

# 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	2.5		60	V
		Protection Range	-40		100	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 Off	$\overline{\text{SHDN}} = 2.5\text{V}$		30	90	$\mu\text{A}$
		$\overline{\text{SHDN}} = 0\text{V}, V_{\text{IN}} = V_{\text{OUT}}$		5	20	$\mu\text{A}$
$I_{\text{VIN(R)}}$	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 ( $\text{GATE} - V_{\text{OUT}}$ )	$V_{\text{IN}} = V_{\text{OUT}} = 5.0\text{V}, I_{\text{GATE}} = 0\mu\text{A}, -1\mu\text{A}$	7.2	8.7	10.8	V
		$V_{\text{IN}} = V_{\text{OUT}} = 12\text{V to } 34\text{V}, I_{\text{GATE}} = -1\mu\text{A}$	10	11	12.2	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	$C_{\text{GATE}} = 2.2\text{nF}, \text{UV or OV Fault}$		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 5µA during shutdown and 70µA 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  $\leq 2.4\text{mA}$ .
- 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 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 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	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**

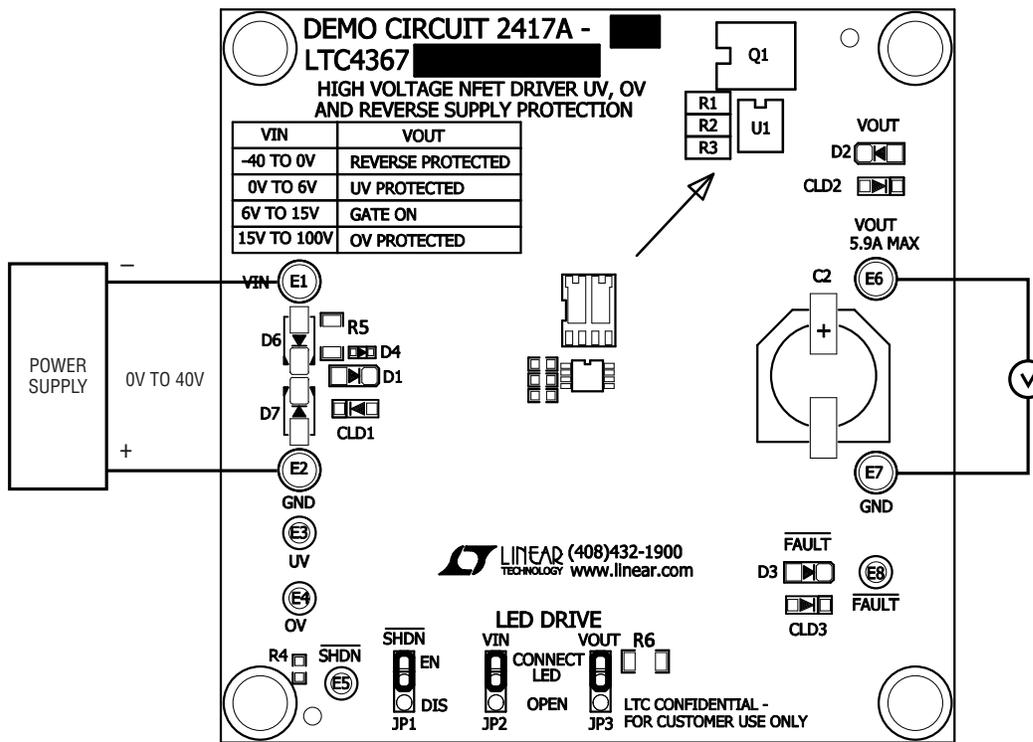


Figure 1a. Reverse Voltage Test

## QUICK START PROCEDURE

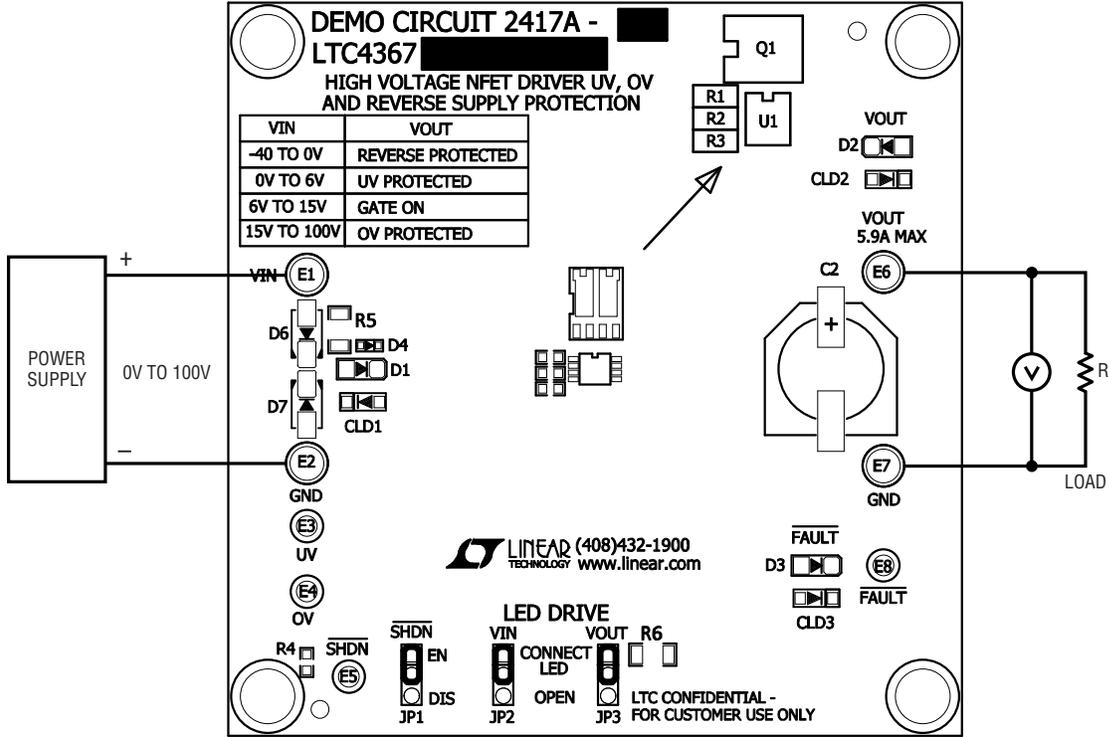
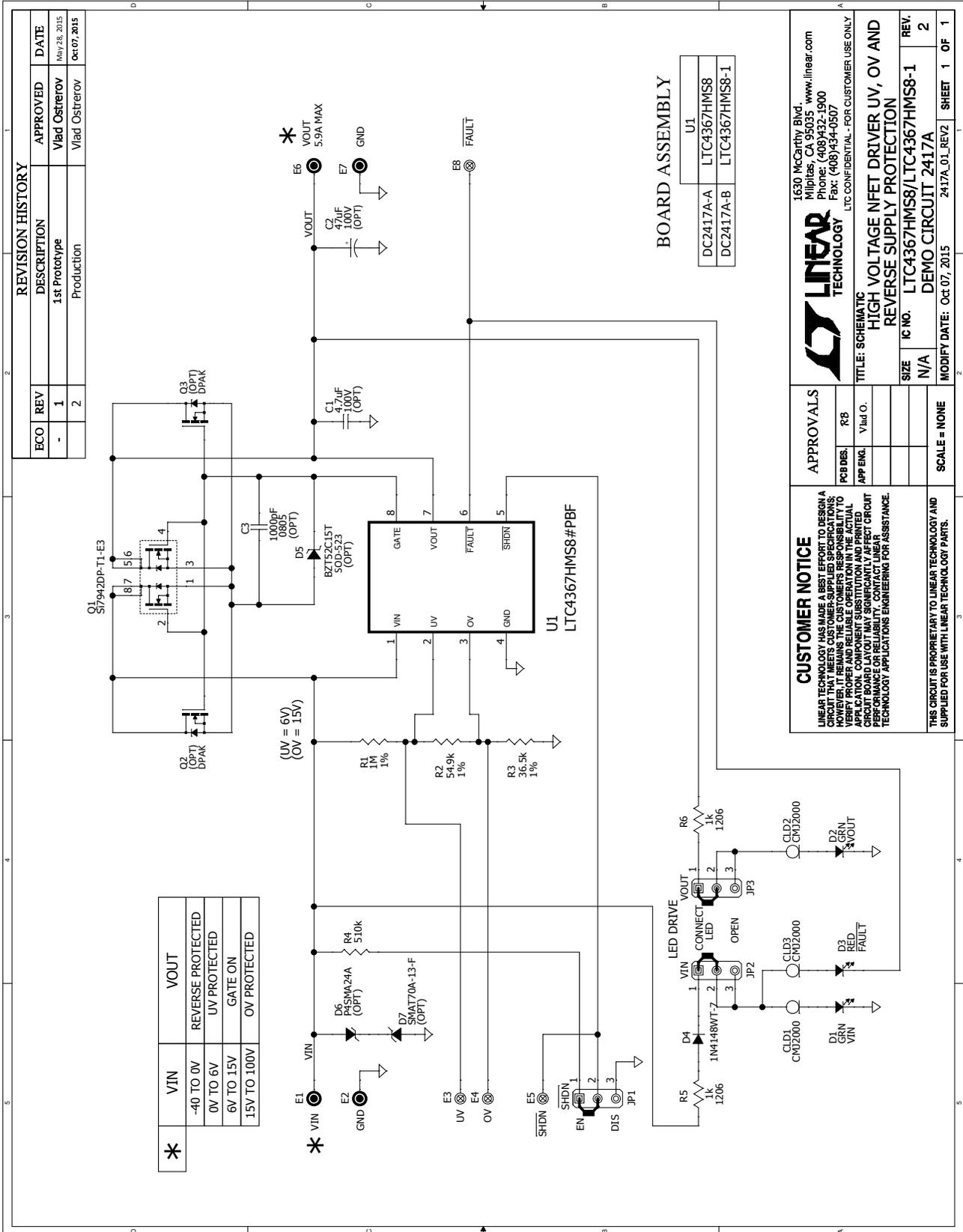


Figure 1b. Undervoltage/Overvoltage Test

**SCHEMATIC DIAGRAM**



REVISION HISTORY				
ECO	REV	DESCRIPTION	APPROVED	DATE
-	1	1st Prototype	Vlad Ostrerov	May 28, 2015
	2	Production	Vlad Ostrerov	Oct 07, 2015

**BOARD ASSEMBLY**

DC2417A-A	LTC4367HMS8	U1
DC2417A-B	LTC4367HMS8-1	

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**APPROVALS**

FCB DES.	RB
APP ENG.	Vlad O.

**TITLE: SCHEMATIC**  
**HIGH VOLTAGE NFEET DRIVER UV, OV AND REVERSE SUPPLY PROTECTION**

SIZE	N/A	REV.	2
IC NO.	LTC4367HMS8/LTC4367HMS8-1		
MODIFY DATE:	Oct 07, 2015	DEMO CIRCUIT	2417A_01_REV2
SCALE	NONE	SHEET	1 OF 1

*	VIN	VOUT
	-40 TO 0V	REVERSE PROTECTED
	0V TO 6V	UV PROTECTED
	6V TO 15V	GATE ON
	15V TO 100V	OV PROTECTED



# DEMO MANUAL DC2417A

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