

## Low ESR Cap. Compatible Positive Voltage Regulators

### ■ GENERAL DESCRIPTION

The XC6206 series are highly precise, low power consumption, 3 terminal, positive voltage regulators manufactured using CMOS and laser trimming technologies. The series provides large currents with a significantly small dropout voltage.

The XC6206 consists of a current limiter circuit, a driver transistor, a precision reference voltage and an error correction circuit. The series is compatible with low ESR ceramic capacitors. The current limiter's foldback circuit operates as a short circuit protection as well as the output current limiter for the output pin.

Output voltages are internally by laser trimming technologies. It is selectable in 0.1V increments within a range of 1.2V to 5.0V. SOT-23, SOT-89 and USP-6B packages are available.

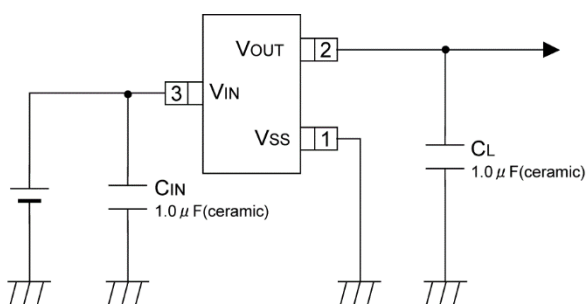
### ■ APPLICATIONS

- Smart phones / Mobile phones
- Portable game consoles
- Digital still cameras / Camcorders
- Digital audio equipments
- Reference voltage sources
- Multi-function power supplies

### ■ FEATURES

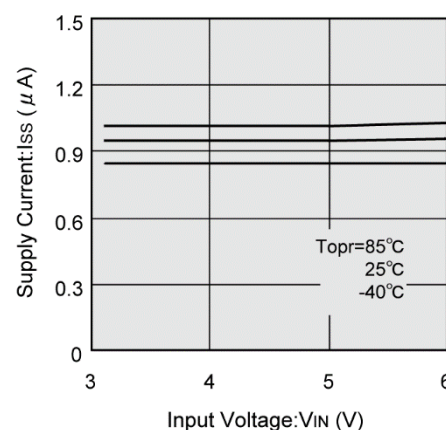
|                                      |                                                                                                                |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Maximum Output Current</b>        | : 200mA (3.0V type)                                                                                            |
| <b>Dropout Voltage</b>               | : 250mV @ 100mA (3.0V type)                                                                                    |
| <b>Maximum Operating Voltage</b>     | : 6.0V                                                                                                         |
| <b>Output Voltage Range</b>          | : 1.2V ~ 5.0V (0.1V increments)                                                                                |
| <b>Highly Accurate</b>               | : $\pm 2\%$ @ $V_{OUT} \geq 1.5V$<br>$\pm 30mV$ @ $V_{OUT} < 1.5V$<br>$(\pm 1\% \text{ @ } V_{OUT} \geq 2.0V)$ |
| <b>Low Power Consumption</b>         | : 1.0 $\mu$ A (TYP.)                                                                                           |
| <b>Low ESR Capacitor</b>             | : Ceramic capacitor compatible                                                                                 |
| <b>Protection</b>                    | : Current Limit                                                                                                |
| <b>Operating Ambient Temperature</b> | : -40°C ~ 85°C                                                                                                 |
| <b>Packages</b>                      | : SOT-23<br>SOT-89<br>USP-6B                                                                                   |
| <b>Environmentally Friendly</b>      | : EU RoHS Compliant, Pb Free                                                                                   |

### ■ TYPICAL APPLICATION CIRCUIT

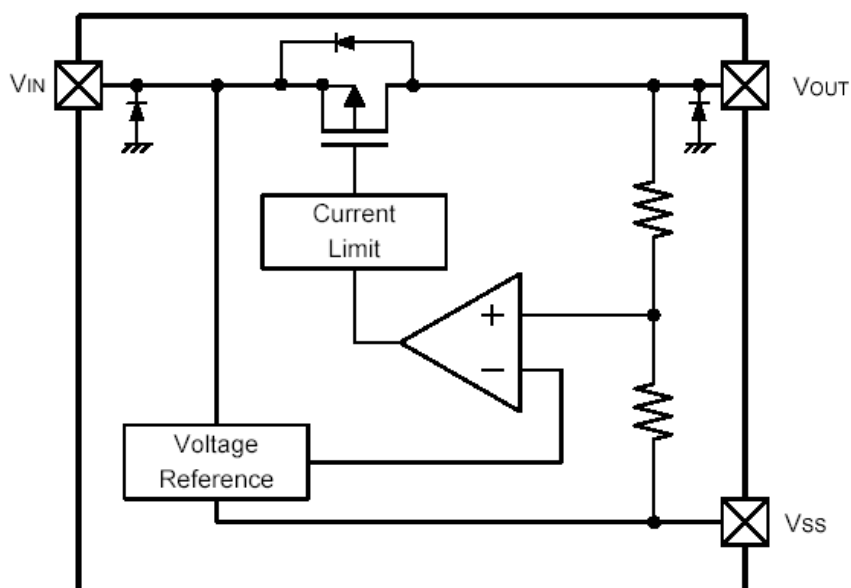


### ■ TYPICAL PERFORMANCE CHARACTERISTICS

XC6206P302



## ■ BLOCK DIAGRAM



\*Diodes inside the circuit are an ESD protection diode and a parasitic diode.

## ■ PRODUCT CLASSIFICATION

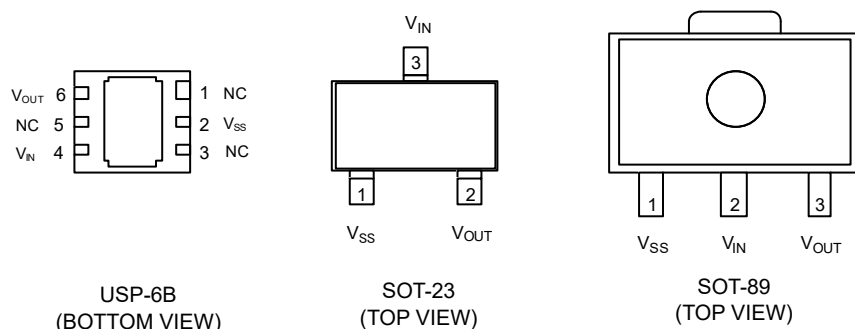
### ● Ordering Information

XC6206P①②③④⑤-⑥<sup>(\*)</sup>

| DESIGNATOR | ITEM                     | SYMBOL | DESCRIPTION                                                    |
|------------|--------------------------|--------|----------------------------------------------------------------|
| ①②         | Output Voltage           | 12~50  | e.g. V <sub>OUT</sub> : 3.0V→①=3, ②=0                          |
| ③          | Accuracy                 | 2      | ±2% (V <sub>OUT</sub> ≥ 1.5V), ±30mV (V <sub>OUT</sub> < 1.5V) |
|            |                          | 1      | ±1% (V <sub>OUT</sub> ≥ 2.0V)                                  |
| ④⑤-⑥       | Packages<br>(Order Unit) | MR-G   | SOT-23 (3,000pcs/Reel)                                         |
|            |                          | PR-G   | SOT-89 (1,000pcs/Reel)                                         |
|            |                          | DR-G   | USP-6B (3,000pcs/Reel)                                         |

<sup>(\*)</sup> The "-G" suffix denotes Halogen and Antimony free as well as being fully EU RoHS compliant.

## PIN CONFIGURATION



\*The dissipation pad for the USP-6B package should be solder-plated in recommended mount pattern and metal masking so as to enhance mounting strength and heat release.  
If the pad needs to be connected to other pins, it should be connected to the pin number 4 (V<sub>IN</sub>).

## PIN ASSIGNMENT

| PIN NUMBER |        |         | PIN NAME         | FUNCTIONS     |
|------------|--------|---------|------------------|---------------|
| SOT-23     | SOT-89 | USP-6B  |                  |               |
| 1          | 1      | 2       | V <sub>SS</sub>  | Ground        |
| 3          | 2      | 4       | V <sub>IN</sub>  | Power Input   |
| 2          | 3      | 6       | V <sub>OUT</sub> | Output        |
| -          | -      | 1, 3, 5 | NC               | No Connection |

## ABSOLUTE MAXIMUM RATINGS

| Ta=25℃                        |        |                  |                                       |       |
|-------------------------------|--------|------------------|---------------------------------------|-------|
| PARAMETER                     |        | SYMBOL           | RATINGS                               | UNITS |
| Input Voltage                 |        | V <sub>IN</sub>  | -0.3 ~ 7.0                            | V     |
| Output Current                |        | I <sub>OUT</sub> | 500 (*1)                              | mA    |
| Output Voltage                |        | V <sub>OUT</sub> | -0.3 ~ V <sub>IN</sub> + 0.3          | V     |
| Power Dissipation             | SOT-23 | Pd               | 250 (IC only)                         | mW    |
|                               |        |                  | 500(40mm x 40mm Standard board) (*2)  |       |
|                               | SOT-89 |                  | 500 (IC only)                         |       |
|                               |        |                  | 1000(40mm x 40mm Standard board) (*2) |       |
|                               | USP-6B |                  | 120 (IC only)                         |       |
|                               |        |                  | 1000(40mm x 40mm Standard board) (*2) |       |
| Operating Ambient Temperature |        | Topr             | -40 ~ 85                              | ℃     |
| Storage Temperature           |        | Tstg             | -55 ~ 125                             | ℃     |

<sup>(\*)1</sup>  $I_{OUT} \leq P_d / (V_{IN} - V_{OUT})$

<sup>(\*)2</sup> The power dissipation figure shown is PCB mounted and is for reference only.

Please refer to PACKAGING INFORMATION for the mounting condition.

## ELECTRICAL CHARACTERISTICS

Ta=25°C

| PARAMETER                                      | SYMBOL                                                      | CONDITIONS                                                                                         |                           | MIN.                | TYP.                                | MAX.                | UNITS  | CIRCUIT |
|------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------|---------------------|-------------------------------------|---------------------|--------|---------|
| Output Voltage (Standard) <sup>(*)2</sup>      | V <sub>OUT(E)</sub> <sup>(*)3</sup>                         | I <sub>OUT</sub> =30mA                                                                             | V <sub>OUT(T)</sub> <1.5V | -0.03               | V <sub>OUT(T)</sub> <sup>(*)4</sup> | +0.03               | V      | ②       |
|                                                |                                                             |                                                                                                    | V <sub>OUT(T)</sub> ≥1.5V | ×0.98               |                                     | ×1.02               |        |         |
| Output Voltage (High Accuracy) <sup>(*)2</sup> |                                                             | I <sub>OUT</sub> =30mA                                                                             | V <sub>OUT(T)</sub> ≥2.0V | ×0.99               |                                     | ×1.01               |        |         |
| Supply Current                                 | I <sub>DD</sub>                                             |                                                                                                    |                           | -                   | 1.0                                 | 3.0                 | μA     | ①       |
| Load Regulation                                | ΔV <sub>OUT</sub>                                           | V <sub>OUT(T)</sub> ≤1.8V, 1mA≤I <sub>OUT</sub> ≤50mA                                              |                           | -                   | -                                   | E-1 <sup>(*)5</sup> | mV     | ②       |
|                                                |                                                             | V <sub>OUT(T)</sub> >1.8V, 1mA≤I <sub>OUT</sub> ≤100mA                                             |                           |                     |                                     |                     |        |         |
| Dropout Voltage 1                              | V <sub>dif1</sub> <sup>(*)6</sup>                           | I <sub>OUT</sub> =30mA                                                                             |                           | -                   | E-2 <sup>(*)5</sup>                 |                     | mV     | ②       |
| Dropout Voltage 2                              | V <sub>dif2</sub> <sup>(*)6</sup>                           | V <sub>OUT(T)</sub> ≤1.8V, I <sub>OUT</sub> =60mA                                                  |                           | -                   | E-3 <sup>(*)5</sup>                 |                     |        |         |
|                                                |                                                             | V <sub>OUT(T)</sub> >1.8V, I <sub>OUT</sub> =100mA                                                 |                           |                     |                                     |                     |        |         |
| Line Regulation                                | ΔV <sub>OUT</sub> / (ΔV <sub>IN</sub> · V <sub>OUT</sub> )  | V <sub>OUT(T)</sub> <4.5V, V <sub>OUT(T)</sub> +1.0V≤V <sub>IN</sub> ≤6.0V, I <sub>OUT</sub> =30mA |                           | -                   | 0.05                                | 0.25                | %V     | ②       |
|                                                |                                                             | V <sub>OUT(T)</sub> ≥4.5V, 5.5V≤V <sub>IN</sub> ≤6.0V, I <sub>OUT</sub> =30mA                      |                           |                     |                                     |                     |        |         |
| Maximum Output Current                         | I <sub>OUTMAX</sub>                                         | V <sub>OUT</sub> ≥V <sub>OUT(E)</sub> × 0.9                                                        |                           | E-4 <sup>(*)5</sup> | -                                   | -                   | mA     | ②       |
| Short Circuit Current                          | I <sub>SHORT</sub>                                          | V <sub>OUT</sub> =V <sub>SS</sub>                                                                  |                           | -                   | E-5 <sup>(*)5</sup>                 | -                   | mA     | ②       |
| Input Voltage                                  | V <sub>IN</sub>                                             |                                                                                                    |                           | 1.8                 | -                                   | 6.0                 | V      | ②       |
| Output Voltage Temperature Characteristics     | ΔV <sub>OUT</sub> / (ΔT <sub>opr</sub> · V <sub>OUT</sub> ) | I <sub>OUT</sub> =30mA, -40°C≤T <sub>opr</sub> ≤85°C                                               |                           | -                   | ±100                                | -                   | ppm/°C | ②       |

\*1: Unless otherwise stated, V<sub>IN</sub> = V<sub>OUT(T)</sub> + 1.0V

\*2: (Standard): ±2% (1.5V≤V<sub>OUT(T)</sub>), ±0.03V (1.5V>V<sub>OUT(T)</sub>)  
(High Accuracy): ±1% (2.0V≤V<sub>OUT(T)</sub>)

\*3: V<sub>OUT(E)</sub>: Effective output voltage.

\*4: V<sub>OUT(T)</sub>: Nominal voltage

\*5: For E-1, E-2, E-3, E-4, E-5, Please refer to Electrical Characteristics Chart.

\*6: V<sub>dif</sub> = V<sub>IN1</sub> - V<sub>OUT1</sub>

V<sub>OUT1</sub>: A voltage equal to 98% of the output voltage whenever an amply stabilized {V<sub>OUT(T)</sub> + 1.0V} is input with each I<sub>OUT</sub>.

V<sub>IN1</sub>: The input voltage when V<sub>OUT1</sub> appears as input voltage is gradually decreased.

\*7: The low ESR capacitors use that is more than 1.0μF as C<sub>L</sub> is possible.

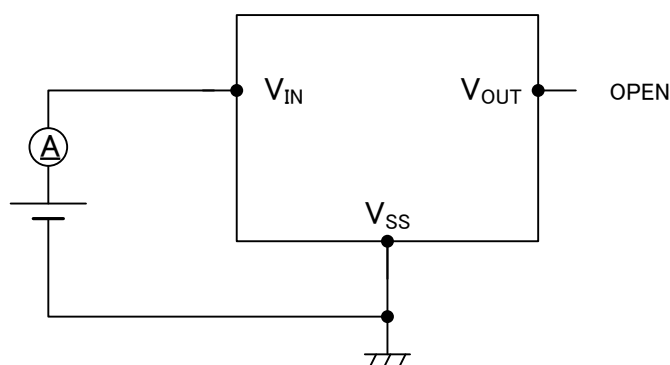
## ■ ELECTRICAL CHARACTERISTICS (Continued)

### ● Electrical Characteristics Chart

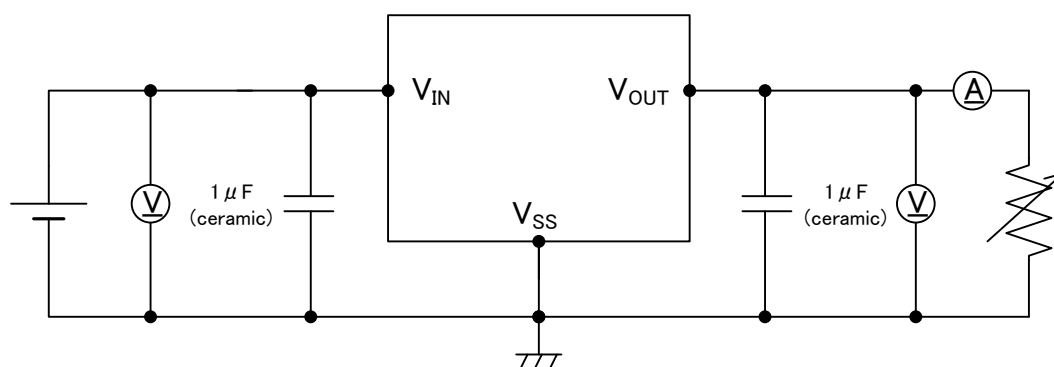
| NOMINAL<br>VOLTAGE | E-1                   | E-2                 |      | E-3                 |      | E-4                       | E-5              |
|--------------------|-----------------------|---------------------|------|---------------------|------|---------------------------|------------------|
|                    | LOAD<br>REGULATION    | DROPOUT<br>VOLTAGE1 |      | DROPOUT<br>VOLTAGE2 |      | MAX.<br>OUTPUT<br>CURRENT | SHORT<br>CURRENT |
|                    | $\Delta V_{OUT}$ (mV) | $V_{dif1}$ (mV)     |      | $V_{dif2}$ (mV)     |      | $I_{OUTMAX}$ (mA)         | $I_{SHORT}$ (mA) |
| $V_{OUT(T)}$       | MAX.                  | TYP.                | MAX. | TYP.                | MAX. | MIN.                      | TYP.             |
| 1.2                | 40                    | 460                 | 760  | 700                 | 960  | 60                        | 180              |
| 1.3                |                       | 400                 | 650  |                     |      |                           |                  |
| 1.4                |                       | 350                 | 590  | 580                 | 860  |                           |                  |
| 1.5                | 45                    | 300                 | 510  |                     |      | 450                       | 810              |
| 1.6                |                       | 250                 | 450  |                     |      |                           |                  |
| 1.7                |                       | 200                 | 410  |                     |      |                           |                  |
| 1.8                |                       | 150                 | 390  | 350                 | 780  | 120                       | 100              |
| 1.9                | 50                    | 100                 | 370  |                     |      |                           |                  |
| 2.0                |                       |                     |      |                     | 710  |                           |                  |
| 2.1                |                       |                     |      |                     |      |                           |                  |
| 2.2                |                       |                     |      |                     |      |                           |                  |
| 2.3                | 55                    | 75                  | 350  | 250                 | 680  | 200                       |                  |
| 2.4                |                       |                     |      |                     |      |                           |                  |
| 2.5                |                       |                     |      |                     |      |                           |                  |
| 2.6                |                       |                     |      |                     |      |                           |                  |
| 2.7                |                       |                     |      |                     |      |                           |                  |
| 2.8                |                       |                     |      |                     |      |                           |                  |
| 2.9                |                       |                     |      |                     |      |                           |                  |
| 3.0                | 60                    | 60                  | 320  | 200                 | 630  | 250                       |                  |
| 3.1                |                       |                     |      |                     |      |                           |                  |
| 3.2                |                       |                     |      |                     |      |                           |                  |
| 3.3                |                       |                     |      |                     |      |                           |                  |
| 3.4                | 65                    | 60                  | 320  | 200                 | 630  | 250                       |                  |
| 3.5                |                       |                     |      |                     |      |                           |                  |
| 3.6                |                       |                     |      |                     |      |                           |                  |
| 3.7                |                       |                     |      |                     |      |                           |                  |
| 3.8                |                       |                     |      |                     |      |                           |                  |
| 3.9                |                       |                     |      |                     |      |                           |                  |
| 4.0                | 70                    | 60                  | 320  | 200                 | 630  | 250                       |                  |
| 4.1                |                       |                     |      |                     |      |                           |                  |
| 4.2                |                       |                     |      |                     |      |                           |                  |
| 4.3                |                       |                     |      |                     |      |                           |                  |
| 4.4                | 75                    | 60                  | 320  | 200                 | 630  | 250                       |                  |
| 4.5                |                       |                     |      |                     |      |                           |                  |
| 4.6                |                       |                     |      |                     |      |                           |                  |
| 4.7                |                       |                     |      |                     |      |                           |                  |
| 4.8                |                       |                     |      |                     |      |                           |                  |
| 4.9                |                       |                     |      |                     |      |                           |                  |
| 5.0                | 80                    | 50                  | 290  | 175                 | 600  |                           |                  |

## TEST CIRCUITS

Circuit ①



Circuit ②

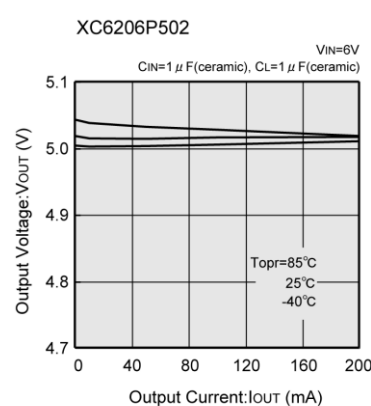
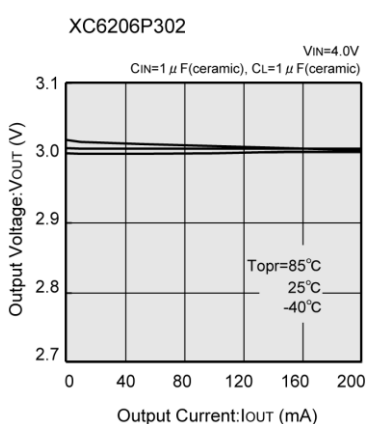
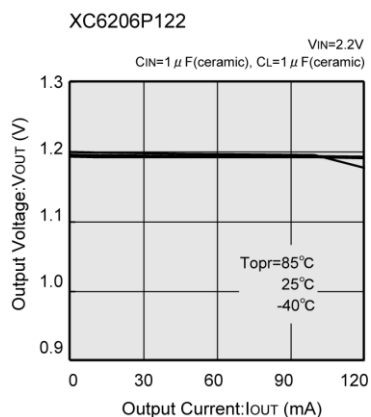


## NOTES ON USE

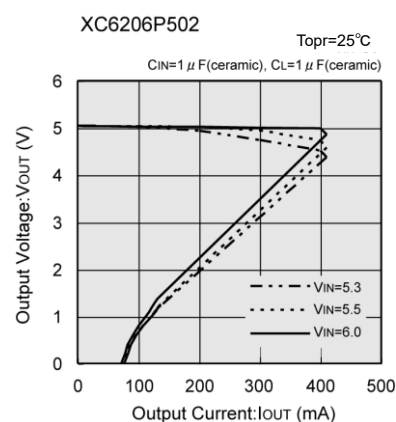
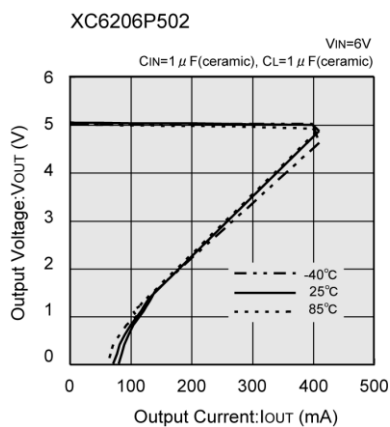
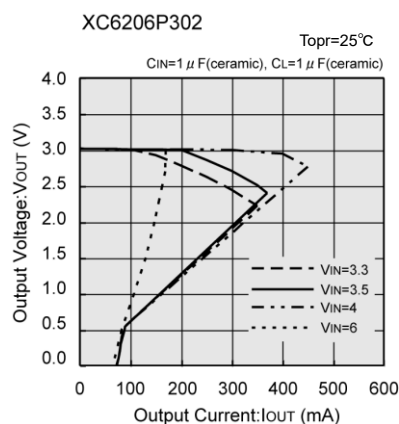
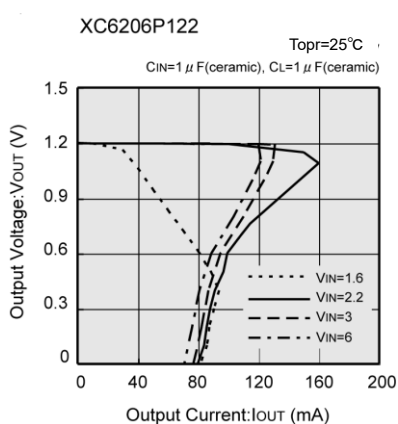
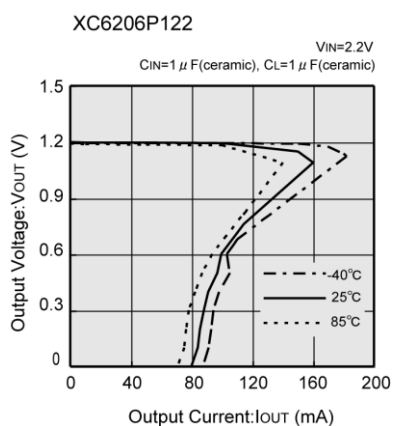
1. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.
2. Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current. Please strengthen  $V_{IN}$  and  $V_{SS}$  wiring in particular
3. Please wire the input capacitor ( $C_{IN}$ ) and the output capacitor ( $C_L$ ) as close to the IC as possible.
4. Capacitances of these capacitors ( $C_{IN}$ ,  $C_L$ ) are decreased by the influences of bias voltage and ambient temperature. Care shall be taken for capacitor selection to ensure stability of phase compensation from the point of ESR influence.
5. When it is used in a quite small input / output dropout voltage, output may go into unstable operation. Please test it thoroughly before using it in production.
6. Torex places an importance on improving our products and their reliability. We request that users incorporate fail-safe designs and post-aging protection treatment when using Torex products in their systems.

## ■ TYPICAL PERFORMANCE CHARACTERISTICS

### (1) Output Voltage vs. Output Current

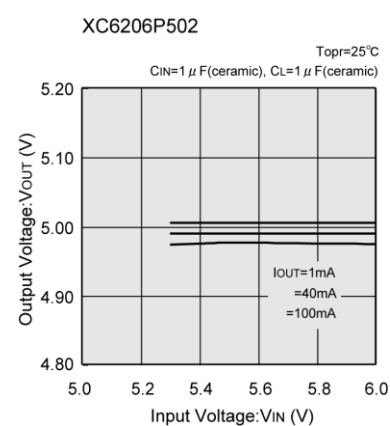
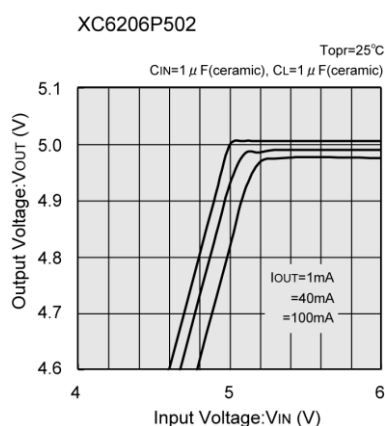
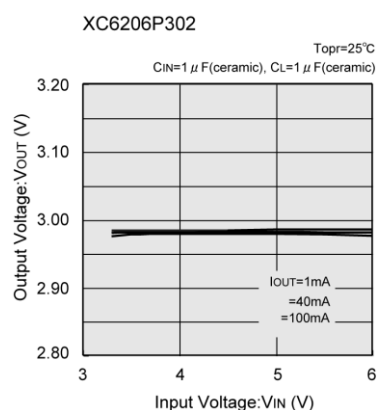
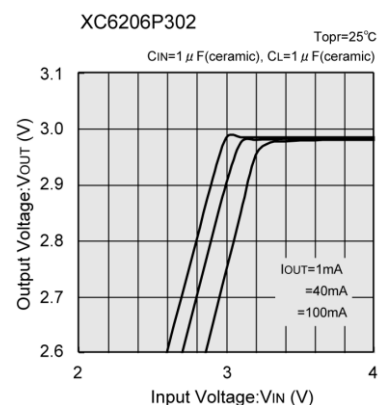
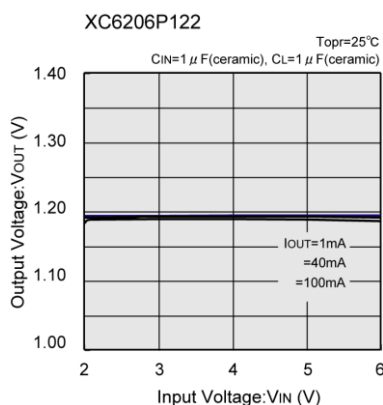
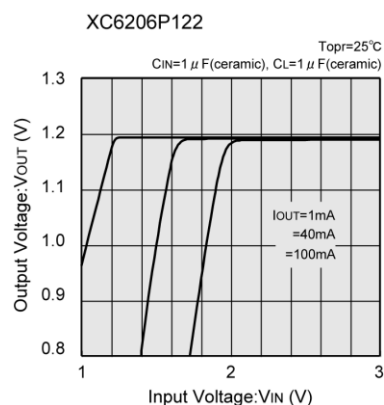


### (2) Current Limit

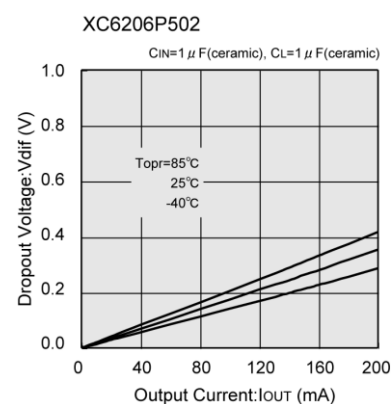
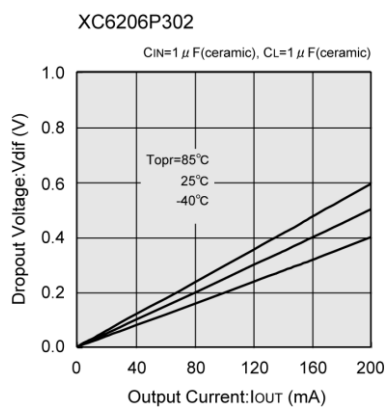
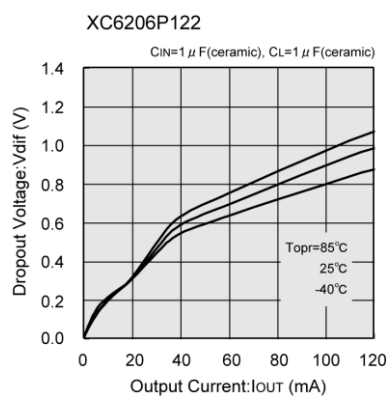


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (3) Output Voltage vs. Input Voltage



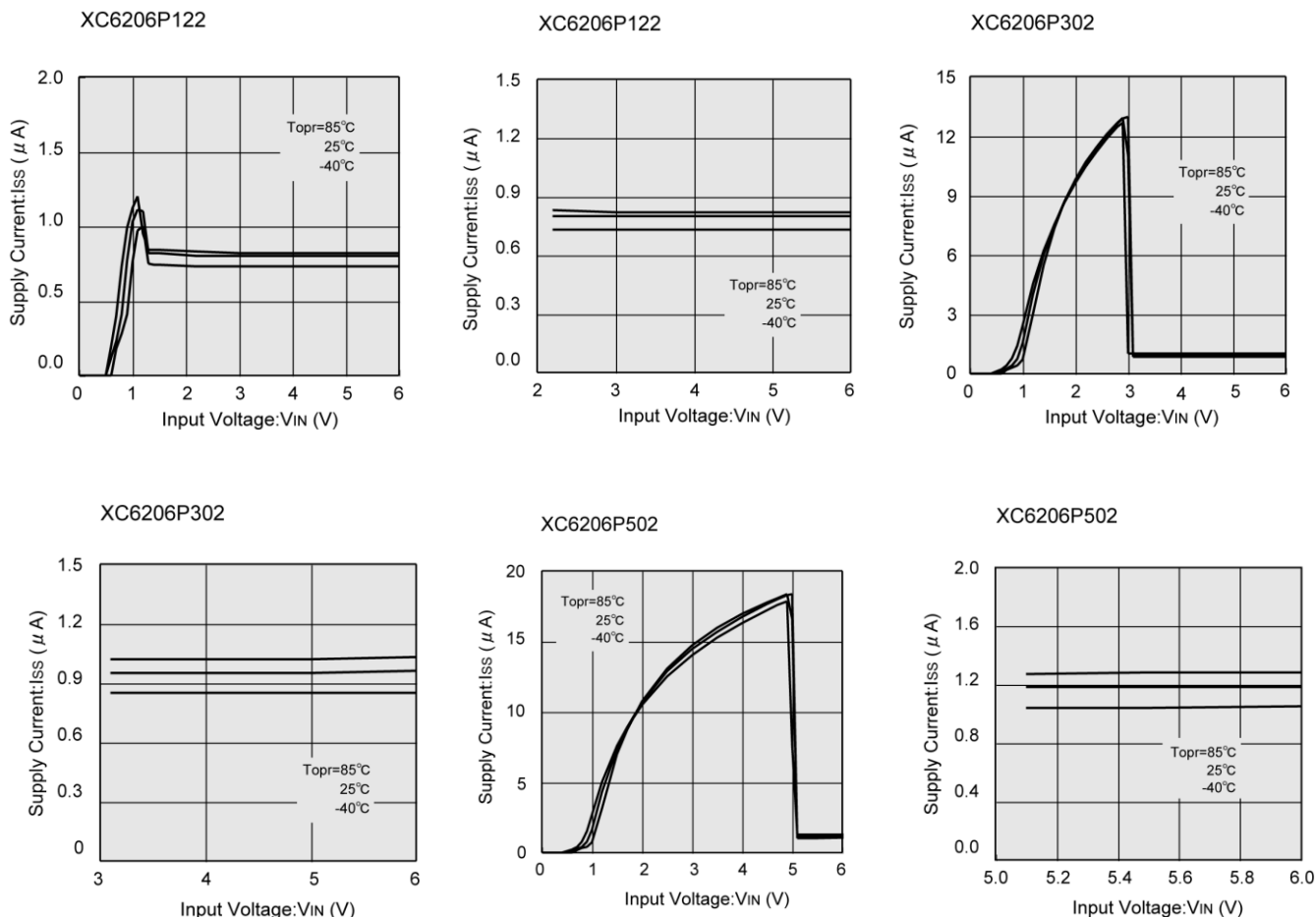
### (4) Dropout Voltage vs. Output Current



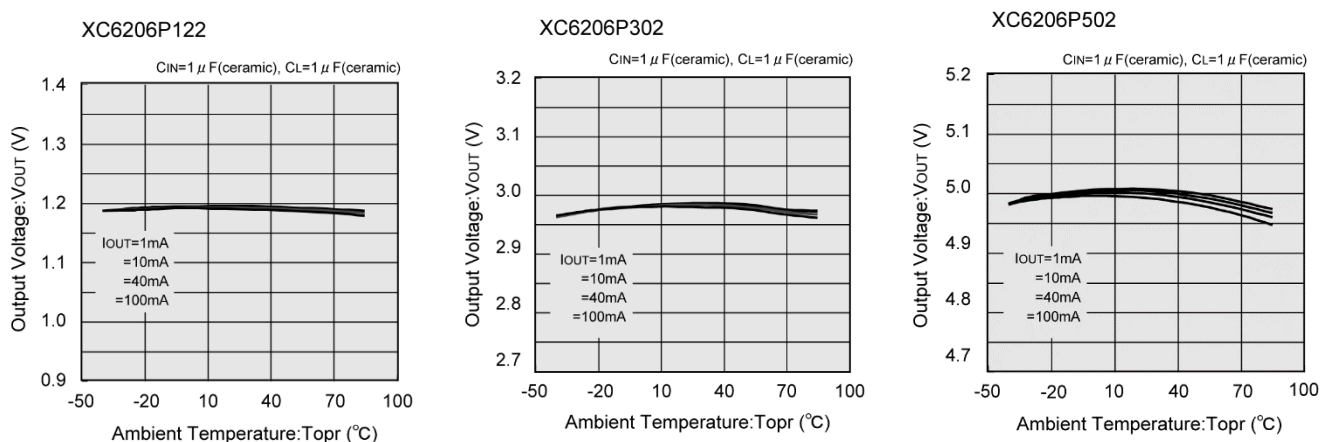


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (5) Supply Current vs. Input Voltage

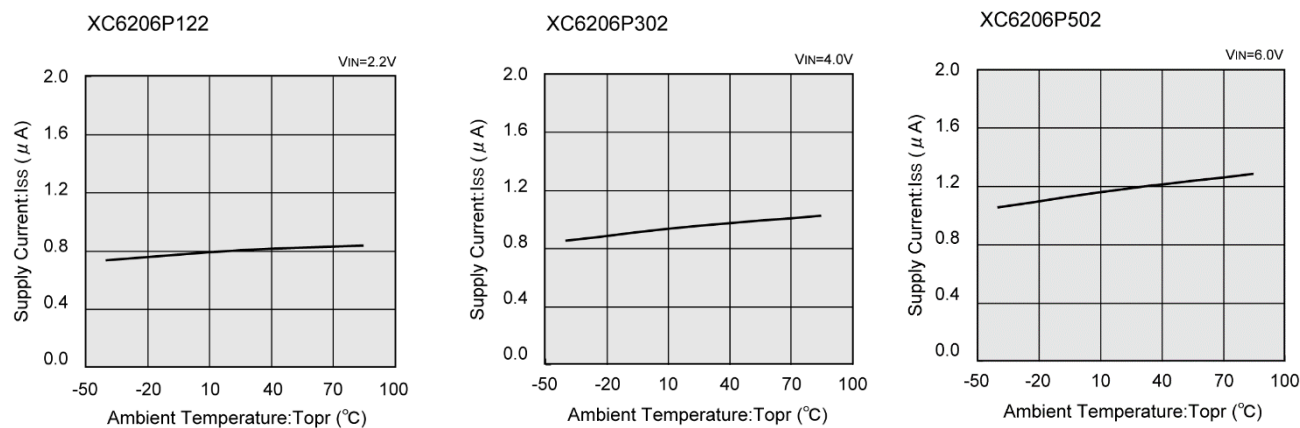


### (6) Output Voltage vs. Ambient Temperature

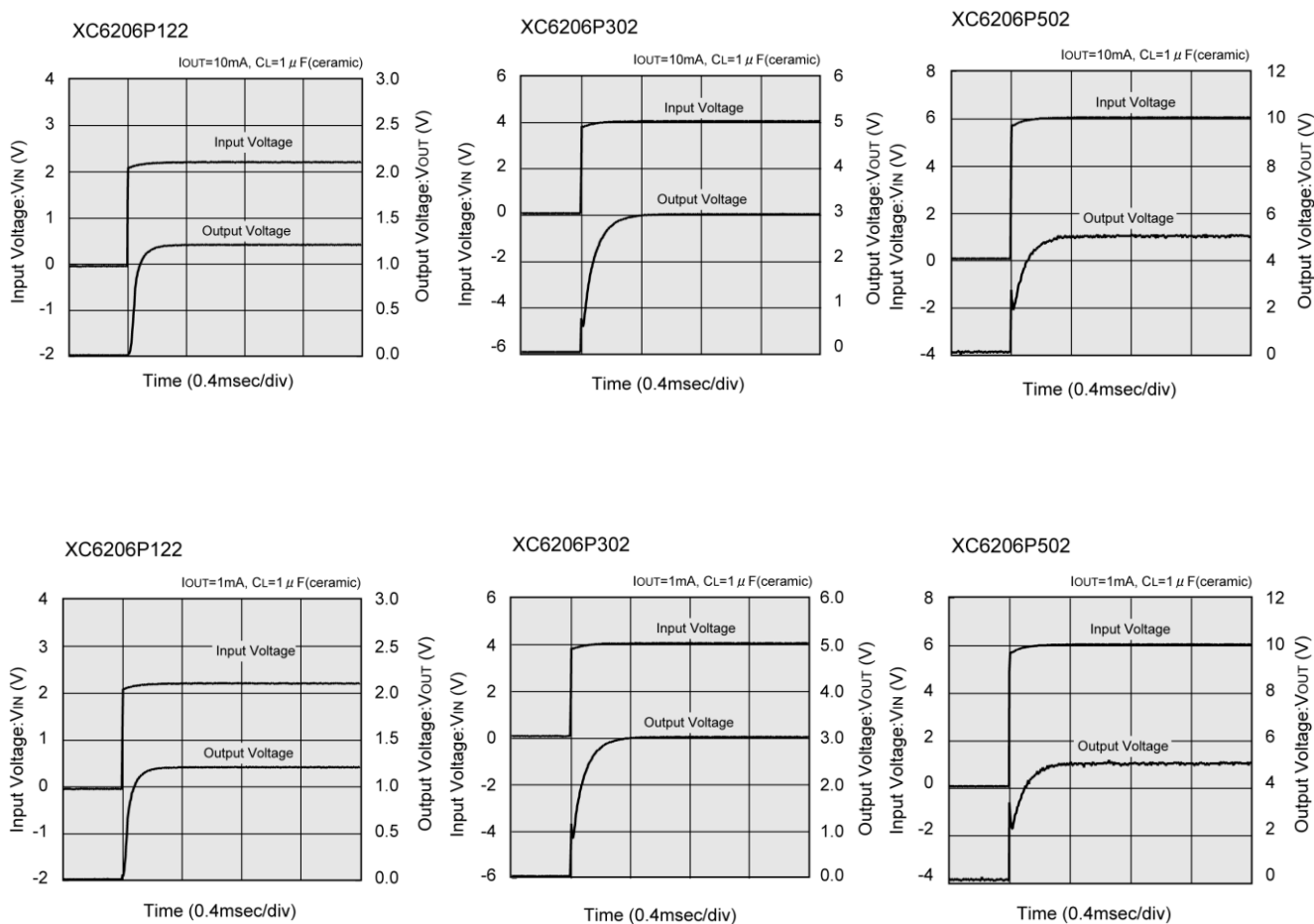


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (7) Output Voltage vs. Ambient Temperature

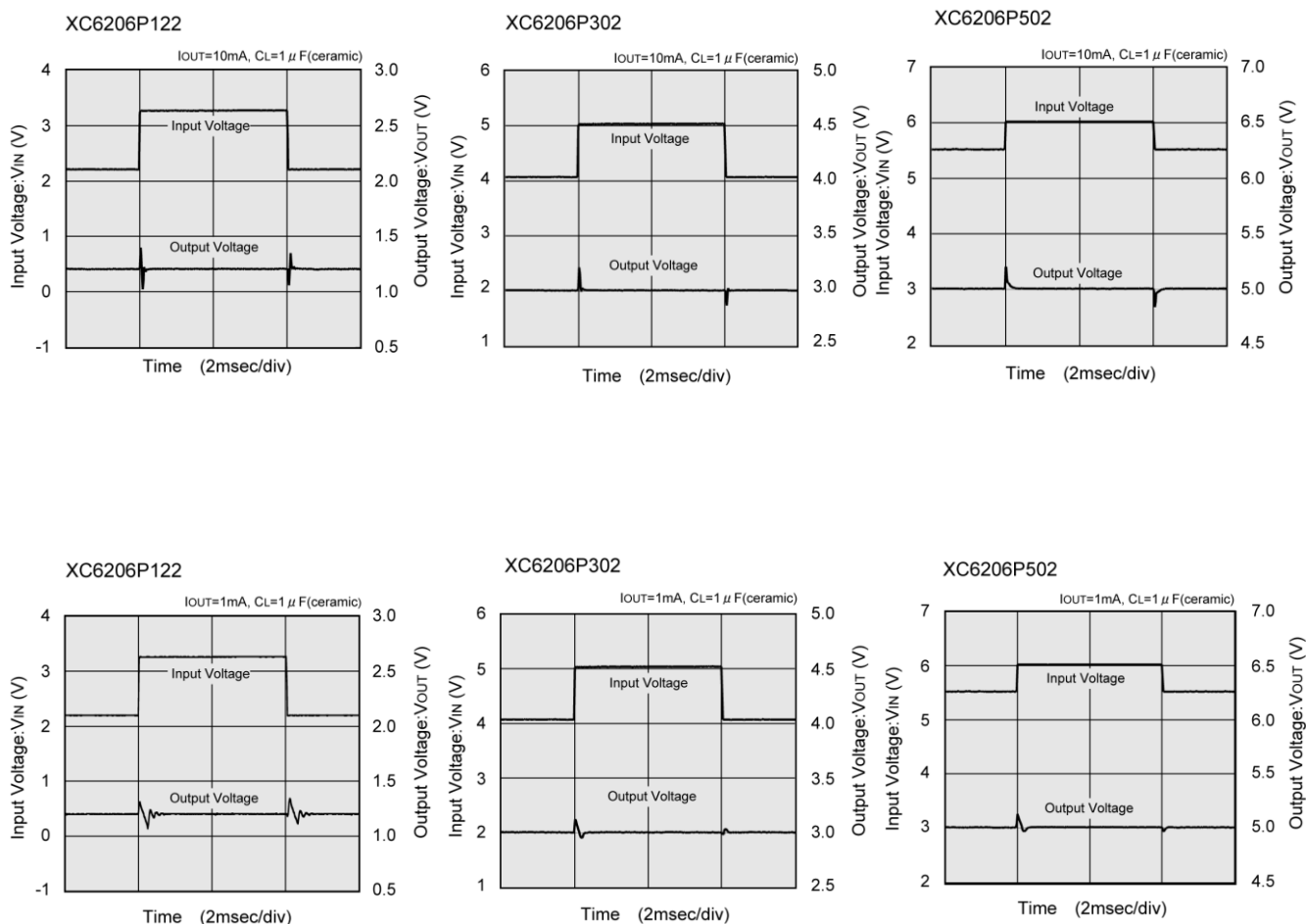


### (8) Input Transient Response 1

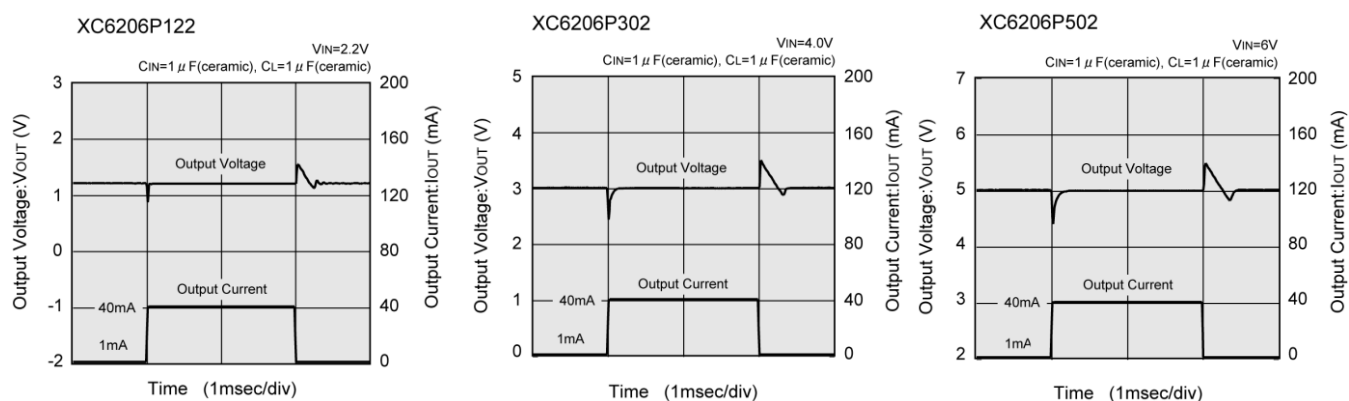


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (9) Input Transient Response 2

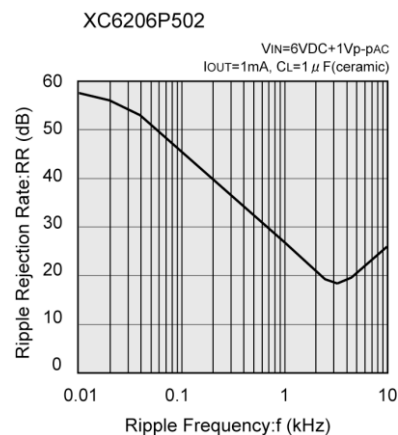
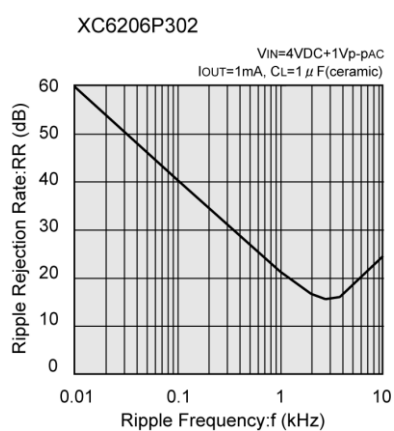
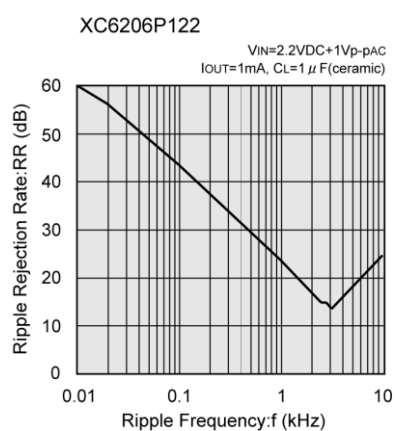
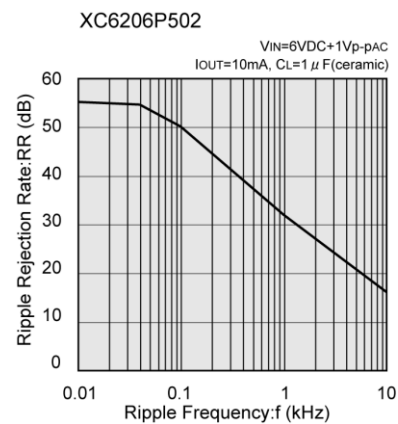
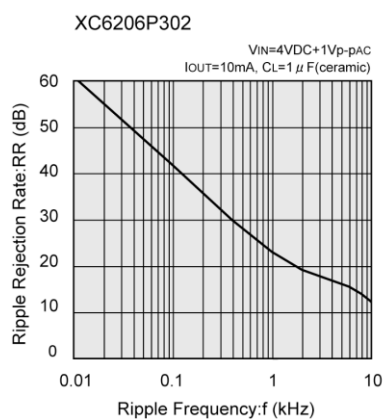
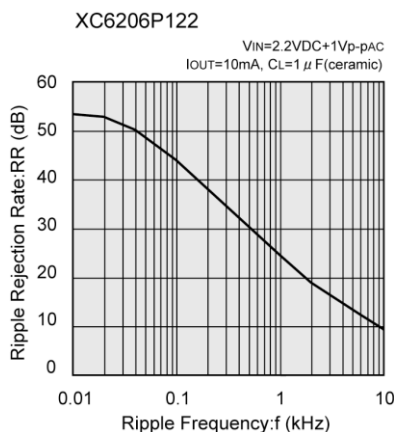


### (10) Load Transient Response



## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (11) Ripple Rejection Rate



## ■ PACKAGING INFORMATION

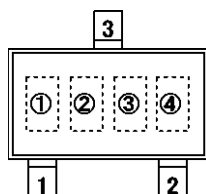
For the latest package information go to, [www.torexsemi.com/technical-support/packages](http://www.torexsemi.com/technical-support/packages)

| PACKAGE | OUTLINE / LAND PATTERN     | THERMAL CHARACTERISTICS                  |
|---------|----------------------------|------------------------------------------|
| SOT-23  | <a href="#">SOT-23 PKG</a> | <a href="#">SOT-23 Power Dissipation</a> |
| SOT-89  | <a href="#">SOT-89 PKG</a> | <a href="#">SOT-89 Power Dissipation</a> |
| USP-6B  | <a href="#">USP-6B PKG</a> | <a href="#">USP-6B Power Dissipation</a> |

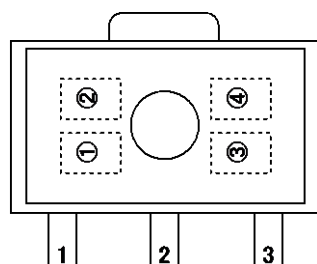
# XC6206 Series

## MARKING RULE

### ●SOT-23, SOT-89



SOT-23  
(TOP VIEW)



SOT-89  
(TOP VIEW)

① represents product number

| MARK | PRODUCT SERIES |
|------|----------------|
| 6    | XC6206P*****   |

② represents 3 pins regulator

| MARK               |                    | PRODUCT SERIES |
|--------------------|--------------------|----------------|
| VOLTAGE=0.1 ~ 3.0V | VOLTAGE=3.1 ~ 6.0V |                |
| 5                  | 6                  | XC6206P*****   |

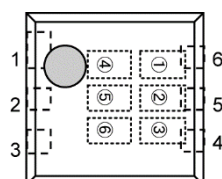
③ represents output voltage

| MARK | VOLTAGE (V) |     |   | MARK | OUTPUT VOLTAGE (V) |     |   |
|------|-------------|-----|---|------|--------------------|-----|---|
| 0    | -           | 3.1 | - | F    | 1.6                | 4.6 | - |
| 1    | -           | 3.2 | - | H    | 1.7                | 4.7 | - |
| 2    | -           | 3.3 | - | K    | 1.8                | 4.8 | - |
| 3    | -           | 3.4 | - | L    | 1.9                | 4.9 | - |
| 4    | -           | 3.5 | - | M    | 2.0                | 5.0 | - |
| 5    | -           | 3.6 | - | N    | 2.1                | -   | - |
| 6    | -           | 3.7 | - | P    | 2.2                | -   | - |
| 7    | -           | 3.8 | - | R    | 2.3                | -   | - |
| 8    | -           | 3.9 | - | S    | 2.4                | -   | - |
| 9    | -           | 4.0 | - | T    | 2.5                | -   | - |
| A    | -           | 4.1 | - | U    | 2.6                | -   | - |
| B    | 1.2         | 4.2 | - | V    | 2.7                | -   | - |
| C    | 1.3         | 4.3 | - | X    | 2.8                | -   | - |
| D    | 1.4         | 4.4 | - | Y    | 2.9                | -   | - |
| E    | 1.5         | 4.5 | - | Z    | 3.0                | -   | - |

④ represents production lot number

0 to 9, A to Z repeated. (G, I, J, O, Q, W excluded)

### ●USP-6B



USP-6B  
(TOP VIEW)

①② represents product number

| MARK |   | PRODUCT SERIES |
|------|---|----------------|
| ①    | ② |                |
| 0    | 6 | XC6206P***D*   |

③ represents 3 pins regulator

| MARK | PRODUCT SERIES |
|------|----------------|
| P    | XC6206P***D*   |

④⑤ represents output voltage

| MARK |   | OUTPUT VOLTAGE(V) | PRODUCT SERIES |
|------|---|-------------------|----------------|
| ④    | ⑤ |                   |                |
| 3    | 3 | 3.3               | XC6206P33*D*   |
| 5    | 0 | 5.0               | XC6206P50*D*   |

⑥ represents production lot number

0 to 9, A to Z repeated. (G, I, J, O, Q, W excluded)

1. The product and product specifications contained herein are subject to change without notice to improve performance characteristics. Consult us, or our representatives before use, to confirm that the information in this datasheet is up to date.
2. The information in this datasheet is intended to illustrate the operation and characteristics of our products. We neither make warranties or representations with respect to the accuracy or completeness of the information contained in this datasheet nor grant any license to any intellectual property rights of ours or any third party concerning with the information in this datasheet.
3. Applicable export control laws and regulations should be complied and the procedures required by such laws and regulations should also be followed, when the product or any information contained in this datasheet is exported.
4. The product is neither intended nor warranted for use in equipment of systems which require extremely high levels of quality and/or reliability and/or a malfunction or failure which may cause loss of human life, bodily injury, serious property damage including but not limited to devices or equipment used in 1) nuclear facilities, 2) aerospace industry, 3) medical facilities, 4) automobile industry and other transportation industry and 5) safety devices and safety equipment to control combustions and explosions. Do not use the product for the above use unless agreed by us in writing in advance.
5. Although we make continuous efforts to improve the quality and reliability of our products; nevertheless Semiconductors are likely to fail with a certain probability. So in order to prevent personal injury and/or property damage resulting from such failure, customers are required to incorporate adequate safety measures in their designs, such as system fail safes, redundancy and fire prevention features.
6. Our products are not designed to be Radiation-resistant.
7. Please use the product listed in this datasheet within the specified ranges.
8. We assume no responsibility for damage or loss due to abnormal use.
9. All rights reserved. No part of this datasheet may be copied or reproduced unless agreed by Torex Semiconductor Ltd in writing in advance.

TOREX SEMICONDUCTOR LTD.