

## VOLTAGE CONVERTER

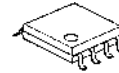
### ■ GENERAL DESCRIPTION

NJU7660A is a CMOS switched capacitor, voltage converter designed to be an Improved direct replacement of popular 7660/1044.

NJU7660A provides several voltage conversion functions.

The application circuit of negative voltage ( $V_{OUT} = -V_{IN}$ ) converter requires only two capacitors, and positive twofold voltage ( $V_{OUT} = 2V_{IN}$ ) converter requires two capacitors and two diodes as external components.

### ■ PACKAGE OUTLINE



NJU7660AM

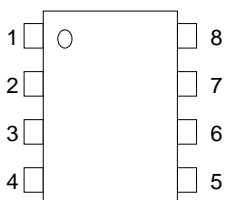


NJU7660AV

### ■ FEATURES

- Full Compatible with NJU7660
- Correspond to MLCC and electrolytic capacitor
- Twofold positive Output
- Polarity-converted Negative voltage Output
- Operating voltage range
  - :+1.5V to +10V(for Negative voltage converter)
  - :+3.0V to +10V(for Twofold voltage converter)
- High-efficiency voltage conversion rate
  - :99.9%(No load, Negative voltage converter)
- Few external components
  - :2 capacitors(Negative voltage converter)
  - :2 capacitors, 2diode(Twofold voltage converter)
- Package Outline
  - :DMP8, SSOP8
- CMOS Technology

### ■ PIN CONFIGURATION



NJU7660AM  
NJU7660AV

#### PIN FUNCTION

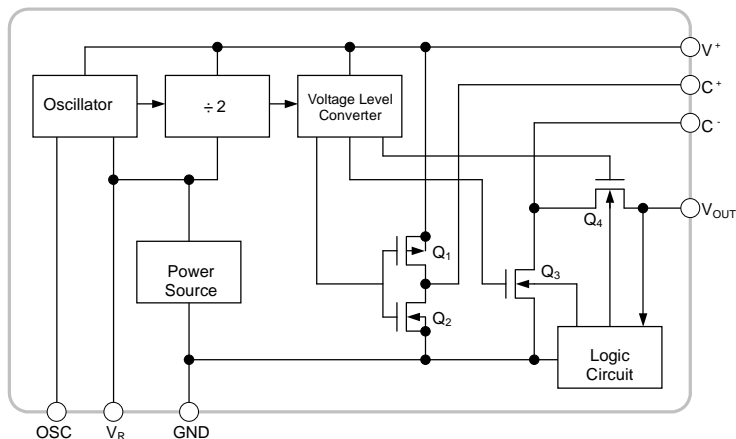
1. N.C. :Non Connection
2. C<sup>+</sup> :Charge pump Capacitor(+) Connecting pin
3. GND :Ground pin
4. C<sup>-</sup> :Charge pump Capacitor(-) Connecting pin
5. V<sub>OUT</sub> :Voltage Output pin
6. V<sub>R</sub> :Voltage Regulator Control pin
7. OSC :Oscillation Capacitor Connecting pin
8. V<sup>+</sup> :Power Supply pin

### ■ PRODUCT CLASSIFICATION

Device Name	Oscillation Frequency	Output Resistance	Operating Current	C1/C2 capacitor	Status
NJU7660A	5kHz typ.	55Ω typ.	40μA typ.	10μF	M.P
NJU7660B	200kHz typ.	30Ω typ.	800μA typ.	1μF	PLAN

# NJU7660A

## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	10.5	V
OSC Pin Voltage	V <sub>OSC</sub>	-0.3 ~ (V <sup>+</sup> +0.3) @ V <sup>+</sup> < 5.5 (V <sup>+</sup> -5.5) ~ (V <sup>+</sup> +0.3) @ V <sup>+</sup> > 5.5	V
V <sub>R</sub> Pin Voltage	V <sub>VR</sub>	-0.3 ~ (V <sup>+</sup> +0.3) @ V <sup>+</sup> < 5.5 (V <sup>+</sup> -5.5) ~ (V <sup>+</sup> +0.3) @ V <sup>+</sup> > 5.5	V
V <sub>R</sub> Pin Current (*3)	I <sub>VR</sub>	20	μA
Output Short		CONTINUITY @ V <sup>+</sup> < 5.5	
Power Dissipation	P <sub>D</sub>	DMP8	470(*1) 600(*2)
		SSOP8	410(*1) 510(*2)
Junction Temperature Range	T <sub>J</sub>	- 40 ~ +150	°C
Operating Temperature Range	T <sub>opr</sub>	- 40 ~ + 85	°C
Storage Temperature Range	T <sub>stg</sub>	- 40 ~ +150	°C

(\*1): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JDEC standard, 2Layers)

(\*2): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JDEC standard, 4Layers,internal Cu area: 74.2 × 74.2mm)

(\*3): Connecting any input terminal to voltages greater than V<sup>+</sup> or less than GND may cause destructive latchup. It is recommended that no inputs from sources operating from external supplies be applied prior to "power-up" of the NJU7660A

## ■ INPUT VOLTAGE RANGE

V<sup>+</sup>=1.5V to 10V (for Negative Voltage Converter)

V<sup>+</sup>=3.0V to 10V (for Twofold Voltage Converter)

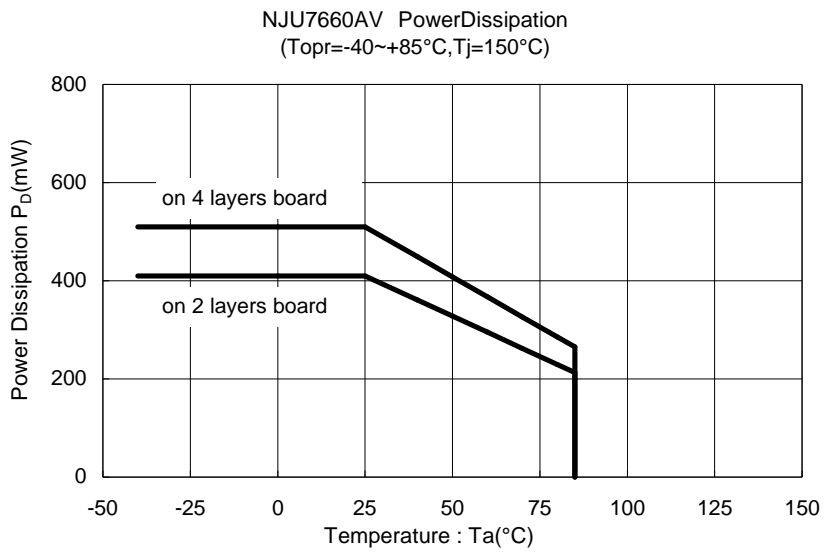
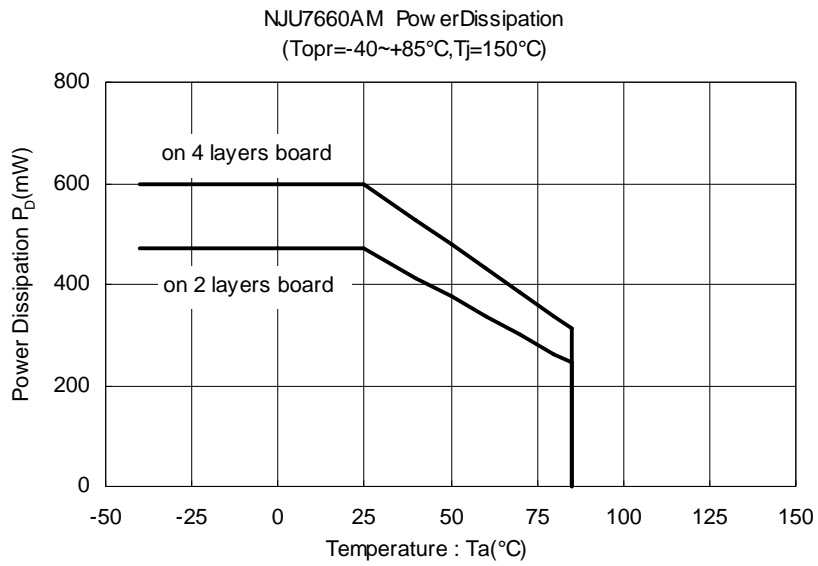
## ■ ELECTRICAL CHARACTERISTICS

(Unless otherwise noted,  $V^+=5.0V$ ,  $C_{OSC}=0$ ,  $T_a=25^\circ C$ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Operating Current	$I^+$	$R_L=\infty$	-	40	130	$\mu A$	
Operating Voltage 1 (Without Dx)	$V_{H1}^+$	$R_L=10k\Omega$	$V_R=OPEN$	3.0	-	6.5	V
	$V_{L1}^+$		$V_R=GND$	1.5	-	3.5	V
Operating Voltage 2 (With Dx)	$V_{H2}^+$	$R_L=10k\Omega$	$V_R=OPEN$	3.0	-	10	V
	$V_{L2}^+$		$V_R=GND$	1.5	-	3.5	V
Output Resistance	$R_o$	$I_{OUT}=20mA$	-	55	100	$\Omega$	
		$V^+=2V, I_{OUT}=3mA, V_R=GND$	-	-	300	$\Omega$	
Oscillation Frequency	$F_o$		-	5	-	kHz	
Power Conversion Rate	$P_{EF}$	$R_L=5k\Omega$	90	98	-	%	
Voltage Conversion Rate	$V_{EF}$	$R_L=\infty$	97	99.9	-	%	
Oscillation Circuit Impedance	$Z_{OSC}$	$V^+=2V$	-	1.0	-	M $\Omega$	
		$V^+=5V$	-	0.1	-		

(\*4): The twofold voltage converter operates over 3.0V

## ■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



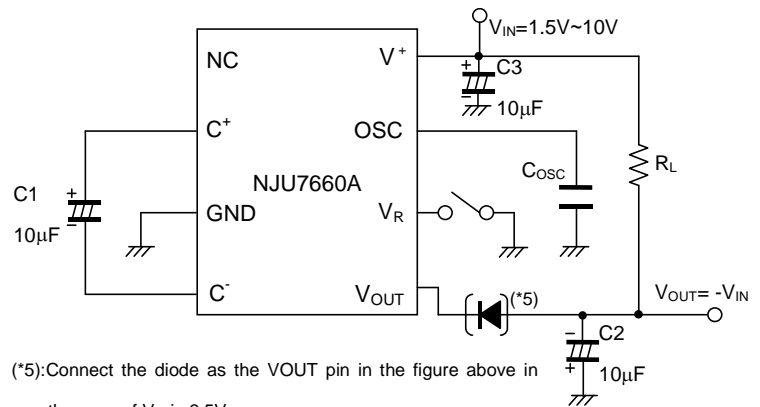
## ■ TEST CIRCUIT

The measurement circuit diagram of negative voltage is shown below.  $V_R$  pin must connect to GND or Open according to the operating voltage as follows:

$V^+ < 3.5V$  :Connected to GND

$V^+ \geq 3.5V$  :OPEN

The oscillation frequency can be lowered by connected external capacitor to the OSC pin, furthermore it can be also driven by external clock generator.

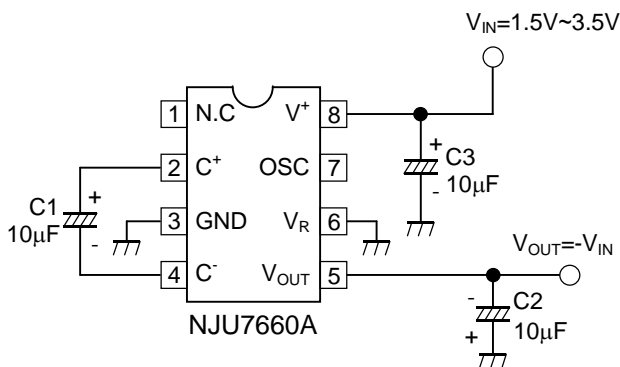


(\*5):Connect the diode as the  $V_{OUT}$  pin in the figure above in the case of  $V^+$  is 6.5V or more.

In the case of less than 6.5V,  $V^+$  does not require this diode.

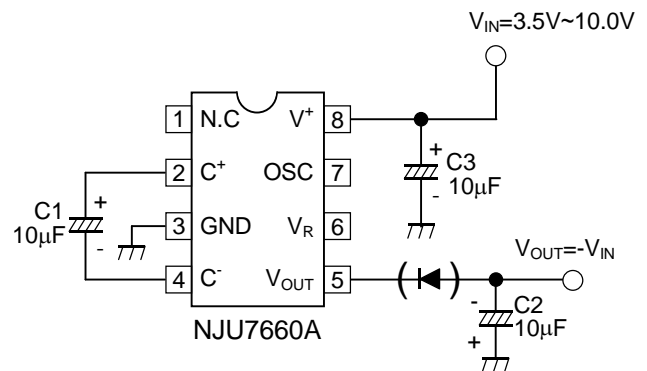
## ■ TYPICAL APPLICATION

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



\*Its Can also be used ceramic capacitor. (C1,C2,C3)  
\*Capacitance of C3 is equal to C1,C2 or more.

### ( 1-2 ) Negative Voltage Output 2 3.5V to 10V operation



\*Can also be used ceramic capacitor. (C1,C2,C3)  
\*Capacitance of C3 is equal to C1,C2 or more.

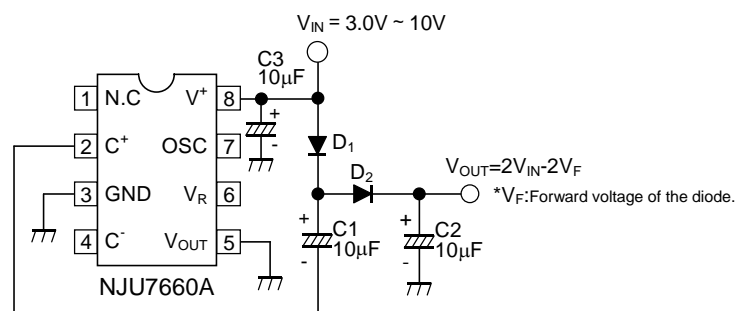
(\*6):  $V_R$  pin must connect to GND or Open according to the operating voltage as follows:

$V^+ < 3.5V$  :Connected to GND

$V^+ \geq 3.5V$  :OPEN

(\*7): In case of the operation voltage is 6.5V or more, a Diode must be connected to  $V_{OUT}$  pin. If it is less than 6.5V, the Diode is not required

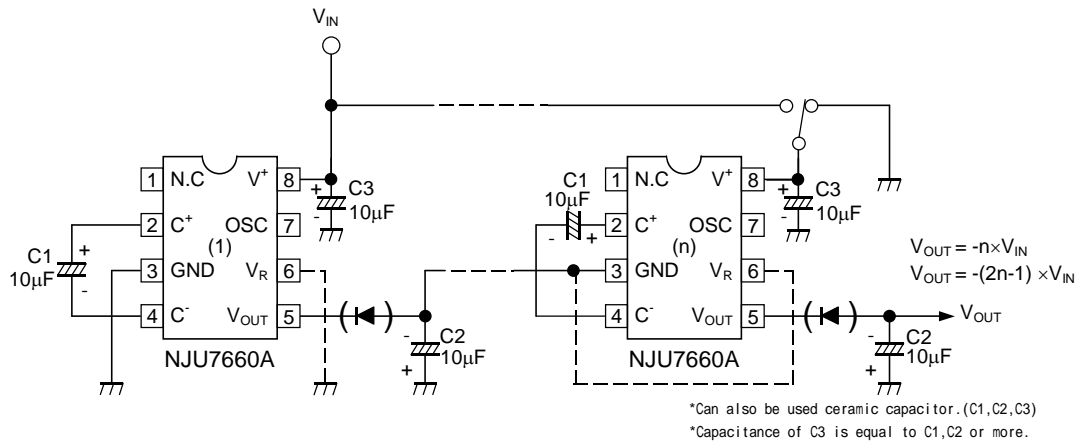
### ( 2 ) Twofold positive Voltage Output



\*Can also be used ceramic capacitor. (C1,C2,C3)  
\*Capacitance of C3 is equal to C1,C2 or more.

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## (3) Cascade Connection (Negative Voltage Output)



(\*8):  $V_R$  pin must connect to GND or Open according to the operating voltage as follows:

$V^+ < 3.5V$  :Connected to GND

$V^+ \geq 3.5V$  :OPEN

(\*9): In case of the operation voltage is 6.5V or more, a Diode must be connected to  $V_{OUT}$  pin. If it is less than 6.5V, the Diode is not required

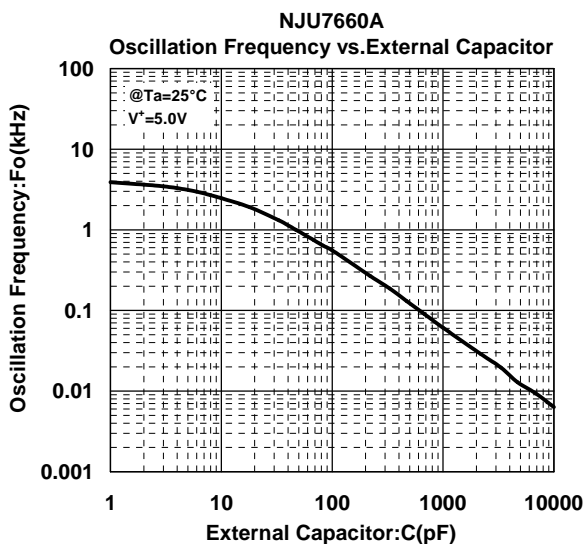
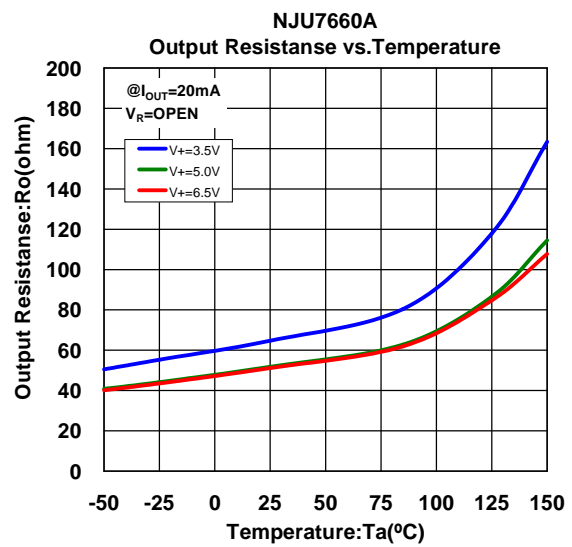
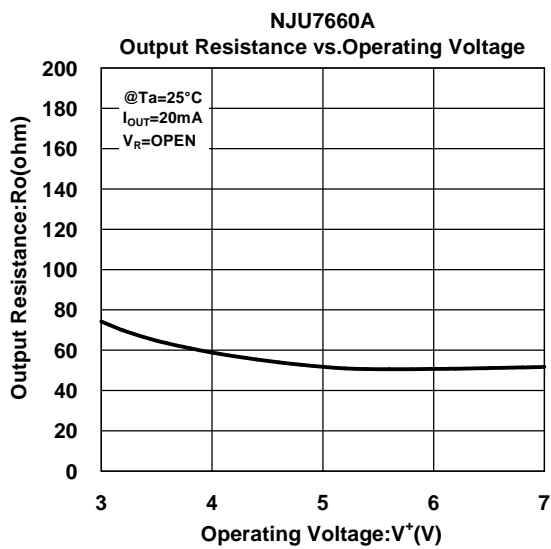
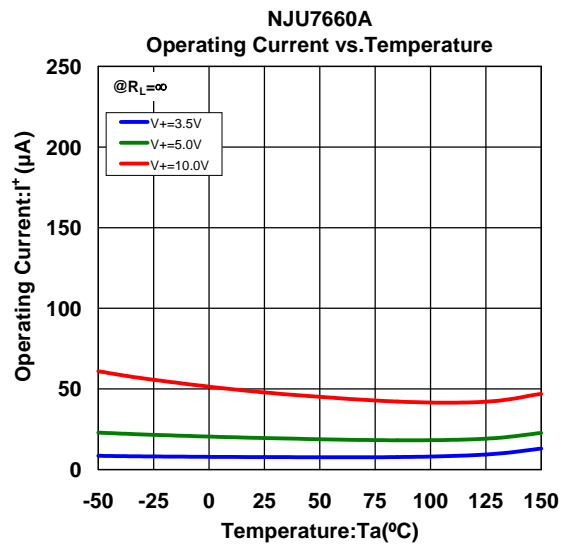
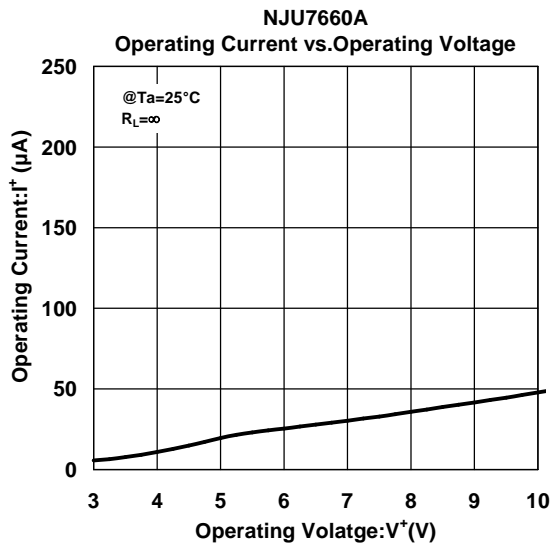
(\*10): In case of the cascade connection (Negative Voltage Output),  $V_R$  pins (after second IC's) must connect as follows, according to  $V^+ - GND$  Voltage.

$V^+ - GND < 3.5V$  :Connected to GND

$V^+ - GND \geq 3.5V$  :OPEN

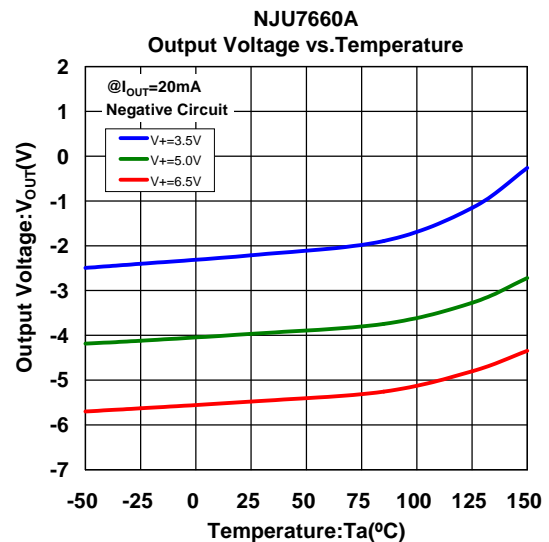
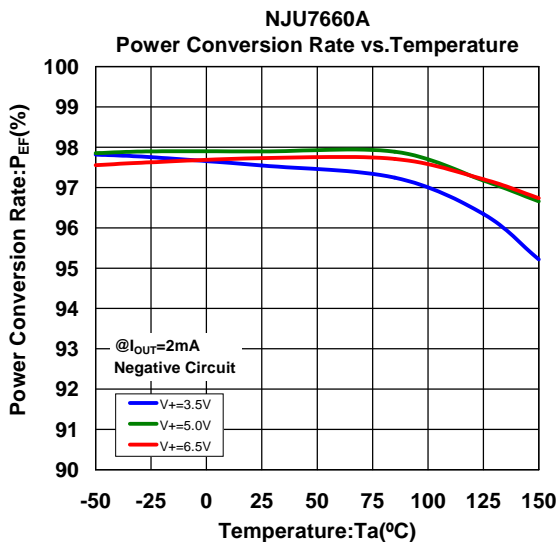
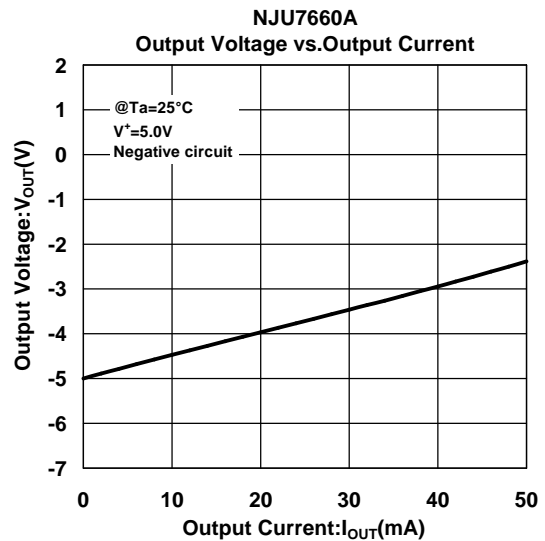
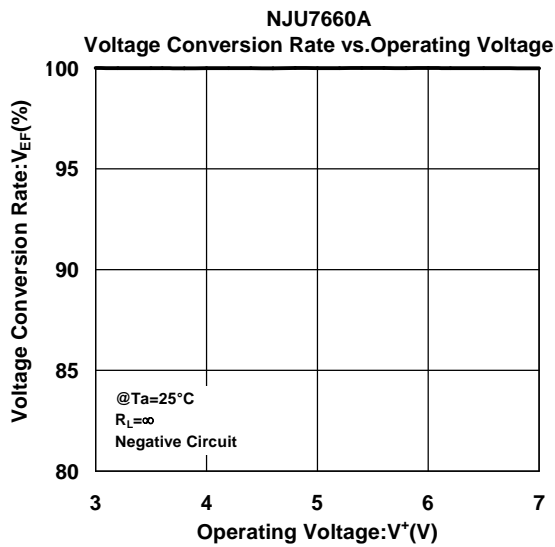
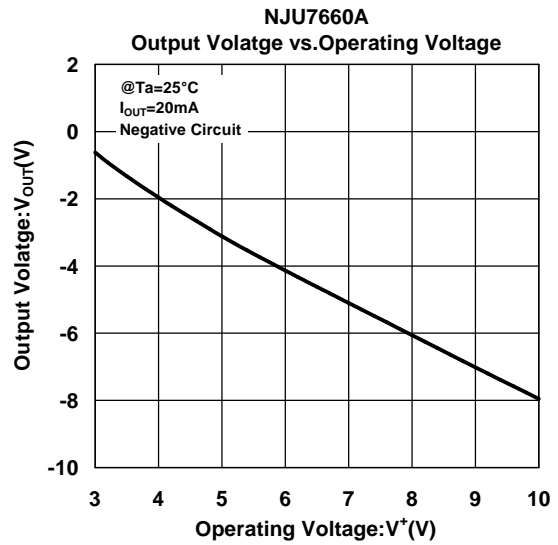
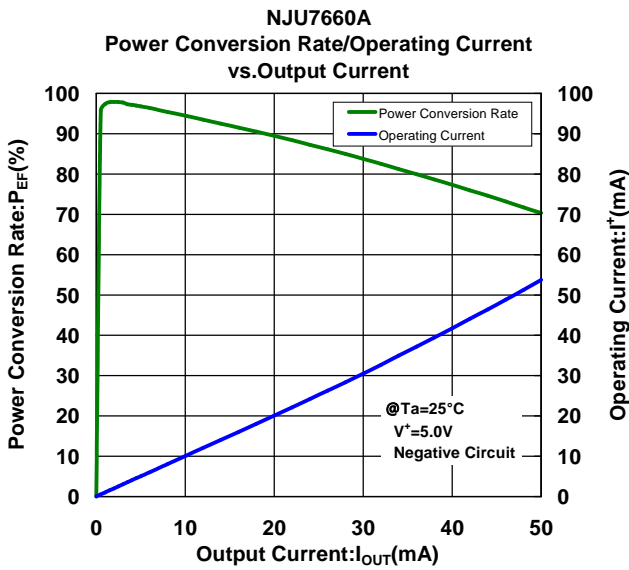
(\*11): Output resistance becomes total of the  $R_o$  of every NJU7660A

## ■ TYPICAL CHARACTERISTICS (Common)



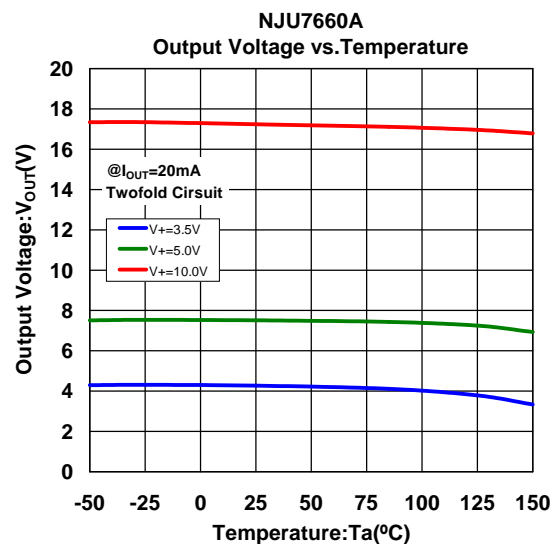
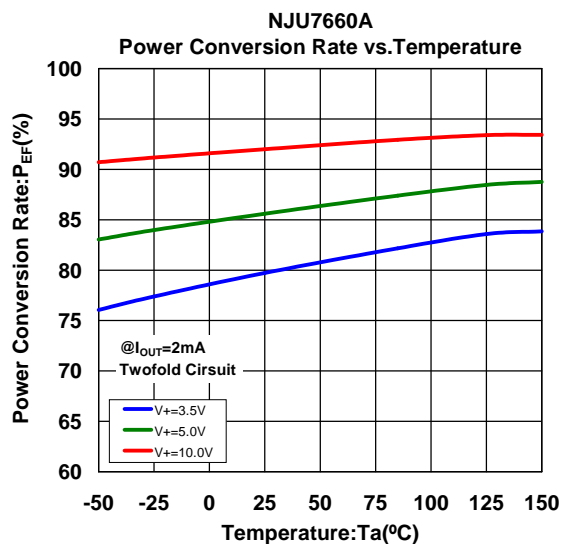
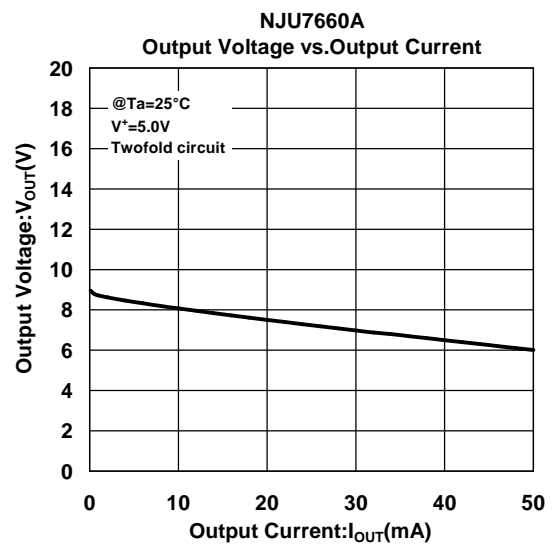
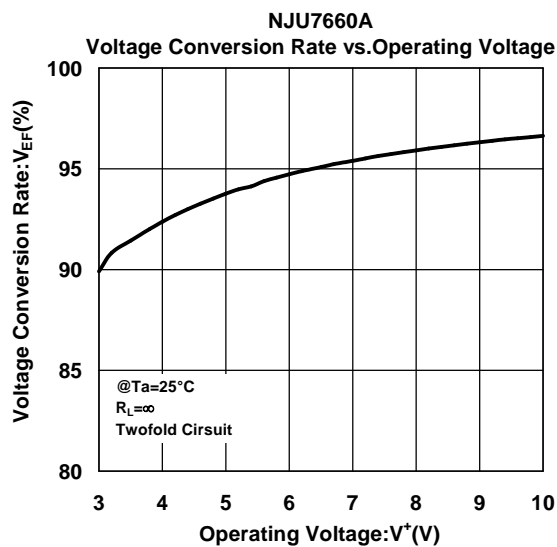
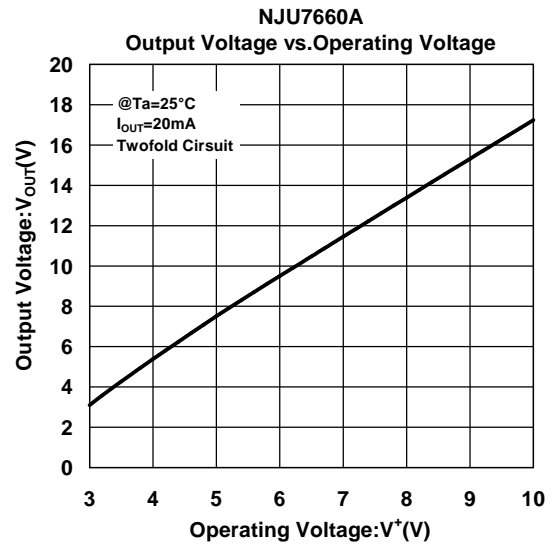
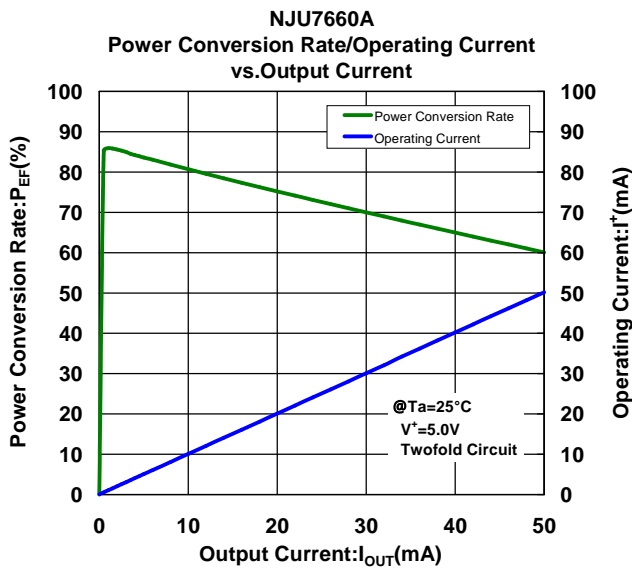
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## ■ TYPICAL CHARACTERISTICS (Negative Circuit)





## ■ TYPICAL CHARACTERISTICS (Twofold Circuit)



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