LOW DROPOUT VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

The NJM2865/66 is a 100mA output low dropout voltage regulator with ON/OFF control. Advanced Bipolar technology achieves low noise, high ripple rejection and low quiescent current. Small packaging, 1µF small decoupling capacitor, built-in noise bypass capacitor make the NJM2865/66 suitable for space conscious applications.

■ FEATURES

- High Ripple Rejection 75dB typ. (f=1kHz Vo=3V Version)
- Output Noise Voltage Vno=45µVrms typ.
- Output capacitor with 1.0µF ceramic capacitor (Vo≥2.7V)
- Output Current Io(max.)=100mA
- High Precision Output Vo±1.0%
- Low Dropout Voltage 0.10V typ. (Io=60mA)
- Input Voltage Range +2.3V ∼ +14V(Vo≤2.0 Version)
- ON/OFF Control (Active High)
- Internal Short Circuit Current Limit
- Internal Thermal Overload Protection
- Bipolar Technology
- Package Outline SC88A (NJM2865F3), SOT-23-5 (NJM2865F/66F)

■ PIN CONFIGURATION

1. CONTROL 2. GND 3. NC 4. VOUT 5. VIN

1. VIN 2. GND 3. CONTROL 4. NC 5. VOUT

NJM2865F3 / NJM2865F  NJM2866F

■ EQUIVALENT CIRCUIT
### OUTPUT VOLTAGE RANK LIST

<table>
<thead>
<tr>
<th>Device Name</th>
<th>V(_{OUT})</th>
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<th>V(_{OUT})</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJM2865F3-/F15</td>
<td>1.5V</td>
<td>NJM2865F3-/F29</td>
<td>2.9V</td>
<td>NJM2865F3-/F38</td>
<td>3.8V</td>
</tr>
<tr>
<td>NJM2865F3-/F18</td>
<td>1.8V</td>
<td>NJM2865F3-/F03</td>
<td>3.0V</td>
<td>NJM2865F3-/F04</td>
<td>4.0V</td>
</tr>
<tr>
<td>NJM2865F3-/F21</td>
<td>2.1V</td>
<td>NJM2865F3-/F31</td>
<td>3.1V</td>
<td>NJM2865F3-/F445</td>
<td>4.45V</td>
</tr>
<tr>
<td>NJM2865F3-/F24</td>
<td>2.4V</td>
<td>NJM2865F3-/F32</td>
<td>3.2V</td>
<td>NJM2865F3-/F46</td>
<td>4.6V</td>
</tr>
<tr>
<td>NJM2865F3-/F25</td>
<td>2.5V</td>
<td>NJM2865F3-/F33</td>
<td>3.3V</td>
<td>NJM2865F3-/F48</td>
<td>4.8V</td>
</tr>
<tr>
<td>NJM2865F3-/F26</td>
<td>2.6V</td>
<td>NJM2865F3-/F34</td>
<td>3.4V</td>
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<td>NJM2865F3-/F27</td>
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<tr>
<td>NJM2865F3-/F28</td>
<td>2.8V</td>
<td>NJM2865F3-/F36</td>
<td>3.6V</td>
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<td>3.0V</td>
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</table>

### ABSOLUTE MAXIMUM RATINGS (\(Ta=25^\circ\)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_{IN})</td>
<td>+14</td>
<td>V</td>
</tr>
<tr>
<td>Control Voltage</td>
<td>(V_{CONT})</td>
<td>+14(^{(*1)})</td>
<td>V</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>(P_{D})</td>
<td>SC88A 250(^{(*2)})</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SOT-23-5 200(^{(*3)})</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>(T_{opr})</td>
<td>-40(\sim)85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>(T_{stg})</td>
<td>-40(\sim)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

\(V_{IN}=+2.3\text{V} - +14.0\text{V}\) (In case of \(V_{O}<2.1\text{V}\))
# ELECTRICAL CHARACTERISTICS

\((V_o \geq 2.0V\) version: \(V_{IN} = V_o + 1V, C_{IN} = 0.1\mu F, C_o = 2.2\mu F (C_o = 4.7\mu F: V_o \leq 1.6V), T_a = 25^\circ C\)

<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>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>I_o</td>
<td>Io=0mA, expect I_cont</td>
<td>–</td>
<td>120</td>
<td>180</td>
<td>(\mu A)</td>
</tr>
<tr>
<td>Quiescent Current at Control OFF</td>
<td>I(OFF)</td>
<td>V_CONT=0V</td>
<td>–</td>
<td>–</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>Output Current</td>
<td>Io</td>
<td>V_o-0.3V</td>
<td>100</td>
<td>130</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, Io=30mA)</td>
<td>–</td>
<td>–</td>
<td>0.10</td>
<td>%V</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>(\Delta V_o/\Delta Io)</td>
<td>Io=0 \sim 60mA</td>
<td>–</td>
<td>–</td>
<td>0.03</td>
<td>%/mA</td>
</tr>
<tr>
<td>Dropout Voltage</td>
<td>(\Delta V_{LO})</td>
<td>Io=60mA</td>
<td>–</td>
<td>0.10</td>
<td>0.18</td>
<td>V</td>
</tr>
<tr>
<td>Ripple Rejection</td>
<td>RR</td>
<td>(\varepsilon = 200mVrms, f=1kHz, Io=10mA, V_o=3V)</td>
<td>–</td>
<td>75</td>
<td>–</td>
<td>dB</td>
</tr>
<tr>
<td>Average Temperature</td>
<td>CoV</td>
<td>(Ta=0 \sim 85^\circ C, Io=10mA)</td>
<td>–</td>
<td>±50</td>
<td>–</td>
<td>ppm/(^\circ C)</td>
</tr>
<tr>
<td>Coefficient of Output</td>
<td>CoV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Noise Voltage</td>
<td>V_NO</td>
<td>(f=10Hz \sim 80kHz, Io=10mA)</td>
<td>–</td>
<td>45</td>
<td>–</td>
<td>(\mu Vrms)</td>
</tr>
<tr>
<td>Control Current</td>
<td>I_CONT</td>
<td>V_CONT=1.6V, Io=0mA</td>
<td>–</td>
<td>–</td>
<td>12</td>
<td>(\mu A)</td>
</tr>
<tr>
<td>Control Voltage for ON-state</td>
<td>V_CONT(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>V_CONT(OFF)</td>
<td></td>
<td>–</td>
<td>–</td>
<td>0.6</td>
<td>V</td>
</tr>
</tbody>
</table>

\((V_o \leq 2.0V\) version: \(V_{IN} = V_o + 1V, C_{IN} = 0.1\mu F, C_o = 2.2\mu F (C_o = 4.7\mu F: V_o \leq 1.6V), T_a = 25^\circ C\)

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</tr>
<tr>
<td>Quiescent Current at Control OFF</td>
<td>I(OFF)</td>
<td>V_CONT=0V</td>
<td>–</td>
<td>–</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>Output Current</td>
<td>Io</td>
<td>V_o-0.3V</td>
<td>100</td>
<td>130</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, Io=30mA)</td>
<td>–</td>
<td>–</td>
<td>0.10</td>
<td>%V</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>(\Delta V_o/\Delta Io)</td>
<td>Io=0 \sim 60mA</td>
<td>–</td>
<td>–</td>
<td>0.03</td>
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<td>Coefficient of Output</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Noise Voltage</td>
<td>V_NO</td>
<td>(f=10Hz \sim 80kHz, Io=10mA)</td>
<td>–</td>
<td>27</td>
<td>–</td>
<td>(\mu Vrms)</td>
</tr>
<tr>
<td>Control Current</td>
<td>I_CONT</td>
<td>V_CONT=1.6V, Io=0mA</td>
<td>–</td>
<td>–</td>
<td>12</td>
<td>(\mu A)</td>
</tr>
<tr>
<td>Control Voltage for ON-state</td>
<td>V_CONT(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>V_CONT(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.
NJM2865/66

TEST CIRCUIT

*4 1.6V<Vo≤2.6V version: Co=2.2μF(ceramic)
Vo≤1.6V version: 4.7μF(ceramic)
**TYPICAL APPLICATION**

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

   ![Diagram showing a circuit with a control terminal connected to the VIN terminal.](image)

   - **Connect control terminal to VIN terminal**

2. In use of ON/OFF CONTROL:

   ![Diagram showing a circuit with a control terminal connected to the VIN terminal and a pull-up resistor inserted.](image)

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

   - **In the case of using a resistance "R" between VIN and control.**
     - The current flow into the control terminal while the IC is ON state (I_{CONT}) can be reduced when a pull up resistance "R" is inserted between VIN and the control terminal.
     - The minimum control voltage for ON state (V_{CONT(ON)}) is increased due to the voltage drop caused by I_{CONT} and the resistance "R". The I_{CONT} is temperature dependence as shown in the "Control Current vs. Temperature" characteristics. Therefore, the resistance "R" should be carefully selected to ensure the control voltage exceeds the V_{CONT(ON)} over the required temperature range.
POWER DISSIPATION vs. AMBIENT TEMPERATURE

NJM2865/66F Power Dissipation
(Topr=−40〜+85°C, Tj=125°C, PD=200mW(Ta≤25°C))

NJM2865F3 Power Dissipation
(Topr=−40〜+85°C, Tj=125°C)

Device itself

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

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

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

**Quiescent Current vs. Input Voltage**
- @ Ta=25°C
- Output is open.
- Co=1.0µF (Ceramic)
- including Icont

**Output Noise Voltage vs. Output Current**
- @ Ta=25°C
- VIN=4.0V
- LPF: 80kHz
- Co=1.0µF
- Co=2.2µF

**Ripple Rejection Ratio vs. Frequency**
- @ Ta=25°C
- VIN=4.0V
- Co=1.0µF (Ceramic)
- Io=0mA
- Io=10mA
- Io=30mA
- f=1kHz
- f=10kHz
## ELECTRICAL CHARACTERISTICS

**Equivalent Series Resistance vs. Output Current**

- **Equivalent Series Resistance (Ω)**
  - Output Current: $I_o (mA)$
  - Temperature: $T_a (°C)$
  - Capacitor: $C_o = 1.0 \mu F$ (Ceramic)

**Dropout Voltage vs. Temperature**

- **Dropout Voltage ($V_D$) (V)**
  - Output Current: $I_o = 60mA$
  - Capacitor: $C_o = 1.0 \mu F$ (Ceramic)

**Output Voltage vs. Temperature**

- **Output Voltage ($V_o$) (V)**
  - Input Voltage: $V_iN = 4.0V$
  - Output: Open
  - Capacitor: $C_o = 1.0 \mu F$ (Ceramic)

**Control Voltage vs. Temperature**

- **Control Voltage ($V_{CONT}$) (V)**
  - Input Voltage: $V_iN = 4V$
  - Output: Open
  - Capacitor: $C_o = 1.0 \mu F$ (Ceramic)

**Control Current vs. Temperature**

- **Control Current ($I_{CONT}$) (µA)**
  - Input Voltage: $V_iN = 4V$
  - Output: Open
  - Capacitor: $C_o = 1.0 \mu F$ (Ceramic)

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**ELECTRICAL CHARACTERISTICS**

**Quiescent Current v.s. Temperature**
- @: $V_{IN}=4.0\,V$
- Output is open.
- $C_o=1.0\,\mu F$ (Ceramic)

**Short Circuit Current v.s. Temperature**
- @: $V_{IN}=4.0\,V$
- Output is short to ground.
- $C_o=1.0\,\mu F$ (Ceramic)

**Line Regulation v.s. Temperature**
- @: $V_{IN}=4.0-9.0\,V$
- $I_o=30\,mA$
- $C_o=1.0\,\mu F$ (Ceramic)

**Load Regulation v.s. Temperature**
- @: $V_{IN}=4.0\,V$
- $I_o=0-60\,mA$
- $C_o=1.0\,\mu F$ (Ceramic)

**Output Voltage v.s. Temperature**
- @: $V_{IN}=4.0\,V$
- $I_o=30\,mA$
- $C_o=1.0\,\mu F$ (Ceramic)
ELECTRICAL CHARACTERISTICS

ON/OFF Transient Response

Output Voltage : $V_o$ [V]
Control Voltage : $V_o$ [V]
Time : $t$ [mS]

@: $T_a=25^\circ C$
$V_{DD}=4.0V$
$C_o=1.0\mu F$ (Ceramic)
$Io=30mA$

ON/OFF Transient Response without load

Output Voltage : $V_o$ [V]
Control Voltage : $V_o$ [V]
Time : $t$ [s]

@: $T_a=25^\circ C$
$V_{DD}=4.0V$
$C_o=1.0\mu F$ (Ceramic)
$Io=0mA$

Load Transient Response

Output Voltage : $V_o$ [V]
Output Current : $I_o$ [mA]
Time : $t$ [$\mu s$]

@: $T_a=25^\circ C$
$V_{DD}=4.0V$
$C_o=1.0\mu F$ (Ceramic)

Line Transient Response

Output Voltage : $V_o$ [V]
Input Voltage : $V_{IN}$ [V]
Time : $t$ [$\mu s$]

@: $T_a=25^\circ C$
$V_{DD}=4.0V$
$C_o=1.0\mu F$ (Ceramic)

[CAUTION]
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