

OUTLINE

The Rx5RW Series are CMOS-based voltage regulator ICs with high accuracy output voltage and ultra-low supply current developed. Each of these ICs consists of a driver transistor, a voltage reference unit, an error amplifier, resistors for setting output voltage and a current limit circuit.

The output voltage of these ICs is fixed with high accuracy.

Even if V_{OUT} is shorted to GND, the included current limit circuit protects the ICs from the destruction. Furthermore, Rx5RWxxA/B have a chip enable function, so that the supply current on standby can be minimized.

Since the packages for these ICs are SC-82AB (Super Mini-mold) package and SON1612-6, high density mounting of the ICs on boards is possible.

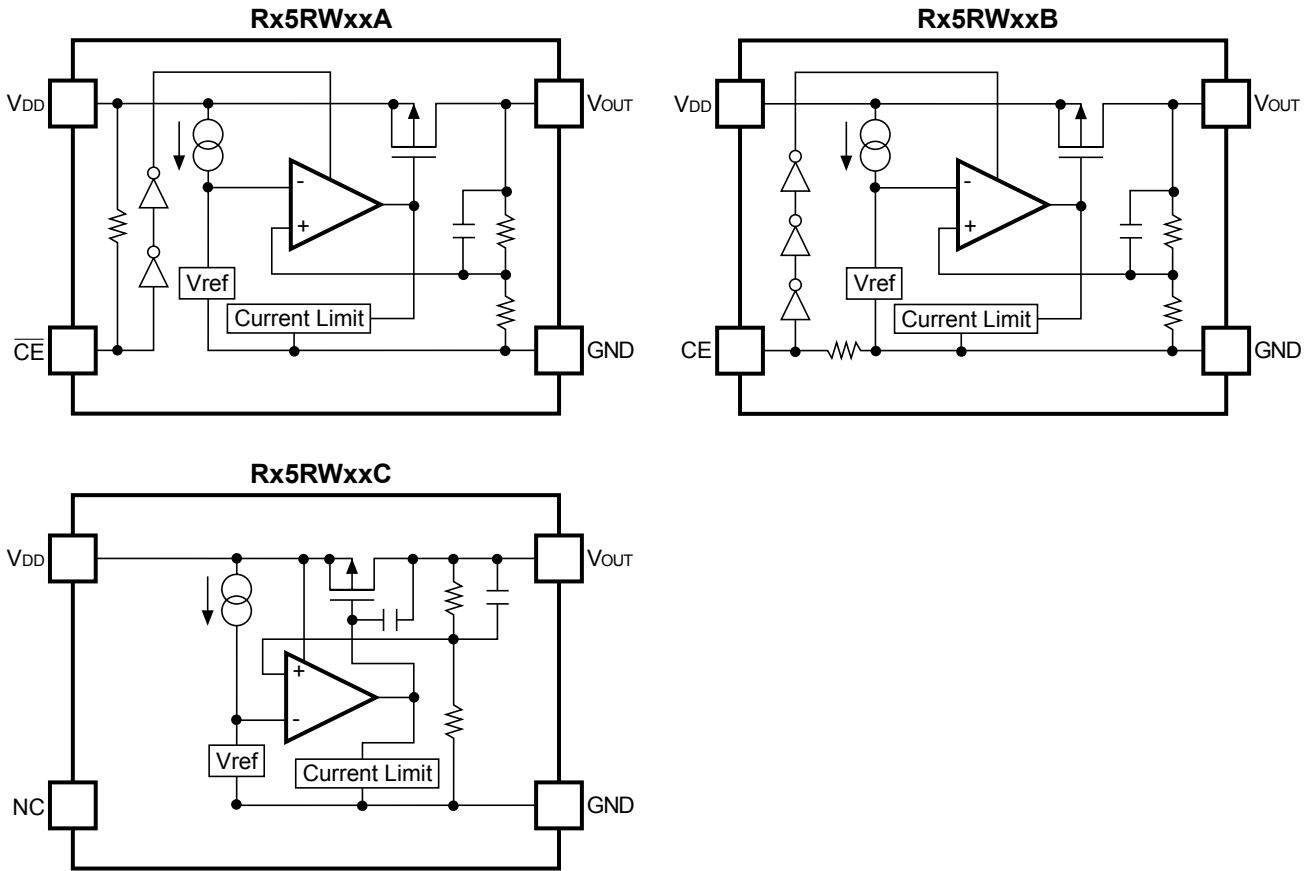
FEATURES

- Ultra-Low Supply Current..... Typ. 1.5 μ A
(except pull-up/pull-down current for \overline{CE} /CE pin)
- Standby Current Typ. 0.1 μ A
- Dropout Voltage Typ. 40mV ($I_{OUT}=1$ mA, Rx5RW30A/B)
- Low Temperature-Drift Coefficient of Output Voltage... Typ. ± 100 ppm/ $^{\circ}$ C
- Excellent Line Regulation Typ. 0.05%/V
- High Accuracy Output Voltage $\pm 2.0\%$
- Ultra-Small Packages SC-82AB (Super Mini-mold), SON1612-6
- Built-in Current Limit Circuits

APPLICATIONS

- Power source for battery-powered equipment.
- Power source for cameras, VCRs, camcorders, hand-held audio instruments and hand-held communication equipment.
- Precision voltage references.

BLOCK DIAGRAMS



SELECTION GUIDE

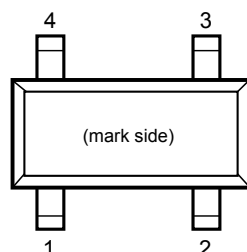
The output voltage, the active type, and the packing type for the ICs can be selected at the user's request. The selection can be made with designating the part number as shown below:

Rx5RWxxxx-xx ←Part Number
 ↑ ↑ ↑ ↑ ↑
 a b c d e

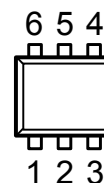
| Code | Contents |
|------|---|
| a | Designation of Package Type Q: SC-82AB D:SON1612-6 |
| b | Setting Output Voltage (V _{OUT}): Stepwise setting with a step of 0.1V in the range of 1.5V to 6.0V is possible. |
| c | Designation of Chip enable Active Type: A: "L" active type B: "H" active type C: no chip enable type |
| d | Designation of Packing Type: A: Taping B: Antistatic bag (for Sample only) |
| e | Designation of Taping Type: TR (refer to Taping Specifications) |

PIN CONFIGURATION

● SC-82AB



● SON1612-6



PIN DESCRIPTION

● SC-82AB

| Pin No | Symbol | Pin Description |
|--------|------------------------------------|----------------------------------|
| 1 | GND | Ground Pin |
| 2 | V _{DD} | Input Pin |
| 3 | V _{OUT} | Output Pin |
| 4 | $\overline{\text{CE}}$ or CE or NC | Chip Enable Pin or No Connection |

SON1612-6

| Pin No | Symbol | Pin Description |
|--------|------------------------------------|----------------------------------|
| 1 | $\overline{\text{CE}}$ or CE or NC | Chip Enable Pin or No Connection |
| 2 | V _{DD} | Input Pin |
| 3 | V _{OUT} | Output Pin |
| 4 | NC | No Connection |
| 5 | V _{DD} | Input Pin |
| 6 | GND | Ground Pin |

ABSOLUTE MAXIMUM RATINGS

| Symbol | Item | Rating | Unit |
|------------------|--|------------------------------|------|
| V _{IN} | Input Voltage | 9.0 | V |
| V _{CE} | Input Voltage for $\overline{\text{CE}}$ /CE Pin | -0.3 to V _{IN} +0.3 | V |
| V _{OUT} | Output Voltage | -0.3 to V _{IN} +0.3 | V |
| I _{OUT} | Output Current | 150 | mA |
| P _D | Power Dissipation (SC-82AB) *1 | 380 | mW |
| | Power Dissipation (SON1612-6) *1 | 500 | |
| T _{opt} | Operating Temperature | -40 to +85 | °C |
| T _{stg} | Storage Temperature | -55 to +125 | °C |

*1) For Power Dissipation, please refer to PACKAGE INFORMATION to be described.

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum ratings are threshold limit values that must not be exceeded even for an instant under any conditions. Moreover, such values for any two items must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or permanent damage to the device. These are stress ratings only and do not necessarily imply functional operation below these limits.

ELECTRICAL CHARACTERISTICS

• Rx5RW30A

T_{opt}=25°C

| Symbol | Item | Conditions | Min. | Typ. | Max. | Unit |
|--------------------------------------|--|--|-------|-------|-------|------------|
| V _{OUT} | Output Voltage | V _{IN} =5.0V 10μA ≤ I _{OUT} ≤ 10mA | 2.940 | 3.000 | 3.060 | V |
| I _{OUT} | Output Current | V _{IN} =5.0V | 50 | | | mA |
| ΔV _{OUT} /ΔI _{OUT} | Load Regulation | V _{IN} =5.0V, 1mA ≤ I _{OUT} ≤ 50mA | | 40 | 60 | mV |
| V _{DIF} | Dropout Voltage | I _{OUT} =1mA | | 40 | 60 | mV |
| I _{SS} | Supply Current | V _{IN} =5.0V | | 1.5 | 3.0 | μA |
| I _{standby} | Standby Current | V _{IN} =5.0V, V _{CE} =5.0V | | 0.1 | 1.0 | μA |
| ΔV _{OUT} /ΔV _{IN} | Line Regulation | I _{OUT} =1mA V _{OUT} +0.5V ≤ V _{IN} ≤ 8V | 0.00 | 0.05 | 0.20 | %/V |
| V _{IN} | Input Voltage | | | | 8.0 | V |
| ΔV _{OUT} /ΔT _{opt} | Output Voltage Temperature Coefficient | I _{OUT} =10mA -40°C ≤ T _{opt} ≤ 85°C | | ±100 | | ppm/ °C |
| I _{LIM} | Short Current Limit | V _{OUT} =0V | | 40 | | mA |
| R _{PU} | Pull up resistance for CE pin | | 1.5 | 4.0 | 12.0 | MΩ |
| V _{CEH} | $\overline{\text{CE}}$ Input Voltage "H" | | 1.5 | | | V |
| V _{CEL} | $\overline{\text{CE}}$ Input Voltage "L" | | 0.25 | | | V |

• Rx5RW30B

T_{opt}=25°C

| Symbol | Item | Conditions | Min. | Typ. | Max. | Unit |
|--------------------------------------|--|--|-------|-------|-------|------------|
| V _{OUT} | Output Voltage | V _{IN} =5.0V 10μA ≤ I _{OUT} ≤ 10mA | 2.940 | 3.000 | 3.060 | V |
| I _{OUT} | Output Current | V _{IN} =5.0V | 50 | | | mA |
| ΔV _{OUT} /ΔI _{OUT} | Load Regulation | V _{IN} =5.0V 1mA ≤ I _{OUT} ≤ 50mA | | 40 | 60 | mV |
| V _{DIF} | Dropout Voltage | I _{OUT} =1mA | | 40 | 60 | mV |
| I _{SS} | Supply Current | V _{IN} =5.0V | | 1.5 | 3.0 | μA |
| I _{standby} | Standby Current | V _{IN} =5.0V, V _{CE} =GND | | 0.1 | 1.0 | μA |
| ΔV _{OUT} /ΔV _{IN} | Line Regulation | I _{OUT} =1mA V _{OUT} +0.5V ≤ V _{IN} ≤ 8V | 0.00 | 0.05 | 0.20 | %/V |
| V _{IN} | Input Voltage | | | | 8.0 | V |
| ΔV _{OUT} /ΔT _{opt} | Output Voltage Temperature Coefficient | I _{OUT} =1mA -40°C ≤ T _{opt} ≤ 85°C | | ±100 | | ppm/ °C |
| I _{LIM} | Short Current Limit | V _{OUT} =0V | | 40 | | mA |
| R _{PD} | Pull down resistance for CE pin | | 1.5 | 4.0 | 12.0 | MΩ |
| V _{CEH} | CE Input Voltage "H" | | 1.5 | | | V |
| V _{CEL} | CE Input Voltage "L" | | 0.25 | | | V |

• Rx5RW30C

T_{opt}=25°C

| Symbol | Item | Conditions | Min. | Typ. | Max. | Unit |
|--------------------------------------|--|---|-------|-------|-------|------------|
| V _{OUT} | Output Voltage | V _{IN} =5.0V 10μA ≤ I _{OUT} ≤ 10mA | 2.940 | 3.000 | 3.060 | V |
| I _{OUT} | Output Current | V _{IN} =5.0V | 50 | | | mA |
| ΔV _{OUT} /ΔI _{OUT} | Load Regulation | V _{IN} =5.0V 1mA ≤ I _{OUT} ≤ 50mA | | 40 | 60 | mV |
| V _{DIF} | Dropout Voltage | I _{OUT} =1mA | | 40 | 60 | mV |
| I _{SS} | Supply Current | V _{IN} =5.0V | | 1.5 | 3.0 | μA |
| ΔV _{OUT} /ΔV _{IN} | Line Regulation | I _{OUT} =1mA 3.5V ≤ V _{IN} ≤ 8.0V | 0.00 | 0.05 | 0.20 | %/V |
| V _{IN} | Input Voltage | | | | 8.0 | V |
| ΔV _{OUT} /ΔT _{opt} | Output Voltage Temperature Coefficient | I _{OUT} =10mA -40°C ≤ T _{opt} ≤ 85°C | | ±100 | | ppm/ °C |
| I _{LIM} | Short Current Limit | | | 40 | | mA |

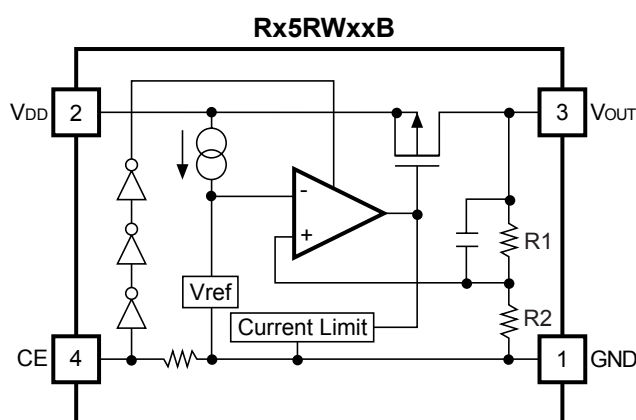
ELECTRICAL CHARACTERISTICS BY OUTPUT VOLTAGE

(common characteristics)

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

| Symbol | Item | Conditions | Min. | Typ. | Max. | Unit |
|---------------------------------|--|---|------|-----------|------|----------------------------|
| I_{SS} | Supply Current | $V_{IN}=\text{set}V_{OUT}+2.0$ | | 1.5 | 3.0 | μA |
| $I_{standby}$ | Standby Current | $V_{IN}=\text{set}V_{OUT}+2.0\text{V}$ $V_{CE}=V_{IN}$ (Rx5RWxxA), $V_{CE}=\text{GND}$ (Rx5RWxxB) | | 0.1 | 1.0 | μA |
| $\Delta V_{OUT}/\Delta V_{IN}$ | Line Regulation | $I_{OUT}=1\text{mA}$ $\text{set}V_{OUT}+0.5\text{V} \leq V_{IN} \leq 8\text{V}$ | 0.00 | 0.05 | 0.20 | $\%/V$ |
| V_{IN} | Input Voltage | | | | 8.0 | V |
| $\Delta V_{OUT}/\Delta T_{opt}$ | Output Voltage Temperature Coefficient | $I_{OUT}=10\text{mA}$ $-40^{\circ}\text{C} \leq T_{opt} \leq 85^{\circ}\text{C}$ | | ± 100 | | ppm/ $^{\circ}\text{C}$ |
| I_{LIM} | Short Current Limit | $V_{OUT}=0\text{V}$ | | 40 | | mA |
| R_{PU}/R_{PD} | $\overline{\text{CE}}$ Pull-up / CE Pull-down Resistance | applied to A/B version | 1.5 | 4.0 | 12.0 | $\text{M}\Omega$ |
| V_{CEH} | $\overline{\text{CE}}$ /CE Input Voltage "H" | applied to A/B version | 1.5 | | | V |
| V_{CEL} | $\overline{\text{CE}}$ /CE Input Voltage "L" | applied to A/B version | | | 0.25 | V |

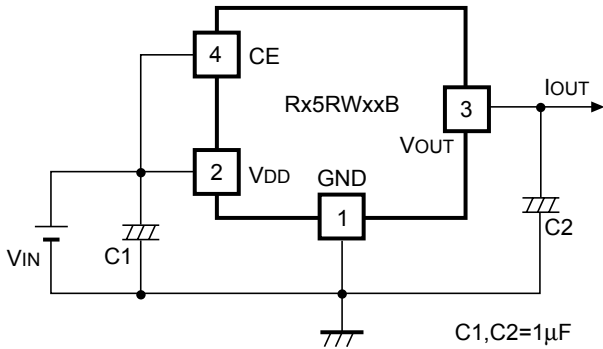
OPERATION



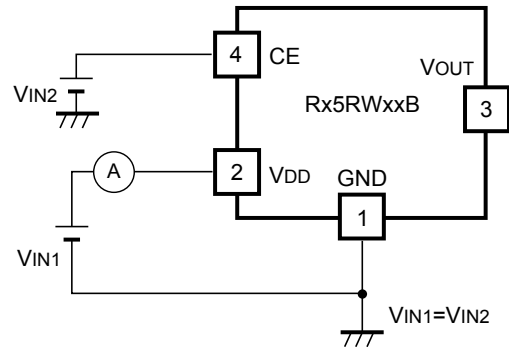
In these ICs, output voltage V_{OUT} is detected by Feedback Registers R1, R2, and the detected output voltage is compared with a reference voltage by the error amplifier, so that a constant voltage is output.

A current limit circuit working for short protect, and a chip enable circuit are included.

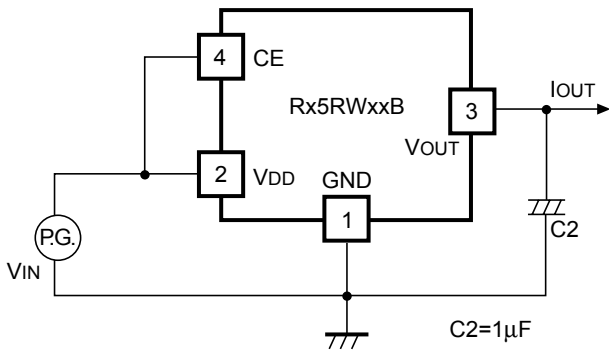
TEST CIRCUITS



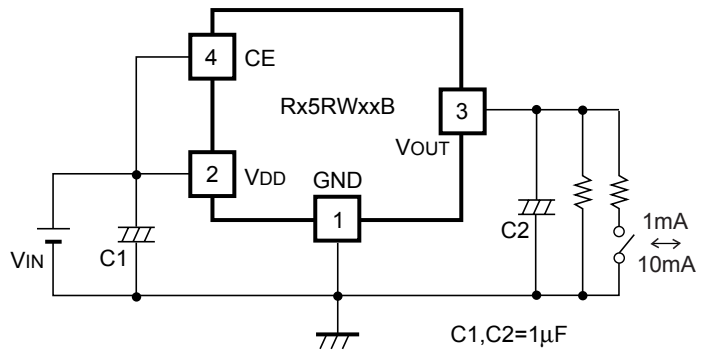
Standard Test Circuit



Test Circuit for Supply Current

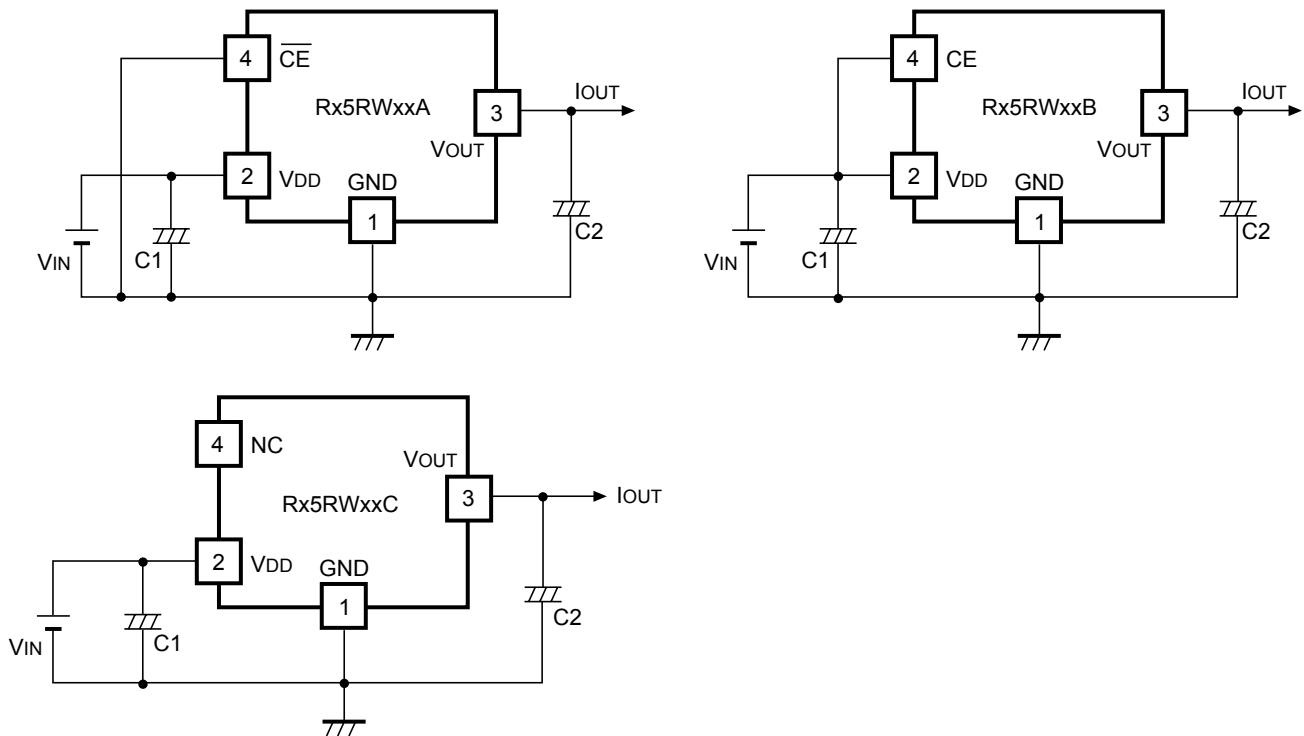


Test Circuit for Ripple Rejection and Line Transient Response



Test Circuit for Load Transient Response

TYPICAL APPLICATION

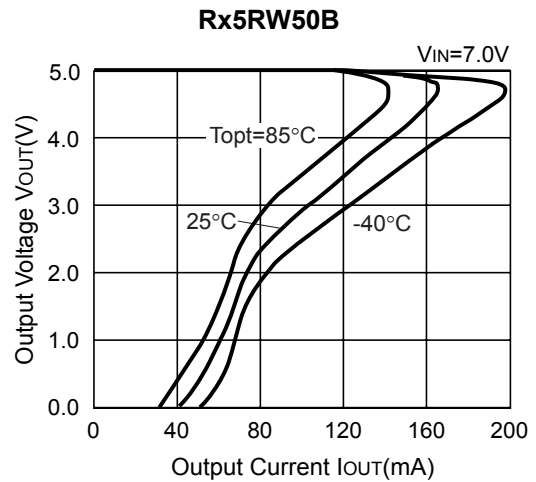
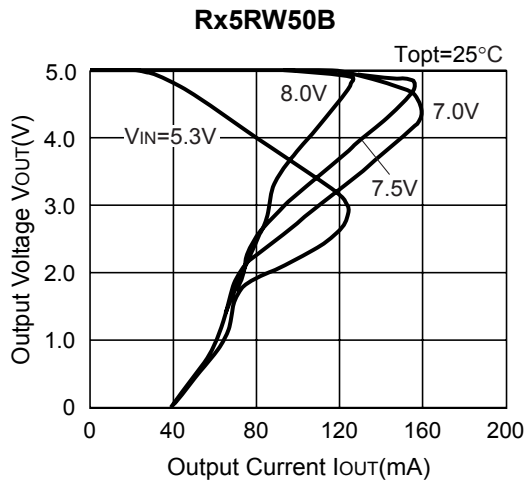
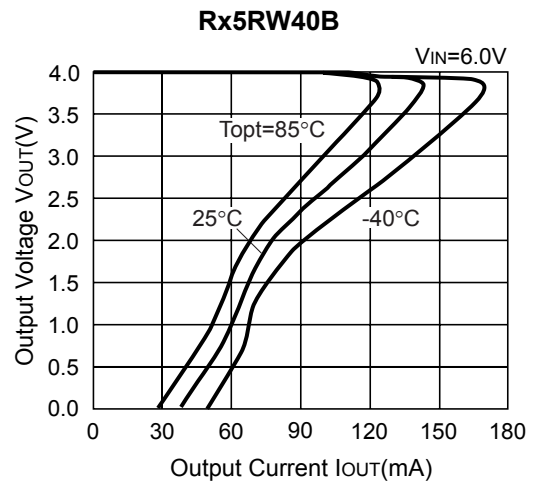
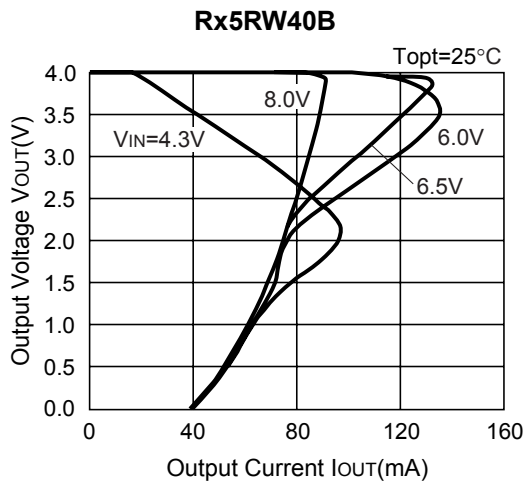
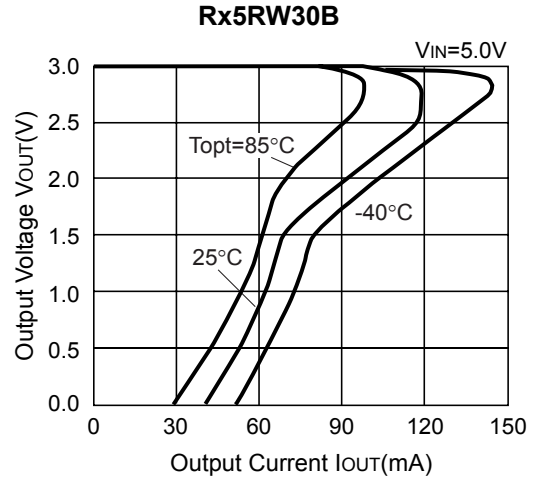
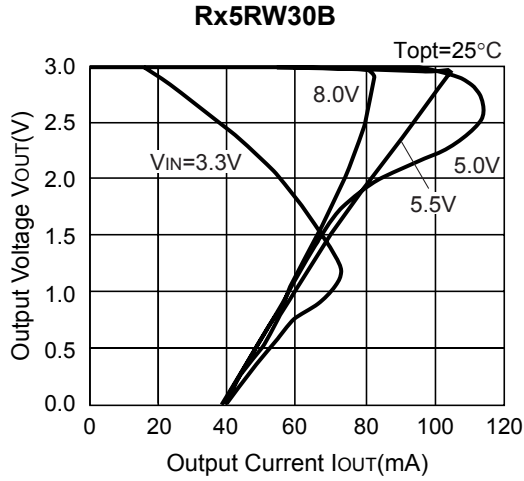


In Rx5RW Series, a constant voltage can be obtained without using capacitors, C1 and C2. However, when the wire connected V_{IN} is long, use capacitor C1. Output noise can be reduced with using capacitor 2.

Insert capacitors C1 and C2 with the capacitance of $0.1\mu\text{F}$ to $2\mu\text{F}$ between input/output pins and GND pin with minimum wiring.

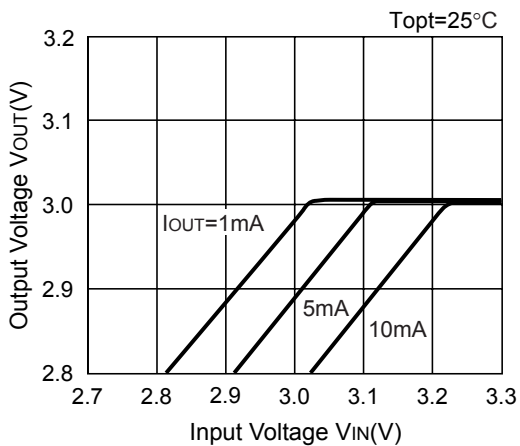
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current

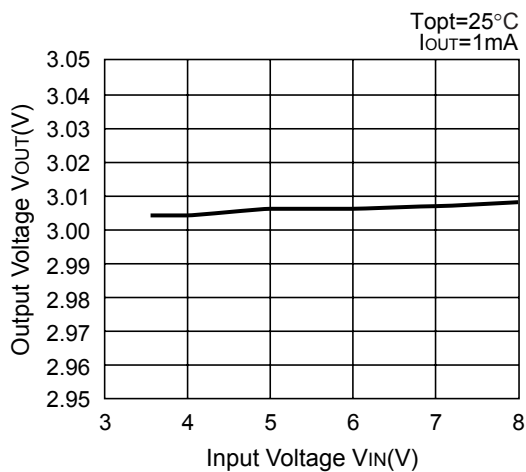


2) Output Voltage vs. Input Voltage

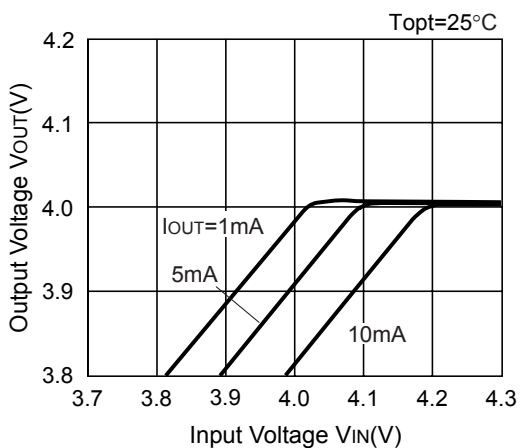
Rx5RW30B



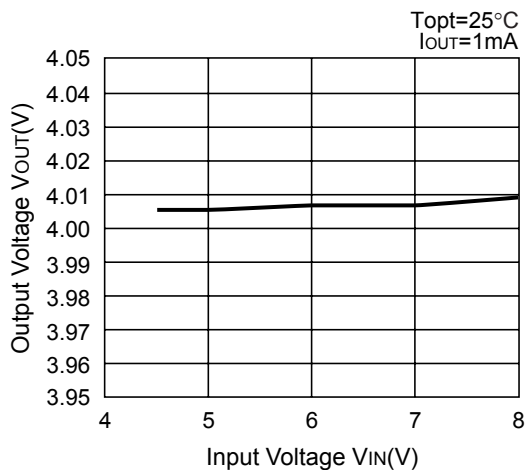
Rx5RW30B



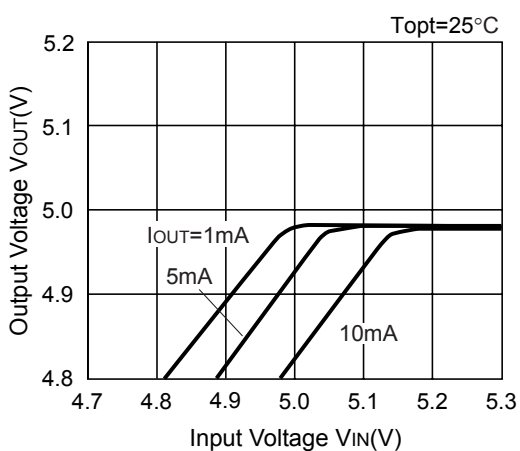
Rx5RW40B



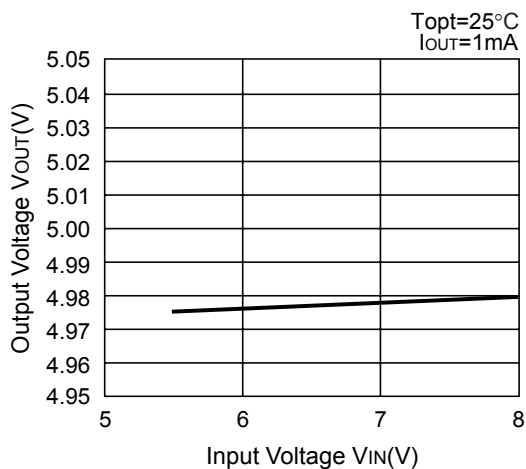
Rx5RW40B



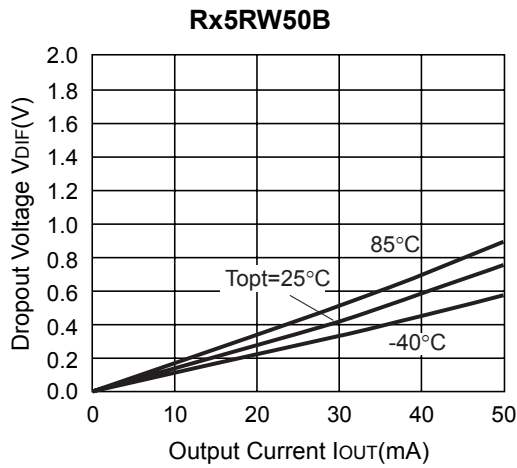
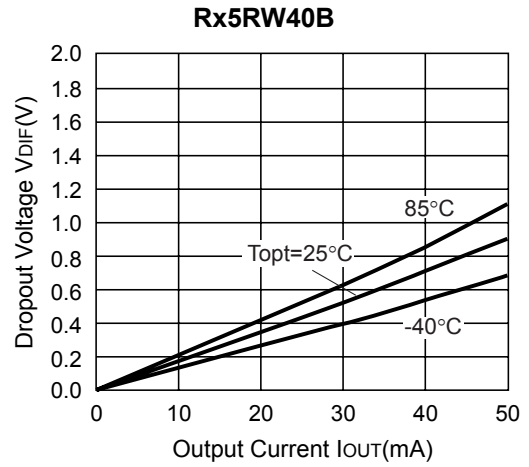
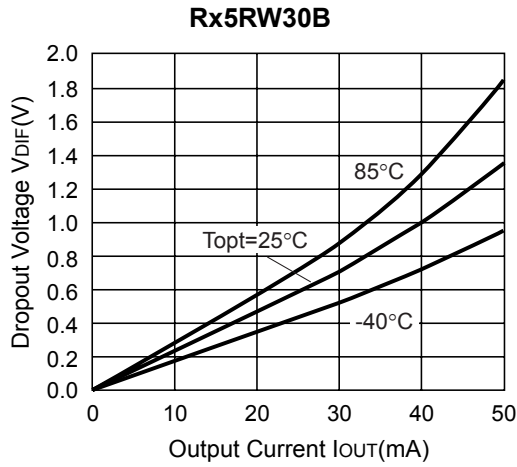
Rx5RW50B



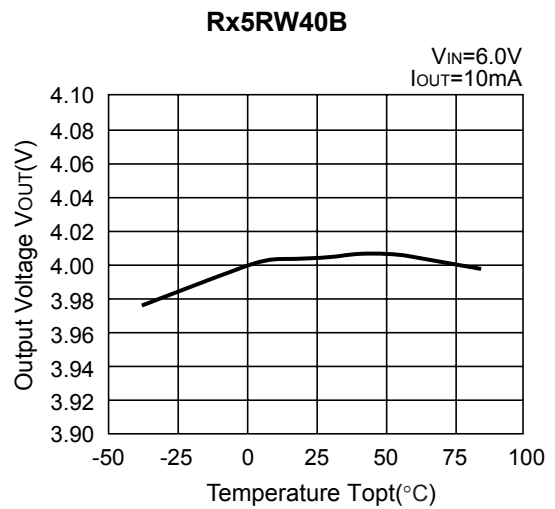
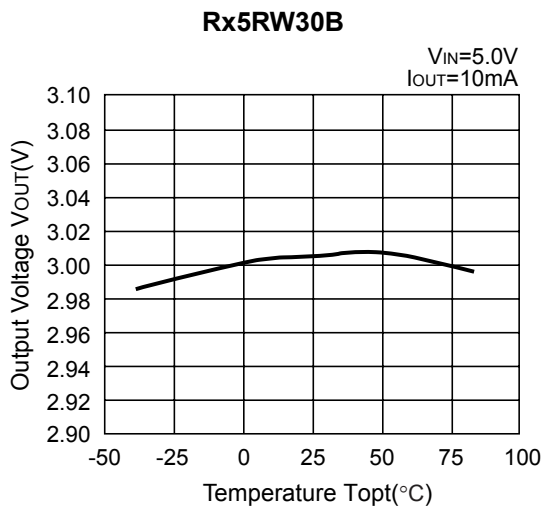
Rx5RW50B

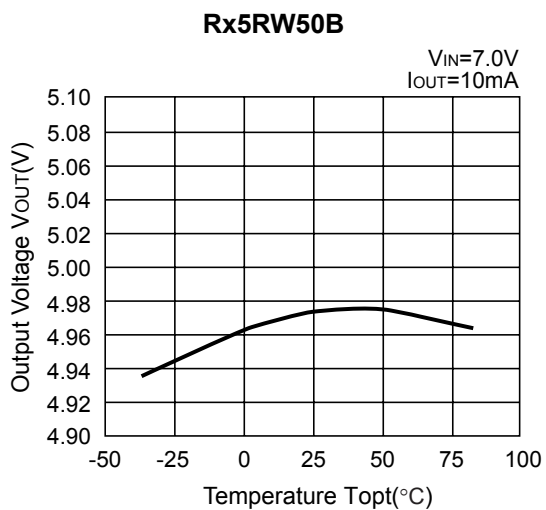


3) Dropout Voltage vs. Output Current

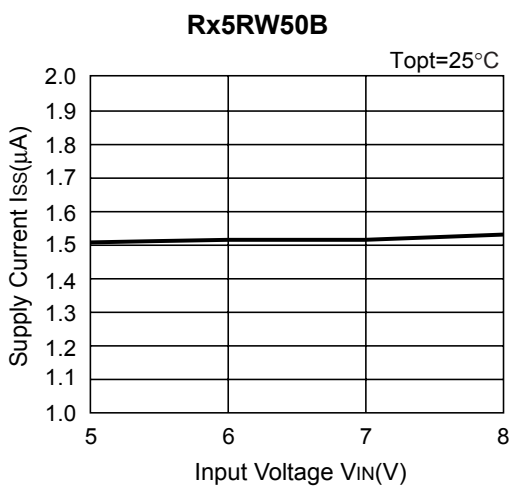
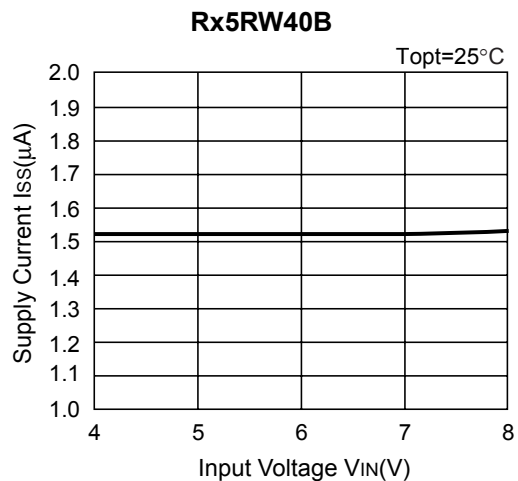
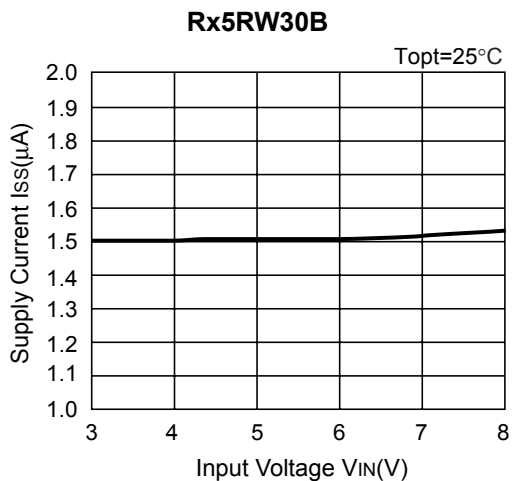


4) Output Voltage vs. Temperature



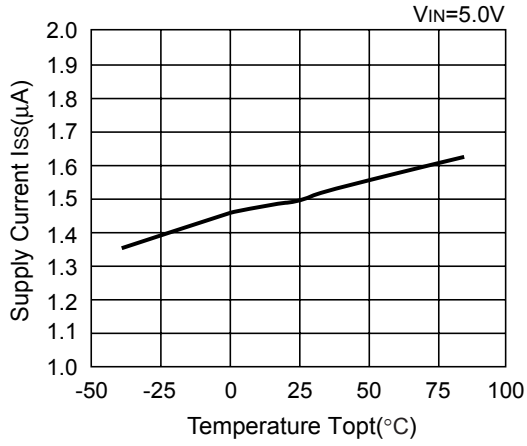


5) Supply Current vs. Input Voltage

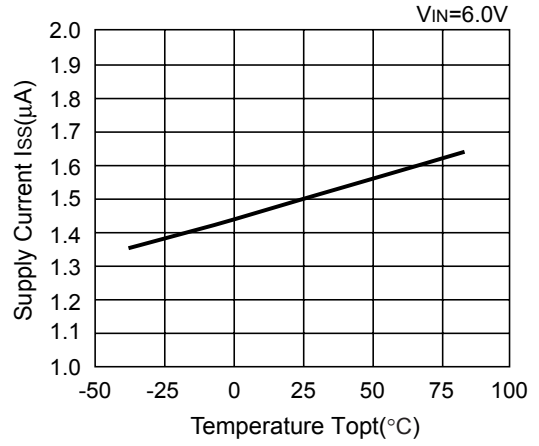


6) Supply Current vs. Temperature

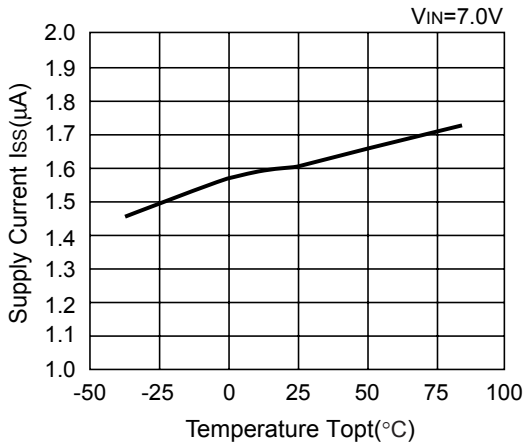
Rx5RW30B



Rx5RW40B

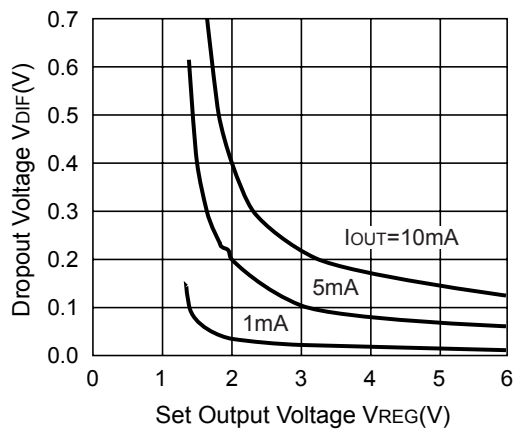


Rx5RW50B

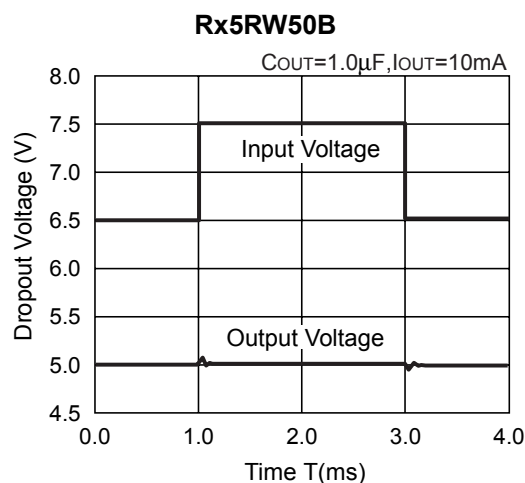
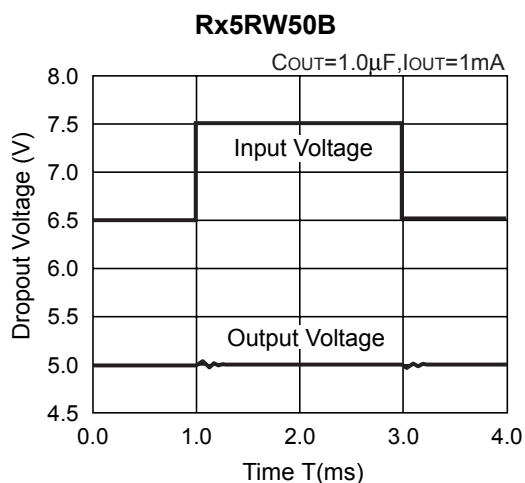
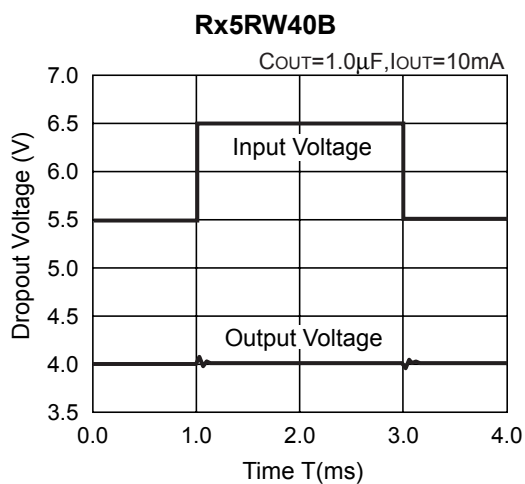
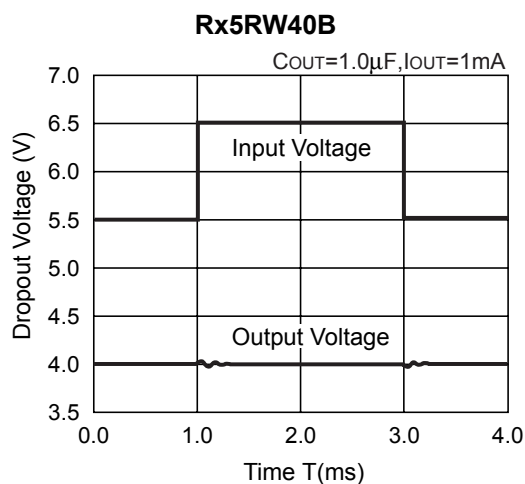
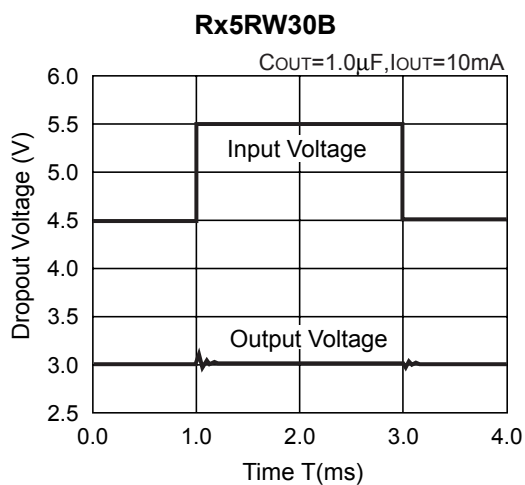
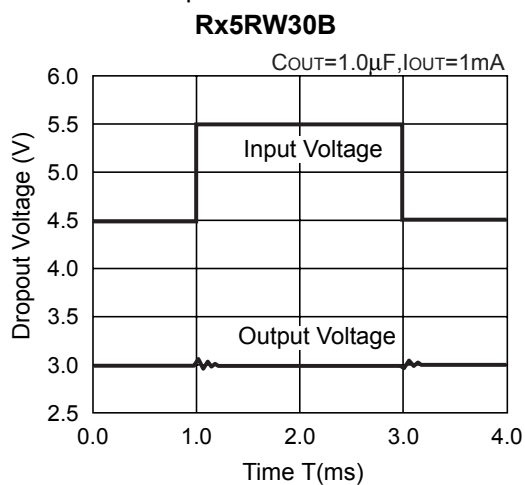


7) Dropout Voltage vs. Set Output Voltage

Rx5RWxxB

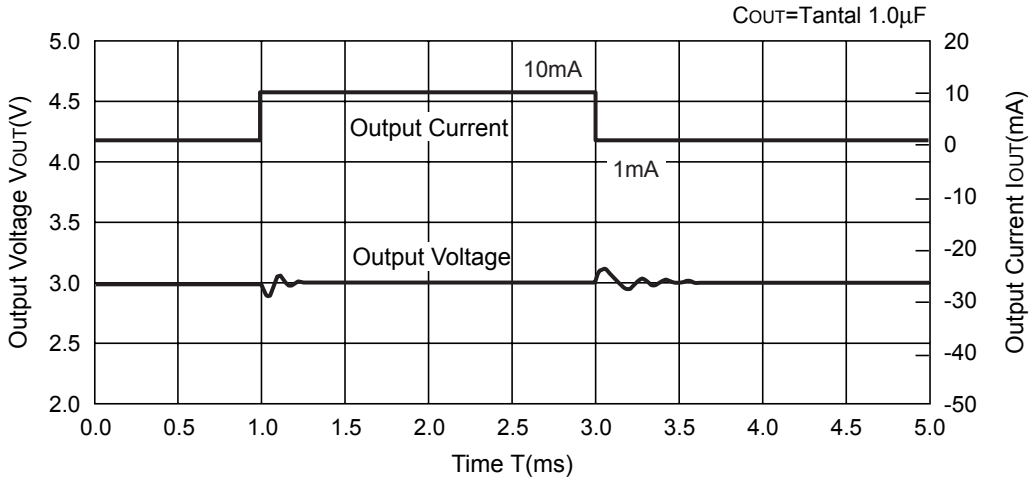


8) Line Transient Response

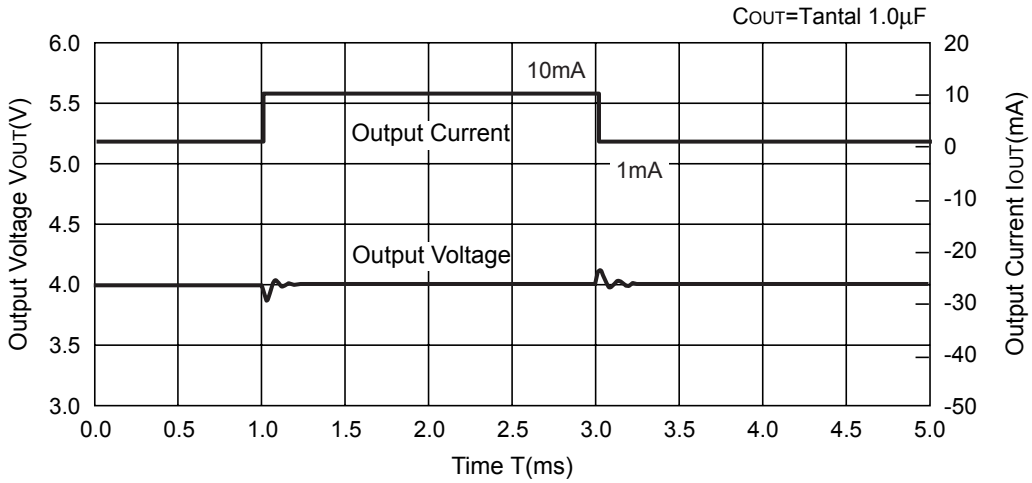


9) Load Transient Response

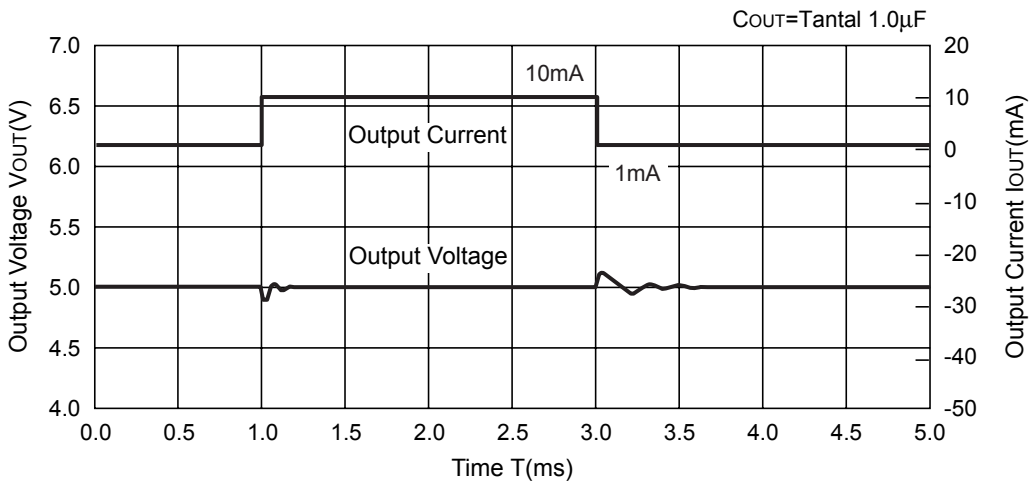
Rx5RW30B



Rx5RW40B



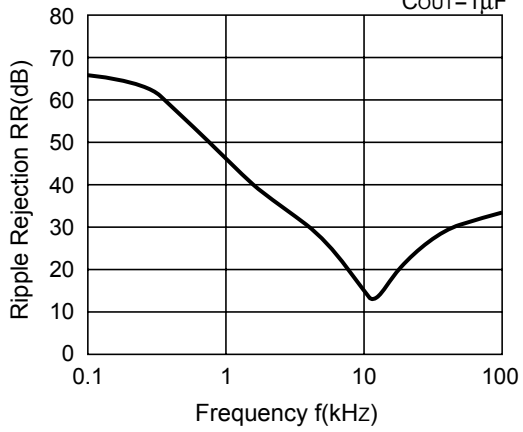
Rx5RW50B



10) Ripple Rejection

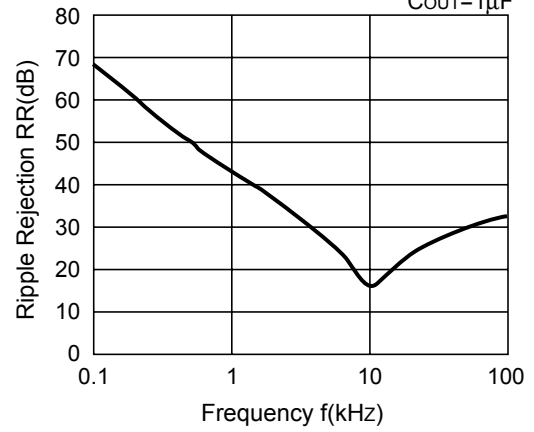
Rx5RW30B

$V_{IN}=5V_{dc}+0.5V_{p-p}$
 $I_{OUT}=10mA$
 $C_{OUT}=1\mu F$



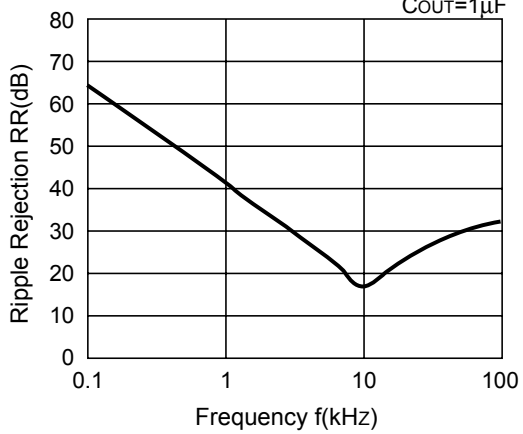
Rx5RW40B

$V_{IN}=6V_{dc}+0.5V_{p-p}$
 $I_{OUT}=10mA$
 $C_{OUT}=1\mu F$



Rx5RW50B

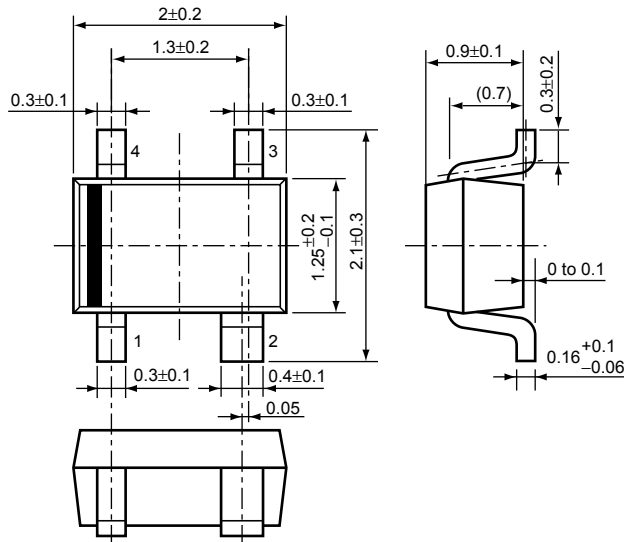
$V_{IN}=7V_{dc}+0.5V_{p-p}$
 $I_{OUT}=10mA$
 $C_{OUT}=1\mu F$



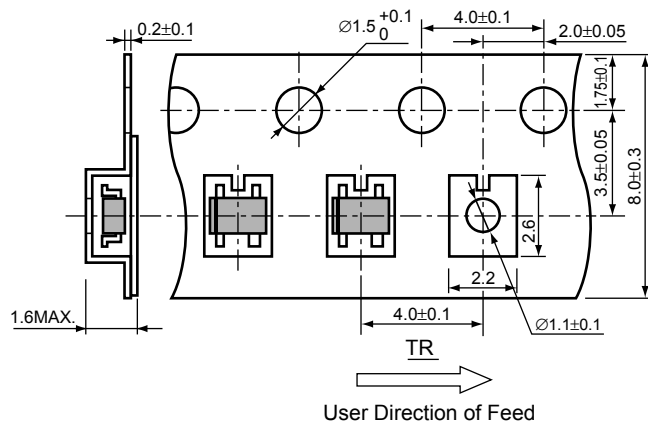
• SC-82AB

Unit: mm

PACKAGE DIMENSIONS

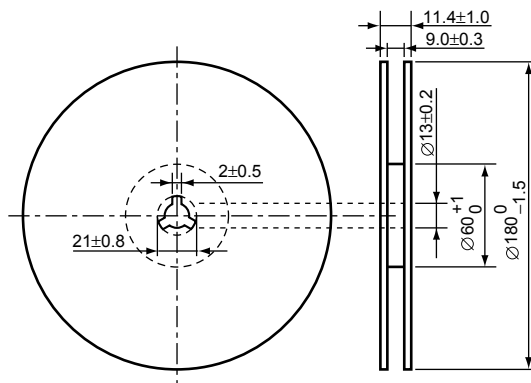


TAPING SPECIFICATION



TAPING REEL DIMENSIONS

(1reel=3000pcs)



POWER DISSIPATION (SC-82AB)

This specification is at mounted on board. Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

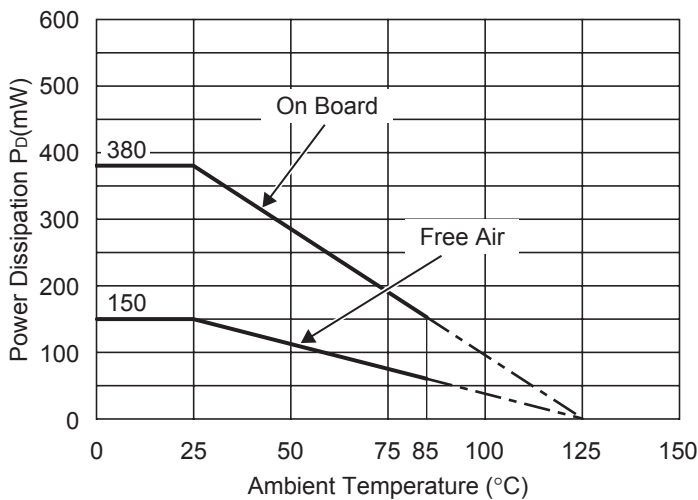
Measurement Conditions

| | |
|------------------|--|
| | Standard Land Pattern |
| Environment | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plactic (Double sided) |
| Board Dimensions | 40mm × 40mm × 1.6mm |
| Copper Ratio | Top side : Approx. 50% , Back side : Approx. 50% |
| Through-hole | φ0.5mm × 44pcs |

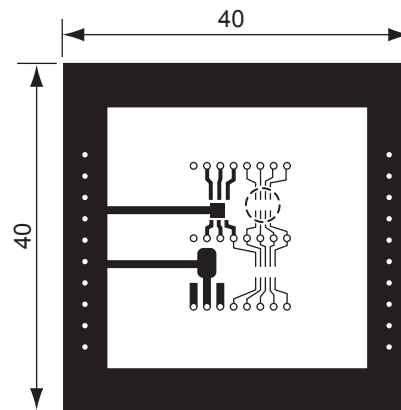
Measurement Result

($T_{opt}=25^{\circ}C, T_{jmax}=125^{\circ}C$)

| | | |
|--------------------|--|-------------------|
| | Standard Land Pattern | Free Air |
| Power Dissipation | 380mW | 150mW |
| Thermal Resistance | $\theta_{ja}=(125-25^{\circ}C)/0.38W=263^{\circ}C/W$ | 667 $^{\circ}C/W$ |



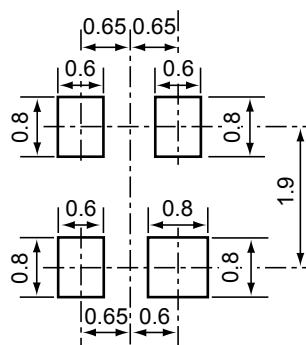
Power Dissipation



Measurement Board Pattern

○ IC Mount Area (Unit : mm)

RECOMMENDED LAND PATTERN



(Unit: mm)

Power Dissipation (SON1612-6)

This specification is at mounted on board.

Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

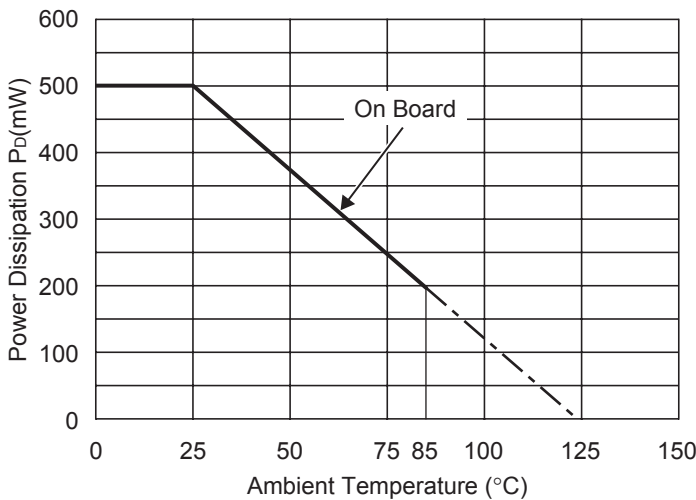
Measurement Conditions

| | |
|------------------|--|
| | Standard Land Pattern |
| Environment | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (Double sided) |
| Board Dimensions | 40mm × 40mm × 1.6mm |
| Copper Ratio | Top side : Approx. 50%, Back side : Approx.50% |
| Through-hole | φ0.5mm × 24pcs |

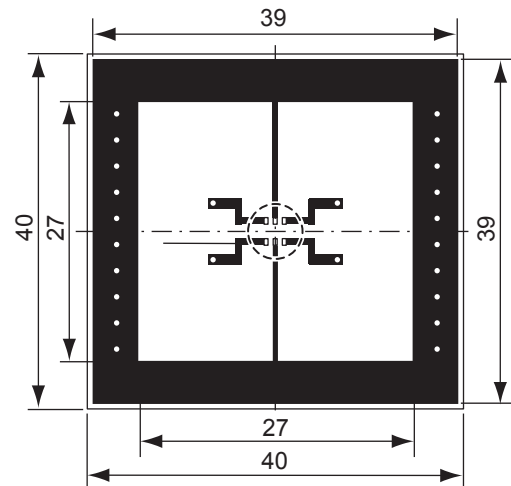
Measurement Result

($T_{opt}=25^{\circ}C, T_{jmax}=125^{\circ}C$)

| | |
|--------------------|---|
| | Standard Land Pattern |
| Power Dissipation | 500mW |
| Thermal Resistance | $\theta_{ja}=(125-25^{\circ}C)/0.5W=200^{\circ}C/W$ |



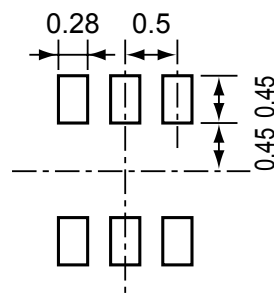
Power Dissipation



Measurement Board Pattern

○ IC Mount Area Unit : mm

RECOMMENDED LAND PATTERN



(Unit: mm)

RQ5RW SERIES MARK SPECIFICATION

● **SC-82AB**



①, ② : Product Code (refer to Part Number vs. Product Code)

③, ④ : Lot Number

● **Part Number vs. Product Code**

| Part Number | Product Code | |
|-------------|--------------|---|
| | ① | ② |
| RQ5RW20AA | 2 | A |
| RQ5RW21AA | 2 | B |
| RQ5RW22AA | 2 | C |
| RQ5RW23AA | 2 | D |
| RQ5RW24AA | 2 | E |
| RQ5RW25AA | 2 | F |
| RQ5RW26AA | 2 | G |
| RQ5RW27AA | 2 | H |
| RQ5RW28AA | 2 | J |
| RQ5RW29AA | 2 | K |
| RQ5RW30AA | 3 | A |
| RQ5RW31AA | 3 | B |
| RQ5RW32AA | 3 | C |
| RQ5RW33AA | 3 | D |
| RQ5RW34AA | 3 | E |
| RQ5RW35AA | 3 | F |
| RQ5RW36AA | 3 | G |
| RQ5RW37AA | 3 | H |
| RQ5RW38AA | 3 | J |
| RQ5RW39AA | 3 | K |
| RQ5RW40AA | 4 | A |
| RQ5RW41AA | 4 | B |
| RQ5RW42AA | 4 | C |
| RQ5RW43AA | 4 | D |
| RQ5RW44AA | 4 | E |
| RQ5RW45AA | 4 | F |
| RQ5RW46AA | 4 | G |
| RQ5RW47AA | 4 | H |
| RQ5RW48AA | 4 | J |
| RQ5RW49AA | 4 | K |
| RQ5RW50AA | 5 | A |
| RQ5RW51AA | 5 | B |
| RQ5RW52AA | 5 | C |
| RQ5RW53AA | 5 | D |

| Part Number | Product Code | |
|-------------|--------------|---|
| | ① | ② |
| RQ5RW54AA | 5 | E |
| RQ5RW55AA | 5 | F |
| RQ5RW56AA | 5 | G |
| RQ5RW57AA | 5 | H |
| RQ5RW58AA | 5 | J |
| RQ5RW59AA | 5 | K |
| RQ5RW60AA | 6 | A |
| RQ5RW19AA | 6 | B |
| RQ5RW18AA | 6 | C |
| RQ5RW17AA | 6 | D |
| RQ5RW16AA | 6 | E |
| RQ5RW15AA | 6 | F |
| RQ5RW20BA | 7 | A |
| RQ5RW21BA | 7 | B |
| RQ5RW22BA | 7 | C |
| RQ5RW23BA | 7 | D |
| RQ5RW24BA | 7 | E |
| RQ5RW25BA | 7 | F |
| RQ5RW26BA | 7 | G |
| RQ5RW27BA | 7 | H |
| RQ5RW28BA | 7 | J |
| RQ5RW29BA | 7 | K |
| RQ5RW30BA | 8 | A |
| RQ5RW31BA | 8 | B |
| RQ5RW32BA | 8 | C |
| RQ5RW33BA | 8 | D |
| RQ5RW34BA | 8 | E |
| RQ5RW35BA | 8 | F |
| RQ5RW36BA | 8 | G |
| RQ5RW37BA | 8 | H |
| RQ5RW38BA | 8 | J |
| RQ5RW39BA | 8 | K |
| RQ5RW40BA | 9 | A |
| RQ5RW41BA | 9 | B |

| Part Number | Product Code | |
|-------------|--------------|---|
| | ① | ② |
| RQ5RW42BA | 9 | C |
| RQ5RW43BA | 9 | D |
| RQ5RW44BA | 9 | E |
| RQ5RW45BA | 9 | F |
| RQ5RW46BA | 9 | G |
| RQ5RW47BA | 9 | H |
| RQ5RW48BA | 9 | J |
| RQ5RW49BA | 9 | K |
| RQ5RW50BA | 0 | A |
| RQ5RW51BA | 0 | B |
| RQ5RW52BA | 0 | C |
| RQ5RW53BA | 0 | D |
| RQ5RW54BA | 0 | E |
| RQ5RW55BA | 0 | F |
| RQ5RW56BA | 0 | G |
| RQ5RW57BA | 0 | H |
| RQ5RW58BA | 0 | J |
| RQ5RW59BA | 0 | K |
| RQ5RW60BA | 1 | A |
| RQ5RW19BA | 1 | B |
| RQ5RW18BA | 1 | C |
| RQ5RW17BA | 1 | D |
| RQ5RW16BA | 1 | E |
| RQ5RW15BA | 1 | F |
| RQ5RW20CA | 2 | L |
| RQ5RW21CA | 2 | M |
| RQ5RW22CA | 2 | N |
| RQ5RW23CA | 2 | P |
| RQ5RW24CA | 2 | R |
| RQ5RW25CA | 2 | S |
| RQ5RW26CA | 2 | T |
| RQ5RW27CA | 2 | U |
| RQ5RW28CA | 2 | V |
| RQ5RW29CA | 2 | W |

| Part Number | Product Code | |
|-------------|--------------|---|
| | ① | ② |
| RQ5RW30CA | 3 | L |
| RQ5RW31CA | 3 | M |
| RQ5RW32CA | 3 | N |
| RQ5RW33CA | 3 | P |
| RQ5RW34CA | 3 | R |
| RQ5RW35CA | 3 | S |
| RQ5RW36CA | 3 | T |
| RQ5RW37CA | 3 | U |
| RQ5RW38CA | 3 | V |
| RQ5RW39CA | 3 | W |
| RQ5RW40CA | 4 | L |
| RQ5RW41CA | 4 | M |
| RQ5RW42CA | 4 | N |
| RQ5RW43CA | 4 | P |
| RQ5RW44CA | 4 | R |
| RQ5RW45CA | 4 | S |
| RQ5RW46CA | 4 | T |
| RQ5RW47CA | 4 | U |
| RQ5RW48CA | 4 | V |
| RQ5RW49CA | 4 | W |
| RQ5RW50CA | 5 | L |
| RQ5RW51CA | 5 | M |
| RQ5RW52CA | 5 | N |
| RQ5RW53CA | 5 | P |
| RQ5RW54CA | 5 | R |
| RQ5RW55CA | 5 | S |
| RQ5RW56CA | 5 | T |
| RQ5RW57CA | 5 | U |
| RQ5RW58CA | 5 | V |
| RQ5RW59CA | 5 | W |
| RQ5RW60CA | 6 | L |
| RQ5RW19CA | 6 | M |
| RQ5RW18CA | 6 | N |
| RQ5RW17CA | 6 | P |
| RQ5RW16CA | 6 | S |

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