



Test Report: HRPG-450-7.5

450W Single Output With PFC Function

■ DESIGN VERIFY TEST

Output Function Test
Input Function Test
Protection Function Test
Control 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 | VERDICT |
|----|-----------------------------|---|---|--|---------|
| 1 | RIPPLE & NOISE | V1 : 80 mVp-p (Max) | I/P : 230VAC O/P : FULL LOAD Ta : 25°C | V1 : 50 mVp-p (Max) | P |
| 2 | OUTPUT VOLTAGE ADJUST RANGE | CH1 : 6.9 V ~ 9 V | I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C | 6.099 V~ 9.278 V/ 230 VAC 6.099 V~ 9.278 V/ 115 VAC | P |
| 3 | OUTPUT VOLTAGE TOLERANCE | V1 : 2%~ -2% (Max) | I/P : 100 VAC / 264 VAC O/P : FULL/ MIN LOAD Ta : 25°C | V1 : 0.34 %~ -0.34 % | P |
| 4 | LINE REGULATION | V1 : 0.5%~ -0.5% (Max) | I/P : 100 VAC ~ 264 VAC O/P : FULL LOAD Ta : 25°C | V1 : 0.08 %~ -0.08 % | P |
| 5 | LOAD REGULATION | V1 : 1 %~ -1% (Max) | I/P : 230 VAC O/P : FULL ~MIN LOAD Ta : 25°C | V1 : 0.34 %~ -0.34 % | P |
| 6 | SET UP TIME | 230VAC : 1000 ms (Max) 115VAC : 2500 ms(Max) | I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C | 230VAC/ 517 ms 115VAC/ 1034 ms | P |
| 7 | RISE TIME | 230VAC : 100 ms (Max) 115VAC : 100 ms (Max) | I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C | 230VAC/ 17 ms 115VAC/ 14 ms | P |
| 8 | HOLD UP TIME | 230VAC : 16 ms (TYP) 115VAC : 16 ms (TYP) | I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C | 230VAC/ 21 ms 115VAC/ 16 ms | P |
| 9 | OVER/UNDERSHOOT TEST | < ±5% | I/P : 230 VAC O/P : FULL LOAD Ta : 25°C | TEST : < 5 % | P |
| 10 | DYNAMIC LOAD | V1 : 750 mVp-p | I/P : 230 VAC (1).O/P : FULL /Min LOAD 90%DUTY/ 1KHZ (2).O/P : FULL /Min LOAD 50%DUTY/ 120HZ Ta : 25°C | (1).530 mVp-p (2).635 mVp-p | P |

INPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|----|---------------------------|--------------------------------|--|--------------------------------|---------|
| 1 | INPUT VOLTAGE RANGE | 100VAC~264 VAC | I/P : TESTING O/P : FULL LOAD Ta : 25°C | 72 V~264V | P |
| | | | I/P : LOW-LINE-3V= 97 V HIGH-LINE+15%=300 V O/P : FULL/MIN LOAD ON : 30 Sec. OFF : 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE) | TEST : OK | |
| 2 | INPUT FREQUENCY RANGE | 47HZ ~63 HZ NO DAMAGE OSC | I/P : 100 VAC ~ 264 VAC O/P : FULL-MIN LOAD Ta : 25°C | TEST : OK | P |
| 3 | POWER FACTOR | 0.95 / 230 VAC(TYP) | I/P : 230 VAC | PF= 0.9801 / 230 VAC | P |
| | | 0.99 / 115 VAC(TYP) | I/P : 115 VAC O/P : FULL LOAD Ta : 25°C | PF= 0.9983 / 115 VAC | |
| 4 | EFFICIENCY | 86% (TYP) | I/P : 230 VAC O/P : FULL LOAD Ta : 25°C | 87.187 % | P |
| 5 | INPUT CURRENT | 230V/ 3.8 A (TYP) | I/P : 230 VAC | I = 2.304 A / 230 VAC | P |
| | | 115V/ 6.3 A (TYP) | I/P : 115 VAC O/P : FULL LOAD Ta : 25°C | I = 4.706 A / 115 VAC | |
| 6 | INRUSH CURRENT | 230V/ 70 A (TYP) | I/P : 230 VAC | I = 62 A / 230 VAC | P |
| | | 115V/ 35 A (TYP) COLD START | I/P : 115 VAC O/P : FULL LOAD Ta : 25°C | I = 31 A / 115 VAC | |
| 7 | LEAKAGE CURRENT | < 1.5 mA / 240 VAC | I/P : 264 VAC O/P : Min LOAD Ta : 25°C | L-FG : 1.2 mA N-FG : 0.6 mA | P |
| 8 | No load power consumption | < 0.5 W | I/P : 230 VAC O/P : NO LOAD RC+&RC- SHORT Ta : 25°C | 0.2W | P |

PROTECTION FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|----|-----------------------------|--|---|--|---------|
| 1 | OVER LOAD PROTECTION | 105% ~ 135 % | I/P : 230 VAC I/P : 115 VAC O/P : TESTING Ta : 25°C | 124.34%/ 230 VAC 124.71%/ 115 VAC Constant current limiting, recovers automatically after fault condition is removed | P |
| 2 | OVER VOLTAGE PROTECTION | CH1 : 9.4 V ~ 10.9 V | I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C | 9.85 V/ 230 VAC 9.86 V/ 115 VAC Shut down Re- power ON | P |
| 3 | OVER TEMPERATURE PROTECTION | SPEC : Shut down o/p voltage , recovers automatically after temperature goes down | I/P : 230 VAC O/P : FULL LOAD | O.T.P. Active Shut down o/p voltage , recovers automatically after temperature goes down | P |
| 4 | SHORT PROTECTION | SHORT EVERY OUTPUT 1 HOUR NO DAMAGE | I/P : 264 VAC O/P : FULL LOAD Ta : 25°C | NO DAMAGE Constant current limiting, recovers automatically after fault condition is removed | P |

CONTROL FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|----|-------------------------|--|---|---|---------|
| 1 | DC OK SIGNAL | PSU turn on : 3.3 ~ 5.6V ; PSU turn off : 0 ~ 1V | I/P : 230 VAC O/P : FULL LOAD Ta : 25°C | PSU turn on : 4.956 V PSU turn off : 0 V | P |
| 2 | REMOTE CONTROL | Rc+ / Rc- 4 ~ 10V or open = power on 0 ~ 0.8V or short = power off | I/P : 230 VAC O/P : FULL LOAD Ta : 25°C | 3.675V ~ 10 V POWER ON 0V ~ 3.25 V POWER OFF | P |
| 3 | REMOTE SENSE | >0.5V | I/P : 230 VAC O/P : FULL LOAD Ta : 25°C | > 0.5 V | P |
| 4 | AUX POWER | 4.75V~5.25V / 0.3A Ripple : 50mV | I/P : 230 VAC O/P : FULL LOAD Ta : 25°C | 4.955V / 0.3A Ripple : 16.5 mv | P |
| 5 | FAN ON/OFF control test | FAN ON : 20%± 10% | I/P : 230 VAC O/P : TESTING Ta : 25°C | > 26.04 %LOAD FAN ON < 19.81 %LOAD FAN OFF | P |

COMPONENT STRESS TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|----|--|---|--|--|---------|
| 1 | Power Transistor (D to S) or (C to E) Peak Voltage | Q3 Rated : IRFP460A 20A/500V | I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C | (1) 422 V (2) 412 V (3) 406 V | P |
| 2 | Diode Peak Voltage | Q 101 Rated : IRFB3607PBF 80A/75V Q 103Rated : IRFB3607PBF 80A/75V | I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C | (1) 31 V (2) 29.6 V (3) 29 V (1) 57.6 V (2) 31.6 V (3) 32.8 V | P |
| 3 | Input Capacitor Voltage | C5 Rated : 330u/400V 105°C 30*30 HU | I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C | (1) 374.5 V (2) 378.2 V (3) 378.6 V | P |
| 4 | Control IC Voltage Test | U1 Rated : FAN4801NY 9.3V~30V | I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C | (1) 15.793 V (2) 14.942 V (3) 14.91 V | P |
| 5 | Power Transistor (D to S) or (C to E) Peak Voltage | Q 1 Rated : IRFP460A 20A/500V | I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C | (1) 482 V (2) 392 V (3) 414 V | P |

SAFETY & E.M.C. TEST
SAFETY TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|----|----------------------|--|---|--|---------|
| 1 | WITHSTAND VOLTAGE | I/P-O/P : 3 KVAC/min I/P-FG : 1.5 KVAC/min O/P-FG : 0.5 KVAC/min | I/P-O/P : 3.6 KVAC/min I/P-FG : 1.8 KVAC/min O/P-FG : 0.6 KVAC/min Ta : 25°C | I/P-O/P : 5.94 mA I/P-FG : 4.74 mA O/P-FG : 3.62 mA NO DAMAGE | P |
| 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/70% RH | I/P-O/P : 10.5 GΩ I/P-FG : 8.67 GΩ O/P-FG : 15.3 GΩ NO DAMAGE | P |
| 3 | GROUNDING CONTINUITY | FG(PE) TO CHASSIS OR TRACE < 100 mΩ | 40 A / 2min Ta : 25°C /70% RH | 8 mΩ | P |
| 4 | APPROVAL | TUV : Certificate NO : UL : File NO : | | | N/A |

E.M.C TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT |
|----|---|---|--|-------------------------------|---------|
| 1 | HARMONIC | EN61000-3-2 CLASS A CLASS D | I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C | PASS | P |
| 2 | CONDUCTION | EN55022 CLASS B | I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C | PASS Test by certified Lab | P |
| 3 | RADIATION | EN55022 CLASS B | I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C | PASS Test by certified Lab | P |
| 4 | E.S.D | EN61000-4-2 INDUSTRY AIR : 8KV / Contact : 4KV | I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C | CRITERIA A | P |
| 5 | E.F.T | EN61000-4-4 INDUSTRY INPUT : 2KV | I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C | CRITERIA A | P |
| 6 | SURGE | IEC61000-4-5 INDUSTRY L-N : 2KV L,N-PE : 4KV | I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C | CRITERIA A | P |
| 7 | Test by certified Lab & Test Report Prepare | | | | |

RELIABILITY TEST
ENVIRONMENT TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | VERDICT | | |
|----|---|--|--|-----------------------------|---------|--|-----------|
| 1 | TEMPERATURE RISE TEST | MODEL : HRPG-450-5 | | | P | | |
| | | 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta=27.1 °C | | | | | |
| | | 2. HIGH AMBIENT BURN-IN : 4.5 HRS I/P : 230VAC O/P : FULL LOAD Ta=50 °C | | | | | |
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| | | 2 | OVER LOAD BURN-IN TEST | NO DAMAGE 1 HOUR (MIN) | | I/P : 230 VAC O/P : 123 % LOAD Ta : 25°C | TEST : OK |
| 3 | LOW TEMPERATURE TURN ON TEST | TURN ON AFTER 2 HOUR | I/P : 264VAC/100VAC O/P : 100 % LOAD Ta= -35 °C | TEST : OK | P | | |
| 4 | HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST | AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C NO DAMAGE | I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H | TEST : OK | P | | |
| 5 | TEMPERATURE COEFFICIENT | ± 0.03 % (0~50°C) | I/P : 230 VAC O/P : FULL LOAD | ± 0.001 % (0~50°C) | P | | |
| 6 | STORAGE TEMPERATURE TEST | 1. Thermal shock Temperature : -45°C ~ +90°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 | | OK | P | | |

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|----|----------------------|--|---|---|
| 7 | THERMAL SHOCK TEST | 1. Thermal shock Temperature : -30°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 | OK | P |
| 8 | VIBRATION TEST | 1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 5G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C | TEST : OK | P |
| 9 | CAPACITOR LIFE CYCLE | HRPG-450-5:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 50 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50 °C LIFE TIME | (1) 487645.9HRS (2) 109089.4HRS (3) 229111HRS | P |
| 10 | MTBF | Conducted by Parts Stress Analysis Prediction 1180.3K hrs min. Telcordia SR-332 (Bellcore) ; 130.5K hrs min. MIL-HDBK-217F (25°C) | | P |

| TEST RESULT | TESTER | APPROVAL |
|-------------|------------|---------------|
| PASS | SANFORD SU | VINCENT TSENG |

2009/08/04 A50-F023