南京拓品微电子有限公司

DATASHEET

(TP7660H　Voltage inverter)

TP7660H Charge pump voltage inverter

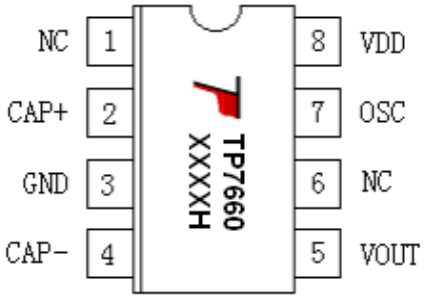
Product Introduction：

TP7660H is a dedicated integrated circuit for DC/DC charge pump voltage inverters. The chip can convert input voltages ranging from 2.5V to 11V into corresponding outputs of -2.5V to -11V, and only requires three external capacitors without inductors, reducing losses, area, and electromagnetic interference. The chip has a low no-load current and strong driving capability (20% larger than similar foreign products).

Product Features：

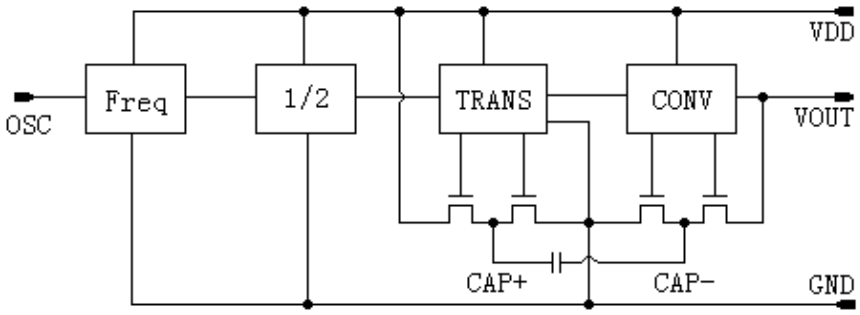
- Wide range of input working voltage： 2.5V～11V
- High voltage conversion accuracy： 99.9％
- High power conversion efficiency： 98％
- low-power consumption：No load current 40uA（VIN=5V）
- Low output resistance： 50Ω（VIN=5V）
- Less peripheral components: only three external capacitors are needed
- High electrostatic breakdown voltage： 3KV
- SOP-8 package

Pin sequence and description：

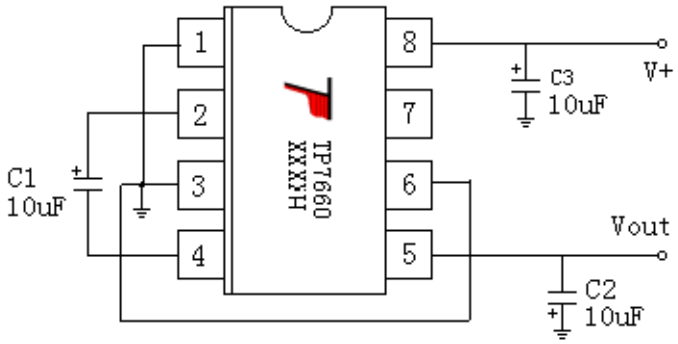


Pin number	symbol	Pin description
1	NC	No connection (recommended grounding)
2	CAP+	External capacitance +
3	GND	GND
4	CAP-	External capacitance -
5	VOUT	OUTPUT
6	NC	No connection (recommended grounding)
7	OSC	External capacitor of oscillator
8	VDD	INPUT VOLTAGE

Functional Block Block Diagram：



Typical application circuit：（It is recommended for customers to ground pins 1 and 6 in the application）



limit parameter：

supply voltage	11.5V
consumption SOP-8	470mW
operation temperatureT_A	-40℃～125℃
Wire welding temperature（10s）	260℃

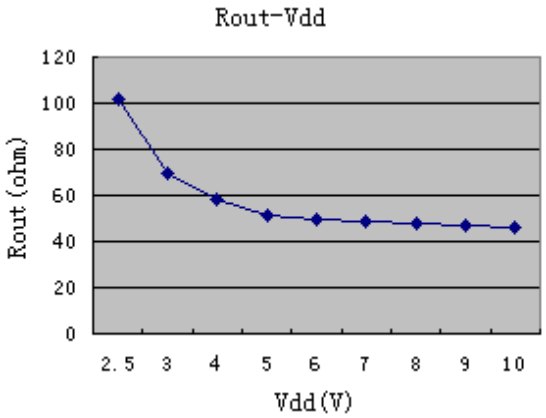
electrical characteristics：

(T_A=25℃,V_{DD}=5V　Unless otherwise specified)

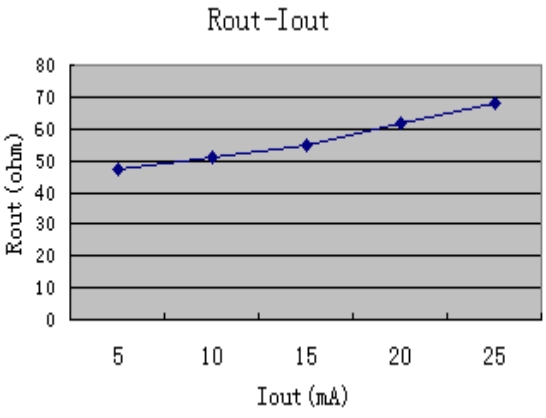
symbol	parameter	Test conditions	MIN	TYP	MAX	unit
V_{DD}	supply voltage		2.5		11	V
I_Q	No load current	R_L=∞		40	60	uA
R_{OUT}	output resistance	I_{OUT}=10mA		50		Ω
F_{OSC}	Frequency	PIN7　open circuit		10		KHz
P_{EFF}	Power Efficiency	R_L=5KΩ	95	98		%
$V_{OUT}E_{FF}$	Conversion accuracy	R_L=∞	98	99.9		%

characteristic curve：

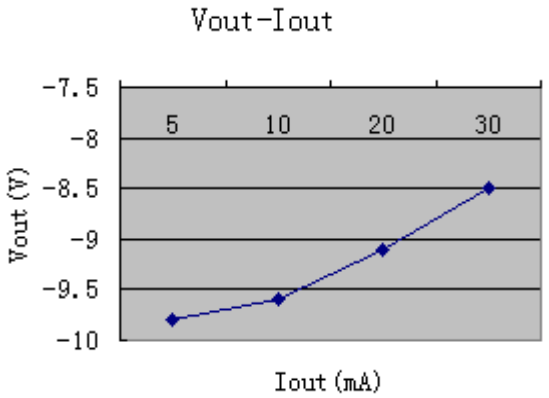
Output resistance VS　input voltage



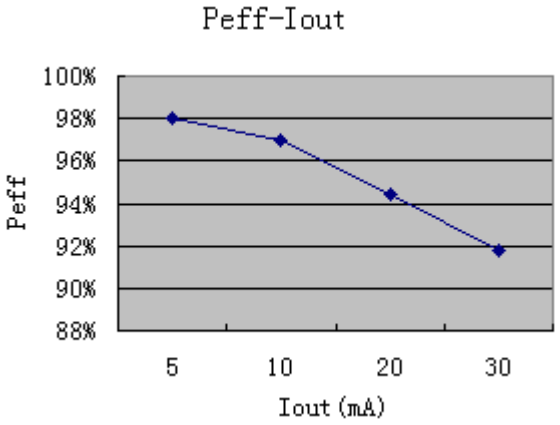
Output resistance VS load current



Output voltage vs load current(Vdd=10V)

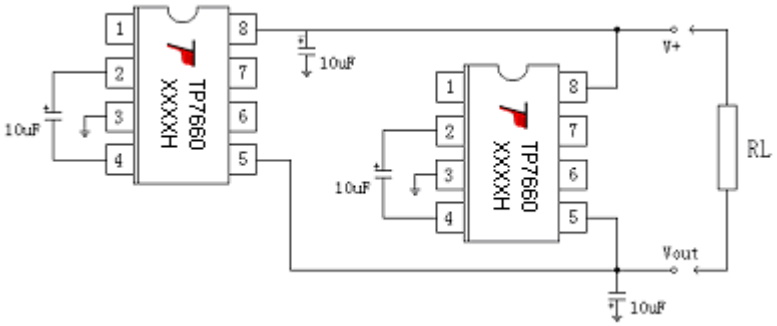


Power efficiency vs load current (Vdd=10V)



Circuit parallel connection：

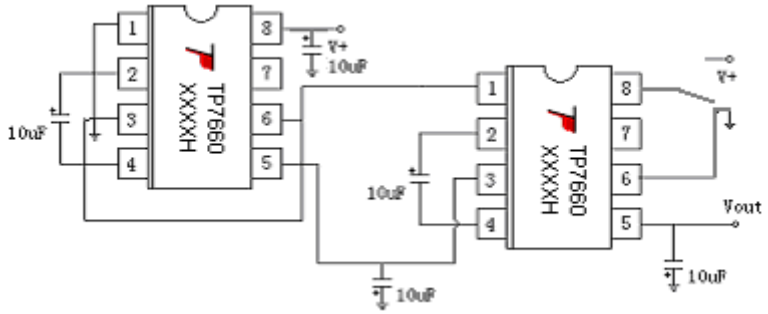
To reduce the output resistance, the TP7660H chip can be connected in parallel, as shown in the following figure：



$$\text{output resistance} = \frac{ROUT(\text{singleIC})}{N(\text{Number of parallel chips})}$$

Circuit cascade：

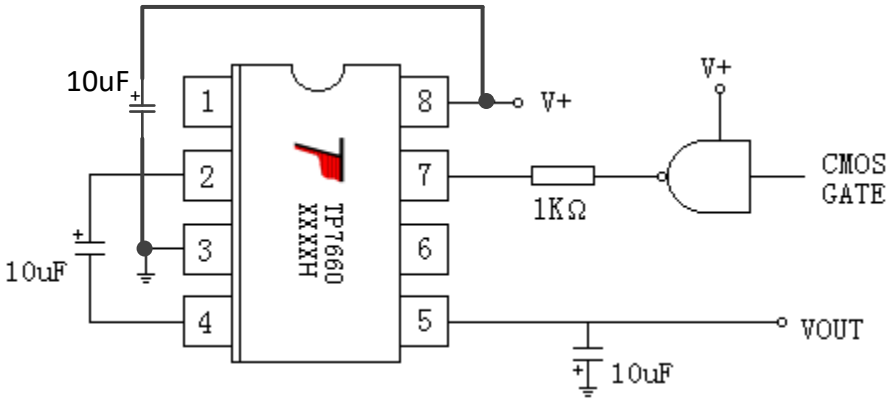
To generate a high output negative voltage through circuit cascading, chip cascading can be used, as shown in the following figure：



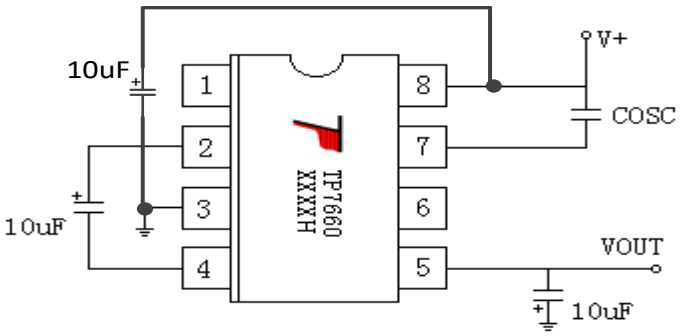
Due to the limited power efficiency of a single chip, the number of cascaded chips in practical applications is also limited. In this case, the output resistance is approximately n times the resistance value of each chip (n is the number of cascaded chips).

Adjust the frequency of TP7660H：

If the frequency of the oscillator needs to be increased, an external clock can be connected for overexcitation, as shown in the following figure：

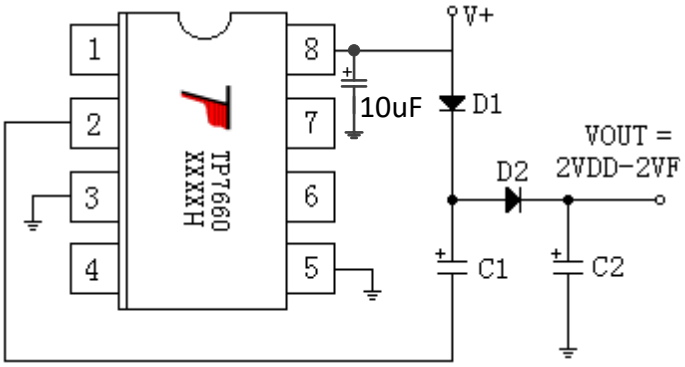


It should be noted that the output terminal of the external clock should be connected to a 1K Ω resistor to prevent self-locking. In addition, due to the internal circuit structure, the frequency of the charge pump is half of the excitation clock frequency. To improve the conversion efficiency of the circuit, the oscillation frequency can also be appropriately reduced by adding a capacitor between pins 7 and 8, as shown in the following figure:

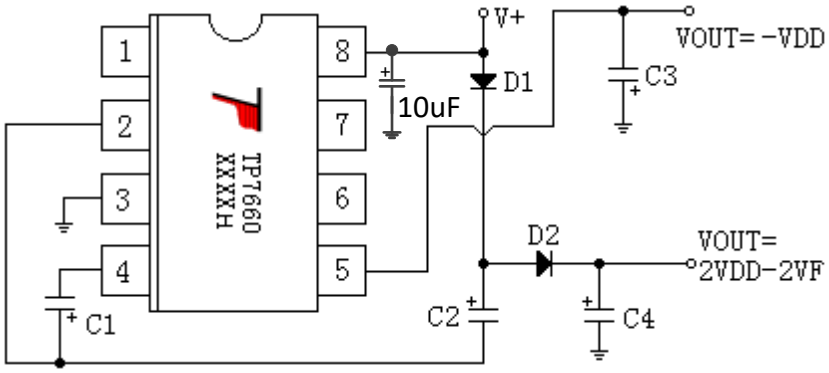


At this point, the switch loss is reduced. However, as the frequency decreases, the impedance of the pump capacitor and storage capacitor will inevitably increase, so it is necessary to increase the values of C1 and C2 by a multiplier of the frequency decrease.

Doublers：



Based on this structure, an application circuit that can simultaneously obtain double voltage and reverse voltage can be obtained, as shown in the following figure:



In this figure, C1 and C3 are the pump capacitors and storage capacitors of the negative voltage circuit, respectively, while C2 and C4 are the pump capacitors and storage capacitors of the voltage doubling circuit, respectively. When the input voltage is+5V, both+9V and -5V output voltages can be obtained simultaneously.

package structure：