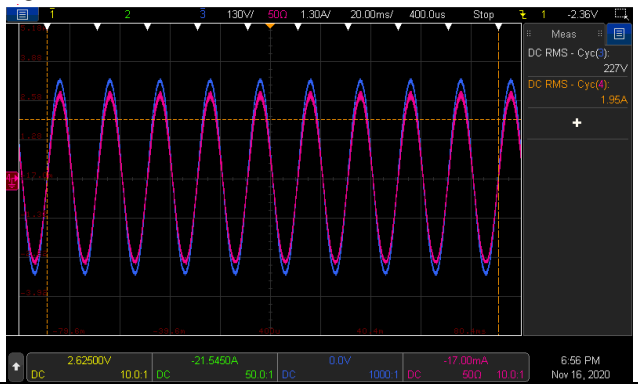
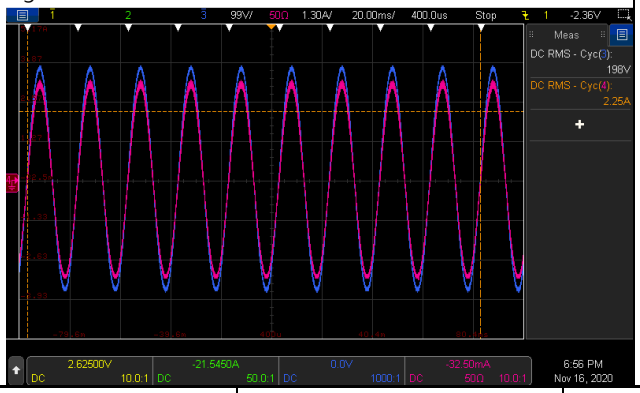
450W High Reliable Built-in Type True Sine Wave DC-AC Power Inverter

- **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: 48VDC Ta:25℃	460 W
2	MAXIMUM OUTPUT POWER (TYP)	(1) 517.5 W/180sec. (2)675W/10sec (3)SURGE POWER 800W FOR 30CYCLE Vin (30±5 CYCLE)	IP: 50VDC OP:TESTING LOAD Ta:25℃	(1) 227.9 V/ 2.21 A/ 180.08 Sec (2) 228.7 V/ 2.86 A/ 10.06 Sec (3) 229 .0V/ 3.99 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: 48VDC OP: FULL LOAD Ta:25℃	DIP S.W 200VAC: 197.9 V DIP S.W 220VAC: 217.9 V DIP S.W 230VAC: 227.8 V DIP S.W 240VAC: 238.1 V
4	FREQUENCY	50/60Hz (±0.1HZ) selectable by DIP S.W	IP: 48VDC 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: 50VDC OP: FULL LOAD (1) Vo(min) (2) Vo(nor) (3) Vo(max) Ta:25℃	(1) 0.75 % / Vo(min) /FULL LOAD (2) 0.77 % / Vo(nor) /FULL LOAD (3) 0.76 % / Vo(max) /FULL LOAD

	CH3:O/P VAC CH4:O/P IAC Fig1  Fig2  Fig3 			
6	AC REGULATION	±3%	IP: 50VDC OP: FULL LOAD/NO LOAD Ta:25℃	0.83 %
7	Overshoot /Undershoot	<±10%	IP: 48VDC OP: (1) full load turn on (2) no load turn on (3) full /no load change Ta:25℃	(1) -1.39 % (2) 1.17 % (3) 1.74 %
8	O/P voltage DC offset	Vin(nor)= 48 v · Vo <200mv · no load : 61mv / full load: 77mv		

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

● Statas test

<table>
<tr><th>LED</th><th>Statas</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>62.0V >Vdc> 50.0V±1v</td><td>61.99V>Vdc>49.03V</td></tr>
<tr><td>Orange</td><td>50>Vdc>44VDC ±1v</td><td>50.01V>Vdc>44.13V</td></tr>
<tr><td>Red</td><td>Vdc< 44.0V · Vdc> 62.0V±1v</td><td>Vdc< 44.12V · Vdc>62 V</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 ~ 41.44%</td></tr>
<tr><td>Orange</td><td>40%±5% ~ 80%±5% LOAD</td><td>41.53%~81.33 %</td></tr>
<tr><td>Red</td><td>80%±5%~ 105%±5%LOAD</td><td>81.44%~106.17%</td></tr>
</table>

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</table>

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE RANGE (TYP)	40VDC~66VDC	IP: TESTING OP:NO LOAD/FULL LOAD Ta:25℃	40.1 VDC~ 66.2 VDC/NO LOAD 40.1 VDC~ 66.2 VDC/FULL LOAD
			I/P: LOW-LINE=42V HIGH-LINE=65V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON:30Sec OFF:30Sec 10MIN (POWER ON/OFF NO DAMAGE) I/P: 48V O/P:FULL LOAD ON:30ec OFF:30ec 12Hr (POWER ON/OFF NO DAMAGE)	Test： OK

2	DC CURRENT (TYP)	14A	IP: 48VDC OP:FULL LOAD Ta:25℃	10 A
3	NO LOAD DISSPATION (Typ.)	≦ 1.5 @ Saving Mode ≤12@NON-Saving Mode	IP: 48VDC OP:NO LOAD Ta:25℃	0.964 W 9.28 W
4	SAVING MODE TO NORMAL	Po≥25W	IP: 48VDC OP: TESTING LOAD Ta:25℃	≥ 21 W
5	NORMAL TO SAVING MODE	Po≦ 10W	IP: 48VDC OP: TESTING LOAD Ta:25℃	≤ 12 W
6	OFF MODE CURRENT DRAW (Typ.)	≦ 1mA	IP: 48VDC OP: Sw off Ta:25℃	0.73mA
7	EFFICIENCY(TYP)	450W/ 93%	IP: 50VDC OP: Po=450W 230V/50HZ (factory setting) Ta:25℃	93.6 %

PROTECTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BAT LOW ALARM	44V±1VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25℃	44.1 V
2	BAT LOW SHUT DOWN	40V±1VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	40.1 V
3	BAT LOW RESTART	50V±1VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	50.3 V
4	BAT HIGH ALARM	62V±1VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25℃	62.2 V
5	BAT HIGH SHUT DOWN	66V±1VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	66.2 V
6	BAT HIGH RESTART	60V±1VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	60.2 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: 48VDC 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: 48VDC OP: TESTING SW:ON Ta:25℃	(1). 105%~111.5 % 180.08 sec (2). 117%~146.6 % 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: 48VDC 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: 318.1 W · turn on OK LAMP: 422.8 W · turn on OK LAMP: 465.9 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= 433W	1. Vin=HIGH LINE 2. O/P=230V/50Hz TEST: OK	
		NO PFC: LRS-350-36 · O/P= 350 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 : 200V / 40A	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)164V (2) 154V (3) 174V (4) 152V (5) 152V

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)532V (2)589V (3)540V (4)557V (5)553V
3	DC BUS Capacitor Voltage	C118/C119 Rated : 390 u/ 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) 245V (2) 245V (3) 245V (4) 245V (5) 249V C119 (1) 241V (2) 245V (3) 245V (4) 245V (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) 553V (2) 625V (3) 589V (4) 549V (5) 540V
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)118.2 V (2) 115.0V (3) 118.2V (4) 119.8V (5) 119.8V Q105 (1) 140V (2) 140V (3) 140V (4) 139V (5) 139V
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) 3.4V (2) 3.48V (3) 3.52V (4) 3.4V (5) 3.36V

		CHARGE IC U101 Rated -0.3V~20V Gate Driver IC U200 Rated -0.3V~20V	(5) Saving mode Ta:25℃	U501 (1) 11.7V (2) 11.7V (3)11.7 V (4) 11.7V (5) 11.7V U101 (1) 12.4V (2) 12.4V (3) 12.4V (4) 12.4V (5) 12.4V U200 (1) 5.08V (2) 5.12V (3) 5.12V (4) 5.04V (5) 5.14V

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: 2.041 mA AC O/P-FG: 1.173 mA NO DAMAGE
2	GROUNDING CONTINUITY	IEC62368 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta:25℃	2mΩ

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: 48VDC 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-450-224
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 ℃

<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>57.7℃</td><td>67.1℃</td></tr>
<tr><td>2</td><td>C101</td><td>57.5℃</td><td>67.1℃</td></tr>
<tr><td>3</td><td>Q103</td><td>49.4℃</td><td>61.4℃</td></tr>
<tr><td>4</td><td>Q104</td><td>49.6℃</td><td>61.4℃</td></tr>
<tr><td>5</td><td>RT300</td><td>48.9℃</td><td>60.3℃</td></tr>
<tr><td>6</td><td>T101</td><td>79.3℃</td><td>87.5℃</td></tr>
<tr><td>7</td><td>C112</td><td>50.4℃</td><td>61.1℃</td></tr>
<tr><td>8</td><td>L100</td><td>47.9℃</td><td>57.8℃</td></tr>
<tr><td>9</td><td>D107</td><td>50.4℃</td><td>61.9℃</td></tr>
<tr><td>10</td><td>D105</td><td>52.5℃</td><td>63.8℃</td></tr>
<tr><td>11</td><td>C119</td><td>54.3℃</td><td>63.2℃</td></tr>
<tr><td>12</td><td>C118</td><td>52.8℃</td><td>62.4℃</td></tr>
<tr><td>13</td><td>Q200</td><td>57.9℃</td><td>69.0℃</td></tr>
<tr><td>14</td><td>L201</td><td>47.3℃</td><td>58.1℃</td></tr>
<tr><td>15</td><td>C219</td><td>54.0℃</td><td>64.3℃</td></tr>
<tr><td>16</td><td>Q203</td><td>57.2℃</td><td>68.8℃</td></tr>
<tr><td>17</td><td>L200</td><td>72.5℃</td><td>80.5℃</td></tr>
<tr><td>18</td><td>RT100</td><td>51.3℃</td><td>60.3℃</td></tr>
<tr><td>19</td><td>ZR200</td><td>35.4℃</td><td>47.7℃</td></tr>
<tr><td>20</td><td>C115</td><td>41.1℃</td><td>52.2℃</td></tr>
<tr><td>21</td><td>T100</td><td>42.8℃</td><td>53.4℃</td></tr>
<tr><td>22</td><td>T501</td><td>54.8℃</td><td>63.0℃</td></tr>
<tr><td>23</td><td>T501</td><td>47.1℃</td><td>56.7℃</td></tr>
<tr><td>24</td><td>Q504</td><td>58.4℃</td><td>67.4℃</td></tr>
<tr><td>25</td><td>Q105</td><td>45.7℃</td><td>55.7℃</td></tr>
<tr><td>26</td><td>U501</td><td>66.4℃</td><td>75.3℃</td></tr>
<tr><td>27</td><td>Q501</td><td>62.2℃</td><td>71.6℃</td></tr>
<tr><td>28</td><td>U101</td><td>47.1℃</td><td>55.9℃</td></tr>
<tr><td>29</td><td>U201</td><td>57.0℃</td><td>66.0℃</td></tr>
<tr><td>30</td><td>U500</td><td>54.9℃</td><td>64.7℃</td></tr>
<tr><td>31</td><td>U100</td><td>53.1℃</td><td>64.0℃</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： 25VDC
O/P：100%LOAD
Ta= -25 ℃</td><td>TEST：OK</td></tr>
</table>

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 281.3K hrs min. Telcordia SR-332 (Bellcore) ; 85K 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