Test Report: HVG-480-54

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

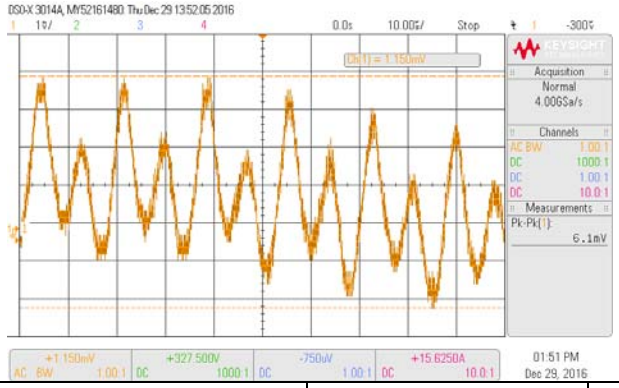
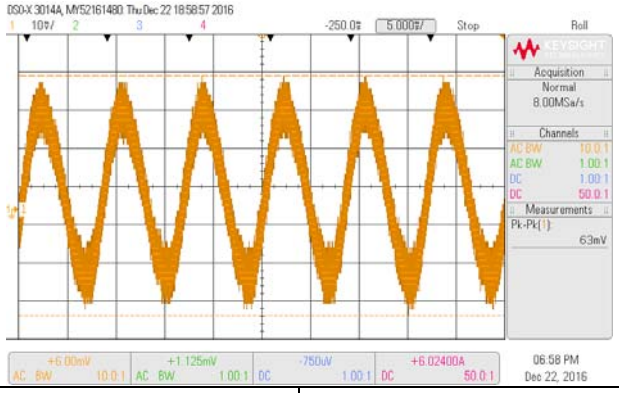
Safety Test
E.M.C. Test

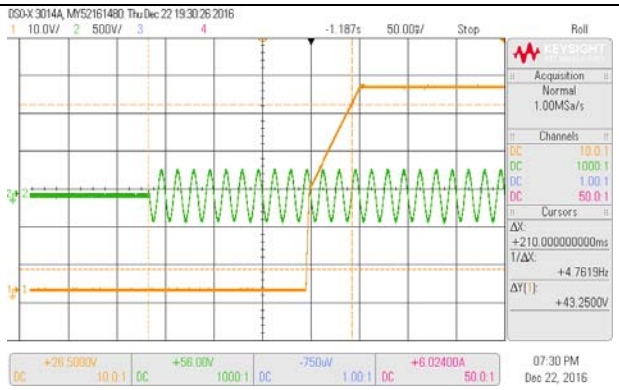
■ RELIABILITY TEST

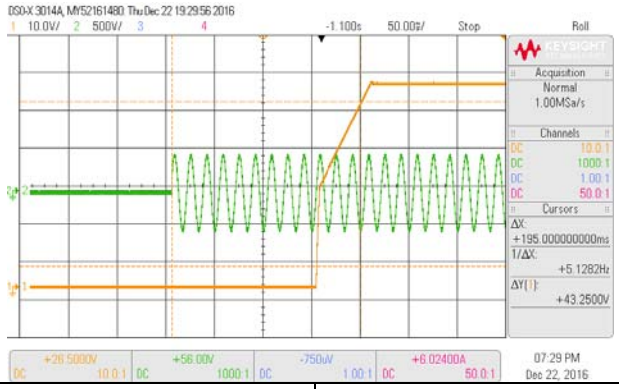
ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONSTANT CURRENT REGION	CH1: 27V~ 54V	I/P: 347 VAC O/P:FULL LOAD Ta:25℃	2V~ 53V /347VAC
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 45.9V~ 56.7V	I/P: 347 VAC I/P:230VAC O/P:MIN LOAD Ta:25℃	41.78V~ 58.212V /347VAC 41.79V~ 58.212V/230VAC
3	CURRENT ADJ. RANGE	CH1:4.4A~ 8.9A	I/P: 347 VAC I/P:230VAC O/P:CV MIN & CV MAX-1V Ta:25℃	3.586A~9.926A /347VAC@CV MAX-1V 3.58A~ 9.936A /347VAC@CV MIN 3.587A~9.926A/230VAC@CV MAX-1V 3.574A~9.937A/230VAC@CV MIN
4	OUTPUT VOLTAGE TOLERANCE (Max)	V1: 1 % ~ -1 %	I/P:180VAC /528AC O/P:FULL/ MIN LOAD Ta:25℃	V1:0.074 %~-0.074%
5	LINE REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P:180VAC~528AC O/P:FULL LOAD Ta:25℃	V1: 0.018%~0%
6	LOAD REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P: 347 VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: 0.037%~ -0.055%
7	OVER/UNDERSHOOT TEST	< ±5%	I/P: 347 VAC O/P:FULL LOAD Ta:25℃	TEST: < 5%
8	RIPPLE & NOISE (Max)	V1: 350 mVp-p	I/P: 347 VAC O/P:FULL LOAD Ta:25℃	V1: 63mVp-p
	high frequency： 		low frequency： 	
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℃	480VAC/195ms 347VAC/210ms 230VAC/230ms
	INPUT=347VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH3 : AC Input Voltage		INPUT=480VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH3 : AC Input Voltage	

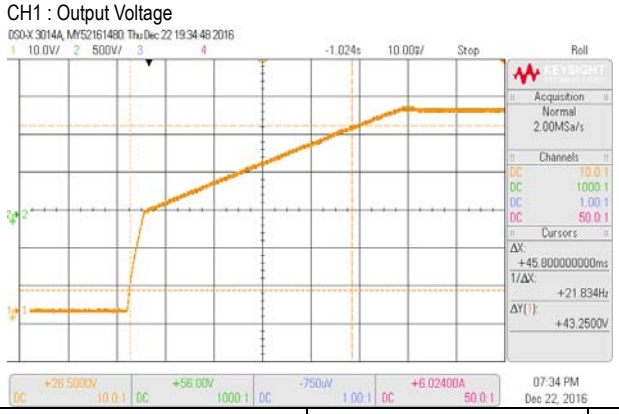




10	RISE TIME	480VAC/ 100 ms (Max) 347VAC/ 100 ms (Max) 230VAC/ 100 ms (Max)	I/P: 480 VAC I/P: 347 VAC I/P: 230 VAC O/P:FULL LOAD Ta:25℃	480VAC/44.6ms 347VAC/45.8ms 230VAC/ 45ms

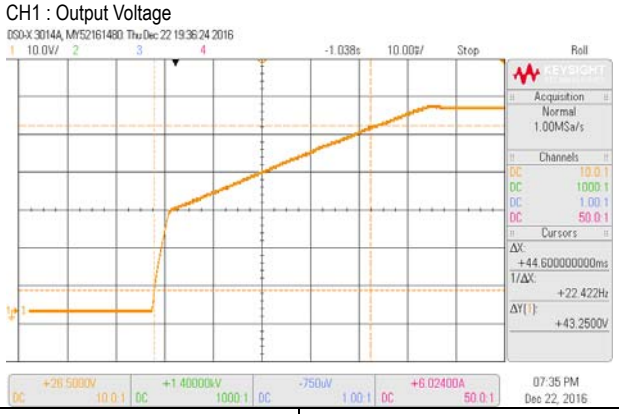
INPUT=347VAC/50HZ @ FULL LOAD

CH1 : Output Voltage



INPUT=480VAC/60HZ @ FULL LOAD

CH1 : Output Voltage



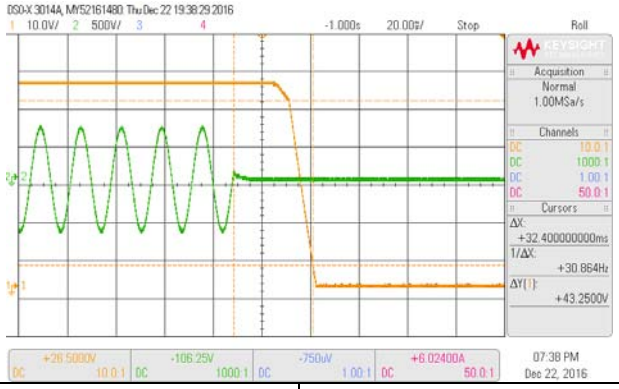
11	HOLD UP TIME	480VAC/ 16ms (Max) 347VAC/ 16 ms (Max)	I/P: 480 VAC I/P: 347 VAC O/P:FULL LOAD Ta:25℃	480VAC/ 32.4ms 347VAC/23.2ms

INPUT=347VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

INPUT=480VAC/60HZ @ FULL LOAD

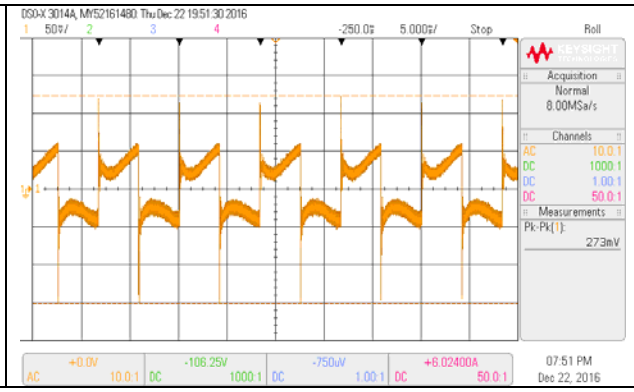
CH1 : Output Voltage CH2 : AC Input Voltage

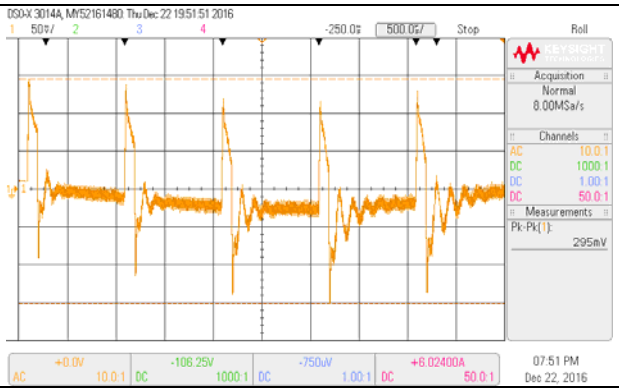


12	DYNAMIC LOAD	V1: 5400 mVp-p	I/P: 347VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	 273mVp-p 295mVp-p

FULL /50% LOAD 50%DUTY / 120HZ

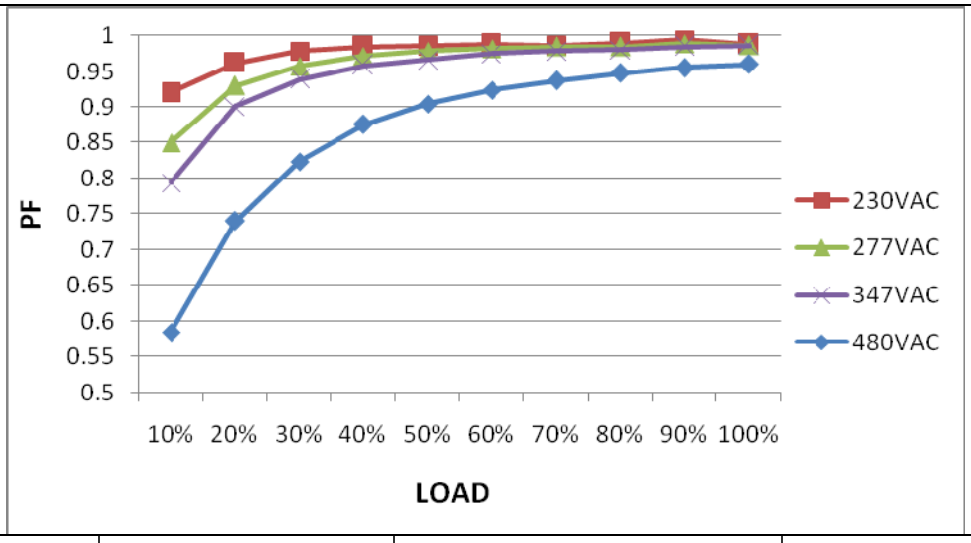
FULL /50% LOAD 50%DUTY / 1KHZ





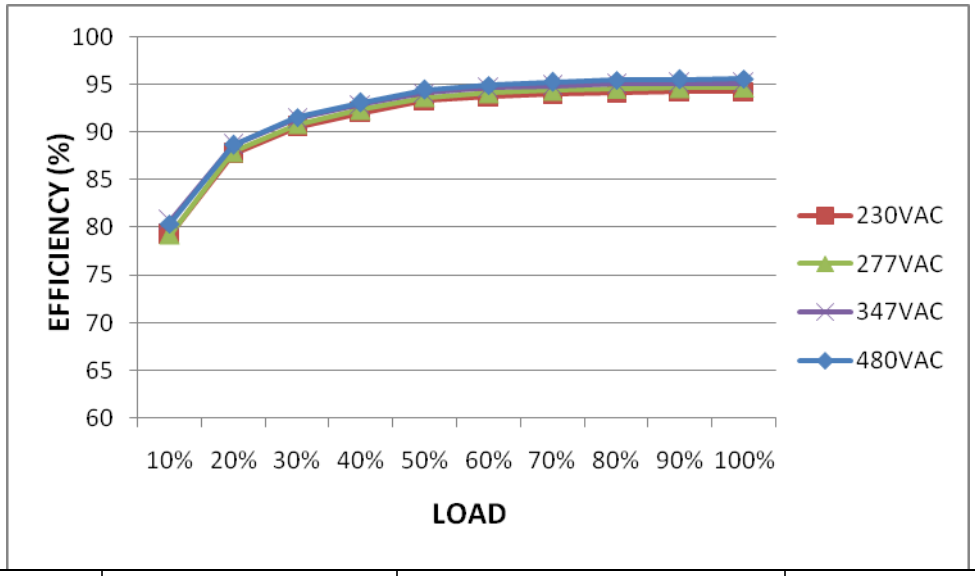
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC~528 VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	127V~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℃	TEST:OK
3	INPUT CURRENT (TYP)	480VAC/ 1.15 A 347 VAC/ 1.52A	I/P: 480VAC/347 VAC O/P:FULL LOAD Ta:25℃	I=1.08A/480VAC I =1.47A/ 347VAC
4	LEAKAGE CURRENT	< 0.75 mA / 480VAC	I/P ： 480 VAC O/P ： Min LOAD Ta ： 25℃	L-FG: 0.29mA N-FG: 0.28mA
5	POWER FACTOR(TYP)	0.94/480 VAC FULL LOAD 0.95/347 VAC FULL LOAD 0.97/277 VAC FULL LOAD 0.98/230 VAC FULL LOAD	I/P: 480VAC/347VAC/230VAC/277VAC O/P:FULL LOAD Ta:25℃	PF=0.964/480V/100%LOAD PF=0.987/347V/100%LOAD PF=0.986/277V/100%LOAD PF=0.988/230V/100%LOAD
	P.F vs LOAD			



6	EFFICIENCY (TYP)	95%	I/P: 347 VAC O/P:FULL LOAD Ta:25℃	95.02 %

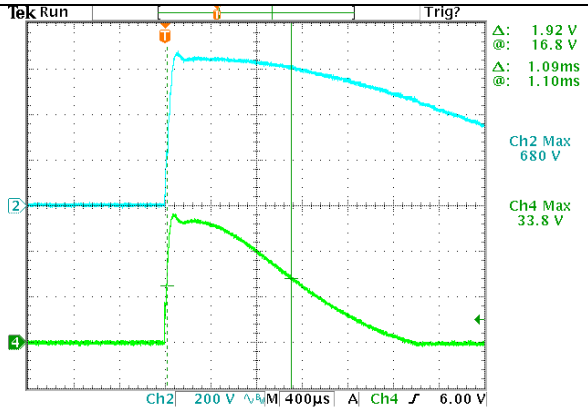
EFFICIENCY vs LOAD



7	INRUSH CURRENT (TYP)	480 V/40A COLD START (twidth=1100us measured at 50% Ipeak) COLD START	I/P: 480VAC O/P:FULL LOAD Ta:25℃	I =33.8A/ 480VAC T50= 1090 us

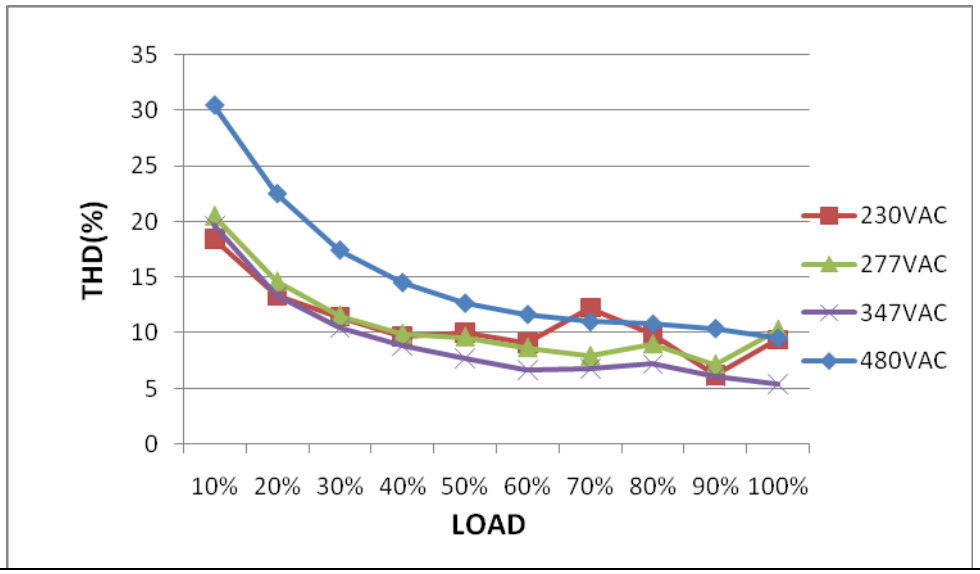
INPUT=480VAC/60HZ @ FULL LOAD

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℃	THD： 10.09 %/230V/ 50% THD： 9.42 %/230V /100% THD： 9.66 %/277V/ 50% THD： 10.28 %/277V/ 100% THD： 7.75 %/347V/ 50% THD： 5.41 %/347V /100% THD： 12.73 %480V/ 50% THD： 9.59 %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℃	101.68%/ 528VAC 101.01%/ 347VAC 101.68%/180VAC PROTECTION TYPE：Constant current limiting, recovers automatically after fault condition is removed

2	OVER VOLTAGE PROTECTION	V1:-59 V~ 63 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℃	60.99V/ 528VAC 61.1V/ 347VAC 60.95V/ 180VAC PROTECTION TYPE： Shut down o/p voltage re-power on to recovery
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℃	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	PFC Transistor (D to S) or (C to E) **Peak Voltage**	Q1 Rated 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℃	531V: VDS: (1)833V (2)833V (3)825V (4)817V (5)817V (6)841V (7)825V 177V: VDS: (1)905V (2)857V (3)905V (4)913V (5)905V (6)881V (7)897V
2	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q10 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	Q10 Q12 531V: 531V: VDS: VDS: (1) 868V (1) 866V (2) 884V (2) 882V (3) 868V (3) 868V

		Q12 Rated 9A/950V	(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 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℃	(4) 868V (5) 860V (6) 852V (7) 868V 177V VDS: (1)868V (2)884V (3)868V (4)868V (5)876V (6)860V (7)884V	(4) 863V (5) 862V (6) 862V (7) 866V 177V: VDS: (1)860V (2)852V (3)844V (4)860V (5)852V (6)852V (7)852V
3	P.F.C DIODE	D9 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℃	(1)825V (2)841V (3)825V (4)817V (1)849V (2)825V (3)841V (4)849V	
4	Diode Peak **Voltage**	Q101 Rated 43 A/150 V Q120 Rated 43 A/150 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)121.9V (2)29.4V (3)121.9V (4)136.3V (5)130.7V (6)138.9V (7)141.3V (8)141.3V	Q120: VDS: (1)123.6V (2)72.2V (3)122.8V (4)141.3V (5)138.1V (6)124.4V (7)135.7V (8)138.9V
5	**Input Capacitor Voltage**	C5 Rated: 150μ/ 450 V	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℃	(1)397V (2)397V (3)397V (4)389V	

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 Vmin.(LOW LINE) Ta:25℃	(1) 14.9V (2) 14.7V (3) 14.7V (4) 14.5V (5) 13.7V (1) 14.7V (2) 14.7V (3) 14.7V (4) 14.5V (5) 13.V

■ 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℃	I/P-O/P: 2.81mA I/P-FG:1.83mA O/P-FG:6.2mA 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℃	I/P-O/P:30GΩ I/P-FG: 25G Ω O/P-FG:29.5G Ω NO DAMAGE
3	GROUNDING CONTINUITY	IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	25mΩ

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℃	PASS Test by certified Lab
2	RADIATION	FCC Part 15 Subpart B	I/P: 480VAC /60HZ O/P:FULL LOAD/30% LOAD Ta:25℃	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℃	CRITERIA A
4	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

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL： HVG-480-54
1. ROOM AMBIENT BURN-IN：3 HRS
I/P： 347VAC O/P： FULL LOAD Ta=25 ℃
2. HIGH AMBIENT BURN-IN： 14 HRS
I/P： 347VAC O/P： FULL LOAD Ta= 60 ℃</td></tr>
<tr><td>2</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER 2 HOUR</td><td>I/P： 528VAC/180VAC
O/P： 100 % LOAD
Ta= -45 ℃</td><td>TEST：OK</td></tr>
<tr><td>3</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 60 ℃
NO DAMAGE</td><td>I/P： 538 VAC
O/P：FULL LOAD
Ta= 60℃
HUMIDITY= 95 %R.H</td><td>TEST：OK</td></tr>
<tr><td>4</td><td>TEMPERATURE
COEFFICIENT</td><td>± 0.03 %/℃(0~60℃)</td><td>I/P： 347 VAC
O/P：FULL LOAD</td><td>± 0.001 %/℃(0~60℃)</td></tr>
<tr><td>5</td><td>STORAGE TEMPERATURE TEST</td><td colspan="2">1. Thermal shock Temperature： -50℃~ +125℃
2. Temperature change rate ：25℃ / MIN
3. Dwell time low and high temperature ： 30 MIN/EACH
4. Total test cycle：100 CYCLE
5. Input/Output condition： STATIC</td><td>OK</td></tr>
</table>

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 60 ℃
1	BD1	62.8℃	96.7℃
2	C10	59.8℃	94.7℃
3	Q1	59.0℃	94.3℃
4	D8	63.8℃	101.2℃
5	LF2	58.7℃	91.7℃
6	Q10	62.8℃	99.3℃
7	RY1	61.5℃	96.6℃
8	C1	56.5℃	90.1℃
9	C5	59.6℃	94.1℃
10	L3	62.7℃	99.2℃
11	U1	57.4℃	91.7℃
12	U107	57.0℃	91.4℃
13	T1-1	63.8℃	99.9℃
14	T2-2	63.7℃	99.1℃
15	Q100	61.3℃	96.6℃
16	C118	55.2℃	89.3℃
17	LF100	55.2℃	89.3℃
18	C511	62.4℃	96.0℃
19	RTH2	60.9℃	94.5℃
20	T3	61.8℃	96.0℃

6	THERMAL SHOCK TEST	1. Thermal shock Temperature： -45℃~ +65℃ 2. Temperature change rate ：25℃ / 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℃	TEST：OK
8	CAPACITOR LIFE CYCLE	SUPPOSE C115 IS THE MOST CRITICAL COMPONENT (1) I/P： 347VAC O/P：FULL LOAD Tc= 80 ℃ LIFE TIME (2) I/P： 347VAC O/P：75% LOAD Tc= 80 ℃ LIFE TIME (3) I/P： 347VAC O/P：50% LOAD Tc= 80 ℃ LIFE TIME	(1) 40748HRS (2) 53714HRS (3) 75327HRS
9	MTBF	318.9K hrs min. Telcordia SR-332(Bellcore) ; 84.5K hrs min. MIL-HDBK-217F (25℃)	
10	Ongoing Reliability Test	I/P：230VAC O/P：FULL LOAD TA=50℃ 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