

120mA LDO REGULATOR

NO.EA-082-111027

OUTLINE

The R1141Q Series consist of CMOS-based voltage regulator ICs with high output voltage accuracy, low supply current, low ON-resistance, and high ripple rejection. Each of these voltage regulator ICs consists of a voltage reference unit, an error amplifier, resistors for setting Output Voltage, a current limit circuit, and a chip enable circuit.

Output Current Limit circuit is embedded in the R1141Q Series to prevent the break down of the IC caused by excess current.

Chip enable circuit realizes standby mode and makes consumption current extremely small.

These ICs perform with low dropout voltage and a chip enable function. The line transient response and load transient response of the R1141Q Series are excellent, making these ICs very suitable for the power supply for hand-held communication equipment.

Their output voltage is internally fixed with high accuracy. Since the package for these ICs is SC-82AB (Super Mini-mold) package, high density mounting of the ICs on boards is possible.

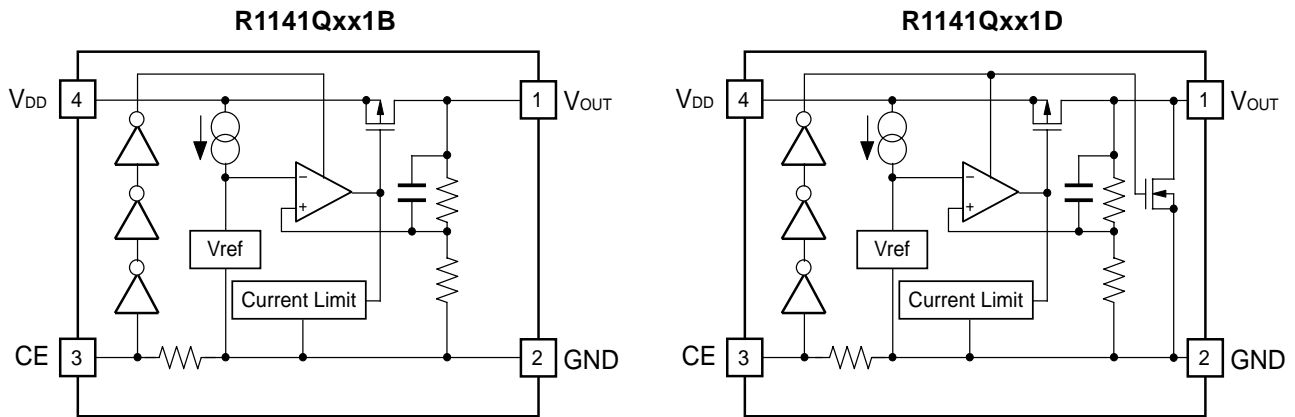
FEATURES

- Supply Current Typ. 90 μ A
- Standby Mode Typ. 0.1 μ A
- Dropout Voltage Typ. 0.15V ($I_{OUT}=100\text{mA}$, Output Voltage=3.0V Type)
- Ripple Rejection Typ. 75dB ($V_{OUT} \leq 2.4\text{V}$)
Typ. 70dB ($V_{OUT} \geq 2.5\text{V}$) ($f=1\text{kHz}$)
- Temperature-Drift Coefficient of Output Voltage Typ. $\pm 100\text{ppm}/^\circ\text{C}$
- Line Regulation Typ. 0.02%/V
- Output Voltage Accuracy $\pm 1.5\%$ or $\pm 30\text{mV}$ ($V_{OUT} \leq 2.0\text{V}$)
- Excellent Dynamic Response
- Package SC-82AB (Super Mini-mold)
- Output Voltage Range 1.5V to 4.0V (0.1V steps)
(For other voltages, please refer to MARK INFORMATIONS.)
- Built-in Chip Enable Circuit (B/D : active high)
- Built-in Fold-back Protection Circuit Typ. 40mA (Short Current)
- Ceramic capacitor can be used for Output pin Recommended value is 2.2 μ F or more.

APPLICATIONS

- Power source for cellular phones such as GSM, CDMA and various kinds of PCS.
- Power source for electrical appliances such as cameras, VCRs and camcorders, and hand-held communication equipment.
- Power source for battery-powered equipment.
- Very stable Voltage Reference

BLOCK DIAGRAMS



SELECTION GUIDE

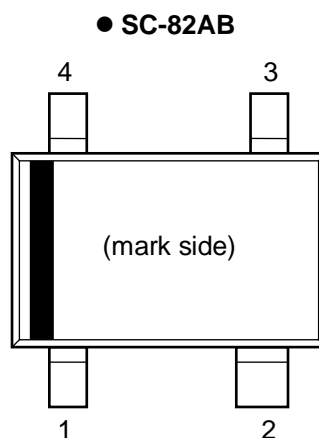
The output voltage, auto discharge function for the ICs can be selected at the user's request.

| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|------------------|---------|-------------------|---------|--------------|
| R1141Qxx1*-TR-FE | SC-82AB | 3,000 pcs | Yes | Yes |

xx: The output voltage can be designated in the range from 1.5V(15) to 4.0V(40) in 0.1V steps.
(For other voltages, please refer to MARK INFORMATIONS.)

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

PIN CONFIGURATION



PIN DESCRIPTION

| Pin No | Symbol | Pin Description |
|--------|-----------|------------------------------|
| 1 | V_{OUT} | Output Pin |
| 2 | GND | Ground Pin |
| 3 | CE | Chip Enable Pin ("H" Active) |
| 4 | V_{DD} | Input Pin |

ABSOLUTE MAXIMUM RATINGS

| Symbol | Item | Rating | Unit |
|-----------|------------------------------|------------------------|------|
| V_{IN} | Input Voltage | 6.5 | V |
| V_{CE} | Input Voltage (CE Pin) | 6.5 | V |
| V_{OUT} | Output Voltage | -0.3 to $V_{IN} + 0.3$ | V |
| I_{OUT} | Output Current | 140 | mA |
| P_D | Power Dissipation (SC-82AB)* | 380 | mW |
| T_{opt} | Operating Temperature Range | -40 to 85 | °C |
| T_{stg} | 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

• R1141Qxx1B/D

T_{opt}=25°C

| Symbol | Item | Conditions | Min. | Typ. | Max. | Unit |
|--------------------------------------|---|--|-------------------|--------------------|-------------------|------------|
| V _{OUT} | Output Voltage | V _{IN} = Set V _{OUT} +1.0V 1mA ≤ I _{OUT} ≤ 30mA(*1) | ×0.985 (-30mV) | | ×1.015 (+30mV) | V |
| I _{OUT} | Output Current | V _{IN} -V _{OUT} =1.0V | 120 | | | mA |
| ΔV _{OUT} /ΔI _{OUT} | Load Regulation | V _{IN} = Set V _{OUT} +1.0V 1mA ≤ I _{OUT} ≤ 120mA | | 12 | 40 | mV |
| V _{DIF} | Dropout Voltage | Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE | | | | |
| I _{SS} | Supply Current | V _{IN} = Set V _{OUT} +1.0V | | 90 | 160 | μA |
| I _{standby} | Supply Current (Standby) | V _{IN} =V _{CE} = Set V _{OUT} +1.0V | | 0.1 | 1.0 | μA |
| ΔV _{OUT} /ΔV _{IN} | Line Regulation | Set V _{OUT} +0.5V ≤ V _{IN} ≤ 6.0V I _{OUT} = 30mA (In case that V _{OUT} ≤ 1.6V, 2.2V ≤ V _{IN} ≤ 6.0V) | | 0.02 | 0.10 | %/V |
| RR | Ripple Rejection | f = 1kHz, Ripple 0.5Vp-p V _{IN} = Set V _{OUT} +1V, I _{OUT} = 30mA (In case that V _{OUT} ≤ 1.7V, V _{IN} -V _{OUT} =1.2V) | | 75 (70) (*2) | | dB |
| V _{IN} | Input Voltage | | 2.2 | | 6.0 | V |
| ΔV _{OUT} /ΔT _{opt} | Output Voltage Temperature Coefficient | I _{OUT} =30mA -40°C ≤ T _{opt} ≤ 85°C | | ±100 | | ppm/ °C |
| I _{SC} | Short Current Limit | V _{OUT} =0V | | 40 | | mA |
| R _{PU} | CE Pull-up resistance | | 0.7 | 2.0 | 8.0 | MΩ |
| V _{CEH} | CE Input Voltage "H" | | 1.5 | | V _{IN} | V |
| V _{CEL} | CE Input Voltage "L" | | 0.0 | | 0.3 | V |
| en | Output Noise | BW=10Hz to 100kHz | | 30 | | μVrms |
| R _{LOW} | Low Output Nch Tr. ON Resistance (of D version) | V _{CE} =0V | | 60 | | Ω |

*1: ±30mV Tolerance at V_{OUT} ≤ 2.0V*2: 70dB at V_{OUT} ≥ 2.5V

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 by OUTPUT VOLTAGE

| Output Voltage V_{OUT} (V) | Dropout Voltage V_{DIF} (V) | | |
|---------------------------------|-------------------------------|------|------|
| | Condition | Typ. | Max. |
| $V_{OUT} = 1.5$ | $I_{OUT} = 120\text{mA}$ | 0.36 | 0.70 |
| $V_{OUT} = 1.6$ | | 0.32 | 0.60 |
| $V_{OUT} = 1.7$ | | 0.30 | 0.50 |
| $1.8 \leq V_{OUT} \leq 2.0$ | | 0.28 | 0.40 |
| $2.1 \leq V_{OUT} \leq 2.7$ | | 0.24 | 0.35 |
| $2.8 \leq V_{OUT} \leq 4.0$ | | 0.18 | 0.28 |

TECHNICAL NOTES

When using these ICs, consider the following points:

Phase Compensation

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, be sure to use a $2.2\mu\text{F}$ or more capacitor C_{OUT} with good frequency characteristics and ESR (Equivalent Series Resistance).

(Note: When the additional ceramic capacitors are connected to the Output Pin with Output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB.)

PCB Layout

Make V_{DD} and GND lines sufficient. When their impedance is high, picking up the noise or unstable operation may result. Connect a capacitor with as much as $1.0\mu\text{F}$ capacitor between V_{DD} and GND pin as close as possible.

Set external components, especially output capacitor as close as possible to the ICs and make wiring as short as possible.

TYPICAL APPLICATION



(External Components)
Output Capacitor; Ceramic Type $C1=1.0\mu\text{F}$ $C2=2.2\mu\text{F}$

TEST CIRCUITS

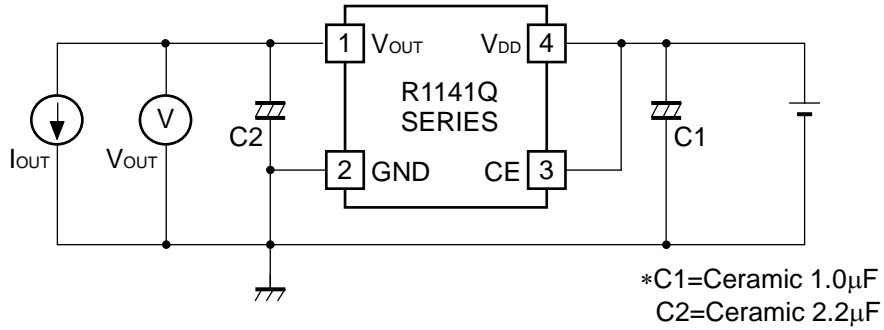


Fig.1 Standard test Circuit

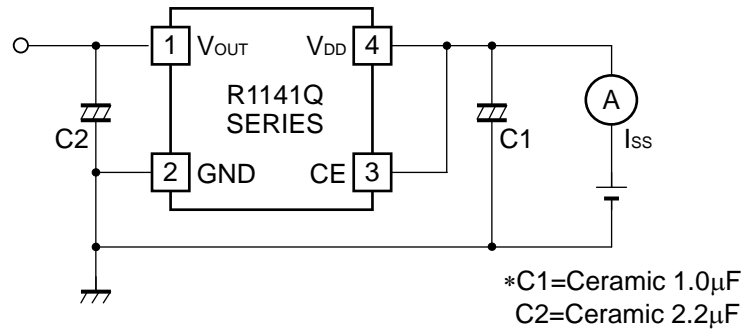


Fig.2 Supply Current Test Circuit

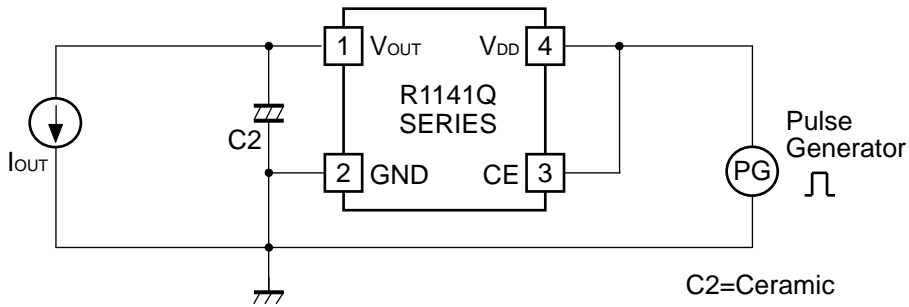


Fig.3 Ripple Rejection, Line Transient Response Test Circuit

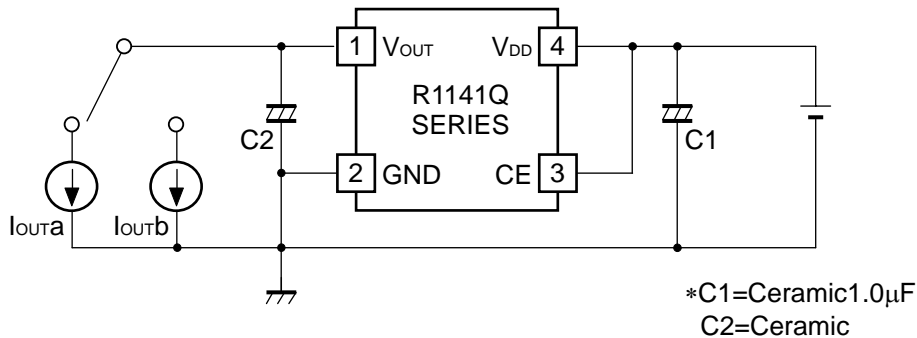
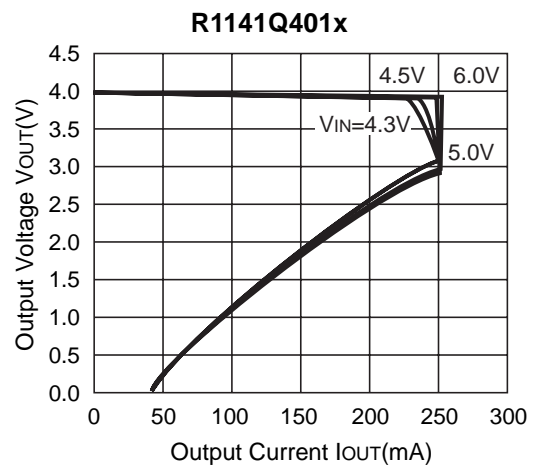
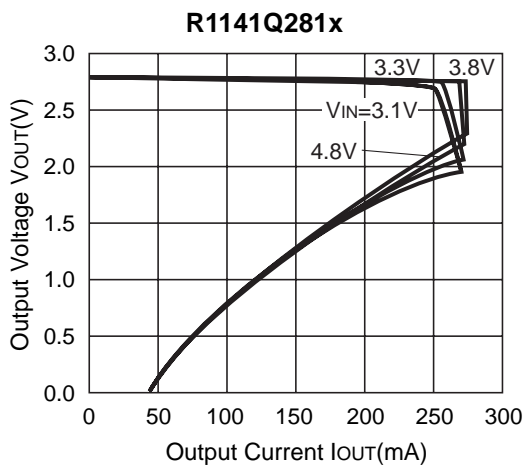
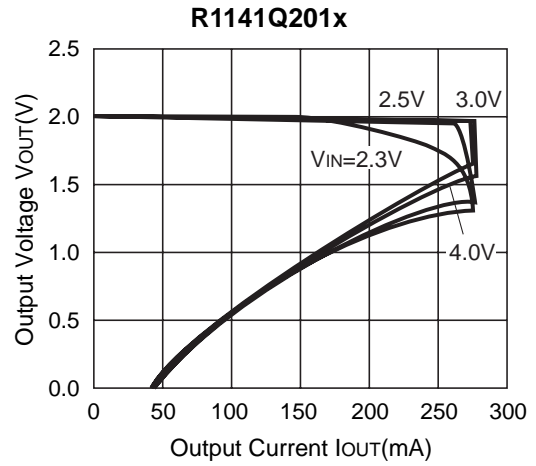
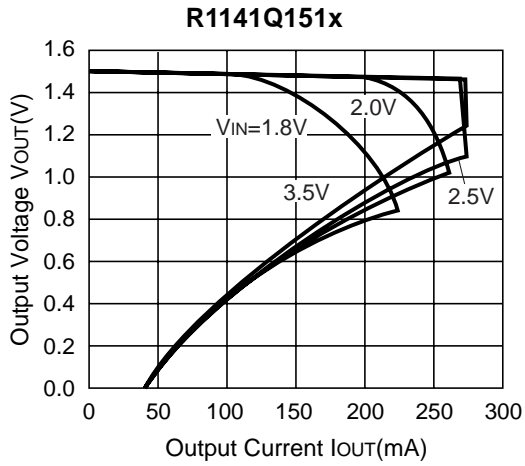


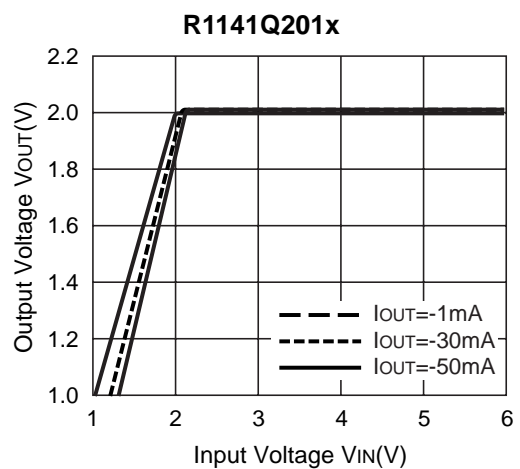
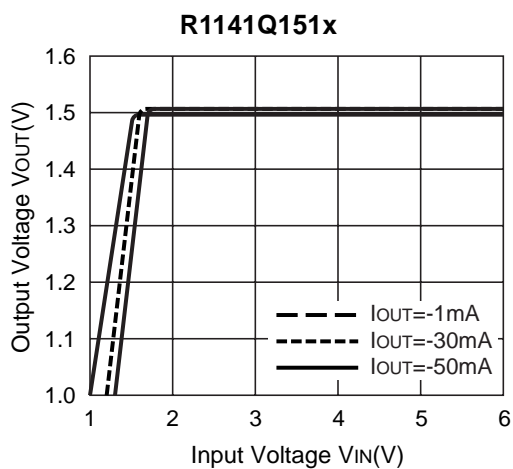
Fig.4 Load Transient Response Test Circuit

TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current

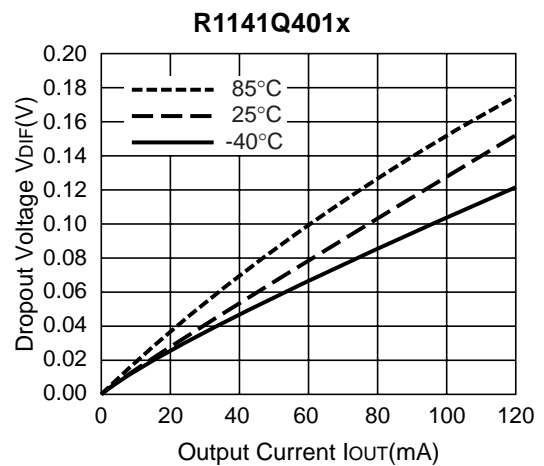
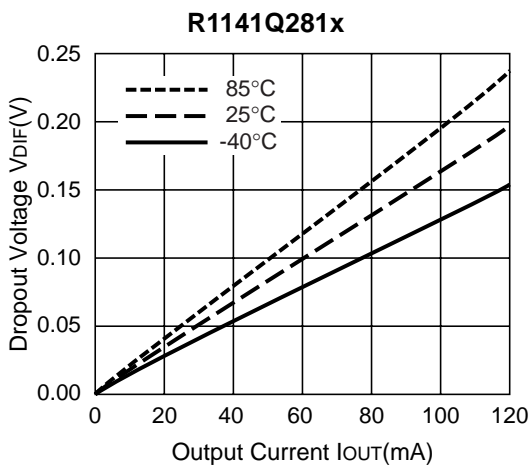
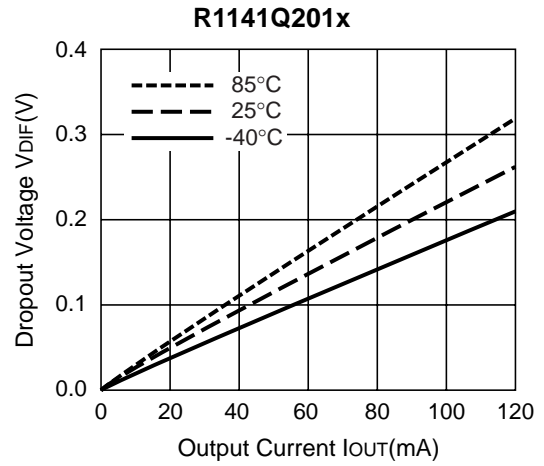
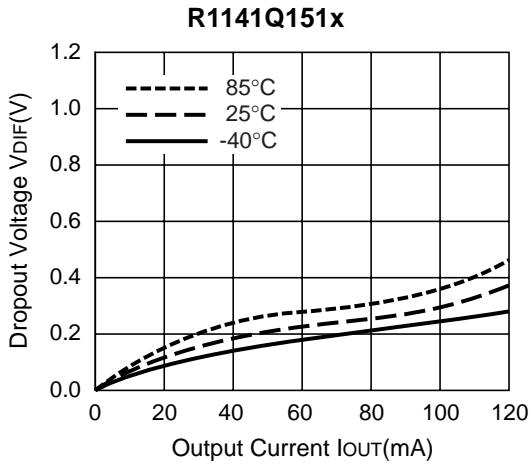


2) Output Voltage vs. Input Voltage

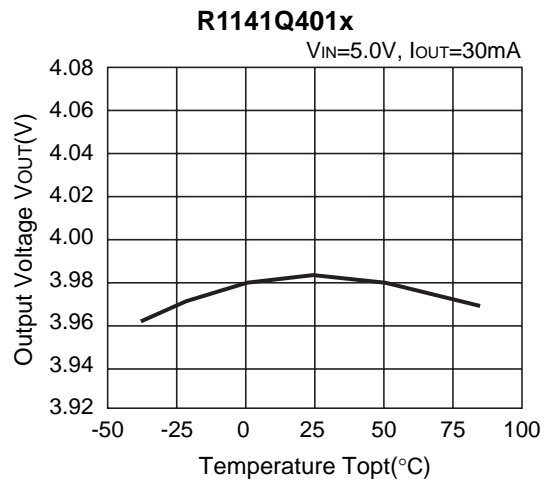
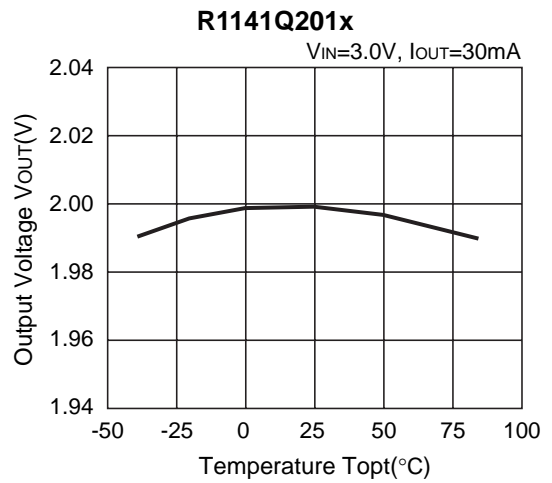
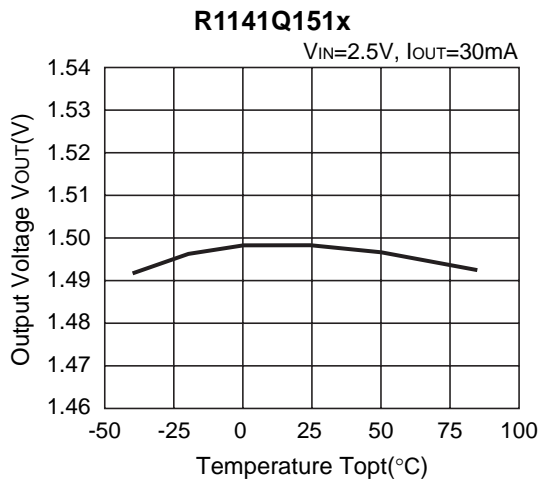




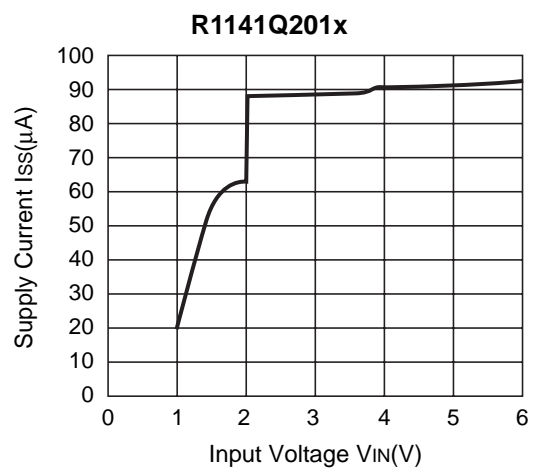
3) Dropout Voltage vs. Output Current



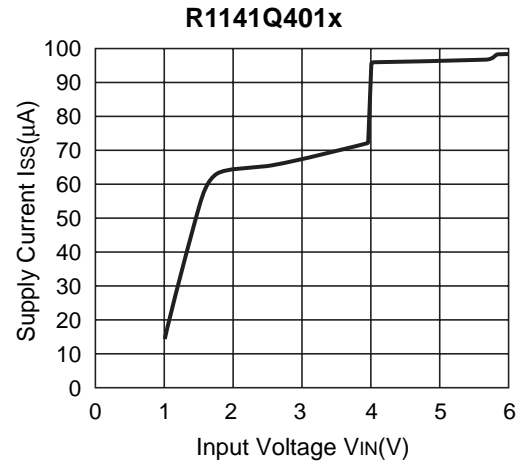
4) Output Voltage vs. Temperature



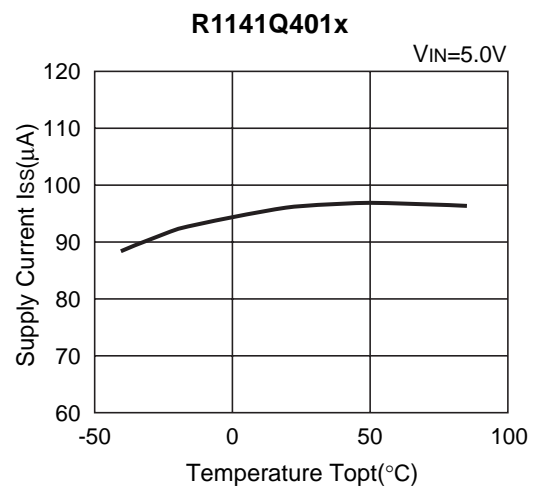
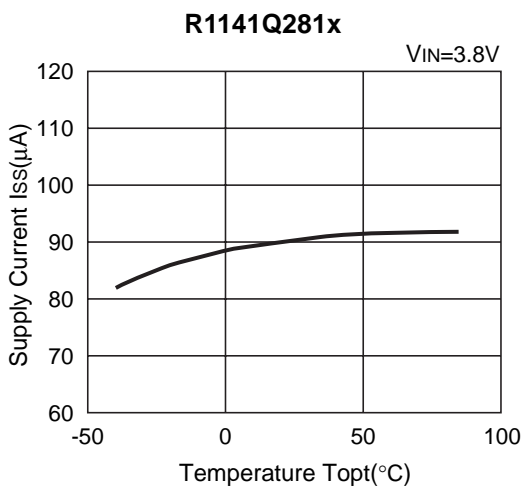
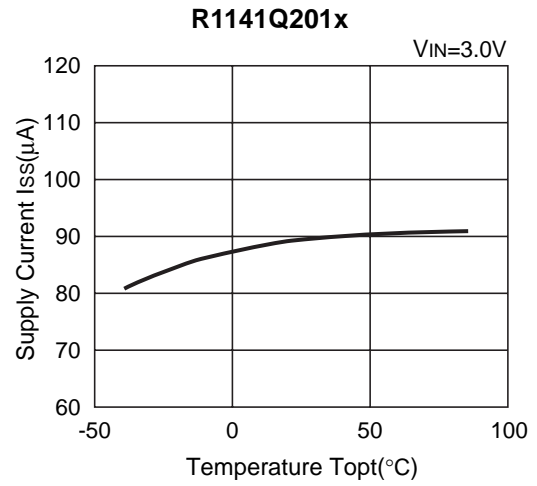
5) Supply Current vs. Input Voltage (T_{opt}=25°C)



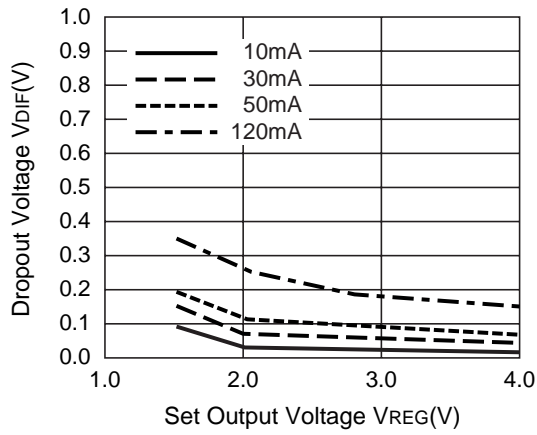
R1141Q



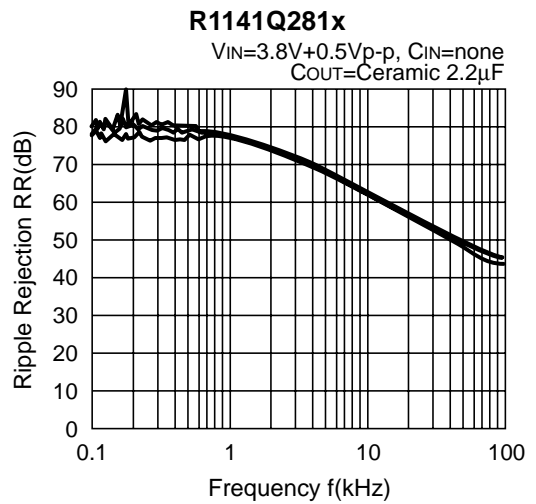
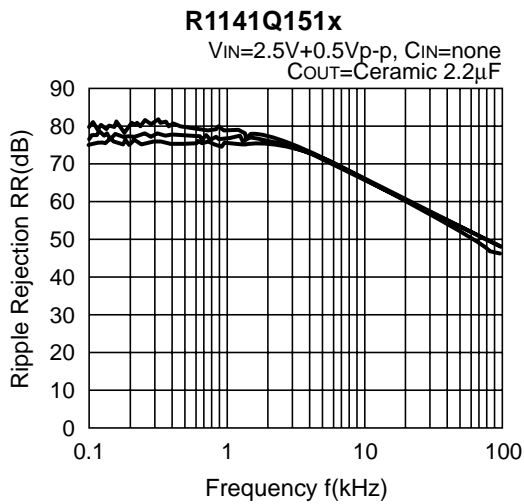
6) Supply Current vs. Temperature



7) Dropout Voltage vs. Set Output Voltage



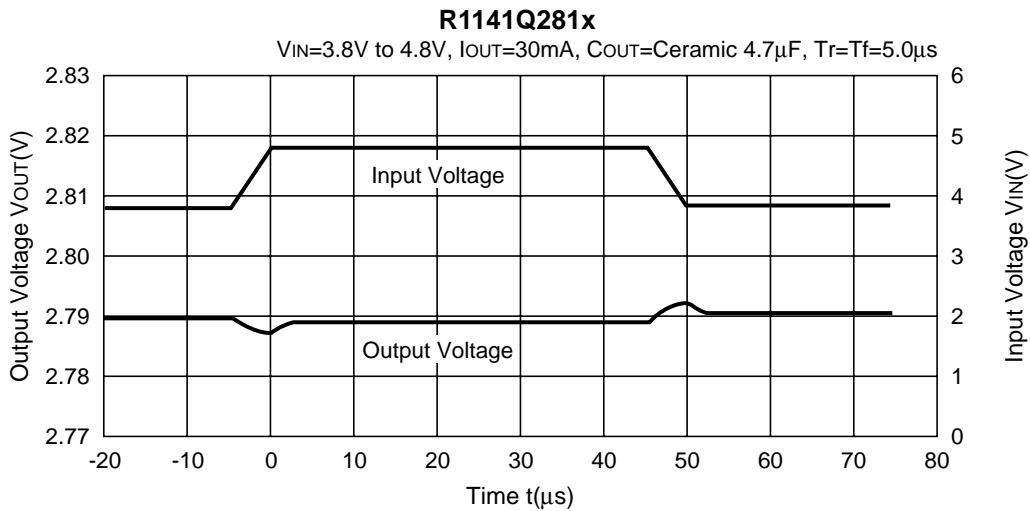
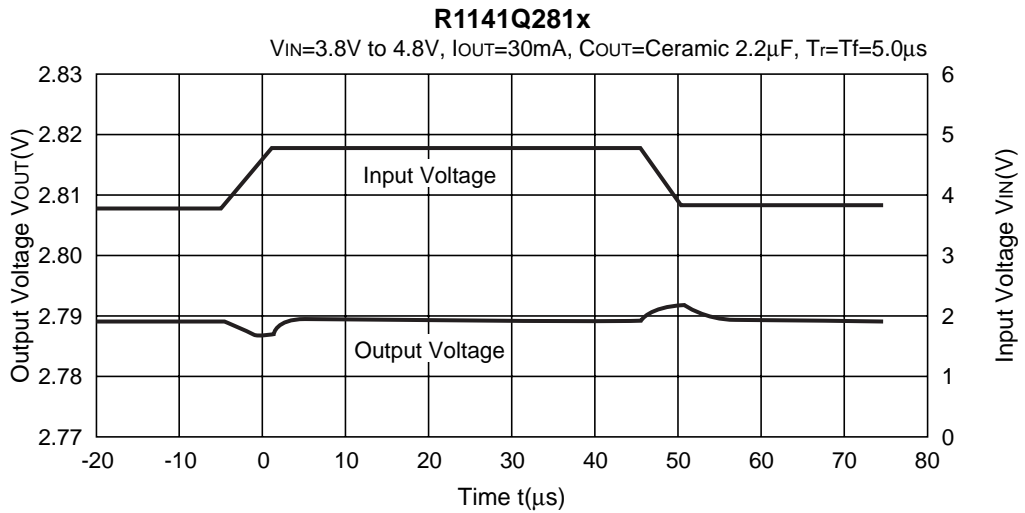
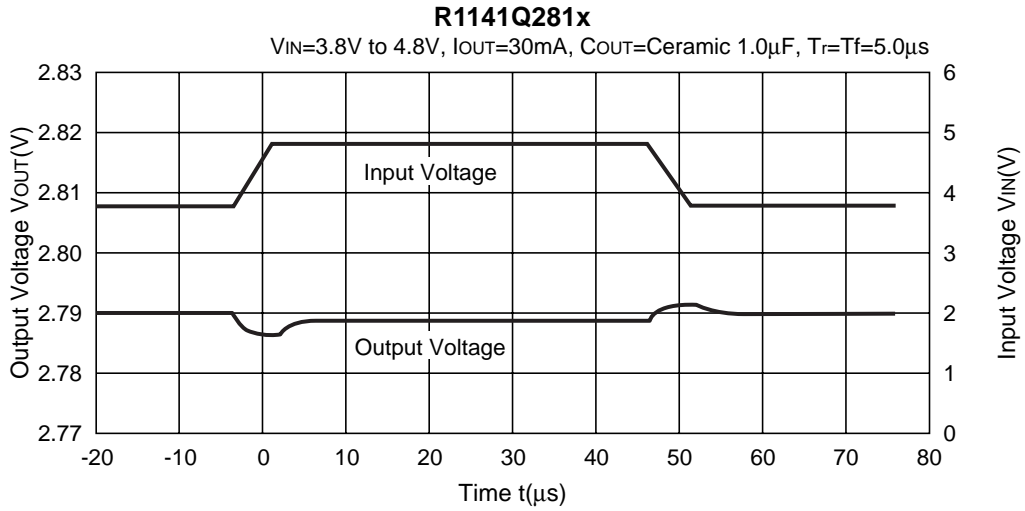
8) Ripple Rejection vs. Frequency



9) Ripple Rejection vs. Input Bias



10) Input Transient Response



11) Load Transient Response



ESR vs. Output Current

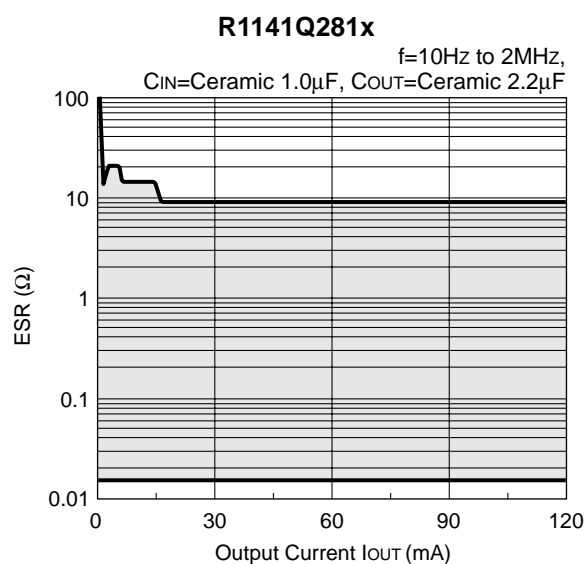
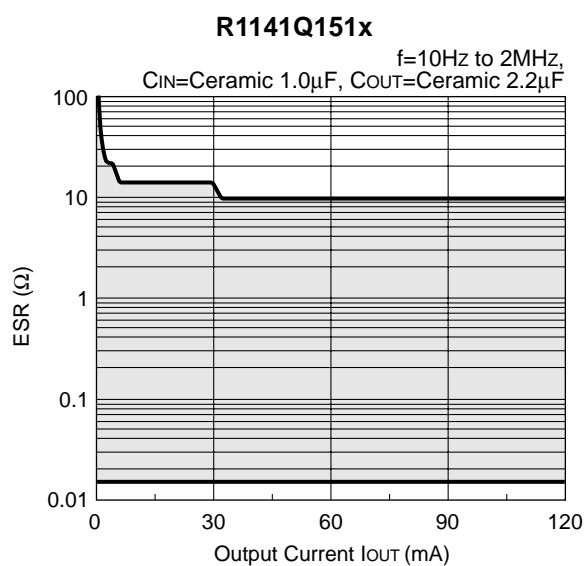
When using these ICs, consider the following points:

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

The relations between I_{OUT} (Output Current) and ESR of Output Capacitor are shown below. The conditions when the white noise level is under $40\mu\text{V}$ (Avg.) are marked as the hatched area in the graph.

<Test conditions>

- (1) $V_{IN}=V_{SET}+1\text{V}$
- (2) Frequency band: 10Hz to 30MHz
- (3) Temperature: 25°C





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