



Test Report: TDR-240-24

240W Slim Three Phase Industrial DIN Rail with PFC Function

■ 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

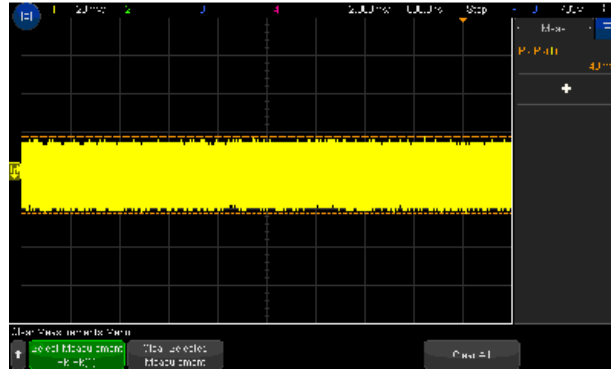
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 24.0V~ 28.0V	I/P : 400 VAC O/P : MIN LOAD Ta : 25℃	23.13V~28.81V
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.0%~1.0%	I/P: 340VAC /550VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1 : -0.07%~0.04%
3	LINE REGULATION (Max)	V1: -0.5%~0.5%	I/P: 340VAC~ 550VAC O/P:FULL LOAD Ta:25℃	V1 : -0.00%~0.00%
4	LOAD REGULATION(Max)	V1: -1.0%~1.0%	I/P: 400VAC O/P:FULL ~MIN LOAD Ta:25℃	V1 : -0.14%~0.13%
5	OVER/UNDERSHOOT TEST	< $\pm 5\%$	I/P: 400VAC O/P:FULL LOAD Ta:25℃	2.1%
6	RIPPLE & NOISE(Max)	V1: 150mVp-p	I/P:400VAC O/P:FULL LOAD Ta:25℃	V1: 40mVp-p

high frequency (V1) :



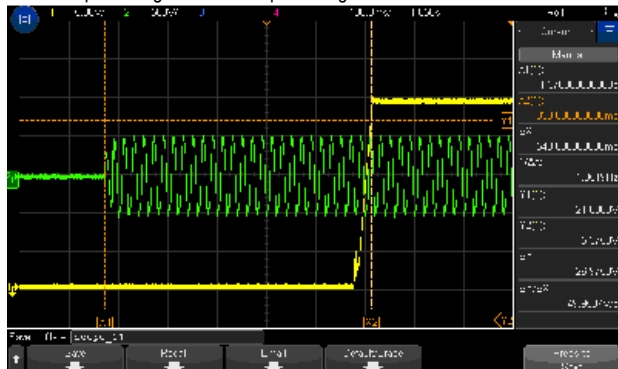
low frequency (V1) :



7	SET UP TIME(Max)	500VAC/1500ms 400VAC/2000ms	I/P : 500 VAC I/P : 400 VAC O/P : FULL LOAD Ta : 25℃	500VAC/ 540ms 400VAC/658ms
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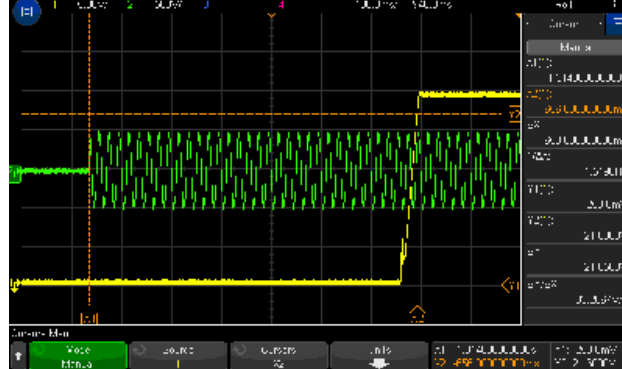
INPUT=500VAC/50HZ @ FULL LOAD

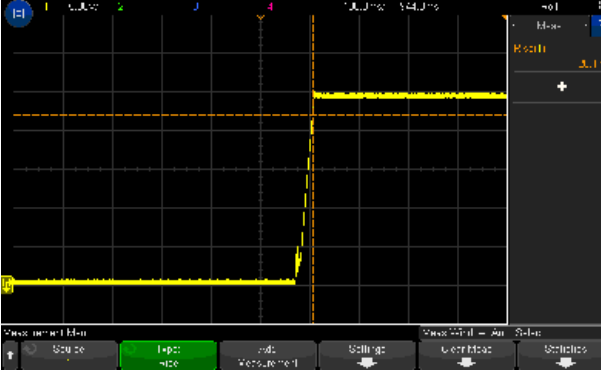
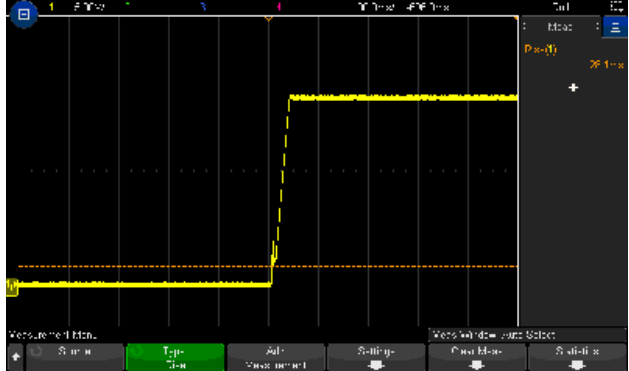
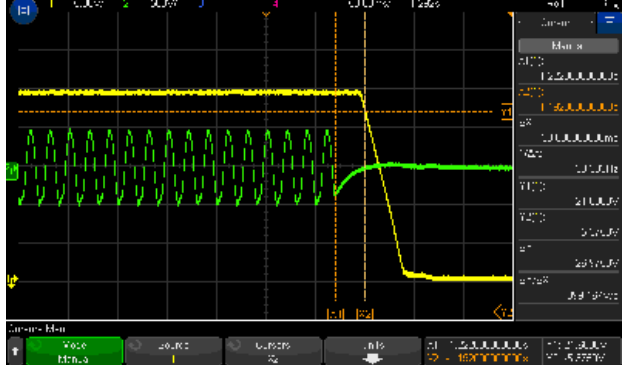
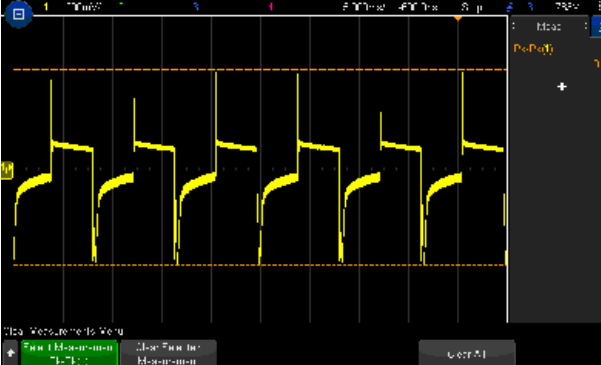
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=400VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

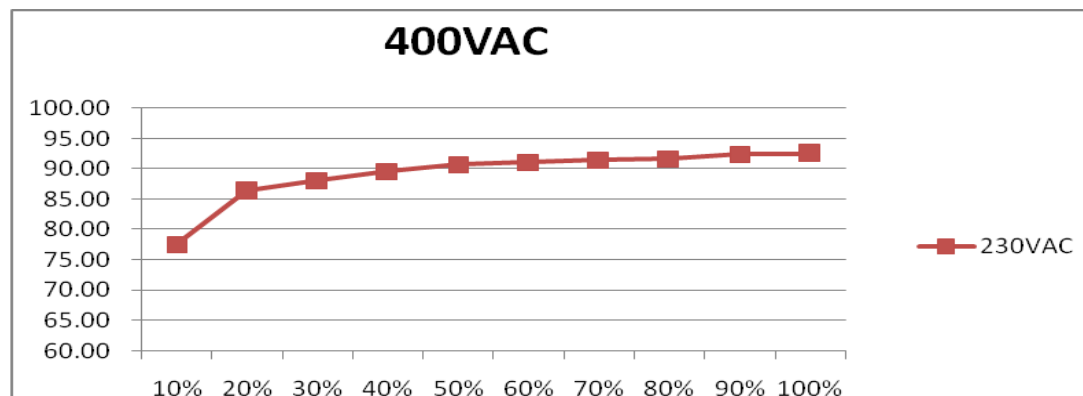


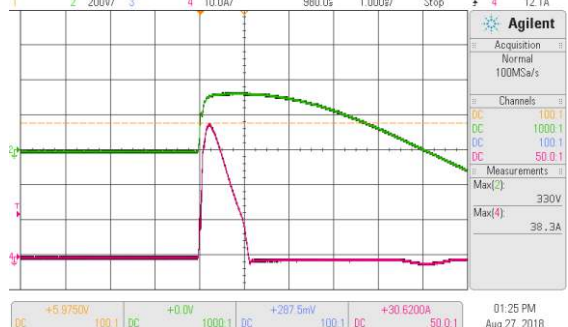
8	RISE TIME (Max)	500VAC/60ms 400VAC/60ms	I/P : 500 VAC I/P : 400 VAC O/P : FULL LOAD Ta : 25°C	
INPUT=500VAC/50HZ @ FULL LOAD CH1 : Output Voltage				
INPUT=400VAC/50HZ @ FULL LOAD CH1 : Output Voltage				
9	HOLD UP TIME (Typ.)	500VAC/40ms 400VAC/20ms	I/P : 500 VAC I/P : 400 VAC O/P : FULL LOAD Ta : 25°C	
INPUT=500VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage				
INPUT=400VAC/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	
FULL /50% LOAD 50%DUTY / 120HZ (V1)				
FULL /50% LOAD 50%DUTY / 1KHZ (V1)				

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	340VAC~550VAC	I/P: TESTING O/P: FULL LOAD Ta: 25°C	272V~550V
			I/P: LOW-LINE-3V=337 V HIGH-LINE+15%=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: 340 VAC ~550 VAC O/P: FULL~MIN LOAD Ta: 25°C	TEST: OK
3	INPUT CURRENT (Typ.)	500V/0.6A 400V/ 0.69A	I/P : 500 VAC I/P : 400 VAC O/P : FULL LOAD Ta : 25°C	IR =0.646A/ 400VAC IS =0.643A/ 400VAC IT =0.646A/ 400VAC IR =0.556A/ 500VAC IS =0.561A/ 500VAC IT =0.557A/ 500VAC
4	POWER FACTOR (Typ.)	$\geq 0.53/400VAC$ $\geq 0.52/500VAC$	I/P : 400 VAC I/P : 500 VAC O/P : FULL LOAD Ta : 25°C	0.59/400VAC R 0.597/400VAC S 0.595/400VAC T 0.556/500VAC R 0.565/500VAC S 0.562/500VAC T
5	LEAKAGE CURRENT	<2.00mA	I/P : 530 VAC O/P : Min LOAD Ta : 25°C	N1,N2,N3 and Earth: 1.5mA
6	EFFICIENCY(Typ.)	92%	I/P: 400 VAC O/P: FULL LOAD Ta: 25°C	92.5%

EFFICIENCY vs LOAD



7	INRUSH CURRENT(Typ.)	400V / 50A COLD START	I/P : 400 VAC O/P : FULL LOAD Ta : 25°C	I = 38.3 A/ 400VAC
INPUT=400VAC/50HZ @ FULL LOAD CH4 : AC Input Voltage CH2 : Input current DSO-X 3014A, M154100664 Mon Aug 27 13:25:25 2018 				

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~135%	I/P: 550VAC I/P: 400VAC I/P: 340VAC O/P: TESTING Ta:25°C	116.1%/ 550VAC 116.1%/ 400VAC 116.0%/340VAC PROTECTION TYPE : Constant current limiting, unit will hiccup after 3sec.
2	OVER VOLTAGE PROTECTION	30.0V~36.0V	I/P: 550VAC I/P: 400VAC I/P: 340VAC O/P: MIN LOAD Ta:25°C	33.7V/ 550VAC 33.7V/ 400VAC 33.7V/ 3340VAC PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
3	OVER TEMPERATURE PROTECTION	Shut down o/p voltage	I/P: 550VAC I/P: 340VAC O/P: FULL LOAD Ta:25°C	TEST: OK PROTECTION TYPE : Shut down o/p voltage, recovers automatically after temperature goes down
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 550VAC I/P: 340VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Hiccup Mode

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : 950 V	AC ON/OFF I/P: High-Line +3V =553V VDS: O/P: (1) Full Load (2) Output Short (3) Full Load Continue Ta:25°C	VDS: (1) 802V (2) 794V (3) 802V
2	O/P MOFET	Q100 Rated : 120 V Q101 Rated : 120 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 Q101 VDS: VDS: (1) 88.2V (1) 88.2V (2) 83.4V (2) 83.4V (3) 88.2V (3) 88.2V

3	Input Capacitor Voltage	C5 Rated :150 μ f/ 400 V	I/P:High-Line +3V =553V 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) 397V (2) 397V (3) 397V (4) 393 V
4	Control IC Voltage Test	U1 Rated : 11V~ 26 V U100 Rated : 0V~ 37 V	AC ON/OFF I/P:High-Line +3V =553 V 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) 17.2V (2) 17.8V (3) 17.4V (4) 18.0V (5) 17.0V U100 (1) 13.2V (2) 12.0V (3) 12.4V (4) 12.2V (5) 12.6V
5	Clamp Diode Peak Voltage	D1 Rated : 1200 V	AC ON/OFF I/P : High-Line +3V =553 V O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25°C	(1) 495V (2) 487V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 4.87KVAC/min I/P-FG: 2.4KVAC/min O/P-FG: 0.5KVAC/min O/P-DC OK:0.5KVAC/min	I/P-O/P: 5.0KVAC/min I/P-FG: 2.88KVAC/min O/P-FG: 0.6KVAC/min O/P-DC OK:0.6KVAC/min Ta:25°C	I/P-O/P: 7.48mA I/P-FG: 5.95mA O/P-FG: 4.42mA 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:500VDC I/P-FG:500VDC O/P-FG:500VDC 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 < 100 mΩ	40 A / 2min Ta: 25°C/70%RH	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 ☐ FAIL
2	CONDUCTION	EN61204-3 CLASS B	I/P : 400 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	EN61204-3 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 ☐ LIGHT INDUSTRY AIR: 8KV / Contact: 4KV ☐ INDUSTRY AIR: 8KV / Contact: 4KV ☒ Din rail Model : AIR: 15KV / Contact: 8KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A

5	E.F.T	EN61000-4-4 □LIGHT INDUSTRY INPUT : 1KV □MEDICAL ☑INDUSTRY INPUT : 2KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	EN61000-4-5 INDUSTRY L-N : 2KV L/N-PE: 4KV	I/P : 400 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 : TDR-240-24 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 400VAC O/P : FULL LOAD Ta= 25.5 °C 2. HIGH AMBIENT BURN-IN : 1 HRS I/P : 400VAC O/P : FULL LOAD Ta= 60.5 °C <table><thead><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 25.5 °C</th><th>HIGH AMBIENT Ta= 60.5 °C</th></tr></thead><tbody><tr><td>1</td><td>L3</td><td>44.0°C</td><td>81.4°C</td></tr><tr><td>2</td><td>C2</td><td>51.1°C</td><td>88.4°C</td></tr><tr><td>3</td><td>ZR4</td><td>57.2°C</td><td>93.7°C</td></tr><tr><td>4</td><td>C125</td><td>55.8°C</td><td>93.3°C</td></tr><tr><td>5</td><td>LF10</td><td>70.5°C</td><td>107.7°C</td></tr><tr><td>6</td><td>U100</td><td>72.9°C</td><td>110.1°C</td></tr><tr><td>7</td><td>D10</td><td>68.2°C</td><td>104.3°C</td></tr><tr><td>8</td><td>D7</td><td>60.5°C</td><td>97.2°C</td></tr><tr><td>9</td><td>C255</td><td>66.0°C</td><td>102.2°C</td></tr><tr><td>10</td><td>LF2</td><td>65.0°C</td><td>100.5°C</td></tr><tr><td>11</td><td>C106</td><td>74.7°C</td><td>100.0°C</td></tr><tr><td>12</td><td>C110</td><td>68.4°C</td><td>104.5°C</td></tr><tr><td>13</td><td>C15</td><td>52.3°C</td><td>88.8°C</td></tr><tr><td>14</td><td>U1</td><td>62.7°C</td><td>100.4°C</td></tr><tr><td>15</td><td>C5</td><td>52.2°C</td><td>89.3°C</td></tr><tr><td>16</td><td>C200</td><td>66.8°C</td><td>103.2°C</td></tr><tr><td>17</td><td>Q101</td><td>62.4°C</td><td>100.6°C</td></tr><tr><td>18</td><td>L5</td><td>46.6°C</td><td>83.7°C</td></tr><tr><td>19</td><td>T1</td><td>96.2°C</td><td>106.0°C</td></tr><tr><td>20</td><td>Q1</td><td>60.4°C</td><td>100.0°C</td></tr><tr><td>21</td><td>C72</td><td>60.8°C</td><td>99.0°C</td></tr><tr><td>22</td><td>D22</td><td>78.7°C</td><td>118.6°C</td></tr></tbody></table>			NO	Position	ROOM AMBIENT Ta= 25.5 °C	HIGH AMBIENT Ta= 60.5 °C	1	L3	44.0°C	81.4°C	2	C2	51.1°C	88.4°C	3	ZR4	57.2°C	93.7°C	4	C125	55.8°C	93.3°C	5	LF10	70.5°C	107.7°C	6	U100	72.9°C	110.1°C	7	D10	68.2°C	104.3°C	8	D7	60.5°C	97.2°C	9	C255	66.0°C	102.2°C	10	LF2	65.0°C	100.5°C	11	C106	74.7°C	100.0°C	12	C110	68.4°C	104.5°C	13	C15	52.3°C	88.8°C	14	U1	62.7°C	100.4°C	15	C5	52.2°C	89.3°C	16	C200	66.8°C	103.2°C	17	Q101	62.4°C	100.6°C	18	L5	46.6°C	83.7°C	19	T1	96.2°C	106.0°C	20	Q1	60.4°C	100.0°C	21	C72	60.8°C	99.0°C	22	D22	78.7°C	118.6°C
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 100 VAC O/P : 116% LOAD Ta : 25°C	TEST : OK																																																																																												
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 550VAC/340VAC 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	± 0.05%/°C (0~60°C)	I/P : 400 VAC O/P : FULL LOAD	± 0.026 %/°C (0~60°C)												
6	STORAGE TEMPERATURE TEST	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		TEST : OK												
7	THERMAL SHOCK TEST	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		TEST : OK												
8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 3G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C 2 Din Rail <table><tr><td></td><td>Displacement</td><td>Acceleration</td></tr><tr><td>2 (+3/-0) Hz up to 15Hz</td><td>± 2.5mm</td><td>-----</td></tr><tr><td>15Hz up to 50Hz</td><td>-----</td><td>2.3g</td></tr><tr><td>Sweep rate</td><td colspan="2">Max 1 Octave/minute</td></tr></table>			Displacement	Acceleration	2 (+3/-0) Hz up to 15Hz	± 2.5mm	-----	15Hz up to 50Hz	-----	2.3g	Sweep rate	Max 1 Octave/minute		TEST : OK
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2 (+3/-0) Hz up to 15Hz	± 2.5mm	-----														
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Sweep rate	Max 1 Octave/minute															
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) 192802.5 HRS (2) 33373.5 HRS (3) 45190.5 HRS (4) 96517.2 HRS												
10	MTBF	Conducted by Parts Stress Analysis Prediction 515.4K hrs min. Telcordia SR-332 (Bellcore) ; 215.6K 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