LT1611

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: <1μA
- 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

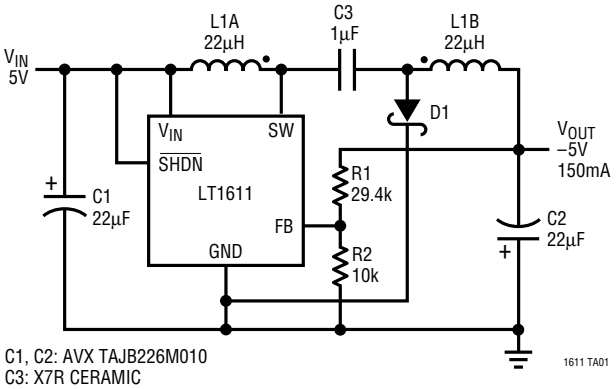
The LT®1611 is the industry's first inverting 5-lead SOT-23 current mode DC/DC converter. Intended for use in small, low power applications, it operates from an input voltage as low as 1.1V and switches at 1.4MHz, allowing the use of tiny, low cost capacitors and inductors 2mm or less in height. Its 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 0.5μA. 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.

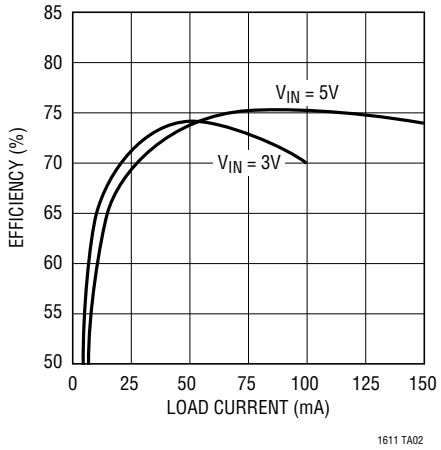
TYPICAL APPLICATION

5V to –5V, 150mA Inverting DC/DC Converter



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

Efficiency

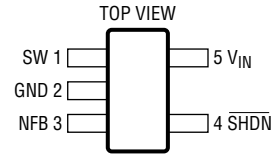


ABSOLUTE MAXIMUM RATINGS

(Note 1)

V_{IN} Voltage 10V
SW Voltage ..... –0.4V to 36V
NFB Voltage ..... –3V
Current into NFB Pin ..... ±1mA
$\overline{SHDN}$ 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



S5 PACKAGE
5-LEAD PLASTIC SOT-23

T_{JMAX} = 125°C, θ_{JA} = 256°C/W

ORDER PART NUMBER
LT1611CS5
S5 PART MARKING
LTES

Consult factory for Industrial and Military grade parts.

ELECTRICAL CHARACTERISTICS

V_{IN} = 1.5V, $V_{\overline{SHDN}}$ = V_{IN}, T_A = 25°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_{NFB} = –1.23V	●	–2.7	–4.7	–6.7	µA
Feedback Voltage		●	–1.205	–1.23	–1.255	V
Quiescent Current	$V_{\overline{SHDN}}$ = 1.5V, Not Switching			3	4.5	mA
Quiescent Current in Shutdown	$V_{\overline{SHDN}}$ = 0V, V_{IN} = 2V $V_{\overline{SHDN}}$ = 0V, V_{IN} = 5V			0 0	0.5 1.0	µA µA
Reference Line Regulation	1.5V ≤ V_{IN} ≤ 10V			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_{SW} = 300mA			300	350	mV
Switch Leakage Current	V_{SW} = 5V			0.01	1	µA
$\overline{SHDN}$ Input Voltage High			1			V
$\overline{SHDN}$ Input Voltage Low					0.3	V
$\overline{SHDN}$ Pin Bias Current	$V_{\overline{SHDN}}$ = 3V $V_{\overline{SHDN}}$ = 0V			25 0	50 0.1	µA 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.

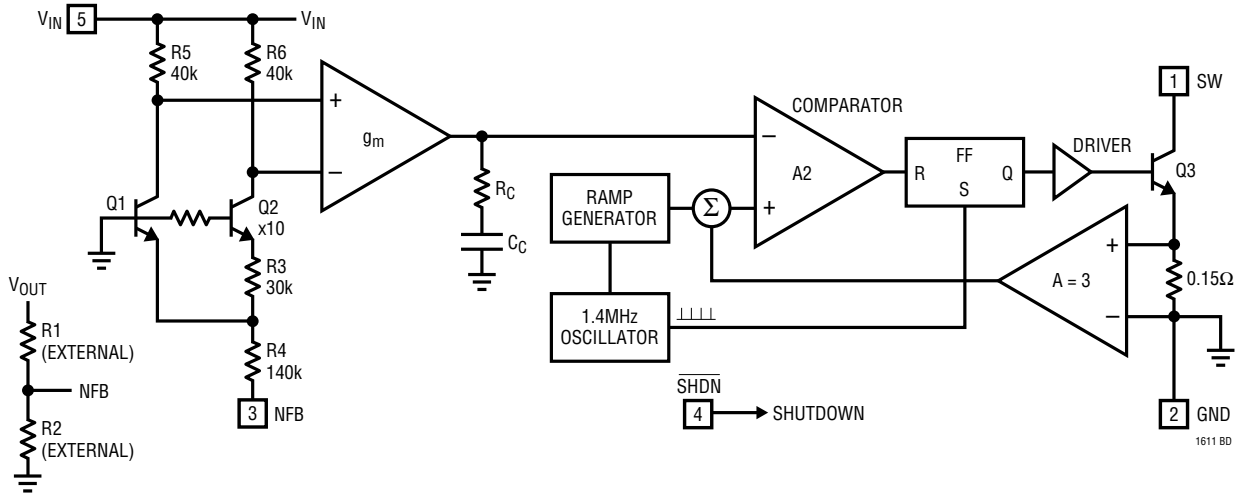
NFB (Pin 3): Negative Feedback Pin. Minimize trace area. Reference voltage is –1.23V. Connect resistive divider tap here. The suggested value for R2 is 10k. Set R1 and R2 according to:

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

$\overline{\text{SHDN}}$ (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.

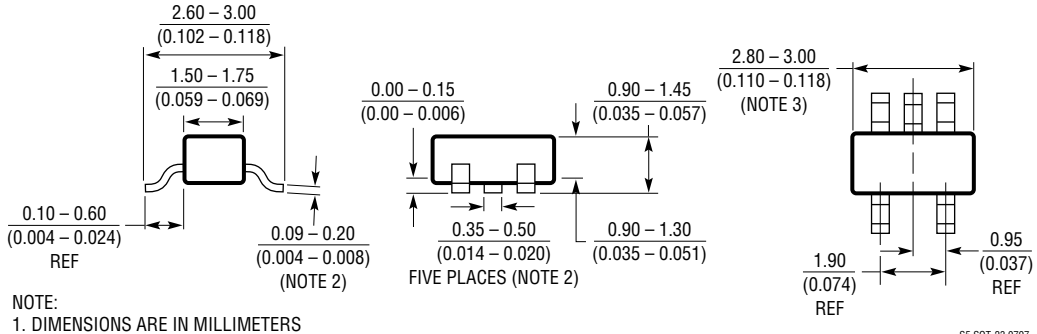
BLOCK DIAGRAM



PACKAGE DESCRIPTION

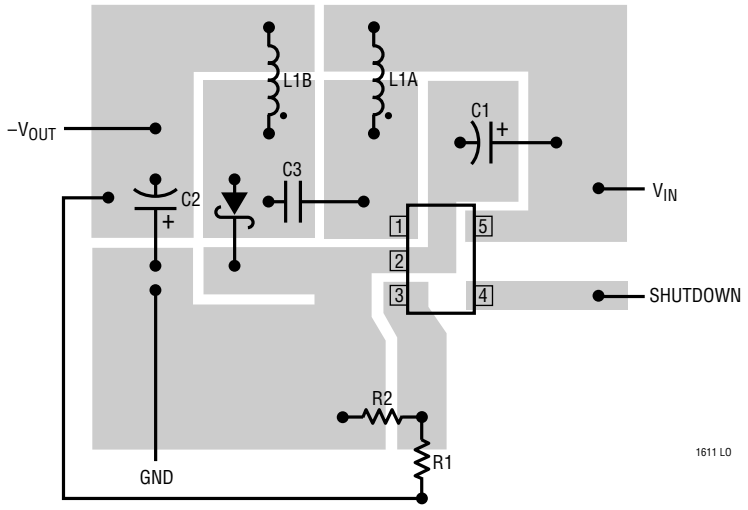
Dimensions in inches (millimeters) unless otherwise noted.

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)

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.

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1611i LT/TP 1098 4K • PRINTED IN USA