



Test Report: HVG-320-24

320W 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

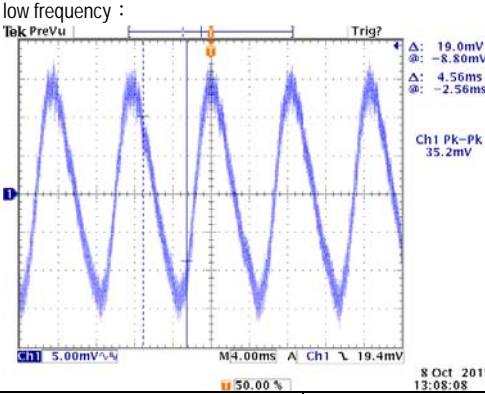
E.M.C. Test

■ RELIABILITY TEST

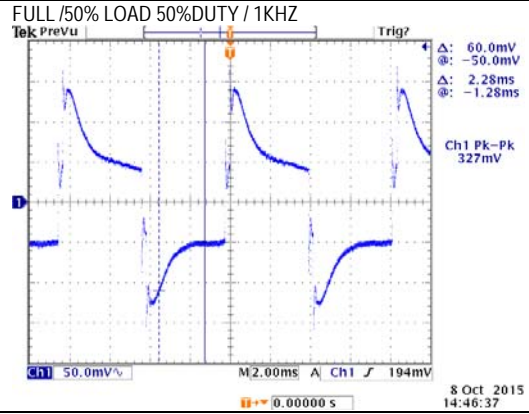
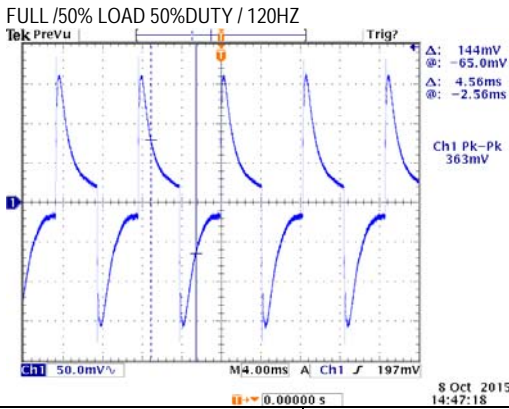
ENVIRONMENT TEST

■ **DESIGN VERIFY TEST**

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONSTANT CURRENT REGION	CH1: 12V~ 24V	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	0.165V~ 23V /347VAC
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 21V~ 26 V	I/P: 347 VAC I/P:230VAC O/P:MIN LOAD Ta:25°C	20.16V~26.91 V /347VAC 20.16V~26.91 V/230VAC
3	CURRENT ADJ. RANGE	CH1:6.7A~ 13.4A	I/P: 347 VAC I/P:230VAC O/P:CV MIN & CV MAX-1V Ta:25°C	5.873A~15.175A /347VAC@CV MAX-1V 6.10A~ 15.22 A /347VAC@CV MIN 5.885A~ 15.17A /230VAC@CV MAX-1V 6.07A~15.22 A/230VAC@CV MIN
4	OUTPUT VOLTAGE TOLERANCE (Max)	V1: 1 % ~ -1 %	I/P:180VAC /528AC O/P:FULL/ MIN LOAD Ta:25°C	V1: 0.358%~ -0.25 %
5	LINE REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P:180VAC~528AC O/P:FULL LOAD Ta:25°C	V1: 0%~ -0.004 %
6	LOAD REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P: 347 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.296~0.308 %
7	OVER/UNDERSHOOT TEST	< ±5%	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	TEST: <5 %
8	RIPPLE & NOISE (Max)	V1: 150 mVp-p	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	V1: 42 mVp-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/ 328ms 347VAC/ 328 ms 230VAC/ 376ms
INPUT=230VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage			INPUT=347VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	

		<p>8 Oct 2015 10:45:18</p>	<p>8 Oct 2015 10:50:20</p>
<p>10 RISE TIME</p>	<p>480VAC/ 80 ms (Max) 347VAC/ 80 ms (Max) 230VAC/ 150 ms (Max)</p>	<p>I/P: 480 VAC I/P: 347 VAC I/P: 230 VAC O/P:FULL LOAD Ta:25°C</p>	<p>480VAC/ 55.2ms 347VAC/ 62.4ms 230VAC/ 59.2ms</p>
<p>INPUT=480VAC/60HZ @ FULL LOAD</p>		<p>INPUT=347VAC/50HZ @ FULL LOAD</p>	
<p>CH1 : Output Voltage</p>		<p>CH1 : Output Voltage</p>	
		<p>8 Oct 2015 10:56:10</p>	<p>8 Oct 2015 10:59:44</p>
<p>11 HOLD UP TIME</p>	<p>480VAC/ 15ms (Max) 347VAC/ 15 ms (Max)</p>	<p>I/P: 480 VAC I/P: 347 VAC O/P:FULL LOAD Ta:25°C</p>	<p>480VAC/ 19.0ms 347VAC/ 18.0 ms</p>
<p>INPUT=347VAC/60HZ @ FULL LOAD</p>		<p>INPUT=480VAC/60HZ @ FULL LOAD</p>	
<p>CH1 : Output Voltage CH2 : AC Input Voltage</p>		<p>CH1 : Output Voltage CH2 : AC Input Voltage</p>	
		<p>8 Oct 2015 11:06:09</p>	<p>8 Oct 2015 11:09:21</p>
<p>12 DYNAMIC LOAD</p>	<p>V1: 2400 mVp-p</p>	<p>I/P: 347VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C</p>	<p>363mVp-p 327mVp-p</p>

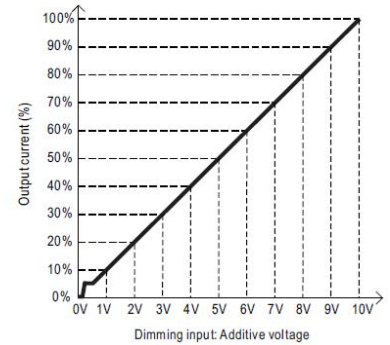
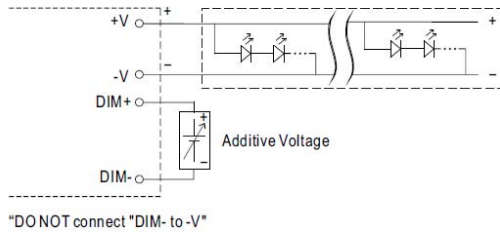


13 DIMMING OPERATION (for B-Type)

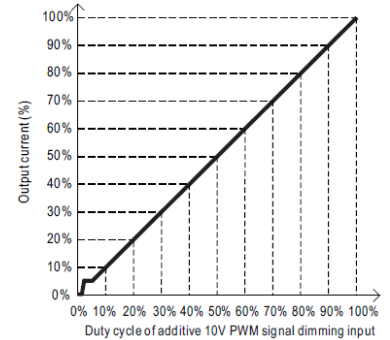
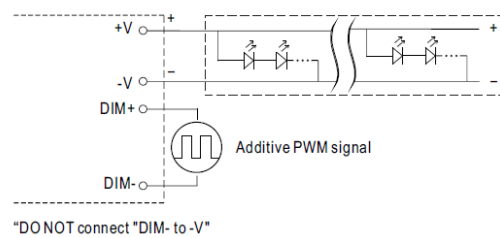
※3 in 1 dimming function

- ※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: 100 μ A (typ.)

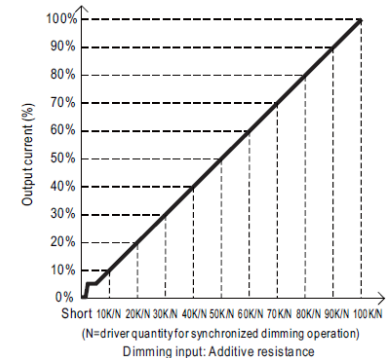
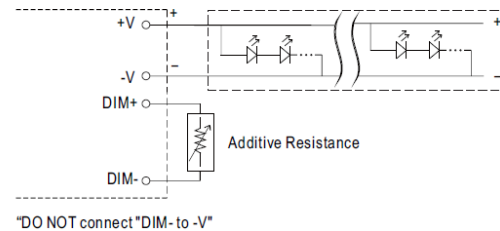
◎ Applying additive 0 ~ 10VDC



◎ 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 0k Ω 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
O/P CURRENT	0A	1.399A	2.680A	4.033A	5.342A	6.613A	7.840A	9.110A	10.334A	11.587A	13.400A	13.539A
%	0.00%	10.44%	20.00%	30.10%	39.87%	49.35%	58.51%	67.99%	77.12%	86.47%	100.00%	101.04%
V	0V	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN
O/P CURRENT	0A	1.481A	2.876A	4.183A	5.533A	6.931A	8.132A	9.502A	10.858A	12.183A	13.398A	13.539A
%	0.00%	11.05%	21.46%	31.22%	41.29%	51.72%	60.69%	70.91%	81.03%	90.92%	99.99%	101.04%
PWM (100HZ)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN
O/P CURRENT	0A	1.497A	2.816A	4.220A	5.590A	6.900A	8.213A	9.524A	10.837A	12.155A	13.456A	13.539A
%	0.00%	11.17%	21.01%	31.49%	41.72%	51.49%	61.29%	71.07%	80.87%	90.71%	100.42%	101.04%

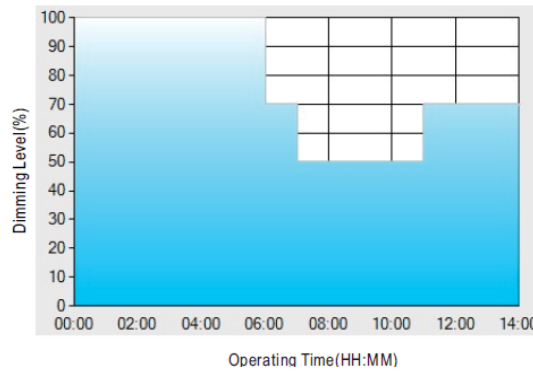
TEST RESULT : OK

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.

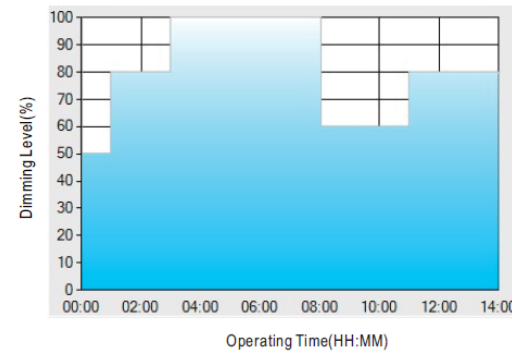
Ex : D01-Type: the profile recommended for residential lighting



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%

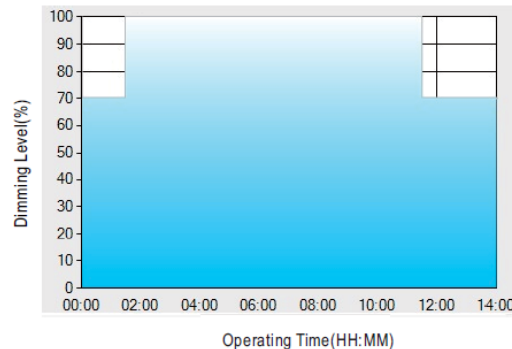
Ex : D02-Type: the profile recommended for street lighting



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%

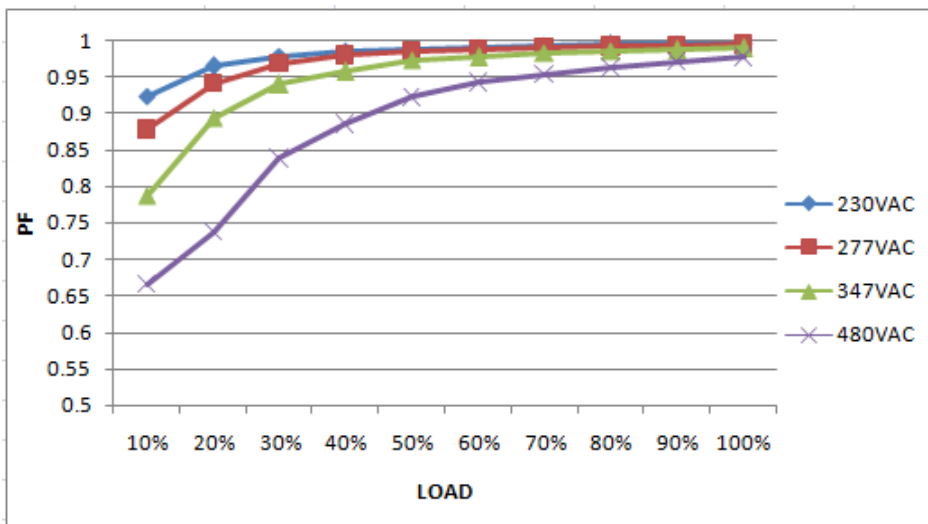
I/P : 347VAC

	O/P : DIMMING TEST TA : 25°C TEST RESULT : OK
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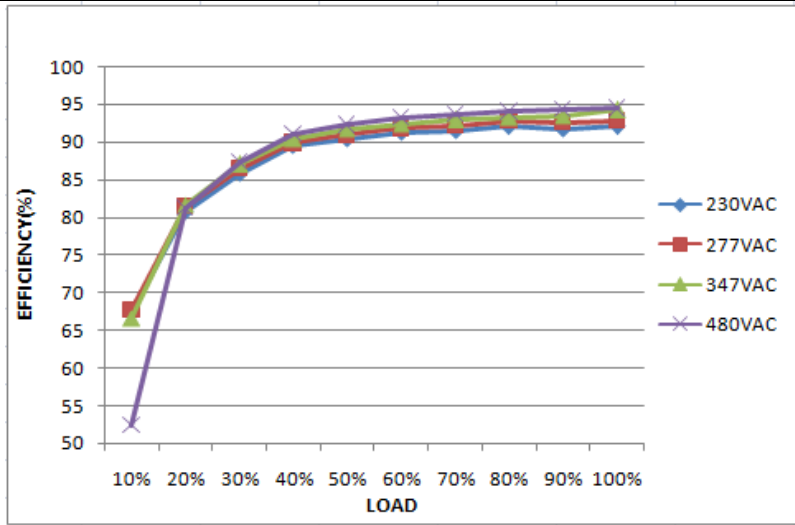
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC-528 VAC	I/P:TESTING O/P:FULL LOAD Ta:25°C	144V-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/ 1.1A	I/P: 480VAC/347 VAC O/P:FULL LOAD Ta:25°C	I= 0.73A/480VAC I =1.059A/ 347VAC
4	LEAKAGE CURRENT	< 0.75 mA / 480VAC	I/P : 480 VAC O/P : Min LOAD Ta : 25°C	L-FG:0.245 mA N-FG:0.25mA
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= 0.9785/480V/100%LOAD PF=0.9926 /347V/100%LOAD PF=0.994 /230V/100%LOAD PF=0.9937 /277V/100%LOAD

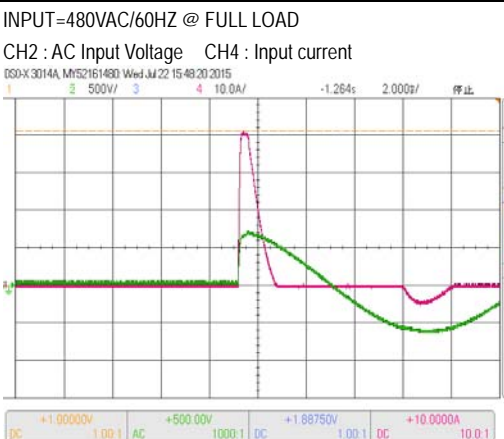
P.F vs LOAD



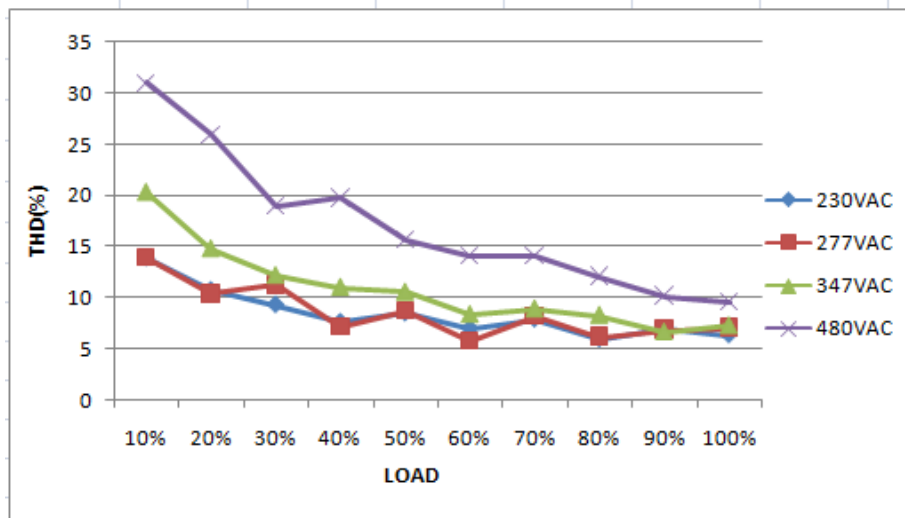
6	EFFICIENCY (TYP)	92.5%	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	93.09 %
EFFICIENCY vs LOAD				



7	INRUSH CURRENT (TYP)	480 V/ 50 A COLD START (twidth= 850us measured at 50% Ipeak) COLD START	I/P: 480VAC O/P: FULL LOAD Ta: 25°C	I = 41 A/ 480VAC T50= 770 us
	INPUT=480VAC/60HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current DSO-X 3014A, MY52161480 Wed Jul 22 15:48:20 2015			



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 : 5.7156 % THD : 7.7025 % THD : 6.715 % THD : 6.5564 % THD : 13.91 %
	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	100.51%/ 528VAC 100.51%/ 347VAC 100.36%/180VAC PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	V1: 27 V- 33 V PROTECTION TYPE : Shut down and latch off o/p voltage, re-power on to recover	I/P: 528VAC I/P: 347VAC I/P: 180VAC O/P: MIN LOAD Ta:25°C	29.066V/ 528VAC 28.874V/ 347VAC 29.034V/ 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 fault 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/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/	VDS: (1) 854V (2) 838V (3) 922V (4) 930V (5) 906V

			<p>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. Ta:25°C</p>	<p>(6)944V (7)846V</p>
2	PWM Transistor (D to S) or (C to E) Peak Voltage	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. Ta:25°C</p>	<p>VDS: (1)942V (2)923V (3)948V (4)923V (5)944V (6)944V (7)916V</p>
3	Diode Peak Voltage	Q102 Rated: 100A/75V	<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 Ta:25°C</p>	<p>Q102: VDS: (1)64.6V (2)52.6V (3)59V (4)65.4V (5)63.8V (6)64.6V (7)58.2V (8)55.8 V</p>
4	Input Capacitor Voltage	C5 Rated: 120u/450V	<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 Ta:25°C</p>	<p>(1)442V (2)389V (3)410V (4) 345V</p>
5	Control IC Voltage Test	PFC IC U1 Rated: 10V-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) 14.78V (2) 13.82V (3) 13.9V (4) 14.06V</p>

SAFETY & EMC TEST REPORT

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
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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: 1.875 mA I/P-FG: 1.931 mA O/P-FG:1.018 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	I/P-O/P: 30GΩ I/P-FG: 11.6G Ω O/P-FG: 30G Ω NO DAMAGE
3	GROUNDING CONTINUITY	IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	25 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 Ta= 30.5 °C	HIGH AMBIENT 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