

## LTC4412/LTC4414: Dual Low Loss High Voltage PowerPath Controllers

### DESCRIPTION

Demonstration circuit 1635A features the [LTC®4412HVIS6](#) and [LTC4414EMS8](#), low loss PowerPath™ controllers. Each controller is capable of automatically switching between primary and auxiliary power sources for a single output. There are two electrically isolated circuits, one for each IC, for independent evaluation. The LTC4412 circuit is intended for lower current loads, while the LTC4414 circuit is capable of driving larger PMOS devices for higher current loads.

The input supply voltage ranges are from 2.5V to 36V for LTC4412 and 5V to 36V for LTC4414. As initially configured with the default MOSFET, the LTC4412 circuit maximum input voltage is 18V. The LTC4412 and LTC4414 circuit current limits are 2A and 8A respectively.

The primary power paths can be controlled with external logic applied to the CTL pins. PowerPath status can be monitored using the STAT pins. Evaluation of higher current or more complex sourcing systems can be accomplished by installing additional ICs, as well as paralleling the inputs and/or outputs using the *optional* supplied pads. Multiple standard MOSFET package options are also available on each circuit for evaluation convenience.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC1635A>**

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### PERFORMANCE SUMMARY Specifications are at T<sub>A</sub> = 25°C

PARAMETER	CONDITIONS	VALUE	UNIT
Minimum LTC4412 Input Voltage	V <sub>IN1</sub>	2.5	V
Maximum LTC4412 Input Voltage	V <sub>IN1</sub> and V <sub>AUX1</sub>	18	V
LTC4412 Maximum Current	MOSFET Limited	2	A
Minimum LTC4414 Input Voltage	V <sub>IN2</sub> and V <sub>AUX2</sub>	5	V
Maximum LTC4414 Input Voltage	V <sub>IN2</sub> and V <sub>AUX2</sub>	36	V
LTC4414 Maximum Current	MOSFET Limited	8	A

## QUICK START PROCEDURE

Demonstration circuit 1635A is easy to set up to evaluate the performance of LTC4412 and LTC4414. Refer to Figure 1 for proper measurement equipment setup of both circuits and follow the procedures below.

### LTC4412 Circuit

1. With all power off, connect auxiliary ( $V_{AUX1}$ ) and primary ( $V_{IN1}$ ) power supplies capable of 2A each, the system load and meters as shown in Figure 1.
2. Preset the system load to 0A and the input supplies to 0V, 0A current limit.
3. Connect the system load to the output terminals,  $V_{OUT1}$  and GND1.
4. Turn on the supplies, setting the current limit up to 2A. Adjust the voltages to the desired value, up to 18V. The higher voltage of the two supplies should appear at the output.
5. Turn the load on and adjust as necessary.
6. Adjust the supplies and observe how the output switches over to follow the higher voltage of the two sources.

### LTC4414 Circuit

1. With all power off, connect auxiliary ( $V_{AUX2}$ ) and primary ( $V_{IN2}$ ) power supplies capable of 8A each, the system load, and meters as shown in Figure 1.
2. Preset the system load to 0A and the input supplies to 0V, 0A current limit.
3. Connect the system load to the output terminals,  $V_{OUT2}$  and GND2.
4. Turn on the supplies, setting the current limit up to 8A. Adjust the voltages to the desired value, up to 36V. The higher voltage of the two supplies should appear at the output.
5. Turn the load on and adjust as necessary.
6. Adjust the supplies and observe how the output switches over to follow the higher voltage of the two sources.

### Optional

7. For improved current handling, install additional MOSFETs, select from different package footprints, or shunt the two circuits at  $V_{IN}$ ,  $V_{OUT}$  and GND.
8. For source-load back-to-back isolation, remove jumpers JMP1 and JMP2, and/or JMP3 and JMP4, then install additional MOSFETs back-to-back as shown in Figure 2.
9. For external control of the primary source power path, remove the 0 $\Omega$  jumper on the CTL1 or CTL2 pin, R2 or R5 respectively. Apply the logic-control signal on CTL1 or CTL2 as necessary.

QUICK START PROCEDURE

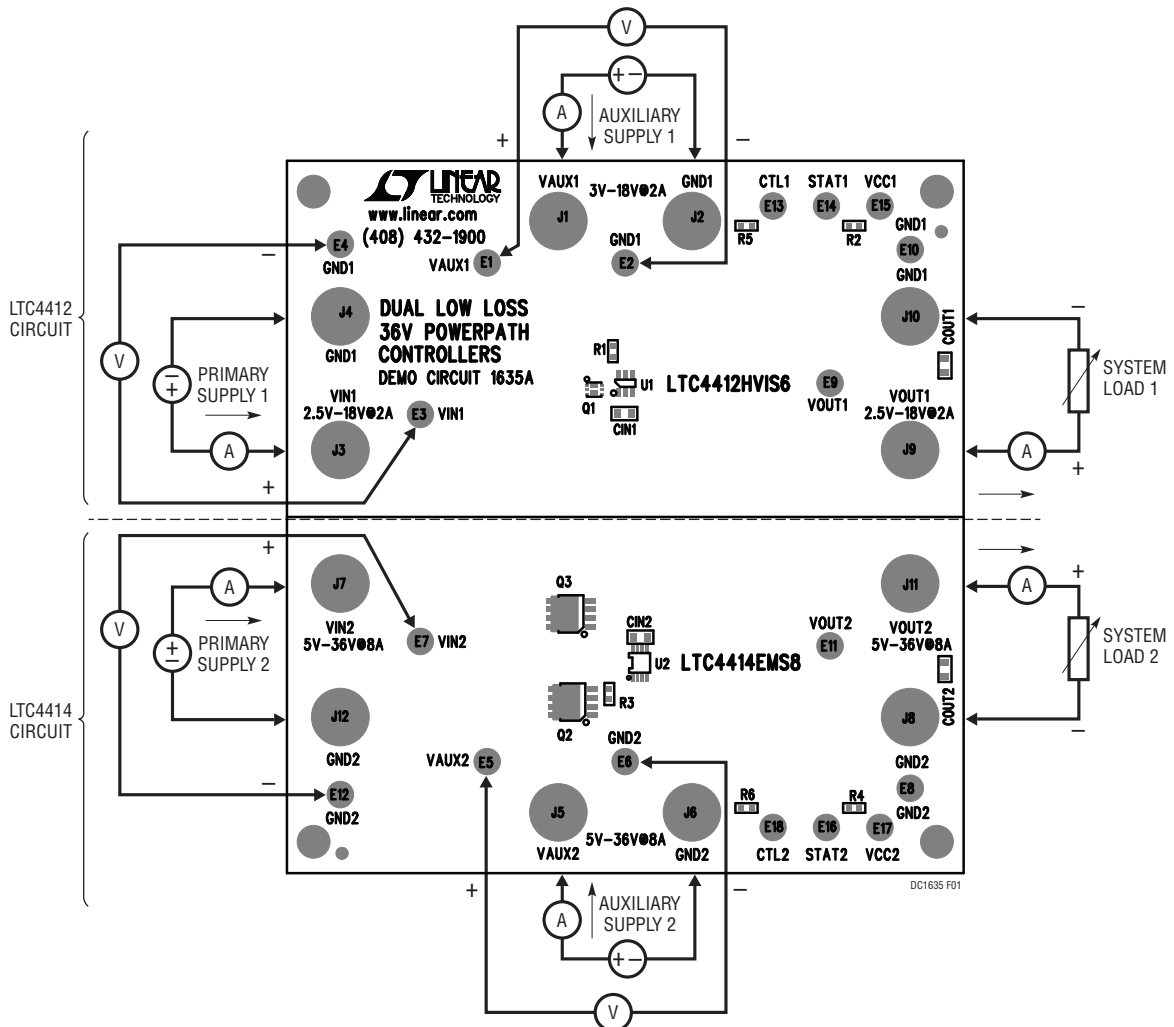


Figure 1. Test Setup of DC1635A

## QUICK START PROCEDURE

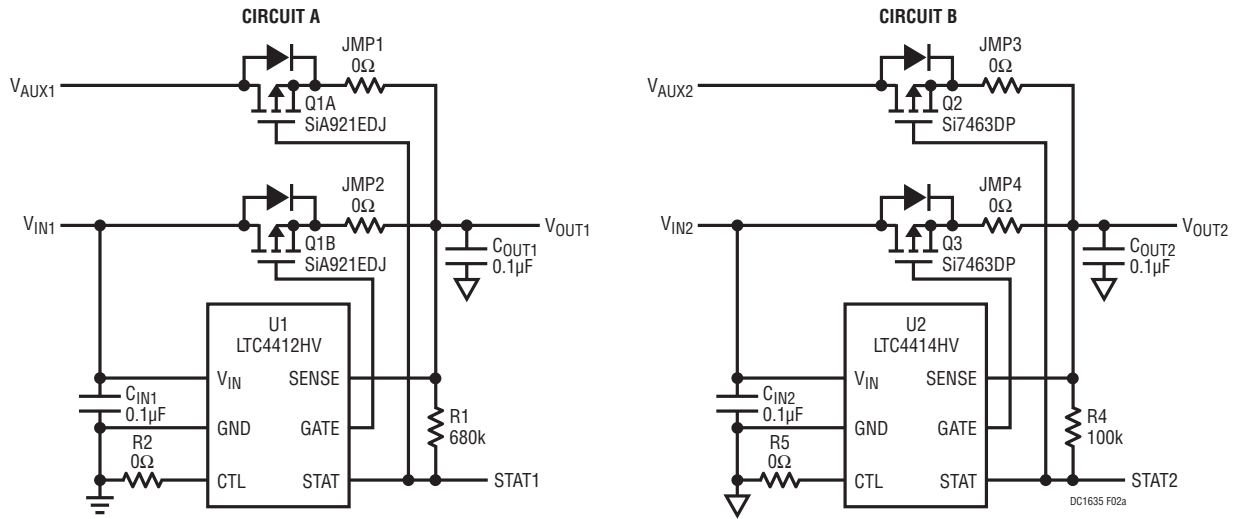


Figure 2a. Standard Configurations with Automatic Switchover Between Sources

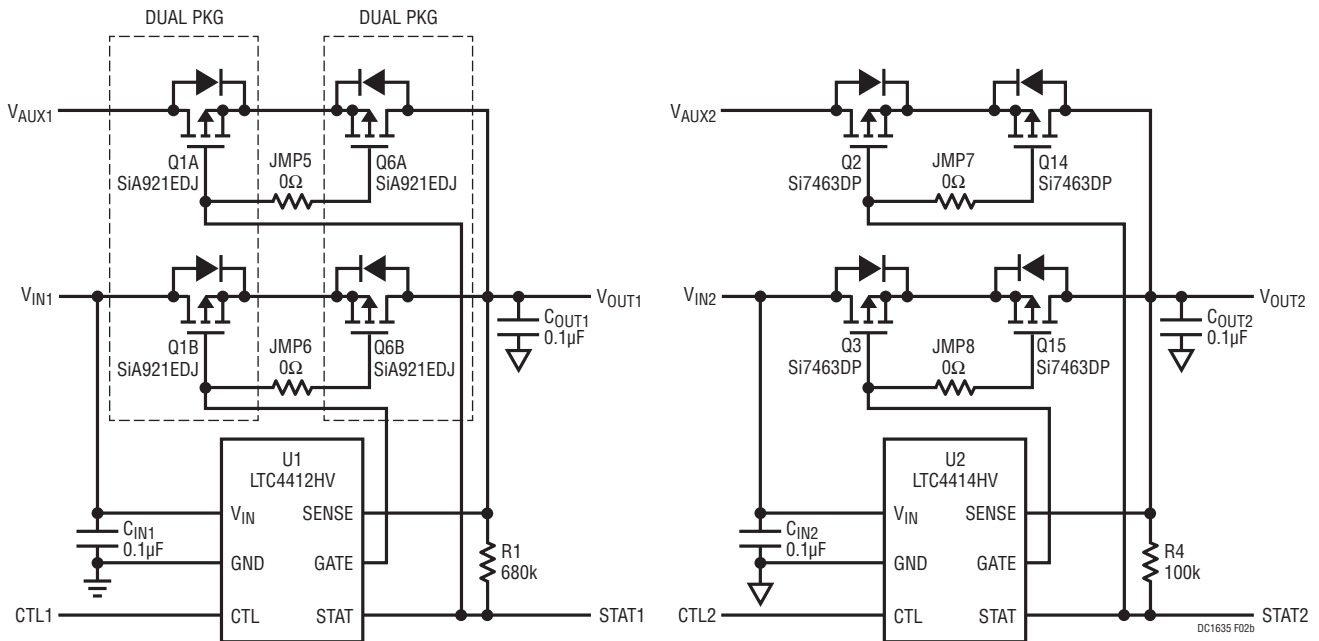


Figure 2b. Optional, Fully-Isolated Configurations with External Logic Control

Diodes shown are body diodes of their respective MOSFETs. Do not install extra diodes or the operation of the power paths may be compromised.

QUICK START PROCEDURE

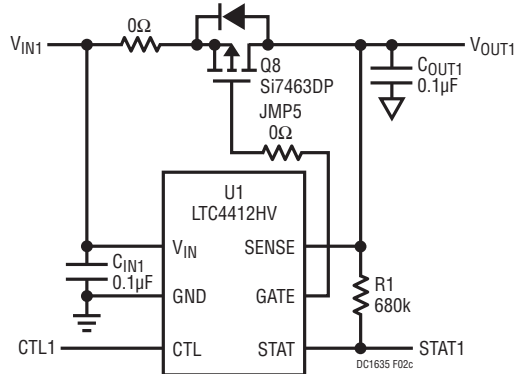


Figure 2c. Optional, High Side Switch with Logic Control and Status Output (Requires 0Ω Jumper Across Drain-Source Pins of Q7)

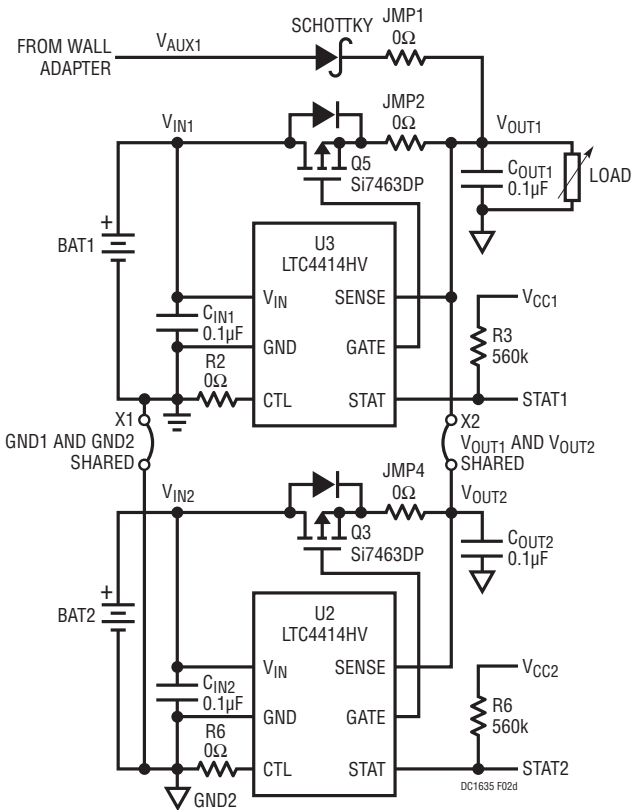


Figure 2d. Optional, High Current Dual Battery Load Sharing with Automatic Switchover and Status Output

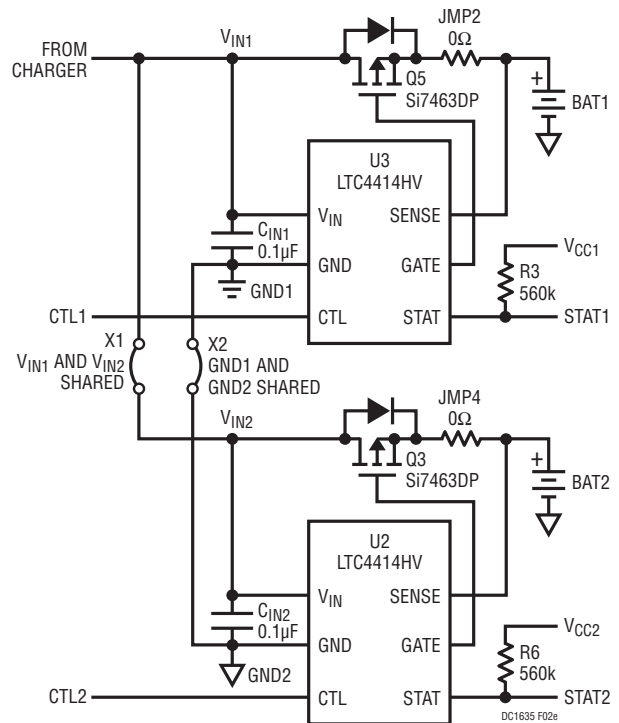
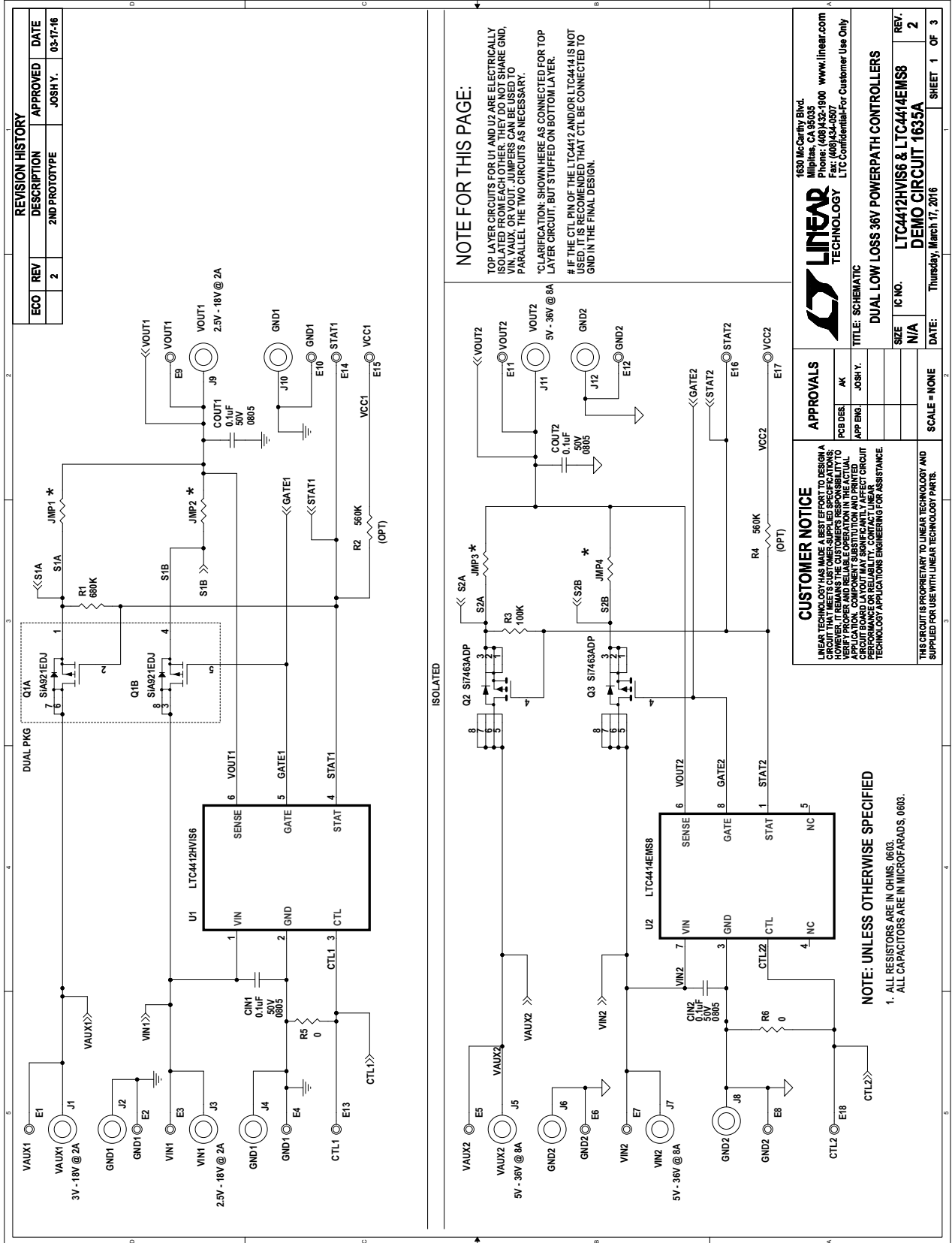
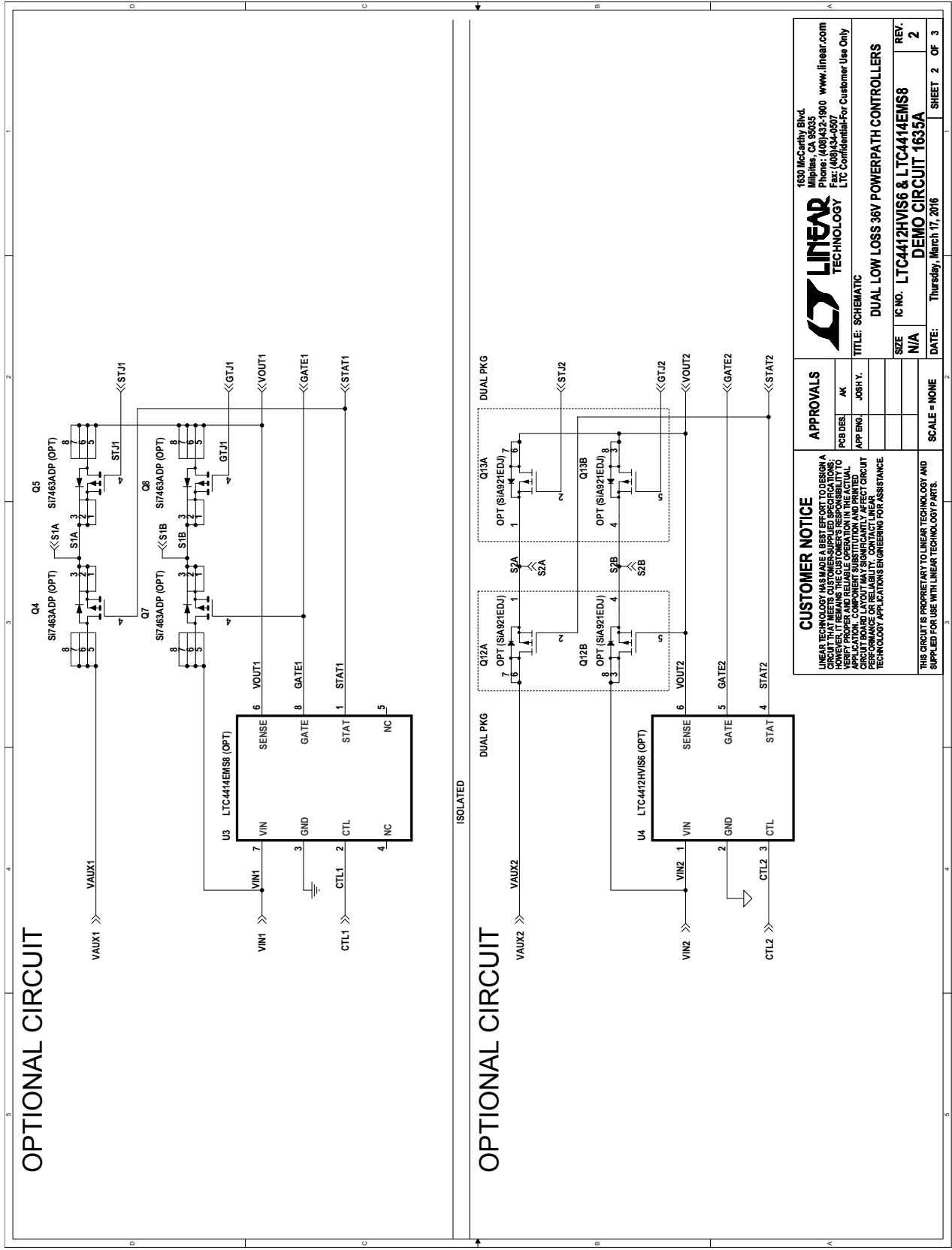


Figure 2e. Optional, Dual Battery Charging with Logic Select and Status Output

## SCHEMATIC DIAGRAMS



SCHEMATIC DIAGRAMS



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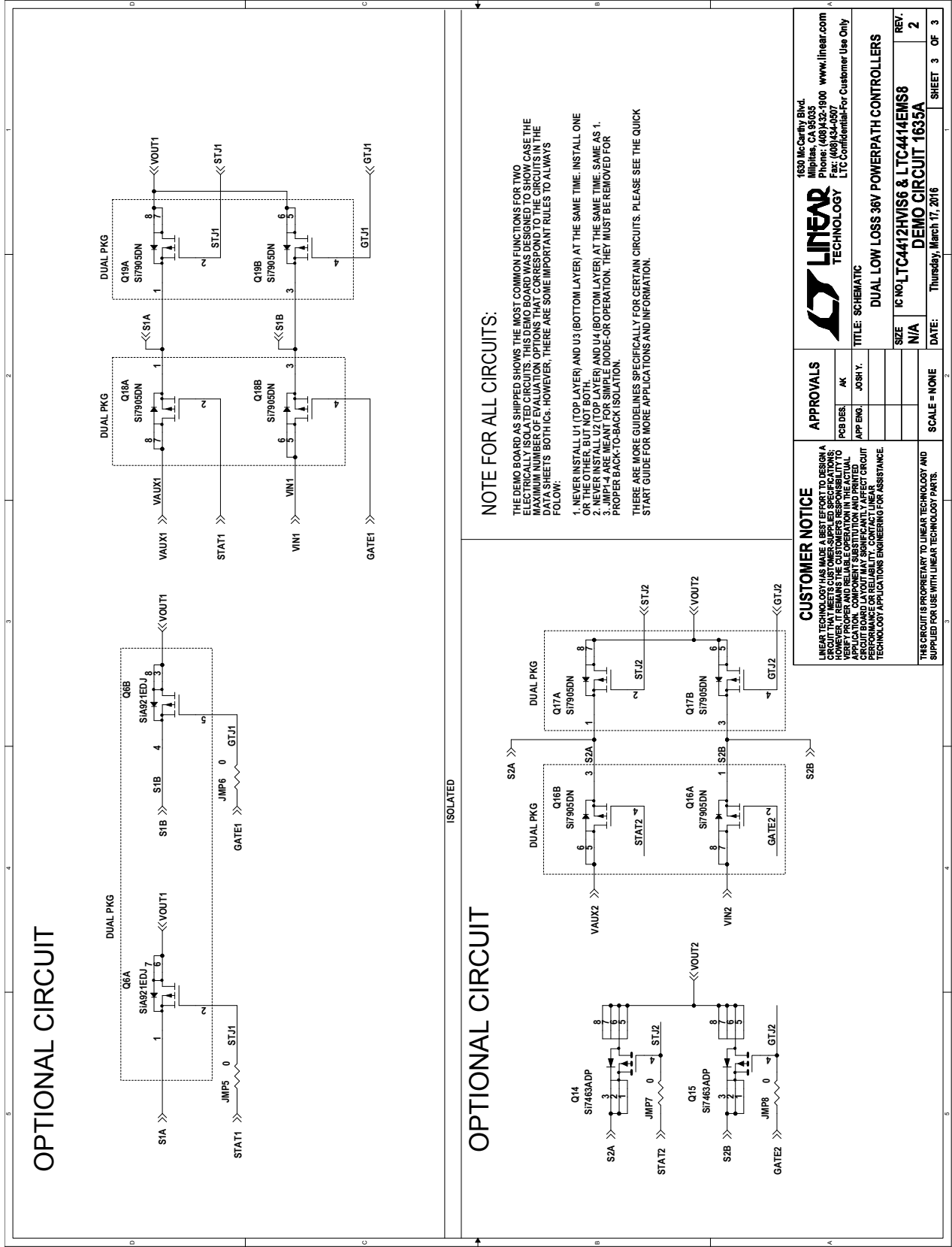
**APPROVALS**

PCB DES.	AK
APP ENG.	
JOSH Y.	

**SCALE = NONE**

**SIZE** N/A **REV.** 2  
**IC NO.** LTC4412HVIS6 & LTC4414EMSS **DEMO CIRCUIT 1635A**  
**TITLE:** SCHEMATIC **DUAL LOW LOSS 38V POWERPATH CONTROLLERS**  
**DATE:** Thursday, March 17, 2016 **SHEET 2 OF 3**

## SCHEMATIC DIAGRAMS



**NOTE FOR ALL CIRCUITS:**

THE DEMO BOARD AS SHIPPED SHOWS THE MOST COMMON FUNCTIONS FOR TWO ELECTRICAL ISOLATION FEED CIRCUITS. INDIVIDUALS DESIGNED TO SHOW CASE THE MAXIMUM NUMBER OF EVALUATION OPTIONS THAT CORRESPOND TO THE CIRCUITS IN THE DATA SHEETS BOTH ICs. HOWEVER, THERE ARE SOME IMPORTANT RULES TO ALWAYS FOLLOW:

1. NEVER INSTALL U1 (TOP LAYER) AND U3 (BOTTOM LAYER) AT THE SAME TIME. INSTALL ONE OR THE OTHER BUT NOT BOTH.
2. NEVER INSTALL U2 (TOP LAYER) AND U4 (BOTTOM LAYER) AT THE SAME TIME. SAME AS 1.
3. JMP1-4 ARE MEANT FOR SIMPLE DIODE-OR OPERATION, THEY MUST BE REMOVED FOR PROPER BACK-TO-BACK ISOLATION.

THERE ARE MORE GUIDELINES SPECIFICALLY FOR CERTAIN CIRCUITS. PLEASE SEE THE QUICK START GUIDE FOR MORE APPLICATIONS AND INFORMATION.

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<b>APPROVALS</b>		TITLE: SCHEMATIC	
PCB DES.	/AK	SIZE	IC NO. L7C4412HVS6 & L7C4414EMS8
APP ENG.	JOSH Y.	REV.	2
SCALE = NONE		DATE:	Thursday, March 17, 2016
THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.		SHEET 3 OF 3	



## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	4	C <sub>OUT1</sub> , C <sub>IN1</sub> , C <sub>OUT2</sub> , C <sub>IN2</sub>	CAP, X7R, 0.1μF, 50V, 10% 0805	AVX, 08055C104KAT2A
2	1	Q1	DUAL P-CHAN., 20V/4.5A	VISHAY, SiA921EDJ-T1-GE3
3	2	Q2, Q3	MOSFET P-CHAN., 40V/10A	VISHAY, Si7463DP-T1-GE3
4	1	R1	RES., CHIP, 690k, 1%, 0603	VISHAY, CRCW0603690KFKEA
5	1	R3	RES., CHIP, 100k, 1%, 0603	VISHAY, CRCW0603100KFKEA
6	2	R5, R6	RES., CHIP, 0Ω, 0603	VISHAY, CRCW06030000Z0EA
7	1	U1	I.C., LTC4412HVIS6	LINEAR TECH., LTC4412HVIS6#PBF
8	1	U2	I.C., LTC4414EMS8	LINEAR TECH., LTC4414EMS8#PBF
<b>Additional Circuit Components</b>				
1	0	Q6, Q12, Q13	OPT	VISHAY, SiA921EDJ-T1-GE3
2	0	Q4, Q5, Q7, Q8, Q14, Q15	OPT	VISHAY, Si7463DP-T1-GE3
3	0	Q16, Q17, Q18, Q19	OPT	VISHAY, Si7905DN-T1-E3
4	4	JMP1, JMP2, JMP3, JMP4	JUMPER, 1206	TEPRO, RN6087
5	2	R2, R4	RES., CHIP, 560k, 1%, 0603	VISHAY, CRCW0603560KFKEA
6	0	JMP5, JMP6, JMP7, JMP8	RES., 0603 OPT	
7	0	U3	I.C., LTC4414EMS8 OPT	LINEAR TECH., LTC4414EMS8#PBF
8	0	U4	I.C., LTC4412HVIS6 OPT	LINEAR TECH., LTC4412HVIS6#PBF
<b>Hardware-For Demo Board Only</b>				
1	18	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10	TEST POINT, TURRET, 0.095"	MILL-MAX, 2501-2-00-80-00-00-07-0
		E11, E12, E13, E14, E15, E16, E17, E18	TEST POINT, TURRET, 0.095"	MILL-MAX, 2501-2-00-80-00-00-07-0
2	12	J1, J2, J3, J4, J5, J6, J7, J8, J10, J11, J12	BANANA JACK	KEYSTONE, 575-4
3	4	(STAND OFF)	STAND OFF, NYLON 0.25"	KEYSTONE, 8831 (SNAP ON)

# DEMO MANUAL DC1635A

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