



Test Report: HEP-480-54

480W Single Output Switching 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

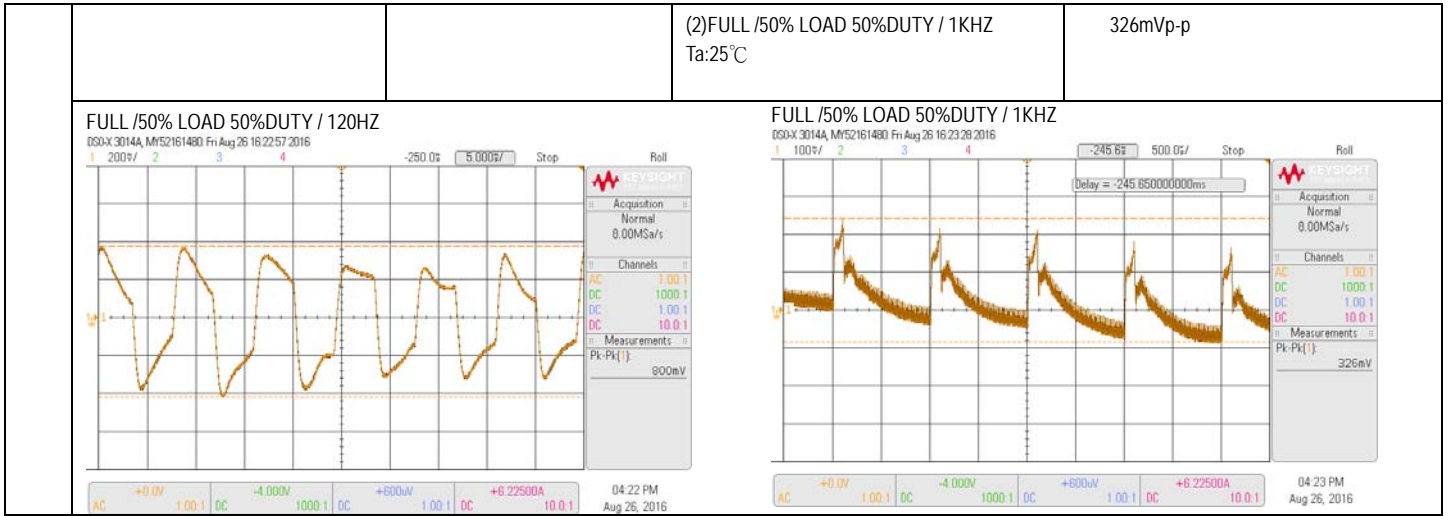
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE ADJUST RANGE	CH1: 45.9 V~ 56.7V	I/P: 230 VAC I/P:115VAC O/P:MIN LOAD Ta:25°C	41.34V~57.91V /230VAC 41.34V~57.91V/115VAC
2	CURRENT ADJ. RANGE	CH1: 4.4 A~ 8.9 A	I/P: 230 VAC I/P:115VAC O/P:CV MIN & CV MAX-1V Ta:25°C	3.77A~11.12A /230VAC@CV MAX-1V 3.77A~11.12A /230VAC@CV MIN 3.77A~11.12A/115VAC@CV MAX-1V 3.77A~11.12A/115VAC@CV MIN
3	OUTPUT VOLTAGE TOLERANCE (Max)	V1:1% ~ -1 %	I/P:100VAC /305AC O/P:FULL/ MIN LOAD Ta:25°C	V1: 0.24%~-0.314 %
4	LINE REGULATION (Max)	V1: 0.5% ~ -0.5 %	I/P:100VAC~305AC O/P:FULL LOAD Ta:25°C	V1: 0.054%~-0.018%
5	LOAD REGULATION (Max)	V1: 0.5 % ~ -0.5 %	I/P: 230 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.166 %~-0.333%
6	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	TEST: <5 %
7	RIPPLE & NOISE (Max)	V1: 350 mVp-p	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	V1: 199mVp-p
		<div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p>high frequency :</p> </div> <div style="width: 45%;"> <p>low frequency :</p> </div> </div>		
8	SET UP TIME (Max)	230VAC/ 500 ms 115VAC/ 500 ms	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230VAC/ 200ms 115 VAC/ 230ms
		<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p> <p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p>		

<p>9 RISE TIME (Max)</p>	<p>230VAC/ 80 ms 115VAC/ 80 ms</p>	<p>I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta: 25°C</p>	<p>230VAC/ 42.8ms 115 VAC/ 42.4ms</p>
<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage</p>			
<p>10 HOLD UP TIME (Typ.)</p>	<p>230VAC/ 16 ms 115VAC/ 16 ms</p>	<p>I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta: 25°C</p>	<p>230VAC/ 29.6ms 115 VAC/ 29.2ms</p>
<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p>			
<p>11 DYNAMIC LOAD</p>	<p>V1: 5400 mVp-p</p>	<p>I/P: 230VAC O/P: (1) FULL /50% LOAD 50% DUTY / 120HZ</p>	<p>800mVp-p</p>

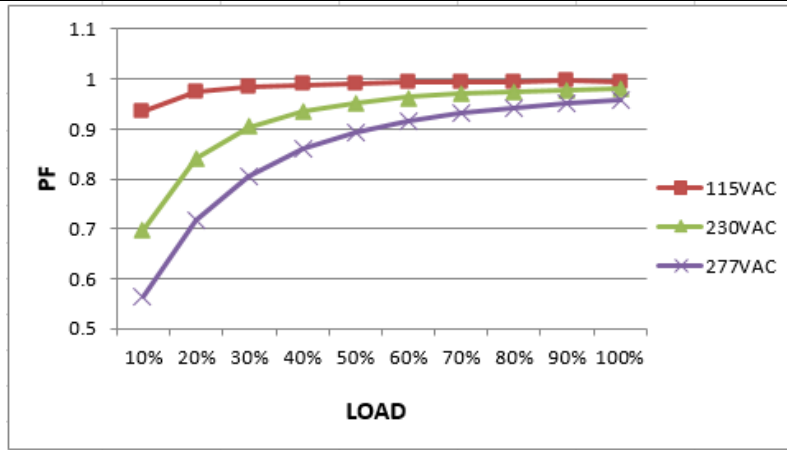
(2)FULL /50% LOAD 50%DUTY / 1KHZ
Ta:25°C

326mVp-p



INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~305 VAC	I/P:TESTING O/P:FULL LOAD Ta:25°C	72V~305 V
			I/P: LOW-LINE-3V=87 V HIGH-LINE+10V=315 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 100 VAC ~305VAC O/P:FULL-MIN LOAD Ta:25°C	OK
3	INPUT CURRENT (TYP)	277VAC/ 2 A 230 VAC/ 2.45 A 115 VAC/ 5 A	I/P: 277VAC/230 VAC/115 VAC O/P:FULL LOAD Ta:25°C	I=1.79 A/277VAC I = 2.12A/ 230VAC I = 4.25A/ 115VAC
4	LEAKAGE CURRENT	< 0.75 mA/ 277VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25°C	L-FG: 0.24mA N-FG: 0.25mA
5	POWER FACTOR(TYP)	0.97/230 VAC FULL LOAD	I/P: 230 VAC/115VAC/277VAC O/P:FULL LOAD Ta:25°C	PF= 0.981 /230V/100%LOAD
		0.98/115 VAC FULL LOAD		PF= 0.997/115V/100%LOAD
		0.95/277 VAC FULL LOAD		PF= 0.958/277V/100%LOAD



6	EFFICIENCY (TYP)	95 %	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	95.01% /230V
7	INRUSH CURRENT (TYP)	230 V/35A COLD START	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	I =33.1 A/ 230VAC
<p>INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current (1V=1A)</p>				

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %- 125 % PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed	I/P: 305VAC I/P: 230VAC I/P: 100VAC O/P:TESTING Ta:25°C	110%/ 305VAC 110%/ 230VAC 110%/100VAC PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	V1: 60 V- 70 V PROTECTION TYPE : Shut down output voltage, re-power on to recovery	I/P: 305VAC I/P: 230VAC I/P: 90VAC O/P:MIN LOAD Ta:25°C	61.02V/ 305VAC 61.14V/ 230VAC 61.13V/ 90VAC PROTECTION TYPE : Shut down output voltage, re-power on to recovery

3	OVER TEMPERATURE PROTECTION	PROTECTION TYPE : Shut down output voltage, re-power on to recovery	I/P: 305 VAC I/P: 90 VAC O/P: FULL LOAD	O.T.P Active PROTECTION TYPE : Shut down output voltage, re-power on to recovery
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed	I/P: 305VAC I/P: 90 VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q 10 Rated 13 A/ 650 V Q 13 Rated 13 A/ 650V	I/P: High-Line +3V =308V AC ON/OFF VDS: O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7) 0%→400% Load. Ta:25°C	Q10 Q13 VDS: (1) 478V (2) 470V (3) 478V (4) 478V (5) 482V (6) 478V (7) 466V VDS: (1) 530V (2) 518V (3) 526V (4) 526V (5) 530V (6) 526V (7) 518V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated 13 A/650V	I/P: High-Line +3V =305V AC ON/OFF O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7) 0%→400% Load. Ta:25°C	VDS: (1) 530V (2) 474V (3) 526V (4) 530V (5) 522V (6) 538V (7) 470V
3	P.F.C DIODE	D8 Rated 12A/ 600V	I/P: High-Line +3V =305V AC ON/OFF O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (4) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25°C	308V (1) 502V (2) 466V (3) 482V (4) 490V
4	Diode Peak Voltage	Q120 Rated 43A/150V	I/P: High-Line +3V =305V AC ON/OFF O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/	Q120: VDS: (1) 124.3V (2) 25.4V (3) 124.3V Q121: VDS: (1) 119V (2) 57V (3) 119V

		Q121 Rated 43A/150V	Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. (8).NO LOAD Ta:25°C	(4) 124.3V (5) 130.7V (6) 123.5V (7) 142V (8)140V	(4) 123V (5) 123V (6) 119V (7) 127V (8) 121V
5	Input Capacitor Voltage	C5 Rated: 150 μ / 450V	I/P:High-Line +3V =308V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue Ta:25°C	(1) 447V (2) 449V (3) 447V (4) 443V	
6	Control IC Voltage Test	PWM IC U2 Rated 16V~ 8.85V(MIN.) PFC IC U1 Rated 20V~10.5V(MIN.)	I/P:High-Line +3V =305V AC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. Ta:25°C	U2 (1) 13.5V (2) 13.98V (3) 13.74V (4) 13.42V	U1 (1) 14.9V (2) 14.42V (3) 14.42V (4) 14.4V

SAFETY & EMC TEST REPORT

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	IEC60950-1 I/P-O/P: 3.75KVAC/min I/P-FG:2 KVAC/min O/P-FG:1.5KVAC/min	I/P-O/P: 4.125 KVAC/min I/P-FG: 2.4KVAC/min O/P-FG: 1.8 KVAC/min Ta:25°C	I/P-O/P: 5.67mA I/P-FG: 4.61 mA O/P-FG: 6.18mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100M Ω I/P-FG: 500VDC>100M Ω O/P-FG:500VDC>100M Ω	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P: 30 G Ω I/P-FG: 30G Ω O/P-FG: 30G Ω NO DAMAGE
3	GROUNDING CONTINUITY	IEC60950-1 FG(PE) TO CHASSIS OR TRACE < 100 m Ω	40A / 2min Ta:25°C	25m Ω

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS C	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	PASS
2	CONDUCTION	EN55015 CLASS B	I/P: 230 VAC /50HZ O/P:FULL/50% LOAD Ta:25°C	PASS Test by certified Lab
3	RADIATION	EN55015 CLASS B	I/P: 230 VAC /50HZ O/P:FULL LOAD Ta:25°C	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°C	CRITERIA A

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
6	SURGE	IEC61000-4-5 INDUSTRY L-N : 3KV L,N-PE: 6KV	I/P: 230 VAC/50HZ O/P: FULL LOAD Ta: 25°C	CRITERIA A
7	Test by certified Lab & Test Report Prepare			

RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																																												
1	TEMPERATURE RISE TEST	MODEL : HEP-480-48 1. ROOM AMBIENT BURN-IN : 2.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 29.4 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 63.8 °C																																																																																																														
			<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 29.4 °C</th> <th>HIGH AMBIENT Ta= 63.8 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD2</td><td>84.4°C</td><td>97.6°C</td></tr> <tr><td>2</td><td>C10</td><td>81.5°C</td><td>94.7°C</td></tr> <tr><td>3</td><td>Q1</td><td>82.4°C</td><td>95.6°C</td></tr> <tr><td>4</td><td>D8</td><td>84.6°C</td><td>97.6°C</td></tr> <tr><td>5</td><td>Q10</td><td>83.0°C</td><td>96.2°C</td></tr> <tr><td>6</td><td>Q12</td><td>83.7°C</td><td>96.9°C</td></tr> <tr><td>7</td><td>RY1</td><td>83.1°C</td><td>95.9°C</td></tr> <tr><td>8</td><td>ZNR2</td><td>77.8°C</td><td>89.2°C</td></tr> <tr><td>9</td><td>C1</td><td>76.8°C</td><td>88.2°C</td></tr> <tr><td>10</td><td>C5</td><td>77.8°C</td><td>89.8°C</td></tr> <tr><td>11</td><td>L3</td><td>83.0°C</td><td>96.5°C</td></tr> <tr><td>12</td><td>U1</td><td>78.4°C</td><td>89.9°C</td></tr> <tr><td>13</td><td>U2</td><td>79.1°C</td><td>91.1°C</td></tr> <tr><td>14</td><td>T1 Primary side</td><td>83.2°C</td><td>98.0°C</td></tr> <tr><td>15</td><td>T2 Primary side</td><td>85.1°C</td><td>99.2°C</td></tr> <tr><td>16</td><td>Q100</td><td>82.9°C</td><td>98.0°C</td></tr> <tr><td>17</td><td>Q121</td><td>83.0°C</td><td>98.2°C</td></tr> <tr><td>18</td><td>C115</td><td>77.6°C</td><td>91.8°C</td></tr> <tr><td>19</td><td>C117</td><td>75.1°C</td><td>89.2°C</td></tr> <tr><td>20</td><td>LF100</td><td>74.5°C</td><td>88.9°C</td></tr> <tr><td>21</td><td>T500</td><td>78.6°C</td><td>91.6°C</td></tr> <tr><td>22</td><td>C511</td><td>78.8°C</td><td>91.8°C</td></tr> <tr><td>23</td><td>U501</td><td>78.0°C</td><td>91.1°C</td></tr> <tr><td>24</td><td>J101</td><td>77.9°C</td><td>92.5°C</td></tr> <tr><td>25</td><td>RTH2</td><td>79.3°C</td><td>91.8°C</td></tr> <tr><td>26</td><td>C93</td><td>80.6°C</td><td>93.4°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 29.4 °C	HIGH AMBIENT Ta= 63.8 °C	1	BD2	84.4°C	97.6°C	2	C10	81.5°C	94.7°C	3	Q1	82.4°C	95.6°C	4	D8	84.6°C	97.6°C	5	Q10	83.0°C	96.2°C	6	Q12	83.7°C	96.9°C	7	RY1	83.1°C	95.9°C	8	ZNR2	77.8°C	89.2°C	9	C1	76.8°C	88.2°C	10	C5	77.8°C	89.8°C	11	L3	83.0°C	96.5°C	12	U1	78.4°C	89.9°C	13	U2	79.1°C	91.1°C	14	T1 Primary side	83.2°C	98.0°C	15	T2 Primary side	85.1°C	99.2°C	16	Q100	82.9°C	98.0°C	17	Q121	83.0°C	98.2°C	18	C115	77.6°C	91.8°C	19	C117	75.1°C	89.2°C	20	LF100	74.5°C	88.9°C	21	T500	78.6°C	91.6°C	22	C511	78.8°C	91.8°C	23	U501	78.0°C	91.1°C	24	J101	77.9°C	92.5°C	25	RTH2	79.3°C	91.8°C	26	C93	80.6°C	93.4°C	
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : 100 % LOAD Ta= -60 °C	TEST : OK
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60 °C NO DAMAGE	I/P : 315 VAC O/P : FULL LOAD Ta= 60°C HUMIDITY= 95 %R.H	TEST : OK
4	TEMPERATURE COEFFICIENT	± 0.02 %/°C(0-60°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.004 %/°C (0-60°C)
5	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -50°C~ +125°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 100 CYCLE 5. Input/Output condition : STATIC		OK
6	THERMAL SHOCK TEST	1. Thermal shock Temperature : -45°C~ +65°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 16 CYCLE 5. Input/Output condition : 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In 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 : 10G (5) Test Time : 72min in each axis (X.Y.Z) (6) Ta : 25°C		TEST : OK
8	CAPACITOR LIFE CYCLE	SUPPOSE C117 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= 60°C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 60°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 60°C LIFE TIME		(1) 132638HRS (2) 47580HRS (3) 58920HRS (4) 89096HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 89.8K hrs min. MIL-HDBK-217F (25°C)		
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : Above 55,000 hours @ TA 60°C		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT TSENG

12.10.30 A50-F031