PRELIMINARY

VOLTAGE TRIPLER

■ GENERAL DESCRIPTION

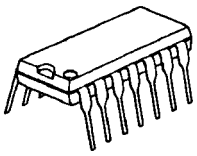
The **NJU7670** is a voltage tripler incorporated CR oscillator, voltage converter, reference voltage circuit and voltage regulator.

It can generates triple or double negative voltage of an operating voltage ranging from -2.6V to -6V.

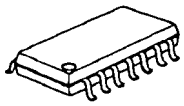
The application circuit of tripler requires three capacitors, and doubler requires only two capacitors.

Furthermore, any kind of output voltage is available by the internal voltage regulator.

■ PACKAGE OUTLINE



NJU7670D



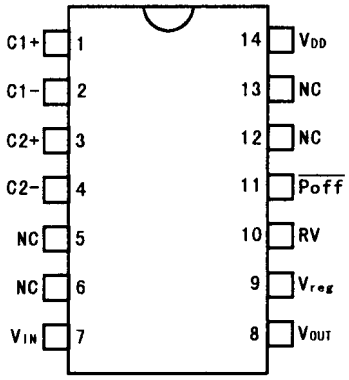
NJU7670M

NJU7670V

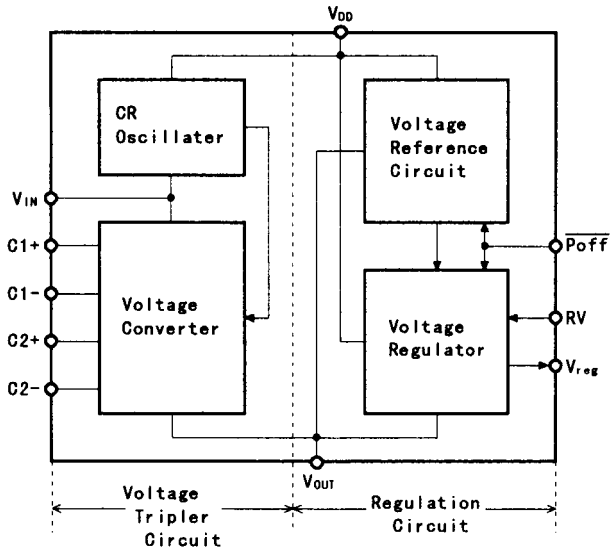
■ FEATURES

- Triple / Double Voltage Output
- Operating Voltage --- -2.6V to -6.0V
- High-efficiency Voltage Conversion Rate
  --- 95% (I_{OUT} = 5mA)
- High Output Current --- MAX 20mA (V_{IN} = -5V)
- CR Oscillator ON-Chip
- Output - OFF Function By External Signal
  --- ON / OFF of V_{reg}
- C-MOS Technology
- Package Outline DIP/DMP/SSOP 14

■ PIN CONFIGURATION



■ BLOCK DIAGRAM



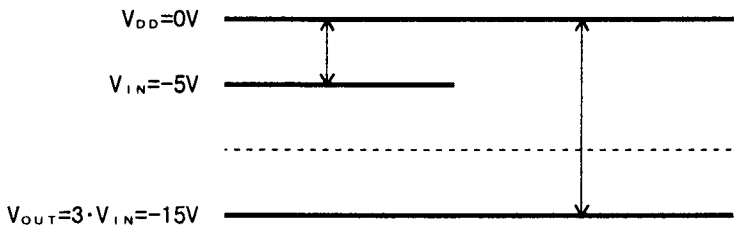
■ TERMINAL DESCRIPTION

No.	SYMBOL	FUNCTION
1	C1+	Charge Pump Capacitor 1(+) Connecting Terminal
2	C1-	Charge Pump Capacitor 1(-) Connecting Terminal
3	C2+	Charge Pump Capacitor 2(+) Connecting Terminal
4	C2-	Charge Pump Capacitor 2(-) Connecting Terminal
5	NC	Non Connection
6	NC	Non Connection
7	V_{IN}	Power Supply Terminal (-)
8	V_{OUT}	Voltage Output Terminal
9	V_{reg}	Voltage Regulator Output Terminal
10	RV	Voltage Regulator Adjustment Terminal
11	$\overline{Poff}$	V_{reg} Output ON/OFF Control Terminal
12	NC	Non Connection
13	NC	Non Connection
14	V_{DD}	Power Supply Terminal (+)

■ FUNCTIONAL DESCRIPTION

(1) Voltage Converter

The voltage converter generates double or triple voltage against V_{IN}.



(2) Voltage Reference Circuit

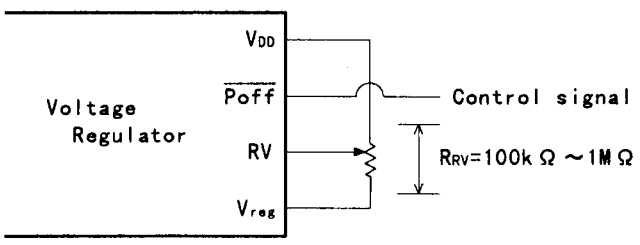
The voltage reference circuit is generating the reference voltage for a voltage regulator.

(3) Voltage Regulator

The voltage regurator output stabilized voltage which regulated by using the external resistor against double or triple voltage of the input voltage.

(3-1) Output-OFF Function

As this circuit incorporated output-off function, the voltage regulator output (ON/OFF) is performed by the signal come from system.



● ON/OFF Control for Vreg Terminal

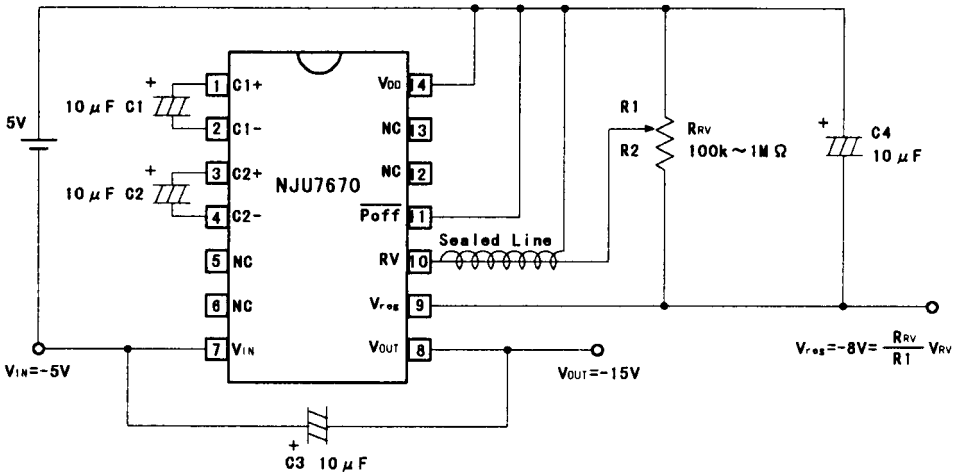
$\overline{Poff}$ Level	Vreg Output
"H" (Connect to V_{DD})	ON
"L" (Connect to V_{IN})	OFF

(3-2) Example of the Voltage Regulation

The voltage regulator has a output terminal which can be adjusted the output voltage to any kind of voltage by resistance R_{RV}.

As the RV terminal input impedance is high. Therefore special care against noise is required.
(Use a sealed line or others noise-proof method)

Tripler Operation + Voltage Regulator Operation



■ ABSOLUTE MAXIMUM RATINGS

(T_a = 25ºC)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{IN}	$\lvert V_{DD} - V_{OUT} \rvert \leq 20$	V
Input Voltage	V_{I1}	V_{IN} -0.5 to + 0.5 Note 1)	V
	V_{I2}	V_{OUT} -0.5 to + 0.5 Note 2)	
Output Voltage	V_{OUT}	-20.0	V
Power Dissipation	P_D	700 (DIP) 300 (DMP) 250 (SSOP)	mW
Operating Temperature Range	T_{opr}	-20 to +75	ºC
Storage Temperature Range	T_{stg}	-40 to +125	ºC

Note1) Apply to P_{OFF} terminal

Note2) Apply to RV terminal

■ ELECTRICAL CHARACTERISTIC

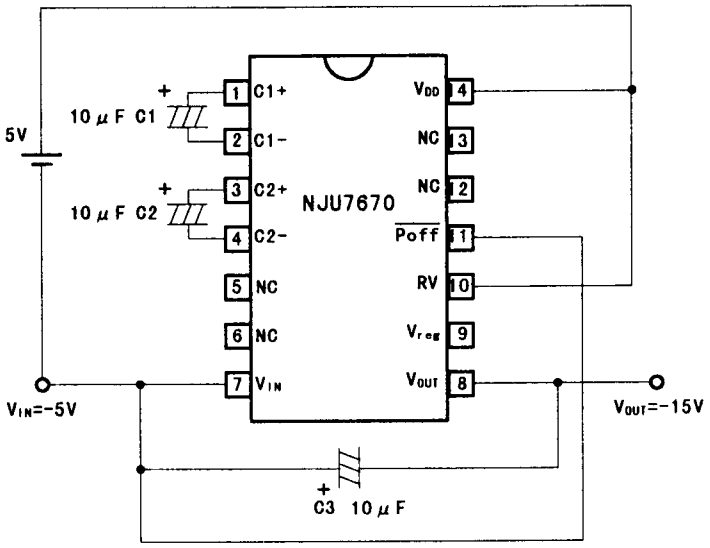
(V_{DD} = 0V, V_{IN} = -5V, T_a = 25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V_{IN}		-6.0	-	-2.6	V
Output Voltage	V_{OUT}		-18.0	-	-	V
	V_{reg}	RL = ∞, R_{RV} = 1MΩ, V_{OUT} = -18V	-18.0	-	-2.6	V
Regulator Operating Voltage	V_{OUT}		-18.0	-	-8.0	V
Current Consumption 1	I_{DD1}	$\overline{Poff}$ = "H" Note 3) RL = ∞, R_{RV} = 1MΩ, V_{reg} = -2.6V	-	75	120	μA
Current Consumption 2	I_{DD2}	$\overline{Poff}$ = "L" Note 3) RL = ∞, R_{RV} = 1MΩ	-	60	100	μA
Output Impedance	R_{OUT}	I_{OUT} = 20mA, C1 = C2 = C3 = 10μF	-	150	200	Ω
Power Conversion Rate	P_{eff}	I_{OUT} = 5mA, C1 = C2 = C3 = 10μF	90	95	-	%
Line Regulation	$\frac{\Delta V_{reg}}{\Delta V_{OUT} \cdot V_{reg}}$	-18V < V_{OUT} < -8V V_{erg} =-8V, RL = ∞	-	0.2	-	%/v
Load Conversion	$\frac{\Delta V_{reg}}{\Delta I_{reg}}$	V_{OUT} = -15V, V_{reg} = -8V 0 < I_{reg} < 20mA	-	5.0	-	Ω
Output Saturation Resistance	R_{SAT}	$R_{SAT} = \Delta (V_{reg} - V_{OUT}) / \Delta I_{reg}$ 0 < I_{reg} < 20mA, RV = V_{DD}	-	8.0	-	Ω
Reference Voltage	V_{RV}		-2.3	-1.5	-1.0	V
Input Current 1	I_{IN1}	RV Terminal	-	-	1.0	μA
Input Current 2	I_{IN2}	$\overline{Poff}$ Terminal	-	-	2.0	μA
Switching Frequency	f_{SW}		-	2.5	-	kHz

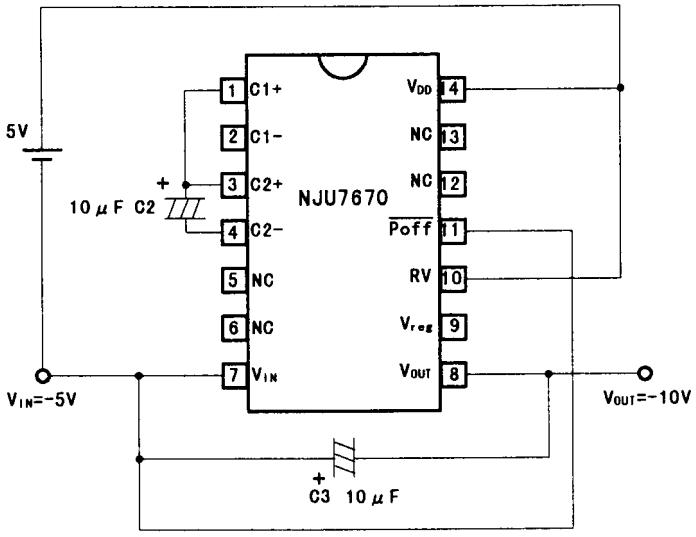
Note 3) Excluding input current on R_{RV}.

■ APPLICATION CIRCUITS (1)

(1-1) Tripler Operation

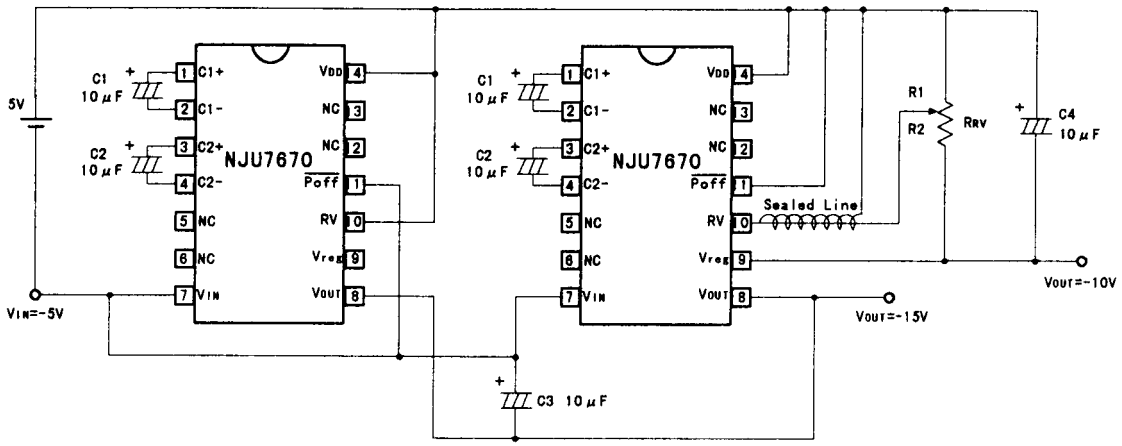


(1-2) Doubler Operation



■ APPLICATION CIRCUIT (2)

(2) Parallel Connection



* The output impedance R_{OUT} can be reduced by parallel connection.
* C3 is a stabilizing capacitor output for stabilized voltage.
* In the parallel connection, one stabilizing capacitor using is better way.