



Test Report: HVG-100-20

100W 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

■ DESIGN 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°C	V1 : 11.8 mVp-p (Max)
2	CONSTANT CURRENT REGION	10V ~ 20V	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	O/P=9V : 4.84A O/P=14V : 4.84 A
3	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 17V ~ 22 V	I/P : 480 VAC I/P : 347 VAC O/P : MIN LOAD Ta : 25°C	16.43 V ~ 22.56 V / 480 VAC 16.43 V ~ 22.56 V / 347 VAC
4	OUTPUT CURRENT ADJUST RANGE	CH1 : 2.4A~4.8A	I/P : 480 VAC I/P : 347 VAC O/P : CV MODE Ta : 25°C	2.194 A~ 5.525 A / 480 VAC 2.192 A~ 5.526 A / 347 VAC
5	OUTPUT VOLTAGE TOLERANCE	V1 : 1%~ -1 % (Max)	I/P : 180 VAC / 528VAC O/P : FULL/ MIN LOAD Ta : 25°C	V1 : 0.3 %~ -0.3 %
6	LINE REGULATION	V1 : 0.5 %~ -0.5% (Max)	I/P : 180 VAC ~ 528 VAC O/P : FULL LOAD Ta : 25°C	V1 : 0 %~ 0 %
7	LOAD REGULATION	V1 : 0.5 %~ -0.5% (Max)	I/P : 347 VAC O/P : FULL -MIN LOAD Ta : 25°C	V1 : 0.3 %~ -0.3 %
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°C	480 VAC/ 366 ms 347VAC/ 377 ms 230VAC/ 402 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°C	480 VAC/ 24 ms 347VAC/ 21 ms 230VAC/ 21 ms
10	HOLD UP TIME	480 VAC : 30 ms (TYP) 347VAC : 30 ms (TYP)	I/P : 480 VAC I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	480 VAC/ 52 ms 347VAC/ 50 ms
11	OVER/UNDERSHOOT TEST	< ±5%	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %

12	DYNAMIC LOAD	V1 : 2000 mVp-p	I/P : 347 VAC (1).O/P : FULL /Min LOAD 90%DUTY/ 1KHZ (2).O/P : FULL /Min LOAD 50%DUTY/ 120HZ Ta : 25°C	(1)436 (2)636	mVp-p mVp-p
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13	<p>DIMMER TEST (B Type only) SPEC:</p> <p>*Reference resistance value for output current adjustment (Typical)</p> <table border="1"> <tr> <td>Resistance value</td> <td>10K</td> <td>20K</td> <td>30K</td> <td>40K</td> <td>50K</td> <td>60K</td> <td>70K</td> <td>80K</td> <td>90K</td> <td>100K</td> </tr> <tr> <td>Output current</td> <td>10%</td> <td>20%</td> <td>30%</td> <td>40%</td> <td>50%</td> <td>60%</td> <td>70%</td> <td>80%</td> <td>90%</td> <td>100%</td> </tr> </table> <p>*1 ~ 10V dimming function for output current adjustment (Typical)</p> <table border="1"> <tr> <td>Dimming value</td> <td>1V</td> <td>2V</td> <td>3V</td> <td>4V</td> <td>5V</td> <td>6V</td> <td>7V</td> <td>8V</td> <td>9V</td> <td>10V</td> </tr> <tr> <td>Output current</td> <td>10%</td> <td>20%</td> <td>30%</td> <td>40%</td> <td>50%</td> <td>60%</td> <td>70%</td> <td>80%</td> <td>90%</td> <td>100%</td> </tr> </table> <p>*10V PWM signal for output current adjustment (Typical)</p> <table border="1"> <tr> <td>Duty value</td> <td>10%</td> <td>20%</td> <td>30%</td> <td>40%</td> <td>50%</td> <td>60%</td> <td>70%</td> <td>80%</td> <td>90%</td> <td>100%</td> </tr> <tr> <td>Output current</td> <td>10%</td> <td>20%</td> <td>30%</td> <td>40%</td> <td>50%</td> <td>60%</td> <td>70%</td> <td>80%</td> <td>90%</td> <td>100%</td> </tr> </table> <p>TEST RESULT: I/P : 230 VAC ;Ta : 25°C</p> <table border="1"> <tr> <td rowspan="3">1</td> <td>Resistance value</td> <td>SHORT</td> <td>10K</td> <td>20K</td> <td>30K</td> <td>40K</td> <td>50K</td> <td>60K</td> <td>70K</td> <td>80K</td> <td>90K</td> <td>100K</td> <td>OPEN</td> </tr> <tr> <td>Output current</td> <td>0.000A</td> <td>0.551A</td> <td>1.024A</td> <td>1.482A</td> <td>2.002A</td> <td>2.421A</td> <td>2.893A</td> <td>3.335A</td> <td>3.824A</td> <td>4.307A</td> <td>4.770A</td> <td>5.000A</td> </tr> <tr> <td>%</td> <td>0.00%</td> <td>11.48%</td> <td>21.33%</td> <td>30.88%</td> <td>41.71%</td> <td>50.44%</td> <td>60.27%</td> <td>69.48%</td> <td>79.67%</td> <td>89.73%</td> <td>99.38%</td> <td>104.17%</td> </tr> <tr> <td rowspan="3">2</td> <td>Dimming value</td> <td>SHORT</td> <td>1V</td> <td>2V</td> <td>3V</td> <td>4V</td> <td>5V</td> <td>6V</td> <td>7V</td> <td>8V</td> <td>9V</td> <td>10V</td> <td>OPEN</td> </tr> <tr> <td>Output current</td> <td>0.000A</td> <td>0.564A</td> <td>2.025A</td> <td>1.505A</td> <td>1.977A</td> <td>2.444A</td> <td>2.922A</td> <td>3.393A</td> <td>3.865A</td> <td>4.339A</td> <td>4.816A</td> <td>5.000A</td> </tr> <tr> <td>%</td> <td>0.00%</td> <td>11.75%</td> <td>42.18%</td> <td>31.35%</td> <td>41.19%</td> <td>50.92%</td> <td>60.88%</td> <td>70.69%</td> <td>80.52%</td> <td>90.40%</td> <td>100.33%</td> <td>104.17%</td> </tr> <tr> <td rowspan="3">3</td> <td>Duty value</td> <td>SHORT</td> <td>10%</td> <td>20%</td> <td>30%</td> <td>40%</td> <td>50%</td> <td>60%</td> <td>70%</td> <td>80%</td> <td>90%</td> <td>100%</td> <td>OPEN</td> </tr> <tr> <td>Output current</td> <td>0.000A</td> <td>0.590A</td> <td>1.059A</td> <td>1.532A</td> <td>1.999A</td> <td>2.476A</td> <td>2.945A</td> <td>3.417A</td> <td>3.890A</td> <td>4.366A</td> <td>4.834A</td> <td>5.000A</td> </tr> <tr> <td>%</td> <td>0.00%</td> <td>12.29%</td> <td>22.06%</td> <td>31.92%</td> <td>41.65%</td> <td>51.58%</td> <td>61.35%</td> <td>71.19%</td> <td>81.04%</td> <td>90.96%</td> <td>100.71%</td> <td>104.17%</td> </tr> </table>												Resistance value	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	1	Resistance value	SHORT	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN	Output current	0.000A	0.551A	1.024A	1.482A	2.002A	2.421A	2.893A	3.335A	3.824A	4.307A	4.770A	5.000A	%	0.00%	11.48%	21.33%	30.88%	41.71%	50.44%	60.27%	69.48%	79.67%	89.73%	99.38%	104.17%	2	Dimming value	SHORT	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN	Output current	0.000A	0.564A	2.025A	1.505A	1.977A	2.444A	2.922A	3.393A	3.865A	4.339A	4.816A	5.000A	%	0.00%	11.75%	42.18%	31.35%	41.19%	50.92%	60.88%	70.69%	80.52%	90.40%	100.33%	104.17%	3	Duty value	SHORT	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN	Output current	0.000A	0.590A	1.059A	1.532A	1.999A	2.476A	2.945A	3.417A	3.890A	4.366A	4.834A	5.000A	%	0.00%	12.29%	22.06%	31.92%	41.65%	51.58%	61.35%	71.19%	81.04%	90.96%	100.71%	104.17%
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INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC-528 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	158 V-528V
			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 ~ 528VAC O/P : FULL -MIN LOAD Ta : 25°C	TEST : OK
3	POWER FACTOR	0.98 / 230 VAC(TYP)	I/P : 230VAC	PF= 0.995 / 230 VAC
		0.98 / 277VAC(TYP)	I/P : 277VAC	PF= 0.994 / 277 VAC
		0.97 /347 VAC(TYP)	I/P : 347VAC	PF= 0.984 / 347VAC
		0.93 / 480 VAC(TYP)	I/P : 480VAC O/P : FULL LOAD Ta : 25°C	PF= 0.949 / 480VAC
4	EFFICIENCY	90 % (TYP)	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	91.45 %
5	INPUT CURRENT	347V/ 0.38 A (TYP)	I/P : 347 VAC	I = 0.31 A/ 347 VAC
		480V/ 0.28 A (TYP)	I/P : 480 VAC O/P : FULL LOAD Ta : 25°C	I = 0.25 A/ 480 VAC
6	INRUSH CURRENT	480V/ 25 A (TYP) twidth=900μ s measured at 50% Ipeak	I/P : 480VAC O/P : FULL LOAD Ta : 25°C	I = 32 A/ 480VAC T50= 378 us
7	LEAKAGE CURRENT	< 0.75 mA / 480 VAC	I/P : 480 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.26 mA N-FG : 0.24 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°C	THD : 10.8 % THD : 12.5 % THD : 16.2 %
		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°C	THD : 16.02 %

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°C	105 %/ 480 VAC 105 %/ 347 VAC Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	CH1 : 23 V ~ 27 V	I/P : 480 VAC I/P : 347 VAC O/P : MIN LOAD Ta : 25°C	25.04 V/ 480VAC 25.04 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°C	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 : 950V/9A	I/P : High-Line +3V = 531 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 474 V (2) 507 V (3) 470 V
2	Diode Peak Voltage	Q101 Rated : 100V/56A	I/P : High-Line +3V = 531 V O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C	(1) 85.2 V (2) 82.8 V (3) 85 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°C	(1) 406 V (2) 418 V (3) 406 V
4	Control IC Voltage Test	U1 Rated : 10.3V~22.5V	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°C	(1) 14.15 V (2) 14.150 V (3) 14.164 V
5	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : 950V/9A	I/P : High-Line +3V = 531 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 507 V (2) 764 V (3) 505 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 : 2 KVAC/min O/P-FG : 1.5KVAC/min	I/P-O/P : 4 KVAC/min I/P-FG : 2.4 KVAC/min O/P-FG : 1.8 KVAC/min Ta : 25°C	I/P-O/P : 3.08 mA I/P-FG : 2.141 mA O/P-FG : 3.41 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 /70%RH	I/P-O/P : 24.5 GΩ I/P-FG : 18.9 GΩ O/P-FG : 30 GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25°C / 70%RH	13 mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS C	I/P:230/380VAC/50HZ O/P:100/50%ELECTRONIC LOAD O/P:100% LED LOAD Ta:25°C	PASS
2	CONDUCTION	EN55015 CLASS B FCC Part 15 Subpart B	I/P: 230/380VAC (50HZ/60HZ) O/P:FULL/50% LOAD Ta:25°C	PASS Test by certified Lab
3	RADIATION	EN55015 CLASS B FCC Part 15 Subpart B	I/P: 230/380 VAC(50HZ/60HZ) O/P:FULL LOAD/50% LOAD Ta:25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR:8KV / Contact:4KV	I/P:230/380VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT : 1KV	I/P: 230/380 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV L,N-PE:4KV	I/P: 230/380 VAC/50HZ O/P:FULL LOAD Ta:25°C	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

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																												
1	TEMPERATURE RISE TEST	MODEL : HVG-100-20 1. ROOM AMBIENT BURN-IN : 1.5 HRS I/P : 347VAC O/P : FULL LOAD Ta= 31 °C 2. HIGH AMBIENT BURN-IN : 1.5 HRS I/P : 347VAC O/P : FULL LOAD Ta=64.6 °C	<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=31 °C</th> <th>HIGH AMBIENT Ta=64.6 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF2</td><td>50.0°C</td><td>75.9°C</td></tr> <tr><td>2</td><td>BD1</td><td>50.7°C</td><td>76.6°C</td></tr> <tr><td>3</td><td>C48</td><td>51.5°C</td><td>77.5°C</td></tr> <tr><td>4</td><td>L1</td><td>51.8°C</td><td>77.6°C</td></tr> <tr><td>5</td><td>D2</td><td>58.1°C</td><td>85.4°C</td></tr> <tr><td>6</td><td>C5</td><td>54.5°C</td><td>79.6°C</td></tr> <tr><td>7</td><td>Q1</td><td>51.7°C</td><td>77.5°C</td></tr> <tr><td>8</td><td>Q3</td><td>53.5°C</td><td>79.7°C</td></tr> <tr><td>9</td><td>T3</td><td>55.0°C</td><td>80.8°C</td></tr> <tr><td>10</td><td>T1</td><td>59.6°C</td><td>84.3°C</td></tr> <tr><td>11</td><td>C203</td><td>55.1°C</td><td>80.7°C</td></tr> <tr><td>12</td><td>RTH2</td><td>52.6°C</td><td>78.7°C</td></tr> <tr><td>13</td><td>C85</td><td>52.5°C</td><td>78.1°C</td></tr> <tr><td>14</td><td>U2</td><td>53.7°C</td><td>79.1°C</td></tr> <tr><td>15</td><td>C103</td><td>53.4°C</td><td>79.6°C</td></tr> <tr><td>16</td><td>C106</td><td>50.1°C</td><td>76.4°C</td></tr> <tr><td>17</td><td>LF100</td><td>51.5°C</td><td>77.7°C</td></tr> <tr><td>18</td><td>Q101</td><td>56.9°C</td><td>82.8°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=31 °C	HIGH AMBIENT Ta=64.6 °C	1	LF2	50.0°C	75.9°C	2	BD1	50.7°C	76.6°C	3	C48	51.5°C	77.5°C	4	L1	51.8°C	77.6°C	5	D2	58.1°C	85.4°C	6	C5	54.5°C	79.6°C	7	Q1	51.7°C	77.5°C	8	Q3	53.5°C	79.7°C	9	T3	55.0°C	80.8°C	10	T1	59.6°C	84.3°C	11	C203	55.1°C	80.7°C	12	RTH2	52.6°C	78.7°C	13	C85	52.5°C	78.1°C	14	U2	53.7°C	79.1°C	15	C103	53.4°C	79.6°C	16	C106	50.1°C	76.4°C	17	LF100	51.5°C	77.7°C	18	Q101	56.9°C	82.8°C	
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 347 VAC O/P : 103 % LOAD Ta : 25°C	TEST : OK																																																																												
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 480VAC/180VAC O/P : 100 % LOAD Ta= -40 °C	TEST : OK																																																																												
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60°C NO DAMAGE	I/P : 531 VAC O/P : FULL LOAD Ta= 60 °C HUMIDITY= 95 %R.H	TEST : OK																																																																												
5	TEMPERATURE COEFFICIENT	± 0.03%(0-50°C)	I/P : 347 VAC O/P : FULL LOAD	± 0.004 %(0-50°C)																																																																												
6	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																																																																												

7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -45°C~ +65°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 : 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°C	TEST : OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C103 IS THE MOST CRITICAL COMPONENT (1) I/P : 347VAC O/P : FULL LOAD Tc= 80 °C LIFE TIME (2) I/P : 347VAC O/P : 75% LOAD Tc= 80 °C LIFE TIME (3) I/P : 347VAC O/P : 50% LOAD Tc= 80 °C LIFE TIME	(1) 29512 HRS (2) 70134 HRS (3) 54234 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 174.9K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 50,000 hours	

RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT TSENG

12.10.30 A50-F031