PQ30RV31

Variable Output Low Power-Loss Voltage Regulator

Features
- Maximum output current: 3A
- Compact resin full-mold package
- Low power-loss (Dropout voltage: MAX. 0.5V)
- Variable output voltage (setting range: 1.5 to 30V)
- Built-in ON/OFF control function.

Applications
- Power supply for print concentration control of word processors
- Series power supply for motors and solenoid
- Series power supply for VCRs and TVs

Outline Dimensions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>VIN</td>
<td>35</td>
<td>V</td>
</tr>
<tr>
<td>Output adjustment terminal voltage</td>
<td>VADJ</td>
<td>7</td>
<td>V</td>
</tr>
<tr>
<td>Output current</td>
<td>IO</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>Power dissipation (No heat sink)</td>
<td>PD1</td>
<td>2.0</td>
<td>W</td>
</tr>
<tr>
<td>Power dissipation (With infinite heat sink)</td>
<td>PD2</td>
<td>20</td>
<td>W</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>TJ</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>T_{op}</td>
<td>-20 to +80</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_{stg}</td>
<td>-40 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>T_{sold}</td>
<td>260 (For 10s)</td>
<td>°C</td>
</tr>
</tbody>
</table>

*1 All are open except GND and applicable terminals.
*2 Overheat protection function may operate at 125<=Tj<=150°C.

Notice
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Internet
Internet address for Electronic Components Group http://sharp-world.com/ecg/
### Electrical Characteristics

(Unless otherwise specified, condition shall be $V_{IN}=12V$, $V_O=10V$, $I_O=1.5A$, $R_1=390\,\Omega$, $T_a=25^\circ C$)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>$V_{IN}$</td>
<td>–</td>
<td>4.5</td>
<td>–</td>
<td>35</td>
<td>V</td>
</tr>
<tr>
<td>output voltage</td>
<td>$V_O$</td>
<td>–</td>
<td>1.5</td>
<td>–</td>
<td>30</td>
<td>V</td>
</tr>
<tr>
<td>Load regulation</td>
<td>$R_{SL}$</td>
<td>$I_O=5mA$ to $3A$</td>
<td>–</td>
<td>0.5</td>
<td>2.0</td>
<td>%</td>
</tr>
<tr>
<td>Line regulation</td>
<td>$R_{SL}$</td>
<td>$V_{IN}=11$ to $21V$, $I_O=0.5mA$</td>
<td>–</td>
<td>0.5</td>
<td>2.5</td>
<td>%</td>
</tr>
<tr>
<td>Ripple rejection</td>
<td>$RR$</td>
<td>Refer to Fig. 2</td>
<td>45</td>
<td>70</td>
<td>–</td>
<td>dB</td>
</tr>
<tr>
<td>Reference voltage</td>
<td>$V_{REF}$</td>
<td>–</td>
<td>1.225</td>
<td>1.25</td>
<td>1.275</td>
<td>V</td>
</tr>
<tr>
<td>Temperature coefficient of reference voltage</td>
<td>$T_cV_{REF}$</td>
<td>$T_a=0$ to $125^\circ C$, $I_O=5mA$</td>
<td>–</td>
<td>±1.0</td>
<td>–</td>
<td>%/°C</td>
</tr>
<tr>
<td>Dropout voltage</td>
<td>$V_{DRO}$</td>
<td>$^a^3$, $I_O=3A$</td>
<td>–</td>
<td>0.3</td>
<td>1.0</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$^a^3$, $I_O=2A$</td>
<td>–</td>
<td>0.2</td>
<td>0.5</td>
<td>V</td>
</tr>
<tr>
<td>Quiescent current</td>
<td>$I_q$</td>
<td>$I_O=0$</td>
<td>–</td>
<td>–</td>
<td>7</td>
<td>mA</td>
</tr>
</tbody>
</table>

$^a^3$ Input voltage shall be the value when output voltage is 95% in comparison with the initial value.

### Fig. 1 Test Circuit

![Test Circuit](image1)

$$V_O = V_{REF} \times \left(1 + \frac{R_2}{R_1}\right)$$

$[R_1=390\,\Omega, V_{REF} \text{ Nearly}=1.25V]$

### Fig. 2 Test Circuit of Ripple Rejection

![Test Circuit of Ripple Rejection](image2)

$I_O=0.5A$, $V_{IN}=12V$, $V_O=10V$

$f=120Hz$ (sine wave)

$e_{i\text{(rms)}}=0.5V_{rms}$

$e_{0\text{(rms)}}=20 \log(e_{i\text{(rms)}/e_{0\text{(rms)}}})$

### Fig. 3 Power Dissipation vs. Ambient Temperature

![Power Dissipation vs. Ambient Temperature](image3)

Note) Oblique line portion : Overheat protection may operate in this area.

### Fig. 4 Overcurrent Protection Characteristics (Typical Value)

![Overcurrent Protection Characteristics](image4)
Fig. 5 Output Voltage Adjustment Characteristics (Typical value)

Fig. 6 Output Voltage vs. Input Voltage

R_i=390Ω, R_L=2.7kΩ, T_j=25°C

Output voltage V_o (V)

Input voltage V_IN (V)

0 5 10 15 20

Fig. 7 Dropout Voltage vs. Junction Temperature

 Dropout voltage V_o-V_i (V)

Junction temperature T_j (°C)

0 5 10 15 20

R_i=390Ω, R_L=2.7kΩ

V_IN : 0.95V_o

IO=3A, 2A, 1A, 0.5A

Fig. 8 Ripple Rejection vs. Input Ripple Frequency

Ripple rejection RR (dB)

Input ripple frequency f (kHz)

0.1 1 10 100 1000

C_ref=3.3μF

C_ref

No C_ref

T_j=25 °C, V_IN=12V

R_i=390Ω, R_L=2.7kΩ

I_o=0.5A, e_i(rms)=0.5V

Fig. 9 Ripple Rejection vs. Output Current

Ripple rejection RR (dB)

Output current I_o (A)

0 1 2 3

C_ref=3.3μF

T_j=25 °C

R_i=390Ω, R_L=2.7kΩ

V_IN=12V, e_i(rms)=0.5V, f=120Hz

Fig. 10 Output Peak Current vs. Dropout Voltage (Typical value)

Output peak current I_oP (A)

Dropout voltage V_vi-o (V)

0 1 2 3 4 5 6 7 8 9 10

R_i=390Ω, R_L=2.7kΩ, T_j=25°C

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### ON/OFF Operation

- **ON/OFF operation** is available by mounting externally D₂ and R₃.
- When \( V_{\text{ADJ}} \) is forcibly raised above \( V_{\text{REF}} \) (1.25V TYP) by applying the external signal, the output is turned off (pass transistor of regulator is turned off). When the output is OFF, \( V_{\text{ADJ}} \) must be higher than \( V_{\text{REF MAX.}} \), and at the same time must be lower than maximum rating 7V.

In OFF-state, the load current flows to \( R_L \) from \( V_{\text{ADJ}} \) through \( R_\text{c} \). Therefore the value of \( R_\text{c} \) must be as high as possible.

- \( V_0' = V_{\text{ADJ}} \times R_1 / (R_1 + R_2) \) occurs at the load. OFF-state equivalent circuit \( R_1 \) up to 10kΩ is allowed. Select as high value of \( R_1 \) and \( R_2 \) as possible in this range. In some case, as output voltage is getting lower (\( V_0 < 1V \)), impedance of load resistance rises. In such condition, it is sometime impossible to obtain the minimum value of \( V_0' \). So add the dummy resistance indicated by \( R_0 \) in the figure to the circuit parallel to the load.
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      --- Test and measurement equipment
      --- Industrial control
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      --- Consumer electronics

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      --- Alarm equipment
      --- Various safety devices, etc.

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      --- Telecommunication equipment [trunk lines]
      --- Nuclear power control equipment
      --- Medical and other life support equipment (e.g., scuba).

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