



Test Report: HVG-65-54

65W 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

■ ESDG VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RIPPLE & NOISE	V1 : 300 mVp-p (Max)	I/P : 347VAC O/P : FULL LOAD Ta : 25°C	V1 : 29 mVp-p (Max)
2	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 49V ~ 58 V	I/P : 480 VAC I/P : 347 VAC O/P : MIN LOAD Ta : 25°C	47.29 V ~ 60.79 V/ 480 VAC 47.284 V ~ 60.79 V/ 347 VAC
3	OUTPUT CURRENT ADJUST RANGE	CH1 : 0.72A~1.21A	I/P : 480 VAC I/P : 347 VAC O/P : CV MODE Ta : 25°C	0.510 A~ 1.338 A/ 480 VAC 0.508 A~ 1.336 A/ 347 VAC
4	OUTPUT VOLTAGE TOLERANCE	V1 : 1%~ -1 % (Max)	I/P : 180 VAC / 480 VAC O/P : FULL/ MIN LOAD Ta : 25°C	V1 : 0.029 %~ -0.029 %
5	LINE REGULATION	V1 : 0.5 %~ -0.5% (Max)	I/P : 180 VAC ~ 480 VAC O/P : FULL LOAD Ta : 25°C	V1 : 0 %~ -0.012 %
6	LOAD REGULATION	V1 : 0.5 %~-0.5% (Max)	I/P : 347 VAC O/P : FULL ~MIN LOAD Ta : 25°C	V1 : 0.023 %~ -0.034 %
7	SET UP TIME	480 VAC : 400 ms (Max) 347VAC : 400 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/ 169 ms 347VAC/ 268 ms 230VAC/ 329 ms
8	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/ 51 ms 347VAC/ 52 ms 230VAC/ 52 ms
9	HOLD UP TIME	480 VAC : 30 ms (TYP) 347VAC : 16 ms (TYP)	I/P : 480 VAC I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	480 VAC/ 37.2 ms 347VAC/ 16.6 ms
10	OVER/UNDERSHOOT TEST	< ±5%	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %

11	DYNAMIC LOAD	V1 : 5400 mVp-p	I/P : 347VAC (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)290 mVp-p (2)180 mVp-p (3)180 mVp-p (4)640 mVp-p																																																																																																																																																																																																						
12	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) <table><tr><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%</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>95%~108%</td></tr></table> *1 ~ 10V dimming function for output current adjustment (Typical) <table><tr><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%</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>95%~108%</td></tr></table> *10V PWM signal for output current adjustment (Typical) : Frequency range :100Hz ~ 3KHz <table><tr><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%</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>95%~108%</td></tr></table> TEST RESULT: I/P : 230 VAC ;Ta : 25℃ <table><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>0.126A</td><td>0.246A</td><td>0.366A</td><td>0.486A</td><td>0.606A</td><td>0.725A</td><td>0.847A</td><td>0.964A</td><td>1.085A</td><td>1.197A</td><td>1.271A</td></tr><tr><td>%</td><td>0.00%</td><td>10.41%</td><td>20.33%</td><td>30.25%</td><td>40.17%</td><td>50.08%</td><td>59.92%</td><td>70.00%</td><td>79.67%</td><td>89.67%</td><td>98.93%</td><td>105.04%</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>0.137A</td><td>0.252A</td><td>0.372A</td><td>0.500A</td><td>0.621A</td><td>0.741A</td><td>0.855A</td><td>0.982A</td><td>1.105A</td><td>1.221A</td><td>1.271A</td></tr><tr><td>%</td><td>0.00%</td><td>11.32%</td><td>20.83%</td><td>30.74%</td><td>41.32%</td><td>51.32%</td><td>61.24%</td><td>70.66%</td><td>81.16%</td><td>91.32%</td><td>100.91%</td><td>105.04%</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>0.152A</td><td>0.261A</td><td>0.381A</td><td>0.502A</td><td>0.622A</td><td>0.743A</td><td>0.864A</td><td>0.985A</td><td>1.106A</td><td>1.227A</td><td>1.271A</td></tr><tr><td>%</td><td>0.00%</td><td>12.56%</td><td>21.57%</td><td>31.49%</td><td>41.49%</td><td>51.40%</td><td>61.40%</td><td>71.40%</td><td>81.40%</td><td>91.40%</td><td>101.40%</td><td>105.04%</td></tr></table>				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%	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%	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%	1	Resistance value	SHORT	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN	Output current	0.000A	0.126A	0.246A	0.366A	0.486A	0.606A	0.725A	0.847A	0.964A	1.085A	1.197A	1.271A	%	0.00%	10.41%	20.33%	30.25%	40.17%	50.08%	59.92%	70.00%	79.67%	89.67%	98.93%	105.04%	2	Dimming value	SHORT	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN	Output current	0.000A	0.137A	0.252A	0.372A	0.500A	0.621A	0.741A	0.855A	0.982A	1.105A	1.221A	1.271A	%	0.00%	11.32%	20.83%	30.74%	41.32%	51.32%	61.24%	70.66%	81.16%	91.32%	100.91%	105.04%	3	Duty value	SHORT	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN	Output current	0.000A	0.152A	0.261A	0.381A	0.502A	0.622A	0.743A	0.864A	0.985A	1.106A	1.227A	1.271A	%	0.00%	12.56%	21.57%	31.49%	41.49%	51.40%	61.40%	71.40%	81.40%	91.40%	101.40%	105.04%
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13	CONSTANT CURRENT REGION	32.4V ~ 54V	I/P : 347 VAC O/P : FULL LOAD Ta : 25℃	O/P=32.4V :1.231 A O/P=53V: 1.231 A																																																																																																																																																																																																						

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
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1	INPUT VOLTAGE RANGE	180VAC~528 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	158V~480V TEST : OK
			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)	
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P : 180VAC ~ 528 VAC O/P : FULL~MIN LOAD Ta : 25°C	TEST : OK
3	POWER FACTOR	0.98 / 230 VAC(TYP)	I/P : 230VAC	PF= 0.9959 / 230 VAC
		0.97 / 277VAC(TYP)	I/P : 277VAC	PF= 0.9912 / 277 VAC
		0.97 /347 VAC(TYP)	I/P : 347VAC	PF= 0.9792 / 347VAC
		0.93 / 480 VAC(TYP)	I/P : 480VAC O/P : FULL LOAD Ta : 25°C	PF= 0.9686 / 480VAC
4	EFFICIENCY	90% (TYP)	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	91.1 %
5	INPUT CURRENT	347V/ 0.22 A (TYP)	I/P : 347 VAC	I = 0.211 A/ 347 VAC
		480V/ 0.18 A (TYP)	I/P : 480 VAC O/P : FULL LOAD Ta : 25°C	I = 0.156 A/ 480 VAC
6	INRUSH CURRENT	480V/ 25 A (TYP) (twidth=420us measured at 50% Ipeak) COLD START	I/P : 480VAC O/P : FULL LOAD Ta : 25°C	I = 20 A/ 480VAC T50= 400 us
7	LEAKAGE CURRENT	< 0.75 mA / 480 VAC	I/P : 480 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.25 mA N-FG : 0.26 mA
8	TOTAL HARMONIC DISTORTION	Total harmonic distortion will be lower than 20% when output loading is 60% or higher at 230VAC / 277VAC / 347VAC	I/P : 230VAC I/P : 277VAC I/P : 347VAC O/P : 60% LOAD Ta : 25°C	THD : 13.38 % THD : 15.04 % THD : 12.93 %
		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 : 16.23 %

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	103.12%/ 480 VAC 102.89%/ 347 VAC Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	CH1 : 59V ~ 65 V	I/P : 480 VAC I/P : 347 VAC O/P : MIN LOAD Ta : 25°C	61.11V/ 480VAC 61.13V/ 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 : 9A/950V	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) 810 V (2) 802 V (3) 546 V
2	Diode Peak Voltage	D101 Rated : 10A/200V	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) 168 V (2) 158 V (3) 168 V
3	Input Capacitor Voltage	C5 Rated : 22u/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) 396 V (2) 384 V (3) 384 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°C	(1) 19.3 V (2) 20.7 V (3) 19.3 V (4) 17.1 V (5) 19.1 V (6) 16.7 V

5	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : 9A/950V	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) 825 V (2) 857 V (3) 817 V
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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 : 1.5 KVAC/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 : 3.28 mA I/P-FG : 2.952 mA O/P-FG : 1.966 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 : 3.37 GΩ I/P-FG : 2.16 GΩ O/P-FG : 10.8 GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25°C / 70%RH	23 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°C	PASS
2	CONDUCTION	EN55015 CLASS B FCC Part 15 Subpart B	I/P: 230VAC/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: 230VAC/380VAC/50HZ/60HZ O/P:FULL LOAD Ta:25°C	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°C	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°C	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°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-65-24 1. ROOM AMBIENT BURN-IN : 4.5 HRS I/P : 347VAC O/P : FULL LOAD Ta=33.2 °C 2. HIGH AMBIENT BURN-IN : 1 HRS I/P : 347VAC O/P : FULL LOAD Ta=65.5 °C <table><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 33.2 °C</th><th>HIGH AMBIENT Ta= 65.5 °C</th></tr><tr><td>1</td><td>BD1</td><td>52.5°C</td><td>82.2°C</td></tr><tr><td>2</td><td>L2</td><td>55.3°C</td><td>84.7°C</td></tr><tr><td>3</td><td>Q1</td><td>57.8°C</td><td>86.9°C</td></tr><tr><td>4</td><td>U1</td><td>55.3°C</td><td>85.1°C</td></tr><tr><td>5</td><td>Q3</td><td>60.1°C</td><td>88.9°C</td></tr><tr><td>6</td><td>C5</td><td>56.6°C</td><td>85.4°C</td></tr><tr><td>7</td><td>RTH2</td><td>54.1°C</td><td>83.5°C</td></tr><tr><td>8</td><td>T1</td><td>65.0°C</td><td>93.4°C</td></tr><tr><td>9</td><td>C62</td><td>56.7°C</td><td>85.6°C</td></tr><tr><td>10</td><td>C46</td><td>51.7°C</td><td>81.8°C</td></tr><tr><td>11</td><td>D101</td><td>65.5°C</td><td>95.1°C</td></tr><tr><td>12</td><td>C102</td><td>60.3°C</td><td>89.5°C</td></tr><tr><td>13</td><td>C203</td><td>58.9°C</td><td>87.8°C</td></tr><tr><td>14</td><td>LF100</td><td>55.1°C</td><td>84.7°C</td></tr><tr><td>15</td><td>C104</td><td>55.7°C</td><td>85.3°C</td></tr></table>			NO	Position	ROOM AMBIENT Ta= 33.2 °C	HIGH AMBIENT Ta= 65.5 °C	1	BD1	52.5°C	82.2°C	2	L2	55.3°C	84.7°C	3	Q1	57.8°C	86.9°C	4	U1	55.3°C	85.1°C	5	Q3	60.1°C	88.9°C	6	C5	56.6°C	85.4°C	7	RTH2	54.1°C	83.5°C	8	T1	65.0°C	93.4°C	9	C62	56.7°C	85.6°C	10	C46	51.7°C	81.8°C	11	D101	65.5°C	95.1°C	12	C102	60.3°C	89.5°C	13	C203	58.9°C	87.8°C	14	LF100	55.1°C	84.7°C	15	C104	55.7°C	85.3°C
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 528VAC/180VAC O/P : 100 % LOAD Ta= -40 °C	TEST : OK																																																																
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60°C NO DAMAGE	I/P : 528 VAC O/P : FULL LOAD Ta= 60 °C HUMIDITY= 95 %R.H	TEST : OK																																																																
4	TEMPERATURE COEFFICIENT	± 0.03%(0~60°C)	I/P : 347 VAC O/P : FULL LOAD	± 0.011 %(0~60°C)																																																																
5	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																																																																
6	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																																																																

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°C	TEST : OK
8	CAPACITOR LIFE CYCLE	SUPPOSE C102 IS THE MOST CRITICAL COMPONENT (1) I/P : 347VAC O/P : FULL LOAD Tc=75 °C LIFE TIME (2) I/P : 347VAC O/P : 75% LOAD Tc= 75 °C LIFE TIME (3) I/P : 347VAC O/P : 50% LOAD Tc=75 °C LIFE TIME	(1) 56870 HRS (2) 63621 HRS (3) 76129 HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 612.6K hrs min. Telcordia SR-332 (Bellcore) ; 208K hrs min. MIL-HDBK-217F (25°C)	
10	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