Test Report：PWM-60-48

60W PWM Output LED 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	VERDICT
1	PWM FREQUENCY	V1: 1.47 KHz(Typ)	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	V1: 1.47 KHz	PASS
2	SET UP TIME	230VAC : 500 ms (Max) 115VAC : 500 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:95% LOAD Ta:25℃	230VAC/ 290 ms 115VAC/ 317 ms	PASS
3	RISE TIME	230VAC : 80 ms (Max) 115VAC : 80 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:95% LOAD Ta:25℃	230VAC/ 0.33 ms 115VAC/ 0.33 ms	PASS
4	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℃	230VAC/ 20 ms 115VAC/ 19 ms	PASS
5	OVER/UNDERSHOOT TEST	＜ ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	TEST: ＜5 %	PASS

7 DIMMER TEST

SPEC:

*The duty of the PWM style output can be adjusted through output cable by connecting a 0~10Vdc or 10V PWM signal or resistance between DIM+ and DIM－.

* Reference resistance value for output current adjustment (Typical)

Resistance value	0K	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K
Output duty	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

*0 ~ 10V dimming function for output current adjustment (Typical)

Dimming value	0V	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V
Output duty	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

*10V PWM signal for output current adjustment (Typical)：Frequency range：100Hz~3KHz

Duty value	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Output duty	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

TEST RESULT: I/P： 230 VAC ;Ta：25℃

1	Resistance value	Short	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K
	Output Current	0A	0.138A	0.265A	0.403A	0.532A	0.662A	0.793A	0.925A	1.043A	1.168A	1.282A
	%	0%	11.04%	21.20%	32.24%	42.56%	52.96%	63.44%	74.00%	83.44%	93.44%	102.56%
2	Dimming value	0V	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V
	Output Current	0A	0.132A	0.264A	0.381A	0.516A	0.659A	0.795A	0.926A	1.064A	1.203A	1.312A
	%	0%	10.56%	21.12%	30.48%	41.28%	52.72%	63.60%	74.08%	85.12%	96.24%	104.96%
3	Duty value	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	Output Current	0A	0.149A	0.268A	0.400A	0.522A	0.658A	0.788A	0.919A	1.056A	1.188A	1.306A
	%	0%	11.92%	21.44%	32.00%	41.76%	52.64%	63.04%	73.52%	84.48%	95.04%	104.48%

PASS

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	90 VAC~305 VAC	I/P：TESTING O/P：FULL LOAD Ta：25℃	87 V~305 V	PASS
			I/P： (1)LOW-LINE-3V=87 V HIGH-LINE+10V=315 V O/P：FULL/NO 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： (1) OK (2) OK (3) OK	
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE OSC	I/P： 90 VAC ~ 305 VAC O/P：FULL ~NO LOAD Ta：25℃	TEST： OK	PASS
3	POWER FACTOR	115V/ 0.97 (TYP) 230V/ 0.95 (TYP) 277V/ 0.92 (TYP)	I/P： 115 VAC I/P： 230 VAC I/P： 277 VAC O/P：FULL LOAD Ta：25℃	PF= 0.995 / 115 VAC PF= 0.976 / 230 VAC PF= 0.953 / 277 VAC	PASS
4	EFFICIENCY	90% (TYP)	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	90.50%	PASS
5	INPUT CURRENT	115V/ 0.8 A (TYP) 230V/ 0.4 A (TYP) 277V/ 0.32 A (TYP)	I/P： 115 VAC I/P： 230 VAC I/P： 277 VAC O/P：FULL LOAD Ta：25℃	I = 0.585 A/ 115 VAC I = 0.294 A/ 230 VAC I = 0.250 A/ 277 VAC	PASS
6	INRUSH CURRENT	230V/ 50 A (TYP) Twidth =270 us measured at 50% Ipeak COLD START	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I = 46.6 A Twidth = 252 us	PASS
7	LEAKAGE CURRENT	< 0.25 mA / 277 VAC	I/P： 305 VAC O/P：NO LOAD Ta：25℃	L-CASE： 0.003 mA N-CASE： 0.003 mA	PASS
8	NO LOAD CONSUMPTION	< 0.5 W	I/P：230VAC O/P：NO LOAD Ta：25℃	0.40 W	PASS
9	TOTAL HARMONIC DISTORTION	Total harmonic distortion will be lower than 20% when output loading is 60% or higher at 230V/115VAC Total harmonic distortion will be lower than 20% when output loading is 75% or higher at 277VAC	I/P： 115 VAC I/P： 230 VAC O/P：60% LOAD I/P： 277 VAC O/P：75%LOAD Ta：25℃	THD： 6.05% /115VAC THD： 14.14% /230VAC THD： 16.33% /277VAC	PASS

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	108% ~ 120 %	I/P： 100 VAC I/P： 230 VAC I/P： 305 VAC O/P：TESTING Ta：25℃	111.3 %/ 100 VAC 111.3 %/ 230 VAC 111.3 %/ 305 VAC Hiccup Mode , recovers automatically after fault condition is removed	PASS
2	OVER VOLTAGE PROTECTION	CH1： 54 V ~ 60 V	I/P： 90 VAC I/P： 230 VAC I/P： 305 VAC O/P：NO LOAD Ta：25℃	57.42 V/ 90 VAC 57.39 V/ 230 VAC 57.40 V/ 305 VAC Shut down o/p voltage， re-power on to recover	PASS
3	OVER TEMPERATURE PROTECTION	SPEC： O.T.P. NO DAMAGE	I/P： 230 VAC O/P：FULL LOAD	O.T.P. Active Shut down o/p voltage， re-power on to recover	PASS
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P： 305 VAC O/P：FULL LOAD Ta：25℃	NO DAMAGE Shut down o/p voltage， re-power on to recover	PASS

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q2 Rated 800 V 9 A	I/P：High-Line +3V = 308 V O/P： (1) FULL LOAD Turn on (2) Output Short (3) FULL LOAD continue Ta：25℃	(1) 640 V (2) 620 V (3) 616 V	PASS
2	Diode Peak Voltage	D100 Rated 300 V 20 A Q105 100 V 62 A	I/P：High-Line +3V = 308 V O/P： (1) FULL LOAD Turn on (2) Output Short (3) FULL LOAD continue Ta：25℃	D100 (1) 225 V (2) 224 V (3) 219 V Q105 (1) 35.2 V (2) 83.2 V (3) 0 V	PASS
3	Input Capacitor Voltage	C5 Rated 47uF / 450 V	I/P：High-Line +3V = 308 V O/P： (1) FULL LOAD Turn on /Off (2) NO LOAD Turn on /Off (3) FULL LOAD / NO LOAD Change Ta：25℃	(1) 448 V (2) 444 V (3) 446 V	PASS
4	Control IC Voltage Test	U1 Rated 28V	I/P：High-Line +3V = 308 V O/P： (1) FULL LOAD Turn on /Off (2) NO LOAD Turn on /Off (3) FULL LOAD / NO LOAD Change Ta：25℃	(1) 17.5 V (2) 17.6 V (3) 17.5 V	PASS
5	PFC Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated 600 V 10 A	I/P：High-Line +3V = 308 V O/P： (1) FULL LOAD Turn on (2) Output Short (3) FULL LOAD continue Ta：25℃	(1) 478 V (2) 466 V (3) 464 V	PASS

SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P： 3.75 KVAC/min	I/P-O/P： 4.2 KVAC/min Ta：25℃	I/P-O/P： 2.659 mA NO DAMAGE	PASS
2	ISOLATION RESISTANCE	I/P-O/P：500VDC>100MΩ	I/P-O/P： 500 VDC Ta：25℃/70%RH	I/P-O/P： >9999 MΩ NO DAMAGE	PASS

E.M.C TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS C	I/P：115VAC/230VAC/50HZ O/P：60%/FULL LOAD I/P：277VAC/50HZ O/P：75%/FULL LOAD Ta:25℃	OK	PASS
2	CONDUCTION	EN55015 CLASS B	I/P：230 VAC/50HZ O/P:FULL LOAD Ta:25℃	OK Test by certified Lab	PASS
3	RADIATION	EN55015 CLASS B	I/P：230 VAC/50HZ O/P:FULL LOAD Ta:25℃	OK Test by certified Lab	PASS
4	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR:8KV / Contact:4KV	I/P：230 VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A	PASS
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT：1KV	I/P：230 VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A	PASS
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV	I/P：230 VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A	PASS
7	Test by certified Lab & Test Report Prepare				

■ RELIABILITY TEST

ENVIRONMENT TEST

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th><th>VERDICT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL： PWM-60-24
1. ROOM AMBIENT BURN-IN：2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=30.3 ℃
2. HIGH AMBIENT BURN-IN： 2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=51.2 ℃
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT
Ta= 30.3 ℃</th><th>HIGH AMBIENT
Ta= 51.2 ℃</th></tr>
<tr><td>1</td><td>C11</td><td>56.8℃</td><td>76.0℃</td></tr>
<tr><td>2</td><td>D6</td><td>58.3℃</td><td>77.6℃</td></tr>
<tr><td>3</td><td>Q1</td><td>60.2℃</td><td>79.7℃</td></tr>
<tr><td>4</td><td>Q2</td><td>62.6℃</td><td>82.1℃</td></tr>
<tr><td>5</td><td>C5</td><td>58.6℃</td><td>77.4℃</td></tr>
<tr><td>6</td><td>T1</td><td>64.9℃</td><td>83.7℃</td></tr>
<tr><td>7</td><td>C45</td><td>57.1℃</td><td>75.6℃</td></tr>
<tr><td>8</td><td>U1</td><td>56.3℃</td><td>75.7℃</td></tr>
<tr><td>9</td><td>C105</td><td>60.0℃</td><td>78.8℃</td></tr>
<tr><td>10</td><td>D100</td><td>62.4℃</td><td>81.4℃</td></tr>
<tr><td>11</td><td>Q105</td><td>58.2℃</td><td>77.1℃</td></tr>
<tr><td>12</td><td>U100</td><td>54.9℃</td><td>73.7℃</td></tr>
<tr><td>13</td><td>RTH2</td><td>56.3℃</td><td>74.9℃</td></tr>
<tr><td>14</td><td>TC</td><td>53.7℃</td><td>71.9℃</td></tr>
<tr><td>15</td><td>C11</td><td>56.8℃</td><td>76.0℃</td></tr>
</table></td><td>PASS</td></tr>
<tr><td>2</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER 2 HOUR</td><td>I/P：305VAC/100VAC
O/P：FULL LOAD
Ta= -45℃/-30℃</td><td>TEST：OK</td><td>PASS</td></tr>
<tr><td>3</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 50℃
NO DAMAGE</td><td>I/P：315 VAC
O/P：FULL LOAD
Ta= 50℃
HUMIDITY= 95% R.H</td><td>TEST：OK</td><td>PASS</td></tr>
<tr><td>4</td><td>TEMPERATURE COEFFICIENT</td><td>±0.03 %(0~50℃)</td><td>I/P： 230 VAC
O/P：FULL LOAD</td><td>±0.008 %(0~50℃)</td><td>PASS</td></tr>
<tr><td>5</td><td>STORAGE TEMPERATURE TEST</td><td colspan="2">1. Thermal shock Temperature： -45℃~ +85℃
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</td><td>OK</td><td>PASS</td></tr>
<tr><td>6</td><td>THERMAL SHOCK TEST</td><td colspan="2">1. Thermal shock Temperature： -45℃~ +55℃
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</td><td>OK</td><td>PASS</td></tr>
<tr><td>7</td><td>VIBRATION TEST</td><td colspan="2">1 Carton & 1 Set
(1) Waveform： Sine Wave
(2) Frequency：10~500Hz
(3) Sweep Time：12min/sweep cycle
(4) Acceleration：5G
(5) Test Time：90min in each axis (X.Y.Z)
(6) Ta：25℃</td><td>TEST：OK</td><td>PASS</td></tr>
</table>

8	CAPACITOR LIFE CYCLE	PWM-60-24：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) 271455 HRS (2) 55504 HRS (3) 72703 HRS (4) 136683 HRS	PASS
9	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE：271.03 KHRS		PASS
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) ： 50000 hours @ Tcase 70℃		PASS

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	ZHANGZJ/ Cary Chen	SKY	LIUWY

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