Test Report:HVG-480-30

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

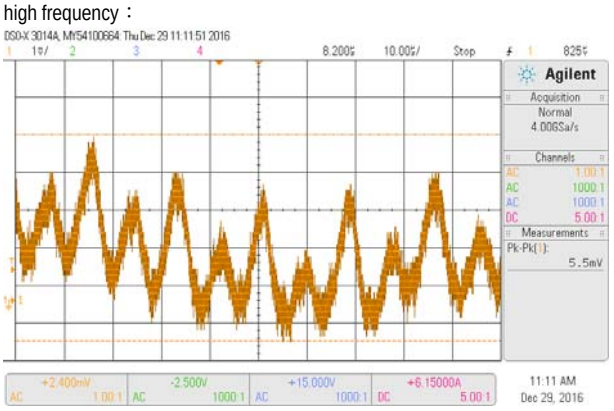
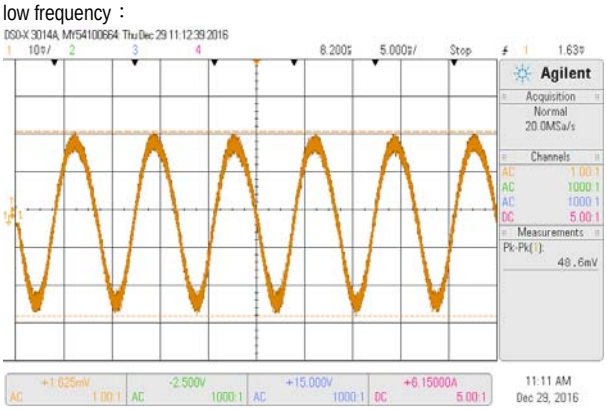
Safety Test
E.M.C. Test

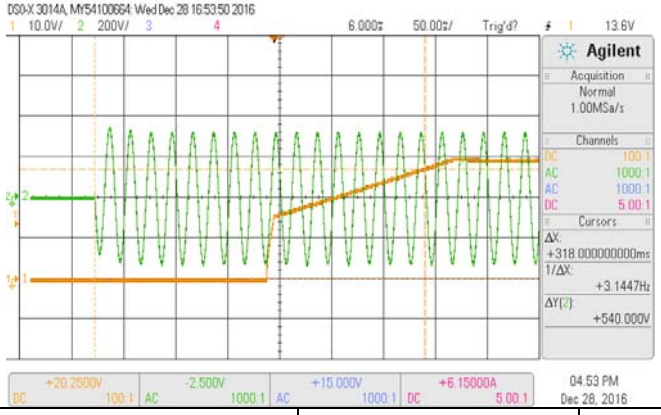
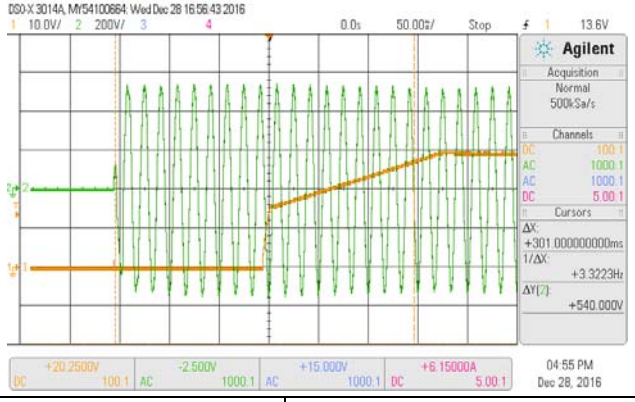
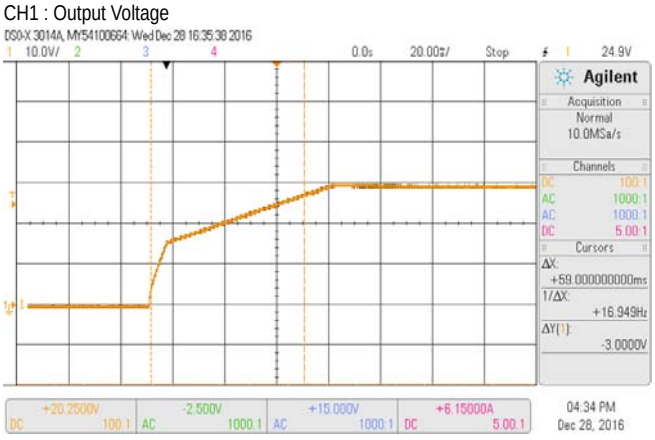
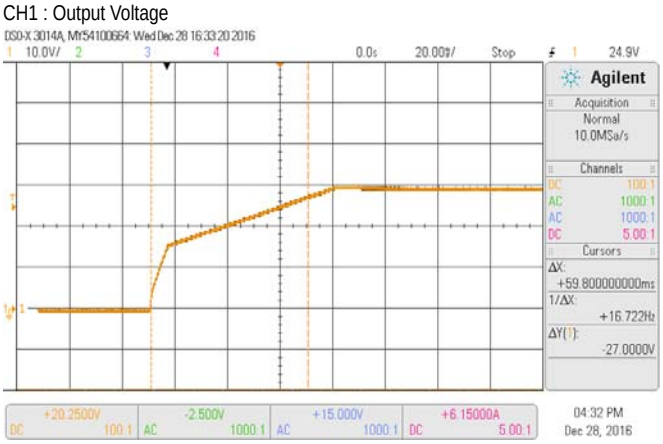
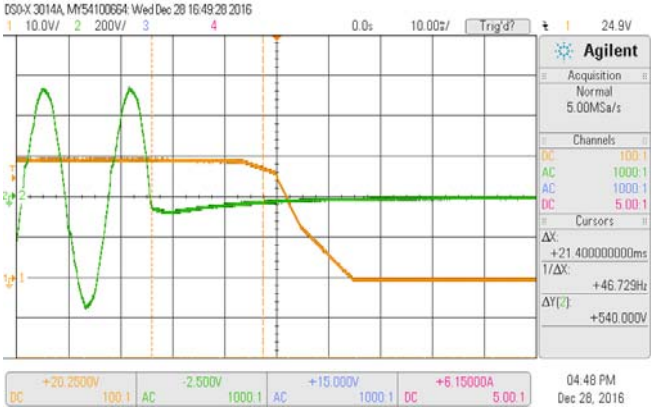
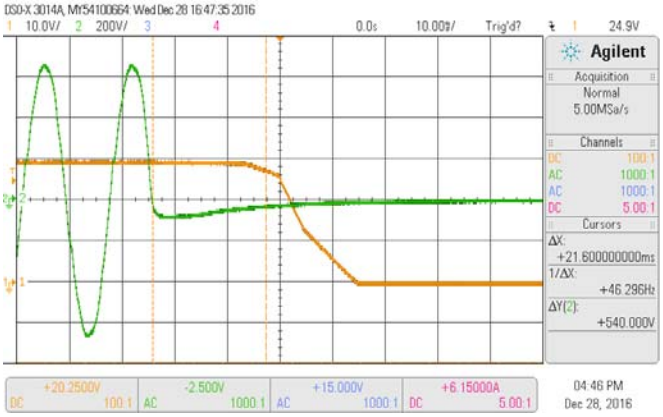
■ RELIABILITY TEST

ENVIRONMENT TEST

■ DESIGN VERIFY TEST

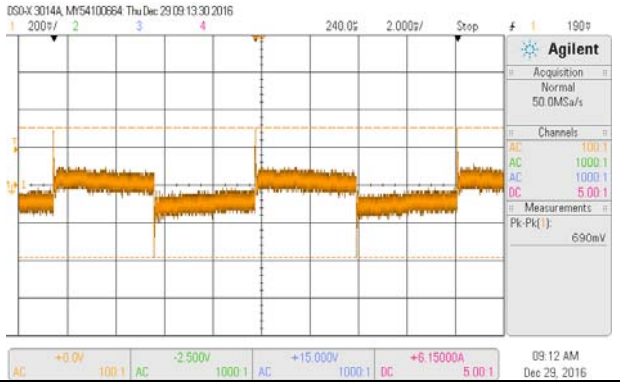
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONSTANT CURRENT REGION	CH1: 15V~ 30V	I/P: 347 VAC O/P:FULL LOAD Ta:25℃	2V~29 V /347VAC
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 25.5V~31.5V	I/P: 347 VAC I/P:230VAC O/P:MIN LOAD Ta:25℃	22.857V~32.281V /347VAC 22.849V~32.269 V/230VAC
3	CURRENT ADJ. RANGE	CH1:8A~16A	I/P: 347 VAC I/P:230VAC O/P:CV MIN & CV MAX-1V Ta:25℃	6.1856A~17.078A /347VAC@CV MAX-1V 6.201A~ 17.067A /347VAC@CV MIN 6.1903A~17.0822A/230VAC@CVMAX-1V 6.201A~17.0625A/230VAC@CV MIN
4	OUTPUT VOLTAGE TOLERANCE (Max)	V1: 1 % ~ -1 %	I/P:180VAC /528AC O/P:FULL/ MIN LOAD Ta:25℃	V1: 0.37%~0.07%
5	LINE REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P:180VAC~528AC O/P:FULL LOAD Ta:25℃	V1: 0 %~0%
6	LOAD REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P: 347 VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: 0.20%~-0.23%
7	OVER/UNDERSHOOT TEST	< ±5%	I/P: 347 VAC O/P:FULL LOAD Ta:25℃	TEST: < 3.57%
8	RIPPLE & NOISE (Max)	V1: 200 mVp-p	I/P: 347 VAC O/P:FULL LOAD Ta:25℃	V1: 48.6 mVp-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/301ms 347VAC/318ms 230VAC/320ms

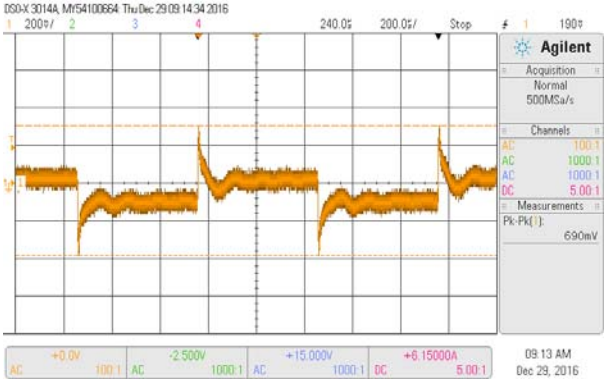
	INPUT=347VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage  		INPUT=480VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2: AC Input Voltage 
10	RISE TIME	480VAC/ 100 ms (Max) 347VAC/ 100 ms (Max) 230VAC/ 100 ms (Max)	I/P: 480 VAC I/P: 347 VAC I/P: 230 VAC O/P:95% LOAD Ta:25℃	480VAC/59ms 347VAC/59.8ms 230VAC/54ms
	INPUT=480VAC/60HZ @ 95% LOAD CH1 : Output Voltage  		INPUT=347VAC/50HZ @95% 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/21.6ms 347VAC/21.4ms
	INPUT=347VAC/60HZ @ 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: 3000 mVp-p	I/P: 347VAC O/P:	

			(1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	690mVp-p 690mVp-p

FULL /50% LOAD 50%DUTY / 120HZ

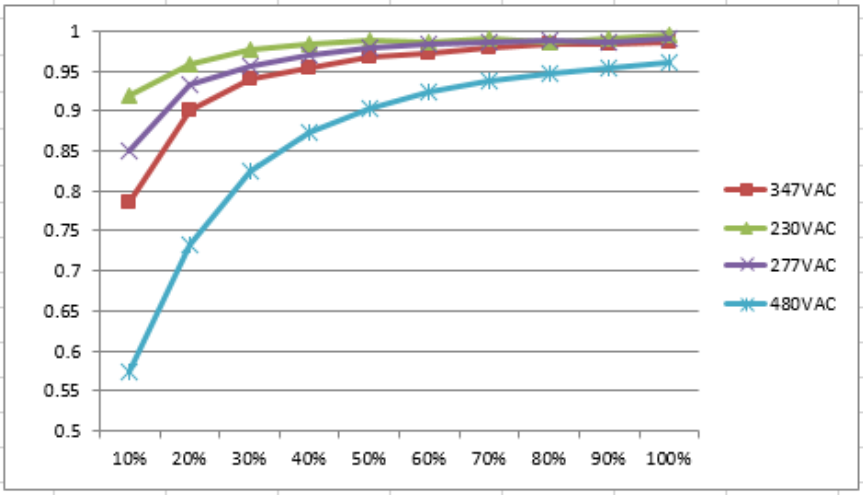


FULL /50% LOAD 50%DUTY / 1KHZ



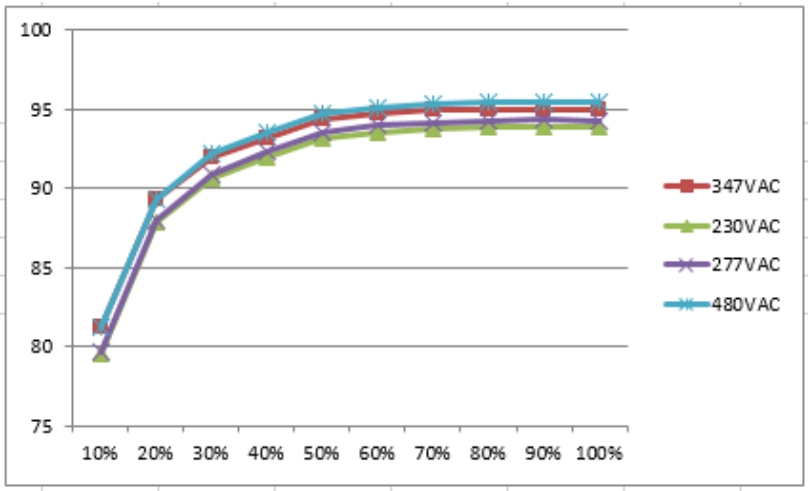
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC~528 VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	130V~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℃	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=1.091A/480VAC I =1.471A/ 347VAC
4	LEAKAGE CURRENT	< 0.75 mA / 480VAC	I/P ： 480 VAC O/P ：Min LOAD Ta ：25℃	L-FG: 0.24mA N-FG:0.24 mA
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℃	PF=0.9604/480V/100%LOAD PF=0.9867/347V/100%LOAD PF=0.991/277V/100%LOAD PF=0.996/230V/100%LOAD
	P.F vs LOAD			



6	EFFICIENCY (TYP)	94%	I/P: 347 VAC O/P:FULL LOAD Ta:25℃	94.926 %

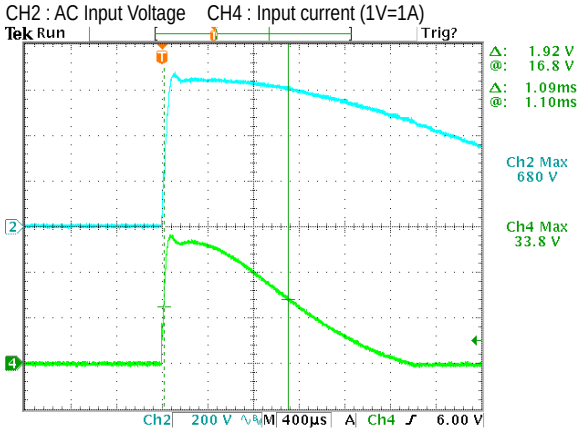
EFFICIENCY vs LOAD



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

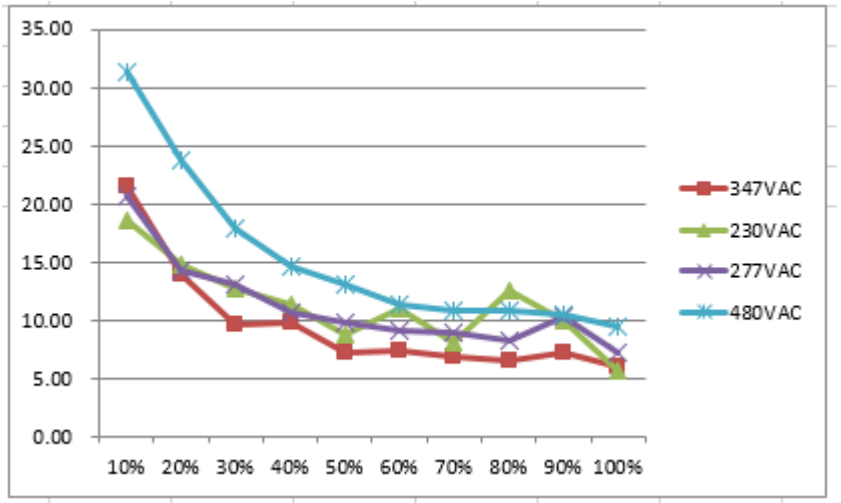
INPUT=480VAC/60HZ @ FULL LOAD

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： 8.72 %/230V/ 50% THD： 5.64 %/230V /100% THD： 9.84 %/277V/ 50% THD： 7.21 %/277V/ 100% THD： 7.23 %/347V/ 50% THD： 6.02 %/347V /100% THD： 13.12 %480V/ 50% THD： 9.42 %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℃	102.44%/ 528VAC 102.44%/ 347VAC 102.48%/180VAC PROTECTION TYPE：Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	V1: 32.5~36.5V 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℃	34.378V/ 528VAC 34.284V/ 347VAC 34.357V/ 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℃	VDS: (1)819V (2)794V (3)810V (4)819V (5)802V (6)802V (7)802V VDS: (1)875V (2)794V (3)875V (4)875V (5)867V (6)843V (7)802V	
2	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q10 Rated 9A/950V Q12 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/ 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℃	531V: VDS: (1)786V (2)794V (3)778V (4)778V (5)778V (6)778V (7)786V 177V: VDS: (1)802V (2)786V (3)794V (4)802V (5)794V (6)794V (7)778V	531V: VDS: (1)770V (2)786V (3)778V (4)786V (5)778V (6)770V (7)786V 177V VDS: (1)794V (2)786V (3)794V (4)770V (5)794V (6)802V (7)786V

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)793V (2)793V (3)801V (4)809V (1)833V (2)841V (3)833V (4)833V
4	Diode Peak **Voltage**	Q101 Rated 80A/100 V Q120 Rated 80A/100 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: Q120: VDS: VDS: (1)76.9V (1)77.7V (2)7.7V (2)18.2V (3)80.1V (3)79.3V (4)81.7V (4)84.9V (5)82.5V (5)84.1V (6)78.5V (6)80.9V (7)77.7V (7)79.3V (8)70.4V (8)67.2V
5	**Input Capacitor Voltage**	C5 Rated: 150 μ / 450 V 105 ℃	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)392V (2)392V (3)392V (4)388V
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) Ta:25℃	U2 U1 (1) 14.6V (1) 14.7V (2) 15.8V (2) 14.8V (3) 15.4V (3) 14.7V (4) 14.4V (4) 14.5V (5) 14.4V (5) 14.5V

■ 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: 2.790mA I/P-FG:1.832mA O/P-FG:5.82mA 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:15.5GΩ I/P-FG: 12.5G Ω O/P-FG:30GΩ NO DAMAGE
3	GROUNDING CONTINUITY	IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	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℃	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

■ RELIABILITY TEST

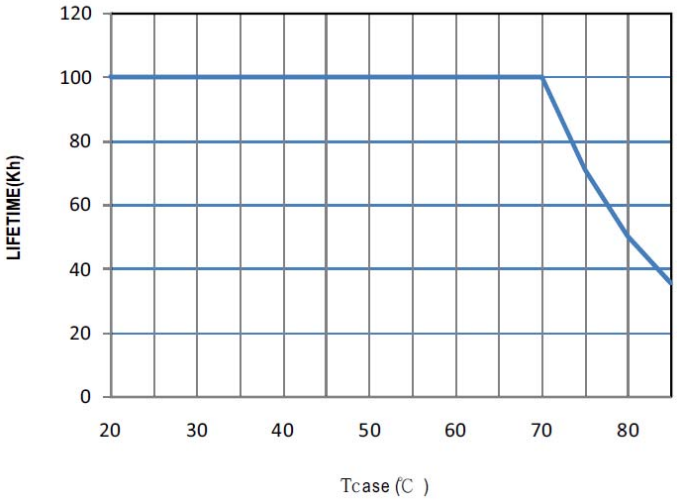
ENVIRONMENT TEST

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 ℃ 2. HIGH AMBIENT BURN-IN： 14 HRS I/P： 347VAC O/P： FULL LOAD Ta= 60 ℃		

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 60 ℃
1	BD1	62.1℃	95.6℃
2	C10	60.9℃	94.8℃
3	Q1	61.7℃	96.0℃
4	D8	65.6℃	102.8℃
5	Q10	64.1℃	100.5℃
6	RY1	63.3℃	98.4℃
7	LF2	60.4℃	93.9℃
8	C1	58.2℃	91.9℃
9	C5	61.0℃	95.3℃
10	L3	64.3℃	100.6℃
11	U1	58.2℃	92.1℃
12	U107	57.9℃	92.5℃
13	T1-1	66.0℃	101.2℃
14	T2-2	70.9℃	106.9℃
15	Q100	62.3℃	97.6℃
16	C115	58.6℃	92.8℃
17	LF100	59.9℃	94.5℃
18	C511	64.2℃	98.8℃
19	RTH2	65.6℃	101.1℃
20	T3	63.2℃	98.6℃

2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P： 528VAC/180VAC O/P： 100 % LOAD Ta= -45 ℃	TEST：OK
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60 ℃ NO DAMAGE	I/P： 538 VAC O/P：FULL LOAD Ta= 60℃ HUMIDITY= 95 %R.H	TEST：OK
4	TEMPERATURE COEFFICIENT	± 0.03 %/℃(0~60℃)	I/P： 347 VAC O/P：FULL LOAD	± 0 %/℃(0~60℃)
5	STORAGE TEMPERATURE TEST	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		OK
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 Ta= 25 ℃ LIFE TIME (2) I/P： 347VAC O/P：FULL LOAD Ta= 60 ℃ LIFE TIME (3) I/P： 347VAC O/P：75% LOAD Ta= 60 ℃ LIFE TIME (4) I/P： 347VAC O/P：50% LOAD Ta= 60 ℃ 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℃)	
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Tcase 80℃	



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

12.10.30 A50-F031