



# Test Report: LRS-150-36

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150W Single Output Switching Power Supply

## DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Component Stress Test

## SAFETY & E.M.C. TEST

Safety Test

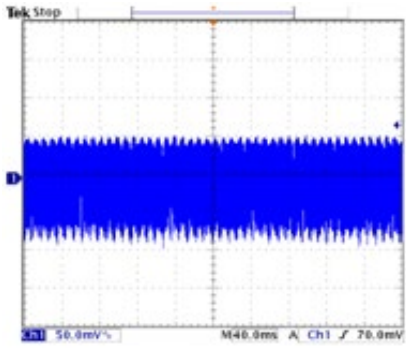
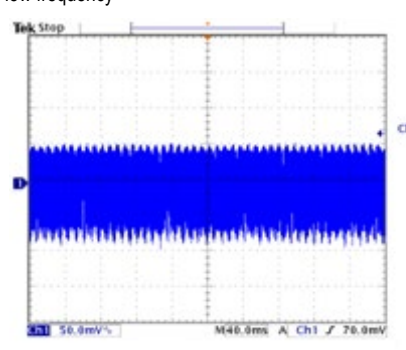
E.M.C. Test

## RELIABILITY TEST

ENVIRONMENT TEST

**DESIGN VERIFY TEST**

**OUTPUT FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 32.4 V~ 39.6 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	31.22V~40.85V/230VAC 31.22V~40.85V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1 %~ -1 %	I/P: 100~132VAC/200~264VAC by switch O/P:FULL/ MIN. LOAD Ta:25°C	V1:-0.02 %~0%
3	LINE REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 100~132VAC/200~264VAC by switch O/P:FULL LOAD Ta:25°C	V1:-0.02 %~0%
4	LOAD REGULATION(Max)	V1: 0.5 %~ -0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0 %~ 0 %
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	<0.44%
6	RIPPLE & NOISE(Max)	V1: 200 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 149 mVp-p
		high frequency :	low frequency :	
				
7	SET UP TIME(Max)	230VAC/500ms 115VAC/500ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 220ms 115VAC/ 224ms
		INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	



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8	<b>RISE TIME (Max)</b>  230VAC/30ms 115VAC/30ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 6.8ms 115VAC/ 6.8ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 	INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage 	
9	<b>HOLD UP TIME (Typ.)</b>  230VAC/40ms 115VAC/35ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 41.6ms 115VAC/ 38ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 	INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 	
10	<b>DYNAMIC LOAD</b>  V1: 3600 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	518mVp-p 452mVp-p

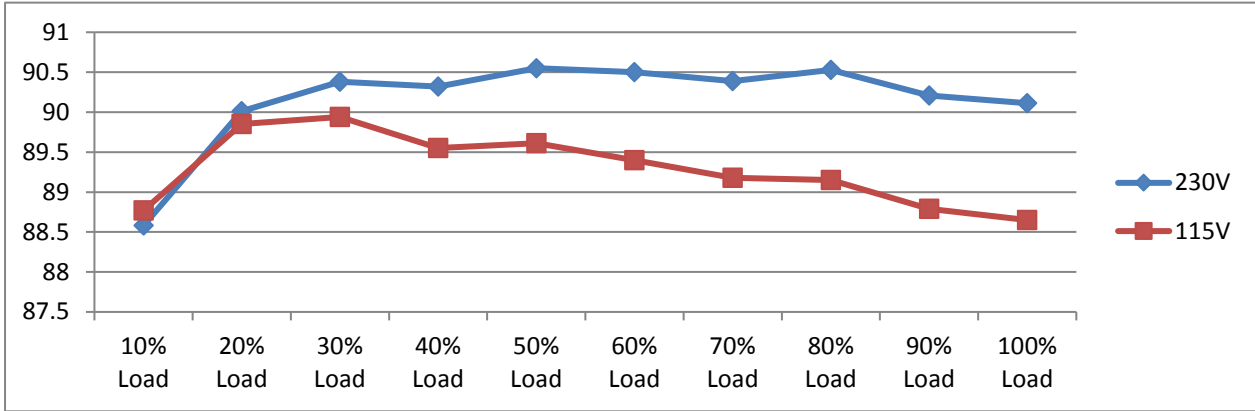
11	TRANSIENT RECOVERY TIME	V1: 3600 mVp-p <500us	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	344mVp-p 120 us

**INPUT FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85~132VAC/170~264VAC by switch  240 ~ 370VDC (switch on 230VAC)	I/P:TESTING O/P:FULL LOAD Ta:25°C  I/P: (1)LOW-LINE-3V=82V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) 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)	78V~132V 130V~264V 230 ~ 370VDC (switch on 230VAC)  TEST: OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:170 VAC ~264 VAC O/P:FULL ~MIN LOAD Ta:25°C	TEST:OK:
3	INPUT CURRENT (Typ.)	230V/ 1.7A 115V/ 3.0 A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =1.19A/ 230VAC I =2.38A/ 115VAC
4	LEAKAGE CURRENT	< 0.75mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.377mA N-FG : 0.377mA
5	NO LOAD CONSUMPTION	< 0.5 W	I/P : 115VAC I/P : 230VAC O/P : NO LOAD Ta : 25°C	< 0.1593W < 0.2519W

6	EFFICIENCY(Typ.)	89 %	I/P:230 VAC O/P:FULL LOAD Ta:25°C	90.12%
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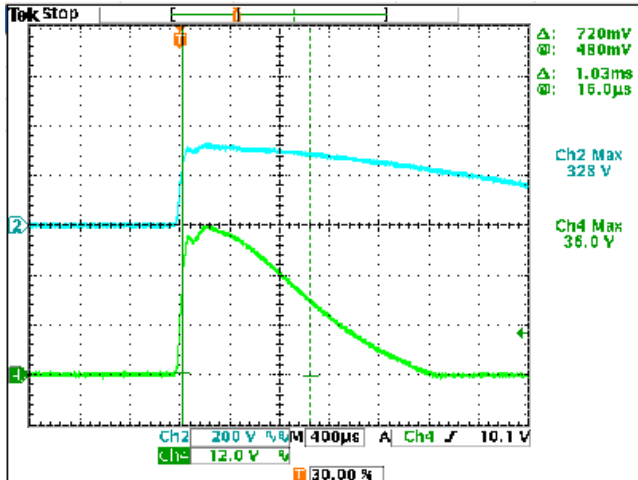
EFFICIENCY vs LOAD



7	INRUSH CURRENT(Typ.)	230V/60A COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I =36A/ 230VAC T50=1030 us/230V
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INPUT=230VAC/50HZ @ FULL LOAD

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



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	110%~ 140 %	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P:TESTING Ta:25°C	121.39%/ 264VAC 120%/ 230VAC 121.86%/100VAC  PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed

2	OVER VOLTAGE PROTECTION	41.4 V~ 48.6 V	I/P: 264VAC I/P: 230VAC I/P: 85VAC O/P:MIN LOAD Ta:25°C	46.32V/ 264VAC 46.43V/ 230VAC 46.2V/ 85VAC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 264VAC I/P: 85VAC O/P:FULL LOAD	O.T.P. Active PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 85VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : 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 VGS ± 25 V	I/P:High-Line +3V =267V AC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (4) 0%→400% Load. I/P:Low-Line -3V = 97V O/P: (1)Full Load (2)Output Short (3) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (4) 0%→400% Load. Ta:25°C	VDS: (1) 546V (2) 470V (3) 574V (4) 568V  VDS: (1) 446V (2) 322V (3) 472V (4) 474V
4	Diode Peak Voltage	Q101 Rated : 20A/300V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (4) 0%→400% Load. (5).NO LOAD Ta:25°C	Q101: VDS: (1) 227V (2) 275V (3) 298V (4) 298V (5) 201V
5	Input Capacitor Voltage	C5 Rated: : 330 μ /200 V 105 °C Suger Voltage=230V	I/P:High-Line +3V =267 V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change Ta:25°C	(1) 175V (2) 175V (3) 175V
6	Control IC Voltage Test	PWM IC U1 Rated : 28 V(MAX.) 10.5 V(MIN.)	I/P:High-Line +3V =267 V AC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VR 下限.LOW	(1) 20.5V (2) 12.2V (3) 12.2V (4) 23.1V (5) 16.7V



			LINE Ta:25°C	
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**SAFETY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 4KVAC/min I/P-FG :2KVAC/min O/P-FG:1.25KVAC/min	I/P-O/P: 4.4 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.5 KVAC/min Ta:25°C	I/P-O/P: 3.468mA I/P-FG: 4.22mA O/P-FG: 3.21mA 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°C	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°C	28mΩ

**E.M.C TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P: 80% LOAD Ta:25°C	PASS
2	CONDUCTION	EN55022 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab



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3	RADIATION	EN55022 CLASS B	I/P : 230 VAC (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 : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
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
7	Test by certified Lab & Test Report Prepare			

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																												
1	TEMPERATURE RISE TEST	MODEL : LRS-150-24  1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=25.5°C  2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=45.3°C																																														
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 25.5 °C</th> <th>HIGH AMBIENT Ta=45.3 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>D5</td><td>87.8°C</td><td>100.6°C</td></tr> <tr><td>2</td><td>C35</td><td>63.3°C</td><td>79.4°C</td></tr> <tr><td>3</td><td>Q1</td><td>80.9°C</td><td>99.3°C</td></tr> <tr><td>4</td><td>BD1</td><td>72.3°C</td><td>88.2°C</td></tr> <tr><td>5</td><td>Q100</td><td>86.3°C</td><td>105.3°C</td></tr> <tr><td>6</td><td>C106</td><td>68.5°C</td><td>85.9°C</td></tr> <tr><td>7</td><td>LF1</td><td>60.3°C</td><td>77.0°C</td></tr> <tr><td>8</td><td>RTH10</td><td>60.5°C</td><td>76.5°C</td></tr> <tr><td>9</td><td>R14</td><td>79.2°C</td><td>95.1°C</td></tr> <tr><td>10</td><td>T1</td><td>82.2°C</td><td>97.8°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 25.5 °C	HIGH AMBIENT Ta=45.3 °C	1	D5	87.8°C	100.6°C	2	C35	63.3°C	79.4°C	3	Q1	80.9°C	99.3°C	4	BD1	72.3°C	88.2°C	5	Q100	86.3°C	105.3°C	6	C106	68.5°C	85.9°C	7	LF1	60.3°C	77.0°C	8	RTH10	60.5°C	76.5°C	9	R14	79.2°C	95.1°C	10	T1	82.2°C	97.8°C
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10	T1	82.2°C	97.8°C																																													
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 120% LOAD Ta : 25°C	TEST : OK																																												





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**LRS-150**series

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 50 °C NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	±0.03 %/°C (0~50°C)	I/P : 230 VAC O/P : FULL LOAD	±0.006%/°C (0~50°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		OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -30°C~ 70°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
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
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=50 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 50 °C LIFE TIME		(1) 146770HRS (2) 30596HRS (3) 54079HRS (4) 92239HRS
10	MTBF	2707.7K hrs min. Telcordia SR-332 (Bellcore) ; 558.2Khrs min. MIL-HDBK-217F (25°C)		
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 50°C		

TEST RESULT	TESTER	APPROVAL
PASS	FRANK	WANGDZ