

# LTM4630A Dual 18A or Single 36A $\mu$ Module Regulator

## DESCRIPTION

Demonstration circuit 2268A-F is a high efficiency, high density, dual 8A, switch mode step-down power supply on a compact 1.5' x 1.2' PCB. It features the LTM<sup>®</sup>4630A  $\mu$ Module<sup>®</sup> regulator. The input voltage is from 4.5V to 15V. The output voltage is programmable from 0.6V to 5.3V. DC2268A-F can deliver up to 18A maximum in each channel. 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 resistor jumper (R1/R2) selects pulse-skipping mode for noise sensitive applications or Burst-Mode<sup>®</sup> 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. Remote output voltage sensing is available for improved output voltage regulation at the load point. An optional input inductor L1 reduces the EMI noise for noise sensitive applications. DC2268A can be easily inserted to an edge connector for testing and debugging. These features and the availability of the LTM4630A in a compact 16mm x 16mm x 4.41mm LGA package make it ideal for use in many high-density point-of-load regulation applications. The LTM4630A data sheet must be read in conjunction with this demo manual for working on or modifying the DC2268A-F.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2268A-F>**

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## BOARD PHOTO

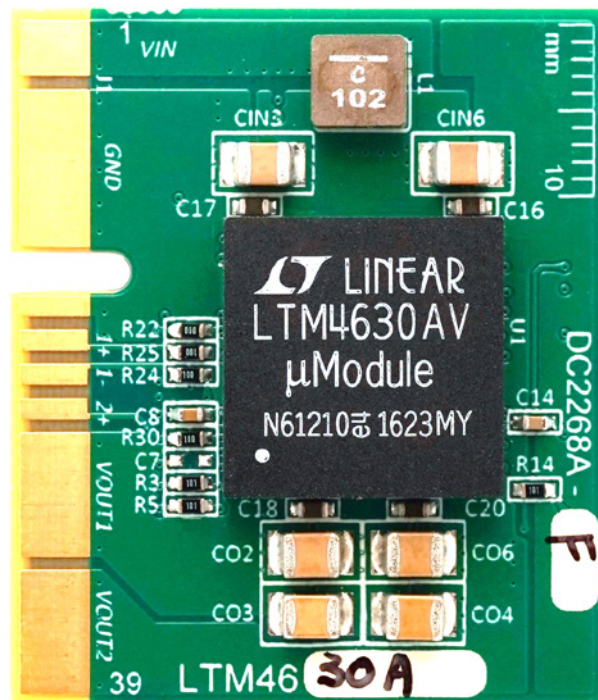


Figure 1. LTM4630A/DC2268A-F Demo Board

## PERFORMANCE SUMMARY Specifications are at $T_A = 25^\circ\text{C}$

Table 1.

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		4.5V ~ 15V
Output Voltage $V_{OUT1}$	$V_{IN} = 4.5\sim 15\text{V}$ , $I_{OUT1} = 0\text{A} \sim 18\text{A}$	$3.3\text{V} \pm 1.5\%$
Output Voltage $V_{OUT2}$	$V_{IN} = 4.5\sim 15\text{V}$ , $I_{OUT2} = 0\text{A} \sim 18\text{A}$	$2.5\text{V} \pm 1.5\%$
Per-Channel Maximum Continuous Output Current	De-rating is necessary for certain $V_{IN}$ , $V_{OUT}$ and thermal conditions	18A (per channel)
Default Operating Frequency		600kHz
Resistor Programmable Frequency Range		250kHz to 780kHz
External Clock Sync. Frequency Range		400kHz to 780kHz
Efficiency of Channel 1	$V_{IN} = 12\text{V}$ , $V_{OUT1} = 3.3\text{V}$ , $I_{OUT1} = 18\text{A}$ , $f_{SW} = 600\text{kHz}$	93.0%, see Figure 3
Efficiency of Channel 2	$V_{IN} = 12\text{V}$ , $V_{OUT2} = 2.5\text{V}$ , $I_{OUT2} = 18\text{A}$ , $f_{SW} = 600\text{kHz}$	91.1%, see Figure 4
Load Transient of Channel 1	$V_{IN} = 12\text{V}$ , $V_{OUT1} = 3.3\text{V}$ , $I_{STEP} = 9\text{A} \sim 13.5\text{A}$	$V_{OPP} = 139\text{mV}$ , see Figure 5
Load Transient of Channel 2	$V_{IN} = 12\text{V}$ , $V_{OUT2} = 2.5\text{V}$ , $I_{STEP} = 9\text{A} \sim 13.5\text{A}$	$V_{OPP} = 102\text{mV}$ , see Figure 6

## QUICK START PROCEDURE

DC2268A-F is easy to set up to evaluate the performance of the LTM4630A. It can be easily inserted to an edge connector (SAMTEC MEC2-20-01-L-DV--TR) for testing and debugging. Please refer to Figure 2 for proper measurement setup and follow the procedure below:

1. Pull up the RUN1(J1 Pin 22) and RUN2(J1 Pin 24) between 1.4V to 5V or leave them floating.
2. With power off, connect the input power supply, load and meters as shown in Figure 2. Preset the load to 0A and  $V_{IN}$  supply to 12V.
3. Turn on the power supply at the input. The output voltage in channel 1 should be  $3.3\text{V} \pm 1.5\%$  (3.2505V ~ 3.3495V) and the output voltage in channel 2 should be  $2.5\text{V} \pm 1.5\%$  (2.4625V ~ 1.5375V),
4. 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  $C_{O3}$  and  $C_{O4}$ .
5. (Optional) LTM4630A can be synchronized to an external clock signal. Remove R2 and apply a clock signal (0V~5V, square wave) to MODE-PLLIN pin.
6. (Optional) LTM4630A can be configured for a 2-phase single output at up to 36A on DC2268A-F. Install  $0\Omega$  resistors on R26, R27, R28, R29, R32, and remove R14, R18 R30. Output voltage is set by R7 based on equation  $V_{OUT} = 0.6\text{V} (1 + 60.4\text{k}/\text{R7})$ .

## QUICK START PROCEDURE

Table 2. DC2268A Demo Circuit

DEMO BOARD NUMBER	μModule REGULATOR ON THE BOARD	OUTPUT CURRENT
DC2268A-A	LTM4620	13A,13A
DC2268A-B	LTM4620A	13A,13A
DC2268A-C	LTM4628	8A, 8A
DC2268A-D	LTM4630	18A,18A
DC2268A-E	LTM4630-1	18A,18A
DC2268A-F	LTM4630A	18A, 18A
DC2268A-G	LTM4631	10A, 10A
DC2268A-H	LTM4650-1	25A, 25A
DC2268A-I	LTM4650A-1	25A, 25A

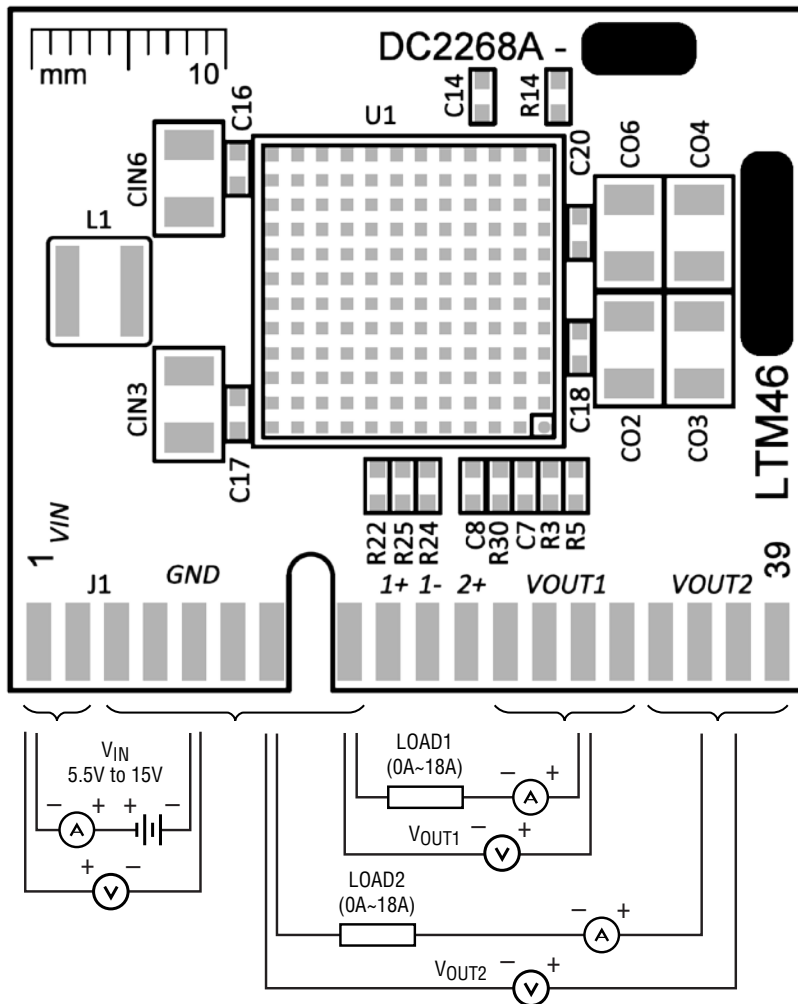


Figure 2. Test Setup of DC2268A-F

## QUICK START PROCEDURE

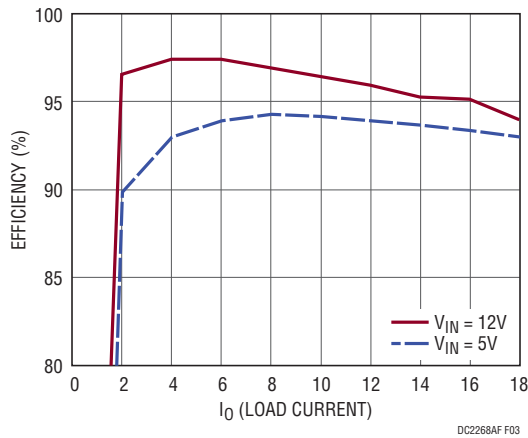


Figure 3. Measured Efficiency on Channel 1 ( $V_{OUT1} = 3.3V$ ,  $f_{sw} = 600kHz$ , Channel 2 Disabled)

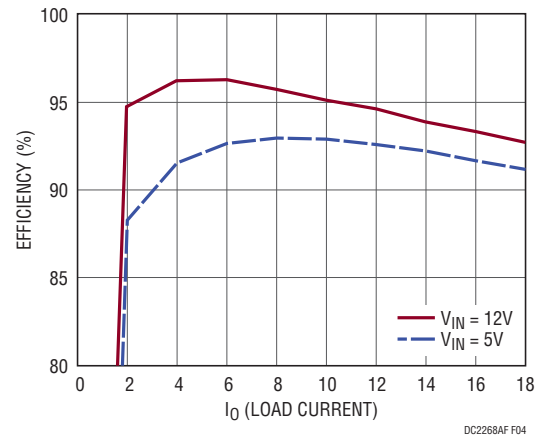


Figure 4. Measured Efficiency on Channel 2 ( $V_{OUT2} = 2.5V$ ,  $f_{sw} = 600kHz$ , Channel 1 Disabled)

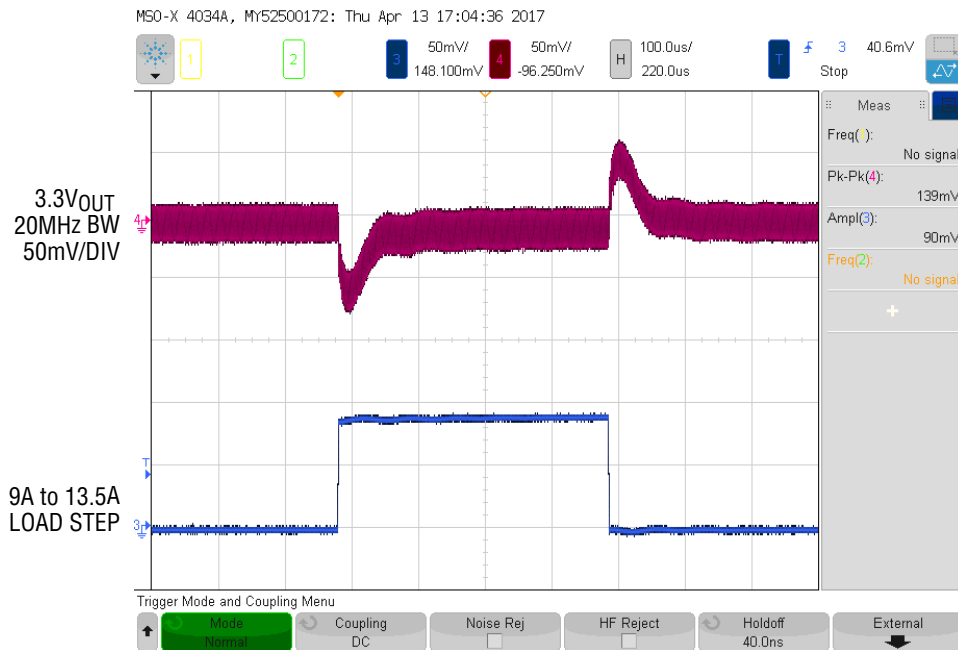


Figure 5. Measured Channel 1 9A to 13.5A Load Transient ( $V_{IN} = 12V$ ,  $V_{OUT1} = 3.3V$ )

**QUICK START PROCEDURE**

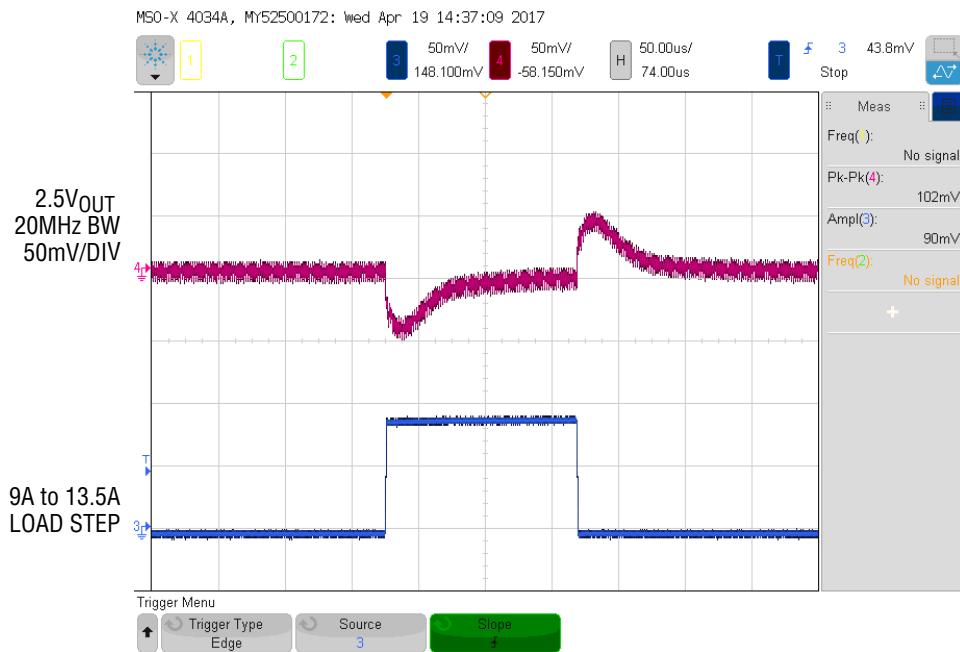


Figure 6. Measured Channel 2 9A to 13.5A Load Transient ( $V_{IN} = 12V$ ,  $V_{OUT2} = 2.5V$ )



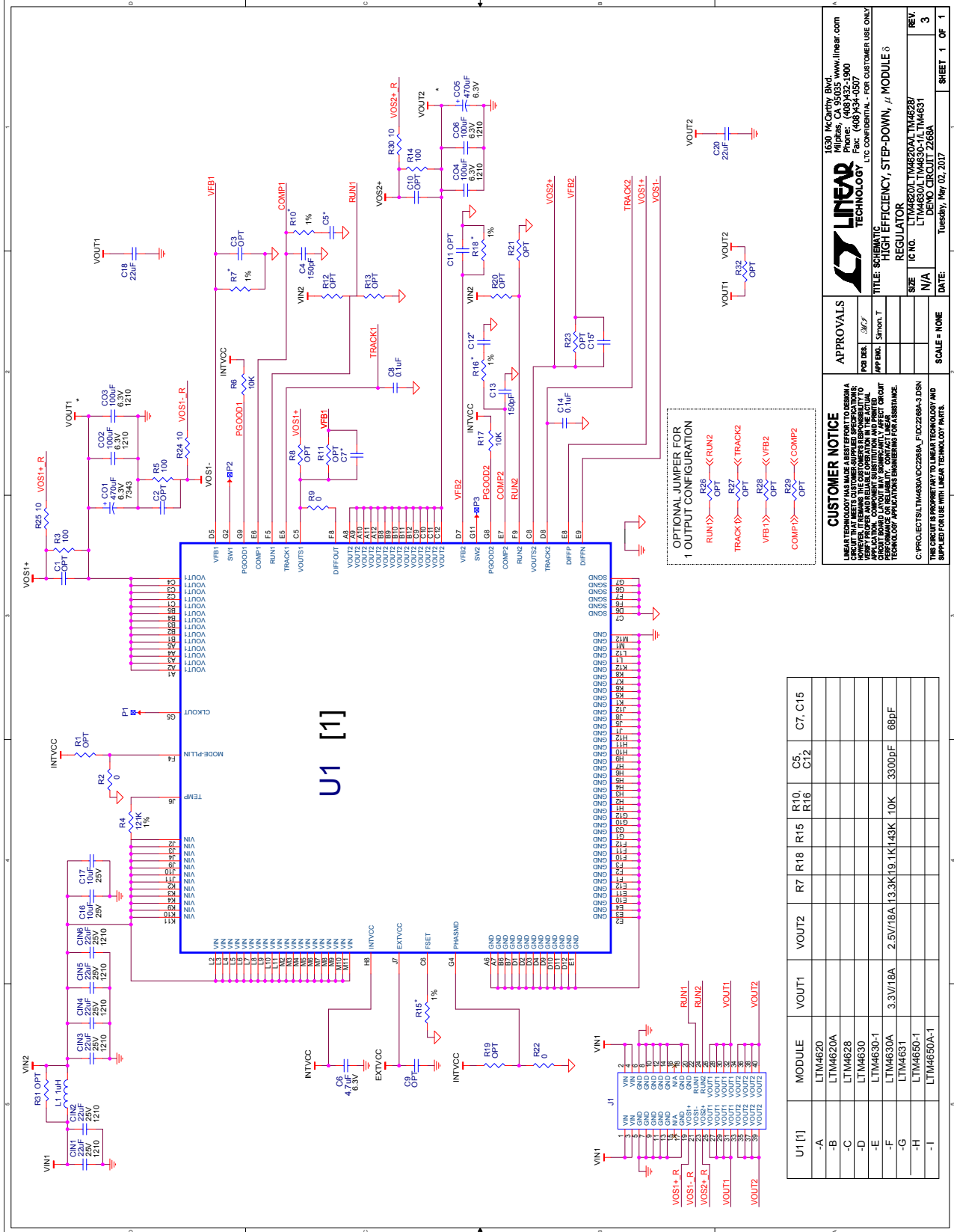
Figure 7. Thermal Performance at  $V_{IN} = 12V$ ,  $V_{OUT1} = 3.3V/15A$ ,  $V_{OUT2} = 2.5V/15A$ ,  $f_{SW} = 600kHz$ ,  $T_A = 23^\circ C$ , 400LFM Airflow

# DEMO MANUAL DC2268A-F

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	6	CIN1, CIN2, CIN3, CIN4, CIN5, CIN6	CAP, 1210 22 $\mu$ F 10% 25V X5R	AVX 12103D226KAT2A
2	2	C01, C05	CAP, 7343 330 $\mu$ F 20% 6.3V POSCAP	PANASONIC 6TPF330M9L
3	4	C02, C03, C04, C06	CAP, 1210 100 $\mu$ F 10% 6.3V X5R	AVX 12106D107KAT2A
4	1	C6	CAP, 0603 4.7 $\mu$ F 20% 6.3V X5R	AVX 06036D475MAT2A
5	2	C7, C15	CAP, 0603 68pF 5% 50V COG / NPO	AVX 06035A680JAT2A
6	2	C8, C14	CAP, 0603 0.1 $\mu$ F 10% 25V X7R	AVX 06033C104KAT2A
7	2	C5, C12	CAP, 0603 3300pF 5% 16V COG	AVX 0603YC332JAT2A
8	2	C16, C17	CAP, 0603 10 $\mu$ F 20% 25V X5R	TDK C1608X5R1E106M080AC
9	2	C18, C20	CAP, 0603 22 $\mu$ F 20% 6.3V X5R	TDK C1608X5R0J226M080AC
10	1	L1	IND, 1.0 $\mu$ H	COILCRAFT XAL5030-102MEC
11	2	R2, R22	RES, 0603 0 $\Omega$ JUMPER	VISHAY CRCW06030000Z0EA
12	3	R3, R5, R14	RES, 0603 100 $\Omega$ 5% 0.1W	VISHAY CRCW0603100RJNEA
13	1	R4	RES, 0603 121k $\Omega$ 1% 0.1W	VISHAY CRCW0603121KFKEA
14	2	R6, R17	RES, 0603 10k $\Omega$ 5% 0.1W	VISHAY CRCW060310K0JNEA
15	1	R7	RES, 0603 13.3k $\Omega$ 1% 0.1W	VISHAY CRCW060313K3FKEA
16	1	R9	RES, 0603 0 $\Omega$	VISHAY CRCW06030000Z0EA
17	2	R10, R16	RES, 0603 10k $\Omega$ 1% 0.1W	VISHAY CRCW060310K0FKEA
18	1	R15	RES, 0603 143k $\Omega$ 1% 0.1W	VISHAY CRCW0603143KFKEA
19	1	R18	RES, 0603 19.1k $\Omega$ 1% 0.1W	VISHAY CRCW060319K1FKEA
20	3	R24, R25, R30	RES, 0603 10 $\Omega$ 5% 0.1W	VISHAY CRCW060310R0JNEA
21	1	U1	IC, VOLTAGE REGULATOR LGA	LINEAR TECH. LTM4628EV#PBF
<b>Additional Demo Board Circuit Components</b>				
1	0	C1, C2, C3, C4, C9, C10, C11, C13	CAP, 0603 OPTION	OPTION
2	0	R1, R8, R11, R12, R13, R19, R20, R21, R23, R26, R27, R28, R29	RES, 0603 OPTION	OPTION
3	0	R31, R32	RES, 2512 OPTION	OPTION
<b>Hardware: For Demo Board Only</b>				
1	1	J1	CONN., CARD EDGE 1.6mm	SAMTEC MEC2-20-01-L-DV--TR

SCHEMATIC DIAGRAM



OPTIONAL JUMPER FOR 1 OUTPUT CONFIGURATION

RUN1 <-> R26 OPT <-> RUN2  
 TRACK1 <-> R27 OPT <-> TRACK2  
 VFB1 <-> R28 OPT <-> VFB2  
 COMP1 <-> R29 OPT <-> COMP2

**CUSTOMER NOTICE**  
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C: PROCECTSU1TM4620A, DC2268A, F: DC2268A-3 DSN  
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APPROVALS	
DESIGN	Simon.T
APP BKM	Simon.T
DATE:	Tuesday, May 02, 2007
SCALE	NONE
SIZE	N/A
IC NO.	LT1M4620, LT1M4620A, LT1M4623, LT1M4630, LT1M4630-1, LT1M4650-1, LT1M4650A-1
REV.	3
SHEET	1 OF 1

U1 [1]	MODULE	VOUT1	VOUT2	C5, C12	R10, R16	R7, R18	R15	R18	C7, C15
-A	LT1M4620								
-B	LT1M4620A								
-C	LT1M4628								
-D	LT1M4630								
-E	LT1M4630-1	3.3V/18A	2.5V/18A	3300pF	10K	1.3K	19.1K	143K	68pF
-G	LT1M4631								
-H	LT1M4650-1								
-I	LT1M4650A-1								

# DEMO MANUAL DC2268A-F

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