



# Test Report: DDR-60L-5

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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

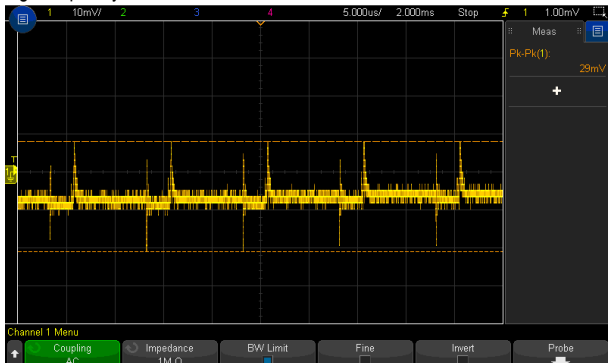
ENVIRONMENT TEST

## DESIGN VERIFY TEST

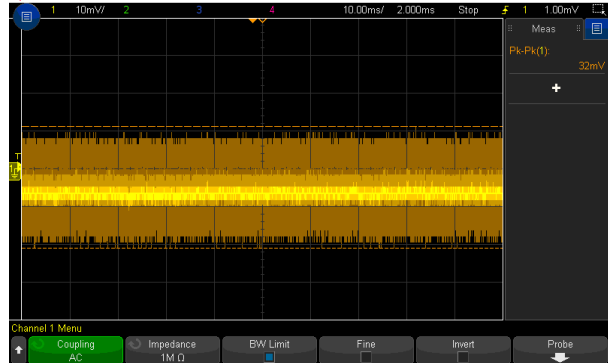
### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1:4.5V~5.5V	I/P : 48VDC O/P : MIN LOAD Ta : 25°C	4.40V~5.65V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -2%~ 2%	I/P:18VDC / 75VDC O/P:FULL/ MIN. LOAD Ta:25°C	V1:- 0.92%~ 0.95%
3	LINE REGULATION (Max)	V1:-0.5%~ 0.5%	I/P: 18VDC / 75VDC O/P:FULL LOAD Ta:25°C	V1:-0.02%~ 0.16%
4	LOAD REGULATION (Max)	V1: -1.5%~ 1.5%	I/P: 48VDC O/P:FULL ~MIN LOAD Ta:25°C	V:-0.92%~ 0.95%
5	OVER/UNDERSHOOT TEST	<±10%	I/P:48VDC O/P:FULL LOAD Ta:25°C	TEST:3.6%
6	RIPPLE & NOISE (Max)	V1: 60mVp-p	I/P: 48VDC O/P:FULL LOAD Ta:25°C	V1: 32mVp-p

high frequency :



low frequency :

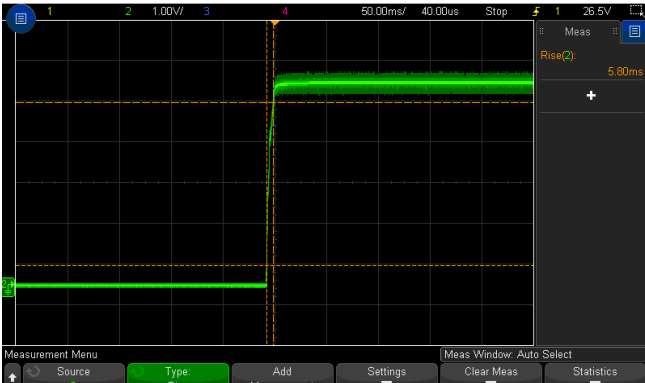

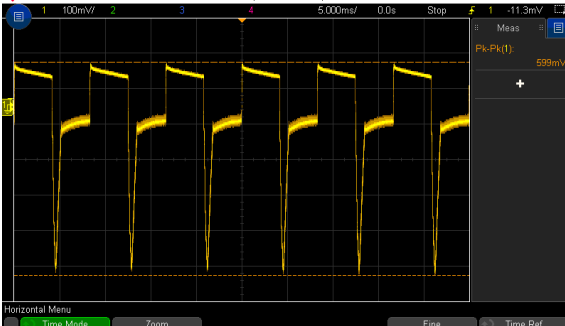
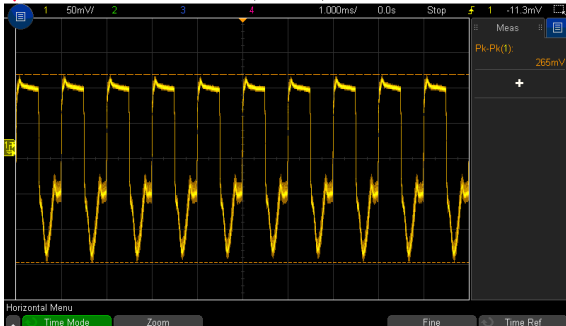


7	SET UP TIME (Max)	48VDC/120 ms	I/P:48VDC O/P:FULL LOAD Ta:25°C	48VDC/ 25.0ms
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INPUT=48VDC @ FULL LOAD

CH1 : DC Input Voltage CH2 : Output Voltage



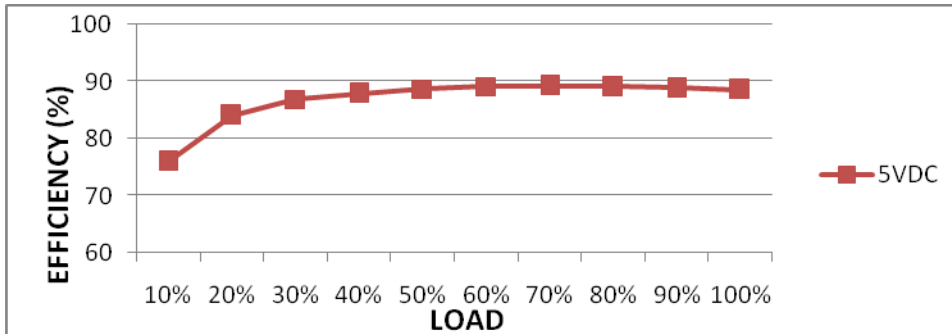
8	RISE TIME (Max)	48VDC/ 85 ms	I/P: 48 VDC O/P:FULL LOAD Ta:25°C	48VDC/ 5.8 ms
<p>INPUT=48VDC@ FULL LOAD</p> 				
9	HOLD UP TIME (TYP)	48VDC/10ms	I/P: 48VDC O/P:FULL LOAD Ta:25°C	48VDC/11.0ms
<p>INPUT=48VDC @ FULL LOAD CH1 : DC Input Voltage CH2 : Output Voltage</p> 				
10	DYNAMIC LOAD	V1: 1000 mVp-p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

### INPUT FUNCTION TEST

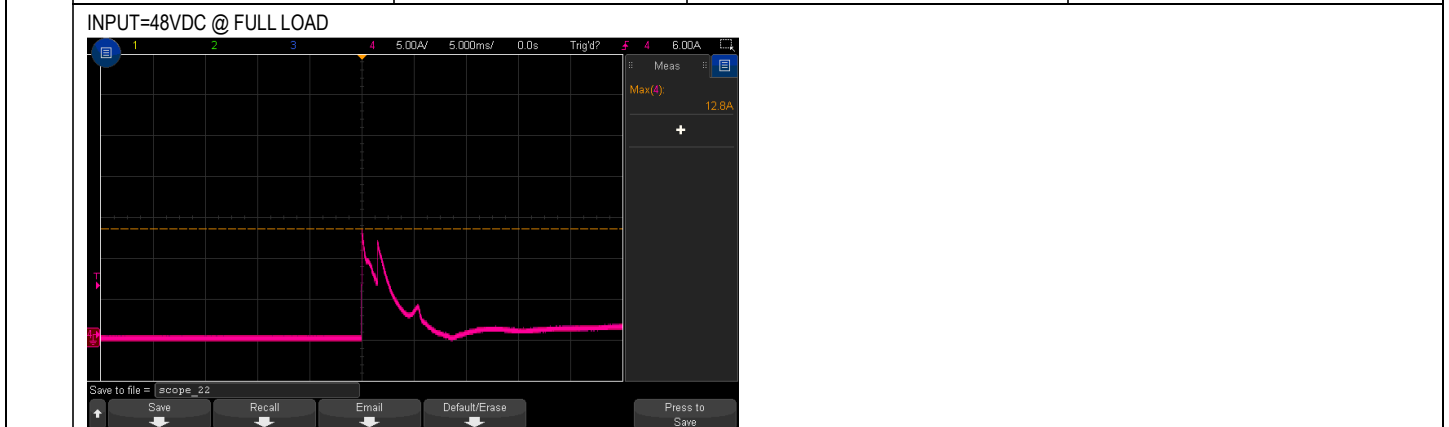
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
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1	INPUT VOLTAGE RANGE	18VDC~ 75 VDC	I/P:TESTING O/P:FULL LOAD Ta:25°C	17.587V~ 75V
			I/P: LOW-LINE-0.2=17.8V HIGH-LINE+3V=78V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec . OFF: 30 Sec 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°C	I=1.407A/48VDC
3	EFFICIENCY(TYP)	87.5%	I/P: 48VDC O/P:FULL LOAD Ta:25°C	88.33%

**EFFICIENCY vs LOAD**



4	INRUSH CURRENT(TYP)	48VDC/ 20A COLD START	I/P: 48VDC O/P:FULL LOAD Ta:25°C	I=12.8A/ 48VDC
		<p>INPUT=48VDC @ FULL LOAD</p>		



**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°C	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°C	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°C	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°C	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°C	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°C	VDS: (1)37.7V (2)35.7V (3)38.5V
3	Input Capacitor Voltage	C5 Rated: : 680 $\mu$ / 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°C	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°C	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°C	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:4 KVDC/min	I/P-O/P: 4.4 KVDC/min Ta:25°C	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°C	I/P-O/P: 9999MΩ  NO DAMAGE

## E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	<input checked="" type="checkbox"/> EN55032 <input type="checkbox"/> EN55011 <input checked="" type="checkbox"/> CLASS A <input type="checkbox"/> CLASS B	I/P: 48VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL Test by certified Lab
2	CONDUCTION	<input checked="" type="checkbox"/> EN55032 <input type="checkbox"/> EN55011 <input checked="" type="checkbox"/> CLASS A <input type="checkbox"/> CLASS B	I/P:48VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL Test by certified Lab
3	E.S.D	EN61000-4-2 <input type="checkbox"/> Din rail Model : AIR: 8KV / Contact: 6KV	I/P: 48VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
4	E.F.T	EN61000-4-4 <input type="checkbox"/> INDUSTRY INPUT: 2KV	I/P: 48VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
5	SURGE	IEC61000-4-5 <input type="checkbox"/> INDUSTRY line-line :1KV	I/P: 48VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> 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 °C 2. HIGH AMBIENT BURN-IN : 1 HRS I/P : 48VDC O/P : FULL LOAD Ta=51.0 °C		



		NO	Position	ROOM AMBIENT Ta=23.7 °C	HIGH AMBIENT Ta=51.0 °C
		1	LF1	55.9°C	80.3°C
		2	C5	58.3°C	81.5°C
		3	T1	82.3°C	107.5°C
		4	Q3	63.0°C	84.9°C
		5	R9	103.7°C	107.9°C
		6	D7	105.5°C	105.7°C
		7	Q100	81.0°C	102.9°C
		8	C105	84.4°C	108.0°C
		9	C107	80.1°C	103.7°C
		10	U1	68.8°C	87.0°C
		11	ZNR1	46.8°C	50.6°C
		12	Q1	51.7°C	77.0°C
		13	L1	87.0°C	105.5°C
		14	RTH1	58.2°C	78.7°C
		15	L100	91.7°C	117.1°C
		16	C40	65.0°C	88.4°C
		17	R5	56.4°C	80.5°C
		18	Q2	56.8°C	80.2°C
		19	T2	65.1°C	87.2°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )		I/P : 48VDC O/P : 116 % LOAD Ta : 25°C	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 °C	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C NO DAMAGE		I/P : 78 VDC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	± 0.03 % (0~50°C)		I/P : 48 VDC O/P : FULL LOAD	± 0.0074 % (0~50°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 : -45°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 : 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°C			TEST : OK



		<table border="1"> <tr> <td colspan="3">2 Din Rail</td> </tr> <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>	2 Din Rail				Displacement	Acceleration	2 (+3/-0) Hz up to 15Hz	±2.5mm	-----	15Hz up to 50Hz	-----	2.3g	Sweep rate	Max 1 Octave/minute		
2 Din Rail																		
	Displacement	Acceleration																
2 (+3/-0) Hz up to 15Hz	±2.5mm	-----																
15Hz up to 50Hz	-----	2.3g																
Sweep rate	Max 1 Octave/minute																	
9	CAPACITOR LIFE CYCLE	<p>SUPPOSE C105 IS THE MOST CRITICAL COMPONENT</p> <p>(1) I/P : 48VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME</p> <p>(2) I/P : 48VDC O/P : FULL LOAD Ta= 50 °C LIFE TIME</p> <p>(3) I/P : 48VDC O/P : 75% LOAD Ta= 50 °C LIFE TIME</p> <p>(4) I/P : 48VDC O/P : 50% LOAD Ta= 50 °C LIFE TIME</p>	<p>(1) 178266.0HRS</p> <p>(2) 35565.6HRS</p> <p>(3) 126231.6HRS</p> <p>(4) 563706.0HRS</p>															
10	MTBF	<p>Conducted by Parts Stress Analysis Prediction</p> <p>3261.6K hrs min. Telcordia SR-332 (Bellcore) ; 611.1K hrs min. MIL-HDBK-217F (25°C)</p>																
11	DMTBF/Accelerated Life Test	<p>Demonstration Mean Time Between Failure (Expected Life): Above30,000 hours @ TA 50°C</p>																

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		wangdz

12.10.30 A50-F031