



# Test Report: PWM-200-12

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## 200W PWM OUTPUT LED DRIVER

### ■ 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

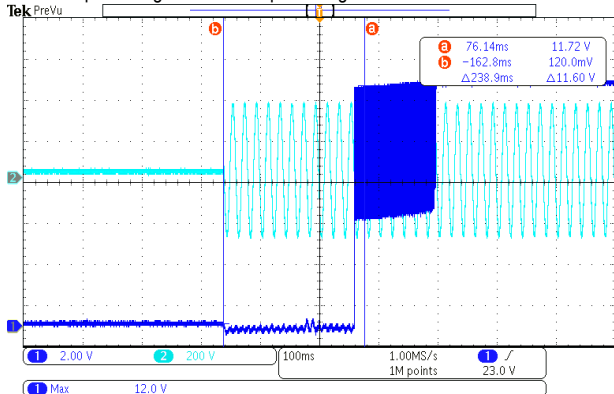
DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	Dimming Range	0~100%	I/P: 230 VAC O/P: 4KHz O/P: 2.5KHz Ta:25°C	V1: 5.5%~100%/3.97KHz for Blank type V2: 0.2%~100%/2.5KHz for DA2 type
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -4% ~ +4% (Max)	I/P: 230VAC O/P:100%load Ta:25°C	V1: -0.16%~1.6%
3	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:100% /0% Ta:25°C	2.1%
4	SET UP TIME(Max)	230VAC/ 500ms (Max) 115VAC/ 500ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230VAC/238ms 115VAC/277.3ms

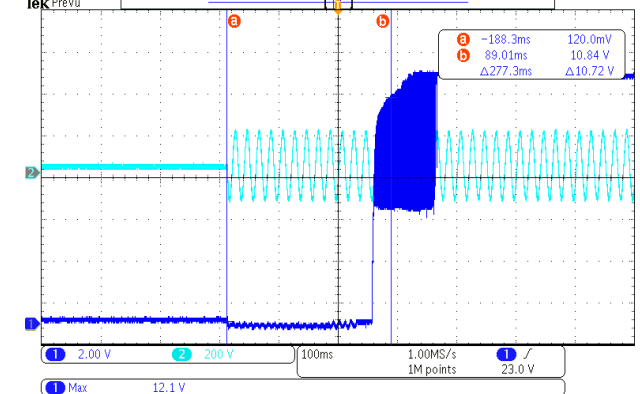
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD

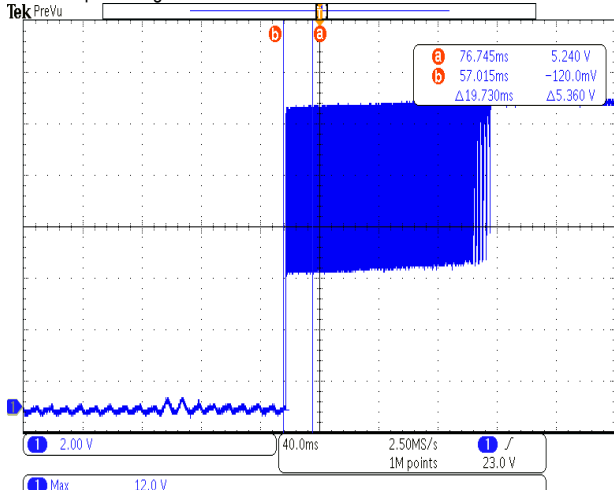
CH1 : Output Voltage CH2 : AC Input Voltage



5	RISE TIME (Max)	230VAC/ 80ms (Max) 115VAC/ 80ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230VAC/19ms 115VAC/33ms
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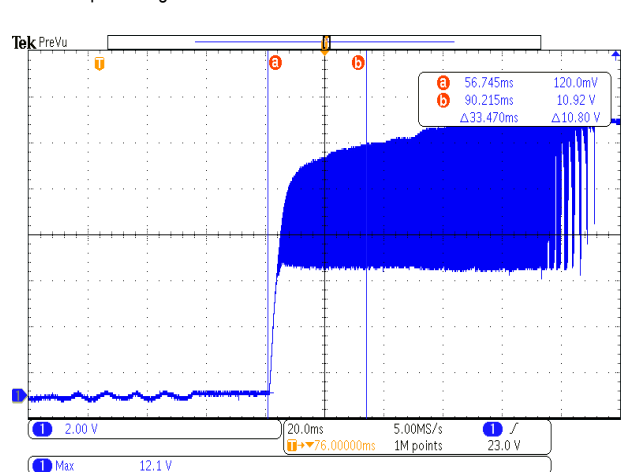
INPUT=230VAC/50HZ @ FULL LOAD

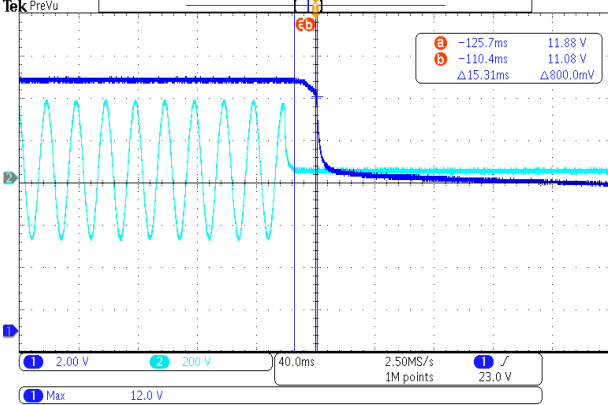
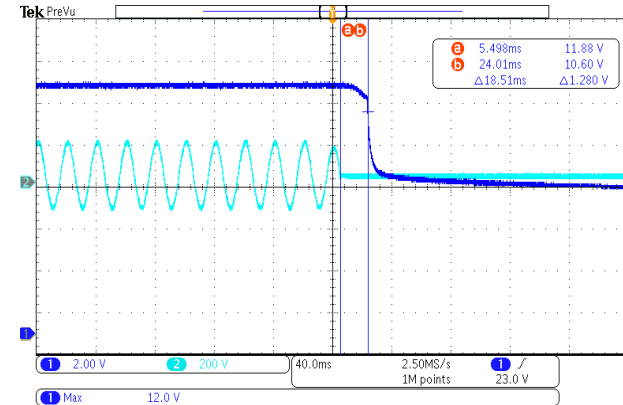
CH1 : Output Voltage



INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage

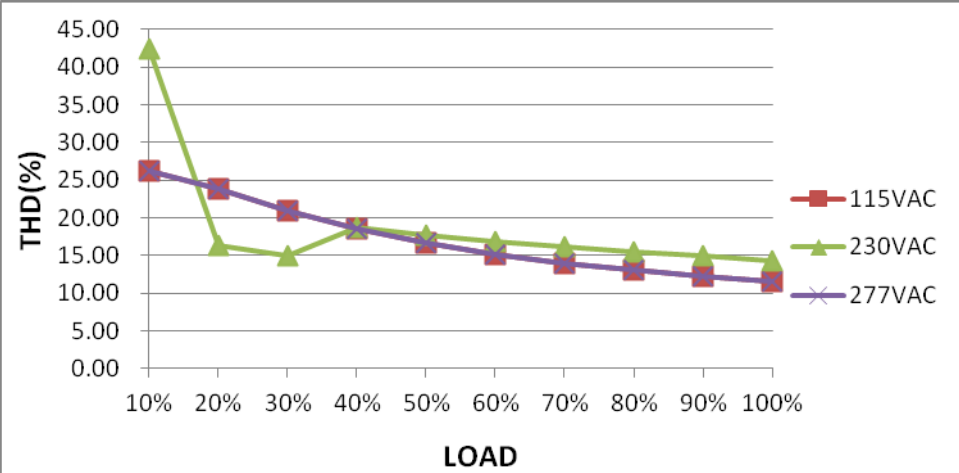


6	HOLD UP TIME (Typ.)	230VAC/ 10ms (Typ) 115VAC/ 10ms (Typ)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230VAC/ 15ms 115VAC/18ms
<p>INPUT=230VAC/50HZ @ FULL LOAD</p> <p>CH1 : Output Voltage CH2 : AC Input Voltage</p> 		<p>INPUT=115VAC/60HZ @ FULL LOAD</p> <p>CH1 : Output Voltage CH2 : AC Input Voltage</p> 		

## INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	100VAC~305VAC	I/P:TESTING O/P:FULL LOAD Ta:25°C  I/P: LOW-LINE-3V=97VAC HIGH-LINE+10=315VAC O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN ( POWER ON/OFF NO DAMAGE )	97VAC ~308VAC  TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:110VAC ~305VAC O/P:FULL~MIN LOAD Ta:25°C	TEST:OK
3	INPUT CURRENT (Typ.)	277 VAC/0.9A 230 VAC/1.1A 115 VAC/2.2A	I/P: 277VAC/230 VAC/115 VAC O/P:FULL LOAD Ta:25°C	I = 0.73A/ 277VAC I = 0.86A/ 230VAC I = 1.74A/ 115VAC
4	LEAKAGE CURRENT	<0.75 mA / 277 VAC	I/P : 277VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.062mA N-FG : 0.059 mA
5	STANDBY POWER CONSUMPTION	<0.5W for Blank/DA2	I/P : 230VAC Ta : 25°C	0.4183W/Blank type 0.3149W/DA2 type

6	POWER FACTOR (Typ.) 0.94/ 277 VAC/FULL LOAD 0.96/ 230 VAC/FULL LOAD 0.97/ 115 VAC/FULL LOAD	I/P: 277 VAC/230VAC/115VAC O/P: FULL LOAD Ta:25°C	PF= 0.947/277VAC PF= 0.974/230VAC PF= 0.992/115VAC																																												
<p>P.F vs LOAD</p> <table border="1"> <caption>Power Factor vs Load Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>115VAC PF</th> <th>230VAC PF</th> <th>277VAC PF</th> </tr> </thead> <tbody> <tr><td>10%</td><td>0.89</td><td>0.60</td><td>0.60</td></tr> <tr><td>20%</td><td>0.94</td><td>0.75</td><td>0.60</td></tr> <tr><td>30%</td><td>0.96</td><td>0.86</td><td>0.70</td></tr> <tr><td>40%</td><td>0.97</td><td>0.91</td><td>0.80</td></tr> <tr><td>50%</td><td>0.98</td><td>0.94</td><td>0.88</td></tr> <tr><td>60%</td><td>0.98</td><td>0.95</td><td>0.92</td></tr> <tr><td>70%</td><td>0.99</td><td>0.96</td><td>0.94</td></tr> <tr><td>80%</td><td>0.99</td><td>0.97</td><td>0.95</td></tr> <tr><td>90%</td><td>0.99</td><td>0.98</td><td>0.96</td></tr> <tr><td>100%</td><td>0.99</td><td>0.98</td><td>0.96</td></tr> </tbody> </table>				LOAD (%)	115VAC PF	230VAC PF	277VAC PF	10%	0.89	0.60	0.60	20%	0.94	0.75	0.60	30%	0.96	0.86	0.70	40%	0.97	0.91	0.80	50%	0.98	0.94	0.88	60%	0.98	0.95	0.92	70%	0.99	0.96	0.94	80%	0.99	0.97	0.95	90%	0.99	0.98	0.96	100%	0.99	0.98	0.96
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7	EFFICIENCY(Typ.) 92%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	92.29%																																												
<p>EFFICIENCY vs LOAD</p> <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>115VAC Efficiency (%)</th> <th>230VAC Efficiency (%)</th> <th>277VAC Efficiency (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>78</td><td>83</td><td>85</td></tr> <tr><td>20%</td><td>86</td><td>89</td><td>90</td></tr> <tr><td>30%</td><td>89</td><td>91</td><td>91</td></tr> <tr><td>40%</td><td>90</td><td>92</td><td>92</td></tr> <tr><td>50%</td><td>91</td><td>92</td><td>92</td></tr> <tr><td>60%</td><td>91</td><td>92</td><td>93</td></tr> <tr><td>70%</td><td>91</td><td>92</td><td>93</td></tr> <tr><td>80%</td><td>91</td><td>92</td><td>93</td></tr> <tr><td>90%</td><td>90</td><td>92</td><td>93</td></tr> <tr><td>100%</td><td>90</td><td>92</td><td>93</td></tr> </tbody> </table>				LOAD (%)	115VAC Efficiency (%)	230VAC Efficiency (%)	277VAC Efficiency (%)	10%	78	83	85	20%	86	89	90	30%	89	91	91	40%	90	92	92	50%	91	92	92	60%	91	92	93	70%	91	92	93	80%	91	92	93	90%	90	92	93	100%	90	92	93
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8	INRUSH CURRENT(Typ.) 230V/ 65A (twidth=550 us measured at 50% Ipeak) COLD START	I/P : 230 VAC/50Hz O/P : FULL LOAD Ta : 25°C	I =57A/ 230VAC T50=424 us/230V																																												
<p>INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH3 : Input current</p> <p>Ch3 Max 57.0 A</p> <p>49.80 %</p>																																															

9	TOTAL HARMONIC DISTORTION	THD<20%@load,≥ 60% at 230VAC/115VAC, load,≥ 75% at 277VAC	I/P : 277VAC /230VAC/115VAC O/P : 75% LOAD/60% LOAD	THD : 16.94%/ 60% Load/230VAC THD : 15.23%/ 60% Load/115VAC THD : 15.78%/ 75% Load/277VAC																																												
<p>THD vs LOAD</p>  <table border="1"> <caption>THD vs LOAD Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>115VAC THD (%)</th> <th>230VAC THD (%)</th> <th>277VAC THD (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>26.0</td><td>42.0</td><td>26.0</td></tr> <tr><td>20%</td><td>24.0</td><td>16.0</td><td>24.0</td></tr> <tr><td>30%</td><td>21.0</td><td>15.0</td><td>21.0</td></tr> <tr><td>40%</td><td>19.0</td><td>18.0</td><td>19.0</td></tr> <tr><td>50%</td><td>17.0</td><td>17.0</td><td>17.0</td></tr> <tr><td>60%</td><td>16.0</td><td>16.0</td><td>16.0</td></tr> <tr><td>70%</td><td>15.0</td><td>15.0</td><td>15.0</td></tr> <tr><td>80%</td><td>14.0</td><td>14.0</td><td>14.0</td></tr> <tr><td>90%</td><td>13.0</td><td>13.0</td><td>13.0</td></tr> <tr><td>100%</td><td>12.0</td><td>12.0</td><td>12.0</td></tr> </tbody> </table>					LOAD (%)	115VAC THD (%)	230VAC THD (%)	277VAC THD (%)	10%	26.0	42.0	26.0	20%	24.0	16.0	24.0	30%	21.0	15.0	21.0	40%	19.0	18.0	19.0	50%	17.0	17.0	17.0	60%	16.0	16.0	16.0	70%	15.0	15.0	15.0	80%	14.0	14.0	14.0	90%	13.0	13.0	13.0	100%	12.0	12.0	12.0
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**PROTECTION FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	108%~ 135%	I/P: 305VAC I/P: 230 VAC I/P: 110 VAC O/P: TESTING Ta:25°C	121.8%/305VAC 122.6%/ 230VAC 122.1%/ 100VAC PROTECTION TYPE : Hiccup mode or Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	13V~18V	I/P: 305 VAC I/P: 230 VAC I/P: 110 VAC O/P: MIN LOAD Ta:25°C	16.1V/305VAC 16.2V/ 230VAC 15.9V/ 110VAC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover after fault condition is removed
3	OVER TEMPERATURE PROTECTION	Protection type : NO DAMAGE	I/P: 305VAC I/P: 230VAC I/P: 110VAC O/P: FULL LOAD	O.T.P. Active Protection type : Shut down o/p voltage, re-power on to recover after fault condition is removed
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 305VAC I/P: 230VAC I/P: 110VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Shut down o/p voltage, re-power on to recover (except for DA2-type) Hiccup mode, recovers automatically after fault condition is removed (only for DA2-type)

**COMPONENT STRESS TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Power Transistor ( D to S) or (C to E) Peak Voltage	Q71 Rated 11A/600V	AC ON/OFF I/P: High-Line +3V = 308VAC O/P: (1)Full Load input (CRH Mode) (2)Output Short (3)Full load continue(CRH Mode) (4) Dimming off (5)OLP (6)0-400%Load  I/P: Low-Line -3V = 107VAC O/P: (1)Full Load input (CRH Mode) (2)Output Short (3)Full load continue (4) Dimming off (5)OLP (6)0-400%Load Ta:25°C	308VAC VDS: (1) 480V (2) 540V (3) 456V (4) 468V (5) 532V (6) 536V  107VAC VDS: (1) 484V (2) 532V (3) 460V (4) 452V (5) 542V (6) 548V
2	LED DIMMING Transistor ( D to S) or (C to E) Peak Voltage	Q200 Rated 40V/208A	AC ON/OFF I/P: High-Line +3V = 308VAC O/P: (1)Full Load input (CRH Mode) (2)Output Short (3)Full load continue(CRH Mode) (4) Dimming off (5)OLP (6)0-400%Load Ta:25°C	VDS: (1) 15.6V (2) 23.2V (3) 0.6V (4) 21.4V (5) 15.6V (6) 13.2V
3	Diode Peak Voltage	Q100 Rated 100 A/ 40V  Q101 Rated 100 A/ 40V	AC ON/OFF I/P: High-Line +3V = 308VAC O/P: (1)Full Load input (CRH Mode) (2)Output Short (3)Full load continue(CRH Mode) (4) Dimming off (5)OLP (6)No Load  Ta:25°C	Q100: VDS: (1) 29.6V (2) 7.6V (3) 29.2V (4) 29.2V (5) 8V (6) 26.8V  Q101: VDS: (1) 30V (2) 12.8V (3) 29.6V (4) 28.8V (5) 29.6V (6) 29.6V
4	Input Capacitor Voltage	C5 Rated: 100uF / 450 V	AC ON/OFF I/P: High-Line +3V =308VAC O/P: (1)Full Load input (CRH Mode) (2) Full load continue(CRH Mode) (3) Dimming off (4) OLP ( 100%-OLP ) Ta:25°C	(1) 448V (2) 442V (3) 444V (4) 441V

5	Control IC Voltage Test	<p>PWM IC U2 Rated -0.3V~20V</p> <p>PFC IC U1 Rated -0.3V~35V</p> <p>AUX IC U500 Rated -0.3V~725V</p>	<p>AC ON/OFF I/P: High-Line +3V =308VAC O/P:(1) Full Load input (CRH Mode) (2) Output Short (3) O.L.P (4) O.V.P (5) NO LOAD VR.LOW LINE (6) Dim off(continue)</p> <p>Ta:25°C</p>	<p>U2</p> <p>(1) 17.8V (2) 17.6V (3) 17.4V (4) 1.8V (5) 17.3V (6) 0.6V</p>	<p>U1</p> <p>(1) 17.5V (2) 17.7V (3) 17.6V (4) 18.4V (5) 18.1V (6) 0.3V</p>	<p>U500</p> <p>(1) 565V (2) 562V (3) 549V (4) 551V (5) 548V (6) 556V</p>
6	P.F.C Transistor (D to S) or (C to E) Peak Voltage	<p>Q 1 Rated 26A 600V</p>	<p>AC ON/OFF I/P: High-Line +3V = 308VAC O/P: (1)Full Load input (CRH Mode) (2)Output Short (3)Full load continue(CRH Mode) (4) Dimming off (5)OLP (6)0-400%Load</p> <p>I/P: Low-Line -3V = 107VAC O/P: (1)Full Load input (CRH Mode) (2)Output Short (3)Full load continue (4) Dimming off (5)OLP (6)0-400%Load</p> <p>Ta:25°C</p>	<p>308VAC VDS:</p> <p>(1) 528V (2) 535V (3) 521V (4) 517V (5) 531V (6) 536V</p>	<p>107VAC VDS:</p> <p>(1) 531V (2) 517V (3) 521V (4) 508V (5) 511V (6) 508V</p>	
7	VCC Diode Peak Voltage	<p>D501 Rated: :2A/400V D601 Rated: : 2A/400V</p>	<p>AC ON/OFF I/P: High-Line +3V = 308VAC O/P: (1)Full Load input (CRH Mode) (2)Output Short (3)Full load continue(CRH Mode) (4) Dimming off (5)OLP (6)0-400%Load</p> <p>Ta:25°C</p>	<p>D501</p> <p>(1) 110.3V (2) 111.7V (3) 109.3V (4) 107.2V (5) 109.6V (6) 107.8V</p>	<p>D601</p> <p>(1) 139.1V (2) 140.6V (3) 136.3V (4) 139.2V (5) 137.8V (6) 137.6V</p>	

### SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3.75KVAC/min	I/P-O/P:4.125 KVAC/min Ta:25°C	I/P-O/P: 2.618mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P: 500VDC>100MΩ	I/P-O/P: 500VDC Ta:25°C	I/P-O/P:9999MΩ NO DAMAGE

### 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 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



## 200W PWM OUTPUT LED DRIVER

## PWM-200-series

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 : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			



■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																																												
1	TEMPERATURE RISE TEST	MODEL : PWM-200-12B 1. ROOM AMBIENT BURN-IN : 2HRS I/P : 230VAC O/P : FULL LOAD Ta=28.7 °C 2. HIGH AMBIENT BURN-IN : 2HRS I/P : 230VAC O/P : FULL LOAD Ta=49.1 °C																																																																																																														
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 119 * LOAD Ta : 25°C	TEST : OK																																																																																																												
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/110VAC O/P : 100 * LOAD Ta=-45/-35 °C	TEST : OK																																																																																																												
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45°C/95 %R.H NO DAMAGE	I/P : 305VAC O/P : FULL LOAD Ta= 45°C HUMIDITY= 95 %R.H	TEST : OK																																																																																																												
5	TEMPERATURE COEFFICIENT	± 0.03 %/°C(0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.021 %/°C(0~50°C)																																																																																																												



6	STORAGE TEMPERATURE TEST	-40~85°C	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 : 10 CYCLE 5. Input/Output condition : STATIC
7	THERMAL SHOCK TEST	-40~45°C	1. Thermal shock Temperature : -45°C~ +50°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
8	VIBRATION TEST	10 ~ 500Hz, 5G 10min./1cycle, 60min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 6G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C
9	CAPACITOR LIFE CYCLE	SUPPOSE C106 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=45 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta=45 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta=45 °C LIFE TIME	(1) 97427HRS (2) 25391HRS (3) 55632HRS (4) 114180HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 712.8K hrs min. Telcordia SR-332 (Bellcore) ; 178.7K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 50,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	WUWQ/HUANGMK	WENF	LINKX

2018.4.30 GP-A50-F010