# CMOS Voltage Converters

## CMOS Voltage Converters

The Intersil LMC7660 are monolithic CMOS power supply circuits which offer unique performance advantages over previously available devices. The LMC7660 performs supply voltage conversions from positive to negative for an input range of +1.5V to +10.0V resulting in complementary output voltages of -1.5V to -10.0V.

Only 2 noncritical external capacitors are needed for the charge pump and charge reservoir functions.

The LMC7660 can also be connected to function as voltage doublers and will generate output voltages up to +18.6V with a +10V input.

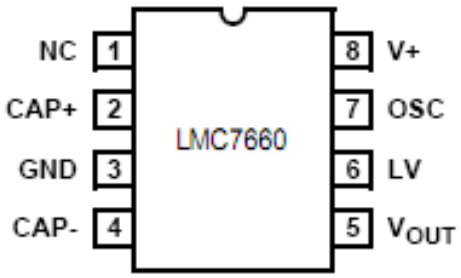
Contained on the chip are a series DC supply regulator, RC oscillator, voltage level translator, and four output power MOS switches. A unique logic element senses the most negative voltage in the device and ensures that the output N-Channel switch source-substrate junctions are not forward biased. This assures latchup free operation. The oscillator, when unloaded, oscillates at a nominal frequency of 10kHz for an input supply voltage of 5.0V. This frequency can be lowered by the addition of an external capacitor to the "OSC" terminal, or the oscillator may be overdriven by an external clock.

The "LV" terminal may be tied to GROUND to bypass the internal series regulator and improve low voltage (LV) operation. At medium to high voltages (+3.5V to +10.0V), the LV pin is left floating to prevent device latchup.

## Pinouts

**DIP8/SOP8**

TOP VIEW




## Features

- Simple Conversion of +5V Logic Supply to ±5V Supplies
- Simple Voltage Multiplication ($V_{OUT}$ = (-) $nV_{IN}$)
- Typical Open Circuit Voltage Conversion Efficiency 99.9%
- Typical Power Efficiency 98%
- Wide Operating Voltage Range
  LMC7660 . . . . . 1.5V to 10.0 V
- Easy to Use - Requires Only 2 External Non-Critical Passive Components

## Applications

- On Board Negative Supply for Dynamic RAMs
- Localized µProcessor (8080 Type) Negative Supplies
- Inexpensive Negative Supplies
- Data Acquisition Systems

## Pin Description

| Name | Pin# | Function |
|---|---|---|
| NC | 1 | |
| CAP+ | 2 | "+" Capacitor Plate |
| GND | 3 | Ground |
| CAP- | 4 | "-" Capacitor Plate |
| $V_{OUT}$ | 5 | Output Voltage |
| LV | 6 | Low Supply Voltage |
| OSC | 7 | Oscillator |
| V+ | 8 | Supply Voltage |

## Absolute Maximum Ratings

Supply Voltage
LMC7660 . . . . . +10.5V
LV and OSC Input Voltage . . . . . -0.3V to (V+ +0.3V) for V+ < 5.5V
(V+ -5.5V) to (V+ +0.3V) for V+ > 5.5V
Current into LV . . . . . 20μA for V+ > 3.5V
Temperature Range. . . . . 0°C to 70°C
Thermal Resistance, $\theta_{JA}$ (°C/W). . . . . .150
Maximum Storage Temperature Range. . . . . -65°C to 150°C

## Electrical Characteristics ( V+ = 5V, $T_A$ = 25°C, $C_{OSC}$ = 0, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Supply Current | I+ | $R_L = \infty$ | - | 170 | 500 | μA |
| Supply Voltage Range - Lo | VL+ | MIN ≤ $T_A$ ≤ MAX, $R_L$ = 10kΩ, LV to GND | 1.5 | - | 3.5 | V |
| Supply Voltage Range - Hi | VL+ | MIN ≤ $T_A$ ≤ MAX, $R_L$ = 10kΩ, LV to Open | 3.0 | - | 10.0 | V |
| Output Source Resistans | $R_{OUT}$ | $I_{OUT}$ = 20mA, $T_A$ = 25°C | - | 55 | 100 | Ω |
| | | $I_{OUT}$ = 20mA, 0°C ≤ $T_A$ ≤ 70°C | - | - | 120 | |
| | | V+ = 2V, $I_{OUT}$ = 3mA, LV to GND, 0°C ≤ $T_A$ ≤ 70°C | - | - | 300 | |
| Oscillator Frequency | $f_{OSC}$ | | 8 | - | 18 | kHz |
| Power Efficiency | $P_{EF}$ | $R_L$ = 5kΩ | 95 | 98 | - | % |
| Voltage Conversion Efficiency | $V_{OUT\ EF}$ | $R_L = \infty$ | 97 | 99.9 | - | % |
| Oscillator Impedance | $Z_{OSC}$ | V+ = 2V | - | 1.0 | - | MΩ |
| | | V+ = 5V | - | 100 | - | kΩ |

## TYPICAL APPLICATION CIRCUITS

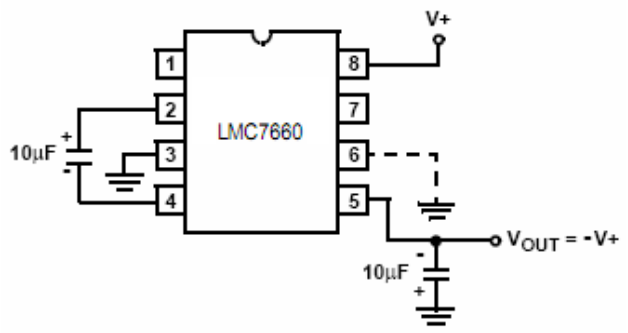



FIGURE 1. SIMPLE NEGATIVE CONVERTER

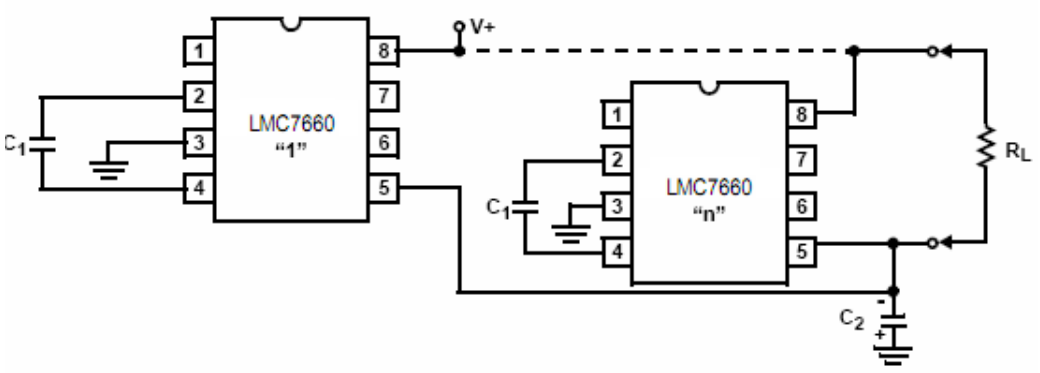



FIGURE 2. PARALLELING DEVICES

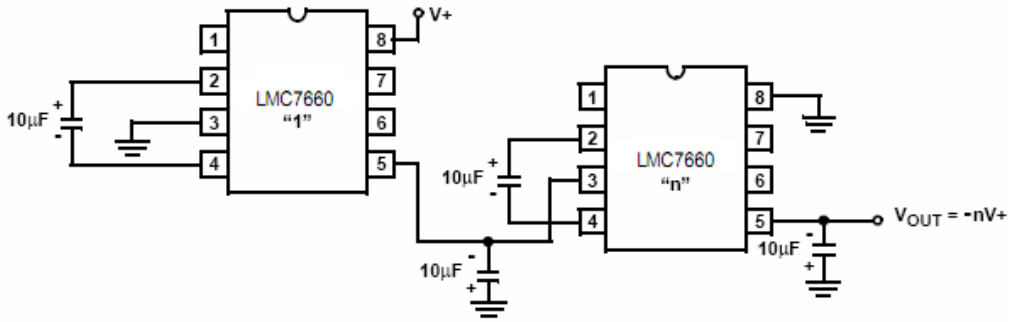



FIGURE 3. CASCADING DEVICES FOR INCREASED OUTPUT VOLTAGE

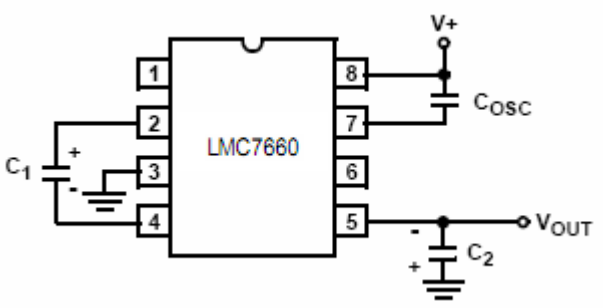



FIGURE 4. LOWERING OSCILLATOR FREQUENCY

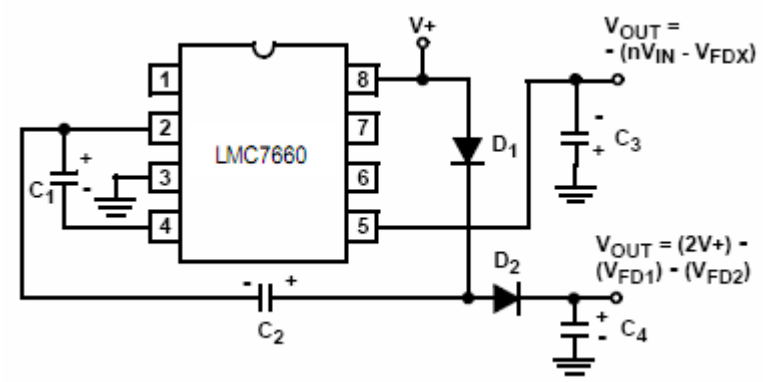



FIGURE 5. COMBINED NEGATIVE VOLTAGE CONVERTER AND POSITIVE DOUBLER

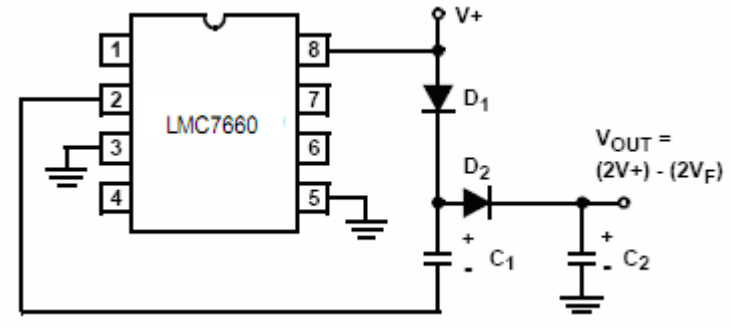



FIGURE 6. POSITIVE VOLT DOUBLER

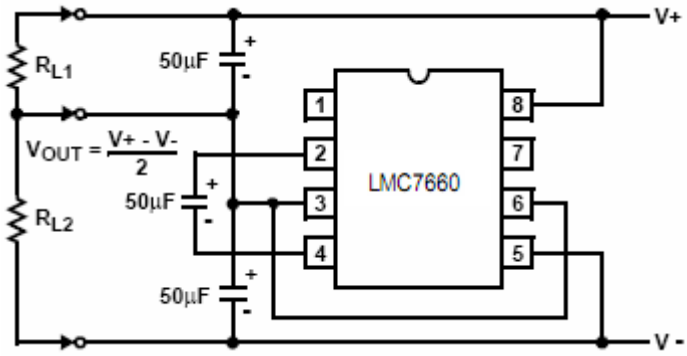



FIGURE 7. SPLITTING A SUPPLY IN HALF

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