

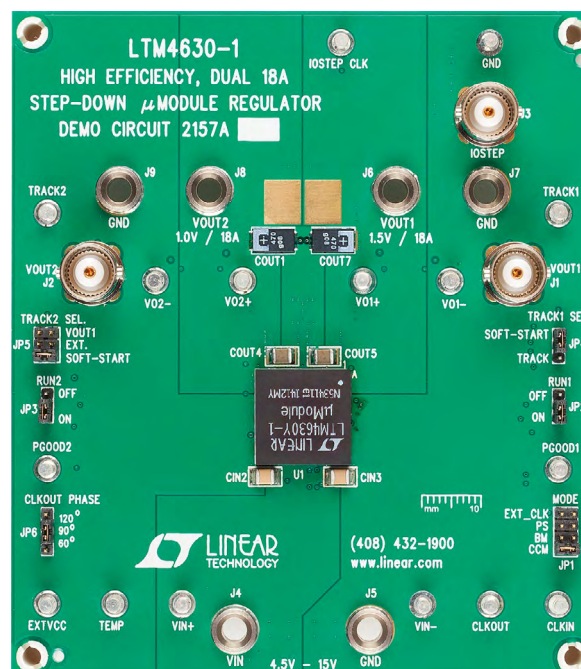
**LTM4630-1**
**Dual 18A or Single 36A  $\mu$ Module<sup>®</sup>  
 Regulator with  $\pm 0.8\%$  DC and 3%  
 Transient Accuracy**
**DESCRIPTION**

Demonstration circuit 2157A features the LTM<sup>®</sup>4630EY-1, the high efficiency, high density, dual 18A, switch mode step-down power module regulator with  $\pm 0.8\%$  total DC output accuracy. The input voltage is from 4.5V to 15V. The output voltage is programmable from 0.6V to 1.8V. DC2157A can deliver up to 18A maximum in each channel. With the help of external compensation,  $\pm 3\%$  transient accuracy can be achieved with 25% load step. As explained in the data sheet, output current derating is necessary for certain  $V_{IN}$ ,  $V_{OUT}$ , and thermal conditions. The board operates in continuous conduction mode in heavy load conditions. For high efficiency at low load currents, the MODE jumper (JP1) selects pulse-skipping mode for noise sensitive applications or Burst Mode<sup>®</sup> operation in less noise sensitive applications. Two outputs can be connected in parallel for a single 36A output solution with optional jumper resistors. The board allows the user to program

how its output ramps up and down through the TRACK/SS pin. The output can be set up to either coincidentally or ratiometrically track with another supply's output. Remote output voltage sensing is available for improved output voltage regulation at the load point. These features and the availability of the LTM4630-1 in a compact  $16\text{mm} \times 16\text{mm} \times 5.01\text{mm}$  BGA package make it ideal for use in many high density point-of-load regulation applications. The LTM4630-1 data sheet must be read in conjunction with this demo manual for working on or modifying the demo circuit DC2157A.

**Design files for this circuit board are available at**  
<http://www.linear.com/demo/DC2157A>

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**BOARD PHOTO**


dc2157afc

# DEMO MANUAL DC2157A

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

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		4.5V ~ 15V
Output Voltage V <sub>OUT1</sub> (LTM4630-1A)	V <sub>IN</sub> = 4.5V ~ 15V, I <sub>OUT1</sub> = 0A ~ 18A, JP1: CCM	1.5V ±0.8% (1.488V ~ 1.512V)
Output Voltage V <sub>OUT2</sub> (LTM4630-1A)	V <sub>IN</sub> = 4.5V ~ 15V, I <sub>OUT2</sub> = 0A ~ 18A, JP1: CCM	1.0V ±0.8% (0.992V ~ 1.008V)
Per Channel Maximum Continuous Output Current	Derating Is Necessary for Certain V <sub>IN</sub> , V <sub>OUT</sub> and Thermal Conditions, See Data Sheet for Details	18A
Default Operating Frequency		500kHz
Resistor Programmable Frequency Range		250kHz to 780kHz
External Clock Sync. Frequency Range		400kHz to 780kHz
Efficiency of Channel 1	V <sub>IN</sub> = 5V, V <sub>OUT1</sub> = 1.5V, I <sub>OUT1</sub> = 18A, f <sub>SW</sub> = 500kHz	89.7% See Figure 2
Efficiency of Channel 2	V <sub>IN</sub> = 5V, V <sub>OUT2</sub> = 1.0V, I <sub>OUT2</sub> = 18A, f <sub>SW</sub> = 500kHz	86.2% See Figure 3
Load Transient of Channel 1	V <sub>IN</sub> = 12V, V <sub>OUT1</sub> = 1.5V, I <sub>STEP</sub> = 0A ~ 4.5A	See Figure 4
Load Transient of Channel 2	V <sub>IN</sub> = 12V, V <sub>OUT2</sub> = 1.0V, I <sub>STEP</sub> = 0A ~ 4.5A	See Figure 5

## QUICK START PROCEDURE

Demonstration circuit DC2157A is easy to set up to evaluate the performance of the LTM4630-1. Please refer to Figure 1 for proper measurement setup and follow the procedure below:

- Place jumpers in the following positions for a typical application:

JP1	JP2	JP3	JP4	JP5	JP6
MODE	RUN1	RUN2	TRACK1 SEL.	TRACK2 SEL.	CLKOUT PHASE
CCM	ON	ON	SOFT-START	SOFT-START	90°

- With power off, connect the input power supply, load and meters as shown in Figure 1. Preset the load to 0A and V<sub>IN</sub> supply to 12V.
- Turn on the power supply at the input. The output voltage in channel 1 should be 1.5V ±0.8% (1.488V ~ 1.512V) and the output voltage in channel 2 should be 1.0V ±0.8% (0.992V ~ 1.008V).
- Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, output voltage ripple, efficiency and other parameters. Output ripple should be measured at J1 and J2 with BNC cables. 50Ω termination should be set on the oscilloscope or BNC cables.

- (Optional) For optional load transient test, apply an adjustable pulse signal between IOSTEP CLK and GND test point. Pulse amplitude (3V ~ 3.5V) sets the load step current amplitude. The output transient current can be monitored at the BNC connector J3 (15mV/A). The pulse signal should have very small duty cycle (<10%) to limit the thermal stress on the transient load circuit. Switch the jumper resistors R34 or R35 (on the backside of boards) to apply load transient on channel 1 or channel 2 correspondingly.
- (Optional) LTM4630-1 can be synchronized to an external clock signal. Place the JP1 jumper on EXT\_CLK and apply a clock signal (0~5V, square wave) on the CLKIN test point.
- (Optional) The outputs of LTM4630-1 can track another supply. The jumpers JP4 and JP5 allow choosing soft-start or output tracking. If tracking external voltage is selected, the corresponding test points, TRACK1 and TRACK2, need to be connected to a valid voltage signal.
- (Optional) LTM4630-1 can be configured for a 2-phase single output at up to 36A on DC2157A. Install 0Ω resistors on R14, R17, R28, R39 and remove R7, R19. Output voltage is set by R25 based on equation:

$$V_{OUT} = 0.6V(1 + 60.4k/R25)$$

**QUICK START PROCEDURE**

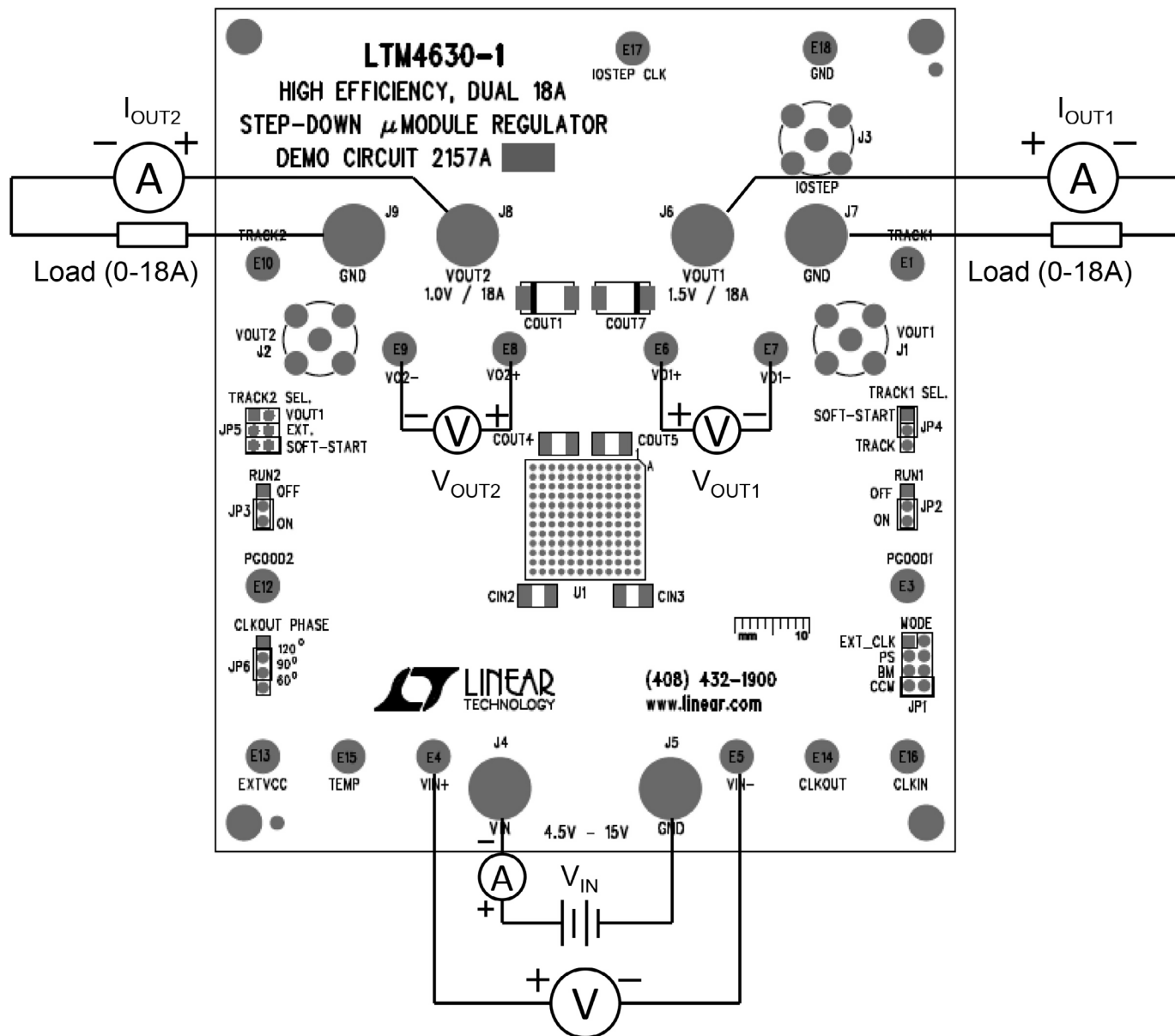


Figure 1. Test Setup of DC2157A

## QUICK START PROCEDURE

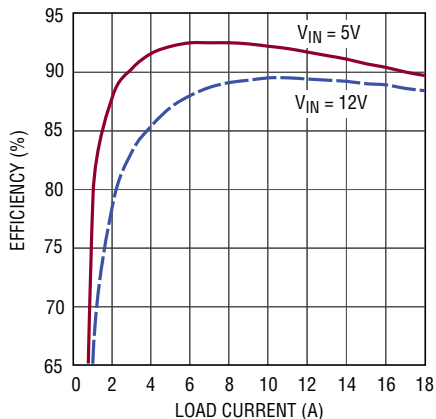


Figure 2. Measured Efficiency on Channel 1 ( $V_{OUT1} = 1.5V$ ,  $f_{SW} = 500kHz$ , Channel 2 Disabled)

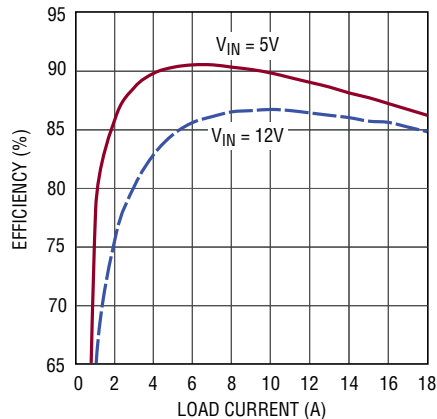


Figure 3. Measured Efficiency on Channel 2 ( $V_{OUT2} = 1.0V$ ,  $f_{SW} = 500kHz$ , Channel 1 Disabled)

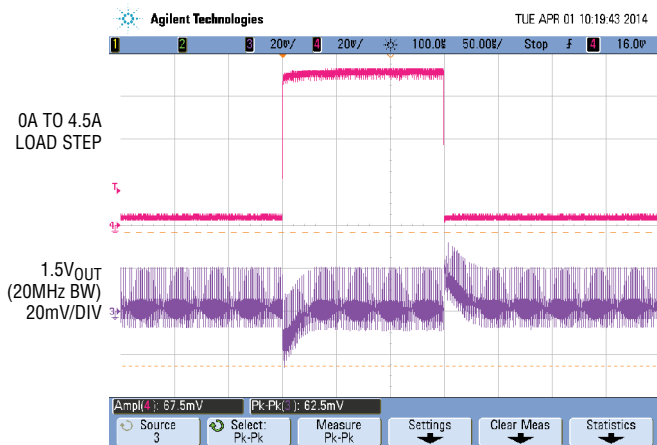


Figure 4. Measured Channel 1 0A to 4.5A Load Transient ( $V_{IN} = 12V$ ,  $V_{OUT1} = 1.5V$ )

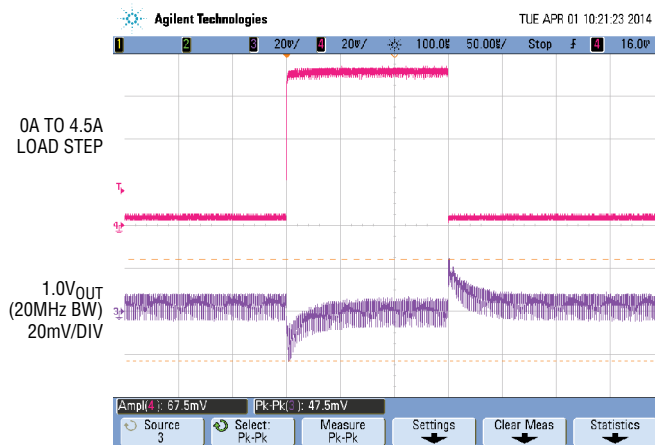


Figure 5. Measured Channel 2 0A to 4.5A Load Transient ( $V_{IN} = 12V$ ,  $V_{OUT2} = 1.0V$ )

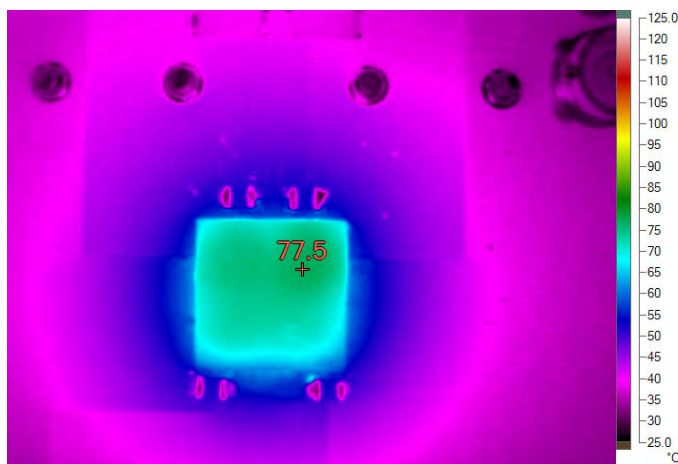


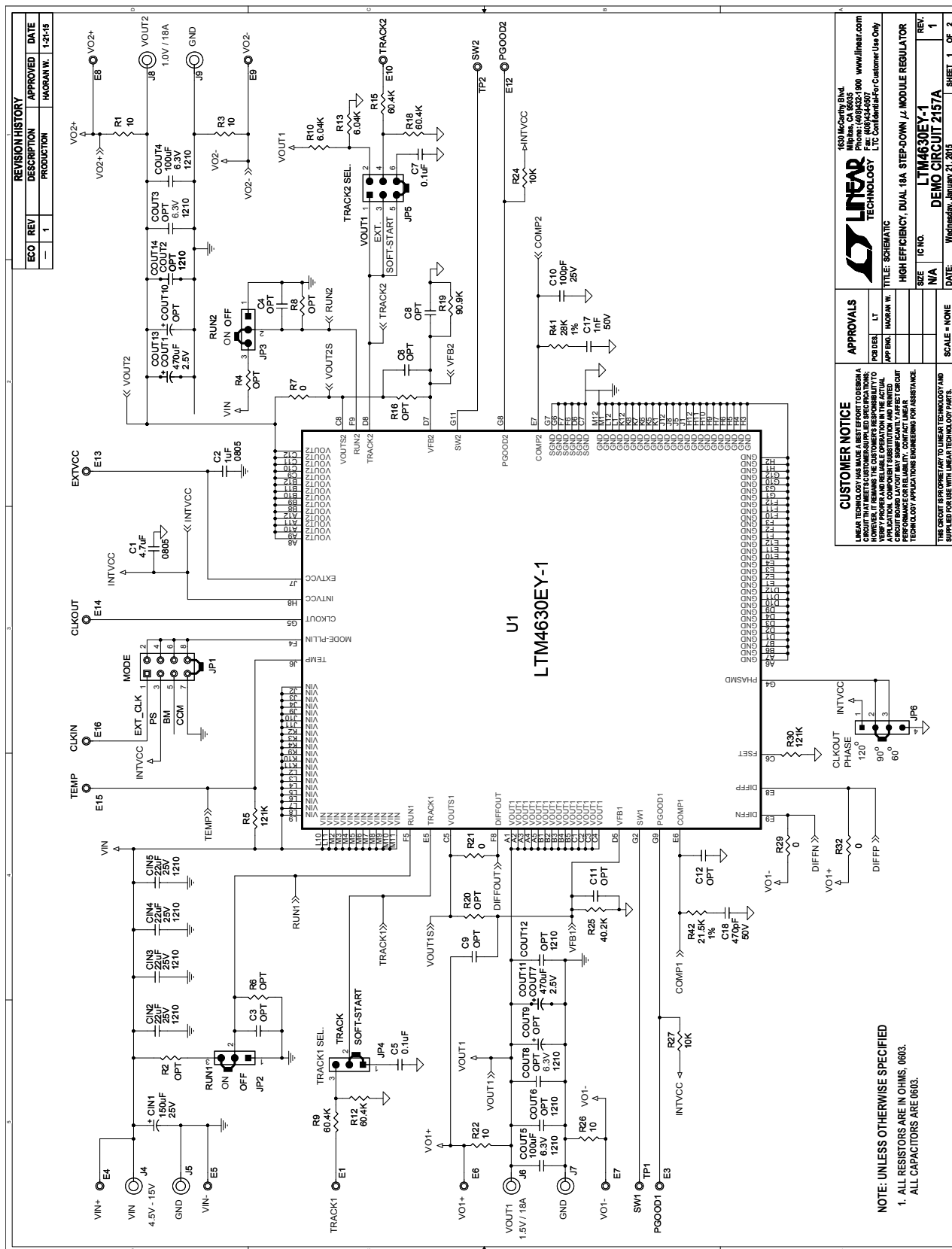
Figure 6. Thermal Capture at  $12V_{IN}$ ,  $1.5V_{OUT1}$  at 18A and  $1V_{OUT2}$  at 18A ( $T_A = 25^\circ C$ , 200LFM Airflow and No Heat Sink)

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	1	CIN1	CAP., 150µF, 25V, Aluminum Electr.	SUN ELECT., 25CE150AX
2	4	CIN2, CIN3, CIN4, CIN5	CAP., X5R, 22µF, 25V, 10%, 1210	MURATA, GRM32ER61E226KE15L
3	4	COU1, COU7, COU11, COU13	CAP., 470µF, 2.5V, POSCAP, F8-D3L	SANYO, 2R5TPF470M6L
4	2	COU4, COU5	CAP., X5R, 100µF, 6.3V, 20% 1210	AVX, 12106D107MAT2A
5	1	U1	I.C., 16X16X5.01-BGA	LINEAR TECH., LTM4630EY-1A#PBF
<b>Additional Demo Board Circuit Components</b>				
6	0	COU2, COU3, COU6, COU8, COU9, COU10, COU12, COU14	OPT, 1210	OPT
7	1	C1	CAP., X5R, 4.7µF, 25V, 10%, 0805	AVX, 08053D475KAT2A
8	1	C2	CAP., X7R, 1µF, 25V, 10%, 0805	AVX, 08053C105KAT2A
9	2	C5, C7	CAP., X5R, 0.1µF, 25V, 10%, 0603	AVX, 06033D104KAT2A
10	0	C3, C4, C6, C8, C9, C11, C12	OPT, 0603	OPT
11	1	C10	CAP., X7R, 100pF, 25V, 10%, 0603	AVX, 06033C101KAT2A
12	4	C13, C14, C15, C16	CAP., X7R, 1µF, 10V, 10%, 0603	AVX, 0603ZC105KAT2A
13	1	C18	CAP., X7R, 470pF, 25V, 10%, 0603	AVX, 06033C471KAT4A
14	1	C17	CAP., X7R, 1nF, 25V, 10%, 0603	AVX, 06033C102JAT2A
15	1	Q1	XSTR, MOSFET	VISHAY, SUD50N04-8M8P-4GE3
16	4	R1, R3, R22, R26	RES., CHIP, 10Ω, 1%, 0603	VISHAY, CRCW060310R0FKEA
17	0	R2, R4, R6, R8, R11, R14, R16, R17, R20, R23, R28, R31, R33, R39, R40	OPT, 0603	OPT
18	3	R24, R27, R36	RES., CHIP, 10k, 1%, 0603	VISHAY, CRCW060310K0FKEA
19	4	R7, R21, R29, R32	RES., CHIP, 0Ω, 1%, 0603	VISHAY, CRCW06030000Z0EA
20	4	R9, R12, R15, R18	RES., CHIP, 60.4k, 1%, 0603	VISHAY, CRCW060360K4FKEA
21	2	R10, R13	RES., CHIP, 6.04k, 1%, 0603	VISHAY, CRCW06036K04FKEA
22	1	R19	RES., CHIP, 90.9k, 1%, 0603	VISHAY, CRCW060390K9FKEA
23	1	R25	RES., CHIP, 40.2k, 1%, 0603	VISHAY, CRCW060340K2FKEA
24	2	R5, R30	RES., CHIP, 121k, 1%, 0603	VISHAY, CRCW0603121KFKEA
25	1	R34	RES., CHIP, 0Ω, 0.5W, 2010	VISHAY, CRCW20100000Z0EF
26	0	R35	OPT, 2010	OPT
27	1	R37	RES., CHIP, 0.015Ω, 1W, 2512	VISHAY, WSL2512R0150FEA
28	0	R38	OPT 2512	OPT
29	1	R42	RES., CHIP, 21.5k, 1%, 0603	VISHAY, CRCW060321K5FKEA
30	1	R41	RES., CHIP, 28k, 1%, 0603	VISHAY, CRCW060328K0FKEA
<b>Hardware-For Demo Board Only</b>				
31	16	E1, E3-E10, E12-E18	TESTPOINT, TURRET, .094"	MILL-MAX, 2501-2-00-80-00-00-07-0
32	3	J1, J2, J3	CONN,BNC,5 PINS	CONNEX 112404
33	6	J4-J9	JACK BANANA	KEYSTONE, 575-4
34	1	JP1	HEADER 4 PIN 0.079 DOUBLE ROW	SULLINS, NRPN042PAEN-RC
35	1	JP6	HEADER 4 PIN 0.079 SINGLE ROW	SULLINS, NRPN041PAEN-RC
36	3	JP2, JP3, JP4	HEADER 3 PIN 0.079 SINGLE ROW	SULLINS, NRPN031PAEN-RC
37	1	JP5	HEADER 3 PIN 0.079 DOUBLE ROW	SULLINS, NRPN032PAEN-RC
38	6	XJP1-XJP6	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
39	4	(STAND-OFF)	STAND-OFF, NYLON 0.50"	KEYSTONE, 8833(SNAP ON)

# DEMO MANUAL DC2157A

## SCHEMATIC DIAGRAM



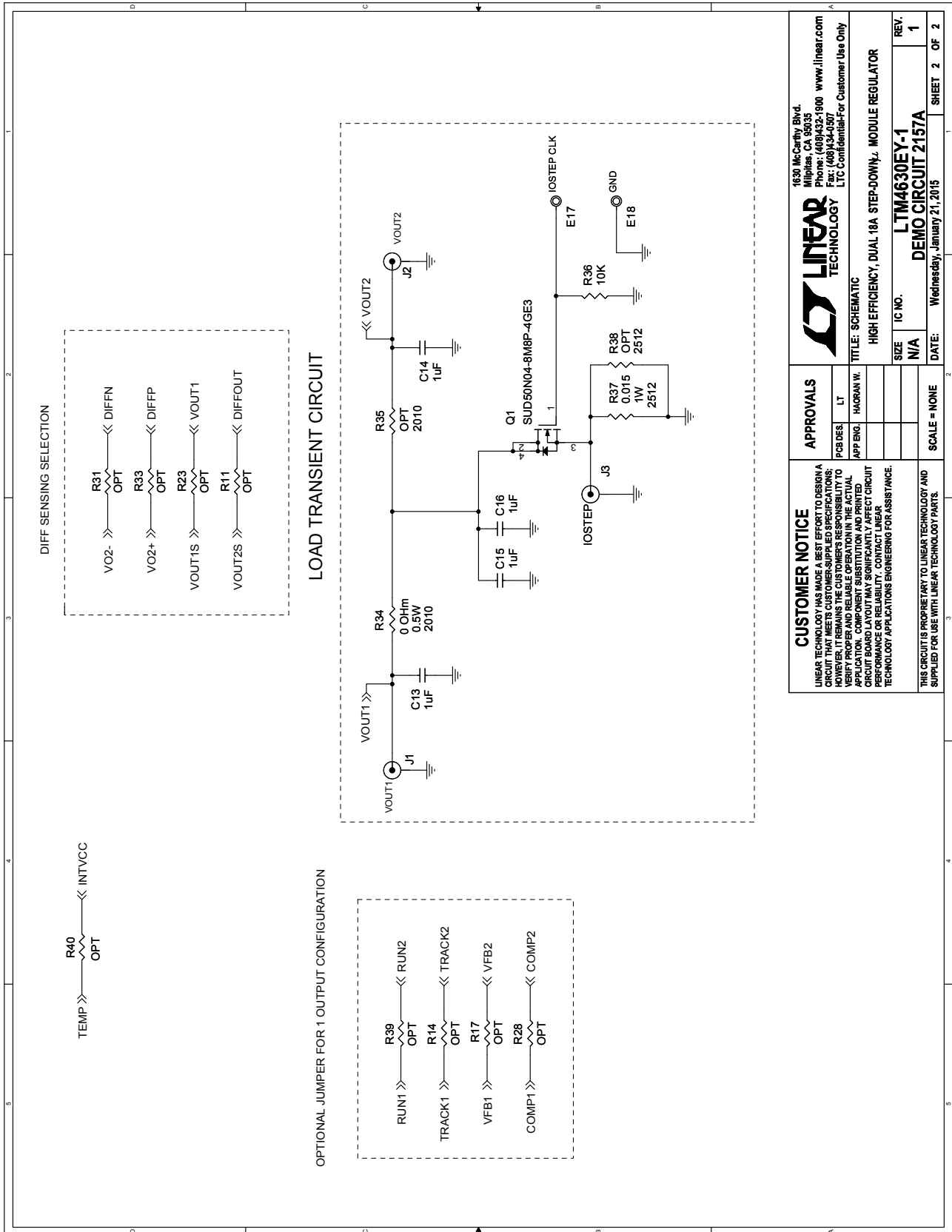
APPROVALS	
DESIGNER	LT
APP. ENGR.	HAGMAN W.

SIZE	TC NO.	REV.
N/A		1
SCALE	DATE	SHEET
NONE	Wednesday, January 21, 2015	1 OF 2

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**LINEAR TECHNOLOGY**  
 TITLE: SCHEMATIC  
 HIGH EFFICIENCY, DUAL 18A STEP-DOWN 1/2 MODULE REGULATOR  
 DEMO CIRCUIT 2157A

**SCHEMATIC DIAGRAM**



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**APPROVALS**

PCB DES.	LT
APP ENGR.	HAORAN W.

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**TITLE: SCHEMATIC**  
 HIGH EFFICIENCY, DUAL, 16A STEP-DOWN, MODULE REGULATOR

SIZE IC NO. N/A

REV. 1

DATE: Wednesday, January 21, 2015

SCALE = NONE

SHEET 2 OF 2

# DEMO MANUAL DC2157A

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