



Test Report: HBG-160-24

160W Constant Voltage + Constant Current LED Driver

■ 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

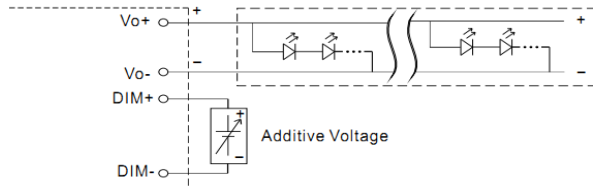
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONSTANT CURRENT REGION	14.4 V~ 24 V	I/P: 230VAC O/P: LED MODE Ta: 25°C	14.4V~ 24 V
2	OUTPUT CURRENT ADJUST RANGE (For A-Type)	3.9A~6.5A	I/P: 230VAC O/P: SETING Ta: 25°C	3.322A~7.194A
3	OUTPUT VOLTAGE TOLERANCE	-2%~+2%	I/P: 90VAC / 305VAC O/P: FULL/80%/ NO LOAD Ta: 25°C	-0.288%~ 0.908%
4	LINE REGULATION	-0.5%~+0.5%	I/P: 90VAC ~ 305VAC O/P: 80% ~ FULL LOAD Ta: 25°C	-0%~ 0 %
5	LOAD REGULATION	-1.0%~+1.0%	I/P: 230VAC O/P: FULL/ NO LOAD Ta: 25°C	-0.288%~ 0.288%
6	OVER/UNDERSHOOT TEST	<±5 %	I/P: 230VAC O/P: FULL LOAD Ta: 25°C	<5 %
7	RIPPLE & NOISE (Max)	200mVp-p	I/P: 230VAC O/P: FULL LOAD Ta: 25°C	40 mVp-p
8	SET UP TIME(Max)	230VAC/ 500ms 115VAC/ 2500ms	I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta: 25°C	230VAC/ 324 ms 115VAC/ 614 ms
9	RISE TIME (Max)	230VAC/ 200ms 115VAC/ 200ms	I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta: 25°C	230VAC/ 7.2 ms 115VAC/ 6.4 ms
10	HOLD UP TIME(Typ)	230VAC/ 12ms 115VAC/ 12ms	I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta: 25°C	230VAC/ 23.2 ms 115VAC/ 23.4 ms
11	DYNAMIC LOAD	V1: 2400 mVp-p	I/P: 230VAC O/P: (1) FULL/50% LOAD 50%DUTY / 120HZ (2) FULL /50% LOAD 50%DUTY / 1KHZ Ta: 25°C	(1) 1200mVp-p (2) 620mVp-p

12 DIMMING OPERATION (for B-Type)

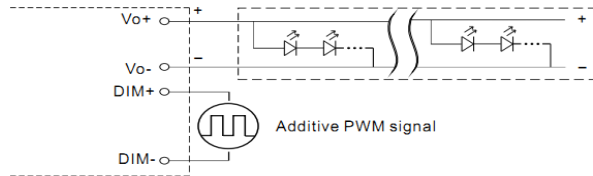
- Output constant current level can be adjusted by applying one of the three methodologies between DIM+ and DIM-: 0 ~ 10Vdc, or 10V PWM signal or resistance.
- Direct connecting to LEDs is suggested. It is not suitable to be used with additional drivers.
- Dimming source current from power supply: 100uA (typ.)

Ⓒ Applying additive 0 ~ 10VDC



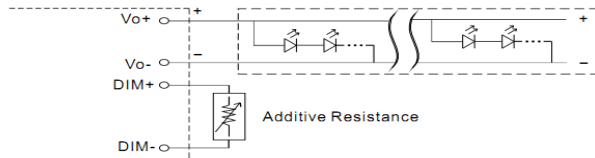
"DO NOT connect "DIM- to Vo-"

Ⓒ Applying additive 10V PWM signal (frequency range 100Hz ~ 3KHz):

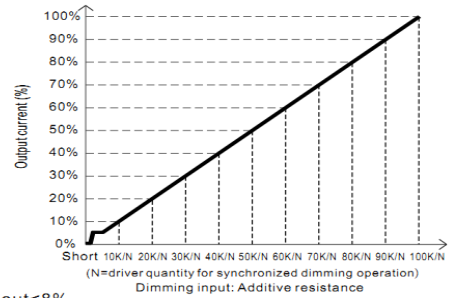
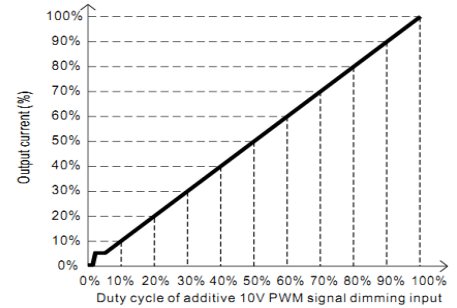
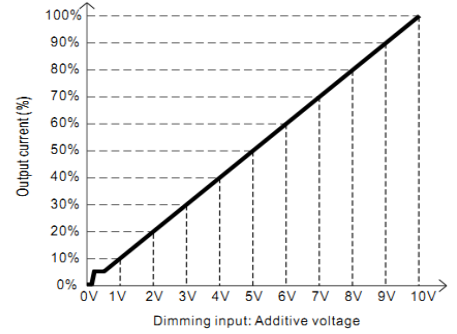


"DO NOT connect "DIM- to Vo-"

Ⓒ Applying additive resistance:



"DO NOT connect "DIM- to Vo-"



Note : 1. Min. dimming level is about 8% and the output current is not defined when 0% < Iout < 8%.
2. The output current could drop down to 0% when dimming input is about 0kΩ or 0Vdc, or 10V PWM signal with 0% duty cycle.

I/P: 230 VAC

O/P: DIMMING TEST

Ta: 25°C

	DIMMING	Short	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V
1	Output Current	0	0.794A	1.426A	2.058A	2.689A	3.318A	3.950A	4.571A	5.211A	5.847A	6.479A
	%	0%	12.03%	21.61%	31.18%	40.74%	50.27%	59.85%	69.26%	78.95%	88.59%	98.17%
	PWM(100Hz)	0V	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
2	Output Current	0	0.869A	1.495A	2.127A	2.748A	3.378A	4.006A	4.631A	5.261A	5.887A	6.474A
	%	0%	13.17%	22.65%	32.23%	41.64%	51.20%	60.70%	70.17%	79.71%	89.20%	98.09%
	R	0%	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K
3	Output Current	0	0.785A	1.410A	2.037A	2.664A	3.291A	3.925A	4.562A	5.194A	5.835A	6.475A
	%	0%	11.89%	21.36%	30.86%	40.36%	49.86%	59.47%	69.12%	78.70%	88.41%	98.11%

TEST RESULT: OK



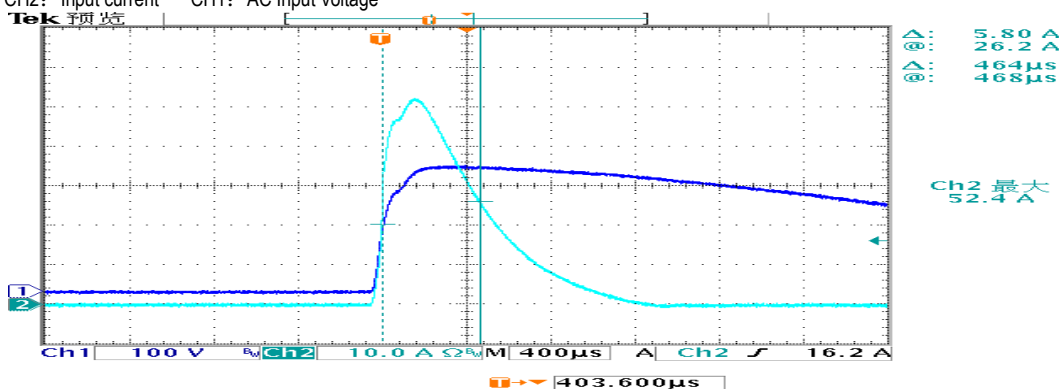
13	DALI DIMMING OPERATION (primary side; for DA-Type)	<p>※DALI Interface ·Apply DALI signal between DA+ and DA-. ·DALI protocol comprises 16 groups and 64 addresses. ·First step is fixed at 8% of output.</p> <p>I/P: 230 VAC O/P: DIMMING TEST Ta: 25°C TEST RESULT: OK</p>
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INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~305VAC	I/P: TESTING O/P: 80% ~FULL LOAD Ta: 25°C (1)I/P: LOW-LINE-3V=87 V HIGH-LINE+10V=315 V O/P: 80% ~FULL LOAD ON: 30 Sec OFF: 30 Sec 10MIN (2)230VAC ON: 0.5 Sec OFF: 0.5 Sec 20MIN (POWER ON/OFF NO DAMAGE)	87 V~ 305 V TEST: OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 90 VAC ~305 VAC O/P: FULL ~NO LOAD Ta: 25°C	TEST: OK
3	AC CURRENT	1.7A/115VAC 0.78A/230VAC 0.7A/277VAC	I/P: 115 VAC I/P: 230 VAC I/P: 277 VAC O/P: FULL LOAD Ta: 25°C	I = 1.25 A/ 115VAC I = 0.74 A/ 230VAC I = 0.63 A/ 277VAC
4	LEAKAGE CURRENT	< 0.75mA / 277VAC	I/P: 277 VAC O/P: NO LOAD Ta: 25°C	L-FG: 0.329 mA N-FG: 0.319 mA
5	INRUSH CURRENT(Typ)	230V/ 65A Twidth =550us measured at 50% Ipeak COLD START	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	I = 52.4 A/ 230VAC Twidth =464 us

INPUT=230VAC/50HZ @ FULL LOAD

CH2: Input current CH1: AC Input Voltage



6	EFFICIENCY(Typ)	92%	I/P: 230VAC O/P: FULL LOAD Ta: 25°C	92.43%																																												
<p>EFFICIENCY vs LOAD</p> <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>277V (%)</th> <th>230V (%)</th> <th>115V (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>55</td><td>55</td><td>55</td></tr> <tr><td>20%</td><td>72</td><td>72</td><td>72</td></tr> <tr><td>30%</td><td>78</td><td>78</td><td>78</td></tr> <tr><td>40%</td><td>82</td><td>82</td><td>82</td></tr> <tr><td>50%</td><td>85</td><td>85</td><td>85</td></tr> <tr><td>60%</td><td>87</td><td>87</td><td>87</td></tr> <tr><td>70%</td><td>88</td><td>88</td><td>88</td></tr> <tr><td>80%</td><td>89</td><td>89</td><td>89</td></tr> <tr><td>90%</td><td>90</td><td>90</td><td>90</td></tr> <tr><td>100%</td><td>92</td><td>92</td><td>92</td></tr> </tbody> </table>					LOAD (%)	277V (%)	230V (%)	115V (%)	10%	55	55	55	20%	72	72	72	30%	78	78	78	40%	82	82	82	50%	85	85	85	60%	87	87	87	70%	88	88	88	80%	89	89	89	90%	90	90	90	100%	92	92	92
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7	POWER FACTOR	0.98/ 115VAC 0.95/ 230VAC 0.92/ 277VAC	I/P: 115 VAC I/P: 230 VAC I/P: 277 VAC O/P: FULL LOAD Ta: 25°C	PF= 0.994 / 115VAC PF= 0.974 / 230VAC PF= 0.947 / 277VAC																																												
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8	TOTAL HARMONIC DISTORTION	THD < 20% (@load ≥ 60% / 115VAC, 230VAC; @load ≥ 75% / 277VAC)	I/P: 115 VAC / 60% LOAD I/P: 230 VAC / 60% LOAD I/P: 277 VAC / 75% LOAD Ta: 25°C	THD=10.04% @60% load /115VAC THD=14.59% @60% load /230VAC THD=15.72% @75% load /277VAC																																												
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PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER CURRENT PROTECTION	95%~108%	I/P: 90VAC I/P: 230VAC I/P: 305VAC O/P: TESTING Ta: 25°C	100.66 %/ 90VAC 100.68 %/ 230VAC 100.75%/ 305VAC Constant Current Limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	28V~34V	I/P: 90VAC I/P: 230VAC I/P: 305VAC O/P: NO LOAD Ta: 25°C	30.8 V/ 90VAC 30.8 V/ 230VAC 30.8V/ 305VAC Shut down o/p voltage with auto-recovery or re-power on to recovery
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 230VAC O/P: FULL LOAD	Shut down o/p voltage, recovers automatically after temperature goes down
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 305VAC O/P: FULL LOAD Ta: 25°C	NO DAMAGE Hiccup mode, recovers automatically after fault condition is removed

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Power Transistor	Q6 Rated 600V/11A	I/P: High-Line +3V =308V O/P: (1) FULL LOAD Turn on (2) Output Short (3) FULL LOAD continue Ta: 25°C	(1) 496 V (2) 454 V (3) 548 V
2	O/P Diode (MOSFET)	D100 Rated 65V/30A	I/P: High-Line +3V =308V O/P: (1) FULL LOAD Turn on (2) Output Short (3) FULL LOAD continue Ta: 25°C	(1)58.0 V (2)10.2 V (3)57.0 V
3	Input Capacitor	C5 Rated 82u/450V	I/P: High-Line +3V =308 V O/P: (1) FULL LOAD input on/off (2) NO LOAD input on /Off (3) FULL LOAD /NO LOAD Change Ta: 25°C	(1) 448 V (2) 440 V (3) 444 V
4	Control IC	U2 Rated 16V (MAX.)	I/P: High-Line +3V =308 V O/P: (1) FULL LOAD (2) NO LOAD input on /Off (3) FULL LOAD /NO LOAD Change Ta: 25°C	(1) 14.1 V (2) 14.3 V (3) 14.1 V
5	PFC Power Transistor	Q 1 Rated 600V/16A	I/P: High-Line +3V =308V O/P: (1) FULL LOAD Turn on (2) Output Short (3) FULL LOAD continue Ta: 25°C	(1) 506 V (2) 462 V (3) 472 V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3.75KVAC/min I/P-FG: 2.0KVAC/min O/P-FG: 0.5KVAC/min	I/P-O/P: 4.2KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG: 0.6 KVAC/min Ta: 25°C	I/P-O/P: 3.975 mA I/P-FG: 3.783 mA O/P-FG: 3.054 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	I/P-O/P: >9999 MΩ I/P-FG: >9999 MΩ O/P-FG: >9999 MΩ
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 50 mΩ EN 60950-1	40 A / 2min Ta: 25°C /70% RH	23 MΩ

E.M.C TEST

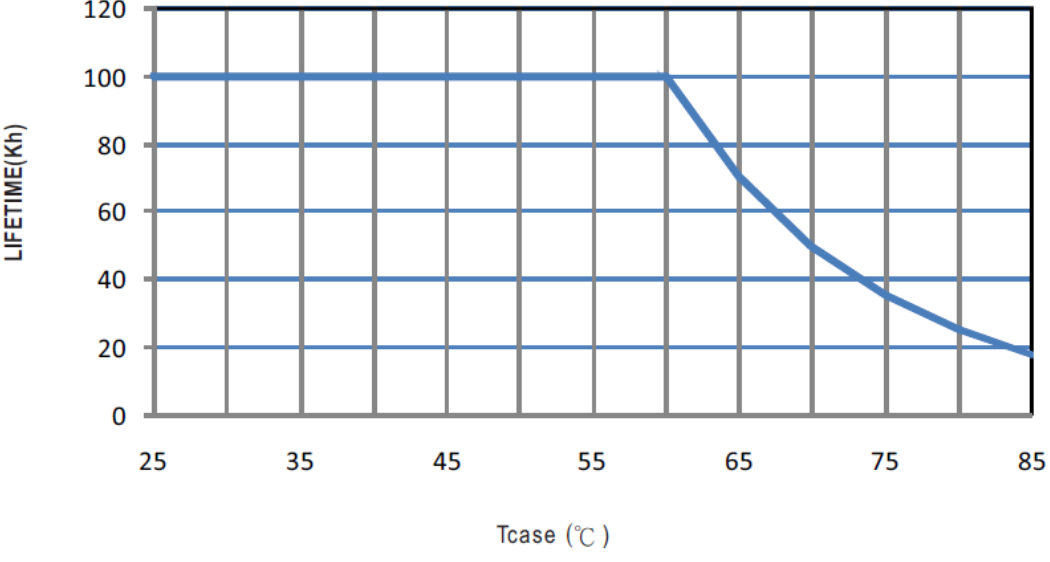
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 Class C	I/P: 230VAC/50HZ O/P: FULL/60% LOAD Ta: 25°C	PASS
2	CONDUCTION	EN55015	I/P: 230 VAC (50HZ) O/P: FULL LOAD Ta: 25°C	PASS Test by certified Lab
3	RADIATION	EN55015	I/P: 230 VAC (50HZ) O/P: FULL LOAD Ta: 25°C	PASS Test by certified 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	PASS
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT: 1KV	I/P: 230VAC/50HZ O/P: FULL LOAD Ta: 25°C	PASS
6	SURGE	EN61000-4-5 INDUSTRY L-N: 2KV L,N-PE: 4KV	I/P: 230VAC/50HZ O/P: FULL LOAD Ta: 25°C	PASS
7	Test by certified Lab & Test Report Prepare			

RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																												
1	TEMPERATURE RISE TEST	MODEL: HBG-160-24 1. ROOM AMBIENT BURN-IN: 2 HRS I/P: 230VAC O/P: 95% LOAD Ta=28.7 °C 2. HIGH AMBIENT BURN-IN: 2 HRS I/P: 230VAC O/P: 95% LOAD Ta=60.7 °C																																														
		<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=28.7 °C</th> <th>HIGH AMBIENT Ta=60.7 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>Q1</td><td>58.4°C</td><td>90.6°C</td></tr> <tr><td>2</td><td>D5</td><td>58.6°C</td><td>89.8°C</td></tr> <tr><td>3</td><td>C5</td><td>51.6°C</td><td>82.8°C</td></tr> <tr><td>4</td><td>U2</td><td>54.1°C</td><td>86.3°C</td></tr> <tr><td>5</td><td>Q6</td><td>48.8°C</td><td>79.5°C</td></tr> <tr><td>6</td><td>T1</td><td>51.0°C</td><td>82.1°C</td></tr> <tr><td>7</td><td>D100</td><td>71.2°C</td><td>103.4°C</td></tr> <tr><td>8</td><td>C102</td><td>60.7°C</td><td>92.4°C</td></tr> <tr><td>9</td><td>RTH2</td><td>54.5°C</td><td>80.0°C</td></tr> <tr><td>10</td><td>TC</td><td>48.2°C</td><td>78.6°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=28.7 °C	HIGH AMBIENT Ta=60.7 °C	1	Q1	58.4°C	90.6°C	2	D5	58.6°C	89.8°C	3	C5	51.6°C	82.8°C	4	U2	54.1°C	86.3°C	5	Q6	48.8°C	79.5°C	6	T1	51.0°C	82.1°C	7	D100	71.2°C	103.4°C	8	C102	60.7°C	92.4°C	9	RTH2	54.5°C	80.0°C	10	TC	48.2°C	78.6°C		
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P: 305VAC/90VAC O/P: FULL/80% LOAD Ta= -45°C/-35°C	TEST: OK																																												
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50°C NO DAMAGE	I/P: 305VAC O/P: FULL LOAD Ta=50°C HUMIDITY= 95 %R.H	TEST: OK																																												
4	TEMPERATURE COEFFICIENT	±0.03 %/°C (0~50°C)	I/P: 230 VAC O/P: FULL LOAD	±0.004 %/°C (0~50°C)																																												
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		TEST: 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: 10 CYCLE 5. Input/Output condition: 230VAC/95% LOAD AC ON/OFF TEST AC on 3 sec/AC off 1 sec TEST		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: 5G (5) Test Time: 72min in each axis (X.Y.Z) (6) Ta: 25°C		TEST: OK																																												



8	CAPACITOR LIFE CYCLE	<p>HBG-160-24: SUPPOSE C102 IS THE MOST CRITICAL COMPONENT</p> <p>(1) I/P: 230VAC O/P: FULL LOAD Ta= 25 °C LIFE TIME</p> <p>(2) I/P: 230VAC O/P: FULL LOAD Ta= 60 °C LIFE TIME</p> <p>(3) I/P: 230VAC O/P: 75% LOAD Ta= 60 °C LIFE TIME</p> <p>(4) I/P: 230VAC O/P: 50% LOAD Ta= 60 °C LIFE TIME</p>	<p>(1) 413163 HRS</p> <p>(2) 37223 HRS</p> <p>(3) 58469 HRS</p> <p>(4) 90733 HRS</p>																						
9	MTBF	<p>Conducted by Parts Stress Analysis Prediction</p> <p>2047.8K hrs min. Telcordia SR-332 (Bellcore) ; 194.1K hrs min. MIL-HDBK-217F (25°C)</p>																							
10	DMTBF/Accelerated Life Test	<p>Demonstration Mean Time Between Failure(Expected Life) :</p> <p>50,000 hours @ Tcase 70°C</p>  <table border="1"> <caption>Graph Data: Lifetime (Kh) vs Tcase (°C)</caption> <thead> <tr> <th>Tcase (°C)</th> <th>Lifetime (Kh)</th> </tr> </thead> <tbody> <tr><td>25</td><td>100</td></tr> <tr><td>35</td><td>100</td></tr> <tr><td>45</td><td>100</td></tr> <tr><td>55</td><td>100</td></tr> <tr><td>60</td><td>100</td></tr> <tr><td>65</td><td>70</td></tr> <tr><td>70</td><td>50</td></tr> <tr><td>75</td><td>35</td></tr> <tr><td>80</td><td>25</td></tr> <tr><td>85</td><td>20</td></tr> </tbody> </table>		Tcase (°C)	Lifetime (Kh)	25	100	35	100	45	100	55	100	60	100	65	70	70	50	75	35	80	25	85	20
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25	100																								
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TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	SHENJW/ZHUOKB	SKY	LIUWY