

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>

LT, LT, LTC, LTM, Linear Technology and the Linear Logo are registered trademarks and PowerPath is a trademark of Linear Technology Corporation. All other trademarks are the property of their respective owners.

PERFORMANCE SUMMARY Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	VALUE	UNIT
Minimum LTC4412 Input Voltage	V _{IN1}	2.5	V
Maximum LTC4412 Input Voltage	V _{IN1} and V _{AUX1}	18	V
LTC4412 Maximum Current	MOSFET Limited	2	A
Minimum LTC4414 Input Voltage	V _{IN2} and V _{AUX2}	5	V
Maximum LTC4414 Input Voltage	V _{IN2} and V _{AUX2}	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 Ω 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

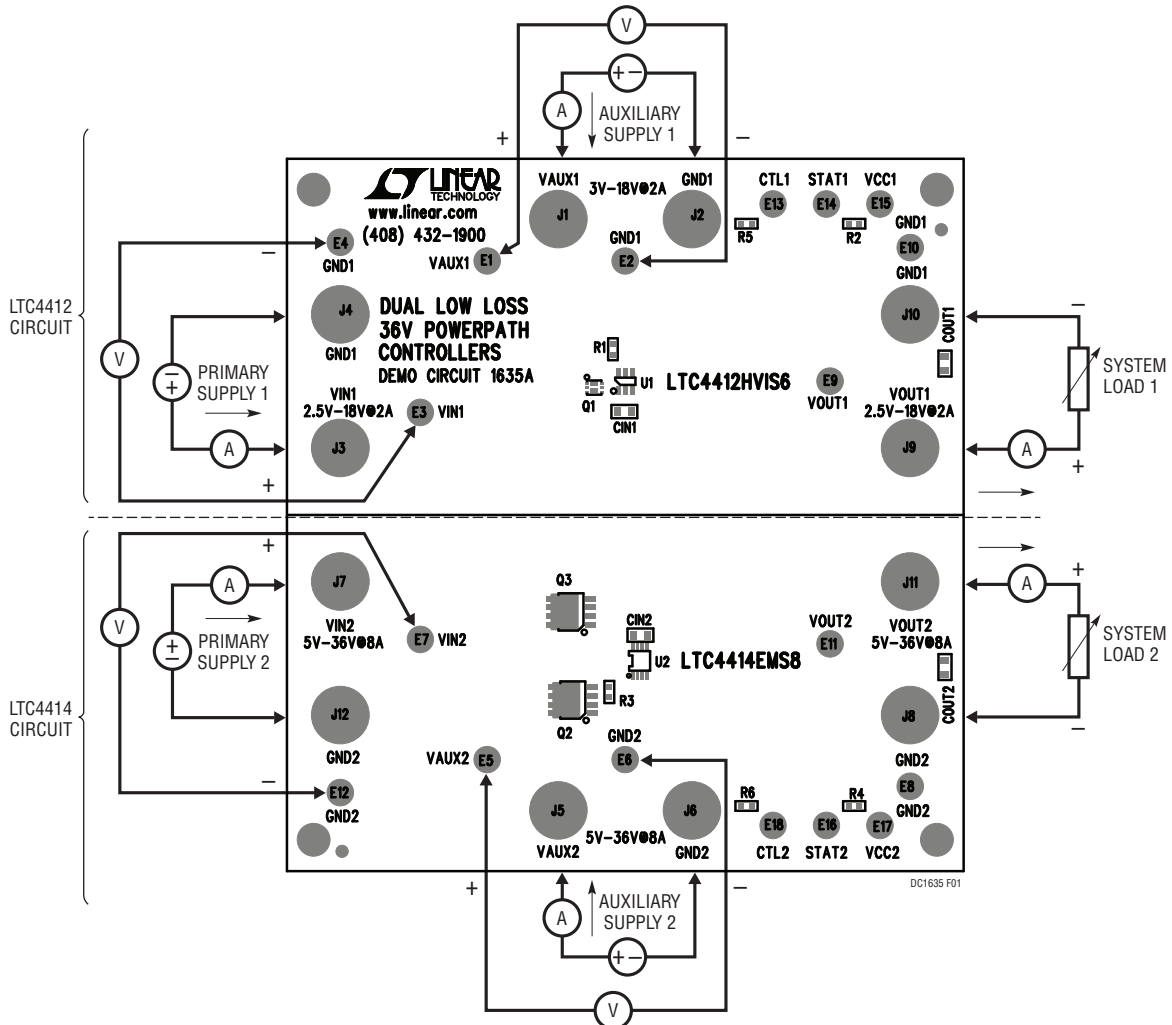


Figure 1. Test Setup of DC1635A

QUICK START PROCEDURE

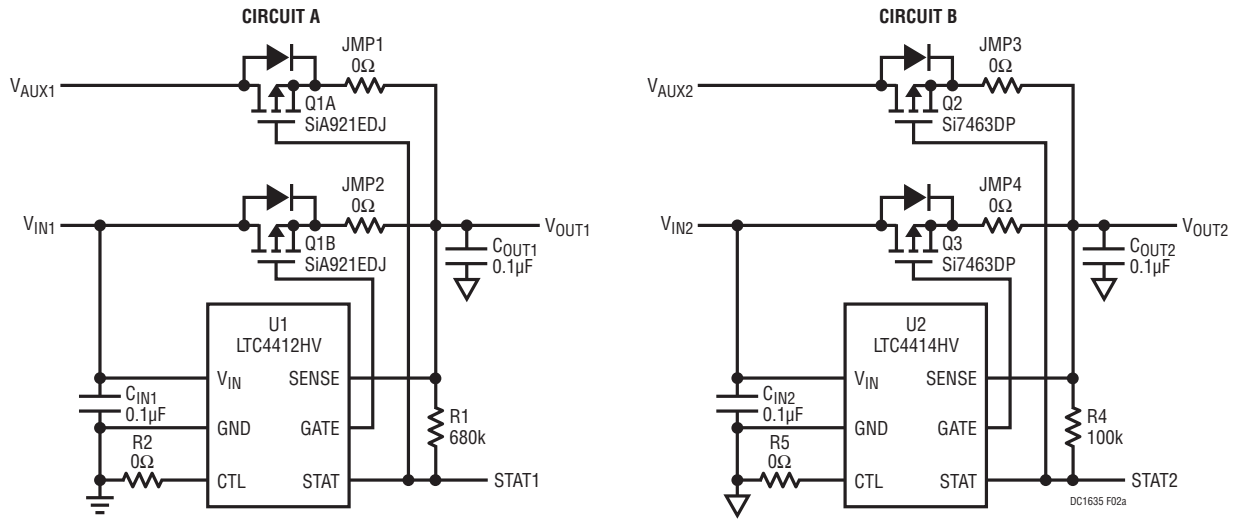


Figure 2a. Standard Configurations with Automatic Switchover Between Sources

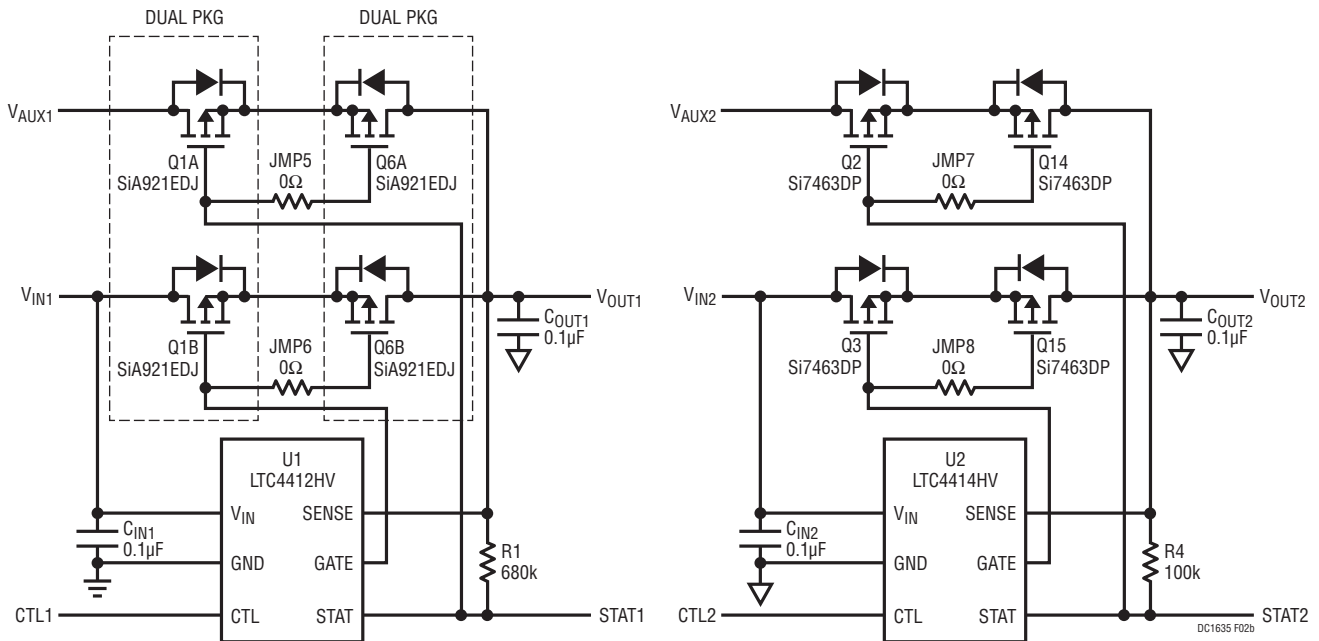


Figure 2b. Optional, Fully-Isolated Configurations with External Logic Control

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

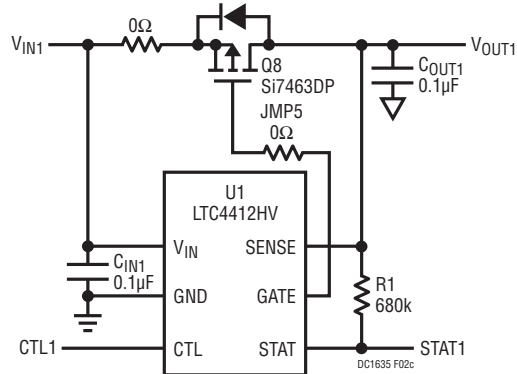


Figure 2c. Optional, High Side Switch with Logic Control and Status Output (Requires 0Ω Jumper Across Drain-Source Pins of Q7)

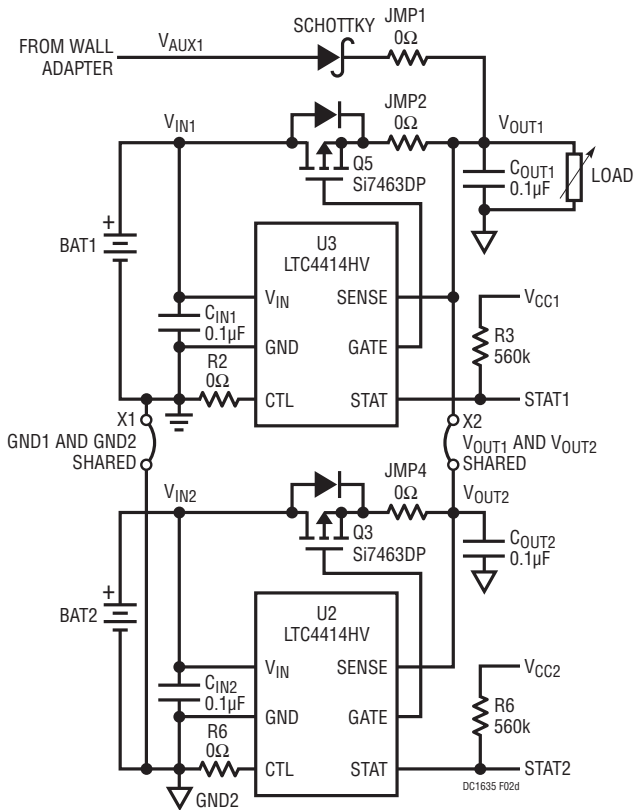


Figure 2d. Optional, High Current Dual Battery Load Sharing with Automatic Switchover and Status Output

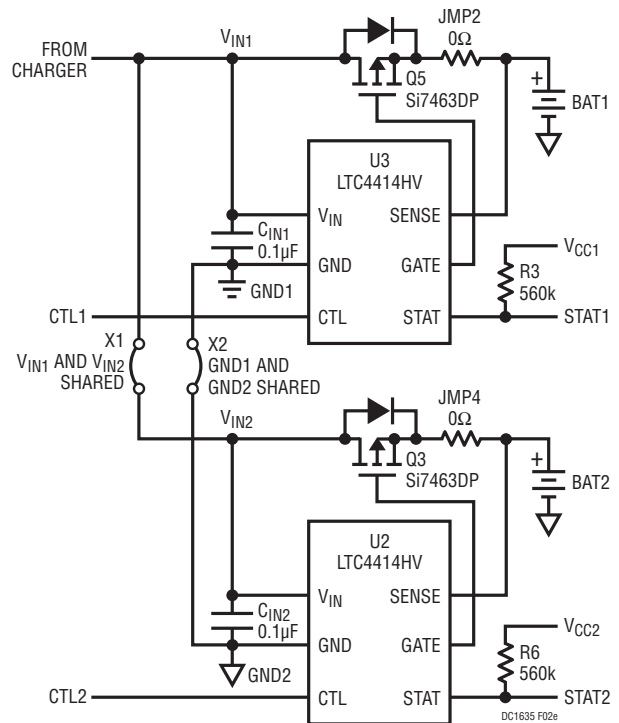
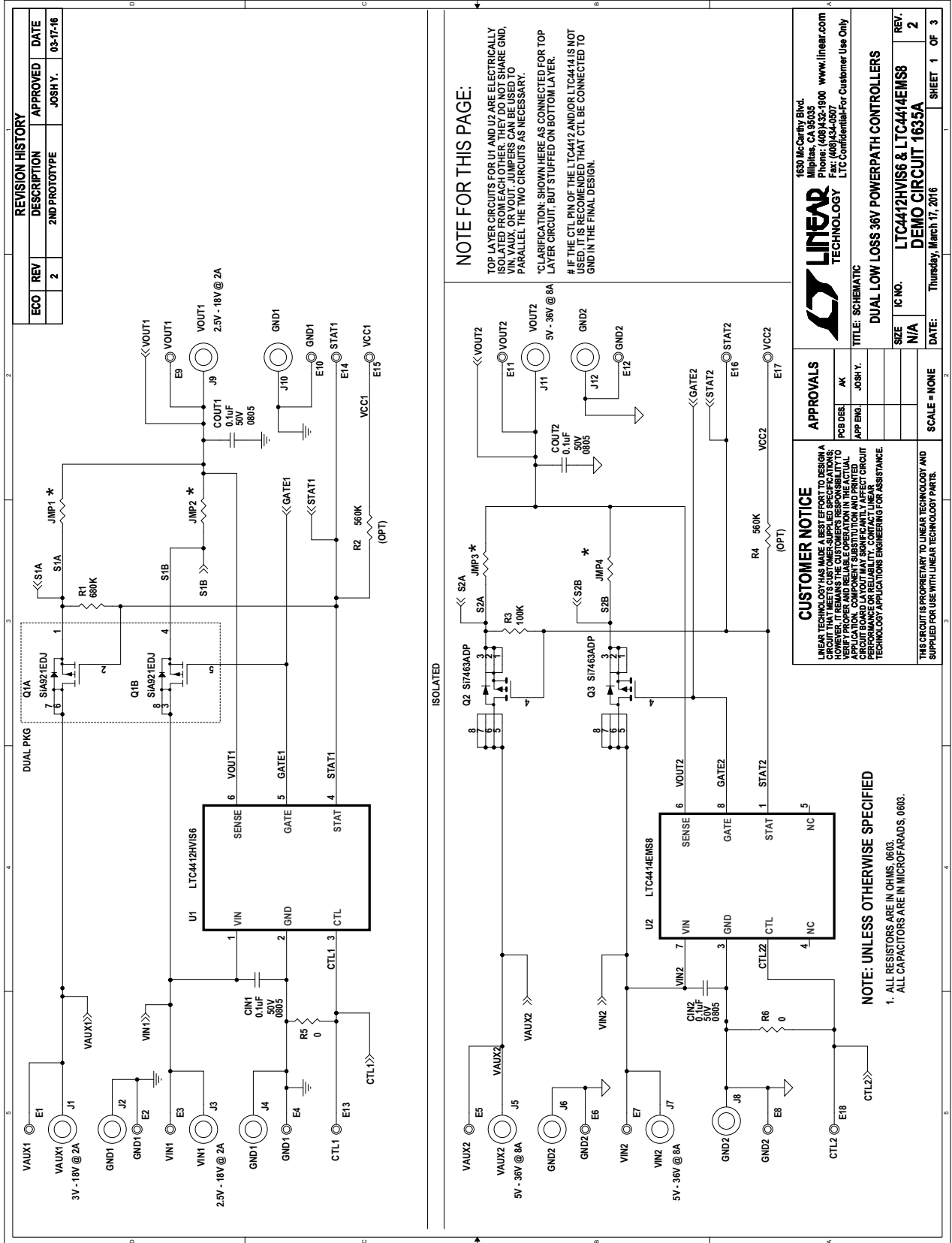
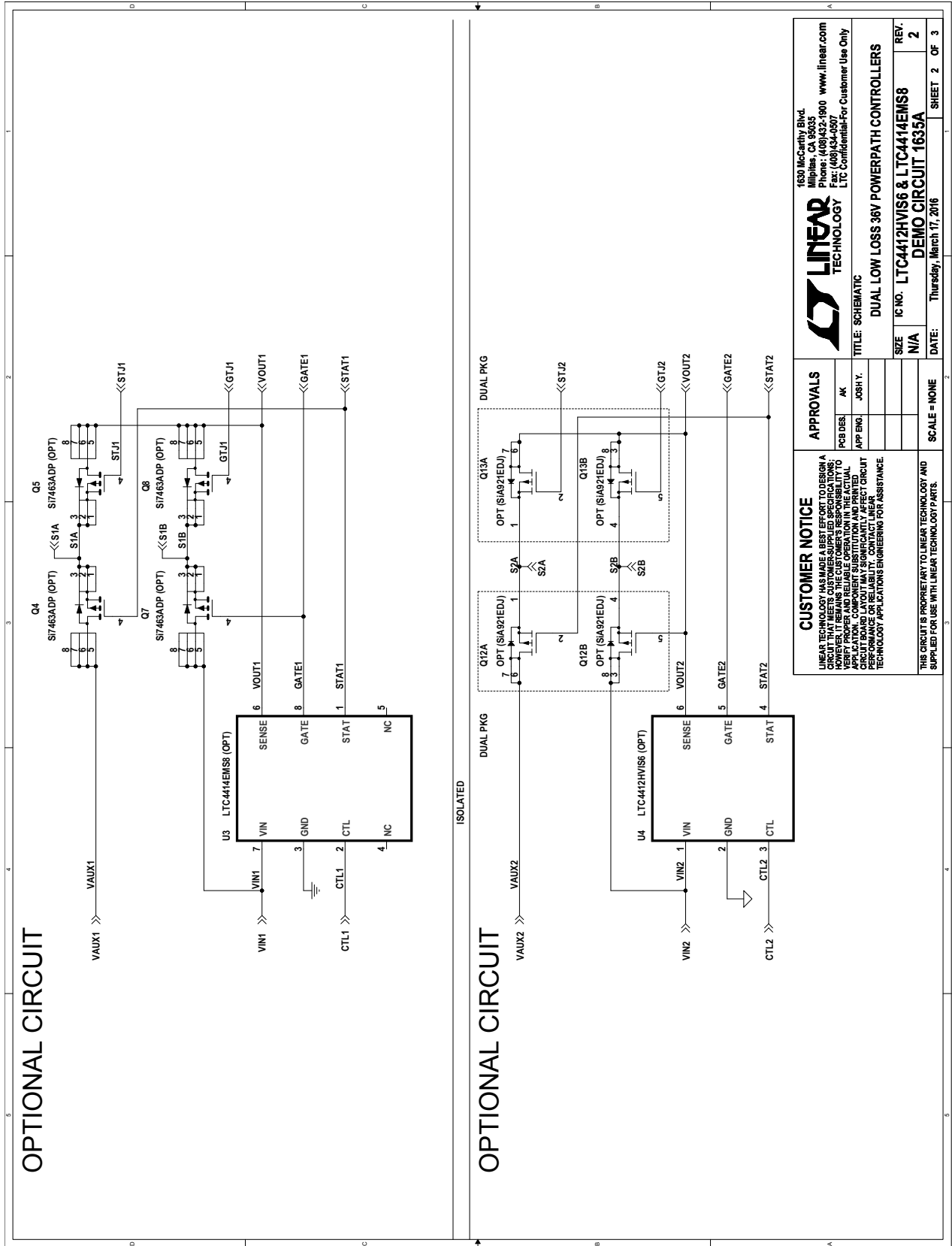


Figure 2e. Optional, Dual Battery Charging with Logic Select and Status Output

SCHEMATIC DIAGRAMS



SCHEMATIC DIAGRAMS



LINEAR TECHNOLOGY
 1630 McCarthy Blvd.
 Milpitas, CA 95035
 Phone: (408)432-1900 www.linear.com
 Fax: (408)434-6507
 LTC Confidential-For Customer Use Only

CUSTOMER NOTICE
 LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A COMPLETELY INTEGRATED POWER SUPPLY SOLUTION. HOWEVER, THE USER MUST VERIFY THE APPLICATION, COMPONENT SUBSTITUTION AND PRINTED CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.

APPROVALS

PCB DES.	AK
APP ENG.	
JOSH Y.	

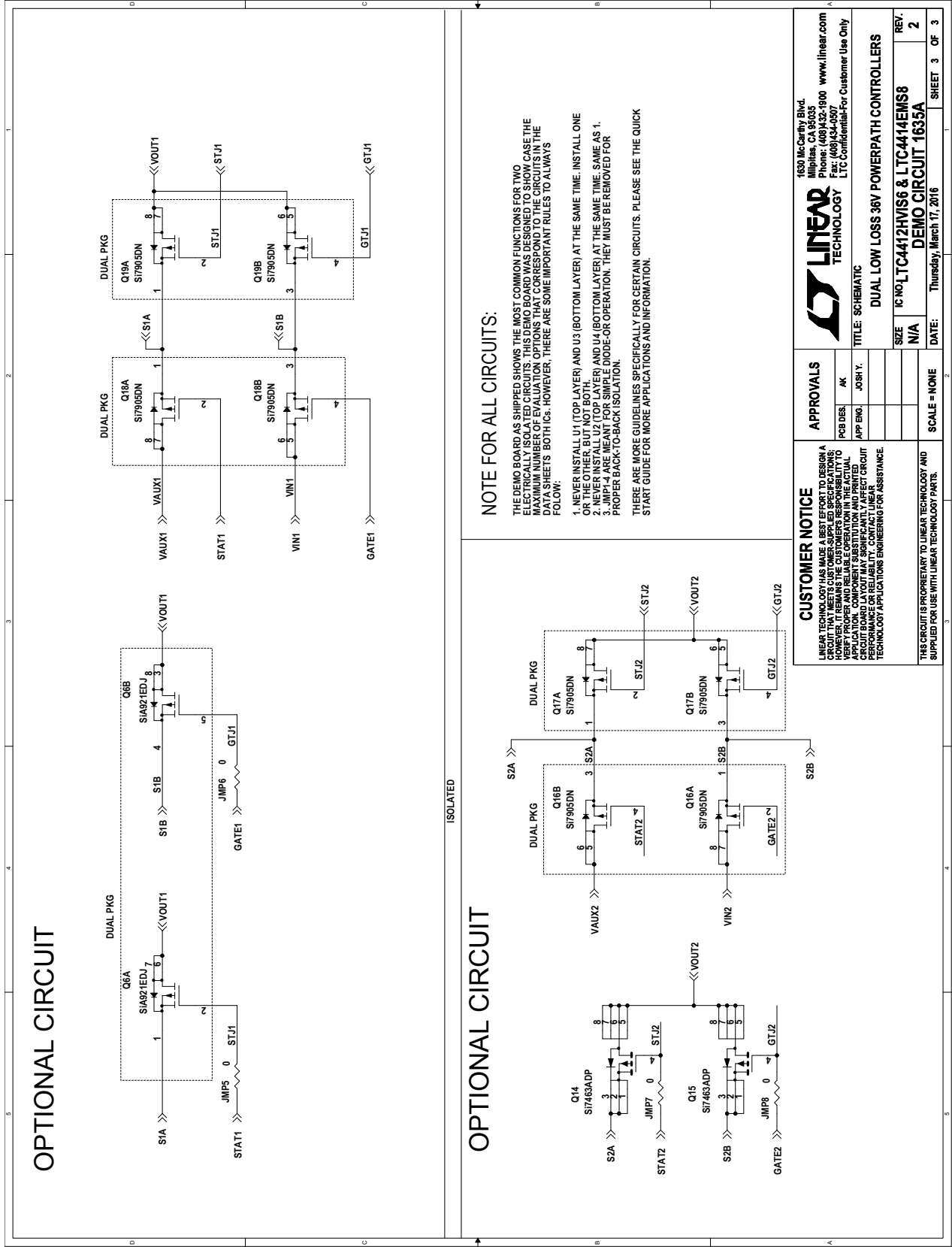
TITLE: SCHEMATIC

DUAL LOW LOSS 38V POWERPATH CONTROLLERS

SIZE	N/A	REV.	2
IC NO.	LTC4412HVIS6 & LTC4414EMS6	DATE:	Thursday, March 17, 2016
DEMO CIRCUIT 1635A		SHEET 2 OF 3	

THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

SCHEMATIC DIAGRAMS



NOTE FOR ALL CIRCUITS:

- THE DEMO BOARD AS SUPPLIED SHOWS THE MOST COMMON FUNCTIONS FOR TWO DIFFERENT LOADS. THE BOARD WAS DESIGNED TO SHOW CASE THE ELECTRICALLY SOUND FEED CIRCUITS AND TO PROVIDE 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.

		1630 McCarthy Blvd. Milpitas, CA 95035 Phone: (408)432-1900 www.linear.com Fax: (408)434-0907 LTC Confidential-For Customer Use Only	
APPROVALS		TITLE: SCHEMATIC	
PCB DES.	/AK	SIZE	IC NO. LTC4412HVS6 & LTC4414EMS8
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.		DUAL LOW LOSS 36V POWERPATH CONTROLLERS DEMO CIRCUIT 1635A SHEET 3 OF 3	

CUSTOMER NOTICE
 LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT IS SAFE FOR CUSTOMERS TO USE. HOWEVER, IT IS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD MANUFACTURING VARIATIONS CAN AFFECT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	4	C _{OUT1} , C _{IN1} , C _{OUT2} , C _{IN2}	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
Additional Circuit Components				
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
Hardware-For Demo Board Only				
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

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

Copyright © 2004, Linear Technology Corporation