



Test Report: WDR-60-5

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

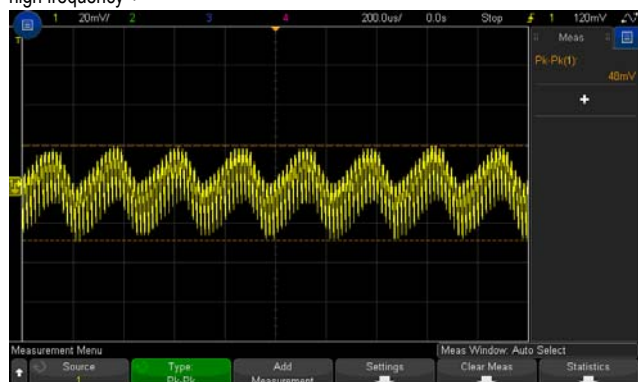
ENVIRONMENT TEST

DESIGN VERIFY TEST

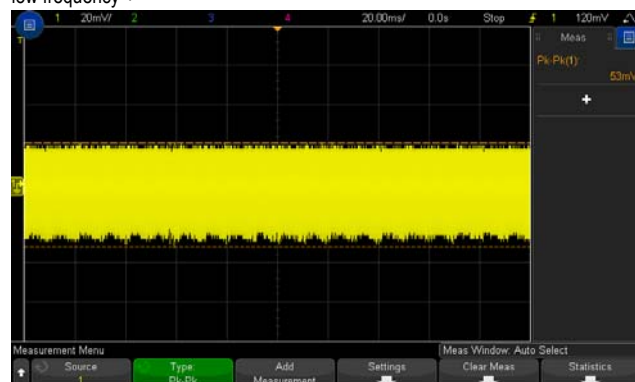
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 5 V~ 6V	I/P : 400 VAC I/P : 230 VAC O/P : MIN LOAD Ta : 25°C	4.65V~6.15V /400VAC 4.65V~6.15V /230VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -2%~ +2 %	I/P: 180VAC /550VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.91 %~0.91%
3	LINE REGULATION (Max)	V1: -0.5%~ +0.5 %	I/P: 180VAC~ 550VAC O/P:FULL LOAD Ta:25°C	V1: -0.01%~ 0.01%
4	LOAD REGULATION(Max)	V1: -1.5%~ +1.5 %	I/P: 400VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.91 %~0.91%
5	OVER/UNDERSHOOT TEST	< ±10%	I/P: 400VAC O/P:FULL LOAD Ta:25°C	1.2%
6	RIPPLE & NOISE(Max)	V1: 100mVp-p	I/P:400VAC O/P:FULL LOAD Ta:25°C	53mVp-p

high frequency :



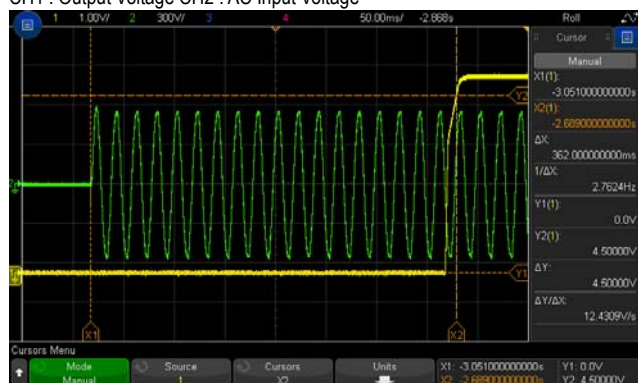
low frequency :



7	SET UP TIME(Max)	400VAC/1000ms 230VAC/2000ms	I/P : 400 VAC I/P : 230VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 362ms 230VAC/ 383ms
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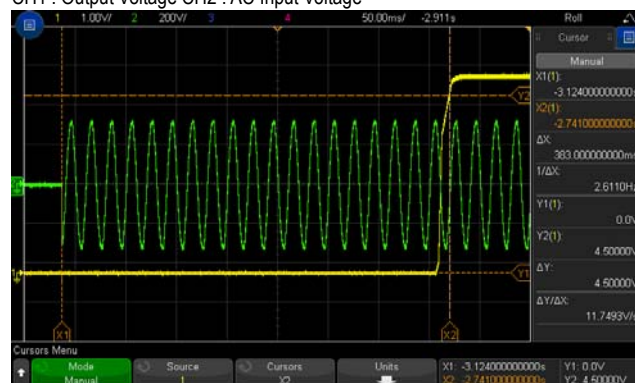
INPUT=400VAC/50HZ @ FULL LOAD

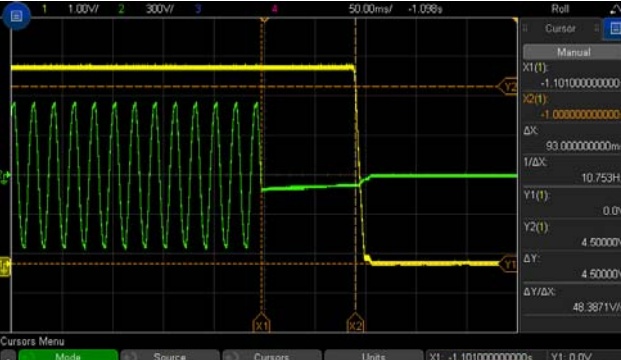
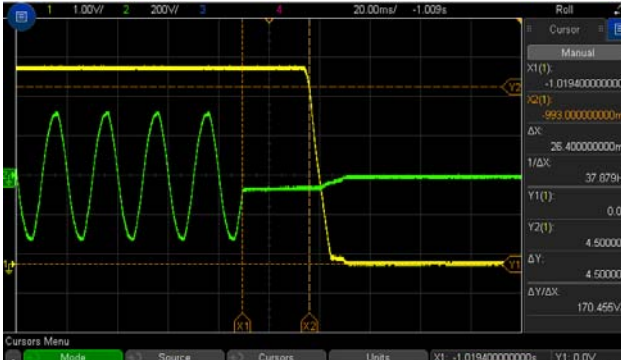
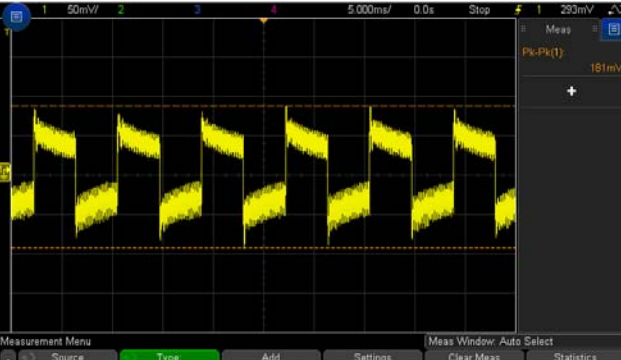
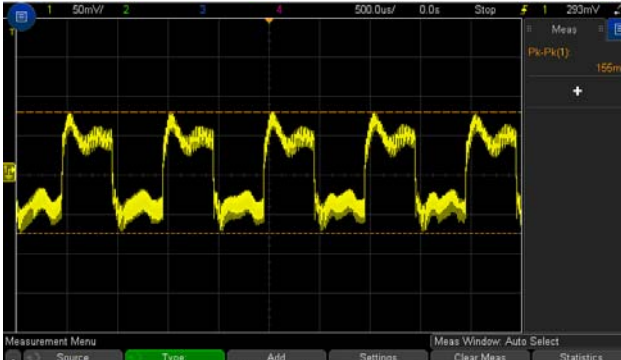
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=230VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

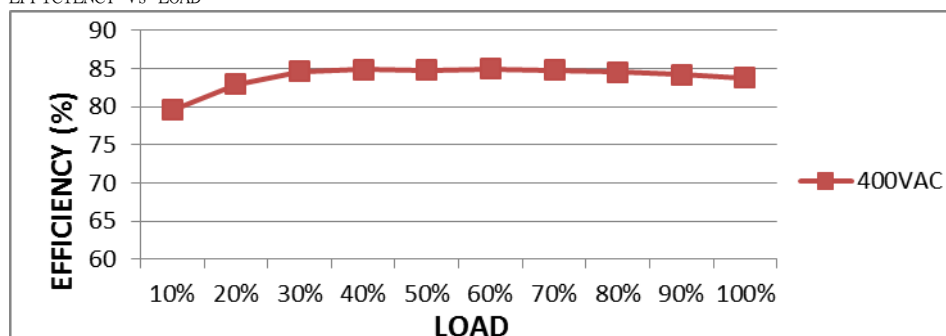


8	RISE TIME (Max) 400VAC/70ms 230VAC/70ms	I/P : 400 VAC I/P : 230VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 9.96ms 230VAC/ 9.56ms
INPUT=400VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		INPUT=230VAC/60HZ @ FULL LOAD CH1 : Output Voltage 	
9	HOLD UP TIME (Typ.) 400VAC/20ms 230VAC/10ms	I/P : 400 VAC I/P : 230VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 93ms 230VAC/ 26.4ms
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: 1000mVp-p	I/P: 400VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	181mVp-p / 120HZ 155mVp-p/ 1KHZ
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	145VAC~550VAC 209VDC~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=0.25A/ 400VAC I=0.41A / 230VAC
4	LEAKAGE CURRENT	< 2mA /530 VAC	I/P : 530 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.57mA N-FG : 0.57mA
5	EFFICIENCY(Typ.)	83.5%	I/P: 400 VAC O/P: FULL LOAD Ta: 25°C	84.26%

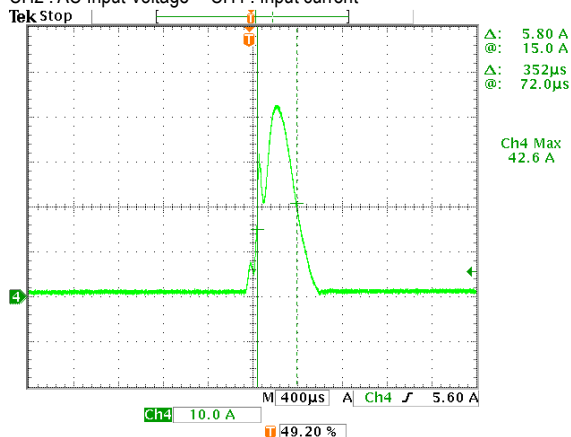
EFFICIENCY vs LOAD



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=42.6A/ 400VAC I=26.6A/ 230VAC
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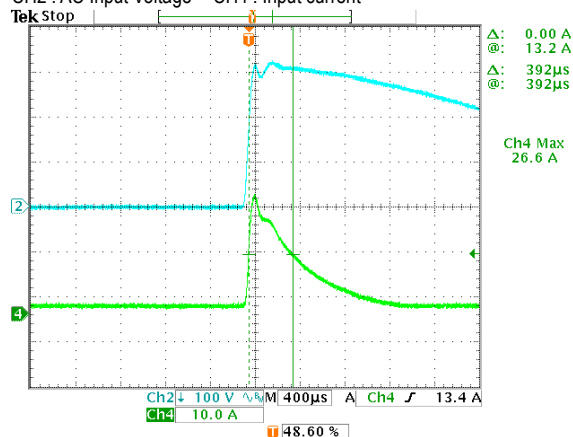
INPUT=400VAC/50HZ @ FULL LOAD

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	121.1%/ 550VAC 121.1%/400 VAC 121.4%/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	6.2V~7.2V	I/P: 550VAC I/P: 400VAC I/P: 180VAC O/P: MIN LOAD Ta:25°C	6.90V/ 550VAC 6.90V/ 400VAC 6.90V/ 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) 615V (1) 830V (2) 579V (2) 798V (3) 587V (3) 726V
2	Diode Peak Voltage	Q100 Rated: 120 A/ 80 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) 49.4V (2) 42.1V (3) 44.1V
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	C5 C6 (1) 397V (1) 397V (2) 395V (2) 397 V

			(3)Full Load /Min load Change (4)Full load continue Ta:25°C	(3) 387V (4) 379V	(3) 383V (4) 375V
4	Control IC Voltage Test	PWM IC U1 Rated: 9V~30 V SR IC U100 Rated: -0.3V~27 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) 22.1V (2) 21.9V (3) 22.3V (4) 21.7V (5) 17.3V U100 (1) 12.8V (2) 11.2V (3) 12.8V (4) 9.4V (5) 7.0V	U101 (1) 6.06V (2) 3.36V (3) 6.26V (4) 6.82V (5) 4.41V

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:4.93 mA I/P-FG:2.57mA O/P-FG:1.98mA O/P-DC OK:0.01mA 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: 600 VDC I/P-FG: 600 VDC O/P-FG: 600 VDC Ta:25°C	I/P-O/P: 9999MΩ I/P-FG: 9999MΩ O/P-FG: 9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 50 mΩ	40A / 2min Ta:25°C	8mΩ

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-60-5 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><thead><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=24.9℃</th><th>HIGH AMBIENT Ta=61.2℃</th></tr></thead><tbody><tr><td>1</td><td>ZNR1</td><td>39.8℃</td><td>77.4℃</td></tr><tr><td>2</td><td>LF1</td><td>41.1℃</td><td>79.1℃</td></tr><tr><td>3</td><td>C1</td><td>44.1℃</td><td>81.7℃</td></tr><tr><td>4</td><td>RY1</td><td>55.4℃</td><td>91.6℃</td></tr><tr><td>5</td><td>LF100</td><td>58.1℃</td><td>95.1℃</td></tr><tr><td>6</td><td>C113</td><td>52.2℃</td><td>88.4℃</td></tr><tr><td>7</td><td>LF2</td><td>39.5℃</td><td>77.0℃</td></tr><tr><td>8</td><td>BD1</td><td>45.7℃</td><td>83.1℃</td></tr><tr><td>9</td><td>C6</td><td>45.5℃</td><td>82.7℃</td></tr><tr><td>10</td><td>RTH1</td><td>55.7℃</td><td>87.5℃</td></tr><tr><td>11</td><td>PCB</td><td>50.5℃</td><td>84.7℃</td></tr><tr><td>12</td><td>R40</td><td>54.7℃</td><td>92.0℃</td></tr><tr><td>13</td><td>Q1</td><td>49.7℃</td><td>87.6℃</td></tr><tr><td>14</td><td>Q2</td><td>53.1℃</td><td>90.7℃</td></tr><tr><td>15</td><td>Q100</td><td>58.5℃</td><td>96.3℃</td></tr><tr><td>16</td><td>T1coil</td><td>61.9℃</td><td>98.7℃</td></tr><tr><td>17</td><td>T1core</td><td>55.3℃</td><td>92.0℃</td></tr><tr><td>18</td><td>T3</td><td>54.0℃</td><td>91.5℃</td></tr><tr><td>19</td><td>C51</td><td>59.8℃</td><td>96.5℃</td></tr><tr><td>20</td><td>C106</td><td>60.5℃</td><td>97.4℃</td></tr><tr><td>21</td><td>C108</td><td>55.3℃</td><td>91.9℃</td></tr><tr><td>22</td><td>U1</td><td>51.2℃</td><td>87.1℃</td></tr><tr><td>23</td><td>RTH2</td><td>50.4℃</td><td>86.7℃</td></tr><tr><td>24</td><td>U2</td><td>51.3℃</td><td>87.8℃</td></tr><tr><td>25</td><td>ZNR3</td><td>44.0℃</td><td>80.8℃</td></tr><tr><td>26</td><td>D5</td><td>54.1℃</td><td>90.2℃</td></tr><tr><td>27</td><td>D51</td><td>62.0℃</td><td>98.1℃</td></tr><tr><td>28</td><td>Q50</td><td>58.5℃</td><td>94.0℃</td></tr><tr><td>29</td><td>Q200</td><td>60.8℃</td><td>96.5℃</td></tr><tr><td>30</td><td>C55</td><td>58.3℃</td><td>95.3℃</td></tr><tr><td>31</td><td>C202</td><td>65.0℃</td><td>102.1℃</td></tr><tr><td>32</td><td>U101</td><td>56.7℃</td><td>93.1℃</td></tr></tbody></table>			NO	Position	ROOM AMBIENT Ta=24.9℃	HIGH AMBIENT Ta=61.2℃	1	ZNR1	39.8℃	77.4℃	2	LF1	41.1℃	79.1℃	3	C1	44.1℃	81.7℃	4	RY1	55.4℃	91.6℃	5	LF100	58.1℃	95.1℃	6	C113	52.2℃	88.4℃	7	LF2	39.5℃	77.0℃	8	BD1	45.7℃	83.1℃	9	C6	45.5℃	82.7℃	10	RTH1	55.7℃	87.5℃	11	PCB	50.5℃	84.7℃	12	R40	54.7℃	92.0℃	13	Q1	49.7℃	87.6℃	14	Q2	53.1℃	90.7℃	15	Q100	58.5℃	96.3℃	16	T1coil	61.9℃	98.7℃	17	T1core	55.3℃	92.0℃	18	T3	54.0℃	91.5℃	19	C51	59.8℃	96.5℃	20	C106	60.5℃	97.4℃	21	C108	55.3℃	91.9℃	22	U1	51.2℃	87.1℃	23	RTH2	50.4℃	86.7℃	24	U2	51.3℃	87.8℃	25	ZNR3	44.0℃	80.8℃	26	D5	54.1℃	90.2℃	27	D51	62.0℃	98.1℃	28	Q50	58.5℃	94.0℃	29	Q200	60.8℃	96.5℃	30	C55	58.3℃	95.3℃	31	C202	65.0℃	102.1℃	32	U101	56.7℃	93.1℃
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 400 VAC O/P : 116% 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	± 0.016%/°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) 829793 HRS (2) 13771 HRS (3) 40642 HRS (4) 96376 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