



Test Report: NTS-450-224

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: 24VDC Ta:25°C	<u>460 W</u>
2	MAXIMUM OUTPUT POWER (TYP)	(1)517.5W/180sec. (2)675w/10sec (3)SURGE POWER 900W FOR 30CYCLE Vin (30±5 CYCLE)	IP: 25VDC OP: TESTING LOAD Ta:25°C	(1) 228.3V/ 2.19 A/180.08 Sec (2) 228.85V/ 2.86 A/ 10.07 Sec (3) 232.1 V/ 3.943A/ 28 Cycle

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

Fig1

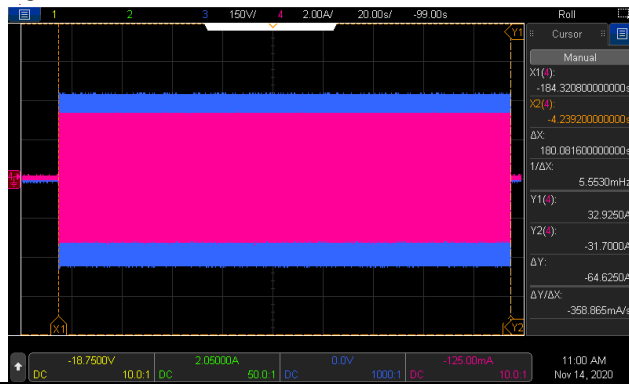


Fig2

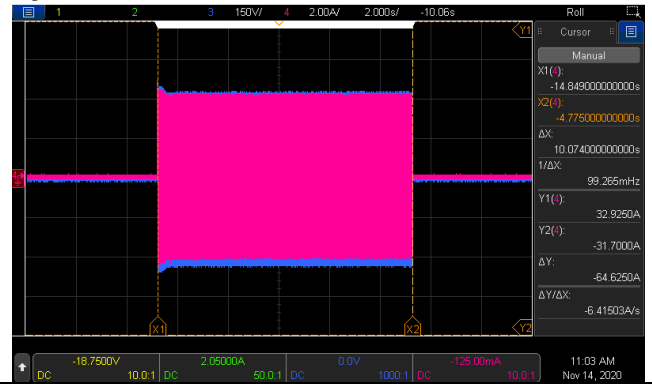


Fig3

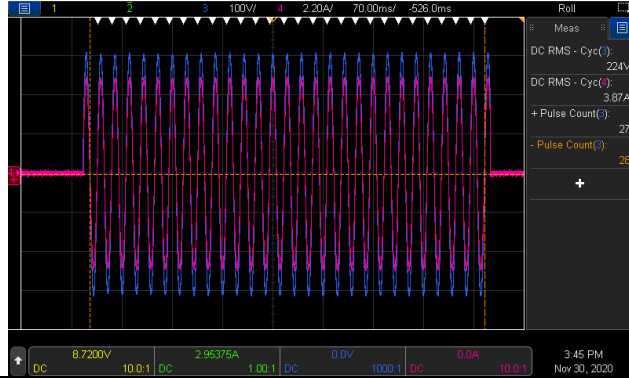


Fig4



3	AC Voltage	200 / 220 / 230 / 240Vac selectable by DIP S.W	IP: 24VDC OP: FULL LOAD Ta:25°C	DIP S.W 200VAC: <u>198.3</u> V DIP S.W 220VAC: <u>218.3</u> V DIP S.W 230VAC: <u>228.6</u> V DIP S.W 240VAC: <u>238.8</u> V
4	FREQUENCY	50/60Hz (±0.1HZ) selectable by DIP S.W	IP: 24VDC OP: FULL LOAD Ta:25°C	DIP S.W 50HZ: <u>50.041</u> HZ DIP S.W 60HZ: <u>59.958</u> HZ
5	WAVEFORM	True sine wave (THD<3%)	IP: 25VDC OP: FULL LOAD (1) Vo(min) (2) Vo(nor) (3) Vo(max) Ta:25°C	(1) <u>0.66</u> % / Vo(min) /FULL LOAD (2) <u>0.68</u> % / Vo(nor) /FULL LOAD (3) <u>0.67</u> % / Vo(max) /FULL LOAD

CH3:O/P VAC CH4:O/P IAC				
6	AC REGULATION	±3%	IP: 25VDC OP: FULL LOAD/NO LOAD Ta:25°C	<u>-0.61 %</u>
7	Overshoot /Undershoot	<±10%	IP: 24VDC OP: (1) full load turn on (2) no load turn on (3) full /no load change Ta:25°C	(1) <u>-7.9%</u> (2) <u>-6.5</u> (3) <u>-2.7%</u>
8	O/P voltage DC offset	Vin(nor)= <u>24</u> v · Vo <200mv · load : <u>92mV</u> / full load: <u>77mV</u>		

9	LED STATUS	<ul style="list-style-type: none"> Status test <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> Battery test <table border="1"> <thead> <tr> <th>LED</th> <th>Battery RANGE</th> <th>RESULT</th> </tr> </thead> <tbody> <tr> <td>Green </td> <td>25VDC~31VDC±0.5v</td> <td>25.11vdc ~31.02 vdc</td> </tr> <tr> <td>Orange </td> <td>22~ 25Vdc ±0.5v</td> <td>22.313Vdc ~25.031 Vdc</td> </tr> <tr> <td>Red </td> <td><22 Vdc ±0.5v > 31Vdc±0.5v</td> <td>< 22.17 vdc > 31.22 Vdc</td> </tr> </tbody> </table> Load test <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 ~ 39.1%</td> </tr> <tr> <td>Orange </td> <td>40%±5% ~ 80%±5% LOAD</td> <td>40.7% ~ 78.4 %</td> </tr> <tr> <td>Red </td> <td>≥ 80%±5% LOAD</td> <td>≥ 79.6 %</td> </tr> </tbody> </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	25VDC~31VDC±0.5v	25.11vdc ~31.02 vdc	Orange	22~ 25Vdc ±0.5v	22.313Vdc ~25.031 Vdc	Red	<22 Vdc ±0.5v > 31Vdc±0.5v	< 22.17 vdc > 31.22 Vdc	LED	LOAD RANGE	RESULT	Green	Min. load ~ 40%±5% LOAD	Min. load ~ 39.1%	Orange	40%±5% ~ 80%±5% LOAD	40.7% ~ 78.4 %	Red	≥ 80%±5% LOAD	≥ 79.6 %
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INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE RANGE (TYP)	20VDC~33VDC	IP: TESTING OP:NO LOAD/FULL LOAD Ta:25°C I/P: LOW-LINE=21V HIGH-LINE=32.5V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON:30Sec OFF:30Sec 10MIN (POWER ON/OFF NO DAMAGE) I/P: 24V O/P:FULL LOAD ON:30ec OFF:30ec 12Hr (POWER ON/OFF NO DAMAGE)	<u>20.2</u> VDC~ <u>33.2</u> VDC/NO LOAD <u>20.2</u> VDC~ <u>33.2</u> VDC/FULL LOAD Test: <u>OK</u>

2	DC CURRENT (TYP)	25A	IP: 24VDC OP:FULL LOAD Ta:25°C	<u>19.92</u> A
3	NO LOAD DISSIPATION (Typ.)	≤ 1.3 @ Saving Mode $\leq 10W$ @NON-Saving Mode	IP: 24VDC OP:NO LOAD Ta:25°C	<u>0.828</u> W <u>8.32</u> W
4	SAVING MODE TO NORMAL	$P_o \geq 25W$	IP: 24VDC OP: TESTING LOAD Ta:25°C	<u>≥ 21</u> W
5	NORMAL TO SAVING MODE	$P_o \leq 10W$	IP: 24VDC OP: TESTING LOAD Ta:25°C	<u>≤ 13.2</u> W
6	OFF MODE CURRENT DRAW (Typ.)	$\leq 1mA$	IP: 24VDC OP: Sw off Ta:25°C	<u>0.82</u> mA
7	EFFICIENCY(TYP)	450W/93%	IP: 25VDC OP: $P_o=450W$ 230V/50HZ (factory setting) Ta:25°C	<u>93.8</u> %

PROTECTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BAT LOW ALARM	22V \pm 0.5VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25°C	<u>22.1</u> V
2	BAT LOW SHUT DOWN	20V \pm 0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>20.2</u> V
3	BAT LOW RESTART	25V \pm 0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>25.2</u> V
4	BAT HIGH ALARM	31V \pm 0.5VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25°C	<u>31.2</u> V
5	BAT HIGH SHUT DOWN	33V \pm 0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>33.2</u> V
6	BAT HIGH RESTART	30V \pm 0.5VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25°C	<u>30.1</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: 24VDC 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: 24VDC OP: TESTING SW:ON Ta:25°C	(1). <u>106 % ~111 % 180.08 sec</u> (2). <u>115.8 % ~148.8 % 10.07 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: 24VDC 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>310 W</u> · turn on <u>OK</u> LAMP: <u>460 W</u> · turn on <u>OK</u> LAMP: <u>604 W</u> · 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>455 W</u>	1. Vin=HIGH LINE 2. O/P=230V/50Hz TEST: <u>OK</u>	
		NO PFC: <u>LRS-350-36</u> · NNO/P= <u>355 W</u>	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 :100V /80 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) 74.8V (2) 74.0V (3) 76.5V (4) 76.5V (5) 81.3V

2	DC TO DC Diode Peak Voltage	D105 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°C	(1)519V (2)564V (3)522V (4)528V (5)528V
3	DC BUS Capacitor Voltage	C118 Rated :330u/ 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) 250V (2) 254V (3) 248V (4) 250V (5)250V C119 (1) 250V (2) 254V (3) 254V (4) 250V (5) 250V
4	DC TO AC Power Transistor (D to S) or (C to E) Peak Voltage	Q 200 Rated : 650V / 15 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) 540V (2) 637V (3) 568V (4) 528V (5) 528V
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 (5)O.L.P(200%) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25°C	Q504 (1) 66.3V (2) 66.3V (3) 66.3V (4) 65.5V (5) 65.5V Q105 (1)72.7 V (2) 70.3V (3) 72.7V (4) 71.9V (5) 71.9V
6	Control IC Voltage Test	MCU IC U303 Rated 2.4 V~ 3.6 V AUX IC U501 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	U303 (1) 3.42V (2) 3.46V (3) 3.46V (4) 3.33V

		<p>8.2V~30V</p> <p>CHARGE IC U101 Rated -0.3V~20V</p> <p>Gate Driver IC U200 Rated -0.3V~20V</p>	<p>(4) NO LOAD Turn On (5) Saving mode</p> <p>Ta:25°C</p>	<p>(5) 3.33V</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) 5.10V (2) 5.10V (3) 5.14V (4) 5.10V (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: 1.926 mA AC O/P-FG: 2.246 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: 24VDC 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-450-224 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 25VDC O/P : FULL LOAD Ta= 25 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 25VDC O/P : FULL LOAD Ta= 40 °C																																																																																																																																		
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		26	U501	66.4°C	75.3°C																																																																																																																															
		27	Q501	62.2°C	71.6°C																																																																																																																															
		28	U101	47.1°C	55.9°C																																																																																																																															
		29	U201	57.0°C	66.0°C																																																																																																																															
30	U500	54.9°C	64.7°C																																																																																																																																	
31	U100	53.1°C	64.0°C																																																																																																																																	
2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 25VDC 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 : 32.5VDC 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 : 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°C		TEST : OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C101 IS THE MOST CRITICAL COMPONENT (1) I/P : 25VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 25VDC O/P : FULL LOAD Ta= 40 °C 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°C)		
11	Ongoing Reliability Test	I/P : 25VDC O/P : 80% LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ

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