



Test Report: HVG-150-12

150W 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

■ ESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RIPPLE & NOISE	V1 : 150 mVp-p (Max)	I/P : 347VAC O/P : FULL LOAD Ta : 25°C	V1 : 9.20 mVp-p (Max)
2	CONSTANT CURRENT REGION	7.2V~12V	I/P: 230 VAC O/P:CV MODE Ta:25°C	O/P=7.2V : 10.232 A O/P=11V : 10.241 A
3	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 10.8V ~ 13.5 V	I/P : 480 VAC I/P : 347 VAC O/P : MIN LOAD Ta : 25°C	10.466 V ~ 13.939 V/ 480 VAC 10.461 V ~ 13.939 V/ 347 VAC
4	OUTPUT CURRENT ADJUST RANGE	CH1 : 6A~10 A	I/P : 480 VAC I/P : 347 VAC O/P : CV MODE Ta : 25°C	5.443 A~ 11.116 A/ 480 VAC 5.438 A~ 11.121 A/ 347 VAC
5	OUTPUT VOLTAGE TOLERANCE	V1 : 2.5%~-2.5 % (Max)	I/P : 180 VAC / 480 VAC O/P : FULL/ MIN LOAD Ta : 25°C	V1 : 0.6 %~-0.6 %
6	LINE REGULATION	V1 : 0.5 %~-0.5% (Max)	I/P : 180 VAC ~ 480 VAC O/P : FULL LOAD Ta : 25°C	V1 : 0 %~-0 %
7	LOAD REGULATION	V1 : 2 %~-2% (Max)	I/P : 347 VAC O/P : FULL ~MIN LOAD Ta : 25°C	V1 : 0.6 %~-0.6 %
8	SET UP TIME	480 VAC : 400 ms (Max) 347VAC : 400 ms(Max) 230VAC : 500 ms(Max)	I/P : 480 VAC I/P : 347 VAC I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	480 VAC/ 221 ms 347VAC/ 280 ms 230VAC/ 342 ms
9	RISE TIME	480 VAC : 80 ms (Max) 347VAC : 80 ms (Max) 230VAC : 80 ms (Max)	I/P : 480 VAC I/P : 347 VAC I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	480 VAC/ 40 ms 347VAC/ 61 ms 230VAC/ 61 ms
10	HOLD UP TIME	480 VAC : 18 ms (TYP) 347VAC : 18 ms (TYP)	I/P : 480 VAC I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	480 VAC/ 46 ms 347VAC/ 30 ms
11	OVER/UNDERSHOOT TEST	< ±5%	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %

12	DYNAMIC LOAD	V1 : 1200 mVp-p	I/P : 347VAC (1).O/P : FULL /Min LOAD 90%DUTY/ 1KHZ (2).O/P : FULL /Min LOAD 90%DUTY/ 3KHZ (3).O/P : FULL /Min LOAD 90%DUTY/ 5KHZ (4).O/P : FULL /Min LOAD 50%DUTY/ 120HZ Ta : 25℃	(1)860 mVp-p (2)656 mVp-p (3)616 mVp-p (4)810 mVp-p																																																																																																																																																																																																						
13	<div>DIMMER TEST (B Type only) SPEC: ※Built-in 3 in 1 dimming function, IP67 rated. Output constant current level can be adjusted through output cable by connecting a resistance or 0 ~ 10Vdc or 10V PWM signal between DIM+ and DIM-. ※Please DO NOT connect "DIM-" to "-V". ※Reference resistance value for output current adjustment (Typical)</div> <table><tr><td>Resistance value</td><td>Short</td><td>10K</td><td>20K</td><td>30K</td><td>40K</td><td>50K</td><td>60K</td><td>70K</td><td>80K</td><td>90K</td><td>100K</td><td>OPEN</td></tr><tr><td>Output current</td><td>0%</td><td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td><td>95%~108%</td></tr></table> <div>*1 ~ 10V dimming function for output current adjustment (Typical)</div> <table><tr><td>Dimming value</td><td>Short</td><td>1V</td><td>2V</td><td>3V</td><td>4V</td><td>5V</td><td>6V</td><td>7V</td><td>8V</td><td>9V</td><td>10V</td><td>OPEN</td></tr><tr><td>Output current</td><td>0%</td><td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td><td>95%~108%</td></tr></table> <div>*10V PWM signal for output current adjustment (Typical) : Frequency range :100Hz ~ 3KHz</div> <table><tr><td>Duty value</td><td>Short</td><td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td><td>OPEN</td></tr><tr><td>Output current</td><td>0%</td><td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td><td>95%~108%</td></tr></table> <div>TEST RESULT: I/P : 230 VAC ;Ta : 25℃</div> <table><tr><td rowspan="3">1</td><td>Resistance value</td><td>SHORT</td><td>10K</td><td>20K</td><td>30K</td><td>40K</td><td>50K</td><td>60K</td><td>70K</td><td>80K</td><td>90K</td><td>100K</td><td>OPEN</td></tr><tr><td>Output current</td><td>0.000A</td><td>1.010A</td><td>2.010A</td><td>3.020A</td><td>4.030A</td><td>5.060A</td><td>6.060A</td><td>6.990A</td><td>7.970A</td><td>9.050A</td><td>10.020A</td><td>10.364A</td></tr><tr><td>%</td><td>0.00%</td><td>10.10%</td><td>20.10%</td><td>30.20%</td><td>40.30%</td><td>50.60%</td><td>60.60%</td><td>69.90%</td><td>79.70%</td><td>90.50%</td><td>100.20%</td><td>103.64%</td></tr><tr><td rowspan="3">2</td><td>Dimming value</td><td>SHORT</td><td>1V</td><td>2V</td><td>3V</td><td>4V</td><td>5V</td><td>6V</td><td>7V</td><td>8V</td><td>9V</td><td>10V</td><td>OPEN</td></tr><tr><td>Output current</td><td>0.000A</td><td>0.960A</td><td>1.980A</td><td>2.980A</td><td>3.980A</td><td>4.980A</td><td>5.990A</td><td>7.000A</td><td>8.000A</td><td>9.000A</td><td>100.00A</td><td>10.364A</td></tr><tr><td>%</td><td>0.00%</td><td>9.60%</td><td>19.80%</td><td>29.80%</td><td>39.80%</td><td>49.80%</td><td>59.90%</td><td>70.00%</td><td>80.00%</td><td>90.00%</td><td>10.00%</td><td>103.64%</td></tr><tr><td rowspan="3">3</td><td>Duty value</td><td>SHORT</td><td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td><td>OPEN</td></tr><tr><td>Output current</td><td>0.000A</td><td>1.280A</td><td>2.250A</td><td>3.220A</td><td>4.200A</td><td>5.170A</td><td>6.140A</td><td>7.110A</td><td>8.090A</td><td>9.050A</td><td>10.020A</td><td>10.364A</td></tr><tr><td>%</td><td>0.00%</td><td>12.80%</td><td>22.50%</td><td>32.20%</td><td>42.00%</td><td>51.70%</td><td>61.40%</td><td>71.10%</td><td>80.90%</td><td>90.50%</td><td>100.20%</td><td>103.64%</td></tr></table>				Resistance value	Short	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN	Output current	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	95%~108%	Dimming value	Short	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN	Output current	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	95%~108%	Duty value	Short	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN	Output current	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	95%~108%	1	Resistance value	SHORT	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN	Output current	0.000A	1.010A	2.010A	3.020A	4.030A	5.060A	6.060A	6.990A	7.970A	9.050A	10.020A	10.364A	%	0.00%	10.10%	20.10%	30.20%	40.30%	50.60%	60.60%	69.90%	79.70%	90.50%	100.20%	103.64%	2	Dimming value	SHORT	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN	Output current	0.000A	0.960A	1.980A	2.980A	3.980A	4.980A	5.990A	7.000A	8.000A	9.000A	100.00A	10.364A	%	0.00%	9.60%	19.80%	29.80%	39.80%	49.80%	59.90%	70.00%	80.00%	90.00%	10.00%	103.64%	3	Duty value	SHORT	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN	Output current	0.000A	1.280A	2.250A	3.220A	4.200A	5.170A	6.140A	7.110A	8.090A	9.050A	10.020A	10.364A	%	0.00%	12.80%	22.50%	32.20%	42.00%	51.70%	61.40%	71.10%	80.90%	90.50%	100.20%	103.64%
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INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC~528 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	164V~480V
			I/P : LOW-LINE-3V=177V HIGH-LINE+3V=531 V O/P : FULL/MIN LOAD 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 : 180VAC ~ 528 VAC O/P : FULL~MIN LOAD Ta : 25°C	TEST : OK
3	POWER FACTOR	0.98 / 230 VAC(TYP) 0.97 / 277VAC(TYP) 0.95 /347 VAC(TYP) 0.93 / 480 VAC(TYP)	I/P : 230VAC I/P : 277VAC I/P : 347VAC I/P : 480VAC O/P : FULL LOAD Ta : 25°C	PF= 0.991 / 230 VAC PF= 0.992 / 277 VAC PF= 0.980 / 347VAC PF= 0.952 / 480VAC
4	EFFICIENCY	87 % (TYP)	I/P : 347 VAC O/P : FULL LOAD Ta : 25°C	87.3 %
5	INPUT CURRENT	347V/ 0.45 A (TYP) 480V/ 0.35 A (TYP)	I/P : 347 VAC I/P : 480 VAC O/P : FULL LOAD Ta : 25°C	I = 0.4 A/ 347 VAC I = 0.3 A/ 480 VAC
6	INRUSH CURRENT	480V/ 35 A (TYP) (twidh=790 us measured at 50% Ipeak) COLD START	I/P : 480VAC O/P : FULL LOAD Ta : 25°C	I = 25 A/ 480VAC T50= 789 us
7	LEAKAGE CURRENT	< 0.75 mA / 480 VAC	I/P : 480 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.36 mA N-FG : 0.36 mA
8	TOTAL HARMONIC DISTORTION	Total harmonic distortion will be lower than 20% when output loading is 60% or higher at 230VAC / 277VAC / 347VAC	I/P : 230VAC I/P : 277VAC I/P : 347VAC O/P : 60% LOAD Ta : 25°C	THD : 5.33 THD : 6.83 THD : 6.35
		Total harmonic distortion will be lower than 20% when output loading is 75% or higher at 480VAC	I/P : 480VAC O/P : 75% LOAD Ta : 25°C	THD : 9.38

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	95% ~ 108%	I/P : 480 VAC I/P : 347 VAC O/P : TESTING Ta : 25°C	102%/ 480 VAC 102%/ 347 VAC Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	CH1 : 14.4V ~ 16.8 V	I/P : 480 VAC I/P : 347 VAC O/P : MIN LOAD Ta : 25°C	15.676 V/ 480VAC 15.707 V/ 347 VAC Shut down o/p voltage with auto-recovery or re-power on to recovery
3	OVER TEMPERATURE PROTECTION	SPEC : NO DAMAGE	I/P : 347 VAC O/P : FULL LOAD	O.T.P. Active Shut down o/p voltage, recovers automatically after temperature goes down
4	SHORT PROTECTION	NO DAMAGE	I/P : 528VAC O/P : FULL LOAD Ta : 25°C	NO DAMAGE Constant current limiting, recovers automatically after fault condition is removed

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q3 Rated : 7A/950V	I/P : High-Line +3V = 531 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 872 V (2) 384 V (3) 840 V
2	Diode Peak Voltage	Q101 Rated : 79A/60V	I/P : High-Line +3V = 531 V O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C	(1) 42.2 V (2) 24.8 V (3) 38.2 V
3	Input Capacitor Voltage	C5 Rated : 56u/450V	I/P : High-Line +3V = 531 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) 424 V (2) 428 V (3) 448 V
4	Control IC Voltage Test	U1 Rated : 10.3V~22.5V U2 Rated : 11V~28V	I/P : High-Line +3V = 531 V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Ta : 25°C	(1) 17.9 V (2) 17.8 V (3) 17.9 V (4) 16.8 (5) 16.5 (6) 16.8

5	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : 7A/950V	I/P : High-Line +3V = 531 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 892 V (2) 832 V (3) 852 V
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SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P : 3.75 KVAC/min I/P-FG : 2 KVAC/min O/P-FG : 1.5 KVAC/min	I/P-O/P : 4 KVAC/min I/P-FG : 2.4 KVAC/min O/P-FG : 1.8 KVAC/min Ta : 25°C	I/P-O/P : 3.59 mA I/P-FG : 2.568 mA O/P-FG : 3.51 mA 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°C /70%RH	I/P-O/P : 17 GΩ I/P-FG : 30 GΩ O/P-FG : 30 GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25°C / 70%RH	15 mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A CLASS C	I/P: 347V/230VAC/60HZ O/P:100%ELECTRONIC LOAD O/P:100% LED LOAD Ta:25°C	PASS
2	CONDUCTION	EN55015 CLASS B	I/P: 230/347VAC (50HZ) O/P:FULL/50% LOAD Ta:25°C	PASS Test by certified Lab
3	RADIATION	EN55015 CLASS B	I/P: 230/347 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:230/347 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT : 1KV	I/P: 230/347 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV L,N-PE:4KV	I/P: 230/347 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A

RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																												
1	TEMPERATURE RISE TEST	<div>MODEL : HVG-150-15</div> <div>1. ROOM AMBIENT BURN-IN : 13 HRS</div> <div>I/P : 347VAC O/P : FULL LOAD Ta= 28.4 °C</div> <div>2. HIGH AMBIENT BURN-IN : 3 HRS</div> <div>I/P : 347VAC O/P : FULL LOAD Ta=60.8 °C</div> <table><thead><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=28.4 °C</th><th>HIGH AMBIENT Ta=60.8 °C</th></tr></thead><tbody><tr><td>1</td><td>LF2</td><td>57.8°C</td><td>83.7°C</td></tr><tr><td>2</td><td>BD1</td><td>60.3°C</td><td>85.9°C</td></tr><tr><td>3</td><td>L2</td><td>67.3°C</td><td>93.5°C</td></tr><tr><td>4</td><td>C48</td><td>61.1°C</td><td>86.7°C</td></tr><tr><td>5</td><td>C46</td><td>60.1°C</td><td>85.7°C</td></tr><tr><td>6</td><td>C15</td><td>65.1°C</td><td>90.7°C</td></tr><tr><td>7</td><td>Q1</td><td>65.0°C</td><td>90.7°C</td></tr><tr><td>8</td><td>C5</td><td>66.8°C</td><td>91.2°C</td></tr><tr><td>9</td><td>Q4</td><td>69.7°C</td><td>95.2°C</td></tr><tr><td>10</td><td>C62</td><td>64.3°C</td><td>88.8°C</td></tr><tr><td>11</td><td>RTH2</td><td>64.0°C</td><td>88.5°C</td></tr><tr><td>12</td><td>T1</td><td>75.7°C</td><td>100.3°C</td></tr><tr><td>13</td><td>C203</td><td>71.2°C</td><td>96.5°C</td></tr><tr><td>14</td><td>Q101</td><td>75.2°C</td><td>100.5°C</td></tr><tr><td>15</td><td>C104</td><td>68.4°C</td><td>93.8°C</td></tr><tr><td>16</td><td>C105</td><td>65.2°C</td><td>91.1°C</td></tr><tr><td>17</td><td>C106</td><td>64.8°C</td><td>90.5°C</td></tr><tr><td>18</td><td>U2</td><td>64.8°C</td><td>88.6°C</td></tr></tbody></table>			NO	Position	ROOM AMBIENT Ta=28.4 °C	HIGH AMBIENT Ta=60.8 °C	1	LF2	57.8°C	83.7°C	2	BD1	60.3°C	85.9°C	3	L2	67.3°C	93.5°C	4	C48	61.1°C	86.7°C	5	C46	60.1°C	85.7°C	6	C15	65.1°C	90.7°C	7	Q1	65.0°C	90.7°C	8	C5	66.8°C	91.2°C	9	Q4	69.7°C	95.2°C	10	C62	64.3°C	88.8°C	11	RTH2	64.0°C	88.5°C	12	T1	75.7°C	100.3°C	13	C203	71.2°C	96.5°C	14	Q101	75.2°C	100.5°C	15	C104	68.4°C	93.8°C	16	C105	65.2°C	91.1°C	17	C106	64.8°C	90.5°C	18	U2	64.8°C	88.6°C
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 347 VAC O/P : 104 % LOAD Ta : 25°C	TEST : OK																																																																												
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 528VAC/200VAC O/P : 100 % LOAD Ta= -40 °C	TEST : OK																																																																												
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50°C NO DAMAGE	I/P : 528 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK																																																																												
5	TEMPERATURE COEFFICIENT	± 0.03%(0~50°C)	I/P : 347 VAC O/P : FULL LOAD	± 0.003 %(0~50°C)																																																																												
6	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																																																																												
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -45°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 : 347VAC/Full Load AC ON/OFF TEST turn on 58sec : turn off 2sec		OK																																																																												

8	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
9	CAPACITOR LIFE CYCLE	HVG-150-15:SUPPOSE C104 IS THE MOST CRITICAL COMPONENT (1) I/P : 347VAC O/P : FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P : 347VAC O/P : FULL LOAD Ta= 60 ℃ LIFE TIME (3) I/P : 347VAC O/P : 75% LOAD Ta= 60 ℃ LIFE TIME (4) I/P : 347VAC O/P : 50% LOAD Ta= 60 ℃ LIFE TIME	(1) 165032 HRS (2) 27362 HRS (3) 45522 HRS (4) 76442 HRS
10	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE : 158.6 KHR	
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Tcase 70℃	

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

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