



Test Report: LRS-600-48

600W Single Output Switching Power Supply

■ 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

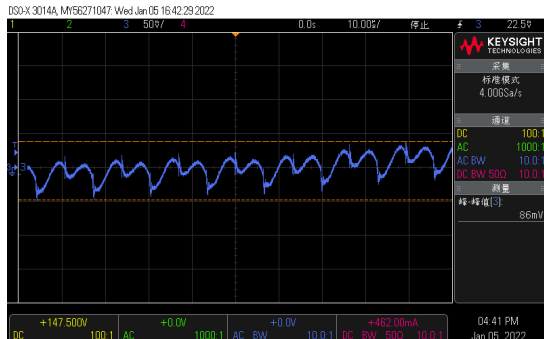
- ENVIRONMENT TEST

DESIGN VERIFY TEST

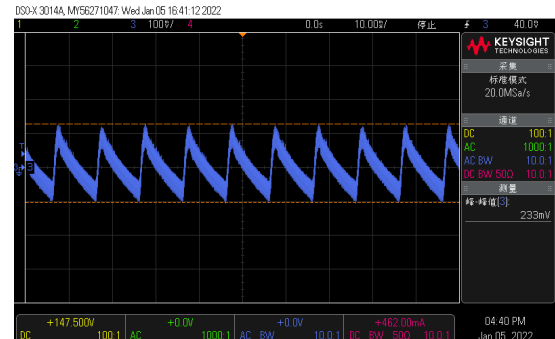
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 45.6 V~ 52.8V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	43.68V~54.75V/230VAC 43.77V~54.81V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: - 1%~ + 1%	I/P: 90VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.13%~ 0.23%
3	LINE REGULATION (Max)	V1: - 0.5%~ + 0.5 %	I/P: 90VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: -0.00%~ 0.042%
4	LOAD REGULATION(Max)	V1: - 0.5%~ + 0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.042%~0.042%
5	RIPPLE & NOISE(Max)	V1: 360mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 233mVp-p

high frequency :



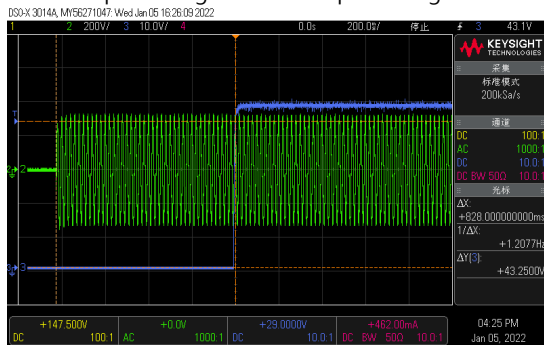
low frequency :



6	SET UP TIME(Max)	230VAC/1300ms 115VAC/1300ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/828ms 115VAC/880ms
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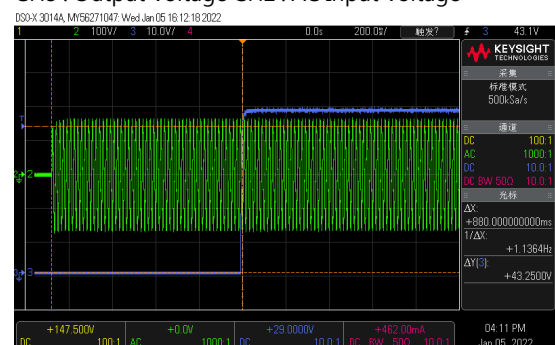
INPUT=230VAC/50HZ @ FULL LOAD

CH3 : Output Voltage CH2 : AC Input Voltage



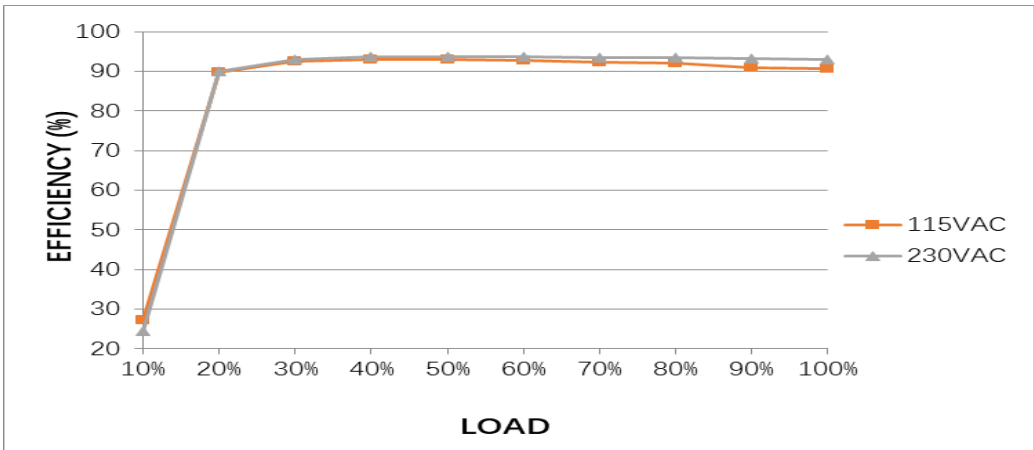
INPUT=115VAC/60HZ @ FULL LOAD

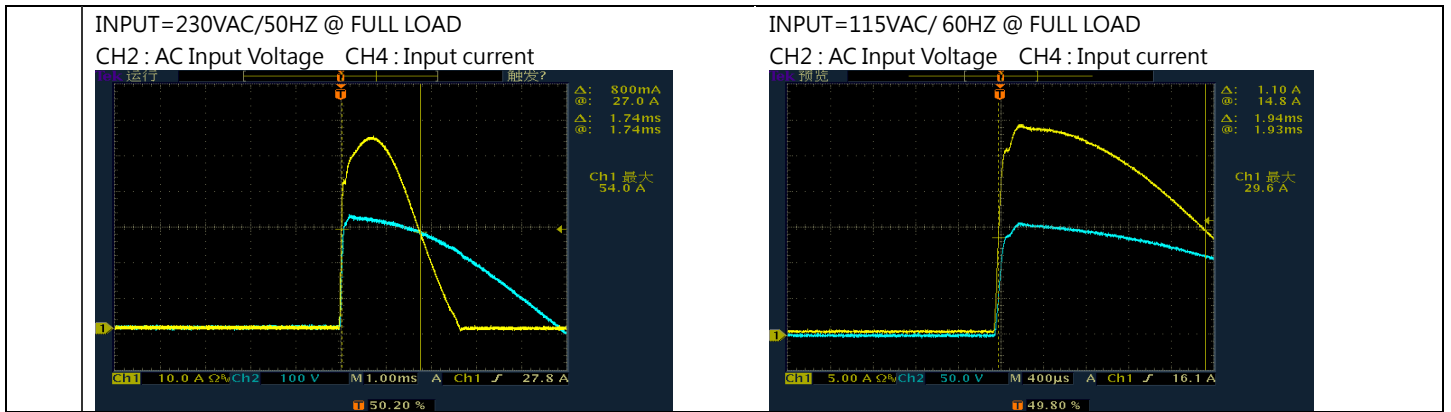
CH3 : Output Voltage CH2 : AC Input Voltage



7	RISE TIME (Max)	230VAC/50ms 115VAC/50ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 8.4ms 115VAC/ 8.8ms
INPUT=230VAC/50HZ @ FULL LOAD		INPUT=115VAC/60HZ @ FULL LOAD		
CH3 : Output Voltage		CH3 : Output Voltage		
8	HOLD UP TIME (Typ.)	230VAC/20ms 115VAC/16ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/28ms 115VAC/22ms
INPUT=230VAC/50HZ @ FULL LOAD		INPUT=115VAC/60HZ @ FULL LOAD		
CH3 : Output Voltage CH2 : AC Input Voltage		CH13 : Output Voltage CH2 : AC Input Voltage		
9	DYNAMIC LOAD	V1: 2400mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	289mVp-p 281mVp-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	90 ~ 132VAC / 180 ~ 264VAC by switch 250VDC~ 370VDC (switch on 230VAC)	(1) I/P:TESTING O/P:FULL LOAD (2) I/P:DC TESTING(L:+ N:-) O/P: FULL / 50% LOAD (3) I/P:DC TESTING(L:- N:+) O/P: FULL / 50% LOAD Ta:25°C	(1) 85VAC~267VAC (2)250Vdc~370Vdc/FULL LOAD 250Vdc~370Vdc/50% LOAD (3) 250Vdc~370Vdc/FULL LOAD 250Vdc~370Vdc/50% LOAD																																	
			I/P: LOW-LINE-3V=87 V HIGH-LINE+15%=300 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:90 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK																																	
3	INPUT CURRENT (Typ.)	230V/ 7.5A 115V/12A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =5.85A/ 230VAC I =10.25A/ 115VAC																																	
4	LEAKAGE CURRENT	< 2mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.871 mA N-FG : 0.876 mA																																	
5	EFFICIENCY(Typ.)	92%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	92.28%																																	
<p>EFFICIENCY vs LOAD</p>  <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>Load (%)</th> <th>115VAC Efficiency (%)</th> <th>230VAC Efficiency (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>28</td><td>25</td></tr> <tr><td>20%</td><td>90</td><td>90</td></tr> <tr><td>30%</td><td>92</td><td>92</td></tr> <tr><td>40%</td><td>92</td><td>92</td></tr> <tr><td>50%</td><td>92</td><td>92</td></tr> <tr><td>60%</td><td>92</td><td>92</td></tr> <tr><td>70%</td><td>92</td><td>92</td></tr> <tr><td>80%</td><td>92</td><td>92</td></tr> <tr><td>90%</td><td>92</td><td>92</td></tr> <tr><td>100%</td><td>92</td><td>92</td></tr> </tbody> </table>					Load (%)	115VAC Efficiency (%)	230VAC Efficiency (%)	10%	28	25	20%	90	90	30%	92	92	40%	92	92	50%	92	92	60%	92	92	70%	92	92	80%	92	92	90%	92	92	100%	92	92
Load (%)	115VAC Efficiency (%)	230VAC Efficiency (%)																																			
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70%	92	92																																			
80%	92	92																																			
90%	92	92																																			
100%	92	92																																			
6	INRUSH CURRENT(Typ.)	230V/60A 115V/35A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =54.0A/ 230VAC I =29.6A/ 115VAC T50= 1940us																																	



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~140%	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P:TESTING Ta:25°C	120.8%/ 264VAC 120.8%/ 230VAC 120.8%/100VAC PROTECTION TYPE : Constant current limiting, unit will shut down after 3 sec. re-power on to recover
2	OVER VOLTAGE PROTECTION	55.2V~64.8V	I/P: 264VAC I/P: 230VAC I/P: 90VAC O/P:MIN LOAD Ta:25°C	59.8V/ 264VAC 59.8V/ 230VAC 60.2V/ 90VAC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 264VAC I/P: 90VAC O/P:FULL LOAD	O.T.P. Active OK Protection type : Shut down o/p voltage, re-power on to recover

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	FAN ON/OFF CONTROL (Typ)	RTH3 ≥50°C FAN ON RTH3 ≤40°C FAN OFF	I/P:230 VAC O/P:FULL LOAD	RTH3 >50°C FAN ON RTH3 <40°C FAN OFF

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q2 Rated: 22A/ 600V	AC ON/OFF I/P:High-Line +3V =267V 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 = 97V 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	VDS: (1) 463V (2) 463V (3) 455V (4) 455V (5) 459V (6) 463V (7) 463V VDS: (1) 303V (2) 304V (3) 303V (4) 302V (5) 302V (6) 302V (7) 326V
2	Diode Peak Voltage	Q101 Rated 30A/ 150V Q104 Rated 30A/ 150V	AC ON/OFF I/P:High-Line +3V =267 V 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 Ta:25°C	Q101: VDS: (1) 134.2V (2) 32.6V (3) 134.3V (4) 134.3V (5) 134.3V (6) 133.5V (7) 139.1V (8) 123.9V Q104: VDS: (1) 129.5V (2) 6.8V (3) 129.3V (4) 129.3V (5) 129.3V (6) 129.3V (7) 128.7V (8) 125.2V

3	Input Voltage	Capacitor C5 Rated: 1000 μ /200V	I/P:High-Line +3V =267V 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°C	(1)191V (2)191V (3)193V (4)191V
4	Control IC Voltage Test	PWM IC U1 Rated HR1001C : 8.9V~ 15.5V	AC ON/OFF I/P:High-Line +3V =267 V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(Low LINE) (6)NO LOAD(AC continue) Ta:25°C	(1) 15.2V (2) 15.1V (3) 15.1V (4) 15.1V (5) 15.1V (6) 14.1 V
5	VCC Diode Peak Voltage	D30 Rated : 400V 2 A D33 Rated : 400V 2 A D34 Rated : 400V 2 A D200 Rated : 400V 2 A	AC ON/OFF I/P : High-Line +3V = 267 V O/P : (1) Full load (2) Full load continue (3) Dynamic Load 90%Duty/1KHz Ta : 25°C	D30 (1)80.5 V (2)62.8V (3) 82.9V D33 (1) 91.2V (2)45.4V (3)94.4V D34 (1)59.9 V (2) 47V (3)63.9V D200 (1)55.3V (2)44.4V (3)56.7V

■ SAFETY& E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG :2KVAC/min O/P-FG:0.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:0.6 KVAC/min Ta:25°C	I/P-O/P: 2.52mA I/P-FG:2.29 mA O/P-FG: 2.38m A NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100M Ω I/P-FG: 500VDC>100M Ω O/P-FG:500VDC>100M Ω	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P: >9999M Ω I/P-FG: >9999M Ω O/P-FG: >9999M Ω NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 m Ω	40A / 2min Ta:25°C	13 m Ω

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONDUCTION	EN55032 CLASS A	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
2	RADIATION	EN55032 CLASS A	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	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
4	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	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
6	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																								
1	TEMPERATURE RISE TEST	MODEL : LRS-600-48 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=26.2 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=45.8 °C																																																																										
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17	RTH3	43.6°C	62.4°C																																																																									
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 119.2 % 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=-25 °C	TEST : OK																																																																								
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45 °C/95 %R.H NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta=45 °C HUMIDITY= 95 %R.H	TEST : OK																																																																								
5	TEMPERATURE COEFFICIENT	± 0.03 %/°C(0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.0148 %/°C(0~50°C)																																																																								

6	STORAGE TEMPERATURE TEST	-40~85°C	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 : 10 CYCLE 5. Input/Output condition : STATIC
7	THERMAL SHOCK TEST	-20~45°C	1. Thermal shock Temperature : -25°C~ +50°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:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test
8	VIBRATION TEST	10 ~ 500Hz, 5G 10min./1cycle, 60min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 6G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C
9	CAPACITOR LIFE CYCLE	SUPPOSE C106 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=45 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta=45 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta=45 °C LIFE TIME	(1) 2356861HRS (2) 601596HRS (3) 722640HRS (4) 813682HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1533.4K hrs min. Telcordia SR-332 (Bellcore) ; 301.7K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	WUWQ/HUANGMK	WENF	LINKX

2020.10.1 TAG-QA-009