# UNISONIC TECHNOLOGIES CO., LTD



# BOOSTING VOLTAGE REGULATORS

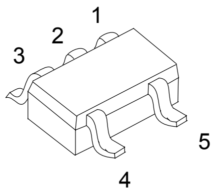
## ■ DESCRIPTION

The UTC **UC621XX** is a positive output voltage regulator that can supply up to 1A of output current using an external transistor. Low power and high accuracy are achieved through CMOS process and metal fuses trimming technologies.

The series consists of a high precision voltage reference, an error correction circuit and a short-circuit protected output driver.

In stand-by mode, supply current can be dramatically cut. Since the input-output voltage differential is small, loss control efficiency is good.

The UTC **UC621XX** is particularly suited for use with battery operated portable products, and products where supply current regulation is required.




SOT-25

*Pb-free plating product number: UC621XXL

## ■ FEATURES

* Ultra Small Input-Output Voltage Differential
  : 100mA of output current is available with a differential of 0.1V.
  (Performance depends on the external transistor characteristics.)
* Maximum Output Current : 1A
* Output Voltage Range : 2V ~ 6V in 0.1V increments
* Highly Accurate : Set-up voltage ±2%
* Low Power Consumption : Typ.50μA ($V_{OUT}$ = 5.0V)
  : Typ.0.2μA (Stand-by)
* Output Voltage Temperature Characteristics: Typ. ±100ppm/℃
* Input Stability : Typ.0.1%/V

## ■ ORDERING INFORMATION

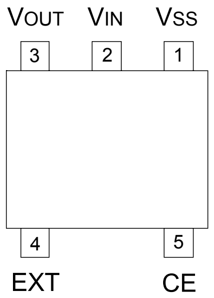
| Order Number | | Package | Packing |
|---|---|---|---|
| Normal | Lead Free Plating | | |
| UC621xx-AF5-R | UC621xxL-AF5-R | SOT-25 | Tape Reel |

Note: xx: Output Voltage, refer to Marking Information.

UC621xxL-AF5-R

| | |
|---|---|
| (1)Packing Type | (1) R: Tape Reel |
| (2)Package Type | (2) AF5: SOT-25 |
| (3)Lead Plating | (3) L: Lead Free Plating, Blank: Pb/Sn |
| (4)Output Voltage Code | (4) xx: refer to Marking Information |

## ■ PIN CONFIGURATION

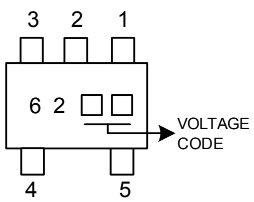



| PIN NO. | PIN NAME | FUNCTION |
|---|---|---|
| 1 | $V_{SS}$ | Ground |
| 2 | $V_{IN}$ | Supply voltage input |
| 3 | $V_{OUT}$ | Regulated voltage output |
| 4 | EXT | Base current control |
| 5 | CE | Chip enable |

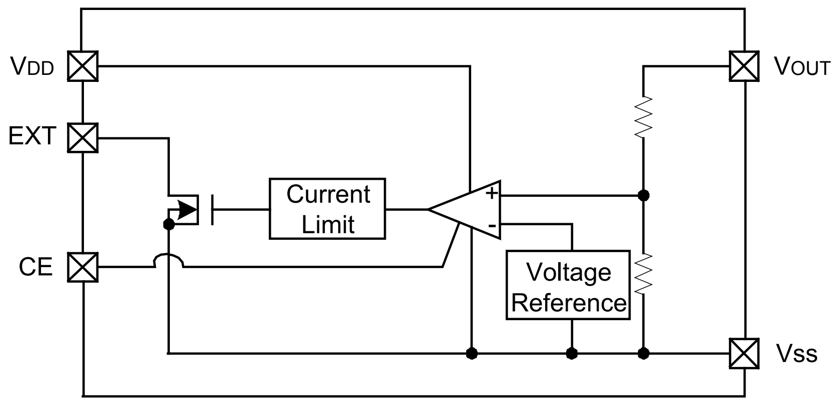
## ■ FUNCTION

| SERIES | CE | OUTPUT VOLTAGE |
|---|---|---|
| UTC UC621XX | H | ON |
| | L | OFF |

## ■ MARKING INFORMATION

| PACKAGE | VOLTAGE CODE | MARKING |
|---|---|---|
| SOT-25 | 30:3.0V<br>33:3.3V<br>40:4.0V<br>50:5.0V |   |

■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Input Voltage | $V_{IN}$ | 12 | V |
| Output Voltage | $V_{OUT}$ | Vss-0.3 ~ $V_{IN}$+0.3 | V |
| CE Input Voltage | $V_{CE}$ | Vss-0.3 ~ $V_{IN}$+0.3 | V |
| EXT Output Voltage | $V_{O(EXT)}$ | 12 | V |
| EXT Output Current | $I_{EXT}$ | 50 | mA |
| Power Dissipation | $P_D$ | 150 | mW |
| Junction Temperature | $T_J$ | +125 | °C |
| Operating Temperature | $T_{OPR}$ | -20 ~ +85 | °C |
| Storage Temperature | $T_{STG}$ | -40 ~ +150 | °C |

Note:1.Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2.The device is guaranteed to meet performance specification within 0°C~+70°C operating temperature range and assured by design from -20°C~+85°C.

## ■ ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise specified.)

**UC62130**( $V_{OUT(T)}$ =3.0V)

| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Output Voltage (Note2) | | $V_{OUT(E)}$ | $I_{OUT}$ =50mA, $V_{IN}$=4.0V | 2.940 | 3.000 | 3.060 | V |
| Input Voltage | | $V_{IN}$ | | | | 8 | V |
| EXT Output Voltage | | $V_{EXT}$ | | | | 8 | V |
| CE Level Voltage | High | $V_{CEH}$ | | 1.5 | | | V |
| | Low | $V_{CEL}$ | | | | 0.25 | V |
| Load Stability (Note 4) | | $\triangle V_{OUT}$ | $V_{IN}$ =4.0V, 1mA≤$I_{OUT}$≤100mA | -60 | | 60 | mV |
| Input-Output Voltage Differential | | $V_{DIFF}$ | $I_{OUT}$ =100mA | | 100 | | mV |
| Maximum Output Current(Note 4) | | $I_{OUT\ (max)}$ | $V_{IN}$=4.0V | | 1000 | | mA |
| Supply Current1 | | Iss1 | $V_{IN}$ =4.0V, $V_{CE}$ =Vss | | | 0.6 | μA |
| Supply Current2 | | Iss2 | $V_{IN}$ =8.0V, $V_{CE}$ =$V_{IN}$ | | 50 | 80 | μA |
| EXT Leakage Current | | $I_{LEAK}$ | | | | 0.5 | μA |
| CE Level Current | High | $I_{CEH}$ | $V_{CE}$ =$V_{IN}$ | | | 0.1 | μA |
| | Low | $I_{CEL}$ | $V_{CE}$ =Vss | -0.2 | -0.05 | 0 | μA |
| Input Stability (Note 4) | | $\frac{\triangle V_{OUT}}{\triangle V_{IN} \times V_{OUT}}$ | $I_{OUT}$ =50mA, 4.0V≤$V_{IN}$≤8.0V | | 0.1 | 0.3 | %/V |
| Output Voltage Temperature Characteristics (Note 4) | | $\frac{\triangle V_{OUT}}{\triangle T_{OPR} \times V_{OUT}}$ | $I_{OUT}$ =10mA, -20°C≤$T_{OPR}$≤85°C | | ±100 | | ppm/°C |

**UC62133**($V_{OUT(T)}$=3.3V)

| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Output Voltage (Note2) | | $V_{OUT(E)}$ | $I_{OUT}$ =50mA, $V_{IN}$ =4.3V | 3.234 | 3.300 | 3.366 | V |
| Input Voltage | | $V_{IN}$ | | | | 8 | V |
| EXT Output Voltage | | $V_{EXT}$ | | | | 8 | V |
| CE Level Voltage | High | $V_{CEH}$ | | 1.5 | | | V |
| | Low | $V_{CEL}$ | | | | 0.25 | V |
| Load Stability (Note 4) | | $\triangle V_{OUT}$ | $V_{IN}$ =4.3V, 1mA≤$I_{OUT}$≤100mA | -60 | | 60 | mV |
| Input-Output Voltage Differential | | $V_{DIFF}$ | $I_{OUT}$ =100mA | | 100 | | mV |
| Maximum Output Current (Note 4) | | $I_{OUT\ (max)}$ | $V_{IN}$ =4.3V | | 1000 | | mA |
| Supply Current1 | | Iss1 | $V_{IN}$ =4.3V, $V_{CE}$ =Vss | | | 0.6 | μA |
| Supply Current2 | | Iss2 | $V_{IN}$ =8.0V, $V_{CE}$ =$V_{IN}$ | | 50 | 80 | μA |
| EXT Leakage Current | | $I_{LEAK}$ | | | | 0.5 | μA |
| CE Level Current | High | $I_{CEH}$ | $V_{CE}$ =$V_{IN}$ | | | 0.1 | μA |
| | Low | $I_{CEL}$ | $V_{CE}$ =Vss | -0.2 | -0.05 | 0 | μA |
| Input Stability (Note 4) | | $\frac{\triangle V_{OUT}}{\triangle V_{IN} \times V_{OUT}}$ | $I_{OUT}$ =50mA, 4.3V≤$V_{IN}$≤8.0V | | 0.1 | 0.3 | %/V |
| Output Voltage Temperature Characteristics (Note 4) | | $\frac{\triangle V_{OUT}}{\triangle T_{OPR} \times V_{OUT}}$ | $I_{OUT}$ =10mA, -20°C≤$T_{OPR}$≤85°C | | ±100 | | ppm/°C |

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

**UC62140** ($V_{OUT(T)}$=4.0V)

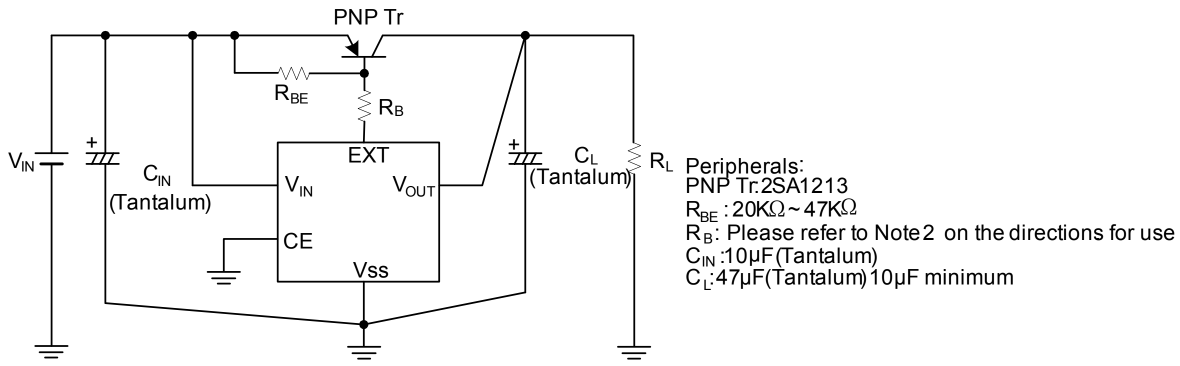
| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Output Voltage (Note2) | | $V_{OUT(E)}$ | $I_{OUT}$ =50mA, $V_{IN}$ =5.0V | 3.92 | 4.000 | 4.08 | V |
| Input Voltage | | $V_{IN}$ | | | | 8 | V |
| EXT Output Voltage | | $V_{EXT}$ | | | | 8 | V |
| CE Level Voltage | High | $V_{CEH}$ | | 1.5 | | | V |
| | Low | $V_{CEL}$ | | | | 0.25 | V |
| Load Stability (Note 4) | | $\triangle V_{OUT}$ | $V_{IN}$ =5.0V, 1mA≤$I_{OUT}$≤100mA | -60 | | 60 | mV |
| Input-Output Voltage Differential | | $V_{DIFF}$ | $I_{OUT}$ =100mA | | 100 | | mV |
| Maximum Output Current(Note 4) | | $I_{OUT\ (max)}$ | $V_{IN}$ =5.0V | | 1000 | | mA |
| Supply Current1 | | Iss1 | $V_{IN}$ =5.0V, $V_{CE}$ =Vss | | | 0.6 | μA |
| Supply Current2 | | Iss2 | $V_{IN}$ =8.0V, $V_{CE}$ =$V_{IN}$ | | 50 | 80 | μA |
| EXT Leakage Current | | $I_{LEAK}$ | | | | 0.5 | μA |
| CE Level Current | High | $I_{CEH}$ | $V_{CE}$ =$V_{IN}$ | | | 0.1 | μA |
| | Low | $I_{CEL}$ | $V_{CE}$ =Vss | -0.2 | -0.05 | 0 | μA |
| Input Stability (Note 4) | | $\frac{\triangle V_{OUT}}{\triangle V_{IN} \times V_{OUT}}$ | $I_{OUT}$ =50mA, 5.0V≤$V_{IN}$≤8.0V | | 0.1 | 0.3 | %/V |
| Output Voltage Temperature Characteristics (Note 4) | | $\frac{\triangle V_{OUT}}{\triangle T_{OPR} \times V_{OUT}}$ | $I_{OUT}$ =10mA, -20°C≤$T_{OPR}$≤85°C | | ±100 | | ppm/°C |

**UC62150** ($V_{OUT(T)}$ =5.0V)

| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Output Voltage (Note2) | | $V_{OUT(E)}$ | $I_{OUT}$ =50mA, $V_{IN}$ =6.0V | 4.900 | 5.000 | 5.100 | V |
| Input Voltage | | $V_{IN}$ | | | | 8 | V |
| EXT Output Voltage | | $V_{EXT}$ | | | | 8 | V |
| CE Level Voltage | High | $V_{CEH}$ | | 1.5 | | | V |
| | Low | $V_{CEL}$ | | | | 0.25 | V |
| Load Stability (Note 4) | | $\triangle V_{OUT}$ | $V_{IN}$ =6.0V, 1mA ≤ $I_{OUT}$ ≤100mA | -60 | | 60 | mV |
| Input-Output Voltage Differential | | $V_{DIFF}$ | $I_{OUT}$ =100mA | | 100 | | mV |
| Maximum Output Current(Note 4) | | $I_{OUT\ (max)}$ | $V_{IN}$ =6.0V | | 1000 | | mA |
| Supply Current1 | | Iss1 | $V_{IN}$=6.0V, $V_{CE}$ =Vss | | | 0.6 | μA |
| Supply Current2 | | Iss2 | $V_{IN}$=8.0V, $V_{CE}$ =$V_{IN}$ | | 50 | 80 | μA |
| EXT Leakage Current | | $I_{LEAK}$ | | | | 0.5 | μA |
| CE Level Current | High | $I_{CEH}$ | $V_{CE}$ =$V_{IN}$ | | | 0.1 | μA |
| | Low | $I_{CEL}$ | $V_{CE}$ =$V_{ss}$ | -0.2 | -0.05 | 0 | μA |
| Input Stability (Note 4) | | $\frac{\triangle V_{OUT}}{\triangle V_{IN} \times V_{OUT}}$ | $I_{OUT}$=50mA, 6.0V≤$V_{IN}$ ≤8.0V | | 0.1 | 0.3 | %/V |
| Output Voltage Temperature Characteristics (Note 4) | | $\frac{\triangle V_{OUT}}{\triangle T_{OPR} \times V_{OUT}}$ | $I_{OUT}$ =10mA, -20°C≤$T_{OPR}$ ≤85°C | | ±100 | | ppm/°C |

Note: 1. $V_{OUT(T)}$=Specified Output Voltage.
2. $V_{OUT(E)}$ =Effective Output Voltage (i.e. the output voltage when "$V_{OUT(T)}$+1.0V" is provided at the $V_{IN}$ pin while maintaining a certain $I_{OUT}$ value).
3. $V_{DIFF}$ = {$V_{IN1}$ -$V_{OUT1}$ }
*$V_{OUT1}$ = A voltage equal to 98% of the Output Voltage whenever an amply stabilized $I_{OUT}$ {$V_{OUT(T)}$+1.0V} is input.
*$V_{IN1}$ = The Input Voltage when $V_{OUT1}$ appears as Input Voltage is gradually decreased.
4. The characteristics for those parameters marked with an asterisk* are liable to vary depending on which transistor is used. Please use a transistor with a low saturation voltage level and $h_{FE}$ equal to 100 or more.

## ■ TYPICAL APPLICATION CIRCUIT




## ■ OPERATIONAL EXPLANATION

**Functional Description**

Output voltage ($V_{OUT}$) can be fixed by revising the external transistor's base current. This can be done by comparing the detected voltage level and the set voltage power supply level.

## ■ DIRECTIONS FOR USE

**Suggestions for External Comporients**

1. PNP Transistor

The selection of a transistor should take into account output current, input voltage and power dissipation for each specific application. It is recommended that a transistor that has a low output saturated voltage ($V_{CE}$) and high $h_{FE}$ characteristics be used.

2. $R_B$ Resistor

Although the IC unit is protected by a base current remitter circuit, it is recommended that a resistor ($R_B$) be connected between the transistor's base and the IC's EXT pin to protect the transistor.

Required output current can be calculated using the following equation although characteristic variations and conditions of use should be carefully checked before use. The following equation also indicates the conditions needed to obtain $I_{OUT\ (max.)}$ at $V_{IN\ (min.)}$. However, the larger the input current, the larger the output current ($I_{OUT}$) that can be obtained.

$$\frac{V_{IN(min)}-1.2(V)}{R_B} - \frac{0.7(V)}{R_{BE}} > \frac{I_{OUT(max)}}{h_{FE}}$$

3. $R_{BE}$ Resistor, $C_L$ Capacitor

To prevent oscillation due to output load variation, use of a phase compensation capacitor $C_L$ is recommended. Please use a Tantalum capacitor of at least 10μF. Please also use an $R_{BE}$ resistor of less than 47kΩ.

An $R_{BE}$ resistor of between 20kΩ and 47kΩ is recommended for less power consumption.

4. Input Impedance

In order to control oscillation brought about as a result of impedance at the power supply line, connect a capacitor of 10μF or more (Tantalum) between the external transistor's emitter and the ground pin.

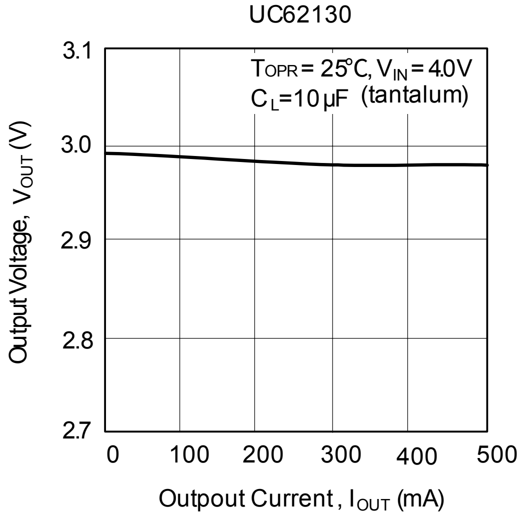
**Special Note**

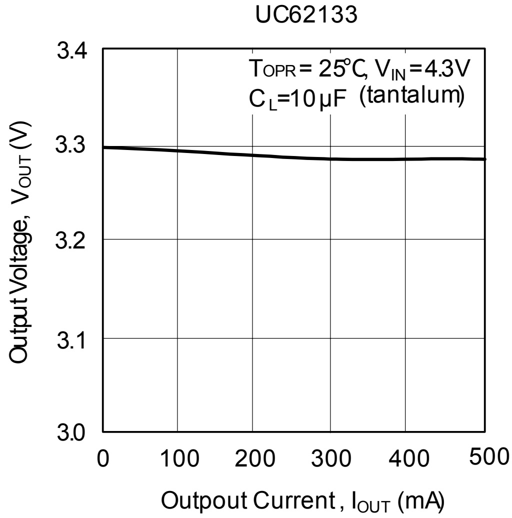
1. Protection Circuit

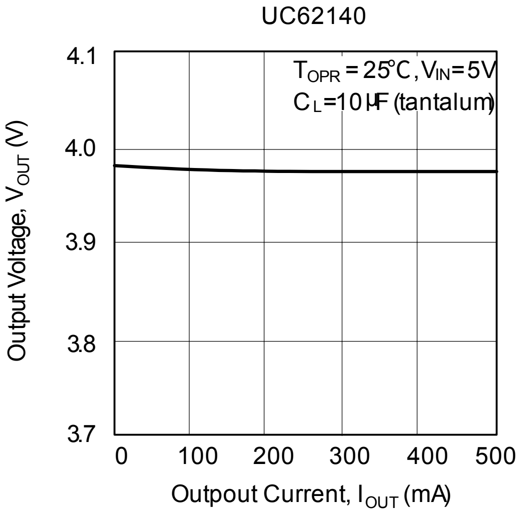
The built-in protect circuit is to protect the IC only. Therefore to prevent output shorts and overshoot current through the transistor, use of a resistor $R_B$ or an overshoot current protection circuit is recommended. Care should also be taken with the transistor's power dissipation.

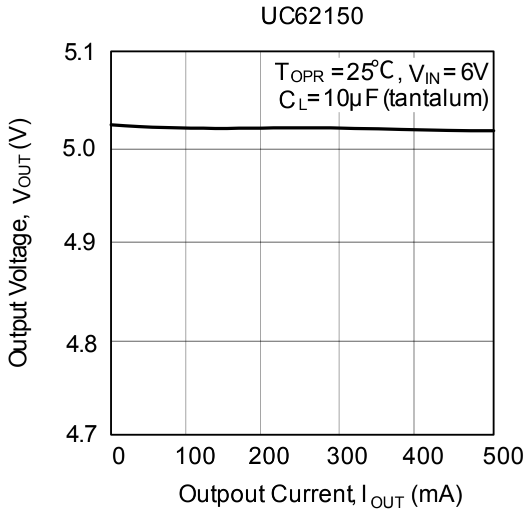
■ TYPICAL CHARACTERISTICS

**(1) OUTPUT VOLTAGE vs. OUTPUT CURRENT**

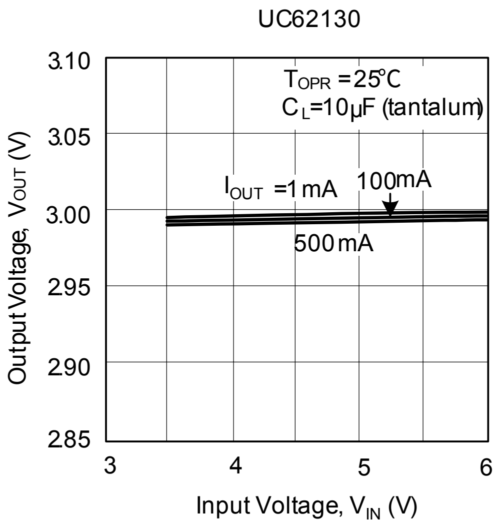


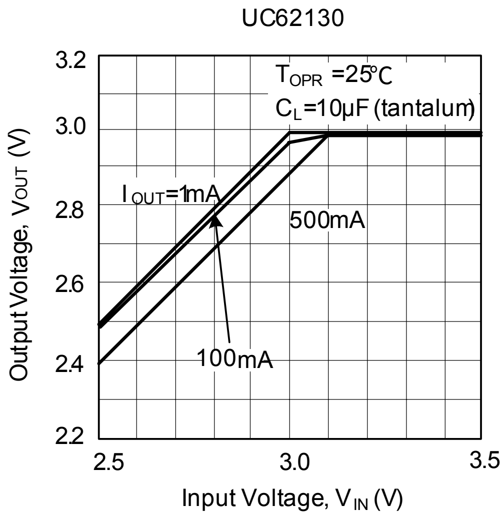



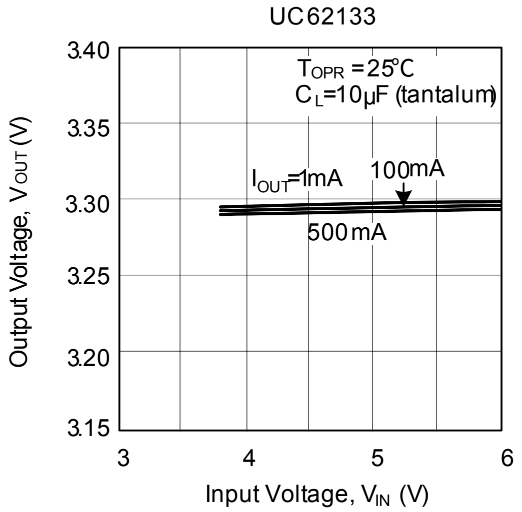



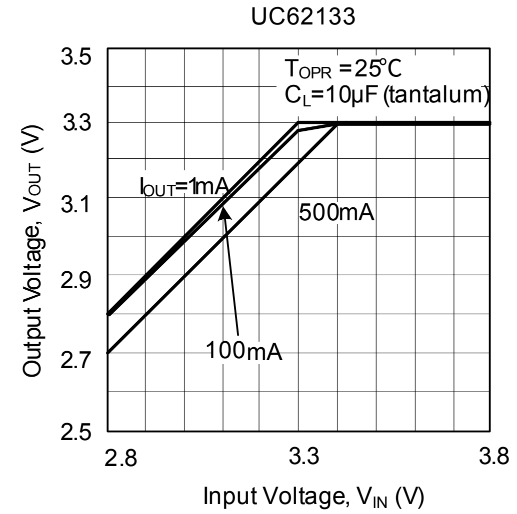

**(2) OUTPUT VOLTAGE vs. INPUT VOLTAGE**

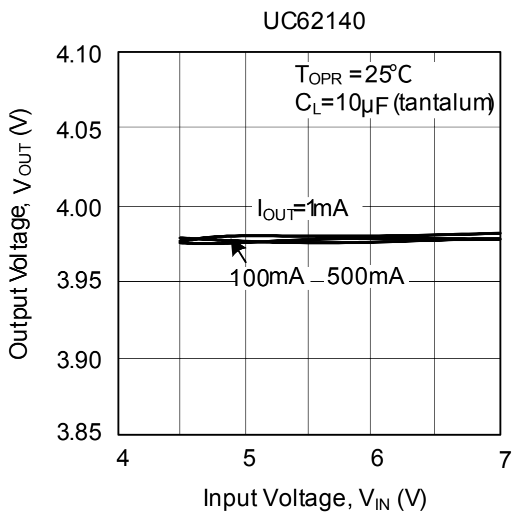


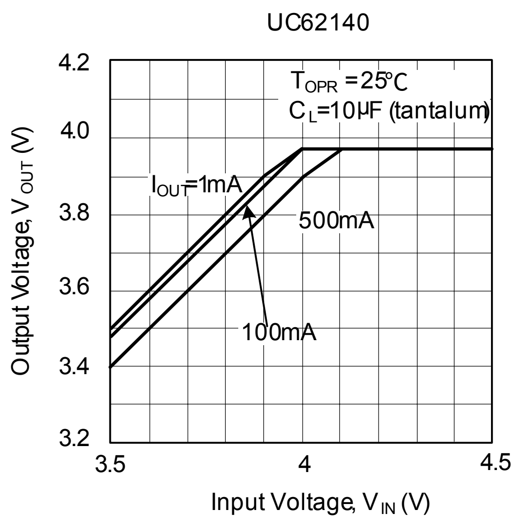



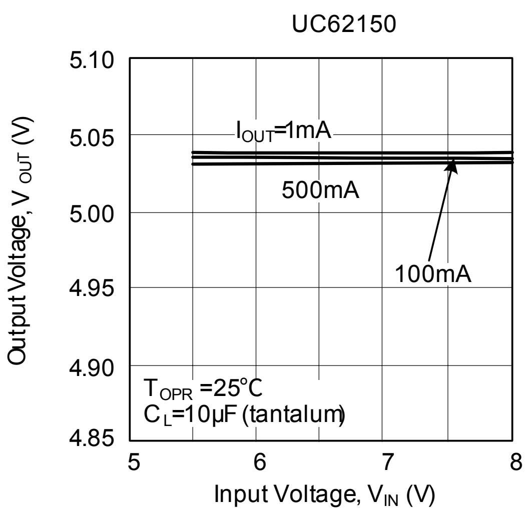
■ TYPICAL CHARACTERISTICS(Cont.)

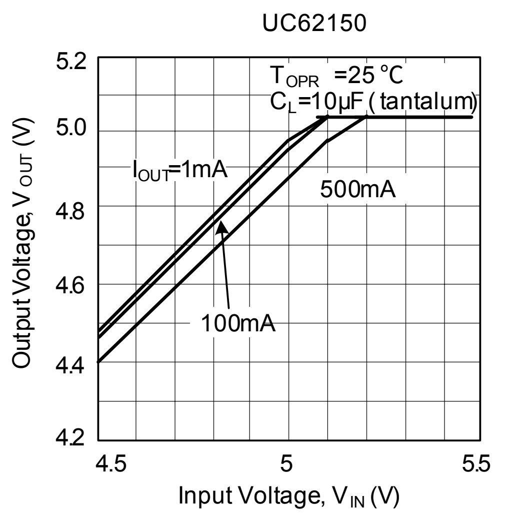


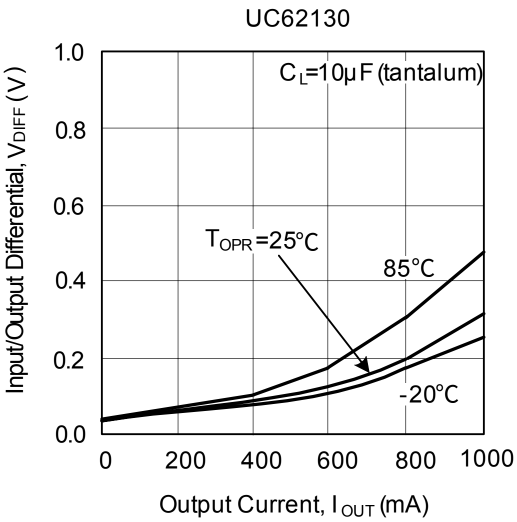



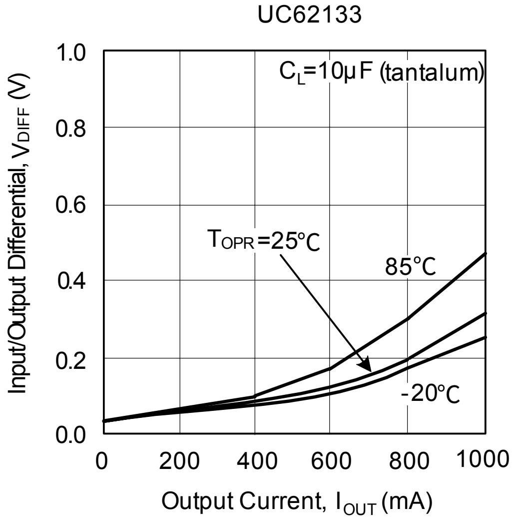



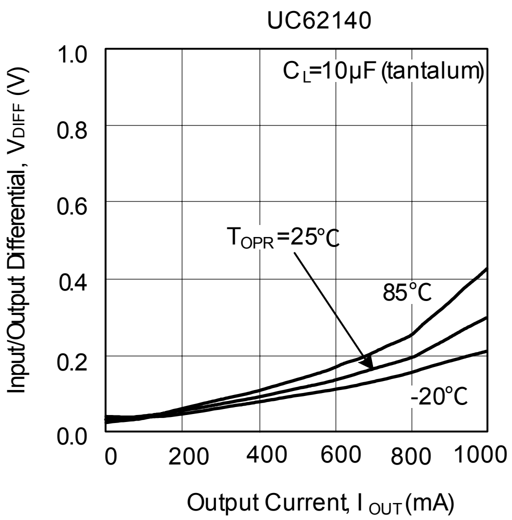



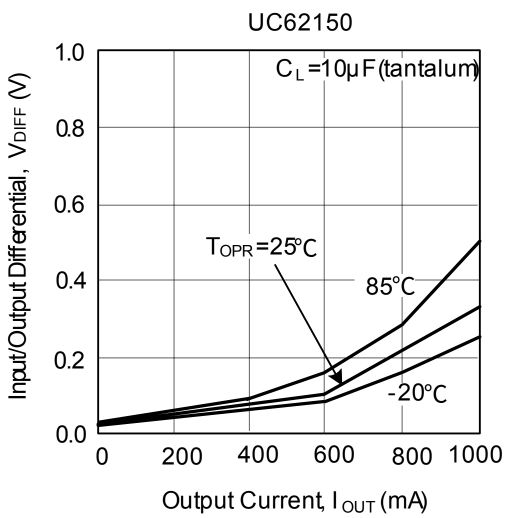
■ TYPICAL CHARACTERISTICS(Cont.)

**(3) INPUT/OUTPUT VOLTAGE DIFFERENTIAL vs. OUTPUT CURRENT**

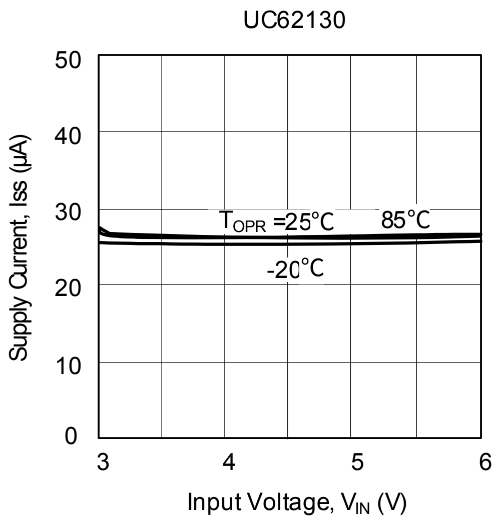


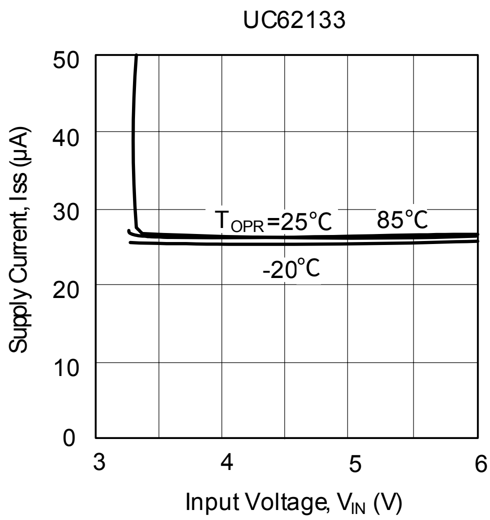



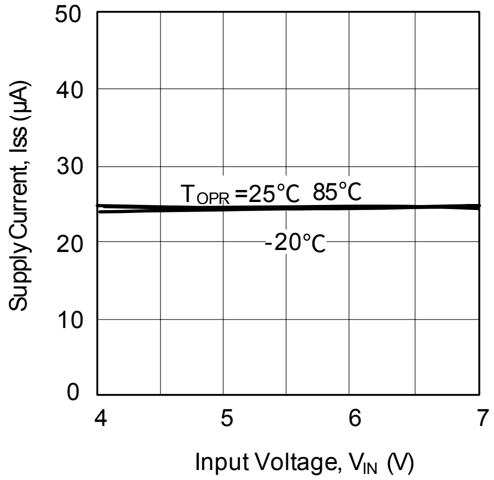

**(4) SUPPLY CURRENT vs. INPUT VOLTAGE**



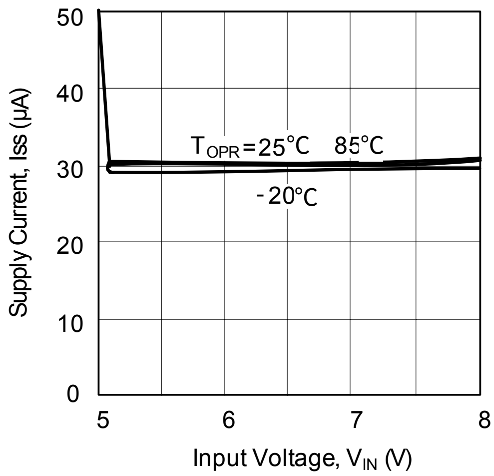



■ TYPICAL CHARACTERISTICS(Cont.)

UC62140

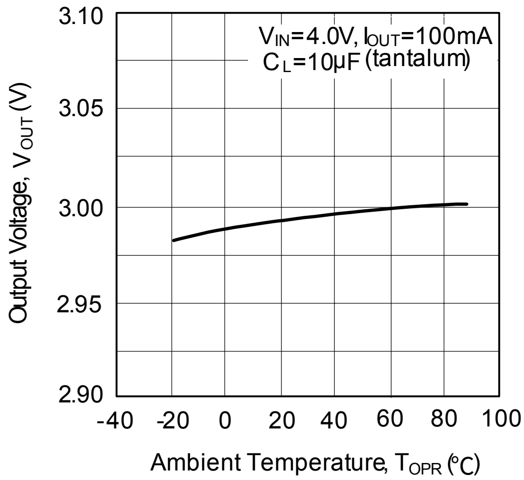



UC62150

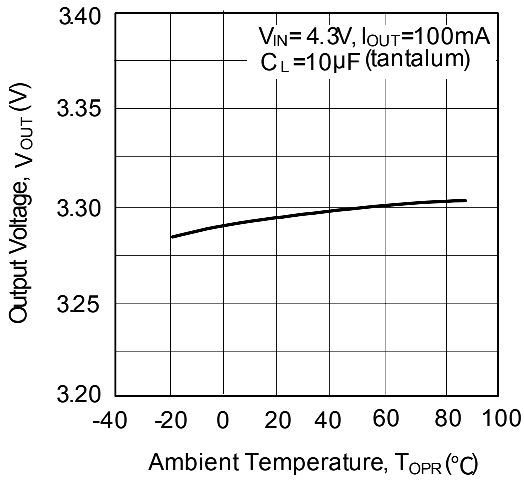



**(5) OUTPUT VOLTTAGE vs. AMBIENT TEMPERATURE**

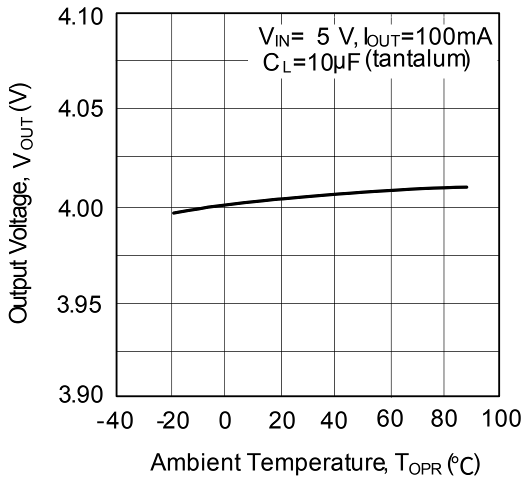
UC62130



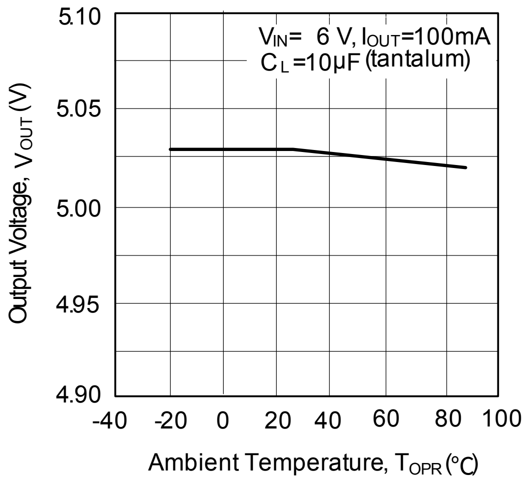

UC62133




UC62140

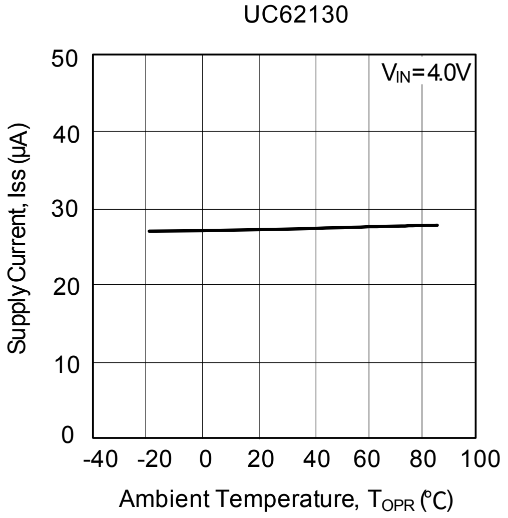


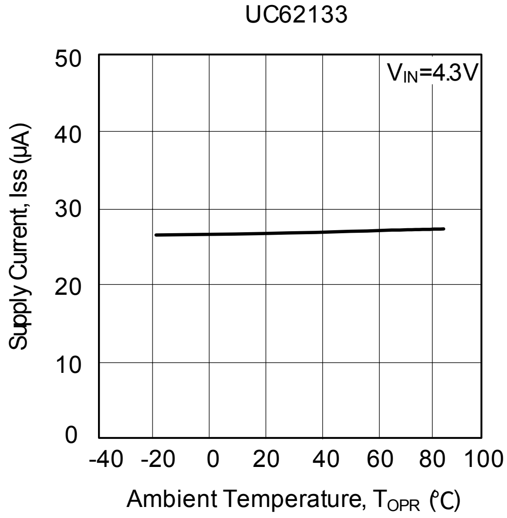

UC62150

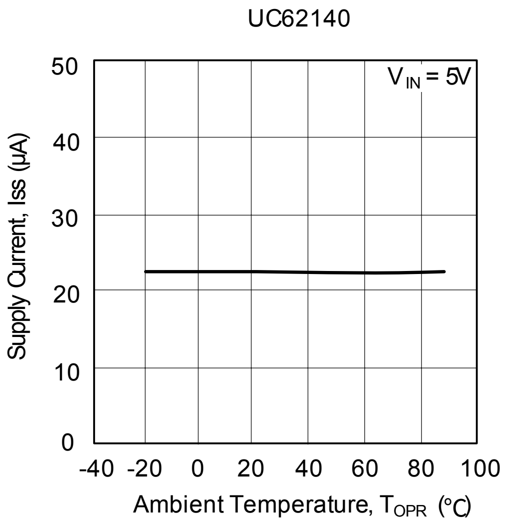


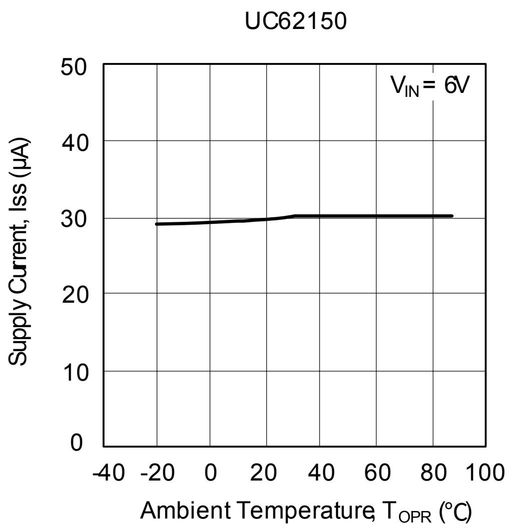
■ TYPICAL CHARACTERISTICS(Cont.)

**(6) SUPPLY CURRENT vs. AMBIENT TEMPERATURE**

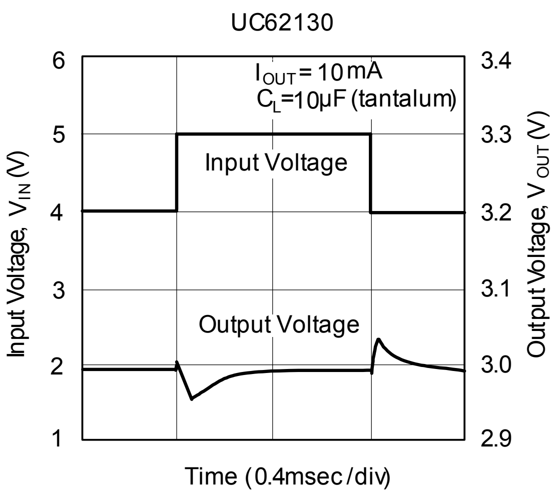


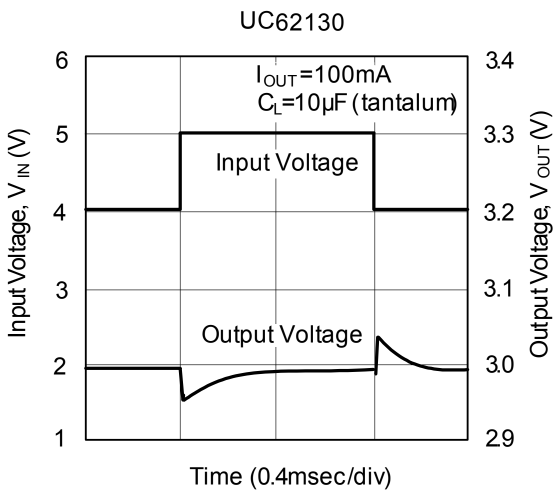



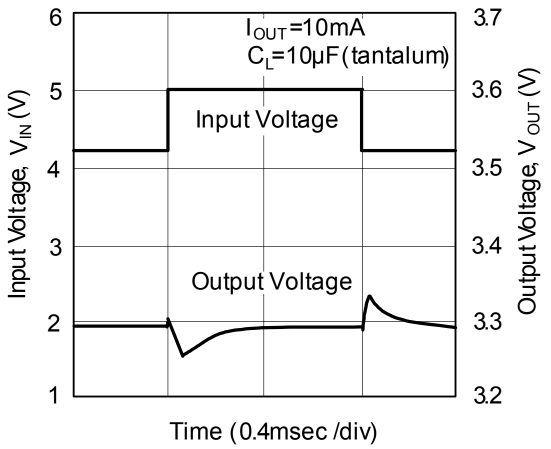

**(7) INPUT TRANSIENT RESPONSE**



■ TYPICAL CHARACTERISTICS(Cont.)

UC62133

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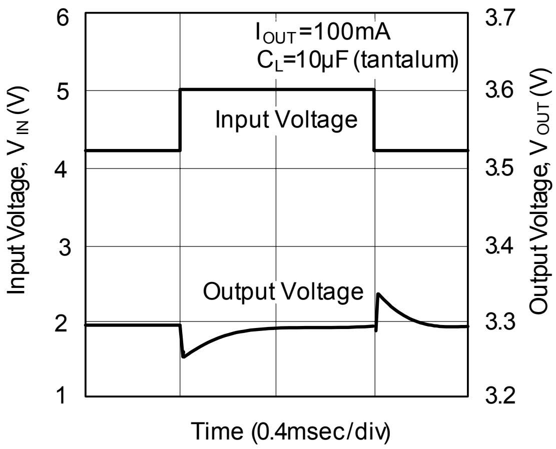
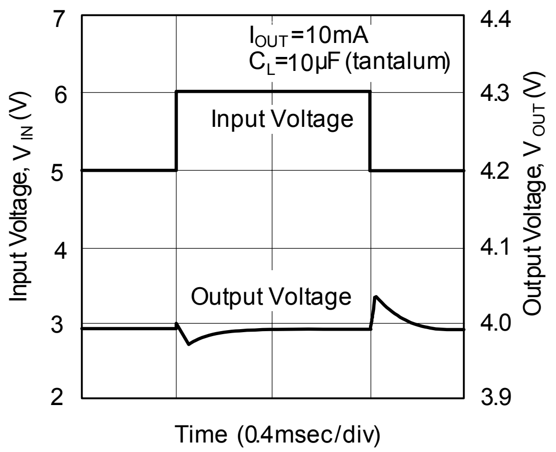
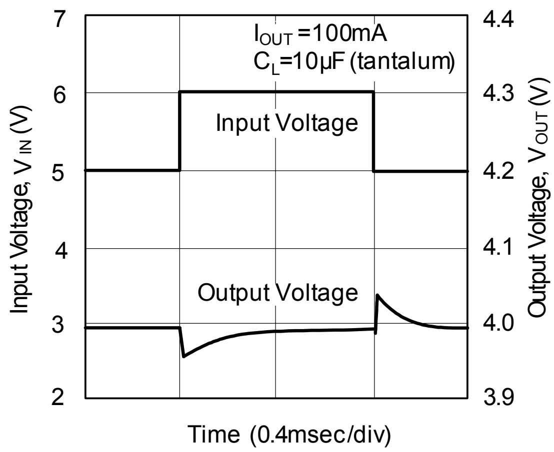


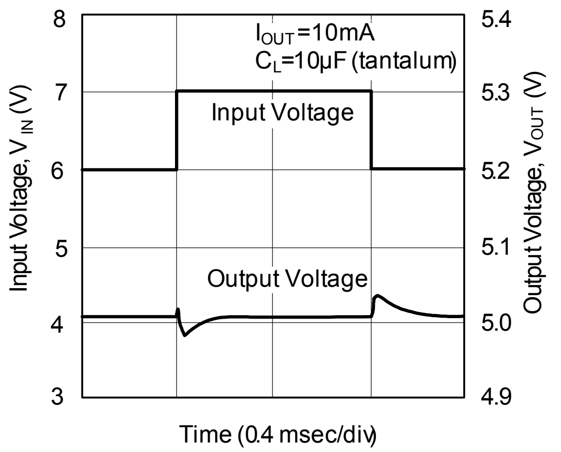

UC62140




UC62140




UC62150

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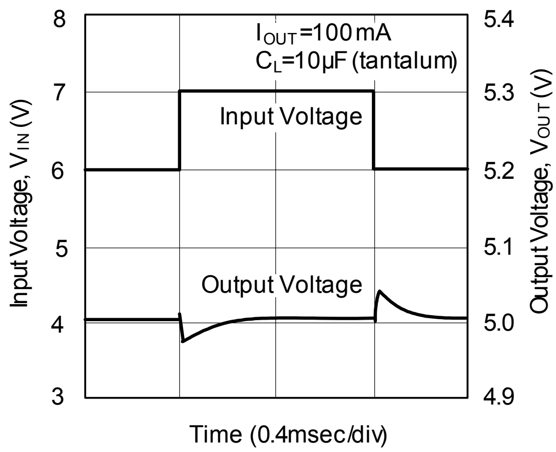
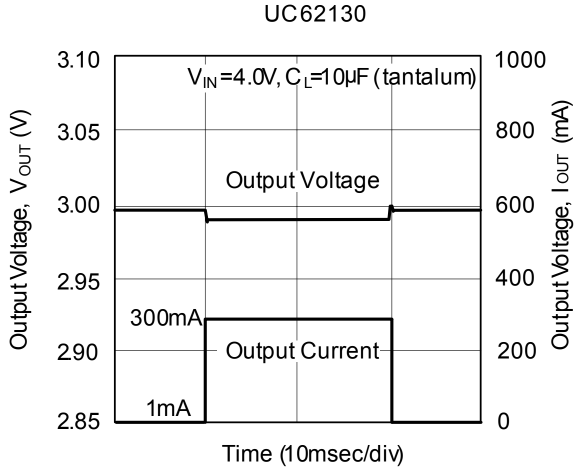
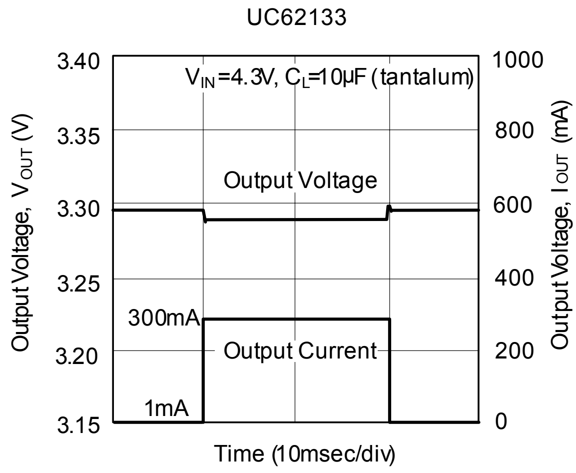
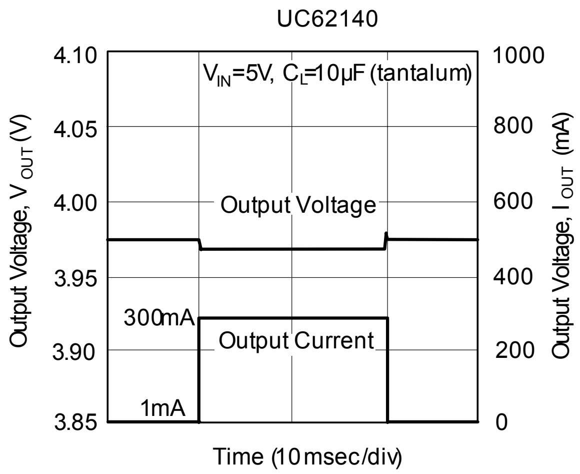


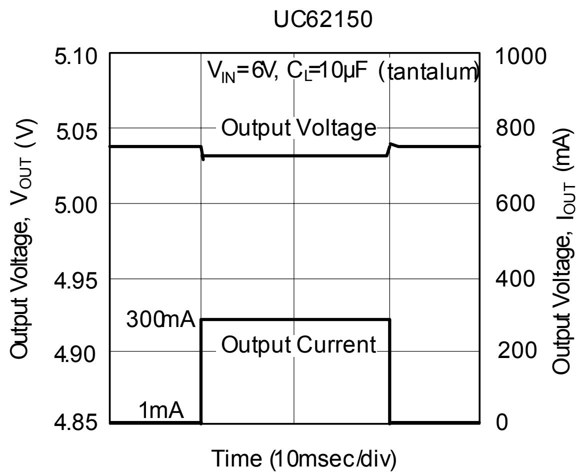
■ TYPICAL CHARACTERISTICS(Cont.)

**(8) LOAD TRANSIENT RESPONSE**

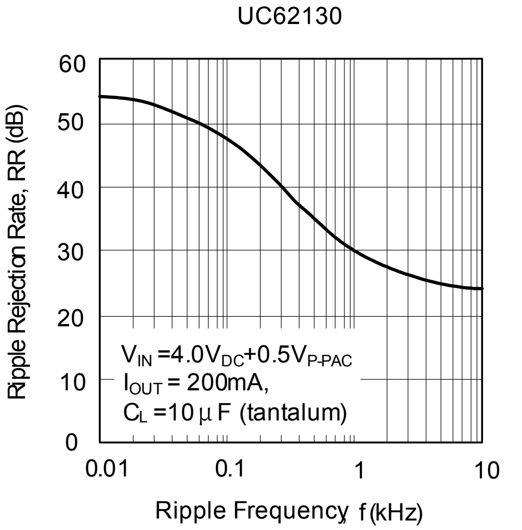


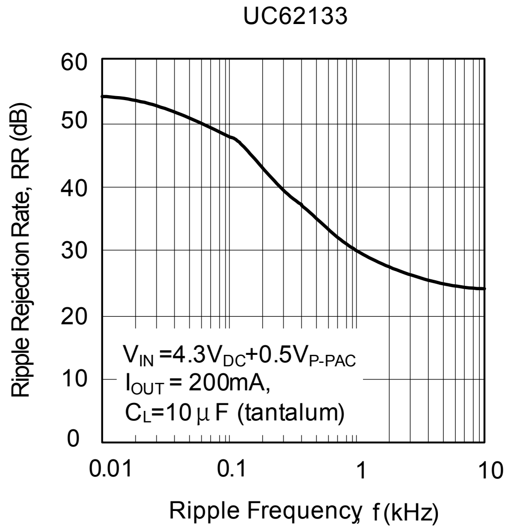




**(9) RIPPLE REJECTION RATE**



■ TYPICAL CHARACTERISTICS(Cont.)