LT3667
40V Step-Down Regulator with Dual LDOs

DESCRIPTION

Demonstration circuit 1869A is a triple power supply including one 400mA step-down regulator and two 200mA low dropout linear regulators (LDOs) featuring the LT®3667. The demo circuit is designed for 5.0V, 3.3V and 2.5V outputs from a 6V to 40V input. Two LDO outputs are configured as post-regulators of the switching regulator output. The total current capability of three output channels is up to 400mA in this configuration, while the two LDO regulators are capable of 200mA each.

The switching frequency of the step-down regulator can be programmed either via a oscillator resistor over a 250kHz to 2.2MHz range or an external clock over a 300kHz to 2.2MHz range. When the circuit is synchronized to an external clock connected to the SYNC terminal, the RT resistor (R8) should be chosen to set the LT3667 internal switching frequency at least 20% below the final SYNC frequency.

The LT3667 internal boost diode and loop compensation reduce the components count and solution size. The current mode control scheme creates fast transient response and good loop stability. The switching regulator has cycle-by-cycle current limit and diode current sense, providing protection against shorted outputs.

JP1 can be used to set the whole LT3667 in shutdown mode. JP3 and JP4 enable and disable the 2.5V LDO output and 3.3V LDO output respectively.

The LT3667 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this quick start guide for DC1869A. Proper board layout is essential for both proper operation and maximum thermal performance. See the PCB Layout section in the data sheet.

Design files for this circuit board are available at http://www.linear.com/demo/DC1869A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN1}	Input Supply Range of V_{IN1}		6		40	V
f_{SW}	Switching Frequency	V_{IN1} = 12V, V_{OUT1} = 5V/I_{OUT1} = 400mA V_{OUT2} = 2.5V/I_{OUT2} = 0mA V_{OUT3} = 3.3V/I_{OUT3} = 0mA	510		690	kHz
V_{OUT1}	Output Voltage 1	V_{IN1} = 12V, V_{OUT1} = 5V/I_{OUT1} = 0mA to 400mA V_{OUT2} = 2.5V/I_{OUT2} = 0mA V_{OUT3} = 3.3V/I_{OUT3} = 0mA	4.9		5.1	V
V_{OUT2}	Output Voltage 2	V_{IN1} = 12V, V_{OUT1} = 5V/I_{OUT1} = 0mA V_{OUT2} = 2.5V/I_{OUT2} = 0mA to 190mA V_{OUT3} = 3.3V/I_{OUT3} = 0mA	2.43		2.57	V
V_{OUT3}	Output Voltage 3	V_{IN1} = 12V, V_{OUT1} = 5V/I_{OUT1} = 0mA V_{OUT2} = 2.5V/I_{OUT2} = 0mA V_{OUT3} = 3.3V/I_{OUT3} = 0mA to 190mA	3.21		3.39	V
$I_{OUT1} + I_{OUT2} + I_{OUT3}$	Maximum Total Output Current	IN2 and IN3 are powered by V_{OUT1}	400			mA
I_{OUT2}, I_{OUT3}	Maximum LDO Output Current		190	200		mA

QUICK START PROCEDURE

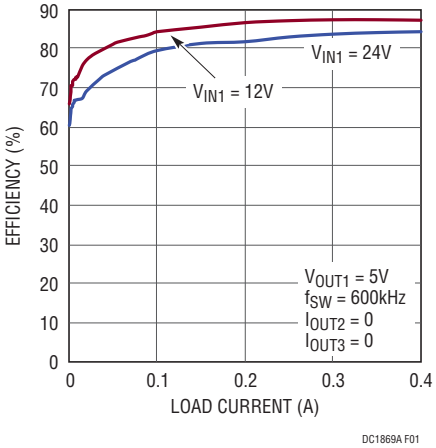


Figure 1. V_{OUT1} Typical Efficiency vs Load Current

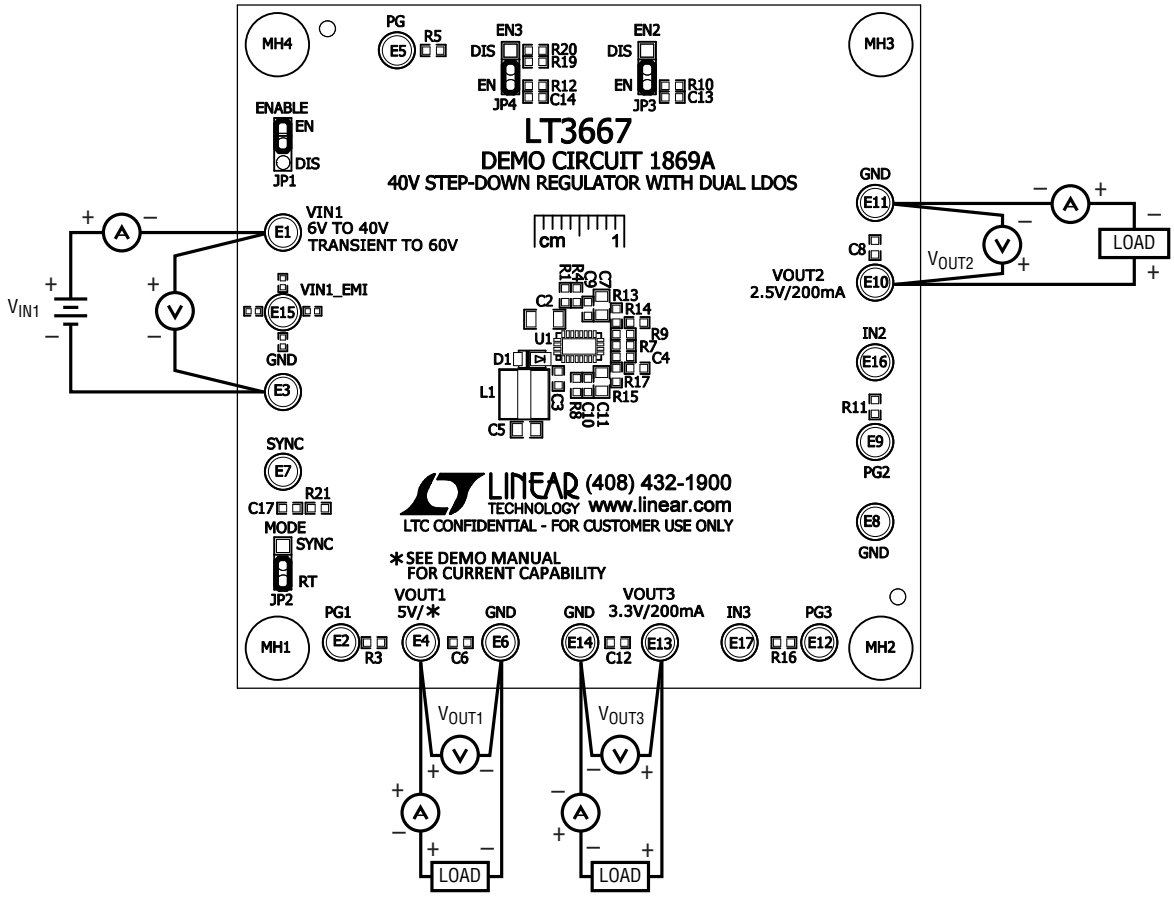


Figure 2. Proper Measurement Equipment Setup

QUICK START PROCEDURE

Demonstration circuit 1869A is easy to set up to evaluate the performance of the LT3667. Refer to Figure 2 for proper measurement equipment setup and follow the procedure below:

NOTE: When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the V_{IN} or V_{OUT} and GND terminals. See Figure 3 for the proper scope technique.

1. Place JP1, JP3 and JP4 on the EN position. Place JP2 on the RT position.
2. With power off, connect the input power supply to V_{IN1} and GND.
3. With power off, connect loads from V_{OUT1} to GND, from V_{OUT2} to GND, and from V_{OUT3} to GND.
4. Turn on the power at the input.

   NOTE: Make sure that the input voltage do not exceed 40V.
5. Check for the proper output voltages:

   V_{OUT1} = 5V, V_{OUT2} = 2.5V, V_{OUT3} = 3.3V

   NOTE. If there is no output, temporarily disconnect the load to make sure that the loads are not set too high or are shorted.
6. Once the proper output voltages are established, adjust the loads within the operating ranges and observe the output voltage regulation, ripple voltage, efficiency and other parameters.
7. An external clock can be added to the SYNC terminal when SYNC function is used (JP2 on the SYNC position). Please make sure that RT should be set to provide a frequency at least 20% below the final SYNC frequency. See the Synchronization section in the data sheet.

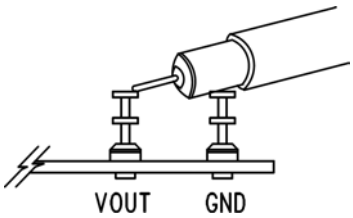
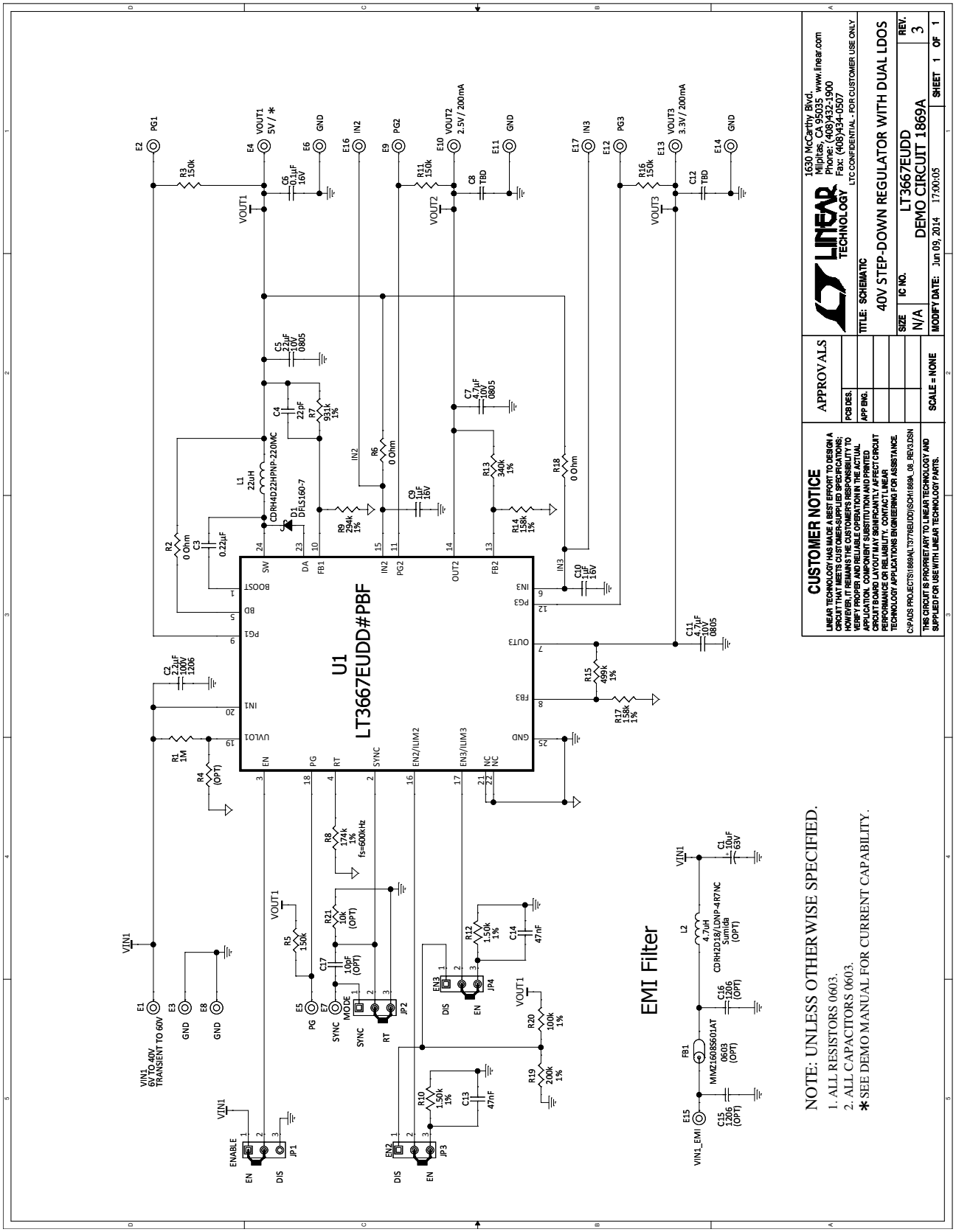


Figure 3. Measuring Input or Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C2	CAP., X7S 2.2µF 100V 20% 1206	TDK C3216X7S2A225M
2	1	C3	CAP., X7R 0.22µF 25V 10% 0603	AVX 06033C224KAT2A
3	1	C4	CAP., NPO 22pF 25V 5% 0603	AVX 06033A220JAT2A
4	1	C5	CAP., X5R 22µF 10V 20% 0805	TAIYO YUDEN LMK212BJ226MG-T
5	2	C7, C11	CAP., X7R 4.7µF 10V 10% 0805	TAIYO YUDEN LMK212B7475KG-T
6	2	C9, C10	CAP., X5R 1µF 16V 10% 0603	TAIYO YUDEN EMK107BJ105KA-T
7	1	D1	SCHOTTKY DIODE 1A/60V POWERDITM123	DIODES INC. DFLS160-7
8	1	L1	INDUCTOR, 22µH	SUMIDA CDRH4D22HPNP-220MC
9	1	R1	RES., CHIP 1M 0.10W 5% 0603	VISHAY CRCW06031M00JNEA
10	4	R3, R5, R11, R16	RES., CHIP 150k 0.10W 5% 0603	VISHAY CRCW0603150KJNEA
11	1	R7	RES., CHIP 931k 0.10W 1% 0603	VISHAY CRCW0603931KFKEA
12	1	R8	RES., CHIP 174k 0.10W 1% 0603	VISHAY CRCW0603174KFKEA
13	1	R9	RES., CHIP 294k 0.10W 1% 0603	VISHAY CRCW0603294KFKEA
14	1	R13	RES., CHIP 340k 0.10W 1% 0603	VISHAY CRCW0603340KFKEA
15	2	R14, R17	RES., CHIP 158k 0.10W 1% 0603	VISHAY CRCW0603158KFKEA
16	1	R15	RES., CHIP 499k 0.10W 1% 0603	VISHAY CRCW0603499KFKEA
17	1	U1	I.C., VOLTAGE REG. QFN(24) (UDD) 3mm × 5mm	LINEAR TECH. CORP. LT3667EUDD#PBF
Additional Demo Board Circuit Components				
1	1	C1	CAP., ALUM 10µF 63V 20% OSCON-CE-6.3	SUN ELECTRONIC INDUSTRIES 63CE10GA
2	1	C6	CAP., X7R 0.1µF 16V 10% 0603	AVX 0603YC104KAT2A
3	0	C8, C12 (OPT)	CAP., 0603	
4	2	C13, C14	CAP., X7R 47nF 25V 20% 0603	AVX 06033C473MAT2A
5	0	C15, C16 (OPT)	CAP., 1206	
6	0	C17 (OPT)	CAP., X7R 10pF 25V 10% 0603	AVX 06033C100KAT2A
7	0	FB1 (OPT)	FERRITE BEAD, 600Ω/500mA 0603	TDK MMZ1608S601AT
8	0	L2 (OPT)	INDUCTOR, 4.7µH	SUMIDA CDRH2D18/LDNP-4R7NC
9	3	R2, R6, R18	RES./JUMPER, CHIP 0Ω 0.1W 5A 0603	VISHAY CRCW06030000Z0EA
10	0	R4 (OPT)	RES., 0603	
11	2	R10, R12	RES., CHIP 1.50k 0.10W 1% 0603	VISHAY CRCW06031K50FKEA
12	1	R19	RES., CHIP 200k 0.10W 1% 0603	VISHAY CRCW0603200KFKEA
13	1	R20	RES., CHIP 100k 0.10W 1% 0603	VISHAY CRCW0603100KFKEA
14	0	R21 (OPT)	RES., CHIP 10k 0.10W 5% 0603	VISHAY CRCW060310K0JNEA
Hardware: For Demo Board Only				
1	17	E1-E17	TURRET, TESTPOINT	MILL-MAX 2501-2-00-80-00-00-07-0
2	4	JP1, JP2, JP3, JP4	HEADERS, 3 PINS 2mm CTRS.	SULLINS NRPN031PAEN-RC
3	4	XJP1, XJP2, XJP3, XJP4	SHUNT, 2mm CTRS.	SAMTEC 2SN-BK-G
4	4	MH1, MH2, MH3, MH4	STAND-OFF, NYLON 0.25" TALL	KEYSTONE 8831(SNAP ON)

SCHEMATIC DIAGRAM



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

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