

## HIGH PRECISION C-MOS 3-TERMINAL VOLTAGE REGULATOR

## ■ GENERAL DESCRIPTION

The NJU7221 series is a high precision output voltage ( $\pm 2\%$ ) 3-terminal positive voltage regulator which contains internal accurate voltage reference, error amplifier, control transistor and output voltage setting resistor.

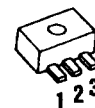
The regulation voltage is fixed by internal circuits and the following line-up of different output voltage versions are available.

The NJU7221 series is suitable for battery operated items and battery back-up systems because of low operating current and low dropout voltage.

## ■ PACKAGE OUTLINE



NJU7221L



NJU7221U

## ■ FEATURES

- High Precision Output Voltage  $\pm 2\%$
- Low Operating Current 19 $\mu$ A typ
- Low Dropout Voltage  $\Delta V_{IO} < 0.6V$  @  $I_O = 100mA$
- Wide Operating Voltage Range
- Small Temperature Coefficient of Output Voltage
- Package Outline TO-92/SOT-89
- C-MOS Technology

## ■ TERMINAL DESCRIPTION

| No. | Description |
|-----|-------------|
| 1   | GND         |
| 2   | Input       |
| 3   | Output      |

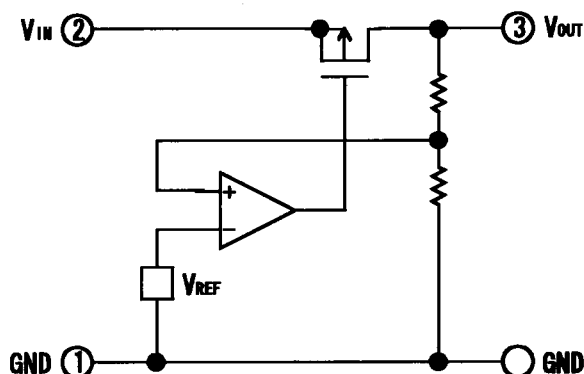
## ■ OUTPUT VOLTAGE LINE-UP

| Output Voltage | TO-92 Type  | SOT-89 Type | Output Voltage | TO-92 Type | SOT-89 Type |
|----------------|-------------|-------------|----------------|------------|-------------|
| +1.2V          | NJU7221L12  | NJU7221U12  | +3.2V          | NJU7221L32 | NJU7221U32  |
| +1.5V          | NJU7221L15  | NJU7221U15  | +3.5V          | NJU7221L35 | NJU7221U35  |
| +1.9V          | NJU7221L19  | NJU7221U19  | +4.0V          | NJU7221L40 | NJU7221U40  |
| +2.0V          | NJU7221L20  | NJU7221U20  | +5.0V          | NJU7221L50 | NJU7221U50  |
| +2.5V          | NJU7221L25  | NJU7221U25  | +5.2V          | NJU7221L52 | NJU7221U52  |
| +2.7V          | NJU7221L27* | NJU7221U27* | +5.5V          | NJU7221L55 | NJU7221U55  |
| +3.0V          | NJU7221L30  | NJU7221U30  | -              | -          | -           |

Note1) The SOT-89 type name is different from the marking, so it refer to attached paper correspondence table.

Note2) \* : Planning products.

## ■ EQUIVALENT CIRCUIT



## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

| PARAMETER             | SYMBOL    | RATINGS                     | UNIT |
|-----------------------|-----------|-----------------------------|------|
| Input Voltage         | $V_{IN}$  | 14                          | V    |
| Output Voltage        | $V_{OUT}$ | GND-0.3 ~ $V_{IN}+0.3$      | V    |
| Output Current        | $I_{OUT}$ | 100                         | mA   |
| Power Dissipation     | $P_D$     | 500 (TO-92)<br>300 (SOT-89) | mW   |
| Operating Temperature | $T_{opr}$ | - 25 ~ + 75                 | °C   |
| Storage Temperature   | $T_{stg}$ | - 40 ~ +125                 | °C   |

## ■ ELECTRICAL CHARACTERISTICS

+1.2V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                         | MIN   | TYP   | MAX   | UNIT |
|-------------------|------------------------------------------------------|-----------------------------------|-------|-------|-------|------|
| Output Voltage    | $V_{OUT}$                                            | $V_{IN}=3.0V, I_{OUT}=5mA$        | 1.176 | 1.200 | 1.224 | V    |
| Dropout Voltage   | $\Delta V_{IO}$                                      | $I_{OUT}=0.5mA$                   | —     | 0.02  | 0.30  | V    |
| Input Voltage     | $V_{IN}$                                             |                                   | —     | —     | 12    | V    |
| Operating Current | $I_Q$                                                | $V_{IN}=3.0V$                     | —     | 19    | 30    | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | $V_{IN}=3.0V, I_{OUT}=1\sim 15mA$ | —     | 10    | 180   | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | $V_{IN}=1.5\sim 12V$              | —     | 0.1   | —     | %/V  |

+1.5V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                         | MIN  | TYP  | MAX  | UNIT |
|-------------------|------------------------------------------------------|-----------------------------------|------|------|------|------|
| Output Voltage    | $V_{OUT}$                                            | $V_{IN}=3.0V, I_{OUT}=5mA$        | 1.47 | 1.50 | 1.53 | V    |
| Dropout Voltage   | $\Delta V_{IO}$                                      | $I_{OUT}=0.5mA$                   | —    | 0.02 | 0.30 | V    |
| Input Voltage     | $V_{IN}$                                             |                                   | —    | —    | 12   | V    |
| Operating Current | $I_Q$                                                | $V_{IN}=3.0V$                     | —    | 19   | 30   | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | $V_{IN}=3.0V, I_{OUT}=1\sim 15mA$ | —    | 10   | 180  | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | $V_{IN}=1.8\sim 12V$              | —    | 0.10 | —    | %/V  |

+1.9V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                         | MIN   | TYP   | MAX   | UNIT |
|-------------------|------------------------------------------------------|-----------------------------------|-------|-------|-------|------|
| Output Voltage    | $V_{OUT}$                                            | $V_{IN}=3.0V, I_{OUT}=5mA$        | 1.862 | 1.900 | 1.938 | V    |
| Dropout Voltage   | $\Delta V_{IO}$                                      | $I_{OUT}=0.5mA$                   | —     | 0.02  | 0.30  | V    |
| Input Voltage     | $V_{IN}$                                             |                                   | —     | —     | 12    | V    |
| Operating Current | $I_Q$                                                | $V_{IN}=3.0V$                     | —     | 19    | 30    | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | $V_{IN}=3.0V, I_{OUT}=1\sim 15mA$ | —     | 10    | 180   | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | $V_{IN}=2.1\sim 12V$              | —     | 0.10  | —     | %/V  |

+2.0V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                                       | MIN  | TYP  | MAX  | UNIT |
|-------------------|------------------------------------------------------|-------------------------------------------------|------|------|------|------|
| Output Voltage    | V <sub>OUT</sub>                                     | V <sub>IN</sub> =4.0V, I <sub>OUT</sub> =10mA   | 1.96 | 2.00 | 2.04 | V    |
| Dropout Voltage   | ΔV <sub>IO</sub>                                     | I <sub>OUT</sub> =20mA                          | —    | 0.2  | 0.6  | V    |
| Input Voltage     | V <sub>IN</sub>                                      |                                                 | —    | —    | 12   | V    |
| Operating Current | I <sub>Q</sub>                                       | V <sub>IN</sub> =4.0V                           | —    | 19   | 30   | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | V <sub>IN</sub> =4.0V, I <sub>OUT</sub> =1~20mA | —    | 15   | 180  | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | V <sub>IN</sub> =3.0~12V                        | —    | 0.10 | —    | %/V  |

+2.5V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                                       | MIN  | TYP  | MAX  | UNIT |
|-------------------|------------------------------------------------------|-------------------------------------------------|------|------|------|------|
| Output Voltage    | V <sub>OUT</sub>                                     | V <sub>IN</sub> =4.5V, I <sub>OUT</sub> =10mA   | 2.45 | 2.50 | 2.55 | V    |
| Dropout Voltage   | ΔV <sub>IO</sub>                                     | I <sub>OUT</sub> =20mA                          | —    | 0.2  | 0.6  | V    |
| Input Voltage     | V <sub>IN</sub>                                      |                                                 | —    | —    | 12   | V    |
| Operating Current | I <sub>Q</sub>                                       | V <sub>IN</sub> =4.5V                           | —    | 19   | 30   | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | V <sub>IN</sub> =4.5V, I <sub>OUT</sub> =1~20mA | —    | 15   | 180  | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | V <sub>IN</sub> =3.5~12V                        | —    | 0.10 | —    | %/V  |

+2.7V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                                       | MIN   | TYP   | MAX   | UNIT |
|-------------------|------------------------------------------------------|-------------------------------------------------|-------|-------|-------|------|
| Output Voltage    | V <sub>OUT</sub>                                     | V <sub>IN</sub> =4.7V, I <sub>OUT</sub> =10mA   | 2.646 | 2.700 | 2.754 | V    |
| Dropout Voltage   | ΔV <sub>IO</sub>                                     | I <sub>OUT</sub> =20mA                          | —     | 0.2   | 0.6   | V    |
| Input Voltage     | V <sub>IN</sub>                                      |                                                 | —     | —     | 12    | V    |
| Operating Current | I <sub>Q</sub>                                       | V <sub>IN</sub> =4.7V                           | —     | 19    | 30    | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | V <sub>IN</sub> =4.7V, I <sub>OUT</sub> =1~20mA | —     | 15    | 180   | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | V <sub>IN</sub> =3.7~12V                        | —     | 0.10  | —     | %/V  |

+3.0V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                                       | MIN  | TYP  | MAX  | UNIT |
|-------------------|------------------------------------------------------|-------------------------------------------------|------|------|------|------|
| Output Voltage    | V <sub>OUT</sub>                                     | V <sub>IN</sub> =5.0V, I <sub>OUT</sub> =10mA   | 2.94 | 3.00 | 3.06 | V    |
| Dropout Voltage   | ΔV <sub>IO</sub>                                     | I <sub>OUT</sub> =20mA                          | —    | 0.2  | 0.6  | V    |
| Input Voltage     | V <sub>IN</sub>                                      |                                                 | —    | —    | 12   | V    |
| Operating Current | I <sub>Q</sub>                                       | V <sub>IN</sub> =5.0V                           | —    | 19   | 30   | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | V <sub>IN</sub> =5.0V, I <sub>OUT</sub> =1~20mA | —    | 15   | 180  | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | V <sub>IN</sub> =4.0~12V                        | —    | 0.10 | —    | %/V  |

+3.2V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                                       | MIN   | TYP   | MAX   | UNIT |
|-------------------|------------------------------------------------------|-------------------------------------------------|-------|-------|-------|------|
| Output Voltage    | V <sub>OUT</sub>                                     | V <sub>IN</sub> =5.2V, I <sub>OUT</sub> =10mA   | 3.136 | 3.200 | 3.264 | V    |
| Dropout Voltage   | ΔV <sub>IO</sub>                                     | I <sub>OUT</sub> =20mA                          | —     | 0.2   | 0.6   | V    |
| Input Voltage     | V <sub>IN</sub>                                      |                                                 | —     | —     | 12    | V    |
| Operating Current | I <sub>Q</sub>                                       | V <sub>IN</sub> =5.2V                           | —     | 19    | 30    | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | V <sub>IN</sub> =5.2V, I <sub>OUT</sub> =1~20mA | —     | 15    | 180   | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | V <sub>IN</sub> =4.2~12V                        | —     | 0.10  | —     | %/V  |

+3.5V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                                       | MIN  | TYP  | MAX  | UNIT |
|-------------------|------------------------------------------------------|-------------------------------------------------|------|------|------|------|
| Output Voltage    | V <sub>OUT</sub>                                     | V <sub>IN</sub> =5.5V, I <sub>OUT</sub> =10mA   | 3.43 | 3.50 | 3.57 | V    |
| Dropout Voltage   | ΔV <sub>IO</sub>                                     | I <sub>OUT</sub> =20mA                          | —    | 0.2  | 0.6  | V    |
| Input Voltage     | V <sub>IN</sub>                                      |                                                 | —    | —    | 12   | V    |
| Operating Current | I <sub>O</sub>                                       | V <sub>IN</sub> =5.5V                           | —    | 19   | 30   | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | V <sub>IN</sub> =5.5V, I <sub>OUT</sub> =1~20mA | —    | 15   | 180  | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | V <sub>IN</sub> =4.5~12V                        | —    | 0.10 | —    | %/V  |

+4.0V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                                       | MIN  | TYP  | MAX  | UNIT |
|-------------------|------------------------------------------------------|-------------------------------------------------|------|------|------|------|
| Output Voltage    | V <sub>OUT</sub>                                     | V <sub>IN</sub> =6.0V, I <sub>OUT</sub> =30mA   | 3.92 | 4.00 | 4.08 | V    |
| Dropout Voltage   | ΔV <sub>IO</sub>                                     | I <sub>OUT</sub> =40mA                          | —    | 0.3  | 0.6  | V    |
| Input Voltage     | V <sub>IN</sub>                                      |                                                 | —    | —    | 12   | V    |
| Operating Current | I <sub>O</sub>                                       | V <sub>IN</sub> =6.0V                           | —    | 19   | 30   | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | V <sub>IN</sub> =6.0V, I <sub>OUT</sub> =1~40mA | —    | 35   | 120  | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | V <sub>IN</sub> =5.0~12V                        | —    | 0.10 | —    | %/V  |

+5.0V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                                       | MIN  | TYP  | MAX  | UNIT |
|-------------------|------------------------------------------------------|-------------------------------------------------|------|------|------|------|
| Output Voltage    | V <sub>OUT</sub>                                     | V <sub>IN</sub> =7.0V, I <sub>OUT</sub> =30mA   | 4.90 | 5.00 | 5.10 | V    |
| Dropout Voltage   | ΔV <sub>IO</sub>                                     | I <sub>OUT</sub> =40mA                          | —    | 0.3  | 0.6  | V    |
| Input Voltage     | V <sub>IN</sub>                                      |                                                 | —    | —    | 12   | V    |
| Operating Current | I <sub>DD1</sub>                                     | V <sub>IN</sub> =7.0V, No Load                  | —    | 19   | 30   | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | V <sub>IN</sub> =7.0V, I <sub>OUT</sub> =1~40mA | —    | 35   | 120  | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | V <sub>IN</sub> =6.0~12V                        | —    | 0.10 | —    | %/V  |

+5.2V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

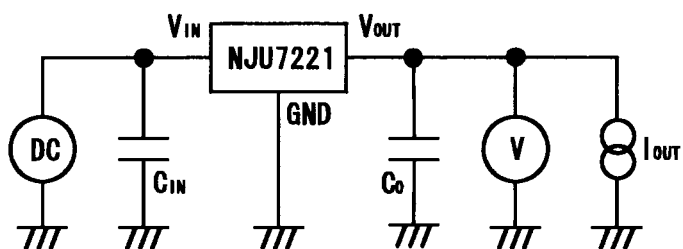
| PARAMETER         | SYMBOL                                               | CONDITION                                       | MIN   | TYP   | MAX   | UNIT |
|-------------------|------------------------------------------------------|-------------------------------------------------|-------|-------|-------|------|
| Output Voltage    | V <sub>OUT</sub>                                     | V <sub>IN</sub> =7.2V, I <sub>OUT</sub> =30mA   | 5.096 | 5.200 | 5.304 | V    |
| Dropout Voltage   | ΔV <sub>IO</sub>                                     | I <sub>OUT</sub> =40mA                          | —     | 0.3   | 0.6   | V    |
| Input Voltage     | V <sub>IN</sub>                                      |                                                 | —     | —     | 12    | V    |
| Operating Current | I <sub>DD1</sub>                                     | V <sub>IN</sub> =7.2V, No Load                  | —     | 19    | 30    | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | V <sub>IN</sub> =7.2V, I <sub>OUT</sub> =1~40mA | —     | 35    | 120   | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | V <sub>IN</sub> =6.2~12V                        | —     | 0.10  | —     | %/V  |

+5.5V Version

(C<sub>IN</sub>=C<sub>O</sub>=0.1μF, Ta=25°C)

| PARAMETER         | SYMBOL                                               | CONDITION                                       | MIN  | TYP  | MAX  | UNIT |
|-------------------|------------------------------------------------------|-------------------------------------------------|------|------|------|------|
| Output Voltage    | V <sub>OUT</sub>                                     | V <sub>IN</sub> =7.5V, I <sub>OUT</sub> =30mA   | 5.39 | 5.50 | 5.61 | V    |
| Dropout Voltage   | ΔV <sub>IO</sub>                                     | I <sub>OUT</sub> =40mA                          | —    | 0.3  | 0.6  | V    |
| Input Voltage     | V <sub>IN</sub>                                      |                                                 | —    | —    | 12   | V    |
| Operating Current | I <sub>DD1</sub>                                     | V <sub>IN</sub> =7.5V, No Load                  | —    | 19   | 30   | μA   |
| Load Regulation   | $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$              | V <sub>IN</sub> =7.5V, I <sub>OUT</sub> =1~40mA | —    | 35   | 120  | mV   |
| Line Regulation   | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | V <sub>IN</sub> =6.5~12V                        | —    | 0.10 | —    | %/V  |

## ■ MEASUREMENT CIRCUIT



## [CAUTION]

The specifications on this databook are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.