



# Test Report: HVG-320-36

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320W Single Output Switching Power Supply

## ■ 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

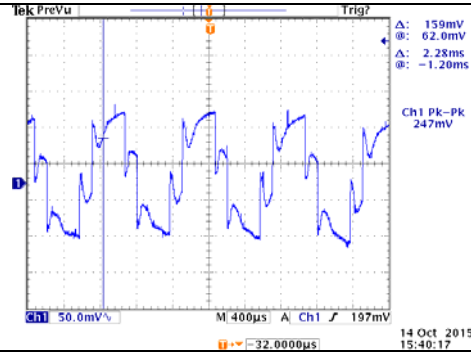
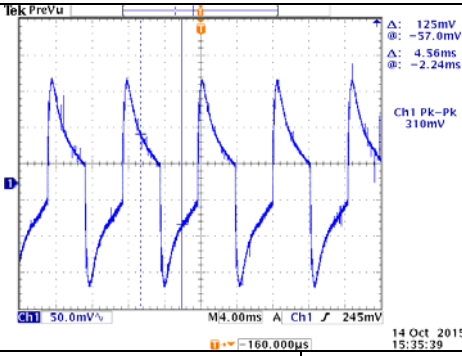
ENVIRONMENT TEST

## DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONSTANT CURRENT REGION	CH1: 18V~ 36V	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	0.11V~ 35 V /347VAC
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 32V~ 39 V	I/P: 347 VAC I/P:230VAC O/P:MIN LOAD Ta:25°C	31.075V~40.022V /347VAC 31.095V~40.18V/230VAC
3	CURRENT ADJ. RANGE	CH1:4.45 A~ 8.9A	I/P: 347 VAC I/P:230VAC O/P:CV MIN & CV MAX-1V Ta:25°C	4.0216A~9.90A /347VAC@CV MAX-1V 4.027A~ 10.05 A /347VAC@CV MIN 4.0216A~10 A/230VAC@CV MAX-1V 4.021A~10.04A/230VAC@CV MIN
4	OUTPUT VOLTAGE TOLERANCE (Max)	V1: 1 % ~ -1 %	I/P:180VAC /528AC O/P:FULL/ MIN LOAD Ta:25°C	V1:-0.19 %~0.06 %
5	LINE REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P:180VAC~528AC O/P:FULL LOAD Ta:25°C	V1: 0 %~0 %
6	LOAD REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P: 347 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.1%~0.09 %
7	OVER/UNDERSHOOT TEST	< ±5%	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	TEST: 2.22 %
8	RIPPLE & NOISE (Max )	V1: 250 mVp-p	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	V1: 48.6mVp-p
<p>low frequency :</p>				
9	SET UP TIME	480VAC/ 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	480VAC/ 314 ms 347VAC/ 306 ms 230 VAC/ 334 ms
INPUT=347VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage			INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	

<b>10</b> RISE TIME	480VAC/ 80 ms (Max) 347VAC/ 80 ms (Max) 230VAC/ 150 ms (Max)	I/P: 480 VAC I/P: 347 VAC I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	480VAC/27.8 ms 347VAC/27.4 ms 230 VAC/26.4 ms
INPUT=347VAC/60HZ @ FULL LOAD CH1 : Output Voltage		INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage	
<b>11</b> HOLD UP TIME	480VAC/ 15ms (Max) 347VAC/15 ms (Max)	I/P: 480 VAC I/P: 347 VAC O/P: FULL LOAD Ta: 25°C	480VAC/ 23.2 ms 347VAC/ 22.8ms
INPUT=480VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=347VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	
<b>12</b> DYNAMIC LOAD	V1: 3600 mVp-p	I/P: 347VAC O/P: (1) FULL /50% LOAD 50%DUTY / 120HZ (2) FULL /50% LOAD 50%DUTY / 1KHZ Ta: 25°C	310mVp-p 247mVp-p
FULL /50% LOAD 50%DUTY / 120HZ		FULL /50% LOAD 50%DUTY / 1KHZ	

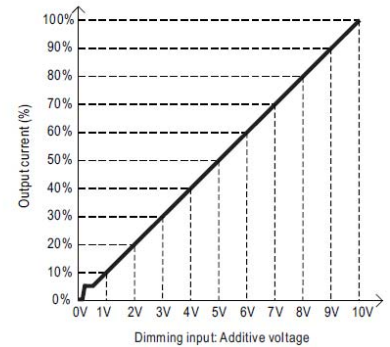
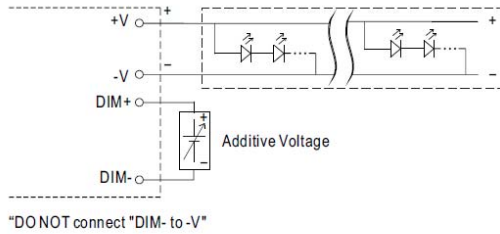


## 13 DIMMING OPERATION (for B-Type)

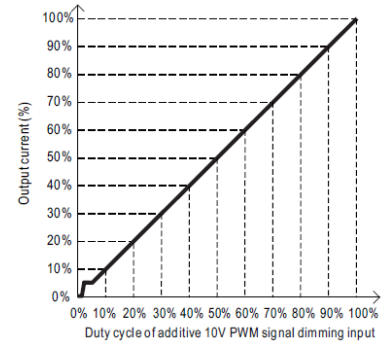
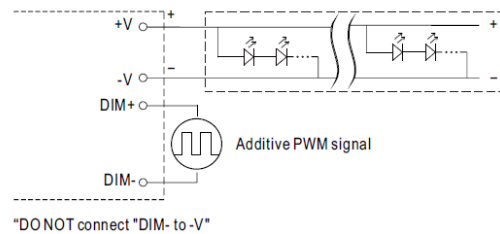
### ※3 in 1 dimming function

- ※Output constant current level can be adjusted by applying one of the three methodologies between DIM+ and DIM-: 0 ~ 10VDC, or 10V PWM signal or resistance.
- ※Direct connecting to LEDs is suggested. It is not suitable to be used with additional drivers.
- ※Dimming source current from power supply: 100µ A (typ.)

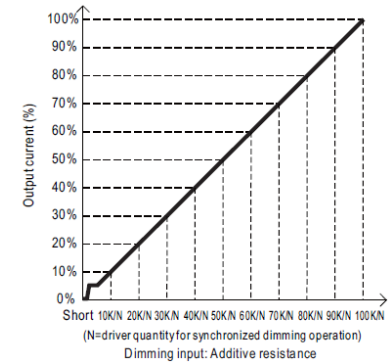
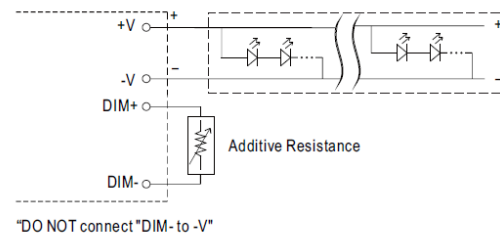
#### ◎ Applying additive 0 ~ 10VDC



#### ◎ Applying additive 10V PWM signal (frequency range 100Hz ~ 3KHz):



#### ◎ Applying additive resistance:



- Note : 1. Min. dimming level is about 5% and the output current is not defined when  $0\% < I_{out} < 5\%$ .  
 2. The output current could drop down to 0% when dimming input is about 0kΩ or 0Vdc, or 10V PWM signal with 0% duty cycle.

I/P : 347VAC  
 O/P : DIMMING TEST  
 TA : 25°C

R	SHORT	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN
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O/P CURRENT	0A	1.020A	1.888A	2.706A	3.681A	4.549A	5.422A	6.314A	7.174A	8.064A	8.852A	9.089A
%	0.00%	11.46%	21.21%	30.40%	41.36%	51.11%	60.92%	70.94%	80.61%	90.61%	99.46%	102.12%
V	0V	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN
O/P CURRENT	0A	1.079A	1.899A	2.821A	3.785A	4.625A	5.522A	6.356A	7.251A	8.149A	9.031A	9.089A
%	0.00%	12.12%	21.34%	31.70%	42.53%	51.97%	62.04%	71.42%	81.47%	91.56%	101.47%	102.12%
PWM (100HZ)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN
O/P CURRENT	0A	1.093A	1.985A	2.879A	3.804A	4.678A	5.566A	6.443A	7.318A	8.194A	9.062A	9.089A
%	0.00%	12.28%	22.30%	32.35%	42.74%	52.56%	62.54%	72.39%	82.22%	92.07%	101.82%	102.12%

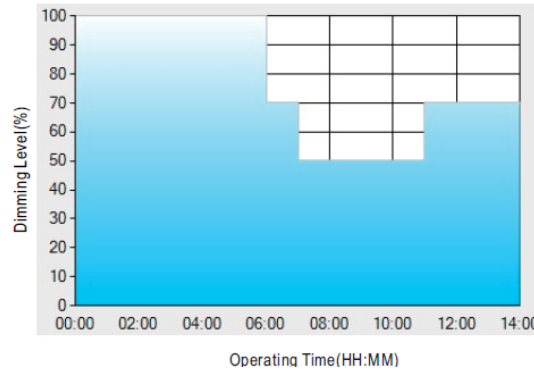
TEST RESULT : OK

## 14 DIMMING OPERATION (for Dxx-Type by User definition)

### ※Smart timer dimming function (for Dxx-Type by User definition)

MEAN WELL Smart timer dimming primarily provides the adaptive proportion dimming profile for the output constant current level to perform up to 14 consecutive hours. 3 dimming profiles hereunder are defined accounting for the most frequently seen applications. If other options may be needed, please contact MEAN WELL for details.

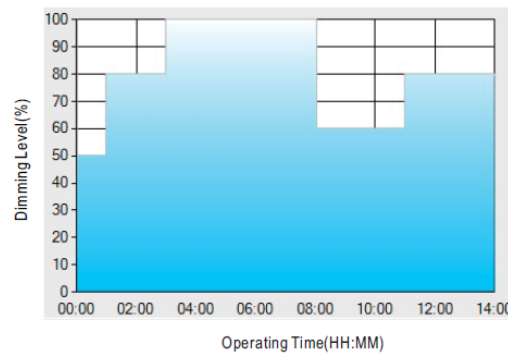
Ex : ☉ D01-Type: the profile recommended for residential lighting



Set up for D01-Type in Smart timer dimming software program:

	T1	T2	T3	T4
TIME**	06:00	07:00	11:00	--
LEVEL**	100%	70%	50%	70%

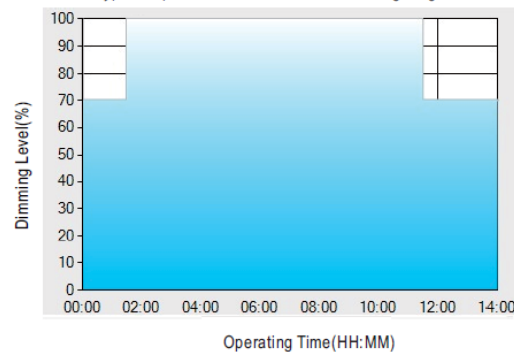
Ex : ☉ D02-Type: the profile recommended for street lighting



Set up for D02-Type in Smart timer dimming software program:

	T1	T2	T3	T4	T5
TIME**	01:00	03:00	8:00	11:00	--
LEVEL**	50%	80%	100%	60%	80%

Ex : ☉ D03-Type: the profile recommended for tunnel lighting



Set up for D03-Type in Smart timer dimming software program:

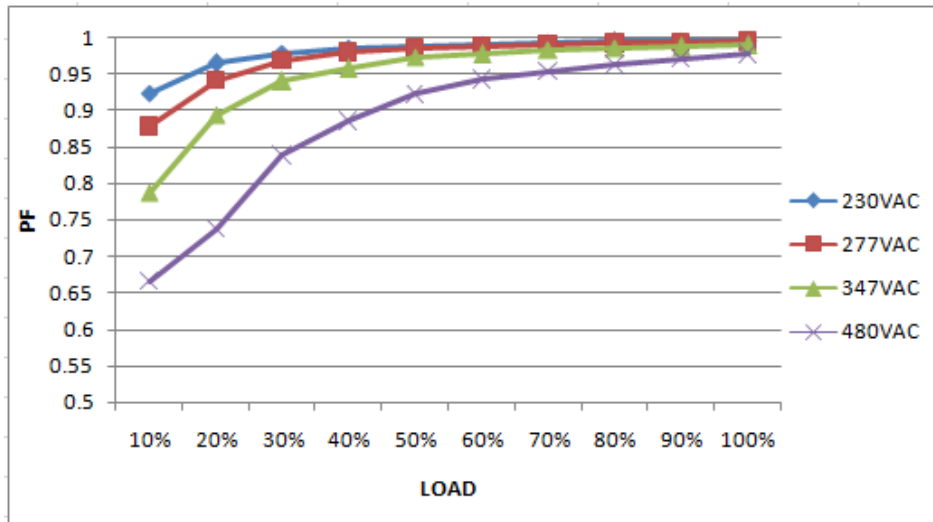
	T1	T2	T3
TIME**	01:30	11:00	--
LEVEL**	70%	100%	70%

I/P : 347VAC  
 O/P : DIMMING TEST  
 TA : 25°C  
 TEST RESULT : OK

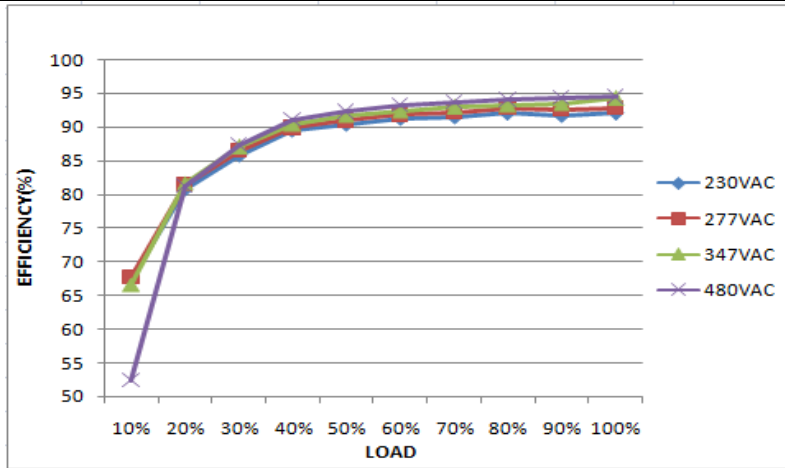
## INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC~528 VAC	I/P: TESTING O/P: FULL LOAD Ta: 25°C	102V~528 V
			I/P: LOW-LINE-3V=177 V HIGH-LINE+10V=538 V O/P: FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST: OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 180 VAC ~528VAC O/P: FULL~MIN LOAD Ta: 25°C	OK
3	INPUT CURRENT (TYP)	480VAC/ 0.8 A 347 VAC/ 1.1 A	I/P: 480VAC/347 VAC O/P: FULL LOAD Ta: 25°C	I=0.72 A /480VAC I =0.981A/ 347VAC
4	LEAKAGE CURRENT	< 0.75 mA / 480VAC	I/P : 480 VAC O/P : Min LOAD Ta : 25°C	L-FG: 0.25 mA N-FG: 0.44 mA L,N -V(+): 0.162 mA L,N-V(-): 0.16 mA
5	POWER FACTOR(TYP)	0.93/480 VAC FULL LOAD 0.95/347 VAC FULL LOAD 0.98/230 VAC FULL LOAD 0.97/277 VAC FULL LOAD	I/P: 480VAC/347VAC/230VAC/277VAC O/P: FULL LOAD Ta: 25°C	PF=0.98/480V/100%LOAD PF=0.9924/347V/100%LOAD PF=0.9948 /230V/100%LOAD PF=0.9933/277V/100%LOAD

P.F vs LOAD

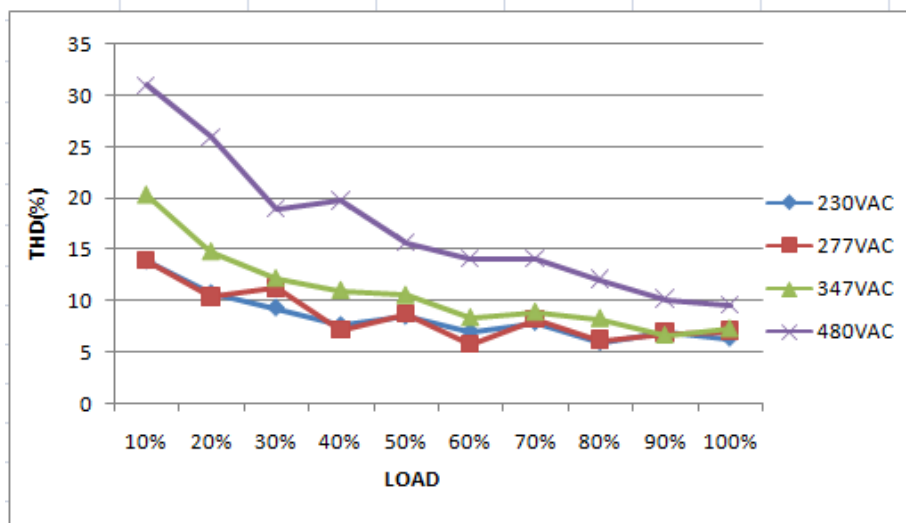


6	EFFICIENCY (TYP)	93.5%	I/P: 347 VAC O/P: FULL LOAD Ta: 25°C	93.84%
EFFICIENCY vs LOAD				



7	INRUSH CURRENT (TYP)	480 V/ 50 A COLD START  (twidth= 850 us measured at 50% Ipeak) COLD START	I/P: 480VAC O/P:FULL LOAD Ta:25°C	I =41 A/ 480VAC  T50= 770 us
	<p>INPUT=480VAC/60HZ @ FULL LOAD</p> <p>CH2 : AC Input Voltage CH4 : Input current (1V=1A)</p> <p>DSO-X 3014A, MY62161480 Wed Jul 22 15:48:20 2015</p> <p>1 2 500V/ 3 10.0A/ -1.264s 2.000s/ 停止</p> <p>DC +1.00000V 1.00.1 AC +500.00V 1000.1 DC +1.98750V 1.00.1 DC +10.0000A 10.0.1</p>			

8	TOTAL HARMONIC DISTORTION	Total harmonic distortion will be lower than 20% when output loading is 50% or higher at 230V/277V/347V/480V	I/P : 347VAC O/P : 100% LOAD 50% LOAD  I/P : 230VAC/277VAC/480V O/P : 50% LOAD Ta : 25°C	THD : 7.8639 % THD : 10.694 %  THD : 7.3488 % THD : 6.4042 % THD : 18.00 %
	THD&LOAD			



## PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	95 %~ 108 % PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed	I/P: 528VAC I/P: 347VAC I/P: 180VAC O/P: TESTING Ta:25°C	102.36%/ 528VAC 102.48%/ 347VAC 102.47%/180VAC PROTECTION TYPE : Constant current limiting, recovers automatically after condition is removed
2	OVER VOLTAGE PROTECTION	V1: 40 V~ 46 V PROTECTION TYPE : Shut down o/p voltage with auto-recovery or re-power on to recovery	I/P: 528VAC I/P: 347VAC I/P: 180VAC O/P: MIN LOAD Ta:25°C	41.27V/ 528VAC 41.30V/ 347VAC 41.29V/ 180VAC PROTECTION TYPE : Shut down and latch off o/p voltage, re-power on to recover.
3	OVER TEMPERATURE PROTECTION	PROTECTION TYPE : Shut down and latch off o/p voltage, re-power on to recover	I/P: 528 VAC I/P: 180 VAC O/P: FULL LOAD	O.T.P. Active PROTECTION TYPE : Shut down and latch off o/p voltage, re-power on to recover.
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed	I/P: 528VAC I/P: 180 VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting, recovers automatically after condition is removed

## COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	P.F.C Transistor ( D to S) or (C to E) Peak Voltage	Q1 Rated 9A/ 950V	I/P: High-Line +3V =531 V AC ON/OFF O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/	VDS: (1) 828V (2) 820V (3) 824V



			<p>Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load.</p> <p>Ta:25°C</p>	<p>(4)828V (5)836V (6)824V (7)828V</p>
2	PWM Transistor ( D to S) or (C to E) <b>Peak Voltage</b>	Q901 Rated 9A/ 950V	<p>I/P:High-Line +3V =531V AC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load.</p> <p>Ta:25°C</p>	<p>VDS: (1)824V (2)824V (3)808V (4)820V (5)828V (6)816V (7)820V</p>
3	Diode <b>Peak Voltage</b>	Q102 Rated: 80A/100 V	<p>I/P:High-Line +3V =531 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. (8)NO LOAD</p> <p>Ta:25°C</p>	<p>Q102: VDS: (1)90.8V (2)88.4V (3)90.4V (4)92.4V (5)92.4V (6)88V (7)87.6V (8)82V</p>
4	<b>Input Capacitor Voltage</b>	C5 Rated: 120 μ/450 V	<p>I/P:High-Line +3V =531V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue</p> <p>Ta:25°C</p>	<p>(1)382V (2)406V (3)390V (4)374V</p>
5	<b>Control IC Voltage Test</b>	PWM IC U901 Rated 8.85V~16V PFC IC U1 Rated: 10 V~20V	<p>I/P:High-Line +3V =531 V AC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. Ta:25°C</p>	<p>(1) 12.8V (2) 12.6V (3) 12.7V (4) 12.8V</p>

## SAFETY & EMC TEST REPORT

### SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	IEC60950-1 I/P-O/P: 3.75KVAC/min I/P-FG:2 KVAC/min<4.5mA O/P-FG:1.5KVAC/min	I/P-O/P: 4.125 KVAC/min I/P-FG: 2.4KVAC/min O/P-FG: 1.8 KVAC/min Ta:25°C	I/P-O/P: 1.78mA I/P-FG: 2.01mA O/P-FG: 1.016mA 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	I/P-O/P: 30.0GΩ I/P-FG: 19.3GΩ O/P-FG: 30.0GΩ NO DAMAGE
3	GROUNDING CONTINUITY	IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	mΩ

### E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONDUCTION	FCC Part 15 Subpart B	I/P: 440 VAC /60HZ O/P:FULL/30% LOAD Ta:25°C	PASS Test by certified Lab
2	RADIATION	FCC Part 15 Subpart B	I/P: 480 VAC /60HZ O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR:8KV / Contact:4KV	I/P: 230VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
3	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT: 1KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
5	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV L,N-PE:4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
6	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-320-24 1. ROOM AMBIENT BURN-IN : 3 HRS I/P : 347VAC O/P : FULL LOAD Ta= 30.5 °C 2. HIGH AMBIENT BURN-IN : 14 HRS I/P : 347VAC O/P : FULL LOAD Ta= 55.9 °C		

		NO	Position	ROOM AMBIENT	HIGH AMBIENT
				Ta= 30.5 °C	Ta= 55.9 °C
		1	BD1	67.7°C	92.5°C
		2	Q1	66.8°C	92.6°C
		3	D1	77.5°C	100.2°C
		4	Q901	67.2°C	93.5°C
		5	RTH3	62.4°C	88.1°C
		6	L2	64.3°C	89.4°C
		7	C2	62.6°C	87.4°C
		8	LF1	63.4°C	87.7°C
		9	ZNR1	62.2°C	86.6°C
		10	C11	64.3°C	89.9°C
		11	D2	65.4°C	90.9°C
		12	C5	66.9°C	92.2°C
		13	C46	64.5°C	90.2°C
		14	C902	66.2°C	92.0°C
		15	T1	74.7°C	102.4°C
		16	L1	67.2°C	93.7°C
		17	T2	67.1°C	92.8°C
		18	C200	64.9°C	90.6°C
		19	Q102	63.4°C	89.4°C
		20	C102	61.3°C	87.0°C
		21	U1	62.1°C	87.4°C
		22	ZNR5	65.1°C	90.5°C
2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR		I/P : 528VAC/180VAC O/P : 100 % LOAD Ta= -45 °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 : 538 VAC O/P : FULL LOAD Ta= 60°C HUMIDITY= 95 %R.H	TEST : OK
4	TEMPERATURE COEFFICIENT	± 0.03 %/°C (0~60°C)		I/P : 347 VAC O/P : FULL LOAD	± 0.005 %/°C (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 : 230VAC/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= 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) 75936HRS (2) 111829HRS (3) 145526HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 124.3K 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	

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

12.10.30 A50-F031