LOW DROPOUT VOLTAGE REGULATOR

■ GENERAL DESCRIPTION
NJM2881/82 is a low dropout voltage regulator with ON/OFF control.
Advanced Bipolar technology achieves low noise, high ripple rejection and low quiescent current.
It is mounted on SOT-23-5 as small package and 1.0μF ceramic capacitor is available. Therefore it is suitable for cellular phone, camcorder, IC decoder, camera, and other portable items.

■ FEATURES
- High Ripple Rejection 75dB typ. (f=1kHz ,Vo=3V version)
- Low Output Noise Voltage Vno=30μVRms (Cp=0.01μF)
- Output capacitor with 1.0μF ceramic capacitor (Vo≥2.7V)
- Output Current Io(max.)=300mA
- High Precision Output Vo±1.0%
- Low Dropout Voltage 0.10V typ. (Io=100mA)
- ON/OFF Control (Active High)
- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- Bipolar Technology
- Package Outline SOT-23-5

■ PIN CONFIGURATION

1. CONTROL (Active High) 5. VOUT
2. GND 4. VOUT
3. NOISE BYPASS 1. VIN 5. VIN

NJM2881F

NJM2882F

■ BLOCK DIAGRAM

New Japan Radio Co., Ltd.
# OUTPUT VOLTAGE RANK LIST

<table>
<thead>
<tr>
<th>Device Name</th>
<th>( V_{\text{OUT}} )</th>
<th>Device Name</th>
<th>( V_{\text{OUT}} )</th>
<th>Device Name</th>
<th>( V_{\text{OUT}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJM288*F15</td>
<td>1.5V</td>
<td>NJM288*F29</td>
<td>2.9V</td>
<td>NJM288*F38</td>
<td>3.8V</td>
</tr>
<tr>
<td>NJM288*F17</td>
<td>1.7V</td>
<td>NJM288*F03</td>
<td>3.0V</td>
<td>NJM288*F04</td>
<td>4.0V</td>
</tr>
<tr>
<td>NJM288*F18</td>
<td>1.8V</td>
<td>NJM288*F31</td>
<td>3.1V</td>
<td>NJM288*F43</td>
<td>4.3V</td>
</tr>
<tr>
<td>NJM288*F21</td>
<td>2.1V</td>
<td>NJM288*F32</td>
<td>3.2V</td>
<td>NJM288*F47</td>
<td>4.7V</td>
</tr>
<tr>
<td>NJM288*F25</td>
<td>2.5V</td>
<td>NJM288*F33</td>
<td>3.3V</td>
<td>NJM288*F05</td>
<td>5.0V</td>
</tr>
<tr>
<td>NJM288*F28</td>
<td>2.8V</td>
<td>NJM288*F345</td>
<td>3.45V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NJM288*F285</td>
<td>2.85V</td>
<td>NJM288*F35</td>
<td>3.5V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# ABSOLUTE MAXIMUM RATINGS \((T_a=25^\circ\text{C})\)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>RATINGS</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage</td>
<td>( V_{\text{IN}} )</td>
<td>+14</td>
<td>V</td>
</tr>
<tr>
<td>Control Voltage</td>
<td>( V_{\text{CONT}} )</td>
<td>+14((^*1))</td>
<td>V</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>( P_{\text{D}} )</td>
<td>SOT-23-5</td>
<td>350((^*2)) mW</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>( V_{\text{TOP}} )</td>
<td>-40 ~ +85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>( T_{\text{STG}} )</td>
<td>-40 ~ +125</td>
<td>°C</td>
</tr>
</tbody>
</table>

\(^*1\): When input voltage is less than +14V, 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.

## Operating voltage
\( V_N = +2.3 \sim +6\text{V} \) (In case of \( V_0 < 2.1\text{V} \))

# ELECTRICAL CHARACTERISTICS

\((V_0 = 2.0\text{V} \text{version}: V_N = V_0 + 1\text{V}, C_N = 0.1\mu\text{F}, C_0 = 1.0\mu\text{F}; V_0 = 2.7\text{V} \text{(Co=2.2}\mu\text{F}; V_0 = 2.6\text{V}), C_p = 0.01\mu\text{F}, T_a = 25^\circ\text{C})\)

<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>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage ( V_0 )</td>
<td>( V_0 )</td>
<td>( I_0 = 30\text{mA} )</td>
<td>-1.0%</td>
<td>-</td>
<td>+1.0%</td>
<td>V</td>
</tr>
<tr>
<td>Quiescent Current ( I_Q )</td>
<td>( I_Q )</td>
<td>( I_0 = 0\text{mA}, \text{except }I_{\text{CONT}} )</td>
<td>-</td>
<td>120</td>
<td>180</td>
<td>\mu\text{A}</td>
</tr>
<tr>
<td>Quiescent Current at Control OFF ( I_{Q(OFF)} )</td>
<td>( I_{Q(OFF)} )</td>
<td>( V_{\text{CONT}} = 0\text{V} )</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>Output Current ( I_O )</td>
<td>( I_O )</td>
<td>( V_0 = 0.3\text{V} )</td>
<td>300</td>
<td>400</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Line Regulation ( \Delta V_0/\Delta V_{\text{IN}} )</td>
<td>( \Delta V_0/\Delta V_{\text{IN}} )</td>
<td>( V_{\text{N}} = V_0 + 1\text{V} \sim V_0 + 6\text{V} ), ( I_0 = 30\text{mA} )</td>
<td>-</td>
<td>-</td>
<td>0.10</td>
<td>%/V</td>
</tr>
<tr>
<td>Load Regulation ( \Delta V_0/\Delta I_0 )</td>
<td>( \Delta V_0/\Delta I_0 )</td>
<td>( I_0 = 0 \sim 300\text{mA} )</td>
<td>-</td>
<td>-</td>
<td>0.03</td>
<td>%/mA</td>
</tr>
<tr>
<td>Dropout Voltage ( \Delta V_{\text{VO}} )</td>
<td>( \Delta V_{\text{VO}} )</td>
<td>( I_0 = 100\text{mA} )</td>
<td>-</td>
<td>0.10</td>
<td>0.18</td>
<td>V</td>
</tr>
<tr>
<td>Ripple Rejection ( R_{\text{RR}} )</td>
<td>( R_{\text{RR}} )</td>
<td>( \text{einst}=200\text{mVrms, } f=1\text{kHz}, I_0 = 10\text{mA}, V_0 = 3\text{V version} )</td>
<td>-</td>
<td>75</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Average Temperature Coefficient of Output Voltage ( \Delta V_0/\Delta T_a )</td>
<td>( \Delta V_0/\Delta T_a )</td>
<td>( Ta = 0 \sim 85^\circ\text{C} ), ( I_0 = 10\text{mA} )</td>
<td>-</td>
<td>± 50</td>
<td>-</td>
<td>ppm/°C</td>
</tr>
<tr>
<td>Output Noise Voltage ( V_{\text{NO}} )</td>
<td>( V_{\text{NO}} )</td>
<td>( f=10\text{Hz} \sim 80\text{kHz}, I_0 = 10\text{mA}, V_0 = 3\text{V version} )</td>
<td>-</td>
<td>30</td>
<td>-</td>
<td>\mu\text{Vrms}</td>
</tr>
<tr>
<td>Control Voltage for ON-state ( V_{\text{CONT(ON)}} )</td>
<td>( V_{\text{CONT(ON)}} )</td>
<td>-</td>
<td>-</td>
<td>1.6</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Control Voltage for OFF-state ( V_{\text{CONT(OFF)}} )</td>
<td>( V_{\text{CONT(OFF)}} )</td>
<td>-</td>
<td>-</td>
<td>0.6</td>
<td>-</td>
<td>V</td>
</tr>
</tbody>
</table>
ELECTRICAL CHARACTERISTICS

(Vo≥2.0V version: Vin=Vo+1V, Cin=0.1μF, Co=2.2μF: Vo≥1.9V (Co=4.7μF: Vo≤1.8V), Cp=0.01μF, 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>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage</td>
<td>Vo</td>
<td>Io=30mA</td>
<td>-1.0%</td>
<td>-</td>
<td>+1.0%</td>
<td>V</td>
</tr>
<tr>
<td>Quiescent Current</td>
<td>Iq</td>
<td>Io=0mA, except ICONT</td>
<td>-</td>
<td>120</td>
<td>180</td>
<td>μA</td>
</tr>
<tr>
<td>Quiescent Current at Control OFF</td>
<td>Iq(OFF)</td>
<td>VCONT=0V</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>Output Current</td>
<td>Io</td>
<td>Vo=0.3V</td>
<td>300</td>
<td>400</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Line Regulation</td>
<td>ΔVo/ΔVin</td>
<td>Vv=Vo+1V ~ Vo+6V, Io=30mA</td>
<td>-</td>
<td>-</td>
<td>0.10</td>
<td>%/V</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>ΔVo/Io</td>
<td>Io=0 ~ 300mA</td>
<td>-</td>
<td>-</td>
<td>0.03</td>
<td>%/mA</td>
</tr>
<tr>
<td>Ripple Rejection</td>
<td>RR</td>
<td>ein=200mVrms,f=1kHz,Io=10mA, Vo=1.8V version</td>
<td>-</td>
<td>80</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Average Temperature Coefficient of Output Voltage</td>
<td>ΔVo/ΔTa</td>
<td>Ta=0 ~ 85°C, Io=10mA</td>
<td>-</td>
<td>±50</td>
<td>-</td>
<td>ppm/°C</td>
</tr>
<tr>
<td>Output Noise Voltage</td>
<td>VNO</td>
<td>f=10Hz ~ 80kHz, Io=10mA, Vo=1.8V version</td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>μVrms</td>
</tr>
<tr>
<td>Control Voltage for ON-state</td>
<td>VCONT(ON)</td>
<td></td>
<td>1.6</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Control Voltage for OFF-state</td>
<td>VCONT(OFF)</td>
<td></td>
<td>-</td>
<td>-</td>
<td>0.6</td>
<td>V</td>
</tr>
</tbody>
</table>

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

*4 1.9V ≤ Vo < 2.6V version: Co=2.2μF (ceramic)
Vo ≤ 1.8V version: Co=4.7μF (ceramic)
**TYPICAL APPLICATION**

1. In the case where ON/OFF Control is not required:
   - Connect control terminal to V\textsubscript{IN} terminal.

2. In use of ON/OFF CONTROL:
   - State of control terminal:
     * "H" → output is enabled.
     * "L" or "open" → output is disabled.

*Noise bypass Capacitance \( C_p \)

   Noise bypass capacitance \( C_p \) reduces noise generated by band-gap reference circuit. Noise level and ripple rejection will be improved when larger \( C_p \) is used. Use of smaller \( C_p \) value may cause oscillation.

   Use the \( C_p \) value of 0.01\( \mu \)F greater to avoid the problem.

*In the case of using a resistance "R" between \( V_N \) and control.

   If this resistor is inserted, the control current could be reduced when the control voltage is high.

   The applied voltage to control pin should set to consider voltage drop through the resistor "R" and the minimum control voltage for ON-state.

   The \( V_{CONT\,(ON)} \) and \( I_{CONT} \) have temperature dependence as shown in the "Control Current vs. Temperature" and "Control Voltage vs. Temperature" characteristics. Therefore, the resistor "R" should be selected to consider the temperature characteristics.
**Input Capacitor C\textsubscript{IN}**

The input capacitor C\textsubscript{IN} is required in order to prevent oscillation and reduce power supply ripple of applications when high power supply impedance or a long power supply line.

Therefore, the recommended capacitance (refer to conditions of ELECTRIC CHARACTERISTIC) or larger input capacitor, connected between V\textsubscript{IN} and GND as short path as possible, is recommended in order to avoid the problem.

**Output Capacitor C\textsubscript{O}**

The output capacitor C\textsubscript{O} is required for a phase compensation of the internal error amplifier, and the capacitance and the equivalent series resistance (ESR) influence stable operation of the regulator.

If use a smaller output capacitor than the recommended capacitance (refer to conditions of ELECTRIC CHARACTERISTIC), it may cause excess output noise or oscillation of the regulator due to lack of the phase compensation. Therefore, the recommended capacitance or larger output capacitor, connected between V\textsubscript{OUT} and GND as short path as possible, is recommended for stable operation. The recommended capacitance may be different by output voltage, therefore confirm the recommended capacitance of the required output voltage.

Furthermore, a larger output capacitor reduces output noise and ripple output, and also improves Output Transient Response when a load changes rapidly.

Selecting the output capacitor, should consider varied characteristics of a capacitor: frequency characteristics, temperature characteristics, DC bias characteristics and so on. Therefore, the capacitor that has a sufficient margin of the rated voltage against the output voltage and superior temperature characteristics, is recommended for C\textsubscript{O}. 
POWER DISSIPATION vs. AMBIENT TEMPERATURE

NJM2881/82F Power Dissipation

(Topr=-40 ~ +85°C, Tj=125°C, P_D=200mW(Ta ≤ 25°C))

- Device itself
- On Board(114.3×76.2×1.6mm, FR-4)
ELECTRICAL CHARACTERISTICS

NJM2881/82

Output Voltage vs. Input Voltage

Output Voltage vs. Output Current

Ground Pin Current vs. Output Current

Dropout Voltage vs. Output Current

Control Current vs. Control Voltage

Output Voltage vs. Control Voltage
**ELECTRICAL CHARACTERISTICS**

**NJM2881/82_3.0V**

- **Load Regulation vs. Output Current**
  - @Ta=25°C, VIN=4V, Co=1.0µF(Ceramic), Cp=0.01µF
  - Output is open.
  - Including Icont

- **Quiescent Current vs. Input Voltage**
  - @Ta=25°C, Co=1.0µF(Ceramic), Cp=0.01µF

- **Peak Output Current vs. Input Voltage**
  - @Ta=25°C, Co=1.0µF(Ceramic), Cp=0.01µF

- **Output Noise Voltage vs. Noise Bypass Capacitor**
  - @Ta=25°C, VIN=4V, Co=1.0µF

- **Output Noise Voltage vs. Output Current**
  - @Ta=25°C, VIN=4V, Co=1.0µF

- **Ripple Rejection Ratio vs. Frequency**
  - @Ta=25°C, VIN=4V, ein=200mVrms, Co=1.0µF(Ceramic), Cp=0.01µF
ELECTRICAL CHARACTERISTICS

### Ripple Rejection vs. Output Current

#### NJM2881/82_3.0V

**Ripple Rejection vs. Output Current**

- **Frequency:**
  - $f=1 \text{kHz}$
  - $f=10 \text{kHz}$

**Conditions:**
- $T_a=25^\circ\text{C}$
- $V_{IN}=4.0\text{V}$
- $C_{in}=200\text{mVrms}$
- $C_{o}=1.0\text{F (Ceramic)}$
- $C_{p}=0.01\text{F}$

**Graph:**
- Output Current ($I_o$) vs. Ripple Rejection ($RR$) in dB.

### Equivalent Series Resistance vs. Output Current

#### NJM2881/82_3.0V

**Equivalent Series Resistance vs. Output Current**

**Conditions:**
- $T_a=25^\circ\text{C}$
- $V_{IN}=4\text{V}$
- $C_{o}=1.0\text{F (Ceramic)}$
- $C_{p}=0.01\text{F}$

**Graph:**
- Output Current ($I_o$) vs. Equivalent Series Resistance ($ESR$) in Ω.

### Dropout Voltage vs. Temperature

#### NJM2881/82_3.0V

**Dropout Voltage vs. Temperature**

**Conditions:**
- $I_o=100\text{mA}$
- $C_{o}=1.0\text{F (Ceramic)}$
- $C_{p}=0.01\text{F}$

**Graph:**
- Temperature ($T_a$) vs. Dropout Voltage ($V_{in-o}$) in V.

### Output Voltage vs. Temperature

#### NJM2881/82_3.0V

**Output Voltage vs. Temperature**

**Conditions:**
- $V_{IN}=4\text{V}$
- $I_o=30\text{mA}$

**Graph:**
- Temperature ($T_a$) vs. Output Voltage ($V_o$) in V.

### Control Voltage vs. Temperature

#### NJM2881/82_3.0V

**Control Voltage vs. Temperature**

**Conditions:**
- $V_{IN}=4\text{V}$

**Graph:**
- Temperature ($T_a$) vs. Control Voltage ($V_{cont-off}$) in V.

### Control Current vs. Temperature

#### NJM2881/82_3.0V

**Control Current vs. Temperature**

**Conditions:**
- $V_{IN}=4\text{V}$

**Graph:**
- Temperature ($T_a$) vs. Control Current ($I_{cont}$) in mA.

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New Japan Radio Co., Ltd.
NJM2881/82

ELECTRICAL CHARACTERISTICS

Quiescent Current vs. Temperature

Short Circuit Current vs. Temperature

Line Regulation vs. Temperature

Load Regulation vs. Temperature

Output Voltage vs. Temperature
ELECTRICAL CHARACTERISTICS

NJM2881_3.0V
ON/OFF Transient Response without Load

Control Voltage
Output Voltage

Time : t [S]

NJM2881_3.0V
ON/OFF Transient Response

Control Voltage
Output Voltage

Time : t [mS]

NJM2881/82_3.0V
Load Transient Response

Output Current
Output Voltage

Time : t [µS]

NJM2881/82_3.0V
Input Transient Response

Input Voltage
Output Voltage

Time : t [µS]

[CAUTION]
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