

# Test Report

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240W Single Output Switching Power Supply

## ■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Other Test

Component Stress Test

## ■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

## ■ RELIABILITY TEST

# 240W Single Output Switching Power Supply

## DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	RIPPLE & NOISE	V1: 250 mVp-p (Max)	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	V1: 77 mVp-p (Max)	P
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 39 V~ 45 V	I/P: 230 VAC I/P:115VAC O/P:MIN LOAD Ta:25°C	38.17V~46.06 V /230VAC 38.17V~46.06 V/115VAC	P
3	CURRENT ADJ RANGE	2.86 A~ 5.72A	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	0.639A~5.94A	P
4	CONSTANT CURRENT REGION	21 V~ 42V	I/P: 230 VAC O/P:CV MODE Ta:25°C	O/P=21V: 5.79 A O/P=41V: 5.89 A	P
5	OUTPUT VOLTAGE TOLERANCE	V1: -1% ~ 1% (Max)	I/P: 100 VAC /305VAC O/P:FULL/ 0% LOAD Ta:25°C	V1: 0.09 %~-0.09 %	P
6	LINE REGULATION	V1: -0.5% ~ 0.5% (Max)	I/P:100 VAC ~305 VAC O/P:FULL LOAD Ta:25°C	V1: 0.09 %~-0.09 %	P
7	LOAD REGULATION	V1: -0.5% ~ 0.5% (Max)	I/P: 230 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.09 %~-0.09 %	P
8	SET UP TIME	230VAC/ 2500 ms (Max) 115VAC/ 2500 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230VAC/ 1813 ms 115 VAC/ 1932 ms	P
9	RISE TIME	230VAC/ 80 ms (Max) 115VAC/ 80 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230VAC/ 34 ms 115 VAC/ 35 ms	P
10	HOLD UP TIME	230VAC/ 12 ms (Typ) 115VAC/ 12 ms (Typ)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230VAC/ 26 ms 115 VAC/ 25 ms	P
11	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	TEST:< 5 %	P
12	DYNAMIC LOAD	V1: 4200 mVp-p	I/P: 230 VAC O/P:(1)FULL /Min LOAD 90%DUTY/1KHZ Ta:25°C	224mVp-p	P

## 240W Single Output Switching Power Supply

13	DIMMER TEST (B Type only)	<p>SPEC:</p> <p><b>*Reference resistance value for output current adjustment (Typical)</b></p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>Resistance value</td> <td>10K</td><td>20K</td><td>30K</td><td>40K</td><td>50K</td><td>60K</td><td>70K</td><td>80K</td><td>90K</td><td>100K</td> </tr> <tr> <td>Output current</td> <td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td> </tr> </table> <p><b>*1 ~ 10V dimming function for output current adjustment (Typical)</b></p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>Dimming value</td> <td>1V</td><td>2V</td><td>3V</td><td>4V</td><td>5V</td><td>6V</td><td>7V</td><td>8V</td><td>9V</td><td>10V</td> </tr> <tr> <td>Output current</td> <td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td> </tr> </table> <p><b>*10V PWM signal for output current adjustment (Typical)</b></p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>Duty value</td> <td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td> </tr> <tr> <td>Output current</td> <td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td> </tr> </table> <p>TEST RESULT: I/P : 230 VAC ; Ta : 25°C</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td rowspan="3" style="width: 5%; text-align: center;">1</td> <td style="width: 10%;">Resistance value</td> <td>10K</td><td>20K</td><td>30K</td><td>40K</td><td>50K</td><td>60K</td><td>70K</td><td>80K</td><td>90K</td><td>100K</td> </tr> <tr> <td>Output current</td> <td>0.299A</td><td>0.893A</td><td>1.505A</td><td>2.212A</td><td>2.740A</td><td>3.350A</td><td>3.923A</td><td>4.501A</td><td>5.124A</td><td>5.436A</td> </tr> <tr> <td>%</td> <td>5.23%</td><td>15.61%</td><td>26.31%</td><td>38.67%</td><td>47.90%</td><td>58.57%</td><td>68.58%</td><td>78.69%</td><td>89.58%</td><td>95.03%</td> </tr> <tr> <td rowspan="3" style="text-align: center;">2</td> <td>Dimming value</td> <td>1V</td><td>2V</td><td>3V</td><td>4V</td><td>5V</td><td>6V</td><td>7V</td><td>8V</td><td>9V</td><td>10V</td> </tr> <tr> <td>Output current</td> <td>0.306A</td><td>0.915A</td><td>1.511A</td><td>2.097A</td><td>2.701A</td><td>3.310A</td><td>3.911A</td><td>4.530A</td><td>5.123A</td><td>5.724A</td> </tr> <tr> <td>%</td> <td>5.35%</td><td>16.00%</td><td>26.42%</td><td>36.66%</td><td>47.22%</td><td>57.87%</td><td>68.37%</td><td>79.20%</td><td>89.56%</td><td>100.07%</td> </tr> <tr> <td rowspan="3" style="text-align: center;">3</td> <td>Duty value</td> <td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td> </tr> <tr> <td>Output current</td> <td>0.361A</td><td>0.979A</td><td>1.583A</td><td>2.185A</td><td>2.780A</td><td>3.369A</td><td>3.954A</td><td>4.539A</td><td>5.127A</td><td>5.719A</td> </tr> <tr> <td>%</td> <td>6.31%</td><td>17.12%</td><td>27.67%</td><td>38.20%</td><td>48.60%</td><td>58.90%</td><td>69.13%</td><td>79.35%</td><td>89.63%</td><td>99.98%</td> </tr> </table>	Resistance value	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	1	Resistance value	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	Output current	0.299A	0.893A	1.505A	2.212A	2.740A	3.350A	3.923A	4.501A	5.124A	5.436A	%	5.23%	15.61%	26.31%	38.67%	47.90%	58.57%	68.58%	78.69%	89.58%	95.03%	2	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	Output current	0.306A	0.915A	1.511A	2.097A	2.701A	3.310A	3.911A	4.530A	5.123A	5.724A	%	5.35%	16.00%	26.42%	36.66%	47.22%	57.87%	68.37%	79.20%	89.56%	100.07%	3	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Output current	0.361A	0.979A	1.583A	2.185A	2.780A	3.369A	3.954A	4.539A	5.127A	5.719A	%	6.31%	17.12%	27.67%	38.20%	48.60%	58.90%	69.13%	79.35%	89.63%	99.98%	P
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# 240W Single Output Switching Power Supply

## INPUT FUNCTION TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	90VAC~305 VAC	I/P:TESTING O/P:FULL LOAD Ta:25°C	69V~305V	P
			I/P: (1)LOW-LINE=3V=87 V (2)HIGH-LINE=305 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 ~305VAC O/P:FULL~MIN LOAD Ta:25°C	OK	P
3	POWER FACTOR	0.95/ 230 VAC FULL LOAD (TYP) 0.98/ 115 VAC FULL LOAD (TYP) 0.9/ 230 VAC 65% LOAD (TYP) 0.9/ 115 VAC 65%LOAD (TYP)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD / 65% LOAD Ta:25°C	PF=0.956 /230V/100%LOAD PF=1 /115V/100%LOAD PF=0.989 /230V/65%LOAD PF=0.995 /115V/65%LOAD	P
4	EFFICIENCY	93% (TYP)	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	93.3 %	P
5	INPUT CURRENT	230 V/ 2 A (Typ) 115 V/ 4 A (Typ)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	I = 1.15 A/ 230VAC I = 2.26 A/ 115VAC	P
6	INRUSH CURRENT	230 V/ 75A (Typ) COLD START	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	I = 67 A/ 230VAC	P

## PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	95 %~108 %	I/P: 305 VAC I/P: 230 VAC I/P: 100 VAC O/P:TESTING Ta:25°C	101 %/305VAC 101 %/ 230VAC 101%/100VAC Constant Current Limiting	P
2	OVER VOLTAGE PROTECTION	V1: 46 V~ 50V	I/P: 305 VAC I/P: 230 VAC I/P: 90 VAC O/P:MIN LOAD Ta:25°C	47.52V/305VAC 47.41V/ 230VAC 47.52V/ 90VAC Shunt down Re- power ON	P
3	OVER TEMPERATURE PROTECTION	SPEC: TSW1: 95±5°C O.T.P. NO DAMAGE	I/P: 230 VAC O/P:FULL LOAD	O.T.P. Active Shut down o/p volotage , recovers automatically after temperature goes down	P
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 305VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE Hiccup Mode	P

## 240W Single Output Switching Power Supply

### COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q4 Rated STF21NM60N 17A/600V	I/P : High-Line +3V = 308 V O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	(1) 470 V (2) 468 V (3) 458 V	P
2	Diode Peak Voltage	Q101 Rated IRF3415 43A/150V	I/P : High-Line +3V = 308 V O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	(1) 141 V (2) 48 V (3) 105 V	P
		Q102 Rated IRF3415 43A/150V	I/P : High-Line +3V = 308 V O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	(1) 150 V (2) 58 V (3) 101 V	
3	Input Capacitor Voltage	C5 Rated: NCC: 150μ/450 V/105°C/PAG Series	I/P : High-Line +3V = 308 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) 429.2 V (2) 432.2 V (3) 431.9 V	P
4	Control IC Voltage Test	U 70 Rated L6599AD : 8.85V~16 V	I/P : High-Line +3V = 308 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) 12.94 V (2) 11.20 V (3) 11.20 V	P
5	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated SPW20N60C3 20.7A/600V	I/P : High-Line +3V = 308 V O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	(1) 510 V (2) 462 V (3) 500 V	P

# 240W Single Output Switching Power Supply

## SAFETY & EMC TEST

### SAFETY TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	IEC60950-1 I/P-O/P: 3.75KVAC/min<10mA I/P-FG:1.88 KVAC/min<10mA O/P-FG:1.5KVAC/min<10mA	I/P-O/P: 4 KVAC/min I/P-FG: 2.256KVAC/min O/P-FG: 1.8 KVAC/min Ta:25°C	I/P-O/P: 5 mA I/P-FG: 4.06 mA O/P-FG: 5.13 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	I/P-O/P: 14 GΩ I/P-FG: 13.8 GΩ O/P-FG: 30 GΩ NO DAMAGE	P
3	GROUNDING CONTINUITY	IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	13 mΩ	P
4	LEAKAGE CURRENT	IEC60950-1 < 0.75 mA / 277VAC	I/P: 280 VAC O/P:Min LOAD Ta:25°C	L-FG: 0.35 mA N-FG: 0.34 mA	P
5	APPROVAL	TUV: Certificate NO : R50171244 UL: File NO : E127738			P

### E.M.C TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS A CLASS C CLASS D	I/P: 240VAC/50HZ LOAD:LED/ELECTRONIC LOAD O/P:100%/50% LOAD Ta:25°C	PASS	P
2	CONDUCTION	EN55022 EN55015 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL/50% LOAD Ta:25°C	PASS Test by certified Lab	P
3	RADIATION	EN55022 EN55015 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

# 240W Single Output Switching Power Supply

## Reliability Test

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT	
1	TEMPERATURE RISE TEST	MODEL : HLG-240H-24 1. ROOM AMBIENT BURN-IN : 1.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 26.5 °C 2. HIGH AMBIENT BURN-IN : 12 HRS I/P : 230VAC O/P : FULL LOAD Ta= 61.7 °C			P	
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : O/P SHORT TEST Ta : 25°C	TEST : OK	P	
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 230 VAC/100VAC O/P : CV=23V Ta= -35 °C	TEST : OK	P	
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60 °C NO DAMAGE	I/P : 305 VAC O/P : CV=23V Ta= 61.7 °C HUMIDITY= 95 %R.H	TEST : OK	P	
5	TEMPERATURE COEFFICIENT	± 0.03 %(0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.003 %(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	
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -35°C ~ +65°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		OK	P	

## 240W Single Output Switching Power Supply

8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 5G (5) Test Time : 72min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK	P
9	CAPACITOR LIFE CYCLE	HLG-240H-24:SUPPOSE C102 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= 60 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 60 °C LIFE TIME	(1) 196640 HRS (2) 27898.3 HRS (3) 54198.9 HRS	P
10	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE : 207.9K HRS		P
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Tcase 70 °C		P