

## VOLTAGE REGULATOR

NO. EA-016-130402

### OUTLINE

The Rx5RE Series are CMOS-based voltage regulator ICs with high output voltage accuracy and ultra-low quiescent current. Each of these ICs consists of a voltage reference unit, an error amplifier, a driver transistor, and resistors for setting output voltage, and a current limit circuit. By use of these ICs, a constant voltage power supply circuit with high efficiency can be constructed because the dropout voltage and quiescent current of these ICs are very small. Furthermore, these ICs have a built-in current limit circuit. The output voltage of these ICs is fixed with high accuracy.

Two types of packages, TO-92 (**Discontinued**) and SOT-89 (Mini-power Mold) are available.

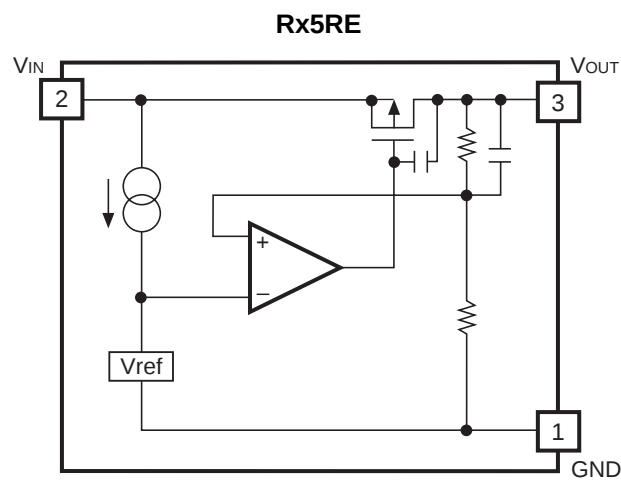
### FEATURES

- Supply Current ..... Typ. 1.1 $\mu$ A ( $V_{OUT}=3.0V$ ,  $V_{IN}=5.0V$ )
- Dropout Voltage ..... Typ. 0.5V ( $I_{OUT}=60mA$ ,  $V_{OUT}=2.8V$ )
- Output Current ..... Typ. 120mA ( $V_{OUT}=5.0V$ )
- Input Voltage Range ..... Max. 10.0V
- Output Voltage Range..... 2.0V to 6.0V (0.1V steps)  
(For other voltages, please refer to MARK INFORMATION.)
- Output Voltage Accuracy.....  $\pm 2.5\%$
- Temperature-Drift Coefficient of Output Voltage ..... Typ.  $\pm 100ppm/^{\circ}C$
- Line Regulation ..... Typ. 0.1%/V
- Packages ..... SOT-89 (Mini-power Mold), TO-92 (**Discontinued**)

### APPLICATIONS

- Power source for battery-powered equipment
- Power source for cameras, video instruments such as camcorders, VCRs, and hand-held communication equipment
- Precision voltage references

BLOCK DIAGRAMS



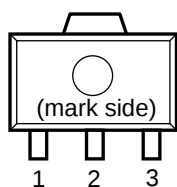
SELECTION GUIDE

The output voltage and package for the ICs can be selected at the user's request.

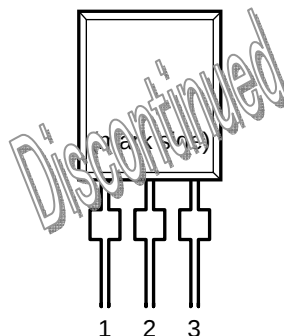
| Product Name                                                                                                                                                | Package              | Quantity per Reel | Pb Free | Halogen Free |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------|---------|--------------|
| RH5RExxAA-T1-FE                                                                                                                                             | SOT-89               | 1,000 pcs         | Yes     | Yes          |
| RE5RExxAA-TZ-F                                                                                                                                              | TO-92 (Discontinued) | 2,500 pcs         | Yes     | No           |
| xx: The output voltage can be designated in the range from 2.0V (20) to 6.0V (60) in 0.1V steps.<br>(For other voltages, please refer to MARK INFORMATION.) |                      |                   |         |              |

## PIN CONFIGURATION

### • SOT-89



### • TO-92



## PIN DESCRIPTION

### • SOT-89

| Pin No | Symbol    | Pin Description |
|--------|-----------|-----------------|
| 1      | GND       | Ground Pin      |
| 2      | $V_{IN}$  | Input Pin       |
| 3      | $V_{OUT}$ | Output Pin      |

### • TO-92 (Discontinued)

| Pin No | Symbol    | Pin Description |
|--------|-----------|-----------------|
| 1      | GND       | Ground Pin      |
| 2      | $V_{IN}$  | Input Pin       |
| 3      | $V_{OUT}$ | Output Pin      |

## ABSOLUTE MAXIMUM RATINGS

| Symbol       | Item                                      | Rating                            | Unit               |
|--------------|-------------------------------------------|-----------------------------------|--------------------|
| $V_{IN}$     | Input Voltage                             | 12                                | V                  |
| $V_{OUT}$    | Output Voltage                            | $-0.3$ to $V_{IN}+0.3$            | V                  |
| $I_{OUT}$    | Output Current                            | 300                               | mA                 |
| $P_D$        | Power Dissipation* (SOT-89)               | 900                               | mW                 |
|              | Power Dissipation* (TO-92) (Discontinued) | 300                               |                    |
| $T_{opt}$    | Operating Temperature Range               | $-40$ to $85$                     | $^{\circ}\text{C}$ |
| $T_{stg}$    | Storage Temperature Range                 | $-55$ to $125$                    | $^{\circ}\text{C}$ |
| $T_{solder}$ | Lead Temperature (Soldering)              | $260^{\circ}\text{C}, 10\text{s}$ |                    |

\*) For Power Dissipation, please refer to PACKAGE INFORMATION.

### ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field.

The functional operation at or over these absolute maximum ratings is not assured.

### RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

## ELECTRICAL CHARACTERISTICS

### • Rx5RE20A

T<sub>opt</sub>=25°C

| Symbol                                  | Item                                   | Conditions                                                            | Min.  | Typ.  | Max.  | Unit   |
|-----------------------------------------|----------------------------------------|-----------------------------------------------------------------------|-------|-------|-------|--------|
| V <sub>OUT</sub>                        | Output Voltage                         | V <sub>IN</sub> =4.0V, I <sub>OUT</sub> =10mA                         | 1.950 | 2.000 | 2.050 | V      |
| I <sub>OUT</sub>                        | Output Current                         | V <sub>IN</sub> =4.0V                                                 | 40    | 60    |       | mA     |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ | Load Regulation                        | V <sub>IN</sub> =4.0V<br>1mA≤I <sub>OUT</sub> ≤50mA                   |       | 40    | 80    | mV     |
| V <sub>DIF</sub>                        | Dropout Voltage                        | I <sub>OUT</sub> =30mA                                                |       | 0.5   | 0.7   | V      |
| I <sub>SS</sub>                         | Quiescent Current                      | V <sub>IN</sub> =4.0V                                                 |       | 1.0   | 3.0   | μA     |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN}}$  | Line Regulation                        | I <sub>OUT</sub> =10mA<br>V <sub>OUT</sub> +1.0V≤V <sub>IN</sub> ≤10V |       | 0.1   |       | %/V    |
| V <sub>IN</sub>                         | Input Voltage                          |                                                                       |       |       | 10    | V      |
| I <sub>lim</sub>                        | Current Limit                          |                                                                       |       | 240   |       | mA     |
| $\frac{\Delta V_{OUT}}{\Delta T_{opt}}$ | Output Voltage Temperature Coefficient | I <sub>OUT</sub> =10mA<br>-40°C≤T <sub>opt</sub> ≤85°C                |       | ±100  |       | ppm/°C |

### • Rx5RE30A

T<sub>opt</sub>=25°C

| Symbol                                  | Item                                   | Conditions                                                            | Min.  | Typ.  | Max.  | Unit   |
|-----------------------------------------|----------------------------------------|-----------------------------------------------------------------------|-------|-------|-------|--------|
| V <sub>OUT</sub>                        | Output Voltage                         | V <sub>IN</sub> =5.0V, I <sub>OUT</sub> =10mA                         | 2.925 | 3.000 | 3.075 | V      |
| I <sub>OUT</sub>                        | Output Current                         | V <sub>IN</sub> =5.0V                                                 | 50    | 80    |       | mA     |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ | Load Regulation                        | V <sub>IN</sub> =5.0V<br>1mA≤I <sub>OUT</sub> ≤60mA                   |       | 40    | 80    | mV     |
| V <sub>DIF</sub>                        | Dropout Voltage                        | I <sub>OUT</sub> =40mA                                                |       | 0.5   | 0.7   | V      |
| I <sub>SS</sub>                         | Quiescent Current                      | V <sub>IN</sub> =5.0V                                                 |       | 1.1   | 3.3   | μA     |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN}}$  | Line Regulation                        | I <sub>OUT</sub> =10mA<br>V <sub>OUT</sub> +1.0V≤V <sub>IN</sub> ≤10V |       | 0.1   |       | %/V    |
| V <sub>IN</sub>                         | Input Voltage                          |                                                                       |       |       | 10    | V      |
| I <sub>lim</sub>                        | Current Limit                          |                                                                       |       | 240   |       | mA     |
| $\frac{\Delta V_{OUT}}{\Delta T_{opt}}$ | Output Voltage Temperature Coefficient | I <sub>OUT</sub> =10mA<br>-40°C≤T <sub>opt</sub> ≤85°C                |       | ±100  |       | ppm/°C |

## • Rx5RE40A

Topt=25°C

| Symbol                                  | Item                                   | Conditions                                                            | Min.  | Typ.  | Max.  | Unit   |
|-----------------------------------------|----------------------------------------|-----------------------------------------------------------------------|-------|-------|-------|--------|
| V <sub>OUT</sub>                        | Output Voltage                         | V <sub>IN</sub> =6.0V, I <sub>OUT</sub> =10mA                         | 3.900 | 4.000 | 4.100 | V      |
| I <sub>OUT</sub>                        | Output Current                         | V <sub>IN</sub> =6.0V                                                 | 65    | 100   |       | mA     |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ | Load Regulation                        | V <sub>IN</sub> =6.0V<br>1mA≤I <sub>OUT</sub> ≤70mA                   |       | 40    | 80    | mV     |
| V <sub>DIF</sub>                        | Dropout Voltage                        | I <sub>OUT</sub> =50mA                                                |       | 0.5   | 0.7   | V      |
| I <sub>SS</sub>                         | Quiescent Current                      | V <sub>IN</sub> =6.0V                                                 |       | 1.2   | 3.6   | μA     |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN}}$  | Line Regulation                        | I <sub>OUT</sub> =10mA<br>V <sub>OUT</sub> +1.0V≤V <sub>IN</sub> ≤10V |       | 0.1   |       | %/V    |
| V <sub>IN</sub>                         | Input Voltage                          |                                                                       |       |       | 10    | V      |
| I <sub>lim</sub>                        | Current Limit                          |                                                                       |       | 240   |       | mA     |
| $\frac{\Delta V_{OUT}}{\Delta T_{opt}}$ | Output Voltage Temperature Coefficient | I <sub>OUT</sub> =10mA<br>−40°C≤T <sub>opt</sub> ≤85°C                |       | ±100  |       | ppm/°C |

## • Rx5RE50A

Topt=25°C

| Symbol                                  | Item                                   | Conditions                                                            | Min.  | Typ.  | Max.  | Unit   |
|-----------------------------------------|----------------------------------------|-----------------------------------------------------------------------|-------|-------|-------|--------|
| V <sub>OUT</sub>                        | Output Voltage                         | V <sub>IN</sub> =7.0V, I <sub>OUT</sub> =10mA                         | 4.875 | 5.000 | 5.125 | V      |
| I <sub>OUT</sub>                        | Output Current                         | V <sub>IN</sub> =7.0V                                                 | 80    | 120   |       | mA     |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ | Load Regulation                        | V <sub>IN</sub> =7.0V<br>1mA≤I <sub>OUT</sub> ≤80mA                   |       | 40    | 80    | mV     |
| V <sub>DIF</sub>                        | Dropout Voltage                        | I <sub>OUT</sub> =60mA                                                |       | 0.5   | 0.7   | V      |
| I <sub>SS</sub>                         | Quiescent Current                      | V <sub>IN</sub> =7.0V                                                 |       | 1.3   | 3.9   | μA     |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN}}$  | Line Regulation                        | I <sub>OUT</sub> =10mA<br>V <sub>OUT</sub> +1.0V≤V <sub>IN</sub> ≤10V |       | 0.1   |       | %/V    |
| V <sub>IN</sub>                         | Input Voltage                          |                                                                       |       |       | 10    | V      |
| I <sub>lim</sub>                        | Current Limit                          |                                                                       |       | 240   |       | mA     |
| $\frac{\Delta V_{OUT}}{\Delta T_{opt}}$ | Output Voltage Temperature Coefficient | I <sub>OUT</sub> =10mA<br>−40°C≤T <sub>opt</sub> ≤85°C                |       | ±100  |       | ppm/°C |

## • Rx5RE60A

T<sub>opt</sub>=25°C

| Symbol                                  | Item                                      | Conditions                                                               | Min.  | Typ.  | Max.  | Unit   |
|-----------------------------------------|-------------------------------------------|--------------------------------------------------------------------------|-------|-------|-------|--------|
| V <sub>OUT</sub>                        | Output Voltage                            | V <sub>IN</sub> =8.0V, I <sub>OUT</sub> =10mA                            | 5.850 | 6.000 | 6.150 | V      |
| I <sub>OUT</sub>                        | Output Current                            | V <sub>IN</sub> =8.0V                                                    | 80    | 120   |       | mA     |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ | Load Regulation                           | V <sub>IN</sub> =8.0V<br>1mA ≤ I <sub>OUT</sub> ≤ 80mA                   |       | 40    | 80    | mV     |
| V <sub>DIF</sub>                        | Dropout Voltage                           | I <sub>OUT</sub> =60mA                                                   |       | 0.5   | 0.7   | V      |
| I <sub>SS</sub>                         | Quiescent Current                         | V <sub>IN</sub> =8.0V                                                    |       | 1.4   | 4.2   | μA     |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN}}$  | Line Regulation                           | I <sub>OUT</sub> =10mA<br>V <sub>OUT</sub> +1.0V ≤ V <sub>IN</sub> ≤ 10V |       | 0.1   |       | %/V    |
| V <sub>IN</sub>                         | Input Voltage                             |                                                                          |       |       | 10    | V      |
| I <sub>lim</sub>                        | Current Limit                             |                                                                          |       | 240   |       | mA     |
| $\frac{\Delta V_{OUT}}{\Delta T_{opt}}$ | Output Voltage<br>Temperature Coefficient | I <sub>OUT</sub> =10mA<br>-40°C ≤ T <sub>opt</sub> ≤ 85°C                |       | ±100  |       | ppm/°C |

## ELECTRICAL CHARACTERISTICS BY OUTPUT VOLTAGE

| Part Number | Output Voltage                             |       |       |       | OutputCurrent         |      |                       | Load Regulation                                    |      |      | Dropout Voltage |      |      |
|-------------|--------------------------------------------|-------|-------|-------|-----------------------|------|-----------------------|----------------------------------------------------|------|------|-----------------|------|------|
|             | Vout(V)                                    |       |       |       | Iout(mA)              |      |                       | ΔVout/ΔIout(mV)                                    |      |      | VDiF(V)         |      |      |
|             | Conditions                                 | Min.  | Typ.  | Max.  | Conditions            | Min. | Typ.                  | Conditions                                         | Typ. | Max. | Conditions      | Typ. | Max. |
| Rx5RE20A    | VIN–<br>VOUT<br>=2.0V<br><br>IOUT<br>=10mA | 1.950 | 2.000 | 2.050 | VIN–<br>VOUT<br>=2.0V | 40   | 60                    | VIN–<br>VOUT<br>=2.0V<br><br>1mA≤<br>IOUT<br>≤50mA | 40   | 80   | IOUT<br>=30mA   | 0.5  | 0.7  |
| Rx5RE21A    |                                            | 2.048 | 2.100 | 2.152 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE22A    |                                            | 2.145 | 2.200 | 2.255 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE23A    |                                            | 2.243 | 2.300 | 2.357 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE24A    |                                            | 2.340 | 2.400 | 2.460 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE25A    |                                            | 2.438 | 2.500 | 2.562 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE26A    |                                            | 2.535 | 2.600 | 2.665 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE27A    |                                            | 2.633 | 2.700 | 2.767 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE28A    |                                            | 2.730 | 2.800 | 2.870 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE29A    |                                            | 2.828 | 2.900 | 2.972 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE30A    |                                            | 2.925 | 3.000 | 3.075 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE31A    |                                            | 3.023 | 3.100 | 3.177 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE32A    |                                            | 3.120 | 3.200 | 3.280 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE33A    |                                            | 3.218 | 3.300 | 3.382 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE34A    |                                            | 3.315 | 3.400 | 3.485 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE35A    |                                            | 3.413 | 3.500 | 3.587 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE36A    |                                            | 3.510 | 3.600 | 3.690 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE37A    |                                            | 3.608 | 3.700 | 3.792 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE38A    |                                            | 3.705 | 3.800 | 3.895 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE39A    |                                            | 3.803 | 3.900 | 3.997 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE40A    |                                            | 3.900 | 4.000 | 4.100 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE41A    |                                            | 3.998 | 4.100 | 4.202 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE42A    |                                            | 4.095 | 4.200 | 4.305 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE43A    |                                            | 4.193 | 4.300 | 4.407 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE44A    |                                            | 4.290 | 4.400 | 4.510 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE45A    |                                            | 4.388 | 4.500 | 4.612 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE46A    |                                            | 4.485 | 4.600 | 4.715 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE47A    |                                            | 4.583 | 4.700 | 4.817 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE48A    |                                            | 4.680 | 4.800 | 4.920 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE49A    |                                            | 4.778 | 4.900 | 5.022 |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE50A    | 4.875                                      | 5.000 | 5.125 |       |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE51A    | 4.973                                      | 5.100 | 5.227 |       |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE52A    | 5.070                                      | 5.200 | 5.330 |       |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE53A    | 5.168                                      | 5.300 | 5.432 |       |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE54A    | 5.265                                      | 5.400 | 5.535 |       |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE55A    | 5.363                                      | 5.500 | 5.637 |       |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE56A    | 5.460                                      | 5.600 | 5.740 |       |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE57A    | 5.558                                      | 5.700 | 5.842 |       |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE58A    | 5.655                                      | 5.800 | 5.945 |       |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE59A    | 5.753                                      | 5.900 | 6.047 |       |                       |      |                       |                                                    |      |      |                 |      |      |
| Rx5RE60A    | 5.850                                      | 6.000 | 6.150 |       |                       |      |                       |                                                    |      |      |                 |      |      |
|             |                                            |       |       |       | 80                    | 120  | 1mA≤<br>IOUT<br>≤80mA |                                                    |      |      |                 |      |      |

T<sub>opt</sub>=25°C

| Quiescent Current                              |      |      | Line Regulation                                                                         |      | Input Voltage       | Current Limit         | Output Voltage Tempco.                                               |      |
|------------------------------------------------|------|------|-----------------------------------------------------------------------------------------|------|---------------------|-----------------------|----------------------------------------------------------------------|------|
| I <sub>ss</sub> (μA)                           |      |      | ΔV <sub>OUT</sub> /ΔV <sub>IN</sub> (%/V)                                               |      | V <sub>IN</sub> (V) | I <sub>lim</sub> (mA) | ΔV <sub>OUT</sub> /ΔT(ppm/°C)                                        |      |
| Conditions                                     | Typ. | Max. | Conditions                                                                              | Typ. | Max.                | Typ.                  | Conditions                                                           | Typ. |
| V <sub>IN</sub> –<br>V <sub>OUT</sub><br>=2.0V | 1.0  | 3.0  | I <sub>OUT</sub><br>=10mA<br><br>V <sub>OUT</sub> +<br>1.0V≤<br>V <sub>IN</sub><br>≤10V | 0.1  | 10                  | 240                   | I <sub>OUT</sub><br>=10mA<br><br>–40°C≤<br>T <sub>opt</sub><br>≤85°C | ±100 |
|                                                | 1.1  | 3.3  |                                                                                         |      |                     |                       |                                                                      |      |
|                                                | 1.2  | 3.6  |                                                                                         |      |                     |                       |                                                                      |      |
|                                                | 1.3  | 3.9  |                                                                                         |      |                     |                       |                                                                      |      |
|                                                | 1.4  | 4.2  |                                                                                         |      |                     |                       |                                                                      |      |

## OPERATION

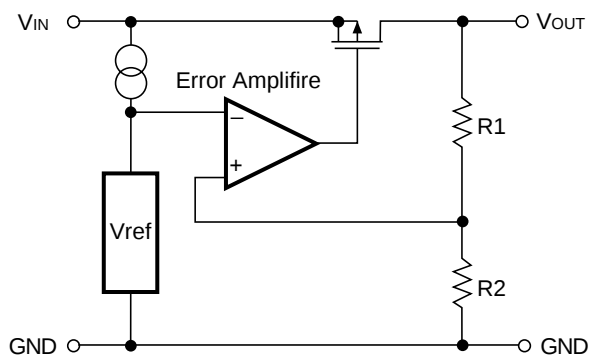


FIG. 1 Block Diagram

Output voltage  $V_{OUT}$  divided at the node between resistors  $R1$  and  $R2$  is compared with reference voltage by error amplifier, so that a constant voltage is output.

## TEST CIRCUITS

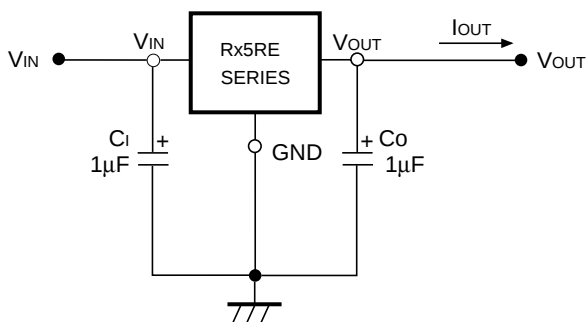


FIG. 2 Test Circuit

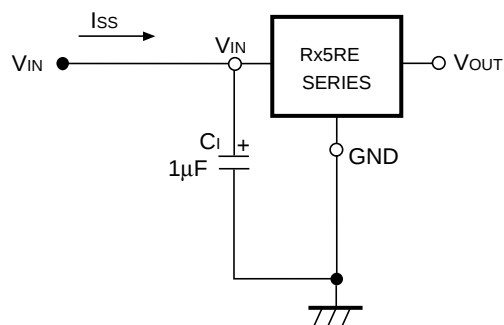


FIG. 3 Quiescent Current Test Circuit

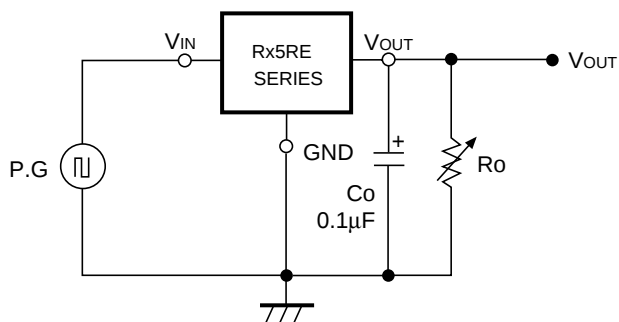
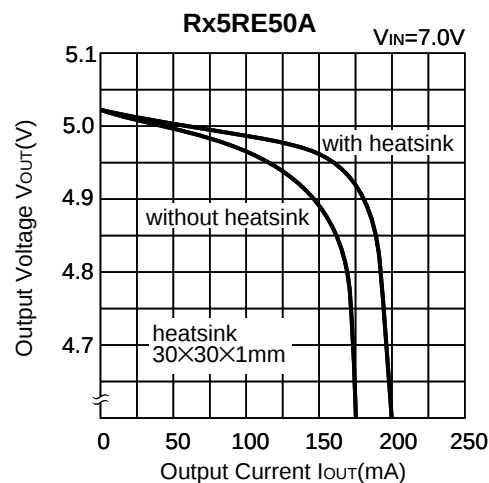
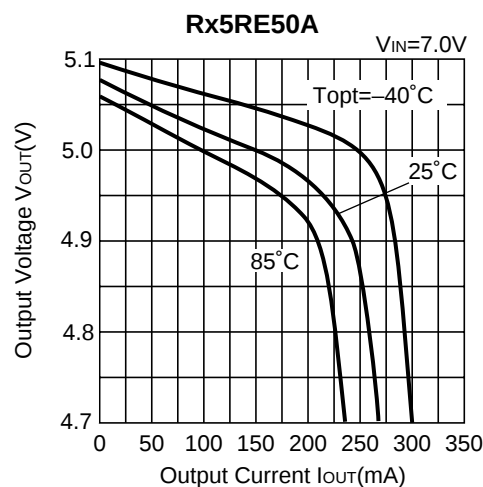
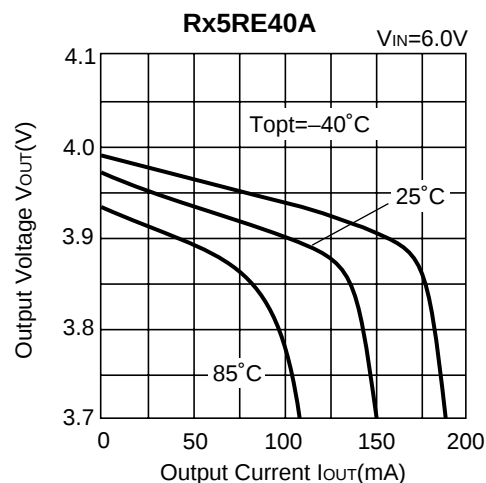
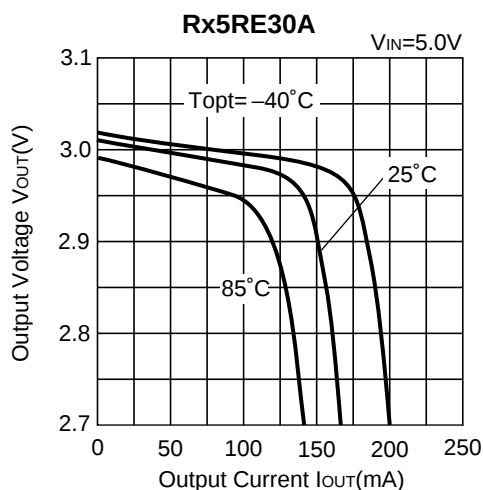


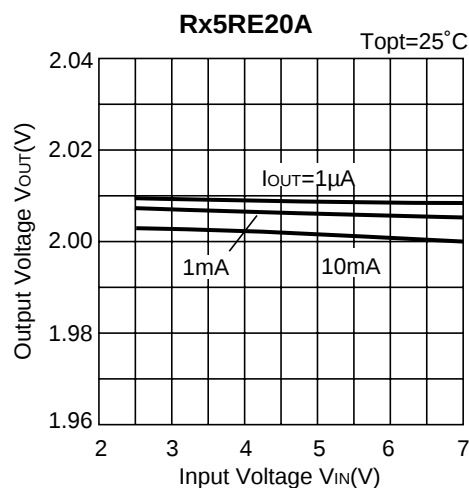
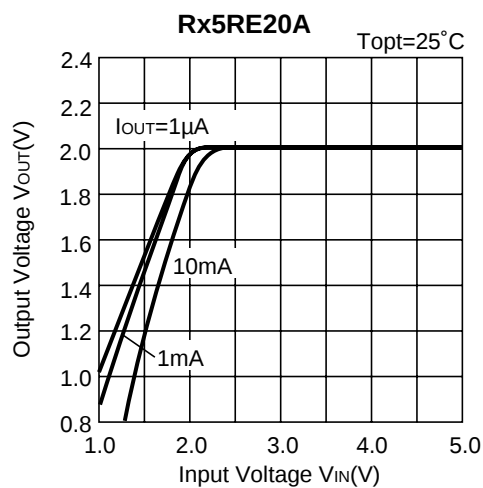
FIG. 4 Line Transient Response Test Circuit

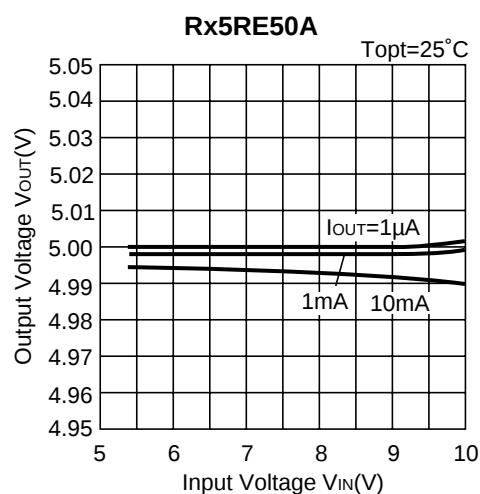
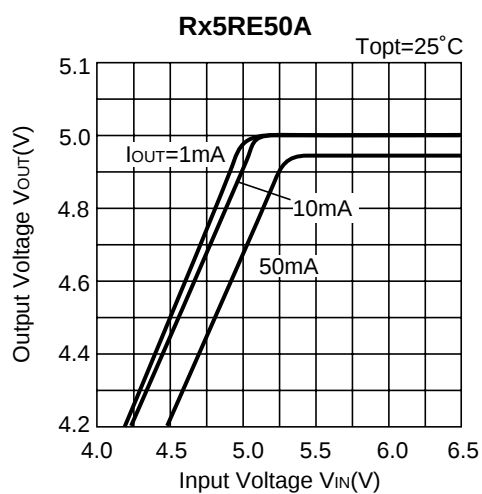
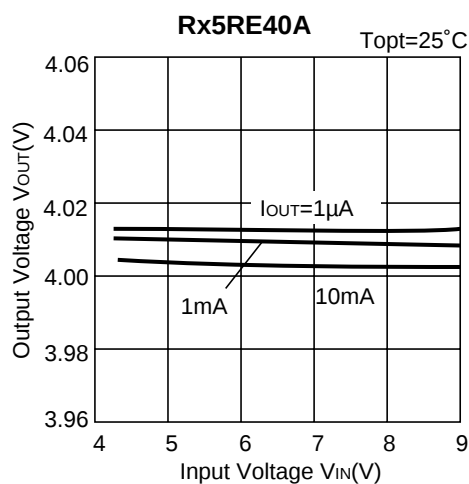
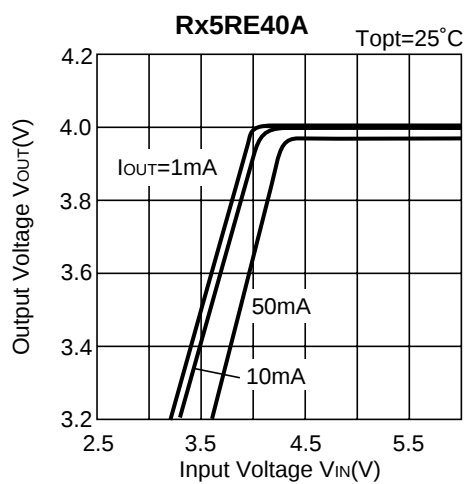
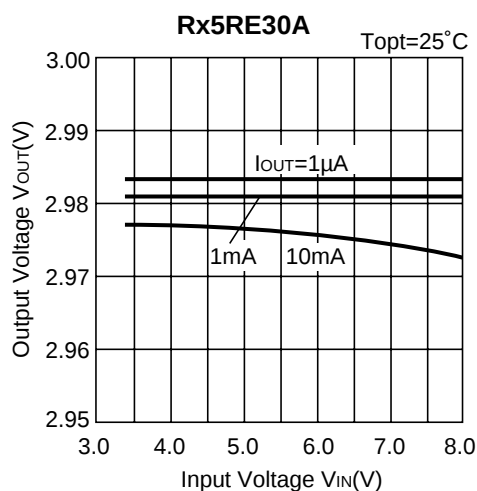
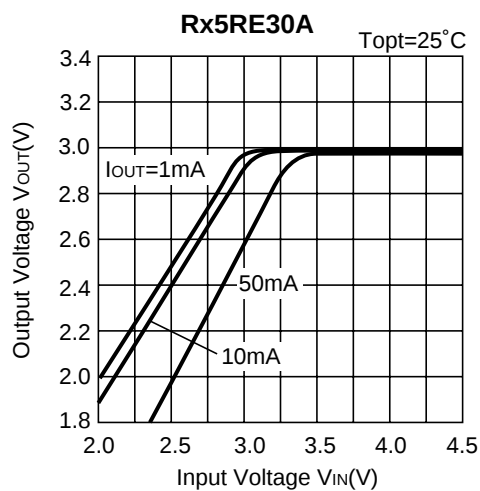
## TYPICAL CHARACTERISTICS

### 1) Output Voltage vs. Output Current

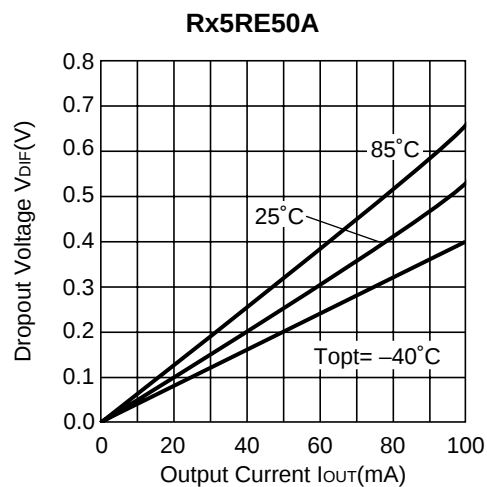
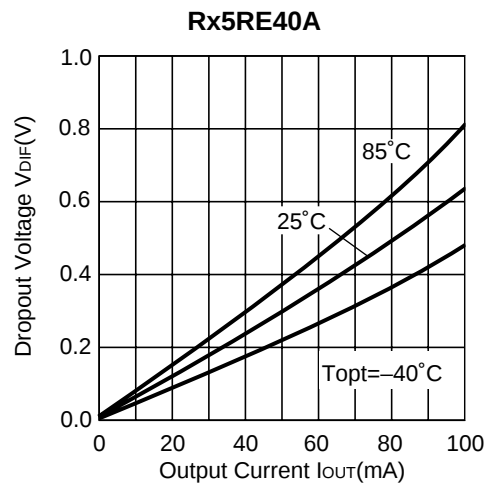
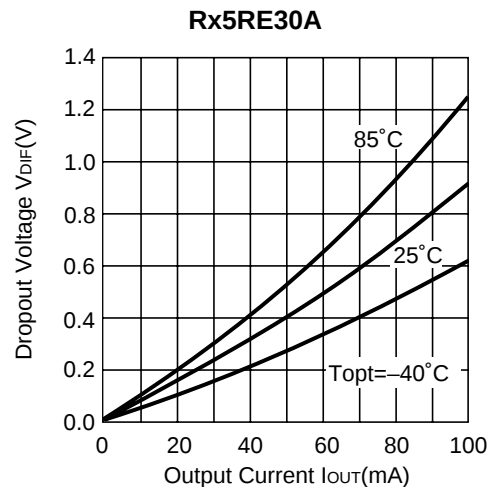


### 2) Output Voltage vs. Input Voltage

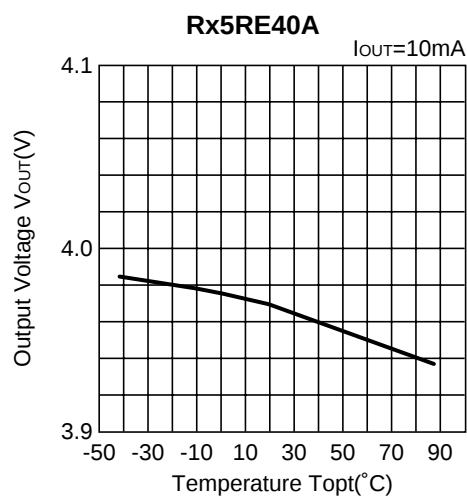
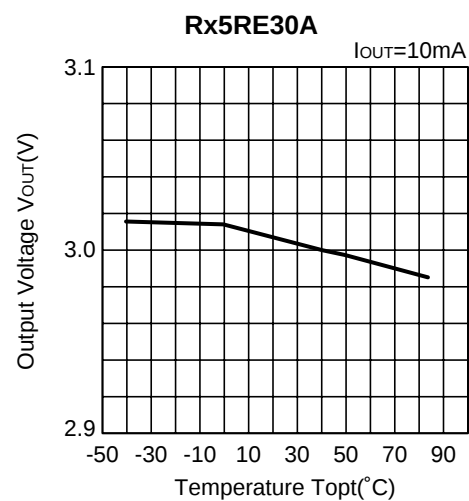


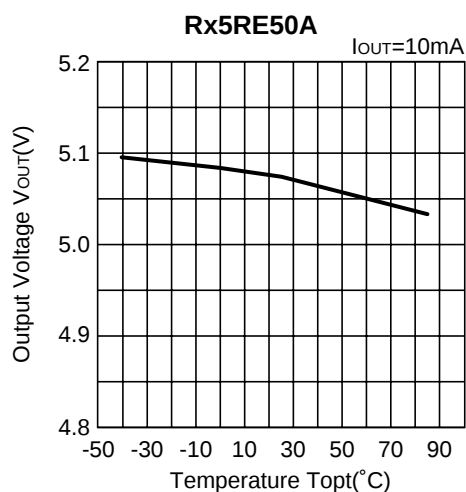


### 3) Dropout Voltage vs. Output Current

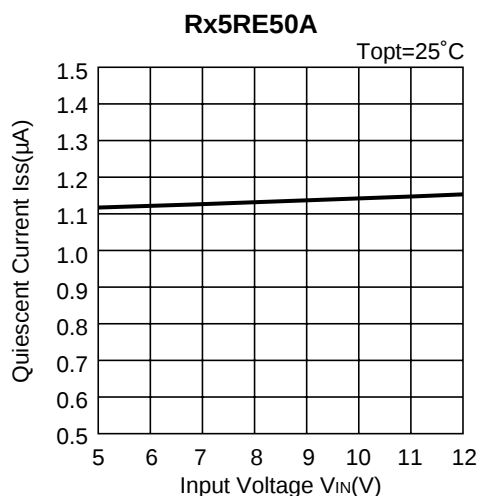
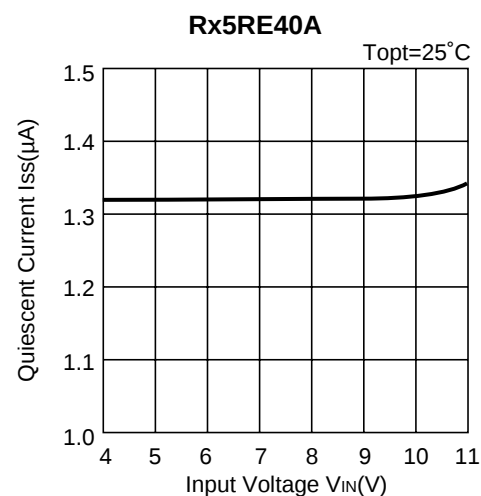
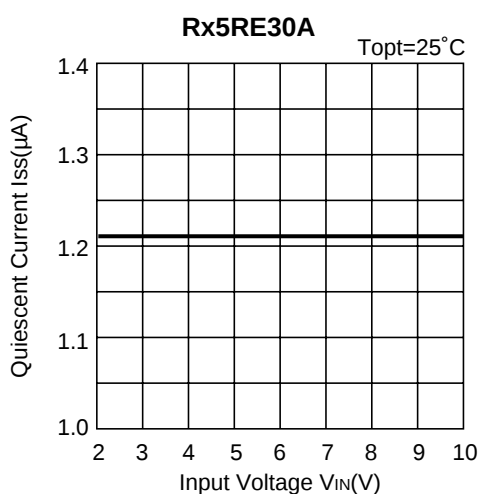
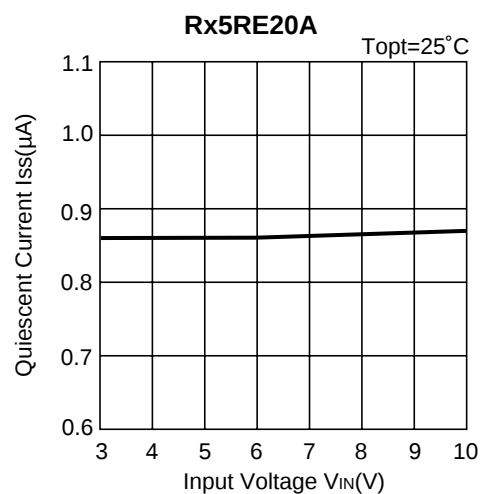


### 4) Output Voltage vs. Temperature



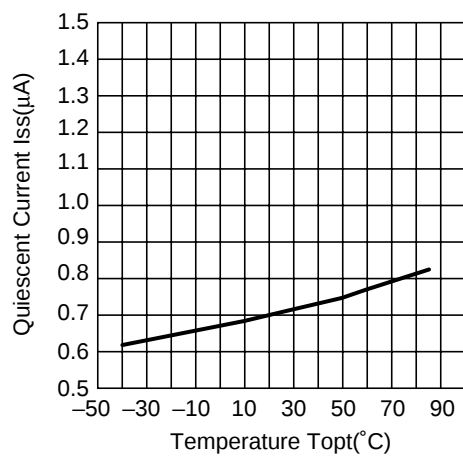


### 5) Quiescent Current vs. Input Voltage

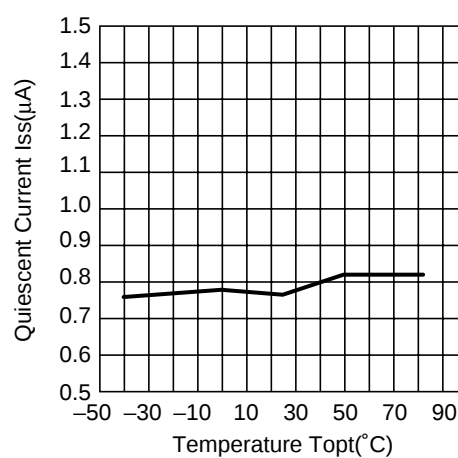


## 6) Quiescent Current vs. Temperature

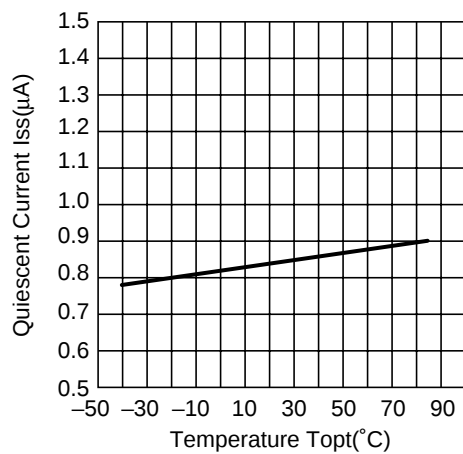
Rx5RE20A



Rx5RE30A

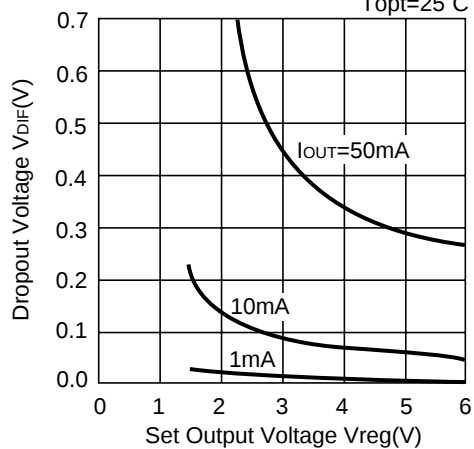


Rx5RE40A

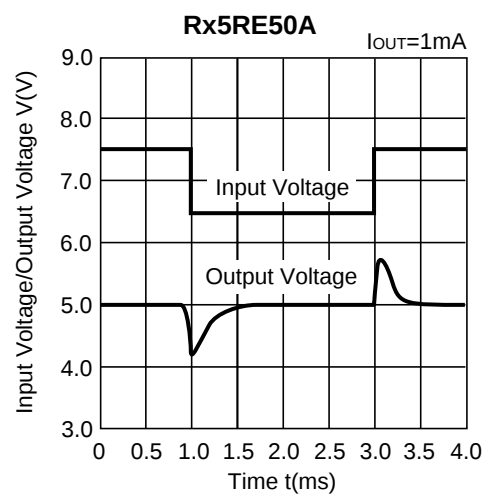
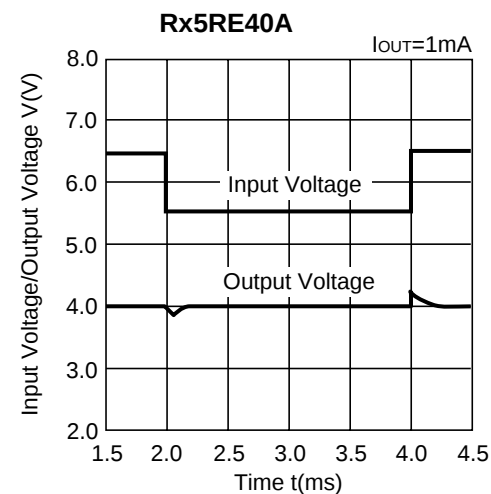
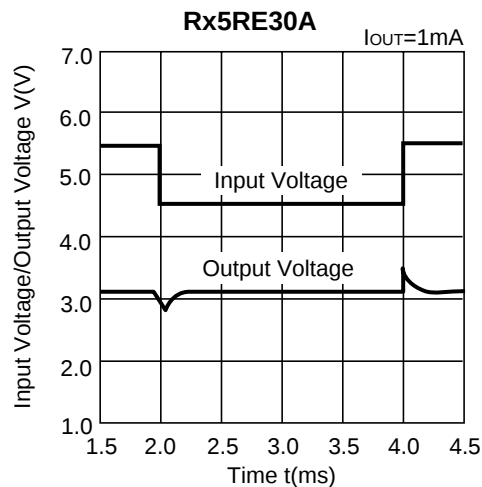
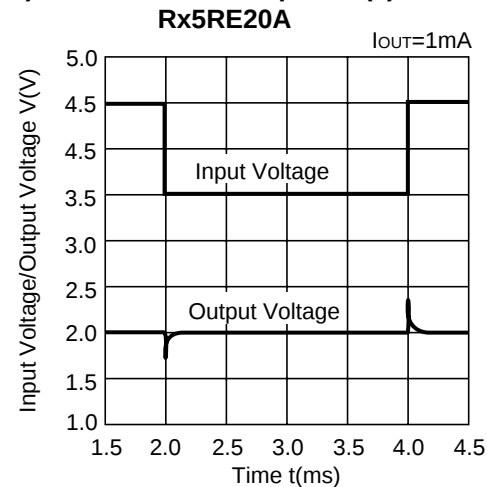


## 7) Dropout Voltage vs. Set Output Voltage

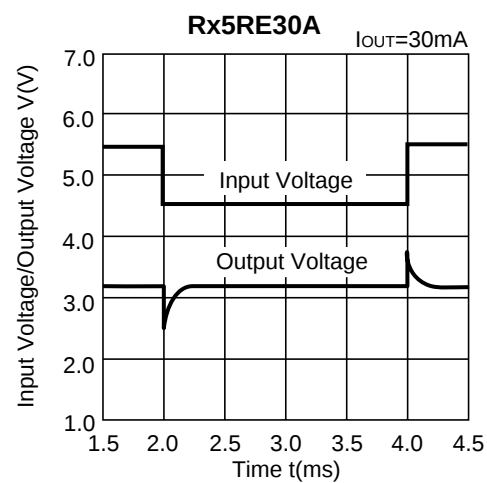
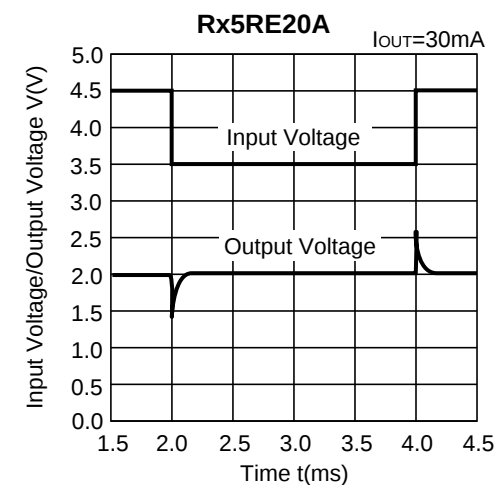
Rx5RE SERIES

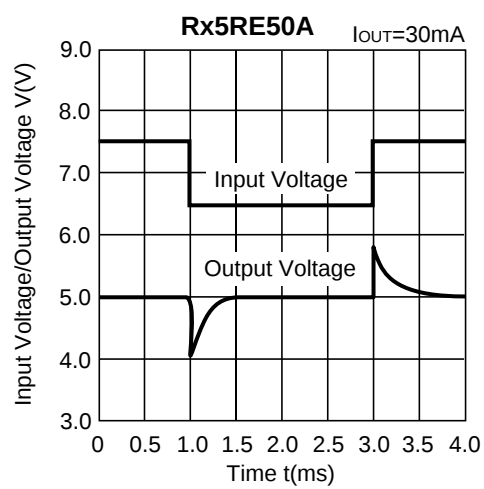
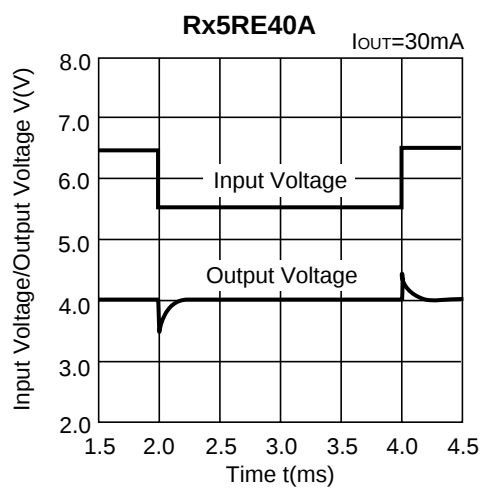
 $T_{opt}=25^{\circ}\text{C}$ 

## 8) Line Transient Response (1)

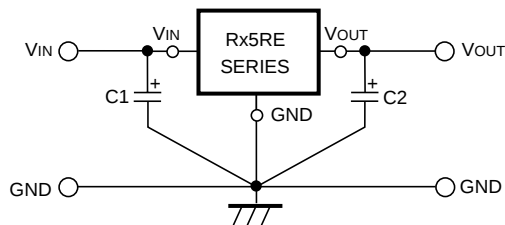


## 9) Line Transient Response (2)





## TYPICAL APPLICATION

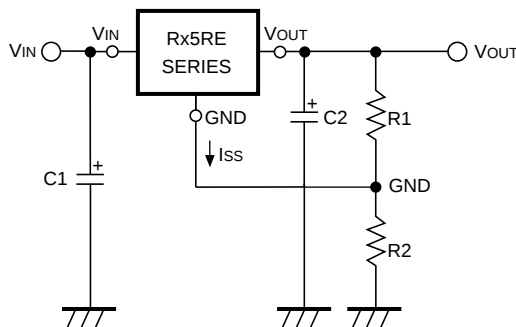


In Rx5RE Series, a constant voltage can be obtained without using capacitors C1 and C2. However, when the wire connected to VIN is long, use capacitor C1. Output noise can be reduced by using capacitor C2.

Insert capacitors C1 and C2 with the capacitance of 0.1μF to 2.0μF between input/output pins and GND pin with minimum wiring.

## APPLICATION CIRCUITS

### • VOLTAGE BOOST CIRCUIT



The output voltage can be obtained by the following formula :

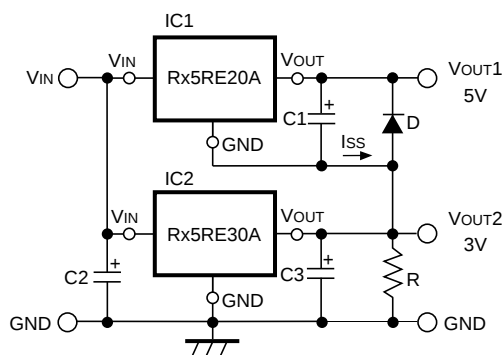
$$V_{OUT} = V_{reg}^{*1} \cdot (1 + R2/R1) + I_{SS} \cdot R2$$

Since the quiescent current of Rx5RE Series is so small that the resistances of R1 and R2 can be set as large as several hundreds kΩ and therefore the supply current of “Voltage Boost Circuit” itself can be reduced.

Furthermore, since Rx5RE Series are operated by a constant voltage, the supply current of “Voltage Boost Circuit” is not substantially affected by the input voltage.

★1) Vreg : Set Output Voltage of Rx5RE Series.

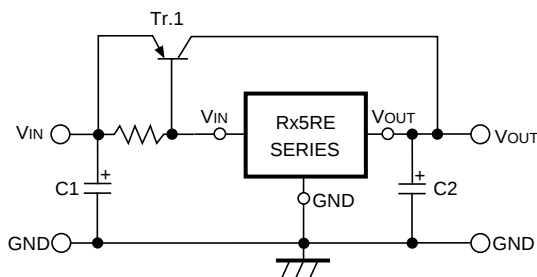
### • DUAL POWER SUPPLY CIRCUIT



As shown in the circuit diagram, a dual power supply circuit can be constructed by using two Rx5RE Series.

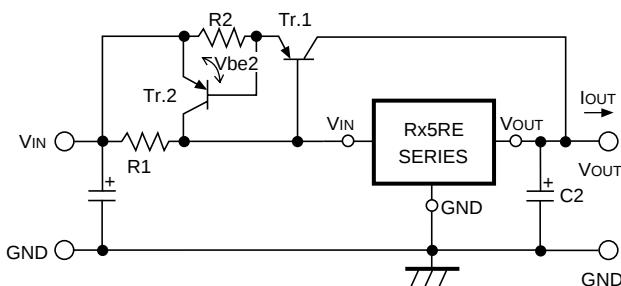
This circuit diagram shows a dual power supply circuit with an output of 3V and an output of 5V. When the minimum output current of IC2 is larger than Iss of IC1, resistor R is unnecessary. Diode D is a protection diode for the case where VOUT2 becomes larger than VOUT1.

## • CURRENT BOOST CIRCUIT



Output current of 120mA or more can be obtained by the current boost circuit constructed as shown in this circuit diagram.

## • CURRENT BOOST CIRCUIT WITH OVERCURRENT LIMIT CIRCUIT



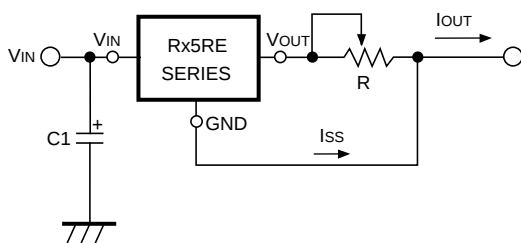
A circuit for protecting Tr.1 from the destruction caused by output short-circuit or overcurrent is shown in this circuit diagram.

When the voltage reduction caused by the current ( $I_{OUT}$ ) which flows through R2 reaches  $V_{be2}$  of Tr.2 by additionally providing the current boost circuit with Tr.2 and R2, Tr.2 is turned ON and the base current of Tr.1 is increased, so that the output current is limited.

Current limit of Overcurrent Limit Circuit is obtained as follows :

$$I_{OUT} \approx V_{be2}/R2$$

## • CURRENT SOURCE



A current source with the structure as shown in this circuit diagram can be used. Output Current  $I_{OUT}$  is obtained as follows :

$$I_{OUT} = V_{reg}^{*1}/R + I_{SS}$$

Take care that Output Current  $I_{OUT}$  does not exceed its allowable current.

\*1)  $V_{reg}$  : Set Output Voltage of Rx5RE Series.



1. The products and the product specifications described in this document are subject to change or discontinuation of production without notice for reasons such as improvement. Therefore, before deciding to use the products, please refer to our sales representatives for the latest information thereon.
2. The materials in this document may not be copied or otherwise reproduced in whole or in part without prior written consent of our company.
3. Please be sure to take any necessary formalities under relevant laws or regulations before exporting or otherwise taking out of your country the products or the technical information described herein.
4. The technical information described in this document shows typical characteristics of and example application circuits for the products. The release of such information is not to be construed as a warranty of or a grant of license under our company's or any third party's intellectual property rights or any other rights.
5. The products listed in this document are intended and designed for use as general electronic components in standard applications (office equipment, telecommunication equipment, measuring instruments, consumer electronic products, amusement equipment etc.). Those customers intending to use a product in an application requiring extreme quality and reliability, for example, in a highly specific application where the failure or misoperation of the product could result in human injury or death (aircraft, spacevehicle, nuclear reactor control system, traffic control system, automotive and transportation equipment, combustion equipment, safety devices, life support system etc.) should first contact us.
6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.
7. Anti-radiation design is not implemented in the products described in this document.
8. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
9. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
10. There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or our distributor before attempting to use AOI.
11. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.



**Nisshinbo Micro Devices Inc.**

**Official website**

<https://www.nisshinbo-microdevices.co.jp/en/>

**Purchase information**

<https://www.nisshinbo-microdevices.co.jp/en/buy/>