

LMC7660

Switched Capacitor Voltage Converter

General Description

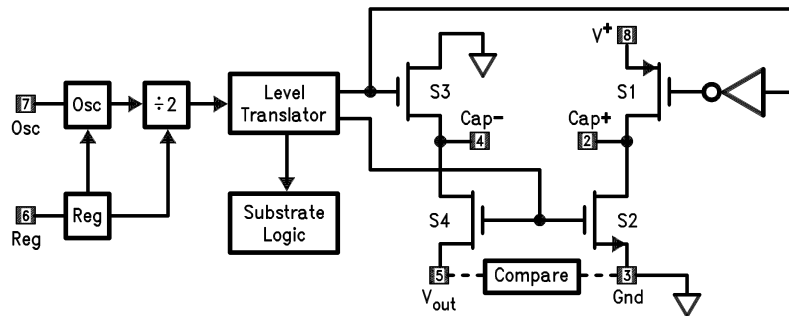
The LMC7660 is a CMOS voltage converter capable of converting a positive voltage in the range of +1.5V to +10V to the corresponding negative voltage of -1.5V to -10V. The LMC7660 is a pin-for-pin replacement for the industry-standard 7660. The converter features: operation over full temperature and voltage range without need for an external diode, low quiescent current, and high power efficiency.

The LMC7660 uses its built-in oscillator to switch 4 power MOS switches and charge two inexpensive electrolytic capacitors.

Features

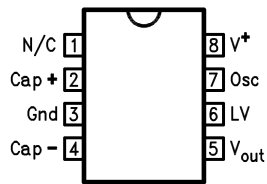
- Operation over full temperature and voltage range without an external diode
- Low supply current, 200 μ A max
- Pin-for-pin replacement for the 7660
- Wide operating range 1.5V to 10V
- 97% Voltage Conversion Efficiency
- 95% Power Conversion Efficiency
- Easy to use, only 2 external components
- Extended temperature range
- Narrow SO-8 Package

Block Diagram



00913601

Pin Configuration



00913602

Ordering Information

Package	Temperature Range	NSC Drawing
	Industrial -40°C to +85°C	
8-Lead Molded DIP	LMC7660IN	N08E
8-Lead Molded Small Outline	LMC7660IM	M08A

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	10.5V
Input Voltage on Pin 6, 7 (Note 2)	-0.3V to ($V^+ + 0.3V$) for $V^+ < 5.5V$ ($V^+ - 5.5V$) to ($V^+ + 0.3V$) for $V^+ > 5.5V$
Current into Pin 6 (Note 2)	20 μA
Output Short Circuit Duration ($V^+ \leq 5.5V$)	Continuous

Power Dissipation (Note 3)

Dual-In-Line Package	1.4W
Surface-Mount Package	0.6W
T_J Max (Note 3)	150°C
θ_{JA} (Note 3)	
Dual-In-Line Package	90°C/W
Surface-Mount Package	160°C/W
Storage Temp. Range	-65°C $\leq T \leq$ 150°C
Lead Temperature (Soldering, 5 sec.)	260°C
ESD Tolerance (Note 7)	$\pm 2000V$

Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	Typ	LMC7660IN/ LMC7660IM	Units Limits
				Limit (Note 5)	
I_s	Supply Current	$R_L = \infty$	120	200 400	μA max
V^+H	Supply Voltage Range High (Note 6)	$R_L = 10\text{ k}\Omega$, Pin 6 Open Voltage Efficiency $\geq 90\%$	3 to 10	3 to 10 3 to 10	V
V^+L	Supply Voltage Range Low	$R_L = 10\text{ k}\Omega$, Pin 6 to Gnd. Voltage Efficiency $\geq 90\%$	1.5 to 3.5	1.5 to 3.5 1.5 to 3.5	V
R_{out}	Output Source Resistance	$I_L = 20\text{ mA}$	55	100 120	Ω max
		$V = 2V$, $I_L = 3\text{ mA}$ Pin 6 Short to Gnd.	110	200 300	Ω max
F_{osc}	Oscillator Frequency		10		kHz
P_{eff}	Power Efficiency	$R_L = 5\text{ k}\Omega$	97	95 90	% min
$V_{o\text{ eff}}$	Voltage Conversion Efficiency	$R_L = \infty$	99.9	97 95	% min
I_{osc}	Oscillator Sink or Source Current	Pin 7 = Gnd. or V^+	3		μA

Note 1: Absolute Maximum ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications do not apply when operating the device beyond its rated operating conditions. See Note 4 for conditions.

Note 2: Connecting any input terminal to voltages greater than V^+ or less than ground may cause destructive latchup. It is recommended that no inputs from sources operating from external supplies be applied prior to "power-up" of the LMC7660.

Note 3: For operation at elevated temperature, these devices must be derated based on a thermal resistance of θ_{ja} and T_J max, $T_J = T_A + \theta_{ja} P_D$.

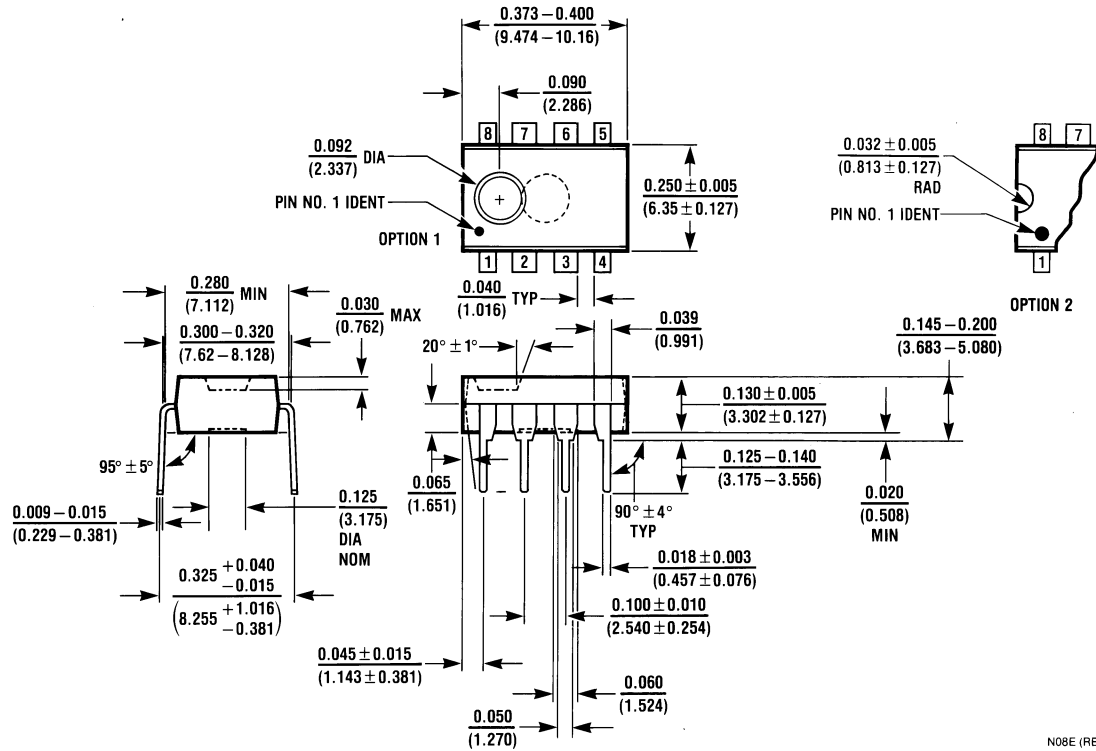
Note 4: Boldface numbers apply at temperature extremes. All other numbers apply at $T_A = 25^\circ C$, $V^+ = 5V$, $C_{osc} = 0$, and apply for the LMC7660 unless otherwise specified. Test circuit is shown in Figure 1.

Note 5: Limits at room temperature are guaranteed and 100% production tested. Limits in **boldface** are guaranteed over the operating temperature range (but not 100% tested), and are not used to calculate outgoing quality levels.

Note 6: The LMC7660 can operate without an external diode over the full temperature and voltage range. The LMC7660 can also be used with the external diode D_x , when replacing previous 7660 designs.

Note 7: The test circuit consists of the human body model of 100 pF in series with 1500 Ω .

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



Molded Dual-In-Line Package (N)
Order Number LMC7660IN
NS Package Number N08E

N08E (REV F)

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