



VOLTAGE CONVERTER

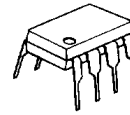
■ GENERAL DESCRIPTION

The NJU7660 is a voltage converter incorporated CR oscillator, voltage-level-shifter and power-MOS, which generates a polarity-converted negative voltage or twofold voltage of an operating voltage ranging from +1.5 to +10V.

The application circuit of negative voltage converter requires only two capacitors, and positive twofold voltage converter requires two capacitors, two resistors and one diode as external components.

The oscillation frequency of the internal oscillator is 5kHz and the negative voltage converter (on no-load condition) achieves extremely high-efficiency voltage conversion rate of 99.9%.

■ PACKAGE OUTLINE



NJU7660D



NJU7660M

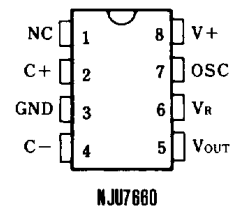


NJU7660V

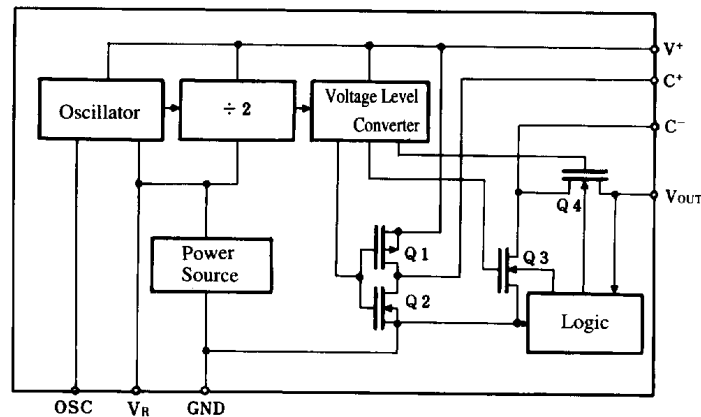
■ FEATURES

- Polarity-converted Negative Voltage Output
- Twofold Positive Voltage Output
- Operating Voltage --- + 1.5 to +10.0V
(for Negative Voltage Converter)
- Operating Voltage --- + 3.0 to +10.0V
(for Positive Voltage Converter)
- High-efficiency Voltage Conversion Rate-- 99.9%
(No-load, Negative Voltage Converter)
- High-efficiency Power Conversion Rate
(Negative Voltage Converter)
- 2n times Voltage Output using cascade connection
- Few External Components
 - 2 Capacitors, (Negative Voltage Converter)
 - 2 Capacitors, 2 Resistors and 1 Diode
(Positive Voltage Converter)
- Package Outline DMP/DMP/SSOP8
- C-MOS Technology

■ PIN CONFIGURATION



■ BLOCK DIAGRAM



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■ TERMINAL DESCRIPTION

NO.	SYMBOL	FUNCTION
1	NC	Non Connection
2	C ⁺	Charge Pump Capacitor (+) Connecting Terminal
3	GND	Ground Terminal
4	C ⁻	Charge Pump Capacitor (-) Connecting Terminal
5	V _{OUT}	Voltage Output Terminal
6	V _R	Voltage Regulator Control Terminal
7	OSC	Oscillation Capacitor Connecting Terminal
8	V ⁺	Power Supply Terminal (+)

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V ⁺	10.5	V
Input Voltage	V _{IN}	-0.3 ~ (V ⁺ +0.3) @ V ⁺ <5.5 (-V ⁺ -5.5) ~ (V ⁺ +0.3) @ V ⁺ >5.5	V
Output Short		CONTINUITY @ V ⁺ <5.5	
Power Dissipation	P _D	(DIP-8) 500 (DMP-8) 300 (SSOP-8) 300	mW
Operating Temperature Range	T _{opr}	-20 ~ +70	°C
Storage Temperature Range	T _{stg}	-65 ~ +150	°C

■ ELECTRICAL CHARACTERISTICS (Negative Voltage Output)

(Ta=25°C, V⁺=5V, C_{osc}=0)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Current	I ⁺	R _L ∞		170	500	μA
Operating Voltage I (Without Dx)	V ^{+H1}	R _L =10kΩ V _R =Open	3.0		6.5	V
	V ^{+L1}		1.5		3.5	V
Operating Voltage II (With Dx)	V ^{+H2}	R _L =10kΩ V _R =Open	3.0		10.0	V
	V ^{+L2}		1.5		3.5	V
Output Resistance	R _O	I _{OUT} =20mA		55	100	Ω
		V ⁺ =2V, I _{OUT} =3mA, V _R =GND			300	Ω
Oscillation Frequency	F _O			5		kHz
Power Conversion Rate	P _{EF}	R _L =5kΩ	90	98		%
Voltage Conversion Rate	V _{EF}	R _L ∞	97	99.9		%
Oscillation Circuit Impedance	Z _{OSC}	V ⁺ =2V		1.0		MΩ
		V ⁺ =5V		100		kΩ

(Note 1) The twofold positive converter operates over 3V.

(Note 2) The twofold positive converter requires 100Ω series resistor on power source terminal, therefore the output resistance increases to 200Ω.

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MEASUREMENT CIRCUIT

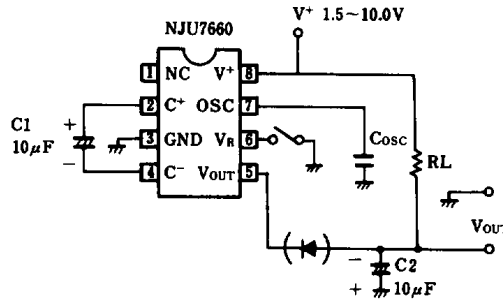
The measurement circuit diagram of negative voltage converter is shown below.

No. 6 terminal must connect to GND or Open according to the operating voltage as follows :

$V^+ < 3.5V$Connect to GND

$V^+ \geq 3.5V$OPEN

The oscillation frequency can be lowered by connecting external capacitor on the No.7 terminal, furthermore it can be also driven by external clock generator.

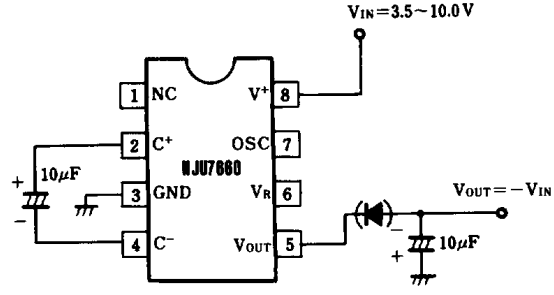
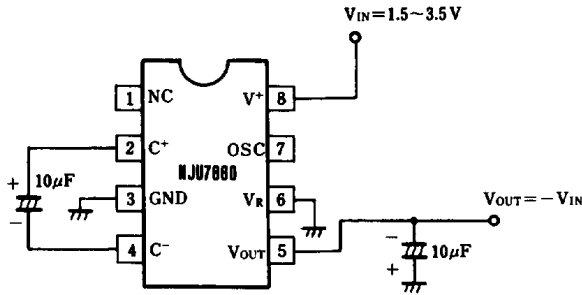


(Note 3) In case of the operation voltage is 6.5V or more, a Diode must be connected to No.5 terminal. If it is less than 6.5V, the Diode is not required.

APPLICATION CIRCUITS

(1-1) Negative Voltage Output 1
1.5 to 3.5V operation

(1-2) Negative Voltage Output 2
3.5 to 10.0V operation



(Note 4) No.6 terminal must connect to GND or Open according to the operating voltage as follows :

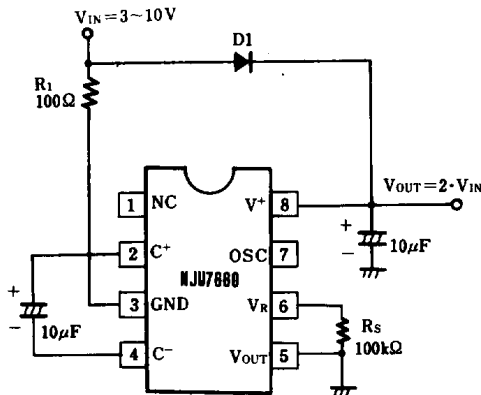
$V^+ < 3.5V$Connect to GND

$V^+ \geq 3.5V$OPEN

(Note 5) In case of the operation voltage is 6.5V or more, a Diode must be connected to No.5 terminal. If it is less than 6.5V, the Diode is not required.

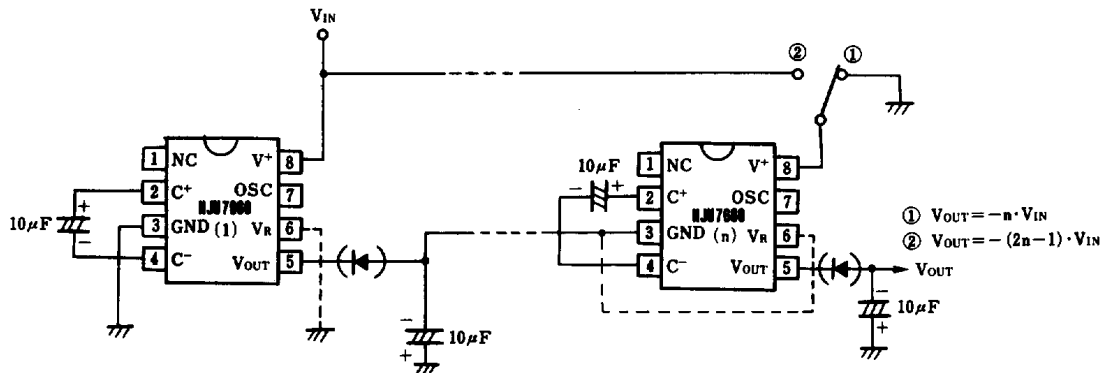


(2) Twofold Positive Voltage Output



(Note 6) In the twofold positive voltage output application, R₁, R_S and D₁ are required for start-up. In this application, the input voltage is 3 to 10V.

(3) Cascade Connection (Negative Voltage Output)



(Note 7) No.6 terminal must connect to GND or Open according to the operating voltage as follows :

- V⁺ < 3.5V.....Connect to GND
- V⁺ ≥ 3.5V.....OPEN

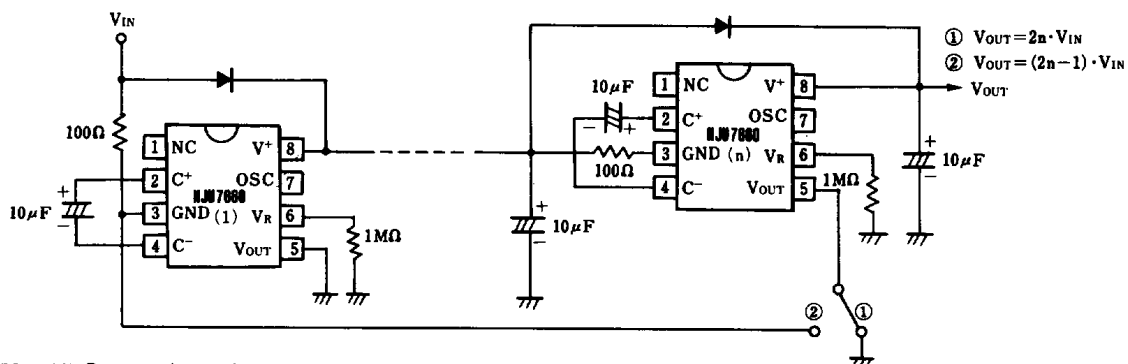
(Note 8) In case of the operation voltage is 6.5V or more, a Diode must be connected to No.5 terminal. If it is less than 6.5V, the Diode is not required.

(Note 9) Output resistance becomes total of the R_O of every NJU7660.

(Note 10) In case of the cascade connection (Negative Voltage Output), No.6 terminals (after second IC's) must connect as follows, according to V⁺ - GND Voltage.

- V⁺ - GND < 3.5V.....GND
- V⁺ - GND ≥ 3.5V.....OPEN

(4) Cascade Connection (Positive Voltage Output)



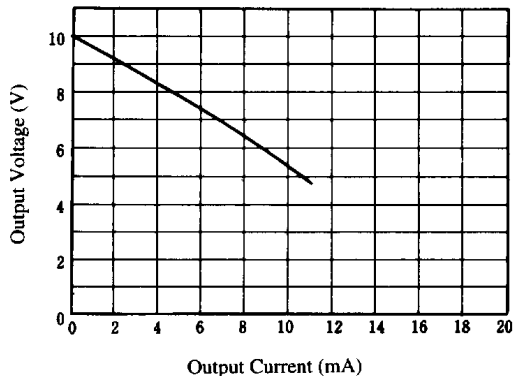
(Note 11) Output resistance becomes total of the R_O of every NJU7660.



■ TYPICAL CHARACTERISTICS

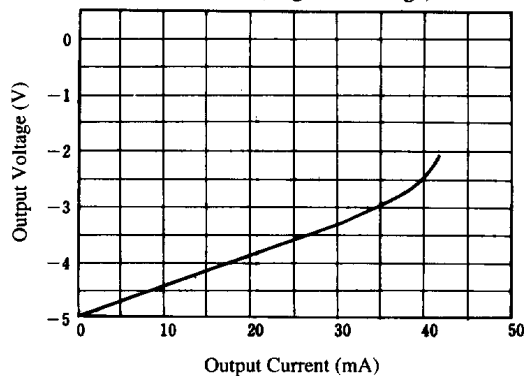
Output Voltage vs. Output Current

$V_{IN}=5V$ (Twofold Voltage)



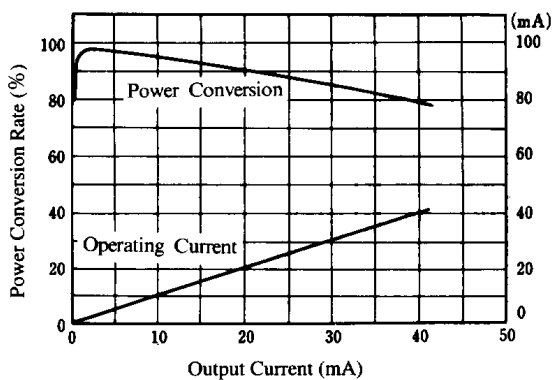
Output Voltage vs. Output Current

$V_{IN}=5V$ (Negative Voltage)



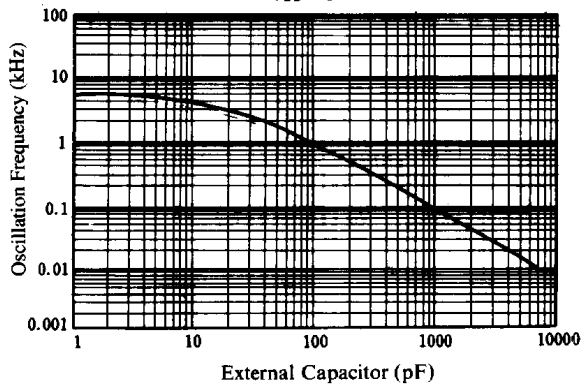
Power Conversion Rate vs. Output Current

$V_{IN}=5V$



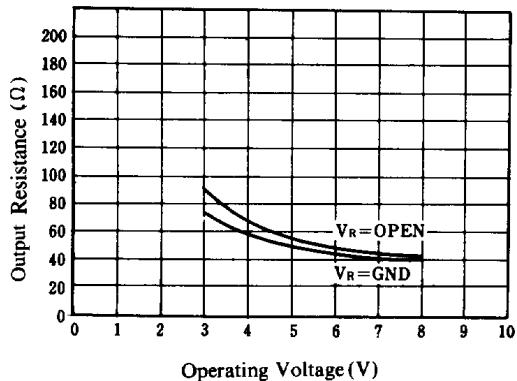
Oscillation Frequency vs. External Capacitor

$V_{DD}=5V$



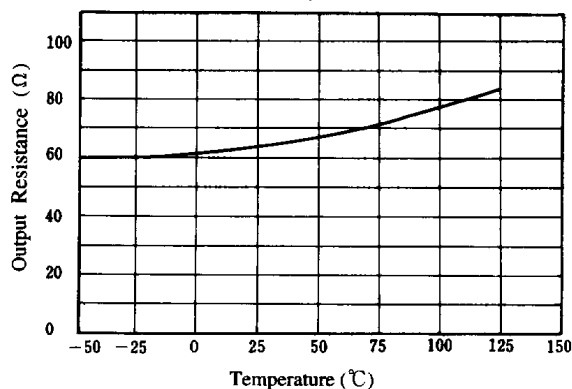
Output Resistance vs. Operating Voltage

$I_O=20mA$



Output Resistance vs. Temperature

$V_{DD}=5V, I_O=20mA$



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