RICOH

# RP170x Series

**AEC-Q100 Compliant**

## 300 mA 10 V Input LDO Regulator for Automotive Applications

No. EC-205-180419

## OUTLINE

The RP170x is an LDO regulator featuring 300 mA output current. Having the 10 V maximum input voltage, the RP170x can be used in 2 cell lithium-ion battery powered portable appliances and besides a portable equipment. The supply current is Typ. 23 μA though an excellent response characteristics. The output voltage range from 1.2 V is possible. The output voltage accuracy and temperature-drift coefficient of output voltage of the RP170x is excellent. RP170x has a fold-back protection circuit and a thermal shutdown circuit. Moreover, a standby mode with ultra low supply current can be realized with the chip enable function. SOT-23-5 and SOT-89-5 with high power dissipation packages are available.

## FEATURES

- Input Voltage Range (Maximum Rating).....2.6 V to 10.0 V (12 V)
- Operating Temperature .....−40°C to 105°C (RP170xx1x-xx-AE)
  −40°C to 125°C (RP170xx1x-xx-KE)
- Supply Current .....Typ. 23 μA
- Standby Current.....Typ. 0.1 μA
- Dropout Voltage .....Typ. 0.20 V ($I_{OUT}$ = 100 mA, $V_{OUT}$ = 3.0 V)
  .....Typ. 0.77 V ($I_{OUT}$ = 300 mA, $V_{OUT}$ = 2.8 V)
- Ripple Rejection.....Typ. 70 dB (f = 1 kHz)
- Temperature-Drift Coefficient of Output Voltage ...Typ. ±80 ppm/°C
- Line Regulation .....Typ. 0.02%/V
- Output Voltage Accuracy.....±1.0%
- Packages .....SOT-23-5, SOT-89-5
- Output Voltage Range.....1.2 V/1.25 V/1.5 V/1.8 V/2.5 V/2.8 V/2.9 V/3.0 V/
  3.3 V/5.0 V/5.5 V/6.0 V
  *Contact Ricoh sales representatives for other voltages.
- Built-in Fold Back Protection Circuit .....Typ. 40 mA (Current at short mode)
- Built-in Thermal Shutdown Circuit.....Shutdown Temperature at 165°C
- Constant Slope Circuit (Soft-start Function)
- Ceramic capacitors are recommended to be used with this IC ..... 1.0 μF or more

## APPLICATIONS

- Power source for accessories such as car audios, car navigation systems, and ETC systems
- Power source for ECUs such as EV inverter and battery charge control unit

# SELECTION GUIDE

The output voltage, auto discharge function[1], and package for the ICs can be selected at the user's request.

**Selection Guide**

| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|---|---|---|---|---|
| RP170Nxx1∗-TR-#E | SOT-23-5 | 3,000 pcs | Yes | Yes |
| RP170Hxx1∗-T1-#E | SOT-89-5 | 1,000 pcs | Yes | Yes |

xx: Specify the set output voltage ($V_{SET}$)
1.2 V (12) / 1.25 V (12) / 1.5 V (15) / 1.8 V (18) / 2.5 V (25) / 2.8 V (28) / 2.9 V (29) / 3.0 V (30) / 3.3 V (33) / 5.0 V (50) / 5.5 V (55) / 6.0 V (60)

If the output voltage includes the 3rd digit, indicate the digit of 0.01 as follows.
1.25 V → RP170x121∗5

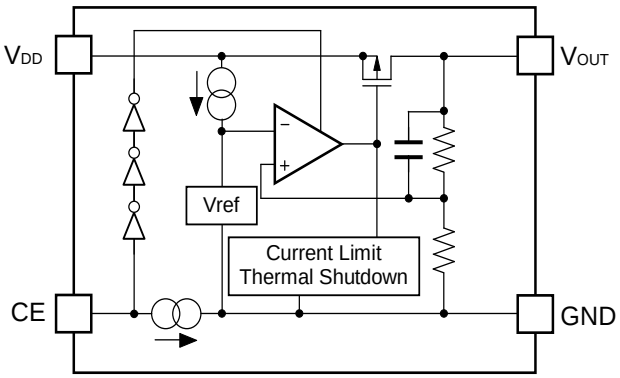
∗ : The auto discharge functions at off state are as follows.
(B) without auto discharge function at off state
(D) with auto discharge function at off state

#: Quality Class

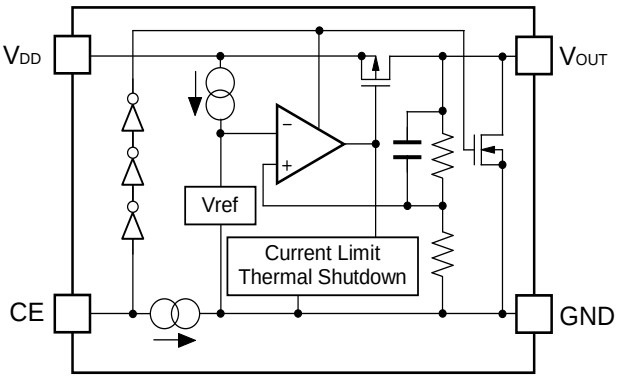
| # | Operating Temperature Range | Test Temperature | AEC-Q100 |
|---|---|---|---|
| **A** | −40°C to 105°C | 25°C, High | Grade 1 |
| **K** | −40°C to 125°C | Low, 25°C, High | Grade 1 |

[1] Auto-discharge function quickly lowers the output voltage to 0 V by releasing the electrical charge accumulated in the external capacitor when the chip enable signal is switched from the active mode to the standby mode.

# BLOCK DIAGRAMS

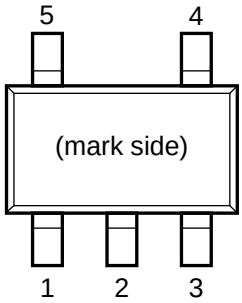



**RP170xxxxB Block Diagram**

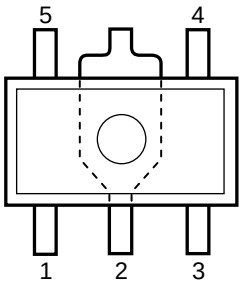



**RP170xxxxD Block Diagram**

# PIN DESCRIPTIONS




**SOT-23-5 Pin Configuration**




**SOT-89-5 Pin Configuration**

**SOT-23-5 Pin Description**

| Pin No | Symbol | Pin Description |
|---|---|---|
| 1 | $V_{DD}$ | Input Pin |
| 2 | GND | Ground Pin |
| 3 | CE | Chip Enable Pin (Active-high) |
| 4 | NC | No Connection |
| 5 | $V_{OUT}$ | Output Pin |

**SOT-89-5 Pin Description**

| Pin No | Symbol | Pin Description |
|---|---|---|
| 1 | $V_{OUT}$ | Output Pin |
| 2 | GND | Ground Pin |
| 3 | CE | Chip Enable Pin (Active-high) |
| 4 | NC | No Connection |
| 5 | $V_{DD}$ | Input Pin |

# ABSOLUTE MAXIMUM RATINGS

**Absolute Maximum Ratings**

| Symbol | Item | | | Rating | Unit |
|---|---|---|---|---|---|
| $V_{IN}$ | Input Voltage | | | 12 | V |
| $V_{CE}$ | Input Voltage (CE Pin) | | | 12 | V |
| $V_{OUT}$ | Output Voltage | | | −0.3 to $V_{IN}$ + 0.3 | V |
| $I_{OUT}$ | Output Current | | | 330 | mA |
| $P_D$ | Power Dissipation(1) | SOT-23-5 | JEDEC STD. 51-7 Test Land Pattern | 830 | mW |
| | | SOT-89-5 | JEDEC STD. 51-7 Test Land Pattern | 3200 | |
| Tj | Junction Temperature | | | −40 to 150 | °C |
| Tstg | Storage Temperature Range | | | −55 to 150 | °C |

**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

**Recommended Operating Conditions**

| Symbol | Item | | Rating | Unit |
|---|---|---|---|---|
| $V_{IN}$ | Input Voltage | | 2.6 to 10 | V |
| Ta | Operating Temperature Range | RP170xx1x-xx-AE | −40 to 105 | °C |
| | | RP170xx1x-xx-KE | −40 to 125 | °C |

**RECOMMENDED OPERATING CONDITIONS**

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.

(1) Refer to *POWER DISSIPATION* for detailed information.

# ELECTRICAL CHARACTERISTICS

$V_{IN}$ = $V_{SET}$ + 1 V, $I_{OUT}$ = 1 mA, unless otherwise noted.
The specifications surrounded by [ ] are guaranteed by design engineering at –40°C ≤ Ta ≤ 105°C.

**RP170xxxxB/D (-AE) Electrical Characteristics** (Ta = 25°)

| Symbol | Item | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | 1.5 V < $V_{SET}$ | Ta = 25°C | $V_{SET}$ x 0.99 | | $V_{SET}$ x 1.01 | V |
| | | | −40°C ≤ Ta ≤ 105°C | [$V_{SET}$ x 0.965] | | [$V_{SET}$ x 1.03] | |
| | | $V_{SET}$ ≤ 1.5V | Ta = 25°C | −15 | | 15 | mV |
| | | | −40°C ≤ Ta ≤ 105°C | [−53] | | [45] | |
| $I_{OUT}$ | Output Current | | | [300] | | | mA |
| $\Delta V_{OUT}$ /$\Delta I_{OUT}$ | Load Regulation | 0.1 mA ≤ $I_{OUT}$ ≤ 300 mA | | | 10 | [80] | mV |
| $V_{DIF}$ | Dropout Voltage | $I_{OUT}$ = 300 mA | | Refer to the *Product-specific Electrical Characteristics* | | | |
| $I_{SS}$ | Supply Current | $I_{OUT}$ = 0 mA | | | 23 | [45] | µA |
| Istandby | Standby Current | $V_{IN}$ = 10.0 V<br>$V_{CE}$ = GND | | | 0.1 | [1.2] | µA |
| $\Delta V_{OUT}$ /$\Delta V_{IN}$ | Line Regulation | $V_{SET}$ + 0.5 V ≤ $V_{IN}$ ≤ 10.0 V<br>(Incase that $V_{SET}$ ≤ 2.1 V,<br>2.6 V ≤ $V_{IN}$ ≤ 10.0 V) | | | ±0.02 | [±0.25] | %/V |
| $I_{SC}$ | Short Current Limit | $V_{OUT}$ = 0 V | | | 40 | | mA |
| $I_{PD}$ | CE Pull-down Current | | | | 0.30 | | µA |
| $V_{CEH}$ | CE Input Voltage “H” | | | [1.7] | | | V |
| $V_{CEL}$ | CE Input Voltage “L” | | | | | [0.8] | V |
| $T_{TSD}$ | Thermal Shutdown Temperature | Junction Temperature | | | 165 | | °C |
| $T_{TSR}$ | Thermal Shutdown Released Temperature | Junction Temperature | | | 110 | | °C |
| $R_{LOW}$ | Nch On Resistance for Auto Discharge (RP170xxx1D only) | $V_{CE}$ = 0 V<br>$V_{IN}$ = 7.0 V | | | 250 | | Ω |

All test items listed under Electrical Characteristics are done under the pulse load condition (Tj ≈ Ta = 25°C).

# ELECTRICAL CHARACTERISTICS (continued)

### Product-specific Electrical Characteristics

The specifications surrounded by ☐ are guaranteed by design engineering at –40°C ≤ Ta ≤ 105°C.

**RP170xxxxB/D (-AE)** (Ta = 25°C)

| Product Name | $V_{OUT}$ [V] (Ta = 25°C) | | | $V_{OUT}$ [V] (Ta = –40 to 105°C) | | | $V_{DIF}$ [V] | |
|---|---|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. | TYP. | MAX. |
| RP170x121x | 1.185 | 1.200 | 1.215 | 1.147 | 1.200 | 1.245 | 1.400 | 1.925 |
| RP170x121x5 | 1.235 | 1.250 | 1.265 | 1.197 | 1.25 | 1.295 | | |
| RP170x151x | 1.485 | 1.500 | 1.515 | 1.447 | 1.500 | 1.545 | 1.200 | 1.655 |
| RP170x181x | 1.782 | 1.800 | 1.818 | 1.737 | 1.800 | 1.854 | 0.980 | 1.305 |
| RP170x251x | 2.475 | 2.500 | 2.525 | 2.413 | 2.500 | 2.575 | 0.770 | 1.185 |
| RP170x281x | 2.772 | 2.800 | 2.828 | 2.702 | 2.800 | 2.884 | | |
| RP170x291x | 2.871 | 2.900 | 2.929 | 2.799 | 2.900 | 2.987 | | |
| RP170x301x | 2.970 | 3.000 | 3.030 | 2.895 | 3.000 | 3.090 | 0.600 | 0.995 |
| RP170x331x | 3.267 | 3.300 | 3.333 | 3.185 | 3.300 | 3.399 | | |
| RP170x501x | 4.950 | 5.000 | 5.050 | 4.825 | 5.000 | 5.150 | 0.500 | 0.875 |
| RP170x551x | 5.445 | 5.500 | 5.555 | 5.308 | 5.500 | 5.665 | | |
| RP170x601x | 5.940 | 6.000 | 6.060 | 5.790 | 6.000 | 6.180 | | |

# ELECTRICAL CHARACTERISTICS (continued)

$V_{IN}$ = $V_{SET}$ + 1 V, $I_{OUT}$ = 1 mA, unless otherwise noted.

**RP170xxxxB/D (-KE) Electrical Characteristics** (−40°C ≤ Ta ≤ 125°C)

| Symbol | Item | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | 1.5 V < $V_{SET}$ | Ta = 25°C | $V_{SET}$ x 0.99 | | $V_{SET}$ x 1.01 | V |
| | | | −40°C ≤ Ta ≤ 125°C | $V_{SET}$ x 0.960 | | $V_{SET}$ x 1.035 | |
| | | $V_{SET}$ ≤ 1.5 V | Ta = 25°C | −15 | | 15 | mV |
| | | | −40°C ≤ Ta ≤ 125°C | −60 | | 50 | |
| $I_{OUT}$ | Output Current | | | 300 | | | mA |
| $\Delta V_{OUT}$ /$\Delta I_{OUT}$ | Load Regulation | 0.1 mA ≤ $I_{OUT}$ ≤ 300 mA | | | 10 | 85 | mV |
| $V_{DIF}$ | Dropout Voltage | $I_{OUT}$ = 300 mA | | Refer to the *Product-specific Electrical Characteristics* | | | |
| $I_{SS}$ | Supply Current | $I_{OUT}$ = 0 mA | | | 23 | 47 | µA |
| Istandby | Standby Current | $V_{IN}$ = 10.0 V<br>$V_{CE}$ = GND | | | 0.1 | 1.25 | µA |
| $\Delta V_{OUT}$ /$\Delta V_{IN}$ | Line Regulation | $V_{SET}$ + 0.5 V ≤ $V_{IN}$ ≤ 10.0 V<br>(In case that $V_{SET}$ ≤ 2.1 V,<br>2.6 V ≤ $V_{IN}$ ≤ 10.0 V) | | | ±0.02 | ±0.25 | %/V |
| $I_{SC}$ | Short Current Limit | $V_{OUT}$ = 0 V | | | 40 | | mA |
| $I_{PD}$ | CE Pull-down Current | | | | 0.30 | | µA |
| $V_{CEH}$ | CE Input Voltage “H” | | | 1.7 | | | V |
| $V_{CEL}$ | CE Input Voltage “L” | | | | | 0.8 | V |
| $T_{TSD}$ | Thermal Shutdown Temperature | Junction Temperature | | | 165 | | °C |
| $T_{TSR}$ | Thermal Shutdown Released Temperature | Junction Temperature | | | 110 | | °C |
| $R_{LOW}$ | Nch On Resistance for Auto Discharge (RP170xxx1D only) | $V_{CE}$ = 0 V<br>$V_{IN}$ = 7.0 V | | | 250 | | Ω |

# ELECTRICAL CHARACTERISTICS (continued)

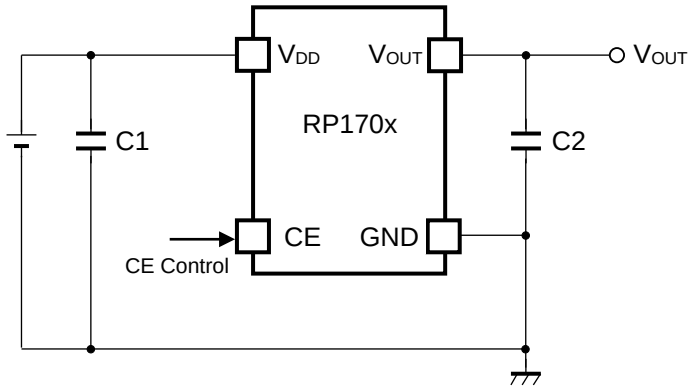
**Product-specific Electrical Characteristics**

**RP170xxxxB/D (-KE)** (−40°C ≤ Ta ≤ 125°C)

| Product Name | $V_{OUT}$ [V] (Ta = 25°C) | | | $V_{OUT}$ [V] (Ta = –40 to 125°C) | | | $V_{DIF}$ [V] | |
|---|---|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. | TYP. | MAX. |
| RP170x121x | 1.185 | 1.200 | 1.215 | 1.140 | 1.200 | 1.250 | 1.400 | 1.925 |
| RP170x121x5 | 1.235 | 1.250 | 1.265 | 1.190 | 1.250 | 1.300 | | |
| RP170x151x | 1.485 | 1.500 | 1.515 | 1.440 | 1.500 | 1.550 | 1.200 | 1.655 |
| RP170x181x | 1.782 | 1.800 | 1.818 | 1.728 | 1.800 | 1.863 | 0.980 | 1.305 |
| RP170x251x | 2.475 | 2.500 | 2.525 | 2.400 | 2.500 | 2.587 | 0.770 | 1.185 |
| RP170x281x | 2.772 | 2.800 | 2.828 | 2.688 | 2.800 | 2.898 | | |
| RP170x291x | 2.871 | 2.900 | 2.929 | 2.784 | 2.900 | 3.001 | | |
| RP170x301x | 2.970 | 3.000 | 3.030 | 2.880 | 3.000 | 3.105 | 0.600 | 0.995 |
| RP170x331x | 3.267 | 3.300 | 3.333 | 3.168 | 3.300 | 3.415 | | |
| RP170x501x | 4.950 | 5.000 | 5.050 | 4.800 | 5.000 | 5.175 | 0.500 | 0.875 |
| RP170x551x | 5.445 | 5.500 | 5.555 | 5.280 | 5.500 | 5.692 | | |
| RP170x601x | 5.940 | 6.000 | 6.060 | 5.760 | 6.000 | 6.210 | | |

# APPLICATION INFORMATION

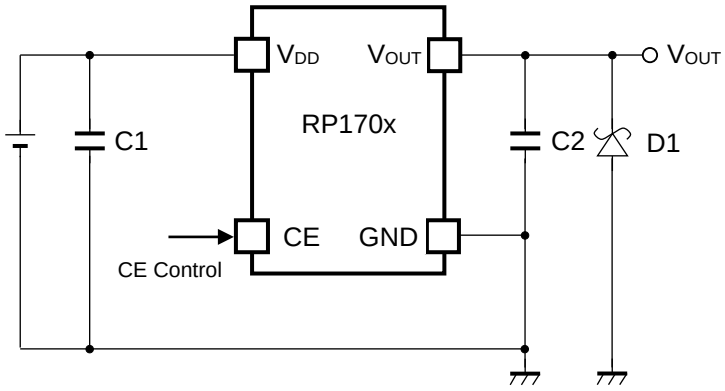
## TYPICAL APPLICATION




### External Components

| Symbol | Descriptions |
|---|---|
| C1 | 1.0 µF, Ceramic Capacitor, MURATA, GRM155B31A105KE15 |
| C2 | 1.0 µF, Ceramic Capacitor, MURATA, GRM155B31A105KE15 |

## TYPICAL APPLICATION FOR IC CHIP BREAKDOWN PREVENTION




When a sudden surge of electrical current travels along the VOUT pin and GND due to a short-circuit, electrical resonance of a circuit involving an output capacitor (C2) and a short circuit inductor generates a negative voltage and may damage the device or the load devices. Connecting a schottky diode (D1) between the VOUT pin and GND has the effect of preventing damage to them.

# TECHNICAL NOTES

### PHASE COMPENSATION

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C2 with 1.0 μF or more and good ESR (Equivalent Series Resistance).
(Note: If additional ceramic capacitors are connected with parallel to the output pin with an output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB).

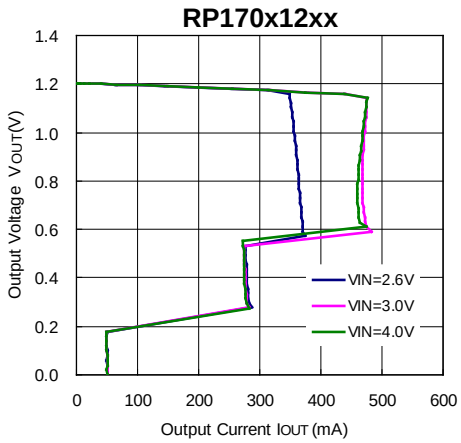
### PCB LAYOUT

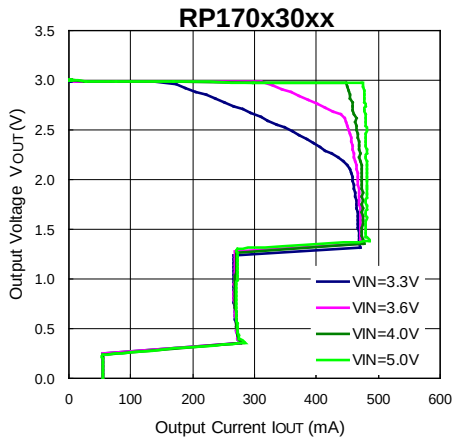
Make $V_{DD}$ and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 1.0 μF or more between $V_{DD}$ and GND, and as close as possible to the pins.
Set external components, especially the output capacitor C2, as close as possible to the ICs, and make wiring as short as possible.

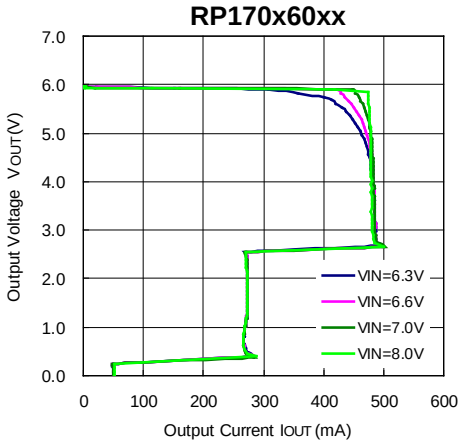
# TYPICAL CHARACTERISTICS

Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

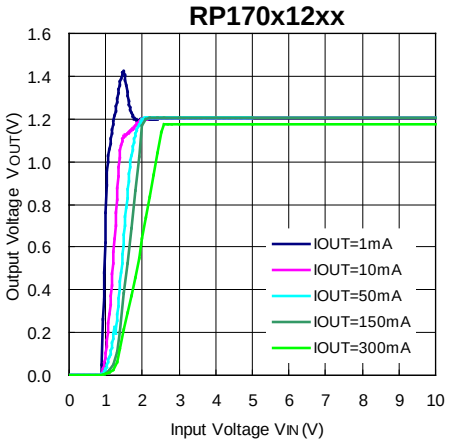
### 1) Output Voltage vs. Output Current (Ta = 25°C)

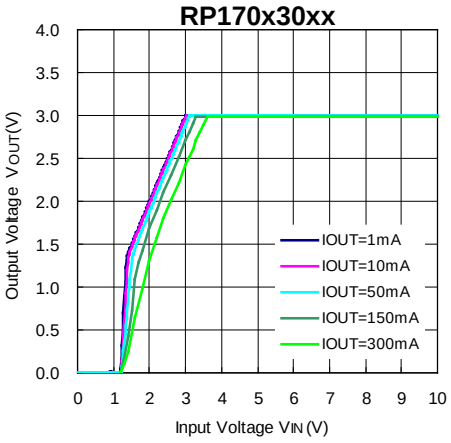


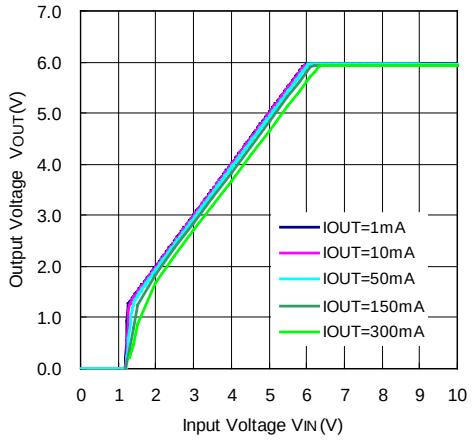




### 2) Output Voltage vs. Input Voltage (Ta = 25°C)



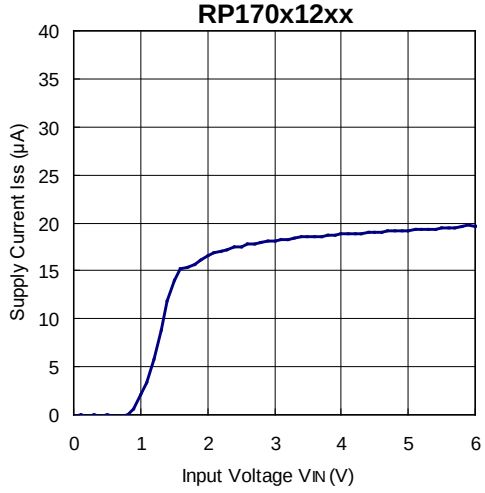



**RP170x60xx**

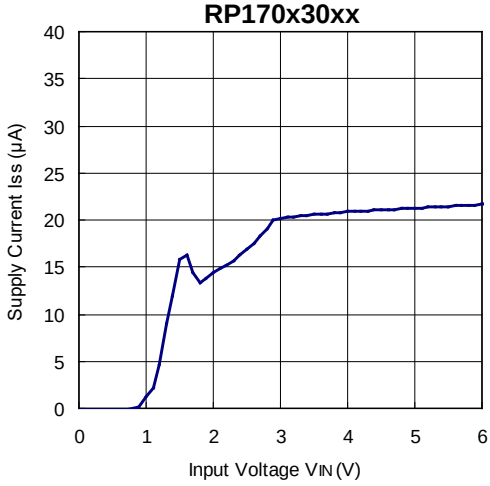



### 3) Supply Current vs. Input Voltage (Ta = 25°C)

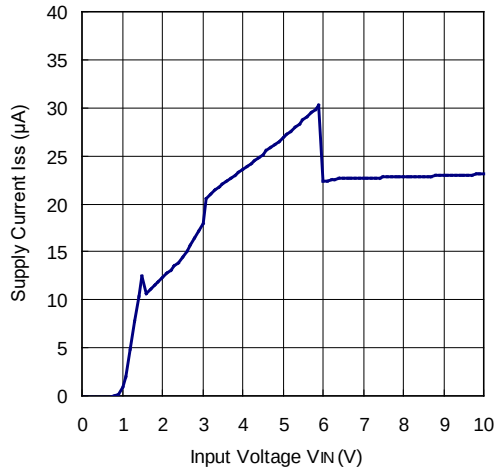
**RP170x12xx**




**RP170x30xx**

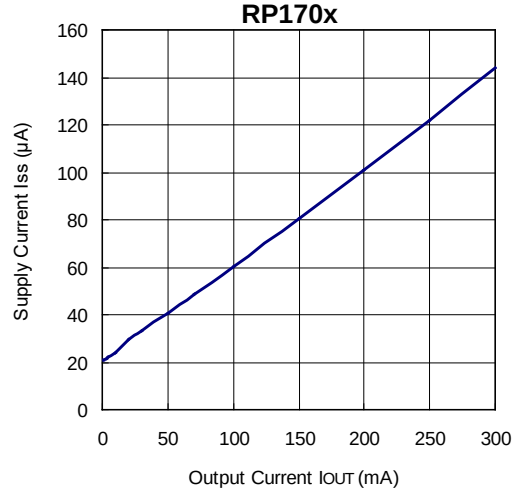



**RP170x60xx**



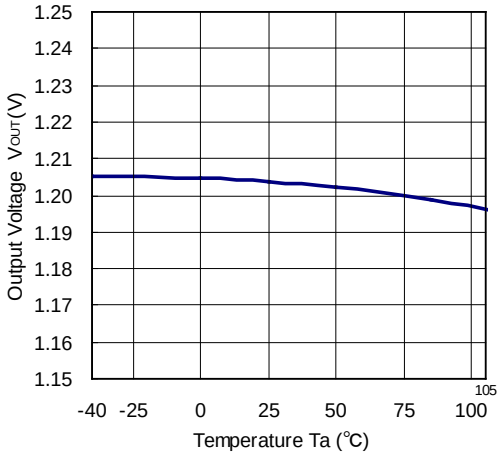
### 4) Supply Current vs. Output Current (Ta = 25°C)

**RP170x**

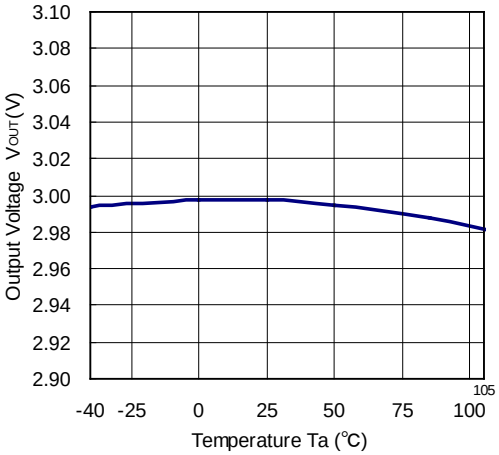



### 5) Output Voltage vs. Temperature

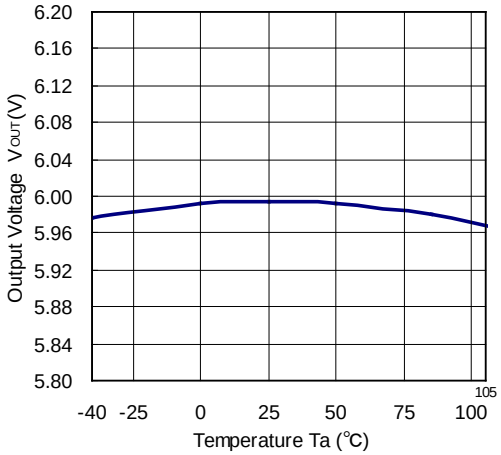
**RP170x12xx**




**RP170x30xx**

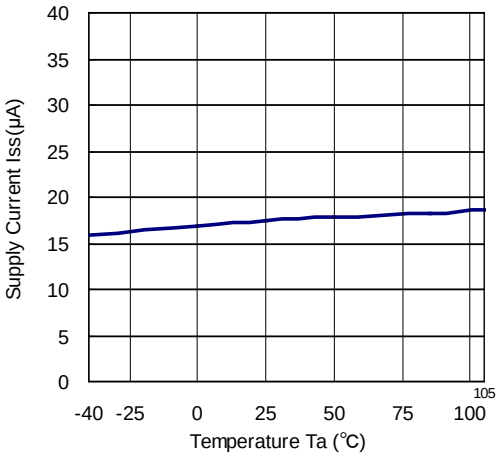



**RP170x60xx**

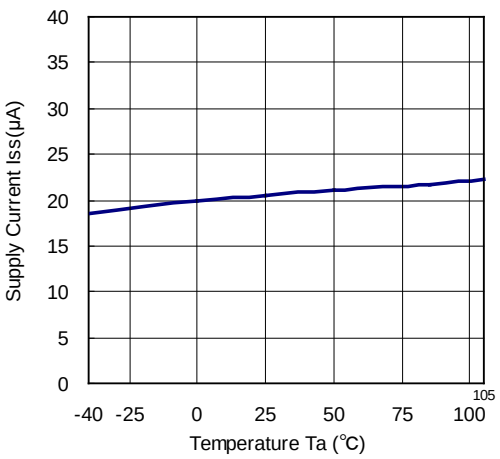


### 6) Supply Current vs. Temperature

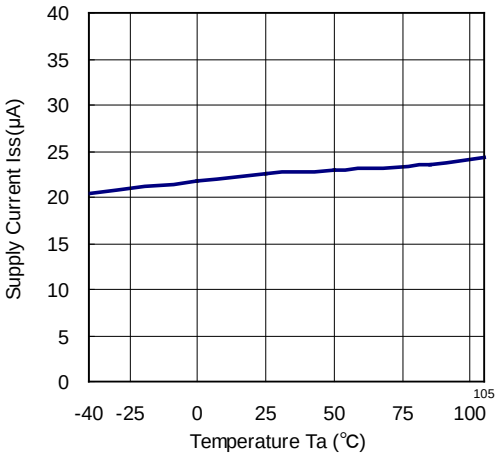
**RP170x12xx**




**RP170x30xx**

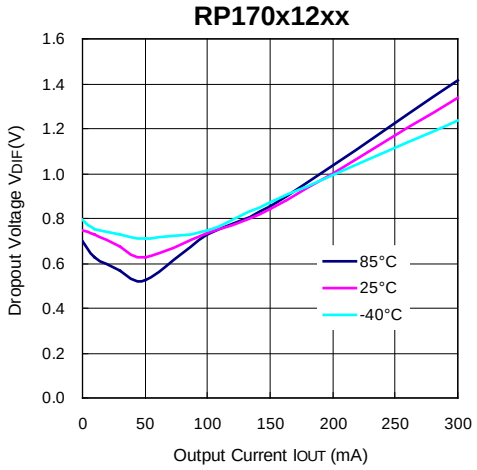



**RP170x60xx**

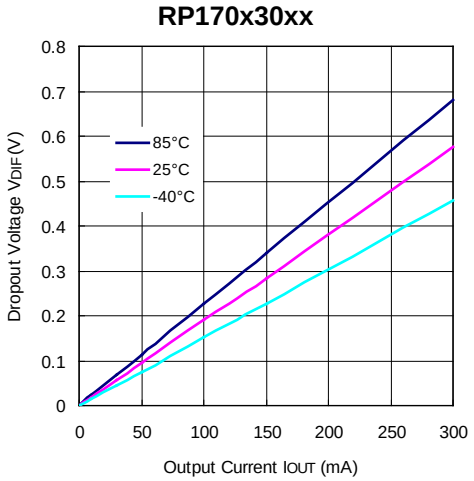


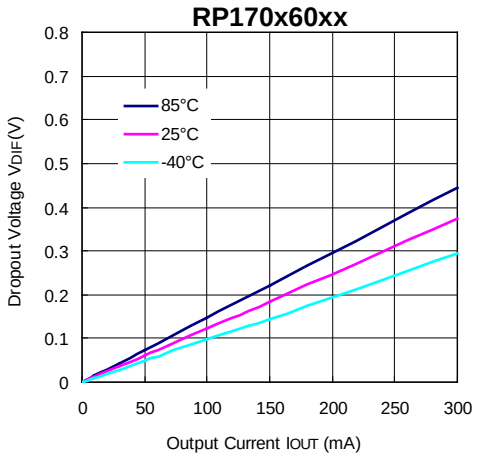

### 7) Dropout Voltage vs. Output Current

**RP170x12xx**

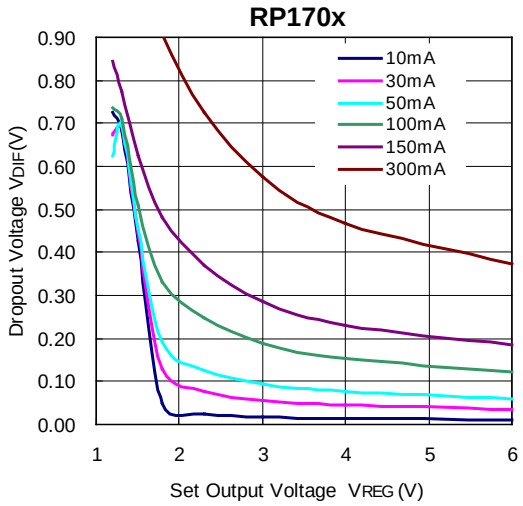



**RP170x30xx**

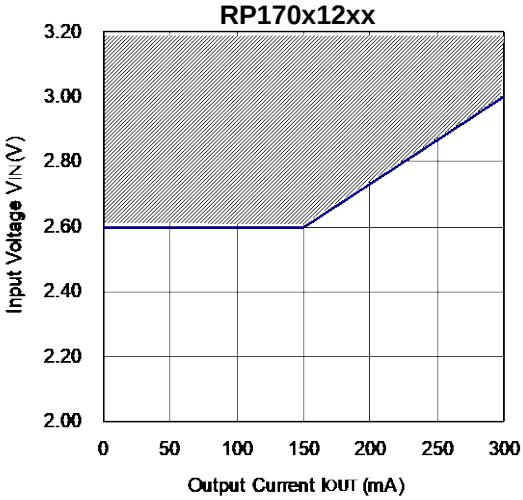





### 8) Dropout Voltage vs. Set Output Voltage (Ta = 25°C)

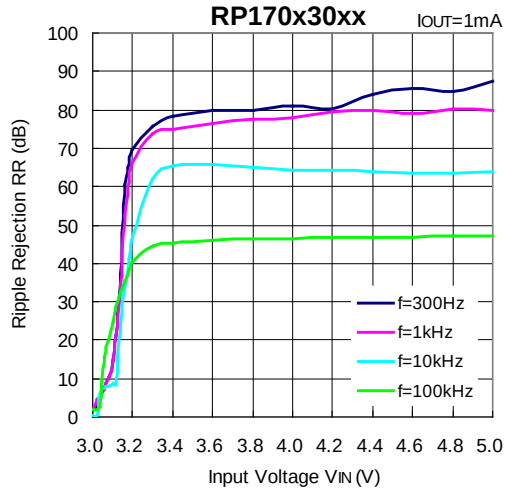


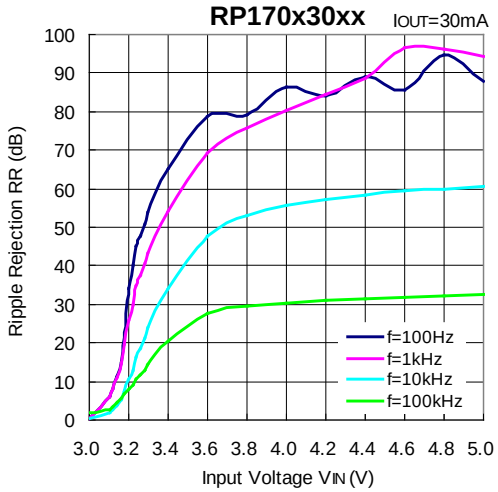

### 9) Minimum Operating Voltage

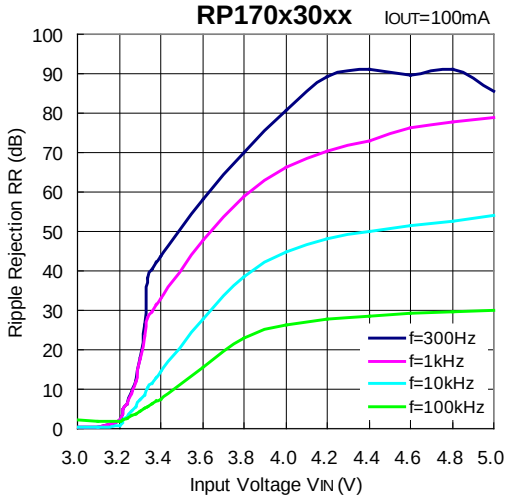



Hatched area is available for 1.2 V output

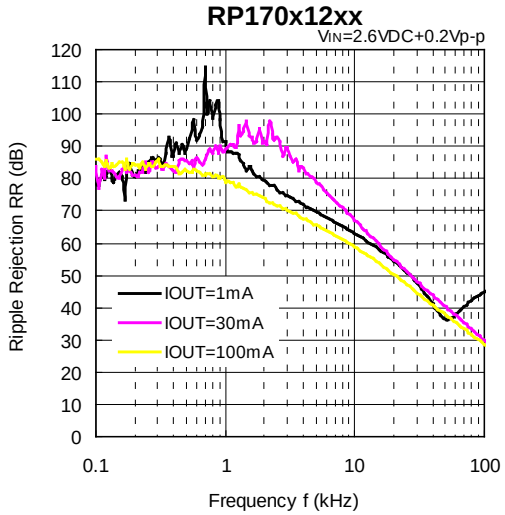
**10) Ripple Rejection vs. Input Bias Voltage (C1 = none, C2 = Ceramic 1.0 µF, Ripple = 0.2 Vp-p, Ta = 25°C)**

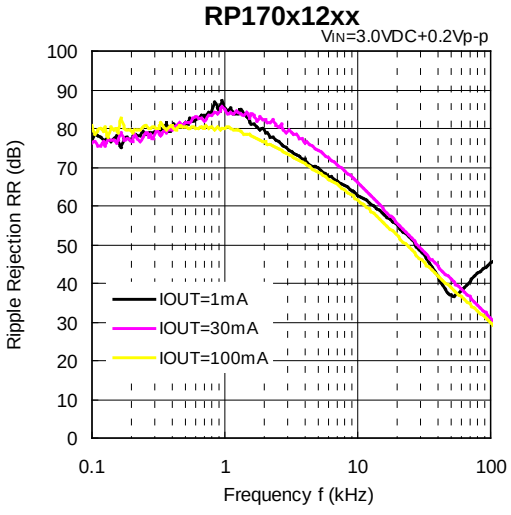


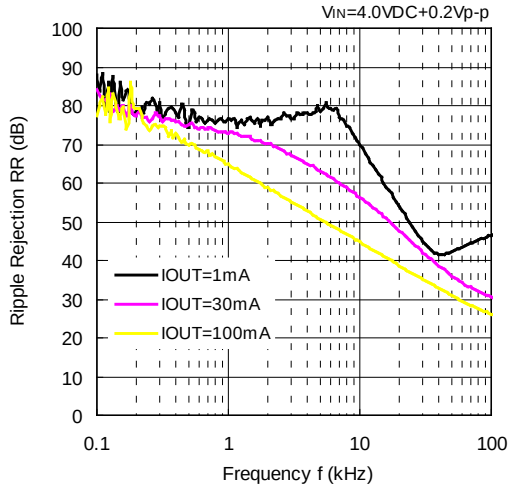




**11) Ripple Rejection vs. Frequency (C1 = none, C2 = Ceramic 1.0 µF, Ta = 25°C)**

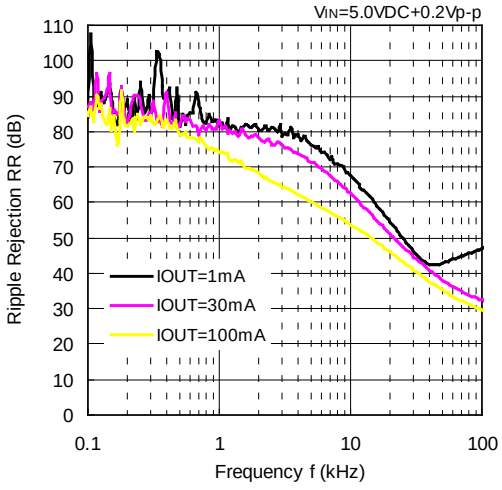


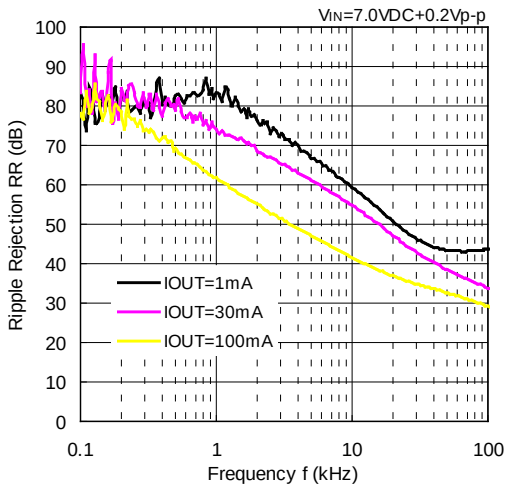
**RP170x30xx**



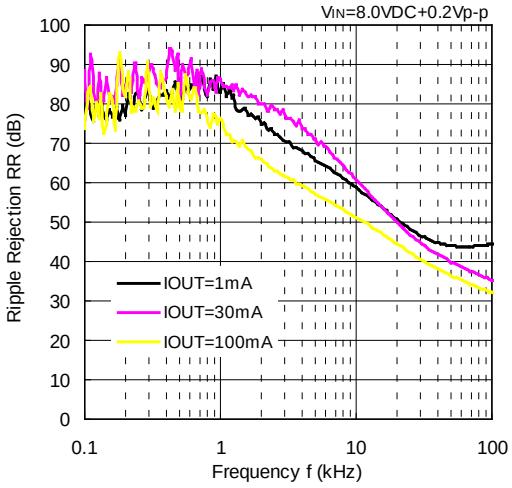

**RP170x30xx**




**RP170x60xx**

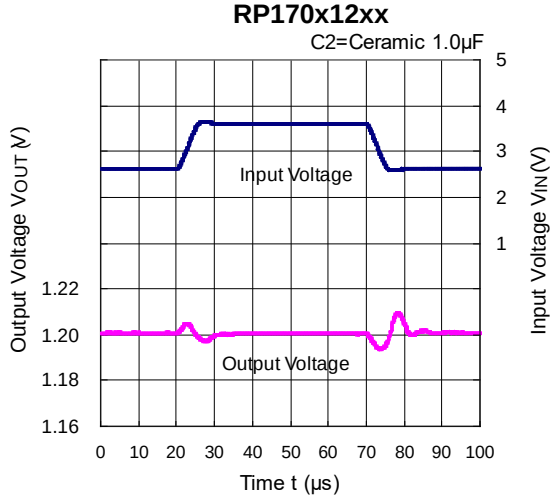



**RP170x60xx**

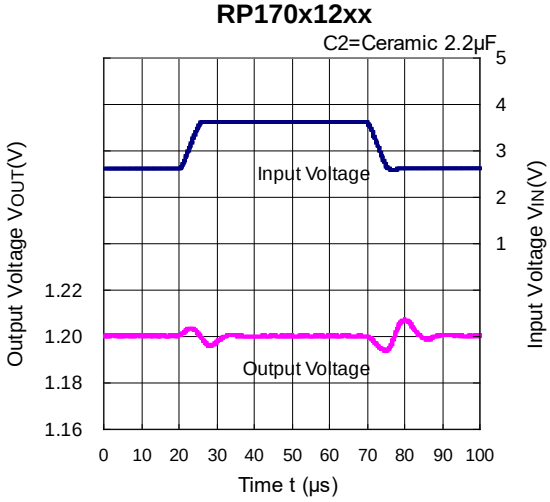



**12) Input Transient Response (C1 = none, $I_{OUT}$ = 30 mA, tr = tf = 5 µs, Ta = 25°C)**

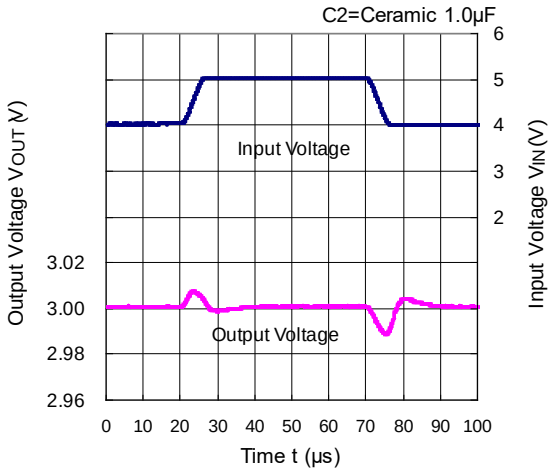
**RP170x12xx**



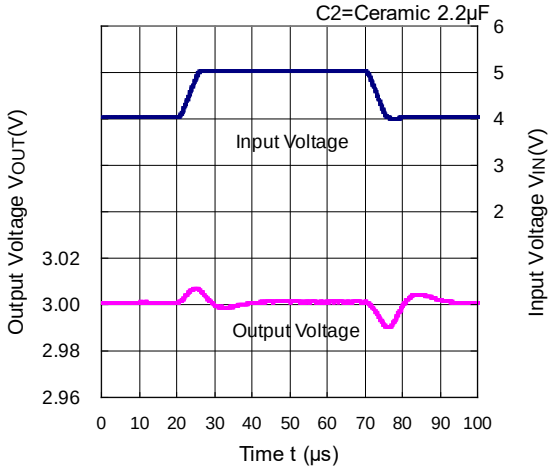

**RP170x12xx**



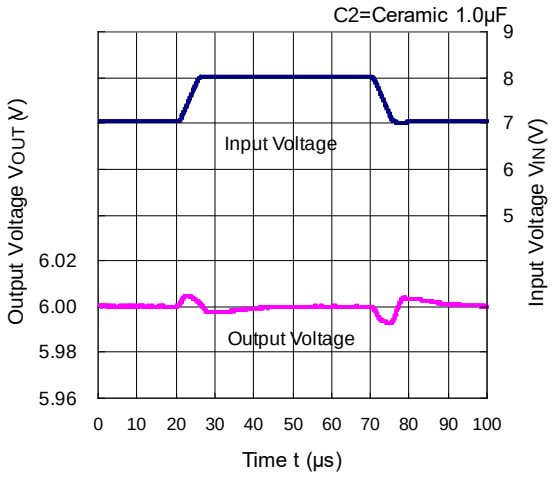
**RP170x30xx**



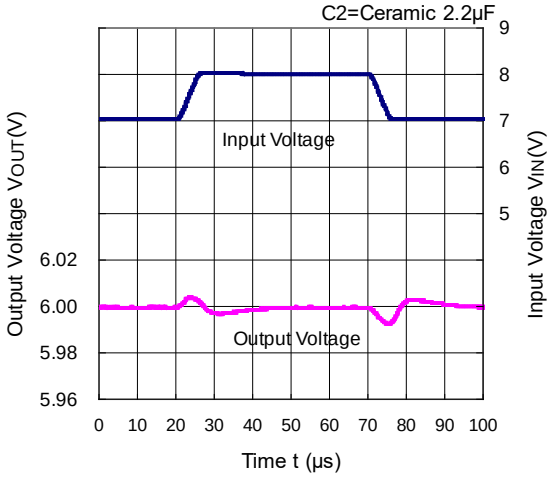

**RP170x30xx**




**RP170x60xx**

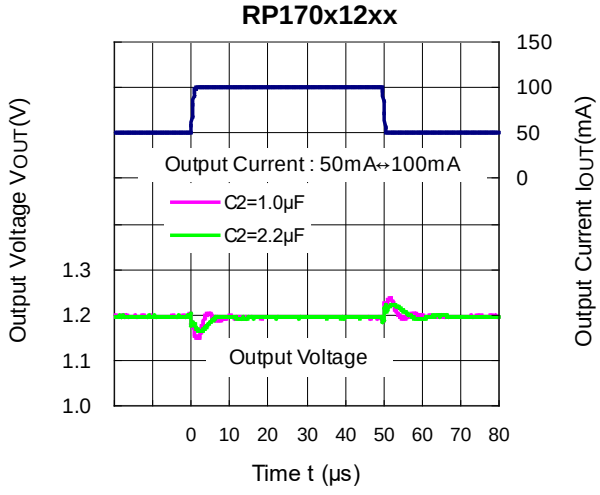



**RP170x60xx**

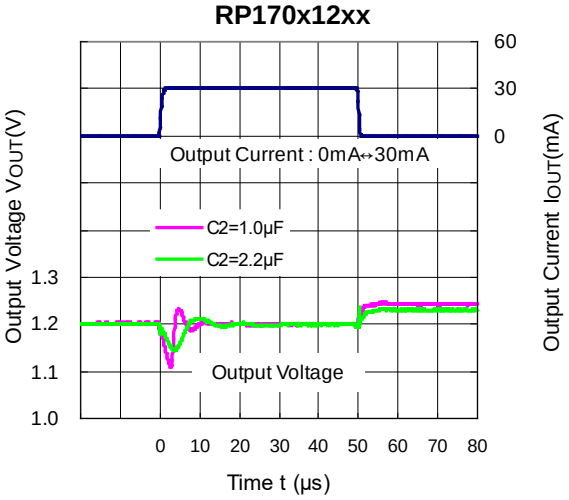



**13) Load Transient Response (C1 = Ceramic 1.0 μF, tr = tf = 500 ns, Ta = 25°C)**

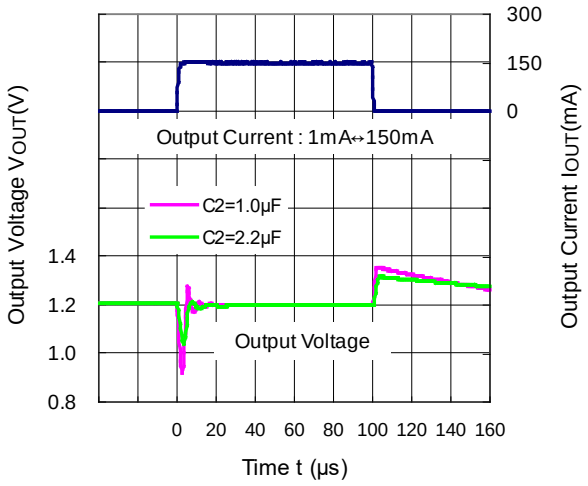
**RP170x12xx**



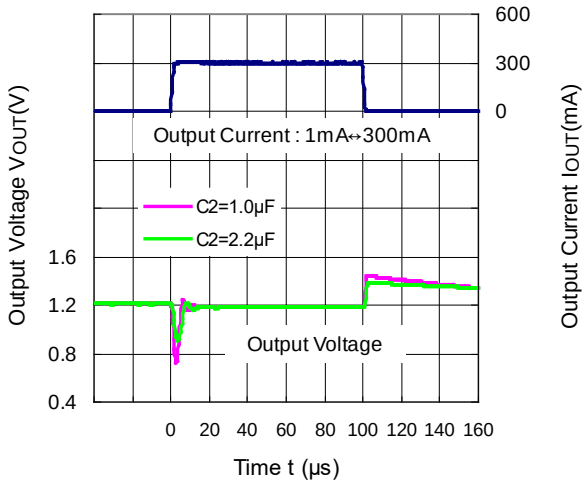

**RP170x12xx**



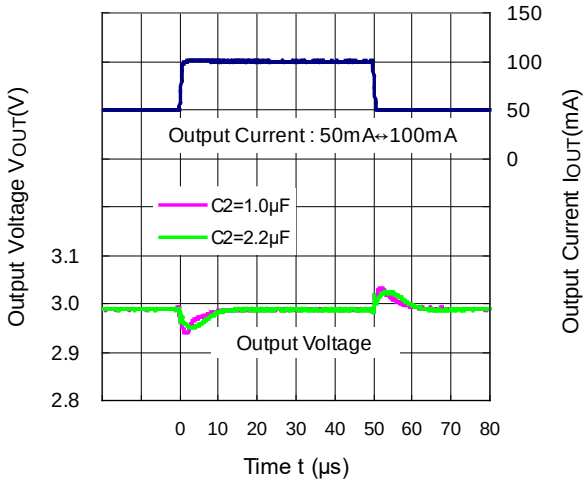
**RP170x12xx**



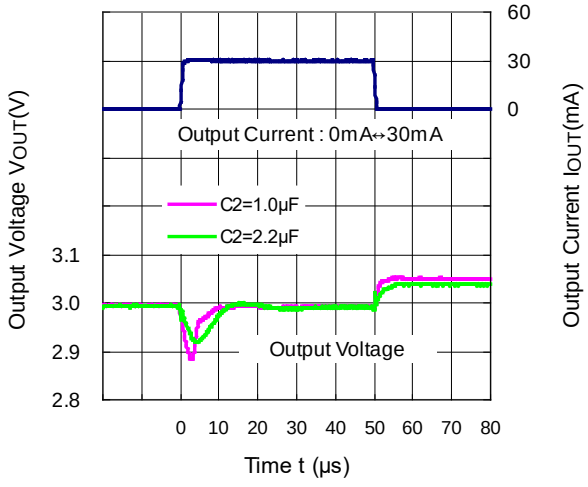

**RP170x12xx**



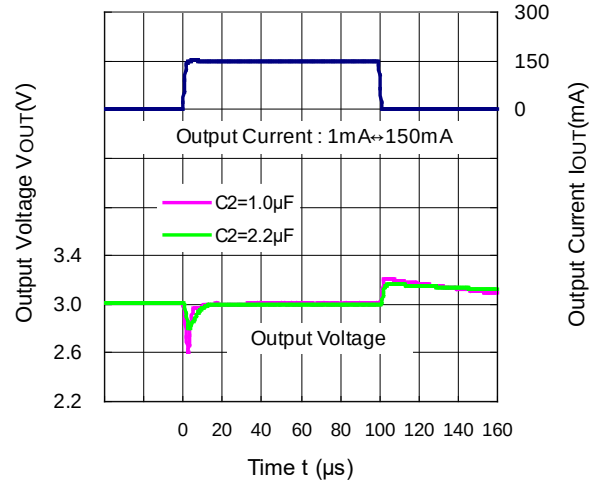

**RP170x30xx**



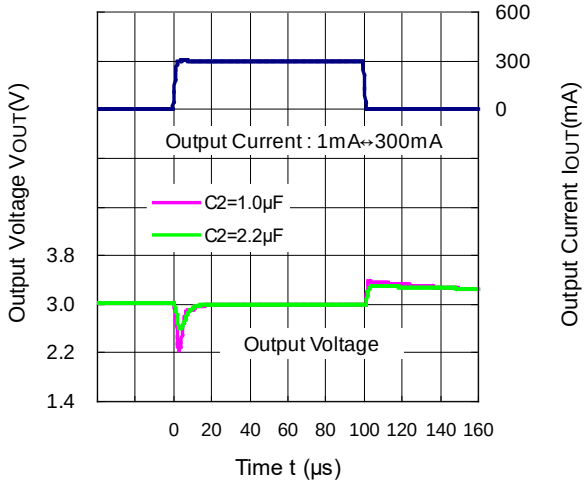

**RP170x30xx**



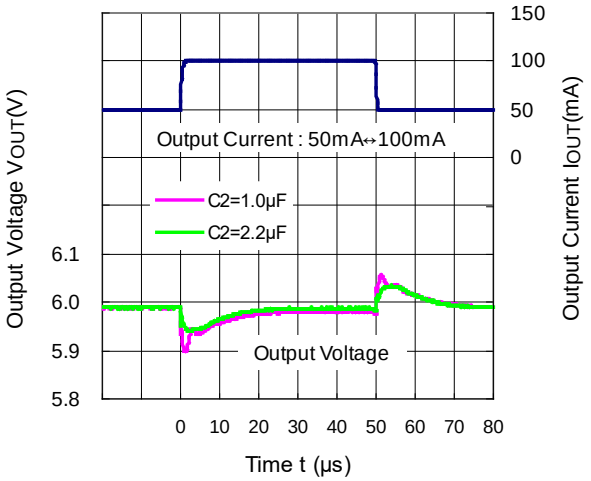

**RP170x30xx**



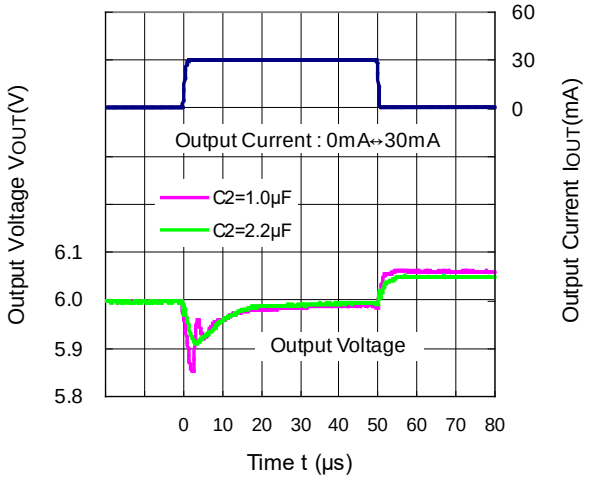

**RP170x30xx**



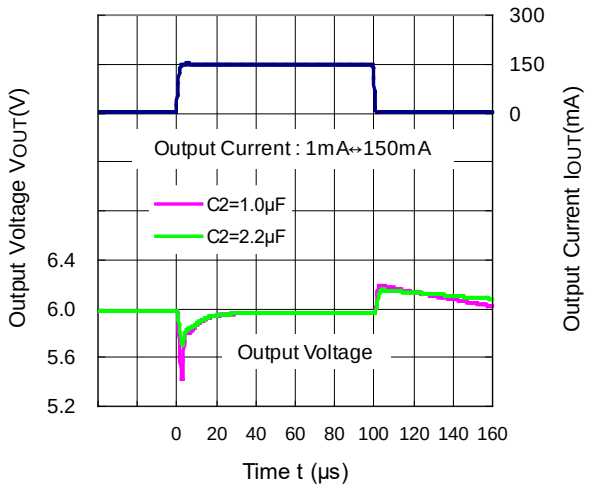
**RP170x60xx**



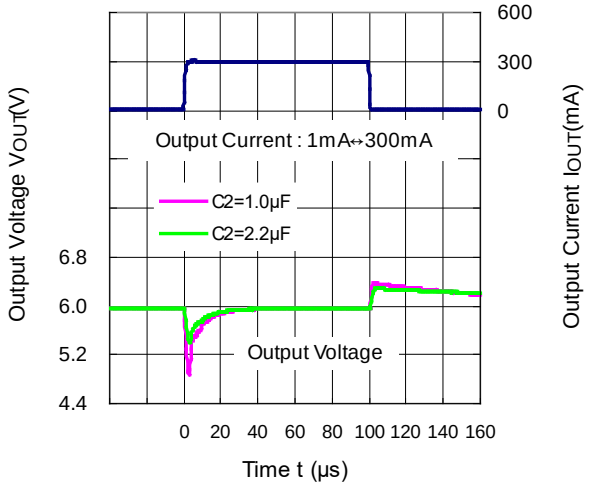

**RP170x60xx**




**RP170x60xx**

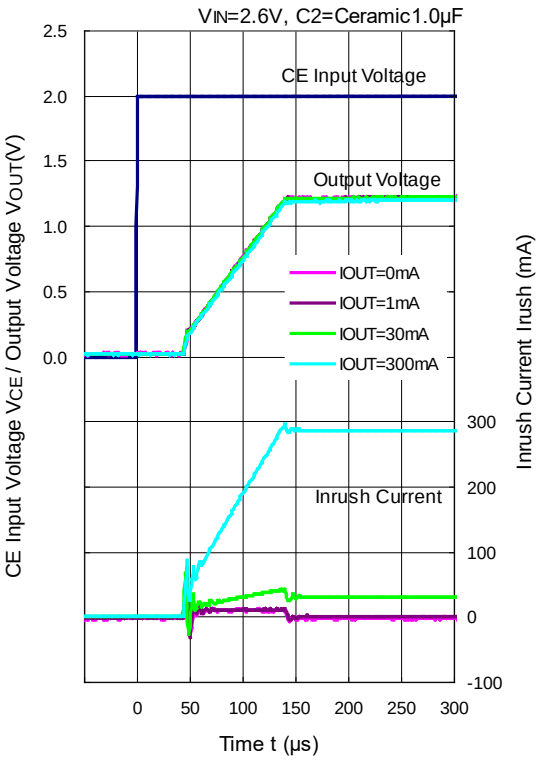



**RP170x60xx**

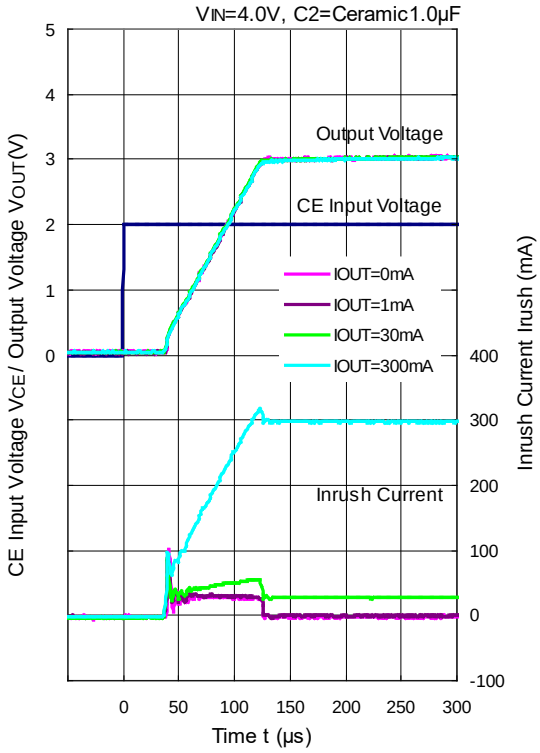


### 14) Turn On Speed with CE pin (C1 = Ceramic 1.0 µF, Ta = 25°C)

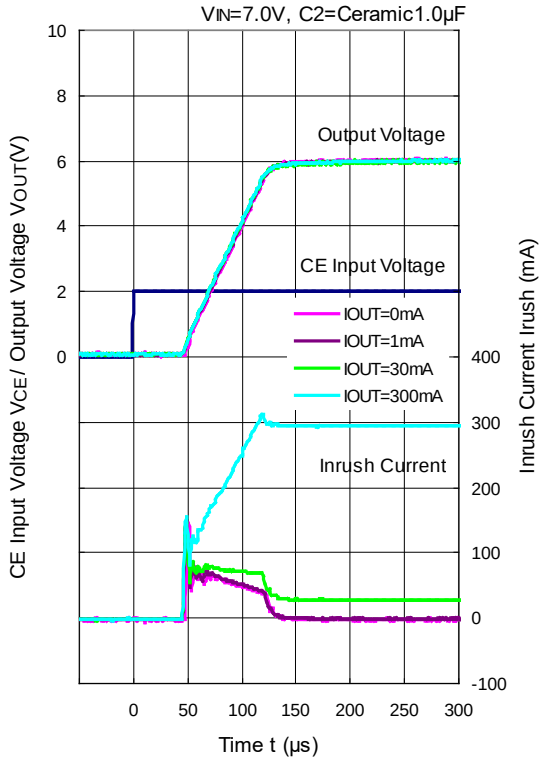
**RP170x12xx**



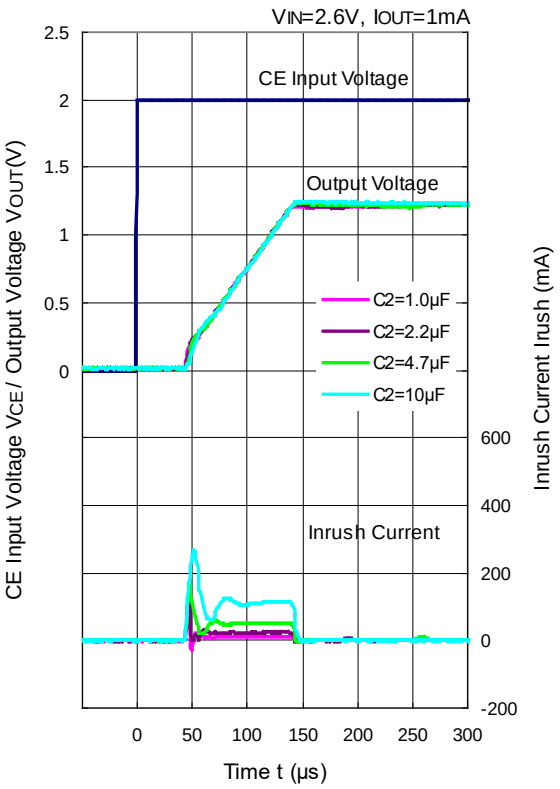

**RP170x30xx**



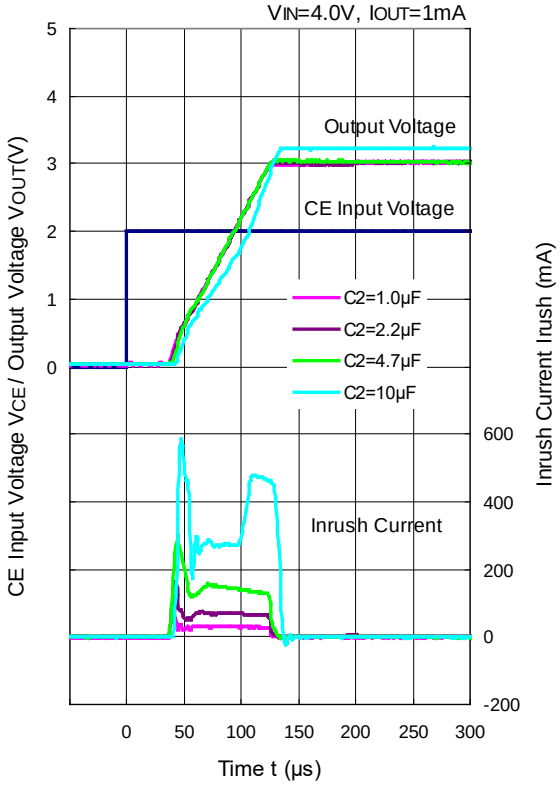

**RP170x60xx**



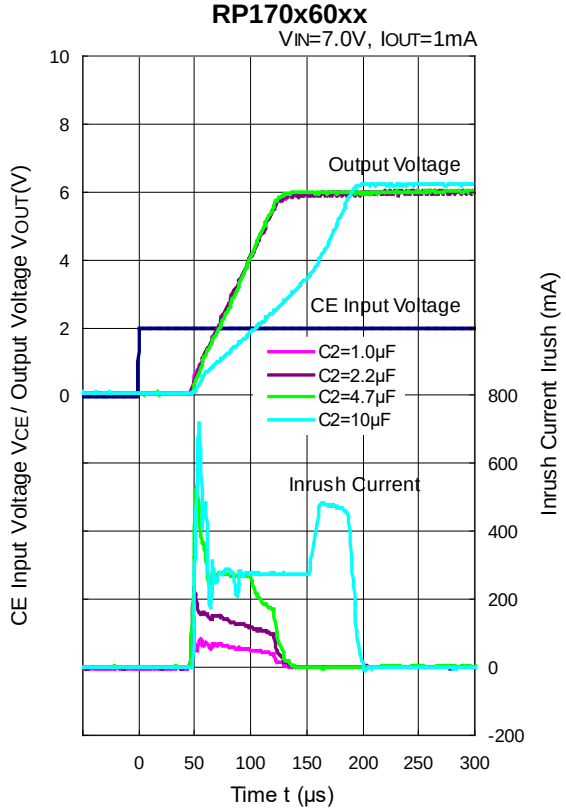
**RP170x12xx**



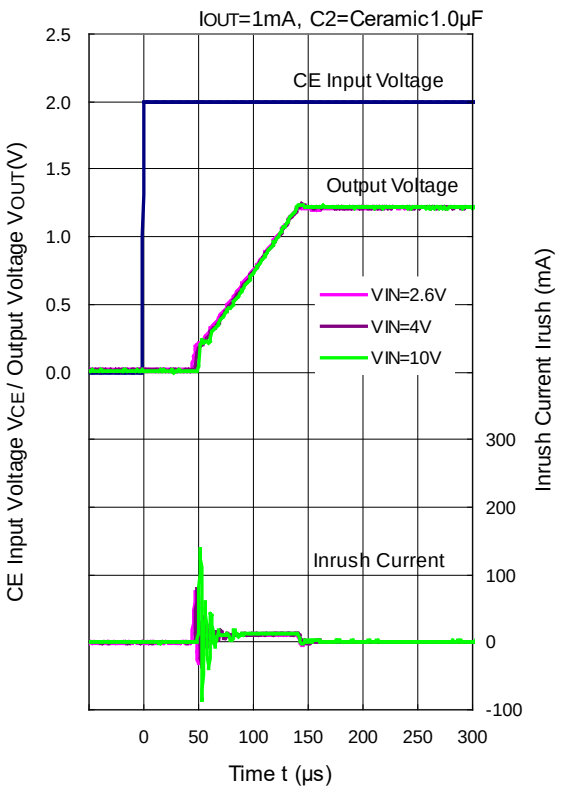

**RP170x30xx**



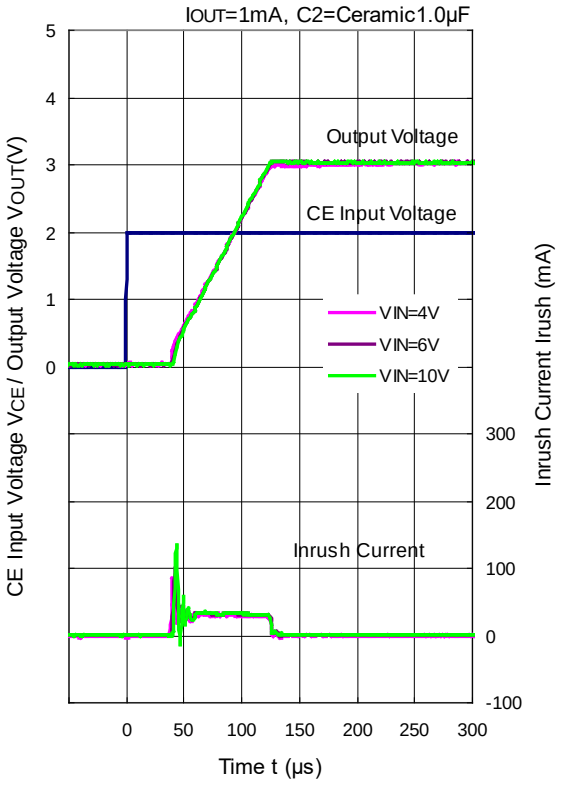

**RP170x60xx**



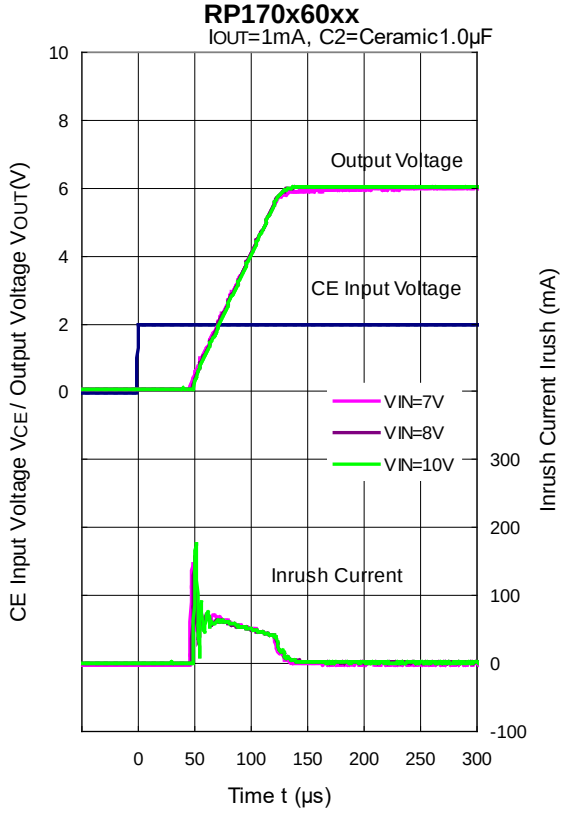
**RP170x12xx**




**RP170x30xx**

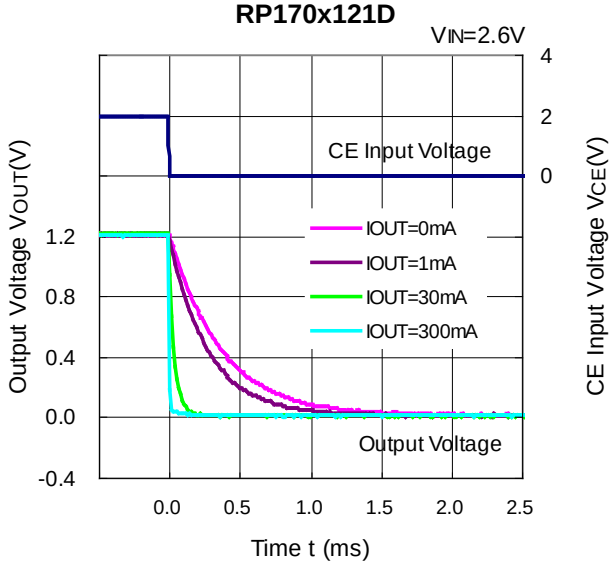



**RP170x60xx**

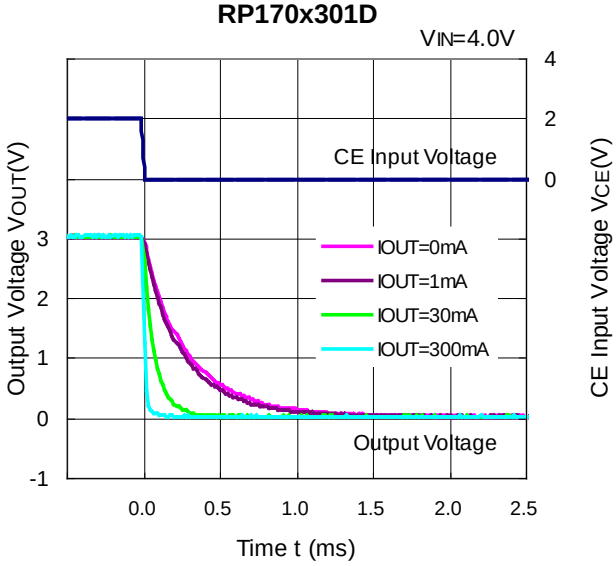


**15) Turn Off Speed with CE pin (RP170xxx1D) (C1 = Ceramic 1.0 μF, Ta = 25°C)**

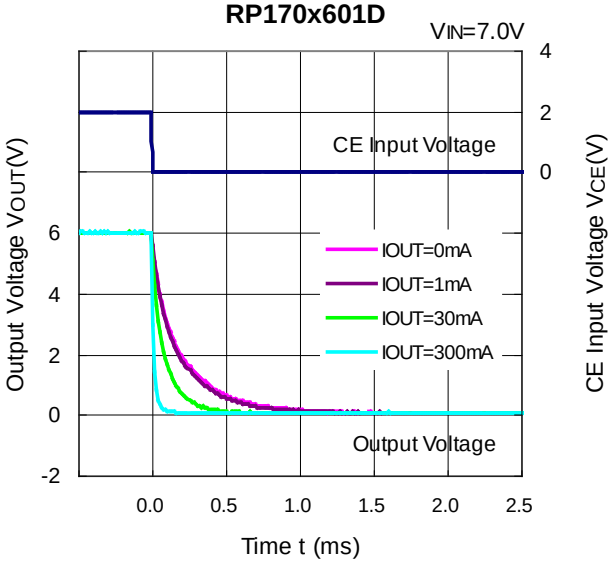
**RP170x121D**




**RP170x301D**




**RP170x601D**



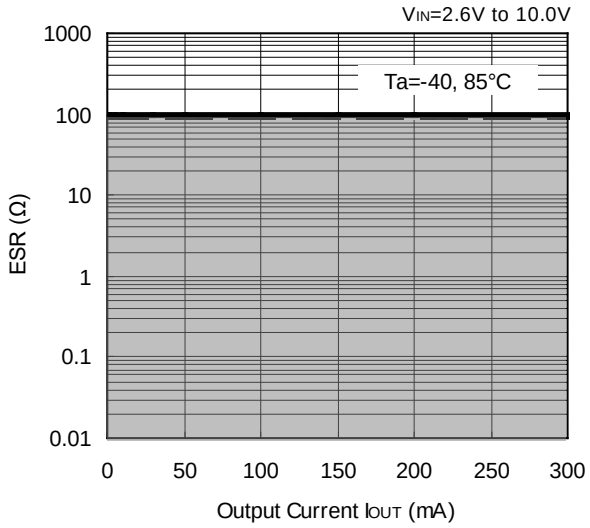
# ESR vs. Output Current

Ceramic type output capacitor is recommended for this IC; however, the other output capacitors with low ESR also can be used. The relations between $I_{OUT}$ (Output Current) and ESR of an output capacitor are shown below. The conditions when the white noise level is under 40 μV (Avg.) are marked as the hatched area in the graph.

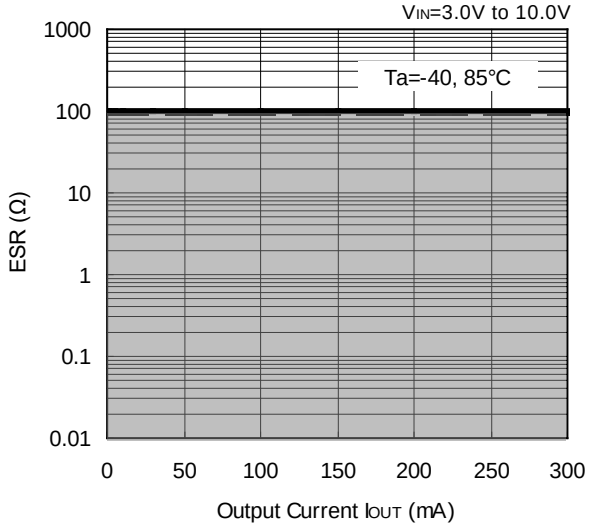
**Measurement conditions**

Frequency Band : 10 Hz to 2 MHz
Temperature : −40°C to 85°C
C1, C2 : Ceramic 1.0 μF (Murata GRM155B31A105KE)

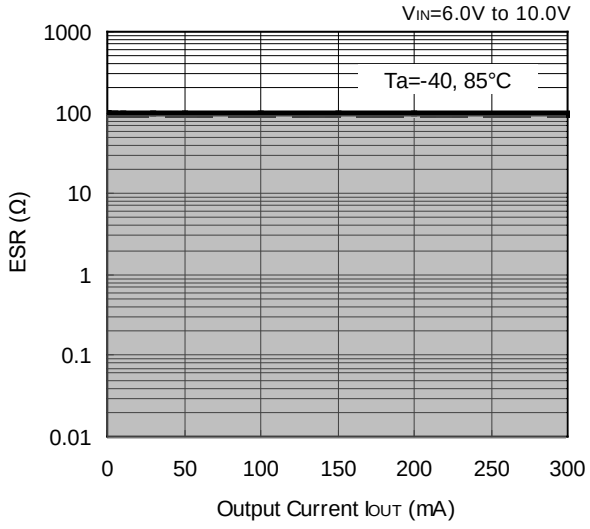
**RP170x12xx**




**RP170x30xx**




**RP170x60xx**



Ver. A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

**Measurement Conditions**

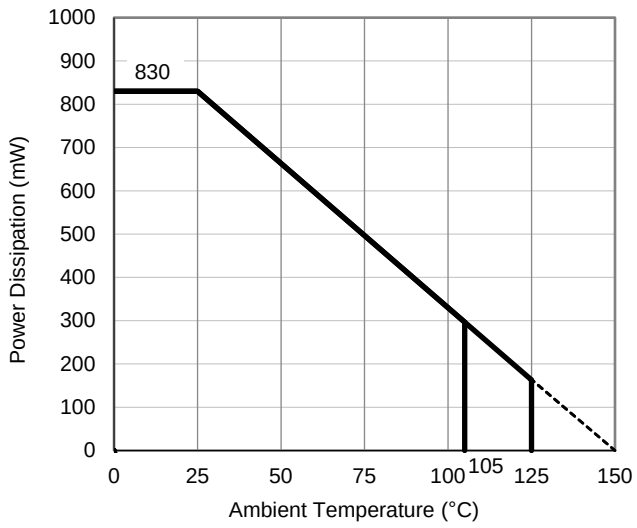
| Item | Measurement Conditions |
|---|---|
| Environment | Mounting on Board (Wind Velocity = 0 m/s) |
| Board Material | Glass Cloth Epoxy Plastic (Four-Layer Board) |
| Board Dimensions | 76.2 mm × 114.3 mm × 0.8 mm |
| Copper Ratio | Outer Layer (First Layer): Less than 95% of 50 mm Square<br>Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square<br>Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square |
| Through-holes | ϕ 0.3 mm × 7 pcs |

**Measurement Result** (Ta = 25°C, Tjmax = 150°C)

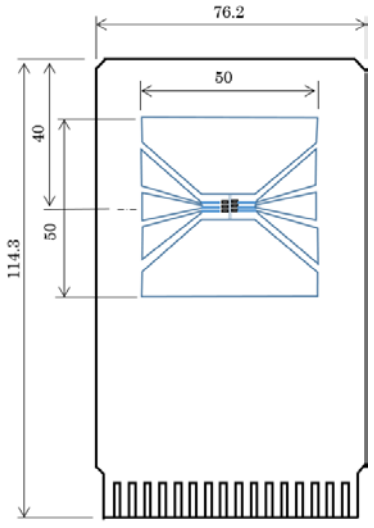
| Item | Measurement Result |
|---|---|
| Power Dissipation | 830 mW |
| Thermal Resistance (θja) | θja = 150°C/W |
| Thermal Characterization Parameter (ψjt) | ψjt = 51°C/W |

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



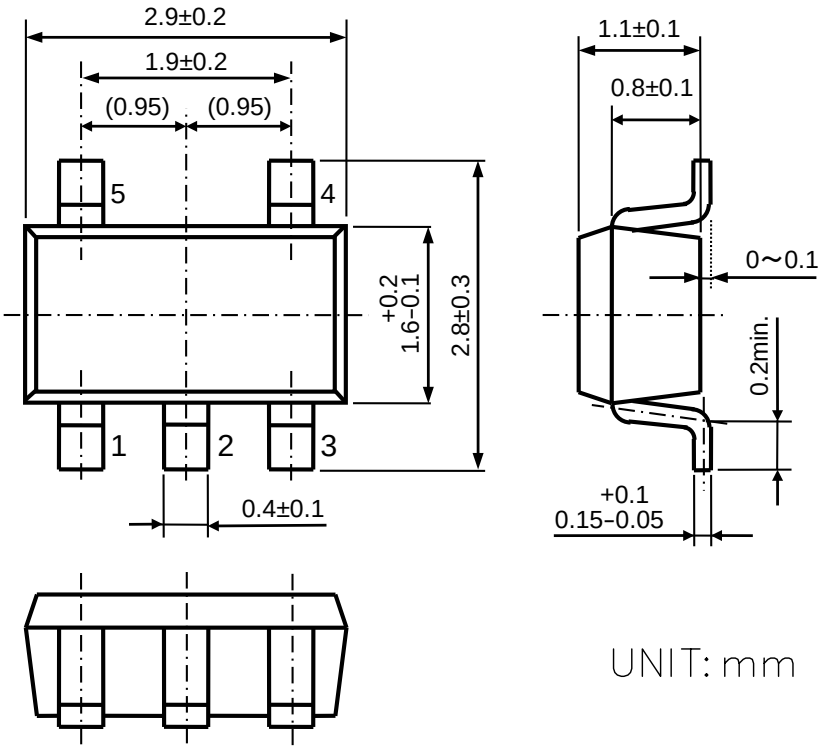

**Power Dissipation vs. Ambient Temperature**




**Measurement Board Pattern**



RICOH




**SOT-23-5 Package Dimensions**

Ver. A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

**Measurement Conditions**

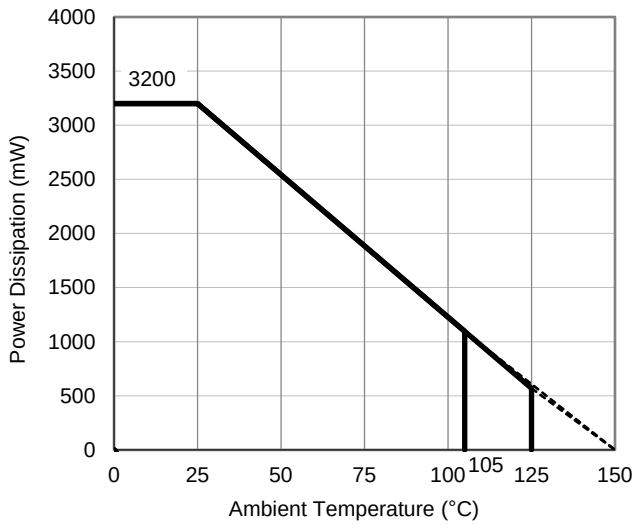
| Item | Measurement Conditions |
|---|---|
| Environment | Mounting on Board (Wind Velocity = 0 m/s) |
| Board Material | Glass Cloth Epoxy Plastic (Four-Layer Board) |
| Board Dimensions | 76.2 mm × 114.3 mm × 0.8 mm |
| Copper Ratio | Outer Layer (First Layer): Less than 95% of 50 mm Square<br>Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square<br>Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square |
| Through-holes | ϕ 0.3 mm × 13 pcs |

**Measurement Result** (Ta = 25°C, Tjmax = 150°C)

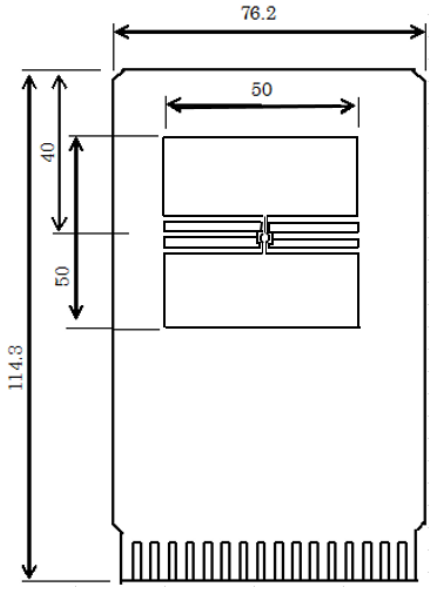
| Item | Measurement Result |
|---|---|
| Power Dissipation | 3200 mW |
| Thermal Resistance (θja) | θja = 38°C/W |
| Thermal Characterization Parameter (ψjt) | ψjt = 13°C/W |

θja: Junction-to-Ambient Thermal Resistance

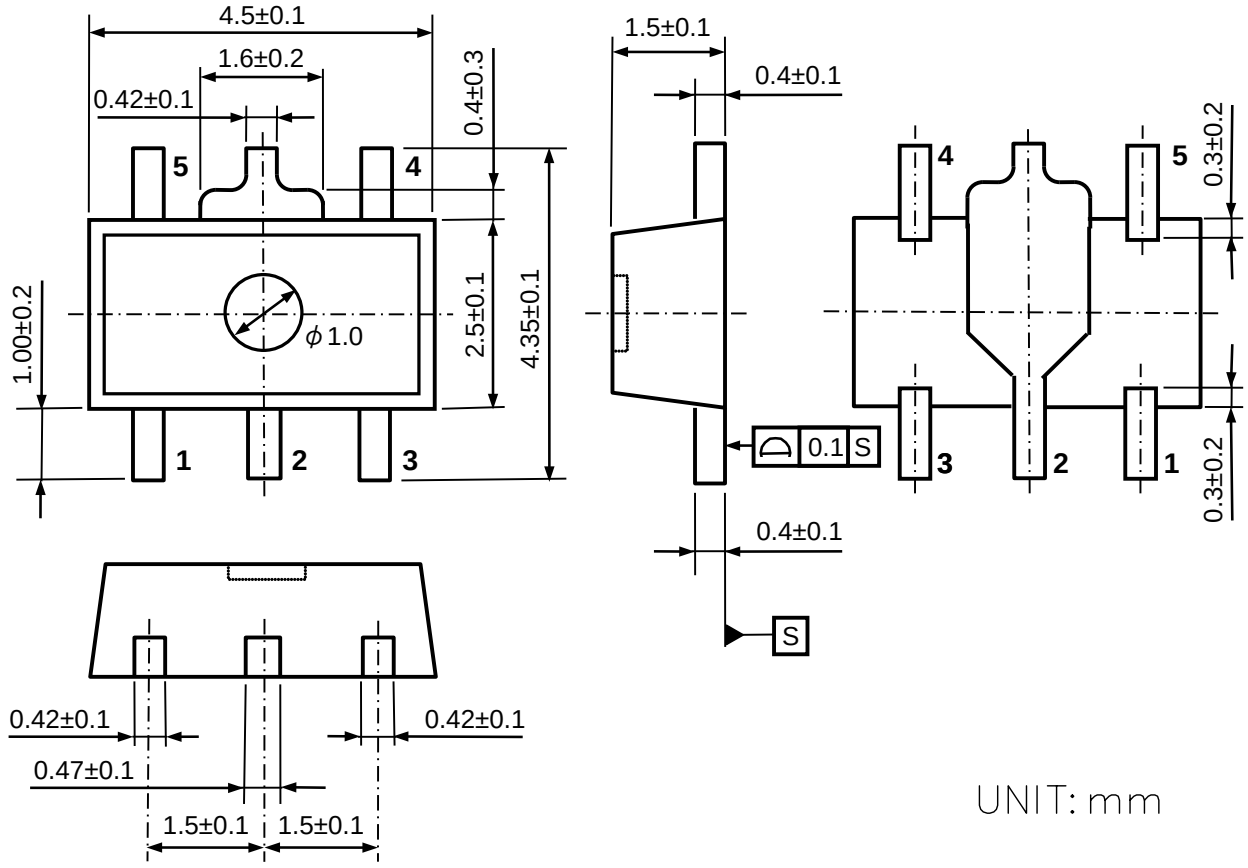
ψjt: Junction-to-Top Thermal Characterization Parameter




**Power Dissipation vs. Ambient Temperature**




**Measurement Board Pattern**




**SOT-89-5 Package Dimensions**

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