

OUTLINE

The R1121N 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 voltage regulator 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 R1121N 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 SOT-23-5 (Mini-mold) package, high density mounting of the ICs on boards is possible.

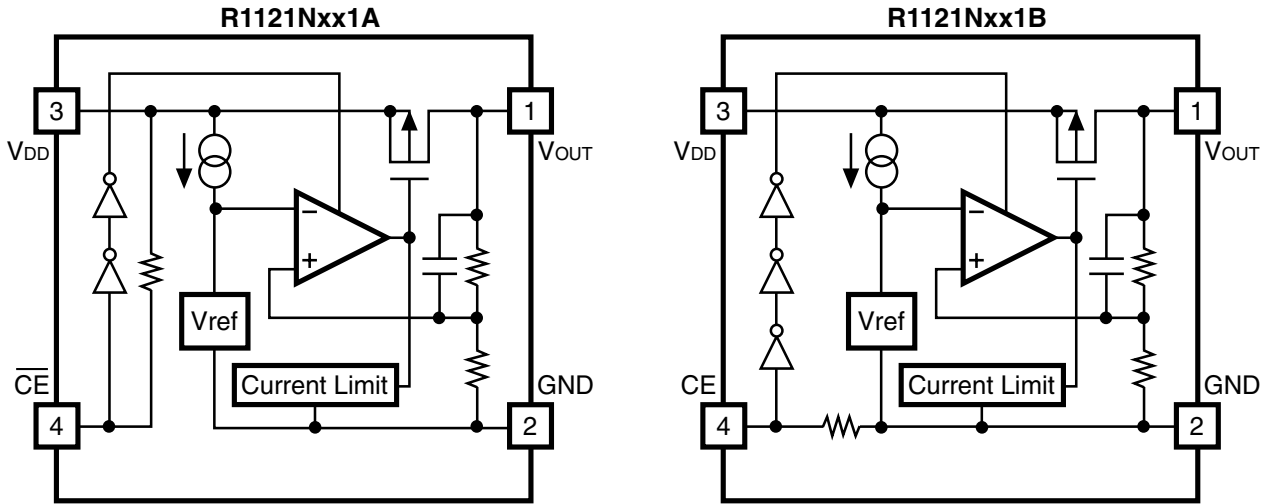
FEATURES

- Ultra-Low Supply Current Typ. 35 μ A
- Standby Mode Typ. 0.1 μ A
- Low Dropout Voltage Typ. 0.2V ($I_{OUT} = 100\text{mA}$)
- High Ripple Rejection Typ. 70db ($f = 1\text{kHz}$)
- Low Temperature-Drift Coefficient of Output Voltage..... Typ. $\pm 100\text{ppm}/^\circ\text{C}$
- Excellent Line Regulation..... Typ. 0.05%/V
- High Accuracy Output Voltage $\pm 2.0\%$
- Small Package SOT-23-5 (Mini-mold)
- 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 "L", B: active "H")
- Pin out..... Similar to the TK112, TK111

APPLICATIONS

- Power source for cellular phones such as GSM, CDMA and various kind of PCSs.
- Power source for domestic appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.

BLOCK DIAGRAM



SELECTION GUIDE

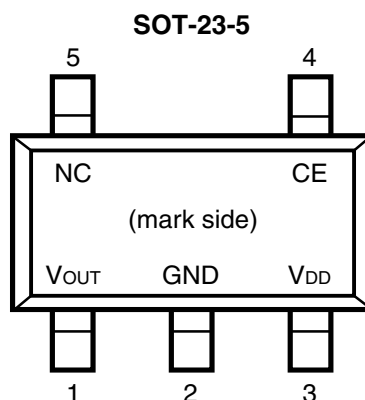
The output voltage, the active type, the packing type, and the taping type for the ICs can be selected at the user's request.

The selection can be made by designating the part number as shown below :

R1121xxx1x-xx ←Part Number
 ↑ ↑ ↑
 a b c

| Code | Contents |
|------|--|
| a | Setting Output Voltage (V _{OUT}) : Stepwise setting with a step of 0.1V in the range of 1.5V to 5.0V is possible. |
| b | Designation of Active Type : A : active "L" type B : active "H" type |
| c | Designation of Taping Type : Ex. TR, TL (refer to Taping Specifications; TR type is the standard direction.) |

PIN CONFIGURATION



PIN DESCRIPTION

| Pin No. | Symbol | Description |
|---------|-----------------------|-----------------|
| 1 | V_{OUT} | Output pin |
| 2 | GND | Ground Pin |
| 3 | V_{DD} | Input Pin |
| 4 | \overline{CE} or CE | Chip Enable Pin |
| 5 | NC | No Connection |

ABSOLUTE MAXIMUM RATINGS

| Symbol | Item | Rating | Unit |
|-----------|------------------------------|---------------------|------|
| V_{IN} | Input Voltage | 9 | V |
| V_{CE} | Input Voltage (CE or CE Pin) | -0.3 ~ $V_{IN}+0.3$ | V |
| V_{OUT} | Output Voltage | -0.3 ~ $V_{IN}+0.3$ | V |
| I_{OUT} | Output Current | 200 | mA |
| P_D | Power Dissipation | 250 | mW |
| T_{opt} | Operating Temperature Range | -40 ~ 85 | °C |
| T_{stg} | Storage Temperature Range | -55 ~ 125 | °C |

ELECTRICAL CHARACTERISTICS

• R1121Nxx1A

Topt = 25°C

| Symbol | Item | Conditions | Min. | Typ. | Max. | Unit |
|---------------------------------|--|---|----------------------------|-----------|----------------------------|---------------------|
| V_{OUT} | Output Voltage | $V_{IN} = \text{Set } V_{OUT} + 1V$ $1mA \leq I_{OUT} \leq 30mA$ | V_{OUT} $\times 0.98$ | | V_{OUT} $\times 1.02$ | V |
| I_{OUT} | Output Current | refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE | | | | |
| $\Delta V_{OUT}/\Delta I_{OUT}$ | Load Regulation | $V_{IN} = \text{Set } V_{OUT} + 1V$ $1mA \leq I_{OUT} \leq 80mA$ | | 12 | 40 | mV |
| V_{DIF} | Dropout Voltage | refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE | | | | |
| I_{SS} | Supply Current | $V_{IN} = \text{Set } V_{OUT} + 1V$ | | 35 | 70 | μA |
| $I_{standby}$ | Supply Current (Standby) | $V_{IN} = V_{CE} = \text{Set } V_{OUT} + 1V$ | | 0.1 | 1.0 | μA |
| $\Delta V_{OUT}/\Delta V_{IN}$ | Line Regulation | Set $V_{OUT} + 0.5V \leq V_{IN} \leq 8V$ $I_{OUT} = 30mA$ | | 0.05 | 0.20 | %/V |
| RR | Ripple Rejection | $f = 1kHz$, Ripple $0.5V_{p-p}$ $V_{IN} = \text{Set } V_{OUT} + 1V$ | | 70 | | dB |
| V_{IN} | Input Voltage | | 2 | | 8 | V |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | $I_{OUT} = 30mA$ $-40^{\circ}C \leq T_{opt} \leq 85^{\circ}C$ | | ± 100 | | ppm/ $^{\circ}C$ |
| I_{lim} | Short Current Limit | $V_{OUT} = 0V$ | | 50 | | mA |
| R_{PU} | \overline{CE} Pull-up Resistance | | 2.5 | 5.0 | 10.0 | $M\Omega$ |
| V_{CEH} | \overline{CE} Input Voltage "H" | | 1.5 | | V_{IN} | V |
| V_{CEL} | \overline{CE} Input Voltage "L" | | 0.00 | | 0.25 | V |
| e_n | Output Noise | $BW = 10Hz \sim 100kHz$ | | 30 | | μV_{rms} |

• R1121Nxx1B

T_{opt} = 25°C

| Symbol | Item | Conditions | Min. | Typ. | Max. | Unit |
|--------------------------------------|---|--|---------------------------|------|---------------------------|------------|
| V _{OUT} | Output Voltage | V _{IN} = Set V _{OUT} +1V 1mA ≤ I _{OUT} ≤ 30mA | V _{OUT} ×0.98 | | V _{OUT} ×1.02 | V |
| I _{OUT} | Output Current | refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE | | | | |
| ΔV _{OUT} /ΔI _{OUT} | Load Regulation | V _{IN} = Set V _{OUT} +1V 1mA ≤ I _{OUT} ≤ 80mA | | 12 | 40 | mV |
| V _{DIF} | Dropout Voltage | refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE | | | | |
| I _{SS} | Supply Current | V _{IN} = Set V _{OUT} +1V | | 35 | 70 | μA |
| I _{standby} | Supply Current (Standby) | V _{IN} = Set V _{OUT} +1V V _{CE} = GND | | 0.1 | 1.0 | μA |
| ΔV _{OUT} /ΔV _{IN} | Line Regulation | Set V _{OUT} +0.5V ≤ V _{IN} ≤ 8V I _{OUT} = 30mA | | 0.05 | 0.20 | %/V |
| RR | Ripple Rejection | f = 1kHz, Ripple 0.5Vp-p V _{IN} = Set V _{OUT} +1V | | 70 | | dB |
| V _{IN} | Input Voltage | | 2 | | 8 | V |
| ΔV _{OUT} /ΔT | Output Voltage Temperature Coefficient | I _{OUT} = 30mA -40°C ≤ T _{opt} ≤ 85°C | | ±100 | | ppm /°C |
| I _{lim} | Short Current Limit | V _{OUT} = 0V | | 50 | | mA |
| R _{PD} | CE Pull-down Resistance | | 2.5 | 5.0 | 10.0 | MΩ |
| V _{CEH} | CE Input Voltage "H" | | 1.5 | | V _{IN} | V |
| V _{CEL} | CE Input Voltage "L" | | 0.00 | | 0.25 | V |
| en | Output Noise | BW = 10Hz ~ 100kHz | | 30 | | μVrms |

• ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE

Topt = 25°C

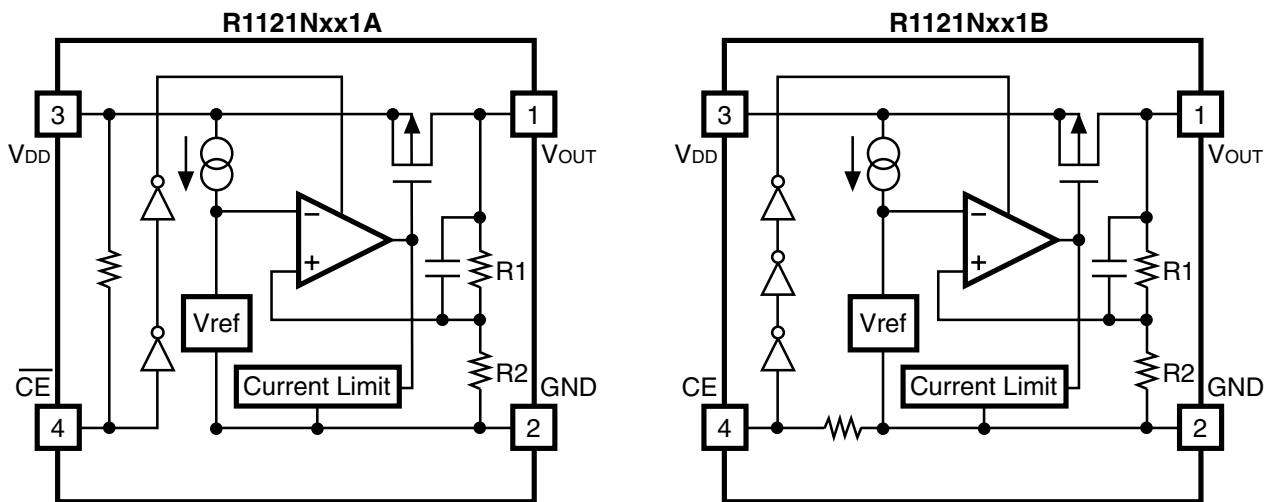
| Output Voltage V _{OUT} (V) | Output Current | |
|--|---|------|
| | I _{OUT} (mA) | |
| | Conditions | Min. |
| 1.5 ≤ V _{OUT} ≤ 1.7 | V _{IN} - V _{OUT} = 1.0V | 100 |
| 1.8 ≤ V _{OUT} ≤ 5.0 | | 150 |

Topt = 25°C

| Output Voltage V _{OUT} (V) | Dropout Voltage | | | |
|--|--------------------------|------|------|------|
| | V _{DIF} (V) | | | |
| | Conditions | Min. | Typ. | Max. |
| 1.5 | I _{OUT} = 100mA | 0.50 | | |
| 1.6 | | 0.40 | | |
| 1.7 | | 0.30 | | |
| 1.8 ≤ V _{OUT} ≤ 1.9 | | | 0.60 | 1.40 |
| 2.0 ≤ V _{OUT} ≤ 2.4 | | | 0.35 | 0.70 |
| 2.5 ≤ V _{OUT} ≤ 2.7 | | | 0.24 | 0.35 |
| 2.8 ≤ V _{OUT} ≤ 3.3 | | | 0.20 | 0.30 |
| 3.4 ≤ V _{OUT} ≤ 5.0 | | | 0.17 | 0.26 |

Note :When set Output Voltage is equal or less than 2.0V, V_{IN} should be equal or more than 2.0V.

OPERATION



In these ICs, fluctuation of the output voltage, V_{OUT} is detected by feed-back registers, R1 and 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 at short mode and a chip enable circuit, are included.

TEST CIRCUITS

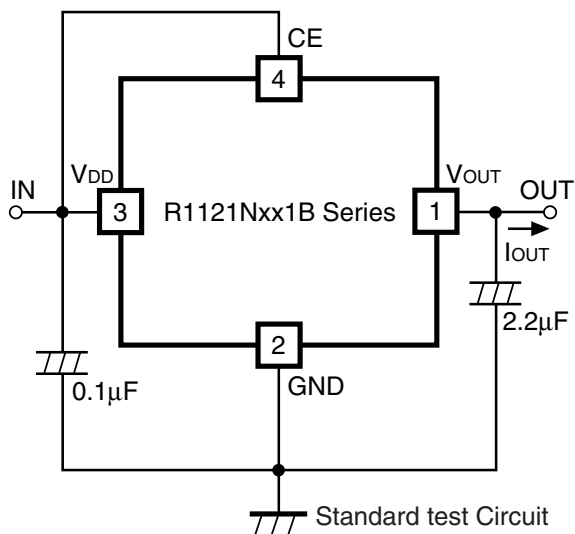


Fig.1 Standard test Circuit

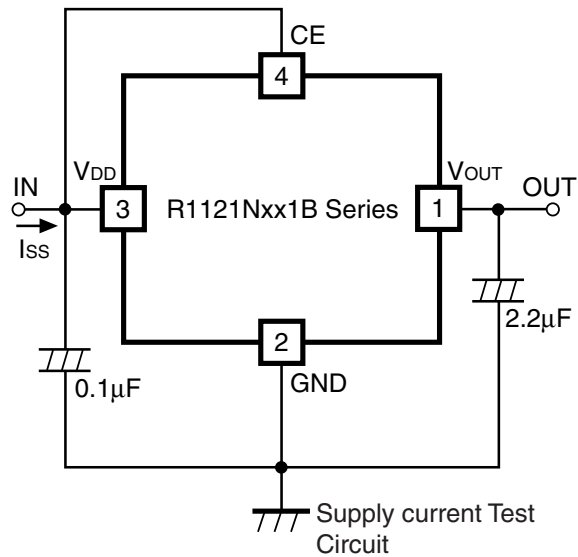


Fig.2 Supply Current Test Circuit

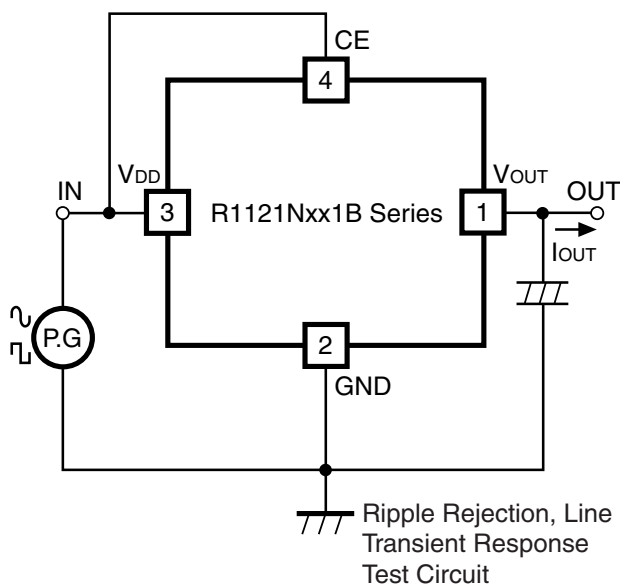


Fig.3 Ripple Rejection, Line Transient Response Test Circuit

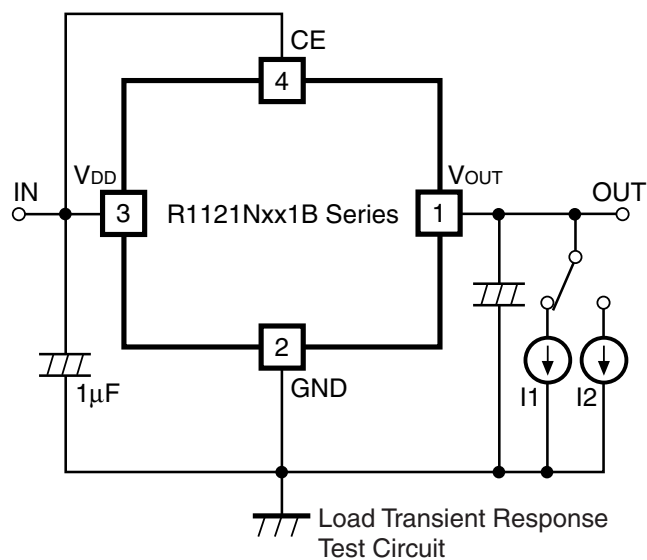
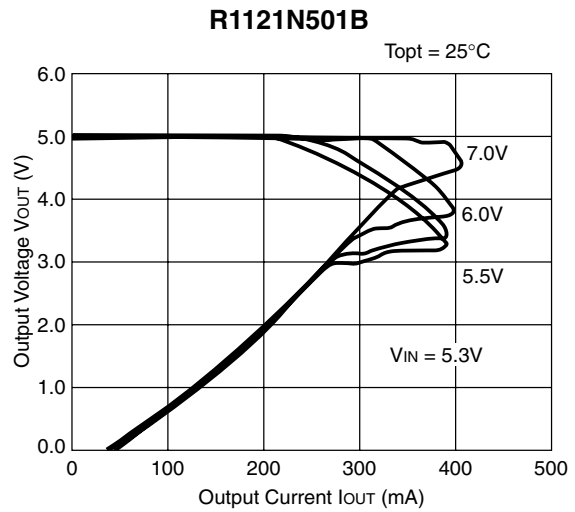
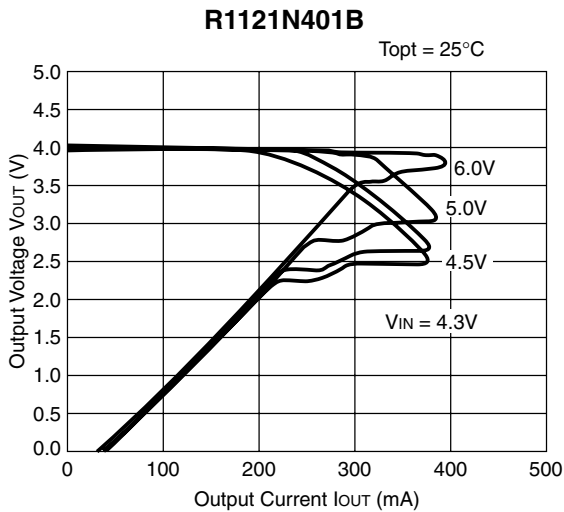
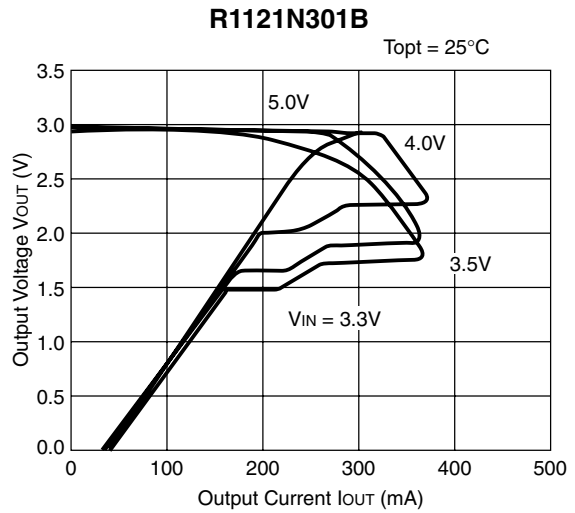
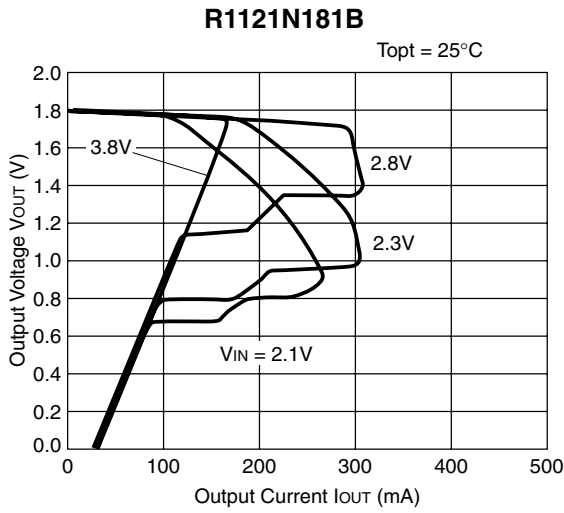


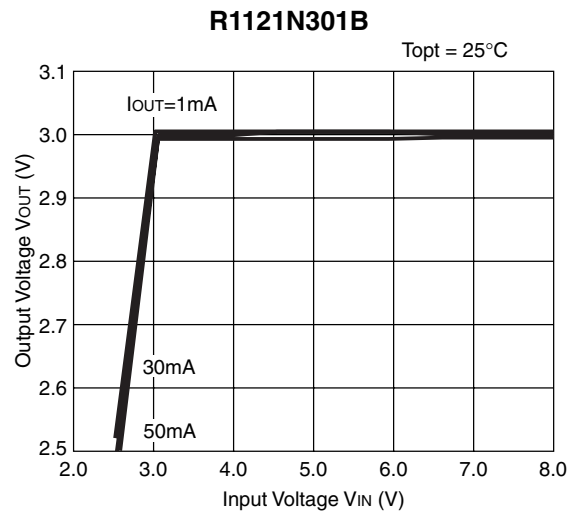
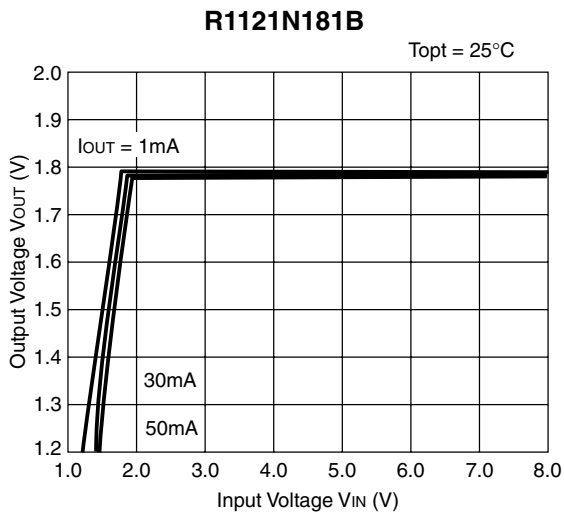
Fig.4 Load Transient Response Test Circuit

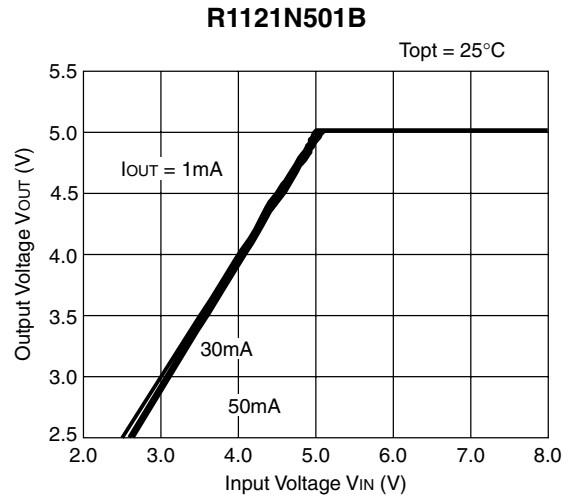
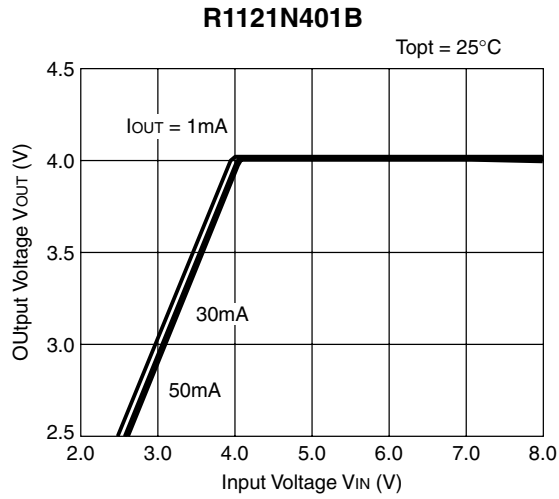
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current

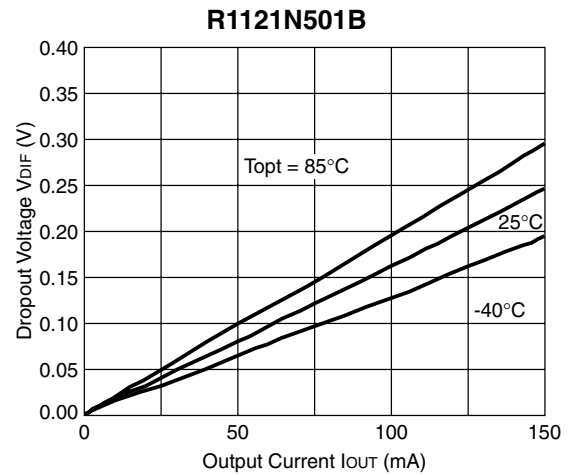
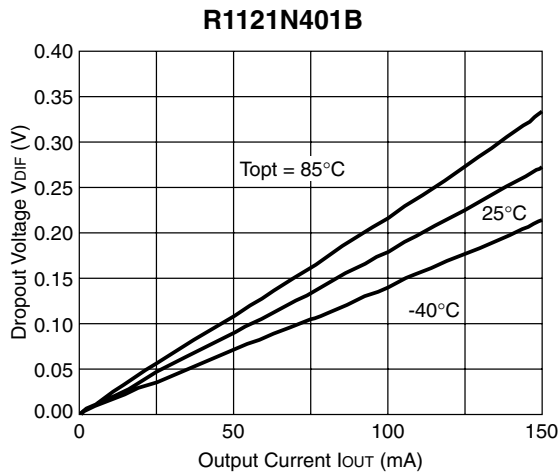
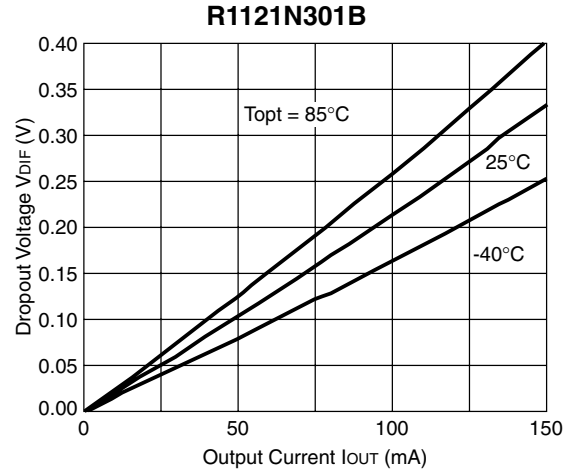
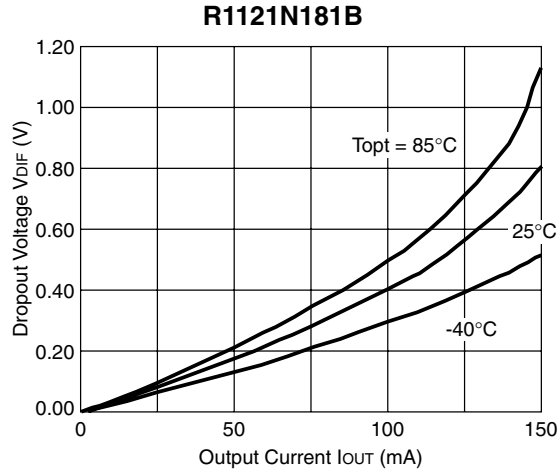


2) Output Voltage vs. Input Voltage





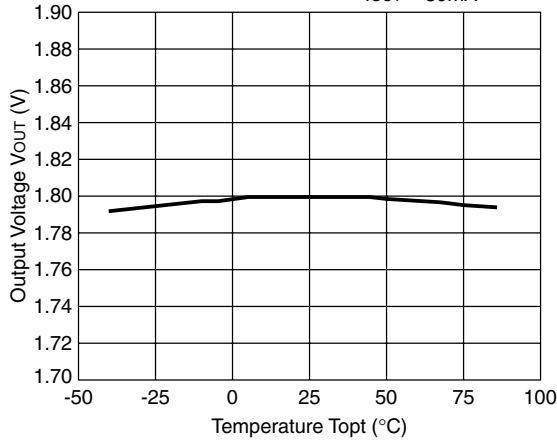
3) Dropout Voltage vs. Output Current



4) Output Voltage vs. Temperature

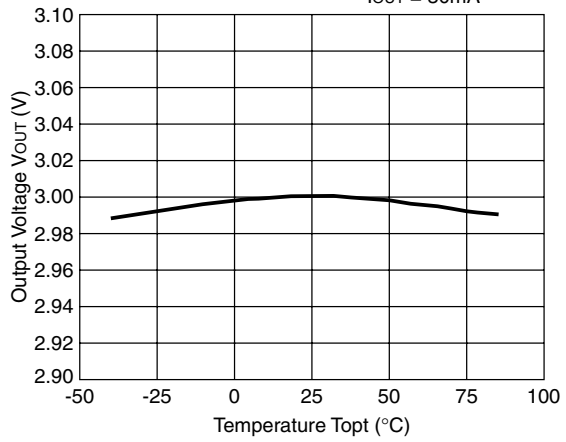
R1121N181B

$V_{IN} = 2.8V$
 $I_{OUT} = 30mA$



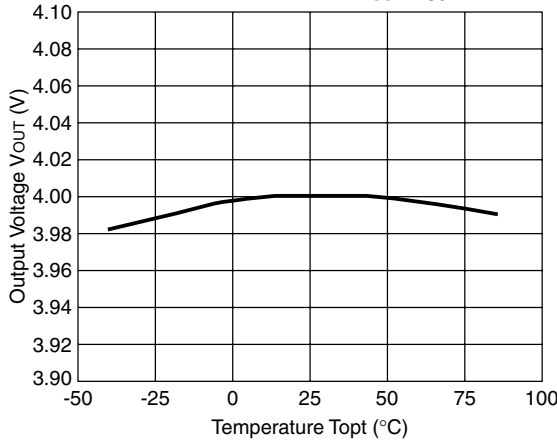
R1121N301B

$V_{IN} = 4.0V$
 $I_{OUT} = 30mA$



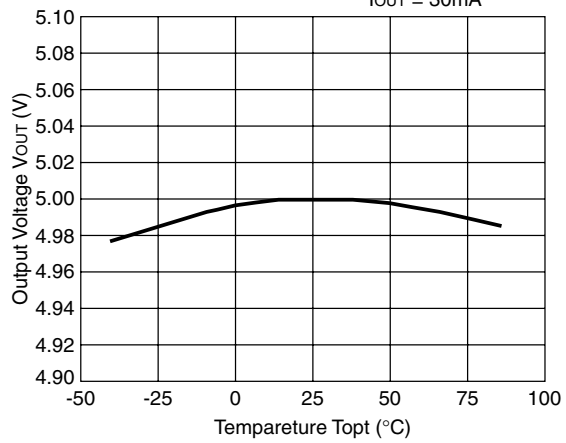
R1121N401B

$V_{IN} = 5.0V$
 $I_{OUT} = 30mA$



R1121N501B

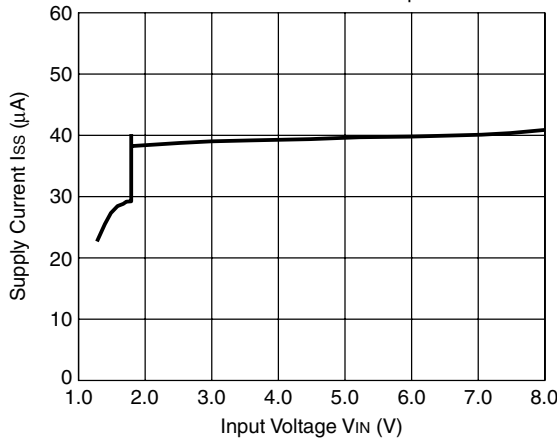
$V_{IN} = 6.0V$
 $I_{OUT} = 30mA$



5) Supply Current vs. Input Voltage

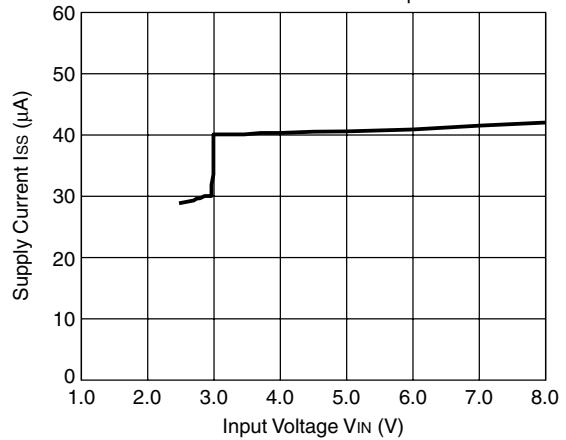
R1121N181B

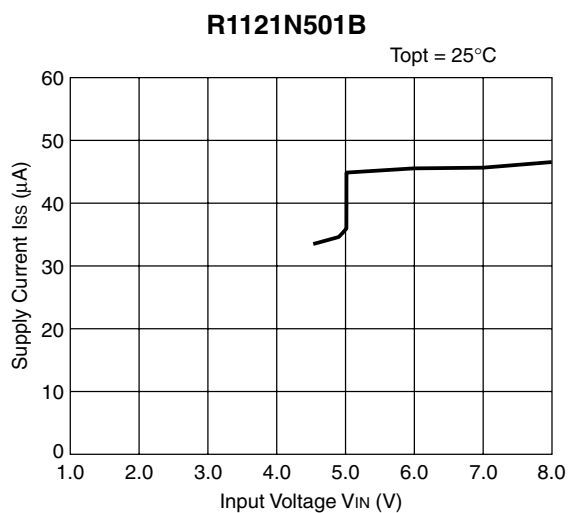
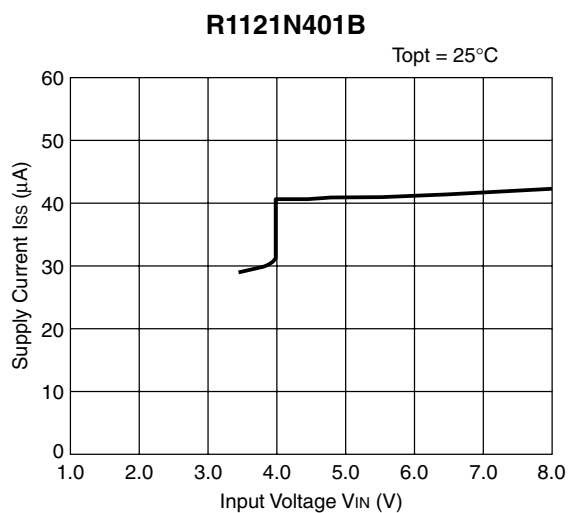
$T_{opt} = 25^{\circ}C$



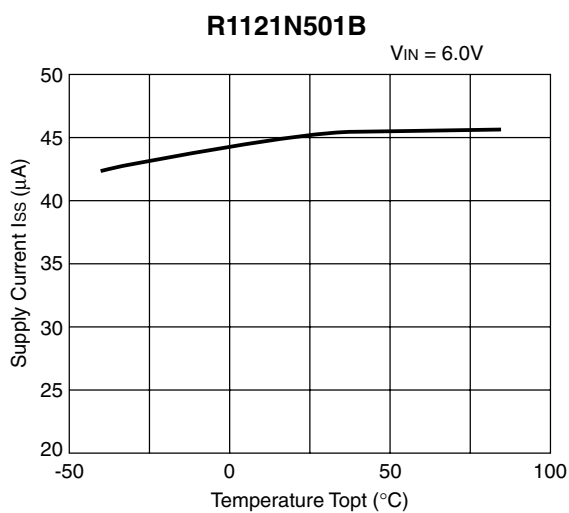
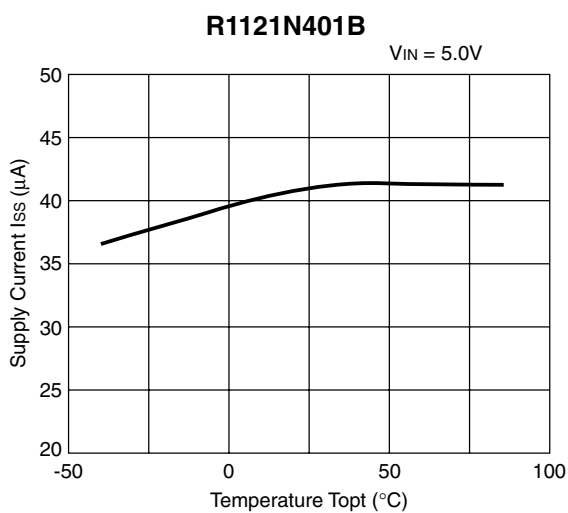
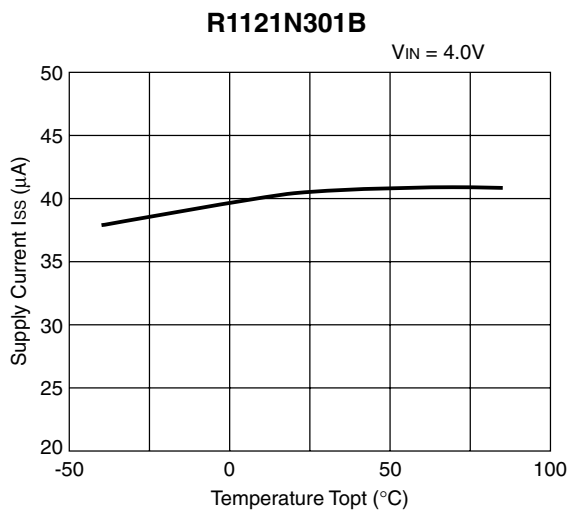
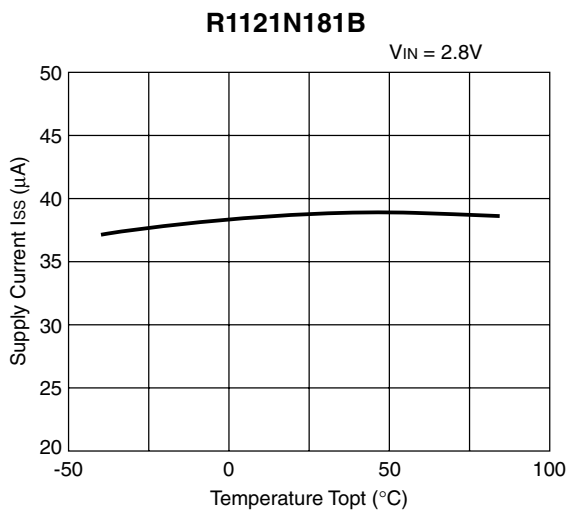
R1121N301B

$T_{opt} = 25^{\circ}C$





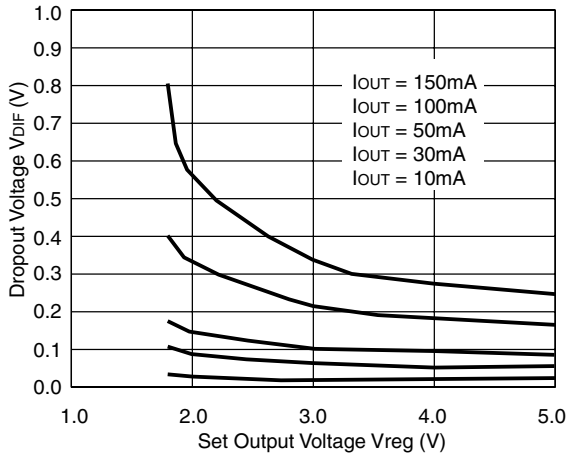
6) Supply Current vs. Temperature



7) Dropout Voltage vs. Set Output Voltage

R1121Nxx1B

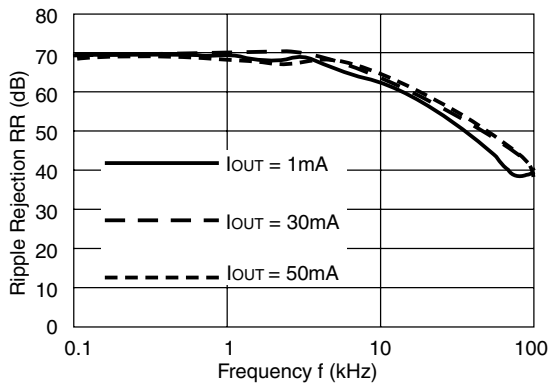
$T_{opt} = 25^{\circ}\text{C}$



8) Ripple Rejection vs. Frequency

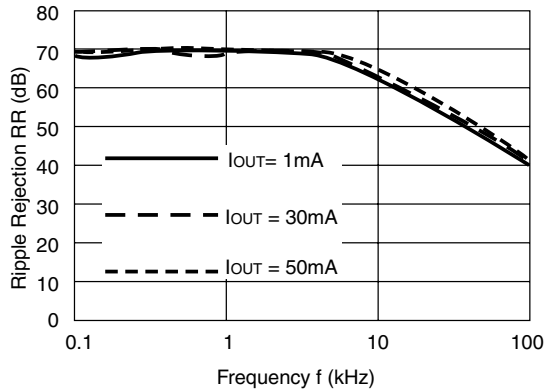
R1121N181B

$V_{IN} = 2.8\text{V}_{DC} + 0.5\text{V}_{p-p}$
 $C_{OUT} = \text{tantal } 1.0\mu\text{F}$



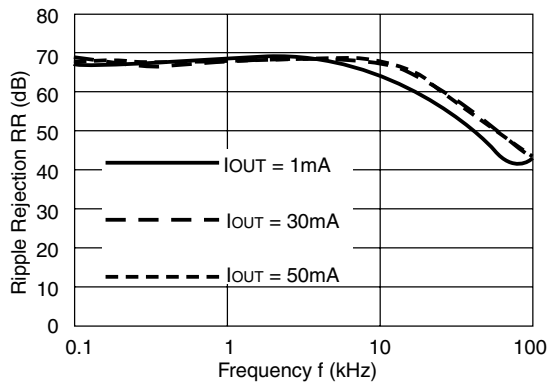
R1121N181B

$V_{IN} = 2.8\text{V}_{DC} + 0.5\text{V}_{p-p}$
 $C_{OUT} = \text{tantal } 2.2\mu\text{F}$



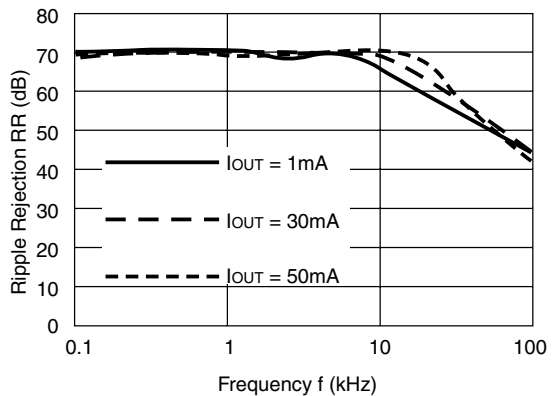
R1121N301B

$V_{IN} = 4.0\text{V}_{DC} + 0.5\text{V}_{p-p}$
 $C_{OUT} = \text{tantal } 1.0\mu\text{F}$



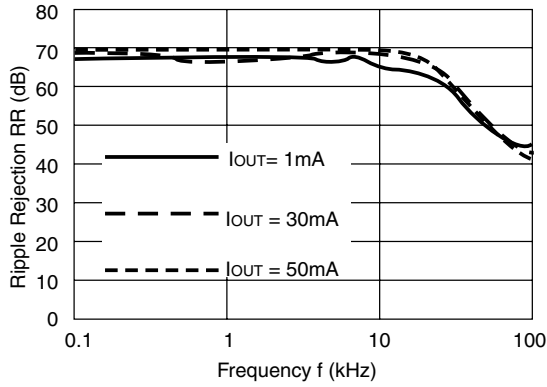
R1121N301B

$V_{IN} = 4.0\text{V}_{DC} + 0.5\text{V}_{p-p}$
 $C_{OUT} = \text{tantal } 2.2\mu\text{F}$



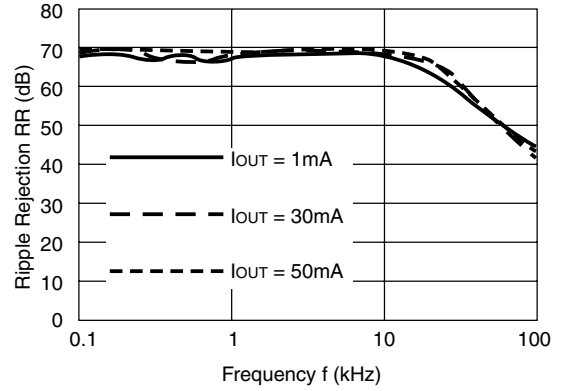
R1121N401B

$V_{IN} = 5.0V_{DC} + 0.5V_{p-p}$
 $C_{OUT} = \text{tantal } 1.0\mu F$



R1121N401B

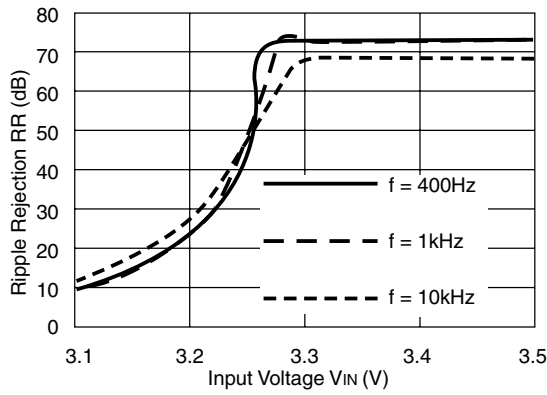
$V_{IN} = 5.0V_{DC} + 0.5V_{p-p}$
 $C_{OUT} = \text{tantal } 2.2\mu F$



9) Ripple Rejection vs. Input Voltage (DC bias)

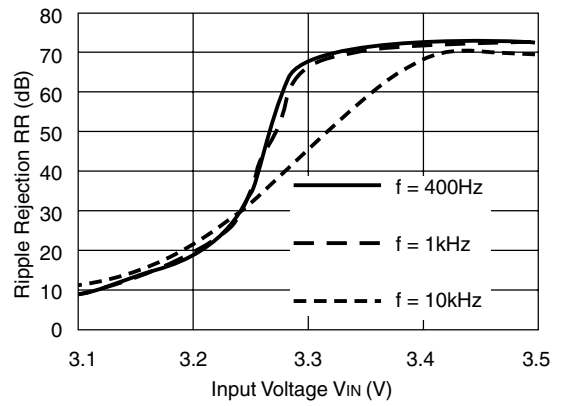
R1121N301B

$I_{OUT} = 1mA$
 $C_{OUT} = 2.2\mu F$



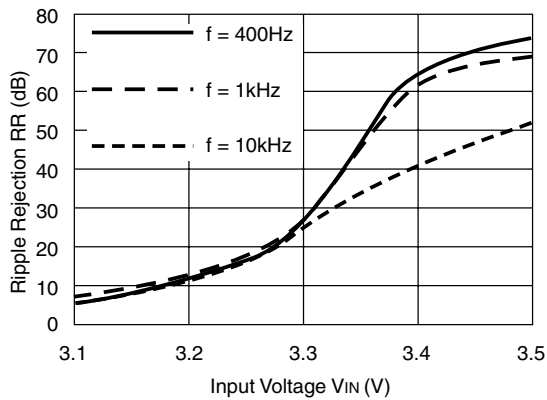
R1121N301B

$I_{OUT} = 10mA$
 $C_{OUT} = 2.2\mu F$



R1121N301B

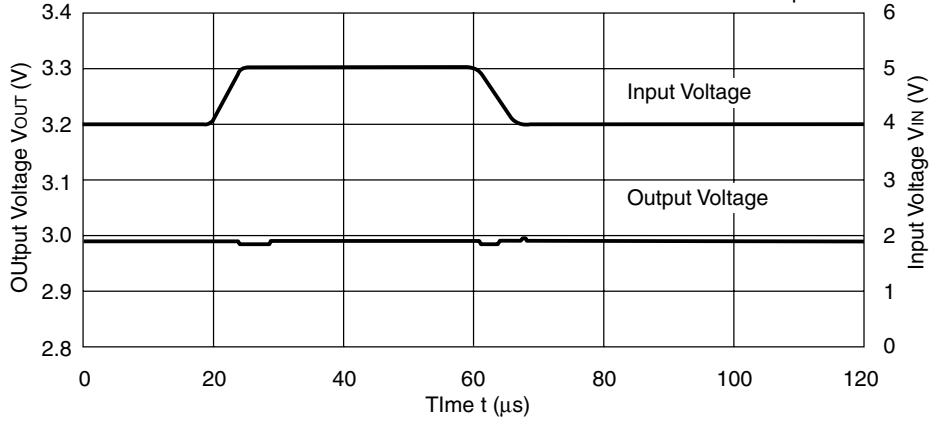
$I_{OUT} = 50mA$
 $C_{OUT} = 2.2\mu F$



10) Line Transient Response

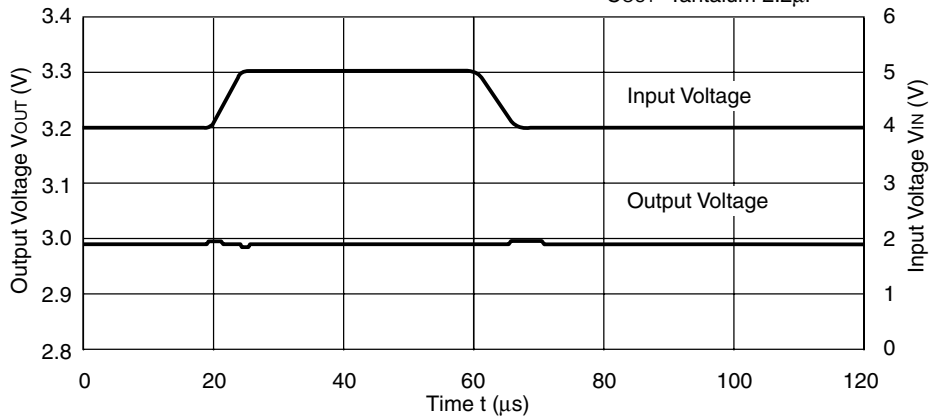
R1121N301B

$I_{OUT}=30\text{mA}$
 $t_r=t_f=5\ \mu\text{s}$
 $C_{OUT}=\text{Tantalum } 1.0\mu\text{F}$



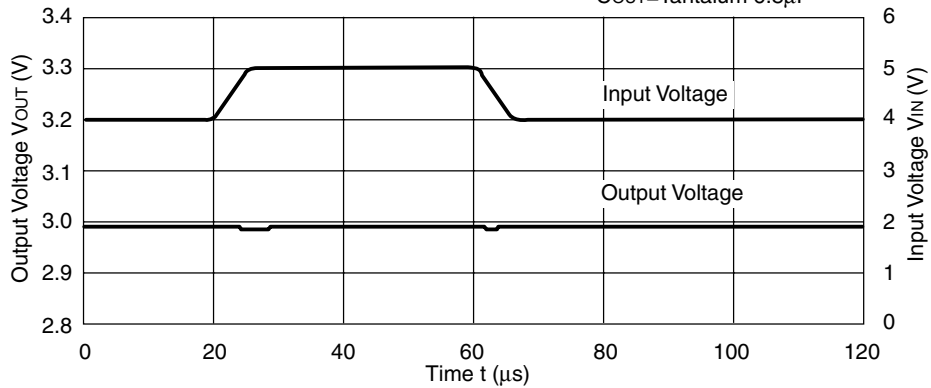
R1121N301B

$I_{OUT}=30\text{mA}$
 $t_r=t_f=5\ \mu\text{s}$
 $C_{OUT}=\text{Tantalum } 2.2\mu\text{F}$



R1121N301B

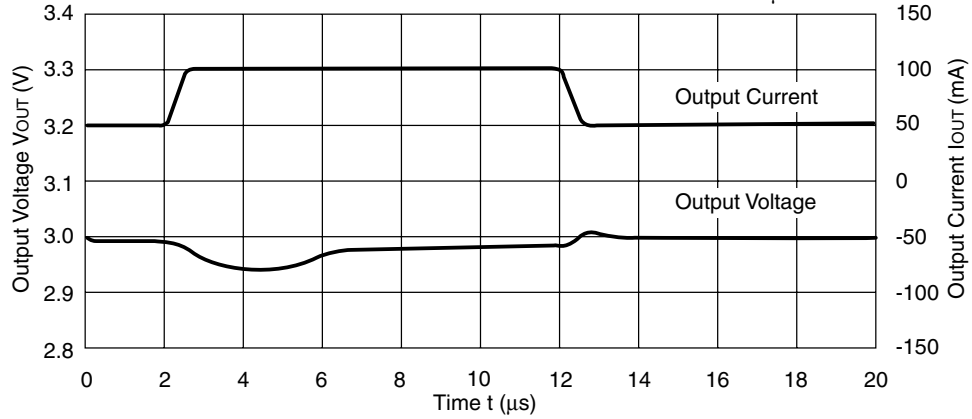
$I_{OUT}=30\text{mA}$
 $t_r=t_f=5\ \mu\text{s}$
 $C_{OUT}=\text{Tantalum } 6.8\mu\text{F}$



11) Load Transient Response

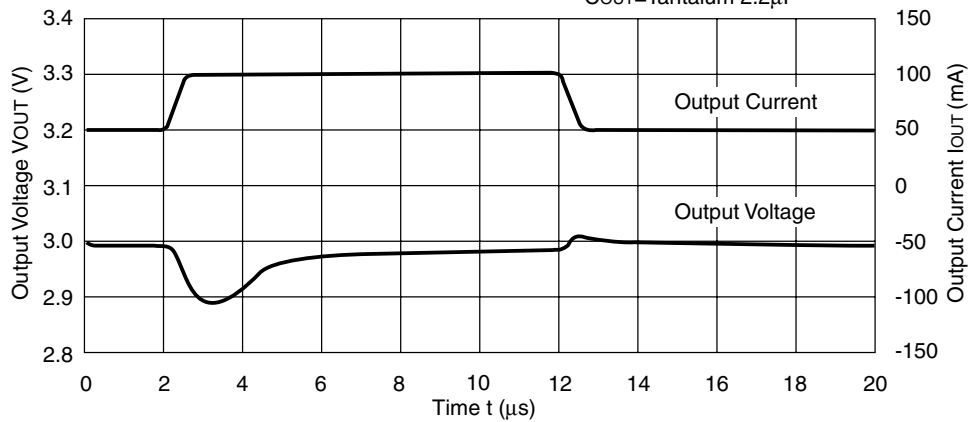
R1121N301B

$V_{IN}=4V$
 $C_{IN}=\text{Tantalum } 1\mu F$
 $C_{OUT}=\text{Tantalum } 1.0\mu F$



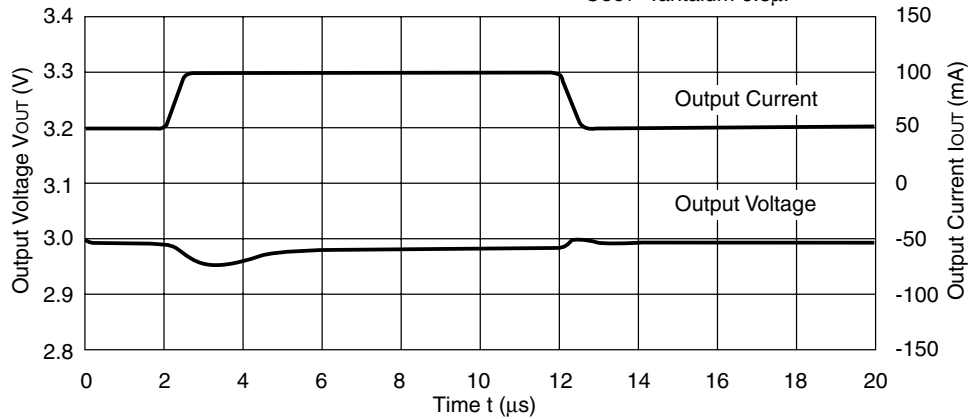
R1121N301B

$V_{IN}=4V$
 $C_{IN}=\text{Tantalum } 1\mu F$
 $C_{OUT}=\text{Tantalum } 2.2\mu F$



R1121N301B

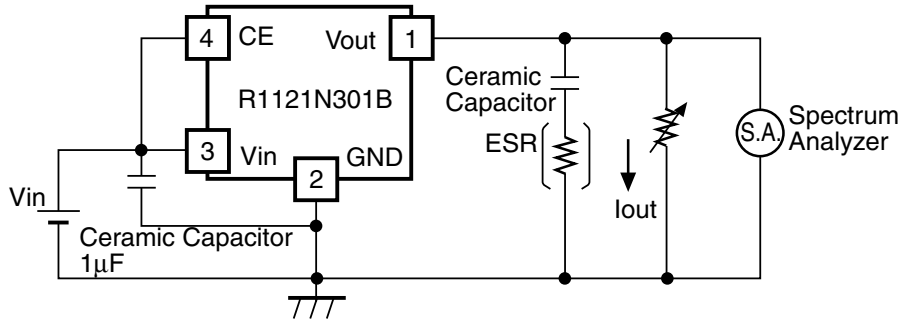
$V_{IN}=4V$
 $C_{IN}=\text{Tantalum } 1\mu F$
 $C_{OUT}=\text{Tantalum } 6.8\mu F$



TECHNICAL NOTES

When using these ICs, be sure to consider following points:

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



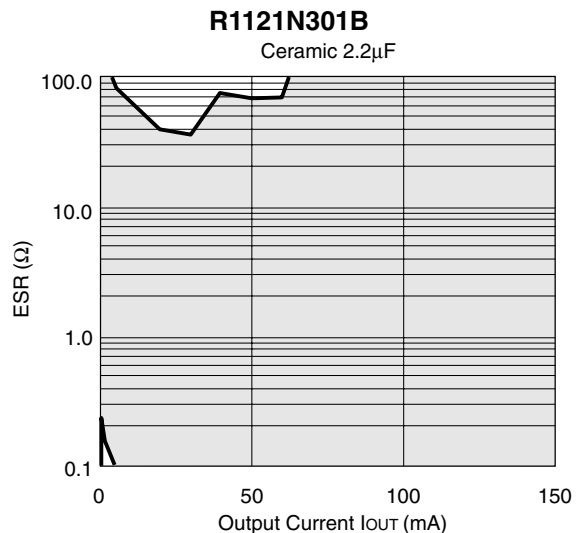
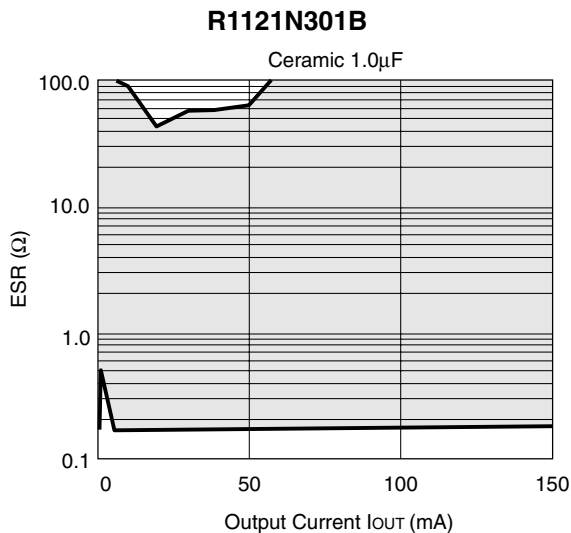
Measuring Circuit for white noise ; R1121N301B

The relationship between I_{OUT} (output current) and ESR of output capacitor is shown in the graphs below. The conditions when the white noise level is under $40\mu V$ (Avg.) are indicated by the hatched area in the graph.

(note: When the 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 the same external components as the ones to be used on the PCB.)

<measuring conditions>

- (1) $V_{IN} = 4V$
- (2) Frequency band :10Hz to 1MHz
- (3) Temperature : $25^{\circ}C$



- Make V_{DD} and GND lines sufficient. If their impedance is high, noise pick-up or incorrect operation may result.
- Connect the capacitor with a capacitance of $1\mu\text{F}$ or more between V_{DD} and GND as close as possible.
- Set external components, especially output capacitor, as close as possible to the ICs and make wiring as short as possible.

TYPICAL APPLICATION

