LTM4612
EN55022B Compliant 36V, 5A Step-Down µModule® Regulator

DESCRIPTION

Demonstration circuit DC1297B features the LTM®4612EV, an EN55022 Class B certified synchronous step-down power module. The board accepts an input voltage from 5V to 36V and delivers a jumper programmable output voltage of 3.3V, 5V or 12V. The rated load current is 5A for 3.3V/5V, 3A for 12V V_{OUT}. Current derating is necessary for certain V_{IN}, V_{OUT}, and thermal conditions. DC1297B supports programming of the output ramp-up and ramp-down through the TRACK/SS pin. The output may be set to coincidentally or ratiometrically track to another voltage rail. The LTM4612 data sheet must be read in conjunction with this demo manual for working on or modifying the demo circuit 1297B.

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

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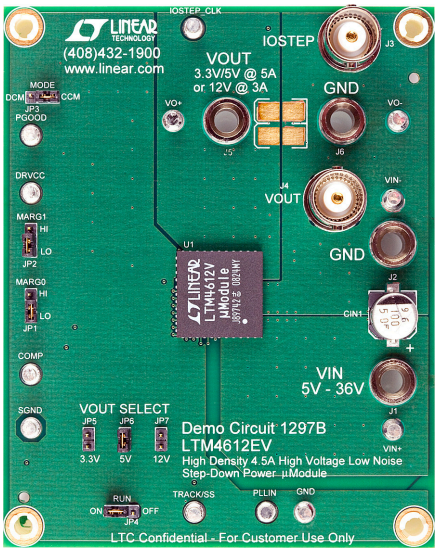
PERFORMANCE SUMMARY (T_A = 25°C)

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		5V to 36V
Output Voltage V_{OUT}	Jumper Selectable	3.3V, 5V, 12V; ± 2%
Maximum Continuous Output Current	Derating is Necessary for Certain V_{IN}, V_{OUT}, and Thermal Conditions	$5A_{DC}$ for 3.3V, 5V $3A_{DC}$ for 12V
Default Operating Frequency		850 kHz for V_{OUT} = 12V; 350kHz for V_{OUT} = 5V; 235kHz for V_{OUT} = 3.3V
Efficiency	V_{IN} = 12V, V_{OUT} = 5V, I_{OUT} = 5A	90.1%, See Figure 3 for Detail

BOARD PHOTO



QUICK START PROCEDURE

Demonstration circuit DC1297B is an easy way to evaluate the performance of the LTM4612EV. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Place jumpers in the following positions for a typical $5V_{OUT}$ application:

MODE	MARG1	MARG0	V_{OUT} SELECT	RUN
CCM	LO	LO	5V	ON

2. With power off, connect the input power supply, load and meters as shown in Figure 1. Preset the load to 0A and the input supply to be 12V.
3. Turn on the power at the input. The output voltage should be 5V ± 2% (4.9V~5.1V).
4. 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.
5. To measure input and output ripple, please refer to Figure 2 for proper setup.
6. For optional load transient test, apply adjustable pulse signal between IOSTEP_CLK and GND pins. The pulse amplitude sets the current step. The pulse signal should have very small duty cycle (<5%) to limit the thermal stress on the transient load circuit. The output transient current can be monitored at BNC connector J3 (10mV/A), the output voltage can be monitored at BNC connector J4.
7. Due to the 400ns minimum off time limit of LTM4612, V_{IN} needs to be higher than 18.5V for 12V V_{OUT}, and higher than 5.85V for 5V V_{OUT}. Otherwise, the switching frequency needs to be reduced by adding a resistor at R6. Please refer to the LTM4612 datasheet for details.

QUICK START PROCEDURE

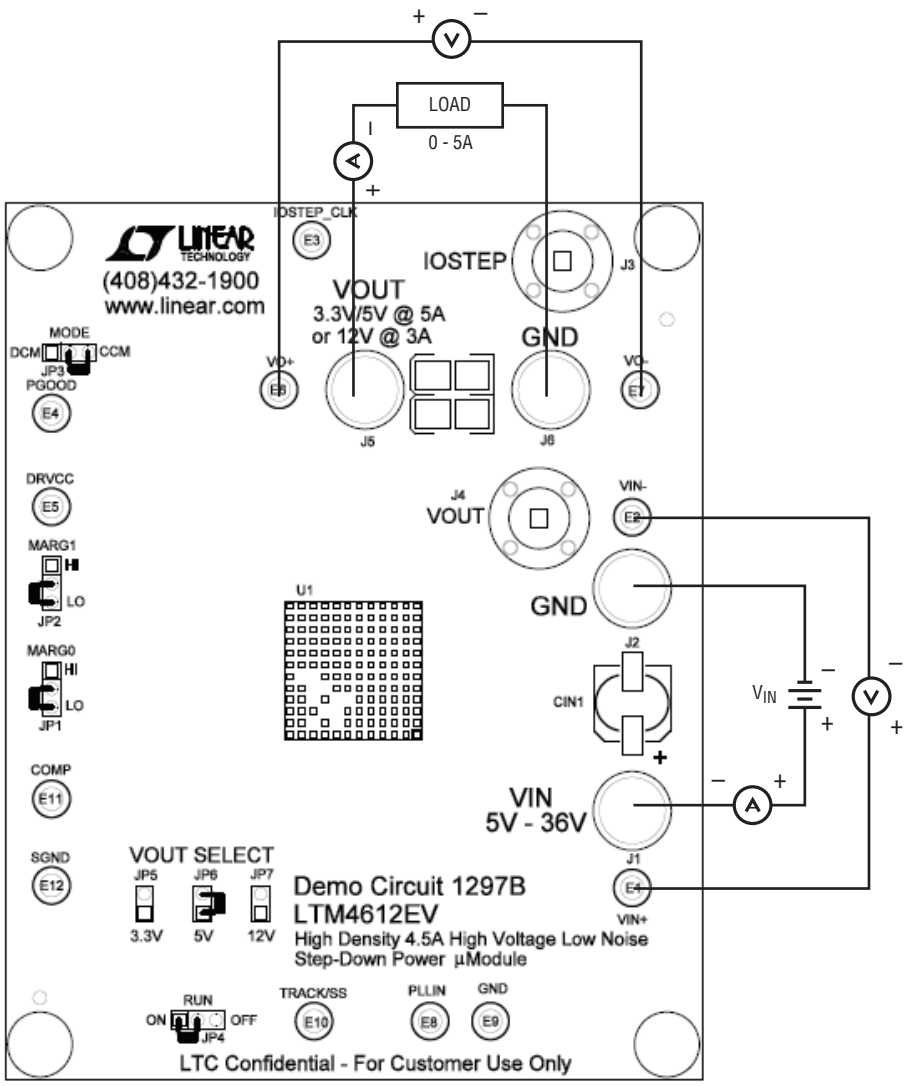


Figure 1. Test Setup of DC1297B

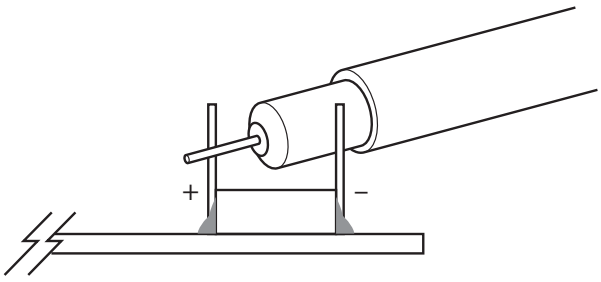
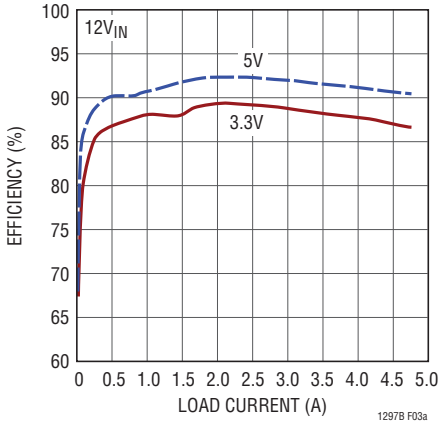
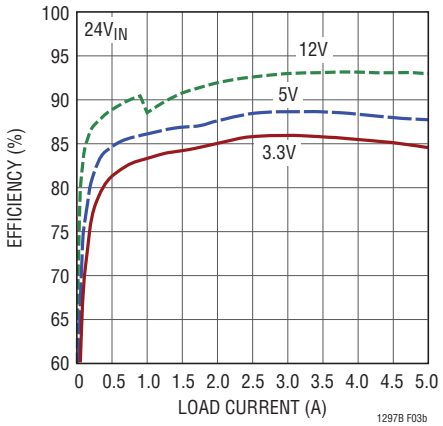


Figure 2. Scope Probe Placements for Measuring Input or Output Ripple

QUICK START PROCEDURE





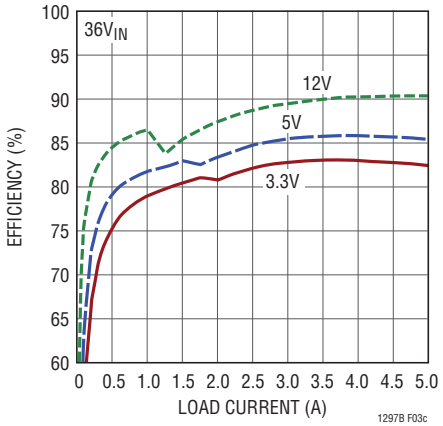
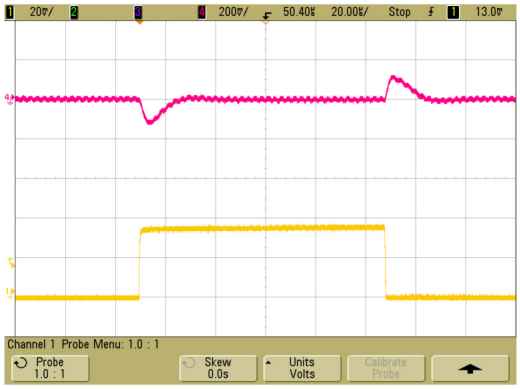


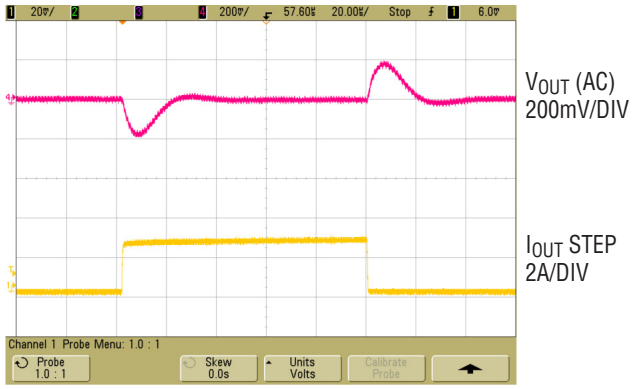
Figure 3. Measured DC1297B Efficiency at $12V_{IN}$, $24V_{IN}$, $36V_{IN}$ (DCM mode enabled)

QUICK START PROCEDURE



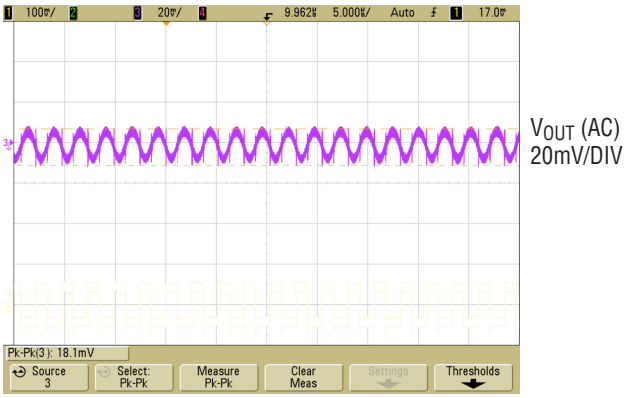
V_{IN}(V)	V_{OUT}(V)	C_{OUT} Ceramic	Mode
12	5	2 × 47µF/16V + 10µF/16V	CCM

Figure 4: Measured Load Transient Response (1.25A to 5A Load Step)



V_{IN}(V)	V_{OUT}(V)	C_{OUT} Ceramic	Mode
36	12	2 × 47µF/16V + 10µF/16V	CCM

Figure 5. Measured Load Transient Response (0.75A to 3A Load Step)



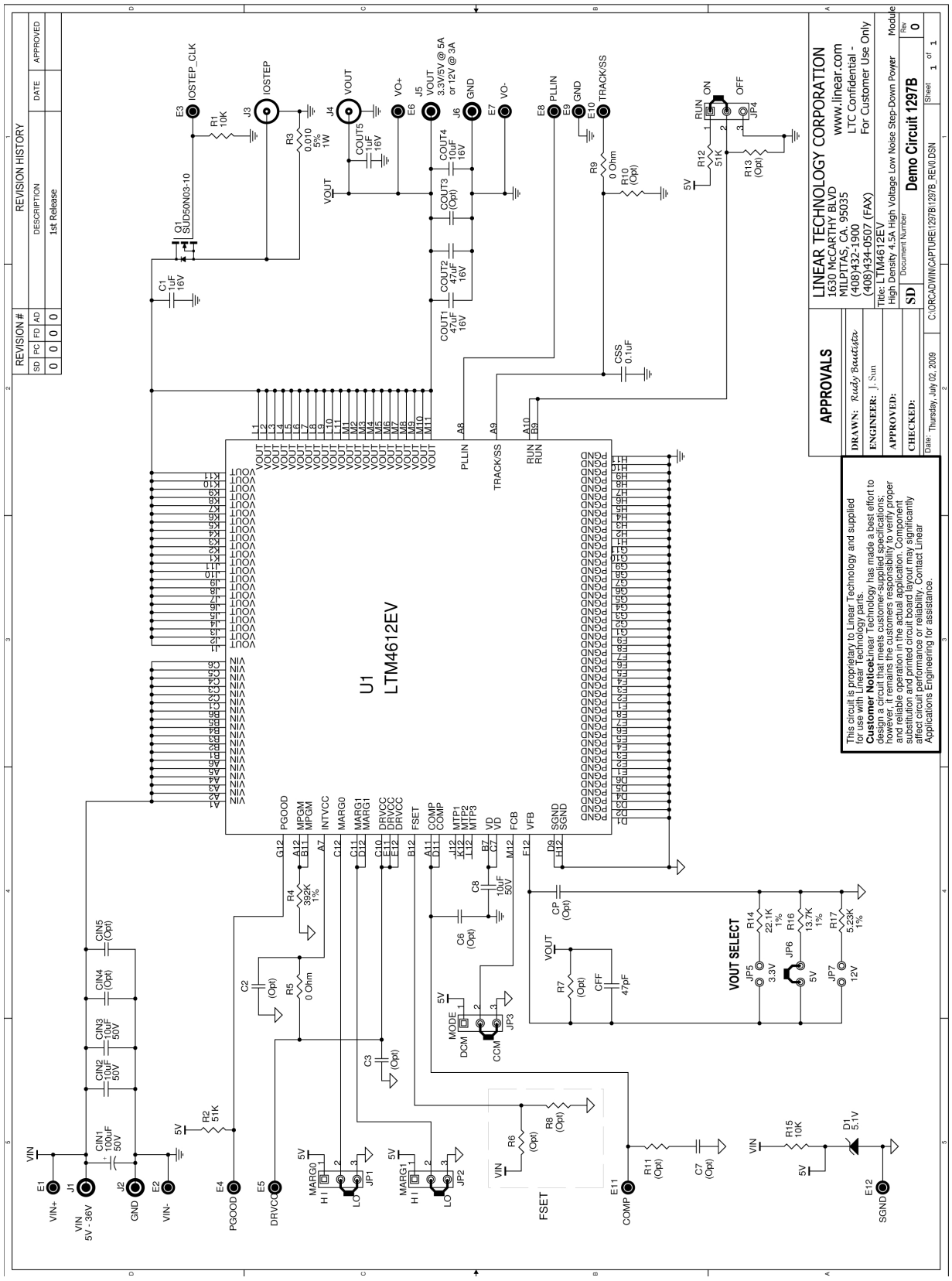
V_{IN}(V)	V_{OUT}(V)	C_{OUT} Ceramic
12	5	2 × 47µF/16V + 10µF/16V

Figure 6. Measured Output Voltage Ripple (300MHz BW)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CFF	Cap, NPO 47pF 50V 10%	AVX 06035A470KAT1A
2	1	C_{IN1}	Cap, Alum 100µF 50V 10%	SANYO 50CE100FS (now SUNCON 50CE100FS)
3	3	C_{IN2}, C_{IN3}, C8	Cap, X5R 10µF 50V 20%	TAIYO YUDEN UMK325BJ106MM-T
4	2	C_{OUT2}, C_{OUT1}	Cap, X5R 47µF 16V 20%	Taiyo Yuden EMK325BJ476MM
5	1	C_{OUT4}	Cap, X5R 10µF 16V 20%	TDK C3225X5R1C106M
6	1	C_{SS}	Cap, X7R 0.1µF 16V 20%	AVX 0603YC104MAT2A
7	1	D1	Zener Diode, 5.1V	On Semi. MMBZ5231B
8	1	R15	Res, Chip 10k 0.06W 5%	Vishay CRCW060310K0JNEA
9	2	R12, R2	Res, Chip 51k 0.06W 5%	Vishay CRCW060351K0JNEA
10	1	R4	Res, Chip 392k 0.06W 1%	Vishay CRCW0603392KFKEA
11	1	R16	Res, Chip 13.7k 0.06W 1%	Vishay CRCW060313K7FKEA
12	1	U1	I.C., Volt. Reg.	Linear Technology Corp. LTM4612EV
Additional Demo Board Circuit Components				
1	0	C_{OUT3}, C_{IN4}, C_{IN5} (Opt)	Cap, 1210 TBD	
2	1	C_{OUT5}	Cap, 1µF	
3	0	C2, C3,C6, C7, CP (Opt)	Cap, 0603 TBD	
4	1	C1	Cap, X7R 1µF 16V 10%	TDK C1608X7R1C105K
5	1	Q1	Mosfet, N-Channel 30V	Siliconix SUD50N03-10
6	1	R1	Res, Chip 10k 0.06W 5%	Vishay CRCW060310K0JNEA
7	1	R3	Res, LRC 0.01Ω 1W 5%	IRC LR2512-01-R010-J
8	2	R9, R5	Res/Jumper, Chip 0Ω 1/16W 1 AMP	Vishay CRCW0603000Z
9	0	R6, R7, R8, R10, R11, R13 (Opt)	Res, 0603 TBD	
10	1	R14	Res, Chip 22.1k 0.06W 1%	Vishay CRCW060322K1FKEA
11	1	R17	Res, Chip 5.23k 0.06W 1%	Vishay CRCW06035K23FKEA
Hardware For Demo Board Only				
1	12	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12	Turret, Testpoint	Mill Max 2501-2-00-80-00-00-07-0
2	4	JP1, JP2, JP3, JP4	Headers, 3 Pins 2mm Ctrs.	Samtec TMM-103-02-L-S
3	3	JP5, JP6, JP7	Jumper, 2 Pins 2mm Ctrs.	Samtec TMM-102-02-L-S
4	4	J1, J2, J5, J6	Connector, Banana Jack	Keystone 575-4
5	2	J3, J4	BNC Connector	Connex 112404
6	5	XJP1, XJP2, XJP3, XJP4, XJP6	Shunt, 2mm Ctrs.	Samtec 2SN-BK-G
7	4		STAND-OFF, NYLON, 0.50" Tall	KEYSTONE, 8833 (SNAP ON)

SCHEMATIC DIAGRAM



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