

LT8310/LT8311  
 48V<sub>IN</sub> to 12V/12A  
 Forward Converter with  
 Synchronous Rectification

## DESCRIPTION

Demonstration circuit 2015A is a resonant reset forward converter with synchronous rectification featuring the [LT<sup>®</sup>8310/LT8311](#) chipset.

This circuit was designed to demonstrate the high levels of performance, efficiency, and small solution size attainable using these parts. It operates at 240kHz and produces a regulated 12V, 12A output from an input voltage range of 36V to 72V: suitable for telecom, industrial, and other applications. It has an eighth-brick footprint area. Synchronous rectification helps to attain efficiency exceeding 94%.

The DC2015A circuit features soft-start which prevents output voltage overshoot on startup or when recovering from overload condition.

The DC2015A takes advantage of the LT8310's input undervoltage and overvoltage protection to shutdown the system when the input voltage is outside of the set limits. The DC2015A also has precise overcurrent protection that allows for continuous operation under short-circuit conditions. The low power dissipation under a short-circuit condition insures high reliability even during a prolonged output voltage short-circuit.

The LT8310/LT8311 data sheets give a complete description of the parts, operation and application information. The data sheets must be read in conjunction with this quick start guide for demo circuit 2015A.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2015A>**

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## PERFORMANCE SUMMARY Specifications are at T<sub>A</sub> = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V <sub>IN</sub>	Input Supply Range		36		72	V
V <sub>OUT</sub>	Output Voltage		11.7	12.0	12.3	V
I <sub>OUT</sub>	Maximum Output Current, Continuous	200LFM Airflow	12			A
f <sub>SW</sub>	Switching (Clock) Frequency			240		kHz
V <sub>OUT(P-P)</sub>	Output Ripple	V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 12A (20MHz BW)		80		mV <sub>P-P</sub>
I <sub>REG</sub>	Output Regulation	Line and Load (36V <sub>IN</sub> to 72V <sub>IN</sub> , 0A <sub>OUT</sub> to 12A <sub>OUT</sub> )		±0.1		%
P <sub>OUT</sub> /P <sub>IN</sub>	Efficiency (See Figure 3)	V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 12A		94		%
	Isolation	Basic		1500		VDC

## QUICK START PROCEDURE

Demonstration circuit 2015A is easy to set up to evaluate the performance of the LT8310/LT8311. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

NOTE. When measuring the output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip and ground ring directly across the last output capacitor as shown in Figure 2.

1. Set an input power supply that is capable of 36V to 72V. Then turn off the supply.
2. Direct an airflow of 200LFM across the unit for sustained operation at full load.
3. With power off, connect the supply to the input terminals  $+V_{IN}$  and  $-V_{IN}$ .
  - a. Input voltages lower than 36V can keep the converter from turning on due to the undervoltage lockout feature of the LT8310/LT8311.
  - b. If efficiency measurements are desired, an ammeter capable of measuring 10ADC can be put in series with the input supply in order to measure the DC2015A's input current.
  - c. A voltmeter with a capability of measuring at least 72V can be placed across the input terminals in order to get an accurate input voltage measurement.
4. Turn on the power at the input.

Note. Make sure that the input voltage does not exceed 100V.
5. Check for the proper output voltage of 12V. Turn off the power at the input.
6. Once the proper output voltages are established, connect a variable load capable of sinking 12A at 12V to the output terminals  $+V_{OUT}$  and  $-V_{OUT}$ . Set the current for 0A.
  - a. If efficiency measurements are desired, an ammeter or a resistor shunt that is capable of handling 12ADC can be put in series with the output load in order to measure the DC2015A's output current.
  - b. A voltmeter with a capability of measuring at least 12V can be placed across the output terminals in order to get an accurate output voltage measurement.
7. Turn on the power at the input.

Note. If there is no output, temporarily disconnect the load to make sure that the load is not set too high.
8. Once the proper output voltage is again established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other desired parameters.

## QUICK START PROCEDURE

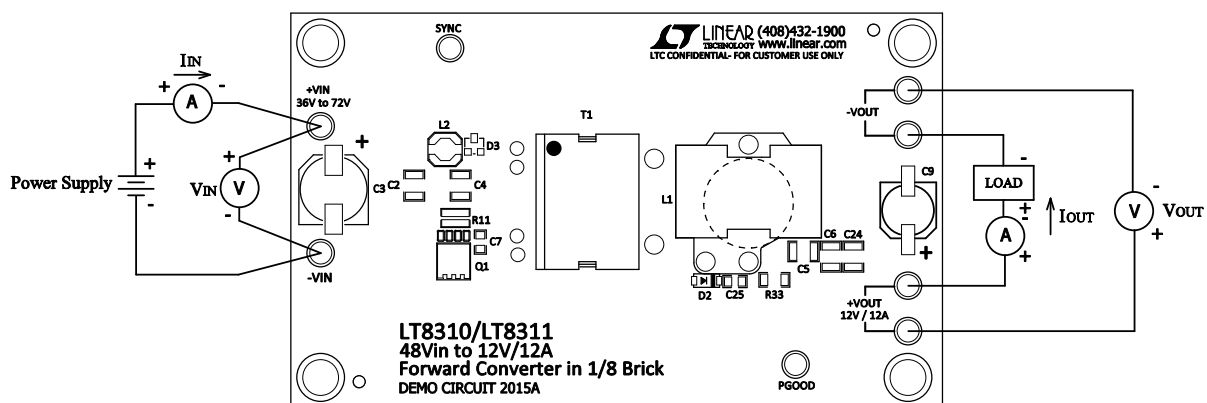


Figure 1. Proper Measurement Equipment Setup

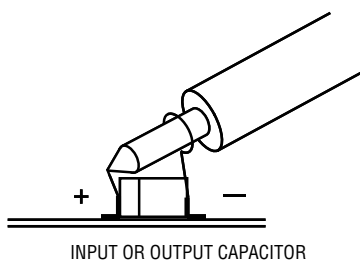


Figure 2. Proper Scope Probe Placement for Measuring Input/Output Ripple

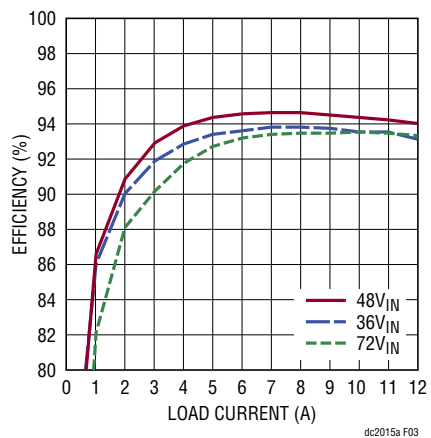


Figure 3. Typical Efficiency Curve

## QUICK START PROCEDURE

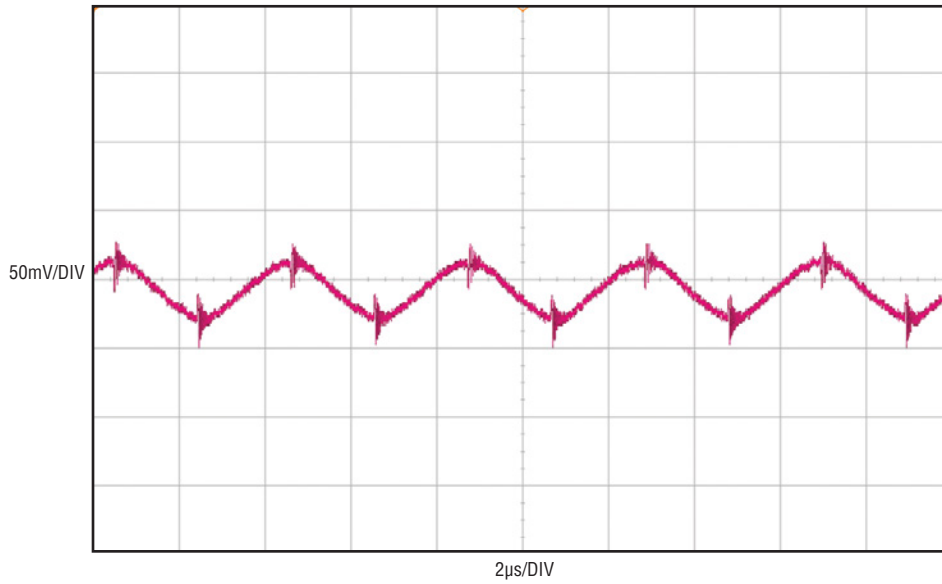


Figure 4. Output Ripple at 48V<sub>IN</sub> and 12A<sub>OUT</sub> (20MHz BW)

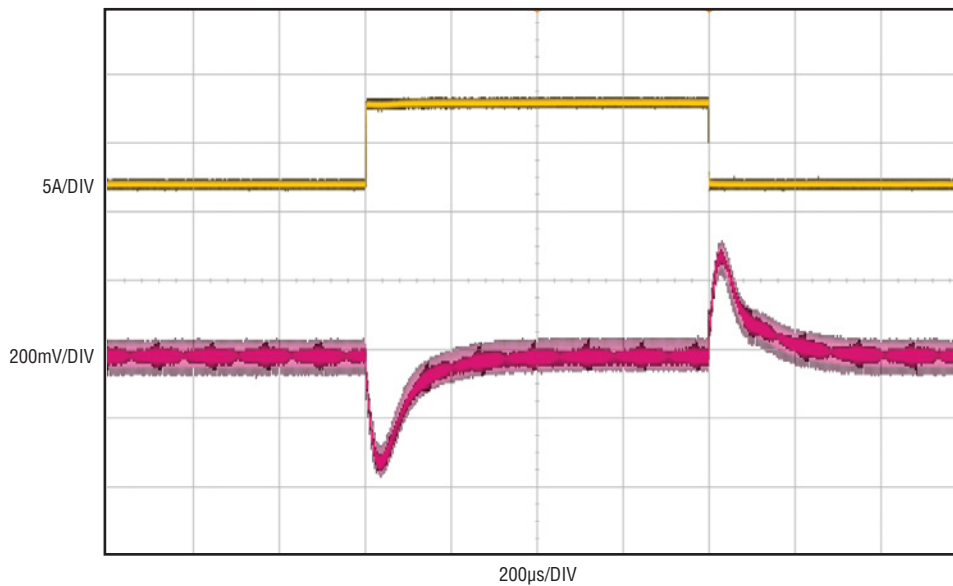


Figure 5. Load Transient Response Waveform at 48V<sub>IN</sub> and 6A<sub>OUT</sub> to 12A<sub>OUT</sub>

**QUICK START PROCEDURE**

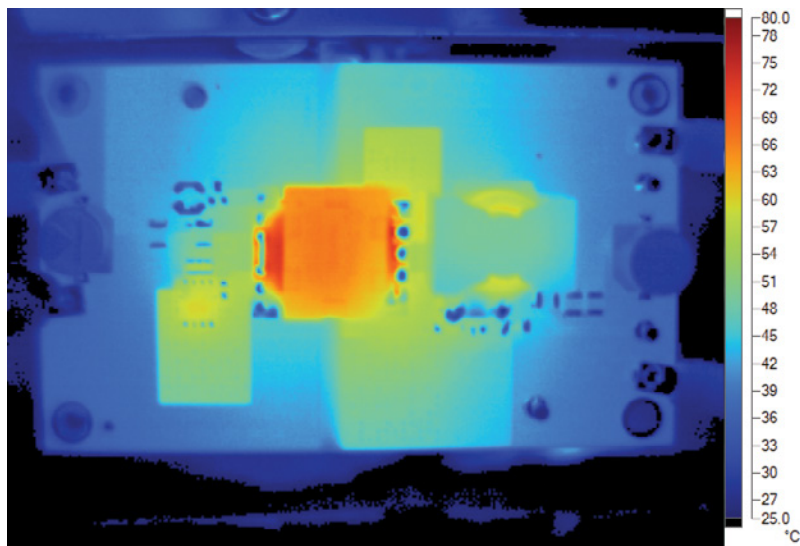


Figure 6. Thermal Map, Frontside at 48V<sub>IN</sub> and 12A<sub>OUT</sub> (T<sub>A</sub> = 25°C, 200LFM)

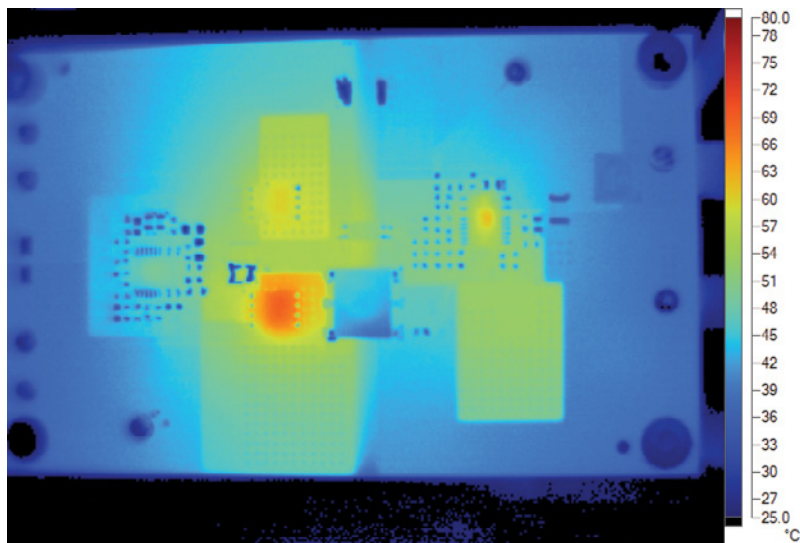


Figure 7. Thermal Map, Backside at 48V<sub>IN</sub> and 12A<sub>OUT</sub> (T<sub>A</sub> = 25°C, 200LFM)

# DEMO MANUAL DC2015A

## PARTS LIST

ITEM	QUANTITY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART #
<b>REQUIRED CIRCUIT COMPONENTS</b>				
1	1	C1	Cap., X7R 4700pF 250V 20% 1812	Murata GA343DR7GD472KW01L
2	3	C2, C4, C23	Cap., X7S 4.7µF 100V 10% 1210	TDK C3225X7S2A475K
3	1	C3	Cap., Alum 10µF 100V 20%	Sun Elect. Ind. Corp. 100HVH10M
4	3	C5, C6, C24	Cap., X5R 47µF 16V 20% 1210	Taiyo Yuden EMK325BJ476MM
5	1	C7	Cap., U2J 390pF 250V 5% 0805	Murata GRM21A7U2E391JW31D
6	1	C9	Cap., Alum 470µF 16V 20%	Sun Elect. Ind. Corp. 16SVPE470M
7	2	C10, C14	Cap., X7R 22nF 25V 10% 0603	AVX 06033C223KAT1A
8	1	C11	Cap., X7S 1µF 100V 10% 0805	TDK C2012X7S2A105K
9	1	C12	Cap., X7R 0.01µF 25V 10% 0603	AVX 06033C103KAT2A
10	3	C13, C17, C19	Cap., X5R 4.7µF 16V 20% 0805	TDK C2012X5R1C475M
11	1	C15	Cap., NPO 100pF 25V 5% 0603	AVX 06033A101JAT2A
12	1	C16	Cap., X7R 0.1µF 25V 10% 0603	AVX 06033C104KAT2A
13	1	C18	Cap., X7R 3.9nF 25V 20% 0603	AVX 06033C392MAT2A
14	1	C20	Cap., NPO 220pF 25V 5% 0603	AVX 06033A221JAT1A
15	1	C25	Cap., U2J 3.9nF 250V 5% 0805	Murata GRM21B7U2E392JW32L
16	1	C26	Cap., X5R 1µF 25V 20% 0603	AVX 06033D105MAT2A
17	1	D2	Diode, 1A/200V SOD-123	Central Semi. CMMR1U-02
18	1	ISO1	Opto Iso., 2.5kV TRANS 4SOIC PbF	NEC PS2801C-1-P-A
19	1	L1	Inductor, 8µH	Champs Tech. PQA2050-08-LTC
20	1	L3	Inductor, 1µH	Coilcraft XAL6030-102MEC
21	1	Q1	MOSFET N-Channel, 200V/36A SuperSO8	Infineon BSC320N20NS3G
22	1	Q2	MOSFET, Single N-Chan. 100V/60A POWER-56	Fairchild Semi. FDMS86101
23	1	Q3	MOSFET N-Channel, 75V/100A SuperSO8	Infineon BSC042NE7NS3G
24	1	R1	Res., Chip 86.6k 0.10W 1% 0603	Vishay CRCW060386K6FKEA
25	1	R3	Res., Chip 100k 0.10W 1% 0603	Vishay CRCW0603100KFKEA
26	3	R4, R14, R36	Res., Chip 10k 0.10W 5% 0603	Vishay CRCW060310K0JNEA
27	1	R5	Res., Chip 11.3k 0.10W 1% 0603	Vishay CRCW060311K3FKEA
28	1	R6	Res., Chip 1.74k 0.10W 1% 0603	Vishay CRCW06031K74FKEA
29	4	R7, R17, R34, R35	Res/Jumper, Chip 0Ω 0.25W 5A 0603	Vishay CRCW06030000Z0EA
30	1	R8	Res., Chip 1.43k 0.10W 1% 0603	Vishay CRCW06031K43FKEA
31	1	R10	Res., Chip 10.0Ω 0.10W 1% 0603	Vishay CRCW060310R0FKEA
32	1	R11	Res., RL Vert. 0.010Ω 1W 1% 0815	SSM Thin Film Tech. RL3720WT-R010-F
33	2	R13, R38	Res., Chip 4.02k 0.10W 1% 0603	Vishay CRCW06034K02FKEA
34	1	R16	Res., Chip 3.32k 0.10W 1% 0603	Vishay CRCW06033K32FKEA
35	1	R18	Res., Chip 113k 0.10W 1% 0603	Vishay CRCW0603113KFKEA
36	1	R19	Res., Chip 20.0k 0.10W 1% 0603	Vishay CRCW060320K0FKEA
37	1	R23	Res/Jumper, Chip 0Ω 0.33W 6A	Vishay CRCW08050000Z0EA
38	1	R26	Res., Chip 41.2k 0.10W 1% 0603	Vishay CRCW060341K2FKEA
39	1	R27	Res., Chip 100k 0.10W 5% 0603	Vishay CRCW0603100KJNEA
40	1	R28	Res., Chip 178Ω 0.10W 1% 0603	Vishay CRCW0603178RFKEA
41	1	R29	Res., Chip 499k 0.10W 1% 0603	Vishay CRCW0603499KFKEA

dc2015af

## PARTS LIST

ITEM	QUANTITY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART #
42	1	R30	Res., Chip 560Ω 0.10W 5% 0603	Vishay CRCW0603560RJNEA
43	1	R32	Res., Chip 178Ω 0.125W 1% 0805	Vishay CRCW0805178RFKTA
44	1	R33	Res., Chip 20k 0.25W 5% 1206	Vishay CRCW120620K0JNED
45	1	R37	Res., Chip 499Ω 0.10W 1% 0603	Vishay CRCW0603499RFKEA
46	1	R39	Res., Chip 61.9k 0.10W 1% 0603	Vishay CRCW060361K9FKEA
47	1	T1	Transformer, 8:4 / (w/4T Pri. Aux)	Pulse PA0423
48	1	T2	Transformer, 1.25:1	Pulse PA3493NL
49	1	U1	I.C., Converter Controller TSSOP20-FE20(16)/CB	Linear Tech. Corp. LT8310EFE#PBF
50	1	U2	I.C., Converter Controller TSSOP20-FE20(16)/CB	Linear Tech. Corp. LT8311EFE#PBF
51	1		FAB, 2015A_Rev3.pcb	Demo Circuit 2015A

### ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS

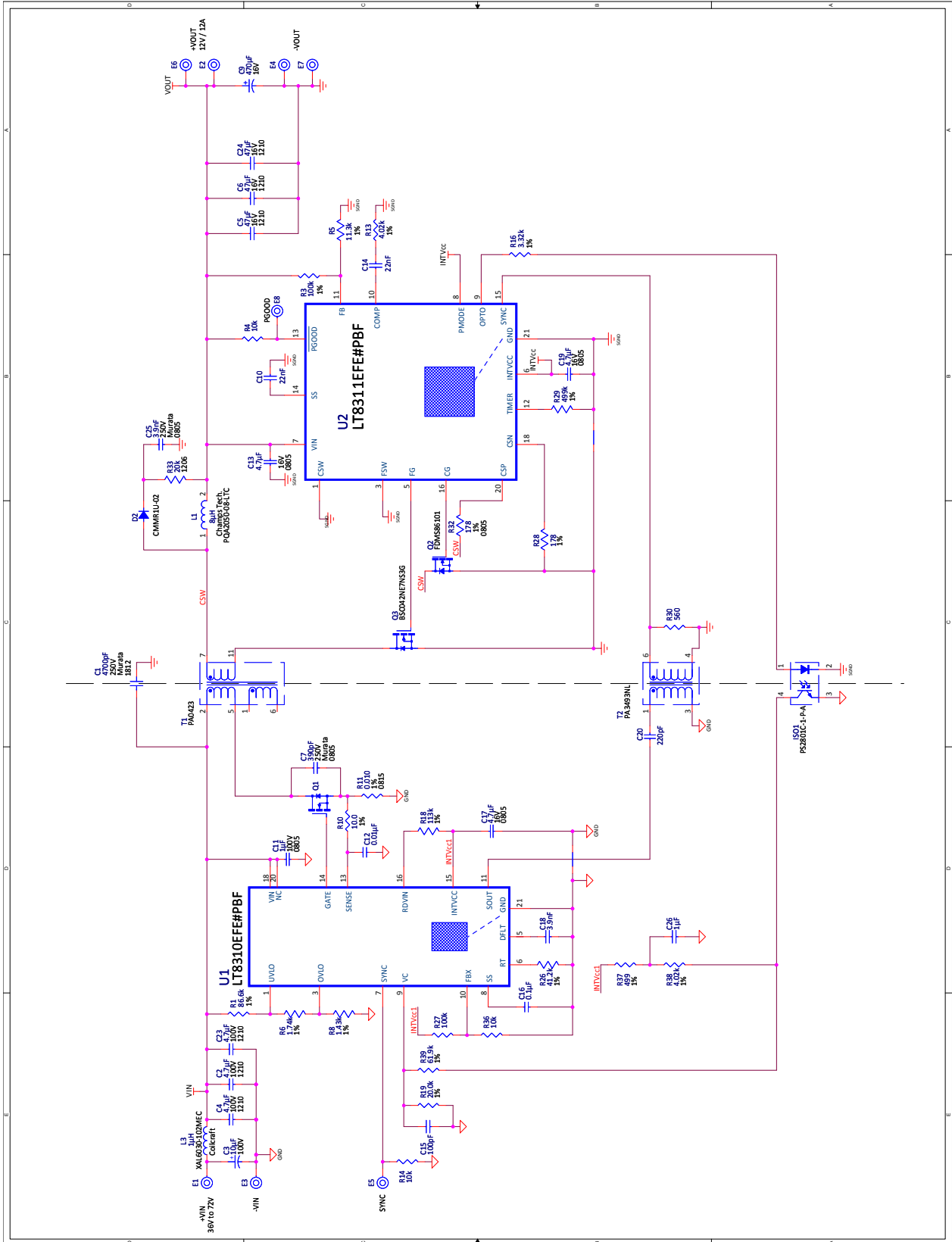
1	0	C27,C28	Cap., 0603	
2	0	D1	Schottky Diode SMA	
3	0	D3	Diode, Common Cathode SOT-23	Central Semi. Corp. CMSD2838
4	0	L2	Inductor	Coilcraft LPS4414 series
5	0	R9, R12	Res., 0805	
6	0	R21, R22	Res., 0603	

### HARDWARE-FOR DEMO BOARD ONLY

1	8	E1, E2, E3, E4, E5, E6, E7, E8	Turret, Testpoint	Mill Max 2501-2-00-80-00-00-07-0
2	4	MH1-MH4	Standoff, Nylon 0.25"	Keystone, 8831 (Snap-On)
3	2		Stencil (Top & Bottom)	Stencil DC2015A

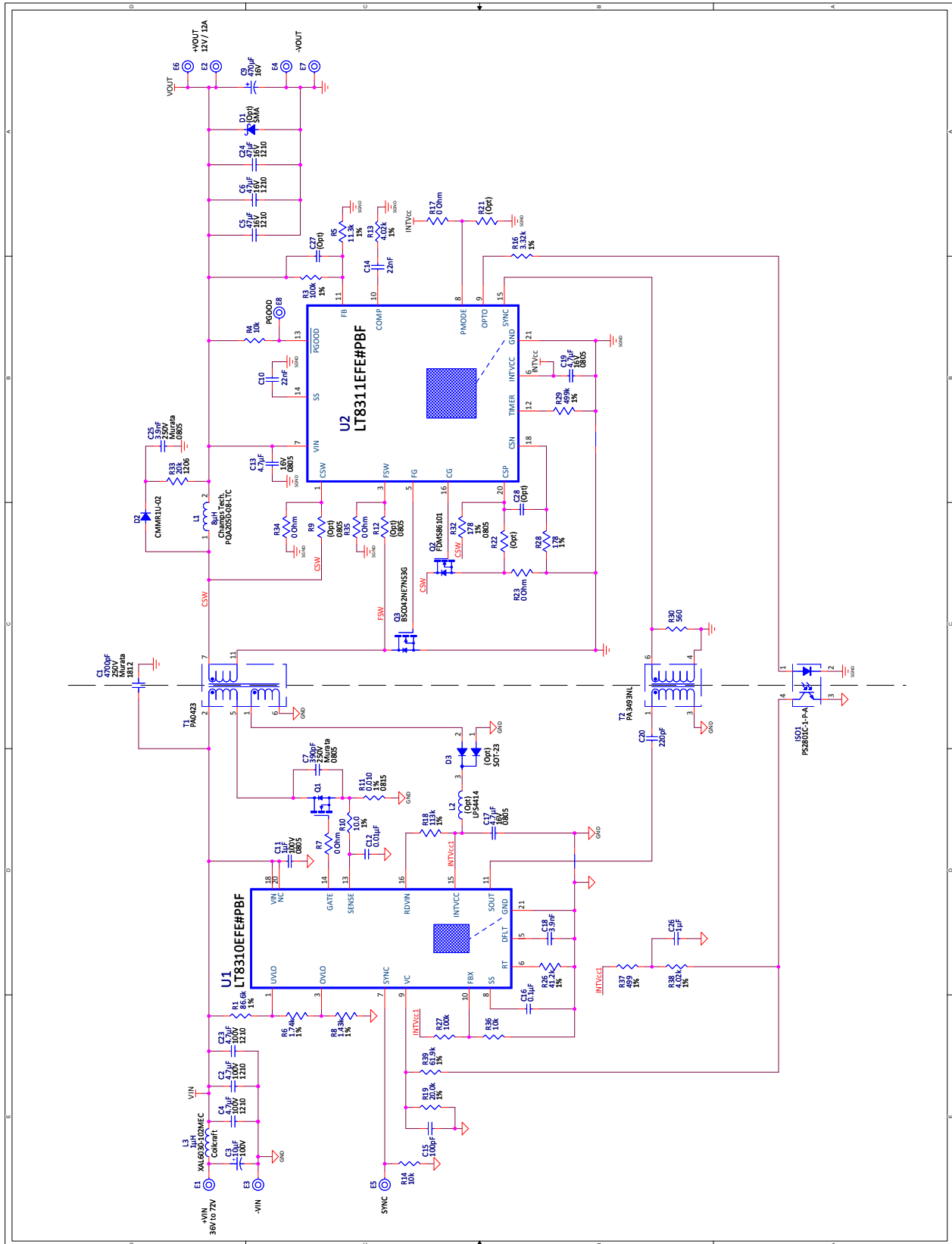
# DEMO MANUAL DC2015A

## SIMPLE SCHEMATIC DIAGRAM





FULL SCHEMATIC DIAGRAM



# DEMO MANUAL DC2015A

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