LOW DROPOUT VOLTAGE REGULATOR

GENERAL DESCRIPTION
The NJM2830 is a 300mA output low dropout voltage regulator with ON/OFF control. Advanced Bipolar technology achieves low noise, high ripple rejection and low quiescent current. 2.1V to 15.5V output voltage range, 1μF small decoupling capacitor, built-in noise bypass capacitor make the NJM2830 suitable for various applications.

FEATURES
- Output voltage options available: 2.1 ~ 15.5V (0.1V step)
- High Ripple Rejection: 75dB typ. (f=1kHz Vo=3V Version)
- Output Noise Voltage: Vno=50μVrms typ. (Vo=3V Version)
- Output capacitor with 1.0μF ceramic capacitor (Vo≥5.6V)
- Output Current: I0(max.)=300mA
- High Precision Output: Vo±1.0%
- Low Dropout Voltage: 0.1V typ. (Io=100mA)
- ON/OFF Control: (Active High)
- Internal Thermal Overload Protection
- Internal Over Current Protection
- Bipolar Technology
- Package Outline: SOT-89-5

PIN CONFIGURATION

1. CONTROL
2. GND
3. N.C.
4. VOUT
5. VIN

BLOCK DIAGRAM

![Block Diagram](image-url)
## OUTPUT VOLTAGE RANK LIST

<table>
<thead>
<tr>
<th>Device Name</th>
<th>Vout</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJM2830U1-21</td>
<td>2.1V</td>
</tr>
<tr>
<td>NJM2830U1-25</td>
<td>2.5V</td>
</tr>
<tr>
<td>NJM2830U1-03</td>
<td>3.0V</td>
</tr>
<tr>
<td>NJM2830U1-33</td>
<td>3.3V</td>
</tr>
<tr>
<td>NJM2830U1-05</td>
<td>5.0V</td>
</tr>
<tr>
<td>NJM2830U1-57</td>
<td>5.7V</td>
</tr>
<tr>
<td>NJM2830U1-58</td>
<td>5.8V</td>
</tr>
<tr>
<td>NJM2830U1-06</td>
<td>6.0V</td>
</tr>
<tr>
<td>NJM2830U1-08</td>
<td>8.0V</td>
</tr>
<tr>
<td>NJM2830U1-85</td>
<td>8.5V</td>
</tr>
<tr>
<td>NJM2830U1-86</td>
<td>8.6V</td>
</tr>
<tr>
<td>NJM2830U1-09</td>
<td>9.0V</td>
</tr>
<tr>
<td>NJM2830U1-12</td>
<td>12.0V</td>
</tr>
<tr>
<td>NJM2830U1-15</td>
<td>15.0V</td>
</tr>
</tbody>
</table>

The WHITE column shows applicable Voltage Rank(s)
### ABSOLUTE MAXIMUM RATINGS

<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_{IN} )</td>
<td>+20</td>
<td>V</td>
</tr>
<tr>
<td>Control Voltage</td>
<td>( V_{CONT} )</td>
<td>+20</td>
<td>V</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>( P_D )</td>
<td>625*(1)</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>960*(2)</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>( T_{OP} )</td>
<td>-40~+85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>( T_{STG} )</td>
<td>-40~+150</td>
<td>°C</td>
</tr>
</tbody>
</table>

*(1): Mounted on glass epoxy board. (76.2 x 114.3 x 1.6mm: based on EIA/JDEC standard size, 2Layers, Cu area 100mm²)
*(2): Mounted on glass epoxy board. (76.2 x 114.3 x 1.6mm: based on EIA/JDEC standard, 4Layers)
4Layers: Applying 74.2 x 74.2mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)

### INPUT VOLTAGE RANGE

\( V_{IN} = +2.3V~18V \) (In case of \( V_o < 2.2V \))

### ELECTRICAL CHARACTERISTICS

\( (V_{IN}, V_o+1V, C_R=0.1\mu F, C_o=1.0\mu F, 4.9V<V_o\leq 5.5V; C_o=2.2\mu F, 2.9V<V_o\leq 4.9V; C_o=4.7\mu F, V_o\leq 2.9V; C_o=10\mu F), T_a=25^\circ C) \)

<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>( V_o )</td>
<td>( I_o=30mA )</td>
<td>1.0%</td>
<td>-</td>
<td>+1.0%</td>
<td>V</td>
</tr>
<tr>
<td>Quiescent Current</td>
<td>( I_o )</td>
<td>( I_o=0mA,) except ( I_{CONT} )</td>
<td>( V_{IN}=5V ) version</td>
<td>-</td>
<td>130</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>( 5V&lt;V_o\leq10V ) version</td>
<td>-</td>
<td>145</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>( 10V&lt;V_o\leq15V ) version</td>
<td>-</td>
<td>160</td>
<td>210</td>
</tr>
<tr>
<td>Quiescent Current at Control OFF</td>
<td>( I_{O(OFF)} )</td>
<td>( V_{CONT}=0V )</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>Output Current</td>
<td>( I_o )</td>
<td>( V_o=0.3V )</td>
<td>300</td>
<td>400</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Line Regulation</td>
<td>( \Delta V_o/\Delta V_N )</td>
<td>( V_{IN}=V_o+1V\sim V_o+6V(\text{( V_{IN}\geq 12V ) version}) )</td>
<td>-</td>
<td>-</td>
<td>0.10</td>
<td>%/V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{IN}=V_o+1V\sim 18V(\text{( V_{IN}&gt; 12V ) version}) ), ( I_o=30mA )</td>
<td>-</td>
<td>-</td>
<td>0.009</td>
<td>%/mA</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>( \Delta V_o/\Delta I_o )</td>
<td>( I_o=0~300mA )</td>
<td>-</td>
<td>-</td>
<td>0.09</td>
<td>%/mA</td>
</tr>
<tr>
<td>Ripple Rejection</td>
<td>( \Delta V_o/\Delta I_o )</td>
<td>( I_o=100mA )</td>
<td>-</td>
<td>0.10</td>
<td>0.18</td>
<td>V</td>
</tr>
<tr>
<td>Average Temperature</td>
<td>( \Delta V_o/\Delta T )</td>
<td>( T_a=0 \sim 85^\circ C, I_o=10mA, V_o=3V ) version</td>
<td>-</td>
<td>75</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Coefficient of Output Voltage</td>
<td>( \Delta V_o/\Delta T )</td>
<td>( T_a=0 \sim 85^\circ C, I_o=10mA )</td>
<td>-</td>
<td>±50</td>
<td>-</td>
<td>ppm/°C</td>
</tr>
<tr>
<td>Output Noise Voltage</td>
<td>( V_{NO} )</td>
<td>( f=10Hz \sim 80kHz, I_o=10mA ) ( V_o=3V ) version</td>
<td>-</td>
<td>50</td>
<td>-</td>
<td>μVrms</td>
</tr>
<tr>
<td>Control Current</td>
<td>( I_{CONT} )</td>
<td>( V_{CONT}=1.6V )</td>
<td>3</td>
<td>12</td>
<td>-</td>
<td>µA</td>
</tr>
<tr>
<td>Control Voltage for ON-state</td>
<td>( V_{CONT(ON)} )</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Control Voltage for OFF-state</td>
<td>( V_{CONT(OFF)} )</td>
<td>-</td>
<td>-</td>
<td>0.6</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

*(3): 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

![Diagram of NJM2830 Test Circuit]

■ TYPICAL APPLICATIONS

In the case where ON/OFF Control is not required:

![Diagram showing typical applications]

Connect control pin to \( V_{IN} \) pin
In use of ON/OFF CONTROL:

\[ V_{IN} \rightarrow 0.1\mu F \rightarrow R \rightarrow V_{OUT} \]

\[ 1.0\mu F^6 \]

State of control pin:
- "H" → output is enabled.
- "L" or "open" → output is disabled.

In the case of using a resistance "R" between \( V_{IN} \) and control.
If this resistor is inserted, it can reduce the control current when the control voltage is high. The applied voltage to control terminal 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 resistance "R" should be selected to consider the temperature characteristics.

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 \( C_{OUT} \)
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.
TYPICAL CHARACTERISTICS

DC CHARACTERISTICS (3V Version)

- 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

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TYPICAL CHARACTERISTICS

- DC CHARACTERISTICS (3V Version)

Load Regulation vs. Output Current

@: Ta=25°C
VIN=4.0V
Co=4.7μF(Ceramic)

Peak Output Current vs. Input Voltage

@: Ta=25°C
Co=4.7μF(Ceramic)

Quiescent Current vs. Input Voltage

@: Ta=25°C
Output is open.
Co=4.7μF(Ceramic)
Including Icont
**TYPICAL CHARACTERISTICS**

- **AC CHARACTERISTICS (3V Version)**

![Output Noise Voltage vs. Output Current](image1)

- **Output Noise Voltage : Vn(Vrms)**
  - $\text{Vin}=4.0V$
  - $\text{LPF}:80kHz$
  - $C_0=4.7\mu F$

![Ripple Rejection Ratio vs. Frequency](image2)

- **Ripple Rejection Ratio : RR (dB)**
  - $\text{Io}=0mA$
  - $\text{Io}=10mA$
  - $\text{Io}=30mA$
  - $\text{Vin}=4.0V$
  - $\text{ein}=200mVrms$
  - $C_0=4.7\mu F$ (Ceramic)

![Ripple Rejection vs. Output Current](image3)

- **Ripple Rejection vs. Output Current**
  - $f=1kHz$
  - $f=10kHz$

![Equivalent Series Resistance vs. Output Current](image4)

- **Equivalent Series Resistance : ESR(\Omega)**
  - STABLE REGION
  - $\text{Vin}=18V$

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Ver.2014-03-20
TYPICAL CHARACTERISTICS

- TEMPERATURE CHARACTERISTICS (3V Version)

![Dropout Voltage vs. Temperature](image1)

![Control Voltage vs. Temperature](image2)

![Control Current vs. Temperature](image3)

![Output Voltage vs. Temperature](image4)

![Quiescent Current vs. Temperature](image5)
TYPICAL CHARACTERISTICS

- TEMPERATURE CHARACTERISTICS (3V Version)

Line Regulation \( \frac{dV_o}{dV_{in}} \) (%/V)

Temperature : \( T_a \) (°C)

Load Regulation \( \frac{dV_o}{dI_o} \) (%/mA)

Output Voltage \( V_o \) (V)

Short Circuit Current \( I_{SC} \) (mA)

Temperature : \( T_a \) (°C)
TYPICAL CHARACTERISTICS

- TRANSIENT RESPONSE (3V Version)

**NJM2830 3.0V**

**ON/OFF Transient Response without Load**

- Control Voltage vs. Time
- Output Voltage vs. Time

**Control Voltage**

- @ Ta=25°C
- VIN=4.0V
- Co=4.7μF (Ceramic)
- Io=0mA

**Output Voltage**

- Time : t [μS]

**njm2830_3.0v on/off transient response**

**Output Voltage : Vo [V]**

**Control Voltage : Vcont [V]**

**Time : t [S]**

**njm2830_3.0v on/off transient response**

**Control Voltage**

- @ Ta=25°C
- VIN=4.0V
- Co=4.7μF (Ceramic)
- Io=30mA

**Output Voltage**

- Time : t [mS]

njm2830_3.0v load transient response

- Control Voltage vs. Time
- Output Voltage vs. Time

- Output Current vs. Time

- Output Voltage vs. Time

**njm2830_3.0v line transient response**

- Input Voltage vs. Time
- Output Voltage vs. Time

- Input Voltage vs. Time
- Output Voltage vs. Time

**njm2830_3.0v load transient response**

- @ Ta=25°C
- VIN=4.0V
- Co=4.7μF (Ceramic)
- Io=30mA

**njm2830_3.0v line transient response**

- @ Ta=25°C
- VIN=4.0V
- Co=4.7μF (Ceramic)
- Io=30mA
■ TYPICAL CHARACTERISTICS

- DC CHARACTERISTICS (8.5V Version)

- 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
TYPICAL CHARACTERISTICS

DC CHARACTERISTICS (8.5V Version)

- Load Regulation vs. Output Current
  - @Ta=25°C
  - VIN=9.5V
  - Co=1µF (Ceramic)

- Peak Output Current vs. Input Voltage
  - @Ta=25°C
  - Co=1µF (Ceramic)

- Quiescent Current vs. Input Voltage
  - @Ta=25°C
  - Output is open
  - Co=1µF (Ceramic)
  - Including Icont
TYPICAL CHARACTERISTICS

- AC CHARACTERISTICS (8.5V Version)

**Output Noise Voltage vs. Output Current**

- Output Current: Io(A)
- Output Noise Voltage: Vn(Vrms)

**Ripple Rejection Ratio vs. Frequency**

- Frequency: f (Hz)
- Ripple Rejection Ratio: RR (dB)

**Ripple Rejection vs. Output Current**

- Output Current: Io(mA)

**Equivalent Series Resistance vs. Output Current**

- Output Current: Io(A)
- Equivalent Series Resistance: ESR(Ω)

**Output Characteristics**

- NJM2830
- Version: 2014-03-20
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TYPICAL CHARACTERISTICS

- TEMPERATURE CHARACTERISTICS (8.5V Version)

**Dropout Voltage v.s. Temperature**

- @: $I_O=100mA$
- $C_O=1F$ (Ceramic)

**Control Voltage v.s. Temperature**

- @: $V_{IN}=9.5V$
- $I_O=30mA$
- $C_O=1F$ (Ceramic)

**Output Voltage v.s. Temperature**

- @: $V_{IN}=9.5V$
- $I_O=30mA$
- $C_O=1mF$ (Ceramic)

**Quiescent Current v.s. Temperature**

- @: $V_{IN}=9.5V$
- Output is open.
- $C_O=1F$ (Ceramic)

**Line Regulation v.s. Temperature**

- @: $V_{IN}=9.5-14.5V$
- $I_O=30mA$
- $C_O=1\mu F$ (Ceramic)

**Load Regulation v.s. Temperature**

- @: $V_{IN}=9.5V$
- $I_O=0-300mA$
- $C_O=1F$ (Ceramic)
TYPICAL CHARACTERISTICS

● TEMPERATURE CHARACTERISTICS (8.5V Version)

![Output Voltage v.s. Temperature](image1)

- Temperature: Ta (°C)
- Output Voltage: Vo (V)
- Conditions: VIn=9.5V, Io=30mA, Co=1μF (Ceramic)

![Short Circuit Current v.s. Temperature](image2)

- Short Circuit Current: Isc (mA)
- Temperature: Ta (°C)
- Conditions: VIn=9.5V
- Output is short to ground. Co=1μF (Ceramic)

● TRANSIENT RESPONSE (8.5V Version)

![ON/OFF Transient Response without Load](image3)

- Control Voltage
- Output Voltage
- Conditions: Ta=25°C, VIn=9.5V, Io=0mA

![ON/OFF Transient Response](image4)

- Control Voltage
- Output Voltage
- Conditions: Ta=25°C, VIn=9.5V, Co=1μF (Ceramic), Io=30mA

![Load Transient Response](image5)

- Output Current
- Output Voltage
- Conditions: Ta=25°C, VIn=9.5V, Co=1μF (Ceramic)

![Line Transient Response](image6)

- Input Voltage
- Output Voltage
- Conditions: Ta=25°C, VIn=9.5V, Io=30mA
TYPICAL CHARACTERISTICS

● DC CHARACTERISTICS (15V Version)

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
TYPICAL CHARACTERISTICS

DC CHARACTERISTICS (15V Version)

Load Regulation vs. Output Current

Output Voltage : dV_out(dBm)/dI_o

Output Current : I_o(mA)

Peak Output Current vs. Input Voltage

Input Voltage : V_IN(V)

Quiescent Current vs. Input Voltage

Input Voltage : V_IN(V)

Quiescent Current : I_Q(uA)

0 500 1000 1500 2000

0 5 10 15 20

0 100 200 300 400 500

0 -200 -160 -120

0 100 200 300 400 500

0 15 15.5 16 16.5 17 17.5 18

0 100 200 300 400 500 600 700 800 900 1000

0 10 15

NJM2830_15V

NJM2830_15V

NJM2830_15V

NJM2830_15.0V

Peak Output Current : I_o(max)(mA)

Vin=16.0V
Co=1JF(Ceramic)

Output is open.
Co=1JF(Ceramic) including I_cont.
TYPICAL CHARACTERISTICS

- AC CHARACTERISTICS (15V Version)

**Output Noise Voltage vs. Output Current**

- Output Noise Voltage: $V_n$ (Vrms)
- Output Current: $I_o$ (A)
- $T_o = 25^\circ C$
- $V_{IN} = 16$V
- LPF: 80kHz
- $C_o = 1$F

**Ripple Rejection Ratio vs. Frequency**

- Ripple Rejection Ratio: $RR$ (dB)
- Frequency: $f$ (Hz)
- $I_o = 0$mA
- $I_o = 10$mA
- $I_o = 30$mA
- $T_o = 25^\circ C$
- $V_{IN} = 16$V
- $V_{in} = 200$mVrms
- $C_o = 1$F (Ceramic)

**Ripple Rejection vs. Output Current**

- Frequency: $f = 1$kHz
- $f = 10$kHz
- $I_o = 0$mA
- $I_o = 10$mA
- $I_o = 30$mA
- $T_o = 25^\circ C$
- $V_{IN} = 16$V
- $V_{in} = 200$mVrms
- $C_o = 1$F (Ceramic)

**Equivalent Serise Resistance vs. Output Current**

- Equivalent Series Resistance: $ESR$ ($\Omega$)
- $T_o = 25^\circ C$
- $V_{IN} = 16$V
- $I_o = 0$mA
- $I_o = 10$mA
- $I_o = 30$mA
- $V_{IN} = 16$V

**Stable Region**

- $V_{IN} = 18$V
TYPICAL CHARACTERISTICS

TEMPERATURE CHARACTERISTICS (15V Version)

NJM2830_15V

Dropout Voltage vs. Temperature

@:Io=100mA
Co=1.0μF (Ceramic)

Control Voltage vs. Temperature

@:V_IN=16V
Io=30mA
Co=1.0μF (Ceramic)

Output Voltage Vo (V)

Temperature Ta (°C)

Quiescent Current vs. Temperature

@:V_IN=16V
Output is open.
Co=1.0μF (Ceramic)

Line Regulation vs. Temperature

@:dV_IN=16-18V
Io=30mA
Co=1.0μF (Ceramic)

Load Regulation vs. Temperature

@:V_IN=16V
Io=0-300mA
Co=1.0μF (Ceramic)
**TYPICAL CHARACTERISTICS**

- **TEMPERATURE CHARACTERISTICS (15V Version)**

**Output Voltage v.s. Temperature**

@: $V_{IN}=16V$  
$Io=30mA$  
$Co=1.0\mu F$ (Ceramic)

**Short Circuit Current v.s. Temperature**

@: $V_{IN}=16V$  
Output is short to ground.  
$Co=1.0\mu F$ (Ceramic)

- **TRANSIENT RESPONSE (15V Version)**

**ON/OFF Transient Response without Load**

@: $Ta=25^\circ C$  
$V_{IN}=16.0V$  
$Co=1.0\mu F$ (Ceramic)  
$Io=0mA$

**ON/OFF Transient Response**

@: $Ta=25^\circ C$  
$V_{IN}=16.0V$  
$Co=1.0\mu F$ (Ceramic)  
$Io=30mA$

**Load Transient Response**

@: $Ta=25^\circ C$  
$V_{IN}=16.0V$  
$Co=1.0\mu F$ (Ceramic)  
$Io=30mA$

**Line Transient Response**

@: $Ta=25^\circ C$  
$V_{IN}=16.0V$  
$Co=1.0\mu F$ (Ceramic)  
$Io=30mA$
[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.