

## Charge Pump DC-DC Voltage Converter

### ■ INTRODUCTION

SMP7660 is a charge pump dc-to-dc voltage converter using CMOS technology and optimization design. It converts a +2.5V to +10V input to a corresponding -2.5V to -10V output using only two low cost external capacitors. The on-board oscillator operates at a nominal frequency of 10KHz. Operation below 10 KHz (for lower supply current applications) is possible by connecting an external capacitor from OSC to ground.

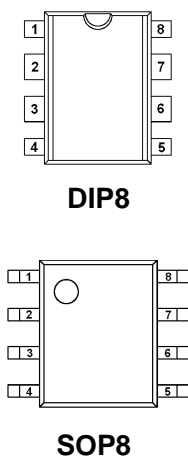
### ■ FEATURES

- Wide input voltage range: 2.5V~10V
- Low power supply: 50uA @ 5V input
- Efficient voltage conversion:99.9%
- Good power efficiency: 98%
- Easy to use: only two external capacitors required
- Compatible with RS232 negative power supply standard
- Cascade connection(two devices are connected,  $V_{OUT} = -2V_{DD}$  OR  $-3V_{DD}$ )
- Available in SOP8&DIP8 Packages

### ■ APPLICATIONS

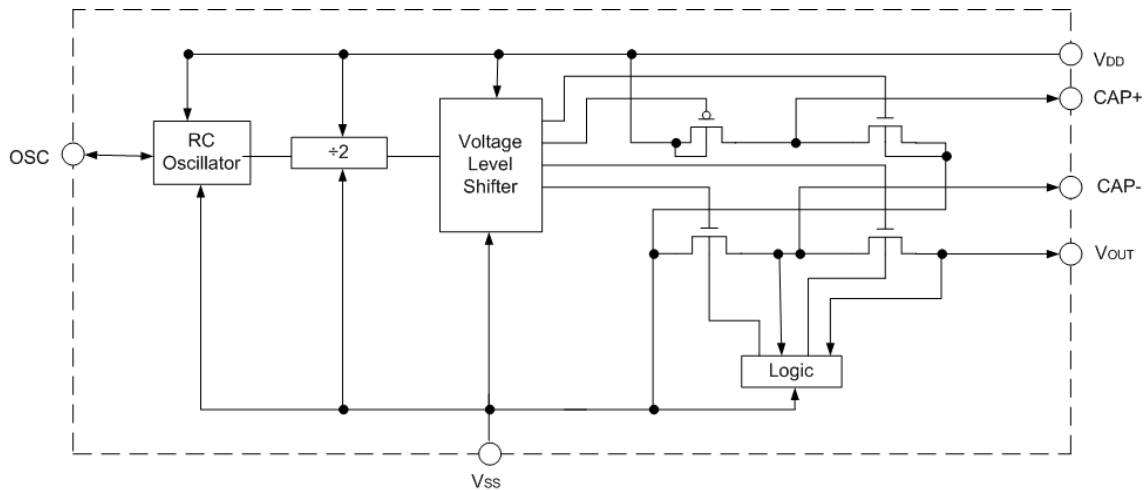
- RS-232 Power Supply
- LCD Display Module
- Supply Voltage Splitter  $V_{OUT} = \pm V_{DD}/2$
- Operation Amplifier Supply
- Instrument Product Supply
- Negative Supply for dynamic RAMS

### ■ PIN CONFIGURATION



PIN NUMBER	PIN NAME	DESCRIPTION
1	NC	No connection
2	CAP+	Connecting external capacitor(+) pin
3	V <sub>SS</sub>	Ground pin
4	CAP-	Connecting external capacitor(-) pin
5	V <sub>OUT</sub>	Voltage output pin
6	LV	Low voltage selection pin
7	OSC	Connecting oscillation capacitor pin
8	V <sub>DD</sub>	Power supply pin

## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNITS
Input voltage		V <sub>DD</sub>	13	V
Power Dissipation	SOP8	P <sub>D</sub>	500	mW
	DIP8	P <sub>D</sub>	500	mW
Operating Temperature		T <sub>opr</sub>	-40~+85	°C
Storage Temperature		T <sub>stg</sub>	-55~+150	°C
Soldering temperature and time		T <sub>solder</sub>	260°C, 10s	

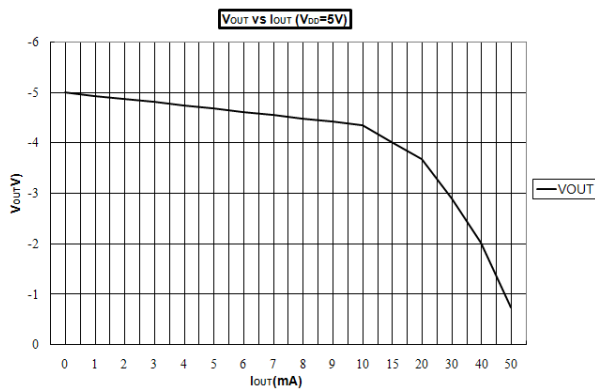
## ■ ELECTRICAL CHARACTERISTICS

(C<sub>1</sub>=C<sub>2</sub>=10μF, T<sub>A</sub>=25°C)

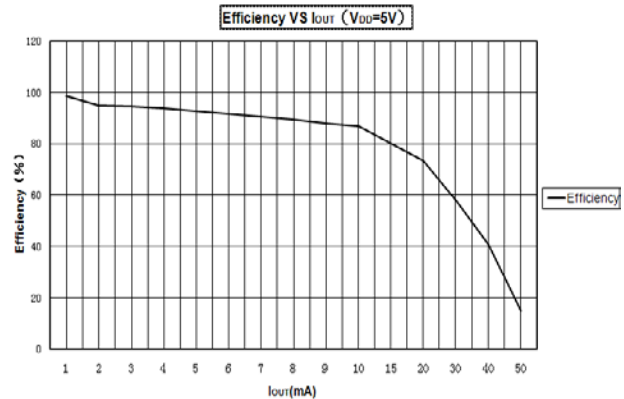
SYMBOL	ITEM	TEST CONDITIONS		MIN	TYP	MAX	UNITS
		V <sub>DD</sub>	CONDITIONS				
V <sub>DD</sub>	Supply Voltage	—	—	2.5	5.0	10.0	V
I <sub>Q</sub>	Supply Current	5V	R <sub>L</sub> =∞	—	50	100	μA
f <sub>OSC</sub>	Oscillator Frequency	5V	—		10		KHz
R <sub>OUT</sub>	Output Resistance	5V	I <sub>OUT</sub> =20mA	—	60	100	Ω
V <sub>CON-EFF</sub>	Voltage Conversion Efficiency	5V	R <sub>L</sub> =∞	99	99.9	—	%
P <sub>EFF</sub>	Power Efficiency	5V	R <sub>L</sub> =5kΩ	96	98	—	%

## ■ TYPICAL CHARACTERISTICS

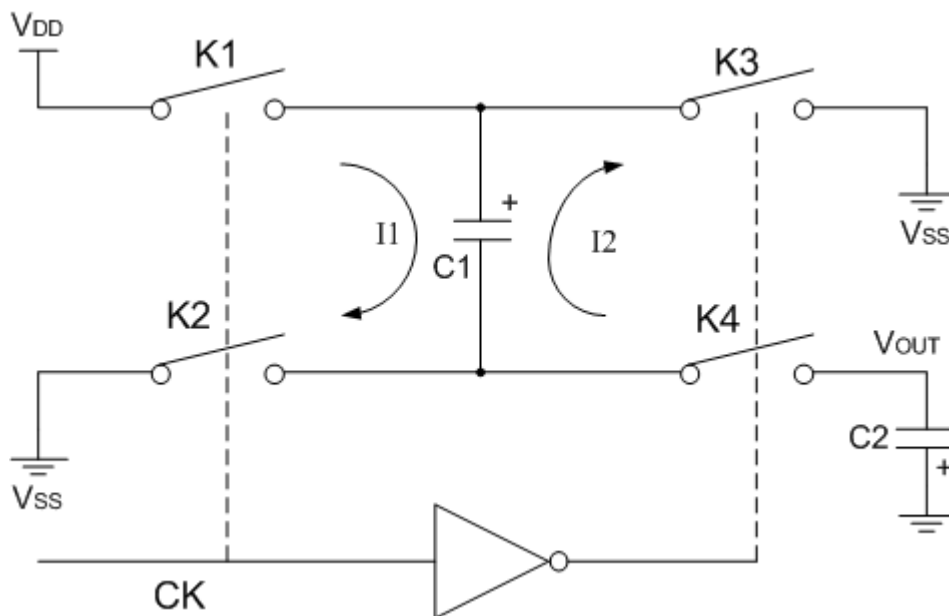
### 1. $V_{OUT}$ vs. $I_{OUT}$



### 2. Efficiency vs. $I_{OUT}$



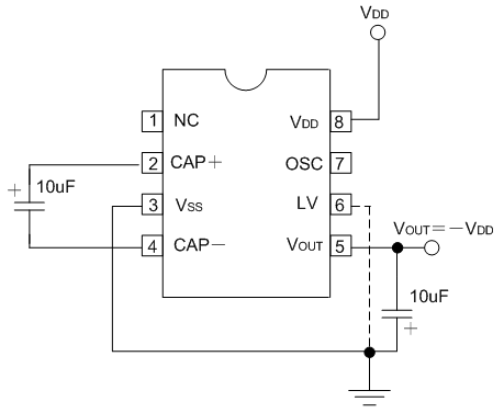
## ■ THEORY OF OPERATION



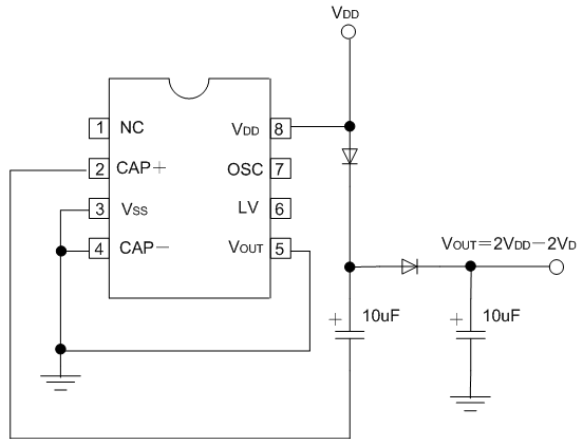
SMP7660 together with two external capacitors C1, C2 complement a voltage Inverter. Capacitor C1 is charged to a voltage  $V_{DD}$ , for the first half cycle when switches K1 and K2 are closed ( while switches K3 and K4 are open during this half cycle); During the second half cycle of operation, switches K3 and K4 are closed, with K1 and K2 open, thereby shifting capacitor C2 negatively to  $-V_{DD}$ .

■ TYPICAL APPLICATIONS

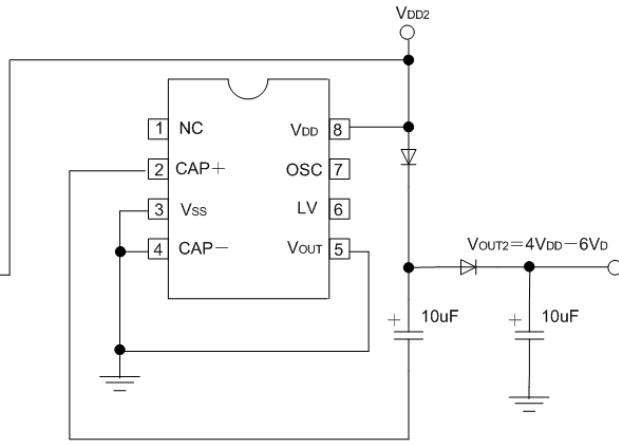
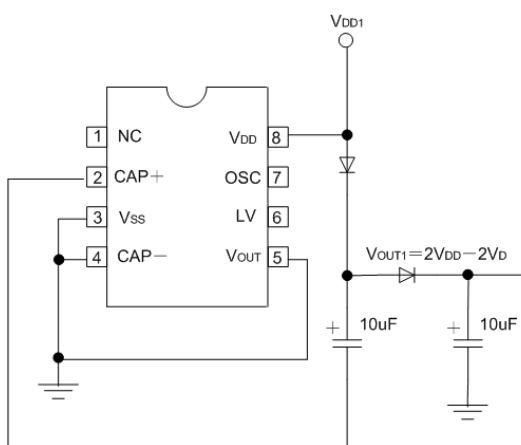
1. Simple negative voltage converter



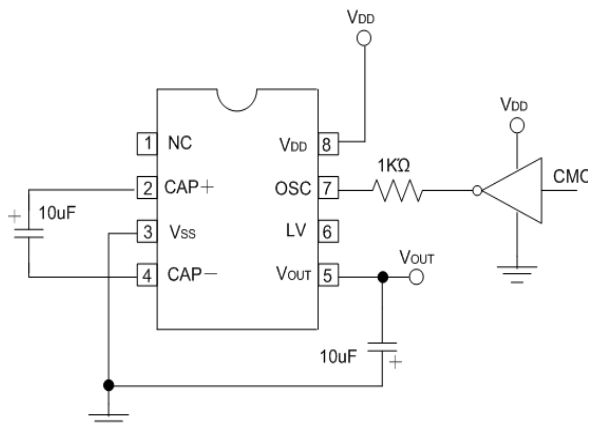
2. Positive voltage doubler



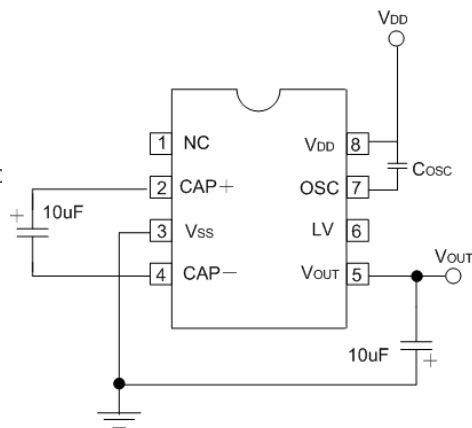
3. Positive voltage multiplier



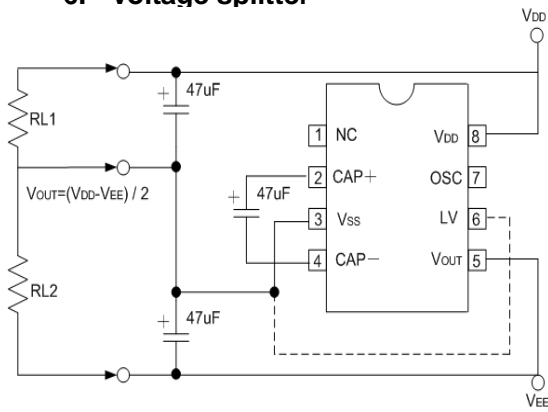
4. External switching frequency



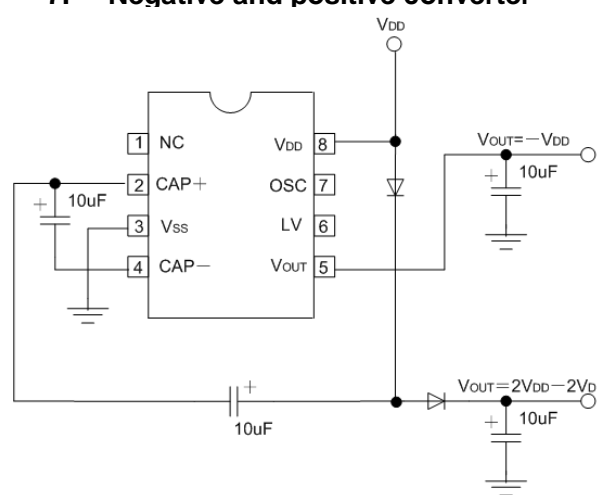
5. Lower switching frequency



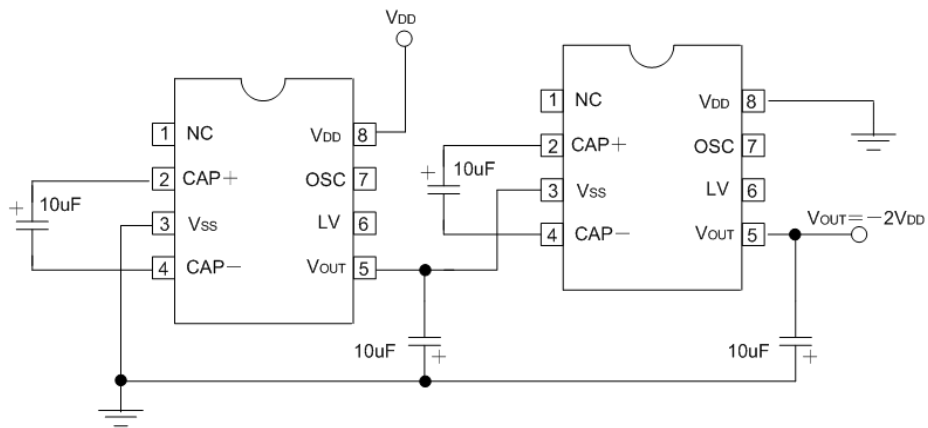
6. Voltage splitter



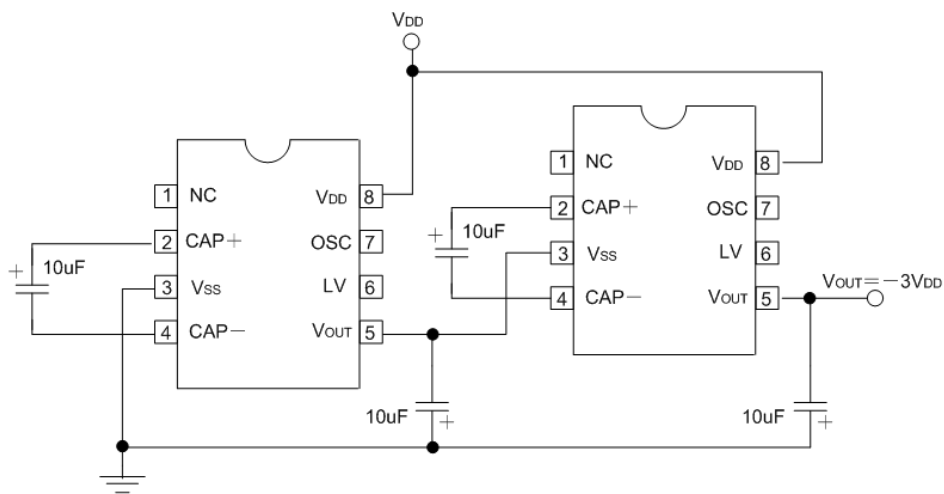
7. Negative and positive converter



8. -2V<sub>DD</sub> voltage multiplier

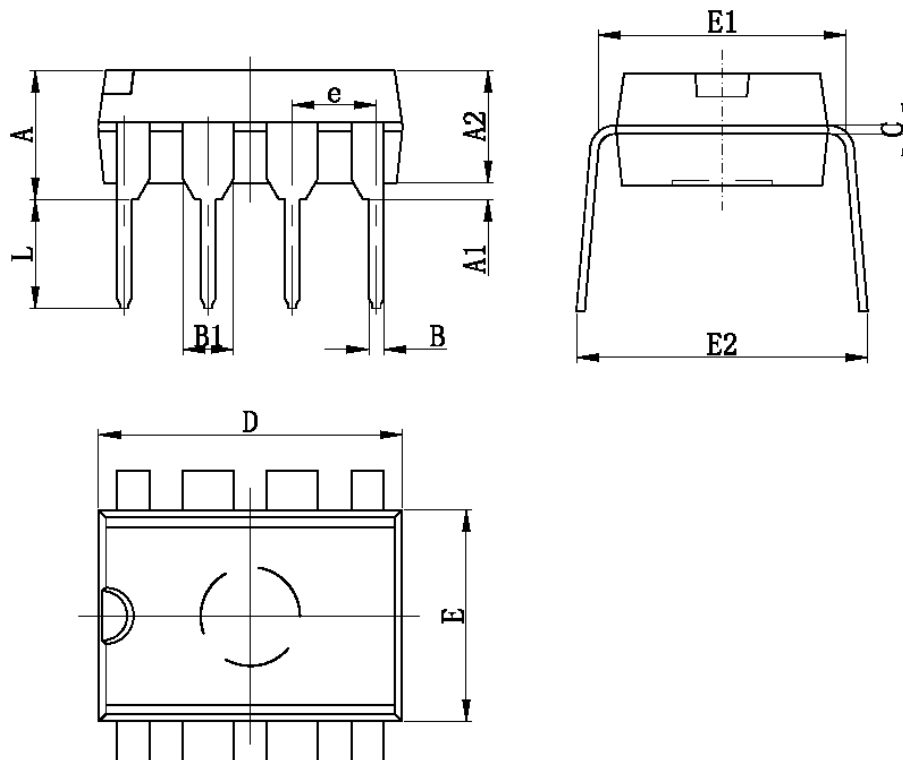


9. -3V<sub>DD</sub> voltage multiplier



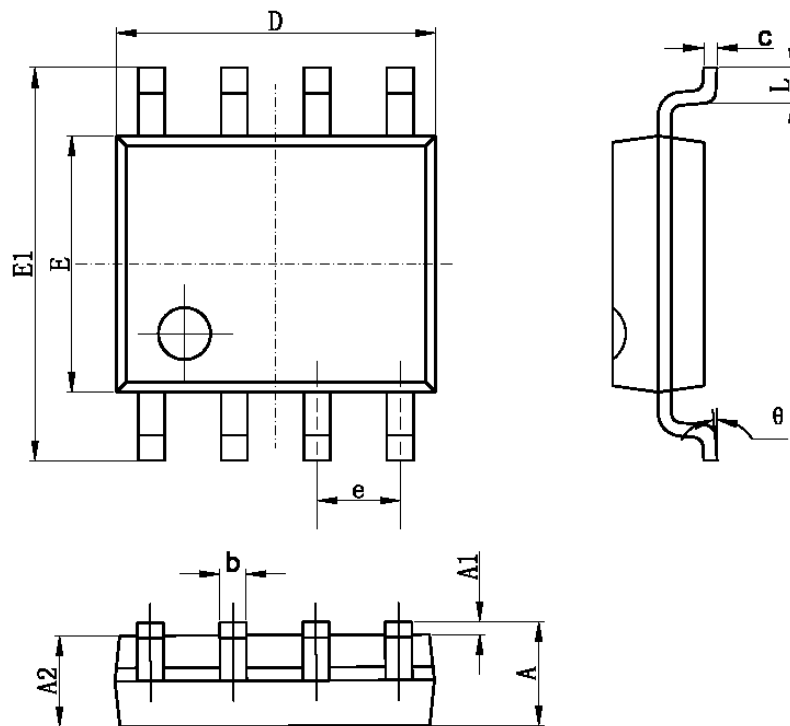
## ■ PACKAGING INFORMATION

### ● DIP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524 (BSC)		0.060 (BSC)	
C	0.204	0.360	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
e	2.540 (BSC)		0.100 (BSC)	
L	3.000	3.600	0.118	0.142
E2	8.400	9.000	0.331	0.354

## ● SOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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