



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

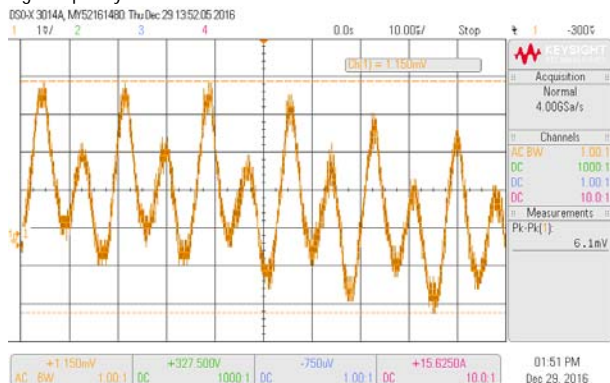
ENVIRONMENT TEST

DESIGN VERIFY TEST

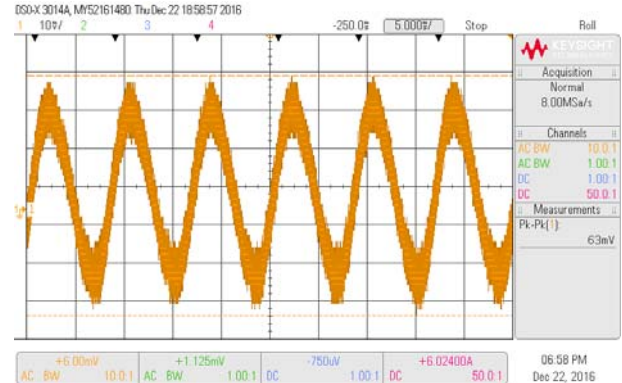
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONSTANT CURRENT REGION	CH1: 27V~ 54V	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	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°C	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°C	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°C	V1:0.074 %~-0.074%
5	LINE REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P:180VAC~528AC O/P:FULL LOAD Ta:25°C	V1: 0.018%~0%
6	LOAD REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P: 347 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.037%~ -0.055%
7	OVER/UNDERSHOOT TEST	< ±5%	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	TEST: < 5%
8	RIPPLE & NOISE (Max)	V1: 350 mVp-p	I/P: 347 VAC O/P:FULL LOAD Ta:25°C	V1: 63mVp-p

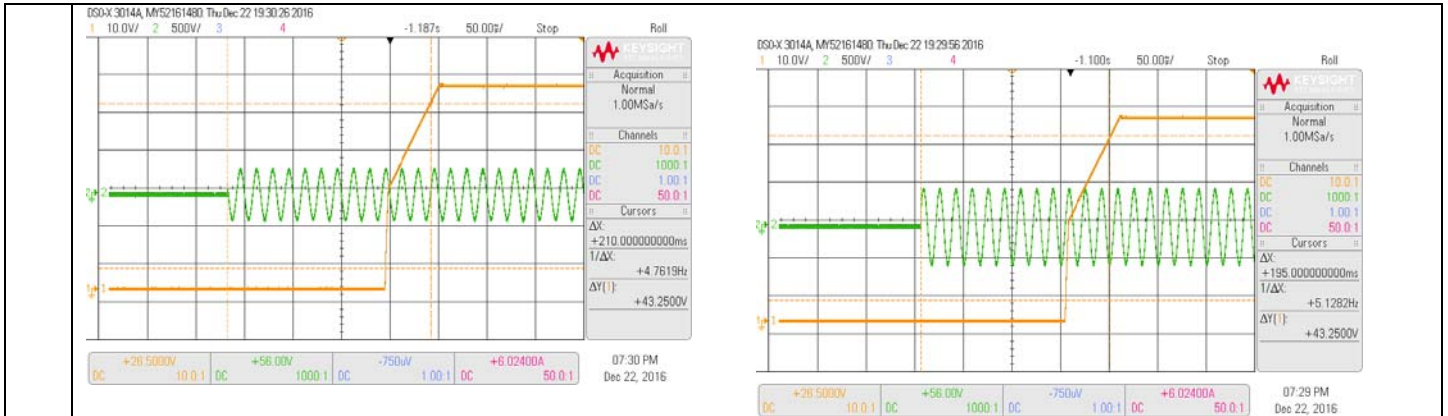
high frequency :



low frequency :



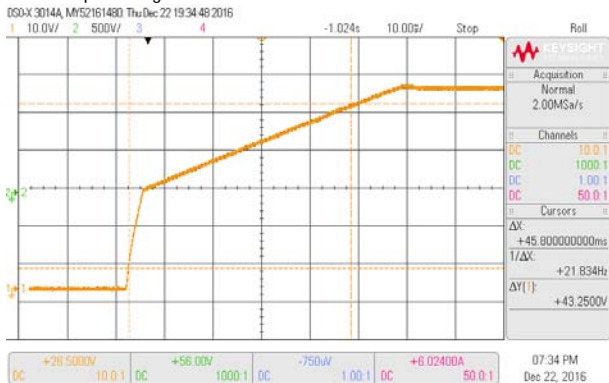
9	SET UP TIME	480VAC/ 500 ms (Max) 347VAC/ 500 ms (Max) 230VAC/ 500 ms (Max)	I/P: 480 VAC I/P: 347 VAC I/P: 230 VAC O/P:FULL LOAD Ta:25°C	480VAC/195ms 347VAC/210ms 230VAC/230ms
INPUT=347VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH3 : AC Input Voltage		INPUT=480VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH3 : AC Input Voltage		



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

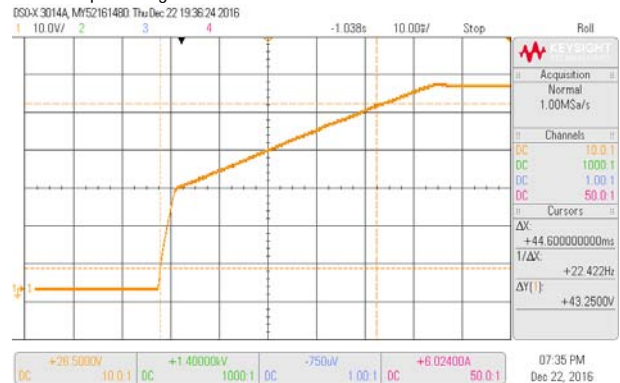
INPUT=347VAC/50HZ @ FULL LOAD

CH1 : Output Voltage



INPUT=480VAC/60HZ @ FULL LOAD

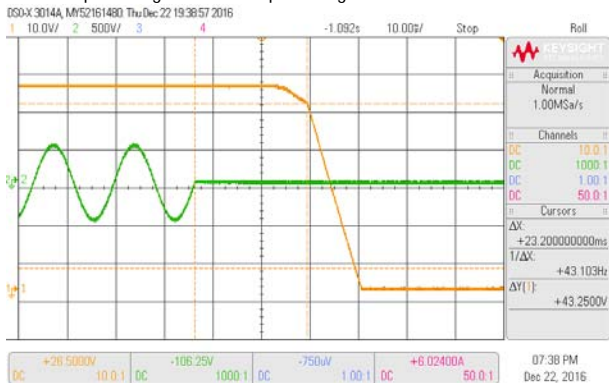
CH1 : Output Voltage



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

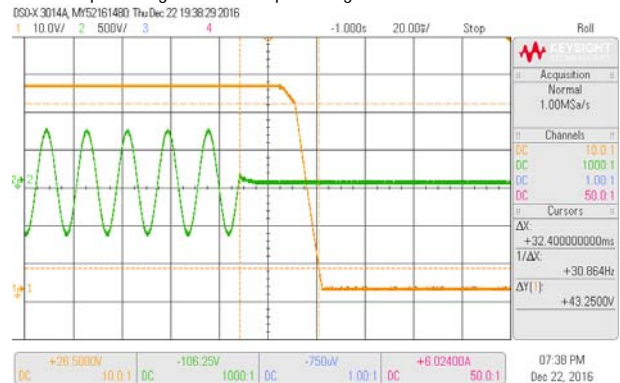
INPUT=347VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

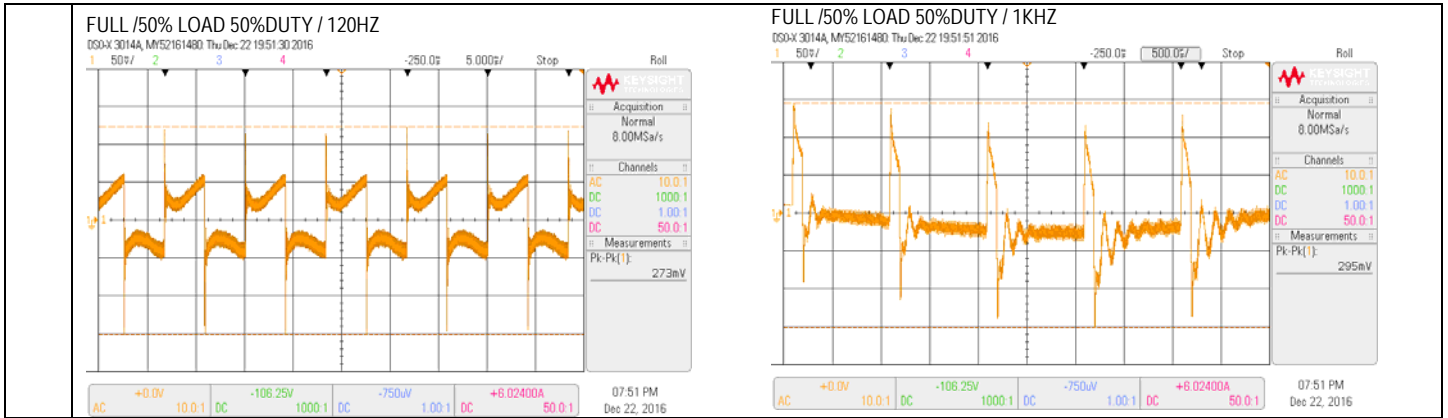


INPUT=480VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

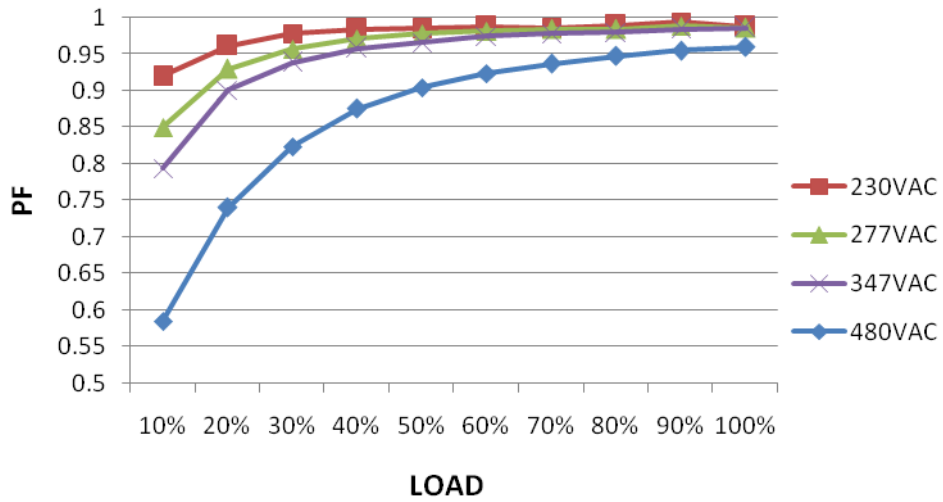


12	DYNAMIC LOAD	V1: 5400 mVp-p	I/P: 347VAC	273mVp-p
			O/P:	295mVp-p
			(1) FULL /50% LOAD 50%DUTY / 120HZ	
			(2) FULL /50% LOAD 50%DUTY / 1KHZ	
			Ta: 25°C	



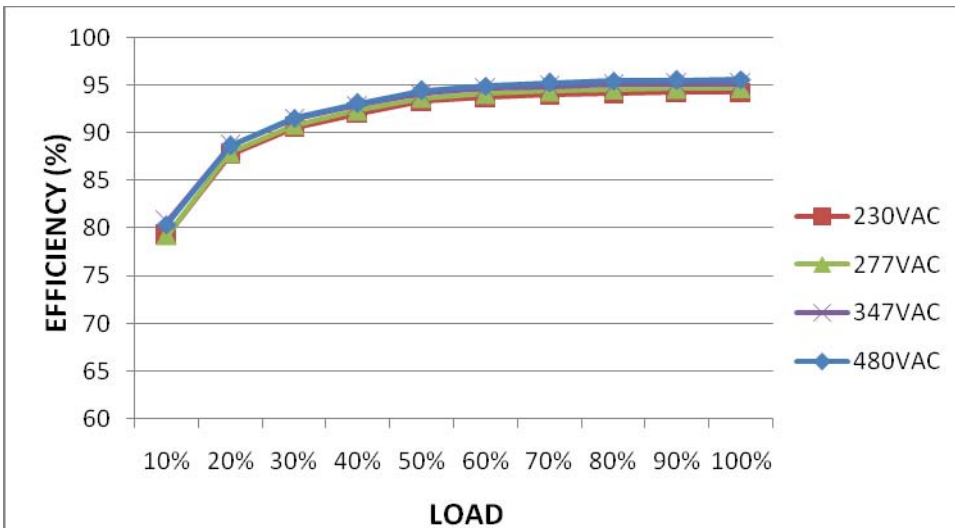
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC~528 VAC	I/P:TESTING O/P:FULL LOAD Ta:25°C	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°C	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°C	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°C	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°C	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			



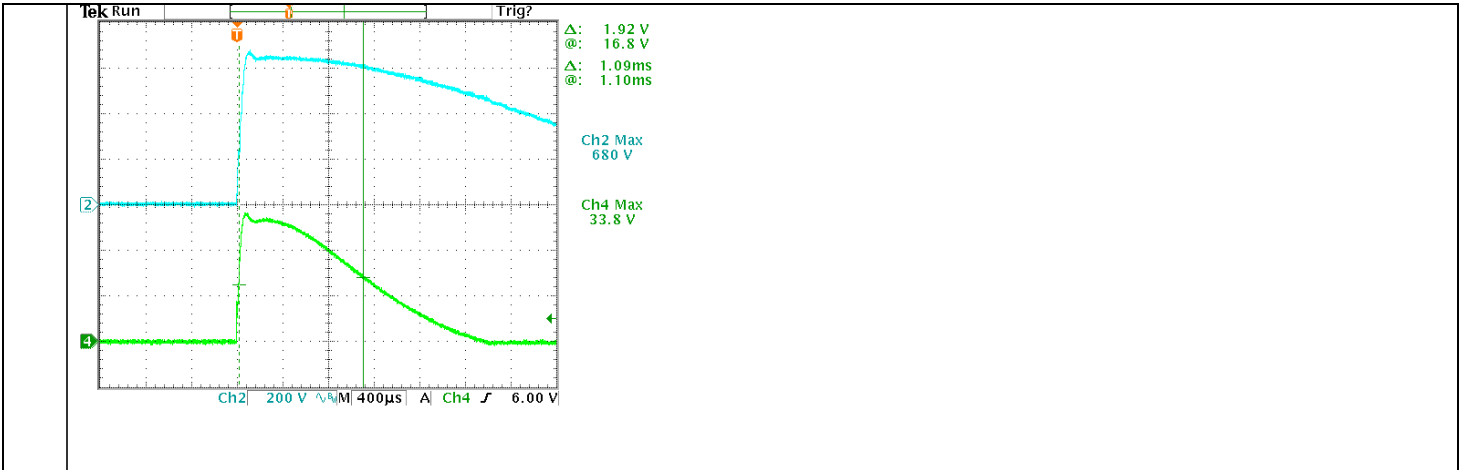
6	EFFICIENCY (TYP)	95%	I/P: 347 VAC O/P: FULL LOAD Ta: 25°C	95.02 %
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EFFICIENCY vs LOAD



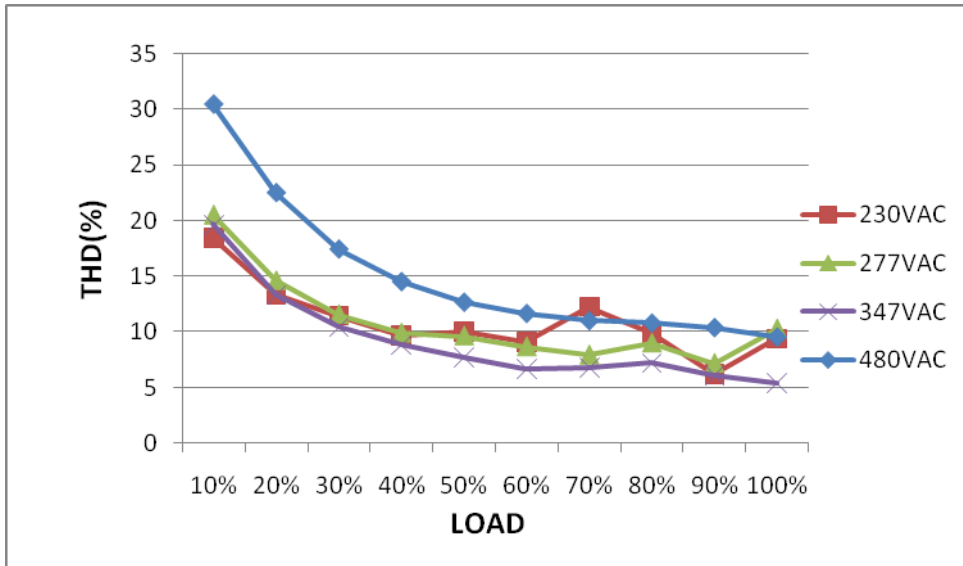
7	INRUSH CURRENT (TYP)	480 V/40A COLD START (twidth=1100us measured at 50% Ipeak) COLD START	I/P: 480VAC O/P: FULL LOAD Ta: 25°C	I = 33.8A/ 480VAC T50= 1090 us
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INPUT=480VAC/60HZ @ FULL LOAD
CH2 : AC Input Voltage CH4 : Input current (1V=1A)



8	TOTAL HARMONIC DISTORTION	HARMONIC	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 : 10.09 %/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°C	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°C	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°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	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°C	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	<p>(4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz</p> <p>(5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz</p> <p>(6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz</p> <p>(7)0%→400% Load.</p> <p>I/P:Low-Line -3V = 177V</p> <p>AC ON/OFF</p> <p>O/P: (1)Full Load</p> <p>(2)Output Short</p> <p>(3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz</p> <p>(4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz</p> <p>(5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz</p> <p>(6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz</p> <p>(7)0%→400% Load.</p> <p>Ta:25°C</p>	<p>(4) 868V</p> <p>(5) 860V</p> <p>(6) 852V</p> <p>(7) 868V</p> <p>177V</p> <p>VDS:</p> <p>(1)868V</p> <p>(2)884V</p> <p>(3)868V</p> <p>(4)868V</p> <p>(5)876V</p> <p>(6)860V</p> <p>(7)884V</p>	<p>(4) 863V</p> <p>(5) 862V</p> <p>(6) 862V</p> <p>(7) 866V</p> <p>177V:</p> <p>VDS:</p> <p>(1)860V</p> <p>(2)852V</p> <p>(3)844V</p> <p>(4)860V</p> <p>(5)852V</p> <p>(6)852V</p> <p>(7)852V</p>
3	P.F.C DIODE	D9 Rated 8A/1200V	<p>I/P:High-Line +3V =531 V</p> <p>AC ON/OFF</p> <p>O/P: (1)Full Load</p> <p>(2)Output Short</p> <p>(3)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz</p> <p>(4)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz</p> <p>I/P:Low-Line -3V = 177V</p> <p>AC ON/OFF</p> <p>O/P: (1)Full Load</p> <p>(2)Output Short</p> <p>(3)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz</p> <p>(4)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz</p> <p>Ta:25°C</p>	<p>(1)825V</p> <p>(2)841V</p> <p>(3)825V</p> <p>(4)817V</p> <p>(1)849V</p> <p>(2)825V</p> <p>(3)841V</p> <p>(4)849V</p>	
4	Diode Peak Voltage	Q101 Rated 43 A/150 V Q120 Rated 43 A/150 V	<p>I/P:High-Line +3V =531 V</p> <p>AC ON/OFF</p> <p>O/P: (1)Full Load</p> <p>(2)Output Short</p> <p>(3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz</p> <p>(4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz</p> <p>(5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz</p> <p>(6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz</p> <p>(7)0%→400% Load.</p> <p>(8).NO LOAD</p>	<p>Q101:</p> <p>VDS:</p> <p>(1)121.9V</p> <p>(2)29.4V</p> <p>(3)121.9V</p> <p>(4)136.3V</p> <p>(5)130.7V</p> <p>(6)138.9V</p> <p>(7)141.3V</p> <p>(8)141.3V</p>	<p>Q120:</p> <p>VDS:</p> <p>(1)123.6V</p> <p>(2)72.2V</p> <p>(3)122.8V</p> <p>(4)141.3V</p> <p>(5)138.1V</p> <p>(6)124.4V</p> <p>(7)135.7V</p> <p>(8)138.9V</p>
5	Input Capacitor Voltage	C5 Rated: 150 μ / 450 V	<p>I/P:High-Line +3V =531V</p> <p>O/P: (1)Full Load input on/off</p> <p>(2) Min load input on /Off</p> <p>(3)Full Load /Min load Change</p> <p>(4)Full load continue</p> <p>Ta:25°C</p>	<p>(1)397V</p> <p>(2)397V</p> <p>(3)397V</p> <p>(4)389V</p>	

6	Control IC Voltage Test	PWM IC U2 Rated 8.85V-16V	I/P:High-Line +3V =531 V AC ON/OFF O/P(1)FULL LOAD	(1) 14.9V (2) 14.7V (3) 14.7V (4) 14.5V (5) 13.7V
		PFC IC U1 Rated 10.5V-20V	(2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD Vmin.(LOW LINE) Ta:25°C	(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°C	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°C	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°C	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°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

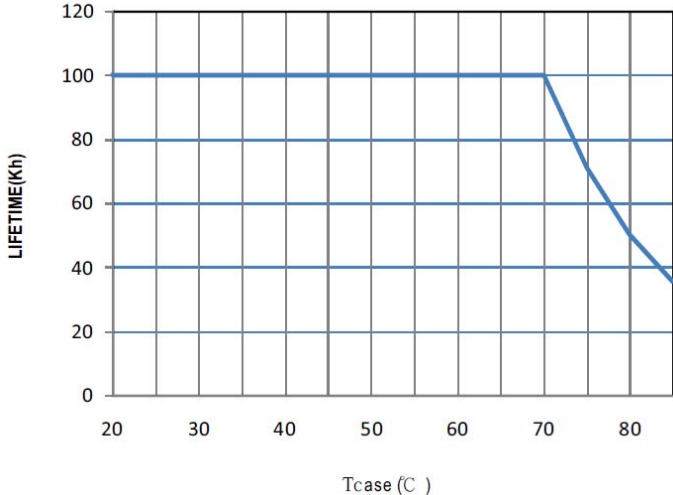
RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL : HVG-480-54 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		
		ROOM AMBIENT Ta= 25 °C		HIGH AMBIENT Ta= 60 °C
NO	Position			
1	BD1	62.8°C		96.7°C
2	C10	59.8°C		94.7°C
3	Q1	59.0°C		94.3°C
4	D8	63.8°C		101.2°C
5	LF2	58.7°C		91.7°C
6	Q10	62.8°C		99.3°C
7	RY1	61.5°C		96.6°C
8	C1	56.5°C		90.1°C
9	C5	59.6°C		94.1°C
10	L3	62.7°C		99.2°C
11	U1	57.4°C		91.7°C
12	U107	57.0°C		91.4°C
13	T1-1	63.8°C		99.9°C
14	T2-2	63.7°C		99.1°C
15	Q100	61.3°C		96.6°C
16	C118	55.2°C		89.3°C
17	LF100	55.2°C		89.3°C
18	C511	62.4°C		96.0°C
19	RTH2	60.9°C		94.5°C
20	T3	61.8°C		96.0°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	± 0.001 %/°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) 433003HRS (2) 40748HRS (3) 53713HRS (4) 75326HRS
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