Application Report
SLUA499–January 2009

Communicating With the UCD9081; Unpowered, in System

Eric Wright *Linear Power*

ABSTRACT

Communication with the UCD9081 in an un-powered user system may be necessary to upload a new configuration or read the flash error log contents. Of course in order to communicate, power must be furnished to the UCD9081. The following application report details a simple circuit that provides isolation between the external communication equipment and system power sources to facilitate communication in the absence of system provided power.

Contents

List of Figures

List of Tables

1 Introduction

The UCD9081 can be configured over the I2C bus as described in the UCD9081EVM User's Guide (SLVU249). In some cases users will have already populated devices loaded with the factory null configuration onto their application circuits, and will require a way to update this configuration in system without powering the system. Referencing the UCD9081EVM User's Guide schematic, configuration can occur through the I2C connector (J3), or alternatively reprogramming can occur using standard programming equipment over the EVM update connector (J2).

In each case, the UCD9081 requires 3.0-3.6V to be configured (or reprogrammed). This power can be furnished by the external configuration (EVM USB-I2C adapter) or programming (EVM Update Connector) equipment, or by the user system. The following report describes a circuit which allows the external equipment to provide this voltage without back feeding the customer application circuitry. The example shown uses the USB-I2C adapter (connected to PC) furnished 3.3V (3P3V_USB) to power the UCD9081 for communication.

2 Power Insertion

Figure 1 illustrates the circuitry required to isolate the UCD9081 and communication interface from the system input voltage. J3 is the USB-I2C connector to which the USB-I2C adapter is connected.

Q1 (P-channel MOSFET) blocks the UCD9081 VCC (UCD_VCC) from the system furnished VCC (SYS_3.3V) during configuration. This is desirable so that the configuration source voltage does not have to power all of the associated customer circuitry that is present on the SYS_3.3V node. When the USB-I2C adapter is connected and furnishes the required voltage at 3P3V_USB, Q1 is turned off through D1 (both upper and lower conduct and keep Q1 Vgs < Vgs-th). 3P3V_USB also provides the voltage to power the UCD9081 through the lower half D1. D1 is a dual, common anode schottky diode with a small forward voltage drop at the low operating currents of the UCD9081 device. Since the gate (pin 1) and source (pin 2) of Q1 are at approximately the same voltage when 3P3V_USB is present, Q1 will remain off and block UCD_VCC from SYS_3.3V.

For normal operation, 3P3V_USB must not be present. R14 will pull 3P3V_USB to 0V as system source voltage is applied. SYS_3.3V and UCD_VCC will rise as current flows through the Q1 body diode. R15 will pull Q1-1 to 0V and when UCD_VCC rises above the Q1 Vgs-th, Q1 will saturate.

Since UCD_VCC can be chosen as the A/D converter reference voltage during normal operation, the selection of Q1 should consider UCD_VCC operating current and the Q1 on state characteristics. The Fairchild FDN340P has a typical RDSon of 70mΩ. Worst case UCD9081 active current will be less than 4mA and typical pullup resister loading will keep the current through Q1 to less than 5mA. The voltage drop across Q1 will be much less than 1mV which is negligible.

In similar fashion, the update connector could furnish the UCD9081 voltage if device reprogramming is required. Standard programmers furnish 3.3V via pin 2 of the update connector (J2 as shown in Figure 2).

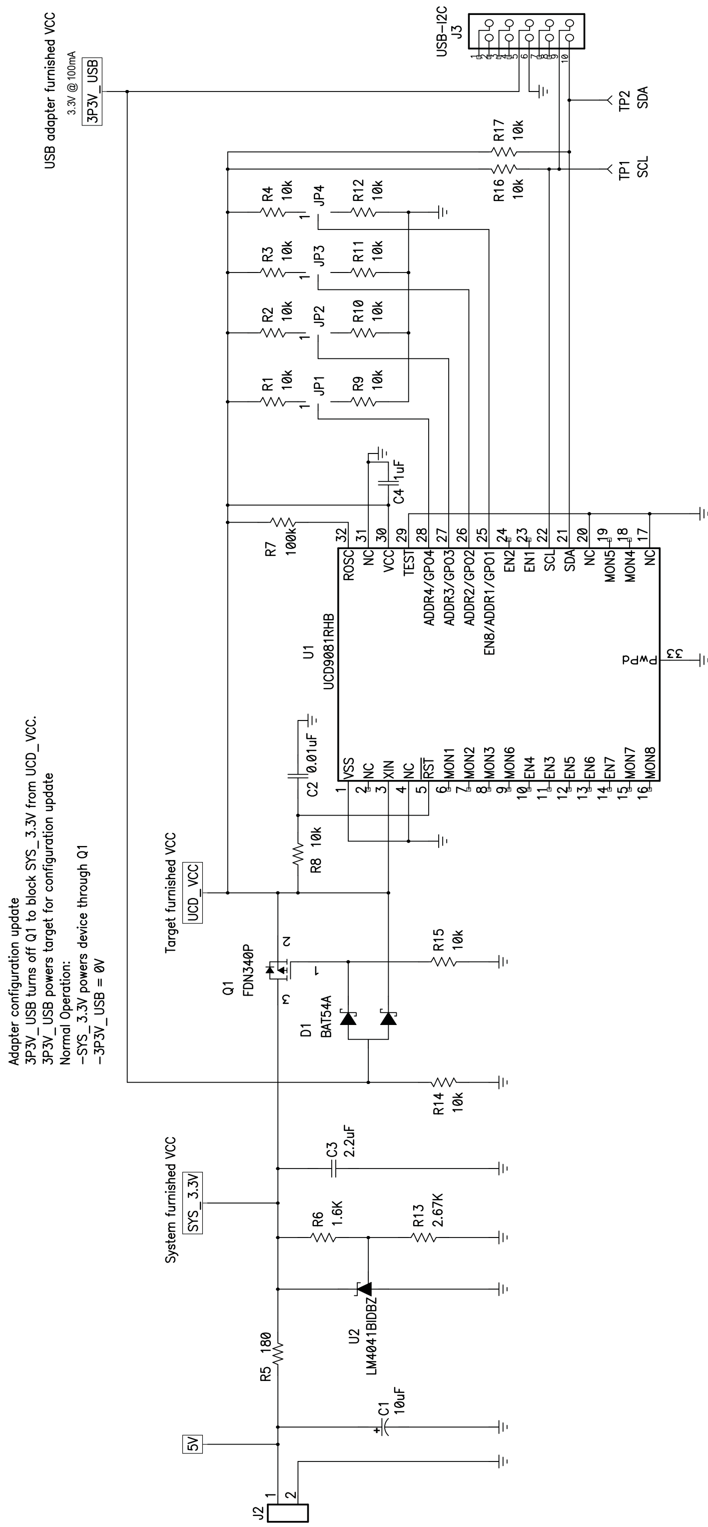

Figure 1. I2C Configuration Power Schematic

3 Test Results

Figure 2 illustrates the UCD9081EVM schematic modified with the circuitry described above. The USB-I2C adapter that is furnished with the UCD9081EVM was used to power the UCD9081 via J3-5. Jumper JP30 was used to select the external voltage source.

The circuitry worked as designed. Communication voltage applied through the USB-I2C connector powered the UCD9081 and not the system 3.3V (C3.3V). Reliable communication between the USB-I2C adapter and UCD9081 was established and flash error log contents could be read. For normal system operation, measurement of the voltage drop across the Q3 MOSFET was below a millivolt (actual Vds was < 300μV) and the device operated normally. The following table documents node voltages for several conditions.

Table 1. Node Voltages

TEST CONDITION	3P3V_USB at JP30-1	C3.3V at TP11	B3.3V at Q3-2	Vgate at Q3-1
USB-I2C adapter power on, system power (TP11) off	3.342 V	0 V	3.093 V	3.178 V
USB-I2C adapter power on, system power (TP11) on	3.341 V	3.293 V	3.096 V	3.180 V
USB-I2C adapter power off, system power (TP11) on	0.011 V	3.292 V	3.292 V	0.011 V

4 Application Notes

- A voltage present at 3P3V_USB may degrade ADC reporting accuracy. For normal operation, voltage at 3P3V_USB should be kept well below SYS_3.3V (TP11 on EVM) to ensure Q1 (Q3 on EVM) is fully on.
- Real world application should add some filtering and gate protection for Q1 (for hot plug transients that may occur) at the 3P3V_USB node. An RC filter of 10Ω and 0.1μF with a 3.6V zener diode should be more than adequate.

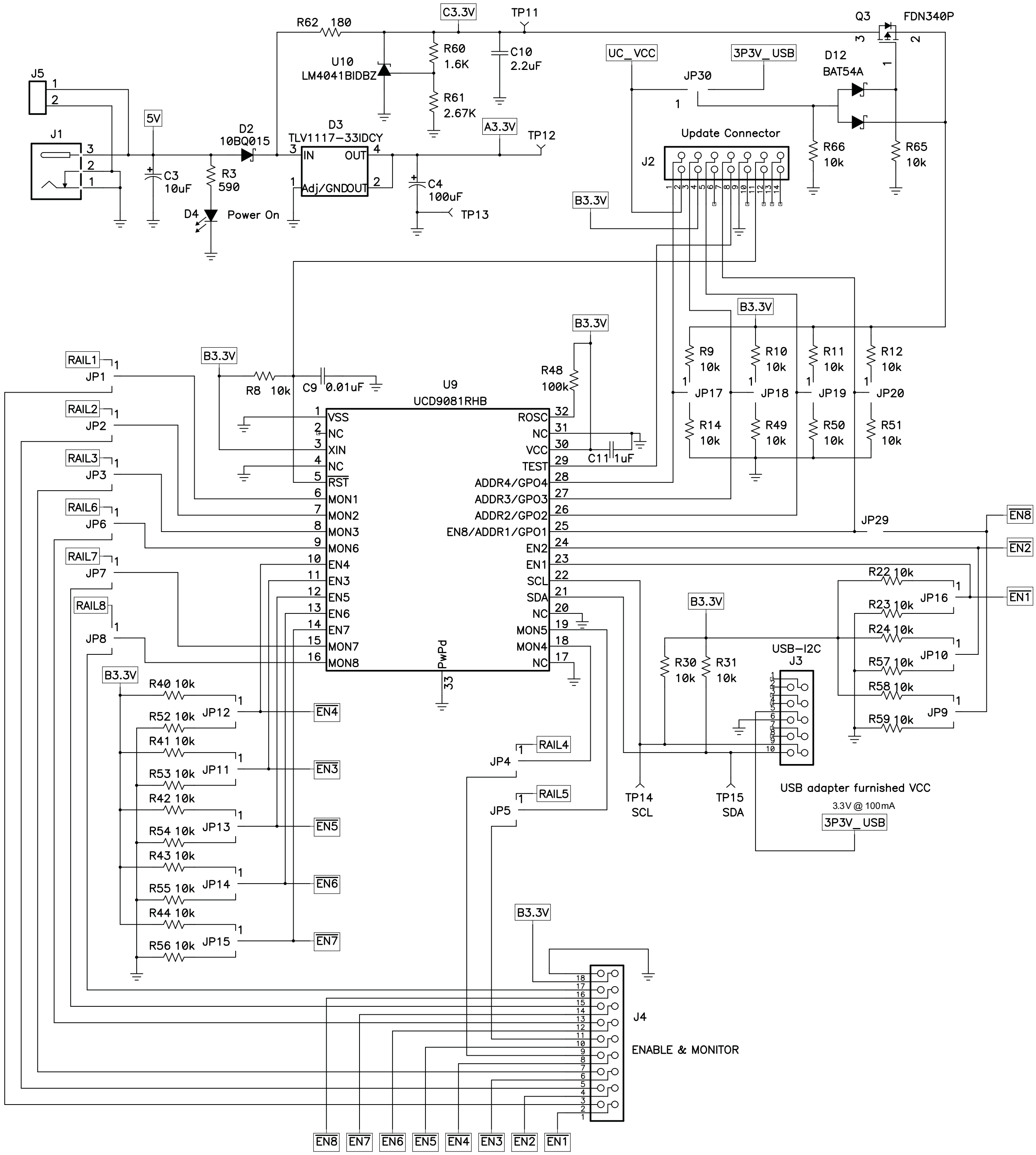

Figure 2. Modified UCD9081EVM Schematic

5 Conclusion

With the addition of four inexpensive components the UCD9081 can be easily set up for in system configuration, programming, or flash log access in the absence of system power.

6 References

1. *UCD9081* Datasheet (SLVS813A)
2. *UCD9081EVM User's Guide* (SLVU249)

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Clocks and Timers	www.ti.com/clocks	Digital Control	www.ti.com/digitalcontrol
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265