



# Test Report: ENC-120-24

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120W Desktop Single Output 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

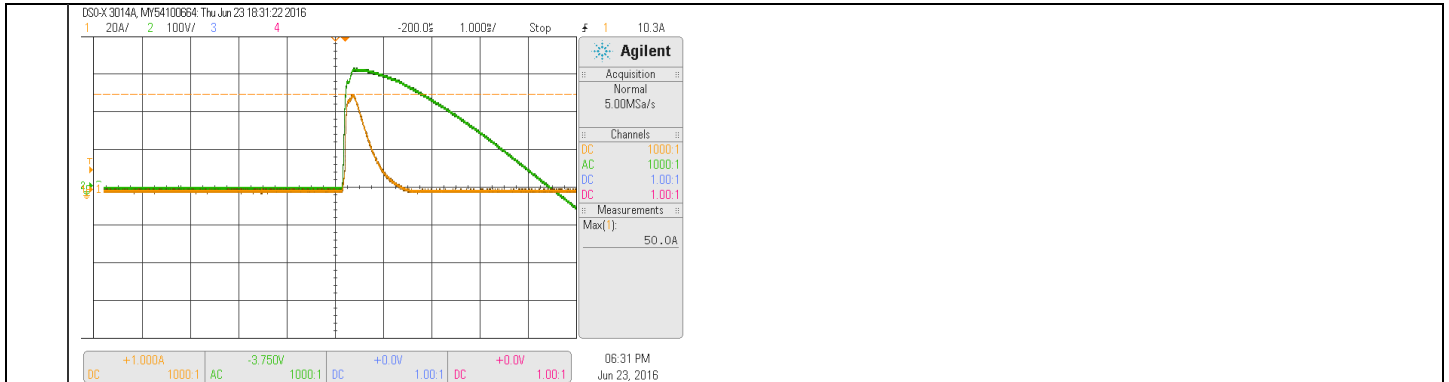
## DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BOOST CHARGE VOLTAGE	28.8V±0.4V	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	28.814V
2	FLOAT CHARGE VOLTAGE	27.6V±0.4V	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	27.658V
3	OUTPUT CURRENT	4A±0.2A	I/P: 230 VAC O/P:C.V MODE-2V Ta:25°C	4.09A
4	LEAKAGE CURRENT FROM BATTERY (TYP)	<1mA	I/P: AC OFF O/P:BAT. LOAD Ta:25°C	260 μA

### INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~264VAC	I/P:TESTING O/P:BAT. LOAD Ta:25°C	60V~ 264 V
			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: 100 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK
3	LEAKAGE CURRENT	< 3.5 mA / 240VAC	I/P: 240 VAC O/P:Min LOAD Ta:25°C	L-FG: 0.66mA N-FG: 0.66mA
4	INPUT CURRENT (TYP)	230 V/ 0.63 A 115 V/ 1.25 A	I/P: 230 VAC I/P: 115 VAC O/P:BAT. LOAD Ta:25°C	I =0.564 A/ 230VAC I = 1.124A/ 115VAC
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°C	PF=0.975 / 230VAC PF=0.991 / 115VAC
6	EFFICIENCY (TYP)	90%	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	90.4%
7	INRUSH CURRENT (TYP)	230 V/ 65 A COLD START	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	I =50A/230VAC T50=480 us/230V
INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH1: Input current				

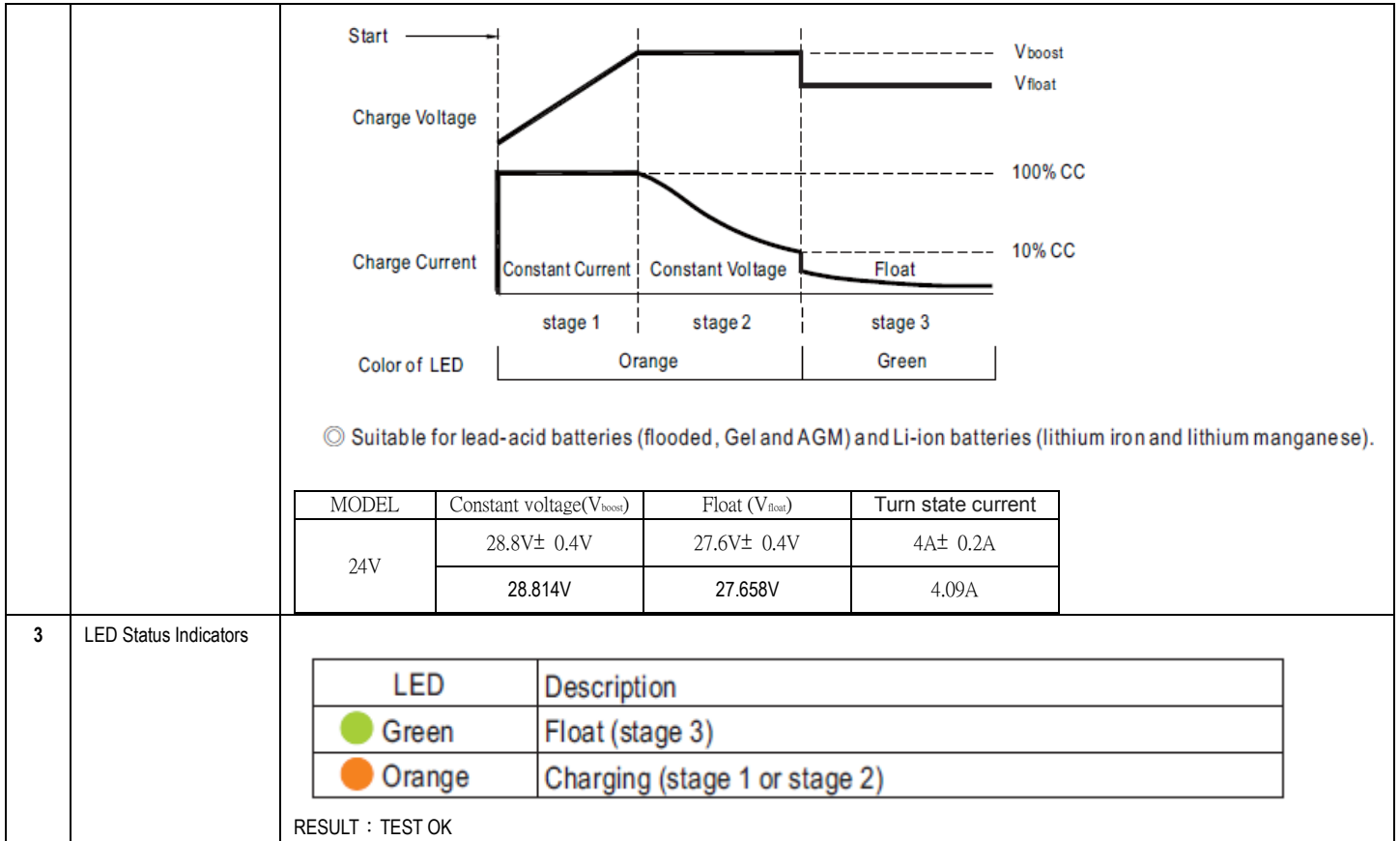


### PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER VOLTAGE PROTECTION	CH1:31V~36.5V PROTECTION TYPE : 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°C	31.2V/264VAC 31.2V/ 90VAC PROTECTION TYPE : Shut down and latch off o/p voltage, re-power on to recover
2	OVER TEMPERATURE PROTECTION	SPEC: NO DAMAGE  PROTECTION TYPE : Shut down O/P voltage, recovers automatically after temperature goes down	I/P: 264 VAC I/P: 90 VAC O/P:BAT. LOAD	O.T.P. Active PROTECTION TYPE : Shut down O/P voltage, recovers automatically after temperature goes down
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed	I/P: 264 VAC O/P: NO LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed
4	BATTERY REVERSE POLARITY	By internal fuse.	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	OK

### CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE COMPENSATION	Constant voltage point(V)		
		Ta=0°C	Ta=25°C	Ta=50°C
		29.7±0.4V	28.8±0.4V	27.9±0.4V
2	Charging curve	I/P:230Vac O/P:TESTING Ta:25°C		
		Constant voltage point(V)		
		Ta=0°C	Ta=25°C	Ta=50°C
		29.71V	28.71V	27.91V



### COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q2 Rated 12 A/800V	I/P:High-Line +3V = 267 V AC ON/OFF VDS : O/P: (1)CV=27.6V (2)OUTPUT SHORT (3)CV=27.6V continue  I/P:High-Line +3V = 97 V AC ON/OFF VDS : O/P: (1)CV=27.6V (2)OUTPUT SHORT (3)CV=27.6V continue  Ta:25°C	VDS : (1) 606V (2) 473V (3) 594V  VDS : (1) 509V (2) 397V (3) 481V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rated 20A/600V	I/P:High-Line +3V = 267 V AC ON/OFF VDS : O/P: (1)CV=27.6V (2)OUTPUT SHORT (3)CV=27.6V continue  I/P:High-Line +3V = 97 V AC ON/OFF VDS : O/P: (1)CV=27.6V	VDS : (1) 449V (2) 409V (3) 425V  VDS : (1) 365V

			(2)OUTPUT SHORT (3)CV=27.6V continue Ta:25°C	(2) 357V (3) 312V
3	P.F.C DIODE	D5 Rated 8A/600 V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)CV=27.6V (2)OUTPUT SHORT (3)CV=27.6V continue Ta:25°C	(1) 409V (2) 389V (3) 401V
4	Diode Peak Voltage	Q 100 Rated 150V30A	I/P:High-Line +3V = 267 V AC ON/OFF O/P: (1)CV=27.6V (2)OUTPUT SHORT (3)CV=27.6V continue Ta:25°C	(1) 103.5V (2) 71.3V (3) 100.3V (4) 97.9V
5	Clamp Diode Peak Voltage	D30 Rated 800V/2 A	I/P:High-Line +3V = 267 V O/P: (1)BAT. LOAD (2)Output Short Ta:25°C	(1) 568V (2) 403V
6	Input Capacitor Voltage	C 5 Rated 100 $\mu$ 400V105°C SURGE VOLTAGE:450V	I/P:High-Line +3V =267 V O/P: (1)CV=27.6V (2)OUTPUT SHORT (3)CV=27.6V continue Ta:25°C	(1) 403V (2) 391V (3) 395V
7	Control IC Voltage Test	PWM IC U1 Rate 20 V~10 V(MIN.)	I/P:High-Line +3V =267 V O/P: (1)CV=27.6V (2)OUTPUT SHORT (3)CV=27.6V continue Ta:25°C	(1) 18.8V (2) 14.7V (3) 18.6V

## 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°C	I/P-O/P: 5.12mA I/P-FG: 4.06mA O/P-FG: 5.72mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100M $\Omega$ I/P-FG: 500VDC>100M $\Omega$ O/P-FG:500VDC>100M $\Omega$	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P:12.8 G $\Omega$ I/P-FG:6.14 G $\Omega$ O/P-FG:30G $\Omega$ NO DAMAGE
3	GROUNDING CONTINUITY	EN 60950-1 FG(PE) TO CHASSIS OR TRACE < 100 m $\Omega$	40A / 2min Ta:25°C	15m $\Omega$

### E.M.C TEST

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

2	CONDUCTION	EN55022 CLASS B	I/P: 230 VAC (50HZ) O/P: FULL/50% LOAD Ta: 25°C	PASS Test by certified Lab
3	RADIATION	EN55022 CLASS B	I/P: 230VAC/50HZ O/P: FULL LOAD Ta: 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR: 8KV / Contact: 4KV	I/P: 230VAC/50HZ O/P: FULL LOAD Ta: 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT: 1KV	I/P: 230VAC/50HZ O/P: FULL LOAD Ta: 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 LIGHT INDUSTRY L-N : 1KV L,N-PE: 2KV	I/P: 230VAC/50HZ O/P: FULL LOAD Ta: 25°C	CRITERIA A

## RELIABILITY TEST

### ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																												
1	TEMPERATURE RISE TEST	MODEL : ENC-120-12 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta= 32.5 °C 2. HIGH AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta= 49.2 °C																																																																														
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 32.5 °C</th> <th>HIGH AMBIENT Ta= 49.2 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>54.7°C</td><td>70.3°C</td></tr> <tr><td>2</td><td>ZR1</td><td>54.0°C</td><td>69.0°C</td></tr> <tr><td>3</td><td>BD1</td><td>70.2°C</td><td>85.6°C</td></tr> <tr><td>4</td><td>L1</td><td>59.5°C</td><td>75.6°C</td></tr> <tr><td>5</td><td>L2</td><td>62.8°C</td><td>78.8°C</td></tr> <tr><td>6</td><td>Q1</td><td>87.2°C</td><td>107.2°C</td></tr> <tr><td>7</td><td>Q2</td><td>87.0°C</td><td>106.9°C</td></tr> <tr><td>8</td><td>D5</td><td>85.3°C</td><td>104.9°C</td></tr> <tr><td>9</td><td>C5</td><td>65.9°C</td><td>82.2°C</td></tr> <tr><td>10</td><td>U1</td><td>60.0°C</td><td>76.5°C</td></tr> <tr><td>11</td><td>D30</td><td>105.3°C</td><td>125.7°C</td></tr> <tr><td>12</td><td>T1</td><td>92.5°C</td><td>111.0°C</td></tr> <tr><td>13</td><td>C52</td><td>83.4°C</td><td>96.4°C</td></tr> <tr><td>14</td><td>Q100</td><td>82.8°C</td><td>100.2°C</td></tr> <tr><td>15</td><td>C108</td><td>77.8°C</td><td>94.7°C</td></tr> <tr><td>16</td><td>LF100</td><td>67.8°C</td><td>84.6°C</td></tr> <tr><td>17</td><td>RT1</td><td>67.8°C</td><td>83.9°C</td></tr> <tr><td>18</td><td>TSW1</td><td>79.2°C</td><td>97.7°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 32.5 °C	HIGH AMBIENT Ta= 49.2 °C	1	LF1	54.7°C	70.3°C	2	ZR1	54.0°C	69.0°C	3	BD1	70.2°C	85.6°C	4	L1	59.5°C	75.6°C	5	L2	62.8°C	78.8°C	6	Q1	87.2°C	107.2°C	7	Q2	87.0°C	106.9°C	8	D5	85.3°C	104.9°C	9	C5	65.9°C	82.2°C	10	U1	60.0°C	76.5°C	11	D30	105.3°C	125.7°C	12	T1	92.5°C	111.0°C	13	C52	83.4°C	96.4°C	14	Q100	82.8°C	100.2°C	15	C108	77.8°C	94.7°C	16	LF100	67.8°C	84.6°C	17	RT1	67.8°C	83.9°C	18	TSW1	79.2°C	97.7°C
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC O/P : 100 % LOAD Ta= -35°C	TEST : OK																																																																												



3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK
4	TEMPERATURE COEFFICIENT	± 0.05 %/°C (0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0 %/°C (0~50°C)
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		OK
6	THERMAL SHOCK TEST	1. Thermal shock Temperature : -35°C ~ +55°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 : 230VAC/Full Load AC ON/OFF TEST turn on 58sec ; turn off 2sec		OK
7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 3G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C		TEST : OK
8	CAPACITOR LIFE CYCLE	SUPPOSE C108 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 50 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 50 °C LIFE TIME		(1) 146404HRS (2) 22040HRS (3) 64321HRS (4) 143471HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 1726.4K hrs min. Telcordia SR-332 (Bellcore) ; 206.1K hrs min. MIL-HDBK-217F (25°C)		
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 50°C		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT ZENG

12.10.30 A50-F031