RICOH

# R1100D SERIES

## ULTRA SMALL PACKAGE VOLTAGE REGULATOR

NO.EA-117-111018

## OUTLINE

The R1100D 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 the GND, the included current limit circuit protects the ICs from the destruction.

Since the package for these ICs is SON1408-3, high density mounting of the ICs on boards is possible.

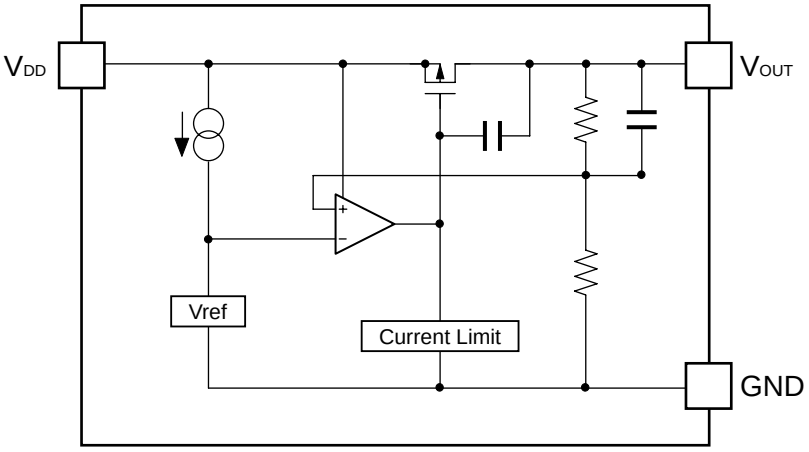
## FEATURES

- Supply current ..... Typ. 0.8μA ($V_{OUT}$=1.0V, $V_{DD}$=3.0V)
- Dropout Voltage ..... Typ. 20mV ($I_{OUT}$=1mA, $V_{OUT}$=3.0V)
- Output Voltage ..... 0.9V to 4.0V (0.1V steps)
  (For other voltages, please refer to MARK INFORMATIONS.)
- Output Voltage Accuracy ..... ±2.0%(1.2V ≤ $V_{OUT}$ ≤ 4.0V),
  ±24mV($V_{OUT}$ <1.2V)
- Temperature-Drift Coefficient of Output Voltage ..... Typ. ±100ppm/°C
- Line Regulation ..... Typ. 0.05%/V
- Package ..... SON1408-3
- Built-in Fold Back Protection Circuit ..... Typ. 40mA (Current at short mode)
- Ceramic capacitors are recommended to be used with this IC .....0.1μF or more

## 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 DIAGRAM



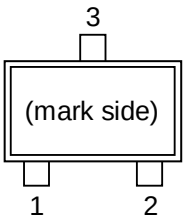

## SELECTION GUIDE

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

| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|---|---|---|---|---|
| R1100Dxx1C-TR-F | SON1408-3 | 9,000 pcs | Yes | Yes |
| xx: The output voltage can be designated in the range from 0.9V(09) to 4.0V(40) in 0.1V steps.<br>(For other voltages, please refer to MARK INFORMATIONS.) | | | | |

# PIN CONFIGURATION

● **SON1408-3**




# PIN DESCRIPTION

● **SON1408-3**

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

# ABSOLUTE MAXIMUM RATINGS

(GND=0V)

| Symbol | Item | Rating | Unit |
|---|---|---|---|
| $V_{IN}$ | Input Voltage | 6.5 | V |
| $V_{OUT}$ | Output Voltage | $V_{SS}$–0.3 to $V_{IN}$+0.3 | V |
| $I_{OUT}$ | Output Current | 180 | mA |
| $P_D$ | Power Dissipation * (SON1408-3) | 250 | mW |
| Topt | Operating Temperature Range | -40 to 85 | °C |
| Tstg | Storage Temperature Range | -55 to~ 125 | °C |

∗) 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.

# ELECTRICAL CHARACTERISTICS

- **R1100D301C**

Topt=25°C

| Symbol | Item | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | $V_{IN}$=5.0V<br>10μA ≤ $I_{OUT}$ ≤ 10mA | 2.940 | 3.000 | 3.060 | V |
| $I_{OUT}$ | Output Current | $V_{IN}$=5.0V | 100 | | | mA |
| $\Delta V_{OUT}/\Delta I_{OUT}$ | Load Regulation | $V_{IN}$=5.0V, 1mA ≤ $I_{OUT}$ ≤ 50mA | | 35 | 60 | mV |
| $V_{DIF}$ | Dropout Voltage | $I_{OUT}$=1mA | | 20 | 30 | mV |
| $I_{SS}$ | Supply Current | $V_{IN}$=5.0V | | 1.5 | 3.0 | μA |
| $\Delta V_{OUT}/\Delta V_{IN}$ | Line Regulation | $I_{OUT}$=1mA<br>Set $V_{OUT}$+0.5V ≤ $V_{IN}$ ≤ 6.0V | −0.20 | | 0.20 | %/V |
| $V_{IN}$ | Input Voltage | | | | 6.0 | V |
| $\Delta V_{OUT}/\Delta Topt$ | Output Voltage Temperature Coefficient | $I_{OUT}$=10mA<br>−40°C ≤ Topt ≤ 85°C | | ±100 | | ppm/°C |
| $I_{SC}$ | Short Current Limit | $V_{OUT}$=0V | | 40 | | mA |

# ELECTRICAL CHARACTERISTICS BY OUTPUT VOLTAGE

Topt=25°C

| Part Number | Output Voltage | | | | Output Current | | | Load Regulation | | | Dropout Voltage | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | VOUT[V] | | | | IOUT[mA] | | | ΔVOUT/ΔIOUT[mV] | | | VDIF[mV] | | |
| | Condi-tions | MIN. | TYP. | MAX. | Condi-tions | MIN. | TYP. | Condi-tions | TYP. | MAX. | Condi-tions | TYP. | MAX. |
| R1100D091C | VIN-Set VOUT =2.0V<br>10μA ≤ IOUT ≤ 10mA | 0.876 | 0.900 | 0.924 | VIN-Set VOUT =2.0V | 35 | | VIN-Set VOUT =2.0V<br>1mA ≤ IOUT ≤ 20mA | 7.5 | 20 | IOUT =1mA | 380 | 750 |
| R1100D101C | | 0.976 | 1.000 | 1.024 | | | | | | | | 280 | 700 |
| R1100D111C | | 1.076 | 1.100 | 1.124 | | | | | | | | 200 | 600 |
| R1100D121C | | 1.176 | 1.200 | 1.224 | | | | | | | | | |
| R1100D131C | | 1.274 | 1.300 | 1.326 | | | | | | | | 100 | 400 |
| R1100D141C | | 1.372 | 1.400 | 1.428 | | | | | | | | | |
| R1100D151C | | 1.470 | 1.500 | 1.530 | | 65 | | VIN-Set VOUT =2.0V<br>1mA ≤ IOUT ≤ 35mA | 20 | 40 | | 50 | 100 |
| R1100D161C | | 1.568 | 1.600 | 1.632 | | | | | | | | | |
| R1100D171C | | 1.666 | 1.700 | 1.734 | | | | | | | | 25 | 50 |
| R1100D181C | | 1.764 | 1.800 | 1.836 | | | | | | | | | |
| R1100D191C | | 1.862 | 1.900 | 1.938 | | | | | | | | | |
| R1100D201C | | 1.960 | 2.000 | 2.040 | | | | | | | | | |
| R1100D211C | | 2.058 | 2.100 | 2.142 | | | | | | | | | |
| R1100D221C | | 2.156 | 2.200 | 2.244 | | | | | | | | | |
| R1100D231C | | 2.254 | 2.300 | 2.346 | | | | | | | | | |
| R1100D241C | | 2.352 | 2.400 | 2.448 | | | | | | | | | |
| R1100D251C | | 2.450 | 2.500 | 2.550 | | | | | | | | | |
| R1100D261C | | 2.548 | 2.600 | 2.652 | | | | | | | | | |
| R1100D271C | | 2.646 | 2.700 | 2.754 | | | | | | | | | |
| R1100D281C | | 2.744 | 2.800 | 2.856 | | | | | | | | | |
| R1100D291C | | 2.842 | 2.900 | 2.958 | | | | | | | | | |
| R1100D301C | | 2.940 | 3.000 | 3.060 | | 100 | | VIN-Set VOUT =2.0V<br>1mA ≤ IOUT ≤ 50mA | 35 | 60 | | 20 | 30 |
| R1100D311C | | 3.038 | 3.100 | 3.162 | | | | | | | | | |
| R1100D321C | | 3.136 | 3.200 | 3.264 | | | | | | | | | |
| R1100D331C | | 3.234 | 3.300 | 3.366 | | | | | | | | | |
| R1100D341C | | 3.332 | 3.400 | 3.468 | | | | | | | | | |
| R1100D351C | | 3.430 | 3.500 | 2.570 | | | | | | | | | |
| R1100D361C | | 3.528 | 3.600 | 3.672 | | | | | | | | | |
| R1100D371C | | 3.626 | 3.700 | 3.774 | | | | | | | | | |
| R1100D381C | | 3.724 | 3.800 | 3.876 | | | | | | | | | |
| R1100D391C | | 3.822 | 3.900 | 3.978 | | | | | | | | | |
| R1100D401C | | 3.920 | 4.000 | 4.080 | | | | | | | | | |

# ELECTRICAL CHARACTERISTICS

(Common characteristics)

| Symbol | Item | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $\Delta V_{OUT}/\Delta V_{IN}$ | Line Regulation | $I_{OUT}$=1mA<br>Set $V_{OUT}$+0.5V ≤ $V_{IN}$ ≤ 6V | -0.20 | | 0.20 | %/V |
| $V_{IN}$ | Input Voltage | | (1.2) | | 6.0 | V |
| $\Delta V_{OUT}/\Delta Topt$ | Output Voltage Temperature Coefficient | $I_{OUT}$=10mA<br>−40°C ≤ Topt ≤ 85°C | | ±100 | | ppm/°C |
| $I_{SC}$ | Short Current Limit | $V_{OUT}$=0V | | 40 | | mA |

# ELECTRICAL CHARACTERISTICS BY OUTPUT VOLTAGE

| Symbol | Item | Output Voltage | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $I_{SS}$ | Supply Current | 0.9V ≤ $V_{OUT}$ ≤ 1.0V | $V_{IN}$=Set $V_{OUT}$+2.0V | | 0.8 | 1.8 | µA |
| | | 1.1V ≤ $V_{OUT}$ ≤ 1.4V | | | 1.0 | 2.4 | |
| | | 1.5V ≤ $V_{OUT}$ ≤ 2.0V | | | 1.2 | 2.7 | |
| | | 2.1V ≤ $V_{OUT}$ ≤ 4.0V | | | 1.5 | 3.0 | |

**RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)**

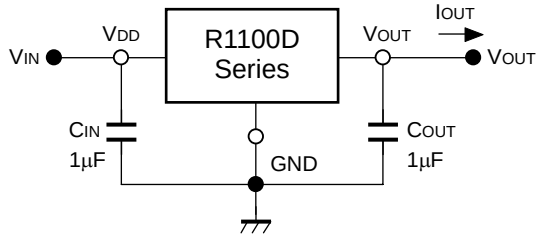
All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic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

## OPERATION

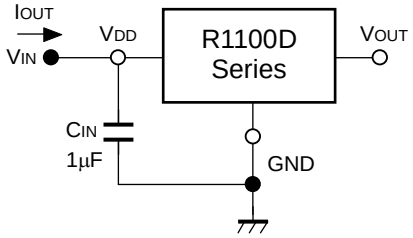
These ICs, the output voltage $V_{OUT}$ is detected by Feedback Resisters, and the detected output voltage is compare with a reference voltage by the error amplifier, so that a constant voltage is output.

A current limit circuit against short protection and a chip enable circuit are included.

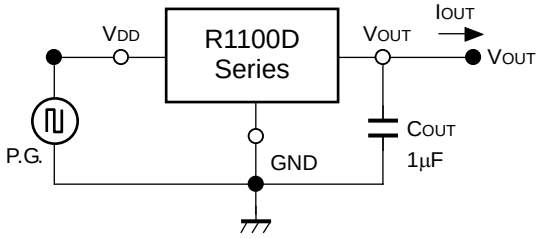
## TEST CIRCUITS




**Standard Test Circuit**




**Test Circuit for Supply Current**




**Test Circuit for Line Transient Response**

## TECHNICAL NOTES

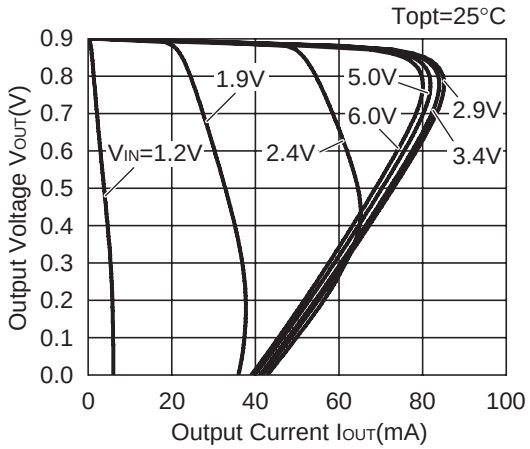
In R1100D Series, a constant voltage can be obtained without using capacitors. However, when the wire connected $V_{IN}$ is long, use a capacitor. Output noise can be reduced with using capacitor.

Insert capacitors with the capacitance of 0.1μF to 2.2μF between input/output pins and GND pin as close as possible.

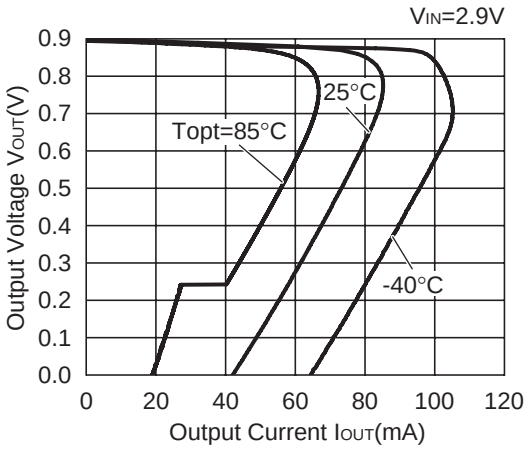
# TYPICAL CHARACTERISTICS

## 1) Output Voltage vs. Output Current

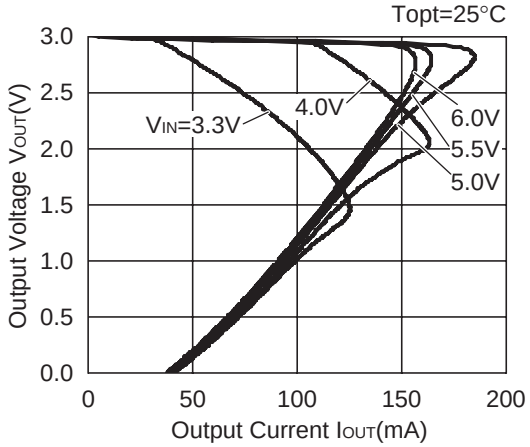
**R1100D091C**



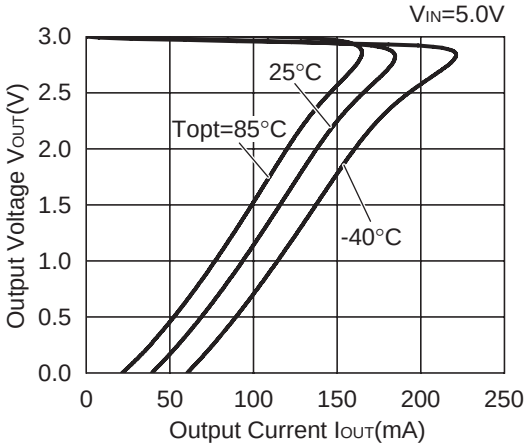

**R1100D091C**



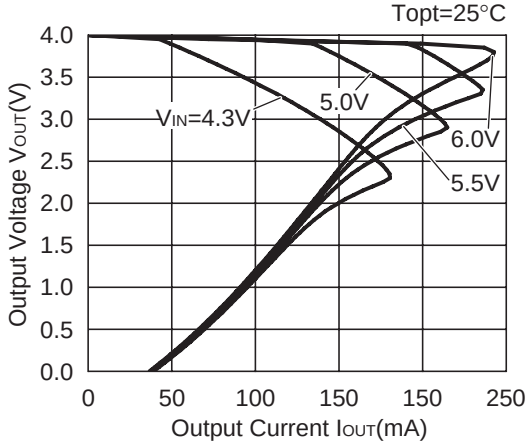

**R1100D301C**



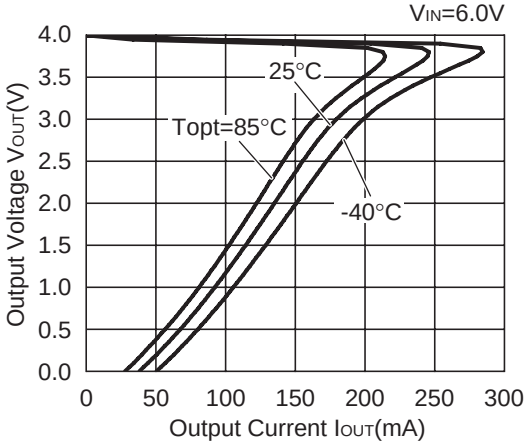

**R1100D301C**




**R1100D401C**

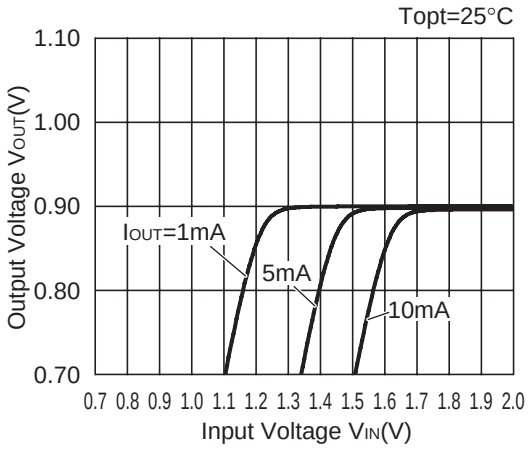



**R1100D401C**

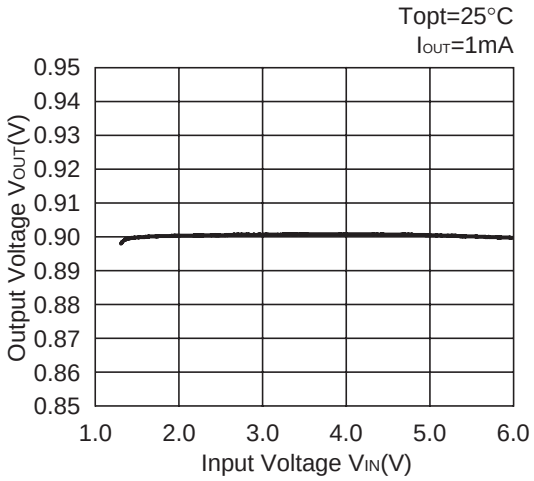


## 2) Output Voltage vs. Input Voltage

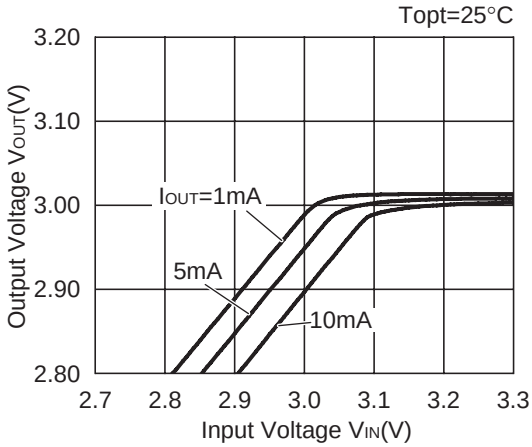
**R1100D091C**



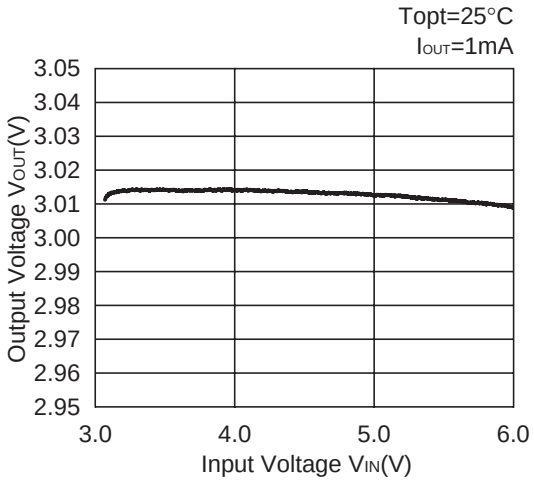

**R1100D091C**



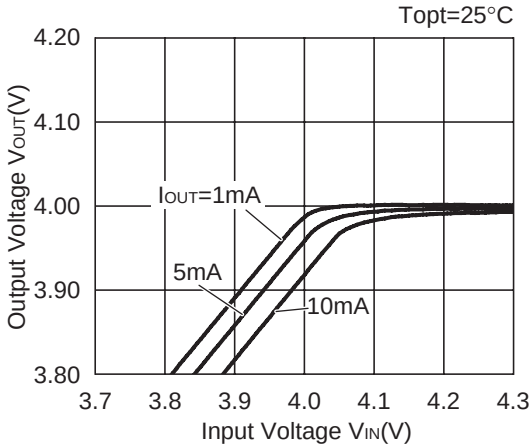

**R1100D301C**




**R1100D301C**




**R1100D401C**

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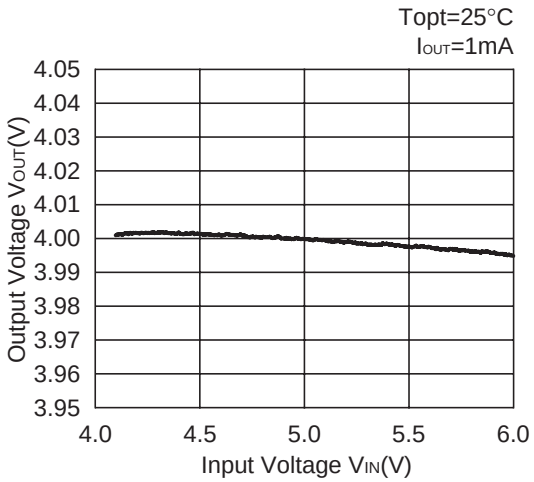
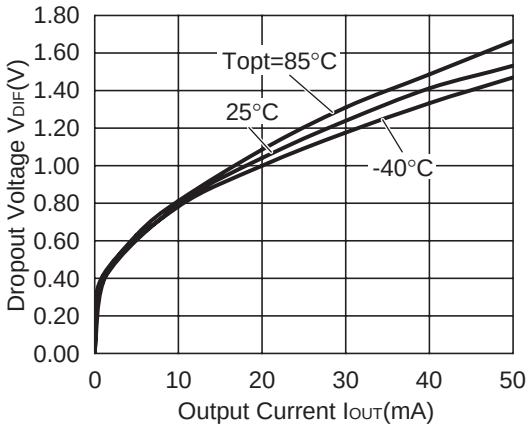
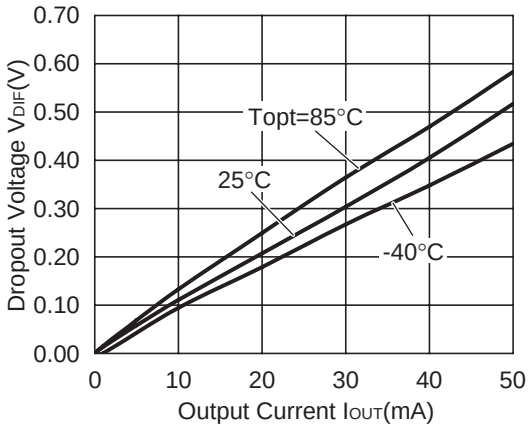


### 3) Dropout Voltage vs. Output Current

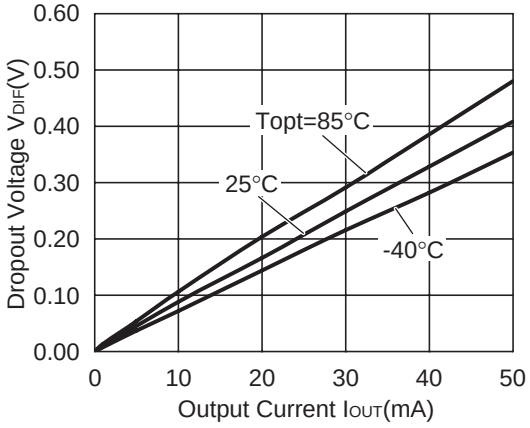
**R1100D091C**




**R1100D301C**

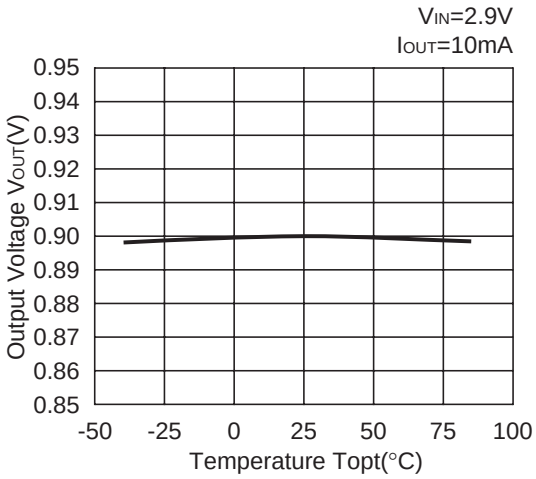



**R1100D401C**

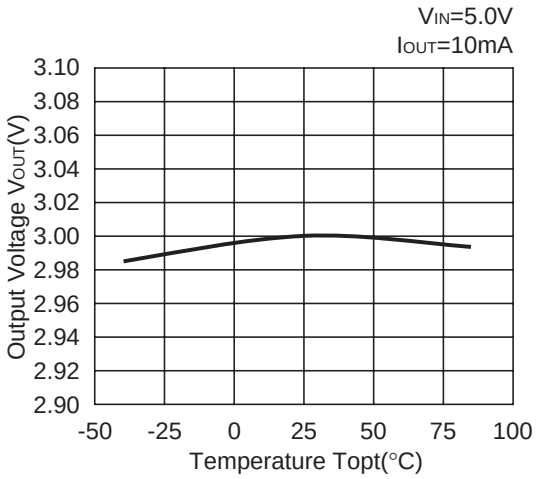



### 4) Output Voltage vs. Temperature

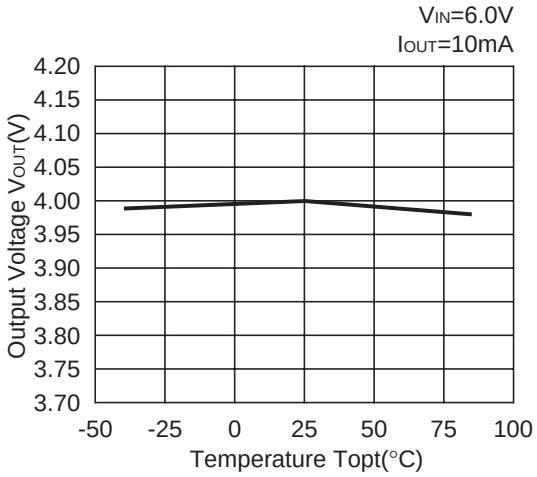
**R1100D091C**




**R1100D301C**

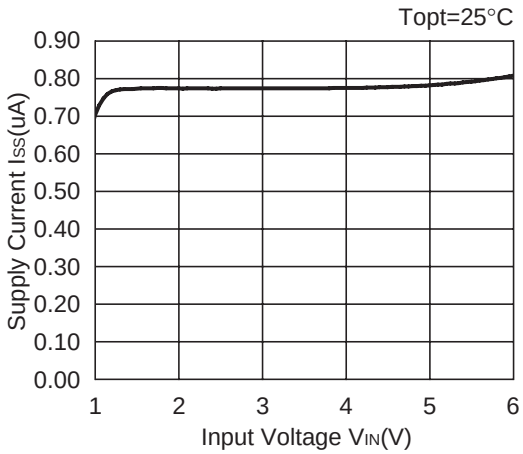


**R1100D401C**

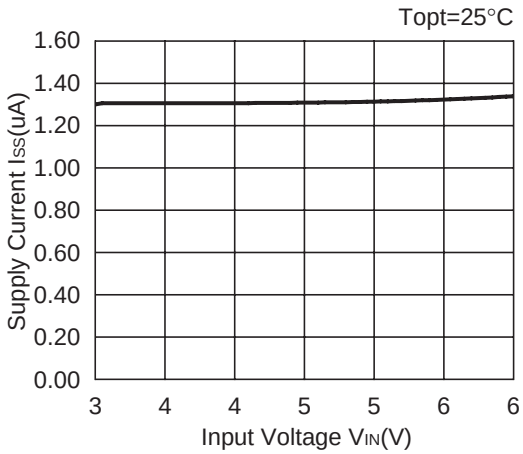



## 5) Supply Current vs. Input Voltage

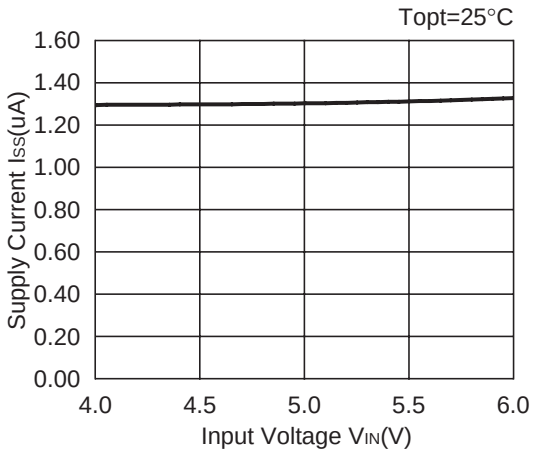
**R1100D091C**




**R1100D301C**

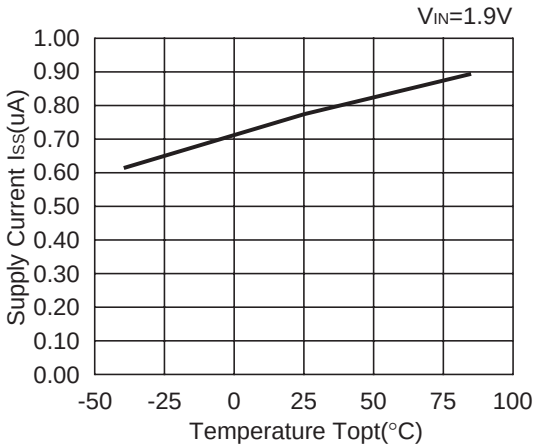



**R1100D401C**

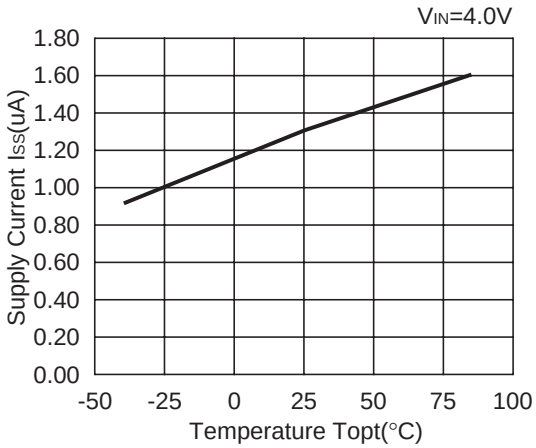


### 6) Supply Current vs. Temperature

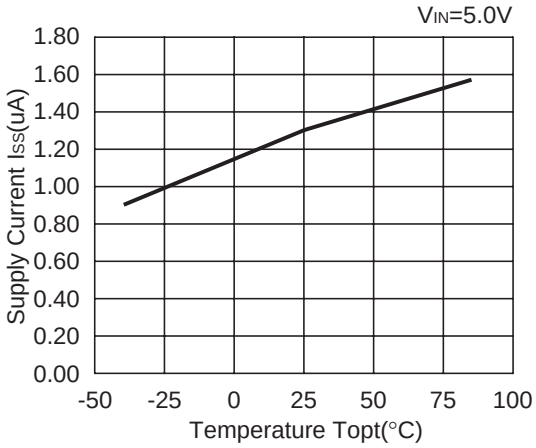
**R1100D091C**




**R1100D301C**

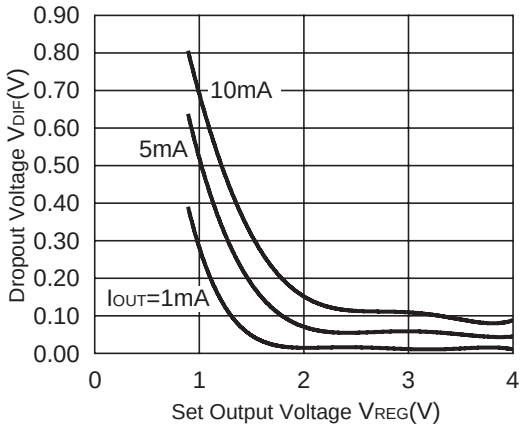



**R1100D401C**



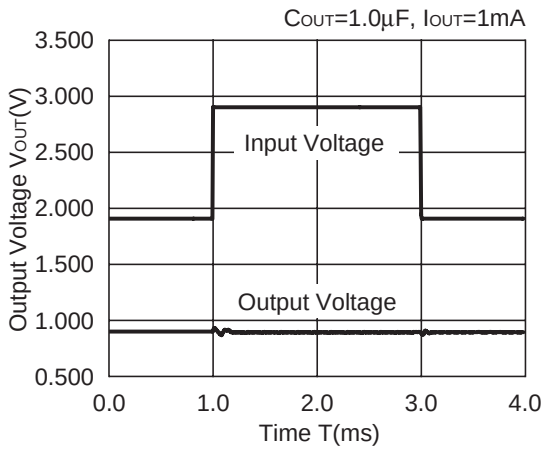

### 7) Dropout Voltage vs. Set Output Voltage

**R1100Dxx1C**

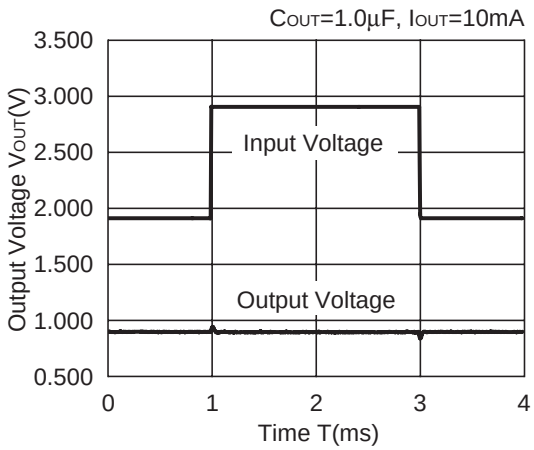


## 8) Line Transient Response

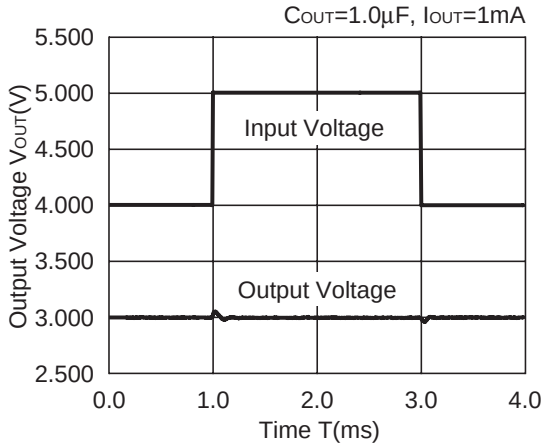
**R1100D091C**



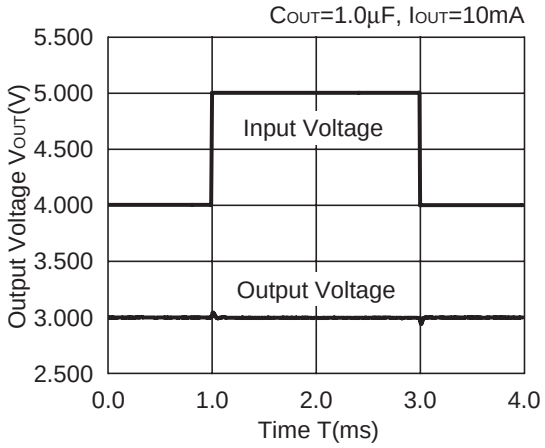

**R1100D091C**




**R1100D301C**




**R1100D301C**

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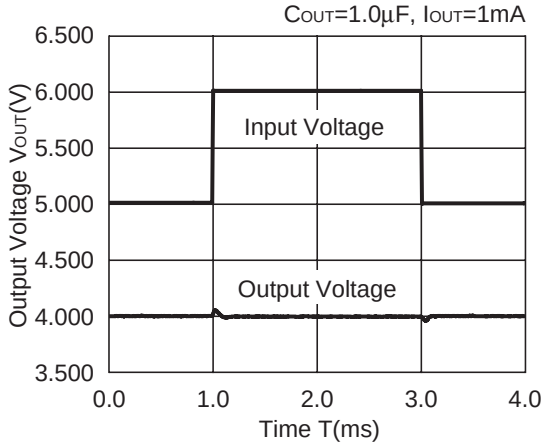


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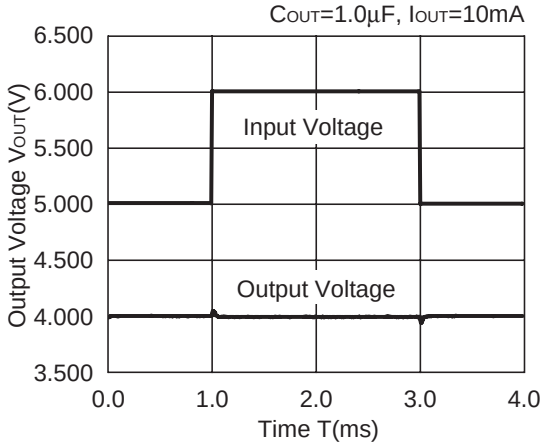
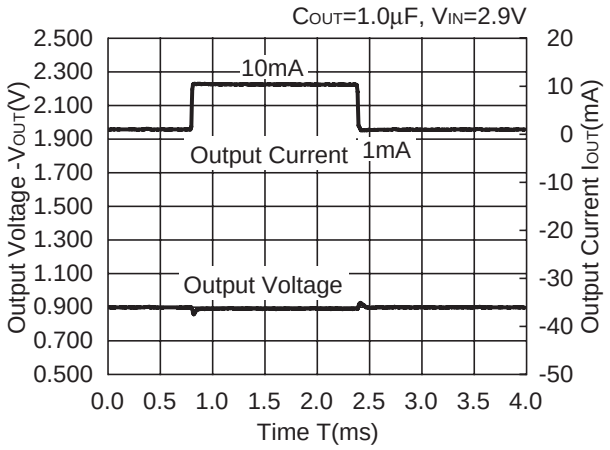


### 9) Load Transient Response

**R1100D091C**

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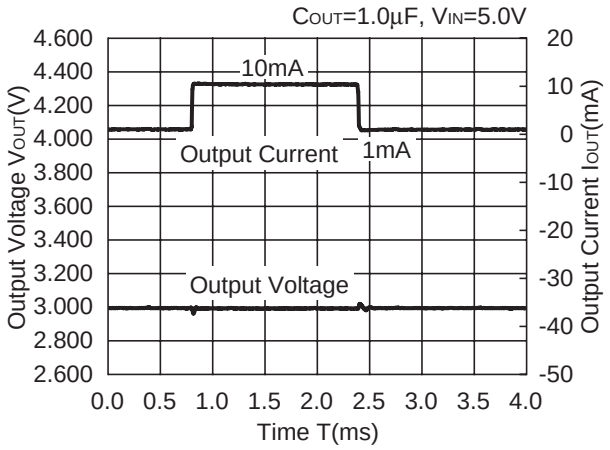


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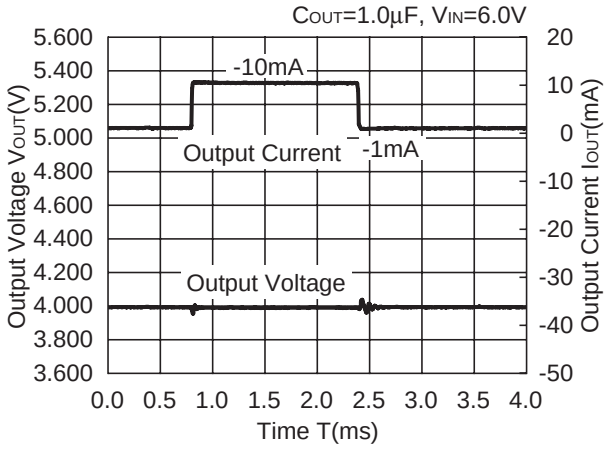
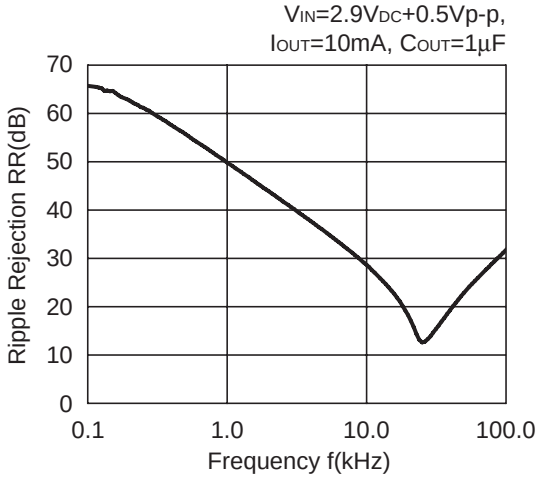
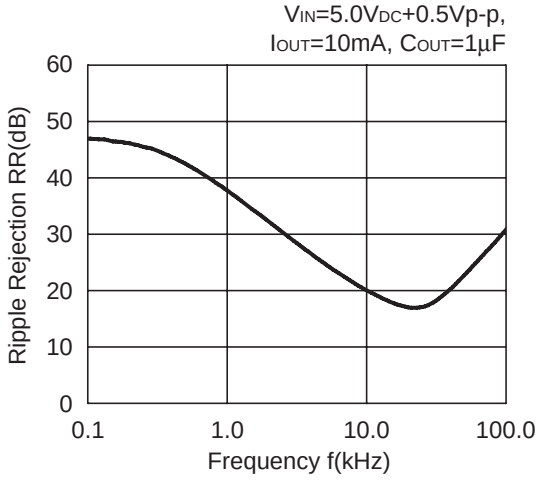



### 10) Ripple Rejection vs. Frequency

**R1100D091C**

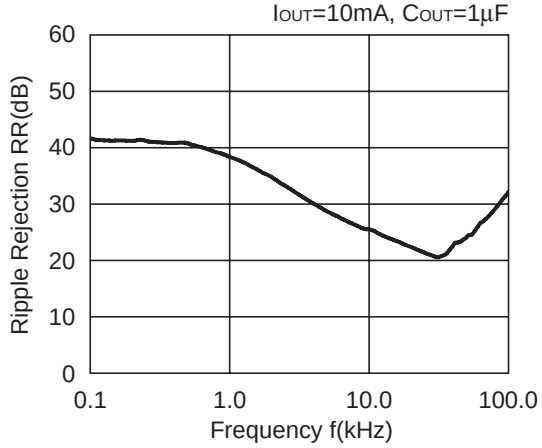



**R1100D301C**



**R1100D401C**

$V_{IN}$=5.5$V_{DC}$+0.5Vp-p,
$I_{OUT}$=10mA, $C_{OUT}$=1µF



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