

**LTC2952**  
**Pushbutton On/Off**  
**Power Path Controller**

## DESCRIPTION

Demonstration circuit 1033B features the **LTC<sup>©</sup>2952**, a micropower, multipurpose, pushbutton On/Off PowerPath™ controller that provides voltage monitoring and supervisory features, as well as ideal diode power paths. Selectable PowerPath management modes allow a variety of power on and off configurations, including pushbutton on/off control and voltage detection on/off control.

The LTC2952's pushbutton input has independently programmable ON and OFF de-bounce times. A simple microprocessor interface allows for proper system housekeeping prior to power down. The status of digital pins G1STAT, PFO, RST and INT are displayed with LEDs. Under system fault conditions, the part's internal KILL timer ensures that the system can be shut down. High reliability systems may

utilize the LTC2952's power fail, voltage monitoring, diode status, watchdog and  $\mu$ P reset features to monitor power status and ensure system integrity.

The DC1033B operates over the full LTC2952 range of 2.7V to 28V to accommodate a wide variety of input power supplies. Low forward drop ideal diodes and very low standby current (25 $\mu$ A typ) make the LTC2952 ideally suited for battery powered or power conscious applications.

**Design files for this circuit board are available at**  
<http://www.linear.com/demo/DC1033B>

LTC, LT, LTC, LTM, Linear Technology and the Linear logo are registered trademarks and PowerPath is a trademark 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	VALUE
Input Voltage Range	V1 and/or V2	2.7V to 28V
Output Voltage $V_S$	Configuration A	V1 or V2*
	Configuration B	V1 or V2*
	Configuration C, Pushbutton Enable On	V1 or V2*
	Configuration D, Pushbutton Enable On, $V_2 > V_2$ Threshold	V1 or V2*
DC/DC Out 2P6V	Configuration A-D, Pushbutton Enable On	2.6V
V2 Trip Threshold	Default Resistors (R9 and R10), JP2 Set to Monitor V2	4.725V
Power Fail Input Voltage PFI	Default Resistors (R3 and R4) Monitor $V_S$	3.055V
	Resistor Options (R17 and R4) Set to Monitor V2	3.055V
Voltage Monitor VM	Default Resistors (R1 and R2) Monitor 2P6V	2.325V
	Resistor Options (R16 and R2) Set to Monitor $V_S$	3.055V
Pushbutton On Time ONT	JP3 Set to OPEN, LTC2952 Default ONT	26ms
	JP3 Set to CAP to Connect 22nF to ONT Pin	26ms + 205ms
Pushbutton Off Time OFFT	JP4 Set to OPEN, LTC2952 Default OFFT	26ms
	JP4 Set to CAP to Connect 68nF to OFFT Pin	26ms + 632ms

\*  $V_S$  will be the ideal diode OR of V1 and V2. There is only a slight voltage drop across the ideal diode.

# DEMO MANUAL DC1033B

## QUICK START PROCEDURE

### (Configuration A)

Demonstration circuit 1033B is easy to set up to evaluate the performance of the LTC2952. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below. This Quick Start Procedure sets up the DC1033B for Configuration A. See Operating Principles for further description of the different configurations

1. Place jumpers in the following positions:

**JP1:** LO  
**JP2:** LO  
**JP3:** CAP  
**JP4:** CAP  
**JP5:** UNTIE

2. Connect a voltmeter across  $V_S$  and GND.
3. Apply a voltage of 2.7V to 28V across  $V_2$  (WALL).
4. Apply a voltage of 2.7V to 28V across  $V_1$  (BAT).
5. Measure  $V_S$ , which will be the ideal diode OR of the higher supply  $V_2$  or  $V_1$ .
6. Push down once and hold on Pushbutton SW1 for a Turn On. Observe both SUP\_EN and RST LEDs turn on. After a short period, RST turns off.
7. Push down again and hold on Pushbutton SW1 for a Turn Off. Observe while SUP\_EN LED is on, INT LED turns on momentarily. After a short period, both SUP\_EN and INT LEDs turn off.

Note: LED sequence in steps 6 and 7 are the same for configurations A through D.

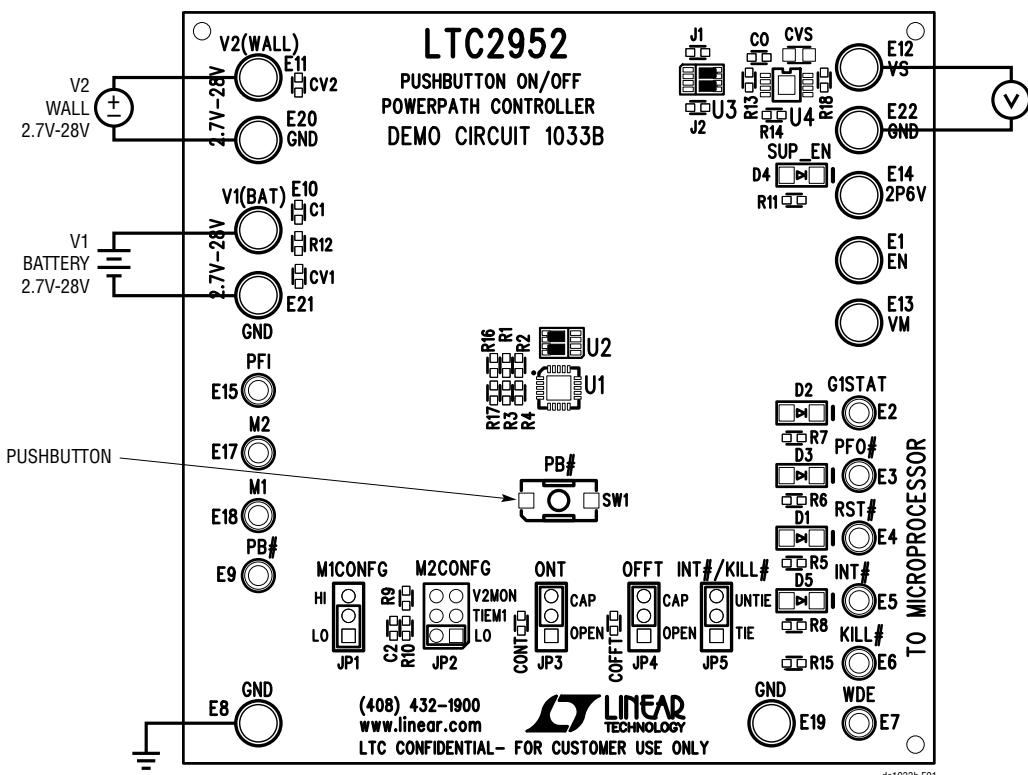


Figure 1. Basic Equipment Setup

## OPERATING PRINCIPLES

The DC1033B operates from 2.7V to 28V applied to either V1 or V2. Configuration of M1 and M2 of the LTC2952 determines the power path to the output voltage and the example DC/DC converter (U4). P-Channel MOSFETs U2 and U3 are driven by the LTC2952 for the ideal diode feature providing a low forward voltage drop. J1 and J2 provide a bypass option if one or both of the PFETs in U3 are not needed. A pushbutton turns on and off the Enable that drives the DC/DC converter and in some configuration also turns on and off the ideal diode power paths. The pushbutton on and off times are set by jumper selectable external capacitors. The status of G1STAT indicates the status of G1.  $\overline{PFO}$  gives an output signal (shown with an LED) if voltage at the PFI input is below the threshold.  $\overline{RST}$  and  $\overline{INT}$  provide maintenance to a microprocessor on a power up or power down. Immediate shutdown can be done by pulling low on KILL.

### CONFIGURATION A

#### (M1 low, M2 low): Pushbutton Controller with Automatic Load Switching Between WALL and Battery

Set both JP1 (M1CONFIG) and JP2 (M2CONFIG) to LO to enable both ideal diodes always.  $V_S$  will be the ideal diode OR of V1 and V2 where  $V_S$  equals the higher of the two supplies minus the slight ideal diode drop. G1STAT LED turns on when  $V2 > V1$ . The pushbutton turns on and off the EN pin which drives the shutdown of the DC/DC converter.

### CONFIGURATION B

#### (M1 low, M2 monitor): Pushbutton Controller with Preferential WALL Operation and Automatic Load Switching to Battery

Set JP1 (M1CONFIG) to LO and JP2 (M2CONFIG) to V2MON to configure M2 as a monitor on the Wall Adapter voltage V2. When V2 is above the trip threshold, the ideal diode

for V2 is turned on always, while the ideal diode for V1 is shutdown, even if V1 is greater than V2.  $V_S$  will then equal V2 minus the ideal diode voltage drop.

When V2 falls below the trip threshold, both ideal diodes are enabled.  $V_S$  will be the ideal diode OR of V1 and V2 where  $V_S$  equals the higher of the two supplies minus the slight ideal diode drop. The pushbutton turns on and off the EN pin which drives the shutdown of the DC/DC converter.

### CONFIGURATION C

#### (M1 high, M2 high): Pushbutton Control of Ideal Diodes Drivers

Set JP1 (M1CONFIG) to HI and JP2 (M2CONFIG) to TIEM1. M1 has an internal pull-up current and pulls up M2 as well when tied together. This sets up the pushbutton to have full control on both ideal diodes and the EN pin. On a pushbutton turn on, both ideal diode drivers are turned on as well as the DC/DC converter.  $V_S$  will be the ideal diode OR of V1 and V2 where  $V_S$  equals the higher of the two supplies minus the ideal diode drop. On a pushbutton turn off, both ideal diode drivers are shutdown and  $V_S$  is turned off.

### CONFIGURATION D

#### (M1 high, M2 monitor): Battery Backup with Pushbutton Power Path Controller

Set JP1 (M1CONFIG) to HI and JP2 (M2CONFIG) to V2MON. M1 is set high due to its internal pull-up current. M2 monitors V2. When V2 is below the trip threshold, both ideal diodes are shutdown always and the input to the  $\overline{PB}$  pin is ignored. When V2 is above the trip threshold, the pushbutton has full control of the EN pin and ideal diode drivers.

Also while M1 is high, a transition on M2 will force a pushbutton turn on or turn off. To test this, move the V2 input to be above and below the trip threshold.

# DEMO MANUAL DC1033B

## OPERATING PRINCIPLES

### ONT/OFFT PROGRAMMING

Additional pushbutton turn on and off de-bounce time can be set by attaching a capacitor from the ONT and OFFT pins to GND and can be done through JP3 and JP4, respectively, on the DC1033B. Select OPEN for the Internal Default Time of the LTC2952 only or choose CAP for additional timing. See figures 2, 3, 4 and 5 for timing differences. The additional timing can be calculated using the following equations:

$$t_{ONT} = C_{ONT} [F] \cdot 9.3 \times 106 [\Omega]$$

$$t_{OFFT} = C_{OFFT} [F] \cdot 9.3 \times 106 [\Omega]$$

### INT/KILL

The INT pin can be tied to the KILL pin through JP5 to immediately shutdown when INT pulls low during a turn off sequence. When the pins are untied, the INT pin becomes open collector for the interrupt period before power is turned off.

### VOLTAGE MONITORS PFI AND VM

Voltage monitoring is also provided by the Power Fail Input (PFI) and Voltage Monitor (VM) pins. If the voltage at PFI falls below its threshold, a signal is given at PFO and shown with an LED. If the voltage at VM falls below its threshold, a signal is given at RST and also shown with an LED. RST is typically connected to the Reset of a microcontroller to reset the device and halt operation until the supply voltage is above a specified voltage.

### WATCHDOG AND EXTEND FUNCTION WITH WDE

During a shutdown process after the INT pin goes high impedance, a rising or falling edge on the WDE pin within a 500ms period extends the waiting period before the EN line is set low. See figure 6 and 7 for timing comparison. The WDE pin can also be used with the VM pin to provide a watchdog timer.

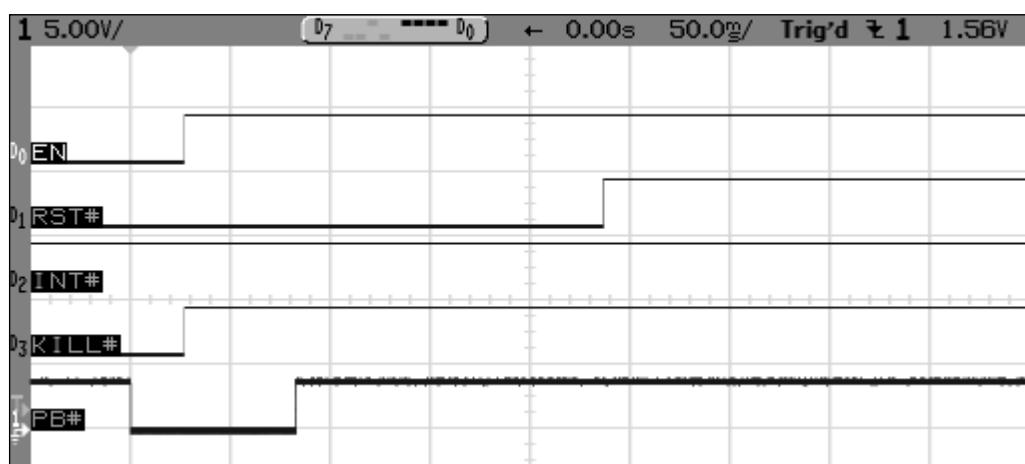


Figure 2. Pushbutton Turn ON with No Additional Timing

## OPERATING PRINCIPLES

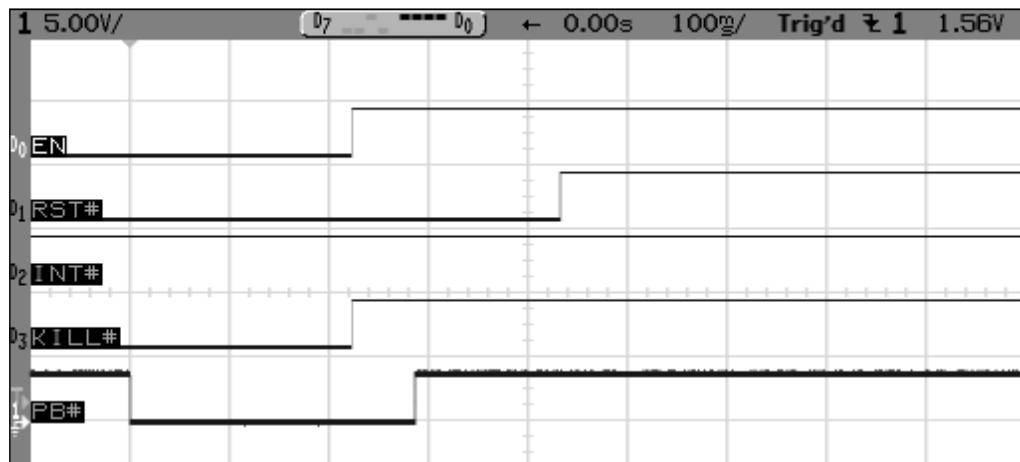


Figure 3. Pushbutton Turn ON with 22nF at ONT

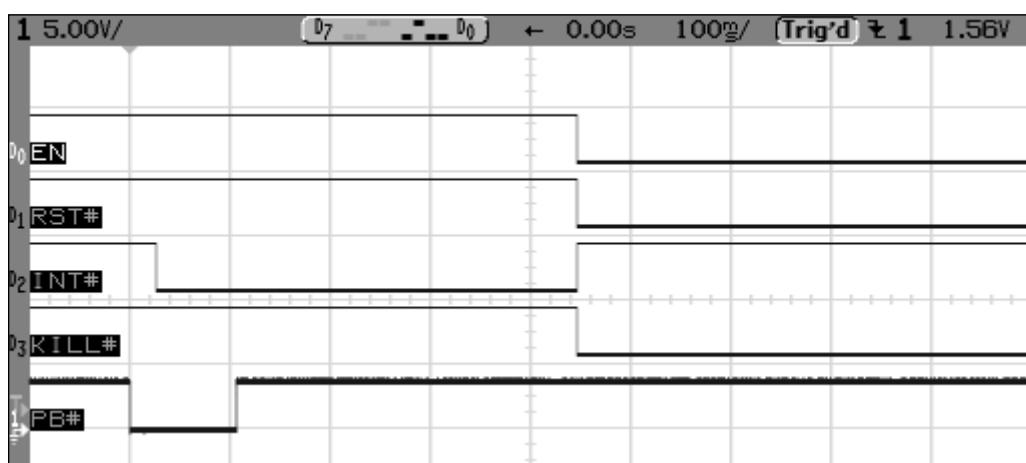


Figure 4. Pushbutton Turn OFF with No Additional Timing

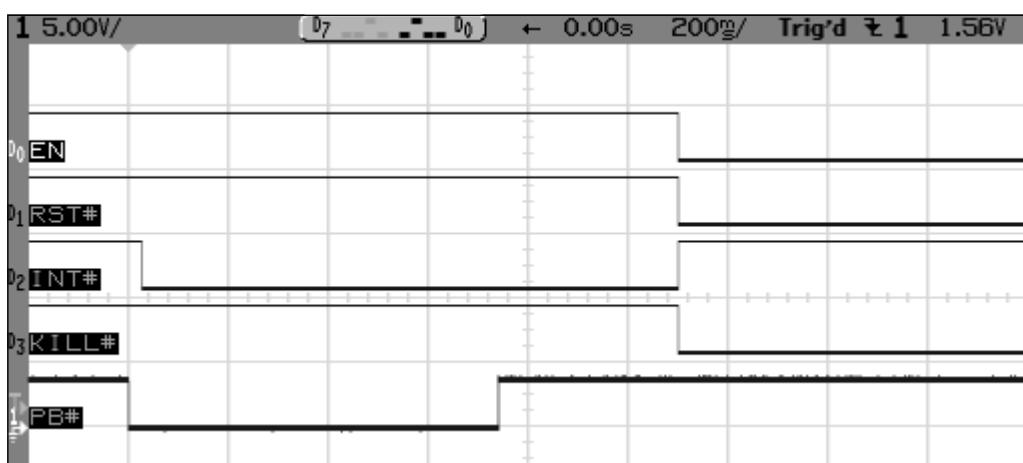


Figure 5. Pushbutton Turn OFF with 68nF at OFFT

# DEMO MANUAL DC1033B

---

## OPERATING PRINCIPLES

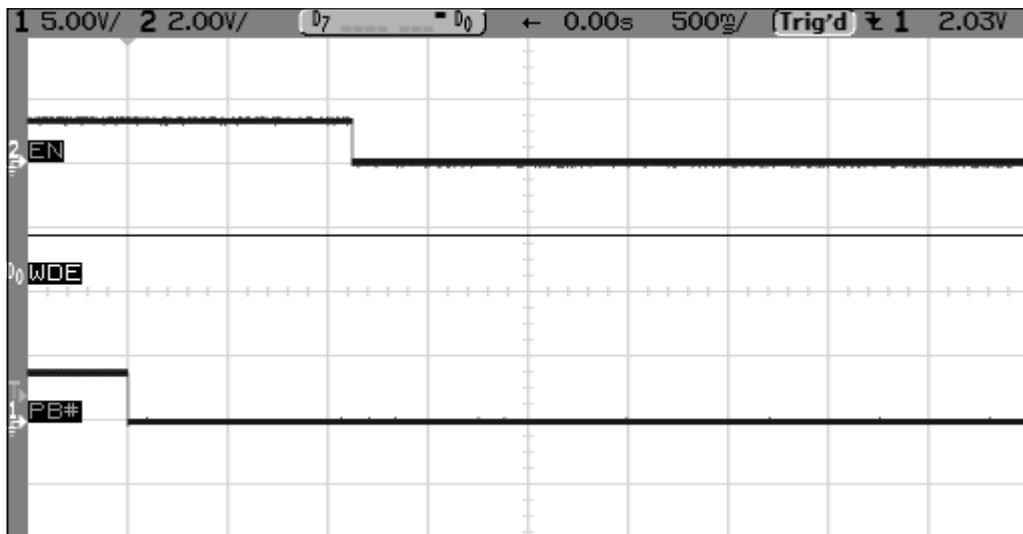


Figure 6. Pushbutton Turn OFF with No WDE Extension

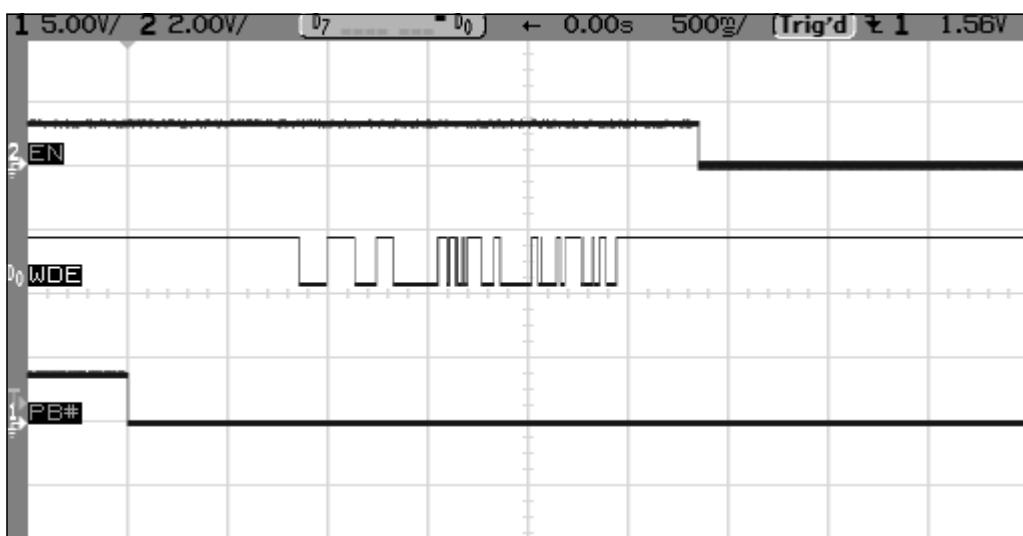
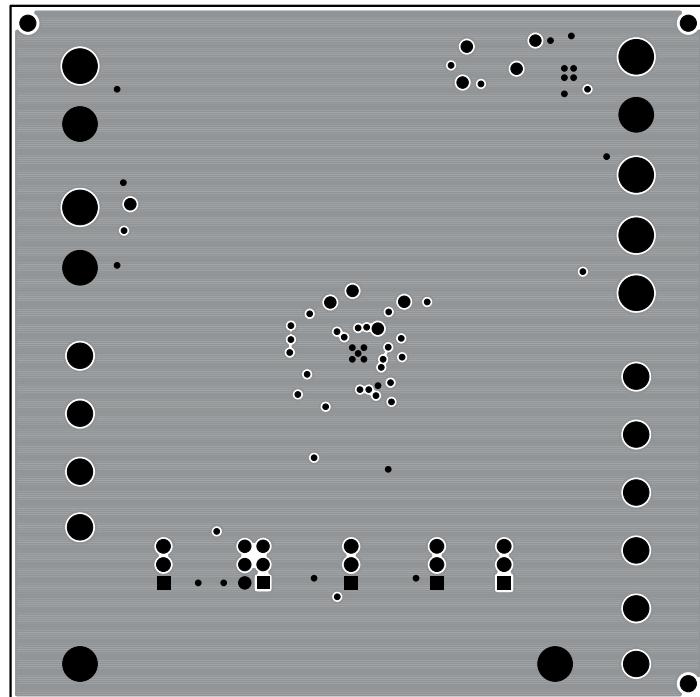


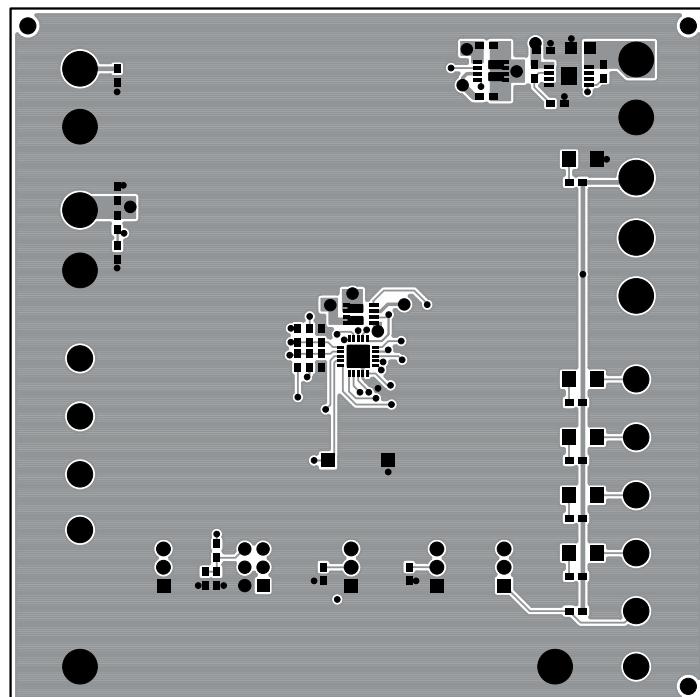
Figure 7. Pushbutton Turn OFF with Transitions at WDE for Time Extension

## PCB LAYOUT

Top Layer



Layer 2

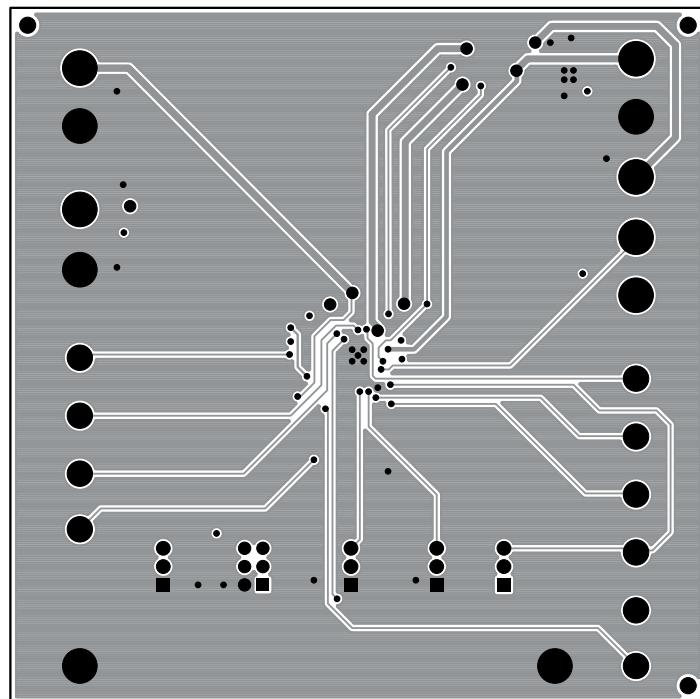


# DEMO MANUAL DC1033B

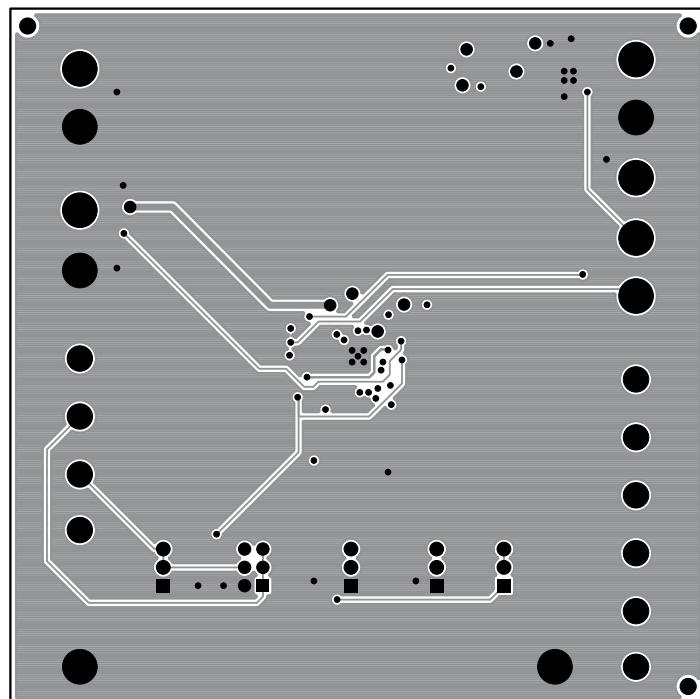
---

## PCB LAYOUT

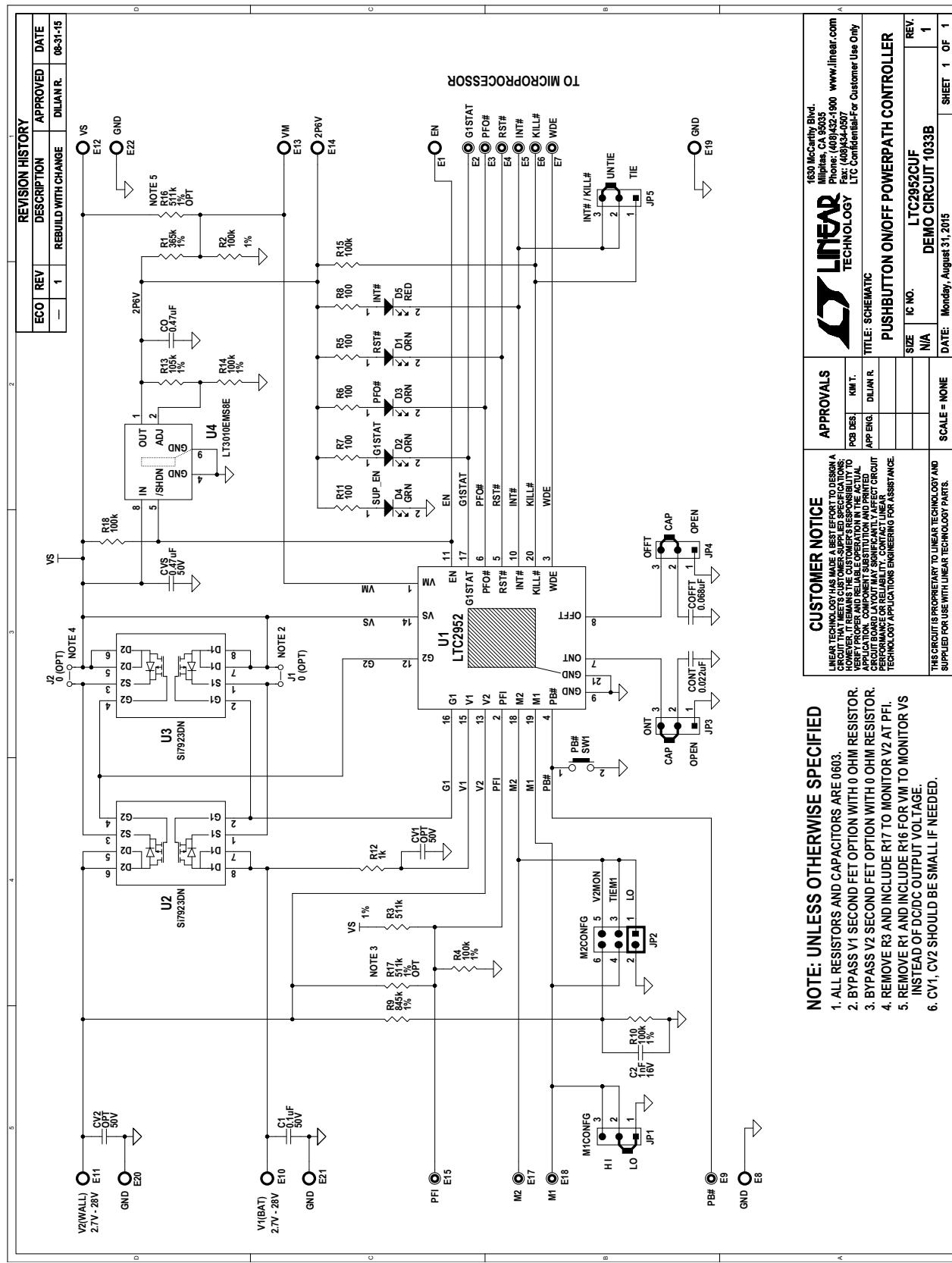
Layer 3



Bottom Layer



## SCHEMATIC DIAGRAM



NOTE: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS AND CAPACITORS ARE 0003.
2. BYPASS V1 SECOND FET OPTION WITH 0 OHM RESISTOR.
3. BYPASS V2 SECOND FET OPTION WITH 0 OHM RESISTOR.
4. REMOVE R3 AND INCLUDE R17 TO MONITOR V2 AT PFL.
5. REMOVE R1 AND INCLUDE R16 FOR VM TO MONITOR VS INSTEAD OF DC/DC OUTPUT VOLTAGE.
6. C1V2 C1V2 SHOULD BE SMALL IF NEEDED.

Information furnished by Linear Technology Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. Linear Technology Corporation makes no representation that the interconnection of its circuits as described herein will not infringe on existing patent rights.

# DEMO MANUAL DC1033B

---

## 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

dc1033bf



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помошь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помошь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: [org@eplast1.ru](mailto:org@eplast1.ru)

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литер A.