



Test Report: HBG-160-24

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 : 200 mVp-p (Max)	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	V1 : 40 mVp-p (Max)	P
2	CONSTANT CURRENT REGION	CH1: 14.4 V ~ 24 V	I/P : 230VAC O/P : CV MODE Ta : 25°C	O/P= 14.4V : 6.682 A O/P= 24 V : 6.744 A	P
3	CURRENT ADJUST RANGE	CH1: 3.9A ~ 6.5 A	I/P : 230VAC I/P : 115VAC O/P : CV MODE Ta : 25°C	3.322 A ~ 7.194 A /230VAC 3.344 A ~ 7.199 A /115VAC	P
4	OUTPUT VOLTAGE TOLERANCE	V1 : 2 %~ -2 % (Max)	I/P : 100 VAC / 305 VAC O/P : FULL/ MIN LOAD Ta : 25°C	V1 : 0.908 %~ -0.288 %	P
5	LINE REGULATION	V1 : 0.5 %~ -0.5 % (Max)	I/P : 100 VAC ~ 305 VAC O/P : FULL LOAD Ta : 25°C	V1 : 0 %~ 0 %	P
6	LOAD REGULATION	V1 : 1 %~ -1 % (Max)	I/P : 230 VAC O/P : FULL ~MIN LOAD Ta : 25°C	V1 : 0.288 %~ -0.288 %	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°C	230VAC/ 253.691 ms 115VAC/ 414.794 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°C	230VAC/ 33.00 ms 115VAC/ 32.93 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°C	230VAC/ 21.23 ms 115VAC/ 21.39 ms	P
10	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %	P
11	DYNAMIC LOAD	V1 : 2400 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°C	(1) 1510 mVp-p (2) 1960 mVp-p	P

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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℃

1	Resistance value	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K
	Output current	0.785A	1.410A	2.037A	2.664A	3.291A	3.925A	4.562A	5.194A	5.835A	6.475A
	%	11.89%	21.36%	30.86%	40.36%	49.86%	59.47%	69.12%	78.70%	88.41%	98.11%
2	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V
	Output current	0.794A	1.426A	2.058A	2.689A	3.318A	3.950A	4.571A	5.211A	5.847A	6.479A
	%	12.03%	21.61%	31.18%	40.74%	50.27%	59.85%	69.26%	78.95%	88.59%	98.17%
3	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	Output current	0.869A	1.495A	2.127A	2.748A	3.378A	4.006A	4.631A	5.261A	5.887A	6.474A
	%	13.17%	22.65%	32.23%	41.64%	51.20%	60.70%	70.17%	79.71%	89.20%	98.09%

P

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°C	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°C	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°C	PF= 0.971 / 100% PF= 0.996 / 100% PF= 0.947 / 100%	P
4	EFFICIENCY	92% (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	92.43 %	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°C	I= 0.726 A/ 230 VAC I= 1.449 A/ 115 VAC I= 0.614 A/ 277 VAC	P
6	INRUSH CURRENT	230V/ 65 A (TYP) COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I= 57.63 A/ 230 VAC	P
7	LEAKAGE CURRENT	< 0.75 mA / 277 VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25°C	L-CASE : 0.3294 mA N-CASE : 0.3193 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°C	100.68 %/ 230 VAC 100.66 %/ 115 VAC Constant current limiting, recovers automatically after fault condition is removed.	P
2	OVER VOLTAGE PROTECTION	CH1 : 28 V ~ 34 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	30.8 V/ 230 VAC 30.8 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°C 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°C	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°C	(1) 496 V (2) 454 V (3) 448 V	P
2	Diode Peak Voltage	D100 Rated : FCQS30A065: 65V/30A	I/P : High-Line +3V = 308 V O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C	(1) 58.0 V (2) 10.2 V (3) 57.0 V	P
3	Input Capacitor Voltage	C5 Rated : 82u/450V 105°C 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°C	(1) 448 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°C	(1) 14.1 V (2) 14.3 V (3) 14.1 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°C	(1) 506 V (2) 462 V (3) 472 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°C	I/P-O/P : 3.975 mA I/P-FG : 3.783 mA O/P-FG : 3.054 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°C /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°C / 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°C	PASS	P
2	CONDUCTION	EN55015	I/P: 230 VAC (50HZ)/115V[60HZ] O/P:FULL/65% LOAD Ta:25°C	PASS Test by certified Lab	P
3	RADIATION	EN55015	I/P: 230 VAC (50HZ)/115V[60HZ] O/P: FULL/65% 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 INDUSTRY L-N :2KV L,N-PE:4KV	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	TEMPERATURE RISE TEST	<div>MODEL : HBG-160-36</div> <div>1. ROOM AMBIENT BURN-IN : 2.5 HRS</div> <div>I/P : 230VAC O/P : 95% LOAD Ta=32.0 ℃</div> <div>2. HIGH AMBIENT BURN-IN : 3.5 HRS</div> <div>I/P : 230VAC O/P : 95% LOAD Ta=57.7 ℃</div> <table><tr><th>NO</th><th>Position</th><th>P/N</th><th>ROOM AMBIENT Ta= 32.0 ℃</th><th>HIGH AMBIENT Ta= 57.7 ℃</th></tr><tr><td>1</td><td>RTH1</td><td>NTC 4A 5Ω 20%</td><td>68.1℃</td><td>91.5℃</td></tr><tr><td>2</td><td>LF1</td><td>TR953-R1</td><td>53.5℃</td><td>78.1℃</td></tr><tr><td>3</td><td>LF2</td><td>TR948-R5</td><td>55.7℃</td><td>80.3℃</td></tr><tr><td>4</td><td>BD1</td><td>GBU608</td><td>59.1℃</td><td>83.8℃</td></tr><tr><td>5</td><td>L1</td><td>TR954-R2</td><td>56.5℃</td><td>81.1℃</td></tr><tr><td>6</td><td>L2</td><td>TF6471</td><td>62.1℃</td><td>87.2℃</td></tr><tr><td>7</td><td>Q1</td><td>STF22NM60N</td><td>65.6℃</td><td>90.6℃</td></tr><tr><td>8</td><td>D5</td><td>YG971S6R</td><td>66.7℃</td><td>91.5℃</td></tr><tr><td>9</td><td>R8</td><td>R/NW 2W 0.062Ω 5%</td><td>63.2℃</td><td>88.2℃</td></tr><tr><td>10</td><td>C5</td><td>C/E 82u/450V</td><td>63.2℃</td><td>87.4℃</td></tr><tr><td>11</td><td>U1</td><td>NCP1608B</td><td>60.2℃</td><td>85.2℃</td></tr><tr><td>12</td><td>C38</td><td>C/E 100u/25V</td><td>55.3℃</td><td>79.9℃</td></tr><tr><td>13</td><td>U2</td><td>L6599ATD</td><td>57.1℃</td><td>81.8℃</td></tr><tr><td>14</td><td>C61</td><td>C/E 47u/25V YXM</td><td>62.6℃</td><td>87.6℃</td></tr><tr><td>15</td><td>RTH2</td><td>NTC 330KΩ</td><td>56.9℃</td><td>81.4℃</td></tr><tr><td>16</td><td>Q5</td><td>STF13NM60N</td><td>65.1℃</td><td>90.3℃</td></tr><tr><td>17</td><td>Q6</td><td>STF13NM60N</td><td>57.6℃</td><td>93.0℃</td></tr><tr><td>18</td><td>T1</td><td>TF-2067A</td><td>60.2℃</td><td>85.0℃</td></tr><tr><td>19</td><td>C102</td><td>680uF/50V YXG</td><td>55.7℃</td><td>80.4℃</td></tr><tr><td>20</td><td>C103</td><td>C/E 330uF/50V ZLH</td><td>58.7℃</td><td>83.1℃</td></tr><tr><td>21</td><td>LF100</td><td>TR884-R4</td><td>53.6℃</td><td>78.2℃</td></tr><tr><td>22</td><td>C110</td><td>C/E 180u/50V KY</td><td>52.2℃</td><td>76.8℃</td></tr><tr><td>23</td><td>D100</td><td>SBR40U100CT</td><td>66.3℃</td><td>91.7℃</td></tr><tr><td>24</td><td>D101</td><td>SBR40U100CT</td><td>66.0℃</td><td>91.2℃</td></tr></table>			NO	Position	P/N	ROOM AMBIENT Ta= 32.0 ℃	HIGH AMBIENT Ta= 57.7 ℃	1	RTH1	NTC 4A 5Ω 20%	68.1℃	91.5℃	2	LF1	TR953-R1	53.5℃	78.1℃	3	LF2	TR948-R5	55.7℃	80.3℃	4	BD1	GBU608	59.1℃	83.8℃	5	L1	TR954-R2	56.5℃	81.1℃	6	L2	TF6471	62.1℃	87.2℃	7	Q1	STF22NM60N	65.6℃	90.6℃	8	D5	YG971S6R	66.7℃	91.5℃	9	R8	R/NW 2W 0.062Ω 5%	63.2℃	88.2℃	10	C5	C/E 82u/450V	63.2℃	87.4℃	11	U1	NCP1608B	60.2℃	85.2℃	12	C38	C/E 100u/25V	55.3℃	79.9℃	13	U2	L6599ATD	57.1℃	81.8℃	14	C61	C/E 47u/25V YXM	62.6℃	87.6℃	15	RTH2	NTC 330KΩ	56.9℃	81.4℃	16	Q5	STF13NM60N	65.1℃	90.3℃	17	Q6	STF13NM60N	57.6℃	93.0℃	18	T1	TF-2067A	60.2℃	85.0℃	19	C102	680uF/50V YXG	55.7℃	80.4℃	20	C103	C/E 330uF/50V ZLH	58.7℃	83.1℃	21	LF100	TR884-R4	53.6℃	78.2℃	22	C110	C/E 180u/50V KY	52.2℃	76.8℃	23	D100	SBR40U100CT	66.3℃	91.7℃	24	D101	SBR40U100CT	66.0℃	91.2℃	P
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : 95 % LOAD Ta= -40/-30℃	TEST : OK	P																																																																																																																													
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 ℃ NO DAMAGE	I/P : 305 VAC O/P : 95% LOAD Ta= 60 ℃ HUMIDITY= 95 %R.H	TEST : OK	P																																																																																																																													
4	TEMPERATURE COEFFICIENT	± 0.03 %(0~50℃)	I/P : 230 VAC O/P : 95% LOAD	± 0.006 %(0~50℃)	P																																																																																																																													
5	STORAGE TEMPERATURE TEST	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		OK	P																																																																																																																													

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-160-36: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) 493901.6 HRS (2) 47769.2 HRS (3) 66189.2 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