

# 南京拓微集成电路有限公司

**NanJing Top Power ASIC Corp.**

## **DATASHEET**

( TP7661A /B )

## TP7661A/B CMOS DC/DC CONVERTER

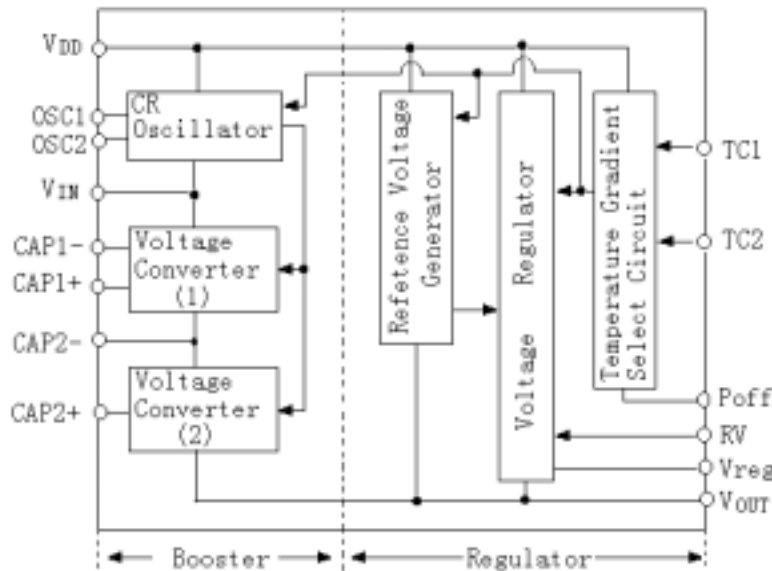
### DESCRIPTION

The TP7661A CMOS DC/DC Converter features high operational performance with low power dissipation. It consists of two major parts: the booster circuitry and the regulator circuitry. The booster generates a doubled output voltage (-2.0V to -16V) from the input (-1.0V to -8.0V) or tripled output voltage (-3.0V to -18.0V) from the input (-1.0V to -6.0V). The regulator is capable of setting the output to any desired voltage. The regulated voltage can be given one of three threshold temperature gradients. (The only difference between TP7661A and TP7661B is that the tp7661B have no the functions of Vreg and RV.) The TP7661A and TP7661B are all compatible with the SCI7661.

### FEATURES

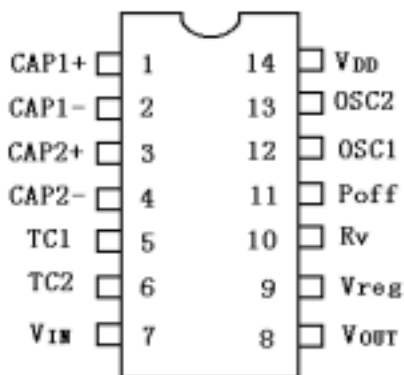
- \*High performance with low power dissipation
- \*low start voltage and High drive performance
- \*Simple conversion of  $V_{IN}$  (-5V) to  $|V_{IN}|$  (+5V), 2  $|V_{IN}|$  (+10V), 2  $V_{IN}$  (-10V) or 3  $V_{IN}$  (-15V)
- \*On-chip output voltage regulator
- \*Power conversion efficiency ..... Typ 95%
- \*Temperature gradient for LCD power supply ..... 0.1%/°C, 0.4%/°C or 0.6%/°C
- \*Power off by external signals — Stationary current at power off ... Max 2 $\mu$ A
- \*Cascade connection — two devices connected .....  $V_{IN}=-5V$ ,  $V_{OUT}=-20V$
- \*On-chip C-R oscillator
- \*Package ..... DIP-14pin (plastic) SOP5-14pin (plastic) SOP16L

### BLOCK DIAGRAM



### PIN CONFIGURATION

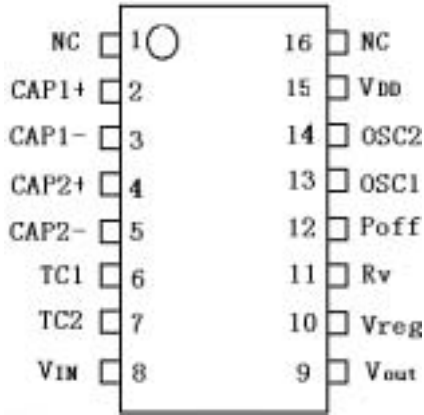
DIP-14 (The same pin configuration in DIP-14 and SOP5-14) ( pin 9 and pin 10 of TP7661B have no functions)



### PIN DESCRIPTION

Pin Name	Pin No.	Function
CAP1+, CAP1-	1,2	Terminal for connection of capacitor for doubler
CAP2+, CAP2-	3,4	Terminal for connection of capacitor for tripler
TC1, TC2	5,6	Temperature gradient selection terminal
$V_{IN}$	7	Power supply terminal (negative, system supply GND)
$V_{OUT}$	8	Output terminal at tripling
$V_{reg}$	9	Regulated voltage output terminal
RV	10	Regulated voltage control terminal
Poff	11	$V_{reg}$ output ON/OFF control terminal
OSC2, OSC1	12,13	Oscillation resistor connection terminal
$V_{DD}$	14	Power supply terminal (positive system supply Vcc)

SOP16L (pin10 and pin 11 of TP7661B have no functions)



Pin Name	Pin No.	Function
NC	1,16	NC
CAP1+, CAP1	2,3	Terminal for connection of capacitor for doubler
CAP2+, CAP2-	4,5	Terminal for connection of capacitor for tripler
TC1, TC2	6,7	Temperature gradient selection terminal
VIN	8	Power supply terminal (negative, system supply GND)
VOUT	9	Output terminal at tripling
Vreg	10	Regulated voltage output terminal
RV	11	Regulated voltage control terminal
Poff	12	Vreg output ON/OFF control terminal
OSC2, OSC1	13,14	Oscillation resistor connection terminal
VDD	15	Power supply terminal (positive system supply Vcc)

### ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Ratings	Unit	Remarks
Input supply voltage	Vi	-18.0/3 to 0.5	V	tripled output voltage
		-8.5 to 0.5	V	Double output voltage
Input terminal voltage	Vi	VIN-0.5 to 0.5	V	OSC1, Poff
		VOUT-0.5 to 0.5	V	TC1, TC2, RV
Output voltage	Vo	min. -18.0	V	
Allowable loss	Pd	500	mW	
Operating temperature	Topr	-30 to 85	°C	Plastic package
Storage temperature	Tstg	-55 to 150	°C	
Soldering temperature and time	Tsol	260°C, 10s (at lead)	—	

### ELECTRICAL CHARACTERISTICS

(VDD=0V, VIN=-5V, Ta=-30° to 85°C)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input supply voltage	Vi		-6.0		-1.0	V
Output voltage	Vo		-18.0		-3.0	V
	Vreg	RL= , RRV=1M , Vo=-19.2V	-18.0		-2.6	V
Booster current consumption	Iopr1	RL= , Rosc=1M		60	100	μA
Regulator current consumption	Iopr2	RL= , RRV=1M , Vo=-15V		5.0	12.0	μA
Stationary current	IQ	TC2=TC1=VOUT, RL=			2.0	μA
Oscillation frequency	fosc	Rosc = 1M	20	30	40	KHz
Booster power conversion efficiency	Peff	IOUT=5mA	90	95		%
Output impedance	ROUT	IOUT=10mA		100	140	
Regulated output voltage fluctuation	$\frac{V_{reg}}{V_{OUT}} - \frac{V_{reg}}{V_{reg}}$	-18V<VOUT<-8V, Vreg=-8V, RL= , Ta=25		0.2		%/V
Regulated output load fluctuation	$\frac{V_{reg}}{I_{OUT}}$	Vo=-15V , Vreg=-8V, 0<IOUT<10 mA, Ta=25 TC1=VDD, TC2=Vo		5		
Regulated output saturation resistance	RSAT	RSAT= (Vreg-VOUT)/ IOUT, 0<IOUT<10mA, Rv=VDD, Ta=25		8		
Reference voltage	VRV0	TC2=VOUT, TC1=VDD, Ta=25	-2.3	-1.5	-1.0	V
	VRV1	TC2= TC1=VOUT, Ta=25	-1.7	-1.2	-0.9	V
	VRV2	TC2=VDD, TC1=VOUT, Ta=25	-1.1	-0.9	-0.8	V
Temperature Gradient	CT0	CT= $\frac{ V_{reg}(50 \text{ }^\circ\text{C})  -  V_{reg}(0 \text{ }^\circ\text{C}) }{50 - 0} \times 100$	-0.25	-0.1	-0.06	%/
	CT1		-0.5	-0.4	-0.2	%/
	CT2		-0.7	-0.6	-0.5	%/
Input leakage current	IL	Poff, TC1, TC2, OSC1, Rv端			2.0	μA

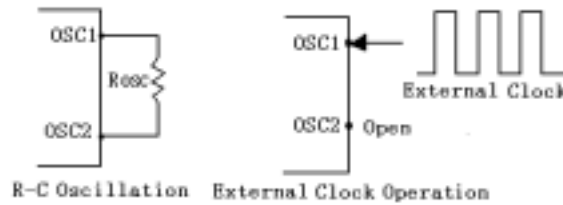
**RECOMMENDED OPERATING CONDITIONS** ( $T_a = -30^\circ \sim 85^\circ\text{C}$ )

Parameter	Symbol	Conditions	Min	Max	Unit
Booster start voltage	VSTA	Rosc=1M $\Omega$		-1.0	V
Booster stop voltage	VSTP	Rosc=1M $\Omega$	-1.0		V
Output load current	IOUT			35	mA
Oscillation frequency	fosc		10	1000	kHz
External resistance for oscillation	Rosc		0	2000	k $\Omega$
Capacitor for booster	C1, C2, C3		0 . 33		$\mu\text{F}$
Regulated output adjustable resistance	RRV		100	1000	K $\Omega$

**CIRCUIT DESCRIPTION**

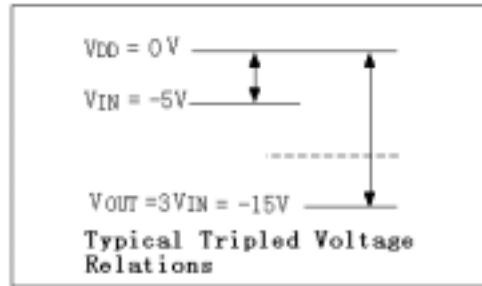
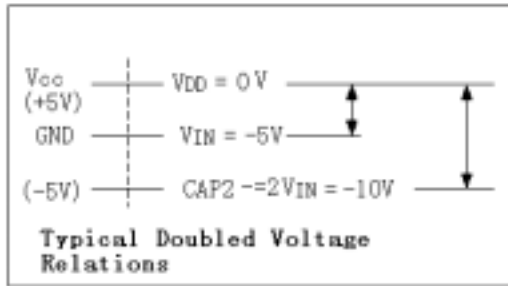
● **C-R Oscillator**

The TP7661A contains a C-R oscillator for internal oscillation. It consists of an external resistor R<sub>osc</sub> connected between the OSC1 pin and OSC2 pin.



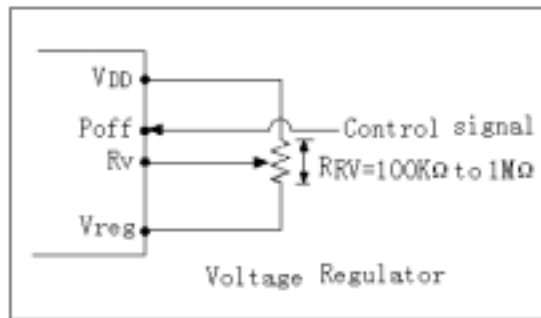
● **Voltage Converters**

The voltage converters double/triple the input supply voltage ( $V_{IN}$ ) using clocks generated by the C-R oscillator.



● **Reference Voltage Generator and Voltage Regulator**

The reference voltage generator produces reference voltage needed for operation of regular circuit. The voltage regulator is used to regulate a boosted output voltage and its circuit contains a power-off function which uses signals from the system for on-off control of the  $V_{reg}$  output.



● **Temperature Gradient Selector Circuit**

The TP7661A provides the  $V_{reg}$  output with a temperature gradient suitable for LCD driving (between  $V_{DD}$  and  $V_{reg}$ ).

● **Temperature Gradient Assignment**

Poff	TC2	TC1	Temp. Gradient	$V_{reg}$ Output	CR oscillation	Remarks
1 ( $V_{DD}$ )	L( $V_{OUT}$ )	L( $V_{OUT}$ )	-0.4%/	ON	ON	
1	L	H( $V_{DD}$ )	-0.1%/	ON	ON	
1	H( $V_{DD}$ )	L	-0.6%/	ON	ON	
1	H	H	-0.6%/	ON	OFF	Cascade connection
0 ( $V_{IN}$ )	L	L		OFF (Hi-Z)	OFF	
0	L	H		OFF (Hi-Z)	OFF	
0	H	L		OFF (Hi-Z)	OFF	
0	H	H		OFF (Hi-Z)	ON	Without regulation

NOTE: The potential at Low level is different between the Poff pin and the TC1/TC2 pin.

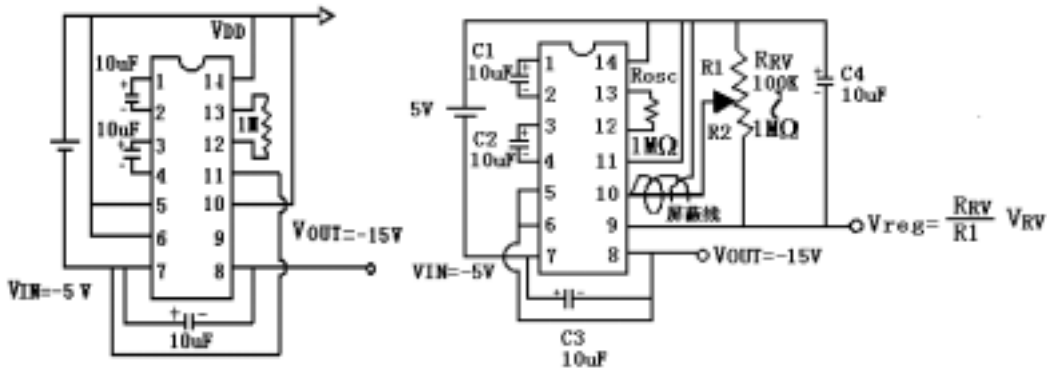
**EXAMPLE OF APPLICATIONS (The pin 9 and pin 10 of TP7661B can be floating)**

● **Voltage Doubler and Tripler**

A doubled voltage can be obtained at  $V_{OUT}$  (CAP2-) by disconnecting capacitor C2 from the tripler configuration and shorting CAP2- (pin 4) and  $V_{OUT}$  (pin 8).

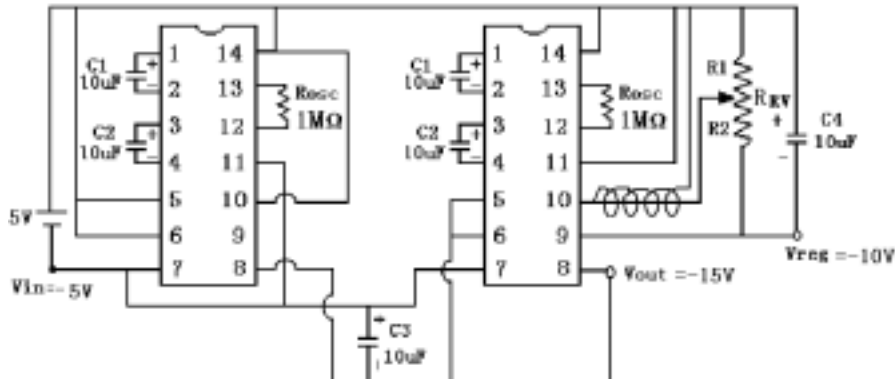
● **Voltage Tripler + Regulator**

$V_{reg}$  output is given a temperature gradient, after boosted output  $V_{OUT}$  regulated. In this connection, both  $V_{OUT}$  and  $V_{reg}$  can be taken out at the same time.



● **Parallel Connection**

Parallel connection of n circuits can reduce  $R_{OUT}$  to about  $1/n$ . A single smoothing capacitor C3 can be used commonly for all parallelly connected circuits. In parallel connection, a regulated output can be obtained by applying the regulation circuit to only one of the n parallelly connected circuits.



PACKAGE DIMENSIONS

