



Test Report: WDR-60-12

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

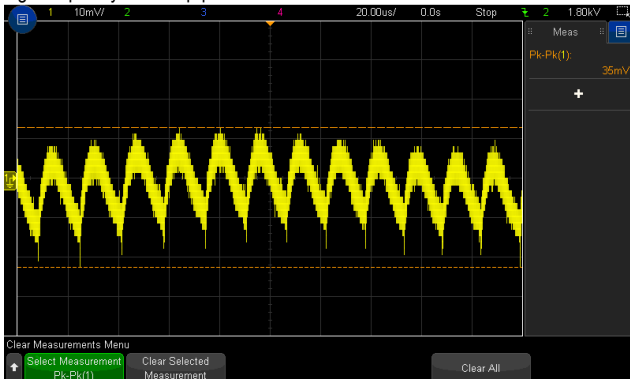
ENVIRONMENT TEST

DESIGN VERIFY TEST

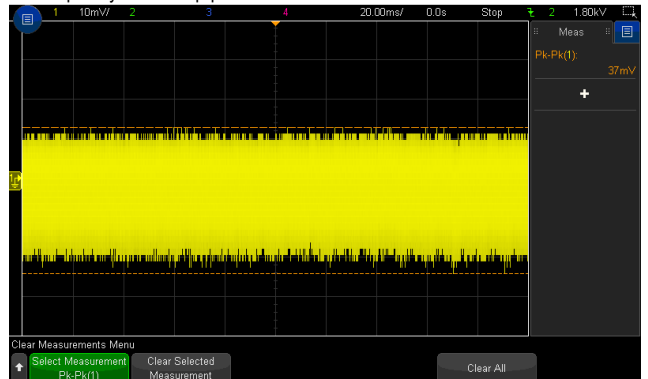
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 12 V~ 15V	I/P : 400 VAC I/P : 230 VAC O/P : MIN LOAD Ta : 25°C	11.51V~15.71V/400VAC 11.51V~15.71V/230VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.5%~ +1.5 %	I/P: 180VAC /550VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.24%~ 0.24%
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: -0.24%~ 0.24%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 400VAC O/P:FULL LOAD Ta:25°C	0.34%
6	RIPPLE & NOISE(Max)	V1: 120mVp-p	I/P:400VAC O/P:FULL LOAD Ta:25°C	37 mVp-p

high frequency : 35mVp-p



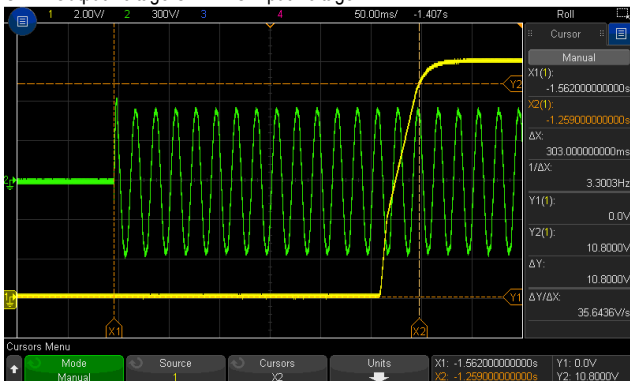
low frequency : 37mVp-p



7	SET UP TIME(Max)	400VAC/1000ms 230VAC/2000ms	I/P : 400 VAC I/P : 230VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 303 ms 230VAC/ 369 ms
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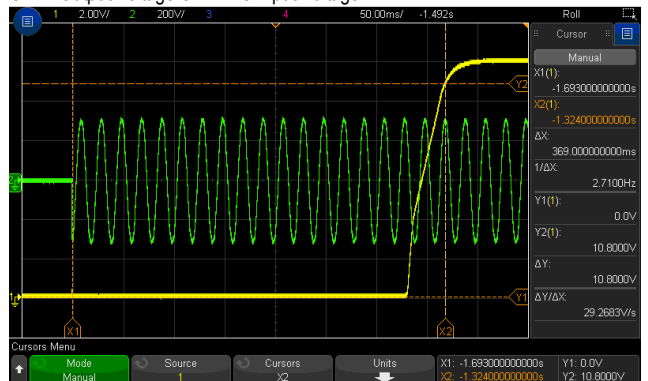
INPUT=400VAC/50HZ @ FULL LOAD

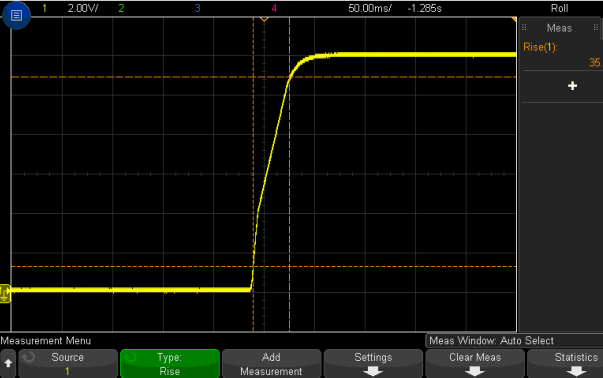
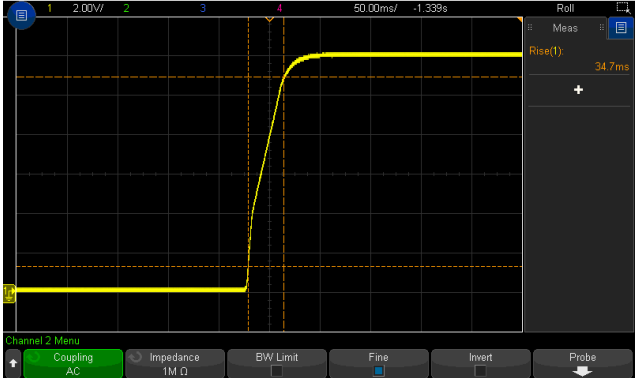
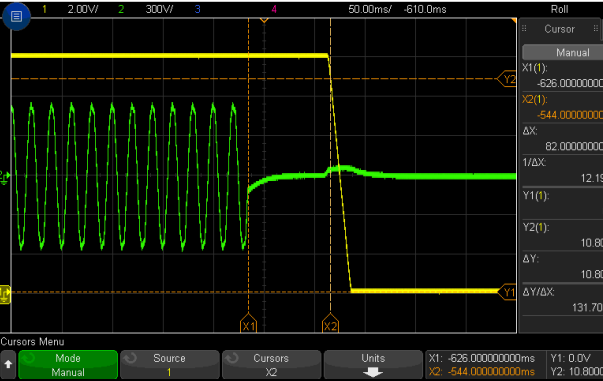
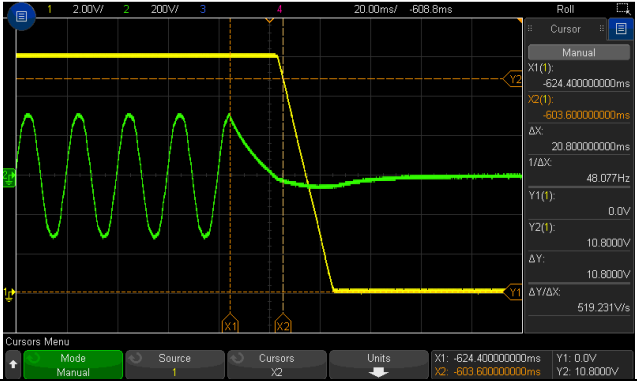
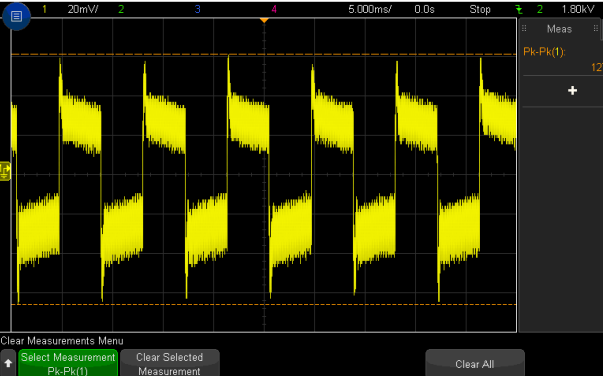
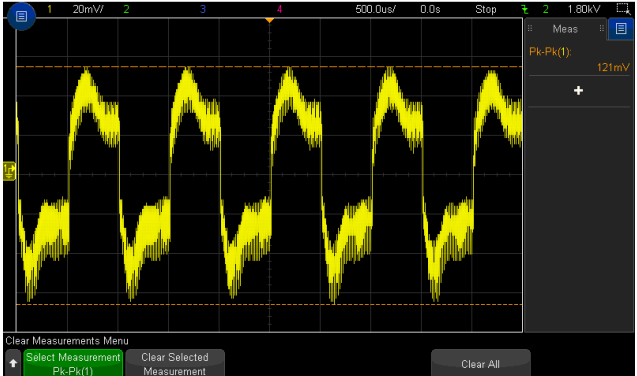
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=230VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

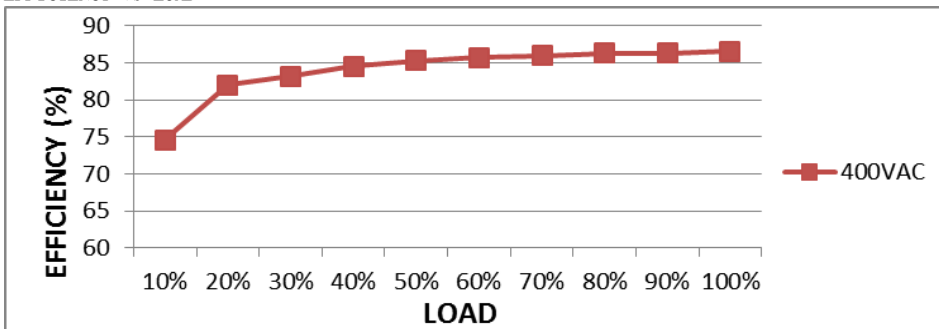


8	RISE TIME (Max) 400VAC/70ms 230VAC/70ms	I/P : 400 VAC I/P : 230VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 35.5 ms 230VAC/ 34.7 ms
<p>INPUT=400VAC/50HZ @ FULL LOAD CH1 : Output Voltage</p> 		<p>INPUT=230VAC/60HZ @ FULL LOAD CH1 : Output Voltage</p> 	
9	HOLD UP TIME (Typ.) 400VAC/20ms 230VAC/10ms	I/P : 400 VAC I/P : 230VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 82 ms 230VAC/ 20.8ms
<p>INPUT=400VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p> 		<p>INPUT=230VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p> 	
10	DYNAMIC LOAD V1: 1200 mVp-p	I/P: 400VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	127mVp-p 121mVp-p
<p>FULL /50% LOAD 50%DUTY / 120HZ</p> 		<p>FULL /50% LOAD 50%DUTY / 1KHZ</p> 	

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	149VAC~550VAC 214VDC~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=0.30A/ 400VAC I=0.46A / 230VAC
4	LEAKAGE CURRENT	< 2mA /530 VAC	I/P : 530 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.58 mA N-FG : 0.58 mA
5	EFFICIENCY(Typ.)	86.5%	I/P:400 VAC O/P:FULL LOAD Ta:25°C	86.60%

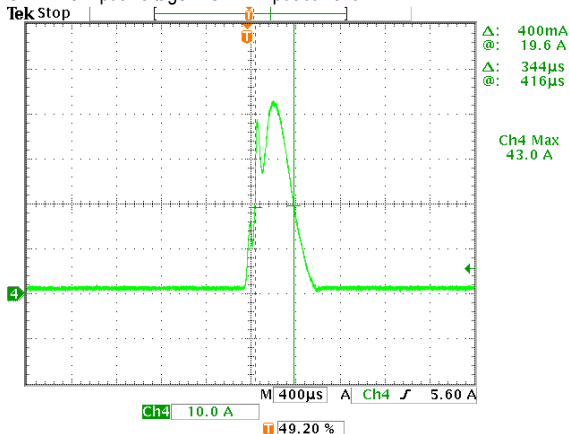
EFFICIENCY vs LOAD



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=43A/ 400VAC I=24.8A/ 230VAC
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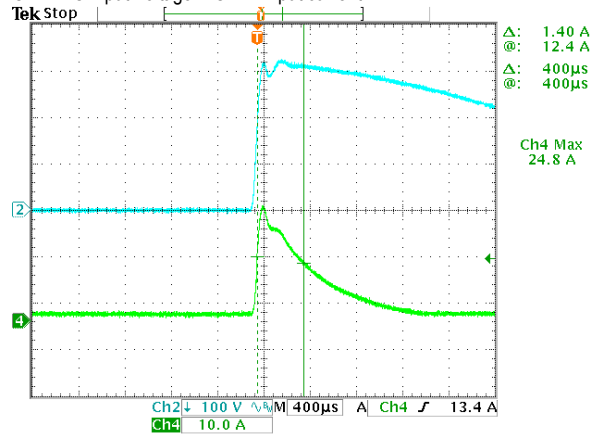
INPUT=400VAC/50HZ @ FULL LOAD

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	118.6%/ 550VAC 118.6%/400 VAC 118.2%/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	16V~18V	I/P: 550VAC I/P: 400VAC I/P: 180VAC O/P: MIN LOAD Ta:25°C	17.2V/ 550VAC 17.2V/ 400VAC 17.4V/ 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

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	DC OK CONTACT RATINGS	60VDC/0.3A 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: VDS: (1) 554V (2) 497V (3) 538V Q2: VDS: (1) 761V (2) 673V (3) 721V
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) 77.5V (2) 65.4V (3) 76.6V
3	Input Capacitor Voltage	C5 /C6 Rated: 82 μ F / 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) 398 V (1) 399V (2) 398V (2) 397V



			(3)Full Load /Min load Change (4)Full load continue Ta:25°C	(3) 387V (4) 375V	(3) 383 V (4) 371V
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) 20.6V (2) 17.2V (3) 20.6V (4) 21.6V (5) 18.8V	U101 (1) 12.8V (2) 2.5V (3) 13.0V (4) 17.4V (5) 11.4V

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: 3KVAC/min O/P-FG:0.6 KVAC/min O/P-DC OK:0.6KVAC/min Ta:25°C	I/P-O/P: 4.84mA I/P-FG: 2.62mA O/P-FG: 2.02mA 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	10mΩ

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	<input checked="" type="checkbox"/> EN55032 CLASS B	I/P : 400 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	<input checked="" type="checkbox"/> 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 <input checked="" type="checkbox"/> INDUSTRY AIR: 8KV / Contact: 4KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
5	E.F.T	EN61000-4-4 <input checked="" type="checkbox"/> INDUSTRY INPUT : 2KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
6	SURGE	IEC61000-4-5 <input checked="" type="checkbox"/> INDUSTRY L-N : 2KV L,N-PE : 4KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> 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°C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 400VAC O/P : FULL LOAD Ta=61.2°C																																																																																																																																						
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=24.9°C</th> <th>HIGH AMBIENT Ta=61.2°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>ZNR1</td><td>38.0°C</td><td>74.1°C</td></tr> <tr><td>2</td><td>LF1</td><td>39.3°C</td><td>75.4°C</td></tr> <tr><td>3</td><td>C1</td><td>41.7°C</td><td>77.3°C</td></tr> <tr><td>4</td><td>RY1</td><td>50.2°C</td><td>84.4°C</td></tr> <tr><td>5</td><td>LF100</td><td>43.7°C</td><td>78.8°C</td></tr> <tr><td>6</td><td>C113</td><td>41.3°C</td><td>76.4°C</td></tr> <tr><td>7</td><td>LF2</td><td>38.1°C</td><td>74.4°C</td></tr> <tr><td>8</td><td>BD1</td><td>45.2°C</td><td>81.0°C</td></tr> <tr><td>9</td><td>C6</td><td>43.9°C</td><td>79.4°C</td></tr> <tr><td>10</td><td>RTH1</td><td>54.1°C</td><td>84.7°C</td></tr> <tr><td>11</td><td>PCB</td><td>50.6°C</td><td>82.6°C</td></tr> <tr><td>12</td><td>R40</td><td>50.7°C</td><td>85.8°C</td></tr> <tr><td>13</td><td>Q1</td><td>47.1°C</td><td>82.1°C</td></tr> <tr><td>14</td><td>Q2</td><td>47.2°C</td><td>82.3°C</td></tr> <tr><td>15</td><td>Q100</td><td>52.2°C</td><td>87.0°C</td></tr> <tr><td>16</td><td>T1coil</td><td>58.7°C</td><td>93.7°C</td></tr> <tr><td>17</td><td>T1core</td><td>55.7°C</td><td>90.4°C</td></tr> <tr><td>18</td><td>T3</td><td>49.0°C</td><td>83.7°C</td></tr> <tr><td>19</td><td>C51</td><td>50.0°C</td><td>84.8°C</td></tr> <tr><td>20</td><td>C106</td><td>46.9°C</td><td>81.3°C</td></tr> <tr><td>21</td><td>C108</td><td>44.7°C</td><td>79.4°C</td></tr> <tr><td>22</td><td>U1</td><td>47.8°C</td><td>82.1°C</td></tr> <tr><td>23</td><td>RTH2</td><td>48.1°C</td><td>82.3°C</td></tr> <tr><td>24</td><td>U2</td><td>48.0°C</td><td>82.9°C</td></tr> <tr><td>25</td><td>ZNR3</td><td>44.7°C</td><td>80.2°C</td></tr> <tr><td>26</td><td>D5</td><td>49.7°C</td><td>84.4°C</td></tr> <tr><td>27</td><td>D51</td><td>49.4°C</td><td>84.0°C</td></tr> <tr><td>28</td><td>Q50</td><td>48.4°C</td><td>82.9°C</td></tr> <tr><td>29</td><td>Q200</td><td>56.2°C</td><td>89.0°C</td></tr> <tr><td>30</td><td>C55</td><td>48.1°C</td><td>82.7°C</td></tr> <tr><td>31</td><td>C202</td><td>48.6°C</td><td>82.8°C</td></tr> <tr><td>32</td><td>U101</td><td>48.7°C</td><td>82.8°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=24.9°C	HIGH AMBIENT Ta=61.2°C	1	ZNR1	38.0°C	74.1°C	2	LF1	39.3°C	75.4°C	3	C1	41.7°C	77.3°C	4	RY1	50.2°C	84.4°C	5	LF100	43.7°C	78.8°C	6	C113	41.3°C	76.4°C	7	LF2	38.1°C	74.4°C	8	BD1	45.2°C	81.0°C	9	C6	43.9°C	79.4°C	10	RTH1	54.1°C	84.7°C	11	PCB	50.6°C	82.6°C	12	R40	50.7°C	85.8°C	13	Q1	47.1°C	82.1°C	14	Q2	47.2°C	82.3°C	15	Q100	52.2°C	87.0°C	16	T1coil	58.7°C	93.7°C	17	T1core	55.7°C	90.4°C	18	T3	49.0°C	83.7°C	19	C51	50.0°C	84.8°C	20	C106	46.9°C	81.3°C	21	C108	44.7°C	79.4°C	22	U1	47.8°C	82.1°C	23	RTH2	48.1°C	82.3°C	24	U2	48.0°C	82.9°C	25	ZNR3	44.7°C	80.2°C	26	D5	49.7°C	84.4°C	27	D51	49.4°C	84.0°C	28	Q50	48.4°C	82.9°C	29	Q200	56.2°C	89.0°C	30	C55	48.1°C	82.7°C	31	C202	48.6°C	82.8°C	32	U101	48.7°C	82.8°C
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 400 VAC O/P : 117% LOAD Ta : 25°C	TEST : OK																																																																																																																																				
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 550VAC/210VAC O/P : 100 % LOAD Ta= -35°C	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 1900.1K hrs min. Telcordia SR-332 (Bellcore) ; 313.7K 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