



# Test Report: ENC-360-12

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360W Programmable Desktop Type 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

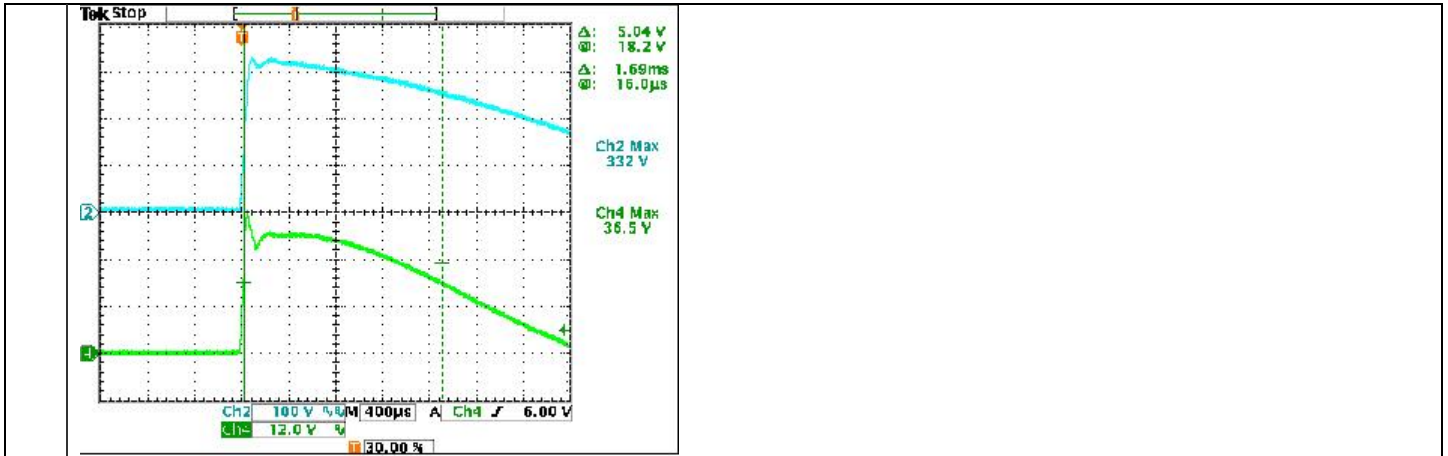
## ■ DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BOOST CHARGE VOLTAGE	14.4V±0.2V	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	14.361V
2	FLOAT CHARGE VOLTAGE	13.8V±0.2V	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	13.773V
3	OUTPUT CURRENT	24A±2.4A	I/P: 230 VAC O/P:C.V MODE-2V Ta:25°C	23.2A
4	LEAKAGE CURRENT FROM BATTERY (TYP)	<1mA	I/P: AC OFF O/P:BAT. LOAD Ta:25°C	510 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	55V~ 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: 0.8 mA N-FG: 0.8 mA
4	INPUT CURRENT (TYP)	230 V/ 1.9 A 115 V/ 3.8 A	I/P: 230 VAC I/P: 115 VAC O/P:BAT. LOAD Ta:25°C	I = 1.56 A/ 230VAC I = 3.17 A/ 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= 0.984/ 230VAC PF= 0.998/ 115VAC
6	EFFICIENCY (TYP)	91%	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	92.76%
7	INRUSH CURRENT (TYP)	230 V/ 80 A COLD START	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	I = 36.5 A/230VAC T50= 1690 us/230V
				INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH1: Input current (1V=1A)

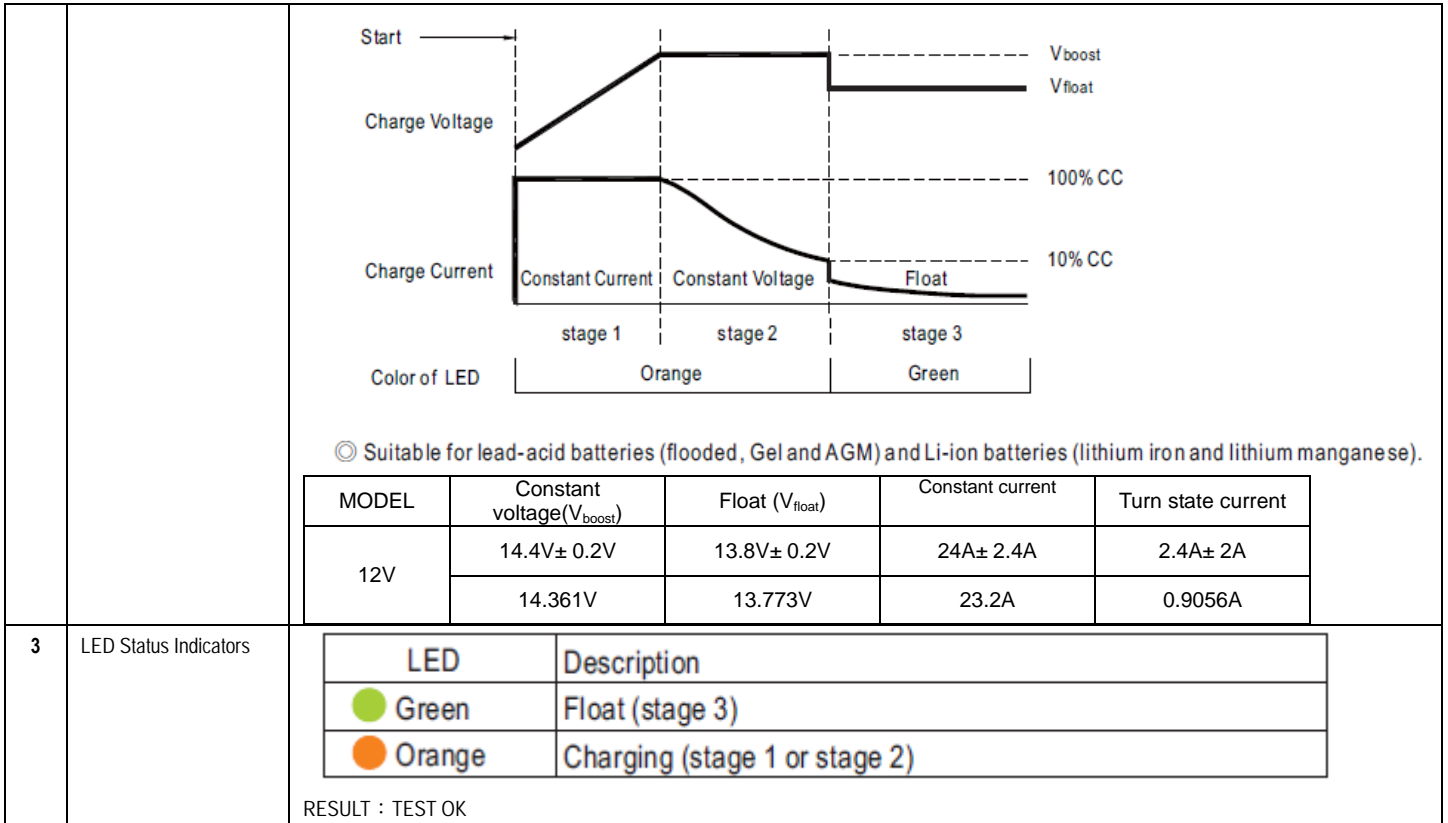


**PROTECTION FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER VOLTAGE PROTECTION	CH1:15.5-18.2V 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	16.01 V/264VAC 16.1V/ 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 : Shut down O/P voltage, re-power on to recover	I/P: 264 VAC O/P: NO LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Shut down O/P voltage, re-power on to recover
4	BATTERY REVERSE POLARITY	By internal fuse.	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	Fuse open

**CONTROL FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT				
1	TEMPERATURE COMPENSATION	Constant voltage point(V)			I/P: 230 VAC O/P:NO . LOAD Ta:25°C	Constant voltage point(V)		
		Ta=0°C	Ta=25°C	Ta=50°C		Ta=0°C	Ta=25°C	Ta=50°C
		14.8±0.2V	14.4±0.2V	13.9±0.2V		14.82V	14.38V	13.93V
2	Charging curve	I/P:230Vac O/P:TESTING Ta:25°C						



**COMPONENT STRESS TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	Power Transistor (D to S) or (C to E) <b>Peak Voltage</b>	Q 902 Rated 22A/600 V	I/P: High-Line +3V = 267 V AC ON/OFF VDS : O/P: (1)CV=13.8V (2)OUTPUT SHORT (3)CV=13.8V continue VGS: (1)CV=13.8V (2)OUTPUT SHORT (3)CV=13.8V continue  I/P: High-Line +3V = 97 V AC ON/OFF VDS : O/P: (1)CV=13.8V (2)OUTPUT SHORT (3)CV=13.8V continue VGS: (1)CV=13.8V (2)OUTPUT SHORT (3)CV=13.8V continue  Ta:25°C	VDS: (1) 419V (2) 484V (3) 427V  VGS: (1) 15.9V (2) 15.5V (3) 15.5V  VDS: (1) 419V (2) 425V (3) 427V  VGS: (1) 15.5V (2) 15.07V (3) 15.5V
2	P.F.C Transistor (D to S) or (C to E) <b>Peak Voltage</b>	Q 1 Rated 26 A/600 V	I/P: High-Line +3V = 267 V AC ON/OFF VDS : O/P: (1)CV=13.8V	VDS: (1) 456V (2) 375V

			<p>(2)OUTPUT SHORT (3)CV=13.8V continue</p> <p>VGS: (1)CV=13.8V (2)OUTPUT SHORT (3)CV=13.8V continue</p> <p>I/P:High-Line -3V = 97 V AC ON/OFF VDS : O/P: (1)CV=13.8V (2)OUTPUT SHORT (3)CV=13.8V continue</p> <p>VGS: (1)CV=13.8V (2)OUTPUT SHORT (3)CV=13.8V continue</p> <p>Ta:25°C</p>	<p>(3)452V</p> <p>VGS: (1)15.9V (2)15.07V (3)15.7V</p> <p>VDS: (1)536V (2)134V (3)500V</p> <p>VGS: (1)16.7V (2)16.9V (3)16.3V</p>												
3	P.F.C DIODE	D1 Rated 600V 15A	<p>I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)CV=13.8V (2)OUTPUT SHORT (3)CV=13.8V continue</p> <p>Ta:25°C</p>	<p>D1: (1)452V (2)432V (3)464V</p>												
4	Diode Peak Voltage	<p>Q 100 Rated 120 A/ 60V</p> <p>Q101 Rated 120 A/ 60V</p>	<p>I/P:High-Line +3V = 267 V AC ON/OFF O/P: (1)CV=13.8V (2)OUTPUT SHORT (3)CV=13.8V continue (4) NO LOAD</p> <p>Ta:25°C</p>	<table border="0"> <tr> <td>Q100:</td> <td>Q101:</td> </tr> <tr> <td>VDS:</td> <td>VDS:</td> </tr> <tr> <td>(1)36V</td> <td>(1)37.6V</td> </tr> <tr> <td>(2)14.7V</td> <td>(2)9.4V</td> </tr> <tr> <td>(3)36V</td> <td>(3)36.9V</td> </tr> <tr> <td>(4)30.4V</td> <td>(4)32V</td> </tr> </table>	Q100:	Q101:	VDS:	VDS:	(1)36V	(1)37.6V	(2)14.7V	(2)9.4V	(3)36V	(3)36.9V	(4)30.4V	(4)32V
Q100:	Q101:															
VDS:	VDS:															
(1)36V	(1)37.6V															
(2)14.7V	(2)9.4V															
(3)36V	(3)36.9V															
(4)30.4V	(4)32V															
6	Input Capacitor Voltage	C 5 Rated 150 μ F/420V 105°C	<p>I/P:High-Line +3V =267 V O/P: (1)CV=13.8V (2)OUTPUT SHORT (3)CV=13.8V continue</p> <p>Ta:25°C</p>	<p>(1)420V (2) 419V (3)420 V</p>												
7	Control IC Voltage Test	<p>PFC IC U1 Rated 20V-9.75V(MIN.)</p> <p>PWM IC U901 Rated 20V-10V(MIN.)</p>	<p>I/P:High-Line +3V =267 V O/P: (1)CV=13.8V (2)OUTPUT SHORT (3)CV=13.8V continue</p> <p>Ta:25°C</p>	<p>(1) 18.8V (2) 9.5V (3) 19.2V</p> <p>(1) 19.6V (2) 16.9V (3) 17.62V</p>												

## 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:8.4 mA I/P-FG: 5.72 mA O/P-FG:3.93mA 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: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P:13.4 G Ω I/P-FG: 5.56GΩ O/P-FG: 30G Ω NO DAMAGE
3.	GROUNDING CONTINUITY	EN 60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	25mΩ

### 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-360-12 1. ROOM AMBIENT BURN-IN : HRS I/P : 230VAC O/P : FULL LOAD Ta= 31.8 °C 2. HIGH AMBIENT BURN-IN : HRS I/P : 230VAC O/P : FULL LOAD Ta= 52.6 °C		

		NO	Position	ROOM AMBIENT Ta=31.8°C	HIGH AMBIENT Ta= 52.6°C
		1	BD1	67.4°C	91.3°C
		2	C1	59.0°C	80.6°C
		3	LF1	61.5°C	84.5°C
		4	LF2	65.7°C	86.8°C
		5	C10	68.1°C	88.8°C
		6	C48	68.6°C	88.8°C
		7	RY1	82.8°C	91.7°C
		8	RT2	64.2°C	83.2°C
		9	PCB	63.9°C	81.9°C
		10	C58	63.9°C	80.0°C
		11	L1	69.3°C	89.8°C
		12	Q2	66.1°C	87.0°C
		13	D1	65.9°C	87.6°C
		14	C5	65.4°C	88.1°C
		15	Q901	65.1°C	87.0°C
		16	C90	70.1°C	91.2°C
		17	C42	68.6°C	89.4°C
		18	C44	65.4°C	87.7°C
		19	C43	70.1°C	90.9°C
		20	T1-1	92.7°C	98.5°C
		21	T1-2	96.5°C	103.5°C
		22	TSW1	65.0°C	87.2°C
		23	U1	63.9°C	84.8°C
		24	U901	64.2°C	87.1°C
		25	C202	69.5°C	89.2°C
		26	Q100	75.5°C	97.6°C
		27	C105	85.4°C	91.3°C
		28	FS10	93.8°C	104.3°C
2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR		I/P : 264VAC/100VAC O/P : 100 % LOAD Ta= -30 °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	± 0.03 %/°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 : 16 CYCLE 5. Input/Output condition : 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test			OK



7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10-500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 2G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK
8	CAPACITOR LIFE CYCLE	SUPPOSE C105 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) 64480HRS (2) 32085HRS (3) 49040HRS (4) 135705HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 138.7K 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 TSENG

12.10.30 A50-F031