Test Report: HVG-150-24

150W Constant Voltage + Constant Current LED Driver

■ 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

■ ESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RIPPLE & NOISE	V1：150 mVp-p (Max)	I/P： 347VAC O/P：FULL LOAD Ta：25℃	V1： 25.6 mVp-p (Max)
2	CONSTANT CURRENT REGION	13.2V~24 V	I/P: 230 VAC O/P:CV MODE Ta:25℃	O/P=13.2V ：6.385 A O/P=23V ：6.385 A
3	OUTPUT VOLTAGE ADJUST RANGE	CH1： 22V ~ 27 V	I/P： 480 VAC I/P： 347 VAC O/P：MIN LOAD Ta：25℃	21.16 V ~ 27.6 V/ 480 VAC 21.16 V ~ 27.6 V/ 347 VAC
4	OUTPUT CURRENT ADJUST RANGE	CH1 ：3.44A~ 6.25 A	I/P： 480 VAC I/P： 347 VAC O/P：CV MODE Ta：25℃	3.015 A~ 6.822 A/ 480 VAC 3.015 A~ 6.822 A/ 347 VAC
5	OUTPUT VOLTAGE TOLERANCE	V1： 1%~ -1 % (Max)	I/P：180 VAC / 480 VAC O/P：FULL/ MIN LOAD Ta：25℃	V1： 0.2 %~ -0.2 %
6	LINE REGULATION	V1：0.5 %~ -0.5% (Max)	I/P：180 VAC ~ 480 VAC O/P：FULL LOAD Ta：25℃	V1： 0 %~ 0 %
7	LOAD REGULATION	V1：0.5 %~-0.5% (Max)	I/P： 347 VAC O/P：FULL ~MIN LOAD Ta：25℃	V1： 0.2 %~ -0.2 %
8	SET UP TIME	480 VAC： 500 ms (Max) 347VAC： 500 ms(Max) 230VAC： 500 ms(Max)	I/P： 480 VAC I/P： 347 VAC I/P： 230 VAC O/P：FULL LOAD Ta：25℃	480 VAC/ 265 ms 347VAC/ 296 ms 230VAC/ 342 ms
9	RISE TIME	480 VAC： 80 ms (Max) 347VAC： 80 ms (Max) 230VAC： 80 ms (Max)	I/P： 480 VAC I/P： 347 VAC I/P： 230 VAC O/P：FULL LOAD Ta：25℃	480 VAC/ 50 ms 347VAC/ 54 ms 230VAC/ 54 ms
10	HOLD UP TIME	480 VAC： 18 ms (TYP) 347VAC： 18 ms (TYP)	I/P： 480 VAC I/P： 347 VAC O/P：FULL LOAD Ta：25℃	480 VAC/ 44 ms 347VAC/ 24 ms
11	OVER/UNDERSHOOT TEST	< ±5%	I/P： 347 VAC O/P：FULL LOAD Ta：25℃	TEST： <5 %

12	DYNAMIC LOAD	V1： 2400 mVp-p	I/P： 347 VAC (1).O/P：FULL /Min LOAD 90%DUTY/ 1KHZ (2).O/P：FULL /Min LOAD 90%DUTY/ 3KHZ (3).O/P：FULL /Min LOAD 90%DUTY/ 5KHZ (4).O/P：FULL /Min LOAD 50%DUTY/ 120HZ Ta：25℃	(1)572 mVp-p (2)652 mVp-p (3)628 mVp-p (4)776 mVp-p

13 DIMMER TEST
(B Type only)
SPEC:
※Built-in 3 in 1 dimming function, IP67 rated. Output constant current level can be adjusted through output cable by connecting a resistance or
0 ~ 10Vdc or 10V PWM signal between DIM+ and DIM-.
※Please DO NOT connect "DIM-" to "-V".
※Reference resistance value for output current adjustment (Typical)

Resistance value	Short	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN
Output current	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**	95%~ 108%

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

Dimming value	Short	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN
Output current	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**	95%~ 108%

*10V PWM signal for output current adjustment (Typical) : Frequency range :100Hz ~ 3KHz

Duty value	Short	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN
Output current	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**	95%~ 108%

TEST RESULT: I/P： 230 VAC ;Ta：25℃

1	Resistance value	SHORT	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN
	Output current	0.000A	0.600A	1.240A	1.950A	2.470A	3.130A	3.750A	4.340A	4.920A	5.600A	6.210A	6.498A
	%	**0.00%**	**9.60%**	**19.84%**	**31.20%**	**39.52%**	**50.08%**	**60.00%**	**69.44%**	**78.72%**	**89.60%**	**99.36%**	**103.97%**
2	Dimming value	SHORT	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN
	Output current	0.000A	0.590A	1.210A	1.840A	2.460A	3.090A	3.720A	4.340A	4.980A	5.600A	6.230A	6.498A
	%	**0.00%**	**9.44%**	**19.36%**	**29.44%**	**39.36%**	**49.44%**	**59.52%**	**69.44%**	**79.68%**	**89.60%**	**99.68%**	**103.97%**
3	Duty value	SHORT	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN
	Output current	0.000A	0.780A	1.390A	2.000A	2.610A	3.230A	3.840A	4.450A	5.070A	5.680A	6.290A	6.498A
	%	**0.00%**	**12.48%**	**22.24%**	**32.00%**	**41.76%**	**51.68%**	**61.44%**	**71.20%**	**81.12%**	**90.88%**	**100.64%**	**103.97%**

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT

1	INPUT VOLTAGE RANGE	180VAC~480 VAC	I/P：TESTING O/P：FULL LOAD Ta：25℃	167 V~480V
			I/P： LOW-LINE-3V=177V HIGH-LINE+3V=531 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	I/P：180VAC ~ 480 VAC O/P：FULL~MIN LOAD Ta：25℃	TEST： OK
3	POWER FACTOR	0.98 / 230 VAC(TYP) 0.97 / 277VAC(TYP) 0.95 /347 VAC(TYP) 0.93 / 480 VAC(TYP)	I/P： 230VAC I/P： 277VAC I/P： 347VAC I/P： 480VAC O/P：FULL LOAD Ta：25℃	PF= 0.995 / 230 VAC PF= 0.994 / 277 VAC PF= 0.984 / 347VAC PF= 0.952 / 480VAC
4	EFFICIENCY	91 % (TYP)	I/P： 347 VAC O/P：FULL LOAD Ta：25℃	91.67 %
5	INPUT CURRENT	347V/ 0.5 A (TYP) 480V/ 0.38 A (TYP)	I/P： 347 VAC I/P： 480 VAC O/P：FULL LOAD Ta：25℃	I = 0.48 A/ 347 VAC I = 0.36 A/ 480 VAC
6	INRUSH CURRENT	480V/ 50 A (TYP) (twidth=790 us measured at 50% Ipeak) COLD START	I/P： 480VAC O/P：FULL LOAD Ta：25℃	I = 25 A/ 480VAC T50= 789 us
7	LEAKAGE CURRENT	< 0.75 mA / 480 VAC	I/P： 480 VAC O/P：Min LOAD Ta：25℃	L-FG： 0.36 mA N-FG： 0.36 mA
8	TOTAL HARMONIC DISTORTION	Total harmonic distortion will be lower than 20% when output loading is 50% or higher at 230VAC / 277VAC / 347VAC	I/P： 230VAC I/P： 277VAC I/P： 347VAC O/P：50% LOAD Ta：25℃	THD： 13.8 THD： 15.91 THD： 18.4
		Total harmonic distortion will be lower than 20% when output loading is 75% or higher at 480VAC	I/P： 480VAC O/P：75% LOAD Ta：25℃	THD： 15.74

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER CURRENT	95% ~ 108%	I/P： 480 VAC I/P： 347 VAC O/P：TESTING Ta：25℃	102 %/ 480 VAC 102 %/ 347 VAC Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	CH1：28 V ~34 V	I/P： 480 VAC I/P： 347 VAC O/P：MIN LOAD Ta：25℃	31.447 V/ 480VAC 31.676 V/ 347 VAC Shut down o/p voltage with auto-recovery or re-power on to recovery
3	OVER TEMPERATURE PROTECTION	SPEC： NO DAMAGE	I/P： 347 VAC O/P：FULL LOAD	O.T.P. Active Shut down o/p voltage, recovers automatically after temperature goes down
4	SHORT PROTECTION	NO DAMAGE	I/P： 528VAC O/P：FULL LOAD Ta：25℃	NO DAMAGE Constant current limiting, recovers automatically after fault condition is removed

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q3 Rated： 7A/950V	I/P：High-Line +3V = 531 V O/P： (1)Full Load Turn on (2) Output Short (3)Full load continue Ta：25℃	(1) 732 V (2) 332 V (3) 708 V
2	Diode Peak Voltage	Q101 Rated： 43A/100V	I/P：High-Line +3V = 531 V O/P： (1)Full Load Turn on (2)Output Short (3)Full load continue Ta：25℃	(1) 87.6 V (2) 99 V (3) 71.6 V
3	Input Capacitor Voltage	C5 Rated： 56u/450V	I/P：High-Line +3V = 531 V O/P： (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta：25℃	(1) 420 V (2) 436 V (3) 448 V
4	Control IC Voltage Test	U1 Rated： 10.3V~22.5V U2 Rated： 11V~28V	I/P：High-Line +3V = 531 V O/P： (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Ta：25℃	(1) 18 V (2) 17.8 V (3) 17.8 V (4) 16.2 (5) 16.2 (6) 16.4

5	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated： 7A/950V	I/P：High-Line +3V = 531 V O/P： (1)Full Load Turn on (2) Output Short (3)Full load continue Ta：25℃	(1) 888 V (2) 820 V (3) 856 V

■ SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P： 3.75 KVAC/min I/P-FG： 2KVAC/min O/P-FG： 1.5 KVAC/min	I/P-O/P： 4 KVAC/min I/P-FG： 2.4KVAC/min O/P-FG： 1.8 KVAC/min Ta：25℃	I/P-O/P： 3.67 mA I/P-FG： 2.607 mA O/P-FG： 3.57 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℃/70%RH	I/P-O/P： 26.9 GΩ I/P-FG： 20.9 GΩ O/P-FG： 30 GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta：25℃ / 70%RH	15 mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS C	I/P:230VAC/380VAC/50HZ/60HZ O/P:100/60%ELECTRONIC LOAD O/P:100%LED LOAD Ta:25℃	PASS
2	CONDUCTION	EN55015 CLASS B FCC Part 15 Subpart B	I/P: 230VAC/380VAC/50HZ/60HZ O/P:FULL/60% LOAD Ta:25℃	PASS Test by certified Lab
3	RADIATION	EN55015 CLASS B FCC Part 15 Subpart B	I/P: 230VAC/380VAC/50HZ/60HZ O/P:FULL LOAD/60% LOAD Ta:25℃	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR:8KV / Contact:4KV	I/P: 230VAC/380VAC/50HZ/60HZ O/P:FULL LOAD Ta:25℃	CRITERIA A
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT： 1KV	I/P: 230VAC/380VAC/50HZ/60HZ O/P:FULL LOAD Ta:25℃	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV L,N-PE:4KV	I/P: 230VAC/380VAC/50HZ/60HZ O/P:FULL LOAD Ta:25℃	CRITERIA A
7	Test by certified Lab ＆ Test Report Prepare. Any contradictions of the test results, please refer to the latest EMC test report.			

■ RELIABILITY TEST

ENVIRONMENT TEST

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL：HVG-150-24
1. ROOM AMBIENT BURN-IN：13 HRS
I/P： 347VAC O/P： FULL LOAD Ta= 28.4 ℃
2. HIGH AMBIENT BURN-IN： 6 HRS
I/P： 347VAC O/P： FULL LOAD Ta=60.8 ℃
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=28.4 ℃</th><th>HIGH AMBIENT Ta=60.8 ℃</th></tr>
<tr><td>1</td><td>LF2</td><td>57.8℃</td><td>83.7℃</td></tr>
<tr><td>2</td><td>BD1</td><td>60.3℃</td><td>85.9℃</td></tr>
<tr><td>3</td><td>L2</td><td>67.3℃</td><td>93.5℃</td></tr>
<tr><td>4</td><td>C48</td><td>61.1℃</td><td>86.7℃</td></tr>
<tr><td>5</td><td>C46</td><td>60.1℃</td><td>85.7℃</td></tr>
<tr><td>6</td><td>C15</td><td>65.1℃</td><td>90.7℃</td></tr>
<tr><td>7</td><td>Q1</td><td>65.0℃</td><td>90.7℃</td></tr>
<tr><td>8</td><td>C5</td><td>66.8℃</td><td>91.2℃</td></tr>
<tr><td>9</td><td>Q4</td><td>69.7℃</td><td>95.2℃</td></tr>
<tr><td>10</td><td>C62</td><td>64.3℃</td><td>88.8℃</td></tr>
<tr><td>11</td><td>RTH2</td><td>64.0℃</td><td>88.5℃</td></tr>
<tr><td>12</td><td>T1</td><td>75.7℃</td><td>100.3℃</td></tr>
<tr><td>13</td><td>C203</td><td>71.2℃</td><td>96.5℃</td></tr>
<tr><td>14</td><td>Q101</td><td>75.2℃</td><td>100.5℃</td></tr>
<tr><td>15</td><td>C104</td><td>68.4℃</td><td>93.8℃</td></tr>
<tr><td>16</td><td>C105</td><td>65.2℃</td><td>91.1℃</td></tr>
<tr><td>17</td><td>C106</td><td>64.8℃</td><td>90.5℃</td></tr>
<tr><td>18</td><td>U2</td><td>64.8℃</td><td>88.6℃</td></tr>
</table></td></tr>
<tr><td>2</td><td>OVER LOAD BURN-IN TEST</td><td>NO DAMAGE
1 HOUR (MIN)</td><td>I/P： 347 VAC
O/P：100 % LOAD
Ta：25℃</td><td>TEST：OK</td></tr>
<tr><td>3</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER 2 HOUR</td><td>I/P： 528VAC/200VAC
O/P： 100 % LOAD
Ta= -40 ℃</td><td>TEST：OK</td></tr>
<tr><td>4</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 60℃
NO DAMAGE</td><td>I/P： 531 VAC
O/P：FULL LOAD
Ta= 60 ℃
HUMIDITY= 95 %R.H</td><td>TEST：OK</td></tr>
<tr><td>5</td><td>TEMPERATURE
COEFFICIENT</td><td>± 0.03%(0~50℃)</td><td>I/P： 347 VAC
O/P：FULL LOAD</td><td>± 0.005 %(0~50℃)</td></tr>
<tr><td>6</td><td>STORAGE TEMPERATURE TEST</td><td colspan="2">1. Thermal shock Temperature： -45℃~ +90℃
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></tr>
</table>

7	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： 347VAC/Full Load AC ON/OFF TEST turn on 58sec；turn off 2sec	OK
8	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
9	CAPACITOR LIFE CYCLE	HVG-150-24:SUPPOSE C104 IS THE MOST CRITICAL COMPONENT (1) I/P： 347VAC O/P：FULL LOAD Tc= 75 ℃ LIFE TIME (2) I/P： 347VAC O/P：FULL LOAD Tc= 75 ℃ LIFE TIME (3) I/P： 347VAC O/P：75% LOAD Tc= 75 ℃ LIFE TIME	(1) 70987HRS (2) 75090HRS (3) 85833 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 158.6K hrs min. MIL-HDBK-217F (25℃)	
11	Ongoing Reliability Test	I/P：230VAC O/P：FULL LOAD TA=50℃ Demonstration Mean Time Between Failure : 50,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT TSENG

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