

## DESCRIPTION

Demonstration circuit 1631A is a dual output DDR2/3 power supply operating with a switching frequency of 400kHz over an input voltage range of 4.5V to 14V. The fixed on-time valley current mode control of the LTC®3876 allows for a fast load step response (see Figure 3). The load step response can be tested with the onboard load step circuit and a bench pulse generator.

The demo board uses a high density, two sided drop-in layout. The entire converter, excluding the bulk output and input capacitors, fits within a compact 1.5" × 1.0" area on the board. The package style for the LTC3876EUHF is a 38-pin 5mm × 7mm QFN with an exposed ground pad.

The main features of the board are listed below:

- MODE jumper to program either discontinuous mode (DCM) or forced continuous mode (FCM) at light or no load.
- EXTVCC pin.
- PLLIN pin to synchronize the converter to an external clock.
- Remote sensing for  $V_{DDQ}$ .
- RUN pin, PGOOD pin and TRACK/SS pin.

Design files for this circuit board are available at  
<http://www.linear.com/demo>

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## PERFORMANCE SUMMARY ( $T_A = 25^\circ\text{C}$ )

PARAMETER	CONDITIONS	VALUE
Minimum Input Voltage		4.5V
Maximum Input Voltage		14V
Output Voltage $V_{DDQ}$	$I_{DDQ} = 0\text{A}$ to $20\text{A}$ , $V_{IN} = 4.5\text{V}$ to $14\text{V}$	$1.8\text{V}/1.5\text{V} \pm 2\%$
Output Voltage $V_{TT}$	$I_{TT} = 0\text{A}$ to $10\text{A}$ , $V_{IN} = 4.5\text{V}$ to $14\text{V}$ , $V_{TTR} = 0.9\text{V}/0.75\text{V}$	$V_{TTR} \pm 15\text{mV}$
$V_{DDQ}$ Maximum Output Current, $I_{DDQ}$	$V_{IN} = 4.5\text{V}$ to $14\text{V}$ , $V_{DDQ} = 1.5\text{V}$	20A
$V_{TT}$ Maximum Output Current, $I_{TT}$	$V_{IN} = 4.5\text{V}$ to $14\text{V}$ , $V_{TT} = 0.75\text{V}$	10A
Nominal Switching Frequency		400kHz
Efficiency See Figure 2	$V_{DDQ} = 1.5\text{V}$ , $I_{DDQ} = 20\text{A}$ , $V_{IN} = 12\text{V}$	87%

# DEMO MANUAL DC1631A

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## QUICK START PROCEDURE

Demonstration circuit 1631A is easy to set up to evaluate the performance of the LTC3876EUHF. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

- 1) With power off, connect the input supply, load and meters as shown in Figure 1. Preset the load to 0A and  $V_{IN}$  supply to be 0V. Place jumpers in the following positions:

JP1	MODE	CCM
JP2	RUN1	ON
JP4	VFB1	DDR3( $V_{DDQ} = 1.5V$ )

Set jumper JP4 to DDR2 to make  $V_{DDQ}$  equal to 1.8V.

- 2) Adjust the input voltage to be between 4.5V to 14V.

$V_{DDQ}$  should be  $1.5V \pm 2\%$ .

$V_{TT}$  should be  $0.75V \pm 2\%$ .

- 3) Next, apply 20A load to  $V_{DDQ}$  and recheck  $V_{DDQ}$  voltage.

- 4) Apply 10A load to  $V_{TT}$  and recheck  $V_{TT}$  voltage.
- 5) Once the DC regulation is confirmed, observe the output voltage ripple, load step response, efficiency and other parameters.
- 6) (Optional) To check the current sinking capability of the  $V_{TT}$  output, connect a power resistor between  $V_{IN}$  and  $V_{TT}$ . The sinking current  $I_{SINK}$  can be calculated by  $I_{SINK} = (V_{IN} - V_{TT})/R_{LOAD}$ . The sinking current should not be more than 10A. The load resistor should be able to take maximum power of  $P_{LOAD} = (V_{IN} - V_{TT}) \cdot I_{SINK}$ . If an active load is used in the  $V_{TT}$  sinking current test, the ground of the active load should be floated/isolated.

Note 1. Use the BNC connectors labeled  $V_{DDQ}$  or  $V_{TT}$  to measure the output voltage ripple,

Note 2. Do not apply the load from the  $VDDQ^+$  turret to the  $VDDQ^-$  turret or from the  $VTT^+$  turret to the  $VTT^-$  turret. These turrets are only intended to monitor the voltage across  $COUT1$  and  $COUT5$  respectively. Heavy load currents applied across these turrets may damage the converter.

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## LOAD STEP TRANSIENT TESTING

Demonstration circuit 1631A provides a simple load step circuit consisting of a MOSFET and sense resistor for each rail. To apply a load step, follow the steps below.

- 1) Preset the amplitude of a pulse generator to 0.0V and the duty cycle to 5% or less.
- 2) Connect the scope to the  $V_{DDQ}$  BNC connectors for the rail under test with a coax cable. To monitor the load step current, connect the scope probe across the I01(2)STEP and GND turrets for that rail.

- 3) Connect the output of the pulse generator to the I01(2)STEP CLK turret for the rail under test and connect the return to one of the GND turrets.
- 4) With the converter running, slowly increase the amplitude of the pulse generator output to provide the desired load step pulse height. The scaling for the LOAD STEP signal is 2.5mV/A.

## LOAD STEP TRANSIENT TESTING

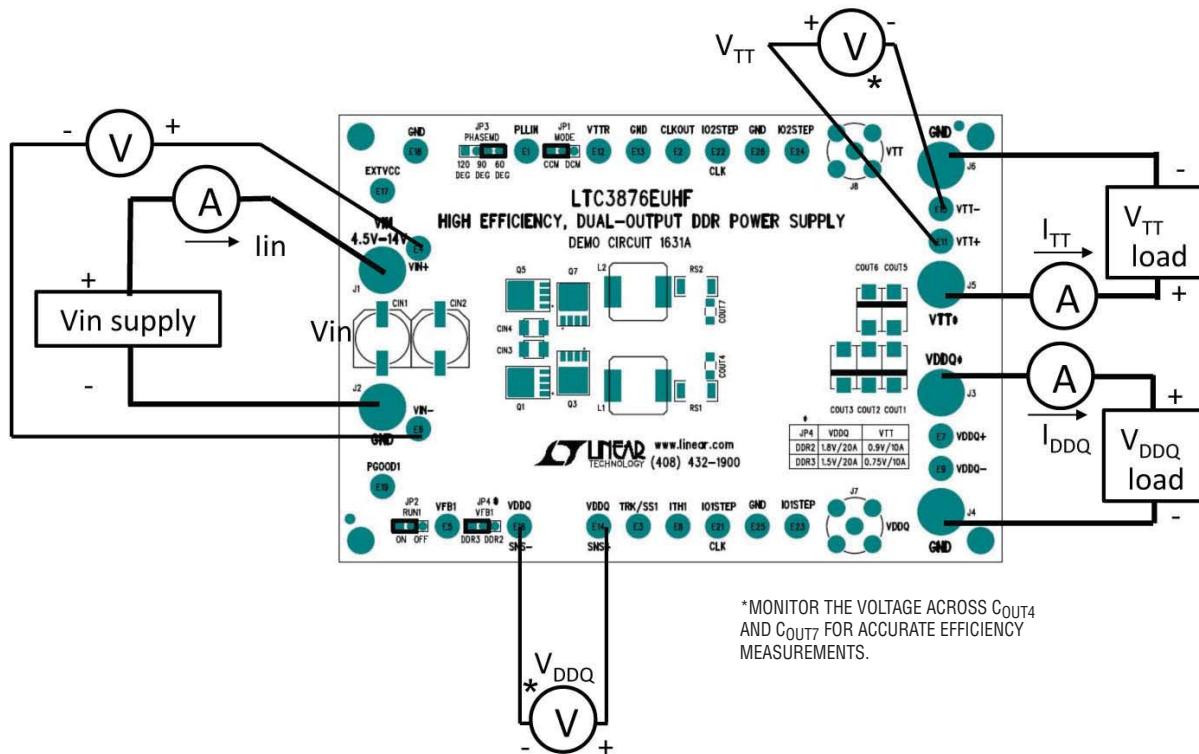


Figure 1. Proper Measurement Equipment Setup

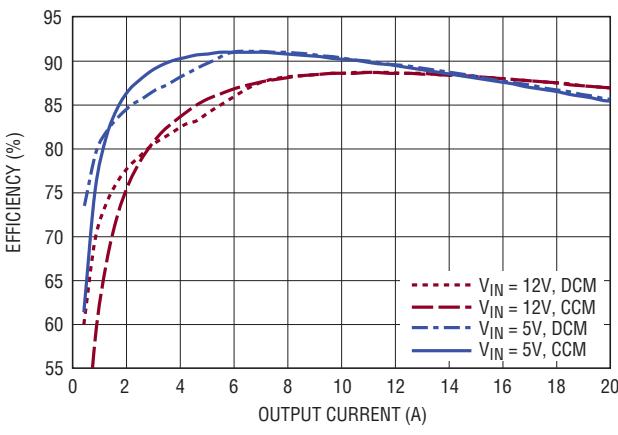
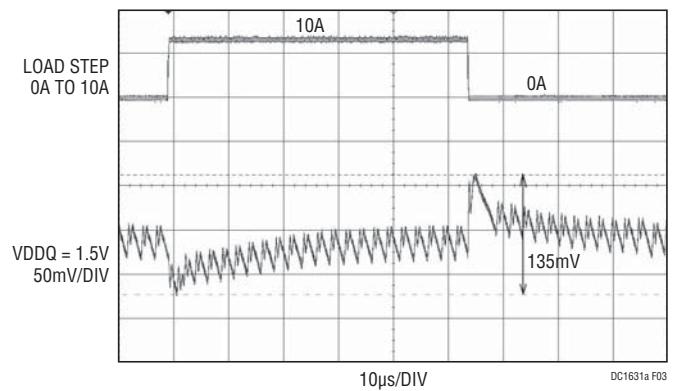


Figure 2. Efficiency Curves for the DC1631A VDDQ

Figure 3. Load Step Response of the VDDQ on the DC1631A at  $V_{IN} = 12V$ .  $C_{OUT} = 2x$  Sanyo 2R5TPE330M9 ||  $1x$   $100\mu F$  X5R 6.3V 1206,  $L = 0.47\mu H$ ,  $f_{SW} = 400kHz$

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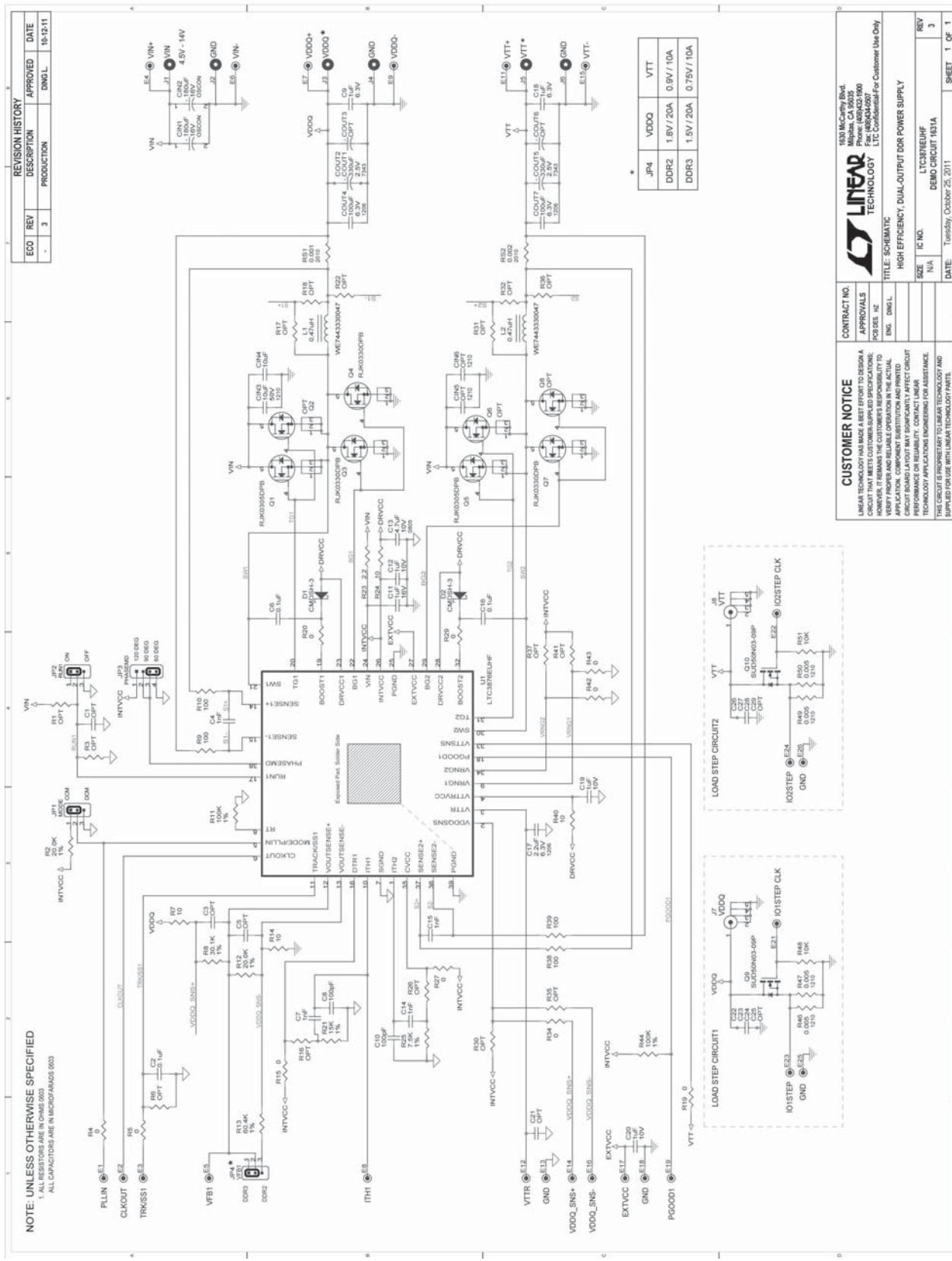
## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	2	C8, C10	CAP, 0603 100pF 10% 25V X7R	AVX 06033C101KAT
2	4	C4, C7, C14, C15	CAP, 0603 1nF 10% 50V X7R	AVX 06035C102KAT
3	3	C2, C6, C16	CAP, 0603 0.1µF 10% 25V X7R	TDK C1608X7R1E104K
4	6	C9, C11, C12, C18, C19, C20	CAP, 0603 1µF 10% 16V X5R	AVX 0603YD105KAT
6	1	C17	CAP, 1206 2.2µF 10% 10V X7R	TAIYO YUDEN LMK316B7225KL-T
7	1	C13	CAP, 0805 4.7µF 10% 10V X5R	TAIYO YUDEN LMK212BJ475KG-T
8	1	CIN3	CAP, 1210 10µF 20% 50V X5R	TAIYO YUDEN UMK325BJ106MM-T
9	2	COUT4, COUT7	CAP, 1206 100µF 20% 6.3V X5R	MURATA GRM31CR60J107ME39L
10	3	COUT1, COUT2, COUT5	CAP, 7343 330µF 20% 2.5V POSCAP	SANYO 2R5TPE330M9
11	1	CIN4	CAP, 1210 10µF 10% 25V X7R	AVX, 12103C106KAT2A
12	2	D2, D1	DIODE, CMDH-3 SOD323	CENTRAL SEMI. CMDH-3TR
13	2	L1, L2	IND, 0.47µH	WE 7443330047
14	2	Q1, Q5	XSTR, N-CHANNEL MOSFET	RENESAS RJK0305DPB
15	3	Q3, Q4, Q7	XSTR, N-CHANNEL MOSFET	RENESAS RJK0330DPB
16	1	RS1	RES, 2010 0.001Ω 1% 1/2W	VISHAY WSL20101L000FEA
17	1	RS2	RES, 2010 0.002Ω 1% 1/2W	VISHAY WSL20102L000FEA
18	10	R4, R5, R15, R19, R20, R27, R29, R34, R42, R43	RES, 0603 0Ω JUMPER	VISHAY CRCW0603000Z0EA
19	1	R23	RES, 0603 2.2Ω 5% 1/10W	VISHAY CRCW06032R20JNEA
20	4	R7, R14, R24, R40	RES, 0603 10Ω 5% 1/10W	VISHAY CRCW060310R0JNEA
21	4	R9, R10, R38, R39	RES, 0603 100Ω 5% 1/10W	VISHAY CRCW0603100RJNEA
22	1	R25	RES, 0603 7.50kΩ 1% 1/10W	VISHAY CRCW06037K50FKEA
23	2	R2, R12	RES, 0603 20kΩ 1% 1/10W	VISHAY CRCW060320K0FKEA
24	1	R21	RES, 0603 15kΩ 1% 1/10W	VISHAY CRCW060315K0FKEA
25	1	R8	RES, 0603 30.1kΩ 1% 1/10W	VISHAY CRCW060330K1FKEA
26	1	R13	RES, 0603 60.4kΩ 1% 1/10W	VISHAY CRCW060360K4FKEA
27	2	R11, R44	RES, 0603 100kΩ 1% 1/10W	VISHAY CRCW0603100KFKEA
28	1	U1	IC, LTC3876EUHF	LINEAR TECHNOLOGY LTC3876EUHF
29	2	L1, L2	IND, 0.47µH	WE 7443330047
<b>Additional Demo Board Circuit Components</b>				
1	1	CIN1, CIN2	CAP, 180µF 20% 16V OSCON	SANYO 16SVP180M
2	8	C22 TO C29	CAP, 1206 1µF 10% 16V X5R	AVX 1206YD105KAT
3	4	R46, R47, R49, R50	RES, 1206 0.005Ω 1% 1/4W	VISHAY WSL12065L000FEA
4	2	R48, R51	RES, 0603 10kΩ 1% 1/10W	VISHAY CRCW060310K0FKEA
5	2	Q9, Q10	N-Channel 30-V MOSFET, TO-252	VISHAY, SUD50N03-09P-E3
6	24	E1 TO E9, E11 TO E19, E21 TO E26	TESTPOINT, TURRET, 0.094" PBF	MILL-MAX, 2501-2-00-80-00-00-07-0
<b>Hardware/Components (For Demo Board Only)</b>				
1	1	JP3	HEADER, 4PIN	SAMTEC, TMM104-02-L-S
2	3	JP1, JP2, JP4	HEADER, 3PIN, 2mm	SAMTEC, TMM103-02-L-S
3	4	XJP1, XJP2, XJP3, XJP4	SHUNT, 2mm	SAMTEC, 2SN-BK-G
4	4	MTG 4 CORNERS	STAND-OFF, NYLON (SNAP ON), 0.25" TALL	KEYSTONE, 8831
5	6	J1, J2, J3, J4, J5, J6	JACK, BANANA	KEYSTONE 575-4
6	2	J7, J8	CONN., VERT. PC-MNT BNC 50Ω	CONNEX 112404

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# DEMO MANUAL DC1631A

## SCHEMATIC DIAGRAM



# DEMO MANUAL DC1631A

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