



Test Report: SPWM-240-24MA

240W Constant Voltage PWM Output LED Driver

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test

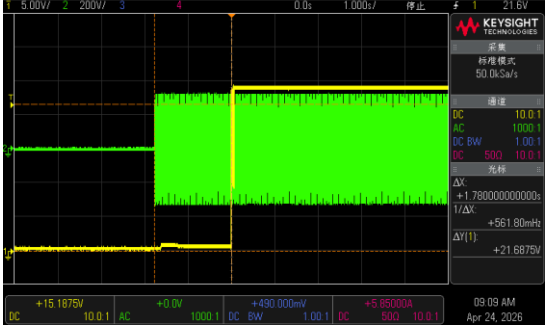
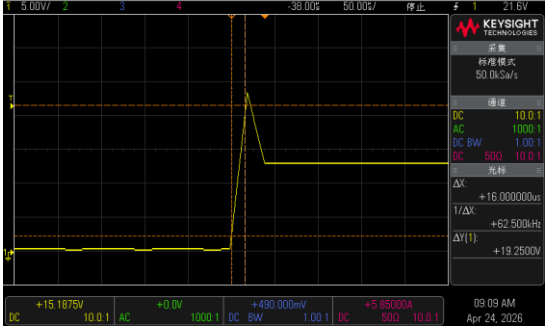
E.M.C. Test

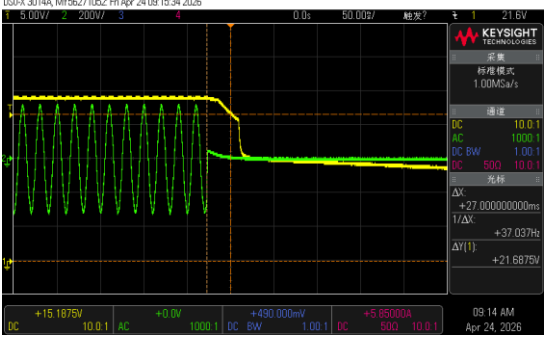
■ RELIABILITY TEST

ENVIRONMENT TEST

■ ESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM FREQUENCY (Typ.)	3.2kHz or 20kHz Set by Dip Switch	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	Test: 3.2khz/3.2Khz(DIP Switch 3 OFF) 20.478KHZ/20khz(DIP Switch 3 ON)
2	VOLTAGE ADJ. RANGE	23 V~26 V	I/P: 230 VAC O/P:NO LOAD Ta:25°C	Test : 22.3 V ~ 26.5 V
3	OVER/UNDERSHOOT TEST	< $\pm$ 5%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	TEST: 0.84 %
4	SET UP TIME (Max)	2500ms /230VAC	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	1780ms/230VAC
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 				
5	RISE TIME (Max)	80 ms /230VAC	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	0.016ms/230VAC
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 				

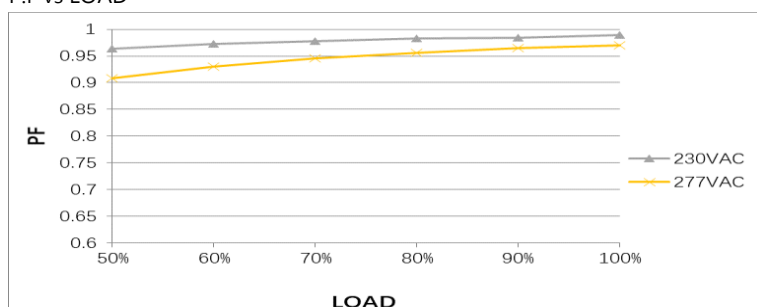
6	HOLD UP TIME (Typ)	10 ms /230VAC	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	27ms/230VAC
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 				

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC~305 VAC 255VDC~410VDC	(1) I/P:TESTING O/P:FULL LOAD (2) I/P:DC TESTING(L: + N:-) O/P: FULL / 50% LOAD (3) I/P:DC TESTING(L:- N: +) O/P: FULL / 50% LOAD (4) I/P: LOW-LINE=255VDC HIGH-LINE=410VDC O/P: Dimming on/off Ta:25°C	(1) 180V~ 305V (2) 255Vdc~410Vdc/FULL LOAD 255 Vdc~410Vdc/50% LOAD (3) 255Vdc~410Vdc/FULL LOAD 255 Vdc~410Vdc/50% LOAD (4) OK
			I/P: LOW-LINE-3V=177 V HIGH-LINE+10V=315 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST: OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 180VAC ~305VAC O/P:FULL~MIN LOAD Ta:25°C	OK
3	INPUT CURRENT (TYP)	1.1 A /277VAC 1.3 A /230VAC	I/P: 277VAC I/P: 230VAC O/P:FULL LOAD Ta:25°C	I = 0.93 A / 277VAC I = 1.11 A / 230VAC

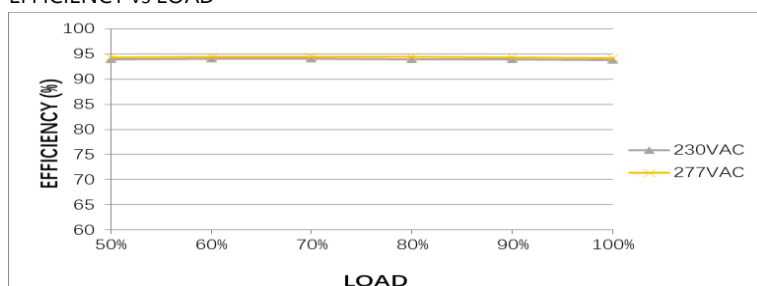
4	LEAKAGE CURRENT	< 0.25mA / 277 VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25°C	L-FG: 0.0121 mA N-FG: 0.0134 mA
5	STANDBY POWER CONSUMPTION	standby power consumption<0.5W (Dimming off)	I/P: 230VAC O/P : DIM OFF Ta : 25°C	0.4309 W / 230VAC
6	POWER FACTOR(TYP)	0.92 /277 VAC 0.95 /230 VAC	I/P: 277VAC I/P: 230VAC O/P: FULL LOAD Ta:25°C	PF= 0.970 /277VAC PF= 0.989 /230VAC

P.F vs LOAD



7	EFFICIENCY (TYP)	93.0 %	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	230VAV/ 93.7%
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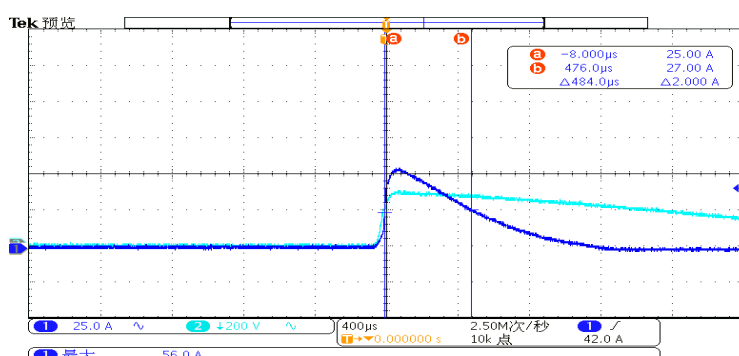
EFFICIENCY vs LOAD

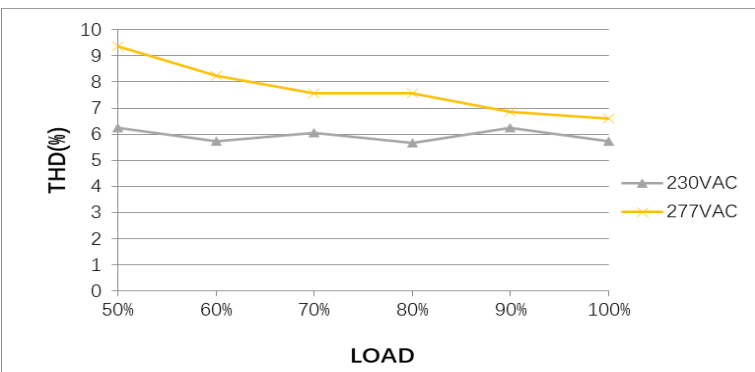


8	INRUSH CURRENT (TYP)	60A /230 VAC COLD START (twidth=700us measured at 50% Ipeak) COLD START	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	I = 56 A/ 230VAC T50= 484 us
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INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Input current CH2 : AC Input Voltage

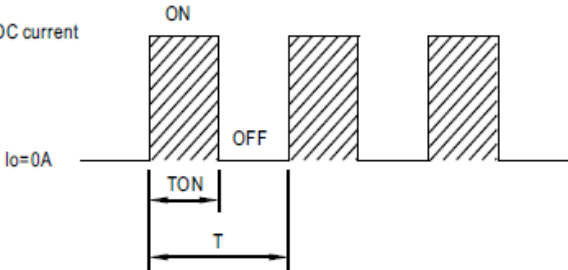
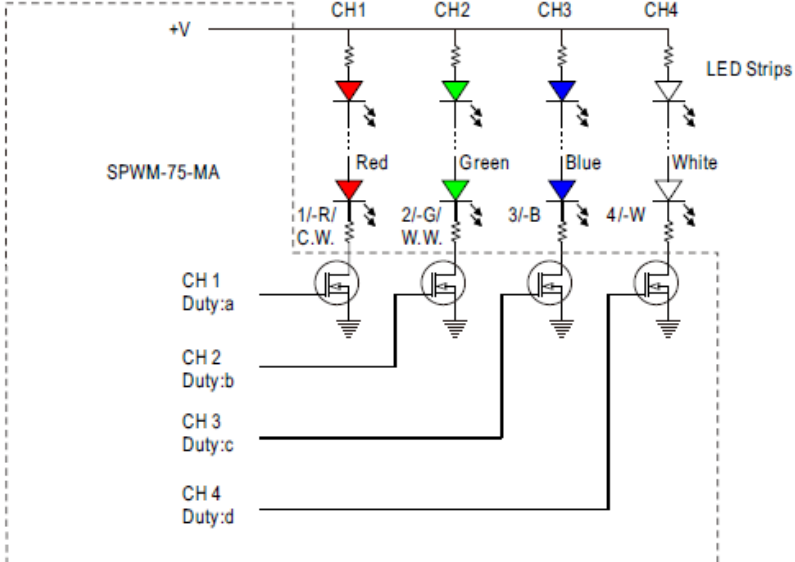


9	TOTAL HARMONIC DISTORTION	HARMONIC	THD<10% @load≥ 50% /230VAC; @load≥ 75%/277VAC	I/P : 230VAC/277VAC O/P : 75% LOAD 50% LOAD Ta : 25°C	THD : 6.24 / 230VAC*50%load THD : 7.55/ 277VAC*75%load																					
THD&LOAD																										
 <table><caption>THD (%) vs LOAD (%) Data</caption><thead><tr><th>LOAD (%)</th><th>230VAC THD (%)</th><th>277VAC THD (%)</th></tr></thead><tbody><tr><td>50%</td><td>6.5</td><td>9.5</td></tr><tr><td>60%</td><td>5.8</td><td>8.5</td></tr><tr><td>70%</td><td>6.2</td><td>7.8</td></tr><tr><td>80%</td><td>5.8</td><td>7.8</td></tr><tr><td>90%</td><td>6.5</td><td>7.2</td></tr><tr><td>100%</td><td>6.2</td><td>6.5</td></tr></tbody></table>						LOAD (%)	230VAC THD (%)	277VAC THD (%)	50%	6.5	9.5	60%	5.8	8.5	70%	6.2	7.8	80%	5.8	7.8	90%	6.5	7.2	100%	6.2	6.5
LOAD (%)	230VAC THD (%)	277VAC THD (%)																								
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PROTECTION FUNCTION TEST

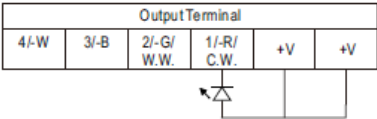
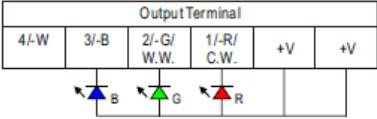
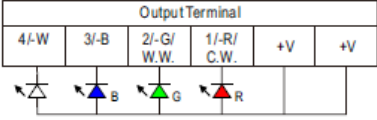
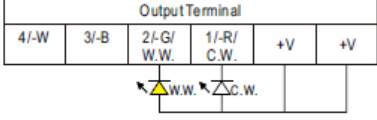
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 % ~ 150 %	I/P: 305VAC I/P: 230VAC I/P: 180VAC O/P: TESTING Ta: 25°C	124.40% / 305VAC 125.20% / 230VAC 125.0% / 180VAC Protection type : Hiccup mode, recovers automatically after fault condition is removed. Hiccup mode, recovers automatically after fault condition is removed.
2	OVER VOLTAGE PROTECTION	V1: 27 V ~ 36 V	I/P: 305VAC I/P: 230VAC I/P: 180VAC O/P: MIN LOAD Ta: 25°C	28.9V / 305VAC 28.9V / 230VAC 28.7V / 180VAC Protection type : Shut down O/P voltage, re-power on to recover after fault condition is removed
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 305 VAC I/P: 180 VAC 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: 180 VAC O/P: FULL LOAD Ta: 25°C	NO DAMAGE Protection type : Hiccup mode, recovers automatically after fault condition is removed.

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	Dimming principle for PWM style output	※ Dimming principle for PWM style output Dimming is achieved by varying the duty cycle of the output current. Output DC current  $\text{Duty cycle(\%)} = \frac{T_{ON}}{T} \times 100\%$ Output PWM frequency : 3.2kHz or 20kHz fixed  I/P : 230 VAC O/P : TESTING Ta : 25°C TEST RESULT : OK		

2 Operating Model

• The color types supported by the driver can be set via the DIP-switch

Dip Switch			Application	Output channels	Output connections schematic diagram
1	2	3			
ON	ON	--	1 logic unit of LED (Dimmable light)	1 channel	
OFF	OFF	--	1 logic unit of colour type (RGB) (Factory default settings)	3 channels	
OFF	ON	--	2 logic units (RGB) (Dimmable light)	4 channels	
ON	OFF	--	1 logic unit of colour type Tc (Color temperature light)	2 channels	

• The output frequency of the driver can be set via the DIP switch

Dip Switch			Application
1	2	3	
--	--	OFF	PWM frequency: 3.2 kHz(AC restart required)
--	--	ON	PWM frequency: 20 kHz(AC restart required)

I/P : 230 VAC

O/P : TESTING

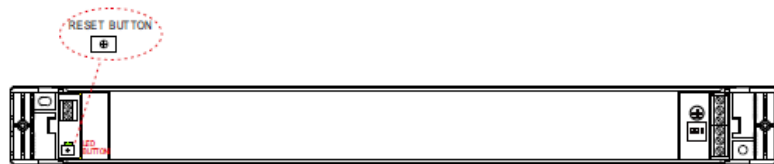
Ta : 25°C

TEST RESULT : OK

3 Factory reset

◎ By RESET BUTTON

Press and hold the reset button for 10 seconds. When the LED indicator flashes quickly, release the button. The factory reset will then be completed.



◎ By AC ON/OFF

To perform factory reset through AC ON/OFF, the following process must be strictly followed. If the AC ON/OFF process is correct, the output light will flash for 15 seconds. When the flashing stop, it means the factory reset is completed. This operation is consistent with the factory reset effect performed by long-pressing the reset button.

AC ON/OFF process to executes factory reset:



Phase	Duration	AC status
1	10-15s	ON
2	>30s	OFF
3	2-5s	ON
4	>30s	OFF
5	10-15s	ON
6	>30s	OFF
7	2-5s	ON
8	>30s	OFF
9	2-5s	ON
10	>30s	OFF
11	>25s	ON (should wait until output light stop flashing)

If there is a malfunction in the 'AC ON/OFF process', the process can be reset by the following method, starting from stage 1 again.

Method 1: AC ON time exceeds 25 seconds



Method 2: AC ON times for 2-5s and twice



I/P : 230 VAC
O/P : TESTING
Ta : 25°C
TEST RESULT : OK

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q3 Rated 600 V/21 A	AC ON/OFF I/P:High-Line +3V =308V O/P: (1)Full Load input (2)Output Short (3)Dimming off (4)OLP (5) No Load I/P:Low-Line -3V = 177V O/P: (1)Full Load input (2)Output Short (3)Dimming off (4)OLP (5) No Load Ta:25°C	 (1) 465 V (2) 449 V (3) 445V (4) 449 V (5) 449V (1) 465 V (2) 457 V (3) 457V (4) 469V (5) 453V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated 650V/25A	AC ON/OFF I/P:High-Line +3V =308 V O/P: (1)Full Load input (2)Output Short (3)Dimming off (4)OLP (5) No Load I/P:Low-Line -3V = 177V O/P: (1)Full Load input (2)Output Short (3)Dimming off (4)OLP (5) No Load Ta:25°C	VDS: (1) 521 V (2) 505 V (3) 493 V (4) 521 V (5) 505 V VDS: (1) 525 V (2) 517 V (3) 525 V (4) 525 V (5) 517 V
3	P.F.C DIODE	D5 Rated 8A/600V	AC ON/OFF I/P:High-Line +3V =308 V O/P: (1)Full Load input (2)Output Short (3)Dimming off (4)OLP (5) No Load I/P: Low-Line -3V = 177V O/P: (1)Full Load (2)Output Short (3)Dimming off (4)OLP (5) No Load Ta:25°C	 (1) 461 V (2) 465 V (3) 457 V (4) 461 V (5) 461 V (1) 461 V (2) 461 V (3) 461 V (4) 461 V (5) 461 V

4	Diode Peak Voltage	Q100 Rated 130 A/80 V	AC ON/OFF I/P: High-Line +3V =308 V O/P: (1)Full Load (2)Output Short (3) Dimming off (4) OLP (5).NO LOAD Ta:25°C	VDS: (1) 61.7V (2) 57.7V (3) 61.7V (4) 58.5V (5) 57.7V
5	Input Capacitor Voltage	C5 Rated: 68μ / 450V Surge voltage: 580V	I/P:High-Line +3V =308V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue Ta:25°C	(1) 453 V (2) 445 V (3) 453 V (4) 441 V
6	Control IC Voltage Test	DD IC U300 Rated(Vin) -0.3V~105V	AC ON/OFF I/P: High-Line +3V =308 V O/P: (1)LEDmax (2) LEDmin (3)OUTPUT SHORT (4) NO LOAD (5) Dim off Ta:25°C	U300 (1) 24.6V (2) 24.4V (3) 24.2V (4) 24.2 V (5) 21.2 V
7	DIMMING MOS	Q110/Q111/Q112/Q113 Rated : 60 V/160A	AC ON/OFF I/P : High-Line +3V = 308 V O/P : (1) Full Load (2) Output Short (3) Dim on/off Ta : 25°C	Q110 (1)17.1V (2)26.1V (3)16.1V Q113 (1)17.1V (2)26.3V (3)16.7V

SAFETY & EMC TEST REPORT

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3.75 K VAC/min	I/P-O/P: 4.125 KVAC/min Ta:25°C	I/P-O/P: 0.8899 mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P: 500 VDC>100MΩ	I/P-O/P: 500 VDC Ta:25°C	I/P-O/P: >9999 MΩ NO DAMAGE

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS C	I/P: 230 VAC/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
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 AIR : 8KV / Contact : 4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA B
5	E.F.T	EN61000-4-4 INPUT: 1KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
6	SURGE	IEC61000-4-5 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 : SPWM-240-24MA 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=30.4 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=46.5 °C <table><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=30.4°C</th><th>HIGH AMBIENT Ta=46.5 °C</th></tr><tr><td>1</td><td>ZNR1</td><td>66.7°C</td><td>78.4°C</td></tr><tr><td>2</td><td>C1</td><td>71.0°C</td><td>83.9°C</td></tr><tr><td>3</td><td>C2</td><td>70.8°C</td><td>83.9°C</td></tr><tr><td>4</td><td>C9</td><td>71.5°C</td><td>85.0°C</td></tr><tr><td>5</td><td>BD1</td><td>76.8°C</td><td>90.2°C</td></tr><tr><td>6</td><td>R7</td><td>81.7°C</td><td>95.2°C</td></tr><tr><td>7</td><td>Q1</td><td>75.1°C</td><td>88.7°C</td></tr><tr><td>8</td><td>C5</td><td>69.2°C</td><td>83.0°C</td></tr><tr><td>9</td><td>C88</td><td>73.3°C</td><td>87.5°C</td></tr><tr><td>10</td><td>U1</td><td>71.4°C</td><td>85.2°C</td></tr><tr><td>11</td><td>Q2</td><td>79.6°C</td><td>93.8°C</td></tr><tr><td>12</td><td>T1</td><td>77.5°C</td><td>91.7°C</td></tr><tr><td>13</td><td>C130</td><td>70.9°C</td><td>84.6°C</td></tr><tr><td>14</td><td>C104</td><td>72.8°C</td><td>86.4°C</td></tr><tr><td>15</td><td>Q100</td><td>73.3°C</td><td>86.8°C</td></tr><tr><td>16</td><td>U100</td><td>82.3°C</td><td>95.9°C</td></tr><tr><td>17</td><td>C307</td><td>63.6°C</td><td>76.3°C</td></tr><tr><td>18</td><td>U300</td><td>60.6°C</td><td>73.2°C</td></tr><tr><td>19</td><td>RTH2</td><td>70.7°C</td><td>84.4°C</td></tr><tr><td>20</td><td>Q110</td><td>81.8°C</td><td>89.6°C</td></tr><tr><td>21</td><td>Q110</td><td>81.8°C</td><td>89.6°C</td></tr><tr><td>22</td><td>TC</td><td>66.8°C</td><td>80.7°C</td></tr></table>			NO	Position	ROOM AMBIENT Ta=30.4°C	HIGH AMBIENT Ta=46.5 °C	1	ZNR1	66.7°C	78.4°C	2	C1	71.0°C	83.9°C	3	C2	70.8°C	83.9°C	4	C9	71.5°C	85.0°C	5	BD1	76.8°C	90.2°C	6	R7	81.7°C	95.2°C	7	Q1	75.1°C	88.7°C	8	C5	69.2°C	83.0°C	9	C88	73.3°C	87.5°C	10	U1	71.4°C	85.2°C	11	Q2	79.6°C	93.8°C	12	T1	77.5°C	91.7°C	13	C130	70.9°C	84.6°C	14	C104	72.8°C	86.4°C	15	Q100	73.3°C	86.8°C	16	U100	82.3°C	95.9°C	17	C307	63.6°C	76.3°C	18	U300	60.6°C	73.2°C	19	RTH2	70.7°C	84.4°C	20	Q110	81.8°C	89.6°C	21	Q110	81.8°C	89.6°C	22	TC	66.8°C	80.7°C
NO	Position	ROOM AMBIENT Ta=30.4°C	HIGH AMBIENT Ta=46.5 °C																																																																																													
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11	Q2	79.6°C	93.8°C																																																																																													
12	T1	77.5°C	91.7°C																																																																																													
13	C130	70.9°C	84.6°C																																																																																													
14	C104	72.8°C	86.4°C																																																																																													
15	Q100	73.3°C	86.8°C																																																																																													
16	U100	82.3°C	95.9°C																																																																																													
17	C307	63.6°C	76.3°C																																																																																													
18	U300	60.6°C	73.2°C																																																																																													
19	RTH2	70.7°C	84.4°C																																																																																													
20	Q110	81.8°C	89.6°C																																																																																													
21	Q110	81.8°C	89.6°C																																																																																													
22	TC	66.8°C	80.7°C																																																																																													
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 121%LOAD Ta : 25°C	TEST : OK																																																																																												
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/180VAC O/P : 100%/80%LOAD Ta= -25°C	TEST : OK																																																																																												
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45 °C NO DAMAGE	I/P : 315 VAC O/P : FULL LOAD Ta=45 °C HUMIDITY= 95 %R.H	TEST : OK																																																																																												
5	TEMPERATURE COEFFICIENT	±0.03 %(0°C~50°C)	I/P : 230 VAC O/P : FULL LOAD	±0.013 %(0~50°C)																																																																																												

6	STORAGE TEMPERATURE TEST	-40~80°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 : 10CYCLE 5. Input/output condition : STATIC TEST : OK
7	THERMAL SHOCK TEST	-20~45°C	1. Thermal shock Temperature : -25°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	5 ~ 100Hz, 2G 12min./1cycle, 72min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 5~100Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 3G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C
9	CAPACITOR LIFE CYCLE	SUPPOSE C104 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) 79423HRS (2) 40266HRS (3) 103997HRS (4) 225017HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1801.3K hrs min. Telcordia SR-332 (Bellcore) ; 155.5K 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	WUWQIN/ZHOUBIAO	WENF	WUWQ

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