



Test Report: WDR-60-24

60W Ultra Wide Input Industrial DIN RAIL Power Supply

■ 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

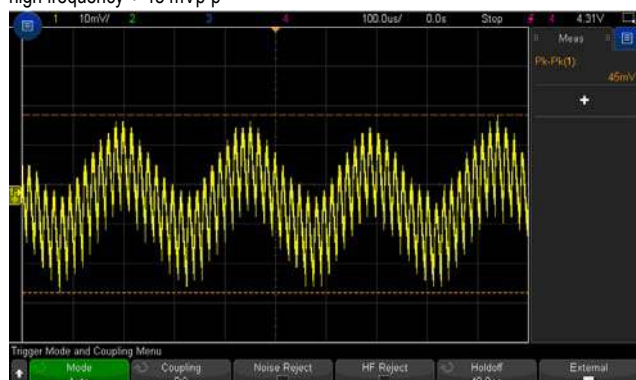
ENVIRONMENT TEST

DESIGN VERIFY TEST

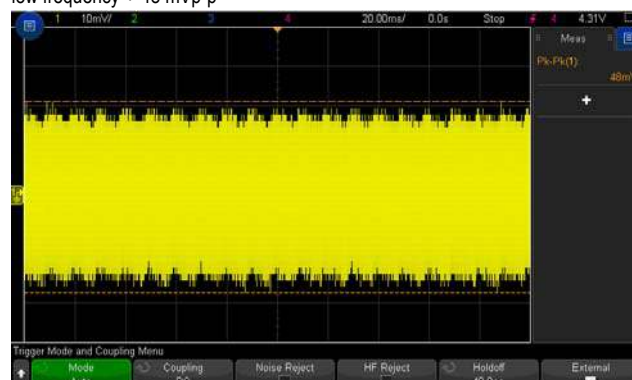
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 24 V~ 29V	I/P : 400 VAC I/P : 230 VAC O/P : MIN LOAD Ta : 25°C	20.213V~30.467V/400VAC 20.213V~30.467V/230VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.0%~ +1.0 %	I/P: 180VAC /550VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.07%~ 0.08%
3	LINE REGULATION (Max)	V1: -0.5%~ +0.5 %	I/P: 180VAC~ 500VAC O/P:FULL LOAD Ta:25°C	V1: -0.01%~ 0.01%
4	LOAD REGULATION(Max)	V1: -0.5%~ +0.5 %	I/P: 400VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.07%~ 0.08%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 400VAC O/P:FULL LOAD Ta:25°C	1.3%
6	RIPPLE & NOISE(Max)	V1: 150mVp-p	I/P:400VAC O/P:FULL LOAD Ta:25°C	V1: 48 mVp-p

high frequency : 45 mVp-p



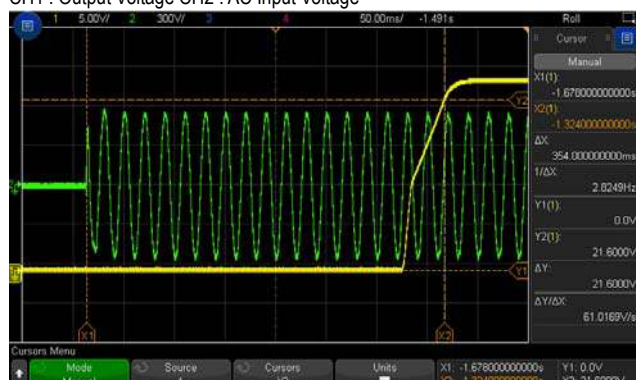
low frequency : 48 mVp-p



7	SET UP TIME(Max)	400VAC/1000ms 230VAC/2000ms	I/P : 400 VAC I/P : 230VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 354 ms 230VAC/ 367 ms
---	------------------	--------------------------------	---	----------------------------------

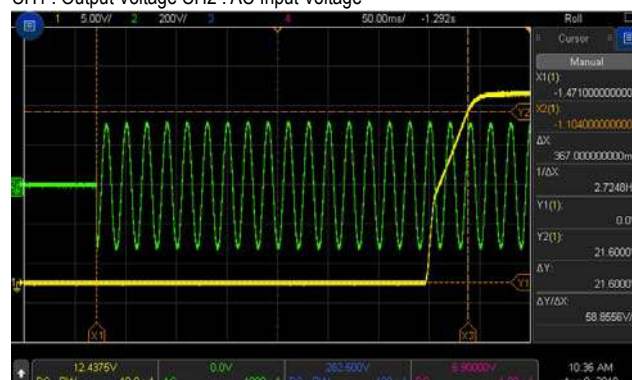
INPUT=400VAC/50HZ @ FULL LOAD

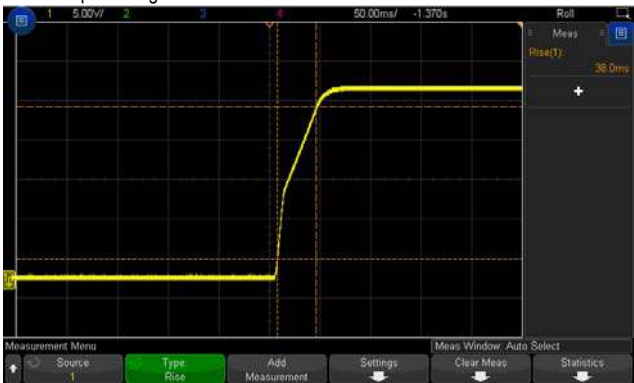
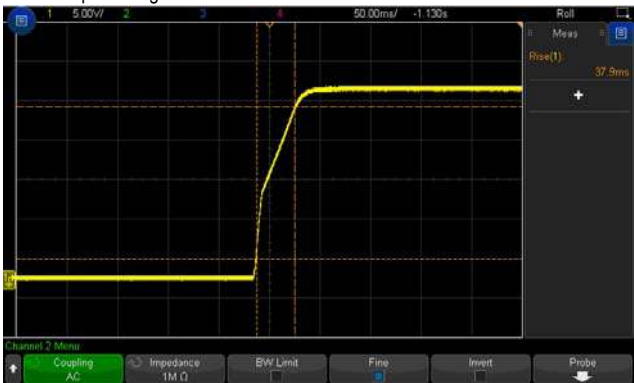
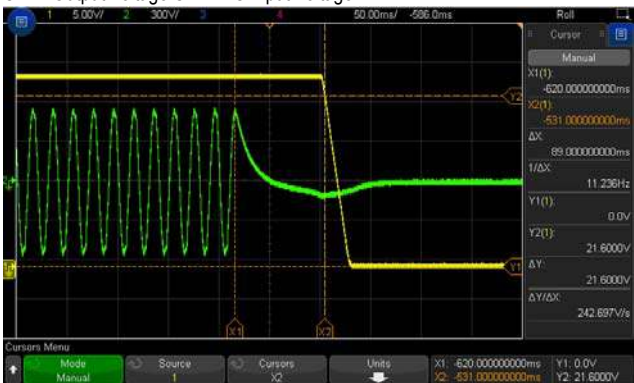
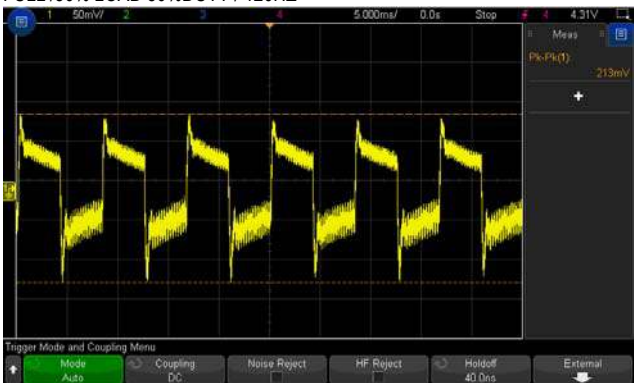
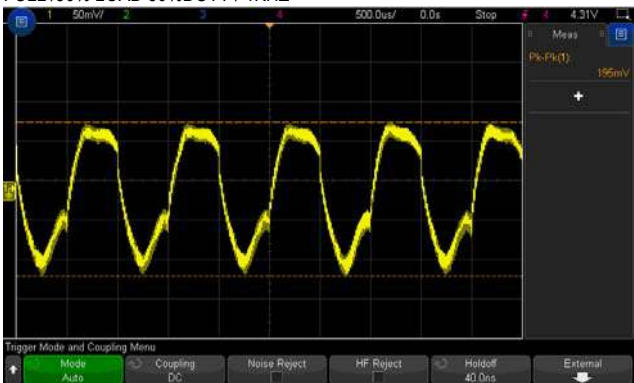
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=230VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

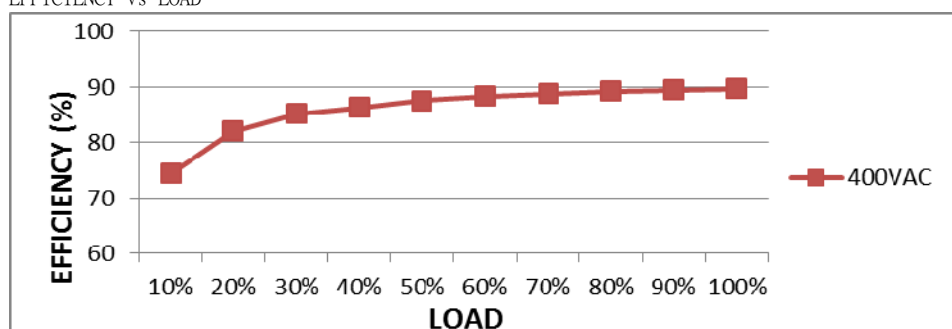


8	RISE TIME (Max)	400VAC/70ms 230VAC/70ms	I/P : 400 VAC I/P : 230VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 38 ms 230VAC/ 37.9 ms
INPUT=400VAC/50HZ @ FULL LOAD CH1 : Output Voltage				
INPUT=230VAC/60HZ @ FULL LOAD CH1 : Output Voltage				
9	HOLD UP TIME (Typ.)	400VAC/20ms 230VAC/10ms	I/P : 400 VAC I/P : 230VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 89 ms 230VAC/25.4 ms
INPUT=400VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage				
INPUT=230VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage				
10	DYNAMIC LOAD	V1: 2400 mVp-p	I/P: 400VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	213mVp-p 195mVp-p
FULL /50% LOAD 50%DUTY / 120HZ				
FULL /50% LOAD 50%DUTY / 1KHZ				

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC~550VAC 254VDC~780VDC	I/P: TESTING O/P: FULL LOAD Ta: 25°C	146VAC~550VAC 210VDC~780VDC
			I/P: LOW-LINE-3V=177 V HIGH-LINE+10=560 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 ~550 VAC O/P: FULL~MIN LOAD Ta: 25°C	TEST: OK
3	INPUT CURRENT (Typ.)	400V/ 0.4 A 230V/ 0.7 A	I/P : 400 VAC I/P : 230VAC O/P : FULL LOAD Ta : 25°C	I=0.292A/ 400VAC I=0.451A/ 230VAC
4	LEAKAGE CURRENT	< 2mA /530 VAC	I/P : 530 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.48 mA N-FG : 0.48 mA
5	EFFICIENCY(Typ.)	89%	I/P: 400 VAC O/P: FULL LOAD Ta: 25°C	89.59%

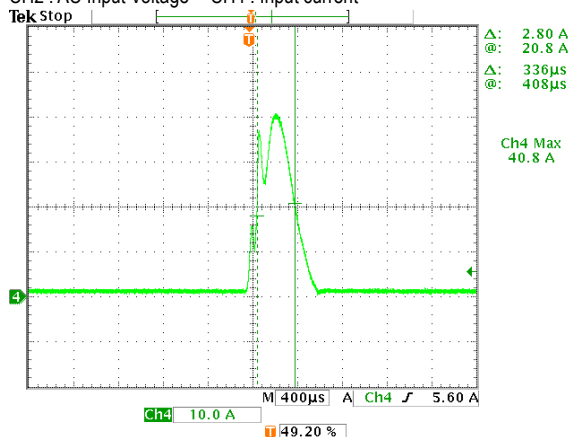
EFFICIENCY vs LOAD



6	INRUSH CURRENT(Typ.)	400V/50A 230V/30A COLD START	I/P : 400 VAC I/P : 230VAC O/P : FULL LOAD Ta : 25°C	I=40.8A/ 400VAC I=25.0A/ 230VAC
---	----------------------	------------------------------------	---	------------------------------------

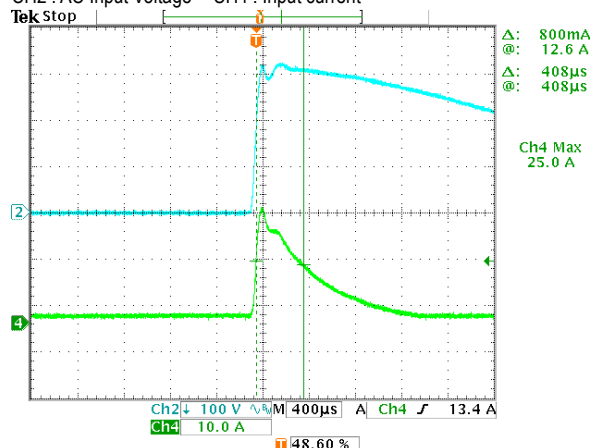
INPUT=400VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current



INPUT=230VAC/ 60HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~ 135%	I/P: 550VAC I/P: 400VAC I/P: 230VAC O/P: TESTING Ta:25°C	120.0%/ 550VAC 120.0%/400 VAC 120.0%/230VAC PROTECTION TYPE: Hiccup mode when output voltage < 50%, recovers automatically after fault condition is removed; Constant current limiting within 50%~100% rated output voltage, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	31V~37V	I/P: 550VAC I/P: 400VAC I/P: 180VAC O/P: MIN LOAD Ta:25°C	33.0V/ 550VAC 33.0V/ 400VAC 33.0V/ 180VAC PROTECTION TYPE : Shut down O/P voltage ,re-power on to recover.
3	OVER TEMPERATURE PROTECTION	Protection type : Shut down O/P voltage ,re-power on to recover	I/P:550VAC I/P: 180VAC O/P:FULL LOAD	O.T.P. Active Protection type : Shut down O/P voltage ,re-power on to recover.
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 550VAC I/P: 180VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Hiccup mode ,recovers automatically after fault condition is removed .

CONTROL FUNCTION TEST

1	DC OK CONTACT RATINGS	30VDC/1A RESISTIVE LOAD	I/P:400VAC O/P:FULL LOAD Ta:25°C	TEST : OK

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q1/Q2 Rated: 9A/ 950V	AC ON/OFF I/P:High-Line +3V =553V O/P: (1)Full Load (2)Output Short (3) Full Load continue Ta:25°C	Q1: Q2: VDS: VDS: (1) 589V (1) 685V (2) 460V (2) 605V (3) 516V (3) 653V
2	Diode Peak Voltage	Q100 Rated: 20 A/ 200 V	AC ON/OFF I/P:High-Line +3V =553 V O/P: (1)Full Load (2)Output Short (3) Full Load continue Ta:25°C	Q100: VDS: (1) 165V (2) 119V (3) 137V

3	Input Capacitor Voltage	C5 /C6 Rated: 82 μ / 420 V	I/P:High-Line +3V =550V 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	C5 (1) 396V (2) 396V (3) 387V (4) 379V	C6 (1) 395V (2) 395V (3) 387V (4) 379V
4	Control IC Voltage Test	PWM IC U1 Rated: 9V~ 30 V O/P IC U101 Rated: -0.3V~ 38 V	AC ON/OFF I/P:High-Line +3V =553V O/P: (1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(LOW LINE) Ta:25°C	U1 (1) 21.9V (2) 17.1V (3) 21.5V (4) 21.7V (5) 18.3V	U101 (1) 18.3V (2) 0.6V (3) 17.7V (4) 26.4V (5) 13.7V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 4.7KVAC/min I/P-FG :2.5KVAC/min O/P-FG:0.5KVAC/min O/P-DC OK:0.5KVAC/min	I/P-O/P: 5 KVAC/min I/P-FG: 3 KVAC/min O/P-FG:0.6 KVAC/min O/P-DC OK:0.6KVAC/min Ta:25°C	I/P-O/P:4.82mA I/P-FG:2.55mA O/P-FG:1.93 m A O/P-DC OK: 0.01mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100M Ω I/P-FG: 500VDC>100M Ω O/P-FG:500VDC>100M Ω	I/P-O/P: 600 VDC I/P-FG: 600 VDC O/P-FG: 600 VDC Ta:25°C	I/P-O/P: 8858M Ω I/P-FG: 5723M Ω O/P-FG:9999M Ω NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 50 m Ω	40A / 2min Ta:25°C	10m Ω

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:400VAC/50HZ O/P:FULL LOAD Ta:25°C	PASS
2	CONDUCTION	☒ EN55032 CLASS B	I/P : 400 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	☒ EN55032 CLASS B	I/P : 400 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 ☒ INDUSTRY AIR: 8KV / Contact: 4KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	☒ CRITERIA A ☐ CRITERIA B
5	E.F.T	EN61000-4-4 ☒ INDUSTRY INPUT : 2KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	☒ CRITERIA A ☐ CRITERIA B
6	SURGE	IEC61000-4-5 ☒ INDUSTRY L-N : 2KV L,N-PE : 4KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	☒ CRITERIA A ☐ CRITERIA B
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 : WDR-60-48 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 400VAC O/P : FULL LOAD Ta=24.9℃ 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 400VAC O/P : FULL LOAD Ta=61.2℃ <table><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=24.9℃</th><th>HIGH AMBIENT Ta=61.2℃</th></tr><tr><td>1</td><td>ZNR1</td><td>38.0℃</td><td>74.1℃</td></tr><tr><td>2</td><td>LF1</td><td>39.3℃</td><td>75.4℃</td></tr><tr><td>3</td><td>C1</td><td>41.7℃</td><td>77.3℃</td></tr><tr><td>4</td><td>RY1</td><td>50.2℃</td><td>84.4℃</td></tr><tr><td>5</td><td>LF100</td><td>43.7℃</td><td>78.8℃</td></tr><tr><td>6</td><td>C113</td><td>41.3℃</td><td>76.4℃</td></tr><tr><td>7</td><td>LF2</td><td>38.1℃</td><td>74.4℃</td></tr><tr><td>8</td><td>BD1</td><td>45.2℃</td><td>81.0℃</td></tr><tr><td>9</td><td>C6</td><td>43.9℃</td><td>79.4℃</td></tr><tr><td>10</td><td>RTH1</td><td>54.1℃</td><td>84.7℃</td></tr><tr><td>11</td><td>PCB</td><td>50.6℃</td><td>82.6℃</td></tr><tr><td>12</td><td>R40</td><td>50.7℃</td><td>85.8℃</td></tr><tr><td>13</td><td>Q1</td><td>47.1℃</td><td>82.1℃</td></tr><tr><td>14</td><td>Q2</td><td>47.2℃</td><td>82.3℃</td></tr><tr><td>15</td><td>Q100</td><td>52.2℃</td><td>87.0℃</td></tr><tr><td>16</td><td>T1coil</td><td>58.7℃</td><td>93.7℃</td></tr><tr><td>17</td><td>T1core</td><td>55.7℃</td><td>90.4℃</td></tr><tr><td>18</td><td>T3</td><td>49.0℃</td><td>83.7℃</td></tr><tr><td>19</td><td>C51</td><td>50.0℃</td><td>84.8℃</td></tr><tr><td>20</td><td>C106</td><td>46.9℃</td><td>81.3℃</td></tr><tr><td>21</td><td>C108</td><td>44.7℃</td><td>79.4℃</td></tr><tr><td>22</td><td>U1</td><td>47.8℃</td><td>82.1℃</td></tr><tr><td>23</td><td>RTH2</td><td>48.1℃</td><td>82.3℃</td></tr><tr><td>24</td><td>U2</td><td>48.0℃</td><td>82.9℃</td></tr><tr><td>25</td><td>ZNR3</td><td>44.7℃</td><td>80.2℃</td></tr><tr><td>26</td><td>D5</td><td>49.7℃</td><td>84.4℃</td></tr><tr><td>27</td><td>D51</td><td>49.4℃</td><td>84.0℃</td></tr><tr><td>28</td><td>Q50</td><td>48.4℃</td><td>82.9℃</td></tr><tr><td>29</td><td>Q200</td><td>56.2℃</td><td>89.0℃</td></tr><tr><td>30</td><td>C55</td><td>48.1℃</td><td>82.7℃</td></tr><tr><td>31</td><td>C202</td><td>48.6℃</td><td>82.8℃</td></tr><tr><td>32</td><td>U101</td><td>48.7℃</td><td>82.8℃</td></tr></table>			NO	Position	ROOM AMBIENT Ta=24.9℃	HIGH AMBIENT Ta=61.2℃	1	ZNR1	38.0℃	74.1℃	2	LF1	39.3℃	75.4℃	3	C1	41.7℃	77.3℃	4	RY1	50.2℃	84.4℃	5	LF100	43.7℃	78.8℃	6	C113	41.3℃	76.4℃	7	LF2	38.1℃	74.4℃	8	BD1	45.2℃	81.0℃	9	C6	43.9℃	79.4℃	10	RTH1	54.1℃	84.7℃	11	PCB	50.6℃	82.6℃	12	R40	50.7℃	85.8℃	13	Q1	47.1℃	82.1℃	14	Q2	47.2℃	82.3℃	15	Q100	52.2℃	87.0℃	16	T1coil	58.7℃	93.7℃	17	T1core	55.7℃	90.4℃	18	T3	49.0℃	83.7℃	19	C51	50.0℃	84.8℃	20	C106	46.9℃	81.3℃	21	C108	44.7℃	79.4℃	22	U1	47.8℃	82.1℃	23	RTH2	48.1℃	82.3℃	24	U2	48.0℃	82.9℃	25	ZNR3	44.7℃	80.2℃	26	D5	49.7℃	84.4℃	27	D51	49.4℃	84.0℃	28	Q50	48.4℃	82.9℃	29	Q200	56.2℃	89.0℃	30	C55	48.1℃	82.7℃	31	C202	48.6℃	82.8℃	32	U101	48.7℃	82.8℃
NO	Position	ROOM AMBIENT Ta=24.9℃	HIGH AMBIENT Ta=61.2℃																																																																																																																																					
1	ZNR1	38.0℃	74.1℃																																																																																																																																					
2	LF1	39.3℃	75.4℃																																																																																																																																					
3	C1	41.7℃	77.3℃																																																																																																																																					
4	RY1	50.2℃	84.4℃																																																																																																																																					
5	LF100	43.7℃	78.8℃																																																																																																																																					
6	C113	41.3℃	76.4℃																																																																																																																																					
7	LF2	38.1℃	74.4℃																																																																																																																																					
8	BD1	45.2℃	81.0℃																																																																																																																																					
9	C6	43.9℃	79.4℃																																																																																																																																					
10	RTH1	54.1℃	84.7℃																																																																																																																																					
11	PCB	50.6℃	82.6℃																																																																																																																																					
12	R40	50.7℃	85.8℃																																																																																																																																					
13	Q1	47.1℃	82.1℃																																																																																																																																					
14	Q2	47.2℃	82.3℃																																																																																																																																					
15	Q100	52.2℃	87.0℃																																																																																																																																					
16	T1coil	58.7℃	93.7℃																																																																																																																																					
17	T1core	55.7℃	90.4℃																																																																																																																																					
18	T3	49.0℃	83.7℃																																																																																																																																					
19	C51	50.0℃	84.8℃																																																																																																																																					
20	C106	46.9℃	81.3℃																																																																																																																																					
21	C108	44.7℃	79.4℃																																																																																																																																					
22	U1	47.8℃	82.1℃																																																																																																																																					
23	RTH2	48.1℃	82.3℃																																																																																																																																					
24	U2	48.0℃	82.9℃																																																																																																																																					
25	ZNR3	44.7℃	80.2℃																																																																																																																																					
26	D5	49.7℃	84.4℃																																																																																																																																					
27	D51	49.4℃	84.0℃																																																																																																																																					
28	Q50	48.4℃	82.9℃																																																																																																																																					
29	Q200	56.2℃	89.0℃																																																																																																																																					
30	C55	48.1℃	82.7℃																																																																																																																																					
31	C202	48.6℃	82.8℃																																																																																																																																					
32	U101	48.7℃	82.8℃																																																																																																																																					
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 400 VAC O/P : 117% LOAD Ta : 25℃	TEST : OK																																																																																																																																				
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 550VAC/210VAC O/P : 100 % LOAD Ta= -35℃	TEST : OK																																																																																																																																				

4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60 °C / 95 %R.H NO DAMAGE	I/P : 560 VAC O/P : FULL LOAD Ta=60°C HUMIDITY= 95 %R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	± 0.03%/°C (0~60°C)	I/P : 400 VAC O/P : FULL LOAD	± 0.001%/°C (0~60°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	-30~60°C	1. Thermal shock Temperature : -35°C~ +65°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:400V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:400V/ FULL LOAD Burn In Test	
8	VIBRATION TEST	10 ~ 500Hz, 2G 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 : 3G (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 : 400VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 400VAC O/P : FULL LOAD Ta= 60 °C LIFE TIME (3) I/P : 400VAC O/P : 75% LOAD Ta= 60 °C LIFE TIME (4) I/P : 400VAC O/P : 50% LOAD Ta= 60 °C LIFE TIME		(1) 521504.4 HRS (2) 52583.4 HRS (3) 73229.4 HRS (4) 93795.7 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 313.68K hrs min. MIL-HDBK-217F (25°C)		
11	Ongoing Reliability Test	I/P : 400VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ

2018.4.30 GP-A50-F010