# DEMO CIRCUIT 818
# QUICK START GUIDE

## LTC2924
## Quad Power Supply Sequencer

## DESCRIPTION

Demonstration circuit 818 is a Quad Power Supply Sequencer featuring the LTC2924.

Demonstration circuit 818 can configure the LTC2924 to sequence up to 4 power supplies via any combination of pass FETS or power supply enable control inputs. The 0.61V reference of the LTC2924 permits the DC818 to be easily modified by simple resistor changes to work with any voltage level from 5V down to 0.8V. The schematic provides a table of resistor values for common supply voltages: 5V, 3.3V, 3.0V, 2.8V, 2.5V, 1.8V, 1.6V, 1.2V and 1.0V. Refer to the data sheet for equations to calculate other voltages and hysteresis levels. Convenient test points are provided to facilitate evaluation of the power up and power down sequencing. Additional jumper options are provided to permit cascading multiple DC818s for additional channels.

The circuit board is assembled with four IRL3714ZS N-channel DD packaged MOSFETs capable of controlling up to 10A loads for connecting each of four rails with the an associated load. The board is designed to also accept SO-8 packaged MOSFETs for lower current operation.

In addition to the output voltage dividers, the circuit board also has two capacitors for sequence and Power Good signal timing adjustments, one resistor for setting the hysteresis current injected into each output voltage divider and two configuration jumpers for cascading boards for additional channels.



## PERFORMANCE SUMMARY

**Specification s are at $T_A$ = 25°C**

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Input Supply Range | | 3.0 | | 6.0 | V |
| $I_{CC}$ | Input Supply Current | $V_{IN}$ = 3.6V, $I_{LOAD}$ = 100mA | | 1.5 | 3.0 | mA |
| $V_{ON(TH)}$ | ON, Low to High Threshold | | 0.6000 | 0.6060 | 0.6121 | V |
| $V_{OFF(TH)}$ | ON, High to Low Threshold | | 0.6013 | 0.6074 | 0.6135 | V |
| $V_{INON(TH)}$ | IN1-IN4 Low to High Threshold | | 0.6020 | 0.6081 | 0.6142 | V |
| $V_{INOFF(TH)}$ | IN1-IN4 High to Low Threshold | | 0,6026 | 0.6087 | 0.6148 | V |
| $V_{OUT(EN)}$ | OUT1-OUT4 Gate Drive Voltage | | $V_{CC}$+4.5 | | $V_{CC}$+6 | V |
| $I_{OUT(EN)}$ | OUT1-OUT4 On Current | | 8.6 | 10 | 11.2 | µA |
| | | | | | | |

## OPERATING PRINCIPLES

The active high ON pin initiates the power on sequence when the applied voltage exceeds 0.61V. Upon sequence initiation, the Sequencer TIMER capacitor $C_{TMR}$ is charged by a 5uA current, generating a sequencing time pulse of $C_{TMR}$(uF)/5. At the end of each sequence timeout, the LTC2924 enables a successive power supply. Each supply is enabled by driving a 10uA current out of the appropriate OUTn pin. This current is derived from a charge pump capable of enhancing the gate of a NMOS pass FET or driving a power supply enable pin. A capacitor can be

connected to the OUTn pins to control the slew rate of each MOSFET controlled supply.

As the power supply turns on, the resistive divider connected to the IN1 pin starts to drive up the voltage at the IN1 pin. When the voltage at this pin exceeds 0.61V, a comparator signals the logic that the supply is on. The timer circuit is enabled again and the cycle repeats until the last power supply has turned on. The power off sequence is initiated by pulling the ON pin voltage below 0.61V after a power on sequence has completed. The power off sequence turns off the power supply in the reverse order of the power on sequence. OUT4 is turned off first. The timer function is used between each supply being sequenced down.

## QUICK START PROCEDURE

Demonstration circuit 818 is easy to set up to evaluate the performance of the LTC2924.

Install all four jumpers in position 1.

Connect an ON signal source to the ON pin circuit (TP7 or TP8, the latter provides a voltage divider which can be configured as an under voltage lockout.) The voltage on TP7 should be less than 0.55V.

Connect four external power supply outputs (3.3V, 2.5V, 1.8V, and 1.2V) to appropriate INPUT pins (TP3, TP4, TP5, and TP6). Refer to the table on the schematic or the data sheet to change the dividers to support other voltages.

Attach optional loads to TP11, TP12, TP13 and TP14 (up to 10 amps depending on acceptable voltage drop).

Initiate the turn on sequence by raising the ON signal source so that TP7 is above 0.62V and observe the load voltage transitions on the four channel scope (see figure 1).

Drop the ON pin voltage below 0.55V (or to ground) to observe the turn off sequence (see Figure 2). NOTE: Output voltage decay will vary with load and capacitance.

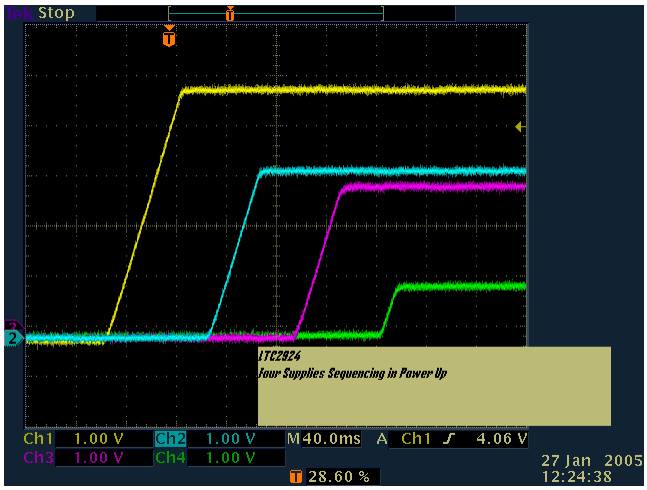



**Figure 1. Power up mode**

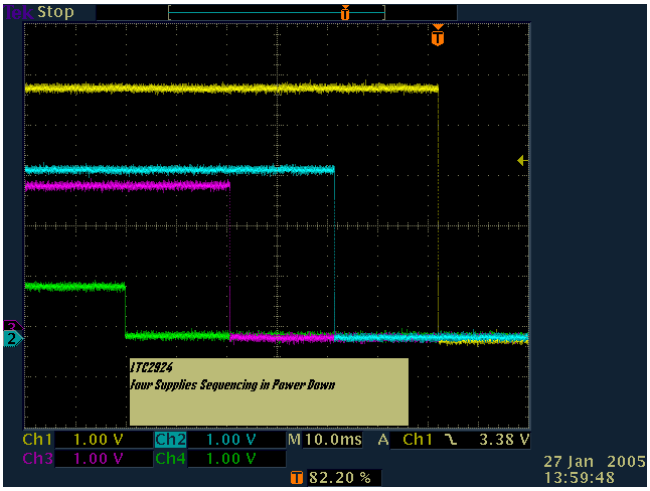
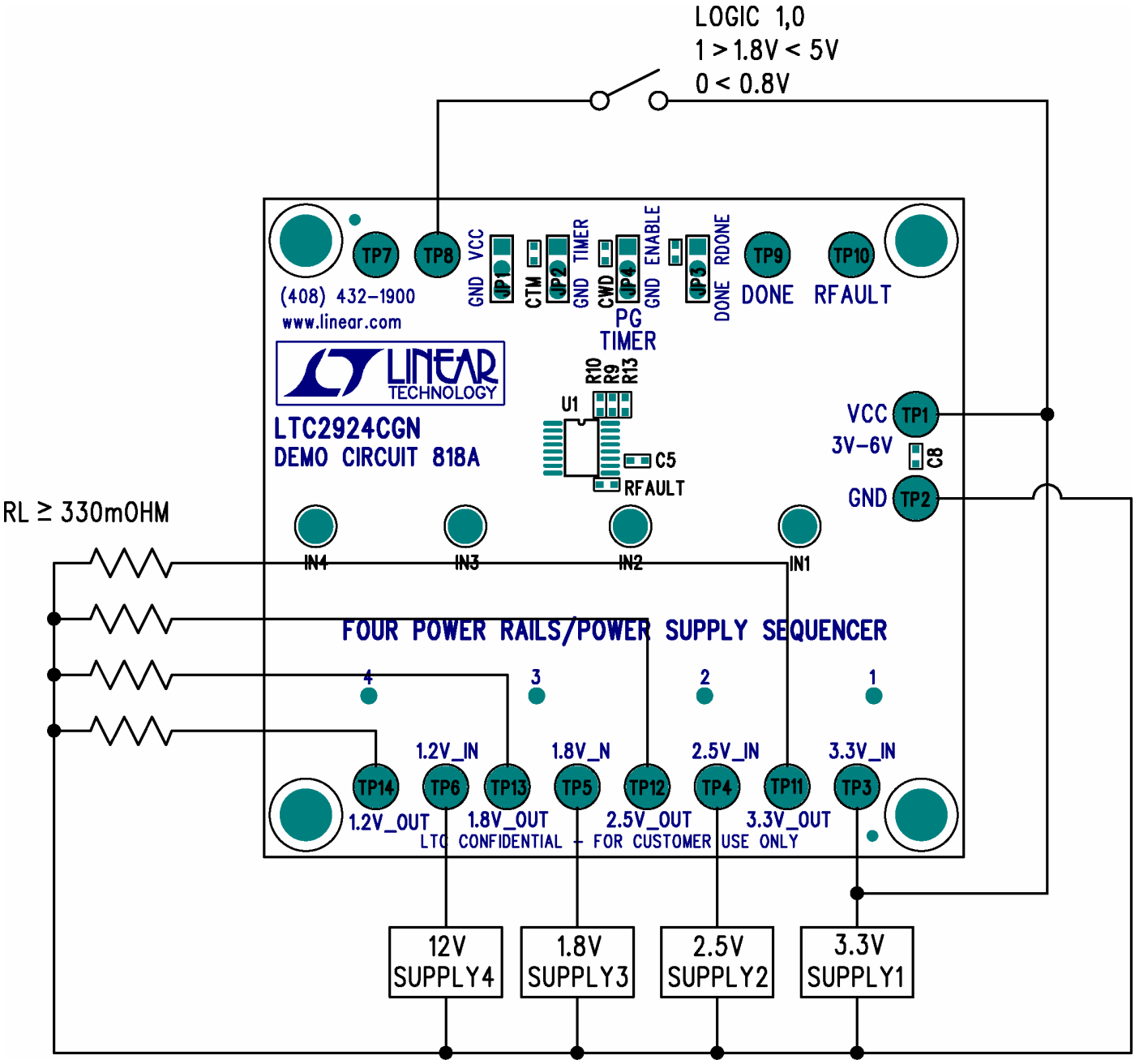
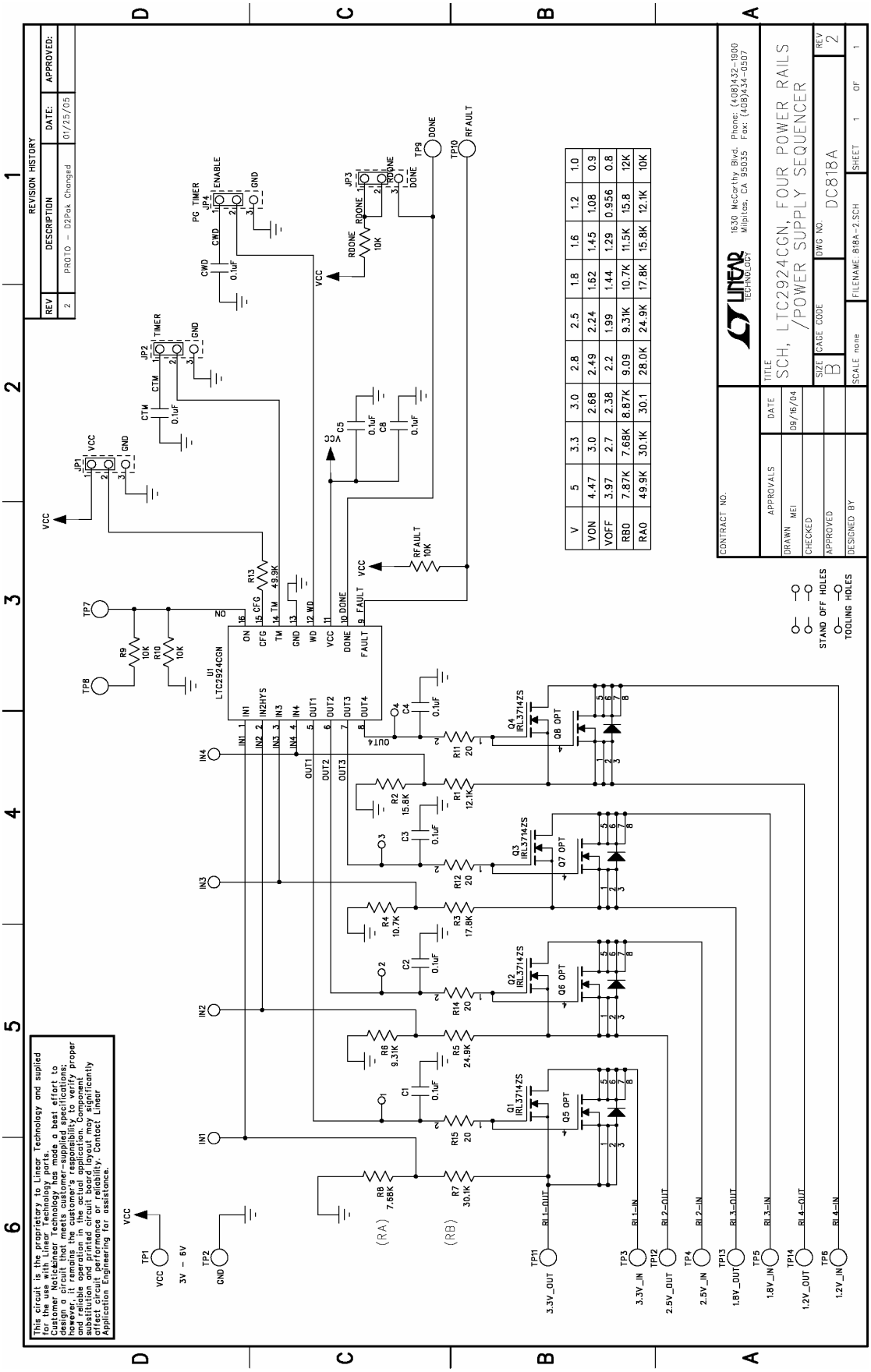



**Figure 2. Power down mode**


LOGIC 1,0
1 > 1.8V < 5V
0 < 0.8V
TP7
TP8
GND VCC
JP1
CTM
JP2
GND TIMER
CWD
JP4
GND ENABLE
JP3
DONE RDONE
TP9
TP10
DONE
RFAULT
(408) 432-1900
www.linear.com
PG
TIMER
LINEAR TECHNOLOGY
LTC2924CGN
DEMO CIRCUIT 818A
R10
R9
R13
U1
C5
RFAULT
VCC
TP1
3V-6V
C8
GND
TP2
RL ≥ 330mOHM
IN4
IN3
IN2
IN1
FOUR POWER RAILS/POWER SUPPLY SEQUENCER
4
3
2
1
1.2V_IN
1.8V_N
2.5V_IN
3.3V_IN
TP14
TP6
TP13
TP5
TP12
TP4
TP11
TP3
1.2V_OUT
1.8V_OUT
2.5V_OUT
3.3V_OUT
LTC CONFIDENTIAL – FOR CUSTOMER USE ONLY
12V
SUPPLY4
1.8V
SUPPLY3
2.5V
SUPPLY2
3.3V
SUPPLY1


REVISION HISTORY
REV
DESCRIPTION
DATE:
APPROVED:
2
PROTO – D2Pak Changed
01/25/05
This circuit is the proprietary to Linear Technology and supplied for the 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 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 Application Engineering for assistance.
U1
LTC2924CGN
JP1
JP2
JP3
JP4
PG TIMER
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11
TP12
TP13
TP14
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
RFAULT 10K
RDONE 10K
CTIM 0.1uF
CWD 0.1uF
C1
C2
C3
C4
C5
C8
Q1 IRL3714ZS
Q2 IRL3714ZS
Q3 IRL3714ZS
Q4 IRL3714ZS
Q5 OPT
Q6 OPT
Q7 OPT
Q8 OPT
(RA)
(RB)
V 5 3.3 3.0 2.8 2.5 1.8 1.6 1.2 1.0
VON 4.47 3.0 2.68 2.49 2.24 1.62 1.45 1.08 0.9
VOFF 3.97 2.7 2.38 2.2 1.99 1.44 1.29 0.956 0.8
RB0 7.87K 7.68K 8.87K 9.09 9.31K 10.7K 11.5K 15.8 12K
RA0 49.9K 30.1K 30.1 28.0K 24.9K 17.8K 15.8K 12.1K 10K
STAND OFF HOLES
TOOLING HOLES
CONTRACT NO.
APPROVALS
DRAWN MEI
DATE 09/16/04
CHECKED
APPROVED
DESIGNED BY
LINEAR TECHNOLOGY
1630 McCarthy Blvd. Milpitas, CA 95035 Phone: (408)432-1900 Fax: (408)434-0507
TITLE
SCH, LTC2924CGN, FOUR POWER RAILS /POWER SUPPLY SEQUENCER
SIZE B
CAGE CODE
DWG NO. DC818A
REV 2
SCALE none
FILENAME 818A-2.SCH
SHEET 1 OF 1