



# TEST REPORT: HDR-60-48

## 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

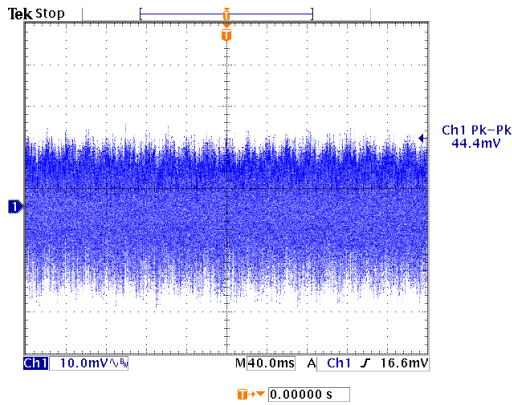
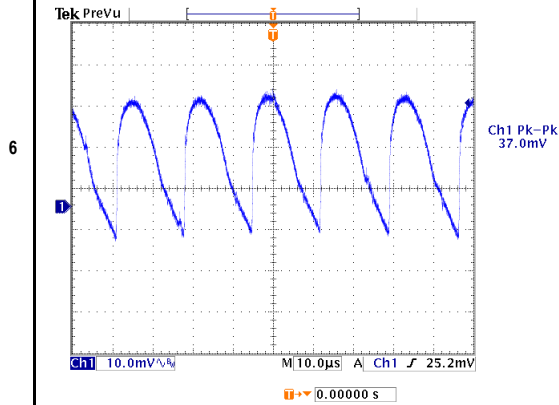
ENVIRONMENT TEST

■ DESIGN VERIFY TEST  
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 43.20V ~ 55.20V	I/P: 230VAC O/P: MIN LOAD TA: 25°C	CH1: 42.225V ~ 57.415V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: 1.0% ~ -1.0%	I/P: 85VAC / 277VAC O/P: FULL / MINLOAD TA= 25°C	V1: 0.10% ~ 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% ~ -0.02%
4	LOAD REGULATION (MAX.)	V1: 1.0% ~ -1.0%	I/P: 230VAC O/P: MIN LOAD ~ FULL LOAD TA: 25°C	V1: 0.02% ~ 0.00%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P: FULL LOAD TA: 25°C	TEST< 2.9 %
	RIPPLE & NOISE(Max)	V1: 240 mVp-p	I/P: 230VAC O/P: FULL LOAD TA: 25°C	V1: 44.4 mVp-p

high frequency:

low frequency:



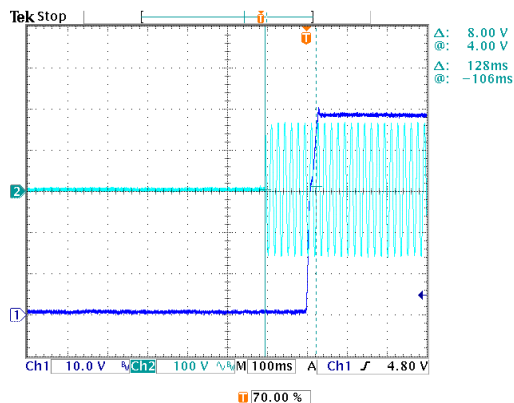
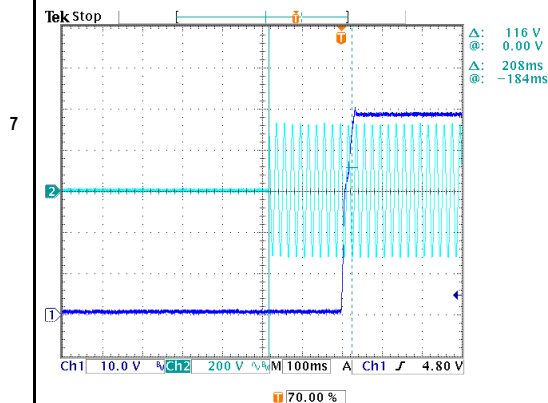
SET UP TIME (MAX.)	230VAC	: 500ms
	115VAC	: 500ms

I/P:	230VAC
I/P:	115VAC
O/P:	FULL LOAD
TA:	25°C

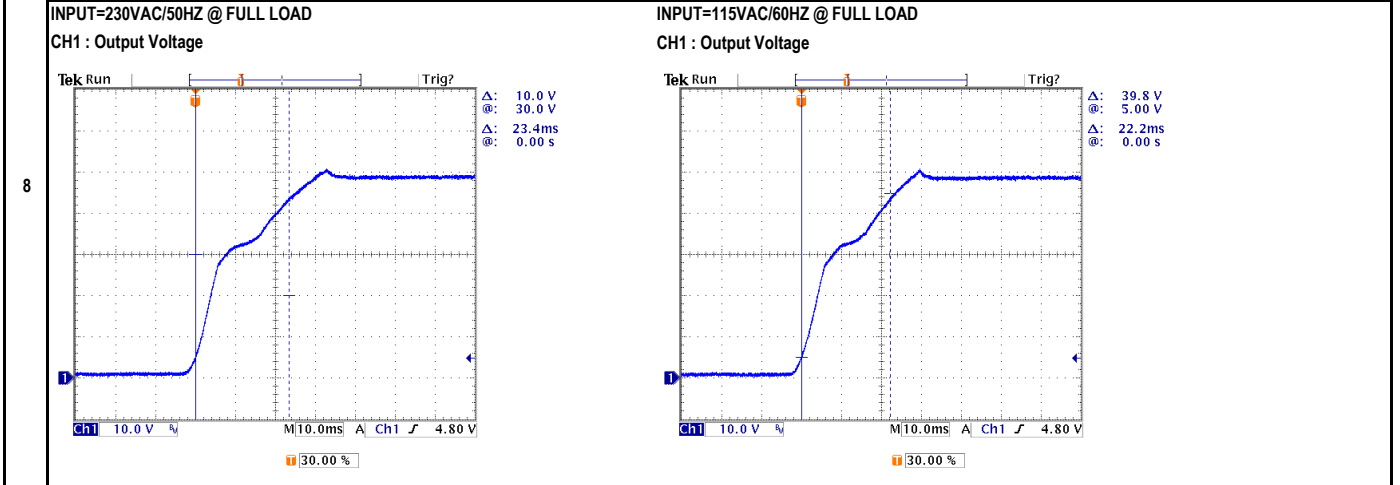
230VAC	: 208ms
115VAC	: 128ms

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

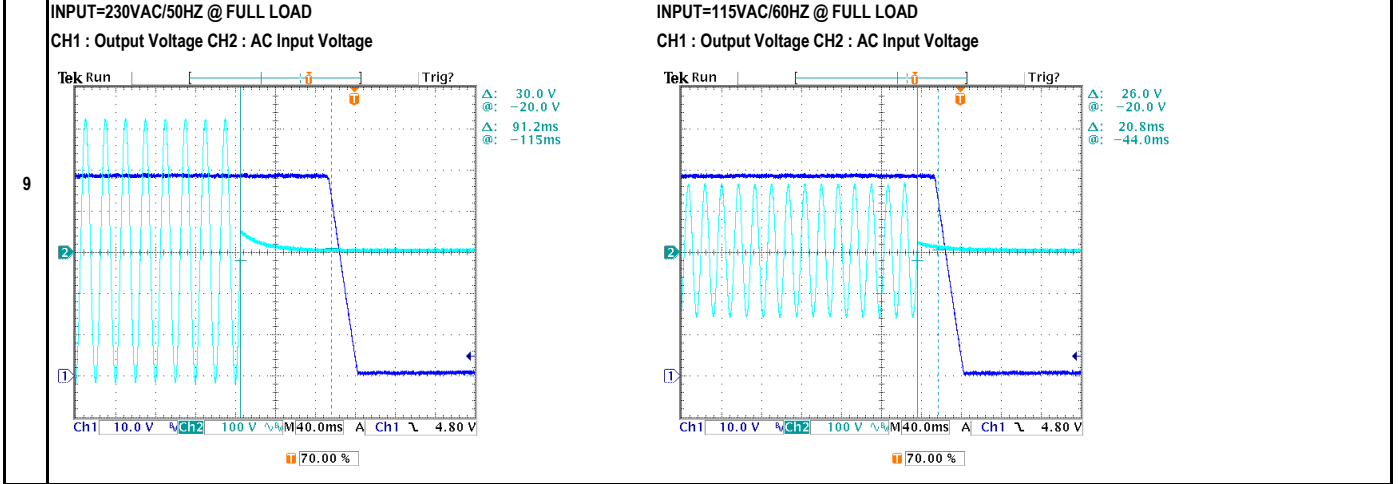
INPUT=115VAC/60HZ @ FULL LOAD  
CH1 : Output Voltage CH2 : AC Input Voltage



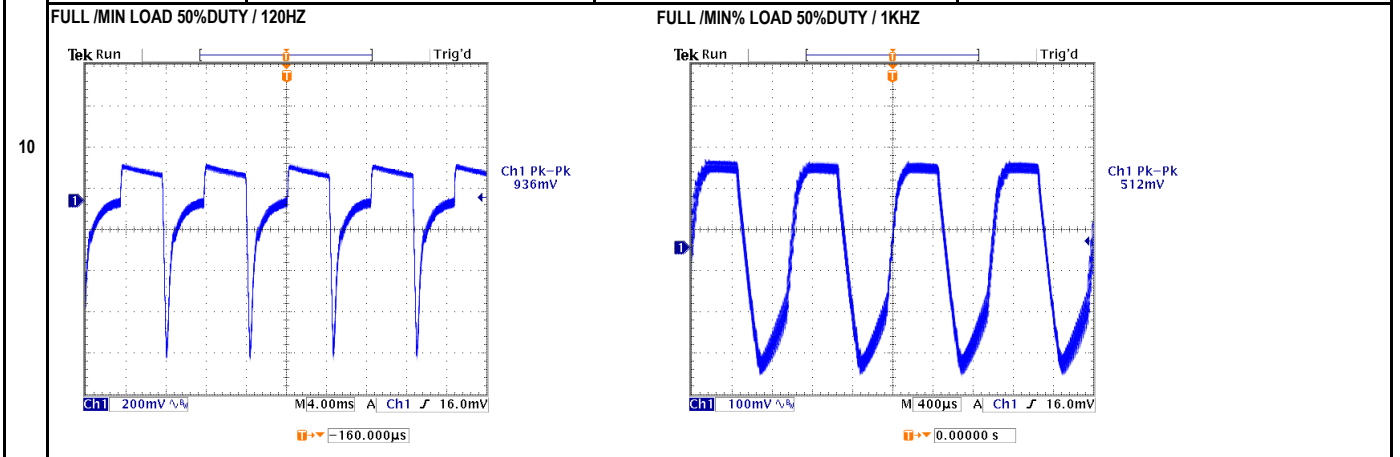
RISE TIME (MAX.)	230VAC	: 50ms	I/P:	230VAC	230VAC	: 23.4ms
	115VAC	: 50ms	I/P:	115VAC	115VAC	: 22.2ms
			O/P:	FULL LOAD		
			TA:	25°C		



HOLD UP TIME (TYP.)	230VAC	: 30ms	I/P:	230VAC	230VAC	: 91.2ms
	115VAC	: 12ms	I/P:	115VAC	115VAC	: 20.8ms
			O/P:	FULL LOAD		
			TA:	25°C		

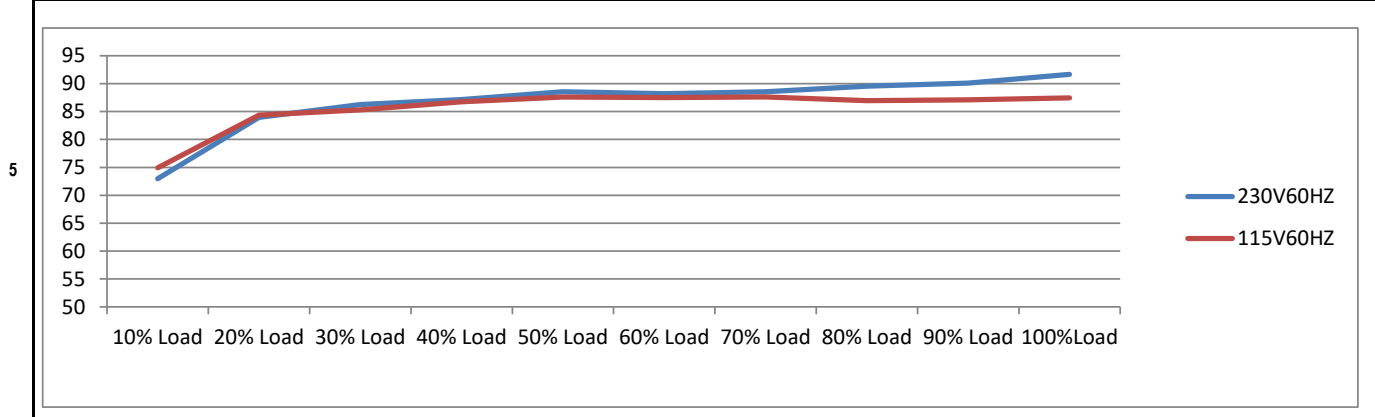


DYNAMIC LOAD	V1:	4800	mVp-p	I/P:	230VAC	(1).	(2).	unit:mVp-p
				O/P:		936mv	512mv	
			(1)Full/Min load 50%duty/120HZ					
			(2)Full/Min load 50%duty/1KHZ					
			TA:		25°C			



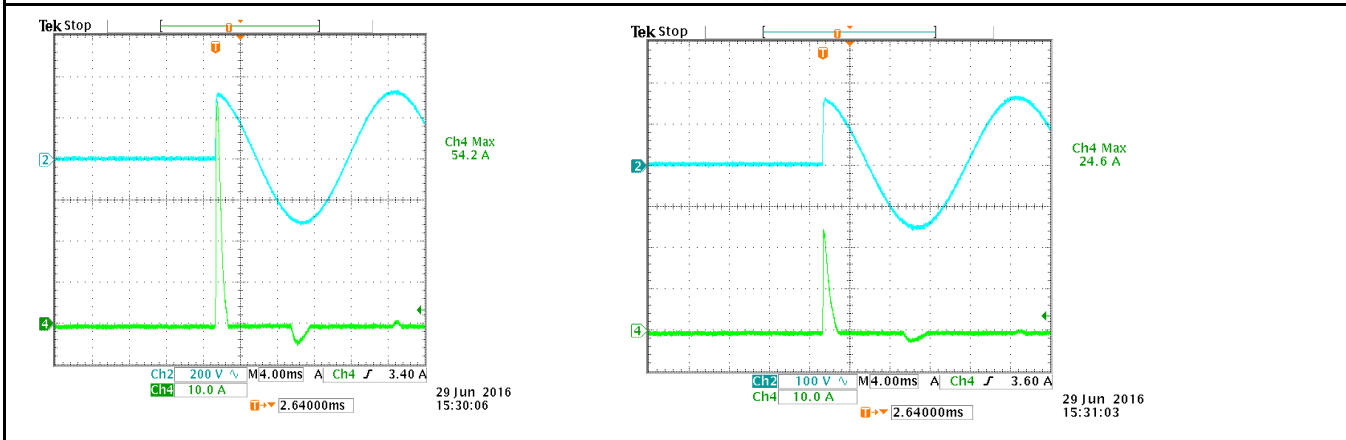
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85VAC ~ 277VAC 120VDC ~ 390VDC	I/P: TESTING O/P: FULL LOAD Ta: 25°C	68.0VAC ~ 277VAC 96.2VDC ~ 390VDC
			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= 0.50A / 230VAC I= 0.93A / 115VAC
4	NO LOAD POWER CONSUMPTION	< 0.30W	I/P: 230VAC O/P: MIN LOAD TA : 25°C	< 0.2198 W
	EFFICIENCY (TYP.)	91.0%	I/P: 230VAC O/P: FULL LOAD TA : 25°C	91.355 %



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= 54.2A / 230VAC I= 24.6A / 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	133.60% 277VAC 133.60% 230VAC 133.60% 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	56.50V ~ 64.80V	I/P: 277VAC I/P: 230VAC I/P: 85VAC O/P: MIN LOAD TA: 25°C	63.60V 277VAC 63.60V 230VAC 63.60V 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). 584.00V (2). 492.00V (3). 564.00V
2	O/P MOSFET	Q100 Rated: 400V 10.0A	I/P: 280VAC  VDS : O/P: (1) Full Load Turn on (2) Output Short (3) Full load continue Ta: 25°C	Q100 VDS : (1). 205.00V (2). 145.00V (3). 204.00V
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). 398.00V (2). 398.00V (3). 374.00V
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 Change (4) O.V.P (5) Low Line No Load Vo(min) Ta: 25°C	U101 U1 (1). 24.50V 24.70V (2). 0.68V 11.50V (3). 3.24V 11.40V (4). 24.50V 30.90V (5). 24.50V 21.00V
5	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). 494.00V (2). 492.00V

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

**SAFETY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 4.000KVAC /min	I/P-O/P: 4.400KVAC /min Ta: 25°C	I/P-O/P: 1.32mA 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	BS EN/EN61000-3-2 CLASS A	I/P: 230VAC /50HZ O/P: FULL LOAD Ta: 25°C	PASS
2	CONDUCTION	BS EN/EN55032(CISPR32), CNS13438 CLASS B	I/P: 230VAC /50HZ O/P: FULL LOAD / 50% LOAD Ta: 25°C	PASS Test by certified Lab
3	RADIATION	BS EN/EN55032(CISPR32), CNS13438 CLASS B	I/P: 230VAC /50HZ O/P: FULL LOAD Ta: 25°C	PASS Test by certified Lab
4	E.S.D	BS EN/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	BS EN/EN61000-4-4 INDUSTRY INPUT: 2KV	I/P: 230VAC /50HZ O/P: FULL LOAD Ta: 25°C	CRITERIA A
6	SURGE	BS EN/EN61000-4-5 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-60-24 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	ROOM AMBIENT Ta: 21.2°C HIGH AMBIENT Ta: 49.8°C																																													
			<table border="1"> <thead> <tr> <th>NO.</th> <th>Position</th> <th>ROOM AMBIENT Ta: 21.2°C</th> <th>HIGH AMBIENT Ta: 49.8°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>48.5°C</td><td>72.5°C</td></tr> <tr><td>2</td><td>BD1</td><td>52.9°C</td><td>76.3°C</td></tr> <tr><td>3</td><td>C5</td><td>54.6°C</td><td>79.6°C</td></tr> <tr><td>4</td><td>Q1</td><td>66.3°C</td><td>88.6°C</td></tr> <tr><td>5</td><td>D42</td><td>71.5°C</td><td>94.9°C</td></tr> <tr><td>6</td><td>T1</td><td>84.6°C</td><td>105.7°C</td></tr> <tr><td>7</td><td>C105</td><td>65.4°C</td><td>87.3°C</td></tr> <tr><td>8</td><td>Q100</td><td>76.4°C</td><td>98.7°C</td></tr> <tr><td>9</td><td>LF101</td><td>63.9°C</td><td>86.3°C</td></tr> <tr><td>10</td><td>U1</td><td>58.2°C</td><td>81.4°C</td></tr> </tbody> </table>	NO.	Position	ROOM AMBIENT Ta: 21.2°C	HIGH AMBIENT Ta: 49.8°C	1	LF1	48.5°C	72.5°C	2	BD1	52.9°C	76.3°C	3	C5	54.6°C	79.6°C	4	Q1	66.3°C	88.6°C	5	D42	71.5°C	94.9°C	6	T1	84.6°C	105.7°C	7	C105	65.4°C	87.3°C	8	Q100	76.4°C	98.7°C	9	LF101	63.9°C	86.3°C	10	U1	58.2°C	81.4°C	
NO.	Position	ROOM AMBIENT Ta: 21.2°C	HIGH AMBIENT Ta: 49.8°C																																													
1	LF1	48.5°C	72.5°C																																													
2	BD1	52.9°C	76.3°C																																													
3	C5	54.6°C	79.6°C																																													
4	Q1	66.3°C	88.6°C																																													
5	D42	71.5°C	94.9°C																																													
6	T1	84.6°C	105.7°C																																													
7	C105	65.4°C	87.3°C																																													
8	Q100	76.4°C	98.7°C																																													
9	LF101	63.9°C	86.3°C																																													
10	U1	58.2°C	81.4°C																																													
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P: 230VAC O/P: 123.10% 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	±0.0072% /(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). 120198 HRS (2). 47838 HRS (3). 73808.8 HRS (4). 153816 HRS
10	MTBF	3524.8K hrs min. Telcordia SR-332 (Bellcore) ; 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 O/P: FULL LOAD	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	FRANK	GESG	WANGDZ

2007/3/20 A50-S014