Test Report: LRS-350-24

350W Single Output Switching Power Supply

■ DESIGN VERIFY TEST

Output Function Test
Input Function Test
Protection Function Test
Component Stress Test

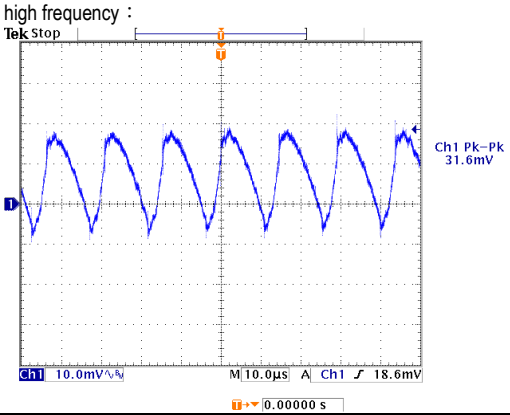
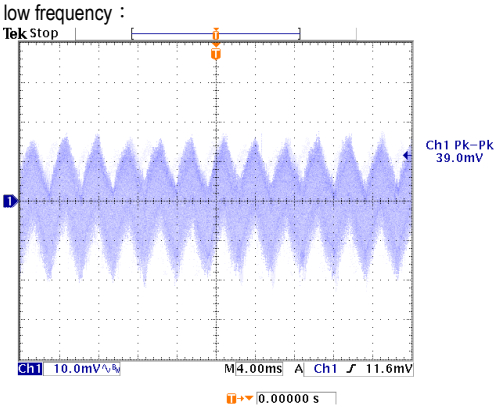
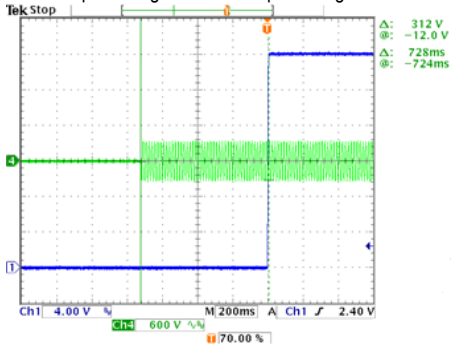
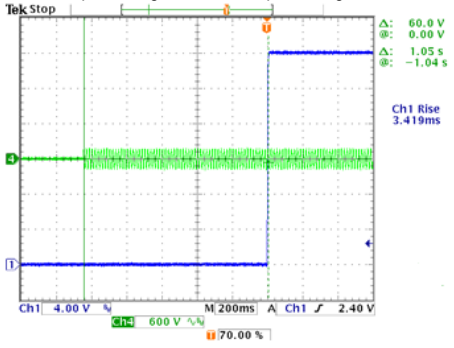
■ SAFETY TEST

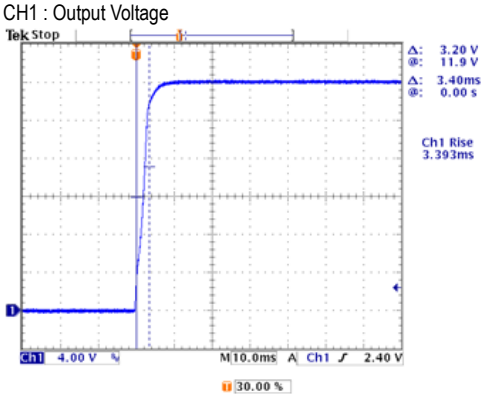
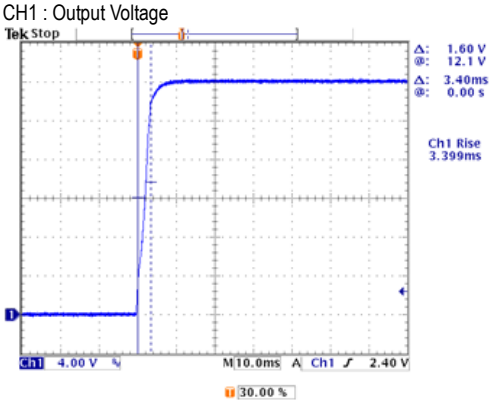
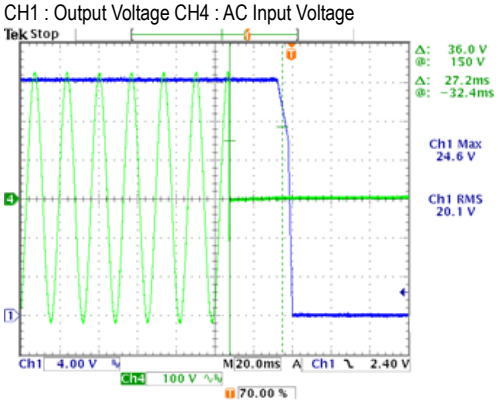
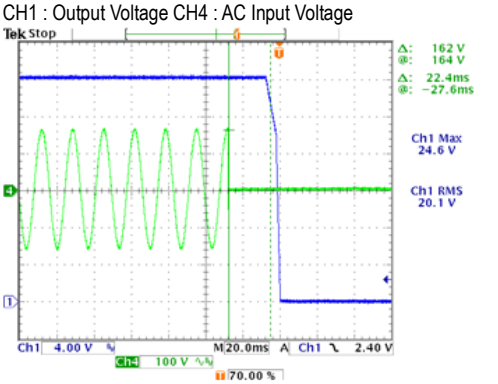
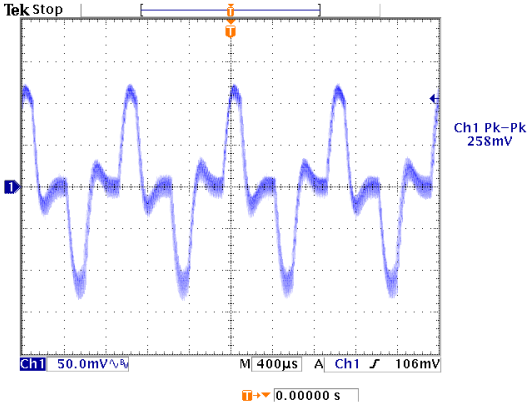
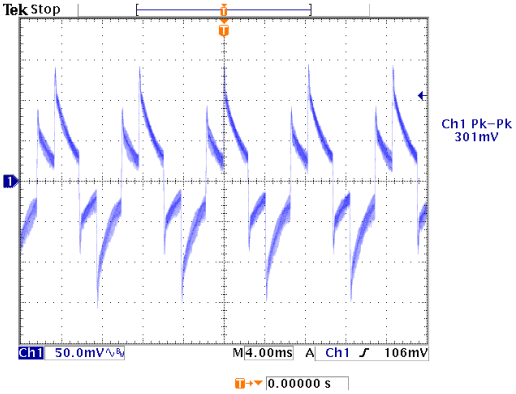
■ RELIABILITY TEST

ENVIRONMENT TEST

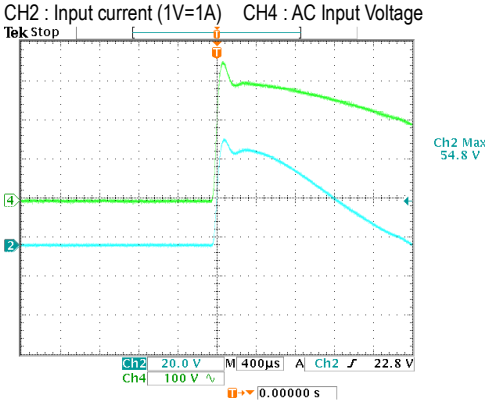
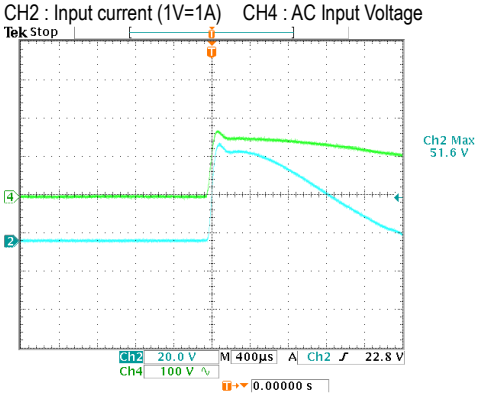
■ DESIGN VERIFY TEST

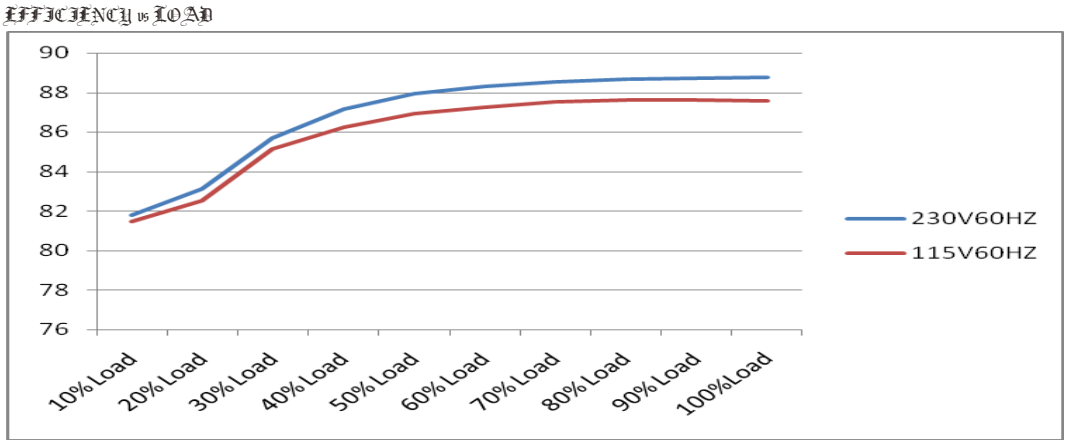
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 21.6V~ 28.8V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	21.26V~30.02V/230VAC 21.23V~30.02V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1 %~ 1%	I/P: 100VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1:- 0.0625 %~ 0.0625%
3	LINE REGULATION (Max)	V1: -0.5 %~ 0.5 %	I/P: 100VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1: -0.0625 %~-0.0625%
4	LOAD REGULATION(Max)	V1: 0.5 %~ -0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1:- 0.%~ 0%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	<5%
6	RIPPLE & NOISE(Max)	V1: 150mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 39.0mVp-p
	high frequency： 		low frequency： 	
7	SET UP TIME(Max)	230VAC/1500ms 115VAC/ 1500ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 728ms 115VAC/ 1050ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH4 : AC Input Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH4 : AC Input Voltage 	

8	RISE TIME (Max)	230VAC/ 50ms 115VAC/ 50ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 3.40ms 115VAC/3.40ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage 	
9	HOLD UP TIME(Typ)	230VAC/ 16ms 115VAC/ 12ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/27.2ms 115VAC/ 22.4ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH4 : AC Input Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH4 : AC Input Voltage 	
10	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℃	 258mVp-p 301mVp-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 240 ~ 370VDC (switch on 230VAC)	I/P:TESTING O/P:FULL LOAD Ta:25℃	78V~132V 138V~264V 230VDC ~ 370VDC(switch on 230VAC)
			I/P: (1)LOW-LINE-3V=87 V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD ON: 30 Sec OFF: 30 Sec 10MIN (2)230Vac ON: 0.5 Sec OFF: 0.5 Sec 20MIN (3)230Vac ON:3Sec OFF:3Sec 12HOURS (POWER ON/OFF NO DAMAGE)	TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 180 VAC ~264 VAC 90 VAC ~132 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	INPUT CURRENT (Typ)	230V/ 3.4.A 115V/ 6.8A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =2.659A/ 230VAC I =5.018A/ 115VAC
4	LEAKAGE CURRENT	< 2 mA / 240 VAC	I/P： 240 VAC O/P：Min LOAD Ta：25℃	L-FG：0.495mA N-FG：0.495mA
5	NO LOAD CONSUMPTION	< 0.75 W	I/P：115VAC I/P：230VAC O/P：NO LOAD Ta：25℃	< 0.53W < 0.59 W
6	INRUSH CURRENT(Typ)	230V/ 60A 115V/ 60A COLD START	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =54.8A/ 230VAC I =51.6A/ 115VAC
	INPUT=230VAC/50HZ @ FULL LOAD CH2 : Input current (1V=1A) CH4 : AC Input Voltage 		INPUT=115VAC/50HZ @ FULL LOAD CH2 : Input current (1V=1A) CH4 : AC Input Voltage 	
7	EFFICIENCY(Typ)	88%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	88.8%



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	110 %~ 140 % rated output power Hiccup mode, recovers automatically after fault condition is removed.	I/P: 230VAC I/P: 115VAC O/P:TESTING Ta:25℃	125.89%/ 230VAC 125.61%/115VAC Protection type : 110 %~ 140 % rated output power Hiccup mode, recovers automatically after fault condition is removed.
2	OVER VOLTAGE PROTECTION	CH: 28.8V~33.6 V Hiccup mode, recovers automatically after fault condition is removed.	I/P: 230VAC I/P: 115VAC O/P:MIN LOAD Ta:25℃	32.1V/ 230VAC 32.1V/115VAC Protection type : Hiccup mode, recovers automatically after fault condition is removed.
3	OVER TEMPERATURE PROTECTION	NO DAMAGE Hiccup mode, recovers automatically after fault condition is removed.	I/P: 230 VAC O/P:FULL LOAD	O.T.P. Active Protection type : Hiccup mode, recovers automatically after fault condition is removed.
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE Hiccup mode, recovers automatically after fault condition is removed

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q 1 Rated 13 A/600V	I/P:High-Line +3V =267V O/P： (1)Full Load Turn on (2)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (3)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25℃	(1)590V (2)588V (3)594V
2	Diode Peak **Voltage**	Q101 Rated 20 A/150V Q103 Rated 20A/200V	I/P:High-Line +3V =267 V O/P: (1)Full Load input on/off (2)Output Short Ta:25℃	Q101: Q103: (1)139V (1)181V (2)113V (2)173V
3	**Input Capacitor Voltage**	C5 Rated: 560 μ / 200V	I/P:High-Line +3V =267 V O/P: (1)Full Load input on/off (2) Min load input on /Off	(1)191V (2)188V (3)190V

			(3)Full Load /Min load Change Ta:25℃	
4	**Control IC Voltage Test**	PWM IC U1 Rated 28 V (MAX.) 10V (MIN.)	I/P:High-Line +3V =267 V O/P: (1)Full Load input on/off (2) Output short (3)No load VR（min） Ta:25℃	U1 (1) 20.7V (2) 19.5V (3) 19.5V

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℃	I I/P-O/P: 2.42mA I/P-FG: 3.32mA O/P-FG:2.71 m A 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: 9999MΩ I/P-FG: 9999MΩ O/P-FG: 9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	24 mΩ

RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL： LRS-350-24 1. ROOM AMBIENT BURN-IN：2 HRS I/P： 230VAC O/P： FULL LOAD Ta=31.6℃ 2. HIGH AMBIENT BURN-IN： 2 HRS I/P： 230VAC O/P： FULL LOAD Ta=48.2℃		

NO	Position	ROOM AMBIENT Ta= 31.6 ℃	HIGH AMBIENT Ta=48.2 ℃
1	LF1	46.0℃	63.6℃
2	BD1	48.0℃	63.7℃
3	ZNR5	40.0℃	58.2℃
4	C5	42.9℃	59.4℃
5	C6	40.1℃	56.9℃
6	C36	36.4℃	53.4℃
7	C37	34.4℃	52.5℃
8	T2	39.5℃	57.6℃
9	Q1	60.5℃	77.5℃
10	D10	43.2℃	60.7℃
11	Q2	53.9℃	69.5℃
12	D11	37.8℃	55.5℃
13	Q102	58.9℃	73.5℃
14	Q103	67.6℃	87.8℃
15	T1coil	72.3℃	92.4℃
16	T1core	56.1℃	72.8℃

			NO / Position / ROOM AMBIENT Ta= 31.6 ℃ / HIGH AMBIENT Ta=48.2 ℃		
			17 C200 48.2℃ 63.8℃		
			18 L101 53.6℃ 70.4℃		
			19 C201 54.2℃ 70.2℃		
			20 RTH3 64.6℃ 80.3℃		
			21 L100 64.7℃ 82.1℃		
			22 C105 45.6℃ 64.4℃		
			23 C221 48.0℃ 63.8℃		
			24 U1 37.9℃ 56.1℃		
			25 D30 39.4℃ 58.8℃		
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P： 230 VAC O/P： 125％LOAD Ta： 25℃	TEST： OK	
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P： 264VAC/100VAC O/P： 100 ％LOAD Ta= -25 ℃	TEST： OK	
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 ℃ NO DAMAGE	I/P： 272 VAC O/P： FULL LOAD Ta= 50 ℃ HUMIDITY= 95 %R.H	TEST： OK	
5	TEMPERATURE COEFFICIENT	± 0.03 %/℃ (0~50℃)	I/P： 230 VAC O/P： FULL LOAD	±0%/℃ (0~50℃)	
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature： -45℃~ +90℃ 2. Temperature change rate ： 25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle： 5 CYCLE 5. Input/Output condition： STATIC		OK	
7	THERMAL SHOCK TEST	1. Thermal shock Temperature： -25℃~ 70℃ 2. Temperature change rate ： 25℃ / 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	
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℃		TEST： OK	
9	CAPACITOR LIFE CYCLE	SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P： 230VAC O/P： FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P： 230VAC O/P： FULL LOAD Ta= 50 ℃ LIFE TIME (3) I/P： 230VAC O/P： 75% LOAD Ta= 50 ℃ LIFE TIME (4) I/P： 230VAC O/P： 50% LOAD Ta= 50 ℃ LIFE TIME		(1) 1183522HRS (2) 183366HRS (3) 179584HRS (4) 1276086HRS	
10	MTBF	2099.9K hrs min. Telcordia SR-332 (Bellcore) ; 328.6Khrs min. MIL-HDBK-217F (25℃)			
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 50℃			

TEST RESULT	TESTER	APPROVAL
PASS	FRANK	WANGDEZHAO