



# Test Report: HVGC-65-500

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65W Constant Current Mode 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	CURRENT TOLERANCE	± 5%	I/P : 347VAC O/P : LED MODE : 13V-130V Ta : 25°C	-0.26 %~ 0.26 %
2	CONSTANT CURRENT REGION	13V ~ 130V	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	O/P=13V : 0.501A O/P=129V : 0.502 A
3	OUTPUT CURRENT ADJUST RANGE	CH1 : 300mA~ 500mA	I/P : 480 VAC I/P : 347 VAC O/P : LED :129V Ta : 25°C	0.1788 A~ 0.5694 A/ 480 VAC 0.1797 A~ 0.5701 A/ 347 VAC
4	CURRENT RIPPLE	5.0% max. @rated current	I/P : 230VAC O/P : LED : 65V-129V Ta : 25°C	LED=65V 2.8 % LED=129V 3.3 %
5	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/ 278 ms 347VAC/ 290 ms 230VAC/ 310 ms
6	OVER/UNDERSHOOT TEST	< ±5%	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %

7	<p><b>DIMMER TEST</b> (B Type only) SPEC: ※Built-in 3 in 1 dimming function, IP67 rated. Output constant current level can be adjusted through output resistance or cable by connecting a 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>													
	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°C													
1	Resistance value	SHORT	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN	
	Output current	0.001A	0.054A	0.103A	0.151A	0.199A	0.248A	0.296A	0.344A	0.391A	0.440A	0.485A	0.519A	
	%	0.18%	10.86%	20.52%	30.14%	39.86%	49.58%	59.14%	68.88%	78.28%	87.92%	96.90%	103.70%	
	2	Dimming value	SHORT	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN
		Output current	0.001A	0.055A	0.104A	0.153A	0.201A	0.256A	0.303A	0.355A	0.401A	0.455A	0.500A	0.519A
		%	0.18%	11.02%	20.80%	30.62%	40.20%	51.16%	60.66%	71.02%	80.24%	90.94%	100.04%	103.70%
	3	Duty value	SHORT	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN
		Output current	0.001A	0.054A	0.103A	0.153A	0.203A	0.253A	0.304A	0.354A	0.404A	0.454A	0.505A	0.519A
		%	0.20%	10.80%	20.68%	30.60%	40.62%	50.68%	60.74%	70.76%	80.80%	90.86%	100.92%	103.70%

## INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC-528VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C I/P : LOW-LINE-3V=177V HIGH-LINE+10V=538 V O/P : FULL/MIN LOAD ON : 30 Sec. OFF : 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE )	168 V-528V  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) 0.97 / 277VAC(TYP) 0.95 /347 VAC(TYP) 0.93 / 480VAC(TYP)	I/P : 230VAC I/P : 277VAC I/P : 347VAC I/P : 480VAC O/P : FULL LOAD Ta : 25°C	PF= 0.992 / 230 VAC PF= 0.991 / 277 VAC PF= 0.978 / 347VAC PF= 0.973 / 480VAC

4	EFFICIENCY	90.5 % (TYP)	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	91.3 %
5	INPUT CURRENT	347V/ 0.22 A (TYP) 480V/ 0.18 A (TYP)	I/P : 347 VAC I/P : 480 VAC O/P : FULL LOAD Ta : 25°C	I = 0.21 A / 347 VAC I = 0.154 A / 480 VAC
6	INRUSH CURRENT	230V/ 25 A (TYP) ( $t_{width}=420\mu s$ measured at 50% I <sub>peak</sub> ) COLD START	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	I = 20 A / 230VAC T50= 406 $\mu s$
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 : 0.29 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 : 7.78 % THD : 12.6 % THD : 13.69 %
		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 : 16.56 %

## PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER VOLTAGE PROTECTION	CH1 : 137 V ~ 150 V	I/P : 480 VAC I/P : 347 VAC O/P : MIN LOAD Ta : 25°C	141.4V/ 480VAC 142 V/ 347 VAC Shut down o/p voltage with auto-recovery or re-power on to recovery
2	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
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P : 528 VAC 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) 732 V (2) 288 V (3) 596 V
2	Diode Peak Voltage	D101 Rated : 3A/600V	I/P : High-Line +3V = 531 V	(1) 422 V

			O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C	(2) 292 V (3) 392 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) 442 V (2) 434 V (3) 440 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 V (2) 19 V (3) 19 V  (4) 16 (5) 16 (6) 16.2
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) 908 V (2) 845 V (3) 840 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 : 1.5 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 : 3.18 mA I/P-FG : 2.958 mA O/P-FG : 1.724 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 : 6.56 <b>GΩ</b> I/P-FG : 3.17 <b>GΩ</b> O/P-FG : 3.30 <b>GΩ</b> 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 : HVGC-65-700 1. ROOM AMBIENT BURN-IN : 1.5 HRS I/P : 347VAC O/P : FULL LOAD Ta= 34.2°C 2. HIGH AMBIENT BURN-IN : 1.5 HRS I/P : 347VAC O/P : FULL LOAD Ta= 58.9°C	<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 34.2 °C</th> <th>HIGH AMBIENT Ta= 58.9 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>51.5°C</td><td>75.7°C</td></tr> <tr><td>2</td><td>Q1</td><td>57.6°C</td><td>80.9°C</td></tr> <tr><td>3</td><td>Q3</td><td>58.8°C</td><td>81.8°C</td></tr> <tr><td>4</td><td>T1</td><td>61.5°C</td><td>84.2°C</td></tr> <tr><td>5</td><td>C5</td><td>49.9°C</td><td>78.4°C</td></tr> <tr><td>6</td><td>RTH2</td><td>53.5°C</td><td>76.9°C</td></tr> <tr><td>7</td><td>C102</td><td>56.8°C</td><td>80.1°C</td></tr> <tr><td>8</td><td>U2</td><td>54.1°C</td><td>77.6°C</td></tr> <tr><td>9</td><td>D101</td><td>59.5°C</td><td>82.7°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 34.2 °C	HIGH AMBIENT Ta= 58.9 °C	1	BD1	51.5°C	75.7°C	2	Q1	57.6°C	80.9°C	3	Q3	58.8°C	81.8°C	4	T1	61.5°C	84.2°C	5	C5	49.9°C	78.4°C	6	RTH2	53.5°C	76.9°C	7	C102	56.8°C	80.1°C	8	U2	54.1°C	77.6°C	9	D101	59.5°C	82.7°C	
NO	Position	ROOM AMBIENT Ta= 34.2 °C	HIGH AMBIENT Ta= 58.9 °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 : 531 VAC O/P : FULL LOAD Ta= 60 °C HUMIDITY= 95 %R.H	TEST : OK																																								
4	TEMPERATURE COEFFICIENT	±0.03%(0-50°C)	I/P : 347 VAC O/P : FULL LOAD	± 0%(0-50°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 : -40°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	HVGC-65-700 : 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 : FULL LOAD Tc= 75 °C LIFE TIME (3) I/P : 347VAC O/P : 75% LOAD Tc= 75 °C LIFE TIME	(1) 54492 HRS (2) 58093 HRS (3) 63558 HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 611K hrs min. Telcordia SR-332 (Bellcore) ; 202.7K 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