Test Report: LCM-25

25W Multiple-Stage Output Current LED Power Supply

■ DESIGN VERIFY TEST

Output Function Test
Input Function Test
Protection Function Test
Control 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	RIPPLE & NOISE	V1：400 mVp-p (Max)	I/P： 230VAC O/P：FULL LOAD Ta：25℃	350mA： 58.0 mVp-p (Max) 500mA： 62.4 mVp-p (Max) 600mA： 70.4 mVp-p (Max) 700mA： 62.0 mVp-p (Max) 900mA： 77.2 mVp-p (Max) 1050mA： 86.8 mVp-p (Max)	PASS
2	NO LOAD O/P VOLTAGE	350mA： 59V (Max) 500mA： 59V (Max) 600mA： 59V (Max) 700mA： 41V (Max) 900mA： 41V (Max) 1050mA： 41V (Max)	I/P： 230 VAC O/P：NO LOAD Ta：25℃	350mA： 56.30 V 500mA： 56.30 V 600mA： 56.30 V 700mA： 39.59 V 900mA： 39.59 V 1050mA： 39.59 V	PASS
3	RIPPLE CURRENT	±5%	I/P： 230VAC O/P：LED LOAD Ta：25℃	350mA：± 4.57 % 500mA：± 4.40 % 600mA：± 4.00 % 700mA：± 4.86 % 900mA：± 4.00 % 1050mA：± 4.95 %	PASS
4	CURRENT ACCURACY	±5%	I/P： 230VAC O/P：MIN~MAX Ta：25℃	350mA：± 2.66 % 500mA：± 2.30 % 600mA：± 2.68 % 700mA：± 2.69 % 900mA：± 2.87 % 1050mA：± 1.19 %	PASS
5	SET UP TIME	230VAC： 500 ms (Max)	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 358 ms	PASS
6	RISE TIME	230VAC： 50 ms (Max)	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 16 ms	PASS
7	HOLD UP TIME	230VAC： 30 ms (TYP)	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 40 ms	PASS
8	OVER/UNDERSHOOT TEST	< ±5%	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	TEST： <5 %	PASS

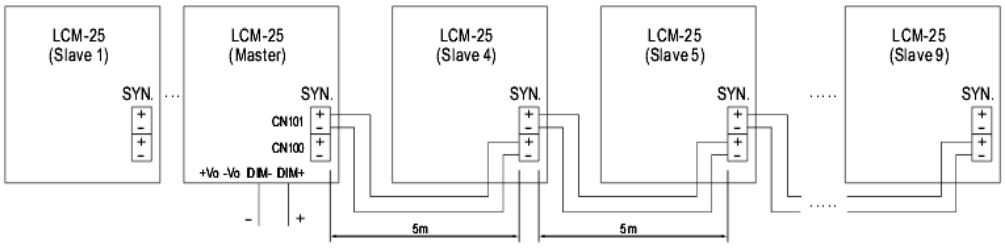
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	180VAC~277 VAC	I/P：TESTING O/P：FULL LOAD Ta：25℃	180 V~277V	PASS
			I/P： (1)LOW-LINE-3V=177 V HIGH-LINE+10V=287 V O/P:FULL/MIN LOAD ON: 30 Sec OFF: 30 Sec 10MIN (2)I/P:230Vac ON: 0.5 Sec OFF: 0.5 Sec 20MIN (3)I/P:230Vac ON: 0.3 Sec OFF: 0.3 Sec 12HOURS (AC POWER ON/OFF NO DAMAGE)	TEST: (1) OK (2) OK (3) OK	
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P： 180 VAC ~ 295 VAC O/P：FULL~MIN LOAD Ta：25℃	TEST： OK	PASS
3	POWER FACTOR	0.94 / 230 VAC(TYP) 0.91 / 277 VAC(TYP)	I/P： 230 VAC I/P： 277 VAC O/P：FULL LOAD Ta：25℃	PF= 0.978 / 230 VAC PF= 0.957 / 277 VAC	PASS
4	EFFICIENCY	86 % (TYP)	I/P： 230 VAC O/P：LED:50V @500mA Ta：25℃	86.21 %	PASS
5	INPUT CURRENT	230V/ 0.17 A (TYP) 277V/ 0.15 A (TYP)	I/P： 230 VAC I/P： 277 VAC O/P：FULL LOAD Ta：25℃	I = 0.136 A/ 230 VAC I = 0.116 A/ 277 VAC	PASS
6	INRUSH CURRENT	230V/ 20 A (TYP) (t_{width}=260us measured at 50% I_{peak}) COLD START	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I = 15.3 A/ 230 VAC T50= 160 us	PASS
7	LEAKAGE CURRENT	< 0.5 mA / 240 VAC	I/P： 240 VAC O/P：Min LOAD Ta：25℃	L-FG： 0.0025 mA N-FG： 0.0025 mA	PASS
8	NO LOAD CONSUMPTION	< 0.5 W	I/P：230VAC O/P：NO LOAD Ta：25℃	0.452 W	PASS
9	TOTAL HARMONIC DISTORTION	Total harmonic distortion will be lower than 20% when output loading is 75% or higher	I/P： 230 VAC O/P：50% LOAD I/P： 277 VAC O/P：75%LOAD Ta：25℃	THD： 15.19% /230VAC THD： 14.46% /277VAC	PASS

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER TEMPERATURE PROTECTION	Shut down Re-power ON	I/P： 230 VAC O/P：FULL LOAD	O.T.P. Active Shut down o/p voltage，recovers automatically after temperature goes down	PASS
2	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P： 295 VAC O/P：FULL LOAD Ta：25℃	NO DAMAGE Constant current limiting，recovers automatically after fault condition is removed	PASS

CONTROL FUNCTION 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>DIP Switch Table</td><td>LCM-25 is a multiple-stage output current supply， selection of output current through DIP switch as table below
<table>
<tr><th>Io \ DIP S.W.</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th></tr>
<tr><td>350mA</td><td>----</td><td>----</td><td>----</td><td>----</td><td>----</td><td>----</td></tr>
<tr><td>500mA</td><td>ON</td><td>----</td><td>----</td><td>----</td><td>----</td><td>----</td></tr>
<tr><td>600mA</td><td>ON</td><td>ON</td><td>----</td><td>----</td><td>----</td><td>----</td></tr>
<tr><td>700mA(Factory Setting)</td><td>ON</td><td>ON</td><td>ON</td><td>----</td><td>----</td><td>ON</td></tr>
<tr><td>900mA</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>----</td><td>ON</td></tr>
<tr><td>1050mA</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
</table>
TEST：OK</td><td></td><td></td><td>PASS</td></tr>
<tr><td>2</td><td>Dimming function</td><td>Built-in 2 in 1 dimming function, output constant current level can be adjusted through output terminal by 0 ~ 10Vdc or 10V PWM signal between DIM+ and DIM-.
Please DO NOT connect "DIM-" to "-Vo".
0 ~ 10V dimming function for output current adjustment (Typical)
<table>
<tr><th>Current</th><th>0V</th><th>1V</th><th>2V</th><th>3V</th><th>4V</th><th>5V</th><th>6V</th><th>7V</th><th>8V</th><th>9V</th><th>10V</th><th>OPEN</th></tr>
<tr><td>350mA</td><td>0%</td><td>10.46 %</td><td>20.60 %</td><td>30.06 %</td><td>40.34 %</td><td>50.06 %</td><td>59.49 %</td><td>70.14 %</td><td>79.86 %</td><td>89.60 %</td><td>98.69 %</td><td>102.66 %</td></tr>
<tr><td>1050mA</td><td>0%</td><td>11.55 %</td><td>21.27 %</td><td>31.17 %</td><td>41.59 %</td><td>50.95 %</td><td>61.42 %</td><td>71.76 %</td><td>81.49 %</td><td>90.86 %</td><td>100.09 %</td><td>101.19 %</td></tr>
</table>
10V PWM signal for output current adjustment (Typical): Frequency range :100Hz ~ 3KHz
<table>
<tr><th>Current</th><th>0V</th><th>10%</th><th>20%</th><th>30%</th><th>40%</th><th>50%</th><th>60%</th><th>70%</th><th>80%</th><th>90%</th><th>100%</th><th>OPEN</th></tr>
<tr><td>350mA</td><td>0%</td><td>10.51 %</td><td>20.31 %</td><td>30.11 %</td><td>39.97 %</td><td>49.77 %</td><td>59.60 %</td><td>69.40 %</td><td>79.20 %</td><td>88.97 %</td><td>98.69 %</td><td>102.66 %</td></tr>
<tr><td>1050mA</td><td>0%</td><td>11.15 %</td><td>20.96 %</td><td>30.78 %</td><td>40.59 %</td><td>50.43 %</td><td>60.26 %</td><td>70.11 %</td><td>79.97 %</td><td>89.85 %</td><td>99.70 %</td><td>101.19 %</td></tr>
</table></td><td></td><td></td><td>PASS</td></tr>
<tr><td>3</td><td>SYNCHRONIZATION OPERATION</td><td>SPECIFICATION:
• Synchronization up to 10 drivers (1 master + 9 slaves)
• Dimming operating range : 10%~100%
• Sync cable length : < 5m
• Sync cable type : Flat cable
• Sync cable cross section area : 22 – 24 AWG (0.2~0.3mm²)
 

• CN100, CN101 : used to synchronously control the LCM units in parallel.
TEST CONDITION：I/P：230 VAC FULL LOAD
RESULT：OK</td><td></td><td></td><td>PASS</td></tr>
</table>

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 950V/2A	I/P：High-Line +3V = 298 V O/P： (1)Full Load Turn on (2) Output Short (3)Full load continue Ta：25℃	(1) 808 V (2) 442 V (3) 800 V	PASS
2	Diode Peak Voltage	D101 Rated 200V/4A	I/P：High-Line +3V = 298 V O/P： (1)Full Load Turn on (2)Output Short (3)Full load continue Ta：25℃	(1) 166 V (2) 149 V (3) 136 V	PASS
3	Input Capacitor Voltage	C5 Rated 10u/450V	I/P：High-Line +3V = 298 V O/P： (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta：25℃	(1) 436 V (2) 436 V (3) 436 V	PASS
4	Control IC Voltage Test	U2 Rated 26V U1 Rated 22.5V	I/P：High-Line +3V = 298 V O/P： (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta：25℃	U2 (1) 17.9 V (2) 18.0 V (3) 17.9 V U1 (1) 19.5 V (2) 19.6 V (3) 19.5 v	PASS
5	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated 600V/4A	I/P：High-Line +3V = 298 V O/P： (1)Full Load Turn on (2) Output Short (3)Full load continue Ta：25℃	(1) 488 V (2) 416 V (3) 426 V	PASS

■ SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P：3.75KVAC/min I/P-DA±：1.875KVAC O/P-DA±：1.875KVAC	I/P-O/P：4.2 KVAC/min I/P-DA±：2.25KVAC O/P-DA±：2.25KVAC Ta：25℃	I/P-O/P： 0.978 mA I/P-DA±： 0.032 mA O/P-DA±： 0.031 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	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS C	I/P： 230 VAC/50HZ O/P：FULL LOAD/50% LOAD Ta：25℃	PASS	PASS
2	CONDUCTION	EN55015 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	PASS Test by certified Lab	PASS
3	RADIATION	EN55015 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	PASS 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 LIGHT 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：LCM-25 DIP switch ：1050mA
1. ROOM AMBIENT BURN-IN：2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=28.2 ℃
2. HIGH AMBIENT BURN-IN： 2 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 42.1 ℃

<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT
Ta= 28.2 ℃</th><th>HIGH AMBIENT
Ta= 42.1 ℃</th></tr>
<tr><td>1</td><td>C5</td><td>76.1℃</td><td>85.5℃</td></tr>
<tr><td>2</td><td>C61</td><td>70.8℃</td><td>80.2℃</td></tr>
<tr><td>3</td><td>C11</td><td>71.2℃</td><td>80.5℃</td></tr>
<tr><td>4</td><td>C42</td><td>82.2℃</td><td>91.6℃</td></tr>
<tr><td>5</td><td>LF1</td><td>55.1℃</td><td>64.9℃</td></tr>
<tr><td>6</td><td>Q1</td><td>81.1℃</td><td>90.2℃</td></tr>
<tr><td>7</td><td>Q2</td><td>98.9℃</td><td>108.9℃</td></tr>
<tr><td>8</td><td>T1</td><td>91.2℃</td><td>100.6℃</td></tr>
<tr><td>9</td><td>L1</td><td>64.0℃</td><td>73.5℃</td></tr>
<tr><td>10</td><td>RTH1</td><td>83.6℃</td><td>92.6℃</td></tr>
<tr><td>11</td><td>C2</td><td>62.0℃</td><td>71.8℃</td></tr>
<tr><td>12</td><td>C105</td><td>87.8℃</td><td>96.8℃</td></tr>
<tr><td>13</td><td>C106</td><td>72.9℃</td><td>82.3℃</td></tr>
<tr><td>14</td><td>C203</td><td>77.7℃</td><td>87.0℃</td></tr>
<tr><td>15</td><td>BD1</td><td>68.0℃</td><td>77.4℃</td></tr>
<tr><td>16</td><td>U1</td><td>77.7℃</td><td>87.2℃</td></tr>
<tr><td>17</td><td>U100</td><td>71.1℃</td><td>80.5℃</td></tr>
<tr><td>18</td><td>ZNR1</td><td>52.1℃</td><td>62.5℃</td></tr>
<tr><td>19</td><td>D101</td><td>102.5℃</td><td>111.4℃</td></tr>
<tr><td>20</td><td>L3</td><td>71.3℃</td><td>80.6℃</td></tr>
<tr><td>21</td><td>RTH2</td><td>78.8℃</td><td>88.4℃</td></tr>
<tr><td>22</td><td>U301</td><td>66.1℃</td><td>75.7℃</td></tr>
<tr><td>23</td><td>U905</td><td>73.3℃</td><td>83.0℃</td></tr>
<tr><td>24</td><td>CASE</td><td>68.6℃</td><td>79.5℃</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： 277VAC/200VAC
O/P： 100% LOAD
Ta= -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 40 ℃
NO DAMAGE</td><td>I/P： 285 VAC
O/P：FULL LOAD
Ta= 40 ℃
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>±0.003 %/℃(0~50℃)</td><td>PASS</td></tr>
</table>

5	STORAGE TEMPERATURE TEST	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	OK	PASS
6	THERMAL SHOCK TEST	1. Thermal shock Temperature： -35℃~+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 58sec； turn off 2sec	OK	PASS
7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (3) Sweep Time：10min/sweep cycle (4) Acceleration：3G (5) Test Time：90min in each axis (X.Y.Z) (6) Ta：25℃	TEST：OK	PASS
8	CAPACITOR LIFE CYCLE	LCM-25 ： 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) 44646 HRS (2) 22160 HRS (3) 28026 HRS (4) 42583 HRS	PASS
9	MTBF	Conducted by Parts Stress Analysis Prediction 3298.3K hrs min. Telcordia SR-332 (Bellcore)； 298.7K hrs min. MIL-HDBK-217F (25℃)		PASS
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 30,000 hours @ Tcase 85℃		PASS

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	ZHOUB/ ZHUOKB	SKY	LIUWY

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