



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°C	<u>460</u> 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°C	(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

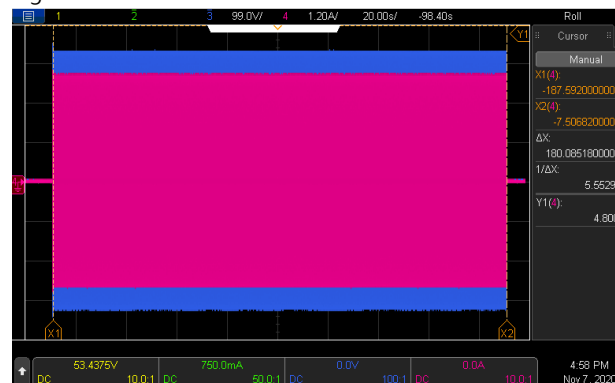


Fig2

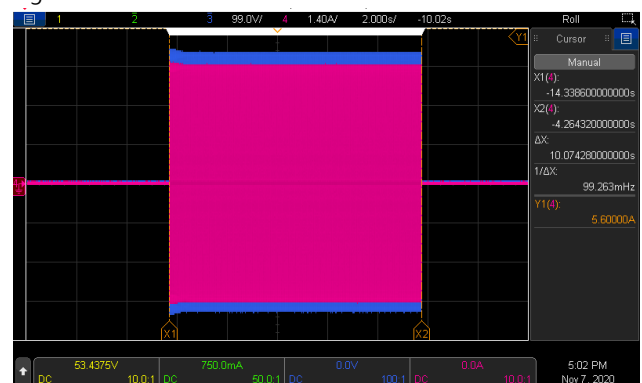


Fig3

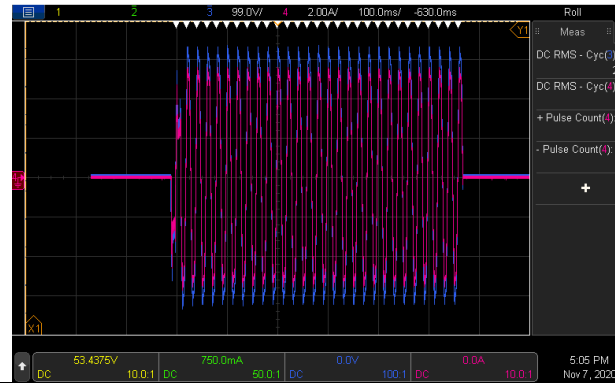












Fig4



3	AC Voltage	200 / 220 / 230 / 240Vac selectable by DIP S.W	IP: 12VDC OP: FULL LOAD Ta:25°C	DIP S.W 200VAC: <u>198.3</u> V DIP S.W 220VAC: <u>218.5</u> V DIP S.W 230VAC: <u>228.4</u> V DIP S.W 240VAC: <u>238.7</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>50.04</u> HZ DIP S.W 60HZ: <u>59.95</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) 1.05 % / 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				
6	AC REGULATION	±3%	IP: 12.5VDC OP: FULL LOAD/NO LOAD Ta:25°C	<u> -0.66 </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> -0.96 </u> % (2) <u> 1.57 </u> % (3) <u> 2.66 </u> %
8	O/P voltage DC offset	Vin(nor)= <u> 12 </u> v · Vo <200mv · no load : <u> 76.4mv </u> / full load: <u> 87.7 mv </u>		

9	LED STATUS	<ul style="list-style-type: none"> • Status test 		
		LED	Status	RESULT
		Green	 Inverter OK	OK
		Orange	 Remote off  Saving mode	OK
		Red	 Abnormal Status (See SPEC)	OK
		<ul style="list-style-type: none"> • 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
		<ul style="list-style-type: none"> • 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%		

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	<u>10.1 VDC~ 16.5 VDC/NO LOAD</u> <u>10.2 VDC~ 16.5 VDC/FULL LOAD</u>
			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: <u>OK</u>

2	DC CURRENT (TYP)	50A	IP: 12VDC OP:FULL LOAD Ta:25°C	<u>41.3</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>0.84</u> W <u>8.78</u> W
4	SAVING MODE TO NORMAL	$P_o \geq 25W$	IP: 12VDC OP: TESTING LOAD Ta:25°C	<u>≥ 21</u> W
5	NORMAL TO SAVING MODE	$P_o \leq 10W$	IP: 12VDC OP: TESTING LOAD Ta:25°C	<u>≤ 12</u> W
6	OFF MODE CURRENT DRAW (Typ.)	$\leq 1mA$	IP: 12VDC OP: Sw off Ta:25°C	0.46mA
7	EFFICIENCY(TYP)	450W/90%	IP: 12.5VDC OP: $P_o=450W$ 230V/50HZ (factory setting) Ta:25°C	90.8 %

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>11.1</u> V
2	BAT LOW SHUT DOWN	10V \pm 0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>10.1</u> V
3	BAT LOW RESTART	12.5V \pm 0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>12.5</u> V
4	BAT HIGH ALARM	15.5V \pm 0.3VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25°C	<u>15.6</u> V
5	BAT HIGH SHUT DOWN	16.5V \pm 0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>16.5</u> V
6	BAT HIGH RESTART	15V \pm 0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>15.0</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: 12VDC 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>105%~111%</u> <u>180.08</u> sec (2). <u>117%~148.8%</u> <u>10.07</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>209</u> W · turn on <u>OK</u> LAMP: <u>423.58</u> W · turn on <u>OK</u> LAMP: <u>526.93</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>451.8W</u>	1. Vin=HIGH LINE 2. O/P=230V/50Hz TEST: <u>OK</u>	
		NO PFC: <u>LRS-350-36</u> · O/P= <u>323</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 /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°C	(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°C	(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°C	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°C	(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°C	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

		<p>CHARGE IC U101 Rated -0.3V~20V</p> <p>Gate Driver IC U200 Rated -0.3V~20V</p>	<p>(5) Saving mode Ta:25°C</p>	<p>U501 (1) 11.6V (2) 11.6V (3) 11.6V (4) 11.6V (5) 11.6V</p> <p>U101 (1) 12.45V (2) 12.45V (3) 12.45V (4) 12.45V (5) 12.45V</p> <p>U200 (1) 5.14V (2) 5.10V (3) 5.14V (4) 5.14V (5) 5.10V</p>
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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	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: 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°C	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°C	CLASS A
2	E.S.D	EN61000-4-2 AIR : 8KV / Contact : 4KV	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-450-212 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 12.5VDC O/P : FULL LOAD Ta= 25 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 12.5VDC O/P : FULL LOAD Ta= 40 °C																																																																																																																										
		<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=25 °C</th> <th>HIGH AMBIENT Ta= 40 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>C100</td><td>91.6°C</td><td>92.7°C</td></tr> <tr><td>2</td><td>C101</td><td>91.1°C</td><td>91.5°C</td></tr> <tr><td>3</td><td>Q104</td><td>69.0°C</td><td>74.8°C</td></tr> <tr><td>4</td><td>Q103</td><td>70.5°C</td><td>76.3°C</td></tr> <tr><td>5</td><td>RT300</td><td>63.3°C</td><td>67.6°C</td></tr> <tr><td>6</td><td>T101</td><td>100.4°C</td><td>96.6°C</td></tr> <tr><td>7</td><td>C112</td><td>56.4°C</td><td>58.7°C</td></tr> <tr><td>8</td><td>D106</td><td>56.3°C</td><td>62.2°C</td></tr> <tr><td>9</td><td>C119</td><td>54.5°C</td><td>58.2°C</td></tr> <tr><td>10</td><td>D108</td><td>55.8°C</td><td>62.1°C</td></tr> <tr><td>11</td><td>C118</td><td>51.4°C</td><td>55.6°C</td></tr> <tr><td>12</td><td>Q200</td><td>62.9°C</td><td>69.5°C</td></tr> <tr><td>13</td><td>U501</td><td>77.3°C</td><td>76.5°C</td></tr> <tr><td>14</td><td>L201</td><td>40.4°C</td><td>48.2°C</td></tr> <tr><td>15</td><td>C219</td><td>50.6°C</td><td>54.7°C</td></tr> <tr><td>16</td><td>Q202</td><td>61.2°C</td><td>68.1°C</td></tr> <tr><td>17</td><td>L200</td><td>69.7°C</td><td>70.5°C</td></tr> <tr><td>18</td><td>TSW1</td><td>62.5°C</td><td>64.3°C</td></tr> <tr><td>19</td><td>U101</td><td>55.2°C</td><td>57.7°C</td></tr> <tr><td>20</td><td>ZR200</td><td>43.3°C</td><td>49.8°C</td></tr> <tr><td>21</td><td>Q105</td><td>51.2°C</td><td>55.2°C</td></tr> <tr><td>22</td><td>T501</td><td>64.1°C</td><td>65.3°C</td></tr> <tr><td>23</td><td>T100</td><td>50.9°C</td><td>55.2°C</td></tr> <tr><td>24</td><td>Q501</td><td>73.6°C</td><td>71.3°C</td></tr> <tr><td>25</td><td>U303</td><td>59.1°C</td><td>64.2°C</td></tr> <tr><td>26</td><td>Q504</td><td>70.3°C</td><td>69.7°C</td></tr> <tr><td>27</td><td>U201</td><td>61.4°C</td><td>65.2°C</td></tr> <tr><td>28</td><td>U500</td><td>60.9°C</td><td>65.0°C</td></tr> <tr><td>29</td><td>U100</td><td>69.0°C</td><td>72.2°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=25 °C	HIGH AMBIENT Ta= 40 °C	1	C100	91.6°C	92.7°C	2	C101	91.1°C	91.5°C	3	Q104	69.0°C	74.8°C	4	Q103	70.5°C	76.3°C	5	RT300	63.3°C	67.6°C	6	T101	100.4°C	96.6°C	7	C112	56.4°C	58.7°C	8	D106	56.3°C	62.2°C	9	C119	54.5°C	58.2°C	10	D108	55.8°C	62.1°C	11	C118	51.4°C	55.6°C	12	Q200	62.9°C	69.5°C	13	U501	77.3°C	76.5°C	14	L201	40.4°C	48.2°C	15	C219	50.6°C	54.7°C	16	Q202	61.2°C	68.1°C	17	L200	69.7°C	70.5°C	18	TSW1	62.5°C	64.3°C	19	U101	55.2°C	57.7°C	20	ZR200	43.3°C	49.8°C	21	Q105	51.2°C	55.2°C	22	T501	64.1°C	65.3°C	23	T100	50.9°C	55.2°C	24	Q501	73.6°C	71.3°C	25	U303	59.1°C	64.2°C	26	Q504	70.3°C	69.7°C	27	U201	61.4°C	65.2°C	28	U500	60.9°C	65.0°C	29	U100	69.0°C	72.2°C		
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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 C100 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) 40049.3HRS (2) 37109.2HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 843.9K hrs min. Telcordia SR-332 (Bellcore) ; 85.0K 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