

# LTC4367

## 100V Overvoltage, Undervoltage and Reverse Supply Protection Controller

### DESCRIPTION

Demonstration circuit 2417A is intended to demonstrate the performance of the [LTC4367](#) 100V overvoltage (OV), undervoltage (UV), and reverse supply protection controller.

This controller protects circuits from input voltages that may be too high, too low or negative. It operates by controlling the gates of two back-to-back connected N-channel MOSFETs to keep the output in a safe range. The UV and OV setpoints are configured by the resistive divider on the UV and OV inputs. Asserting the  $\overline{\text{SHDN}}$  pin disables the MOSFETs and places the LTC4367 in a low current shutdown state. The  $\overline{\text{FAULT}}$  pin asserts when the controller is in the shutdown mode or when the input voltage is outside of the UV/OV window. The LTC4367

can withstand DC voltages between  $-40\text{V}$  and  $100\text{V}$  and has an operating range of  $2.5\text{V}$  to  $60\text{V}$ .

The DC2417A includes the LTC4367, two back-to-back connected power MOSFETs, three jumpers and three LEDs to indicate the input and output voltages and the  $\overline{\text{FAULT}}$  pin signal.

The DC2417A is assembled in two options: DC2417A-A, which is populated with LTC4367, and DC2417A-B, which uses LTC4367-1.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2417A>**

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### PERFORMANCE SUMMARY

Specifications are at  $T_A = 25^\circ\text{C}$

| SYMBOL                       | PARAMETER                                     | CONDITIONS   | MIN        | TYP       | MAX          | UNITS                          |
|------------------------------|---|--|------------|-----------|--------------|--------------------------------|
| $V_{\text{IN}}$              | Input Voltage Range                           | Operating Range<br>Protection Range  | 2.5<br>-40 |           | 60<br>100    | V<br>V                         |
| $V_{\text{IN(UVLO)}}$        | Input Supply Undervoltage Lockout             | $V_{\text{IN}}$ Rising   | 1.8        | 2.2       | 2.4          | V                              |
| $I_{\text{VIN}}$             | Input Supply Current; On<br>Off               | $\overline{\text{SHDN}} = 2.5\text{V}$<br>$\overline{\text{SHDN}} = 0\text{V}, V_{\text{IN}} = V_{\text{OUT}}$   |            | 30<br>5   | 90<br>20     | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{\text{VIN(R)}}$          | Reverse Input Supply Current                  | $V_{\text{IN}} = -40\text{V}, V_{\text{OUT}} = 0\text{V}$  |            | -1.5      | -2           | mA                             |
| $\Delta V_{\text{GATE}}$     | Gate Drive ( $\text{GATE} - V_{\text{OUT}}$ ) | $V_{\text{IN}} = V_{\text{OUT}} = 5.0\text{V}, I_{\text{GATE}} = 0\mu\text{A}, -1\mu\text{A}$<br>$V_{\text{IN}} = V_{\text{OUT}} = 12\text{V to } 34\text{V}, I_{\text{GATE}} = -1\mu\text{A}$ | 7.2<br>10  | 8.7<br>11 | 10.8<br>12.2 | V<br>V                         |
| $I_{\text{GATE(UP)}}$        | Gate Pull-Up Current                          | $\text{GATE} = 15\text{V}, V_{\text{IN}} = V_{\text{OUT}} = 12\text{V}$  | -20        | -35       | -50          | $\mu\text{A}$                  |
| $I_{\text{GATE(FAST)}}$      | Gate Fast Pull-Down Current                   | $\text{GATE} = 20\text{V}, V_{\text{IN}} = V_{\text{OUT}} = 12\text{V}$  | 30         | 60        | 90           | mA                             |
| $I_{\text{GATE(SLOW)}}$      | Gate Slow Pull-Down Current                   | $\text{GATE} = 20\text{V}, V_{\text{IN}} = V_{\text{OUT}} = 12\text{V}$  | 50         | 90        | 160          | $\mu\text{A}$                  |
| $V_{\text{UV}}$              | UV Input Threshold Voltage                    | UV Falling   | 492.5      | 500       | 507.5        | mV                             |
| $V_{\text{OV}}$              | OV Input Threshold Voltage                    | OV Rising  | 492.5      | 500       | 507.5        | mV                             |
| $t_{\text{GATE(FAST)}}$      | Gate Fast Turn-Off Delay                      | $C_{\text{GATE}} = 2.2\text{nF}$ , UV or OV Fault  |            | 2         | 4            | $\mu\text{s}$                  |
| $t_{\text{FAULT}}$           | OV, UV Fault Propagation Delay                | Overdrive = $50\text{mV}$ , $V_{\text{IN}} = V_{\text{OUT}} = 12\text{V}$  |            | 1         | 2            | $\mu\text{s}$                  |
| $V_{\overline{\text{SHDN}}}$ | $\overline{\text{SHDN}}$ Input Threshold      | $\overline{\text{SHDN}}$ Falling   | 0.4        | 0.75      | 1.2          | V                              |
| $V_{\text{UV\_BOARD}}$       | Board UV Range                                |  | 5.75       | 5.97      | 6.17         | V                              |
| $V_{\text{OV\_BOARD}}$       | Board OV Range                                |  | 14.44      | 14.95     | 15.47        | V                              |

## OPERATING PRINCIPLES

The LTC4367 monitors the input voltage and disconnects downstream circuits when the input voltage is too low, too high or negative. The LTC4367 provides accurate overvoltage and undervoltage comparators to ensure that power is applied to the system only if the input supply is within the allowable voltage window. Reverse supply protection circuits automatically isolate the load from negative input voltages.

During normal operation, a high voltage charge pump enhances the gate of the external N-channel power MOSFETs.

The LTC4367 consumes 5 $\mu$ A during shutdown and 70 $\mu$ A while operating.

## QUICK START PROCEDURE

DC2417A is easy to set up to evaluate the performance of the LTC4367. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

### Reverse Voltage Tests

- 1 Set JP1 to EN.
- 2 Set JP2 and JP3 to CONNECT LED.
- 3 Connect a power supply across VIN and GND in negative configuration (connect positive terminal to GND and negative terminal to VIN).
- 4 Connect voltmeters at the input and output and an ammeter in series with the supply.
- 5 Ramp VIN down to -30V (referenced to GND).
- 6 Verify output voltage is 0V and all LEDs are off.
- 7 Set JP2 and JP3 to OPEN position and measure the input current. It should be  $\leq 2.4$ mA.
- 8 Ramp VIN back to 0V and set JP2 and JP3 to CONNECT LED position.

### Undervoltage/Overvoltage Test

- 9 Correct the polarity of the power supply connection across VIN to GND (connect positive terminal to VIN and negative terminal to GND).

- 10 Ramp supply up to 60V and verify that the green VIN LED and the red  $\overline{\text{FAULT}}$  LED light up, but the green VOUT LED, does not light up.

- 11 Ramp supply down from 60V to 0V and verify the green VIN LED, red  $\overline{\text{FAULT}}$  LED, green VOUT LED, and VOUT voltage according to Table 1 below.

- 12 Repeat steps 10 and 11 with a 3 A resistive load connected between VOUT and GND.

Table 1

| VIN             | VOUT            | VIN LED    | VOUT LED | $\overline{\text{FAULT}}$ LED |
|-----------------|-----------------|------------|----------|-------------------------------|
| 0V to 5.97V     | 0V              | Off/Dim/On | Off      | On                            |
| 5.97V to 14.95V | V <sub>IN</sub> | On         | On       | Off                           |
| 14.95V to 60V   | 0V              | On         | Off      | On                            |

- 13 Remove load and set supply to 9V.

- 14 Move jumpers and verify LEDs according to Table 2 below.

Table 2

| JP1 | JP2/JP3     | VIN LED | VOUT LED |
|-----|-------------|---------|----------|
| EN  | CONNECT LED | On      | On       |
| DIS | CONNECT LED | On      | Off      |
| EN  | OPEN        | Off     | Off      |

QUICK START PROCEDURE

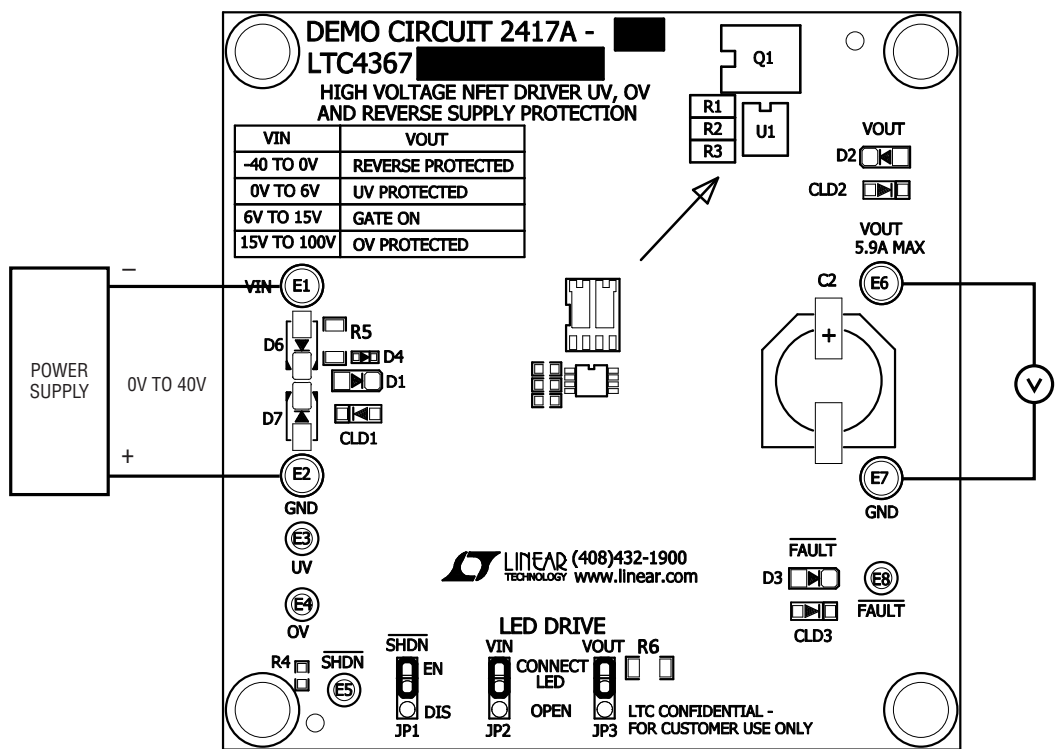


Figure 1a. Reverse Voltage Test

QUICK START PROCEDURE

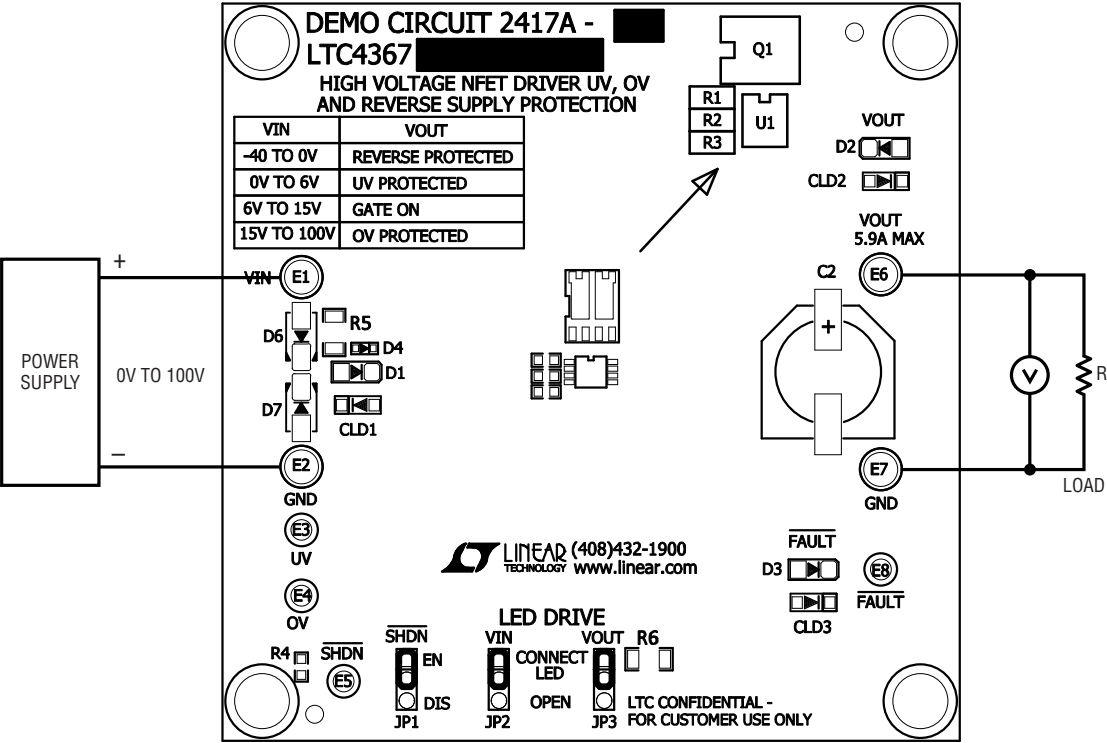
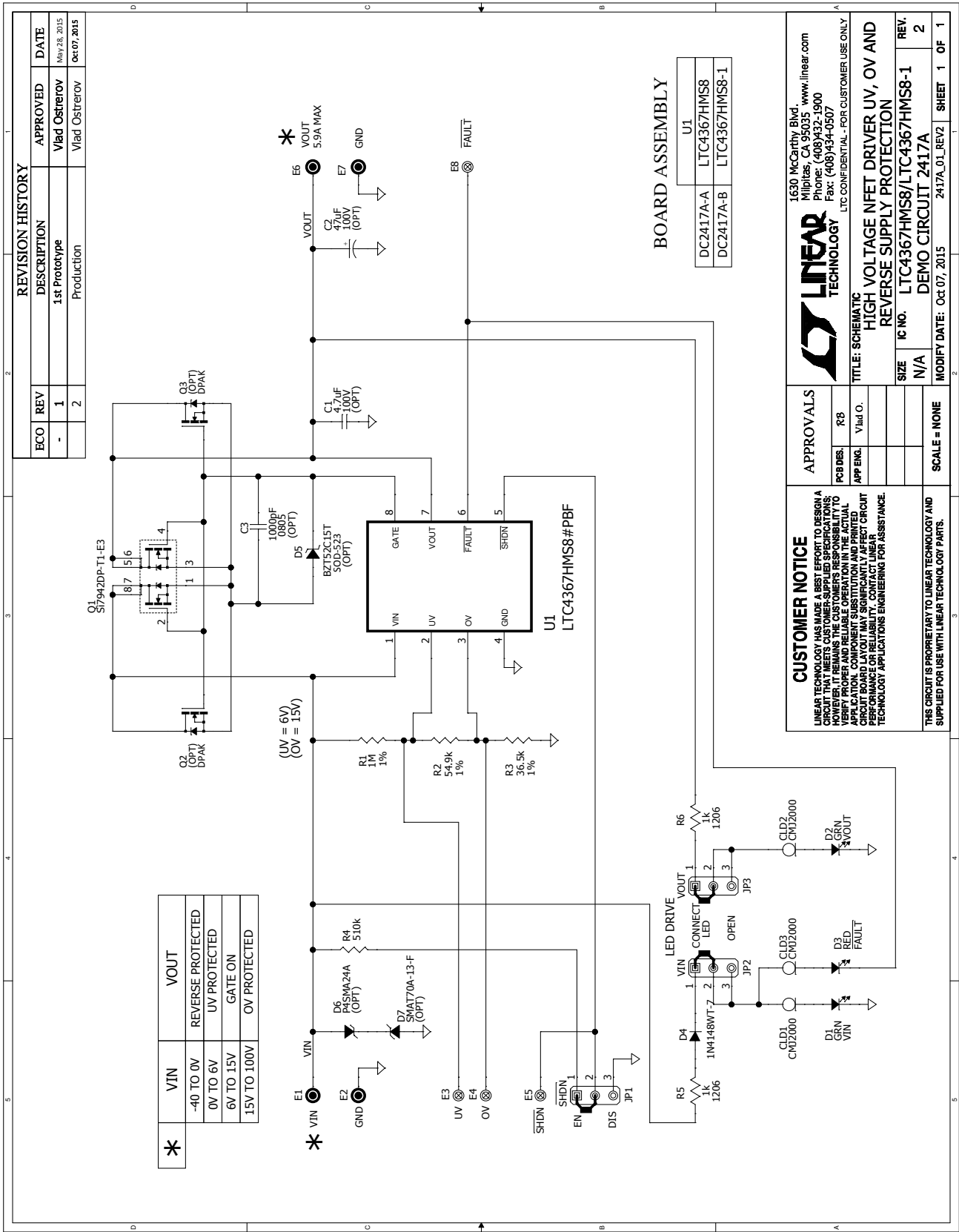


Figure 1b. Undervoltage/Overvoltage Test

## SCHEMATIC DIAGRAM



# DEMO MANUAL DC2417A

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dc2417af



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