Test Report： PWM-120-12

120W PWM Output LED Driver

■ DESIGN VERIFY TEST

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

■ SAFETY & E.M.C. TEST

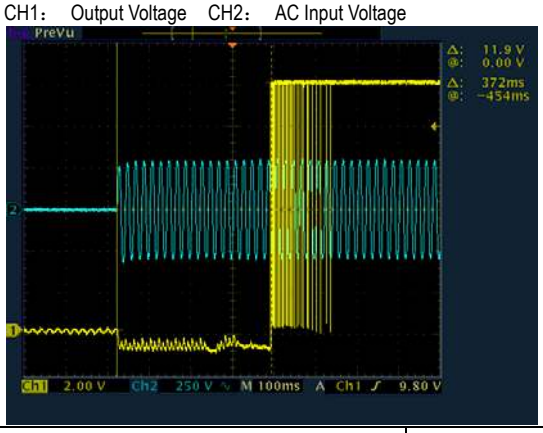
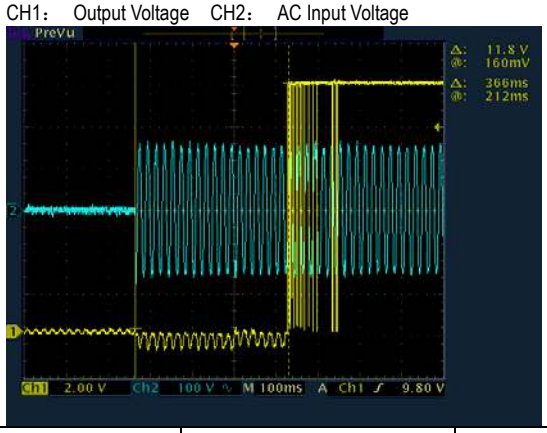
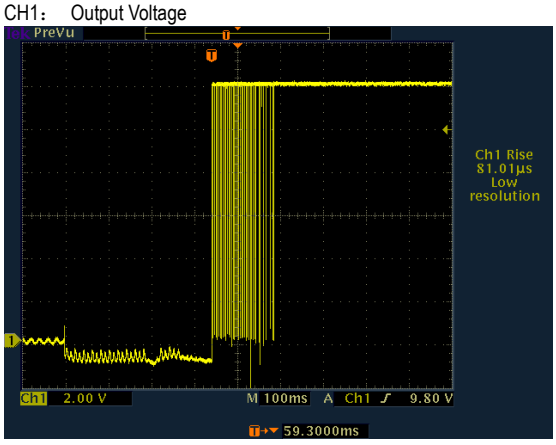
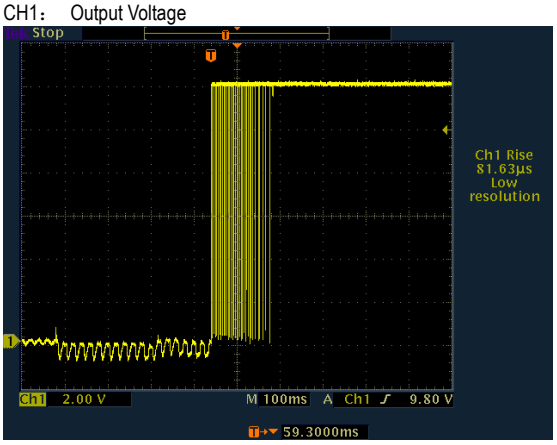
Safety Test
E.M.C. Test

■ RELIABILITY TEST

Environment Test

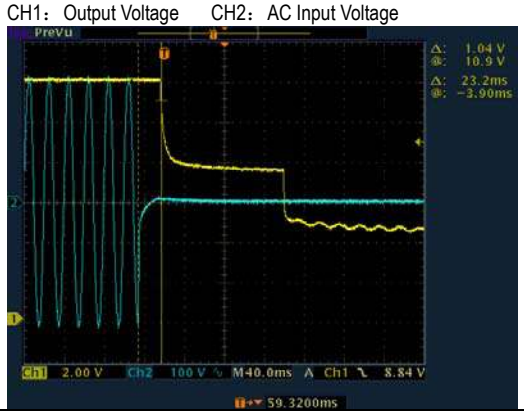
■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM FREQUENCY	1.47KHz	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	1.479KHz
2	OVER/UNDERSHOOT TEST	<±5 %	I/P： 230VAC O/P：FULL LOAD Ta：25℃	<5 %
3	SET UP TIME(Max)	230VAC/ 500ms 115VAC/ 500ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 372ms 115VAC/ 366ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1： Output Voltage CH2： AC Input Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1： Output Voltage CH2： AC Input Voltage 	
4	RISE TIME (Max)	230VAC/ 80ms 115VAC/ 80ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/0.081ms 115VAC/0.081ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1： Output Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1： Output Voltage 	
5	HOLD UP TIME(Typ)	230VAC/ 16ms 115VAC/ 16ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/23.2ms 115VAC/19.2ms

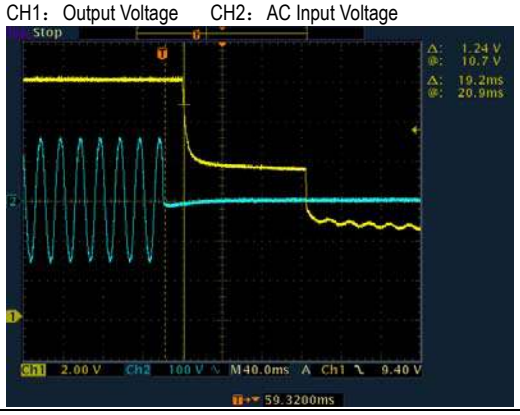
INPUT=230VAC/50HZ @ FULL LOAD

CH1：Output Voltage CH2：AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD

CH1：Output Voltage CH2：AC Input Voltage

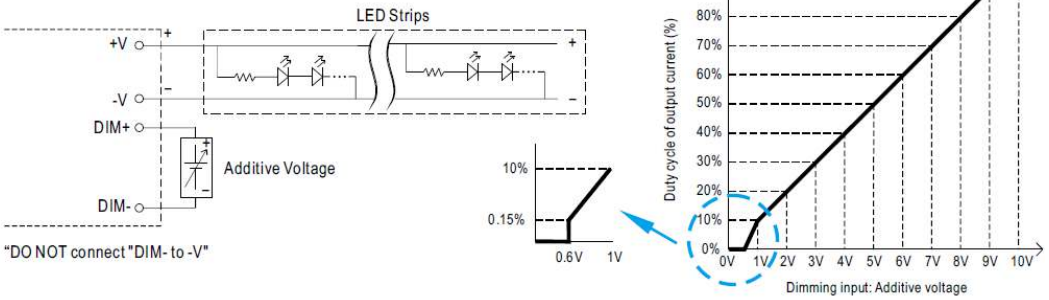


6 DIMMING TEST(for Blank-Type)

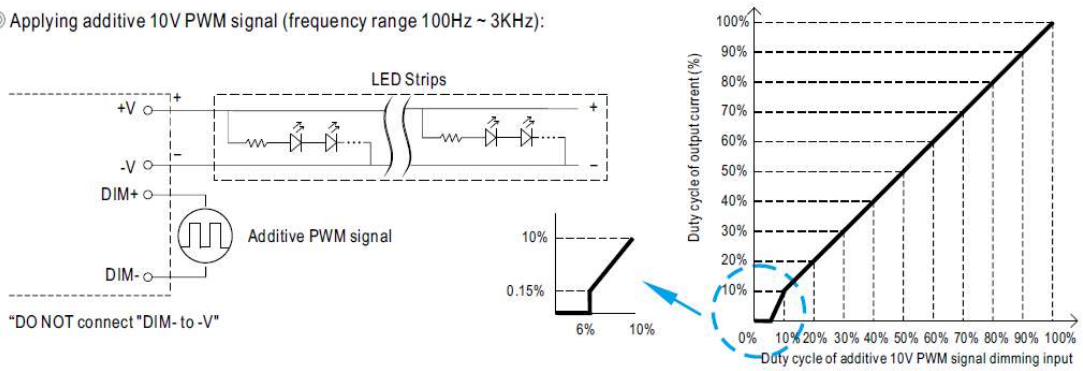
※ 3 in 1 dimming function (for Blank-Type)

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

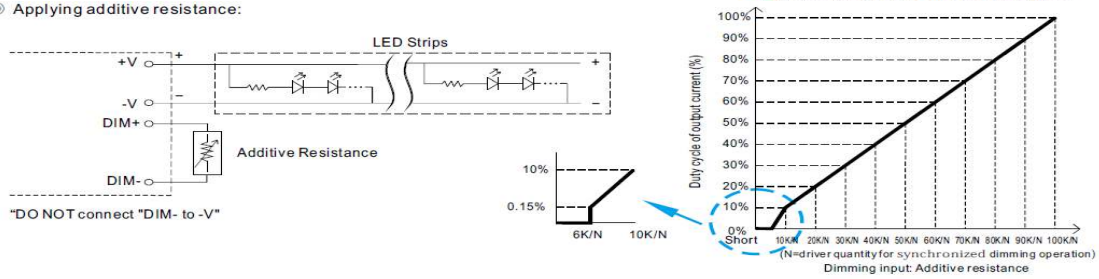
◎ Applying additive 0 ~ 10VDC



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



◎ Applying additive resistance:



Note : 1. Min. duty cycle of output current is about 0.15%, and the dimming input is about 6KΩ or 0.6VDC, or 10V PWM signal with 6% duty cycle.
2. The duty cycle of output current could drop down to 0% when dimming input is less than 6KΩ or less than 0.6VDC, or 10V PWM signal with duty cycle less than 6%.

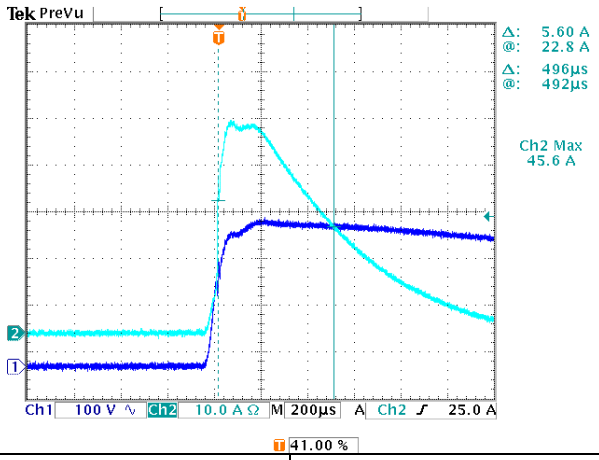
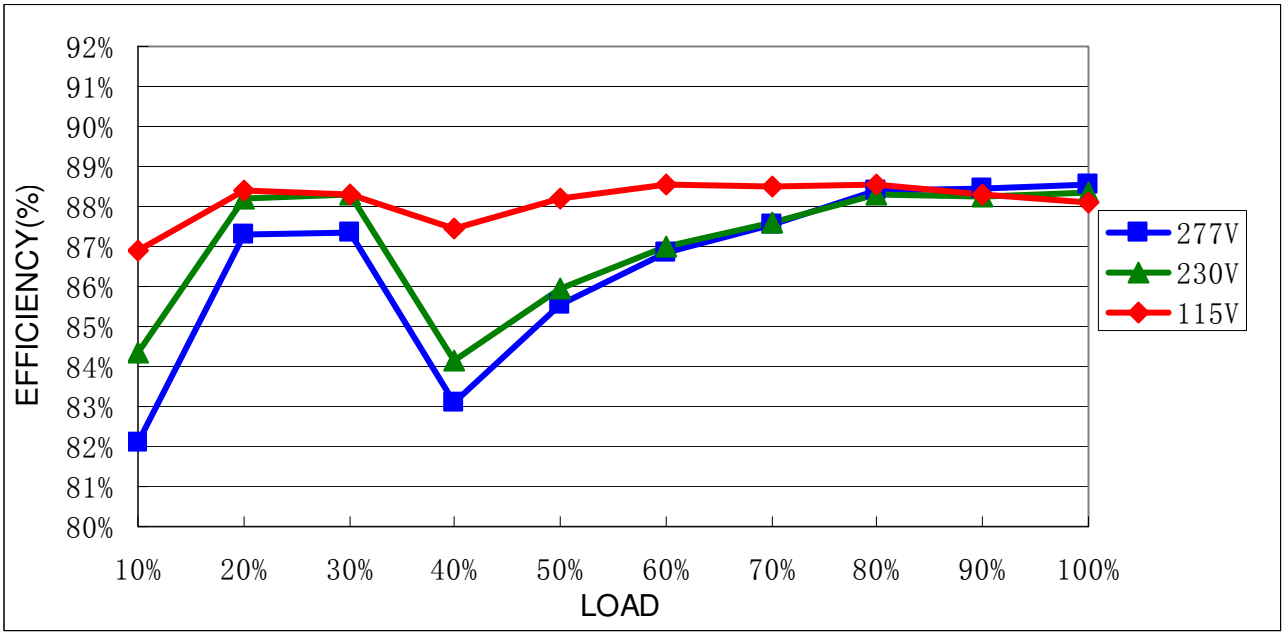
I/P： 230 VAC； O/P： DIMMING TEST ;Ta： 25℃

1	Resistance value	Short	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN
	Output Current	0	0.966	2.040	3.120	4.200	5.200	6.190	7.200	8.220	9.200	10.200	10.200
	Output Current duty	0%	9.66 %	20.40 %	31.20 %	42.00 %	52.00 %	61.90 %	72.00 %	82.20 %	92.00 %	102.00 %	102.00 %
2	Dimming value	0V	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN
	Output Current	0	0.987	2.000	2.960	3.990	5.030	6.040	7.110	8.190	9.220	10.200	10.200
	Output Current duty	0%	9.87 %	20.00 %	29.60 %	39.90 %	50.30 %	60.40 %	71.10 %	81.90 %	92.20 %	102.00 %	102.00 %
3	Duty value	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN
	Output Current	0	1.010	1.970	2.950	3.960	4.900	5.950	6.950	8.010	9.040	9.970	10.200
	Output Current duty	0%	10.10 %	19.70 %	29.50 %	39.60 %	49.00 %	59.50 %	69.50 %	80.10 %	90.40 %	99.70 %	102.00 %

7	DALI DIMMING OPERATION (primary side； for DA-Type)	※DALI Interface ·Apply DALI signal between DA+ and DA-. ·DALI protocol comprises 16 groups and 64 addresses. ·Firse step is fixed at 6% of output. I/P： 230 VAC O/P：DIMMING TEST Ta：25℃ TEST RESULT：OK

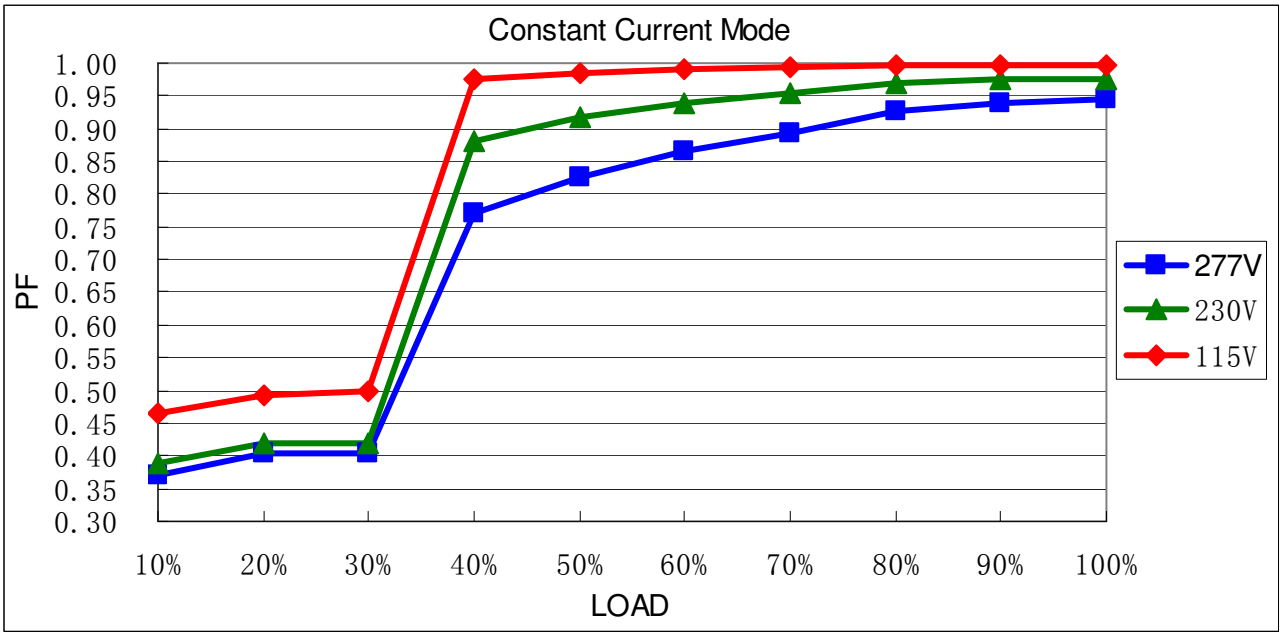
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~305VAC	I/P：TESTING O/P：FULL LOAD Ta：25℃	87V~305V
			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	TEST：OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P： 90 VAC ~305 VAC O/P：FULL~NO LOAD Ta：25℃	TEST：OK
3	AC CURRENT	1.3A/115VAC 0.65A/230VAC 0.55A/277VAC	I/P： 115 VAC I/P： 230 VAC I/P： 277 VAC O/P：FULL LOAD Ta：25℃	I =1.127A/ 115VAC I =0.571A/ 230VAC I =0.490A/ 277VAC
4	LEAKAGE CURRENT	< 0.25mA / 277VAC	I/P： 277 VAC O/P：NO LOAD Ta：25℃	L-FG： 0.003 mA N-FG： 0.003 mA
5	NO LOAD/STANDBY POWER CONSUMPTION	< 0.5W	I/P：230VAC O/P：NO LOAD Ta：25℃	0.173W
6	TOTAL HARMONIC DISTORTION	THD＜20% （@load≥60%/115VAC，230VAC；@load≥75%/277VAC）	I/P：115 VAC/60% LOAD I/P：230 VAC/60% LOAD I/P：277 VAC/75% LOAD Ta：25℃	THD： 7.64 %@60% load /115VAC THD： 18.60 %@60% load /230VAC THD： 17.99 %@75% load /277VAC

7	INRUSH CURRENT(Typ)	60A/230VAC Twidth =520 us measured at 50% Ipeak COLD START	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I=45.6A/ 230VAC Twidth =496us
	INPUT=230VAC/50HZ @ FULL LOAD CH2： Input current CH1： AC Input Voltage 			
8	EFFICIENCY(Typ)	88%	I/P： 230VAC O/P：FULL LOAD Ta：25℃	88.35%
	EFFICIENCY vs LOAD 			

9	POWER FACTOR	0.97/ 115VAC 0.96/ 230VAC 0.94/ 277VAC	I/P： 115 VAC I/P： 230 VAC I/P： 277 VAC O/P：FULL LOAD Ta：25℃	PF=0.997/ 115VAC PF=0.977/ 230VAC PF=0.943/ 277VAC

P.F vs LOAD



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	108 %~ 120 %	I/P： 230VAC O/P：TESTING Ta：25℃	115.4%/ 230VAC Hiccup mode，recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	15V~17V	I/P： 230VAC O/P：NO LOAD Ta：25℃	16.83V/ 230VAC Shut down o/p voltage，re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P： 230 VAC O/P：FULL LOAD	O.T.P. Active Shut down o/p voltage，re-power on to recover
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P： 295VAC O/P：FULL LOAD Ta：25℃	NO DAMAGE Shut down o/p voltage，re-power on to recover

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q 2 Rated 730V/10A	I/P：High-Line +3V =308V O/P： (1) Full Load Turn on (2) Output Short (3) Full load continue Ta：25℃	 (1) 702V (2) 716V (3) 672V
2	**Diode Peak Voltage**	Q101 Rated 75V/80A	I/P：High-Line +3V =308V O/P： (1) Full Load Turn on (2) Output Short (3) Full load continue Ta：25℃	 (1) 71.2V (2) 73.8V (3) 70.0V
3	**Input Capacitor Voltage**	C5 Rated 100u/ 450V	I/P：High-Line +3V =308 V O/P：(1) Full Load input on/off (2) NO load input on /Off (3) Full Load /NO load Change Ta：25℃	 (1) 446V (2) 440V (3) 448V
4	**Control IC Voltage Test**	U1 Rated 28V	I/P：High-Line +3V =308 V O/P：(1) Full Load input on/off (2) NO load input on /Off (3) Full Load /NO load Change Ta：25℃	 (1) 17.4V (2) 17.0V (3) 17.4V
5	PFC Transistor (D to S) or (C to E) **Peak Voltage**	Q 1 Rated 600V/15A	I/P：High-Line +3V =308V O/P： (1) Full Load Turn on (2) Output Short (3) Full load continue Ta：25℃	 (1) 482V (2) 454V (3) 478V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P： 3.75KVAC/min	I/P-O/P： 4.2KVAC/min Ta：25℃	I/P-O/P：1.724mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P：500VDC>100MΩ	I/P-O/P： 500VDC Ta：25℃	I/P-O/P： ＞9999MΩ

E.M.C TEST

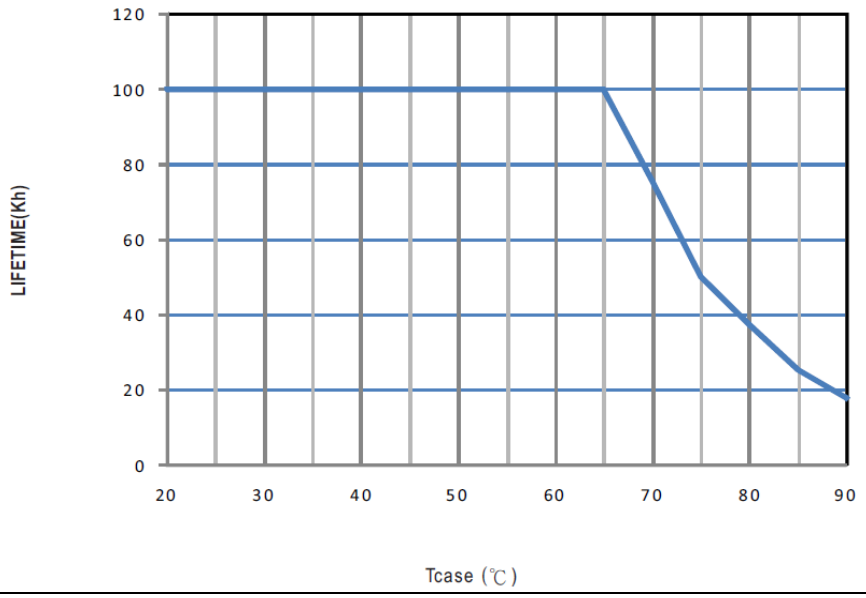
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS C	I/P：230VAC/50HZ O/P：60%/FULL LOAD Ta:25℃	PASS
2	CONDUCTION	EN55015	I/P：230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	PASS Test by certified Lab
3	RADIATION	EN55015	I/P：230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR：8KV Contact：4KV	I/P：230 VAC/50HZ O/P：FULL LOAD Ta：25℃	PASS
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT：1KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	PASS
6	SURGE	EN61000-4-5 INDUSTRY L-N：2KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	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></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL： PWM-120-12
1. ROOM AMBIENT BURN-IN：2 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 30.5℃
2. HIGH AMBIENT BURN-IN： 2 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 41.2℃
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 30.5 ℃</th><th>HIGH AMBIENT Ta=41.2 ℃</th></tr>
<tr><td>1</td><td>C110</td><td>71.5℃</td><td>84.1℃</td></tr>
<tr><td>2</td><td>Q105</td><td>73.4℃</td><td>86.1℃</td></tr>
<tr><td>3</td><td>C5</td><td>79.3℃</td><td>88.8℃</td></tr>
<tr><td>4</td><td>C11</td><td>83.0℃</td><td>92.5℃</td></tr>
<tr><td>5</td><td>C105</td><td>77.6℃</td><td>90.2℃</td></tr>
<tr><td>6</td><td>T1</td><td>85.6℃</td><td>96.8℃</td></tr>
<tr><td>7</td><td>RTH2</td><td>83.8℃</td><td>92.8℃</td></tr>
<tr><td>8</td><td>Q1</td><td>86.6℃</td><td>96.6℃</td></tr>
<tr><td>9</td><td>Q2</td><td>97.0℃</td><td>107.7℃</td></tr>
<tr><td>10</td><td>Q101</td><td>75.1℃</td><td>88.7℃</td></tr>
<tr><td>11</td><td>RTH1</td><td>63.8℃</td><td>70.7℃</td></tr>
<tr><td>12</td><td>D10</td><td>101.5℃</td><td>113.4℃</td></tr>
<tr><td>13</td><td>C45</td><td>75.9℃</td><td>85.7℃</td></tr>
<tr><td>14</td><td>Q102</td><td>70.7℃</td><td>83.8℃</td></tr>
<tr><td>15</td><td>U1</td><td>74.9℃</td><td>84.3℃</td></tr>
<tr><td>16</td><td>R7</td><td>100.6℃</td><td>113.4℃</td></tr>
<tr><td>17</td><td>C15</td><td>96.1℃</td><td>105.4℃</td></tr>
<tr><td>18</td><td>C12</td><td>84.8℃</td><td>94.6℃</td></tr>
<tr><td>19</td><td>RTH3</td><td>72.3℃</td><td>81.8℃</td></tr>
<tr><td>20</td><td>TC</td><td>66.6℃</td><td>75.5℃</td></tr>
</table></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></tr>
<tr><td>3</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 40 ℃
NO DAMAGE</td><td>I/P： 315VAC
O/P：FULL LOAD
Ta=40 ℃
HUMIDITY= 95% R.H</td><td>TEST：OK</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>±0.004%/℃(0~50℃)</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>TEST：OK</td></tr>
</table>

6	THERMAL SHOCK TEST	1. Thermal shock Temperature： -45℃~ +45℃ 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 58 sec，turn off 2 sec；	TEST：OK
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： 72min in each axis (X.Y.Z) (6) Ta： 25℃	TEST：OK
8	CAPACITOR LIFE CYCLE	PWM-120-12：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= 40 ℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 40 ℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 40 ℃ LIFE TIME	(1) 102005 HRS (2) 31602 HRS (3) 55800 HRS (4) 110870 HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 860.4K hrs min. Telcordia SR-332 (Bellcore) 228.7K hrs min. MIL-HDBK-217F (25℃)	
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life)： Above 50000 hours @ TC 75℃	



TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	ZHANGZJ/ZHUOKB	SKY	LIUWY