LOW DROPOUT VOLTAGE REGULATOR

GENERAL DESCRIPTION
NJU7771/72/73/74/75/76 is a low dropout voltage regulator designed for portable items. Advanced CMOS technology achieves high ripple rejection and low quiescent current. NJU7774/75/76 features shunt switch which improves turn off response of output voltage when ON/OFF control is used.

FEATURES
- High Ripple Rejection: 65dB typ. (f=1kHz, Vo=3.0V version)
- Low quiescent Current: Iq=18µA (Io=0mA)
- Output capacitor with 1.0µF ceramic capacitor (Vo=2.0V version)
- Output Current: Io(max.)=150mA
- High Precision Output: Vo±1.0%
- Low Dropout Voltage: 0.15V typ. (Io=100mA, Vo=3.0V)
- Input Voltage Range: V IN=+2.3V~9V (Vo≤2.0V version)
- ON/OFF Control: (Active High)
- With Shunt Switch: Only NJU7774/75/76
- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- CMOS Technology
- Package Outline: SOT-23-5

EQUIVALENT CIRCUIT

PACKAGE OUTLINE

PIN FUNCTION

PIN CONFIGURATION

NJU777*F
### OUTPUT VOLTAGE RANK LIST

#### NJU7771

<table>
<thead>
<tr>
<th>Device Name</th>
<th>$V_{OUT}$</th>
<th>Device Name</th>
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#### NJU7772

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### ABSOLUTE MAXIMUM RATINGS  
(Ta=25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>RATINGS</th>
<th>UNIT</th>
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<tbody>
<tr>
<td>Input Voltage</td>
<td>V_{IN}</td>
<td>+10</td>
<td>V</td>
</tr>
<tr>
<td>Control Voltage</td>
<td>V_{CONT}</td>
<td>+10(*1)</td>
<td>V</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>P_{D}</td>
<td>350(2)</td>
<td>200(3) mW</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>T_{opr}</td>
<td>-40 ~ +85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>T_{stg}</td>
<td>-40 ~ +125</td>
<td>°C</td>
</tr>
<tr>
<td>OFF-state Output Sink Current(*4)</td>
<td>I_{O}</td>
<td>10</td>
<td>mA</td>
</tr>
</tbody>
</table>

(*1): When input voltage is less than +10V, the absolute maximum control voltage is equal to the input voltage.
(*2): Mounted on glass epoxy board based on EIA/JEDEC. (114.3x76.2x1.6mm: 2Layers)
(*3): Device itself
(*4): This maximum rating is applied to NJU7774/75/76.

### ELECTRICAL CHARACTERISTICS
(V_{IN}=V_{o}+1V, C_{IN}=0.1µF, C_{O}=1.0µF(C_{O}=2.2µF: V_{O}≤2.0V), Ta=25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITION</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
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<tbody>
<tr>
<td>Output Voltage</td>
<td>V_{O}</td>
<td>V_{O}=30mA</td>
<td>-1.0%</td>
<td>–</td>
<td>+1.0%</td>
<td>V</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>V_{IN}</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>9</td>
<td>V</td>
</tr>
<tr>
<td>Quiescent Current</td>
<td>I_{O}</td>
<td>I_{O}=0mA, V_{CONT}=V_{IN}</td>
<td>–</td>
<td>18</td>
<td>35</td>
<td>µA</td>
</tr>
<tr>
<td>Quiescent Current at Control OFF</td>
<td>I_{Q(OFF)}</td>
<td>V_{CONT}=0V</td>
<td>–</td>
<td>0.1</td>
<td>1</td>
<td>µA</td>
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<tr>
<td>Output Current</td>
<td>I_{O}</td>
<td>V_{O}=0.1V (V_{O}≤2.0V) V_{O}=0.3V (V_{O}≥2.1V)</td>
<td>150</td>
<td>–</td>
<td>–</td>
<td>mA</td>
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<td>Short Current Limit</td>
<td>I_{LM}</td>
<td>V_{O}=0V</td>
<td>–</td>
<td>50</td>
<td>–</td>
<td>mA</td>
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<tr>
<td>Line Regulation</td>
<td>ΔV_{O}/ΔV_{IN}</td>
<td>V_{IN}=V_{O}+1V ~ V_{O}+6.0V (V_{O}≤3.0V)</td>
<td>–</td>
<td>–</td>
<td>0.20</td>
<td>%/V</td>
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<tr>
<td>Load Regulation</td>
<td>ΔV_{O}/ΔI_{O}</td>
<td>I_{O}=0 ~ 100mA</td>
<td>–</td>
<td>–</td>
<td>0.03</td>
<td>%/mA</td>
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<tr>
<td>Dropout Voltage(*note 3)</td>
<td>ΔV_{O}</td>
<td>I_{O}=100mA, 2.1V≤V_{O}≤2.4V</td>
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<td>0.2</td>
<td>0.3</td>
<td>V</td>
</tr>
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<td>I_{O}=100mA, 2.5V≤V_{O}≤2.7V</td>
<td>–</td>
<td>0.18</td>
<td>0.28</td>
<td>V</td>
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<td></td>
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<td>I_{O}=100mA, 2.8V≤V_{O}≤3.3V</td>
<td>–</td>
<td>0.15</td>
<td>0.25</td>
<td>V</td>
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<td>I_{O}=100mA, 3.4V≤V_{O}≤5.0V</td>
<td>–</td>
<td>0.12</td>
<td>0.22</td>
<td>V</td>
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<tr>
<td>Ripple Rejection</td>
<td>RR</td>
<td>ein=200mVrms,f=1kHz,Io=10mA, V_{O}=3.0V Version</td>
<td>–</td>
<td>65</td>
<td>–</td>
<td>dB</td>
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<tr>
<td>Average Temperature Coefficient of Output Voltage</td>
<td>ΔV_{O}/ΔTa</td>
<td>Ta=0 ~ 85°C, Io=10mA</td>
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<td>±100</td>
<td>–</td>
<td>ppm/°C</td>
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<td>Output Noise Voltage</td>
<td>V_{NO1}</td>
<td>f=10Hz ~ 80kHz, Io=0mA, V_{O}=3.0V Version</td>
<td>–</td>
<td>40</td>
<td>–</td>
<td>µVrms</td>
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<td>V_{NO2}</td>
<td>f=10Hz ~ 80kHz, Io=10mA, V_{O}=3.0V Version</td>
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<td>70</td>
<td>–</td>
<td>µVrms</td>
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<td>Pull-down Resistance</td>
<td>R_{CONT}</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>MΩ</td>
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<td>Control Voltage for ON-state</td>
<td>V_{CONT(ON)}</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>V</td>
<td></td>
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<tr>
<td>Control Voltage for OFF-state</td>
<td>V_{CONT(OFF)}</td>
<td>–</td>
<td>–</td>
<td>0.3</td>
<td>V</td>
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<tr>
<td>Pull-down Resistance at OFF-state(*6)</td>
<td>R_{O(OFF)}</td>
<td>V_{CONT}=0V (V_{O}≤3.0V Version)</td>
<td>–</td>
<td>120</td>
<td>–</td>
<td>Ω</td>
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</table>

(*5): Except output voltage less than 2.1V.
(*6) This electrical characteristics is applied to NJU7774/75/76.

The above specification is a common specification for all output voltages. Therefore, it may be different from the individual specification for a specific output voltage.
**TEST CIRCUIT**

![Test Circuit Diagram]

*7 $V_o \leq 2.0V$ version: $C_o = 2.2\mu F$ (ceramic)

**POWER DISSIPATION vs. AMBIENT TEMPERATURE**

![Power Dissipation Graph]

NJU777*F Power Dissipation

(Topr=-40°C to +85°C, $T_j=125°C$, $P_D=200mW(T_a < 25°C)$)

- On Board (114.3×76.2×1.6mm, FR-4)
- Device itself
TYPICAL APPLICATION

① In case that ON/OFF Control is not required:

Connect control terminal to \( V_{IN} \) terminal.

② In use of ON/OFF Control

State of control terminal:
- "H" → output is enabled.
- "L" or "open" → output is disabled.
*Input Capacitor \( C_{IN} \)

Input Capacitor \( C_{IN} \) is required to prevent oscillation and reduce power supply ripple for applications when high power supply impedance or a long power supply line.

Therefore, use the recommended \( C_{IN} \) value (refer to conditions of ELECTRIC CHARACTERISTIC) or larger and should connect between GND and \( V_{IN} \) as shortest path as possible to avoid the problem.

*Output Capacitor \( C_{O} \)

Output capacitor (\( C_{O} \)) will be required for a phase compensation of the internal error amplifier.

The capacitance and the equivalent series resistance (ESR) influence to stable operation of the regulator. Use of a smaller \( C_{O} \) may cause excess output noise or oscillation of the regulator due to lack of the phase compensation.

On the other hand, Use of a larger \( C_{O} \) reduces output noise and ripple output, and also improves output transient response when rapid load change.

Therefore, use the recommended \( C_{O} \) value (refer to conditions of ELECTRIC CHARACTERISTIC) or larger and should connect between GND and \( V_{OUT} \) as shortest path as possible for stable operation.

The recommended capacitance depends on the output voltage rank. Especially, low voltage regulator requires larger \( C_{O} \) value.

In addition, you should consider varied characteristics of capacitor (a frequency characteristic, a temperature characteristic, a DC bias characteristic and so on) and unevenness peculiar to a capacitor supplier enough.

When selecting \( C_{O} \), recommend that have withstand voltage margin against output voltage and superior temperature characteristic though this product is designed stability works with wide range ESR of capacitor including low ESR products.
ELECTRICAL CHARACTERISTICS

**Output Voltage vs. Input Voltage**

- Input Voltage: $V_{IN}(V)$
- Output Voltage: $V_o(V)$

**Output Voltage vs. Output Current**

- Output Current: $I_o(mA)$

**Ground Pin Current vs. Output Current**

- Ground Pin Current: $I_{GND}($µA$)$

**Dropout Voltage vs. Output Current**

- Dropout Voltage: $dV_{I-O}(V)$

**Output Voltage vs. Control Voltage**

- Control Voltage: $V_{cont}(V)$

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NJU7771/72/73/74/75/76

New Japan Radio Co., Ltd.

Ver.2013-04-05
ELECTRICAL CHARACTERISTICS

Load Regulation vs. Output Current
@ Ta=25°C
VIN=4.0V
Co=1.0µF (Ceramic)

Output Current: Io (mA)
Input Voltage: Vin (V)
Co=1.0µF (Ceramic)

Peak Output Current vs. Input Voltage
@ Ta=25°C
VIN=4.0V
Co=1.0µF (Ceramic)

Input Voltage: VIN (V)
Output Current: Io (mA)
C0=1.0µF (Ceramic)
C0=2.2µF (Ceramic)

Quiescent Current vs. Input Voltage
@ Ta=25°C
Output is open.
C0=1.0µF (Ceramic)
Including Icont

Input Voltage: VIN (V)
Quiescent Current: IQ (µA)

Output Noise Voltage vs. Output Current
@ Ta=25°C
VIN=4.0V
LPF: 80kHz
C0=1.0µF (Ceramic)
C0=2.2µF (Ceramic)

Output Noise Voltage: Vn (µVrms)
Output Current: Io (mA)

Ripple Rejection Ratio vs. Frequency
@ Ta=25°C
VIN=4.0V
sein=200mVrms
Co=1.0µF (Ceramic)

Ripple Rejection Ratio: RR (dB)
Frequency: f (Hz)
Io=0mA
Io=10mA
Io=30mA
ELECTRICAL CHARACTERISTICS

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Ripple Rejection vs. Output Current

- Frequency: 1 kHz
- Temperature: Ta = 25°C
- VIN = 4.0V
- ein = 200mV rms
- Co = 1.0 µF (Ceramic)

Ripple Rejection vs. Output Current

- Frequency: 10 kHz
- Temperature: Ta = 25°C
- VIN = 4.0V
- ein = 200mV rms
- Co = 1.0 µF (Ceramic)

Equivalent Series Resistance vs. Output Current

@: Io = 100mA
- Co = 1.0 µF (Ceramic)
- Cin = 0.1 µF

Dropout Voltage vs. Temperature

@: Io = 100mA
- Co = 1.0 µF (Ceramic)

OFF Control Voltage vs. Temperature

@: VIN = 4.0V
- Co = 1.0 µF (Ceramic)

Output Voltage vs. Temperature

@: VIN = 4.0V
- Io = 30mA
- Co = 1.0 µF (Ceramic)

Quiescent Current vs. Temperature

@: VIN = 4.0V
- Output is open.
- Co = 1.0 µF (Ceramic)
ELECTRICAL CHARACTERISTICS

**Line Regulation vs. Temperature**

@: $V_D = 4.0 - 9.0 \text{V}$

$\text{Io} = 30 \text{mA}$

$C_o = 1.0 \mu\text{F (Ceramic)}$

**Load Regulation vs. Temperature**

@: $V_D = 4.0 \text{V}$

$\text{Io} = 0 - 100 \text{mA}$

$C_o = 1.0 \mu\text{F (Ceramic)}$

**Output Voltage vs. Temperature**

@: $V_D = 4.0 \text{V}$

$\text{Io} = 30 \text{mA}$

$C_o = 1.0 \mu\text{F (Ceramic)}$

**Short Circuit Current vs. Temperature**

@: $V_D = 4.0 \text{V}$

Output is short to ground.

$C_o = 1.0 \mu\text{F (Ceramic)}$
ELECTRICAL CHARACTERISTICS

NJU777* 3.0V
ON/OFF Transient Response
$V_{IN}=4.0V, I_o=30mA, C_o=1.0\mu F\text{(ceramic)}$

NJU777* 3.0V
ON/OFF Transient Response without Load
$V_{IN}=4.0V, I_o=0A, C_o=1.0\mu F\text{(ceramic)}$

NJU777* 3.0V
ON/OFF Transient Response without Load
$I_o=30mA, C_o=1.0\mu F\text{(ceramic)}$

NJU777* 3.0V
ON/OFF Transient Response without Load
$V_{IN}=4.0V, C_o=1.0\mu F\text{(ceramic)}$

[CAUTION]
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