

LTC4366HTS8-1/LTC4366HTS8-2
 Very High Voltage Surge Stopper

DESCRIPTION

Demonstration Circuit 1850A showcases the [LTC®4366](#) high voltage surge stopper in a 28V vehicular application. DC1850A withstands inputs of up to 100VDC and input transients of up to 250V while maintaining the output at 43.1V. Reverse battery and errant inputs of up to -100VDC are blocked from reaching the output.

DC1850A-A features latching behavior after a fault and is reset by asserting the SHUTDOWN input high for at least 100 μ s. DC1850A-B features auto-retry 9 seconds after tripping off in an overvoltage fault condition. The 9 second delay can be interrupted by pulsing the SHUTDOWN input.

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

LT, LT, LTC, LTM, Linear Technology and the Linear logo are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

PERFORMANCE SUMMARY

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

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Range	Load = 1.5A	18	28	41	V
Operating		-100		100	V
DC Survival		250			V
1ms Transient					
Output Regulation		41	43.1	45.3	V
Surge Timer	Input = 100V (DC1850A-B)	1.2	2.8	4.9	ms
Cool-Down Timer		5.9	9	16	s

OVERVIEW

The LTC4366 surge stopper operates in a floating topology, permitting the design of circuits capable of operating at virtually unlimited input voltage. DC1850A has been designed to protect against $\pm 100\text{VDC}$ and 250V for 1ms, in 28V vehicle applications. The input start-up range is 18V to 41V, while after start-up the input can fall to approximately 7V while still passing 1.5A load current.

Careful attention has been paid to the layout to provide at least 87mil (2.2mm) clearance between input and output, and input and ground. This wide clearance is capable of withstanding 100VDC and spikes to 250V without arcing.

The operating ranges are shown in silkscreen on the top of the board. The bottom shows the U1 part number, top mark and behavior associated with the -A and -B versions of DC1850A. This same information is shown on the schematic.

Three ancillary circuits are located on the bottom of the board.

Shutdown Level Shifter

Since the LTC4366 operates in a floating topology, it is necessary to level shift ground-referred shutdown signaling. A simple NPN circuit provides level shifting between the SHUTDOWN turret and the LTC4366's $\overline{\text{SD}}$ pin.

Wide Voltage Range Constant Current LED Driver

Making an LED operate at constant brightness over a wide operating range is made possible by a simple, two-transistor circuit. Input LED (D6) current is held constant from 18V to 250V, and emits some light as low as 7V.

Output LED (D5) is biased with a 9.1k resistor (R7, on bottom of board). Its brightness will vary with output voltage.

-100V Reverse Voltage Protection Circuit

Reverse polarity inputs of up to -100V are blocked from reaching the load by M2, whose associated circuitry is located on the bottom of the board. This circuit blocks reverse inputs of up to -250VDC, provided the input is applied from a cold start. If DC1850A is already on and operating with a positive input voltage, instantaneous spikes must not exceed -100V.

SHUTDOWN TURRET

If the SHUTDOWN turret is left open, DC1850A defaults to the ON state and turns on when an input supply is connected. Pulling SHUTDOWN to 1.8V or higher causes the LTC4366 to enter its shutdown state. The circuit board layout limits the maximum SHUTDOWN voltage to 60VDC, while R2 limits the peak applied transient voltage capability to 100V.

OPTIONAL COMPONENTS

Two optional components, CX and RX are made available for those who wish to experiment with the frequency response of the overvoltage regulation loop.

HOW TO OPERATE DC1850A

Operation of DC1850A is straightforward: connect an input supply of 18V to 41V, and an output load of up to 1.5A. If the SHUTDOWN turret is open circuit the output will power up. If the input voltage is increased above $\approx 43.1\text{V}$, the output will limit and shut off after 2.8ms. DC inputs of up to $\pm 100\text{V}$ may be applied. The basic hookup is shown in Figure 1.

OVERVIEW

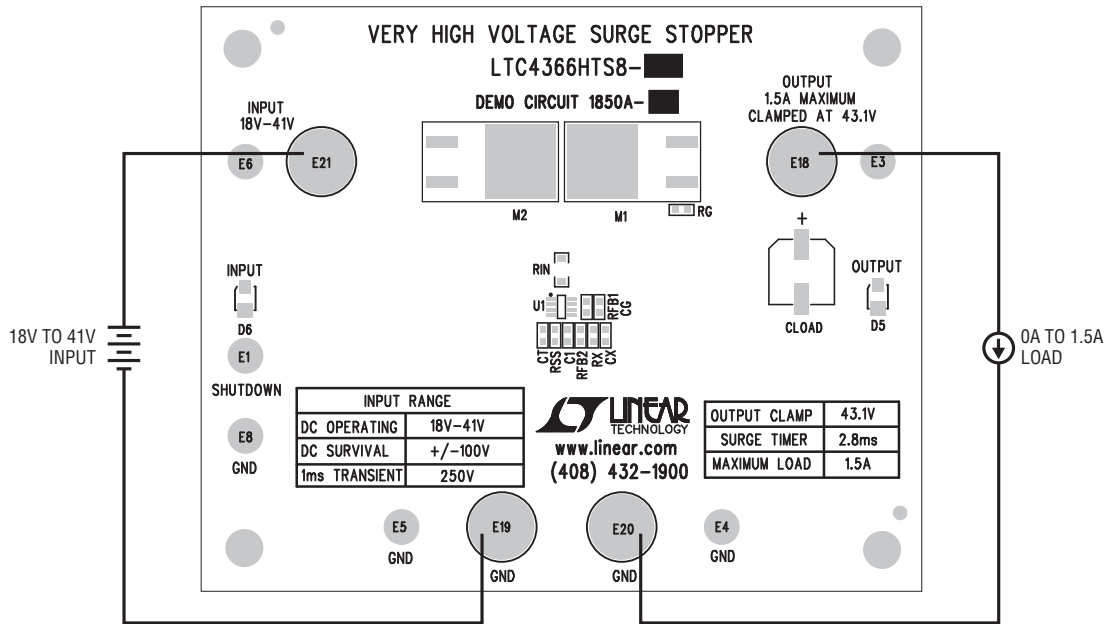


Figure 1. DC1850A Basic Hookup

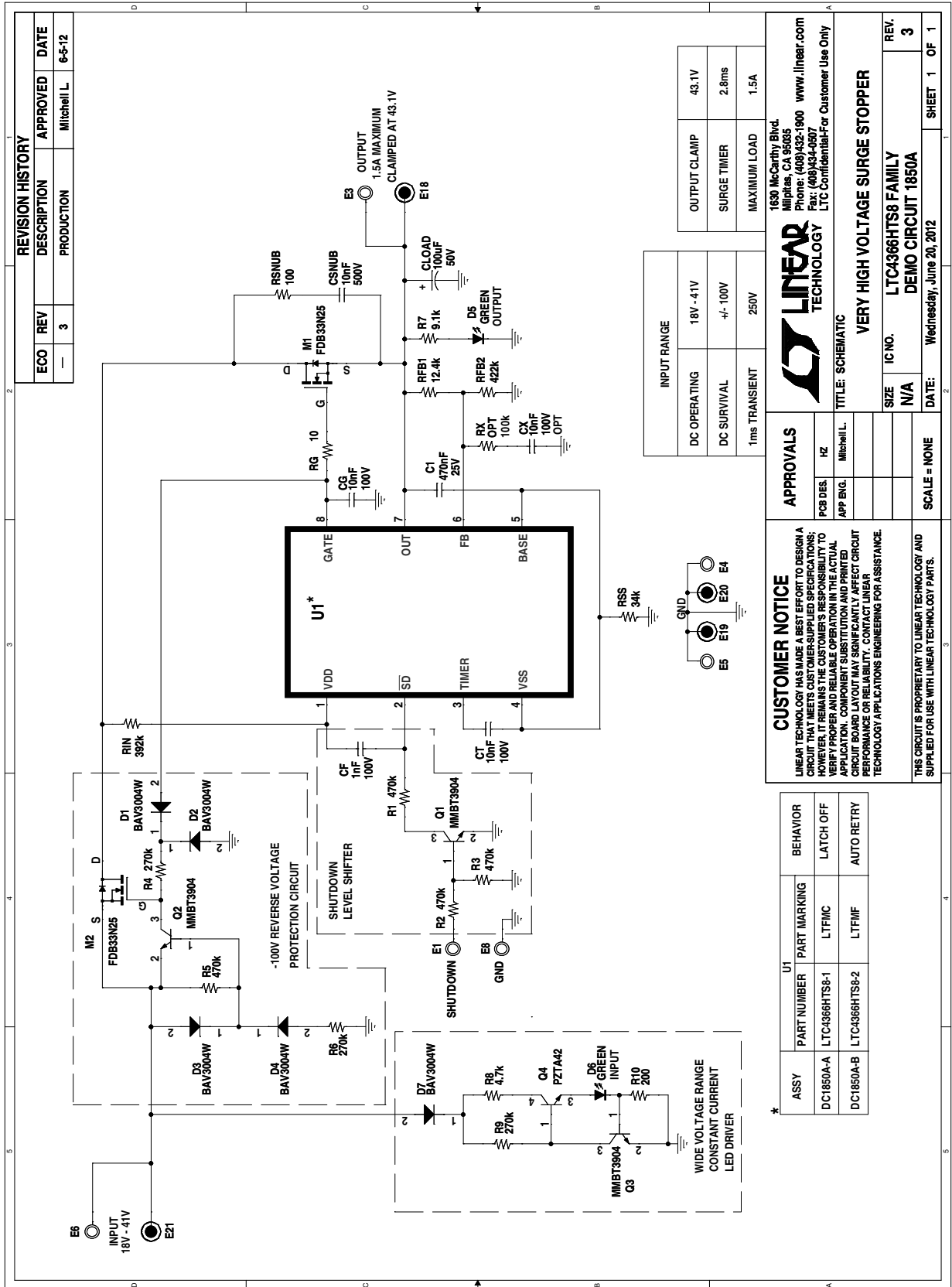
DEMO MANUAL

DC1850A-A/DC1850A-B

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	1	CF	CAP., X7R, 1000pF 100V, 10%, 0603	AVX, 06031C102KAT2A
2	2	CT, CG	CAP., X7R, 0.01µF 100V, 10%, 0603	AVX, 06031C103KAT2A
3	1	CLOAD	CAP., ALUM. 100µF 50V, 20%	SUN ELECT, 50CE100LX
4	1	C1	CAP., X7R, 0.47µF 25V, 10%, 0603	AVX, 06033C474KAT2A
5	0	CX (OPT)	CAP., X7R, 0.01µF 100V, 10%, 0603	
6	1	CSNUB	CAP., X7R, 0.01µF 500V, 20%, 1210	AVX, 12107C103MAT2A
7	5	D1, D2, D3, D4, D7	DIODE, SWITCH 300V 400MW SOD123	DIODES INC, BAV3004W-7-F
8	2	D5, D6	LED, GREEN S-GW TYPE SMD	PANASONIC, LN1371SGTRP
9	6	E1, E3, E4, E5, E6, E8	TESTPOINT, TURRET, .094"	MILL-MAX, 2501-2-00-80-00-00-07-0
10	4	E18, E19, E20, E21	JACK, BANANA	KEYSTONE, 575-4
11	2	M1, M2	MOSFET, N-CH 250V 33A D2PAK	FAIRCHILD, FDB33N25TM
12	3	Q1, Q2, Q3	TRANSISTOR, GP NPN AMP SOT-23	DIODES INC, MMBT3904-7-F
13	1	Q4	TRANS., AMP NPN GP 300V SOT-223	FAIRCHILD, PZTA42 TR
14	1	RFB1	RES., CHIP, 12.4k, 1%, 0603	NIC, NRC06F1242TRF
15	1	RFB2	RES., CHIP, 422k, 1%, 0603	NIC, NRC06F4223TRF
16	1	RG	RES., CHIP, 10, 5%, 0603	NIC, NRC06J100TRF
17	1	RSS	RES., CHIP, 34k, 1%, 0603	VISHAY, CRCW060334K0FKEA
18	1	RIN	RES., CHIP, 392k, 1%, 1206	VISHAY, CRCW1206392KFKEA
19	4	R1, R2, R3, R5	RES., CHIP, 470k, 5%, 0603	NIC, NRC06J474TRF
20	3	R4, R6, R9	RES., CHIP, 270k, 5%, 1206	NIC, NRC12J274TRF
21	1	R7	RES., CHIP, 9.1k, 5%, 1206	NIC, NRC12J912TRF
22	1	R8	RES., CHIP, 4.7k, 5%, 0603	NIC, NRC06J472TRF
23	1	R10	RES., CHIP, 200, 5%, 0603	NIC, NRC06J201TRF
24	0	RX (OPT)	RES., CHIP, 100k, 1%, 0603	
25	1	RSNUB	RES., CHIP, 100Ω, 5%, 1210	NIC, NRCP25J101TRF
26	4	STAND OFF	STAND OFF 0.375"	KEYSTONE, 8832

SCHEMATIC DIAGRAM



REVISION HISTORY				
ECO	REV	DESCRIPTION	APPROVED	DATE
—	3	PRODUCTION	Mitchell L.	6-5-12

INPUT RANGE	
DC OPERATING	18V - 41V
DC SURVIVAL	+/- 100V
1ms TRANSIENT	250V

OUTPUT CLAMP	43.1V
SURGE TIMER	2.8ms
MAXIMUM LOAD	1.5A

LINEAR TECHNOLOGY
 1630 McCarthy Blvd.
 Milpitas, CA 95026
 Phone: (408) 432-1900 www.linear.com
 Fax: (408) 432-4977
 LTC Confidential For Customer Use Only

APPROVALS

PCB DES.	HZ
APP ENG.	Mitchell L.

TITLE: SCHEMATIC

SIZE	IC NO.	REV.
N/A	LTC4366HTS8 FAMILY	3

VERY HIGH VOLTAGE SURGE STOPPER

DEMO CIRCUIT 1850A

DATE: Wednesday, June 20, 2012

SCALE = NONE

SHEET 1 OF 1

CUSTOMER NOTICE

LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS. HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.

THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

ASSY	PART NUMBER	PART MARKING	BEHAVIOR
DC1850A-A	LTC4366HTS8-1	LTFMC	LATCH OFF
DC1850A-B	LTC4366HTS8-2	LTFMF	AUTO RETRY

DEMO MANUAL

DC1850A-A/DC1850A-B

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

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

Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

Copyright © 2004, Linear Technology Corporation