LTC2923

DESCRIPTION

Demonstration circuit 732 allows evaluating performance of the LTC2923 Power Supply Tracking Controller which is intended to provide hot swapping of one not regulated voltage source (master supply) and tracking or sequencing of two other regulated power supplies via current injection into their respective feedback nodes.

The DC732 provides two different configurations on one snap apart circuit board.

Circuit 1 provides for tracking of two regulated supplies via feedback node current injection.

Circuit 2 provides an additional pass FET to control a third fixed rail on a larger board. Both boards provide very small footprints for easy installation into existing systems.

Design files for this circuit board are available. Call the LTC factory.

LTC is a trademark of Linear Technology Corporation

Table 1. Performance Summary (T_A = 25°C)

PARAMETER	CONDITION	VALUE
Supply Voltage	Rated operating limits	2.9 • V_{CC} • 5.5V
Under voltage lockout	V_{CC} rising	2.2V • V_{CC} • 2.7V
ON Pin Threshold	Precision threshold accurately holds off power supplies until both supplies are fully up	1.212 • $V_{VON(TH)}$ • 1.248V
ON Pin Hysteresis		30mV• $V_{ON(HYS)}$ •150mV30A
Gate Pin Current	Gate On : V_{GATE}=0V, No Faults	-7µA •$_{GATE}$ • -13 µA
	Gate Off: V_{GATE} =5V, No Faults	7 µA • I_{GATE} • 13 µA
	Gate Fault: V_{GATE} =5V, Short-Circuit Fault	5mA • I_{GATE} • 50mA
FET Drain-Source Overcurrent Voltage Threshold (V_{CC}- V_{RAMP})	FET Over Current Sensed by Drain-Source Voltage	160mV • V_{DSTH} • 240mV
Fixed Rail Current Capability	Limited by Si4412 MOSFET (To Control Higher Current Replace MOSFET with a Larger Device)	4A Max
Track Pin Voltage		0.776V • V_{TRACK} • 0.824V
Feedback Pin Compliance	Regulated Power Supplies Feedback Voltage Must be Less Than 1.5V	0V • V_{FB} • 1.5V
Feedback Node Control Current	V_{FB} • 1.5V	1V MIN

OPERATING PRINCIPLES

The LTC2923 controls two regulated power supplies by introducing a precision controlled current into the feedback node of the supplies.

A third fixed rail can be controlled via a series pass FET. The power supply's feedback node must be accessible and should be high impedance.

NOTE: The feedback nodes of many linear regulators (and of some boost converters) do not meet the above high input impedance requirement when the output voltage is programmed below•0.6V or V_{REF} of the supply is not suitable for tracking by feedback node current injection. Sequencing and tracking via series pass FET using the LTC2921 is a preferred approach.

NOTE: The LTC2923 V_{CC} must be present and above $V_{CC(UVL)}$ BEFORE the tracked supplies are enable or powered up. If V_{CC} is not present, the slave supplies will power up normally and uncontrolled.

The series pass FET can control a third primary supply or a supply where the feedback node either is not accessible or does not provide the required high impedance such as a linear LDO. An electronic circuit breaker function implemented in the LTC2923 protects the pass FET. This function is activated after the pass FET is fully enhanced. The LTD2923 monitors the drain to source voltage and rapidly pulls the gate voltage to ground if FET drops out of saturation.

The LTC2923 is designed to track two slave supplies to an externally generated ramp voltage applied to the RAMP pin. This ramp voltage can be generated by using the LTC2923 GATE pin constant current source to charge a capacitor or using the output of the pass FET controlled supply or using other voltage source is conditioned not to exceed V_{CC}.

A pair of resistors configures the behavior of each slave supply relative to the master ramp signal. The choice of resistors can control a slave supply to track the master ramp signal coincidently, ratiometrically, with offset and or time delay (sequencing).

The high impedance feedback current outputs of the LTC2923 do not load the feedback node of the slave supplies and therefore do not affect the slave power supply stability or transient response.

The LTC2923 is able to control power supplies satisfying these two conditions:

1. The feedback node potential must be lower than 1.5V when the supply is in regulation.

2. The power supply feedback divider current should satisfy the following expression:

$10\mu A \cdot V_{FB}/R_{EQ} \cdot 1mA$. Where R_{EQ} is the parallel (Thevenin) impedance of the feedback resistors and V_{FB} is the reference voltage of the power supply.

Condition 1 requires the slave power supply feedback voltage to be within the compliance range of the LTC2923 current source output.

Condition 2 requires the power supply feedback node impedance to be within a range where a0 the available control current can drive the slave power supply output voltage to zero and b) the LTc2923 leakage current does not introduce errors in the power supply output voltage exceeding ½% worst case.

QUICK START PROCEDURE

Demonstration Circuit DC732 provides two separate circuits, one with pass FET capable of handling a 4A supply and a smaller board without the pass FET. Two circuits can be separated by snapping them apart along the score line. The back sides of the boards contain no parts to facilitate mounting the boards into an existing system with double sides adhesive tape if needed.

The board with drawing number DC732A-1 does not have a power FET and the master ramp signal is derived from the LTC2923 gate pin voltage. Both boards schematics are showh in Fig.2 and board assembly=ies in Fig.2.

NOTE: Because of the many options and circuit dependencies on the slave supplies involved, DC732A is provided without RTA1, RTB1, RTA2, and RTB2 installed. Refer to the LTC2923 Data Sheet available at www.linear.com for extensive design instructions on calculating the values of $R_{TAX} < R_{TBX}$ as well as options for R_{ONA}, R_{ONB}, and $C_{GATE.}$

Initial information for the LTC2923 adjustment is:

- master power supply (unregulated)voltage, steady state load current and capacitive load,

- power supply feedback node resistors R_{FA1}, R_{FB1}, R_{FA2}, R_{FB2}.
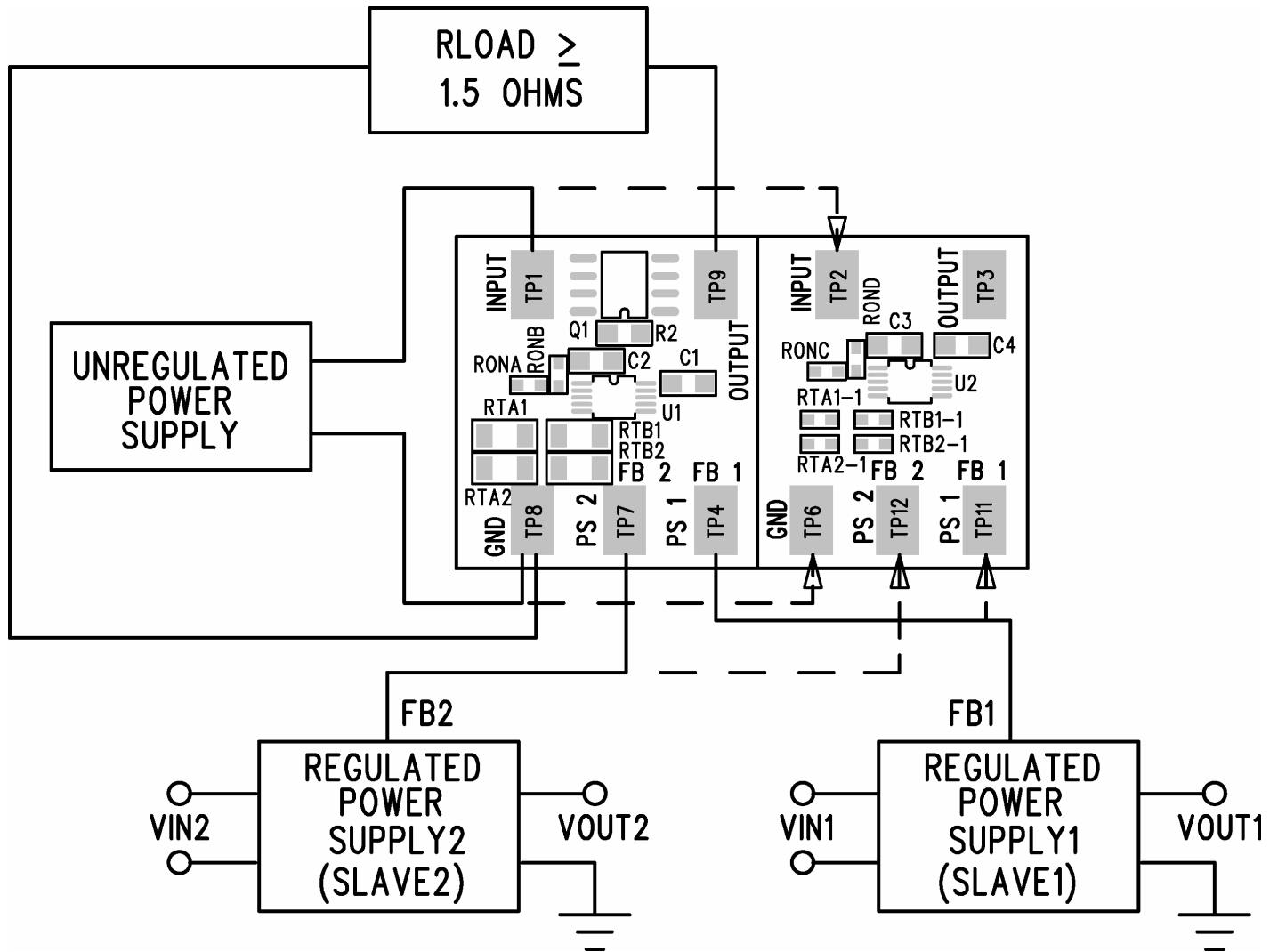
- defined power supply output voltage profile in the power-up and power-down,

- all supply output voltage slew rate a=dV/dt (a_{MASTER}, a_{SLAVE_1}, a_{SLAVE_2}).

- desired delay time (in the offset tracking or in supply sequencing).

1) Chose power MOSFET for master supply and install on the board (only for board DC732A).

2) Calculate the resistor R_{FA1}, R_{FB1}, R_{FA2}, $R_{FB2,}$ values and gate pin capacitor value (C1 for DC732A board and C4 for DC732A-1 board) according to the LTC2923 Data Sheet and install on the board.

3) Connect power supply feedback nodes with FEEDBACK1 (TP4) and FEEDBACK2 (TP7) pins.

4) Connect power supply with board GND with TP8.

5) Connect load to MASTER OUTPUT VOLTAGE (TP9).

6) Apply MASTER INPUT VOLTAGE and observe transient.

Note that that *ON* circuit resistors R_{ONA} and R_{ONB} are configured for a 2.9V turn-on signal level.

This circuit is proprietary to Linear Technology and supplied for use with Linear Technology parts.

Customer Notice: Linear Technology has made a best effort to design a circuit that meets customer-supplied specifications; however, it remains the customers 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 Applications Engineering for assistance.
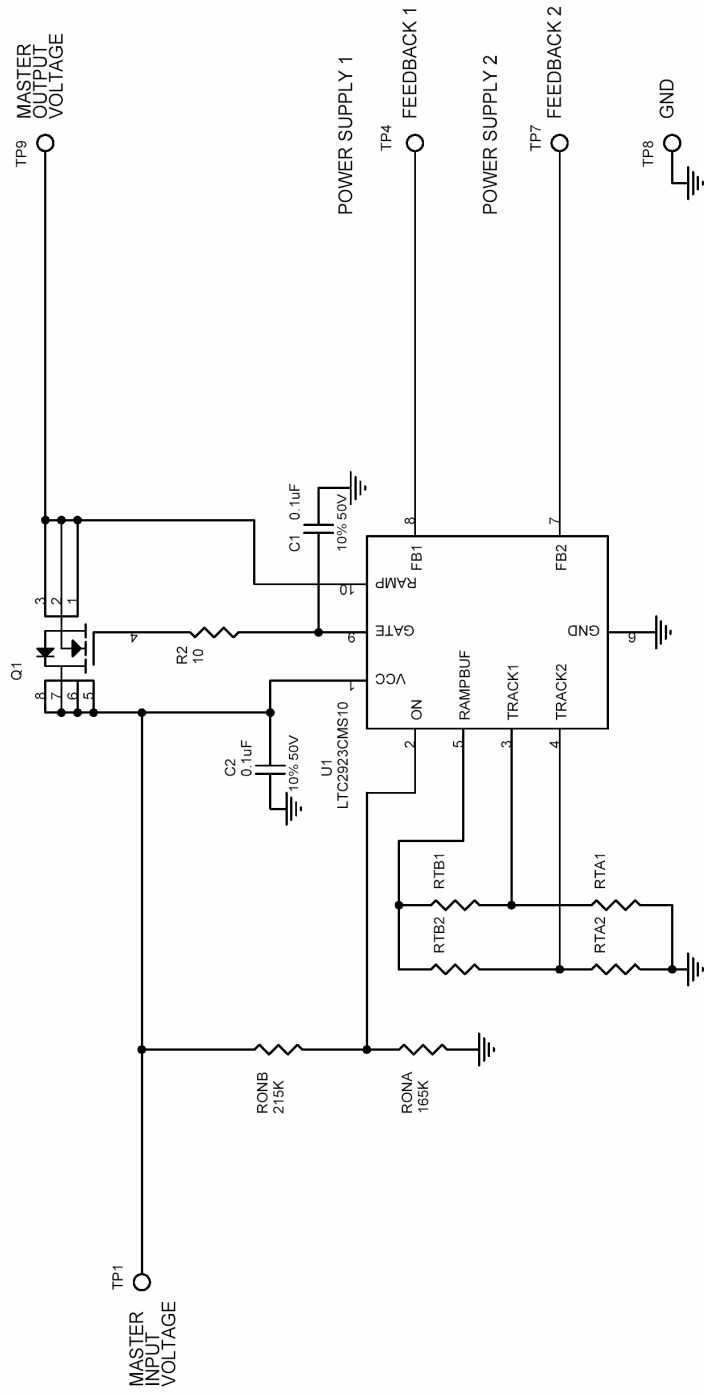
REVISION HISTORY

ECO	REV	DESCRIPTION	DATE	APPROVED
	2	PROTO	04/21/04	

TP9 MASTER OUTPUT VOLTAGE

POWER SUPPLY 1 — TP4 FEEDBACK 1

POWER SUPPLY 2 — TP7 FEEDBACK 2

TP8 GND

C1 0.1uF 10% 50V

C2 0.1uF 10% 50V

Q1

R2 10

U1 LTC2923CMS10

FB1 8 · RAMP 10 · GATE 9 · VCC 1 · ON 2 · RAMPBUF 5 · TRACK1 3 · TRACK2 4 · FB2 7 · GND 6

RTB1 / RTB2 / RTA1 / RTA2

RONB 215K

RONA 165K

TP1 MASTER INPUT VOLTAGE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLE - - -
2 PLACES - - - 3 PLACES - - -
INTERPRET DIM AND TOL
PER ASME Y14.5M -1994

THIRD ANGLE PROJECTION

CONTRACT NO.

APPROVALS	DATE
DRAWN MEI	09/30/03
CHECKED	
APPROVED	
ENGINEER	
DESIGNER	

LINEAR TECHNOLOGY

1630 McCarthy Blvd.
Milpitas, CA 95035
Phone: (408)432-1900 Fax: (408)434-0507

TITLE SCH, LTC2923CMS, POWER SUPPLY TRACKING AND SEQUENCING CONTROLLER

DWG NO DC732A

SIZE CAGE CODE | FILENAME732A-2.DSN | REV 2

SCALE NONE

Wednesday, April 21, 2004

SHEET 1 OF 1

DO NOT SCALE DRAWING

LINEAR TECHNOLOGY

5