



Test Report: HBG-160-48

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

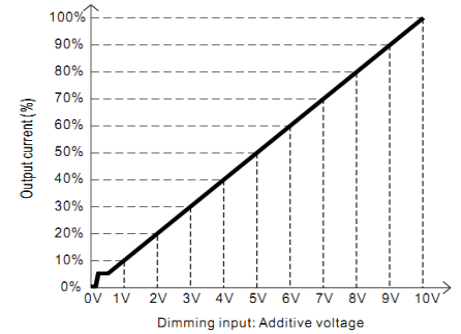
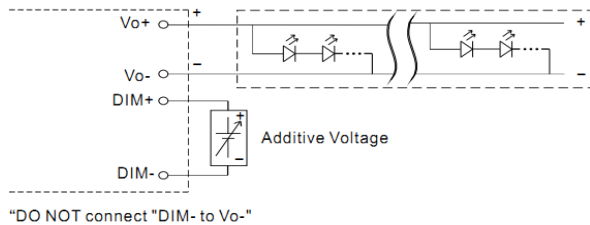
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONSTANT CURRENT REGION	28.8 V~ 48 V	I/P: 230VAC O/P: LED MODE Ta: 25°C	28.8V~ 48 V
2	OUTPUT CURRENT ADJUST RANGE (For A-Type)	1.98A~3.3A	I/P: 230VAC O/P: SETING Ta: 25°C	1.603A~3.437A
3	OUTPUT VOLTAGE TOLERANCE	-2%~+2%	I/P: 90VAC / 305VAC O/P: FULL/80%/ NO LOAD Ta: 25°C	-0.064%~ 0.702%
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	-0.064%~ 0.072%
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/ 230 ms 115VAC/ 421 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/ 36.7 ms 115VAC/ 36.9 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/ 20.7ms 115VAC/ 20.9 ms
11	DYNAMIC LOAD	V1: 4800 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) 376mVp-p (2) 1820mVp-p

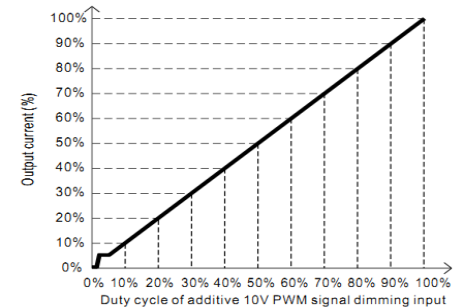
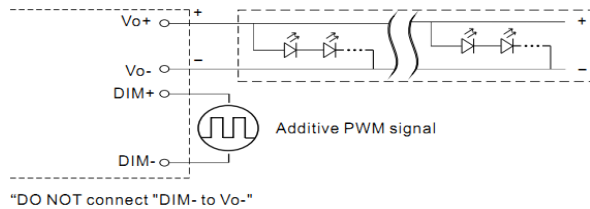
12 DIMMING OPERATION (for B-Type)

- 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.)

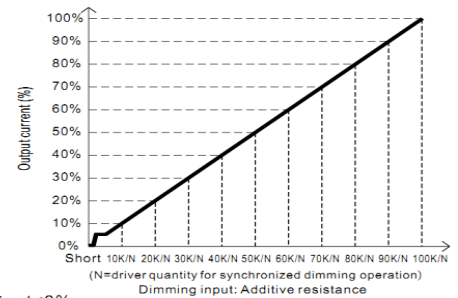
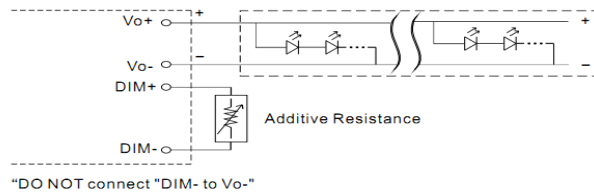
☉ Applying additive 0 ~ 10VDC



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



☉ Applying additive resistance:



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	0.393A	0.708A	1.021A	1.332A	1.638A	1.950A	2.257A	2.567A	2.877A	3.241A
	%	0%	11.91%	21.45%	30.94%	40.36%	49.64%	59.09%	68.39%	77.79%	87.18%	98.21%
	PWM(100Hz)	0V	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
2	Output Current	0	0.428A	0.738A	1.051A	1.361A	1.668A	1.974A	2.281A	2.591A	2.898A	3.255A
	%	0%	12.97%	22.36%	31.85%	41.24%	50.55%	59.82%	69.12%	78.52%	87.82%	98.64%
	R	0%	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K
3	Output Current	0	0.408A	0.737A	1.053A	1.375A	1.692A	2.011A	2.330A	2.649A	2.969A	3.289A
	%	0%	12.36%	22.33%	31.91%	41.67%	51.27%	60.94%	70.61%	80.27%	89.97%	99.67%

TEST RESULT: OK

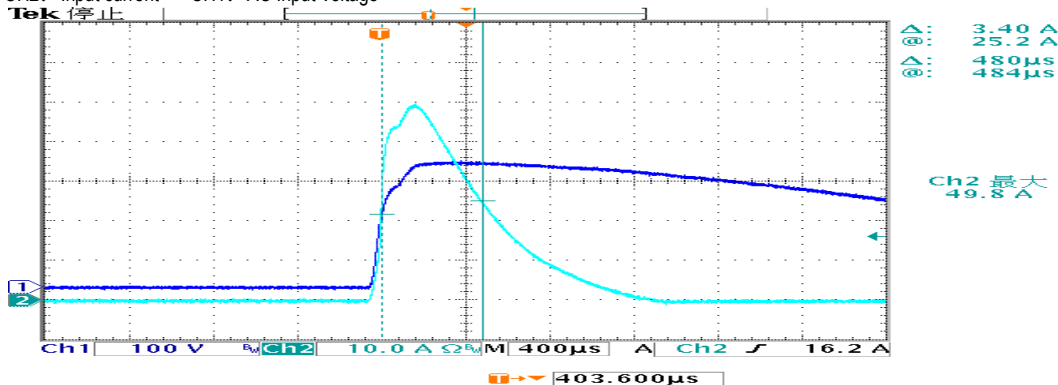
13	DALI DIMMING OPERATION (primary side; for DA-Type)	※DALI Interface ·Apply DALI signal between DA+ and DA-. ·DALI protocol comprises 16 groups and 64 addresses. ·First step is fixed at 8% of output. I/P: 230 VAC O/P: DIMMING TEST Ta: 25°C TEST RESULT: OK
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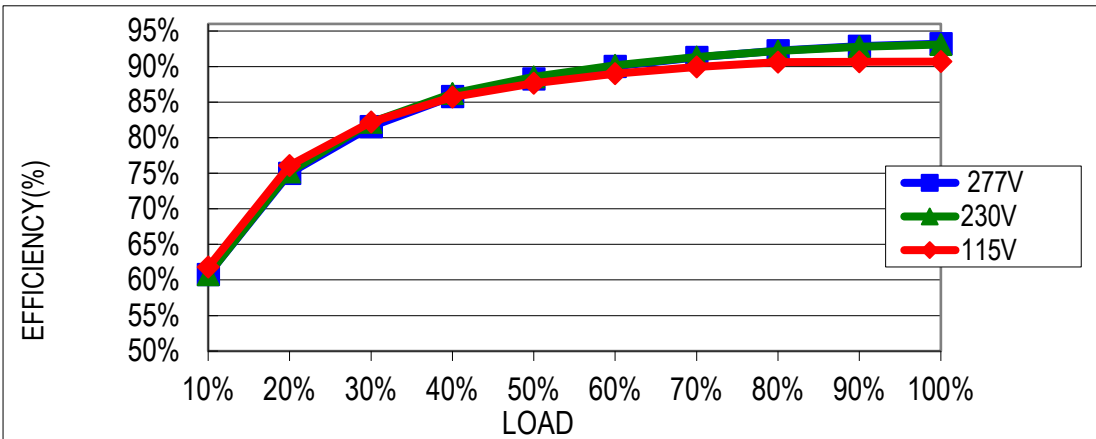
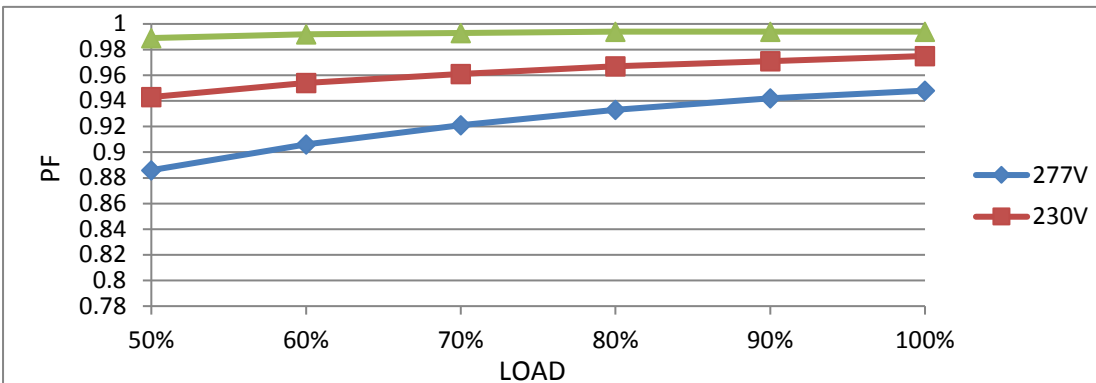
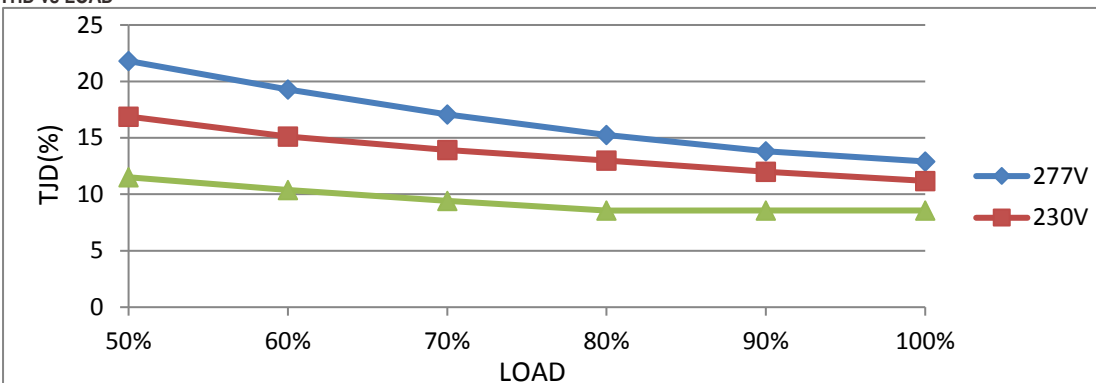
INPUT FUNCTION TEST

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 = 1.50 A/ 115VAC I = 0.76 A/ 230VAC I = 0.64 A/ 277VAC
4	LEAKAGE CURRENT	< 0.75mA / 277VAC	I/P: 277 VAC O/P: NO LOAD Ta: 25°C	L-FG: 0.348 mA N-FG: 0.330 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 = 49.8 A/ 230VAC Twidth =480 us

INPUT=230VAC/50HZ @ FULL LOAD

CH2: Input current CH1: AC Input Voltage



6	EFFICIENCY(Typ)	93%	I/P: 230VAC O/P: FULL LOAD Ta: 25°C	93.23%																																											
	EFFICIENCY vs LOAD  <table><caption>Efficiency vs Load Data (Approximate)</caption><thead><tr><th>LOAD</th><th>115V</th><th>230V</th><th>277V</th></tr></thead><tbody><tr><td>10%</td><td>60%</td><td>60%</td><td>60%</td></tr><tr><td>20%</td><td>75%</td><td>75%</td><td>75%</td></tr><tr><td>30%</td><td>82%</td><td>82%</td><td>82%</td></tr><tr><td>40%</td><td>86%</td><td>86%</td><td>86%</td></tr><tr><td>50%</td><td>88%</td><td>88%</td><td>88%</td></tr><tr><td>60%</td><td>90%</td><td>90%</td><td>90%</td></tr><tr><td>70%</td><td>91%</td><td>91%</td><td>91%</td></tr><tr><td>80%</td><td>92%</td><td>92%</td><td>92%</td></tr><tr><td>90%</td><td>92.5%</td><td>92.5%</td><td>92.5%</td></tr><tr><td>100%</td><td>93%</td><td>93%</td><td>93%</td></tr></tbody></table>				LOAD	115V	230V	277V	10%	60%	60%	60%	20%	75%	75%	75%	30%	82%	82%	82%	40%	86%	86%	86%	50%	88%	88%	88%	60%	90%	90%	90%	70%	91%	91%	91%	80%	92%	92%	92%	90%	92.5%	92.5%	92.5%	100%	93%	93%
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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= 0.975 / 230VAC PF= 0.948 / 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=10.39% @60% load /115VAC THD=15.12% @60% load /230VAC THD=16.10% @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	101.27%/ 90VAC 101.22 %/ 230VAC 101.26%/ 305VAC Constant Current Limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	54V~62V	I/P: 90VAC I/P: 230VAC I/P: 305VAC O/P: NO LOAD Ta: 25°C	58.0 V/ 90VAC 58.0 V/ 230VAC 58.0V/ 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) 474 V (2) 452 V (3) 454 V
2	O/P Diode (MOSFET)	D100 Rated 150V/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)108 V (2)11.0 V (3)109 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) 446 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)Min load Turn on /Off (3)Full Load /Min load Change Ta: 25°C	(1) 14.1 V (2) 13.8 V (3) 14.0 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) 486 V (2) 460 V (3) 464 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: 2.966 mA I/P-FG: 2.816 mA O/P-FG: 3.653 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

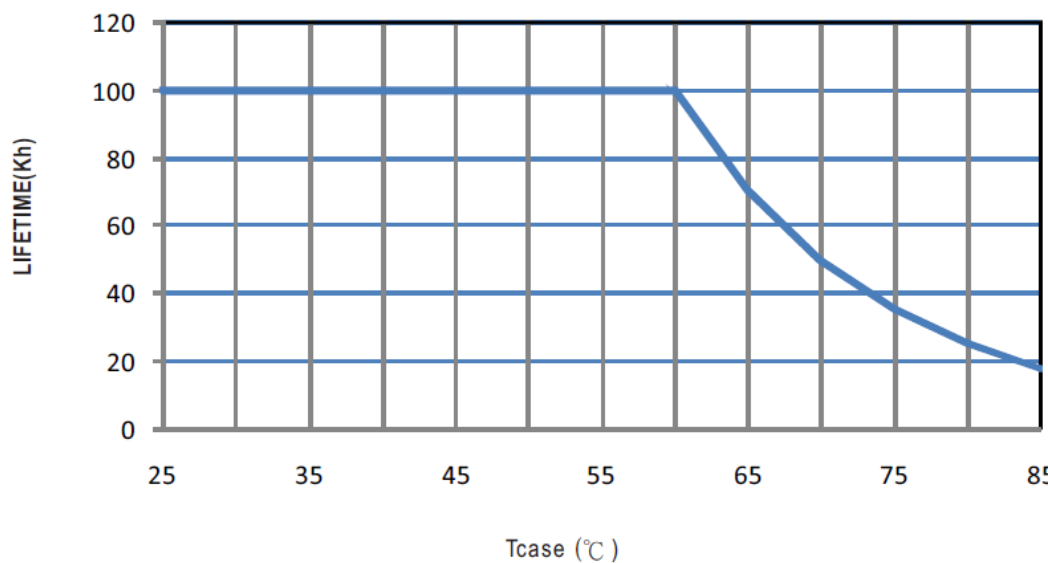
E.M.C TEST

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-160-60 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><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=28.7 °C</th><th>HIGH AMBIENT Ta=60.7 °C</th></tr><tr><td>1</td><td>Q1</td><td>60.7°C</td><td>91.7°C</td></tr><tr><td>2</td><td>D5</td><td>60.2°C</td><td>91.3°C</td></tr><tr><td>3</td><td>C5</td><td>57.0°C</td><td>87.3°C</td></tr><tr><td>4</td><td>U2</td><td>53.6°C</td><td>84.7°C</td></tr><tr><td>5</td><td>Q6</td><td>60.0°C</td><td>91.6°C</td></tr><tr><td>6</td><td>T1</td><td>63.8°C</td><td>93.9°C</td></tr><tr><td>7</td><td>D100</td><td>63.4°C</td><td>94.0°C</td></tr><tr><td>8</td><td>C102</td><td>57.0°C</td><td>87.4°C</td></tr><tr><td>9</td><td>RTH2</td><td>53.7°C</td><td>84.3°C</td></tr><tr><td>10</td><td>TC</td><td>47.6°C</td><td>77.2°C</td></tr></table>			NO	Position	ROOM AMBIENT Ta=28.7 °C	HIGH AMBIENT Ta=60.7 °C	1	Q1	60.7°C	91.7°C	2	D5	60.2°C	91.3°C	3	C5	57.0°C	87.3°C	4	U2	53.6°C	84.7°C	5	Q6	60.0°C	91.6°C	6	T1	63.8°C	93.9°C	7	D100	63.4°C	94.0°C	8	C102	57.0°C	87.4°C	9	RTH2	53.7°C	84.3°C	10	TC	47.6°C	77.2°C
NO	Position	ROOM AMBIENT Ta=28.7 °C	HIGH AMBIENT Ta=60.7 °C																																													
1	Q1	60.7°C	91.7°C																																													
2	D5	60.2°C	91.3°C																																													
3	C5	57.0°C	87.3°C																																													
4	U2	53.6°C	84.7°C																																													
5	Q6	60.0°C	91.6°C																																													
6	T1	63.8°C	93.9°C																																													
7	D100	63.4°C	94.0°C																																													
8	C102	57.0°C	87.4°C																																													
9	RTH2	53.7°C	84.3°C																																													
10	TC	47.6°C	77.2°C																																													
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	±0.003 %/°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	HBG-160-60: SUPPOSE C102 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) 534600 HRS (2) 52866 HRS (3) 61035 HRS (4) 89397 HRS																						
9	MTBF	Conducted by Parts Stress Analysis Prediction 2047.8K hrs min. Telcordia SR-332 (Bellcore) ; 194.1K hrs min. MIL-HDBK-217F (25°C)																							
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Tcase 70°C <table><caption>Graph Data Points (Estimated)</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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TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	SHENJW/ZHUOKB	SKY	LIUWY