

## DESCRIPTION

Demonstration circuit DC1041A-A features the LTM<sup>®</sup>4601EV, the high efficiency, high density switch mode step-down power module. The input voltage range is from 4.5V to 20V. The output voltage is programmable from 0.6V to 5V, refer to step down ratio curve in the LTM4601 datasheet. The rated load current is 12A, while de-rating is necessary for certain  $V_{IN}$ ,  $V_{OUT}$ , and thermal conditions. Integrated input and output filters enable a simple PCB layout. Only bulk input and output capacitors are needed externally. An internal phase-lock

clock. The LTM4601 allows the user to program output ramp-up and ramp-down through the TRACK/SS pin. The output can be set to coincidentally or ratiometrically track with another supply's output. Margining function is provided for the user who wants to stress their system by varying supply voltages during testing; refer to data-sheet for functional diagram.

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

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**Table 1. Performance Summary ( $T_A = 25^\circ\text{C}$ )**

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		4.5V
Maximum Input Voltage		20V
Output Voltage $V_{OUT}$	Jumper selectable (open for 0.6V)	1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5V
Maximum Continuous Output Current	De-rating is necessary for certain $V_{IN}$ , $V_{OUT}$ , and thermal conditions	12A <sub>DC</sub>
Default Operating Frequency		800kHz
External Sync. Clock Freq. Range	Please refer to datasheet for minimum $T_{on}$ and $T_{off}$ requirement.	560kHz to 1000kHz
Efficiency	$V_{IN}=12\text{V}$ , $V_{OUT}=1.5\text{V}$ , $I_{OUT}=12\text{A}$	83%, See Figure 2
Load Transient	$V_{IN}=12\text{V}$ , $V_{OUT}=1.5\text{V}$	See Figure 3 and Table 1 for details

## QUICK START PROCEDURE

Demonstration circuit DC1041A-A is easy to set up to evaluate the performance of the LTM4601EV. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

- Place jumpers in the following positions for a typical 1.5V<sub>OUT</sub> application:

Vout Select	RUN	MARG0	MARG1
1.5V	ON	LO	LO

- With power off, connect the input power supply, load and meters as shown in Figure 1.

Preset the load to 0A and  $V_{in}$  supply to be less than 20V.

- Turn on the power at the input. The output voltage should be  $1.5\text{V} \pm 1\%$ .
- Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters. Output ripple should be measured at J4 with a BNC cable.
- For optional load transient test, apply adjustable pulse signal between IOSTEP CLK and GND pins. Pulse amplitude sets the current step. The pulse signal should have very small duty cycle (<15%) to limit the thermal stress

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on the transient load circuit. The output transient current can be monitored at BNC connector J3 (10mV/A).

- For Margining function test, place jumper MARG0 and MARG1 in the configurations shown in the following table, measure the output voltage at J4.

MARG1	MARG0	Vout
LO	LO	0
LO	HI	+5%
HI	LO	-5%
HI	HI	0

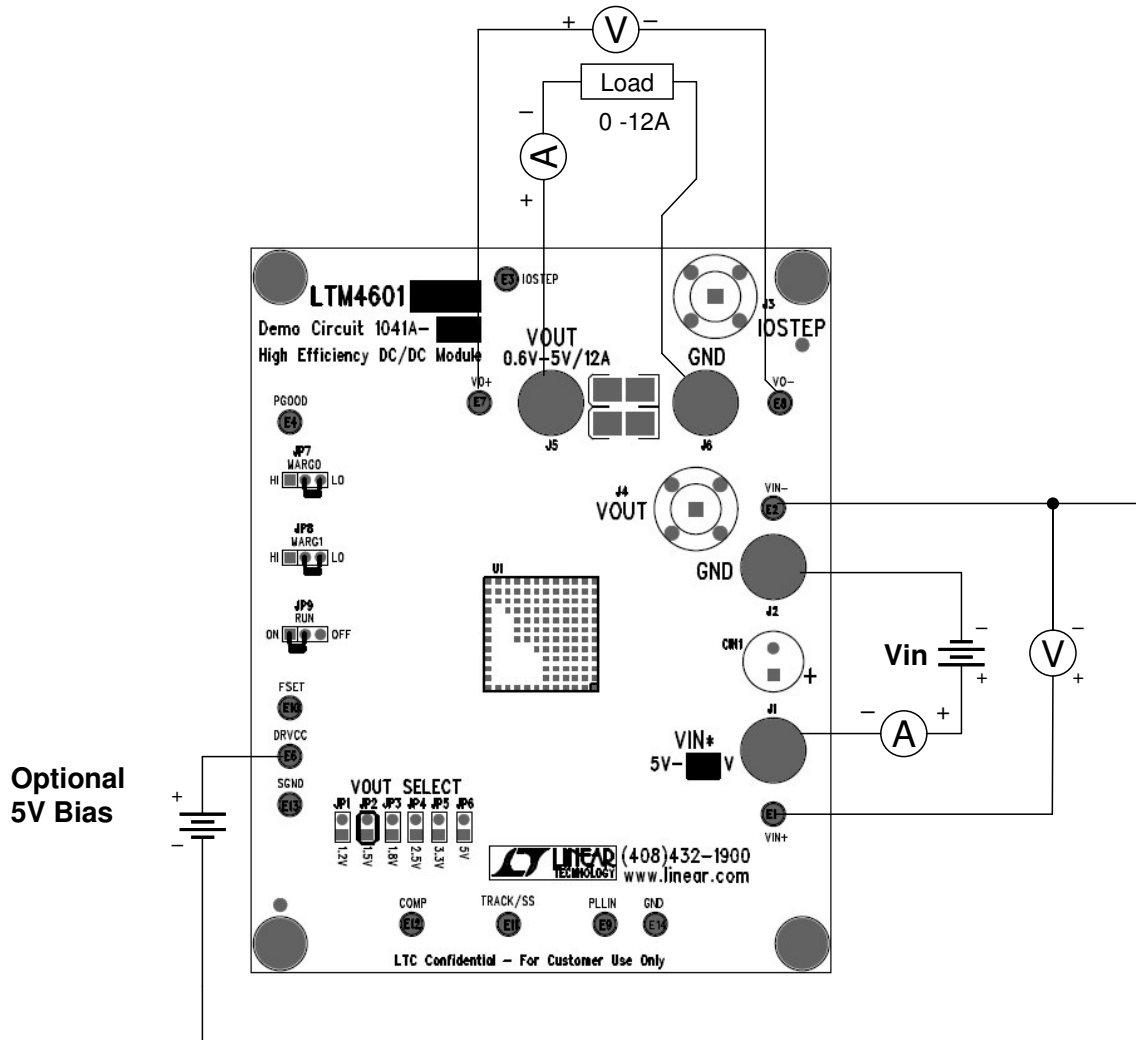


Figure 1. Test Setup of DC1041A-A (DRVCC Bias Supply is Optional)

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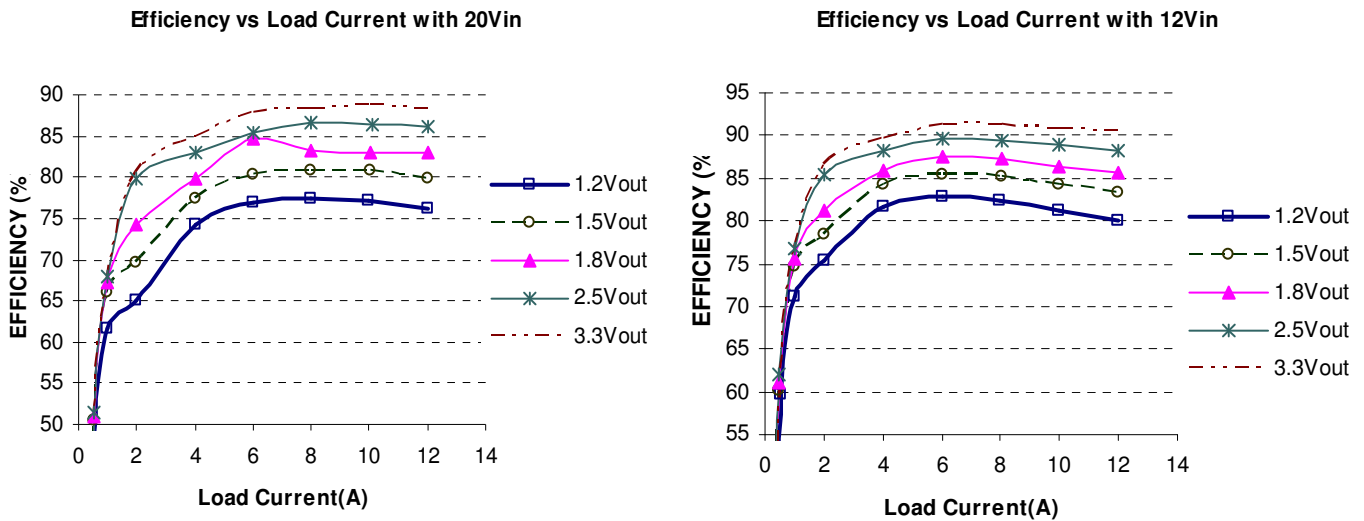
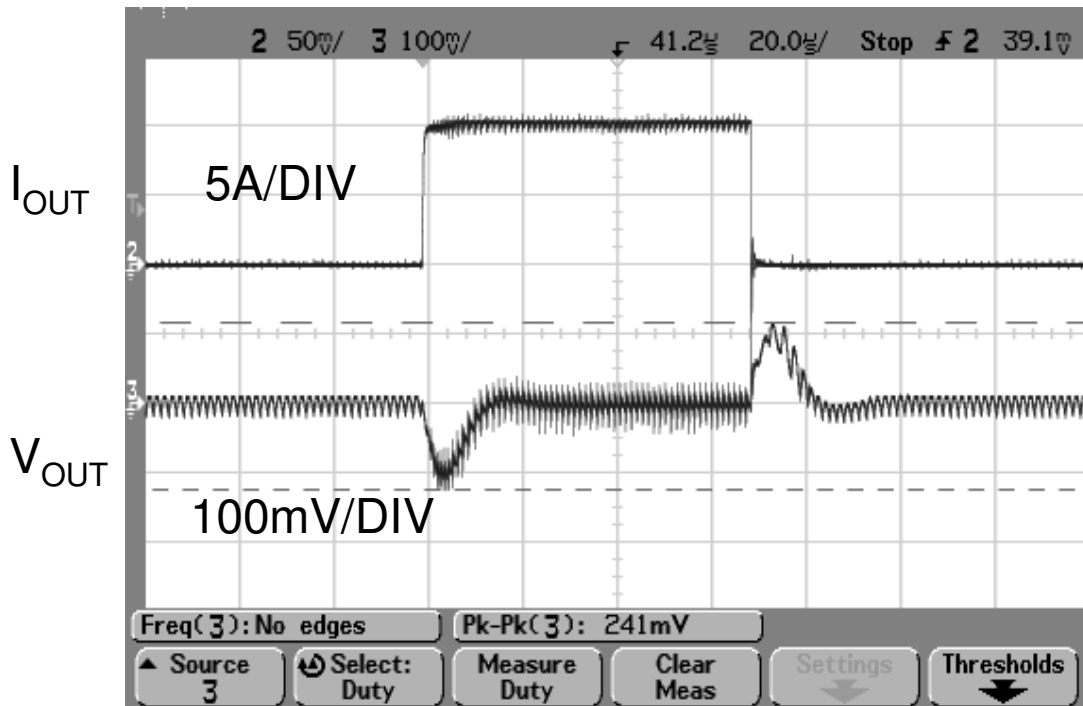


Figure 2. Measured Supply Efficiency with Different  $V_{IN}$  and  $V_{OUT}$



$V_{in} = 12V$

$V_{out} = 1.5V$

0A to 10A LOAD STEP

$C_{out} = 1 \times 22\mu F$  ceramic,  $2 \times 100\mu F$  ceramic,  $C3 = 47pF$

Figure 3. Measured Load Transient Response (0-10A Step)

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Table1. Output Capacitor vs, Load Transient (0-6A Step)

TYPICAL MEASURED VALUES			
C <sub>OUT1</sub> VENDORS	PART NUMBER	C <sub>OUT2</sub> VENDORS	PART NUMBER
TDK	C4532X5R0J107MZ (100UF, 6.3V)	SANYO POS CAP	6TPE330ML (330UF, 6.3V)
TAIYO YUDEN	JMK432BJ107MU-T (100UF, 6.3V)	SANYO POS CAP	2R5TPE470M9 (470UF, 2.5V)
TAIYO YUDEN	JMK316BJ226ML-T501 (22UF, 6.3V)	SANYO POS CAP	4TPE470MCL (470UF, 4V)

**To be determined.**

\* LTM4601 module has similar load transient response at 12V<sub>in</sub> and 24V<sub>in</sub>

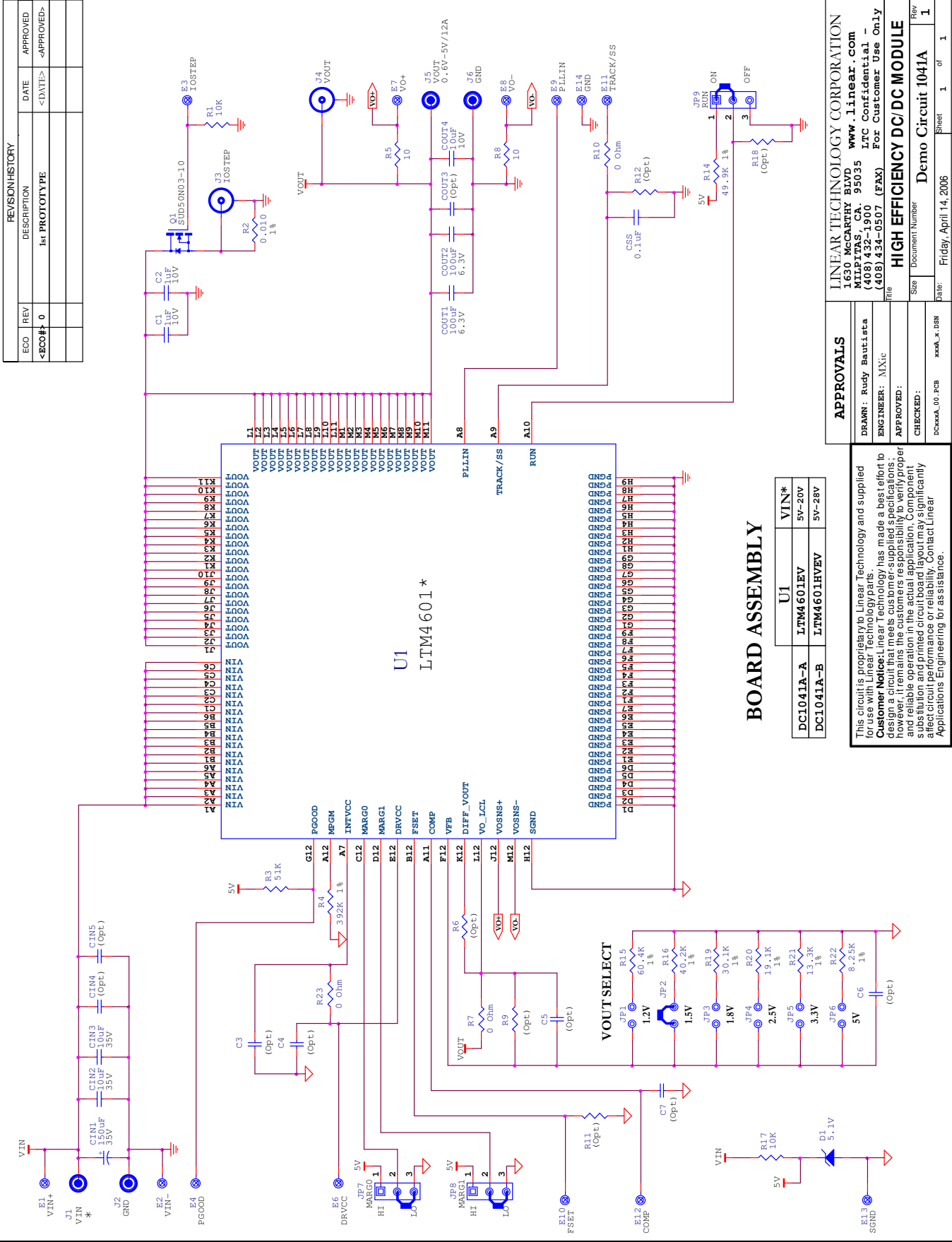
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DC1041A-A BOM

REQUIRED CIRCUIT COMPONENTS:				
<i>Item</i>	<i>Qty</i>	<i>Reference</i>	<i>Part Description</i>	<i>Manufacturer / Part #</i>
1	1	CIN1	Cap., Alum 150uF 35V 20%	SANYO 35ME150WXV
2	2	CIN2,CIN3	Cap., X7R 10uF 35V 20%	Taiyo Yuden GMK316BJ106ML-T
3	2	COOUT1,COOUT2	Cap., X5R 100uF 6.3V 20%	Taiyo Yuden JMK432BJ107MU-T
4	1	COOUT4	Cap., X5R 10uF 10V 10%	Taiyo Yuden LMK316BJ106KL-T
5	1	CSS	Cap., X7R 0.1uF 16V 20%	AVX 0603YC104MAT2A
6	1	R4	Res., Chip 392K 0.1W 1%	AAC CR16-3923FM
7	2	R8,R5	Res., Chip 10 0.1W 5%	AAC CR16-100JM
8	1	R19	Res., Chip 30.1K 0.06W 1%	AAC CR16-3012FM
9	1	U1	I.C., Volt. Reg.	Linear Technology Corp. LTM4601EV
ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS:				
1	0	CIN4,CIN5	Cap., 1206 TBD	
2	0	COOUT3	Cap., 1210 TBD	
3	0	C3,C4,C5,C6,C7	Cap., 0603 TBD	
4	2	C1,C2	Cap., X5R 1uF 10V 10%	Taiyo Yuden LMK107BJ105KA
5	1	D1	Zener Diode, 5.1V	On Semi. MMBZ5231B
6	1	Q1	Mosfet, N-Channel 30V	Siliconix SUD50N03-10
7	0	R6,R9,R11,R12,R18	Res., 0603 TBD	
8	2	R17,R1	Res., Chip 10K 0.1W 5%	AAC CR16-103JM
9	1	R2	Res., LRC 0.010 0.25W 1%	IRC LRF1206-01-R010-F
10	1	R3	Res., Chip 51K 0.1W 5%	AAC CR16-513JM
11	3	R7,R10,R23	Res/Jumper, Chip 0 Ohm 1/16W 1 AM	AAC CJ06-000M
12	1	R14	Res., Chip 49.9K 0.06W 1%	AAC CR16-4992FM
13	1	R15	Res., Chip 60.4K 0.1W 1%	AAC CR16-6042FM
14	1	R16	Res., Chip 40.2K 0.1W 1%	AAC CR16-4022FM
15	1	R20	Res., Chip 19.1K 0.1W 1%	AAC CR16-1912FM
16	1	R21	Res., Chip 13.3K 0.1W 1%	AAC CR16-1332FM
17	1	R22	Res., Chip 8.25K 0.1W 1%	AAC CR16-8251FM
HARDWARE-FOR DEMO BOARD ONLY:				
1	13	E1-E4,E6-E13	Turret, Testpoint	Mill Max 2308-2
2	6	JP1,JP2,JP3,JP4,JP5,JP6	Jumper, 2 Pins 2mm Ctrs.	Samtec TMM-102-02-L-S
3	3	JP7,JP8,JP9	Headers, 3 Pins 2mm Ctrs.	Samtec TMM-103-02-L-S
4	4	J1,J2,J5,J6	Connector, Banana Jack	Keystone 575-4
5	2	J3,J4	BNC Connector	Connex 112404
6	4	XJP2,XJP7,XJP8,XJP9	Shunt, 2mm Ctrs.	Samtec 2SN-BK-G
7	4		STAND-OFF, NYLON, 0.25" Tall	KEYSTONE, 8831 (SNAP ON)
8	1		FAB, 1041A_Rev1	DEMO CIRCUIT #1041A-A

# QUICK START GUIDE FOR DEMONSTRATION CIRCUIT DC1041A-A HIGH EFFICIENCY POWER MODULE

REVISION/HISTORY				
ECC	REV	DESCRIPTION	DATE	APPROVED
<ECC#>	0	1st PROTOTYPE	<DATE>	<APPROVED>



## BOARD ASSEMBLY

	U1	VIN*
DC1041A-A	LTM4601EV	5V-20V
DC1041A-B	LTM4601HVEV	5V-28V

This circuit is proprietary to Linear Technology and supplied as is without warranty. 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 Applications Engineering for assistance.

## APPROVALS

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**HIGH EFFICIENCY DC/DC MODULE**  
Demo Circuit 1041A  
Date: Friday, April 14, 2006  
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