LT8316A
Nonisolated Buck Converter

DESCRIPTION

Demonstration circuit 2781A is a nonisolated buck converter featuring the LT8316. The demo board outputs 12V and maintains tight regulation with a load current from 10mA to 0.2A. It is optimized to operate over a wide 19V to 600V DC input voltage range. Output voltage accuracy stays within ±1% over the entire input voltage and load range.

The LT®8316 is a high voltage flyback controller that can implement a high voltage buck converter if isolation is not needed. The nonisolated buck converter is a smaller, lower cost solution than the flyback converter.

Quasi-resonant boundary mode operation improves load regulation. The LT8316 is available in a thermally enhanced 20-pin TSSOP package with four pins removed for high voltage spacing.

The LT8316 datasheet gives a complete description of the part, operation and application information. The datasheet must be read in conjunction with the DC2781A demo manual.

Design files for this circuit board are available.

PERFORMANCE SUMMARY Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage		19		600	V
Output Voltage	I_{OUT} = 10mA to 0.2A	11.6	12.1	12.6	V
Maximum Output Current		0.2			A
Output Voltage Ripple	V_{IN}=19V, I_{OUT}=0.2A		180		mVp-p
Typical Switching Frequency	V_{IN} = 19V, I_{OUT} = 0.2A		9		kHz
	V_{IN} = 600V, I_{OUT} = 0.2A		28		kHz
Efficiency	V_{IN} = 19V, I_{OUT} = 0.2A		84		%
	V_{IN} = 600V, I_{OUT} = 0.2A		74		%

QUICK START PROCEDURE

IMPORTANT NOTE TO CUSTOMERS:

HIGH VOLTAGES ARE PRESENTED ON THE DEMO CIRCUIT, AND CAN LEAD TO LETHAL INJURIES TO THE HUMAN BODY. ONLY QUALIFIED PERSONEL 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 deteriorations, circuit malfunction, property damage, and even life-threathening injuries. Contact linear technology applications engineers for proper component replacement.

Demonstration circuit 2781A is easy to set up to evaluate the performance of the LT8316. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Select an input power supply that is capable of 19V to 600V adjustments. Turn off the supply.
2. With power off, connect the DC input power supply to the board through $+V_{IN}$ and GND terminals. Connect the load to the terminals $+V_{OUT}$ and GND on the board.
3. Turn on the power at the input.

NOTE: Make sure that the input voltage does not exceed 600V

4. Check for the proper output voltage. The output should be regulated at 12.1V (±4%).

NOTE: The LT8316 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 1.2kΩ resistor with the tradeoff of lower efficiency. The IC has a shutdown current that flows through the inductor to the output in a buck converter. The 1.2kΩ resistor keeps the output voltage at almost 0V in shutdown.

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 $+V_{OUT}$ and GND terminals. See Figure 2 for proper scope probe technique.

Refer to Figure 3 through Figure 10 for additional performance data for the DC2781A.

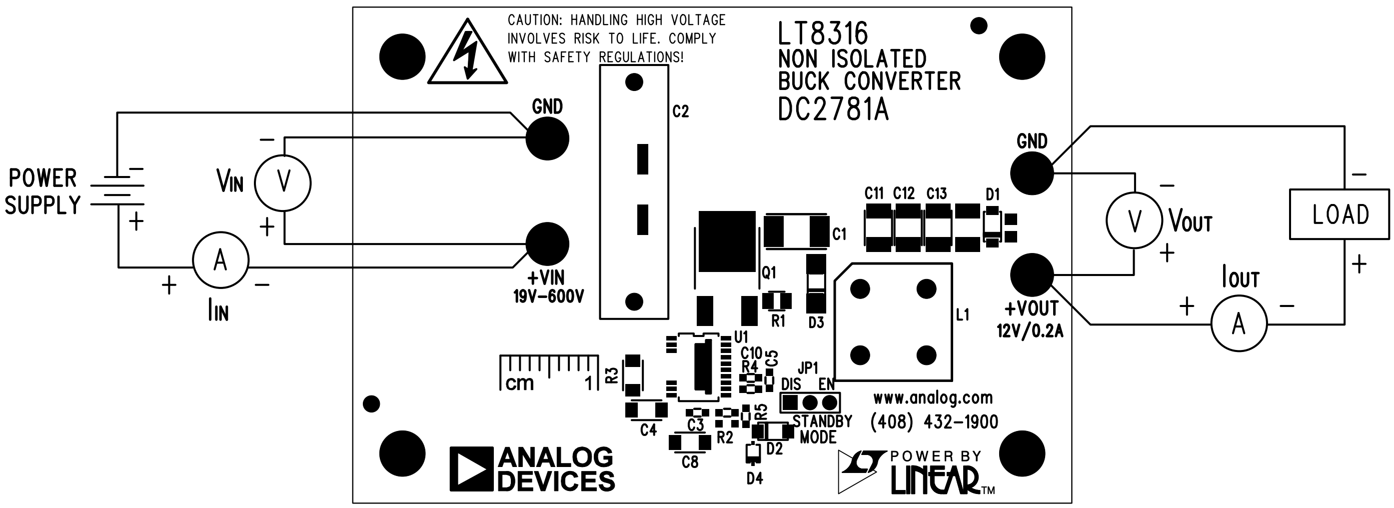


Figure 1. Proper Measurement Equipment Setup

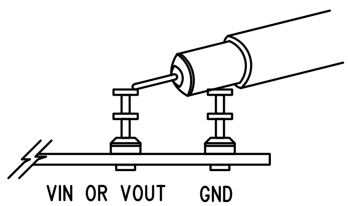


Figure 2. Proper Scope Probe Placement for Measuring Input or Output Ripple

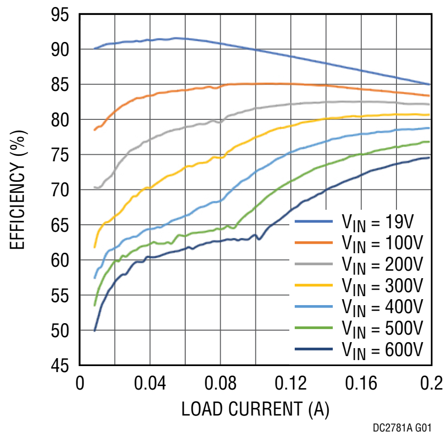


Figure 3. Efficiency vs Load Current

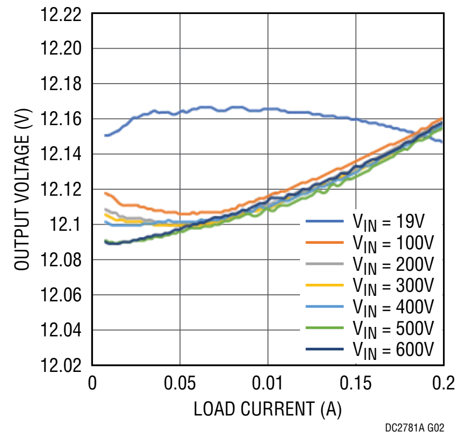


Figure 4. Load and Line Regulation

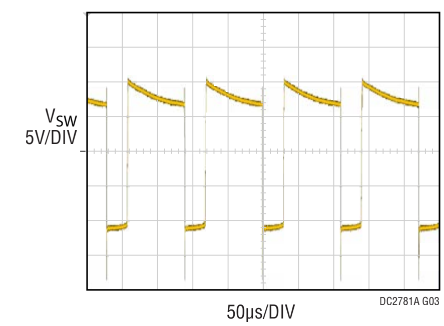


Figure 5. Steady State Switch Node Voltage at 19V Full Load Condition

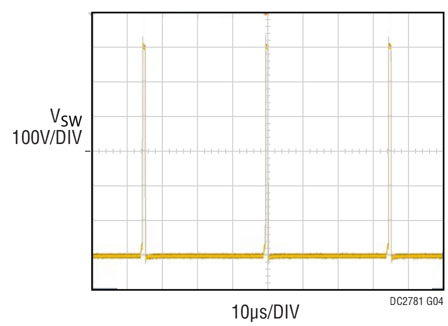


Figure 6. Steady State Switch Node Voltage at 600V Full Load Condition

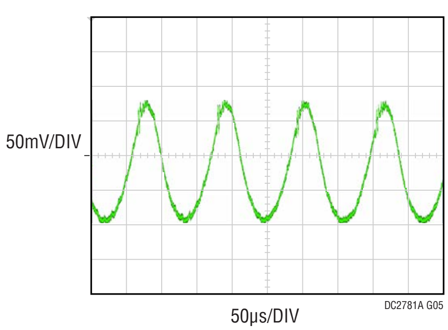


Figure 7. Output Ripple Voltage at 19V Full Load Condition

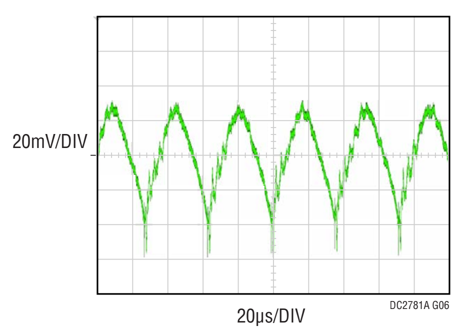


Figure 8. Output Ripple Voltage at 600V Full Load Condition

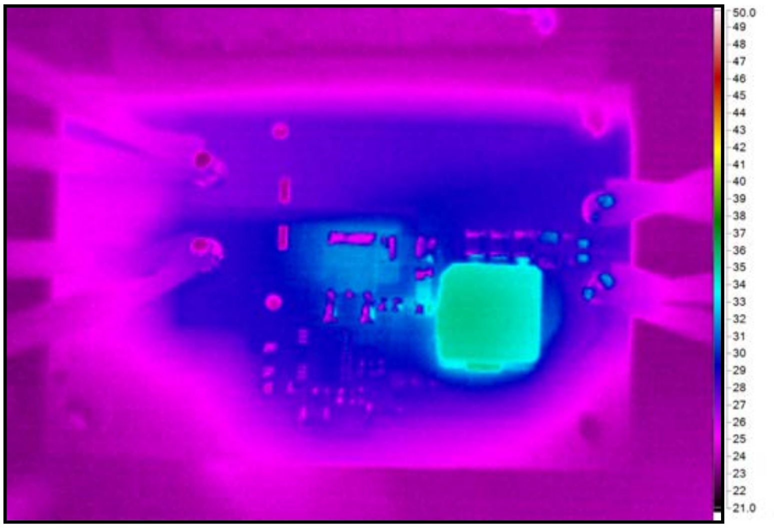


Figure 9. Thermal Map, Front Side at 19V Full Load Condition (T_A = 25°C)

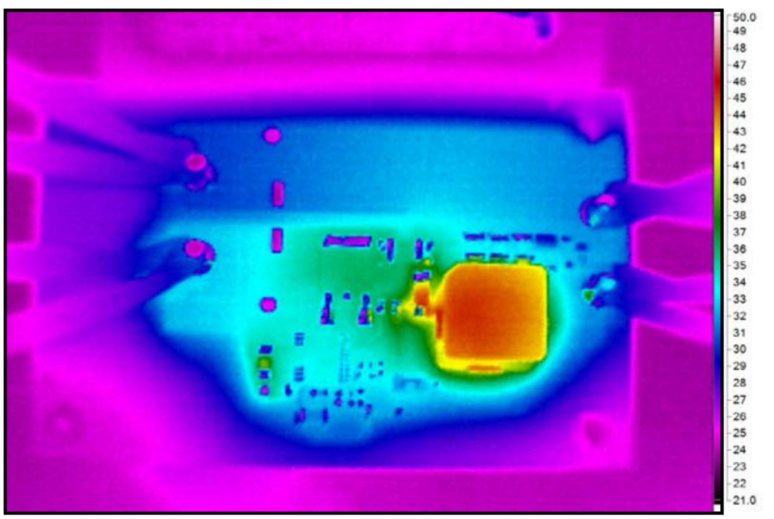
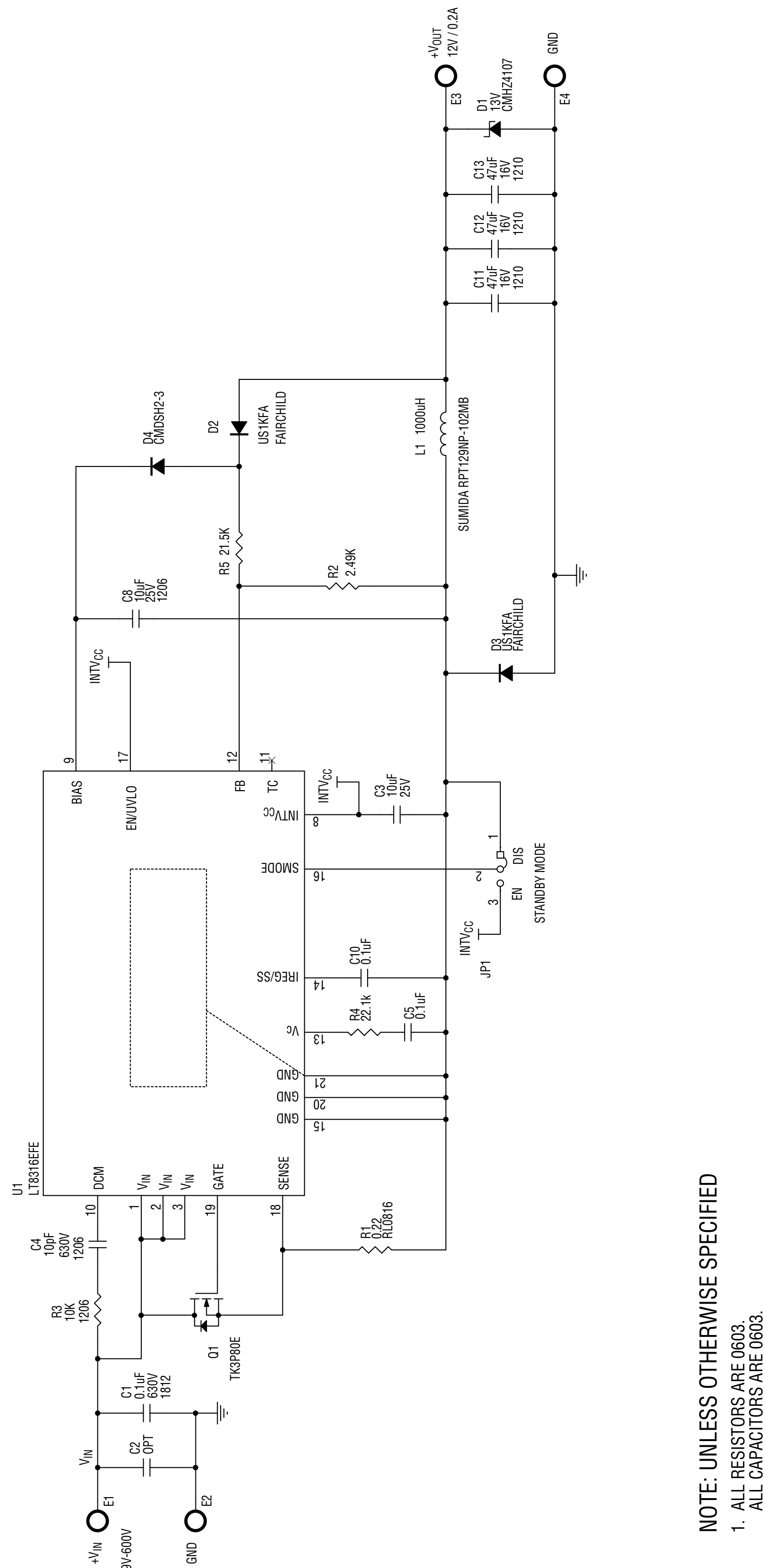


Figure 10. Thermal Map, Front Side at 600V Full Load Condition (T_A = 25°C)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP., 0.1uF, X7R, 630V, 10%, 1812	MURATA , GRM43DR72J104KW01L
2	1	C3	CAP., 10uF, X5R, 25V, 20%, 0603	MURATA, GRM188R61E106MA73D
3	1	C4	CAP., 10pF, C0G, 630V, 5%, 1206	MURATA, GRM31A5C2J100JW01D
4	2	C5,C10	CAP., 0.1uF, X7R, 25V, 10%, 0603	MURATA, GRM188R71E104KA01D
5	1	C8	CAP., 10uF, X7R, 25V, 10%, 1206	MURATA, GRM31CR71E106KA12L
6	3	C11,C12,C13	CAP., 47uF, X5R, 16V, 10%, 1210	MURATA, GRM32ER61C476KE15K
7	1	D1	DIODE, ZENER, 13V, SOD-123	CENTRAL SEMI., CMHZ4107 TR
8	1	D2,D3	DIODE RECTIFIER 800V, 1A, SOD-123FA	FAIRCHILD, US1KFA
9	1	D4	DIODE SCHOTTKY, 30V, 200MA, SOD323	CENTRAL SEMI., CMDSH2-3 TR
10	1	L1	INDUCTOR, 1000uH, RTP129	SUMIDA, RPT129NP-102MB
11	1	Q1	MOSFET, DPAK	TOSHIBA, TK3P80E
12	1	R1	RES., CHIP, 0.22 OHM, 0.2W, 1%, RL0816	SUSUMU, RL0816S-R22-F
13	1	R2	RES., CHIP, 2.49K,1/10W, 1%, 0603	VISHAY, CRCW06032K49FKEA
14	1	R3	RES., CHIP, 10K, 1/4W, 1%, 1206	VISHAY, CRCW120610K0FKEA
15	1	R4	RES., CHIP, 22.1k, 1/10W , 1%, 0603	VISHAY, CRCW060322K1FKEA
16	1	R5	RES., CHIP, 21.5K, 1/10W, 1%, 0603	PANASONIC, ERJ-3EKF2152V
17	1	U1	I.C., LT8316EFE	ANALOG DEVICES, LT8316EFE#PBF
Additional Demo Board Circuit Components				
1	0	C2 (OPT)	CAP., MKP338 2 X2, 8 X10	
Hardware: For Demo Board Only				
1	4	E1-E4	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, 3X1 PIN, 0.079", SINGLE ROW	WURTH ELECTRONIK, 62000311121
4	1	XJP1	SHUNT, .079" CENTER	WURTH ELECTRONIK, 60800213421
5	1		FAB, PRINTED CIRCUIT BOARD	DC2781A
6	1		STENCIL FOR TOP	STENCIL FOR DC2781A

SCHEMATIC DIAGRAM



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.