Test Report: HBG-160-48

160W Single Output Switching Power Supply

■ 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	RIPPLE & NOISE	V1：300 mVp-p (Max)	I/P： 230VAC O/P：FULL LOAD Ta：25℃	V1： 45 mVp-p (Max)	P
2	CONSTANT CURRENT REGION	CH1： 28.8 V ~ 48 V	I/P： 230VAC O/P：CV MODE Ta：25℃	O/P= 28.8V： 3.312 A O/P= 48 V： 3.340 A	P
3	CURRENT ADJUST RANGE	CH1: 1.98 A ~ 3.3 A	I/P： 230VAC I/P： 115VAC O/P：CV MODE Ta：25℃	1.603 A ~ 3.437 A /230VAC 1.600 A ~ 3.407 A /115VAC	P
4	OUTPUT VOLTAGE TOLERANCE	V1： 2 %~ -2 % (Max)	I/P：100 VAC / 305 VAC O/P：FULL/ MIN LOAD Ta：25℃	V1： 0.702 %~ -0.064 %	P
5	LINE REGULATION	V1： 0.5 %~ -0.5 % (Max)	I/P：100 VAC ~ 305 VAC O/P：FULL LOAD Ta：25℃	V1： 0 %~ 0 %	P
6	LOAD REGULATION	V1： 1 %~ -1 % (Max)	I/P： 230 VAC O/P：FULL ~MIN LOAD Ta：25℃	V1： 0.077 %~ -0.064 %	P
7	SET UP TIME	230VAC： 500 ms (Max) 115VAC： 2500 ms(Max)	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 229.848 ms 115VAC/ 420.686 ms	P
8	RISE TIME	230VAC： 200 ms (Max) 115VAC： 200 ms (Max)	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 36.74 ms 115VAC/ 36.86 ms	P
9	HOLD UP TIME	230VAC： 12 ms (TYP) 115VAC： 12 ms (TYP)	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 20.66 ms 115VAC/ 20.78 ms	P
10	OVER/UNDERSHOOT TEST	< ±5%	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	TEST： <5 %	P
11	DYNAMIC LOAD	V1： 4800 mVp-p	I/P： 230 VAC (1).O/P：FULL /Min LOAD 90%DUTY/ 1KHZ (2).O/P：FULL /Min LOAD 50%DUTY/ 120HZ Ta：25℃	(1) 376 mVp-p (2) 1820 mVp-p	P

12 DIMMER TEST

SPEC:

*Output constant current level can be adjusted through output cable by 1 ~ 10Vdc, PWM signal or resistor between ADJ1(+) and ADJ2(-).

*Reference resistance value for output current adjustment (Typical)

Resistance value	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K
Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

*1 ~ 10V dimming function for output current adjustment (Typical)

Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V
Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

*10V PWM signal for output current adjustment (Typical)

Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

TEST RESULT: I/P： 230 VAC ;Ta：25℃

P

1	Resistance value	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K
	Output current	0.408A	0.737A	1.053A	1.375A	1.692A	2.011A	2.330A	2.649A	2.969A	3.289A
	%	12.36%	22.33%	31.91%	41.67%	51.27%	60.94%	70.61%	80.27%	89.97%	99.67%
2	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V
	Output current	0.393A	0.708A	1.021A	1.332A	1.638A	1.950A	2.257A	2.567A	2.877A	3.241A
	%	11.91%	21.45%	30.94%	40.36%	49.64%	59.09%	68.39%	77.79%	87.18%	98.21%
3	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	Output current	0.428A	0.738A	1.051A	1.361A	1.668A	1.974A	2.281A	2.591A	2.898A	3.255A
	%	12.97%	22.36%	31.85%	41.24%	50.55%	59.82%	69.12%	78.52%	87.82%	98.64%

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	100VAC~305 VAC	I/P：TESTING O/P：FULL LOAD Ta：25℃	87 V~305V	P
			I/P： LOW-LINE-3V=97 V HIGH-LINE=305 V O/P：FULL/MIN LOAD ON： 30 Sec . OFF： 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE)	TEST： OK	
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE OSC	I/P： 100 VAC ~ 305 VAC O/P：FULL~MIN LOAD Ta：25℃	TEST： OK	P
3	POWER FACTOR	0.95 / 230 VAC(TYP) 0.98 / 115 VAC(TYP) 0.92 / 277 VAC(TYP)	I/P： 230 VAC I/P： 115 VAC I/P： 277 VAC O/P：FULL LOAD Ta：25℃	PF= 0.971 / 100% PF= 0.996 / 100% PF= 0.948 / 100%	P
4	EFFICIENCY	93 % (TYP)	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	93.23 %	P
5	INPUT CURRENT	230V/ 0.78 A (TYP) 115V/ 1.70 A (TYP) 277V/ 0.70 A (TYP)	I/P： 230 VAC I/P： 115 VAC I/P： 277 VAC O/P：FULL LOAD Ta：25℃	I = 0.759 A/ 230 VAC I = 1.502 A/ 115 VAC I = 0.640 A/ 277 VAC	P
6	INRUSH CURRENT	230V/ 65 A (TYP) COLD START	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I = 58.73 A/ 230 VAC	P
7	LEAKAGE CURRENT	< 0.75 mA / 277 VAC	I/P： 277 VAC O/P：Min LOAD Ta：25℃	L-CASE： 0.3481 mA N-CASE： 0.3300 mA	P

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	95 % ~ 108 %	I/P： 230 VAC I/P： 115 VAC O/P：TESTING Ta：25℃	101.22 %/ 230 VAC 101.27 %/ 115 VAC Constant current limiting, recovers automatically after fault condition is removed.	P
2	OVER VOLTAGE PROTECTION	CH1： 54 V ~ 62 V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	58.0 V/ 230 VAC 58.0 V/ 115 VAC Shut down o/p voltage with auto-recovery or , re-power on to recover	P
3	OVER TEMPERATURE PROTECTION	SPEC： RTH2： 100± 10℃ O.T.P. NO DAMAGE	I/P： 230 VAC O/P：FULL LOAD	O.T.P. Active Shut down o/p voltage, recovers automatically after temperature goes down	P
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P： 305 VAC O/P：FULL LOAD Ta：25℃	NO DAMAGE Hiccup mode, recovers automatically after fault condition is removed.	P

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q6 Rated： STF13NM60N: 600V/11A	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on (2) Output Short (3)Full load continue Ta：25℃	(1) 474 V (2) 452 V (3) 454 V	P
2	Diode Peak Voltage	D100 Rated： MBR30B150CTH: 150V/30A	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on (2)Output Short (3)Full load continue Ta：25℃	(1) 108 V (2) 11.0 V (3) 109 V	P
3	Input Capacitor Voltage	C5 Rated： 82u/450V 105℃ 18*30 CST	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta：25℃	(1) 446 V (2) 440 V (3) 444 V	P
4	Control IC Voltage Test	U 2 Rated： L6599AD: 16V (MAX)	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta：25℃	(1) 14.1 V (2) 13.8 V (3) 14.0 V	P
5	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated： STF22NM60N :600V/16A	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on (2) Output Short (3)Full load continue Ta：25℃	(1) 486 V (2) 460 V (3) 464 V	P

■ SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P： 3.75 KVAC/min I/P-FG： 1.88 KVAC/min O/P-FG： 0.5 KVAC/min	I/P-O/P： 4 KVAC/min I/P-FG： 2.26 KVAC/min O/P-FG： 0.6 KVAC/min Ta：25℃	I/P-O/P： 2.966 mA I/P-FG： 2.816 mA O/P-FG： 3.653 mA NO DAMAGE	P
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℃/70%RH	I/P-O/P： >9999 MΩ I/P-FG： >9999 MΩ O/P-FG： >9999 MΩ NO DAMAGE	P
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta：25℃ / 70%RH	23 mΩ	P

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS C	I/P:220VAC/230VAC/240VAC50HZ O/P:100%,75%,60%LOAD Ta:25℃	PASS	P
2	CONDUCTION	EN55015	I/P: 230 VAC (50HZ)/115V[60HZ] O/P:FULL/65% LOAD Ta:25℃	PASS Test by certified Lab	P
3	RADIATION	EN55015	I/P: 230 VAC (50HZ)/115V[60HZ] O/P: FULL/65% LOAD Ta:25℃	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℃	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℃	CRITERIA A	P
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV L,N-PE:4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A	P
7	Test by certified Lab & Test Report Prepare				

■ RELIABILITY TEST

ENVIRONMENT TEST

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th><th>VERDICT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL： HBG-160-60
1. ROOM AMBIENT BURN-IN：2.5 HRS
I/P： 230VAC O/P： 95% LOAD Ta=24.1 ℃
2. HIGH AMBIENT BURN-IN：3.5 HRS
I/P： 230VAC O/P： 95% LOAD Ta=57.7 ℃
<table>
<tr><th>NO</th><th>Position</th><th>P/N</th><th>ROOM AMBIENT Ta= 24.1 ℃</th><th>HIGH AMBIENT Ta= 57.7 ℃</th></tr>
<tr><td>1</td><td>RTH1</td><td>NTC 4A 5Ω 20%</td><td>58.5℃</td><td>89.9℃</td></tr>
<tr><td>2</td><td>LF1</td><td>TR953-R1</td><td>46.9℃</td><td>78.4℃</td></tr>
<tr><td>3</td><td>LF2</td><td>TR948-R5</td><td>49.6℃</td><td>81.9℃</td></tr>
<tr><td>4</td><td>BD1</td><td>GBU608</td><td>53.3℃</td><td>85.2℃</td></tr>
<tr><td>5</td><td>Q1</td><td>STF22NM60N</td><td>57.7℃</td><td>89.0℃</td></tr>
<tr><td>6</td><td>D5</td><td>YG971S6R</td><td>59.4℃</td><td>92.8℃</td></tr>
<tr><td>7</td><td>R8</td><td>R/NW 2W 0.062Ω 5%</td><td>55.6℃</td><td>89.5℃</td></tr>
<tr><td>8</td><td>C5</td><td>C/E 82u/450V</td><td>55.1℃</td><td>88.9℃</td></tr>
<tr><td>9</td><td>U1</td><td>NCP1608B</td><td>53.0℃</td><td>85.4℃</td></tr>
<tr><td>10</td><td>C38</td><td>C/E 100u/25V</td><td>49.2℃</td><td>81.8℃</td></tr>
<tr><td>11</td><td>U2</td><td>L6599ATD</td><td>51.5℃</td><td>85.1℃</td></tr>
<tr><td>12</td><td>C61</td><td>C/E 47u/25V YXM</td><td>54.9℃</td><td>88.0℃</td></tr>
<tr><td>13</td><td>RTH2</td><td>NTC 330KΩ</td><td>50.4℃</td><td>83.6℃</td></tr>
<tr><td>14</td><td>Q5</td><td>STF13NM60N</td><td>57.0℃</td><td>89.7℃</td></tr>
<tr><td>15</td><td>Q6</td><td>STF13NM60N</td><td>57.7℃</td><td>91.2℃</td></tr>
<tr><td>16</td><td>T1</td><td>TF6524</td><td>60.7℃</td><td>93.1℃</td></tr>
<tr><td>17</td><td>C103</td><td>220uF/80V ZLH</td><td>46.5℃</td><td>79.9℃</td></tr>
<tr><td>18</td><td>LF100</td><td>TR884-R4</td><td>47.6℃</td><td>79.8℃</td></tr>
<tr><td>19</td><td>C110</td><td>C/E 47u/100V ZLH</td><td>46.6℃</td><td>79.8℃</td></tr>
<tr><td>20</td><td>D100</td><td>MBR30U150CTH</td><td>61.6℃</td><td>95.1℃</td></tr>
<tr><td>21</td><td>D101</td><td>MBR30U150CTH</td><td>61.1℃</td><td>94.5℃</td></tr>
</table></td><td>P</td></tr>
<tr><td>2</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER 2 HOUR</td><td>I/P： 305VAC/100VAC
O/P： 95 % LOAD
Ta= -40/-30℃</td><td>TEST：OK</td><td>P</td></tr>
<tr><td>3</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 50 ℃
NO DAMAGE</td><td>I/P： 305 VAC
O/P：95% LOAD
Ta= 60 ℃
HUMIDITY= 95 %R.H</td><td>TEST：OK</td><td>P</td></tr>
<tr><td>4</td><td>TEMPERATURE
COEFFICIENT</td><td>± 0.03 %(0~50℃)</td><td>I/P： 230 VAC
O/P：95% LOAD</td><td>± 0.005 %(0~50℃)</td><td>P</td></tr>
<tr><td>5</td><td>STORAGE TEMPERATURE TEST</td><td colspan="2">1. Thermal shock Temperature： -45℃~ +85℃
2. Temperature change rate ：25℃ / MIN
3. Dwell time low and high temperature ： 30 MIN/EACH
4. Total test cycle：5 CYCLE
5. Input/Output condition： STATIC</td><td>OK</td><td>P</td></tr>
</table>

6	THERMAL SHOCK TEST	1. Thermal shock Temperature： -45℃~ +65℃ 2. Temperature change rate ：25℃ / 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	P
7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (3) Sweep Time：12min/sweep cycle (4) Acceleration：5G (5) Test Time：72min in each axis (X.Y.Z) (6) Ta：25℃	TEST：OK	P
8	CAPACITOR LIFE CYCLE	HBG-160-60:SUPPOSE C103 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=60 ℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta=60 ℃ LIFE TIME	(1) 666537 HRS (2) 59778 HRS (3) 97047 HRS	P
9	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE：252.3KHRS		P
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Tcase 70℃		P

DATE	SAMPLE	TEST RESULT	TESTER	APPROVAL
2012/12/26	PRODUCT SAMPLE	PASS	ZOULF	HOWAY

2009/08/04 A50-G058