



# TEST REPORT: HDR-60-12

## 60W Ultra Slim Step Shape DIN Rail

### ■ 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

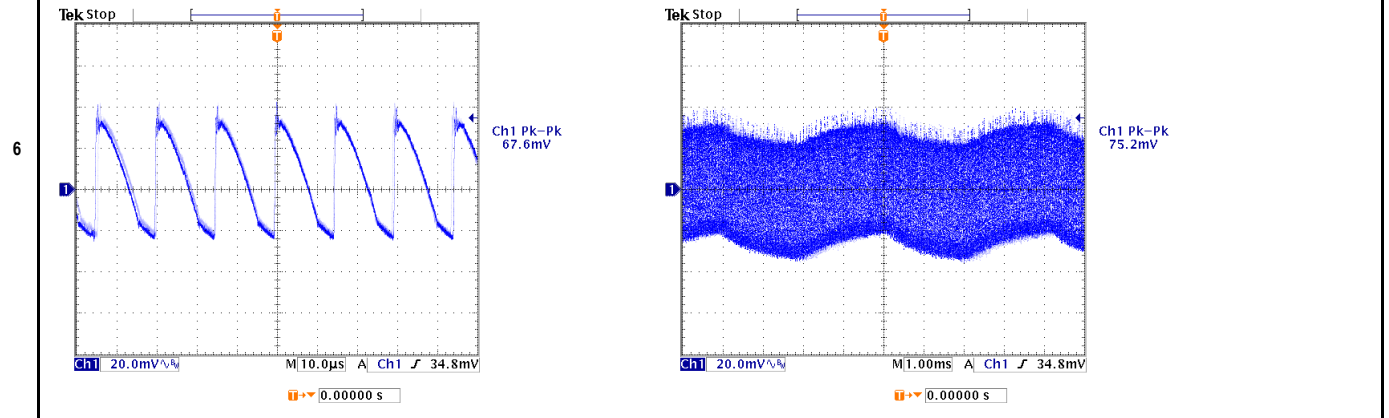
ENVIRONMENT TEST

DESIGN VERIFY TEST  
OUTPUT FUNCTION

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 10.80V ~ 13.80V	I/P : 230VAC O/P: MIN LOAD TA : 25°C	CH1: 10.45V ~ 14.80V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 1.0% ~ -1.0%	I/P : 85VAC / 277VAC O/P: FULL / MINLOAD TA= 25°C	V1: 0.25% ~ 0.08%
3	LINE REGULATION (MAX.)	V1 : 1.0% ~ -1.0%	I/P : 85VAC / 277VAC O/P: FULL LOAD TA : 25°C	V1: 0.00% ~ -0.08%
4	LOAD REGULATION (MAX.)	V1 : 1.0% ~ -1.0%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA : 25°C	V1: 0.08% ~ 0.00%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA : 25°C	TEST< 1.7 %
	RIPPLE & NOISE(Max)	V1 : 120 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25°C	V1 : 75.2 mVp-p

high frequency:

low frequency:



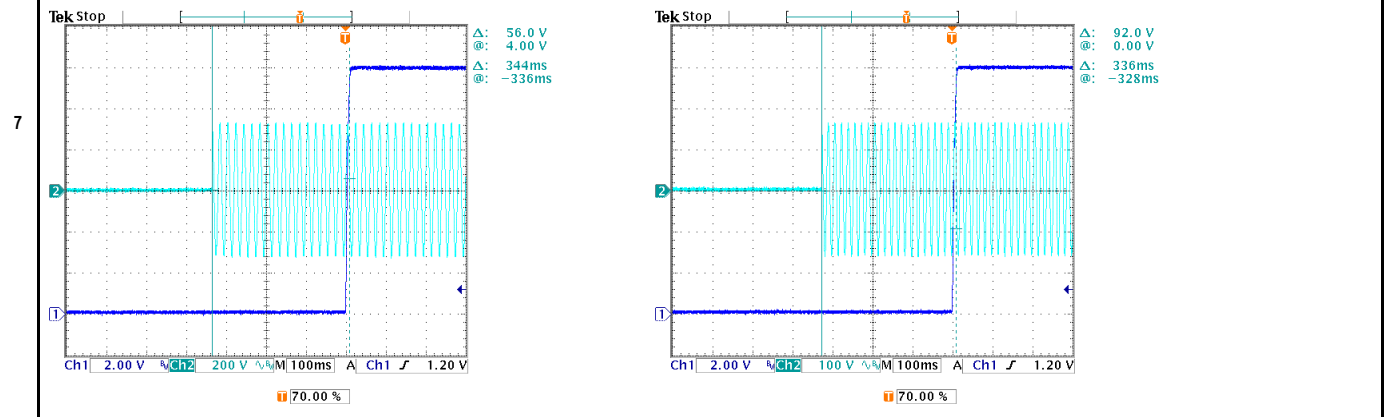
SET UP TIME (MAX.)	230VAC : 500ms 115VAC : 500ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 344ms 115VAC : 336ms
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INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

INPUT=115VAC/60HZ @ FULL LOAD

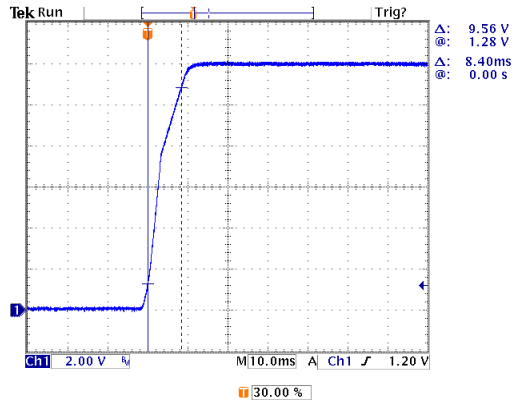
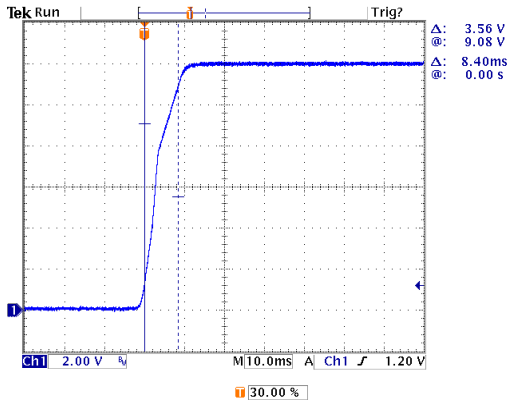
CH1 : Output Voltage CH2 : AC Input Voltage



RISE TIME (MAX.)	230VAC	: 50ms	I/P :	230VAC	230VAC	: 8.4ms
	115VAC	: 50ms	I/P :	115VAC	115VAC	: 8.4ms
			O/P:	FULL LOAD		
			TA :	25°C		

INPUT=230VAC/50HZ @ FULL LOAD  
CH1 : Output Voltage

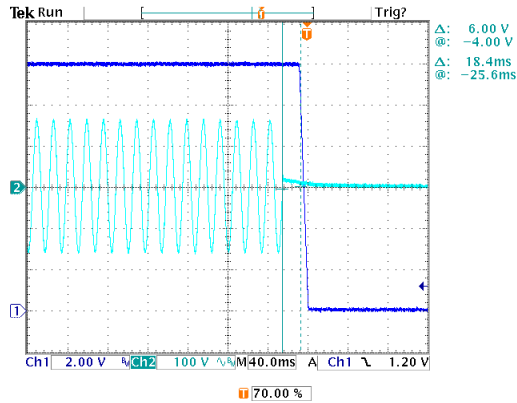
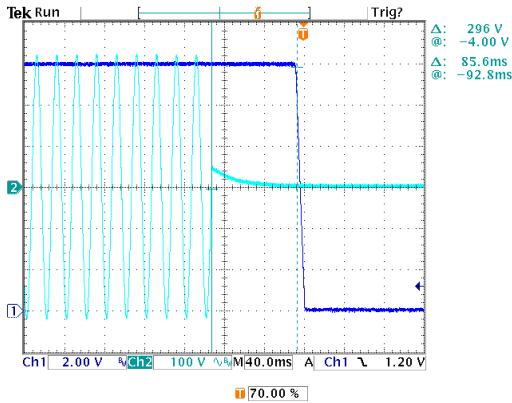
INPUT=115VAC/60HZ @ FULL LOAD  
CH1 : Output Voltage



HOLD UP TIME (TYP.)	230VAC	: 30ms	I/P :	230VAC	230VAC	: 85.6ms
	115VAC	: 12ms	I/P :	115VAC	115VAC	: 18.4ms
			O/P:	FULL LOAD		
			TA :	25°C		

INPUT=230VAC/50HZ @ FULL LOAD  
CH1 : Output Voltage CH2 : AC Input Voltage

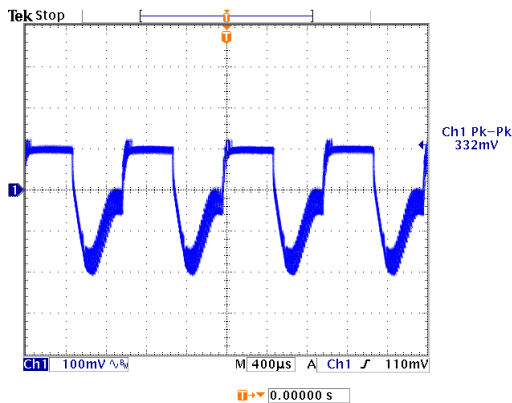
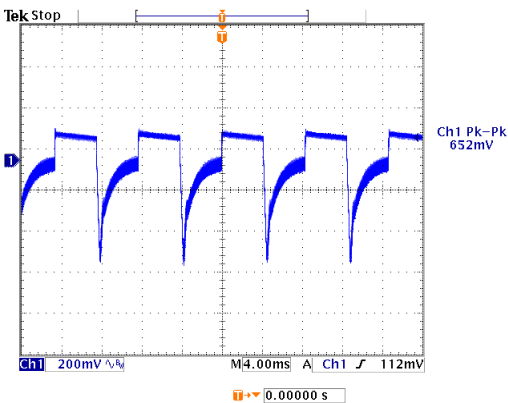
INPUT=115VAC/60HZ @ FULL LOAD  
CH1 : Output Voltage CH2 : AC Input Voltage



DYNAMIC LOAD	V1 :	1200	mVp-p	I/P :	230VAC	(1).	(2).	unit:mVp-p
				O/P:		652mv	332mv	
				(1)Full/Min load 50%duty/120HZ				
				(2)Full/Min load 50%duty/1KHZ				
				TA :	25°C			

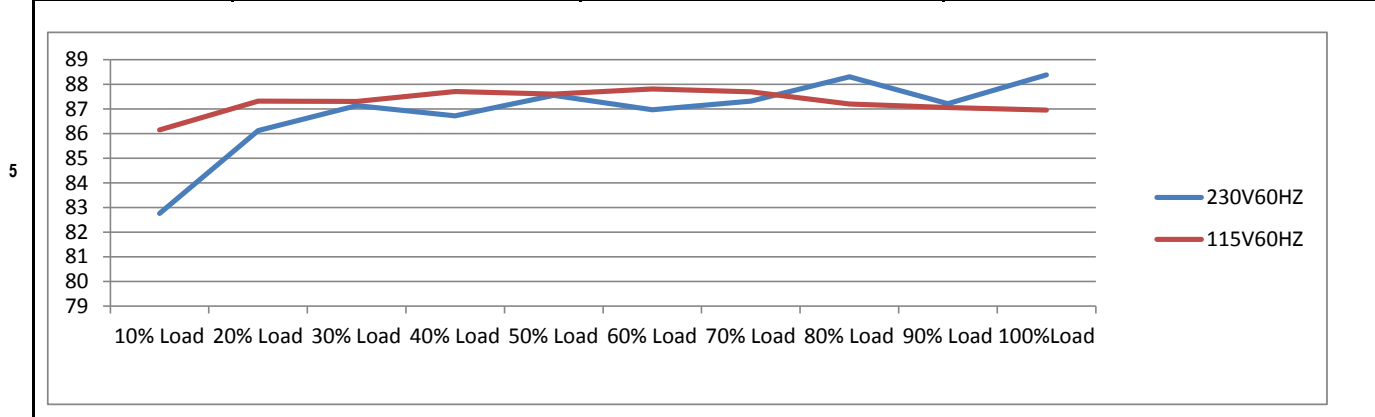
FULL /MIN LOAD 50%DUTY / 120HZ

FULL /MIN% LOAD 50%DUTY / 1KHZ



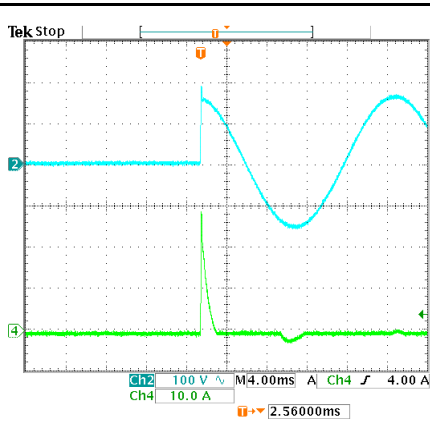
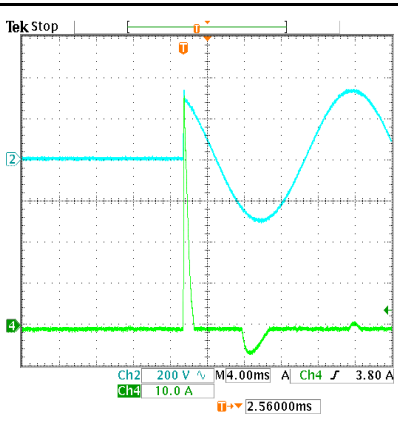
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85VAC ~ 277VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	68.0VAC ~ 277VAC
			I/P : LOW-LINE = 82VAC HIGH-LINE = 300VAC O/P : FULL/MIN LOAD ON:30 Sec ; OFF:30 Sec 10MIN ( POWER ON/OFF NO DAMAGE )	TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~ 63HZ NO DAMAGE	I/P : 85VAC ~ 277VAC O/P : FULL-MIN LOAD Ta : 25°C	TEST : OK
3	INPUT CURRENT (TYP.)	0.80A / 230VAC 1.20A / 115VAC	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 0.54A / 230VAC I= 0.89A / 115VAC
4	NO LOAD POWER CONSUMPTION	< 0.30W	I/P : 230VAC O/P : MIN LOAD TA : 25°C	< 0.1019 W
	EFFICIENCY (TYP.)	88.0%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	88.381 %



6	INRUSH CURRENT (TYP.)	60A / 230VAC 30A / 115VAC twidh= 555 us measured at 50% Ipeak COLD START	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 56.0A / 230VAC I= 29.0A / 115VAC
		INPUT=230VAC/50HZ @ FULL LOAD	INPUT=115VAC/50HZ @ FULL LOAD	

CH2 : AC Input Voltage CH4 : Input current (1V=1A)      CH2 : AC Input Voltage CH4 : Input current (1V=1A)



**PROTECTION FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105% ~ 160%	I/P: 277VAC I/P: 230VAC I/P: 85VAC O/P: TESTING  TA : 25°C	135% 277VAC 135% 230VAC 135% 85VAC  Hiccup mode when output voltage < 50%, recovers automatically after fault condition is removed;  Constant current limiting within 50%~100% rated output voltage, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	14.20V ~ 16.20V	I/P: 277VAC I/P: 230VAC I/P: 85VAC O/P: MIN LOAD TA : 25°C	15.80V 277VAC 15.80V 230VAC 15.80V 85VAC Shut down Re- power ON
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 277VAC I/P: 85VAC O/P: FULL LOAD Ta: 25°C	NO DAMAGE  hiccup mode,it will recover automatically after fault condition is removed

**COMPONENT STRESS TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Power Transistor	Q1 Rated : 600V 13.0A	I/P : 280VAC  VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	VIN: 280VAC VDS: (1). 582V (2). 534.00V (3). 588.00V
2	O/P MOSFET	Q100 Rated : 120V 20.0A	I/P : 280VAC  VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	Q100 VDS : (1). 52.40V (2). 39.20V (3). 52.40V
3	Input Capacitor	C5 Rated : 120uf 400V	I/P : 280VAC O/P : (1)Full Load Turn on /Off (2)Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C	(1). 380.00V (2). 384.00V (3). 378.00V
4	Control IC	U101 Rated : 38V (max) 0V (min)  U1 Rated : 35V (max) 0V (min)	I/P : 280VAC O/P : (1)Full Load (2)Output Short (3)O.L.P (4)O.V.P (5)Low Line No Load Vo(min) Ta : 25°C	U101 U1 (1). 12.50V 24.20V (2). 0.85V 11.60V (3). 3.18V 11.60V (4). 15.90V 28.80V (5). 10.10V 17.80V
6	Clamp Diode	D42 Rated : 1000V 2.0A	I/P : 280VAC O/P : (1)Dynamic Load Full/Min Load 90%Duty/1KHz (2)Full load continue Ta : 25°C	(1). 502.00V (2). 492.00V

**SAFETY & E.M.C. TEST**

**SAFETY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P : 4.00KVAC /min	I/P-O/P: 4.40KVAC /min Ta : 25°C	I/P-O/P: 0.94mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ	I/P-O/P: 500VDC Ta : 25°C/70%RH	I/P-O/P: 9999MΩ NO DAMAGE

**E.M.C. TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	PASS
2	CONDUCTION	EN55022 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD / 50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	EN55022 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 INDUSTRY AIR: 8KV / Contact: 4KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT: 2KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N: 2KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A

**RELIABILITY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																												
1	TEMPERATURE RISE TEST	MODEL : HDR-60-5 1. ROOM AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 100% LOAD TA= 21.2°C 2. HIGH AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 100% LOAD TA= 49.8°C	<table border="1"> <thead> <tr> <th>NO.</th> <th>Position</th> <th>ROOM AMBIENT 21.2°C</th> <th>HIGH AMBIENT Ta: 49.8°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>41.9°C</td><td>65.6°C</td></tr> <tr><td>2</td><td>BD1</td><td>44.5°C</td><td>67.9°C</td></tr> <tr><td>3</td><td>C5</td><td>46.1°C</td><td>69.9°C</td></tr> <tr><td>4</td><td>Q1</td><td>56.1°C</td><td>74.9°C</td></tr> <tr><td>5</td><td>D42</td><td>64.9°C</td><td>80.1°C</td></tr> <tr><td>6</td><td>T1</td><td>74.2°C</td><td>97.1°C</td></tr> <tr><td>7</td><td>C105</td><td>67.0°C</td><td>90.1°C</td></tr> <tr><td>8</td><td>Q100</td><td>69.7°C</td><td>92.2°C</td></tr> <tr><td>9</td><td>LF101</td><td>68.0°C</td><td>90.9°C</td></tr> <tr><td>10</td><td>U1</td><td>51.2°C</td><td>73.8°C</td></tr> </tbody> </table>	NO.	Position	ROOM AMBIENT 21.2°C	HIGH AMBIENT Ta: 49.8°C	1	LF1	41.9°C	65.6°C	2	BD1	44.5°C	67.9°C	3	C5	46.1°C	69.9°C	4	Q1	56.1°C	74.9°C	5	D42	64.9°C	80.1°C	6	T1	74.2°C	97.1°C	7	C105	67.0°C	90.1°C	8	Q100	69.7°C	92.2°C	9	LF101	68.0°C	90.9°C	10	U1	51.2°C	73.8°C	
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230VAC O/P : 133.85% LOAD Ta : 25°C	TEST : OK																																												
3	LOW TEMPERATURE TURN ON TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 277VAC / 100VAC O/P : FULL LOAD Ta : -30.0°C	TEST : OK																																												
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45°C NO DAMAGE	I/P : 287VAC O/P : FULL LOAD Ta : 45°C HUMIDITY= 95.0% RH	TEST : OK																																												
5	TEMPERATURE COEFFICIENT	±0.03% /(0°C~50°C)	I/P : 230VAC O/P : FULL LOAD	±0.0070% /(0°C~50°C)																																												
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -40°C ~ +85°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		TEST : OK																																												
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -35°C ~ +50°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		TEST : OK																																												



8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (4) Acceleration : 2G (5) Test Time : 60 min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK
9	CAPACITOR LIFE CYCLE	:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25.0°C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 45.0°C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 45.0°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 45.0°C LIFE TIME	(1). 158118 HRS (2). 50019 HRS (3). 125618 HRS (4). 158118 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 927.6K hrs min. MIL-HDBK-217F (25°C)	
11	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure (Expected Life): Above 30000HRS @ TA 45°C	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	FRANK	GESG	WANGDZ

2007/3/20 A50-S014