



Inverting 1.4MHz Switching Regulator in 5-Lead SOT-23

October 1998

FEATURES

- Better Regulation Than a Charge Pump
- Effective Output Impedance: 0.1Ω
- $-5V$ at $150mA$ from a $5V$ Input
- Uses Tiny Capacitors and Inductor
- Internally Compensated
- Fixed Frequency 1.4MHz Operation
- Low Shutdown Current: $<1\mu A$
- Low V_{CESAT} Switch: $300mV$ at $300mA$
- 5-Lead SOT-23 Package

APPLICATIONS

- Digital Camera CCD Bias
- MR Head Bias
- LCD Bias
- Positive-to-Negative Conversion
- GaAs FET Bias

DESCRIPTION

The LT[®]1611 is the industry's first inverting 5-lead SOT-23 current mode DC/DC converter. Intended for use in small, low power applications, it operates from an input voltage as low as $1.1V$ and switches at $1.4MHz$, allowing the use of tiny, low cost capacitors and inductors $2mm$ or less in height. Its small size and high switching frequency enable the complete DC/DC converter function to take up less than 0.25 square inches of PC board area. Capable of generating $-5V$ at $150mA$ from a $5V$ supply or $-5V$ at $100mA$ from a $3V$ supply, the LT1611 replaces nonregulated "charge pump" solutions in many applications.

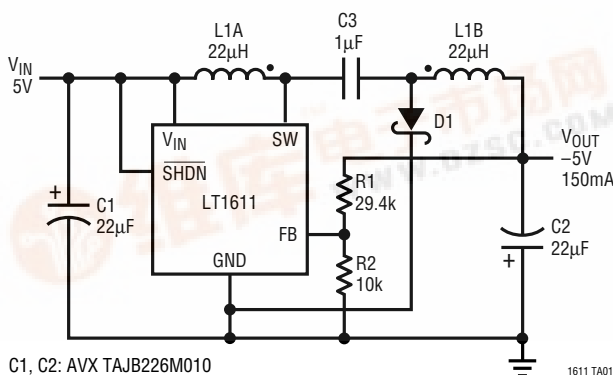
The LT1611 operates in a dual inductor inverting topology which filters the input side as well as the output side of the DC/DC converter. Fixed frequency switching ensures a clean output free from low frequency noise typically present with charge pump solutions. No load quiescent current of the LT1611 is $3mA$, while in shutdown quiescent current drops to $0.5\mu A$. The $36V$ switch allows V_{IN} to V_{OUT} differential of up to $33V$.

The LT1611 is available in the 5-lead SOT-23 package.

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TYPICAL APPLICATION

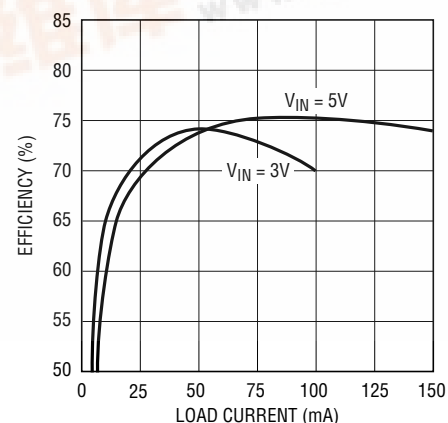
5V to $-5V$, $150mA$ Inverting DC/DC Converter



C1, C2: AVX TAJB226M010
C3: X7R CERAMIC
D1: MBR0520
L1: SUMIDA CLS62-220 OR 2x MURATA LQH3C220 (UNCOUPLED)

1611 TA01

Efficiency



1611 TA02



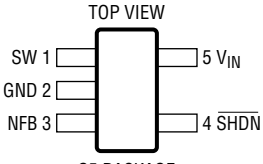
LT1611

ABSOLUTE MAXIMUM RATINGS

(Note 1)

V_{IN} Voltage	10V
SW Voltage	–0.4V to 36V
NFB Voltage	–3V
Current into NFB Pin	± 1 mA
SHDN Voltage	10V
Maximum Junction Temperature	125°C
Operating Temperature Range	
Commercial	0°C to 70°C
Extended Commercial (Note 2)	–40°C to 85°C
Storage Temperature Range	–65°C to 150°C
Lead Temperature (Soldering, 10 sec)	300°C

PACKAGE/ORDER INFORMATION

 <p>S5 PACKAGE 5-LEAD PLASTIC SOT-23</p> <p>$T_{JMAX} = 125^{\circ}\text{C}$, $\theta_{JA} = 256^{\circ}\text{C/W}$</p>	ORDER PART NUMBER
	LT1611CS5
	S5 PART MARKING
	LTES

Consult factory for Industrial and Military grade parts.

ELECTRICAL CHARACTERISTICS

$V_{IN} = 1.5\text{V}$, $V_{SHDN} = V_{IN}$, $T_A = 25^{\circ}\text{C}$, unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Minimum Operating Voltage				0.9	1.1	V
Maximum Operating Voltage					10	V
NFB Pin Bias Current	$V_{\text{NFB}} = -1.23\text{V}$	●	-2.7	-4.7	-6.7	μA
Feedback Voltage		●	-1.205	-1.23	-1.255	V
Quiescent Current	$V_{\text{SHDN}} = 1.5\text{V}$, Not Switching			3	4.5	mA
Quiescent Current in Shutdown	$V_{\text{SHDN}} = 0\text{V}$, $V_{\text{IN}} = 2\text{V}$			0	0.5	μA
	$V_{\text{SHDN}} = 0\text{V}$, $V_{\text{IN}} = 5\text{V}$			0	1.0	μA
Reference Line Regulation	$1.5\text{V} \leq V_{\text{IN}} \leq 10\text{V}$			0.02	0.2	%/V
Switching Frequency		●	1.0	1.4	1.8	MHz
Maximum Duty Cycle		●	82	86		%
Switch Current Limit	(Note 3)		550	800		mA
Switch V_{CESAT}	$I_{\text{SW}} = 300\text{mA}$			300	350	mV
Switch Leakage Current	$V_{\text{SW}} = 5\text{V}$			0.01	1	μA
SHDN Input Voltage High			1			V
SHDN Input Voltage Low					0.3	V
SHDN Pin Bias Current	$V_{\text{SHDN}} = 3\text{V}$			25	50	μA
	$V_{\text{SHDN}} = 0\text{V}$			0	0.1	μA

The ● denotes specifications which apply over the specified temperature range.

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Note 2: C grade device specifications are guaranteed over the 0°C to 70°C temperature range. In addition, C grade device specifications are assured

over the –40°C to 85°C temperature range by design or correlation, but are not production tested.

Note 3: Current limit guaranteed by design and/or correlation to static test.

PIN FUNCTIONS

SW (Pin 1): Switch Pin. Minimize trace area at this pin to keep EMI down.

GND (Pin 2): Ground. Tie directly to local ground plane.

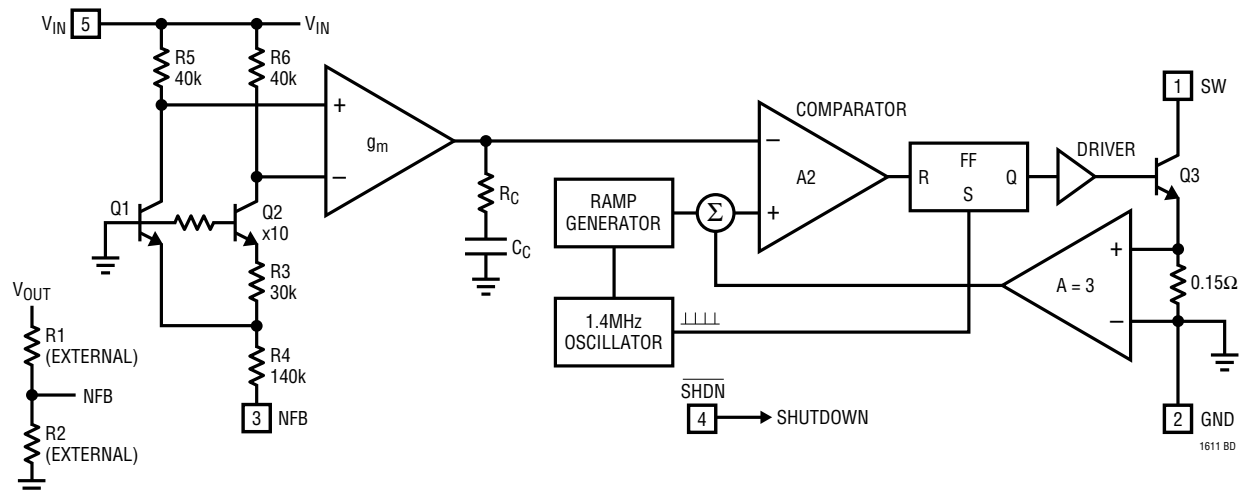
NFB (Pin 3): Negative Feedback Pin. Minimize trace area. Reference voltage is -1.23V . Connect resistive divider tap here. The suggested value for R2 is 10k. Set R1 and R2 according to:

$$R1 = \frac{|V_{OUT}| - 1.23}{\frac{1.23}{R2} + (4.5 \cdot 10^{-6})}$$

SHDN (Pin 4): Shutdown Pin. Tie to 1V or more to enable device. Ground to shut the device down.

V_{IN} (Pin 5): Input Supply Pin. Must be locally bypassed.

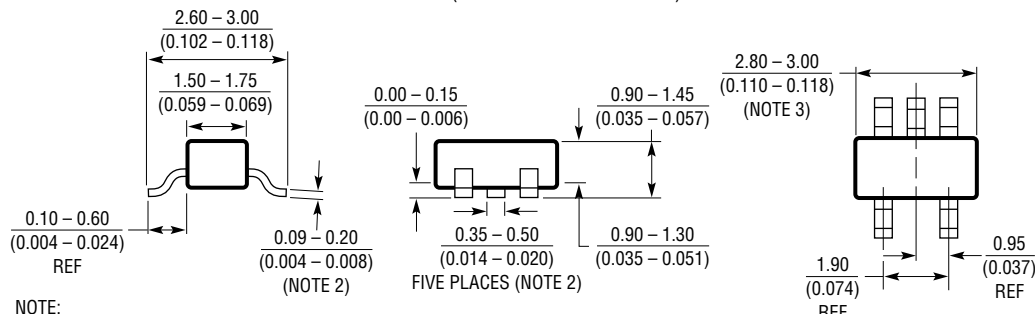
BLOCK DIAGRAM



PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

S5 Package 5-Lead Plastic SOT-23 (LTC DWG # 05-08-1633)



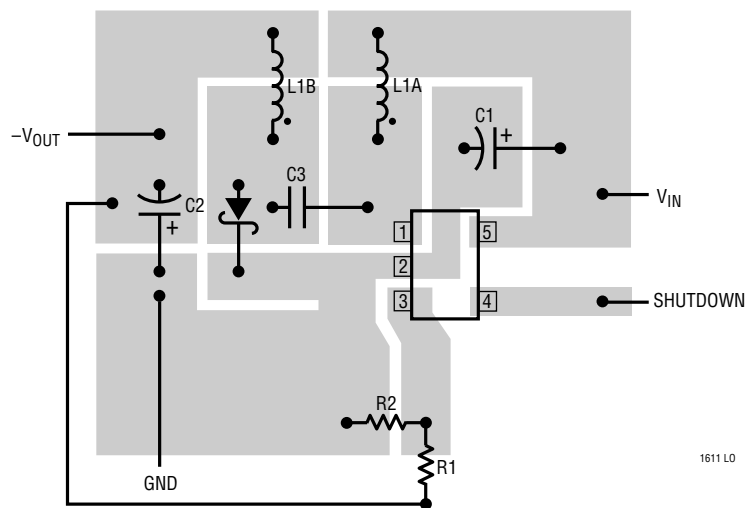
NOTE:

1. DIMENSIONS ARE IN MILLIMETERS
2. DIMENSIONS ARE INCLUSIVE OF PLATING
3. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH AND METAL BURR
4. MOLD FLASH SHALL NOT EXCEED 0.254mm
5. PACKAGE EIAJ REFERENCE IS SC-74A (EIAJ)

S5 SOT-23 0797

LT1611

SUGGESTED LAYOUT



RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1307	Single Cell Micropower DC/DC with Low Battery Detector	3.3V/75mA from 1V; 600kHz Fixed Frequency
LT1316	Burst Mode™ Operation DC/DC with Programmable Current Limit	1.5V Minimum V_{IN} ; Precise Control of Peak Switch Current
LT1317	2-Cell Micropower DC/DC with Low Battery Detector	3.3V/200mA from Two Cells; 600kHz Fixed Frequency
LT1370	500kHz High Efficiency DC/DC Converter	42V, 6A Internal Switch, Negative Feedback Regulation
LT1371	500kHz High Efficiency DC/DC Converter	42V, 3A Internal Switch, Negative Feedback Regulation
LT1610	Single Cell Micropower DC/DC	3V/30mA from 1V; 1.7MHz Fixed Frequency
LT1614	Inverting Mode Switching Regulator with Low-Battery Detector	-5V at 200mA from 5V Input in MSOP

Burst Mode is a trademark of Linear Technology Corporation.