

# LTC3115EDHD-2

## 40V, 2A Synchronous Buck-Boost DC/DC Converter

### DESCRIPTION

Demonstration circuit 2119A features the [LTC<sup>®</sup>3115-2](#), a high voltage monolithic synchronous buck-boost converter optimized for applications with fast input voltage transients.

The DC2119A demo board has two user selectable operating modes: Burst Mode<sup>®</sup> and Forced Continuous Operation (Fixed Frequency PWM) (JP1). There is also an accurate programmable RUN pin which is used to ENABLE the converter (JP2).

The DC2119A operates with a 2.7V to 40V input voltage range. The demo board has been designed with the output voltage set to 5.0V. The LTC3115-2 incorporates a proprietary low noise switching algorithm which optimizes efficiency with input voltages above, below or equal to the output voltage and ensures seamless transitions between operating modes.

The demo board has been programmed to operate at 750kHz in PWM mode to optimize small size with high efficiency operation.

The demo board also has optional provisions to back-feed  $V_{CC}$  in order to increase efficiency in some 5V output applications. There is also a provision for an optional Schottky diode from SW2 to  $V_{OUT}$  for applications where  $V_{OUT}$  is greater than 20V and short-circuit protection is desired. Consult the data sheet for more information on these options.

Figures 1 and 2 show typical demo board efficiency. Figure 3 shows the response to an input voltage step.

The LTC3115-2 data sheet has detailed information about the operation, specifications, and applications of the part. The data sheet should be read in conjunction with this Quick Start Guide.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2119A>**

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### PERFORMANCE SUMMARY

|                        |                                                    |
|------------------------|----------------------------------------------------|
| Input Voltage Range    | 2.7V to 40V                                        |
| $V_{OUT}$              | 5.0V                                               |
| $I_{OUT}$ (see Note 1) | 0.8A for $V_{IN} > 3.6V$ ,<br>2A for $V_{IN} > 6V$ |
| Efficiency             | See Figures 1 & 2                                  |

NOTE 1: The demo board output current is a function of  $V_{IN}$ . Please refer to the data sheet for more information.

## QUICK START PROCEDURE

Using short twisted pair leads for any power connections and with all loads and power supplies off, refer to Figure 4 for the proper measurement and equipment setup. The Battery/Power Supply (PS1) should not be connected to the circuit until told to do so in the procedure below.

When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the  $V_{IN}$  or  $V_{OUT}$  and GND terminals (see Figure 5), or by using an oscilloscope probe tip jack.

1. Jumper and PS1 settings to start:

PS1 = OFF

JP1 (PWM) = FIXED FREQUENCY

JP2 (RUN) = ON

2. With power OFF connect the power supply (PS1) as shown in Figure 4. If accurate current measurements are desired (for efficiency calculation for example) then connect an ammeter in series with the supply as shown. The ammeter is not required however.

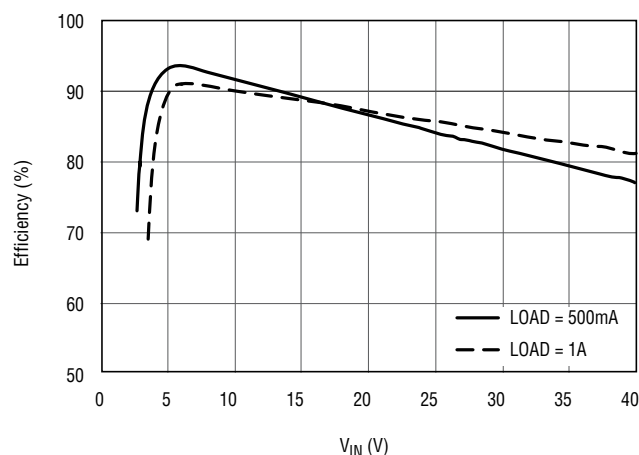


Figure 1. DC2119A Efficiency in PWM Mode

3. Connect a 500mA load to  $V_{OUT}$  as shown in Figure 2 ( $10\Omega$  for  $V_{OUT} = 5V$ ). Connect an ammeter if accurate current measurement or monitoring is desired.
4. Turn on PS1 and slowly increase voltage until the voltage at  $V_{IN}$  is 4.0V.
5. Verify  $V_{OUT}$  is ~5.0V.
6.  $V_{IN}$  can now be varied between 2.7V and 40.0V.  $V_{OUT}$  should remain in regulation.
7. Load current ( $I_{OUT}$ ) can also be varied. The maximum  $I_{OUT}$  is a function of  $V_{IN}$  and the current limit. Consult the datasheet for more information on  $I_{OUT}$  vs  $V_{IN}$ . In general for  $V_{IN} > 3.6V$   $I_{OUT}$  can be increased to 0.8A. For  $V_{IN} > 6V$   $I_{OUT}$  can be increased to 2A.
8. For operation in Burst Mode move Jumper JP1 to BURST.  $I_{OUT}$  is limited in Burst Mode. See the data sheet for more information.
9. NOTE: If  $V_{OUT}$  drops out of regulation, check to be sure the maximum load has not been exceeded, or that  $V_{IN}$  is not below the minimum value for regulation (see data sheet)

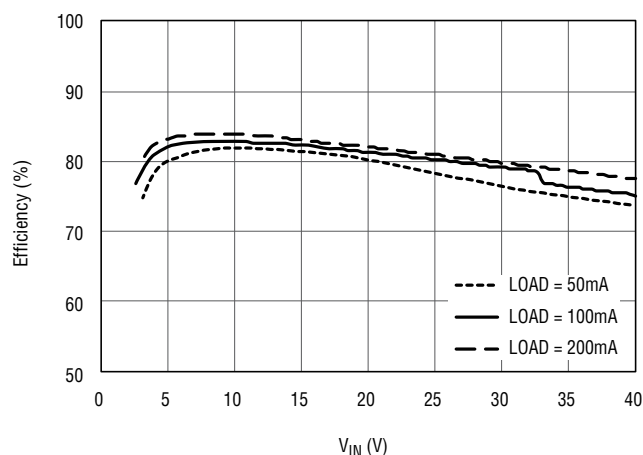


Figure 2. DC2119A Efficiency in Burst Mode

QUICK START PROCEDURE

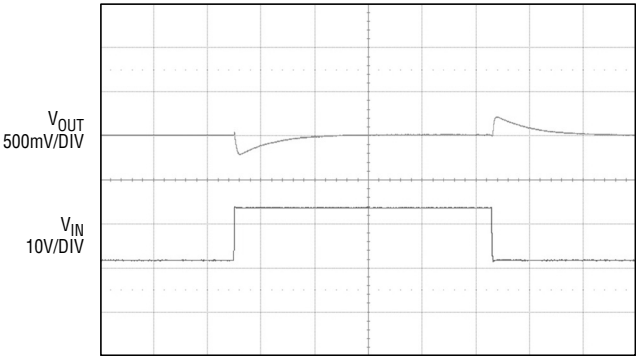


Figure 3. DC2119A Step Input Response

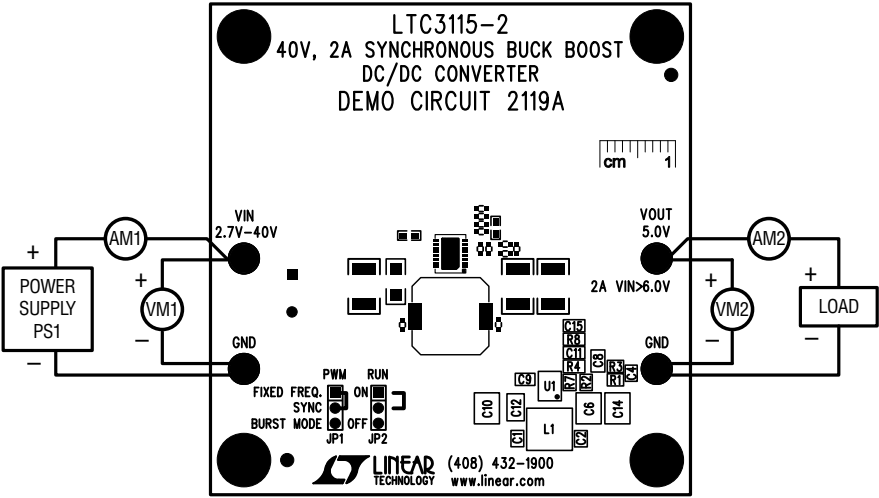


Figure 4. Proper Measurement Equipment Setup

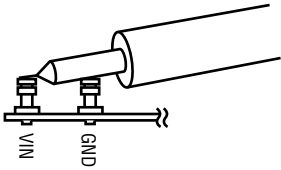


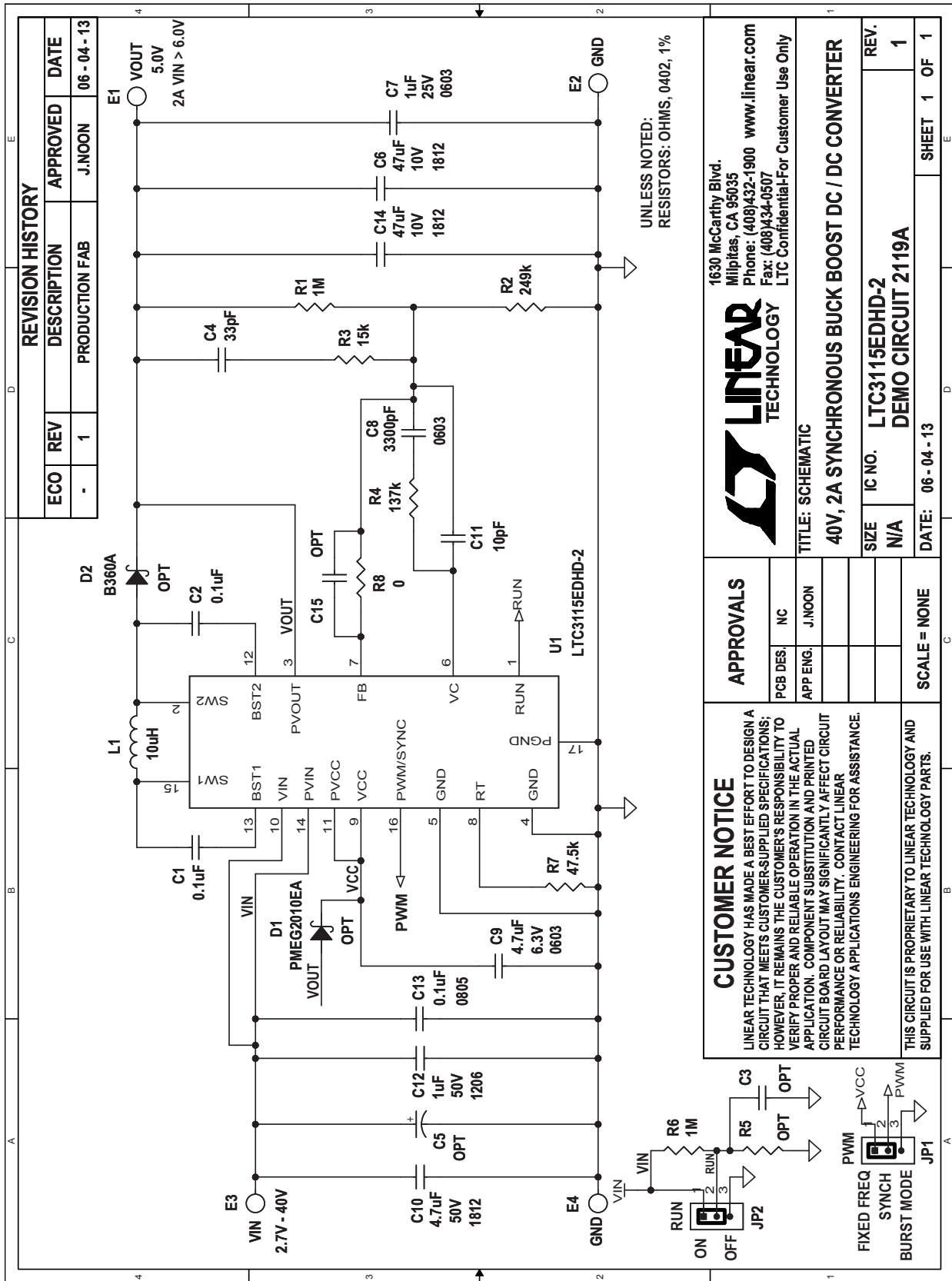
Figure 5. Measuring Input or Output Ripple

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## PARTS LIST

| ITEM                                            | QTY | REFERENCE  | PART DESCRIPTION                       | MANUFACTURER/PART NUMBER          |
|-------------------------------------------------|-----|------------|----------------------------------------|-----------------------------------|
| <b>Required Circuit Components</b>              |     |            |                                        |                                   |
| 1                                               | 2   | C1, C2     | CAP CER 0.10μF, 16V, X7R, ±20%, 0402   | TDK, C1005X7R1C104M               |
| 2                                               | 1   | C4         | CAP CER, 33pF, 50V, C0G, 5%, 0402      | TDK, C1005C0G1H330J               |
| 3                                               | 2   | C6, C14    | CAP CER, 47μF, 10V, 20%, X5R, 1812     | TDK, C4532X5R1A476M               |
| 4                                               | 1   | C7         | CAP CER, 1.0μF, 25V, X5R, 0603         | TDK, C1608X5R1E105M               |
| 5                                               | 1   | C8         | CAP CER, 3300pF, 50V, 5%, NP0, 0603    | TDK, C1608C0G1H332J               |
| 6                                               | 1   | C9         | CAP CER, 4.7μF, 6.3V, X5R, 20%, 0603   | TDK, C1608X5R0J475M               |
| 7                                               | 1   | C10        | CAP CER, 4.7μF, 50V, 20%, X7R, 1812    | TDK, C4532X7R1H475M/2.00          |
| 8                                               | 1   | C11        | CAP CER, 10pF, 50V, C0G, 0402          | TDK, C1005C0G1H100D               |
| 9                                               | 1   | C12        | CAP CER, 1.0μF, 50V, X7R, 20%, 1206    | TDK, C3216X7R1H105M               |
| 10                                              | 1   | C13        | CAP CER, 0.1μF, 50V, 20%, X7R, 0805    | TDK, C2012X7R1H104M/0.85          |
| 11                                              | 1   | L1         | INDUCTOR, 10μH, ±20%                   | COILCRAFT, MSS1048-103MLB         |
| 12                                              | 2   | R1, R6     | RES, 1.00MΩ, 1/16W, 1%, 0402, SMD      | VISHAY, CRCW04021M00FKED          |
| 13                                              | 1   | R2         | RES, 249kΩ, 1/16W, 1%, 0402, SMD       | VISHAY, CRCW0402249KFKED          |
| 14                                              | 1   | R3         | RES, 15.0kΩ, 1/10W, 1%, 0402, SMD      | PANASONIC, ERJ-2RKF1502X          |
| 15                                              | 1   | R4         | RES 137KΩ, 1/10W, 1%, 0402, SMD        | PANASONIC, ERJ-2RKF1373X          |
| 16                                              | 1   | R7         | RES, 47.5kΩ, 1/16W, 1%, 0402, SMD      | VISHAY, CRCW040247K5FKED          |
| 17                                              |     | R8         | RES 0.0Ω, 1/10W, JUMP 0402 SMD         | PANASONIC, ERJ-2GE0R00X           |
| 18                                              | 1   | U1         | 40V, 2A BUCK BOOST DC/DC CONVERTER     | LINEAR TECHNOLOGY, LTC3115EDHD-2  |
| <b>Additional Demo Board Circuit Components</b> |     |            |                                        |                                   |
| 1                                               | 0   | C3, C15    | 0402 (OPT)                             |                                   |
| 2                                               | 0   | C5         | CAP ALUM 150μF, 50V, 20%, RADIAL (OPT) | PANASONIC, EEU-FM1H151            |
| 3                                               | 0   | D1         | DIODE SCHOTTKY, 20V, 1A, SOD323 (OPT)  | NXP SEMI, PMEG2010EA              |
| 4                                               | 0   | D2         | DIODE SCHOTTKY 60V, 3A, SMA (OPT)      | DIODES INC., B360A-13             |
| 5                                               | 0   | R5         | RES, 0402 (OPT)                        |                                   |
| <b>Hardware: For Demo Board Only</b>            |     |            |                                        |                                   |
| 1                                               | 4   | E1-E4      | TP, TURRET, 0.094", PBF                | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 2                                               | 2   | JP1, JP2   | JMP, 3-PIN, 1 ROW .079CC               | SAMTEC, TMM-103-02-L-S            |
| 3                                               | 2   | XJP1, XJP2 | SHUNT, .079" CENTER                    | SAMTEC, 2SN-BK-G                  |
| 4                                               | 4   |            | SPACER STACKING #4 SCREW NYLON .500"   | KEYSTONE, 8833                    |

## SCHEMATIC DIAGRAM



dc2119af

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This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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