



# Test Report: TDR-960-24

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960W 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	VERDICT
1	RIPPLE & NOISE	V1 : 180 mVp-p (Max)	I/P : 400VAC O/P : FULL LOAD Ta : 25°C	V1 : 23.6 mVp-p (Max)	P
2	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 24 V ~ 28 V	I/P : 400 VAC I/P : 500 VAC O/P : MIN LOAD Ta : 25°C	23.413 V~ 28.837 V/ 400 VAC 23.415 V~ 28.837 V/ 500 VAC	P
3	OUTPUT VOLTAGE TOLERANCE	V1 : 1%~ -1% (Max)	I/P : 380 VAC / 550 VAC O/P : FULL/ MIN LOAD Ta : 25°C	V1 : 0.24 %~ -0.24 %	P
4	LINE REGULATION	V1 : 0.5%~ -0.5% (Max)	I/P : 380VAC ~ 550 VAC O/P : FULL LOAD Ta : 25°C	V1 : 0.01 %~ -0.01 %	P
5	LOAD REGULATION	V1 : 1%~ -1% (Max)	I/P : 400 VAC O/P : FULL ~MIN LOAD Ta : 25°C	V1 : 0.24 %~ -0.24 %	P
6	SET UP TIME	400VAC : 1000 ms (Max) 500VAC : 800 ms(Max)	I/P : 400 VAC I/P : 500 VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 502 ms 500VAC/ 376 ms	P
7	RISE TIME	400VAC : 100 ms (Max) 500VAC : 100 ms (Max)	I/P : 400 VAC I/P : 500 VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 17.6 ms 500VAC/ 16.8 ms	P
8	HOLD UP TIME	400VAC : 12 ms (TYP) 500VAC : 14 ms (TYP)	I/P : 400 VAC I/P : 500 VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 16 ms 500VAC/ 18.4 ms	P
9	OVER/UNDERSHOOT TEST	< ±5%	I/P : 400 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %	P
10	DYNAMIC LOAD	V1 : 2400 mVp-p	I/P : 400 VAC (1).O/P : FULL /Min LOAD 90%DUTY/ 1KHZ (2).O/P : FULL /Min LOAD 90%DUTY/ 3KHZ (3).O/P : FULL /Min LOAD 90%DUTY/ 5KHZ (4).O/P : FULL /Min LOAD 50%DUTY/ 120HZ Ta : 25°C	(1)1260 mVp-p (2)1250 mVp-p (3)1040 mVp-p (4)2030 mVp-p	P

**INPUT FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	380VAC~550 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C  I/P : LOW-LINE-3V= 377 V HIGH-LINE+10V=560 V O/P : FULL/MIN LOAD ON : 30 Sec. OFF : 30 Sec 10MIN ( AC POWER ON/OFF NO DAMAGE )	267 V~550V  TEST : OK	P
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE OSC	I/P : 380 VAC ~ 550 VAC O/P : FULL-MIN LOAD Ta : 25°C	TEST : OK	P
3	POWER FACTOR	0.88 / 400 VAC(TYP) 0.86 / 500 VAC(TYP)	I/P : 400 VAC I/P : 500 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.930 / 400 VAC PF= 0.902 / 500 VAC	P
4	EFFICIENCY	94 % (TYP)	I/P : 400 VAC O/P : FULL LOAD Ta : 25°C	94.65 %	P
5	INPUT CURRENT	400V/ 2 A (TYP) 500V/ 1.4 A (TYP)	I/P : 400 VAC I/P : 500 VAC O/P : FULL LOAD Ta : 25°C	I = 1.57 A/ 400 VAC I = 1.3 A/ 500 VAC	P
6	INRUSH CURRENT	400V/ 60 A (TYP)  COLD START	I/P : 400 VAC O/P : FULL LOAD Ta : 25°C	I = 58 A/ 400 VAC	P
7	LEAKAGE CURRENT	< 3.5 mA / 530VAC	I/P : 530VAC O/P : Min LOAD Ta : 25°C	L1-FG : 2.1 mA L2-FG : 2.1 mA L3-FG : 2.1 mA	P

**PROTECTION FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	105% ~130 %	I/P : 400 VAC I/P : 500 VAC O/P : TESTING Ta : 25°C	120.7 %/ 400 VAC 120.7 %/ 500 VAC Constant current limiting, unit will shut down after 3 sec. ,re-power on to recover	P
2	OVER VOLTAGE PROTECTION	CH1 : 29V ~ 33 V	I/P : 400 VAC I/P : 500 VAC O/P : MIN LOAD Ta : 25°C	30.63 V/ 400 VAC 30.58 V/ 500 VAC Shut down Re- power ON	P
3	OVER TEMPERATURE PROTECTION	SPEC : TSW1 : 90 ± 5°C O.T.P. NO DAMAGE	I/P : 400 VAC O/P : FULL LOAD	O.T.P. Active Shut down o/p voltage , recovers automatically after temperature goes down	P
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P : 550 VAC O/P : FULL LOAD Ta : 25°C	NO DAMAGE Constant current limiting, unit will shut down after 3 sec. ,re-power on to recover	P

**CONTROL FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	DC OK RELAY CONTACT RATINGS	60Vdc/0.3A, 30Vdc/1A, 30Vac/0.5A resistive load	I/P : 400 VAC O/P : FULL LOAD	TEST : OK	P

**COMPONENT STRESS TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor ( D to S) or (C to E) Peak Voltage	Q301 Rated : FET STP26NM60N 20A/600V	I/P : High-Line +3V = 553 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 452 V (2) 440 V (3) 442 V	P
2	Diode Peak Voltage	Q104 Rated : IPP034NE7N3G 100A/75V	I/P : High-Line +3V = 553 V O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C	(1) 72.4 V (2) 71.6 V (3) 72 V	P
3	Input Capacitor Voltage	C905 Rated : 150u/450V 105°C 18*40 CXW	I/P : High-Line +3V = 553 V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C	(1) 442 V (2) 448 V (3) 448 V	P
4	Control IC Voltage Test	U 301 Rated : L6599 AD 8.15V~17V	I/P : High-Line +3V = 553 V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C	(1) 15.1 V (2) 14.9 V (3) 15.1 V	P
5	P.F.C. Transistor ( D to S) or (C to E) Peak Voltage	Q 902 Rated : IPW90R500C3 11A/900V	I/P : High-Line +3V = 553 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 899 V (2) 852 V (3) 896 V	P

**■ SAFETY & E.M.C. TEST**
**SAFETY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P : 3 KVAC/min I/P-FG : 2 KVAC/min O/P-FG : 0.5 KVAC/min	I/P-O/P : 3.6 KVAC/min I/P-FG : 2.4 KVAC/min O/P-FG : 0.6 KVAC/min Ta : 25°C	I/P-O/P : 8.94 mA I/P-FG : 7.23 mA O/P-FG : 8.77 mA NO DAMAGE	P
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ I/P-FG : 500VDC>100MΩ O/P-FG : 500VDC>100MΩ	I/P-O/P : 500 VDC I/P-FG : 500 VDC O/P-FG : 500 VDC Ta : 25°C/70% RH	I/P-O/P : 30 GΩ I/P-FG : 30 GΩ O/P-FG : 28.3 GΩ NO DAMAGE	P
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25°C /70% RH	18 mΩ	P

**E.M.C TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS A CLASS D	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	PASS	P
2	CONDUCTION	EN55022 CLASS B	I/P : 400 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab	P
3	RADIATION	EN55022 CLASS B	I/P : 400 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab	P
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	P
5	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
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	P
7	Test by certified Lab & Test Report Prepare				

**RELIABILITY TEST**
**ENVIRONMENT TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT																																																																																																																				
1	TEMPERATURE RISE TEST	MODEL : TDR-960-24 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 400VAC O/P : FULL LOAD Ta=33.8 °C 2. HIGH AMBIENT BURN-IN : 3.5 HRS I/P : 400VAC O/P : FULL LOAD Ta=55 °C	<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=33.8 °C</th> <th>HIGH AMBIENT Ta=55 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>L3</td><td>70.0°C</td><td>88.8°C</td></tr> <tr><td>2</td><td>LF1</td><td>79.5°C</td><td>98.3°C</td></tr> <tr><td>3</td><td>D5</td><td>92.2°C</td><td>110.6°C</td></tr> <tr><td>4</td><td>D10</td><td>86.4°C</td><td>104.9°C</td></tr> <tr><td>5</td><td>C11</td><td>80.1°C</td><td>98.8°C</td></tr> <tr><td>6</td><td>L180</td><td>87.6°C</td><td>108.9°C</td></tr> <tr><td>7</td><td>C186</td><td>79.4°C</td><td>99.8°C</td></tr> <tr><td>8</td><td>C115</td><td>82.8°C</td><td>103.8°C</td></tr> <tr><td>9</td><td>C110</td><td>85.5°C</td><td>105.8°C</td></tr> <tr><td>10</td><td>C106</td><td>71.3°C</td><td>92.3°C</td></tr> <tr><td>11</td><td>Q100</td><td>77.4°C</td><td>97.5°C</td></tr> <tr><td>12</td><td>C205</td><td>79.4°C</td><td>99.3°C</td></tr> <tr><td>13</td><td>T300</td><td>85.9°C</td><td>105.8°C</td></tr> <tr><td>14</td><td>T1</td><td>95.4°C</td><td>115.8°C</td></tr> <tr><td>15</td><td>Q305</td><td>72.3°C</td><td>92.7°C</td></tr> <tr><td>16</td><td>TSW</td><td>72.8°C</td><td>93.1°C</td></tr> <tr><td>17</td><td>T903</td><td>76.9°C</td><td>96.0°C</td></tr> <tr><td>18</td><td>L8</td><td>71.9°C</td><td>91.6°C</td></tr> <tr><td>19</td><td>C14</td><td>73.9°C</td><td>93.0°C</td></tr> <tr><td>20</td><td>C929</td><td>74.6°C</td><td>92.6°C</td></tr> <tr><td>21</td><td>C905</td><td>70.9°C</td><td>90.2°C</td></tr> <tr><td>22</td><td>L900</td><td>79.9°C</td><td>100.0°C</td></tr> <tr><td>23</td><td>D911</td><td>69.9°C</td><td>90.2°C</td></tr> <tr><td>24</td><td>Q902</td><td>80.5°C</td><td>102.4°C</td></tr> <tr><td>25</td><td>U301</td><td>68.8°C</td><td>88.4°C</td></tr> <tr><td>26</td><td>U800</td><td>70.8°C</td><td>89.3°C</td></tr> <tr><td>27</td><td>C326</td><td>67.6°C</td><td>86.9°C</td></tr> <tr><td>28</td><td>C305</td><td>71.0°C</td><td>91.2°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=33.8 °C	HIGH AMBIENT Ta=55 °C	1	L3	70.0°C	88.8°C	2	LF1	79.5°C	98.3°C	3	D5	92.2°C	110.6°C	4	D10	86.4°C	104.9°C	5	C11	80.1°C	98.8°C	6	L180	87.6°C	108.9°C	7	C186	79.4°C	99.8°C	8	C115	82.8°C	103.8°C	9	C110	85.5°C	105.8°C	10	C106	71.3°C	92.3°C	11	Q100	77.4°C	97.5°C	12	C205	79.4°C	99.3°C	13	T300	85.9°C	105.8°C	14	T1	95.4°C	115.8°C	15	Q305	72.3°C	92.7°C	16	TSW	72.8°C	93.1°C	17	T903	76.9°C	96.0°C	18	L8	71.9°C	91.6°C	19	C14	73.9°C	93.0°C	20	C929	74.6°C	92.6°C	21	C905	70.9°C	90.2°C	22	L900	79.9°C	100.0°C	23	D911	69.9°C	90.2°C	24	Q902	80.5°C	102.4°C	25	U301	68.8°C	88.4°C	26	U800	70.8°C	89.3°C	27	C326	67.6°C	86.9°C	28	C305	71.0°C	91.2°C		P
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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	P																																																																																																																				
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 550VAC/100VAC O/P : 100 % LOAD Ta= -35 °C	TEST : OK	P																																																																																																																				
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK	P																																																																																																																				
5	TEMPERATURE COEFFICIENT	± 0.03 %/°C (0~50°C)	I/P : 400 VAC O/P : FULL LOAD	± 0.006 %/°C (0~50°C)	P																																																																																																																				

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 : 5 CYCLE 5. Input/Output condition : STATIC	OK	P
7	THERMAL SHOCK TEST	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 : 10 CYCLE 5. Input/Output condition : 400VAC/Full Load AC ON/OFF TEST turn on 58sec ; turn off 2sec	OK	P
8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 2G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK	P
9	CAPACITOR LIFE CYCLE	TDR-960-24:SUPPOSE C110 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= 50 °C LIFE TIME (3) I/P : 400VAC O/P : 75% LOAD Ta= 50 °C LIFE TIME (4) I/P : 400VAC O/P : 50% LOAD Ta=50 °C LIFE TIME	(1) 86884HRS (2) 16375HRS (3) 44970HRS (4) 95805HRS	P
10	MTBF	Conducted by Parts Stress Analysis Prediction 647.1K hrs min. Telcordia SR-332 (Bellcore) ; 59.5K hrs min. MIL-HDBK-217F (25°C)		P
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 50°C		P

DATE	SAMPLE	TEST RESULT	TESTER	APPROVAL
2012/6/29	RD SAMPLE	PASS	SANFORD SU	VINCENT TSENG
2012/7/4	PRODUCT SAMPLE	PASS	SANFORD SU	VINCENT TSENG
2012/9/26	PRODUCT SAMPLE W1208C25	PASS	SANFORD SU	VINCENT TSENG

2009/08/04 A50-F023