



# Test Report: GC160A24

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160W Single Output Battery Charger

## ■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection 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	VERDICT
1	DC VOLTAGE (Typ.)	27.2V	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	26.92 V /230V 26.92 V /115V	P
2	CONTINUOUS OUTPUT CURRENT (Typ.)	5.89A	I/P : 230 VAC I/P : 115 VAC O/P : CV=26V Ta : 25°C	6.09 A /230V 6.07 A /115V	P
3	LED INDICATOR	Charging(CC) : RED Floating charging(CC) : GREEN	I/P : 230 VAC O/P : setting Ta : 25°C	> 0.759 A,LED :RED < 0.744 A,LED :GREEN	P

**INPUT FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	90VAC~264 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C  I/P : LOW-LINE-3V= 87 V HIGH-LINE+15%=300 V O/P : FULL/MIN LOAD ON : 30 Sec. OFF : 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE)	62 V~264V  TEST : OK	P
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE OSC	I/P : 90 VAC ~ 264 VAC O/P : FULL-MIN LOAD Ta : 25°C	TEST : OK	P
3	POWER FACTOR	0.95 / 230 VAC(TYP) 0.98 / 115 VAC(TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.955 / 230 VAC PF= 0.996 / 115 VAC	P
4	EFFICIENCY	92.5 % (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	93.837 %	P
5	INPUT CURRENT	230V/ 1 A (TYP) 115V/ 1.85 A (TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I = 0.77 A / 230 VAC I = 1.51 A / 115 VAC	P
6	INRUSH CURRENT	230V/ 120 A (TYP)  COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I = 105 A / 230 VAC	P
7	LEAKAGE CURRENT	< 0.75 mA / 240 VAC	I/P : 264 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.22 mA N-FG : 0.22 mA	P
8	No load consumption	< 1 W	I/P : 230 VAC I/P : 115VAC O/P : MIN LOAD Ta : 25°C	<0.43 W/230V <0.46 W/115V	P

### PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	90 %~ 110 %	I/P : 230 VAC I/P : 115 VAC O/P : TESTING Ta : 25°C	103%/ 230 VAC 103%/ 115 VAC Constant current limiting recovers automatically after fault condition is removed	P
2	OVER VOLTAGE PROTECTION	CH1 : 28.56 V~ 36.72 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	33.73V/ 230 VAC 33.74V/ 115 VAC Shut down o/p voltage, re-power on to recover	P
3	OVER TEMPERATURE PROTECTION	SPEC : RTH2 : 90 ± 10°C O.T.P. NO DAMAGE	I/P : 230 VAC O/P : FULL LOAD	O.T.P. Active Shut down o/p voltage, re-power on to recover	P
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P : 264 VAC O/P : FULL LOAD Ta : 25°C	NO DAMAGE Hiccup mode	P

### COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor ( D to S ) or ( C to E ) Peak Voltage	Q 6 Rated : STF13NM50N 12A/500V	I/P : High-Line +3V = 267 V O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	(1) 458 V (2) 436 V (3) 402 V	P
2	Diode Peak Voltage	D101 Rated : STPS30M100ST 30A/100V	I/P : High-Line +3V = 267 V O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	(1) 58.8 V (2) 7.92 V (3) 58.4 V	P
3	Input Capacitor Voltage	C 5 Rated : 150µ/420V 105°C KMG	I/P : High-Line +3V = 267 V O/P : (1) Full Load Turn on /Off (2) Min load Turn on /Off (3) Full Load /Min load Change Ta : 25°C	(1) 382.5 V (2) 396.7 V (3) 396.8 V	P
4	Control IC Voltage Test	U 1 Rated : NCP1605DR2G 10V~20V	I/P : High-Line +3V = 267 V O/P : (1) Full Load Turn on /Off (2) Min load Turn on /Off (3) Full Load /Min load Change Ta : 25°C	(1) 13.684 V (2) 12.253 V (3) 12.253 V	P
5	Power Transistor ( D to S ) or ( C to E ) Peak Voltage	Q1 Rated : STF21NM60N 17A/600V	I/P : High-Line +3V = 267 V O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	(1) 486 V (2) 434 V (3) 436 V	P

**■ SAFETY & E.M.C. TEST**
**SAFETY TEST**

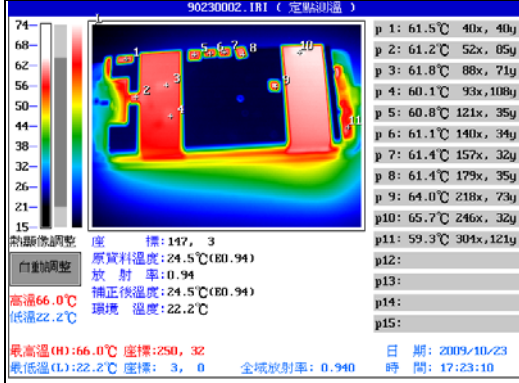
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P : KVAC/min	I/P-O/P : 3.6 KVAC/min Ta : 25°C	I/P-O/P : 4.10 mA NO DAMAGE	P
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ	I/P-O/P : 500 VDC Ta : 25°C/70%RH	I/P-O/P : 29.1 GΩ NO DAMAGE	P
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25°C / 70%RH	9 mΩ	P
4	APPROVAL	TUV : Certificate NO : S50178235 UL : File NO :			P

**E.M.C TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2,-3 CLASS A CLASS D	I/P : 220 /230/240VAC/50HZ O/P : FULL LOAD Ta : 25°C	PASS	P
2	CONDUCTION	EN55022 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab	P
3	RADIATION	EN55022 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab	P
4	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR : 8KV / Contact : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT : 1KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
6	SURGE	IEC61000-4-5 LIGHT INDUSTRY L-N : 1KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
7	Test by certified Lab & Test Report Prepare				

## RELIABILITY TEST

### ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT																																																																																					
1.	THERMO TRACER TEST (ROOM AMBIENT)	MODEL:GC160A-12 TEST CONDITION: 100VAC FULL LOAD ROOM AMBIENT = 26°C 	<table border="1"> <thead> <tr> <th>Position</th> <th>P/N</th> <th>Temp</th> <th>VERDICT</th> </tr> </thead> <tbody> <tr><td>P1</td><td>BD1</td><td>US6KB80R</td><td>61.5</td><td>PASS</td></tr> <tr><td>P2</td><td>LF2</td><td>TR-827</td><td>61.2</td><td>PASS</td></tr> <tr><td>P3</td><td>L2</td><td>TR-892</td><td>61.8</td><td>PASS</td></tr> <tr><td>P4</td><td>L1</td><td>TF-2101</td><td>60.1</td><td>PASS</td></tr> <tr><td>P5</td><td>Q1</td><td>STP16NM50N</td><td>60.8</td><td>PASS</td></tr> <tr><td>P6</td><td>D2</td><td>BYV29X-600</td><td>61.1</td><td>PASS</td></tr> <tr><td>P7</td><td>Q6</td><td>STP13NM50N</td><td>61.4</td><td>PASS</td></tr> <tr><td>P8</td><td>Q5</td><td>STP13NM50N</td><td>61.4</td><td>PASS</td></tr> <tr><td>P9</td><td>LF1</td><td>TR-889</td><td>64</td><td>PASS</td></tr> <tr><td>P10</td><td>D102</td><td>PFR40L45CT</td><td>65.7</td><td>PASS</td></tr> </tbody> </table>	Position	P/N	Temp	VERDICT	P1	BD1	US6KB80R	61.5	PASS	P2	LF2	TR-827	61.2	PASS	P3	L2	TR-892	61.8	PASS	P4	L1	TF-2101	60.1	PASS	P5	Q1	STP16NM50N	60.8	PASS	P6	D2	BYV29X-600	61.1	PASS	P7	Q6	STP13NM50N	61.4	PASS	P8	Q5	STP13NM50N	61.4	PASS	P9	LF1	TR-889	64	PASS	P10	D102	PFR40L45CT	65.7	PASS		P																															
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2	TEMPERATURE RISE TEST	MODEL : GC160A12 1. ROOM AMBIENT BURN-IN : 13.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 27.1 °C 2. HIGH AMBIENT BURN-IN : 96HRS I/P : 230VAC O/P : FULL LOAD Ta= 57.3°C	<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>P/N</th> <th>ROOM AMBIENT Ta= 27.1°C</th> <th>HIGH AMBIENT Ta= 57.3°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>L2</td><td>TR949</td><td>66.2°C</td><td>91.1°C</td></tr> <tr><td>2</td><td>BD1</td><td>6A/800V SILICON GBU608</td><td>67.0°C</td><td>92.0°C</td></tr> <tr><td>3</td><td>Q1</td><td>STF21NM60N 17A/600V TO220FP</td><td>67.8°C</td><td>93.1°C</td></tr> <tr><td>4</td><td>D2</td><td>BYV29X-600 7A/600V TO220F</td><td>68.0°C</td><td>93.5°C</td></tr> <tr><td>5</td><td>Q5</td><td>STF13NM50N 12A/500V TO220F</td><td>67.9°C</td><td>93.1°C</td></tr> <tr><td>6</td><td>L1</td><td>TF2101</td><td>66.8°C</td><td>91.8°C</td></tr> <tr><td>7</td><td>C902</td><td>220u/25V UL7Kh 8*11.5 KY</td><td>70.1°C</td><td>94.4°C</td></tr> <tr><td>8</td><td>RTH2</td><td>NTC 330KΩ 3Φ TTC3A334F4573EY 1%</td><td>68.8°C</td><td>93.8°C</td></tr> <tr><td>9</td><td>C101</td><td>2200u/16V UL10Kh 12.5*20 ZLH</td><td>79.3°C</td><td>104.1°C</td></tr> <tr><td>10</td><td>C102</td><td>1500u/16V UL10Kh 10*20 ZLH</td><td>79.0°C</td><td>104.1°C</td></tr> <tr><td>11</td><td>T1</td><td>TF2134</td><td>83.0°C</td><td>107.8°C</td></tr> <tr><td>12</td><td>D101</td><td>PFR40L45CT 40A/45V TO220</td><td>80.8°C</td><td>106.4°C</td></tr> <tr><td>13</td><td>U900</td><td>L6599AD SO-16N</td><td>65.9°C</td><td>90.6°C</td></tr> <tr><td>14</td><td>C11</td><td>474/450V 10% P=10 MEX</td><td>66.7°C</td><td>91.4°C</td></tr> <tr><td>15</td><td>C216</td><td>220u/35V UL8Kh 8*11.5 ZLH</td><td>72.8°C</td><td>98.0°C</td></tr> <tr><td>16</td><td>CASE</td><td>CASE</td><td>56.4°C</td><td>83.0°C</td></tr> </tbody> </table>	NO	Position	P/N	ROOM AMBIENT Ta= 27.1°C	HIGH AMBIENT Ta= 57.3°C	1	L2	TR949	66.2°C	91.1°C	2	BD1	6A/800V SILICON GBU608	67.0°C	92.0°C	3	Q1	STF21NM60N 17A/600V TO220FP	67.8°C	93.1°C	4	D2	BYV29X-600 7A/600V TO220F	68.0°C	93.5°C	5	Q5	STF13NM50N 12A/500V TO220F	67.9°C	93.1°C	6	L1	TF2101	66.8°C	91.8°C	7	C902	220u/25V UL7Kh 8*11.5 KY	70.1°C	94.4°C	8	RTH2	NTC 330KΩ 3Φ TTC3A334F4573EY 1%	68.8°C	93.8°C	9	C101	2200u/16V UL10Kh 12.5*20 ZLH	79.3°C	104.1°C	10	C102	1500u/16V UL10Kh 10*20 ZLH	79.0°C	104.1°C	11	T1	TF2134	83.0°C	107.8°C	12	D101	PFR40L45CT 40A/45V TO220	80.8°C	106.4°C	13	U900	L6599AD SO-16N	65.9°C	90.6°C	14	C11	474/450V 10% P=10 MEX	66.7°C	91.4°C	15	C216	220u/35V UL8Kh 8*11.5 ZLH	72.8°C	98.0°C	16	CASE	CASE	56.4°C	83.0°C		P
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3	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : O/P SHORT TEST Ta : 25°C	TEST : OK	P																																																																																					

4	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC O/P : CV=12V Ta= -30 °C	TEST : OK	P
5	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 : CV=12V Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK	P
6	TEMPERATURE COEFFICIENT	± 0.03 %(0-50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.01 %(0-50°C)	P
7	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	P
8.	THERMAL SHOCK TEST	1. Thermal shock Temperature : -30°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 turn on 58 sec ; turn off 2 sec		OK	P
9	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10-500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 2G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C		TEST : OK	P
10	CAPACITOR LIFE CYCLE	GC160A24:SUPPOSE C101 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		(1) 81753 HRS (2) 21063 HRS	P
11	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE : 274.1K HRS			P

DATE	SAMPLE	TEST RESULT	TESTER	APPROVAL
2010/3/11	RD SAMPLE	PASS	SANFORD SU	VINCENT TSENG
2010/4/2	PRODUCT SAMPLE	PASS	SANFORD SU	VINCENT TSENG
2010/5/5	PRODUCT SAMPLE W1004A24	PASS	SANFORD SU	VINCENT TSENG

2003/12/12 A50-F023