Switched Capacitor Voltage Converter

FEATURES

- Plug-In Compatible with 7660 with These Additional Features:
  - *Guaranteed* Operation to 9V, with No External Diode, Over Full Temperature Range
  - Boost Pin (Pin 1) for Higher Switching Frequency
  - Lower Quiescent Power
  - Efficient Voltage Doubler
- 200μA *Max.* No Load Supply Current at 5V
- 97% *Min.* Open Circuit Voltage Conversion Efficiency
- 95% *Min.* Power Conversion Efficiency
- Wide Operating Supply Voltage Range, 1.5V to 9V
- Easy to Use
- Commercial Device *Guaranteed* Over −40°C to 85°C Temperature Range

APPLICATIONS

- Conversion of +5V to ±5V Supplies
- Precise Voltage Division, $V_{OUT} = V_{IN}/2 \pm 20ppm$
- Voltage Multiplication, $V_{OUT} = \pm nV_{IN}$
- Supply Splitter, $V_{OUT} = \pm V_S/2$

DESCRIPTION

The LTC1044 is a monolithic CMOS switched capacitor voltage converter which is manufactured using Linear Technology's enhanced LTCMOS™ silicon gate process. The LTC1044 provides several voltage conversion functions: the input voltage can be inverted ($V_{OUT} = -V_{IN}$), doubled ($V_{OUT} = 2V_{IN}$), divided ($V_{OUT} = V_{IN}/2$) or multiplied ($V_{OUT} = \pm nV_{IN}$).

Designed to be pin-for-pin and functionally compatible with the popular 7660, the LTC1044 provides significant features and improvements over earlier 7660 designs. These improvements include: full 1.5V to 9V supply operation over the entire operating temperature range, without the need for external protection diodes; 2½ times lower quiescent current for greater power conversion efficiency; and a "boost" function which is available to raise the internal oscillator frequency to optimize performance in specific applications.

Although the LTC1044 provides significant design and performance advantages over the earlier 7660 device, it still maintains its compatibility with existing 7660 designs.

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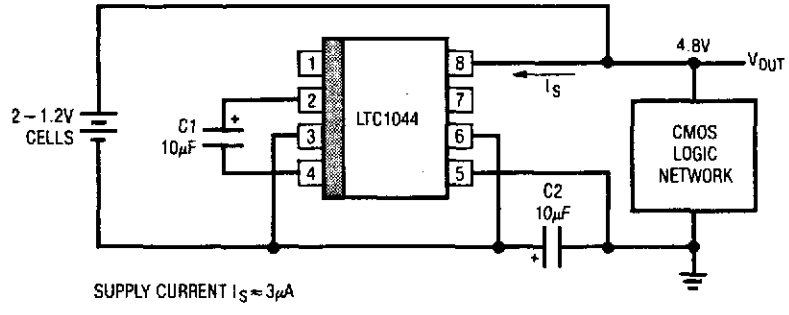
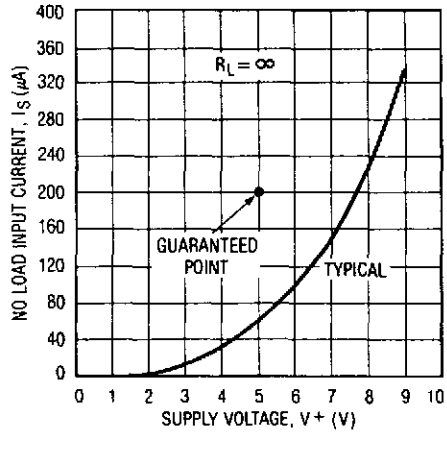
Generating CMOS Logic Supply from 2 Mercury Batteries



SUPPLY CURRENT $I_S \approx 3\mu A$

Supply Current vs Supply Voltage

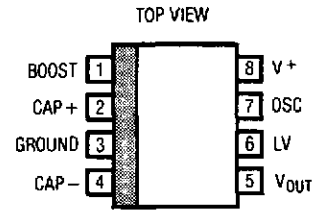


ABSOLUTE MAXIMUM RATINGS

(Notes 1 and 2)

Supply Voltage 9.5V
Input Voltage on Pins 1, 6 and 7
(Note 2) ..... $-0.3V \leq V_{IN} \leq V^+ + 0.3V$
Current into Pin 6 ..... 20μA
Output Short Circuit Duration
($V^+ \leq 5.5V$) ..... Continuous
Operating Temperature Range.... $-40°C \leq T_A \leq 85°C$
Storage Temperature Range..... $-65°C$ to $+150°C$
Lead Temperature (Soldering, 10 sec.) .....300°C

PACKAGE/ORDER INFORMATION



S8 PACKAGE
PLASTIC SO

ORDER PART NUMBER
LTC1044CS8
PART MARKING
1044

ELECTRICAL CHARACTERISTICS

$V^+ = 5V$, $T_A = 25°C$, unless otherwise specified.
See LTC1044/7660 data sheet for test circuit.

SYMBOL	PARAMETER	CONDITIONS		LTC1044CS8 MIN	TYP	MAX	UNITS
I_S	Supply Current	$R_L = \infty$, Pins 1 and 7 No Connection			60	200	μA
		$R_L = \infty$, Pins 1 and 7 V = 3V			20		μA
V^+_L	Minimum Supply Voltage	$R_L = 10k$	●	1.5			V
V^+_H	Maximum Supply Voltage	$R_L = 10k$ (Note 3)	●			9	V
R_{OUT}	Output Resistance	$I_L = 200mA$, $f_{OSC} = 5kHz$				100	Ω
			●			130	Ω
		$V^+ = 2V$, $I_L = 3mA$, $f_{OSC} = 1kHz$	●			325	Ω
f_{OSC}	Oscillator Frequency	$C_{OSC} = 1pF$ (Note 4)					
		$V^+ = 5V$	●	5			kHz
		$V^+ = 2V$	●	1			kHz
P_{EFF}	Power Efficiency	$R_L = 5k\Omega$, $f_{OSC} = 5kHz$		95	98		%
V_{OUTEFF}	Voltage Conversion Efficiency	$R_L = \infty$		97	99.9		%
I_{OSC}	Oscillator Sink or Source Current	$V_{OSC} = 0V$ or V^+					
		Pin 1 = 0V	●			3	μA
		Pin 1 = V^+	●			20	μA

The ● denotes the specifications which apply over the full operating temperature range.

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

Note 2: Connecting any input terminal to voltages greater than V^+ or less than ground may cause destructive latch-up. It is recommended that no inputs from sources operating from external supplies be applied prior to power-up of the LTC1044.

Note 3: The LTC1044 is guaranteed to operate with alkaline, mercury or NiCad 9V batteries, even though the initial battery voltage may be slightly higher than 9.0V.

Note 4: f_{OSC} is tested with $C_{OSC} = 100pF$ to minimize the effects of test fixture capacitance loading. The 1pF frequency is correlated to this 100pF test point, and is intended to simulate the capacitance at pin 7 when the device is plugged into a test socket and no external capacitor is used.