LT8315
Nonisolated Buck Converter

DESCRIPTION

Demonstration circuit 2478A is a nonisolated buck converter featuring the LT®8315. The demo board outputs 12V, and maintains tight regulation with a load current from 4mA to 120mA. It is optimized to operate over a wide 19V to 400V DC input voltage range. Output voltage accuracy stays within ±1% over the entire input voltage and load range.

The LT8315 is a high voltage flyback converter with integrated 630V/300mA switch. It can implement a high voltage buck converter if isolation is not needed. The nonisolated buck converter solution is much smaller and cheaper than the flyback converter solution.

Quasi-resonant boundary mode operation improves load regulation. The LT8315 is available in a thermally enhanced 20-pin TSSOP package with four pins removed for high voltage spacing.

The LT8315 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with the DC2478A demo manual.

Design files for this circuit board are available at http://www.linear.com/demo/DC2478A

PERFORMANCE SUMMARY Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage		19		400	V
Output Voltage	I_{OUT} = 4mA to 0.12A	11.5	12	12.5	V
Maximum Output Current		0.12			A
Output Voltage Ripple	V_{IN} = 19V, I_{OUT} = 0.12A		150		mV_{P-P}
Typical Switching Frequency	V_{IN} = 19V, I_{OUT} = 0.12A		10		kHz
	V_{IN} = 400V, I_{OUT} = 0.12A		31		kHz
Efficiency	V_{IN} = 19V, I_{OUT} = 0.12A		82		%
	V_{IN} = 400V, I_{OUT} = 0.12A		74		%

QUICK START PROCEDURE

IMPORTANT NOTE TO CUSTOMERS:

HIGH VOLTAGES ARE PRESENTED ON THE DEMO CIRCUIT, AND CAN LEAD TO LETHAL INJURIES TO HUMAN BODY. ONLY QUALIFIED PERSONNEL SHOULD OPERATE IT. IT IS STRONGLY RECOMMENDED TO USE SAFETY GLASSES AND AN ISOLATION TRANSFORMER.

NOTE: IMPROPER COMPONENT REPLACEMENT ON THE DEMO CIRCUIT CAN CAUSE PERFORMANCE DETERIORATION, CIRCUIT MALFUNCTION, PROPERTY DAMAGE, AND EVEN LIFE-THREATENING INJURIES. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERS FOR PROPER COMPONENT REPLACEMENT.

Demonstration circuit 2478A is easy to set up to evaluate the performance of the LT8315. Refer to Figure 1 for proper measurement equipment setup and follow this procedure:

1. Select an input power supply that is capable of 19V to 400V to 19V adjustments. Turn off the supply.
2. With power off, connect the DC input power supply to the board through the +VIN and GND terminals. Connect the load to terminals +VOUT and GND on the board.
3. Turn on the power at the input.

   NOTE: Make sure that the input voltage does not exceed 400V
4. Check for proper output voltage. The output should be regulated at 12V (±4%).

   NOTE: The LT8315 requires a very small minimum load to maintain good output voltage regulation. A Zener diode is placed on the output to clamp the voltage to 13V. This Zener can be replaced with a 3000Ω resistor with the trade-off being lower efficiency.
5. Once the proper output voltage is established, adjust the input voltage and load current within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

   NOTE: When measuring the input or 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 directly across the +VOUT and GND terminals. See Figure 2 for proper scope probe technique.

QUICK START PROCEDURE

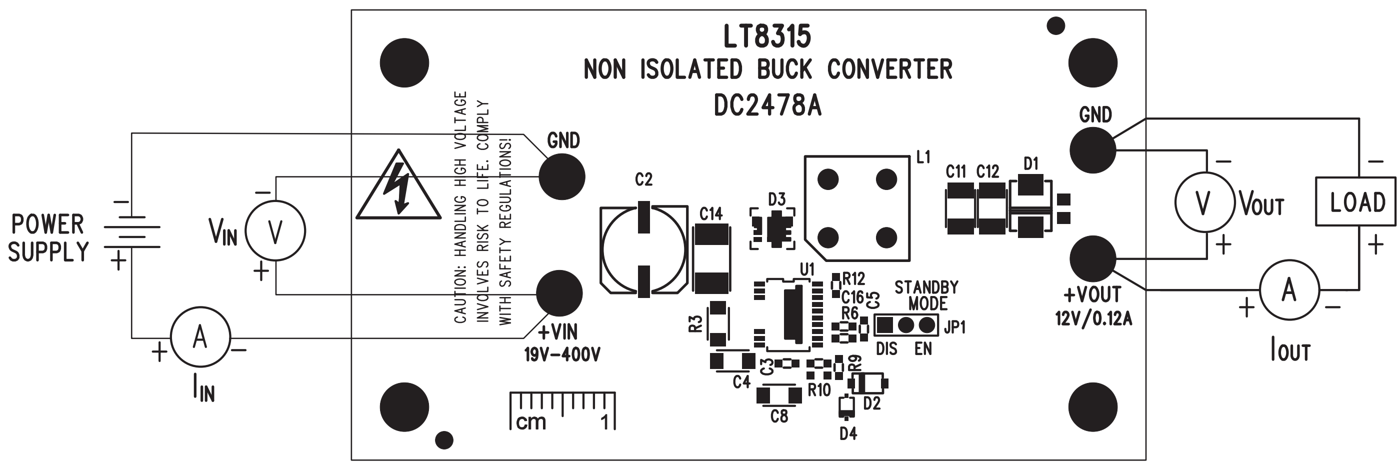


Figure 1. Proper Measurement Equipment Setup

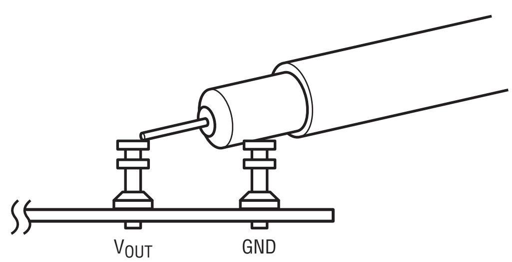


Figure 2. Proper Scope Probe Placement for Measuring Output Ripple

QUICK START PROCEDURE

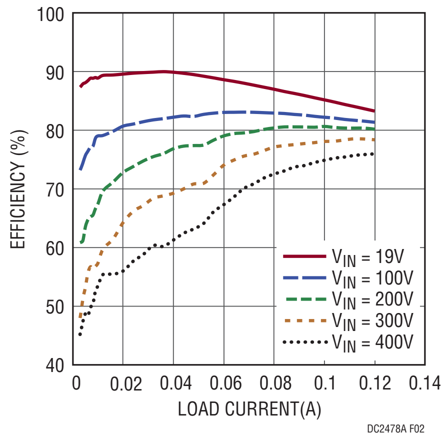


Figure 3. Efficiency vs Load Current

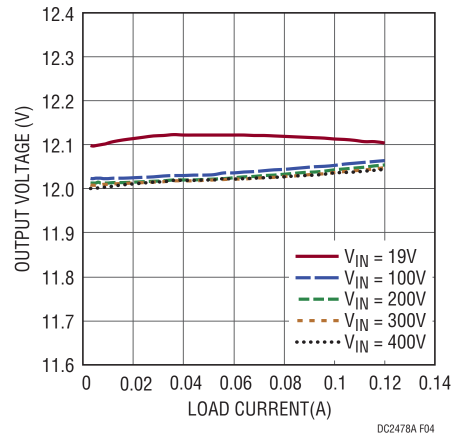


Figure 4. Load and Line Regulation

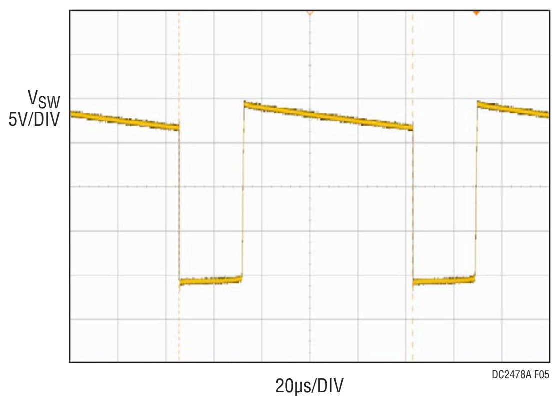


Figure 5. Steady State Switch Node Voltage at Full Load (V_{IN} = 19V)

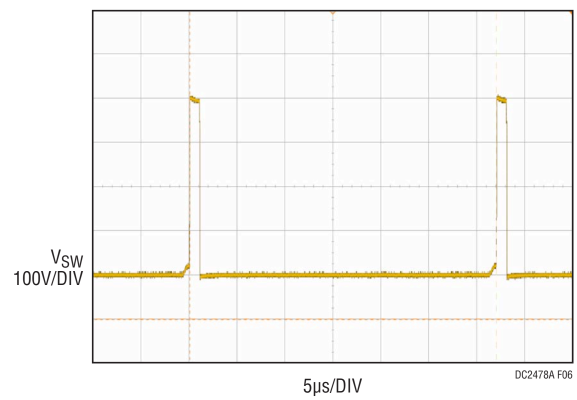


Figure 6. Steady State Switch Node Voltage at Full Load (V_{IN} = 400V)

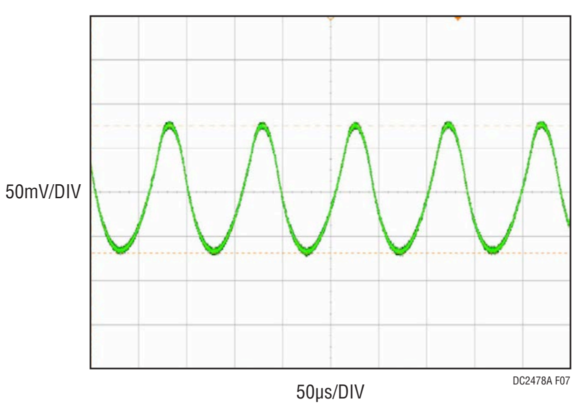


Figure 7. Output Ripple Voltage at 19V Full Load Condition

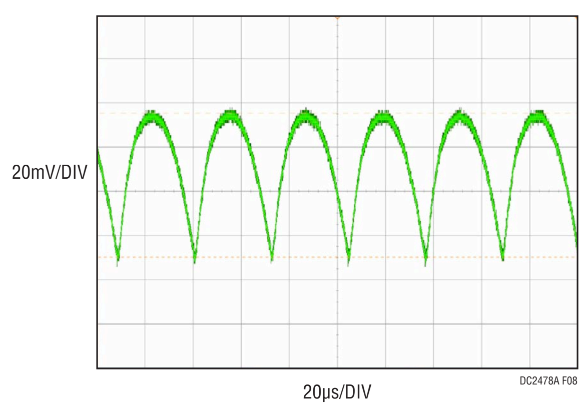


Figure 8. Output Ripple Voltage at 400V Full Load Condition

QUICK START PROCEDURE

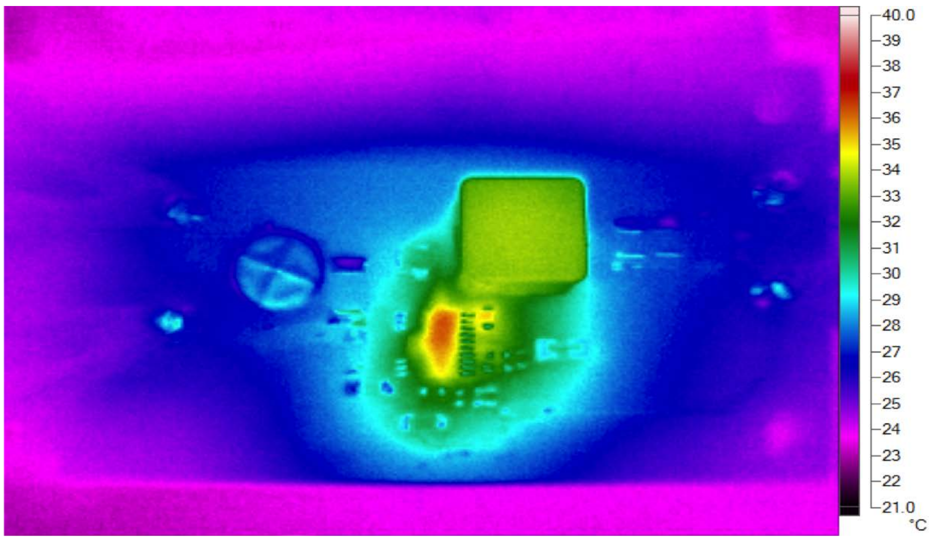


Figure 9. Thermal Map, Front Side at 19V Full Load Condition (T_A = 25°C)

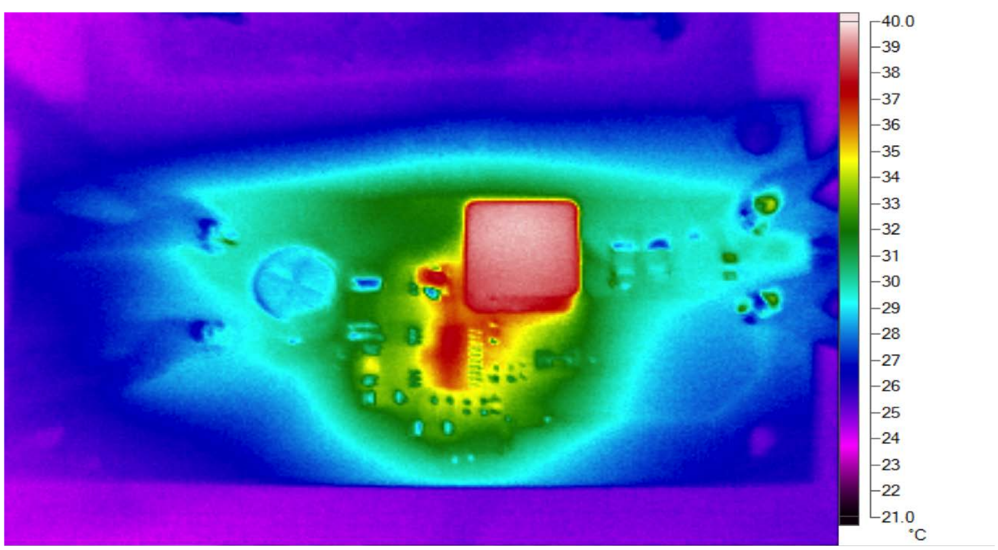
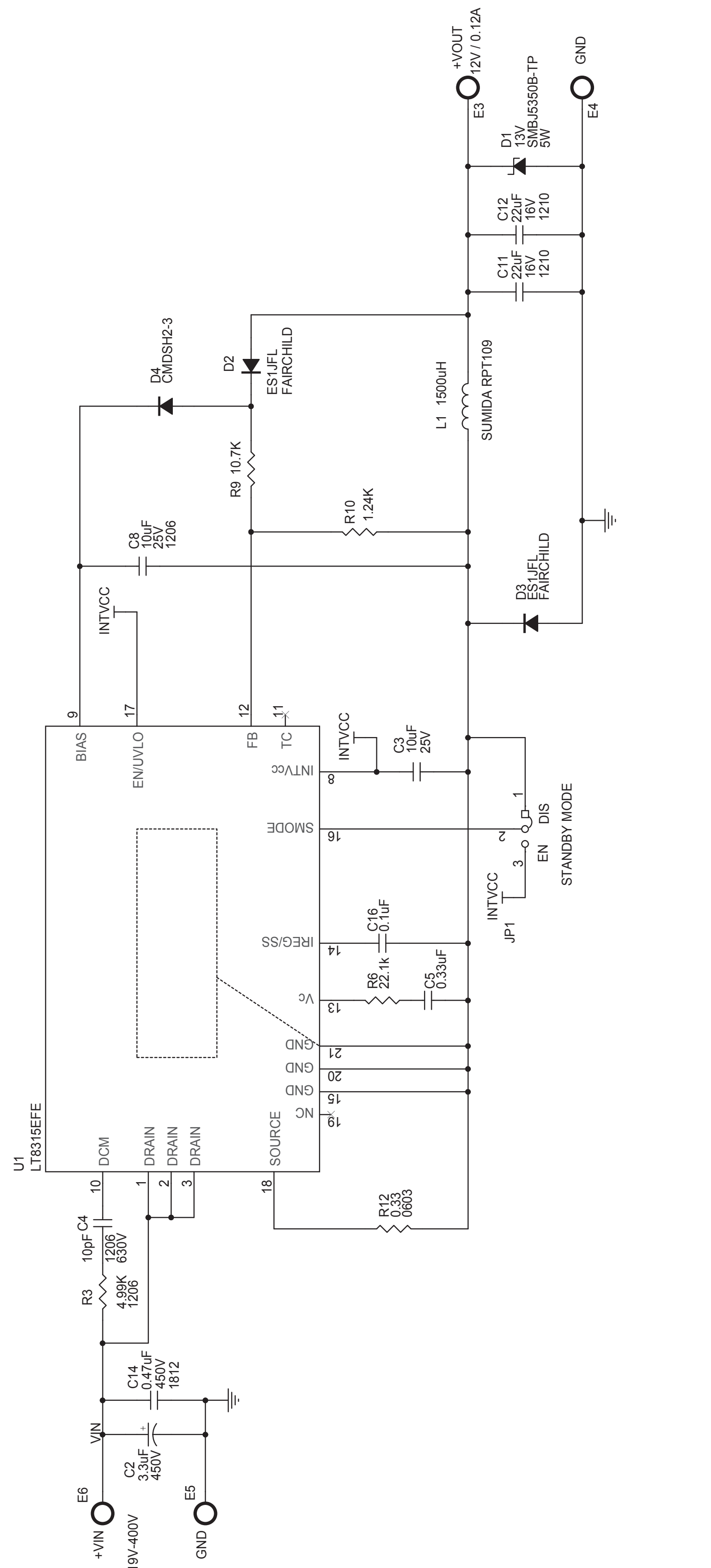


Figure 10. Thermal Map, Front Side at 400V Full Load Condition (T_A = 25°C)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C2	CAP., 3.3µF, ALUM,450V,20%	NICHICON, ULT2W3R3MNL1GS
2	1	C3	CAP., 10µF, X5R, 25V, 20%, 0603	MURATA, GRM188R61E106MA73D
3	1	C8	CAP., 10µF, X7R, 25V, 10%, 1206	MURATA, GRM31CR71E106KA12L
4	1	C4	CAP., 10pF, C0G, 630V,5%, 1206	MURATA, GRM31A5C2J100JW01D
5	1	C5	CAP., 0.33µF, X5R, 25V,10%, 0603	AVX, 06033D334KAT2A
6	2	C11, C12	CAP., 22µF, X7R, 16V, 10%, 1210	MURATA , GRM32ER71C226KE18L
7	1	C14	CAP., 0.47µF, X7T, 450V, 20%, 1812	TDK, C4532X7T2W474M
8	1	C16	CAP., 0.1µF, X7R, 25V, 10%, 0603	MURATA, GRM188R71E104KA01D
9	1	D1	ZENER DIODE, 5W,DO-214AA	MCC, SMBJ5350B-TP
10	2	D2, D3	RECTIFIER DIODE, 600V, 1A, SOD123F	FAIRCHILD, ES1JFL
11	1	D4	SCHOTTKY DIODE, 30V, 200MA, SOD323	CENTRAL SEMI., CMDSH2-3 TR
12	1	L1	INDUCTOR, 1500µH	SUMIDA, RPT109NP-152MC
13	1	R3	RES., CHIP, 4.99k, 1/4W, 1%, 1206	VISHAY, CRCW12064K99FKEA
14	1	R6	RES., CHIP, 22.1k, 1/10W , 1%, 0603	VISHAY, CRCW060322K1FKEA
15	1	R9	RES., CHIP, 10.7k, 1/10W, 1%, 0603	VISHAY, CRCW060310K7FKEA
16	1	R10	RES., CHIP, 1.24k,1/10W, 1%, 0603	VISHAY, CRCW06031K24FKEA
17	1	R12	RES., CHIP, 0.33Ω, 0.2W, 1%, 0603	SUSUMU, RL0816R-R33-F
18	1	U1	I.C., LT8315EFE	LINEAR, LT8315EFE#PBF
Hardware: For Demo Board Only				
1	4	E3-E6	TESTPOINT, TURRET, .094" PBF	MILL MAX, 2501-2-00-80-00-00-07-0
2	4	MH1-MH4	STANDOFF, NYLON, 0.25"	KEYSTONE, 8831 (SNAP ON)
3	1	JP1	HEADER, 3×1 PIN, 0.079", SINGLE ROW	WURTH ELEKTRONIK, 62000311121
4	1	XJP1	SHUNT, .079" CENTER	WURTH ELEKTRONIK, 60800213421

SCHEMATIC DIAGRAM



NOTE: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE 0603.
   ALL CAPACITORS ARE 0603.

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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