



Test Report : PWM-60-24

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

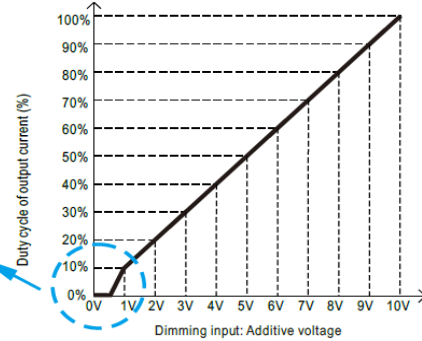
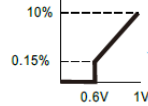
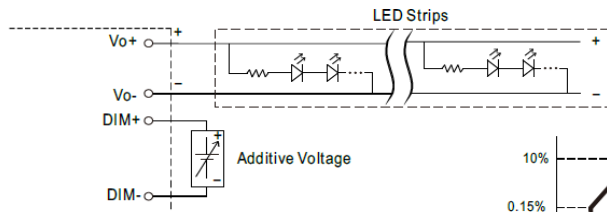
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	PWM FREQUENCY	1.47KHz	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	1.483KHz	PASS
2	OUTPUT VOLTAGE TOLERANCE	V1: -3.0%~ +3.0% (Max)	I/P: 90 VAC / 305VAC O/P:FULL/ NO LOAD Ta:25°C	V1: -0.49% ~ 0.79%	PASS
3	SET UP TIME	230VAC : 500 ms (Max) 115VAC : 500 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:95% LOAD Ta:25°C	230VAC/ 322 ms 115VAC/ 338 ms	PASS
4	RISE TIME	230VAC : 80 ms (Max) 115VAC : 80 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:95% LOAD Ta:25°C	230VAC/ 0.33 ms 115VAC/ 0.32 ms	PASS
5	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°C	230VAC/ 19 ms 115VAC/ 19 ms	PASS
6	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	TEST: <5 %	PASS

7 DIMMER TEST

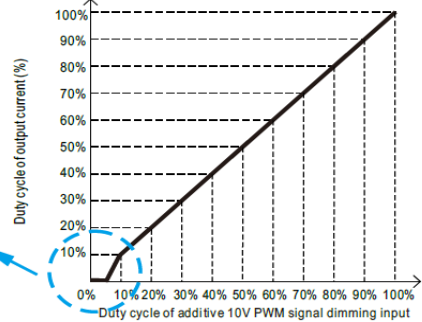
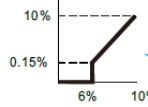
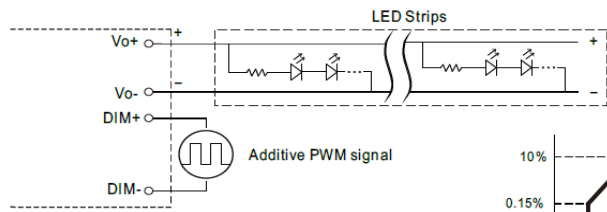
※ 3 in 1 dimming function (for Blank-Type)

- Apply one of the three methodologies between DIM+ and DIM-: 0 ~ 10VDC, or 10V PWM signal or resistance.
- Dimming source current from power supply: 100 μ A (typ.)

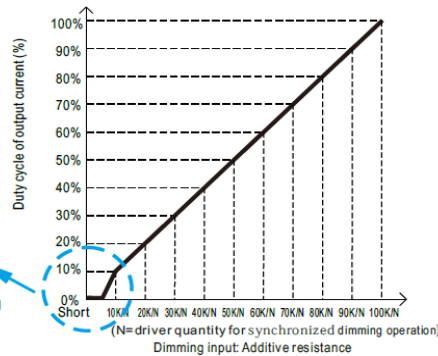
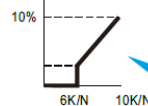
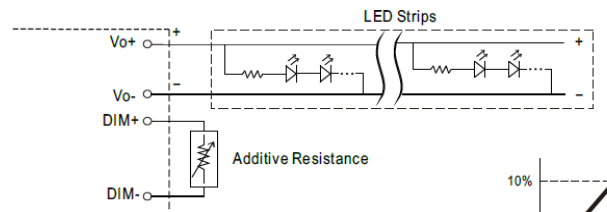
◎ Applying additive 0 ~ 10VDC



◎ Applying additive 10V PWM signal (frequency range 100Hz ~ 3KHz):



◎ Applying additive resistance:



Note : 1. Min. duty cycle of output current is about 6% and the output current is not defined when $0\% < I_{out} < 6\%$.
 2. The duty cycle of output current could drop down to 0% when dimming input is about 0k Ω or 0Vdc, or 10V PWM signal with 0% duty cycle.

TEST RESULT: I/P : 230 VAC ; Ta : 25 $^{\circ}$ C

1	Resistance value	Short	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K
	Output Current	0A	0.265A	0.512A	0.775A	1.054A	1.329A	1.595A	1.864A	2.117A	2.402A	2.571A
%	0%	10.60%	20.48%	31.00%	42.16%	53.16%	63.80%	74.56%	84.68%	96.08%	102.84%	
2	Dimming value	0V	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V
	Output Current	0A	0.257A	0.493A	0.731A	0.998A	1.279A	1.548A	1.820A	2.081A	2.357A	2.607A
	%	0%	10.28%	19.72%	29.24%	39.92%	51.16%	61.92%	72.80%	83.24%	94.28%	104.28%
3	Duty value	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	Output Current	0A	0.285A	0.495A	0.755A	1.006A	1.269A	1.534A	1.786A	2.055A	2.326A	2.559A
	%	0%	11.40%	19.80%	30.20%	40.24%	50.76%	61.36%	71.44%	82.20%	93.04%	102.36%

PASS

8	DALI DIMMING OPERATION (primary side : for DA-Type)	<p>※DALI Interface ·Apply DALI signal between DA+ and DA-. ·DALI protocol comprises 16 groups and 64 addresses. ·First step is fixed at 0.2% of output.</p> <p>I/P : 230 VAC O/P : DIMMING TEST Ta : 25°C TEST RESULT : OK</p>	PASS
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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°C 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)	87 V~305 V TEST : (1) OK (2) OK (3) OK	PASS
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE OSC	I/P : 90 VAC ~ 305 VAC O/P : FULL ~NO LOAD Ta : 25°C	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°C	PF= 0.995 / 115 VAC PF= 0.983 / 230 VAC PF= 0.954 / 277 VAC	PASS
4	EFFICIENCY	89% (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	90.03%	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°C	I = 0.596 A / 115 VAC I = 0.296 A / 230 VAC I = 0.253 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°C	I = 48.0 A Twidth = 256 us	PASS
7	LEAKAGE CURRENT	< 0.25 mA / 277 VAC	I/P : 305 VAC O/P : NO LOAD Ta : 25°C	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°C	0.32 W	PASS

9	TOTAL HARMONIC DISTORTION	<p>Total harmonic distortion will be lower than 20% when output loading is 60% or higher at 230V/115VAC</p> <p>Total harmonic distortion will be lower than 20% when output loading is 75% or higher at 277VAC</p>	I/P : 115 VAC	THD : 5.11% /115VAC	PASS
			I/P : 230 VAC	THD : 12.72% /230VAC	
			O/P : 60% LOAD	THD : 14.74% /277VAC	
			I/P : 277 VAC		
			O/P : 75%LOAD		
			Ta : 25°C		

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°C	114.2 %/ 100 VAC 113.9 %/ 230 VAC 114.0 %/ 305 VAC Hiccup Mode , recovers automatically after fault condition is removed	PASS
2	OVER VOLTAGE PROTECTION	CH1 : 28 V ~ 34 V	I/P : 90 VAC I/P : 230 VAC I/P : 305 VAC O/P : NO LOAD Ta : 25°C	31.08 V/ 90 VAC 31.07 V/ 230 VAC 31.09 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°C	NO DAMAGE Hiccup mode , recovers automatically after fault condition is removed	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°C	(1) 640 V (2) 616 V (3) 614 V	PASS
2	Diode Peak Voltage	D100 Rated 150 V 30 A Q105 60 V 79 A	I/P : High-Line +3V = 308 V O/P : (1) FULL LOAD Turn on (2) Output Short (3) FULL LOAD continue Ta : 25°C	D100 (1) 112 V (2) 111 V (3) 109 V Q105 (1) 12.7 V (2) 50.4 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°C	(1) 448 V (2) 442 V (3) 442 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	(1) 17.6 V	PASS

			(2) NO LOAD Turn on /Off (3) FULL LOAD / NO LOAD Change Ta : 25°C	(2) 17.8 V (3) 17.8 V	
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°C	(1) 474 V (2) 468 V (3) 462 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°C	I/P-O/P : 2.656 mA NO DAMAGE	PASS
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ	I/P-O/P : 500 VDC Ta : 25°C/70%RH	I/P-O/P : >9999 MΩ NO DAMAGE	PASS

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	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°C	OK	PASS
2	CONDUCTION	EN55015 CLASS B	I/P : 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	OK Test by certified Lab	PASS
3	RADIATION	EN55015 CLASS B	I/P : 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	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°C	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°C	CRITERIA A	PASS
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV	I/P : 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A	PASS
7	Test by certified Lab & Test Report Prepare				

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT																																																																
1	TEMPERATURE RISE TEST	MODEL : PWM-60-24 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=30.3 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=51.2 °C			PASS																																																																
		<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 30.3 °C</th> <th>HIGH AMBIENT Ta= 51.2 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>C11</td><td>56.8°C</td><td>76.0°C</td></tr> <tr><td>2</td><td>D6</td><td>58.3°C</td><td>77.6°C</td></tr> <tr><td>3</td><td>Q1</td><td>60.2°C</td><td>79.7°C</td></tr> <tr><td>4</td><td>Q2</td><td>62.6°C</td><td>82.1°C</td></tr> <tr><td>5</td><td>C5</td><td>58.6°C</td><td>77.4°C</td></tr> <tr><td>6</td><td>T1</td><td>64.9°C</td><td>83.7°C</td></tr> <tr><td>7</td><td>C45</td><td>57.1°C</td><td>75.6°C</td></tr> <tr><td>8</td><td>U1</td><td>56.3°C</td><td>75.7°C</td></tr> <tr><td>9</td><td>C105</td><td>60.0°C</td><td>78.8°C</td></tr> <tr><td>10</td><td>D100</td><td>62.4°C</td><td>81.4°C</td></tr> <tr><td>11</td><td>Q105</td><td>58.2°C</td><td>77.1°C</td></tr> <tr><td>12</td><td>U100</td><td>54.9°C</td><td>73.7°C</td></tr> <tr><td>13</td><td>RTH2</td><td>56.3°C</td><td>74.9°C</td></tr> <tr><td>14</td><td>TC</td><td>53.7°C</td><td>71.9°C</td></tr> <tr><td>15</td><td>C11</td><td>56.8°C</td><td>76.0°C</td></tr> </tbody> </table>	NO	Position		ROOM AMBIENT Ta= 30.3 °C	HIGH AMBIENT Ta= 51.2 °C	1	C11	56.8°C	76.0°C	2	D6	58.3°C	77.6°C	3	Q1	60.2°C	79.7°C	4	Q2	62.6°C	82.1°C	5	C5	58.6°C	77.4°C	6	T1	64.9°C	83.7°C	7	C45	57.1°C	75.6°C	8	U1	56.3°C	75.7°C	9	C105	60.0°C	78.8°C	10	D100	62.4°C	81.4°C	11	Q105	58.2°C	77.1°C	12	U100	54.9°C	73.7°C	13	RTH2	56.3°C	74.9°C	14	TC	53.7°C	71.9°C	15	C11	56.8°C	76.0°C		
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : FULL LOAD Ta= -45°C/-30°C	TEST : OK	PASS																																																																
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50°C NO DAMAGE	I/P : 315 VAC O/P : FULL LOAD Ta= 50°C HUMIDITY= 95% R.H	TEST : OK	PASS																																																																
4	TEMPERATURE COEFFICIENT	±0.03 %(0~50°C)	I/P : 230 VAC O/P : FULL LOAD	±0.008 %(0~50°C)	PASS																																																																
5	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -45°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	PASS																																																																



6	THERMAL SHOCK TEST	1. Thermal shock Temperature : -45°C ~ +55°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	PASS
7	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 : 90min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK	PASS
8	CAPACITOR LIFE CYCLE	PWM-60-24 : SUPPOSE C105 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) 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°C		PASS

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

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