



# Test Report: ENC-180-48

---

180W 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

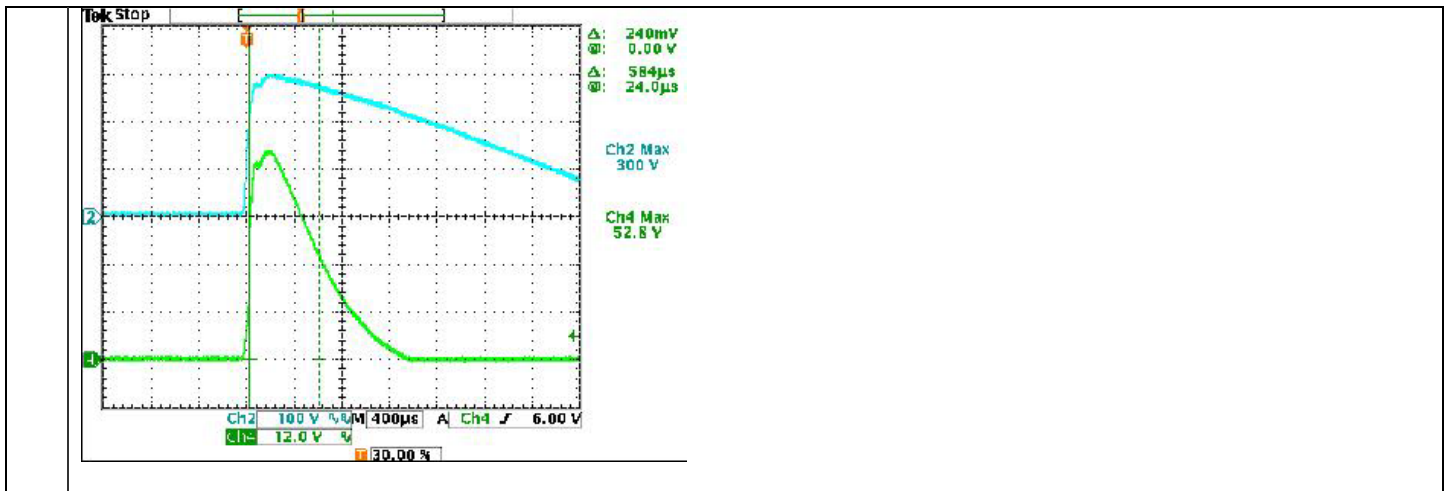
## DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BOOST CHARGE VOLTAGE	57.6V±0.8V	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	57.66V
2	FLOAT CHARGE VOLTAGE	55.2V±0.8V	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	55.28 V
3	OUTPUT CURRENT	3A±0.3A	I/P: 230 VAC O/P:C.V MODE-2V Ta:25°C	3.07A
4	LEAKAGE CURRENT FROM BATTERY (TYP)	<1mA	I/P: AC OFF O/P:BAT. LOAD Ta:25°C	270 $\mu$ A

### 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	75V~ 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: 0.9 mA N-FG: 0.9 mA
4	INPUT CURRENT (TYP)	230 V/ 0.95 A 115 V/ 1.9 A	I/P: 230 VAC I/P: 115 VAC O/P:BAT. LOAD Ta:25°C	I = 0.84A/ 230VAC I = 1.67A/ 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= 0.963/ 230VAC PF= 0.992 / 115VAC
6	EFFICIENCY (TYP)	93%	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	93.45%
7	INRUSH CURRENT (TYP)	230 V/ 70 A COLD START	I/P: 230 VAC O/P:BAT. LOAD Ta:25°C	I = 52.8A/230VAC T50= 584 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	CH1:62.1~72.9V 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	63.95 V/230VAC 64.05 V/ 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)			Constant voltage point(V)		
		Ta=0°C	Ta=25°C	Ta=50°C	Ta=0°C	Ta=25°C	Ta=50°C
		59.3±0.8V	57.6±0.8V	55.8±0.8V	59.44V	57.66V	55.84V
2	Charging curve	I/P:230Vac O/P:TESTING Ta:25°C					

	<p>Start →</p> <p>Charge Voltage: <math>V_{boost}</math>, <math>V_{float}</math></p> <p>Charge Current: 100% CC, 10% CC</p> <p>Color of LED: Orange (stage 1), Green (stage 3)</p> <p>© Suitable for lead-acid batteries (flooded, Gel and AGM) and Li-ion batteries (lithium iron and lithium manganese).</p> <table border="1"> <thead> <tr> <th>MODEL</th> <th>Constant voltage(<math>V_{boost}</math>)</th> <th>Float (<math>V_{float}</math>)</th> <th>Constant current</th> <th>Turn state current</th> </tr> </thead> <tbody> <tr> <td rowspan="2">48V</td> <td><math>57.6V \pm 0.8V</math></td> <td><math>55.2V \pm 0.8V</math></td> <td><math>3A \pm 0.3A</math></td> <td><math>0.3A \pm 0.2A</math></td> </tr> <tr> <td>57.66V</td> <td>55.28V</td> <td>3.07A</td> <td>0.21A</td> </tr> </tbody> </table>	MODEL	Constant voltage( $V_{boost}$ )	Float ( $V_{float}$ )	Constant current	Turn state current	48V	$57.6V \pm 0.8V$	$55.2V \pm 0.8V$	$3A \pm 0.3A$	$0.3A \pm 0.2A$	57.66V	55.28V	3.07A	0.21A
MODEL	Constant voltage( $V_{boost}$ )	Float ( $V_{float}$ )	Constant current	Turn state current											
48V	$57.6V \pm 0.8V$	$55.2V \pm 0.8V$	$3A \pm 0.3A$	$0.3A \pm 0.2A$											
	57.66V	55.28V	3.07A	0.21A											
<p>3 LED Status Indicators</p>	<table border="1"> <thead> <tr> <th>LED</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td><span style="color: green;">●</span> Green</td> <td>Float (stage 3)</td> </tr> <tr> <td><span style="color: orange;">●</span> Orange</td> <td>Charging (stage 1 or stage 2)</td> </tr> </tbody> </table> <p>RESULT : TEST OK</p>	LED	Description	<span style="color: green;">●</span> Green	Float (stage 3)	<span style="color: orange;">●</span> Orange	Charging (stage 1 or stage 2)								
LED	Description														
<span style="color: green;">●</span> Green	Float (stage 3)														
<span style="color: orange;">●</span> Orange	Charging (stage 1 or stage 2)														

## COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q902 Rated 500V/12A	I/P: High-Line +3V = 267 V AC ON/OFF VDS : O/P: (1) CV=55.2V (2) OUTPUT SHORT (3) CV=55.2V continue I/P: High-Line +3V = 97 V AC ON/OFF VDS : O/P: (1) CV=55.2V (2) OUTPUT SHORT (3) CV=55.2V continue Ta: 25°C	VDS : (1) 469V (2) 469V (3) 429V  VDS : (1) 481V (2) 465V (3) 441V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rated 600V/18A	I/P: High-Line +3V = 267 V AC ON/OFF VDS : O/P: (1) CV=55.2V (2) OUTPUT SHORT (3) CV=55.2V continue I/P: High-Line +3V = 97 V AC ON/OFF VDS : O/P: (1) CV=55.2V (2) OUTPUT SHORT (3) CV=55.2V continue Ta: 25°C	VDS : (1) 537V (2) 421V (3) 465V  VDS : (1) 517V (2) 445V (3) 517V
3	P.F.C DIODE	D1 Rated 8A/600V	I/P: High-Line +3V = 267 V AC ON/OFF O/P: (1) CV=55.2V	(1) 493V (2) 461V (3) 425V

			(2)OUTPUT SHORT (3)CV=55.2V continue  Ta:25°C	
4	Diode Peak Voltage	Q 100 Rated 150V/30A Q101 Rated 150V/30A	I/P:High-Line +3V = 267 V AC ON/OFF O/P: (1)CV=55.2V (2)OUTPUT SHORT (3)CV=55.2V continue (4) NO LOAD Ta:25°C	Q100:      Q101: (1) 126.7V    (1) 126.7V (2) 14.2V     (2) 17.4V (3) 121.1V    (3) 121.9V (4) 120.3V    (4) 120.3V
6	Input Capacitor Voltage	C 5 Rated 150uF/420V	I/P:High-Line +3V =267 V O/P: (1)CV=55.2V (2)OUTPUT SHORT (3)CV=55.2V continue Ta:25°C	(1) 420V (2) 408V (3) 417V
7	Control IC Voltage Test	PWM IC U1 Rated 9.5V~ 28V  PWM IC U901 Rated 10V~20V	I/P:High-Line +3V =267 V O/P: (1)CV=55.2V (2)OUTPUT SHORT (3)CV=55.2V continue Ta:25°C	U1:            U901: (1) 17.8V    (1) 16.6V (2) 17.6V    (2) 16.6V (3) 17V       (3) 16.8V (4) 17V       (4) 16.6V

## 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: 6.49 mA I/P-FG: 5.97 mA O/P-FG: 5.69 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: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P: 13.3 G Ω I/P-FG: 6.77GΩ 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-180-12 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 25 °C 2. HIGH AMBIENT BURN-IN : 1.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 50 °C																																																																																																																		
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 25 °C</th> <th>HIGH AMBIENT Ta= 50 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>V1</td><td>13.80V</td><td>13.89V</td></tr> <tr><td>2</td><td>Io</td><td>12.650A</td><td>12.770A</td></tr> <tr><td>3</td><td>C1</td><td>43.6°C</td><td>66.5°C</td></tr> <tr><td>4</td><td>ZR1</td><td>40.7°C</td><td>63.5°C</td></tr> <tr><td>5</td><td>RT1</td><td>66.9°C</td><td>87.8°C</td></tr> <tr><td>6</td><td>LF1</td><td>48.2°C</td><td>70.3°C</td></tr> <tr><td>7</td><td>LF2</td><td>49.3°C</td><td>71.0°C</td></tr> <tr><td>8</td><td>BD1</td><td>47.8°C</td><td>68.2°C</td></tr> <tr><td>9</td><td>C11</td><td>47.3°C</td><td>69.5°C</td></tr> <tr><td>10</td><td>L2</td><td>45.7°C</td><td>68.3°C</td></tr> <tr><td>11</td><td>L1</td><td>53.2°C</td><td>75.7°C</td></tr> <tr><td>12</td><td>Q1</td><td>45.6°C</td><td>69.6°C</td></tr> <tr><td>13</td><td>D1</td><td>46.0°C</td><td>70.2°C</td></tr> <tr><td>14</td><td>C5</td><td>49.6°C</td><td>71.9°C</td></tr> <tr><td>15</td><td>Q902</td><td>47.5°C</td><td>71.8°C</td></tr> <tr><td>16</td><td>C90</td><td>56.7°C</td><td>79.0°C</td></tr> <tr><td>17</td><td>C42</td><td>54.6°C</td><td>76.8°C</td></tr> <tr><td>18</td><td>C44</td><td>54.7°C</td><td>77.3°C</td></tr> <tr><td>19</td><td>T1-1</td><td>78.3°C</td><td>100.5°C</td></tr> <tr><td>20</td><td>T1-2</td><td>75.4°C</td><td>97.8°C</td></tr> <tr><td>21</td><td>C202</td><td>51.2°C</td><td>74.1°C</td></tr> <tr><td>22</td><td>Q101</td><td>52.7°C</td><td>76.3°C</td></tr> <tr><td>23</td><td>U1</td><td>48.5°C</td><td>71.0°C</td></tr> <tr><td>24</td><td>C109</td><td>58.8°C</td><td>82.8°C</td></tr> <tr><td>25</td><td>TSW1</td><td>45.3°C</td><td>69.1°C</td></tr> <tr><td>26</td><td>PCB</td><td>57.7°C</td><td>77.8°C</td></tr> <tr><td>27</td><td>U901</td><td>56.8°C</td><td>79.3°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 25 °C	HIGH AMBIENT Ta= 50 °C	1	V1	13.80V	13.89V	2	Io	12.650A	12.770A	3	C1	43.6°C	66.5°C	4	ZR1	40.7°C	63.5°C	5	RT1	66.9°C	87.8°C	6	LF1	48.2°C	70.3°C	7	LF2	49.3°C	71.0°C	8	BD1	47.8°C	68.2°C	9	C11	47.3°C	69.5°C	10	L2	45.7°C	68.3°C	11	L1	53.2°C	75.7°C	12	Q1	45.6°C	69.6°C	13	D1	46.0°C	70.2°C	14	C5	49.6°C	71.9°C	15	Q902	47.5°C	71.8°C	16	C90	56.7°C	79.0°C	17	C42	54.6°C	76.8°C	18	C44	54.7°C	77.3°C	19	T1-1	78.3°C	100.5°C	20	T1-2	75.4°C	97.8°C	21	C202	51.2°C	74.1°C	22	Q101	52.7°C	76.3°C	23	U1	48.5°C	71.0°C	24	C109	58.8°C	82.8°C	25	TSW1	45.3°C	69.1°C	26	PCB	57.7°C	77.8°C	27	U901	56.8°C	79.3°C
NO	Position	ROOM AMBIENT Ta= 25 °C	HIGH AMBIENT Ta= 50 °C																																																																																																																	
1	V1	13.80V	13.89V																																																																																																																	
2	Io	12.650A	12.770A																																																																																																																	
3	C1	43.6°C	66.5°C																																																																																																																	
4	ZR1	40.7°C	63.5°C																																																																																																																	
5	RT1	66.9°C	87.8°C																																																																																																																	
6	LF1	48.2°C	70.3°C																																																																																																																	
7	LF2	49.3°C	71.0°C																																																																																																																	
8	BD1	47.8°C	68.2°C																																																																																																																	
9	C11	47.3°C	69.5°C																																																																																																																	
10	L2	45.7°C	68.3°C																																																																																																																	
11	L1	53.2°C	75.7°C																																																																																																																	
12	Q1	45.6°C	69.6°C																																																																																																																	
13	D1	46.0°C	70.2°C																																																																																																																	
14	C5	49.6°C	71.9°C																																																																																																																	
15	Q902	47.5°C	71.8°C																																																																																																																	
16	C90	56.7°C	79.0°C																																																																																																																	
17	C42	54.6°C	76.8°C																																																																																																																	
18	C44	54.7°C	77.3°C																																																																																																																	
19	T1-1	78.3°C	100.5°C																																																																																																																	
20	T1-2	75.4°C	97.8°C																																																																																																																	
21	C202	51.2°C	74.1°C																																																																																																																	
22	Q101	52.7°C	76.3°C																																																																																																																	
23	U1	48.5°C	71.0°C																																																																																																																	
24	C109	58.8°C	82.8°C																																																																																																																	
25	TSW1	45.3°C	69.1°C																																																																																																																	
26	PCB	57.7°C	77.8°C																																																																																																																	
27	U901	56.8°C	79.3°C																																																																																																																	

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	± 0.027 %/°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 C109 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) 336391HRS (2) 65937HRS (3) 134946HRS (4) 239512HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 1445.6K hrs min. Telcordia SR-332 (Bellcore) ; 155.9K 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