



# Test Report: DDR-60G-24

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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

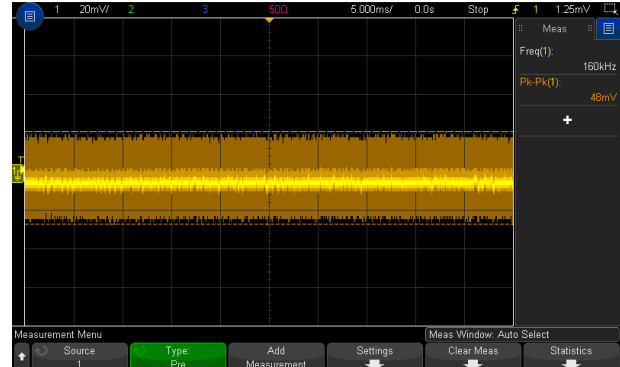
### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1:21.6 V~28 V	I/P : 24 VDC O/P : MIN LOAD Ta : 25°C	20.09V~28.71V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -2%~ 2%	I/P:9 VDC / 36VDC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.10 %~ 0.13%
3	LINE REGULATION (Max)	V1:-0.5%~ 0.5%	I/P: 9VDC /36VDC O/P:FULL LOAD Ta:25°C	V1: -0.008%~ 0.004%
4	LOAD REGULATION (Max)	V1: -0.5%~ 0.5%	I/P: 24VDC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.10 %~ 0.13%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P:24VDC O/P:FULL LOAD Ta:25°C	TEST: 2.1%
6	RIPPLE & NOISE (Max)	V1: 100 mV p-p	I/P: 24VDC O/P:FULL LOAD Ta:25°C	V1: 48mV p-p

high frequency :



low frequency :



7	SET UP TIME (Max)	24VDC/120 ms	I/P:24 VDC O/P:FULL LOAD Ta:25°C	24VDC/ 36.6 ms
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INPUT=24VDC@ FULL LOAD

CH1 : DC Input Voltage CH2 : Output Voltage



8	RISE TIME (Max)	24VDC/ 85 ms	I/P: 24 VDC O/P:FULL LOAD Ta:25°C	24VDC/ 25.1 ms
	<p>INPUT=24VDC@ FULL LOAD</p>			
9	HOLD UP TIME (TYP)	24VDC/5ms	I/P: 24VDC O/P:FULL LOAD Ta:25°C	24VDC/5.64ms
	<p>INPUT=24VDC @ FULL LOAD CH1 : DC Input Voltage CH2 : Output Voltage</p>			
10	DYNAMIC LOAD	V1: 2400 mVp-p	I/P: 24VDC O/P: (1)FULL /MIN LOAD 50%DUTY / 120HZ (2)FULL /MIN LOAD 50%DUTY / 1KHZ Ta:25°C	880 mVp-p 527 mVp-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
1	INPUT VOLTAGE RANGE	9VDC~ 36VDC	I/P:TESTING O/P:FULL LOAD Ta:25°C	7.85VDC~36VDC

			I/P: LOW-LINE-0.2=8.8V HIGH-LINE+3V=39V 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)	24VDC/3A	I/P: 24VDC O/P:FULL LOAD Ta:25°C	I =2.76 A/24VDC																						
3	EFFICIENCY(TYP)	91%	I/P: 24VDC O/P:FULL LOAD Ta:25°C	91.23 %																						
<p><b>EFFICIENCY vs LOAD</b></p> <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>Load (%)</th> <th>Efficiency (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>90.5</td></tr> <tr><td>20%</td><td>91.5</td></tr> <tr><td>30%</td><td>91.5</td></tr> <tr><td>40%</td><td>91.5</td></tr> <tr><td>50%</td><td>91.5</td></tr> <tr><td>60%</td><td>91.5</td></tr> <tr><td>70%</td><td>91.5</td></tr> <tr><td>80%</td><td>91.5</td></tr> <tr><td>90%</td><td>91.5</td></tr> <tr><td>100%</td><td>91.5</td></tr> </tbody> </table>					Load (%)	Efficiency (%)	10%	90.5	20%	91.5	30%	91.5	40%	91.5	50%	91.5	60%	91.5	70%	91.5	80%	91.5	90%	91.5	100%	91.5
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80%	91.5																									
90%	91.5																									
100%	91.5																									
4	INRUSH CURRENT(TYP)	24VDC/ 20 A COLD START	I/P: 24VDC O/P:FULL LOAD Ta:25°C	8.4 A/ 24VDC																						
<p><b>INPUT=24VDC @ FULL LOAD</b></p>																										

### PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~135%RATED OUTPUT POWER	I/P: 36VDC I/P: 24 VDC I/P: 9 VDC O/P:TESTING Ta:25°C	122.8%/36VDC 122.8%/24VDC 123.4%/9VDC ROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed

2	OVER VOLTAGE PROTECTION	CH: 28.8V~34V	I/P: 36VDC I/P: 24 VDC I/P: 9 VDC O/P:MIN LOAD Ta:25°C	31.0V/36VDC 31.0V/24VDC 31.0V/9VDC PROTECTION TYPE : Shut down O/P voltage,re-power on to recover
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 36VDC O/P: FULL LOAD Ta:25°C	OK PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed
4	INPUT REVERSE	POWER OK	I/P:36VDC 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 : 100 V	I/P:High-Line +3V =39V DC ON/OFF VDS: O/P: ((1)Full Load (2)Output Short (3)full load continue Ta:25°C.	VDS: (1) 77.0V (2) 74.6V (3)77.0V
2	Diode Peak Voltage	Q100 Rated : 200V	I/P:High-Line +3V =39 V DC ON/OFF O/P: (1)Full Load (2)Output Short (3) full load continue Ta:25°C	VDS: (1)135V (2)111V (3)133V
3	Input Capacitor Voltage	C5 Rated: : 1200 $\mu$ / 50V	I/P:High-Line +3V =39 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)41.5V (2)41.5V (3)41.5V (4)41.9V
4	Control IC Voltage Test	PWM IC U1 Rated -0.3V~30V	I/P:High-Line +3V =39 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) 11.36V (2) 11.36V (3) 11.60V (4) 11.19V
5	Clamp Diode Peak Voltage	D4 Rated : 600V	I/P : High-Line +3V =39 V DC ON/OFF O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25°C	D4 (1)43.0V (2)41.6V



## 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: 24VDC 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: 24 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: 24 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:24VDC 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: 24VDC 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-60G-24 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 24VDC O/P : FULL LOAD Ta=27.3°C 2. HIGH AMBIENT BURN-IN : 1 HRS I/P : 24VDC O/P : FULL LOAD Ta=60.8°C		



		NO	Position	ROOM AMBIENT Ta= °C	HIGH AMBIENT Ta= °C												
		1	LF1	54.9°C	85.3°C												
		2	C5	60.3°C	94.3°C												
		3	T1	68.2°C	100.8°C												
		4	Q3	68.3°C	107.4°C												
		5	D4	70.5°C	107.0°C												
		6	R9	68.9°C	104.1°C												
		7	Q100	79.5°C	107.9°C												
		8	C105	63.2°C	94.6°C												
		9	C107	63.6°C	93.4°C												
		10	C108	57.3°C	89.7°C												
		11	U1	64.3°C	98.7°C												
		12	ZNR1	44.1°C	77.4°C												
		13	Q1	47.1°C	82.4°C												
		14	RTH1	46.0°C	82.6°C												
		15	L100	60.0°C	91.6°C												
		16	C110	61.1°C	89.4°C												
		17	C40	64.7°C	95.4°C												
		18	Q2	57.4°C	88.8°C												
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )		I/P : 24VDC O/P : 118 % LOAD Ta : 25°C	TEST : OK												
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR		I/P : 36 VDC/ 18VDC O/P : 100 % LOAD Ta= -40 °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 : 39 VDC O/P : FULL LOAD Ta= 60 °C HUMIDITY= 95 %R.H	TEST : OK												
5	TEMPERATURE COEFFICIENT	± 0.03 % (0~55°C)		I/P : VDC O/P : FULL LOAD	±0.0041% (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~ +65°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 : 24VDC/Full Load DC ON/OFF TEST turn on 3sec ; turn off 1sec@15cycle \ 24VDC/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 2 Din Rail <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Displacement</th> <th>Acceleration</th> </tr> </thead> <tbody> <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> </tbody> </table>				Displacement	Acceleration	2 ( +3/-0 ) Hz up to 15Hz	± 2.5mm	-----	15Hz up to 50Hz	-----	2.3g	Sweep rate	Max 1 Octave/minute		TEST : OK
	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	SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 24VDC O/P : FULL LOAD Ta=25°C LIFE TIME (2) I/P : 24VDC O/P : FULL LOAD Ta= 60°C LIFE TIME (3) I/P : 24VDC O/P : 75% LOAD Ta= 60°C LIFE TIME (4) I/P : 24VDC O/P : 50% LOAD Ta= 60°C LIFE TIME	(1) 245255.4HRS (2) 25033.1HRS (3) 47453.3HRS (4) 86258HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 3261.6K hrs min. Telcordia SR-332 (Bellcore) ; 611.1K hrs min. MIL-HDBK-217F (25°C)	
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above30,000 hours @ TA 60°C	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		wangdz

12.10.30 A50-F031