



# Test Report: HVG-480-24

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480W 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

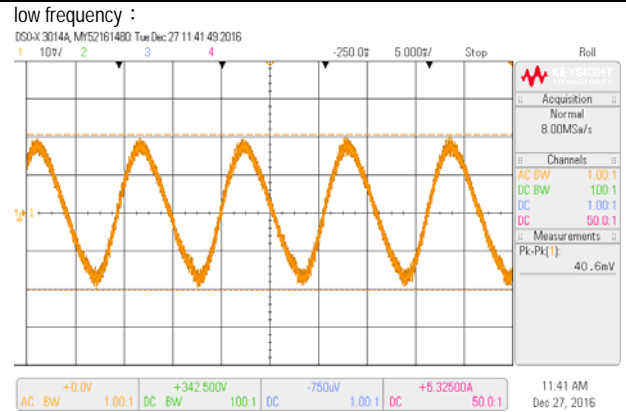
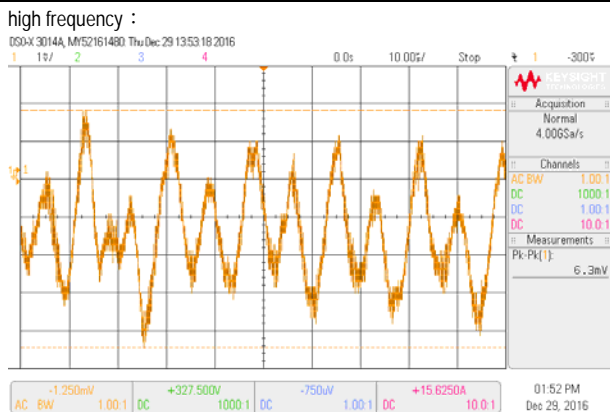
## ■ RELIABILITY TEST

ENVIRONMENT TEST

■ **DESIGN VERIFY TEST**

**OUTPUT FUNCTION TEST**

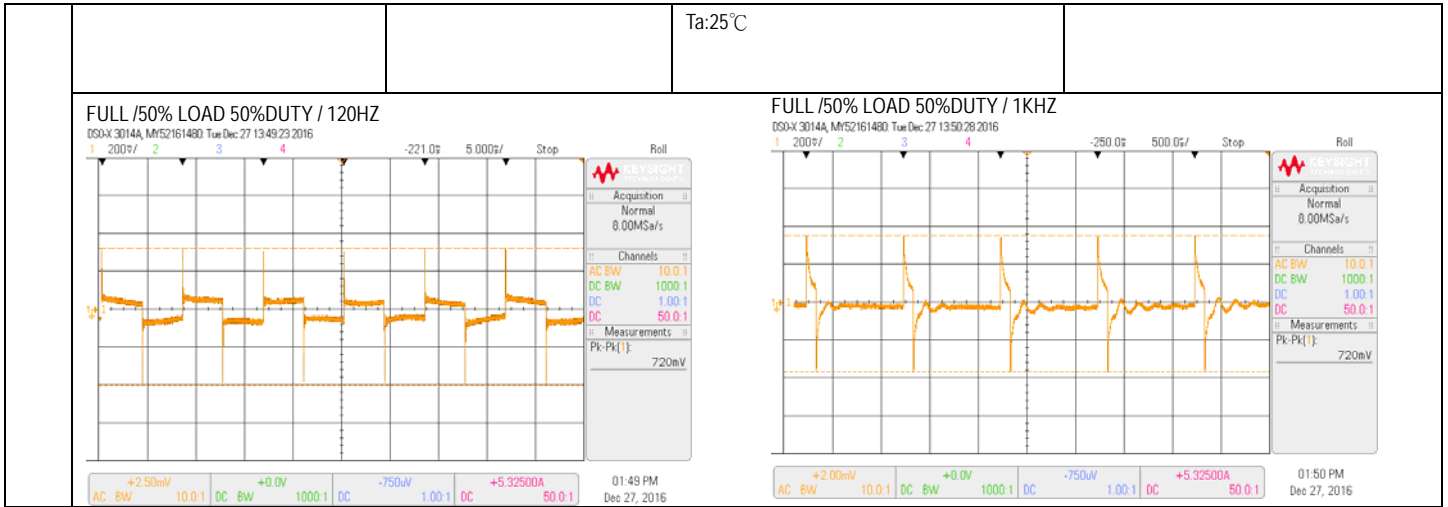
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONSTANT CURRENT REGION	CH1: 12V~ 24V	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	0.2V~ 23V /347VAC
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 20.4V~25.2V	I/P: 347 VAC I/P:230VAC O/P:MIN LOAD Ta:25°C	18.642V~25.874V /347VAC 18.648V~ 25.875V/230VAC
3	CURRENT ADJ. RANGE	CH1:10A~ 20A	I/P: 347 VAC I/P:230VAC O/P:CV MIN & CV MAX-1V Ta:25°C	7.71A~22.022A /347VAC@CV MAX-1V 7.73A~21.983 A /347VAC@CV MIN 7.71A~22.026A /230VAC@CV MAX-1V 7.73A~ 21.983A/230VAC@CV MIN
4	OUTPUT VOLTAGE TOLERANCE (Max)	V1: 1 % ~ -1 %	I/P:180VAC /528AC O/P:FULL/ MIN LOAD Ta:25°C	V1: 0.083%~ -0.612 %
5	LINE REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P:180VAC~528AC O/P:FULL LOAD Ta:25°C	V1: 0 %~-0.016%
6	LOAD REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P: 347 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.342%~ -0.35%
7	OVER/UNDERSHOOT TEST	< ±5%	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	TEST: < 5 %
8	RIPPLE & NOISE (Max)	V1: 200 mVp-p	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	V1: 40.6mVp-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/ 190 ms 347VAC/ 207ms 230VAC/ 220ms
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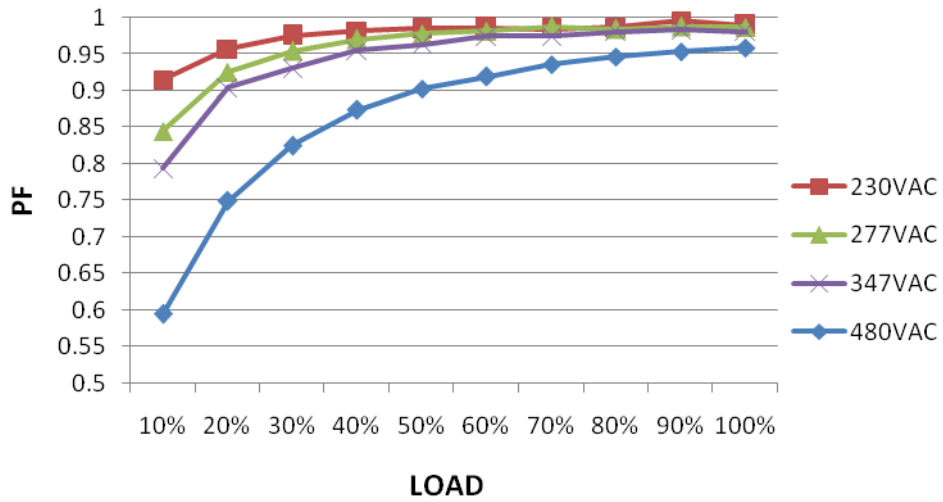
	<p>INPUT=347VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p>	<p>INPUT=480VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p>	
<p>10 RISE TIME</p>	<p>480VAC/ 100 ms (Max) 347VAC/ 100 ms (Max) 230VAC/ 100 ms (Max)</p>	<p>I/P: 480 VAC I/P: 347 VAC I/P: 230 VAC O/P:FULL LOAD Ta:25°C</p>	<p>480VAC/39.6 ms 347VAC/40.2ms 230VAC/39.6ms</p>
	<p>INPUT=347VAC/50HZ @ FULL LOAD CH1 : Output Voltage</p>		<p>INPUT=480VAC/60HZ @ FULL LOAD CH1 : Output Voltage</p>
<p>11 HOLD UP TIME</p>	<p>480VAC/ 16ms (Max) 347VAC/ 16 ms (Max)</p>	<p>I/P: 480 VAC I/P: 347 VAC O/P:FULL LOAD Ta:25°C</p>	<p>480VAC/ 19.8ms 347VAC/ 19.8ms</p>
	<p>INPUT=347VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p>		<p>INPUT=480VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</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</p>	<p>720mVp-p 720mVp-p</p>

Ta:25°C



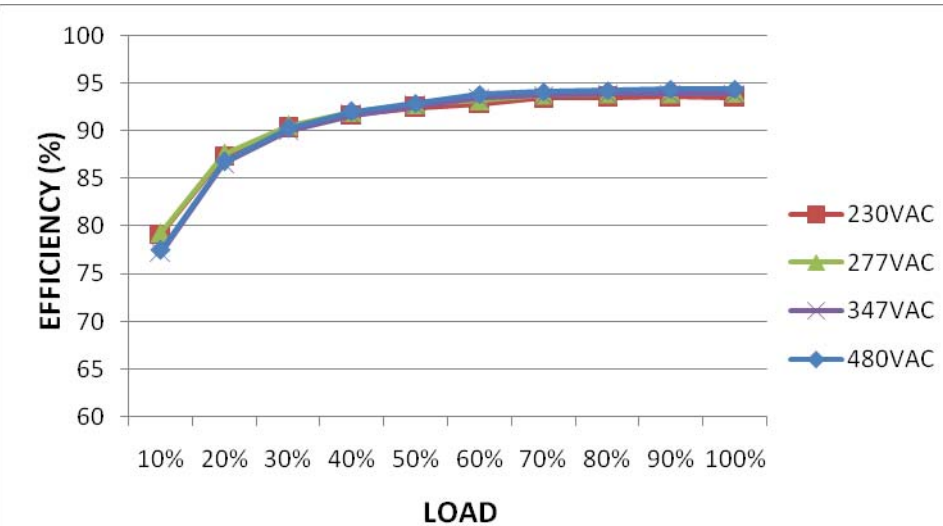
### INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC~528 VAC	I/P:TESTING O/P:FULL LOAD Ta:25°C	128V~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/ 1.15 A 347 VAC/ 1.52A	I/P: 480VAC/347 VAC O/P:FULL LOAD Ta:25°C	I= 1.079A/480VAC I= 1.477A/ 347VAC
4	LEAKAGE CURRENT	< 0.75 mA / 480VAC	I/P : 480 VAC O/P : Min LOAD Ta : 25°C	L-FG: 0.25mA N-FG: 0.245mA
5	POWER FACTOR(TYP)	0.95/480 VAC FULL LOAD 0.97/347 VAC FULL LOAD 0.98/277 VAC FULL LOAD 0.98/230 VAC FULL LOAD	I/P: 480VAC/347VAC/230VAC/277VAC O/P:FULL LOAD Ta:25°C	PF= 0.958/480V/100%LOAD
				PF= 0.981/347V/100%LOAD PF= 0.987/277V/100%LOAD PF= 0.99/230V/100%LOAD
P.F vs LOAD				



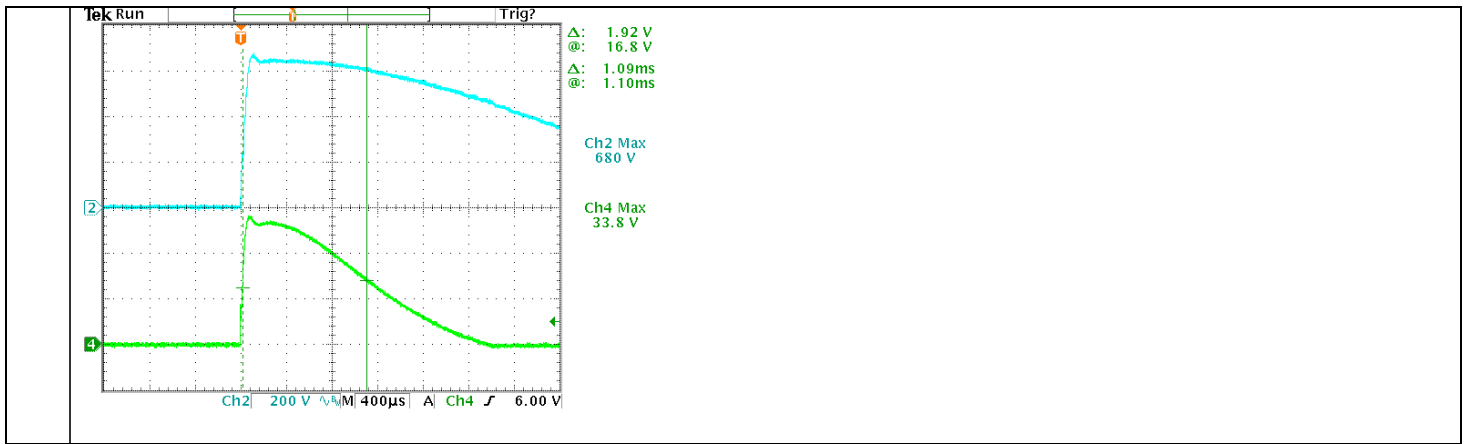
6	EFFICIENCY (TYP)	94%	I/P: 347 VAC O/P: FULL LOAD Ta: 25°C	94.21 %
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EFFICIENCY vs LOAD



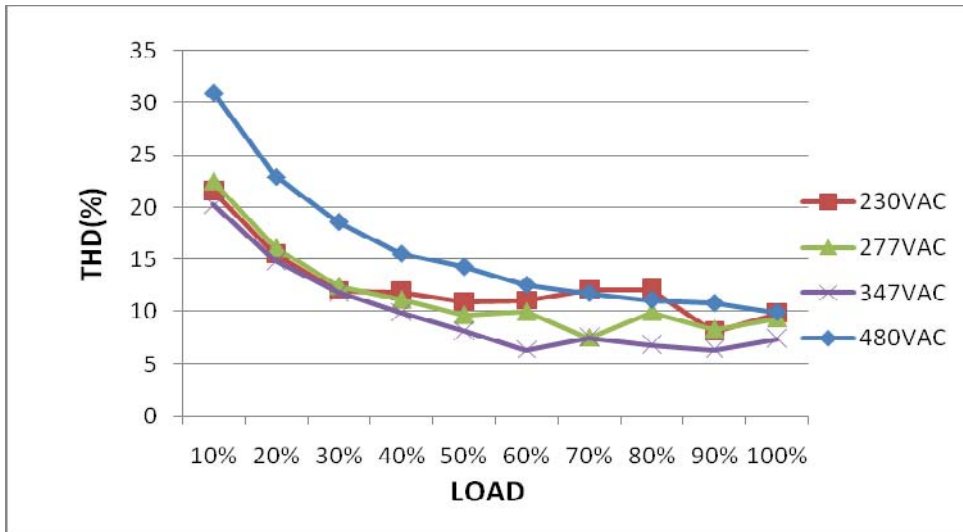
7	INRUSH CURRENT (TYP)	480 V/ 40A COLD START  (twidth=1100 us measured at 50% Ipeak) COLD START	I/P: 480VAC O/P: FULL LOAD Ta: 25°C	I = 33.8A/ 480VAC  T50= 1090 us
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INPUT=480VAC/60HZ @ FULL LOAD  
CH2 : AC Input Voltage CH4 : Input current (1V=1A)



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 : 230V/277V/347V/480V O/P : 100% LOAD 50% LOAD Ta : 25°C	THD : 10.96	%/230V 50%
				THD : 9.87	%/230V 100%
				THD : 9.71	%/277V 50%
				THD : 9.41	%/277V 100%
				THD : 8.16	%/347V 50%
				THD : 7.45	%/347V 100%
				THD : 14.2	%/480V 50%
				THD : 9.95	%/480V 100%

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	104.15%/ 528VAC 104.21%/ 347VAC 104.15%/ 180VAC PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	V1: 26 V~ 30 V PROTECTION TYPE : Shut down o/p voltage re-power on to recovery	I/P: 528VAC I/P: 347VAC I/P: 180VAC O/P: MIN LOAD Ta: 25°C	28.143V/ 528VAC 28.072V/ 347VAC 28.071V/ 180VAC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover

3	OVER TEMPERATURE PROTECTION	PROTECTION TYPE : Shut down 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 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	PWM Transistor ( D to S) or (C to E) <b>Peak Voltage</b>	Q4Rated 9A/950V	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.  I/P:Low-Line -3V = 177V 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	VDS: (1) 906V (2)842V (3)906V (4)882V (5)898V (6)874V (7)842V  VDS: (1)898V (2)866V (3)898V (4)890V (5)898V (6)890V (7)882V
2	P.F.C Transistor ( D to S) or (C to E) <b>Peak Voltage</b>	Q11Rated 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/ 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.	Q11                    Q13 531V:                531V: VDS:                VDS: (1)826V            (1)858V (2)834V            (2)890V (3)834V            (3)874V (4)834V            (4)866V (5)834V            (5)858V (6)834V            (6)866V (7)833V            (7)874V 177V:                177V: VDS:                VDS: (1)834V            (1)874V (2)834V            (2)890V

		Q13 rated 9A/950V	I/P:Low-Line -3V = 177V 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. Ta:25°C	(3)842V (4)842V (5)842V (6)842V (7)842V	(3)874V (4)874V (5)866V (6)874V (7)890V
3	P.F.C DIODE	D8 Rated 8A/1200V	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/5KHz (4)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz I/P:Low-Line -3V = 177V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (4)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25°C	531V (1)826V (2)850V (3)834V (4)834V  177V (1)834V (2)858V (3)810V (4)834V	
4	Diode Peak Voltage	Q101 Rated 64A/ 80V  Q121 Rated 64A/80 V	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	Q101: VDS: (1)60.6V (2)9.6V (3)60.6V (4)63.1V (5)62.7V (6)60.6V (7)60.2V (8)63.1V	Q121: VDS: (1)64.3V (2)67.1V (3)67.1V (4)67.1V (5)67.5V (6)66.3V (7)67.5V (8)67.9V
5	Input Capacitor Voltage	C5 Rated: 150u/450V -40~105°C	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	(1)405V (2)405V (3)401V (4)397V	
6	Control IC Voltage Test	PWM IC U2 Rated 8.85V~16V  PFC IC U1 Rated: 10.5V~20V	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. (5)NO LOAD VR MIN(LOW LINE)	U2 (1) 14.51V (2) 14.51V (3) 14.42V (4) 14.42V (5) 13.38V	U101 (1)11.77V (2)11.93V (3)12.01V (4)11.53V (5)11.3V



		O/P IC U101 Rated: 8V-24V	Ta:25°C	U1 (1)14.67V (2) 12.9-14.59 (3)14.59 V (4)14.51V (5)13.22V
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## 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: 2.72mA I/P-FG: 1.77mA O/P-FG: 5.41mA 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: 14.8GΩ I/P-FG: 13.2G Ω O/P-FG:21.5G Ω NO DAMAGE
3	GROUNDING CONTINUITY	IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	25 mΩ

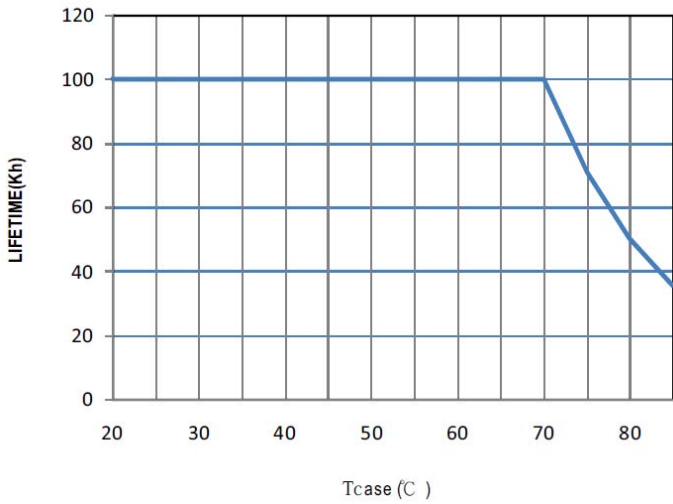
### E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONDUCTION	FCC Part 15 Subpart B	I/P: 440VAC /60HZ O/P:FULL LOAD/40% LOAD Ta:25°C	PASS Test by certified Lab
2	RADIATION	FCC Part 15 Subpart B	I/P: 480VAC /60HZ O/P:FULL LOAD/30% LOAD Ta:25°C	PASS Test by certified Lab
3	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV L,N-PE:4KV	I/P: 230VAC/50HZ 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-480-24 1. ROOM AMBIENT BURN-IN : 3 HRS I/P : 347VAC O/P : FULL LOAD Ta=25 °C 2. HIGH AMBIENT BURN-IN : 14 HRS I/P : 347VAC O/P : FULL LOAD Ta= 60 °C																																																																																						
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 25 °C</th> <th>HIGH AMBIENT Ta= 60 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>62.1°C</td><td>95.6°C</td></tr> <tr><td>2</td><td>C10</td><td>60.9°C</td><td>94.8°C</td></tr> <tr><td>3</td><td>Q1</td><td>61.7°C</td><td>96.0°C</td></tr> <tr><td>4</td><td>D8</td><td>65.6°C</td><td>102.8°C</td></tr> <tr><td>5</td><td>Q10</td><td>64.1°C</td><td>100.5°C</td></tr> <tr><td>6</td><td>RY1</td><td>63.3°C</td><td>98.4°C</td></tr> <tr><td>7</td><td>LF2</td><td>60.4°C</td><td>93.9°C</td></tr> <tr><td>8</td><td>C1</td><td>58.2°C</td><td>91.9°C</td></tr> <tr><td>9</td><td>C5</td><td>61.0°C</td><td>95.3°C</td></tr> <tr><td>10</td><td>L3</td><td>64.3°C</td><td>100.6°C</td></tr> <tr><td>11</td><td>U1</td><td>58.2°C</td><td>92.1°C</td></tr> <tr><td>12</td><td>U107</td><td>57.9°C</td><td>92.5°C</td></tr> <tr><td>13</td><td>T1-1</td><td>66.0°C</td><td>101.2°C</td></tr> <tr><td>14</td><td>T2-2</td><td>70.9°C</td><td>106.9°C</td></tr> <tr><td>15</td><td>Q100</td><td>62.3°C</td><td>97.6°C</td></tr> <tr><td>16</td><td>C115</td><td>58.6°C</td><td>92.8°C</td></tr> <tr><td>17</td><td>LF100</td><td>59.9°C</td><td>94.5°C</td></tr> <tr><td>18</td><td>C511</td><td>64.2°C</td><td>98.8°C</td></tr> <tr><td>19</td><td>RTH2</td><td>65.6°C</td><td>101.1°C</td></tr> <tr><td>20</td><td>T3</td><td>63.2°C</td><td>98.6°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 25 °C	HIGH AMBIENT Ta= 60 °C	1	BD1	62.1°C	95.6°C	2	C10	60.9°C	94.8°C	3	Q1	61.7°C	96.0°C	4	D8	65.6°C	102.8°C	5	Q10	64.1°C	100.5°C	6	RY1	63.3°C	98.4°C	7	LF2	60.4°C	93.9°C	8	C1	58.2°C	91.9°C	9	C5	61.0°C	95.3°C	10	L3	64.3°C	100.6°C	11	U1	58.2°C	92.1°C	12	U107	57.9°C	92.5°C	13	T1-1	66.0°C	101.2°C	14	T2-2	70.9°C	106.9°C	15	Q100	62.3°C	97.6°C	16	C115	58.6°C	92.8°C	17	LF100	59.9°C	94.5°C	18	C511	64.2°C	98.8°C	19	RTH2	65.6°C	101.1°C	20	T3	63.2°C	98.6°C
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12	U107	57.9°C	92.5°C																																																																																					
13	T1-1	66.0°C	101.2°C																																																																																					
14	T2-2	70.9°C	106.9°C																																																																																					
15	Q100	62.3°C	97.6°C																																																																																					
16	C115	58.6°C	92.8°C																																																																																					
17	LF100	59.9°C	94.5°C																																																																																					
18	C511	64.2°C	98.8°C																																																																																					
19	RTH2	65.6°C	101.1°C																																																																																					
20	T3	63.2°C	98.6°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 %/°C (0-60°C)																																																																																				
5	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -50°C~ +125°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 100 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 : 16 CYCLE 5. Input/Output condition : 15cycle:347V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle: 347V/ FULL LOAD Burn In Test	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 C115 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) 313619HRS (2) 29311HRS (3) 45290HRS (4) 59976HRS
9	MTBF	318.9K hrs min. Telcordia SR-332(Bellcore) ; 84.5K hrs min. MIL-HDBK-217F (25°C)	
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Tcase 80°C 	

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

12.10.30 A50-F031