OUTLINE

The R1113Z Series are CMOS-based voltage regulator ICs with high output voltage accuracy, extremely low supply current, low ON-resistance, and high ripple rejection. Each of these ICs consists of a voltage reference unit, an error amplifier, resistors, a current limit circuit, and a chip enable circuit.

These ICs perform with low dropout voltage and a chip enable function. The line transient response and load transient response of the R1113Z Series are excellent, thus these ICs are very suitable for the power supply for hand-held communication equipment.

The output voltage of these ICs is fixed with high accuracy. Since the package for these ICs is WL-CSP4-P1 (Wafer Level CSP), high density mounting of the ICs on boards is possible.

FEATURES

- Ultra-Low Supply Current .................................................. Typ. 100μA
- Standby Mode ................................................................. Typ. 0.1μA
- Low Dropout Voltage ....................................................... Typ. 0.23V (IOUT=100mA 3.0V Output type)
- High Ripple Rejection ..................................................... Typ. 80dB (f=1kHz 3.0V Output type)
- Low Temperature-Drift Coefficient of Output Voltage ...... Typ. ±100ppm/°C
- Excellent Line Regulation ............................................... Typ. 0.05%/V
- High Output Voltage Accuracy ........................................ ±2.0%
- Excellent Dynamic Response
- Small Package .............................................................. WL-CSP4-P1 (Wafer Level CSP)
- Output Voltage ............................................................ Stepwise setting with a step of 0.1V in the range of 1.5V to 5.0V is possible
- Built-in Chip Enable Circuit (2 types; A: active low, B: active high)
- Built-in Fold Back Protection Circuit ............................... Typ. 30mA (Current at short mode)
- Ceramic capacitors are recommended to be used with this IC

APPLICATIONS

- Power source for cellular phones such as GSM, CDMA and various kinds of PCS.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.
SELECTION GUIDE

The output voltage, the active type, the packing type, and the taping type for the ICs can be selected at the user's request. The selection can be made with designating the part number as shown below:

\[ \text{R1113xxx}1 \times \text{xx} \rightarrow \text{Part Number} \]

\[ \begin{array}{cccc}
a & b & c & d \\
\end{array} \]

<table>
<thead>
<tr>
<th>Code</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Designation of Package Type: Z:WL-CSP4-P1 (Wafer Level CSP)</td>
</tr>
<tr>
<td>b</td>
<td>Setting Output Voltage ((V_{\text{out}})): Stepwise setting with a step of 0.1V in the range of 1.5V to 5.0V is possible.</td>
</tr>
<tr>
<td>c</td>
<td>Designation of Active Type: A: active low type B: active high type</td>
</tr>
<tr>
<td>d</td>
<td>Designation of Taping Type: Ex. TR, TL (refer to Taping Specifications; TR type is the standard direction.)</td>
</tr>
</tbody>
</table>
PIN CONFIGURATION

WL-CSP4-P1

3 VDD 4 CE
2 VOUT 1 GND

Bottom View

4 Top View

PIN DESCRIPTION

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Ground Pin</td>
</tr>
<tr>
<td>2</td>
<td>VOUT</td>
<td>Output pin</td>
</tr>
<tr>
<td>3</td>
<td>VDD</td>
<td>Input Pin</td>
</tr>
<tr>
<td>4</td>
<td>CE or CE</td>
<td>Chip Enable Pin</td>
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</tbody>
</table>

ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Item</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN</td>
<td>Input Voltage</td>
<td>7.0</td>
<td>V</td>
</tr>
<tr>
<td>VCE</td>
<td>Input Voltage (CE or CE Pin)</td>
<td>-0.3 ~ VIN+0.3</td>
<td>V</td>
</tr>
<tr>
<td>VOUT</td>
<td>Output Voltage</td>
<td>-0.3 ~ VIN+0.3</td>
<td>V</td>
</tr>
<tr>
<td>IOUT</td>
<td>Output Current</td>
<td>200</td>
<td>mA</td>
</tr>
<tr>
<td>PD</td>
<td>Power Dissipation</td>
<td>190</td>
<td>mW</td>
</tr>
<tr>
<td>Topt</td>
<td>Operating Temperature Range</td>
<td>-40 ~ 85</td>
<td>°C</td>
</tr>
<tr>
<td>Tstg</td>
<td>Storage Temperature Range</td>
<td>-55 ~ 125</td>
<td>°C</td>
</tr>
</tbody>
</table>
Power Dissipation

Typical Characteristics

- **Measurement Conditions**
  - Mounted on board (Wind velocity = 0 m/s)
  - Board Material: FR-4 (Double-layer)
  - Board Size: 40mm × 40mm × t1.6mm
  - Wiring area ratio against the board: 50%

- **Result**
  - Power dissipation: 465 mW
  - Thermal Resistance: 215°C/W

![Power Dissipation Graph](image-url)
### ELECTRICAL CHARACTERISTICS

#### R1113Zxx1A

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Item</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOUT</td>
<td>Output Voltage</td>
<td>$V_{IN} = Set V_{OUT} + 1V$</td>
<td>$1mA \leq I_{OUT} \leq 30mA$</td>
<td>$V_{OUT} = 0.98$</td>
<td>$V_{OUT} = 1.02$</td>
<td>V</td>
</tr>
<tr>
<td>IOUT</td>
<td>Output Current</td>
<td>$V_{IN} - V_{OUT} = 1.0V$</td>
<td></td>
<td>150</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>$\Delta V_{OUT}/\Delta I_{OUT}$</td>
<td>Load Regulation</td>
<td>$V_{IN} = Set V_{OUT} + 1V$</td>
<td></td>
<td>20</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>VDIFF</td>
<td>Dropout Voltage</td>
<td>Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISS</td>
<td>Supply Current</td>
<td>$V_{IN} = Set V_{OUT} + 1V$</td>
<td></td>
<td>100</td>
<td>170</td>
<td>μA</td>
</tr>
<tr>
<td>Istandby</td>
<td>Supply Current (Standby)</td>
<td>$V_{IN} = V_{CE} = Set V_{OUT} + 1V$</td>
<td></td>
<td>0.1</td>
<td>1.0</td>
<td>μA</td>
</tr>
<tr>
<td>$\Delta V_{OUT}/\Delta V_{IN}$</td>
<td>Line Regulation</td>
<td>Set $V_{OUT} - 0.5V \leq V_{IN} \leq 6V$</td>
<td></td>
<td>0.05</td>
<td>0.20</td>
<td>%/V</td>
</tr>
<tr>
<td>RR</td>
<td>Ripple Rejection</td>
<td>Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIN</td>
<td>Input Voltage</td>
<td></td>
<td>2.0</td>
<td>6.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$\Delta V_{OUT}/\Delta T$</td>
<td>Output Voltage Temperature Coefficient</td>
<td>$I_{OUT} = 30mA$</td>
<td>$-40°C \leq \text{Topt} \leq 85°C$</td>
<td>±100</td>
<td></td>
<td>ppm/°C</td>
</tr>
<tr>
<td>ILim</td>
<td>Short Current Limit</td>
<td>$V_{OUT} = 0V$</td>
<td></td>
<td>30</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Rpu</td>
<td>CE Pull-up Resistance</td>
<td></td>
<td>2.5</td>
<td>5.0</td>
<td>10.0</td>
<td>MΩ</td>
</tr>
<tr>
<td>VCEH</td>
<td>CE Input Voltage &quot;H&quot;</td>
<td></td>
<td>1.5</td>
<td>$V_{IN}$</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>VCEL</td>
<td>CE Input Voltage &quot;L&quot;</td>
<td></td>
<td>0.00</td>
<td>0.25</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>en</td>
<td>Output Noise</td>
<td>BW=10Hz to 100kHz</td>
<td></td>
<td>30</td>
<td></td>
<td>μVrms</td>
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</table>

#### R1113Zxx1B

<table>
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<tr>
<th>Symbol</th>
<th>Item</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
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<tbody>
<tr>
<td>VOUT</td>
<td>Output Voltage</td>
<td>$V_{IN} = Set V_{OUT} + 1V$</td>
<td></td>
<td>$V_{OUT} = 0.98$</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>IOUT</td>
<td>Output Current</td>
<td>$V_{IN} - V_{OUT} = 1.0V$</td>
<td></td>
<td>150</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>$\Delta V_{OUT}/\Delta I_{OUT}$</td>
<td>Load Regulation</td>
<td>$V_{IN} = Set V_{OUT} + 1V$</td>
<td></td>
<td>20</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>VDIFF</td>
<td>Dropout Voltage</td>
<td>Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISS</td>
<td>Supply Current</td>
<td>$V_{IN} = Set V_{OUT} + 1V$</td>
<td></td>
<td>100</td>
<td>170</td>
<td>μA</td>
</tr>
<tr>
<td>Istandby</td>
<td>Supply Current (Standby)</td>
<td>$V_{IN} = V_{CE} = Set V_{OUT} + 1V$</td>
<td></td>
<td>0.1</td>
<td>1.0</td>
<td>μA</td>
</tr>
<tr>
<td>$\Delta V_{OUT}/\Delta V_{IN}$</td>
<td>Line Regulation</td>
<td>Set $V_{OUT} - 0.5V \leq V_{IN} \leq 6V$</td>
<td></td>
<td>0.05</td>
<td>0.20</td>
<td>%/V</td>
</tr>
<tr>
<td>RR</td>
<td>Ripple Rejection</td>
<td>Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIN</td>
<td>Input Voltage</td>
<td></td>
<td>2.0</td>
<td>6.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$\Delta V_{OUT}/\Delta T$</td>
<td>Output Voltage Temperature Coefficient</td>
<td>$I_{OUT} = 30mA$</td>
<td>$-40°C \leq \text{Topt} \leq 85°C$</td>
<td>±100</td>
<td></td>
<td>ppm/°C</td>
</tr>
<tr>
<td>ILim</td>
<td>Short Current Limit</td>
<td>$V_{OUT} = 0V$</td>
<td></td>
<td>30</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Rpu</td>
<td>CE Pull-up Resistance</td>
<td></td>
<td>2.5</td>
<td>5.0</td>
<td>10.0</td>
<td>MΩ</td>
</tr>
<tr>
<td>VCEH</td>
<td>CE Input Voltage &quot;H&quot;</td>
<td></td>
<td>1.5</td>
<td>$V_{IN}$</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>VCEL</td>
<td>CE Input Voltage &quot;L&quot;</td>
<td></td>
<td>0.00</td>
<td>0.25</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>en</td>
<td>Output Noise</td>
<td>BW=10Hz to 100kHz</td>
<td></td>
<td>30</td>
<td></td>
<td>μVrms</td>
</tr>
</tbody>
</table>
ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE

Topt = 25°C

<table>
<thead>
<tr>
<th>Output Voltage VOUT (V)</th>
<th>Dropout Voltage VDIF (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>Typ.</td>
</tr>
<tr>
<td>1.5</td>
<td>0.50</td>
</tr>
<tr>
<td>1.6</td>
<td>0.45</td>
</tr>
<tr>
<td>1.7</td>
<td>0.40</td>
</tr>
<tr>
<td>1.8</td>
<td>0.34</td>
</tr>
<tr>
<td>1.9</td>
<td>0.28</td>
</tr>
<tr>
<td>2.0 ≤ VOUT ≤ 2.3</td>
<td>0.25</td>
</tr>
<tr>
<td>2.4 ≤ VOUT ≤ 2.7</td>
<td>0.24</td>
</tr>
<tr>
<td>2.8 ≤ VOUT ≤ 5.0</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Ripple Rejection RR (dB)

Topt = 25°C

<table>
<thead>
<tr>
<th>Output Voltage VOUT (V)</th>
<th>Condition</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 ≤ VOUT ≤ 4.0</td>
<td>f = 1kHz, Ripple 0.5Vp-p</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>4.1 ≤ VOUT ≤ 5.0</td>
<td>VIN = Set VOUT + 1V</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>

OPERATION

In these ICs, fluctuation of output voltage, VOUT is detected by feedback registers R1, R2, and the result is compared with a reference voltage by the error amplifier, so that a constant voltage is output. A current limit circuit for protection in short mode and a chip enable circuit, are included.
TECHNICAL NOTES

When using these ICs, consider the following points:

Phase Compensation

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor $C_{\text{out}}$ with good frequency characteristics and ESR (Equivalent Series Resistance). We use Ceramic Capacitors for evaluation of these ICs.

Recommended Capacitors:
- GRM40X5R225K6.3 (Murata)
- GRM40-034X5R335K6.3 (Murata)
- GRM40-034X5R475K6.3 (Murata)

(Note: When the additional ceramic capacitors are connected to the output pin with an output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB.)

PCB Layout

Make $V_{\text{DD}}$ and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor with a capacitance value as much as 2.2μF or more between $V_{\text{DD}}$ and GND pin, and as close as possible to the pins.

Set external components, especially the output capacitor, as close as possible to the ICs, and make wiring as short as possible.
TEST CIRCUITS

Fig.1 Standard test Circuit

Fig.2 Supply Current Test Circuit

Fig.3 Ripple Rejection, Line Transient Response Test Circuit

Fig.4 Load Transient Response Test Circuit

TYPICAL APPLICATION

(External Components)
Output Capacitor : Ceramic 2.2\mu \text{F} (Set Output Voltage in the range from 2.6 to 5.0V)
Ceramic 4.7\mu \text{F} (Set Output Voltage in the range from 1.5 to 2.5V)
Input Capacitor : Ceramic 2.2\mu \text{F}
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current  \( T_{\text{opt}}=25^\circ \text{C} \)

\[
\begin{array}{c|c|c|c|c|c|c|c}
R1113Z201B & R1113Z301B \\
\hline
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
100 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
200 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
300 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
400 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
500 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{array}
\]

2) Output Voltage vs. Input Voltage  \( T_{\text{opt}}=25^\circ \text{C} \)

\[
\begin{array}{c|c|c|c|c|c|c|c}
R1113Z201B & R1113Z301B \\
\hline
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
5 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{array}
\]
3) Dropout Voltage vs. Output Current

**R1113Z401B**

- Input Voltage VIN (V)
- Output Voltage VOUT (V)

<table>
<thead>
<tr>
<th>VIN (V)</th>
<th>Output Current IOUT (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td>1mA</td>
</tr>
<tr>
<td>3.8</td>
<td>30mA</td>
</tr>
<tr>
<td>3.6</td>
<td>50mA</td>
</tr>
</tbody>
</table>

**R1113Z501B**

- Input Voltage VIN (V)
- Output Voltage VOUT (V)

<table>
<thead>
<tr>
<th>VIN (V)</th>
<th>Output Current IOUT (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2</td>
<td>1mA</td>
</tr>
<tr>
<td>4.8</td>
<td>30mA</td>
</tr>
<tr>
<td>4.6</td>
<td>50mA</td>
</tr>
</tbody>
</table>

**R1113Z201B**

- Output Current IOUT (mA)
- Dropout Voltage VDIFF (V)

<table>
<thead>
<tr>
<th>IOUT (mA)</th>
<th>Dropout Voltage VDIFF (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.60</td>
</tr>
<tr>
<td>50</td>
<td>0.50</td>
</tr>
<tr>
<td>100</td>
<td>0.40</td>
</tr>
<tr>
<td>150</td>
<td>0.30</td>
</tr>
</tbody>
</table>

**R1113Z301B**

- Output Current IOUT (mA)
- Dropout Voltage VDIFF (V)

<table>
<thead>
<tr>
<th>IOUT (mA)</th>
<th>Dropout Voltage VDIFF (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.60</td>
</tr>
<tr>
<td>50</td>
<td>0.50</td>
</tr>
<tr>
<td>100</td>
<td>0.40</td>
</tr>
<tr>
<td>150</td>
<td>0.30</td>
</tr>
</tbody>
</table>

**R1113Z401B**

- Output Current IOUT (mA)
- Dropout Voltage VDIFF (V)

<table>
<thead>
<tr>
<th>IOUT (mA)</th>
<th>Dropout Voltage VDIFF (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.60</td>
</tr>
<tr>
<td>50</td>
<td>0.50</td>
</tr>
<tr>
<td>100</td>
<td>0.40</td>
</tr>
<tr>
<td>150</td>
<td>0.30</td>
</tr>
</tbody>
</table>

**R1113Z501B**

- Output Current IOUT (mA)
- Dropout Voltage VDIFF (V)

<table>
<thead>
<tr>
<th>IOUT (mA)</th>
<th>Dropout Voltage VDIFF (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.60</td>
</tr>
<tr>
<td>50</td>
<td>0.50</td>
</tr>
<tr>
<td>100</td>
<td>0.40</td>
</tr>
<tr>
<td>150</td>
<td>0.30</td>
</tr>
</tbody>
</table>
4) Output Voltage vs. Temperature

- **R1113Z201B**
  - VIN=3.0V, IOUT=30mA
- **R1113Z301B**
  - VIN=4.0V, IOUT=30mA
- **R1113Z401B**
  - VIN=5.0V, IOUT=30mA
- **R1113Z501B**
  - VIN=6.0V, IOUT=30mA

5) Supply Current vs. Input Voltage

Topt=25°C

- **R1113Z201B**
- **R1113Z301B**
6) Supply Current vs. Temperature

- **VIN=3.0V**
  - R1113Z401B
  - Supply Current (μA): 0 to 200
  - Temperature: -50°C to 100°C

- **VIN=4.0V**
  - R1113Z501B
  - Supply Current (μA): 0 to 200
  - Temperature: -50°C to 100°C

- **VIN=5.0V**
  - R1113Z401B
  - Supply Current (μA): 0 to 200
  - Temperature: -50°C to 100°C

- **VIN=6.0V**
  - R1113Z501B
  - Supply Current (μA): 0 to 200
  - Temperature: -50°C to 100°C
7) Dropout Voltage vs. Set Output Voltage

**R1113Zxx1B**

- Dropout Voltage $V_{DIFF}(V)$ vs. Set Output Voltage $V_{REG}(V)$
- Curves for different current levels: 25mA, 50mA, 100mA, 150mA

8) Ripple Rejection vs. Frequency

**R1113Z201B**

- Ripple Rejection $RR(dB)$ vs. Frequency $f(kHz)$
- Data points for $I_{OUT}=1mA$, $30mA$, $50mA$
- Input voltage $V_{IN}=3.0V+0.5V_{p-p}$, $C_{OUT}=ceramic\ 4.7\mu F$

**R1113Z301B**

- Ripple Rejection $RR(dB)$ vs. Frequency $f(kHz)$
- Data points for $I_{OUT}=1mA$, $30mA$, $50mA$
- Input voltage $V_{IN}=4.0V+0.5V_{p-p}$, $C_{OUT}=ceramic\ 2.2\mu F$

**R1113Z401B**

- Ripple Rejection $RR(dB)$ vs. Frequency $f(kHz)$
- Data points for $I_{OUT}=1mA$, $30mA$, $50mA$
- Input voltage $V_{IN}=5.0V+0.5V_{p-p}$, $C_{OUT}=ceramic\ 2.2\mu F$

**R1113Z501B**

- Ripple Rejection $RR(dB)$ vs. Frequency $f(kHz)$
- Data points for $I_{OUT}=1mA$, $30mA$, $50mA$
- Input voltage $V_{IN}=6.0V+0.5V_{p-p}$, $C_{OUT}=ceramic\ 2.2\mu F$
9) Ripple Rejection vs. Input Voltage (DC bias)

R1113Z301B

- IOUT=1mA, COUT=ceramic 2.2µF

Ripple Rejection RR(dB) vs Input Voltage VIN(V)

- f=400Hz
- f=1kHz
- f=10kHz

R1113Z301B

- IOUT=30mA, COUT=ceramic 2.2µF

Ripple Rejection RR(dB) vs Input Voltage VIN(V)

- f=400Hz
- f=1kHz
- f=10kHz

R1113Z301B

- IOUT=50mA, COUT=ceramic 2.2µF

Ripple Rejection RR(dB) vs Input Voltage VIN(V)

- f=400Hz
- f=1kHz
- f=10kHz

10) Input Transient Response

R1113Z201B

Topt=25°C

VIN

VOUT

V_{IN}=3.0V \leftrightarrow 4.0V
I_{OUT}=30mA
C_{IN}=none
C_{OUT}=4.7\mu F
tr/tf=5\mu s
R1113Z301B  Topt=25°C

VIN 4.0V → 5.0V
IOUT = 30mA
CIN = none
COUT = 2.2μF
tr/τf = 5μs

R1113Z401B  Topt=25°C

VIN 5.0V → 6.0V
IOUT = 30mA
CIN = none
COUT = 2.2μF
tr/τf = 5μs

R1113Z501B  Topt=25°C

VIN 6.0V → 7.0V
IOUT = 30mA
CIN = none
COUT = 2.2μF
tr/τf = 5μs
11) Load Transient Response

**R1113Z201B**

- $I_{OUT} = 50mA \leftrightarrow 100mA$
- $V_{IN} = 3.0V$
- $C_{IN} = 2.2\mu F$
- $C_{OUT} = 4.7\mu F$
- $t_{r}/t_{f} = 5\mu s$

**R1113Z301B**

- $I_{OUT} = 50mA \leftrightarrow 100mA$
- $V_{IN} = 4.0V$
- $C_{IN} = 2.2\mu F$
- $C_{OUT} = 2.2\mu F$
- $t_{r}/t_{f} = 5\mu s$

**R1113Z401B**

- $I_{OUT} = 50mA \leftrightarrow 100mA$
- $V_{IN} = 5.0V$
- $C_{IN} = 2.2\mu F$
- $C_{OUT} = 2.2\mu F$
- $t_{r}/t_{f} = 5\mu s$
**TECHNICAL NOTES**

When using these ICs, consider the following points:

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor $C_{\text{OUT}}$ with good frequency characteristics and ESR (Equivalent Series Resistance) of which is in the range described as follows:

![Circuit Diagram]

Measuring Circuit for white noise; R1113Zxx1B

**Specifications**

- $I_{\text{OUT}}$: 50mA to 100mA
- $V_{\text{IN}}$: 6.0V
- $C_{\text{IN}}$: 2.2 μF
- $C_{\text{OUT}}$: 2.2 μF
- $t_r/t_f$: 5 μs

**Spectrum Analyzer**
The relations between $I_{OUT}$ (Output Current) and ESR of an output capacitor are shown below. The conditions when the white noise level is under 40μV (Avg.) are marked as the hatched area in the graph.

(Note: If additional ceramic capacitors are connected to the Output Pin with Output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB.)

**<Measurement conditions>**

1. $V_{IN}=V_{OUT}+1V$
2. Frequency Band: 10Hz to 1MHz
3. Temperature: 25°C

<table>
<thead>
<tr>
<th>Component</th>
<th>ESR (Ω)</th>
<th>IOUT (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUT=2.2μF, CIN=2.2μF</td>
<td>0.001</td>
<td>0 30 60 90 120 150</td>
</tr>
<tr>
<td>COUT=4.7μF, CIN=2.2μF</td>
<td>0.001</td>
<td>0 30 60 90 120 150</td>
</tr>
<tr>
<td>COUT=2.2μF, CIN=2.2μF</td>
<td>0.001</td>
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</tr>
</tbody>
</table>
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