Test Report: NPB-450-72

450W High Reliable Ultra Wide Output Range
Intelligent Battery Charger

■ DESIGN VERIFY TEST

Output Function Test
Input Function Test
Protection Function Test
Control Function Test
Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test
E.M.C. Test

■ RELIABILITY TEST

ENVIRONMENT TEST

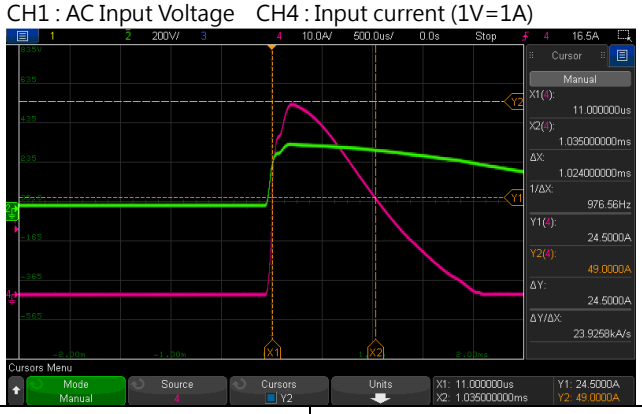
■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BOOST CHARGE VOLTAGE (default)	72V± 1.2 V	I/P: 230 VAC O/P:BAT. LOAD Ta:25℃	72.6V
2	FLOAT CHARGE VOLTAGE **(default)**	69V± 0.6 V	I/P: 230 VAC O/P:BAT. LOAD Ta:25℃	69.6V
3	MAX. OUTPUT CURRENT	5.5A± 0.055 A	I/P: 230 VAC O/P:C.V =Vboost-4V Ta:25℃	5.53A
4	LEAKAGE CURRENT FROM BATTERY (TYP)	<1mA	I/P: AC OFF O/P:BAT. LOAD Ta:25℃	0.48mA
5	OUTPUT CURRENT RANGE	50%~100%Io	I/P: 230 VAC O/P:C.V =84V Ta:25℃	2.59~5.53A
6	MAX. POWER	462W	I/P: 230 VAC O/P:C.V =84V Ta:25℃	463.4W

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~264VAC 127VDC~370VDC	(1) I/P:TESTING O/P:FULL LOAD (2) I/P:DC TESTING(L:+ N:-) O/P: FULL LOAD (3) I/P:DC TESTING(L:- N:+) O/P: FULL LOAD Ta:25℃	(1) 86.4V~264V (2) 120Vdc~370Vdc/FULL LOAD (3) 120Vdc~370Vdc/FULL LOAD
			I/P: LOW-LINE-3V=87 V HIGH-LINE+15%= 300 V O/P:BAT. LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec . OFF: 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE)	TEST: OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 90 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	LEAKAGE CURRENT	< 0.75 mA / 240VAC	I/P: 240 VAC O/P:Min LOAD Ta:25℃	0.48mA
4	INPUT CURRENT (TYP)	230 V/ 2.2 A 115 V/ 4.5A	I/P: 230 VAC I/P: 115 VAC	I = 2.18A/ 230VAC I = 4.42A/ 115VAC

			O/P:BAT. LOAD Ta:25℃	
5	POWER FACTOR (TYP)	0.95/ 230 VAC 0.98/ 115 VAC	I/P: 230 VAC I/P: 115 VAC O/P:BAT. LOAD Ta:25℃	PF= 0.989/ 230VAC PF= 0.998/ 115VAC
6	EFFICIENCY (TYP)	93%	I/P: 230 VAC O/P:BAT. LOAD(C.V =84V) Ta:25℃	93.6%
7	INRUSH CURRENT (TYP)	230 V/ 50 A COLD START	I/P: 230 VAC O/P:BAT. LOAD Ta:25℃	I =49.0A/ 230VAC T50=1.02ms/230V
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : AC Input Voltage CH4 : Input current (1V=1A) 			
8	GAIN-PHASE MARGIN TEST 1.	GAIN MARGIN < -10dB PHASE MARGIN>=60 Gain Curve slope: -10dB/dec~-40dB/dec	(1) CC MODE(Vboost)/ 90% LOAD /264Vac (2) CC MODE(Vboost)/ 90% LOAD /90Vac Ta:25℃	(1) 60.3090°/ -13.203dB / -29.2 dB/dec (2) 60.5110 °/ -13.005 dB / -22.4 dB/dec

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER VOLTAGE PROTECTION	CH1:102V~120V PROTECTION RESULT Shut down and latch off o/p voltage, re-power on to recover.	I/P: 264 VAC I/P: 90 VAC O/P:TESTING Ta:25℃	112.0/ 264VAC 112.0V/ 90VAC PROTECTION TYPE : Shut down and latch off o/p voltage, re-power on to recover.
2	OVER TEMPERATURE PROTECTION	SPEC: NO DAMAGE Shut down o/p voltage, recover automatically after temperature goes on.	I/P: 264 VAC I/P: 90 VAC O/P:BAT. LOAD	O.T.P. Active PROTECTION TYPE : OK Shut down o/p voltage, recover automatically after temperature goes on.
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE 4.95A~11.5A Constant current	I/P: 264 VAC O/P: BAT. LOAD Ta:25℃	NO DAMAGE 8.12 A PRO TECTION TYPE : Constant current

		limiting ,charger will shut down after 5 sec, re-power on to recover.		limiting ,charger will shut down after 5 sec, re-power on to recover.
4	BATTERY REVERSE POLARITY	Protected internal reverse detection, No damage, re-power on to recover after conduction is removed.	I/P: 230 VAC O/P:BAT. LOAD Ta:25℃	Protected internal reverse detection, No damage, re-power on to recover after conduction is removed
5	ERROR INPUT HIGH VOLTAGE BATTERY	Shut down o/p voltage, re-power on to recover	I/P: 230 VAC O/P:BAT. LOAD Ta:25℃	PROTECTION TYPE : Shut down o/p voltage, re-power on to recover

CONTROL FUNCTION 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>FAN SPEED CONTROL</td><td>FAN control mosfet duty：
30%（-1%）@RTH5＜45℃
FAN control mosfet duty：
100%（-1%）@RTH5＞60℃</td><td>I/P: 230 VAC
O/P:BAT. LOAD
Ta:25℃</td><td>30% @RTH5＜45℃
99.2% @RTH5＞60℃</td></tr>
<tr><td>2</td><td>REMOTE CONTROL</td><td>Rc+ / Rc-
OPEN/(-0.5~0.5V):
Charger stop charging
SHORT/(10.8~13.2V):
Charger normal work</td><td>I/P: 230 VAC
O/P:BAT. LOAD
Ta:25℃</td><td>TEST:
OPEN/-0.5~2.5 V
SHORT/2.6~13.2V
(1) Remote off Pin=4.43W
(2) Remote off Vo= 0.037V</td></tr>
<tr><td>3</td><td>AUX POWER</td><td>OUTPUT VOLTAGE RANGE：
10.8~13.2V
OUTPUT RIPPLE&NOISE：
150mVp-p</td><td>I/P: 230 VAC
O/P:BAT. LOAD
Ta:25℃</td><td>TEST: 12.09 V
78 mVp-p</td></tr>
<tr><td>4</td><td>LED INDICATOR</td><td><table><tr><th>LED</th><th>Description</th></tr><tr><td>Green</td><td>Float(stage 3) or Battery full</td></tr><tr><td>Orange</td><td>Charging (stage 1 or stage 2)</td></tr><tr><td>Orange (Flashing)</td><td>Auto ranging for charging</td></tr><tr><td>Red</td><td>Abnormal status (OTP,OVP, Short, Reverse polarity, Charging timeout.)</td></tr><tr><td>Red (Flashing)</td><td>The LED will flash with the red light when the internal temperature reaches 95℃; under this condition, the unit still operates normally without entering OTP.</td></tr></table>I/P: TESTING VAC
O/P:TESTING LOAD
Ta:25℃</td><td>TEST： OK</td></tr>
</table>

<table>
<tr><td>5</td><td>TEMPERATURE
COMPENSATION</td><td colspan="3">I/P: 230 VAC
O/P:BAT. LOAD
Ta:25℃
<table>
<tr><td colspan="4">Constant Voltage</td></tr>
<tr><td rowspan="2">SPEC:</td><td>Ta=0℃ (17KΩ)</td><td>Ta=25℃ (5KΩ)</td><td>Ta=50℃ (1.7KΩ)</td></tr>
<tr><td>74.25±1.2V</td><td>72±1.2V</td><td>70.65±1.2V</td></tr>
<tr><td>TEST RESULT:</td><td>73.81V</td><td>71.59V</td><td>70.27V</td></tr>
</table></td></tr>
<tr><td>6</td><td>CHARGE OK</td><td>The TTL signal out,
Charger OK = 4.5 ~ 5.5V;
Charger failure or protection = -0.5 ~ 0.5V</td><td>I/P: 230 VAC
O/P:BAT. LOAD
Ta:25℃</td><td>TEST：
Charger OK = 5.21 V;
Charger failure = 36 mV;
Charger protection= 36 mV</td></tr>
<tr><td>7</td><td>BATTERY FULL SIGNAL</td><td>The TTL signal out, Battery full = 4.5 ~ 5.5V ;
Charging = -0.5 ~ 0.5V</td><td>I/P: 230 VAC
O/P:BAT. LOAD
Ta:25℃</td><td>TEST：
Battery full = 5.18 V
Charging = 35 mV</td></tr>
</table>

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q 5/Q6 Rated : 600V/25 A	AC ON/OFF I/P:High-Line +3V = 267 V VDS : O/P: (1)CV(max) V (2) CV(min) V (3)no load (4)CV=84V Full Load Ta:25℃	Q5 VDS : (1) 477V (2) 481V (3) 457V (4) 489V Q6 VDS : (1) 469V (2) 465V (3) 453V (4) 447V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rate: 600V /18 A	AC ON/OFF I/P:High-Line +3V = 267 V VDS : O/P: (1)CV(max) V (2) CV(min) V (3)no load (4)CV=84V Full Load Ta:25℃	VDS : (1) 505V (2) 465V (3) 501V (4) 485V
3	AUX MOS	U600 Rate: 725V/ 0.88A	AC ON/OFF I/P:High-Line +3V = 267 V VDS : O/P: (1)CV(max) V (2) CV(min) V (3)no load (4) CV=84V Full Load Ta:25℃	VDS : (1) 614V (2) 574V (3) 570V (4) 586V
4	P.F.C DIODE	D19 Rated : 650 V/ 6 A	AC ON/OFF I/P:High-Line +3V = 267 V O/P: (1)CV(max) V (2) CV(min) V (3)no load (4) CV=84V Full Load Ta:25℃	(1) 441V (2) 417V (3) 461V (4) 457V

5	Diode Peak Voltage	Q210/ Q213 Rated :300V/ 20A	AC ON/OFF I/P:High-Line +3V = 267 V VDS : O/P: (1)CV(max) V (2) CV(min) V (3)no load (4) CV=84V Full Load Ta:25℃	Q210 VDS : (1) 240V (2) 178V (3) 236V (4) 214V	Q213 VDS : (1) 238V (2) 186V (3) 232V (4) 212V
6	Input Capacitor Voltage	C 5 Rated : 220u / 450 V	AC ON/OFF I/P:High-Line +3V = 267 V VDS : O/P: (1)CV(max) V (2) CV(min) V (3)no load (4) CV=84V Full Load Ta:25℃	(1) 444V (2) 432V (3) 444V (4) 442V	
7	Control IC Voltage Test	PWM IC U3Rated 8.9V~15.5V PFC IC U2Rated 11V~26V O/P IC U801 Rated 4.5V~36V MCU IC U701 Rated 2.4V~ 3.6 V	AC ON/OFF I/P:High-Line +3V = 267 V VDS : O/P: (1)CV(max) V (2) CV(min) V (3)no load (4) CV=84V Full Load Ta:25℃	U3 (1) 13.9V (2) 13.9V (3) 13.7V (4) 13.7V U2 (1) 14.6V (2) 14.3V (3) 14.6V (4) 14.6V	U801 (1) 10.9V (2) 10.9V (3) 10.9V (4) 10.9V U701 (1) 3.35V (2) 3.35V (3) 3.35V (4) 3.35V

■ SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3 KVAC/min I/P-FG:2 KVAC/min O/P-FG:0.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG: 0.6 KVAC/min Ta:25℃	I/P-O/P: 2.478 mA I/P-FG: 3.302 mA O/P-FG: 0.800 mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ	I/P-O/P: 600 VDC I/P-FG: 600 VDC O/P-FG: 600 VDC Ta:25℃	I/P-O/P: 9999M Ω I/P-FG: 5620MΩ O/P-FG: 9999M Ω NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	19mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	BS EN/EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	PASS

2	CONDUCTION	BS EN/EN 55032 (CISPR32), BS EN / EN55014-1 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL/50% LOAD Ta:25℃	PASS Test by certified Lab
3	RADIATION	BS EN/EN 55032 (CISPR32), BS EN / EN55014-1 CLASS B	I/P:230VAC/50HZ O/P:FULL/50% LOAD Ta:25℃	PASS Test by certified Lab
4	E.S.D	BS EN/EN61000-4-2 AIR：8KV / Contact：4KV	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A
5	E.F.T	BS EN/EN61000-4-4 INPUT: 1KV	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A
6	SURGE	BS EN/EN 61000-4-5 L-N :1KV L,N-PE:2KV	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL：NPB-450-72 1. ROOM AMBIENT BURN-IN：2 HRS I/P： 230VAC O/P： FULL LOAD Ta= 22.8 ℃ 2. HIGH AMBIENT BURN-IN： 2 HRS I/P： 230VAC O/P： FULL LOAD Ta= 50.9 ℃		

NO	Position	ROOM AMBIENT Ta= 22.8 ℃	HIGH AMBIENT Ta=50.9℃
1	ZNR1	31.5℃	55.2℃
2	U3	37.7℃	59.5℃
3	LF1	33.3℃	56.3℃
4	RY1	37.5℃	59.2℃
5	RTH2	37.0℃	58.1℃
6	LF3	48.2℃	66.3℃
7	BD1	56.0℃	74.9℃
8	C8	50.7℃	68.0℃
9	Q1	60.9℃	80.1℃
10	TSW1	36.7℃	58.2℃
11	L1	68.0℃	80.8℃
12	C5	47.0℃	64.5℃
13	R18	55.6℃	72.2℃
14	C24	44.5℃	62.6℃
15	Q6	43.2℃	62.7℃
16	C60	54.5℃	69.9℃
17	T1	84.9℃	95.1℃
18	T600	41.3℃	62.0℃
19	Q211	44.6℃	64.1℃
20	Q214	45.5℃	65.2℃
21	C111	37.1℃	57.0℃
22	C115	29.8℃	53.5℃
23	Q352	26.5℃	52.1℃
24	U701	32.7℃	56.9℃
25	LF100	26.7℃	52.8℃
26	U503	31.1℃	56.0℃
27	U150	30.9℃	55.1℃
28	RG5	43.2℃	64.7℃
29	J102	35.3℃	57.8℃
30	R228	43.9℃	63.0℃
31	D19	55.1℃	74.6℃
32	U2	52.0℃	70.3℃
33	PCB	55.6℃	70.3℃
34	D651	40.4℃	63.2℃
35	RG6	32.9℃	54.0℃
36	Q500	40.2℃	61.3℃
37	RTH5	49.6℃	66.6℃
38	TC	37.4℃	59.7℃
39	U600	53.0℃	72.0℃
40	C114	39.2℃	59.1℃

2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P： 230VAC/100VAC O/P： 100 %LOAD Ta= -35℃	TEST：OK
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 ℃ NO DAMAGE	I/P： 272 VAC O/P：FULL LOAD Ta= 50.9 ℃ HUMIDITY= 95 %R.H	TEST：OK
4	TEMPERATURE COEFFICIENT	± 0.05%/ (0℃~50℃)	I/P： 230 VAC O/P：FULL LOAD	0.0067 %/℃(0~50℃)
5	STORAGE TEMPERATURE TEST	-40~85℃	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：10CYCLE 5. Input/Output condition： STATIC	

6	THERMAL SHOCK TEST	-30~50℃	1. Thermal shock Temperature： -35℃~ +55℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：16 CYCLE 5. Input/Output condition： 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test
7	VIBRATION TEST	10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (3) Sweep Time：10min/sweep cycle (4) Acceleration：3G (5) Test Time：180min in each axis (X.Y.Z) (6) Ta：25℃
8	CAPACITOR LIFE CYCLE	SUPPOSE C114 IS THE MOST CRITICAL COMPONENT (1) I/P： 230VAC O/P：FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P： 230VAC O/P：FULL LOAD Ta= 50 ℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 50 ℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 50 ℃ LIFE TIME	 (1) 949225.9HRS (2) 296236.9HRS (3) 392593.3HRS (4) 477087.5HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 821.0K hrs min. Telcordia SR-332 (Bellcore) ; 83.4K hrs min. MIL-HDBK-217F (25℃)	
10	Ongoing Reliability Test	I/P：230VAC O/P：FULL LOAD TA=50℃ Demonstration Mean Time Between Failure : 30,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		Wangdz

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