



# Test Report: DDR-60L-15

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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

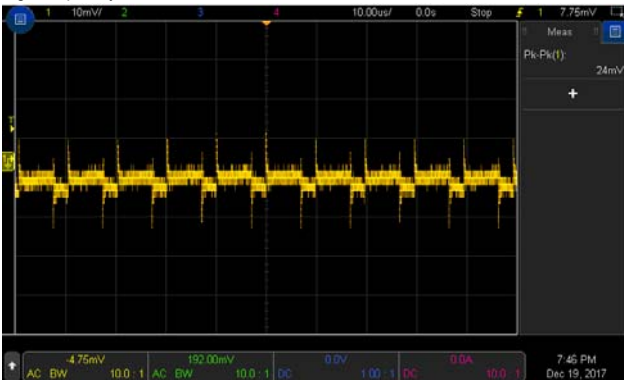
ENVIRONMENT TEST

DESIGN VERIFY TEST

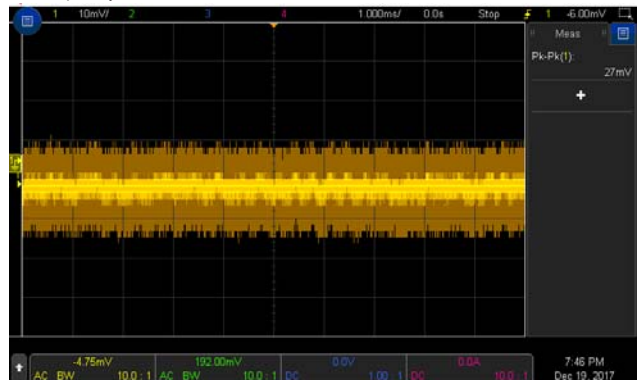
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -2%~ 2%	I/P:18 VDC / 75VDC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.30 %~ 0.21%
2	LINE REGULATION (Max)	V1:-0.5%~ 0.5%	I/P: 18 VDC / 75VDC O/P:FULL LOAD Ta:25°C	V1:-0.01 %~ 0.01%
3	LOAD REGULATION (Max)	V1: -0.5%~ 0.5%	I/P: 48VDC O/P:FULL ~MIN LOAD Ta:25°C	V1:-0.30 %~ 0.21%
4	OVER/UNDERSHOOT TEST	< ±5%	I/P:48VDC O/P:FULL LOAD Ta:25°C	TEST: 3.3%
5	RIPPLE & NOISE (Max)	V1: 75 mVp-p	I/P: 48VDC O/P:FULL LOAD Ta:25°C	V1: 27 mVp-p

high frequency :



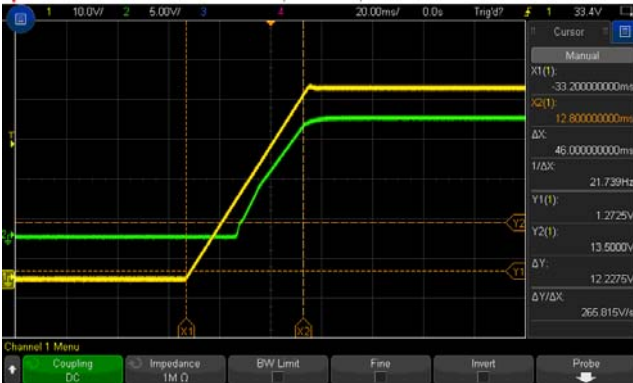
low frequency :



6	SET UP TIME (Max)	48VDC/120 ms	I/P:48 VDC O/P:FULL LOAD Ta:25°C	48VDC/46.0 ms
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INPUT=48VDC @ FULL LOAD

CH1 : DC Input Voltage CH2 : Output Voltage



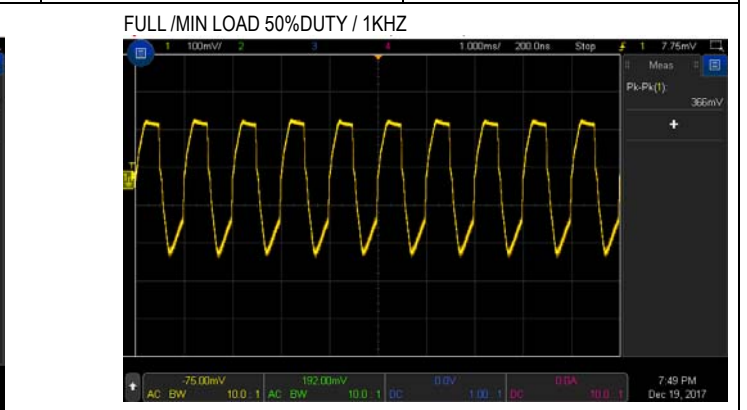
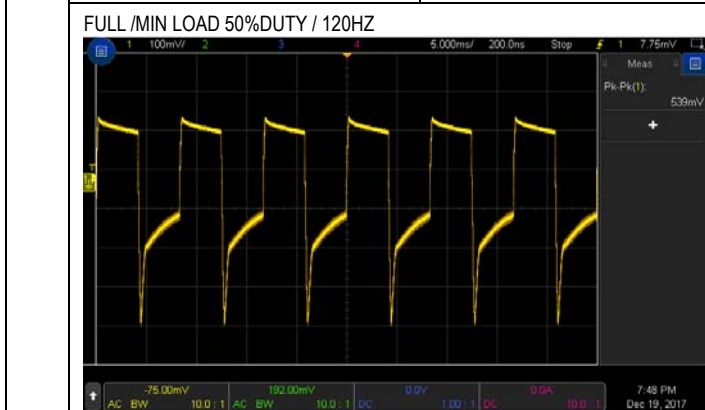
7	RISE TIME (Max)	48VDC/ 85 ms	I/P: 48 VDC O/P:FULL LOAD Ta:25°C	48VDC/ 23.02 ms
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8	HOLD UP TIME (TYP)	48VDC/10ms	I/P: 48VDC O/P: FULL LOAD Ta:25°C	48VDC/12.1 ms
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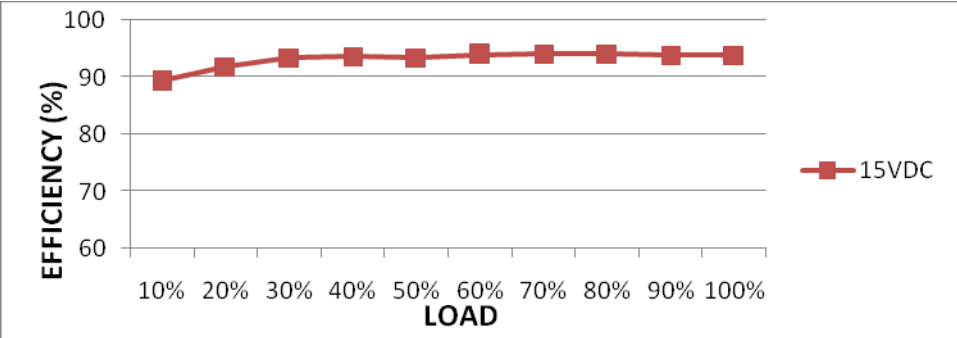
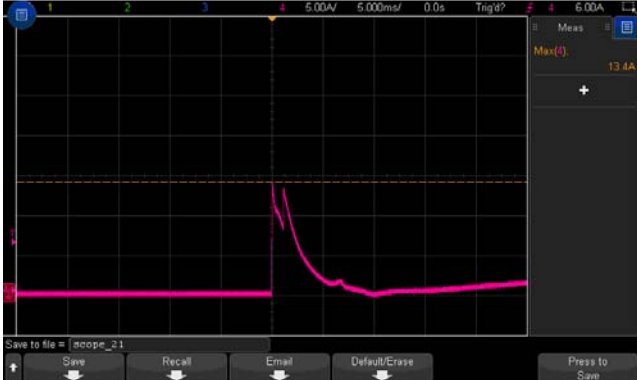


9	DYNAMIC LOAD	V1: 1500 mVp-p	I/P: 48VDC O/P: (1)FULL /MIN LOAD 50%DUTY / 120HZ (2)FULL /MIN LOAD 50%DUTY / 1KHZ Ta:25°C	539mVp-p 366mVp-p
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**INPUT FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	18VDC~ 75 VDC	I/P:TESTING O/P:FULL LOAD Ta:25°C	17.68V~ 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 =1.331A/48VDC																						
3	EFFICIENCY(TYP)	92 %	I/P: 48VDC O/P:FULL LOAD Ta:25°C	93.49%																						
<p>EFFICIENCY vs LOAD</p>  <table border="1"> <caption>Efficiency vs Load Data (15VDC)</caption> <thead> <tr> <th>LOAD (%)</th> <th>EFFICIENCY (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>90.0</td></tr> <tr><td>20%</td><td>92.0</td></tr> <tr><td>30%</td><td>93.0</td></tr> <tr><td>40%</td><td>93.5</td></tr> <tr><td>50%</td><td>93.5</td></tr> <tr><td>60%</td><td>94.0</td></tr> <tr><td>70%</td><td>94.0</td></tr> <tr><td>80%</td><td>93.5</td></tr> <tr><td>90%</td><td>93.5</td></tr> <tr><td>100%</td><td>93.5</td></tr> </tbody> </table>					LOAD (%)	EFFICIENCY (%)	10%	90.0	20%	92.0	30%	93.0	40%	93.5	50%	93.5	60%	94.0	70%	94.0	80%	93.5	90%	93.5	100%	93.5
LOAD (%)	EFFICIENCY (%)																									
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60%	94.0																									
70%	94.0																									
80%	93.5																									
90%	93.5																									
100%	93.5																									
4	INRUSH CURRENT(TYP)	48VDC/ 20 A COLD START	I/P: 48VDC O/P:FULL LOAD Ta:25°C	I =13.4A/ 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	122.2%/ 75VDC 122.2%/ 48VDC 123.7%/ 18VDC PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	CH: 17.25V~20.25 V	I/P: 75VDC I/P: 48 VDC I/P: 18 VDC O/P:MIN LOAD Ta:25°C	19.1V/75VDC 18.9V/ 48VDC 18.9V/ 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)114.7V (2)107.6V (3)114.1V
2	Diode Peak Voltage	Q100 Rated : 150 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	Q100: VDS: (1)114.1V (2)90.7V (3)113.2V
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)78.7 V (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) 11.0V (2) 11.2V (3) 11.4V (4) 11.0V U100 (1)18.7V (2)16.0V (3)18.7V (4)17.1V
5	Clamp Diode Peak Voltage	D4 Rated : 400V	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)99.5V (2)97.9V

### 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°C	I/P-O/P: 0.0 $\mu$ A  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
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## 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: 48 VDC 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: 48 VDC 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: 48 VDC 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: 48 VDC 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-24 1. ROOM AMBIENT BURN-IN : HRS I/P : 48VDC O/P : FULL LOAD Ta=23.7°C 2. HIGH AMBIENT BURN-IN : HRS I/P : 48VDC O/P : FULL LOAD Ta=60.8°C		



		NO	Position	ROOM AMBIENT Ta= °C	HIGH AMBIENT Ta= °C
		1	LF1	45.2°C	82.0°C
		2	C5	49.3°C	85.7°C
		3	T1	63.3°C	96.9°C
		4	Q3	54.3°C	92.1°C
		5	R9	56.4°C	92.4°C
		6	Q100	70.2°C	103.9°C
		7	C105	58.1°C	91.2°C
		8	C107	59.1°C	92.8°C
		9	C108	50.8°C	84.6°C
		10	U1	54.1°C	90.4°C
		11	ZNR1	35.7°C	73.1°C
		12	Q1	40.4°C	77.4°C
		13	Q2	44.1°C	81.1°C
		14	D4	58.3°C	94.2°C
		15	L100	56.6°C	90.2°C
		16	C15	55.5°C	91.0°C
		17	C110	54.2°C	88.1°C
		18	C40	54.6°C	90.2°C
		19	T2	51.6°C	87.3°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )		I/P : 48 VDC O/P : 115% 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 60 °C NO DAMAGE		I/P : 78 VDC O/P : FULL LOAD Ta= 60 °C HUMIDITY= 95 %R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	± 0.03 %(0~60°C)		I/P : 48VDC O/P : FULL LOAD	± 0.0000%(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 : -45°C~ +60°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 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= 60 °C LIFE TIME</p> <p>(3) I/P : 48VDC O/P : 75% LOAD Ta= 60 °C LIFE TIME</p> <p>(4) I/P : 48VDC O/P : 50% LOAD Ta= 60 °C LIFE TIME</p>	<p>(1) 272134.2HRS</p> <p>(2) 31724.0HRS</p> <p>(3) 53297.3HRS</p> <p>(4) 91804.0HRS</p>															
10	MTBF	<p>Conducted by Parts Stress Analysis Prediction</p> <p>611K hrs min. MIL-HDBK-217F (25°C)</p>																
11	DMTBF/Accelerated Life Test	<p>Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 60°C</p>																

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		wangdz

12.10.30 A50-F031