



# Test Report: HVG-65-15

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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

■ **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°C	V1 : 39 mVp-p (Max)
2	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 13.5V ~ 17V	I/P : 480 VAC I/P : 347 VAC O/P : MIN LOAD Ta : 25°C	12.894 V ~ 17.689 V / 480 VAC 12.886 V ~ 17.689 V / 347 VAC
3	OUTPUT CURRENT ADJUST RANGE	CH1 : 2.58A~4.3 A	I/P : 480 VAC I/P : 347 VAC O/P : CV MODE Ta : 25°C	1.917 A~ 4.599 A / 480 VAC 1.918 A~ 4.599 A / 347 VAC
4	OUTPUT VOLTAGE TOLERANCE	V1 : 2%~-2% (Max)	I/P : 180 VAC / 480 VAC O/P : FULL/ MIN LOAD Ta : 25°C	V1 : 0.71 %~-0.71 %
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 %
6	LOAD REGULATION	V1 : 1.5 %~-1.5% (Max)	I/P : 347 VAC O/P : FULL ~MIN LOAD Ta : 25°C	V1 : 0.54 %~-0.83 %
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/ 15.2 ms 347VAC/ 18.6 ms 230VAC/ 18.6 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/ 42 ms 347VAC/ 20 ms
10	OVER/UNDERSHOOT TEST	< ±5%	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %

11	DYNAMIC LOAD	V1 : 1500 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°C	(1)310 mVp-p (2)249 mVp-p (3)181 mVp-p (4)567 mVp-p																																																																																																																																																																																																						
12	<p>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)</p> <table border="1" data-bbox="146 833 1326 947"> <tr> <th>Resistance value</th> <th>Short</th> <th>10K</th> <th>20K</th> <th>30K</th> <th>40K</th> <th>50K</th> <th>60K</th> <th>70K</th> <th>80K</th> <th>90K</th> <th>100K</th> <th>OPEN</th> </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> <p>*1 ~ 10V dimming function for output current adjustment (Typical)</p> <table border="1" data-bbox="146 981 1326 1095"> <tr> <th>Dimming value</th> <th>Short</th> <th>1V</th> <th>2V</th> <th>3V</th> <th>4V</th> <th>5V</th> <th>6V</th> 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13	CONSTANT CURRENT REGION	9V ~ 15V	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	O/P=9V : 4.365 A O/P=14V : 4.365 A																																																																																																																																																																																																						

**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	159V-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 ~ 528 VAC O/P : FULL-MIN LOAD Ta : 25°C	TEST : OK
3	POWER FACTOR	0.98 / 230 VAC(TYP)	I/P : 230VAC	PF= 0.9897 / 230 VAC
		0.97 / 277VAC(TYP)	I/P : 277VAC	PF= 0.9842 / 277 VAC
		0.97 /347 VAC(TYP)	I/P : 347VAC	PF= 0.9657 / 347VAC
		0.93 / 480 VAC(TYP)	I/P : 480VAC O/P : FULL LOAD Ta : 25°C	PF= 0.9388 / 480VAC
4	EFFICIENCY	87.5 % (TYP)	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	88.5 %
5	INPUT CURRENT	347V/ 0.22 A (TYP)	I/P : 347 VAC	I = 0.15644 A/ 347 VAC
		480V/ 0.18 A (TYP)	I/P : 480 VAC O/P : FULL LOAD Ta : 25°C	I = 0.11904 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 = 19.4 A/ 480VAC T5= 390 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 : 0.28 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 : 12.53 % THD : 14.37 % THD : 16.35 %
		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 : 15.54 %

**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	101.8%/ 480 VAC 101.9%/ 347 VAC Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	CH1 : 18V - 21 V	I/P : 480 VAC I/P : 347 VAC O/P : MIN LOAD Ta : 25°C	19.674V/ 480VAC 19.615V/ 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	SHORT EVERY OUTPUT 1 HOUR 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) 786 V (2) 722 V (3) 585 V
2	Diode Peak Voltage	D101 Rated : 30A/65V	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) 56.1 V (2) 48.9 V (3) 52.1 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) 428 V (2) 416 V (3) 396 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) 20.8 V (2) 18.8 V (3) 18.8 V  (4) 16.8 V (5) 16.4 V (6) 16.2 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) 841 V (2) 776 V (3) 784 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 : 3.31 mA I/P-FG : 2.948 mA O/P-FG : 2.012 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 : 4.24 GΩ I/P-FG : 3.00 GΩ O/P-FG : 18.2 GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25°C / 70%RH	24 mΩ

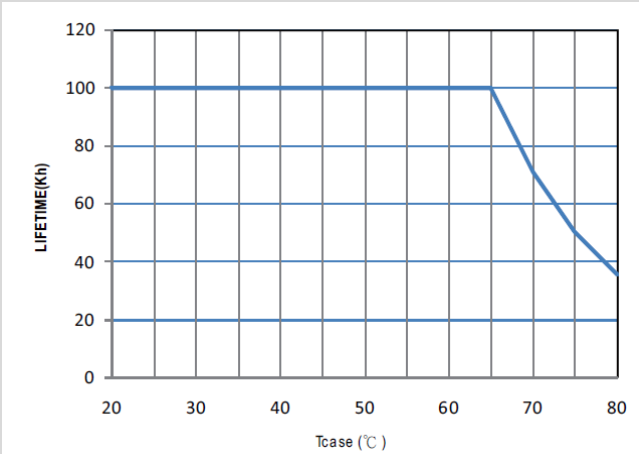
### E.M.C TEST

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

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																
1	TEMPERATURE RISE TEST	MODEL : HVG-65-12 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 border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 33.2 °C</th> <th>HIGH AMBIENT Ta= 65.5 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>55.8°C</td><td>85.2°C</td></tr> <tr><td>2</td><td>L2</td><td>56.4°C</td><td>85.9°C</td></tr> <tr><td>3</td><td>Q1</td><td>60.6°C</td><td>89.5°C</td></tr> <tr><td>4</td><td>U1</td><td>57.6°C</td><td>86.8°C</td></tr> <tr><td>5</td><td>Q3</td><td>61.6°C</td><td>90.6°C</td></tr> <tr><td>6</td><td>C5</td><td>58.7°C</td><td>87.4°C</td></tr> <tr><td>7</td><td>RTH2</td><td>57.3°C</td><td>86.4°C</td></tr> <tr><td>8</td><td>T1</td><td>67.0°C</td><td>96.3°C</td></tr> <tr><td>9</td><td>C62</td><td>59.2°C</td><td>88.2°C</td></tr> <tr><td>10</td><td>C46</td><td>54.1°C</td><td>83.3°C</td></tr> <tr><td>11</td><td>D101</td><td>67.1°C</td><td>97.1°C</td></tr> <tr><td>12</td><td>C102</td><td>64.2°C</td><td>94.0°C</td></tr> <tr><td>13</td><td>C203</td><td>61.8°C</td><td>91.3°C</td></tr> <tr><td>14</td><td>LF100</td><td>59.2°C</td><td>89.5°C</td></tr> <tr><td>15</td><td>C104</td><td>60.1°C</td><td>89.9°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 33.2 °C	HIGH AMBIENT Ta= 65.5 °C	1	BD1	55.8°C	85.2°C	2	L2	56.4°C	85.9°C	3	Q1	60.6°C	89.5°C	4	U1	57.6°C	86.8°C	5	Q3	61.6°C	90.6°C	6	C5	58.7°C	87.4°C	7	RTH2	57.3°C	86.4°C	8	T1	67.0°C	96.3°C	9	C62	59.2°C	88.2°C	10	C46	54.1°C	83.3°C	11	D101	67.1°C	97.1°C	12	C102	64.2°C	94.0°C	13	C203	61.8°C	91.3°C	14	LF100	59.2°C	89.5°C	15	C104	60.1°C	89.9°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/Fu11 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 Ta= 25 °C LIFE TIME (2) I/P : 347VAC O/P : FULL LOAD Ta= 60 °C LIFE TIME (3) I/P : 347VAC O/P : 75% LOAD Ta= 60 °C LIFE TIME (4) I/P : 347VAC O/P : 50% LOAD Ta= 60 °C LIFE TIME	(1) 441928 HRS (2) 46472 HRS (3) 55019 HRS (4) 90612 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	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Tcase 75°C <div data-bbox="469 831 1110 1283" data-label="Figure">  <table border="1"> <caption>Graph Data: Lifetime vs Tcase</caption> <thead> <tr> <th>Tcase (°C)</th> <th>Lifetime (kh)</th> </tr> </thead> <tbody> <tr><td>20</td><td>100</td></tr> <tr><td>30</td><td>100</td></tr> <tr><td>40</td><td>100</td></tr> <tr><td>50</td><td>100</td></tr> <tr><td>60</td><td>100</td></tr> <tr><td>65</td><td>100</td></tr> <tr><td>70</td><td>70</td></tr> <tr><td>75</td><td>50</td></tr> <tr><td>80</td><td>35</td></tr> </tbody> </table> </div>		Tcase (°C)	Lifetime (kh)	20	100	30	100	40	100	50	100	60	100	65	100	70	70	75	50	80	35
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RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT TSENG

12.10.30 A50-F031