Test Report: DDR-60L-5

60W DIN Rail Type DC-DC Converter

■ DESIGN VERIFY TEST

Output Function Test
Input Function Test
Protection Function Test
Control Function Test
Component Stress Test

■ SAFETY & E.M.C. TEST

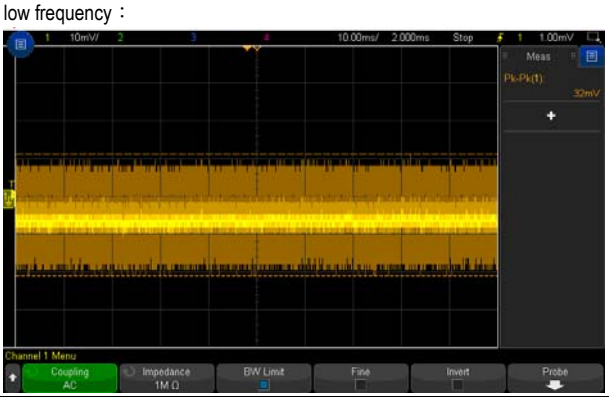
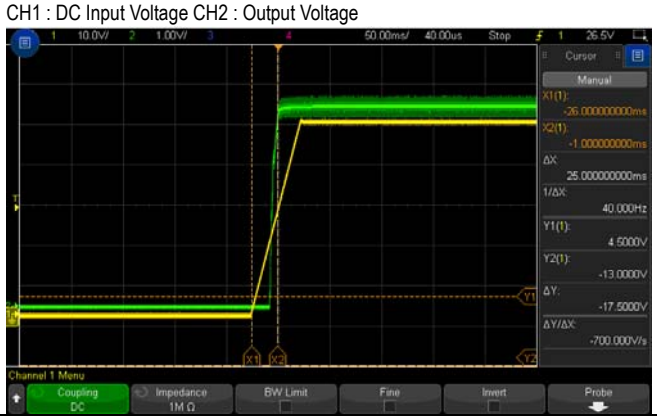
Safety Test
E.M.C. Test

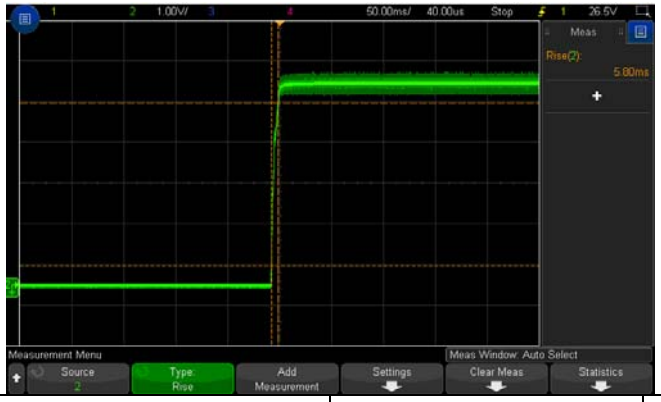
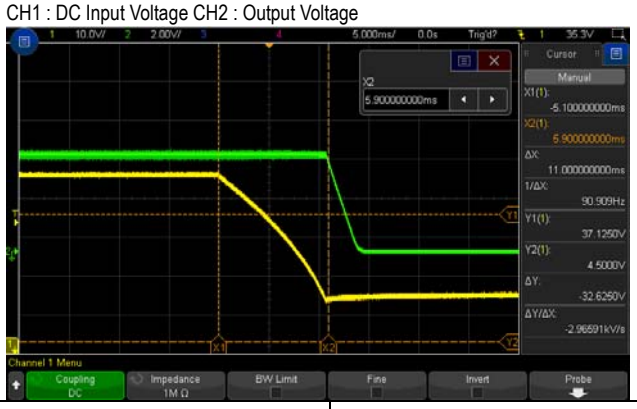
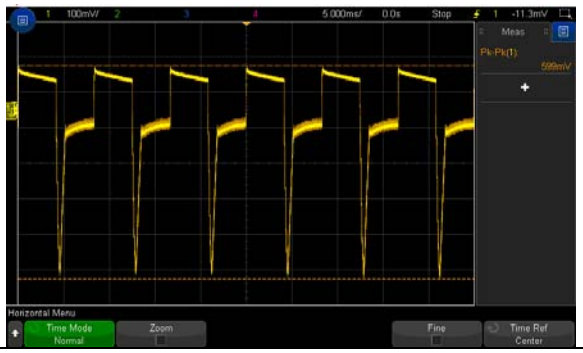
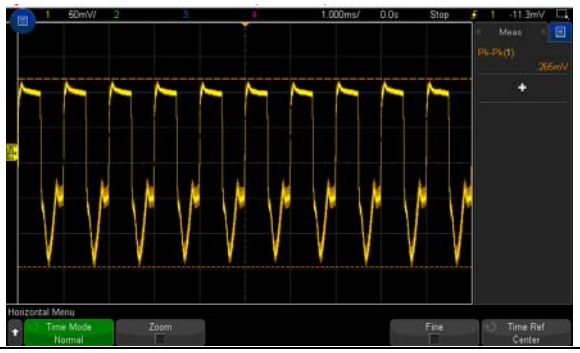
■ RELIABILITY TEST

ENVIRONMENT TEST

■ DESIGN VERIFY TEST

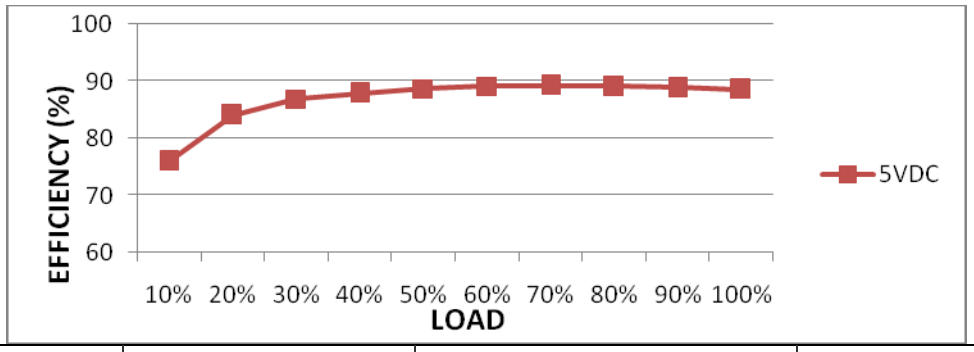
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1:4.5 V~5.5 V	I/P： 48 VDC O/P：MIN LOAD Ta：25℃	4.40V~5.65V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -2%~ 2%	I/P:18 VDC / 75VDC O/P:FULL/ MIN. LOAD Ta:25℃	V1:- 0.92%~ 0.95%
3	LINE REGULATION (Max)	V1:-0.5%~ 0.5%	I/P: 18 VDC / 75VDC O/P:FULL LOAD Ta:25℃	V1: -0.02 %~ 0.16 %
4	LOAD REGULATION (Max)	V1: -1.5%~ 1.5%	I/P: 48VDC O/P:FULL ~MIN LOAD Ta:25℃	V:-0.92%~ 0.95%
5	OVER/UNDERSHOOT TEST	<±10%	I/P:48VDC O/P:FULL LOAD Ta:25℃	TEST:3.6%
6	RIPPLE & NOISE (Max)	*V1: 60 mVp-p*	I/P: 48VDC O/P:FULL LOAD Ta:25℃	V1: 32 mVp-p
	high frequency： 		low frequency： 	
7	SET UP TIME (Max)	48VDC/120 ms	I/P:48 VDC O/P:FULL LOAD Ta:25℃	48VDC/ 25.0ms
	INPUT=48VDC @ FULL LOAD CH1 : DC Input Voltage CH2 : Output Voltage 			

8	RISE TIME (Max)	48VDC/ 85 ms	I/P: 48 VDC O/P:FULL LOAD Ta:25℃	48VDC/ 5.8 ms
	INPUT=48VDC@ FULL LOAD 			
9	HOLD UP TIME (TYP)	48VDC/10ms	I/P: 48VDC O/P:F ULL LOAD Ta:25℃	48VDC/11.0ms
	INPUT=48VDC @ FULL LOAD CH1 : DC Input Voltage CH2 : Output Voltage 			
10	DYNAMIC LOAD	V1: 1000 mVp-p	I/P: 48VDC O/P: (1)FULL /MIN LOAD 50%DUTY / 120HZ (2)FULL /MIN LOAD 50%DUTY / 1KHZ Ta:25℃	 599mVp-p 265mVp-p
	FULL /MIN LOAD 50%DUTY / 120HZ 		FULL /MIN LOAD 50%DUTY / 1KHZ 	

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT

1	INPUT VOLTAGE RANGE	18VDC~ 75 VDC	I/P:TESTING O/P:FULL LOAD Ta:25℃	17.587V~ 75V
			I/P: LOW-LINE-0.2=17.8V HIGH-LINE+3V=78V 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 CURRENT(TYP)	48VDC/1.5 A	I/P: 48VDC O/P:FULL LOAD Ta:25℃	I =1.407A/48VDC
3	EFFICIENCY(TYP)	87.5%	I/P: 48VDC O/P:FULL LOAD Ta:25℃	88.33%
	EFFICIENCY vs LOAD 			
4	INRUSH CURRENT(TYP)	48VDC/ 20A COLD START	I/P: 48VDC O/P:FULL LOAD Ta:25℃	I =12.8A/ 48VDC
	INPUT=48VDC @ FULL LOAD 			

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~135%RATED OUTPUT POWER	I/P: 75VDC I/P: 48 VDC I/P: 18 VDC O/P:TESTING Ta:25℃	117.7%/ 75VDC 117.6%/ 48VDC 117.3%/ 18VDC PROTECTION TYPE： Constant current limiting, recovers automatically after fault condition is removed

2	OVER VOLTAGE PROTECTION	CH:5.75V~7 V	I/P: 75VDC I/P: 48 VDC I/P: 18 VDC O/P:MIN LOAD Ta:25℃	6.38V/75VDC 6.50V/ 48VDC 6.42V/ 18VDC PROTECTION TYPE： Shut down O/P voltage,re-power on to recover
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 75 VDC O/P: FULL LOAD Ta:25℃	NO DAMAGE PROTECTION TYPE： Constant current limiting, recovers automatically after fault condition is removed
4	INPUT REVERSE	POWER OK	I/P:75VDC O/P: NO LOAD Ta:25℃	NO DAMAGE

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q 3 Rated ： 150 V	I/P:High-Line +3V =78V DC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3)full load continue Ta:25℃	VDS: (1) 124V (2)100V (3)124V
2	Diode Peak **Voltage**	Q100 Rated ： 60 V	I/P:High-Line +3V =78 V DC ON/OFF O/P: (1)Full Load (2)Output Short (3)full load continue Ta:25℃	VDS: (1)37.7V (2)35.7V (3)38.5V
3	**Input Capacitor Voltage**	C5 Rated: ： 680 μ / 80V	I/P:High-Line +3V =78 V 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℃	C5 (1) 79.5V (2) 79.5V (3) 79.5V (4) 79.5V
4	**Control IC Voltage Test**	PWM IC U1 Rated 9V~20V U100 Rated -0.3V~38V	I/P:High-Line +3V =78 V DC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. Ta:25℃	U1 (1) 11.51V (2) 11.51V (3) 11.47V (4) 11.31V U100 (1) 9.46V (2) 4.55V (3) 9.78V (4) 8.01V
5	Clamp Diode Peak Voltage	D4 Rated： 200V D7 Rated： 200V	I/P：High-Line +3V = 78 V DC ON/OFF O/P： (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta：25℃	D4 (1)128V (2)124V D7 (1)142V (2)136V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	EN 60950-1 I/P-O/P:3KVDC/min	I/P-O/P: 3.6KVDC/min Ta:25℃	I/P-O/P: 0.0μA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ	I/P-O/P: 500 VDC Ta:25℃	I/P-O/P: 9999MΩ NO DAMAGE

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	☑EN55032 ☐EN55011 ☑CLASS A ☐CLASS B	I/P: 48VDC O/P:FULL LOAD Ta:25℃	☑PASS ☐FAIL Test by certified Lab
2	CONDUCTION	☑EN55032 ☐EN55011 ☑CLASS A ☐CLASS B	I/P:48VDC O/P:FULL LOAD Ta:25℃	☑PASS ☐FAIL Test by certified Lab
3	E.S.D	EN61000-4-2 □Din rail Model : AIR：8KV / Contact：6KV	I/P: 48VDC O/P:FULL LOAD Ta:25℃	☑CRITERIA A ☐CRITERIA B
4	E.F.T	EN61000-4-4 ☐INDUSTRY INPUT: 2KV	I/P: 48VDC O/P:FULL LOAD Ta:25℃	☑CRITERIA A ☐CRITERIA B
5	SURGE	IEC61000-4-5 ☐INDUSTRY line-line :1KV	I/P: 48VDC O/P:FULL LOAD Ta:25℃	☑CRITERIA A ☐CRITERIA B
6	Test by certified Lab & Test Report Prepare			

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL：DDR-60L-5 1. ROOM AMBIENT BURN-IN：1 HRS I/P：48VDC O/P： FULL LOAD Ta=23.7 ℃ 2. HIGH AMBIENT BURN-IN：1 HRS I/P：48VDC O/P： FULL LOAD Ta=51.0 ℃		

			NO	Position	ROOM AMBIENT Ta=23.7 ℃ / HIGH AMBIENT Ta=51.0 ℃
			1	LF1	55.9℃ / 80.3℃
			2	C5	58.3℃ / 81.5℃
			3	T1	82.3℃ / 107.5℃
			4	Q3	63.0℃ / 84.9℃
			5	R9	103.7℃ / 107.9℃
			6	D7	105.5℃ / 105.7℃
			7	Q100	81.0℃ / 102.9℃
			8	C105	84.4℃ / 108.0℃
			9	C107	80.1℃ / 103.7℃
			10	U1	68.8℃ / 87.0℃
			11	ZNR1	46.8℃ / 50.6℃
			12	Q1	51.7℃ / 77.0℃
			13	L1	87.0℃ / 105.5℃
			14	RTH1	58.2℃ / 78.7℃
			15	L100	91.7℃ / 117.1℃
			16	C40	65.0℃ / 88.4℃
			17	R5	56.4℃ / 80.5℃
			18	Q2	56.8℃ / 80.2℃
			19	T2	65.1℃ / 87.2℃

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P：48VDC O/P：116 % LOAD Ta：25℃	TEST：OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P：36 VDC/ 75 VDC O/P： 100 % LOAD Ta= -45 ℃	TEST：OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 ℃ NO DAMAGE	I/P：78 VDC O/P：FULL LOAD Ta= 50 ℃ HUMIDITY= 95 %R.H	TEST：OK
5	TEMPERATURE COEFFICIENT	± 0.03 %(0~50℃)	I/P：48 VDC O/P：FULL LOAD	± 0.0074 %(0~50℃)
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature： -45℃~ +90℃ 2. Temperature change rate ：25℃ / 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： -45℃~ +55℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：16 CYCLE 5. Input/Output condition：48VDC/Full Load DC ON/OFF TEST turn on 3sec；turn off 1sec@15cycle\ 48VDC/Full Load DC ON@1cycle		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：60min in each axis (X.Y.Z) (6) Ta：25℃		TEST：OK

<table>
<tr><td></td><td></td><td>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></td><td></td></tr>
<tr><td>9</td><td>CAPACITOR
LIFE CYCLE</td><td>SUPPOSE C105 IS THE MOST CRITICAL COMPONENT
(1) I/P： 48VDC O/P：FULL LOAD Ta= 25 ℃ LIFE TIME
(2) I/P： 48VDC O/P：FULL LOAD Ta= 50 ℃ LIFE TIME
(3) I/P： 48VDC O/P：75% LOAD Ta= 50 ℃ LIFE TIME
(4) I/P： 48VDC O/P：50% LOAD Ta= 50 ℃ LIFE TIME</td><td>(1) 178266.0HRS
(2) 35565.6HRS
(3) 126231.6HRS
(4) 563706.0HRS</td></tr>
<tr><td>10</td><td>MTBF</td><td colspan="2">Conducted by Parts Stress Analysis Prediction
611K hrs min. MIL-HDBK-217F (25℃)</td></tr>
<tr><td>11</td><td>DMTBF/Accelerated Life Test</td><td colspan="2">Demonstration Mean Time Between Failure (Expected Life): Above30,000 hours @ TA 50℃</td></tr>
</table>

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		wangdz

12.10.30 A50-F031