Test Report: NPB-1200-12

1200W 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

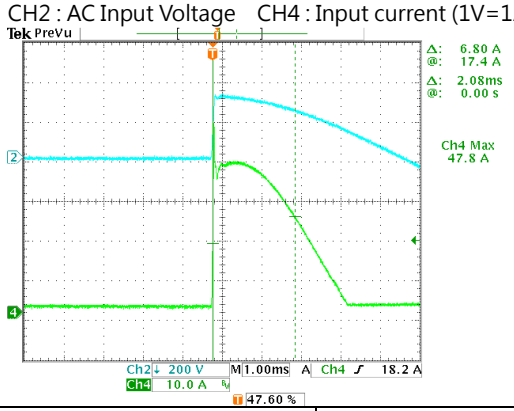
■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BOOST CHARGE VOLTAGE （default）	14.4V± 0.12 V	I/P: 230 VAC O/P:BAT. LOAD Ta:25℃	14.47V
2	FLOAT CHARGE VOLTAGE （default）	13.8V± 0.12 V	I/P: 230 VAC O/P:BAT. LOAD Ta:25℃	13.84V
3	MAX. OUTPUT CURRENT	70A±0.7A	I/P: 230 VAC O/P: C.V =13.4V Ta:25℃	69.86A
4	MAX. POWER	1176W	I/P: 230 VAC O/P:C.V =16.8V Ta:25℃	1177.2W
5	LEAKAGE CURRENT FROM BATTERY (TYP)	<1mA	I/P: AC OFF O/P:BAT. LOAD Ta:25℃	0.237mA
6	OUTPUT CURRENT RANGE	50%~100%Io	I/P: 230 VAC O/P:CV =16.8V Ta:25℃	32.76~69.55A

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: 80% LOAD (3) I/P:DC TESTING(L:- N:+) O/P: FULL LOAD Ta:25℃	(1) 173V~264V/FULL LOAD 84.5V~264V/80% LOAD (2) 118Vdc~370Vdc/80% LOAD (3) 160Vdc~370Vdc/FULL LOAD
			I/P: LOW-LINE-3V=87 V HIGH-LINE+15%= 300 V O/P: FULL 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	< 1 mA / 240VAC	I/P: 240 VAC O/P:Min LOAD Ta:25℃	0.189mA
4	INPUT CURRENT (TYP)	230 V/6.5 A 115 V/ 12A	I/P: 230 VAC I/P: 115 VAC	I =5.54A/ 230VAC I =9.83A/ 115VAC

			O/P: FULL 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=0.987 / 230VAC PF=0.994 / 115VAC
6	EFFICIENCY (TYP)	92%	I/P: 230 VAC O/P: BAT. LOAD (C.V =16.8V) Ta:25℃	92.2%
7	INRUSH CURRENT (TYP)	230 V/ 50 A COLD START	I/P: 230 VAC O/P:BAT. LOAD Ta:25℃	I =47.8A/ 230VAC T50= 2.08ms/230VAC
	INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current (1V=1A) 			
8	GAIN-PHASE MARGIN TEST	GAIN MARGIN < -10dB PHASE MARGIN>=60 Gain Curve slope: -10dB/dec~-40dB/dec	(1) CV MODE(Vboost)/264Vac (2) CV MODE(Vboost)/90Vac	(1)97.891°/-12.679dB / -24.4dB/dec (2)97.194°/-13.654dB / -14.5dB/dec

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER VOLTAGE PROTECTION	CH1:21.5V~26V 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℃	24.1V/ 264VAC 23.9V/ 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 down.	I/P: 264 VAC I/P: 90 VAC O/P:BAT. LOAD	O.T.P. Active OK PROTECTION TYPE : Shut down o/p voltage, recover automatically after temperature goes down.
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE Constant current Range: 66.5~73.5A Constant current	I/P: 264 VAC O/P: BAT. LOAD Ta:25℃	NO DAMAGE Constant current Range: 68.48 A PROTECTION 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

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	FAN SPEED CONTROL	FAN control mosfet duty： 30%（±2%）@RTH5＜55℃ FAN control mosfet duty： 100%（-2%）@RTH5＞70℃	I/P: 230 VAC O/P:BAT. LOAD Ta:25℃	29.94% @RTH5＜55℃ 99.725% @RTH5＞70℃
2	REMOTE CONTROL	Rc+ / Rc- OPEN：(-0.5~0.5V) Charger stop charging SHORT：(10.8~13.2V) Charger normal work	I/P: 230 VAC O/P:BAT. LOAD Ta:25℃	TEST: OPEN/ -0.5~2.6V SHORT/ 2.9~13.2V (1) Remote off Pin= 3.45 W (2) Remote off Vo= 0.03 V
3	AUX POWER	OUTPUT VOLTAGE RANGE： 10.8~13.2V OUTPUT RIPPLE&NOISE： 150mVp-p	I/P: 230 VAC O/P:BAT. LOAD Ta:25℃	TEST: 11.35 V 29 mVp-p
4	LED INDICATOR	<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 circuit, 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.(In the meantime, an alarm signal will be sent out through the CANBus interface)</td></tr></table> I/P: TESTING VAC O/P:TESTING LOAD Ta:25℃		TEST： OK

<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>14.85±0.12V</td><td>14.4±0.12V</td><td>14.13±0.12V</td></tr>
<tr><td>TEST RESULT:</td><td>14.789V</td><td>14.297V</td><td>14.092V</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 = 5.185 V;
Charger failure=0.173 V
Charger protection=0.173 V</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 = 5.19 V
Charging = 0.019 V</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 901/Q903 Rated : 600V/ 40A	AC ON/OFF I/P:High-Line +3V = 267 V VDS : O/P: (1)CV(max)=20V (2)CV(min)=10.5V (3)no load (4)OUTPUT SHORT Ta:25℃	Q901 Q903 VDS : VDS : (1) 483V (1) 487V (2) 427V (2) 439V (3) 471V (3) 483V (4) 487V (4) 495V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rate: 600V / 34A	AC ON/OFF I/P:High-Line +3V = 267 V VDS : O/P: (1)CV (max)=20V (2)CV(min)=10.5V (3)no load (4)OUTPUT SHORT Ta:25℃	VDS : (1) 479V (2) 415V (3) 463V (4) 479V
3	AUX MOS	U600 Rate: 800V /4.9 A	AC ON/OFF I/P:High-Line +3V = 267 V VDS : O/P: (1)CV (max)=20V (2)CV(min)=10.5V (3)no load (4)OUTPUT SHORT Ta:25℃	VDS : (1) 584V (2) 540V (3) 580V (4) 592V
4	P.F.C DIODE	D8 Rated : 6A/650V	AC ON/OFF I/P:High-Line +3V =267 V O/P: (1)CV(max)=20V (2)CV(min)=10.5V (3)no load (4)OUTPUT SHORT Ta:25℃	(1) 491V (2) 447V (3) 487V (4) 495V

5	Diode Peak Voltage	Q210/Q214/Q218/Q222 Rated :80V	AC ON/OFF I/P:Low-Line +3V = 267 V O/P: (1)CV(max)=20V (2)CV(min)=10.5V (3)no load (4)OUTPUT SHORT Ta:25℃	Q210 VDS : (1) 49.8V (2) 31.7V (3) 48.6V (4) 55.4V Q214 VDS : (1) 49.4V (2) 31.7V (3) 49.0V (4) 50.2V	Q218 VDS : (1) 51.4V (2) 33.7V (3) 49.4V (4) 51.4V Q222 VDS : (1) 51.8V (2) 33.7V (3) 48.6V (4) 51.8V
6	Input Capacitor Voltage	C5 Rated : 220u / 450V	I/P:High-Line +3V =267 V O/P: (1)CV(max)=20V (2)CV(min)=10.5V (3)no load (4)OUTPUT SHORT Ta:25℃	(1) 443V (2) 399V (3) 443V (4) 445V	
7	Control IC Voltage Test	PWM IC U800 Rated 8.9V~15.5V PFC IC U1Rated 11V~26V O/P IC U801 Rated 4.5V~36V U250 Rated -0.3V~37V MCU IC U701 Rated 2.4V~3.6V	AC ON/OFF I/P:High-Line +3V =267 V O/P: (1)CV(max)=20V (2)CV(min)=10.5V (3)no load (4)OUTPUT SHORT Ta:25℃	U800 (1) 13.84V (2) 13.52V (3) 13.52V (4) 13.68V U1 (1) 13.12V (2) 13.36V (3) 13.04V (4) 13.12V U801 (1) 12.64V (2) 12.64V (3) 12.64V (4) 12.64V	U250 (1) 13.28V (2) 13.20V (3) 13.12V (4) 13.76V U701 (1) 3.38V (2) 3.38V (3) 3.34V (4) 3.38V

■ SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	EN 60950-1 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: 3.78mA I/P-FG: 3.40mA O/P-FG: 4.09mA 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: 1G Ω I/P-FG: 1GΩ O/P-FG 1G Ω NO DAMAGE

3	GROUNDING CONTINUITY	EN 60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	27mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	BS EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	PASS
2	CONDUCTION	BS EN/EN55032(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/EN55032(CISPR32), BS EN/EN55014-1 CLASS A	I/P:230VAC/50HZ O/P:FULL /50% LOAD Ta:25℃	PASS Test by certified Lab
4	E.S.D	BS EN61000-4-2 AIR：8KV / Contact：4KV	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A
5	E.F.T	BS EN61000-4-4 INPUT: 1KV	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A
6	SURGE	BS IEC61000-4-5 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-1200-12 1. ROOM AMBIENT BURN-IN：2 HRS I/P： 230VAC O/P： FULL LOAD Ta= 25.9 ℃ 2. HIGH AMBIENT BURN-IN： 2 HRS I/P： 230VAC O/P： FULL LOAD Ta= 54.5 ℃		

NO	Position	ROOM AMBIENT Ta= 25.9 ℃	HIGH AMBIENT Ta= 54.5 ℃
1	ZNR1	35.6℃	64.8℃
2	C2	41.9℃	72.7℃
3	LF1	44.7℃	74.1℃
4	BD1	64.2℃	92.0℃
5	C11	51.2℃	79.0℃
6	C10	49.9℃	77.8℃
7	Q2	58.5℃	87.0℃
8	Q1	58.3℃	86.8℃
9	LF3	47.0℃	75.5℃
10	L1	55.7℃	83.0℃
11	C923	43.1℃	71.2℃
12	RT80	55.4℃	83.4℃
13	U1	48.7℃	76.9℃
14	RY1	55.6℃	83.3℃
15	RTH1	51.0℃	78.8℃
16	C7	47.8℃	76.4℃
17	Q901	68.5℃	100.1℃
18	T601	76.0℃	105.8℃
19	U600	74.7℃	104.0℃
20	U701	31.9℃	60.9℃
21	L3	45.5℃	74.8℃
22	U800	39.2℃	68.5℃
23	RG6	31.9℃	60.8℃
24	U150	33.0℃	62.1℃
25	T1	64.7℃	94.5℃
26	C116	53.0℃	81.7℃
27	Q367	58.4℃	88.7℃
28	LF100	72.4℃	103.4℃
29	T2	64.2℃	92.6℃
30	RTH5	64.9℃	94.0℃
31	Q219	61.8℃	90.9℃
32	U260	62.2℃	90.5℃
33	Q214	61.7℃	90.1℃
34	R12	65.3℃	93.2℃
35	D8	58.2℃	85.9℃
36	J103	73.1℃	100.1℃
37	C115	55.0℃	82.0℃
38	C113	44.7℃	73.4℃
39	Q224	61.5℃	90.3℃
40	D651	54.2℃	82.9℃

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= 50.5 ℃ HUMIDITY= 95 %R.H	TEST：OK
4	TEMPERATURE COEFFICIENT	± 0.05%/ (0℃~50℃)	I/P： 230 VAC O/P：FULL LOAD	± 0.0068%/℃(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 C115 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) 143102.6HRS (2) 28264.2HRS (3) 73735.4HRS (4) 126824.9HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 172.5K hrs min. Telcordia SR-332 (Bellcore) ; 47.5K 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

2020.10.1 TAG-QA-009