Test Report:RPB-1600-12

1600W Intelligent Single Output Battery Charger

■ 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

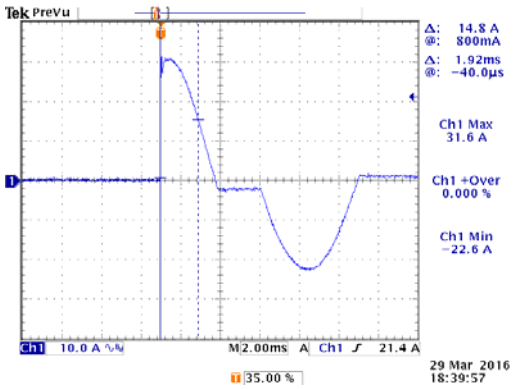
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BOOST CHARGE VOLTAGE(Vboost)(default)	Default, programmable 14.4V±0.12V	I/P: 230 VAC O/P: CV MODE Ta:25℃	14.43V
2	FLOAT CHARGE VOLTAGE	Default, programmable 13.8V±0.12V	I/P: 230 VAC O/P: CV MODE Ta:25℃	13.82V
3	OUTPUT CURRENT	100A±3A	I/P: 230 VAC O/P:CV MODE-2V Ta:25℃	100.4A
4	VOLTAGE ADJ. RANGE	11.5V~15V (D0、-V short)	I/P: 230 VAC O/P:NO LOAD Ta:25℃	11.03V~15.26V/230VAC 11.03V~15.26V/115VAC
5	LEAKAGE CURRENT FROM BATTERY (Typ.)	<1mA	I/P: AC OFF O/P:BATTERY Ta:25℃	3uA

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~264VAC	I/P:TESTING O/P: FULL LOAD Ta:25℃	150 V~ 264 V
			I/P: LOW-LINE-3V=87 V HIGH-LINE+15%= 300 V O/P: FULL LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec . OFF: 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE)	TEST: OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 100 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	LEAKAGE CURRENT	< 2 mA / 240VAC	I/P: 240 VAC O/P:Min LOAD Ta:25℃	L-FG: 0.74 mA N-FG:0.74 mA
4	INPUT CURRENT (TYP)	230 V/ 8 A 115 V/ 14 A	I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD (PLEASE CHECK DERATING CURVE) Ta:25℃	I =7.49A/ 230VAC I =12.41A/ 115VAC
5	POWER FACTOR (TYP)	0.97/ 230 VAC	I/P: 230 VAC O/P: FULL LOAD Ta:25℃	PF= 0.977 / 230VAC
6	EFFICIENCY (TYP)	91%	I/P: 230 VAC O/P: FULL LOAD Ta:25℃	91.1 %
7	INRUSH CURRENT(Typ.)	230V/35 A COLD START	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I =31.6A/ 230VAC T50= 1920 us/230V

INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Input current

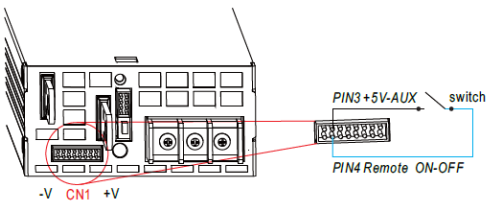


PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER VOLTAGE PROTECTION	15.75 V~ 18.75 V PROTECTION TYPE： Shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 90VAC O/P:MIN LOAD Ta:25℃	17.5V/ 264VAC 17.5V/ 230VAC 17.5V/ 90VAC PROTECTION TYPE： Shut down o/p voltage, re-power on to recover
2	OVER TEMPERATURE PROTECTION	NO DAMAGE PROTECTION TYPE： Shut down o/p voltage, recovers automatically after temperature goes down	I/P: 264VAC I/P: 90VAC O/P:FULL LOAD	O.T.P. Active PROTECTION TYPE： Shut down o/p voltage, recovers automatically after temperature goes down

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	AUXILIARY POWER (AUX)	1. 5V±10%@0.3A ripple:150mVp-p 2. 12V±10%@0.8A ripple:250mVp-p	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	4.74 V 0.3 A ；ripple: 24mVp-p 11.28V 0.8 A；ripple: 195 mVp-p
2	REMOTE ON/OFF CONTROL	The power supply can be turned ON/OFF individually or along with other units in parallel by using the "Remote ON-OFF" function.		



Between Remote ON-OFF and +5V-AUX	Power Supply Status
Switch Short	ON
Switch Open	OFF

I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：

Between Remote ON-OFF and +5V-AUX	OUTPUT
SW SHORT	ON
SW OPEN	OFF

3 ALARM SIGNAL

1. DC OK SIGNAL
   High (4.5 ~ 5.5V) : When the Vout≦ 8V/16V/32V ±1V.
   Low (0 ~ 0.5V) : When Vout≧ 8V/16V/32V ±1V. The maximum sourcing current is 10mA and only for output.
   DC OK is associated with battery low protection.
   I/P: 230 VAC
   O/P:FULL LOAD
   Ta:25℃
   Test Result：

Vout	DC OK SIGNAL
Vout≦ 75%	5V
Vout≧ 85%	-0.09V

2. T-ALARM

P.S.U STATUS	Vo	T-ALARM
NORMAL	100%±2%	-0.1 ~0.5V
OTP OR FAN LOCK	0V	4.5~5.5V

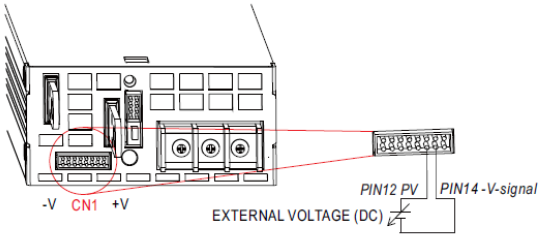
   I/P: 230 VAC
   O/P:FULL LOAD
   Ta:25℃
   Test Result：

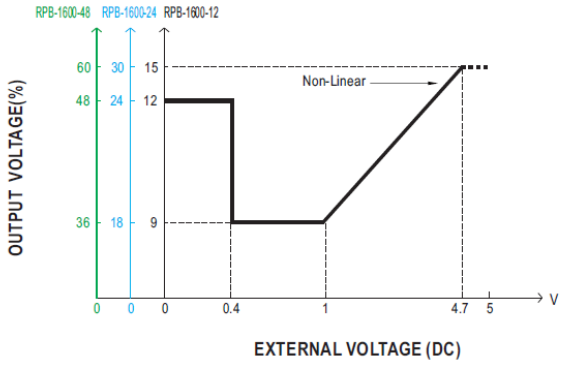
P.S.U STATUS	T-ALARM
NORMAL	-0.09V
OTP OR FAN LOCK	4.937V

4 OUTPUT VOLTAGE PROGRAMMABLE(PV)

(D0、-V short)

※ In addition to the adjustment via the built-in potentiometer, the output voltage can be trimmed by applying EXTERNAL VOLTAGE.





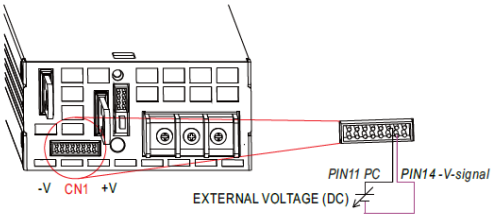
I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：

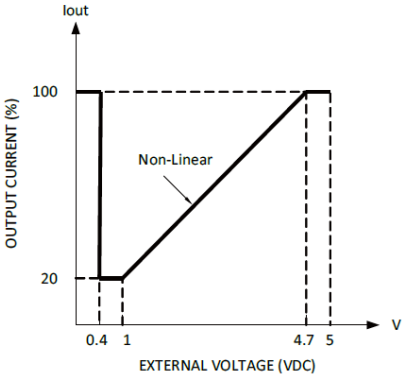
PV / MODEL	<0.4V	1V	4.7V	5V
SPEC	12V±5%	9V±5%	15V±5%	15V±5%
Vout	12.088V	8.941V	14.929V	15.132V

5 OUTPUT CURRENT PROGRAMMABLE (PC)

(D0、-V short)

※ The output current can be trimmed to 20~100% of the rated current by applying EXTERNAL VOLTAGE.



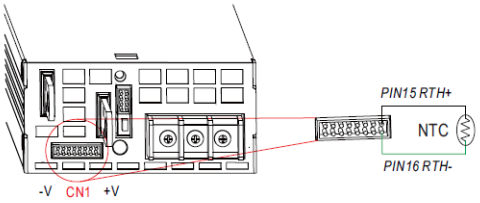


I/P: 230 VAC
O/P:TESTING
Ta:25℃
Test Result：

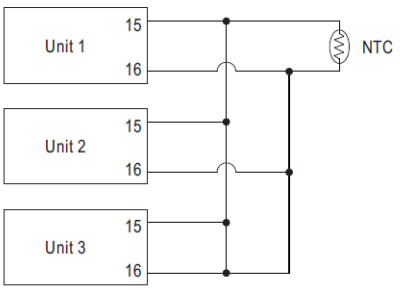
ADJ V	<0.4V	1V	4.7V	5V
SPEC	100%±10%	20%±10%	100%±10%	100%±10%
Iout	101.6%	19.8%	100.8%	101.68%

6 Temperature Compensation

Temperature sense associated with the temperature compensation function.



◎ To exploit the temperature compensation function, please attach the temperature sensor, NTC, which is enclosed with the charger, to the battery or the battery's vicinity.
◎ The charger is able to work normally without the NTC.



When multiple chargers are connected in parallel, please configure with the NTC as exhibited in the diagram .
If the temperature compensation is not required, RTH+ (PIN15) and RTH- (PIN16) from each unit still need to be connected.

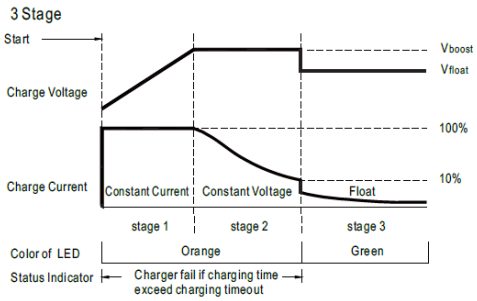
I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：

TEMP	Voltage compensation	Temperature compensation	
		BEFORE	AFTER
(Ta=0℃)	14.4V = + 0.45V ±0.12V	14.438V	14.871V
(Ta=25℃)	14.4V = 0V	14.443V	14.443V
(Ta=50℃)	14.4V = - 0.45V ±0.12V	14.444V	14.038V

7 Charging Curve

※ By factory default, this charger performs the default curve which can be programmed via PMBus.
※ To disable / enable the charging curve, change to a 2 stage curve, a different curve frequently used for certain types of batteries in the industry, and so on, please refer to the Installation Manual.

◎ Default 3 stage charging curve



◎ Embedded 3 stage charging curve

MODEL	Description	Vboost	Vfloat
12V	Default, programmable	14.4	13.8
	Pre-defined, gel batter	14	13.6
	Pre-defined, flooded battery	14.2	13.4
	Pre-defined, AGM battery	14.5	13.5
24V	Default, programmable	28.8	27.6
	Pre-defined, gel batter	28	27.2
	Pre-defined, flooded battery	28.4	26.8
	Pre-defined, AGM battery	29	27
48V	Default, programmable	57.6	55.2
	Pre-defined, gel batter	56	54.4
	Pre-defined, flooded battery	56.8	53.6
	Pre-defined, AGM battery	58	54

◎ Suitable for lead-acid batteries (flooded, Gel and AGM) and Li-ion batteries (lithium iron and lithium manganese).

I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：

MODEL	Constant voltage(V_{boost})	Float (V_{float})	Turn state current
12V	14.4V± 0.12V	13.8V± 0.12V	10A± 3A
	14.43V	13.82V	9.85A

8 LED Status Indicators

LED	Description
Green	Float (stage 3)
Orange	Charging (stage 1 or stage 2)
Red	Abnormal status (OTP, OLP, Fan Fail, Charging timeout.)

TEST：OK

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q901 Rated 37A/600V	I/P:High-Line +3V =267V AC ON/OFF VDS: O/P: (1)Full Load Ta:25℃	VDS: (1)494V
2	P.F.C Transistor (D to S) or (C to E) **Peak Voltage**	Q52 Rated 52 A/600 V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load Ta:25℃	VDS: (1)439V
4	Input Capacitor Voltage	C5 Rated: 680 μ /400V SURGE VOLTAGE:450V	I/P:High-Line +3V =267 V O/P: (1)Full Load Ta:25℃	(1)395V
5	Control IC Voltage Test	PWM IC U901 Rated 6.5 V~24 V PFC IC U51 Rated 6V~16V O/P IC U142 Rated 4V~ 15V	I/P:High-Line +3V =267 V AC ON/OFF O/P(1)FULL LOAD Ta:25℃	U901 U51 U142 13.4 V 12.93V 12.5 V
6	Transistor	Q154 Rated： 100A/40V	I/P:High-Line +3V =267 V O/P: (1)FULL LOAD	 (1)2.4 V
7	Transistor	Q163 Rated：	I/P:High-Line +3V =267 V	(1)0.948V

		3.8A/100V	O/P: (1) FULL LOAD (2)NO LOAD	(2)0.744V
8	Diode Peak **Voltage**	Q101 Rated 210A/75V VGS:±20V Q104 Rated 210A/75V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1) FULL LOAD (2)Output Short (3).NO LOAD Ta:25℃	VDS: (1)58.4V (2)51.2V (3)61.0V VDS: (1)49.4V (2)51.4V (3)72.3V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG : 2KVAC/min O/P-FG:1.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.8 KVAC/min Ta:25℃	I/P-O/P:6.23mA I/P-FG:5.77mA O/P-FG:6.08m A NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25℃	I/P-O/P: 7.28GΩ I/P-FG: 5.7GΩ O/P-FG: 9.2GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	17mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:100% LOAD Ta:25℃	PASS
2	CONDUCTION	EN55022 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL/50% LOAD Ta：25℃	PASS Test by certified Lab
3	RADIATION	EN55022 CLASS A	I/P： 230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 INDUSTRY AIR：8KV / Contact：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT： 2KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N ：2KV L,N-PE：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
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： RPB-1600-24
1. ROOM AMBIENT BURN-IN：1 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 28.3 ℃
2. HIGH AMBIENT BURN-IN： 3 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 52.5 ℃</td></tr>
<tr><td colspan="5">
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 28.3 ℃</th><th>HIGH AMBIENT Ta= 52.5 ℃</th></tr>
<tr><td>1</td><td>Q901</td><td>48.6℃</td><td>72.3℃</td></tr>
<tr><td>2</td><td>Q904</td><td>75.5℃</td><td>81.5℃</td></tr>
<tr><td>3</td><td>Q52</td><td>63.2℃</td><td>87.8℃</td></tr>
<tr><td>4</td><td>D50</td><td>68.9℃</td><td>99.6℃</td></tr>
<tr><td>5</td><td>BD1</td><td>58.1℃</td><td>85.6℃</td></tr>
<tr><td>6</td><td>L900</td><td>45.9℃</td><td>68.6℃</td></tr>
<tr><td>7</td><td>T3</td><td>37.6℃</td><td>61.7℃</td></tr>
<tr><td>8</td><td>RG301</td><td>53.9℃</td><td>81.7℃</td></tr>
<tr><td>9</td><td>RG302</td><td>51.7℃</td><td>76.2℃</td></tr>
<tr><td>10</td><td>C302</td><td>30.3℃</td><td>55.3℃</td></tr>
<tr><td>11</td><td>C355</td><td>38.1℃</td><td>59.4℃</td></tr>
<tr><td>12</td><td>T1</td><td>30.2℃</td><td>76.1℃</td></tr>
<tr><td>13</td><td>Q101</td><td>47.8℃</td><td>76.0℃</td></tr>
<tr><td>14</td><td>Q104</td><td>48.7℃</td><td>77.2℃</td></tr>
<tr><td>15</td><td>U921</td><td>41.9℃</td><td>70.4℃</td></tr>
<tr><td>16</td><td>C5</td><td>38.4℃</td><td>64.2℃</td></tr>
<tr><td>17</td><td>L100</td><td>65.7℃</td><td>97.8℃</td></tr>
<tr><td>18</td><td>C980</td><td>33.4℃</td><td>63.9℃</td></tr>
<tr><td>19</td><td>C11</td><td>42.8℃</td><td>69.2℃</td></tr>
<tr><td>20</td><td>ZNR1</td><td>46.0℃</td><td>70.9℃</td></tr>
<tr><td>21</td><td>ZNR2</td><td>42.3℃</td><td>75.6℃</td></tr>
<tr><td>22</td><td>LF1</td><td>43.8℃</td><td>69.7℃</td></tr>
<tr><td>23</td><td>C2</td><td>43.0℃</td><td>69.7℃</td></tr>
<tr><td>24</td><td>D2</td><td>42.9℃</td><td>65.1℃</td></tr>
<tr><td>25</td><td>L1</td><td>49.1℃</td><td>77.9℃</td></tr>
<tr><td>26</td><td>L2</td><td>51.0℃</td><td>79.1℃</td></tr>
<tr><td>27</td><td>RY1</td><td>45.3℃</td><td>71.4℃</td></tr>
<tr><td>28</td><td>C101</td><td>47.0℃</td><td>73.6℃</td></tr>
<tr><td>29</td><td>T52</td><td>37.9℃</td><td>65.3℃</td></tr>
<tr><td>30</td><td>RTH21</td><td>54.0℃</td><td>76.4℃</td></tr>
<tr><td>31</td><td>RTH9</td><td>45.3℃</td><td>72.3℃</td></tr>
<tr><td>32</td><td>U671</td><td>43.8℃</td><td>70.0℃</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： 230VAC/180VAC
O/P： 100 % LOAD
Ta= -35℃ / -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 50 ℃
NO DAMAGE</td><td>I/P： 272 VAC
O/P：FULL LOAD
Ta= 50 ℃
HUMIDITY= 95 %R.H</td><td>TEST：OK</td></tr>
</table>

4	TEMPERATURE COEFFICIENT	± 0.03 %/℃(0~50℃)	I/P： 230 VAC O/P：FULL LOAD	± 0.005 %/℃(0~50℃)
5	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature： -45℃~ +90℃ 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
6	THERMAL SHOCK TEST	1. Thermal shock Temperature： -35℃~ +55℃ 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： 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST(13500 TIMES) 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：2G (5) Test Time：60min in each axis (X.Y.Z) (6) Ta：25℃		TEST：OK
8	CAPACITOR LIFE CYCLE	SUPPOSE C101 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= 50℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 50℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 50℃ LIFE TIME		(1) 781466HRS (2) 119480HRS (3) 179758HRS (4) 222934HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 154K hrs min. Telcordia SR-332 (Bellcore) ; 100.3K hrs min. MIL-HDBK-217F (25℃)		
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 50,000 hours @ TA 50℃		

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

12.10.30 A50-F031