



# Test Report: VFD-350P-48

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350W General type DC Input Variable Frequency Drive

## ■ 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	VOLTAGE RANGE(UVW)	3 $\psi$ 0~34VAC  Three phase line-to-line 0~34V, suit for 48V class motor	I/P : 20VDC 48VDC 55VDC O/P : 0~34VAC PWM Freq.:15KHz Ta : 25°C	V@min load 1.2~14.96VAC /0.1A @ I/P:20VDC 1.2~36.4VAC /0.1A @ I/P:48VDC 1.81~39.64VAC /0.1A @ I/P:55VDC V@ Derating load 9.95~14.52VAC /derating load @ I/P:20VDC 10.2~35.5VAC /derating load @ I/P:48VDC 11.6~38.76VAC /derating load @ I/P:55VDC
2	RATED CURRENT (A)	10A	I/P : 20VDC 48VDC 55VDC O/P:Rated output current PWM Freq.:15KHz Ta : 25°C	10A@20Vdc (Vo=14V) 10A@48Vdc (Vo=24V) 10A@55Vdc (Vo=24V)
3	Max. CURRENT	20A	I/P : 48 VDC O/P : 20A PWM Freq.:15KHz Ta : 25°C	TEST: OK
4	EFFICIENCY(Typ.)	92.5%	I/P : 48 VDC O/P: Full load PWM Freq.:15KHz Ta : 25°C	Eff : 95.79%
5	DC BUS VOILTAGE	DC BUS:48V DC BUS voltage sensor:2.5±0.05V	I/P : 48 VDC O/P: Rated output current PWM Freq.:15KHz Ta : 25°C	48V@ DC BUS voltage sensor: 2.5022V

### INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RATED INPUT VOLTAGE	20VDC~55VDC	I/P : 19.8VDC~58VDC O/P: Full load PWM Freq.:15KHz Ta : 25°C	TEST : 17.66~58V
			I/P : HIGH-LINE+3V=58 V O/P: FULL/MIN LOAD PWM Freq.:15KHz (PLEASE CHECK DERATING CURVE) ON : 30 Sec OFF : 30 Sec 10MIN ( POWER ON/OFF NO DAMAGE )	TEST : OK

4	RATED INPUT CURRENT	48VDC/8.5A	I/P : 48 VDC O/P: Full load PWM Freq.:15KHz Ta : 25°C	7.54 A @48Vdc
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### PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	SHORT PROTECTION	SHORT ANY TWO PHASE OUTPUT 1 HOUR NO DAMAGE Protection type : Shut down o/p voltage, re-power on to recover  Inverter fault signal(Short circuit/OCP, PIN7 of CN93). TTL input: Normal: High(>3V); Abnormal: Low(<0.5V)	I/P : 58VDC I/P : 19.8VDC O/P : Short Any Two Phase Output Ta : 25°C	Test Result : O/P shut down PROTECTION TYPE : re-power on  FAULT SIGNAL Normal:3.45V Abnormal:0V
2	OVER TEMPERATURE PROTECTION	Protection type : auto-recovery Built-in 10KΩ NTC for sensing IGBTs operating temperature. (TSM2A103F34D1R (Thinking Electronic), PIN2 of CN93)	I/P : 58VDC I/P : 19.8VDC O/P: Full load PWM Freq.:15KHz Ta : 25°C	Test Result : O/P shut down Protection type : Auto-Recovery
3	OVER LOAD PROTECTION)	Protection type : Shut down o/p voltage, re-power on to recover Built-in 6mΩ low-side shunt resistor (each phase), (PIN4~6 of CN93)	I/P : 48 VDC O/P : max. current@rated motor speed Ta : 25°C	Test Result : 200% OK · 256% shut down PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
4	OVER VOLTAGE PROTECTION	When the voltage of the DC bus exceed 60V, the PWM input signal must shut down for protection.	I/P : 48 VDC O/P: Rated output current PWM Freq.:15KHz Ta : 25°C	Test Result : shut down for protection · re-power on

### CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1.	VCC	14.5~15.5V / 0.2A Ripple:1000mVp-p	I/P : 48 VDC O/P: Full load PWM Freq.:15KHz Ta : 25°C	15.3V /346 mVp-p

### COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	IGBT	Q902(High side)/Q905(Low side) Rated : 100A/100V	DC ON/OFF I/P : High-Line +3V =58 V O/P : (1)Full Load (2)Output Short (UVW) (3)0%→400% Load. (4)NO LOAD Ta:25°C	VDS(Q902I) (1) 75.8V (2) 88.5V (3) 88.5V (4) 60.1V  VDS(Q905) (1) 73.4V (2) 73.4V (3) 87.9V (4) 59.5V
2	Input Capacitor Voltage	C5 Rated: : 330μ /63V	I/P : High-Line +3V =58V 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) 58.6V (2) 59.1V (3) 58.6V (4) 58.6V
3	Control IC Voltage Test	O/P IC U901 Rated: 13V~ 17.5 V	DC ON/OFF I/P : High-Line +3V =58 V O/P : (1)FULL LOAD (Vo: 24.3VAC /Io:10A) (2) Output Short (UVW) (3)0~200% (4)O.V.P. (5)NO LOAD PWM Freq.:15KHz Ta : 25°C	(1) 15.7V (2) 15.7V (3) 15.8V (4) 15.7V (5) 15.7V
4	TOP SWITCHING STAND BY POWER	U322 Rated: 100V	DC ON/OFF I/P : High-Line +3V =58 V O/P : (1)Full Load (2)Output Short (UVW) Ta : 25°C	(1) 60.0V (2) 60.4V

### E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONDUCTION	■ EN55032 □ EN55011 CLASS B	I/P : 48 VDC O/P : motor Ta : 25°C	Test by certified Lab
2	RADIATION	■ EN55032 □ EN55011 CLASS B	I/P : 48 VDC O/P : motor Ta : 25°C	Test by certified Lab

3	E.S.D	EN61000-4-2 ■ <u>INDUSTRY</u> AIR : 8KV / Contact : 4KV	I/P : 48 VDC O/P : motor Ta : 25°C	■ CRITERIA A □ CRITERIA B
4	E.F.T	EN61000-4-4 ■ <u>INDUSTRY</u> INPUT : 2KV	I/P : 48 VDC O/P : motor Ta : 25°C	■ CRITERIA A □ CRITERIA B
5	SURGE	IEC61000-4-5 ■ <u>LIGHT INDUSTRY</u> L-N : 1KV	I/P : 48 VDC O/P : motor Ta : 25°C	■ CRITERIA A □ CRITERIA B
6	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 : VFD-350P-48 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 48VDC O/P : FULL LOAD Ta= 25 °C 2. HIGH AMBIENT BURN-IN : 2HRS I/P : 48VDC O/P : FULL LOAD Ta= 50 °C																																																																																		
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=23.8°C</th> <th>HIGH AMBIENT Ta= 50.6 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>L1</td><td>56.4°C</td><td>83.7°C</td></tr> <tr><td>2</td><td>C6</td><td>70.7°C</td><td>96.8°C</td></tr> <tr><td>3</td><td>C5</td><td>60.3°C</td><td>86.4°C</td></tr> <tr><td>4</td><td>C932</td><td>64.9°C</td><td>91.8°C</td></tr> <tr><td>5</td><td>L931</td><td>52.3°C</td><td>79.8°C</td></tr> <tr><td>6</td><td>C934</td><td>41.4°C</td><td>68.6°C</td></tr> <tr><td>7</td><td>U322</td><td>57.2°C</td><td>82.7°C</td></tr> <tr><td>8</td><td>Q901</td><td>79.7°C</td><td>105.2°C</td></tr> <tr><td>9</td><td>Q902</td><td>86.7°C</td><td>109.9°C</td></tr> <tr><td>10</td><td>Q903</td><td>91.8°C</td><td>119.8°C</td></tr> <tr><td>11</td><td>Q904</td><td>84.8°C</td><td>112.0°C</td></tr> <tr><td>12</td><td>Q905</td><td>88.9°C</td><td>115.2°C</td></tr> <tr><td>13</td><td>Q906</td><td>90.2°C</td><td>117.8°C</td></tr> <tr><td>14</td><td>RTH4</td><td>88.3°C</td><td>116.3°C</td></tr> <tr><td>15</td><td>U901</td><td>71.2°C</td><td>99.7°C</td></tr> <tr><td>16</td><td>U950</td><td>51.4°C</td><td>78.9°C</td></tr> <tr><td>17</td><td>R913</td><td>91.6°C</td><td>116.9°C</td></tr> <tr><td>18</td><td>D905</td><td>78.5°C</td><td>101.4°C</td></tr> <tr><td>19</td><td>Q950</td><td>56.4°C</td><td>84.3°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=23.8°C	HIGH AMBIENT Ta= 50.6 °C	1	L1	56.4°C	83.7°C	2	C6	70.7°C	96.8°C	3	C5	60.3°C	86.4°C	4	C932	64.9°C	91.8°C	5	L931	52.3°C	79.8°C	6	C934	41.4°C	68.6°C	7	U322	57.2°C	82.7°C	8	Q901	79.7°C	105.2°C	9	Q902	86.7°C	109.9°C	10	Q903	91.8°C	119.8°C	11	Q904	84.8°C	112.0°C	12	Q905	88.9°C	115.2°C	13	Q906	90.2°C	117.8°C	14	RTH4	88.3°C	116.3°C	15	U901	71.2°C	99.7°C	16	U950	51.4°C	78.9°C	17	R913	91.6°C	116.9°C	18	D905	78.5°C	101.4°C	19	Q950	56.4°C	84.3°C
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 55VDC/20VDC O/P : 100%LOAD Ta= -35°C	TEST : OK
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C/95 %R.H NO DAMAGE	I/P : 58 VDC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK
4	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	
5	THERMAL SHOCK TEST	-30~50°C	1. Thermal shock Temperature : -35°C~ +55°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:48V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:48V/ FULL LOAD Burn In Test	
6	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 : 10min/sweep cycle (4) Acceleration : 3G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C	
7	CAPACITOR LIFE CYCLE	SUPPOSE C932 IS THE MOST CRITICAL COMPONENT (1) I/P : 48VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 48VDC O/P : FULL LOAD Ta= 50 °C LIFE TIME (3) I/P : 48VDC O/P : 75% LOAD Ta= 50 °C LIFE TIME (4) I/P : 48VDC O/P : 50% LOAD Ta= 50 °C LIFE TIME	(1) 88952HRS (2) 15616HRS (3) 35876HRS (4) 70276HRS	
8	Ongoing Reliability Test	I/P : 48VDC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Yuwei	Liutt	Wangdz

2020.10.1 TAG-QA-009