



# Test Report: LCM-60

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60W 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 : 700 mVp-p (Max)	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	500mA : 121 mVp-p (Max) 600mA : 179 mVp-p (Max) 700mA : 241 mVp-p (Max) 900mA : 122 mVp-p (Max) 1050mA : 56 mVp-p (Max) 1400mA : 29 mVp-p (Max)	P
2	NO LOAD O/P VOLTAGE	500mA : 90V-95V 600mA : 90V-95V 700mA : 90V-95V 900mA : 67V-73V 1050mA : 67V-73V 1400mA : 67V-73V	I/P : 230 VAC O/P : MIN LOAD Ta : 25°C	500mA : 93.11 V/230 VAC 600mA : 93.12 V/230 VAC 700mA : 93.12 V/230 VAC 900mA : 69.58 V/230 VAC 1050mA : 69.56 V/230 VAC 1400mA : 69.56 V/230 VAC	P
3	RIPPLE CURRENT	±5%	I/P : 230VAC O/P : LED LOAD Ta : 25°C	500mA : ±2.1 % 600mA : ±2 % 700mA : ±2 % 900mA : ±2.6 % 1050mA : ±1.6 % 1400 mA : ±1.7 %	P
4	CURRENT ACCURACY	±5%	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	500mA : ± 0.14 % 600mA : ± 0.15 % 700mA : ± 0.15 % 900mA : ± 0.2 % 1050mA : ± 0.01 % 1400 mA : ± 0.3 %	P
5	SET UP TIME	230VAC : 500 ms (Max)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 382 ms	P
6	RISE TIME	230VAC : 80 ms (Max)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 15 ms	P
7	HOLD UP TIME	230VAC : 16 ms (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 21 ms	P
8	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %	P

**INPUT FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	180VAC~295 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C  I/P : LOW-LINE-3V= 177 V (PLEASE CHECK DERATING CURVE) HIGH-LINE+10V=305 V O/P : FULL/MIN LOAD ON : 30 Sec . OFF : 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE )	163 V~295V  TEST : OK	P
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P : 200 VAC ~ 295 VAC O/P : FULL-MIN LOAD Ta : 25°C	TEST : OK	P
3	POWER FACTOR	0.975 / 230 VAC(TYP) 0.96 / 277 VAC(TYP)	I/P : 230 VAC I/P : 277 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.9915 / 230 VAC PF= 0.9753 / 277 VAC	P
4	EFFICIENCY	92 % (TYP)	I/P : 230 VAC O/P : LEDH:67V/900mV Ta : 25°C	92.45 %	P
5	INPUT CURRENT	230V/ 0.32 A (TYP) 277V/ 0.27 A (TYP)	I/P : 230 VAC I/P : 277 VAC O/P : FULL LOAD Ta : 25°C	I = 0.2873 A/ 230 VAC I = 0.2447 A/ 277 VAC	P
6	INRUSH CURRENT	230V/ 20 A (TYP)  (twidth=270us measured at 50% Ipeak) COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I = 19.2 A/ 230 VAC T50= 263 us	P
7	LEAKAGE CURRENT	< 0.5 mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.003 mA N-FG : 0.002 mA	P
8	NO LOAD CONSUMPTION	< 1 W	I/P : 180VAC I/P : 230VAC I/P : 277VAC O/P : NO LOAD Ta : 25°C	< 0.932 W < 0.939 W < 0.966 W	P
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 : 75% LOAD  I/P : 277 VAC O/P : 75%LOAD Ta : 25°C	THD : 10.11 /230VAC  THD : 13.64 /277VAC	P

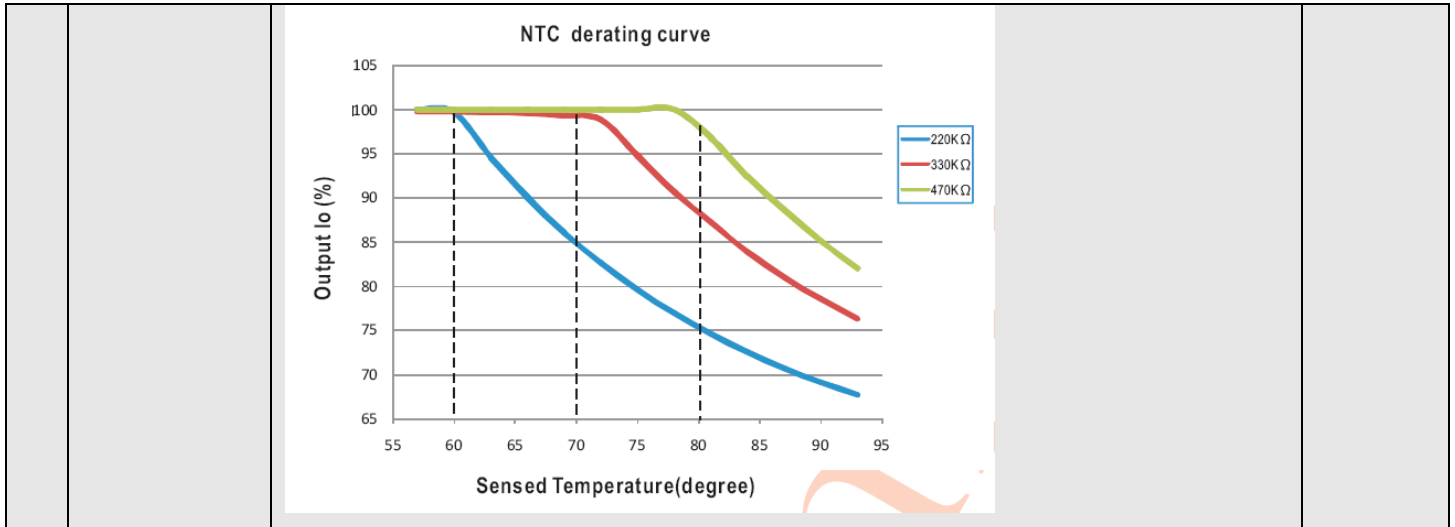
**PROTECTION FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER VOLTAGE PROTECTION	CH1 : 105 V ~ 125 V	I/P : 230 VAC I/P : 180 VAC O/P : MIN LOAD Ta : 25°C	117.25V/ 230 VAC 116.15V/ 180VAC Shut down Re- power ON	P

2	OVER TEMPERATURE PROTECTION	Shut down Re-power ON	I/P : 230 VAC O/P : FULL LOAD	O.T.P. Active Shut down Re-power ON	P
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P : 295 VAC O/P : FULL LOAD Ta : 25°C	NO DAMAGE Constant Current Limiting	P

### CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT																																																	
1	AUXILIARY POWER	12V @ 50mA for driving fan; Tolerance ±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	11.981 V/230V	P																																																	
2	DIP Switch Table	<p>LCM-60 is a multiple-stage output current supply, selection of output current through DIP switch as table below.</p> <table border="1"> <thead> <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> </thead> <tbody> <tr> <td>500mA</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> </tr> <tr> <td>600mA</td> <td>ON</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> </tr> <tr> <td>700mA(Factory Setting)</td> <td>ON</td> <td>ON</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> </tr> <tr> <td>900mA</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>---</td> <td>---</td> <td>ON</td> </tr> <tr> <td>1050mA</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>---</td> <td>ON</td> </tr> <tr> <td>1400mA</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table> <p>TEST : OK</p>	Io \ DIP S.W.	1	2	3	4	5	6	500mA	---	---	---	---	---	---	600mA	ON	---	---	---	---	---	700mA(Factory Setting)	ON	ON	---	---	---	---	900mA	ON	ON	ON	---	---	ON	1050mA	ON	ON	ON	ON	---	ON	1400mA	ON	ON	ON	ON	ON	ON			P
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3	TEMP. COMPENSATION	<p><b>SPECIFICATION:</b> LCM-60 have the built-in temperature compensation function (<math>T \uparrow</math>, <math>I_o \downarrow</math>). By connecting a temperature sensor (NTC resistor) between the NTC +/- terminal of LCM-60 and the detecting point on the lighting system or the surrounding environment, output current of LCM-60 could be correspondingly changed to ensure the long life of LED.</p> <p>1.LCM-60 can still be operated well when the NTC resistor is not connected and the value of output current will be the current level that you set</p> <p>2.</p> <table border="1"> <thead> <tr> <th>NTC resistance</th> <th>Output Current</th> </tr> </thead> <tbody> <tr> <td>220K</td> <td>&lt; 60°C, 100% of the rated current (corresponds to the setting current level) &gt;60°C, 100% of the rated current (corresponds to the setting current level)</td> </tr> <tr> <td>330K</td> <td>&lt; 70°C, 100% of the rated current (corresponds to the setting current level) &gt; 70°C, output current begin to reduce, details please refer to the curve.</td> </tr> <tr> <td>470K</td> <td>&lt; 80°C, output current begin to reduce, details please refer to the curve. &gt; 80°C, output current begin to reduce, details please refer to the curve.</td> </tr> </tbody> </table> <p>Notes: 1. MW does not offer the NTC resistor and all the data above are measured by using THINKING TTC03 series. 2. If other brands of NTC resistor is applied,please check the temperature curve first. 3. Synchronization function of the power supply will be invalid when the "temperature compensation" function is in use.</p> <p><b>TEST CONDITION :</b> I/P : 230 VAC <b>RESULT:OK</b></p>	NTC resistance	Output Current	220K	< 60°C, 100% of the rated current (corresponds to the setting current level) >60°C, 100% of the rated current (corresponds to the setting current level)	330K	< 70°C, 100% of the rated current (corresponds to the setting current level) > 70°C, output current begin to reduce, details please refer to the curve.	470K	< 80°C, output current begin to reduce, details please refer to the curve. > 80°C, output current begin to reduce, details please refer to the curve.			P																																									
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**4 Dimming function**

.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 "-V".  
 .0 ~ 10V dimming function for output current adjustment (Typical)

O/P Current	0V	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V
1.4A	0%	10.9%	20.7%	30.2%	40.2%	50.11%	60.5%	70.2%	80%	90%	100%

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

O/P Current	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
1.4A	0%	11%	20.8%	30.7%	40.5%	50.4%	60.2%	70.1%	79.9%	89.8%	99.1%

P

**5 SYNCHRONIZATION OPERATION**

**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 (0.2~0.3mm<sup>2</sup>)

**TEST CONDITION** : I/P : 230 VAC FULL LOAD  
**RESULT:OK**

P

**COMPONENT STRESS TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor (D to S) or (C to E) Peak Voltage	U2 Rated 550V/5.2A	I/P : High-Line +3V = 298 V O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	(1) 435 V (2) 427 V (3) 439 V	P
2	Diode Peak Voltage	D100 Rated 300V/10A	I/P : High-Line +3V = 298 V O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	(1) 87.8 V (2) 15.5 V (3) 87.8 V	P
3	Input Capacitor Voltage	C5 Rated: 22u/450V SURGE POWER : 495V	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°C	(1) 439 V (2) 435 V (3) 459 V	P
4	Control IC Voltage Test	U2 Rated 11.4V -15V	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°C	(1) 13.5 V (2) 13.3 V (3) 13.3 V	P
5	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated 7.3A/650V	I/P : High-Line +3V = 298 V O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	(1) 439 V (2) 459 V (3) 439 V	P

■ 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 KVAC/min Ta : 25°C	I/P-O/P : 2.2 mA  NO DAMAGE	P
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ	I/P-O/P : 500 VDC Ta : 25°C/70%RH	I/P-O/P : 30 GΩ  NO DAMAGE	P

**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 Ta : 25°C	PASS	P
2	CONDUCTION	EN55015 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab	P
3	RADIATION	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 LIGHT 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 LIGHT INDUSTRY INPUT : 1KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
6	SURGE	IEC61000-4-5 LIGHT INDUSTRY L-N : 1KV L,N-PE : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
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 : LCM-60                      DIP switch : 1400mA 1. ROOM AMBIENT BURN-IN : 13 HRS I/P : 230VAC O/P : FULL LOAD Ta= 26.7 °C 2. HIGH AMBIENT BURN-IN : 6 HRS I/P : 230VAC O/P : FULL LOAD Ta=48.36 °C	<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 26.7 °C</th> <th>HIGH AMBIENT Ta= 48.3°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>C11</td><td>81.3°C</td><td>96.6°C</td></tr> <tr><td>2</td><td>C12</td><td>81.9°C</td><td>97.4°C</td></tr> <tr><td>3</td><td>RG1</td><td>81.5°C</td><td>97.5°C</td></tr> <tr><td>4</td><td>LF2</td><td>71.7°C</td><td>87.0°C</td></tr> <tr><td>5</td><td>BD1</td><td>81.9°C</td><td>97.0°C</td></tr> <tr><td>6</td><td>L1</td><td>70.8°C</td><td>85.9°C</td></tr> <tr><td>7</td><td>L2</td><td>79.0°C</td><td>94.6°C</td></tr> <tr><td>8</td><td>C60</td><td>73.8°C</td><td>90.3°C</td></tr> <tr><td>9</td><td>C5</td><td>79.0°C</td><td>95.8°C</td></tr> <tr><td>10</td><td>C61</td><td>84.1°C</td><td>100.0°C</td></tr> <tr><td>11</td><td>U2</td><td>89.3°C</td><td>109.7°C</td></tr> <tr><td>12</td><td>D91</td><td>85.0°C</td><td>104.1°C</td></tr> <tr><td>13</td><td>C36</td><td>75.1°C</td><td>93.7°C</td></tr> <tr><td>14</td><td>C92</td><td>88.3°C</td><td>105.8°C</td></tr> <tr><td>15</td><td>RTH2</td><td>79.6°C</td><td>98.7°C</td></tr> <tr><td>16</td><td>T1</td><td>93.0°C</td><td>109.6°C</td></tr> <tr><td>17</td><td>C203</td><td>74.5°C</td><td>89.9°C</td></tr> <tr><td>18</td><td>C105</td><td>63.1°C</td><td>78.8°C</td></tr> <tr><td>19</td><td>LF100</td><td>64.0°C</td><td>79.7°C</td></tr> <tr><td>20</td><td>Q1</td><td>76.5°C</td><td>91.5°C</td></tr> <tr><td>21</td><td>D8</td><td>81.7°C</td><td>96.9°C</td></tr> <tr><td>22</td><td>D100</td><td>99.3°C</td><td>114.5°C</td></tr> <tr><td>23</td><td>U905</td><td>70.4°C</td><td>86.5°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 26.7 °C	HIGH AMBIENT Ta= 48.3°C	1	C11	81.3°C	96.6°C	2	C12	81.9°C	97.4°C	3	RG1	81.5°C	97.5°C	4	LF2	71.7°C	87.0°C	5	BD1	81.9°C	97.0°C	6	L1	70.8°C	85.9°C	7	L2	79.0°C	94.6°C	8	C60	73.8°C	90.3°C	9	C5	79.0°C	95.8°C	10	C61	84.1°C	100.0°C	11	U2	89.3°C	109.7°C	12	D91	85.0°C	104.1°C	13	C36	75.1°C	93.7°C	14	C92	88.3°C	105.8°C	15	RTH2	79.6°C	98.7°C	16	T1	93.0°C	109.6°C	17	C203	74.5°C	89.9°C	18	C105	63.1°C	78.8°C	19	LF100	64.0°C	79.7°C	20	Q1	76.5°C	91.5°C	21	D8	81.7°C	96.9°C	22	D100	99.3°C	114.5°C	23	U905	70.4°C	86.5°C		P
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 230VAC/100VAC O/P : 100 % LOAD Ta= -35°C	TEST : OK	P																																																																																																
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 40 °C NO DAMAGE	I/P : 305 VAC O/P : FULL LOAD Ta= 40 °C HUMIDITY= 95 %R.H	TEST : OK	P																																																																																																
4	TEMPERATURE COEFFICIENT	± 0.03 %/°C(0-50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.002 %/°C (0-50°C)	P																																																																																																
5	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																																																																																																



6	THERMAL SHOCK TEST	1. Thermal shock Temperature : -35°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	P
7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10-500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 2G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK	P
8	CAPACITOR LIFE CYCLE	LCM-60: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) 179638HRS (2) 47775HRS (3) 49175HRS (4) 52325HRS	P
9	MTBF	MIL-HDBK-217F NOTICE S2 PARTS COUNT TOTAL FAILURE RATE : 260.6 KHRS		P
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 30,000 hours @ Tcase 80°C 50,000 hours @ Tcase 70°C		P

DATE	SAMPLE	TESTER	REVIEW	APPROVAL
2012/11/29	RD SAMPLE	DANIEL GAO	SANFORD SU	VINCENT TSENG
2013/2/22	PRODUCT SAMPLE W1301A31	DANIEL GAO	SANFORD SU	VINCENT TSENG

2009/08/04 A50-F023