SCI7660 Series
POWER SUPPLY IC

1. DC/DC Converter

DESCRIPTION

The SCI7660 Series is a highly efficient CMOS DC/DC converter for doubling an input voltage. This power-saving IC allows portable computers and similar hand-held equipment to operate from a single power supply, even when they incorporate LSIs that operate at voltages different from those of logic circuits, for example, LCD drivers and analog LSIs.
The SCI7660C0B is available in 8-pin plastic DIPs, and the SCI7660M0B, in 8-pin plastic SOPs.

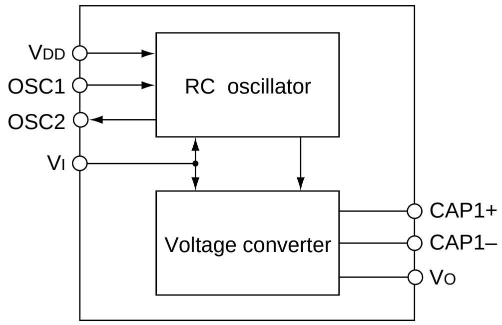
FEATURES

- 95% (typ.) conversion efficiency
- Two output voltages, V_O, relative to V_{DD} and V_I
- 30mA maximum output current at 5V
- Two-in-series configuration doubles negative output voltage.
- Low operating voltage
- On-chip RC oscillator
- 8-pin plastic DIP and 8-pin plastic SOP

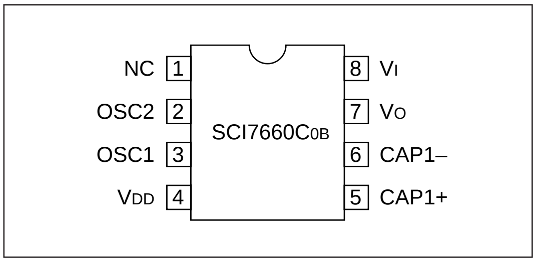
APPLICATIONS

- Fixed-voltage power supplies for battery-operated equipment
- Power supplies for pagers, memory cards, calculators and similar hand-held equipment
- Fixed-voltage power supplies for medical equipment
- Fixed-voltage power supplies for communications equipment
- Uninterruptable power supplies

BLOCK DIAGRAM



PIN CONFIGURATION



PIN DESCRIPTION

Number	Name	Description
1	NC	No connection
2	OSC2	Resistor connection. Open when using external clock
3	OSC1	Resistor connection. Clock input when using external clock
4	V_{DD}	Positive supply (system V_{CC})
5	CAP1+	Positive charge-pump connection
6	CAP1–	Negative charge-pump connection
7	V_O	$\times$2 multiplier output
8	V_I	Negative supply (system ground)

SPECIFICATIONS

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Input voltage range	V_I	–10.0 to 0.5	V
Output voltage range	V_O	Min. –20.0	V
Power dissipation	P_D	300 (DIP)	mW
		150 (SOP)	
Operating temperature range	T_{opr}	–40 to 85	˚C
Storage temperature range	T_{stg}	–65 to 150	˚C
Soldering temperature(for 10s). See note.	T_{sol}	260	˚C

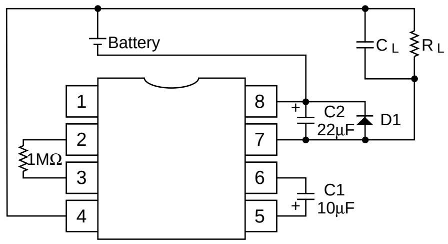
Note:
Temperatures during reflow soldering must remain within the limits set out in LSI Device Precautions. Never use solder dip to mount SCI7000 series power supply devices.

Recommended Operating Conditions

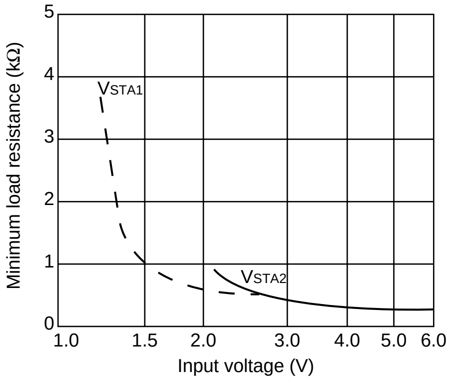
V_{DD} = 0V, Ta = –40 to 85˚C unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			Min.	Typ.	Max.	
Oscillator startup voltage	V_{STA}	R_{OSC} = 1MΩ, $C_1/C_2 \leq 1/20$, $C_2 \geq 10\mu F$, Ta = –40 to 85˚C See note 1.	—	—	–1.5	V
		R_{OSC} = 1MΩ	—	—	–2.2	
Oscillator shutdown voltage	V_{STP}	R_{OSC} = 1MΩ	–1.5	—	—	V
Load resistance	R_L		R_L min See note 2.	—	—	Ω
Output current	I_O		—	—	30.0	mA
Clock frequency	f_{OSC}		10.0	—	30.0	kHz
RC oscillator network resistance	R_{OSC}		680	—	2,000	kΩ
Capacitance	C_1, C_2		3.3	—	—	µF

Notes:
1. The recommended circuit configuration for low-voltage operation (when V_I is between –1.2V and –2.2V) is shown in the following figure. Note that diode D1 should have a maximum forward voltage of 0.6V with 1.0mA forward current.
2. R_L min can be varied depending on the input voltage.



3. RL min is a function of VI.

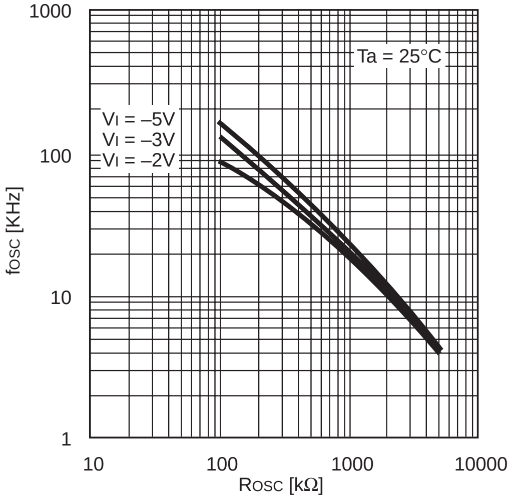


Electrical Characteristics

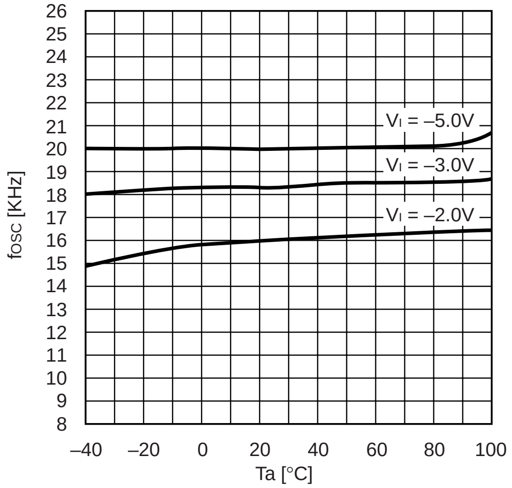
VDD = 0V, Ta = –40 to 85˚C unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			Min.	Typ.	Max.	
Input voltage	VI		–8.0	—	–1.5	V
Output voltage	VO		–16.0	—	—	V
Multiplier current	Iopr	RL = ∞, ROSC = 1MΩ VI = –5V	—	20	30	µA
Quiescent current	IQ	RL =∞, VI = –8V	—	—	2.0	µA
Clock frequency	fOSC	ROSC = 1MΩ, VI = –5V	16	20	24	kHz
Output impedance	RO	IO = 10mA, VI = –5V	—	75	100	Ω
Multiplication efficiency	Peff	IO = 5mA, VI = –5V	90	95	—	%
OSC1 Input leakage current	ILKI	VI = –8V	—	—	2.0	µA

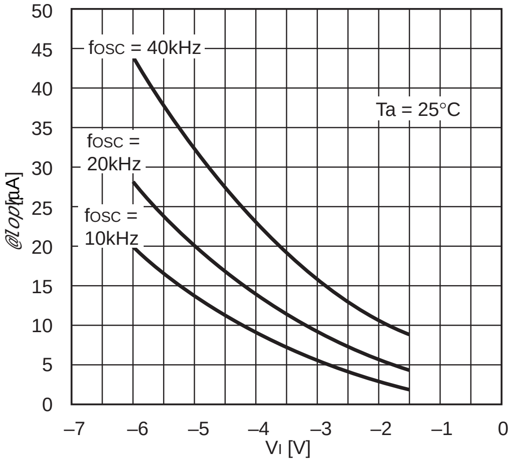
Typical Performance Characteristics



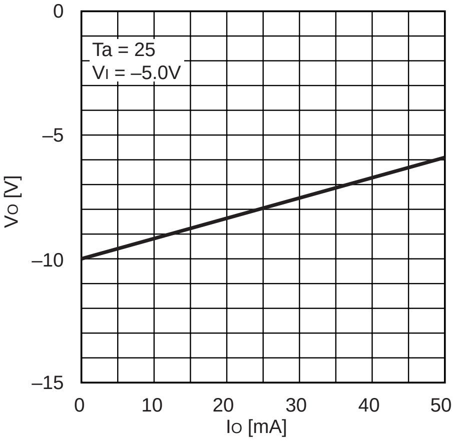
Clock frequency vs. External resistance



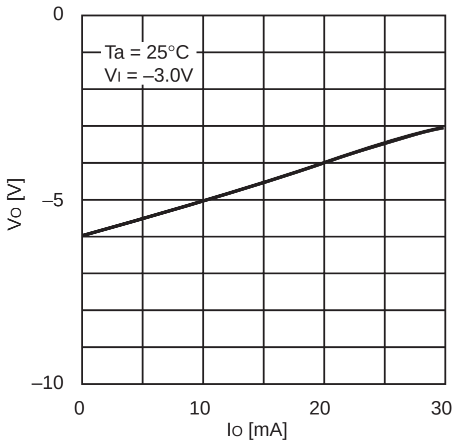
Clock frequency vs. Ambient temperature



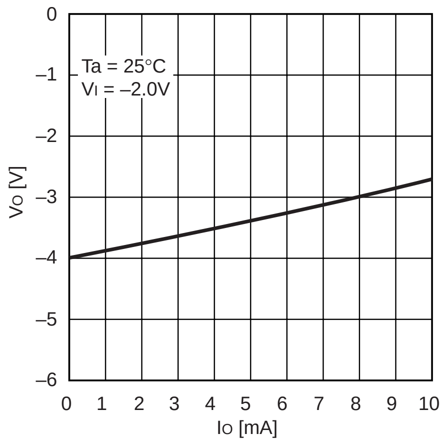
Multiplier current vs. Input voltage



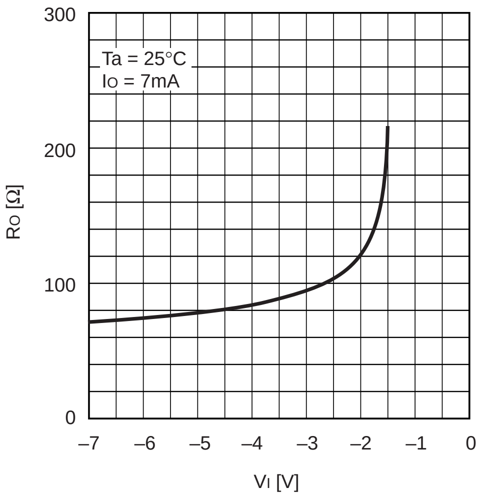
Output voltage vs. Output current



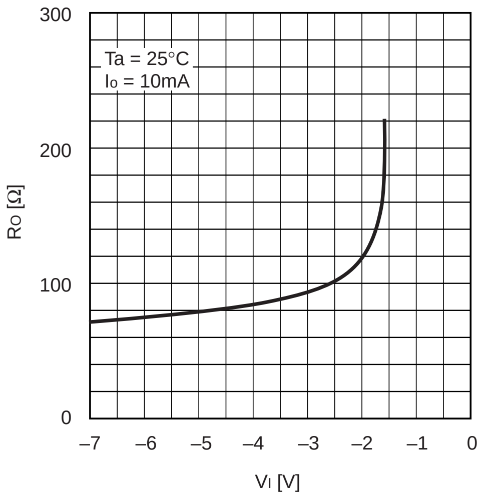
Output voltage vs. Output current



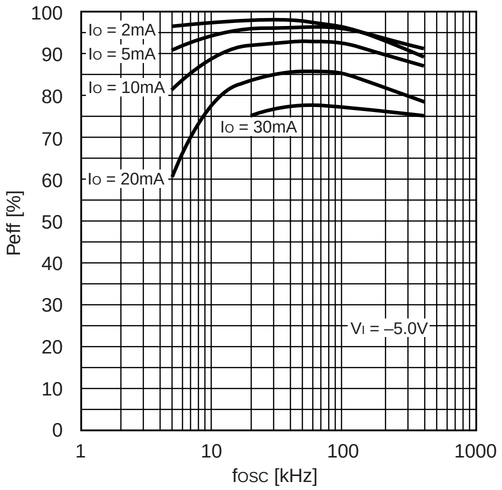
Output voltage vs. Output current



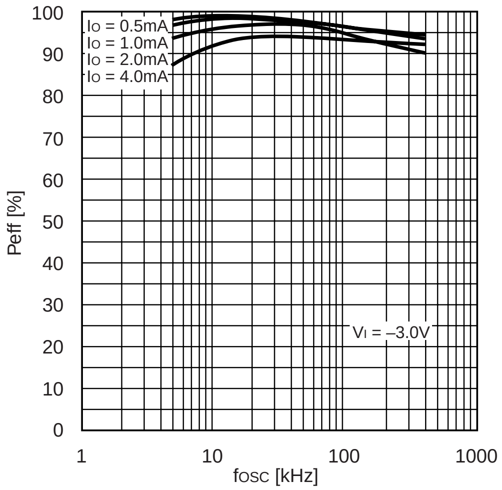
Output impedance vs. Input voltage



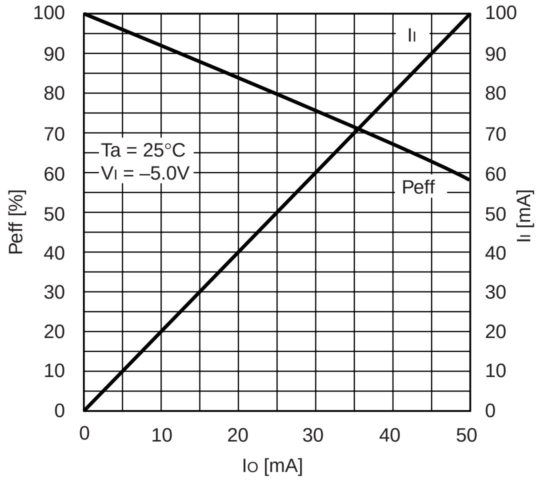
Output impedance vs. Input voltage



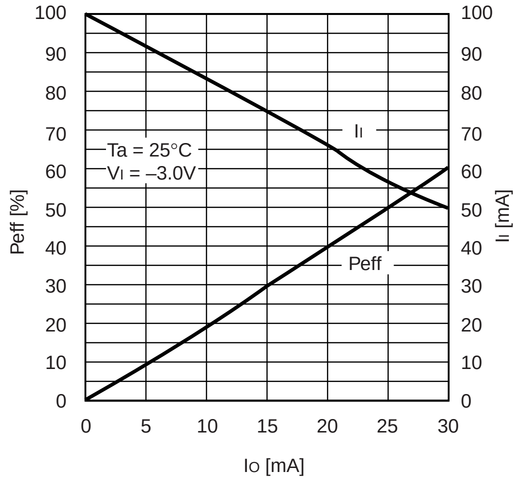
Multiplication efficiency vs. Clock frequency



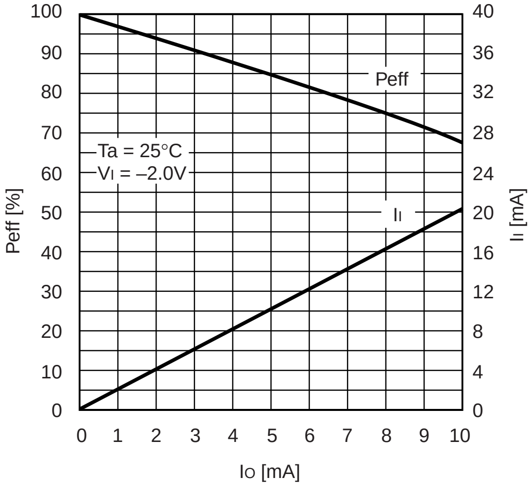
Multiplication efficiency vs. Clock frequency



Multiplication efficiency/input current vs. Output current



Multiplication efficiency/input current vs. Output current

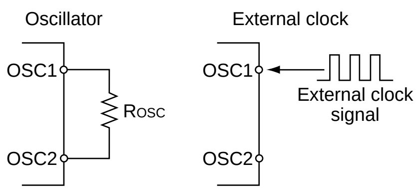


Multiplication efficiency/input current vs. Output current

FUNCTIONAL DESCRIPTION

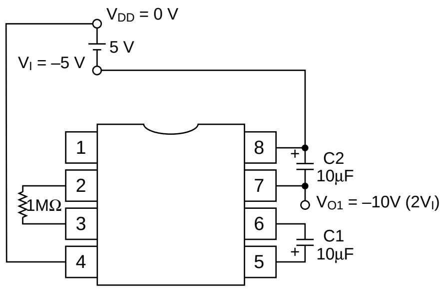
RC Oscillator

The on-chip RC oscillator network frequency is determined by the external resistor, R_{OSC}, connected between OSC1 and OSC2. This oscillator can be disabled in favor of an external clock by leaving OSC2 open and applying an external clock signal to OSC1.

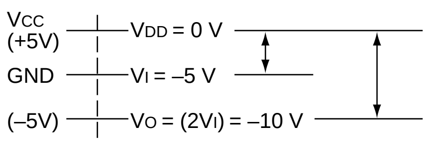


Voltage Multiplier

The voltage multiplier uses the clock signal from the oscillator to double the input voltage. This requires two external capacitors—a charge-pump capacitor, C1, between CAP1+ and CAP1–, and a smoothing capacitor, C2, between V_I and V_O.



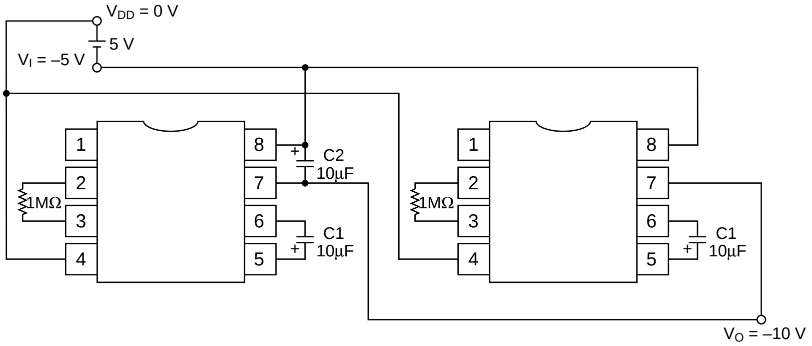
Doubled potential levels



TYPICAL APPLICATIONS

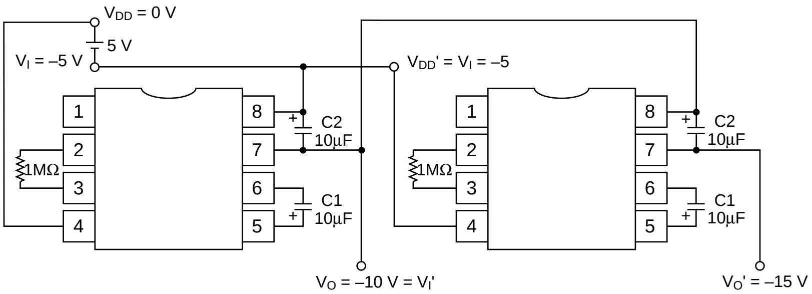
Parallel Connection

Connecting two or more chips in parallel reduces the output impedance by 1/*n*, where *n* is the number of devices used.

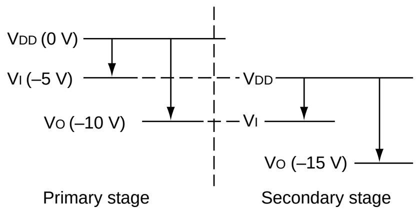


Serial Connection

Connecting two or more chips in series obtains a higher output voltage than can be obtained using a parallel connection, however, this also raises the output impedance.

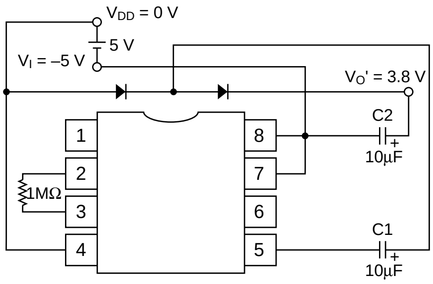


Potential levels



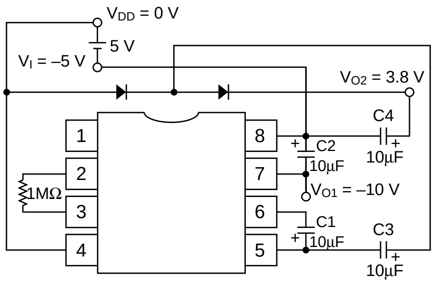
Positive Voltage Conversion

Diodes can be added to a circuit connected in parallel to make a negative voltage positive.



Simultaneous Voltage Conversion

Combining a multiplier circuit with a positive voltage conversion circuit generates both –10 and 3.8 V outputs from a single input.



Potential levels