

# QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 1033A PUSH BUTTON ON/OFF POWER PATH CONTROLLER

## LTC2952CUF20

### DESCRIPTION

Demonstration Circuit 1033A features the LTC2952, a micro power, multi-purpose, push-button On/Off Power-Path™ 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 push button on/off control and voltage detection on/off control.

The LTC2952's push button 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 DC1033A 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. Call the LTC factory.**

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**Table 1. DC1033A Typical Performance Summary (T<sub>A</sub> = 25°C)**

PARAMETER	CONDITION	VALUE
Input Voltage Range	V1 and/or V2	2.7V to 28V
Output Voltage V <sub>S</sub>	Configuration A	V1 or V2*
	Configuration B	V1 or V2*
	Configuration C, Push Button Enable On	V1 or V2*
	Configuration D, Push Button Enable On, V2 > V2 Threshold	V1 or V2*
DC/DC Out 2P6V	Configuration A-D, Push Button 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 <sub>S</sub>	3.055V
	Resistor Options (R17 and R4) Set to Monitor V2	3.055V
Voltage Monitor V <sub>M</sub>	Default Resistors (R1 and R2) Monitor 2P6V	2.325V
	Resistor Options (R16 and R2) Set to Monitor V <sub>S</sub>	3.055V
Push Button On Time ONT	JP3 Set to OPEN, LTC2952 Default ONT	26ms
	JP3 Set to CAP to Connect 22nF to ONT Pin	26ms + 205ms
Push Button Off Time OFFT	JP4 Set to OPEN, LTC2952 Default OFFT	26ms
	JP4 Set to CAP to Connect 68nF to OFFT Pin	26ms + 632ms

\* V<sub>S</sub> will be the ideal diode OR of V1 and V2. There is only a slight voltage drop across the ideal diode.

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## QUICK START PROCEDURE

### (Configuration A)

Demonstration circuit 1033A 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 DC1033A for Configuration A. See Operating Principles for further description of the different configurations

1. Place jumpers in the following positions:

<b>JP1</b>	LO
<b>JP2</b>	LO
<b>JP3</b>	CAP
<b>JP4</b>	CAP
<b>JP5</b>	UNTIE

2. Connect a voltmeter across  $V_S$  and GND.

3. Apply a voltage of 2.7V to 28V across V2 (WALL).

4. Apply a voltage of 2.7V to 28V across V1 (BAT).

5. Measure  $V_S$ , which will be the ideal diode OR of the higher supply V2 or V1.

6. Push down once and hold on Push Button 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 Push Button 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.

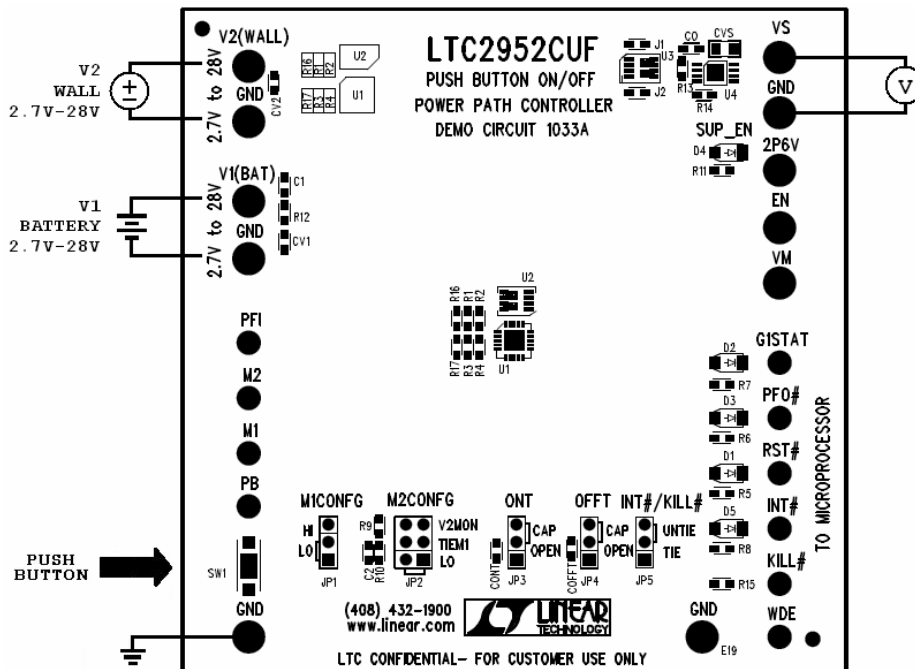


Figure 1. Basic Equipment Setup

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## OPERATING PRINCIPLES

The DC1033A 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 push button 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 push button on and off times are set by jumper selectable external capacitors. The status of G1STAT indicates the status of G1. PFO# gives an output signal (shown with an LED) if voltage at the PFI input is below the threshold. RST# and 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): Push Button 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 push button turns on and off the EN pin which drives the shutdown of the DC/DC converter.

### CONFIGURATION B

#### **(M1 low, M2 monitor): Push Button 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 push button turns on and off the EN pin which drives the shutdown of the DC/DC converter.

### CONFIGURATION C

#### **(M1 high, M2 high): Push Button 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 push button to have full control on both ideal diodes and the EN pin. On a push button 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 push button turn off, both ideal diode drivers are shutdown and  $V_S$  is turned off.

### CONFIGURATION D

#### **(M1 high, M2 monitor): Battery Backup with Push Button 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 PB# pin is ignored. When V2 is above the trip threshold, the push button has full control of the EN pin and ideal diode drivers.

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

### ONT/OFFT PROGRAMMING

Additional push button 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 DC1033A. Select OPEN for the Internal Default Time of the LTC2952 only or choose

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CAP for additional timing. See figures 2, 3, 4 and 5 for timing differences. The additional timing can be calculated using the following equations:

$$t_{\text{ONT}} = C_{\text{ONT}} [\text{F}] * 9.3 \times 10^6 [\Omega]$$

$$t_{\text{OFFT}} = C_{\text{OFFT}} [\text{F}] * 9.3 \times 10^6 [\Omega]$$

## **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.

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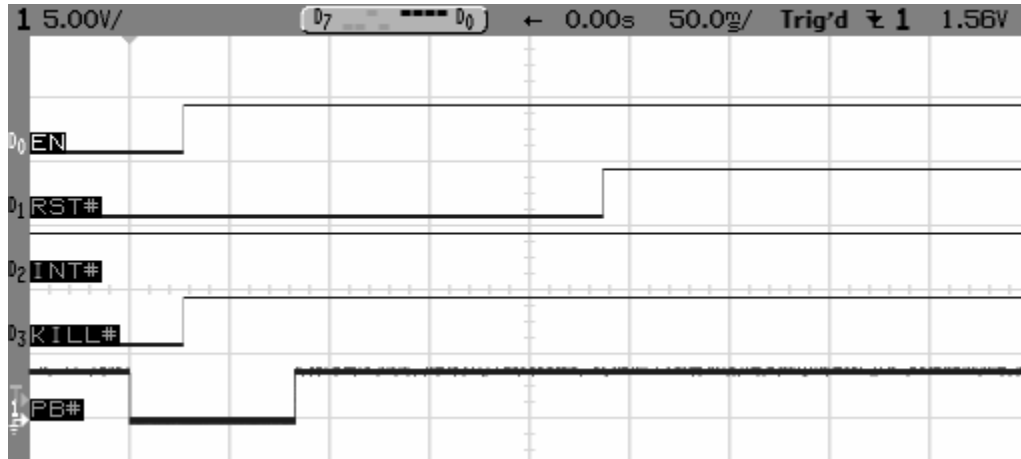


Figure 2. Push Button Turn ON with No Additional Timing

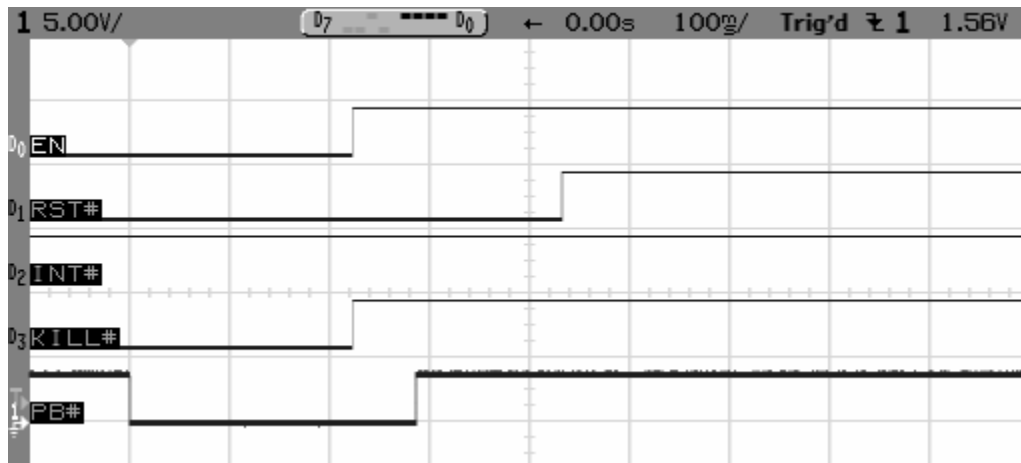


Figure 3. Push Button Turn ON with 22nF at ONT

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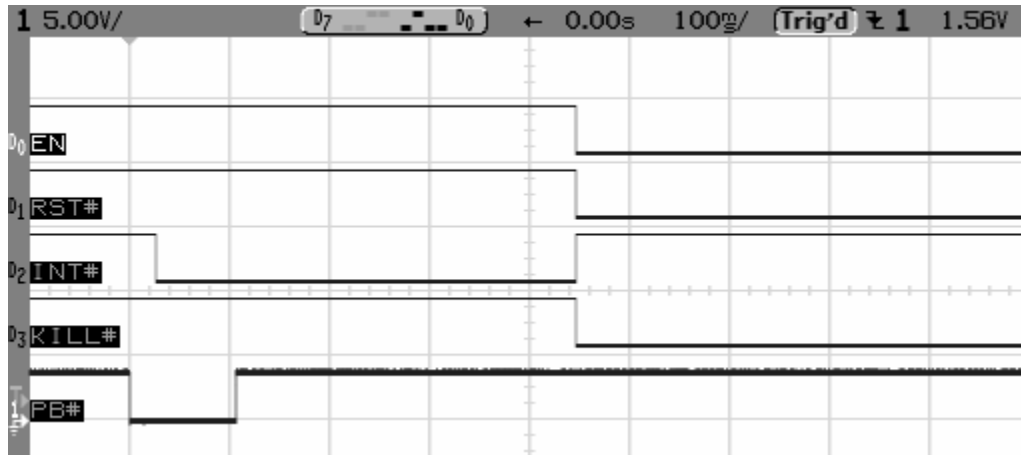


Figure 4. Push Button Turn OFF with No Additional Timing

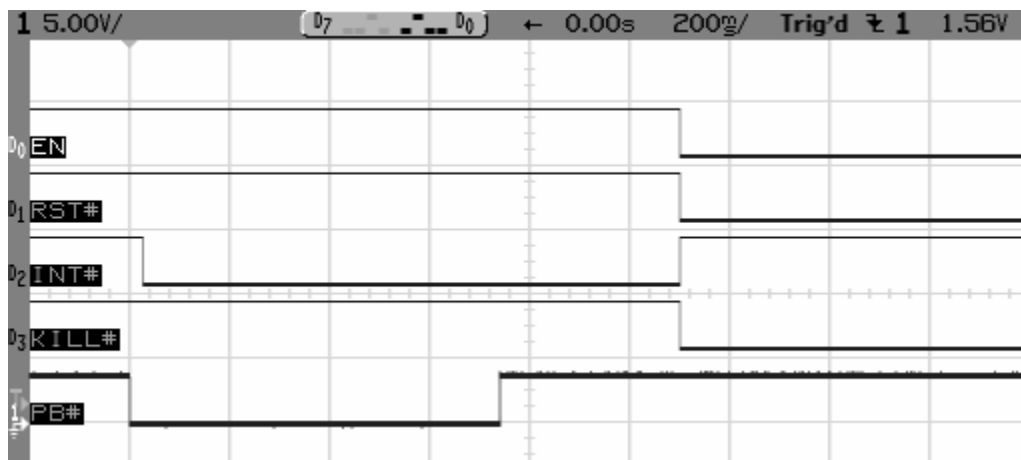


Figure 5. Push Button Turn OFF with 68nF at OFFT

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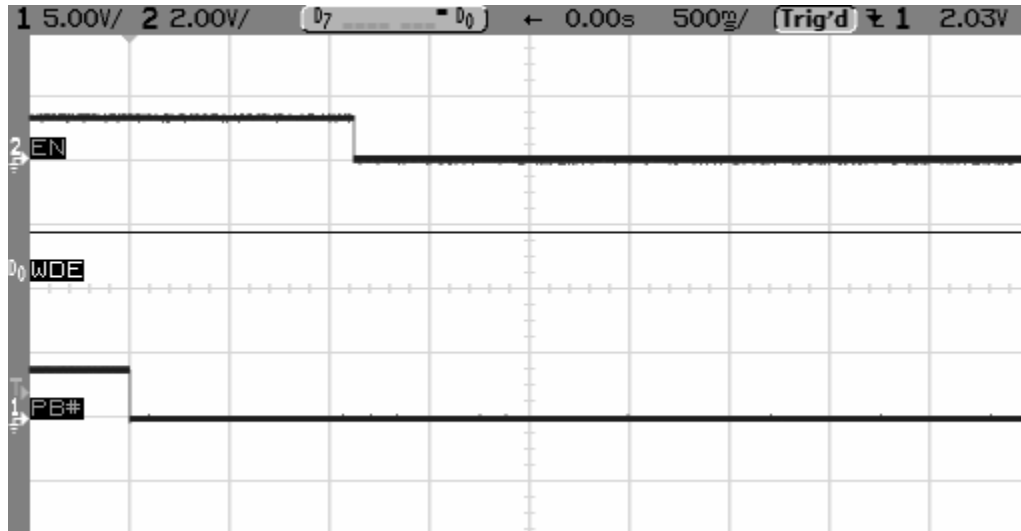


Figure 6. Push Button Turn OFF with No WDE Extension

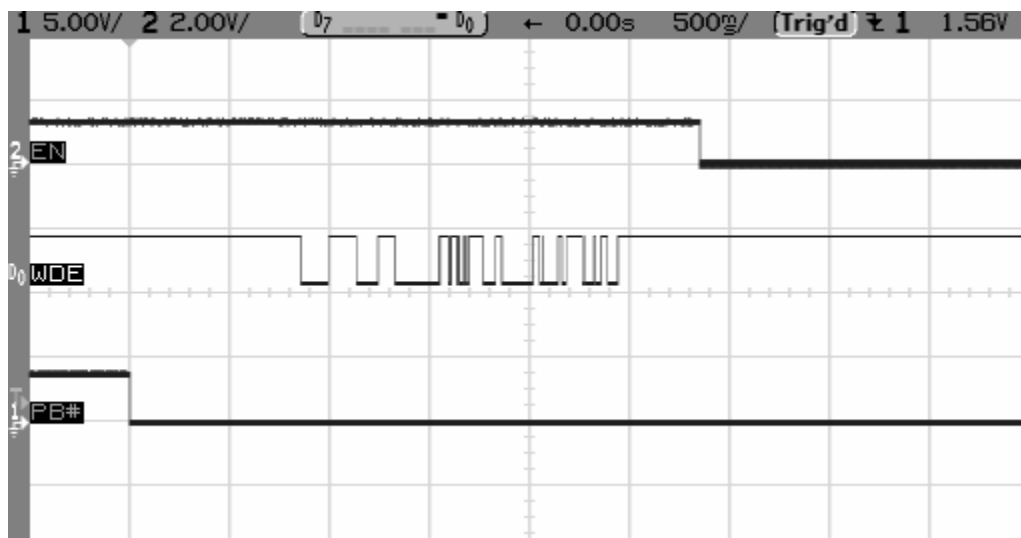
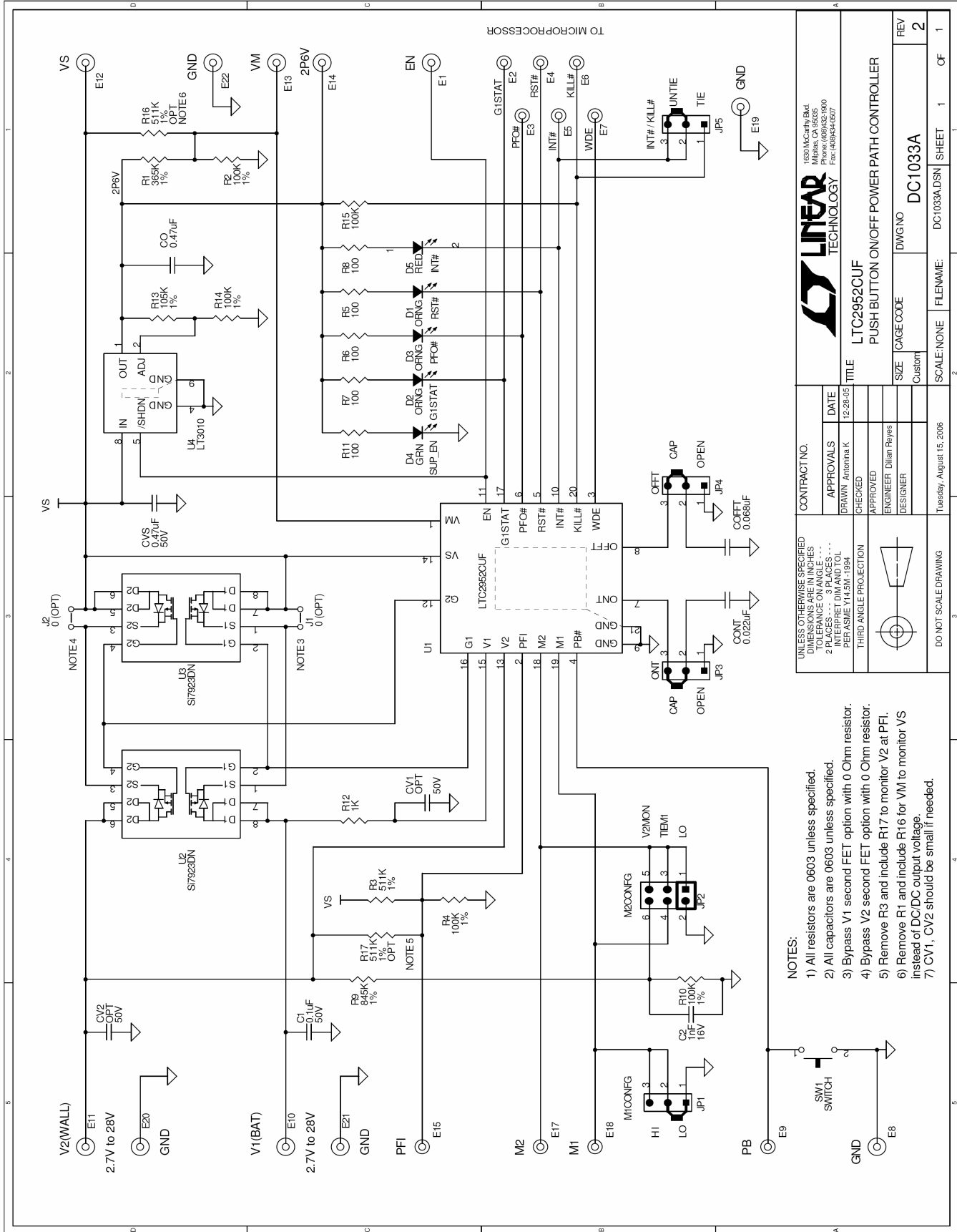


Figure 7. Push Button Turn OFF with Transitions at WDE for Time Extension

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- NOTES:
- 1) All resistors are 0603 unless specified.
  - 2) All capacitors are 0603 unless specified.
  - 3) Bypass V1 second FET option with 0 Ohm resistor.
  - 4) Bypass V2 second FET option with 0 Ohm resistor.
  - 5) Remove R3 and include R17 to monitor V2 at PFI.
  - 6) Remove R1 and include R16 for VM to monitor VS instead of DC/DC output voltage.
  - 7) CV1, CV2 should be small if needed.

CONTRACT NO.		DATE	
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DRAWN: Antonina K		CHECKED:	
APPROVED:		DESIGNER:	
ENGINEER: Dillon Reyes		SCALE: NONE	
DESIGNER:		FILENAME: DC1033A.DSN	
DO NOT SCALE DRAWING		SHEET 1 OF 1	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLE ... 2 MILLI METERS INTERPRET DIM AND ... PER ASME Y14.5M-1994 THIRD ANGLE PROJECTION		LTC2952CJF PUSH BUTTON ON/OFF POWER PATH CONTROLLER	
		DWG NO DC1033A	
DO NOT SCALE DRAWING		REV 2	



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