

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

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

■ TYPICAL APPLICATION CIRCUIT



■ TYPICAL PERFORMANCE CHARACTERISTICS



■ BLOCK DIAGRAM



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

■ PRODUCT CLASSIFICATION

● Ordering Information

XC6206P①②③④⑤-⑥^(*)

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

^(*) 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_{IN}).

■ PIN ASSIGNMENT

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

■ ABSOLUTE MAXIMUM RATINGS

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

(*)1 I_{OUT} ≤ Pd / (V_{IN}-V_{OUT})

(*)2 The power dissipation figure shown is PCB mounted and is for reference only.
The mounting condition is please refer to PACKAGING INFORMATION.

ELECTRICAL CHARACTERISTICS

Ta=25°C

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

*1: Unless otherwise stated, V_{IN} = V_{OUT(T)} + 1.0V

*2: (Standard): ±2% (1.5V ≤ V_{OUT(T)}), ±0.03V (1.5V > V_{OUT(T)})
(High Accuracy): ±1% (2.0V ≤ V_{OUT(T)})

*3: V_{OUT(E)}: Effective output voltage.

*4: V_{OUT(T)}: Nominal voltage

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

*6: V_{dif} = V_{IN1} - V_{OUT1}

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

V_{IN1}: The input voltage when V_{OUT1} appears as input voltage is gradually decreased.

*7: The low ESR capacitors use that is more than 1.0μF as C_L is possible.

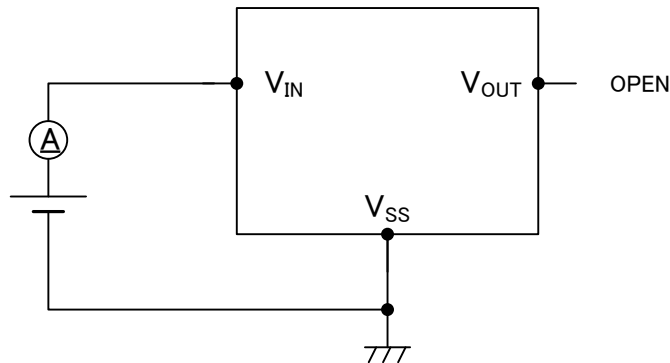
■ ELECTRICAL CHARACTERISTICS (Continued)

● Electrical Characteristics Chart

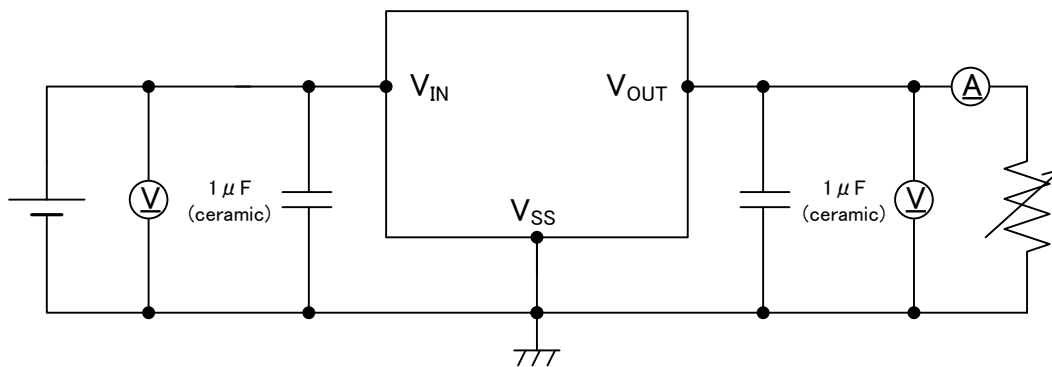
| NOMINAL VOLTAGE | E-1 | E-2 | | E-3 | | E-4 | E-5 |
|--------------------|-----------------------|---------------------|------|---------------------|------|---------------------------|------------------|
| | LOAD REGULATION | DROPOUT VOLTAGE1 | | DROPOUT VOLTAGE2 | | MAX. OUTPUT CURRENT | SHORT CURRENT |
| | ΔV_{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 | | | | |
| 1.5 | 45 | 300 | 510 | 580 | 860 | 80 | 155 |
| 1.6 | | 250 | 450 | 450 | 810 | | |
| 1.7 | | 200 | 410 | | | | |
| 1.8 | | 150 | 390 | | | | |
| 1.9 | 50 | 100 | 370 | 350 | 780 | 120 | 130 |
| 2.0 | | | | | | | |
| 2.1 | | | | | | | |
| 2.2 | | | | | | | |
| 2.3 | | | | | | | |
| 2.4 | 55 | 100 | 370 | 350 | 710 | 150 | 100 |
| 2.5 | | | | | | | |
| 2.6 | | | | | | | |
| 2.7 | | | | | | | |
| 2.8 | | | | | | | |
| 2.9 | 60 | 75 | 350 | 250 | 680 | 200 | 100 |
| 3.0 | | | | | | | |
| 3.1 | | | | | | | |
| 3.2 | | | | | | | |
| 3.3 | | | | | | | |
| 3.4 | 65 | 75 | 350 | 250 | 680 | 200 | 100 |
| 3.5 | | | | | | | |
| 3.6 | | | | | | | |
| 3.7 | | | | | | | |
| 3.8 | | | | | | | |
| 3.9 | 70 | 60 | 320 | 200 | 630 | 250 | 100 |
| 4.0 | | | | | | | |
| 4.1 | | | | | | | |
| 4.2 | | | | | | | |
| 4.3 | | | | | | | |
| 4.4 | 75 | 60 | 320 | 200 | 630 | 250 | 100 |
| 4.5 | | | | | | | |
| 4.6 | | | | | | | |
| 4.7 | | | | | | | |
| 4.8 | | | | | | | |
| 4.9 | 80 | 50 | 290 | 175 | 600 | 250 | 100 |
| 5.0 | | | | | | | |

TEST CIRCUITS

Circuit ①



Circuit ②

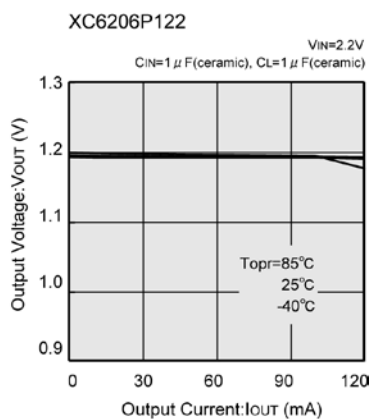


NOTES ON USE

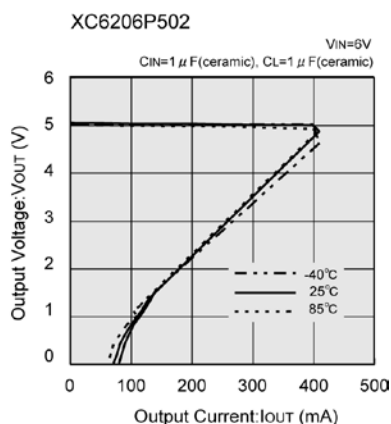
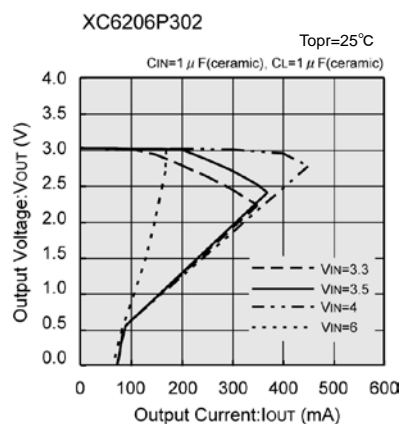
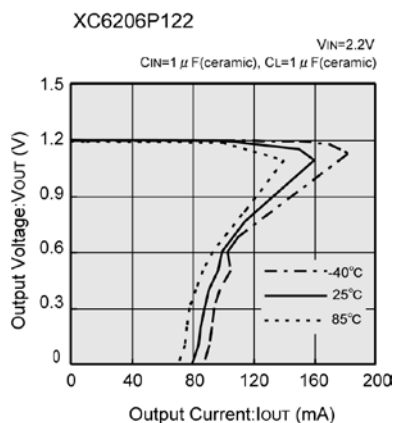
1. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.
2. Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current. Please strengthen V_{IN} and V_{SS} wiring 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



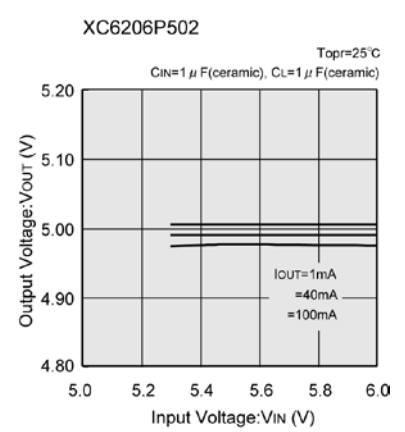
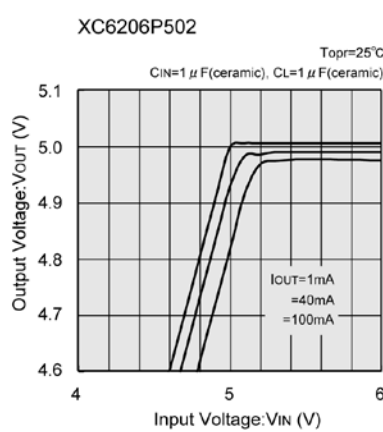
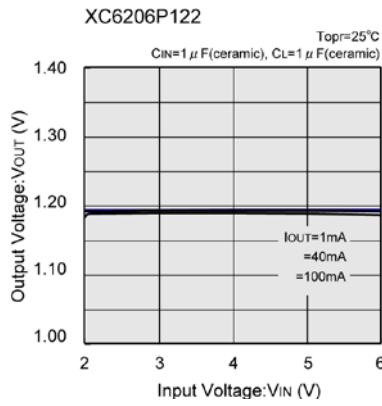
(2) Current Limit



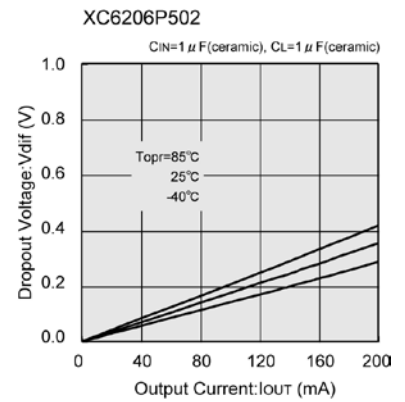
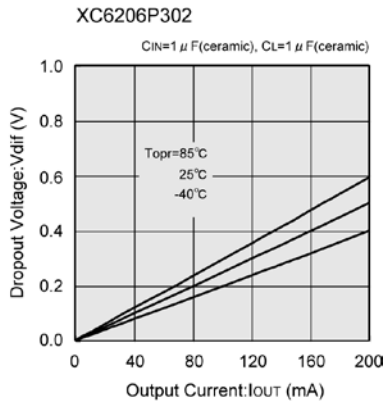
XC6206 Series

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(3) Output Voltage vs. Input Voltage

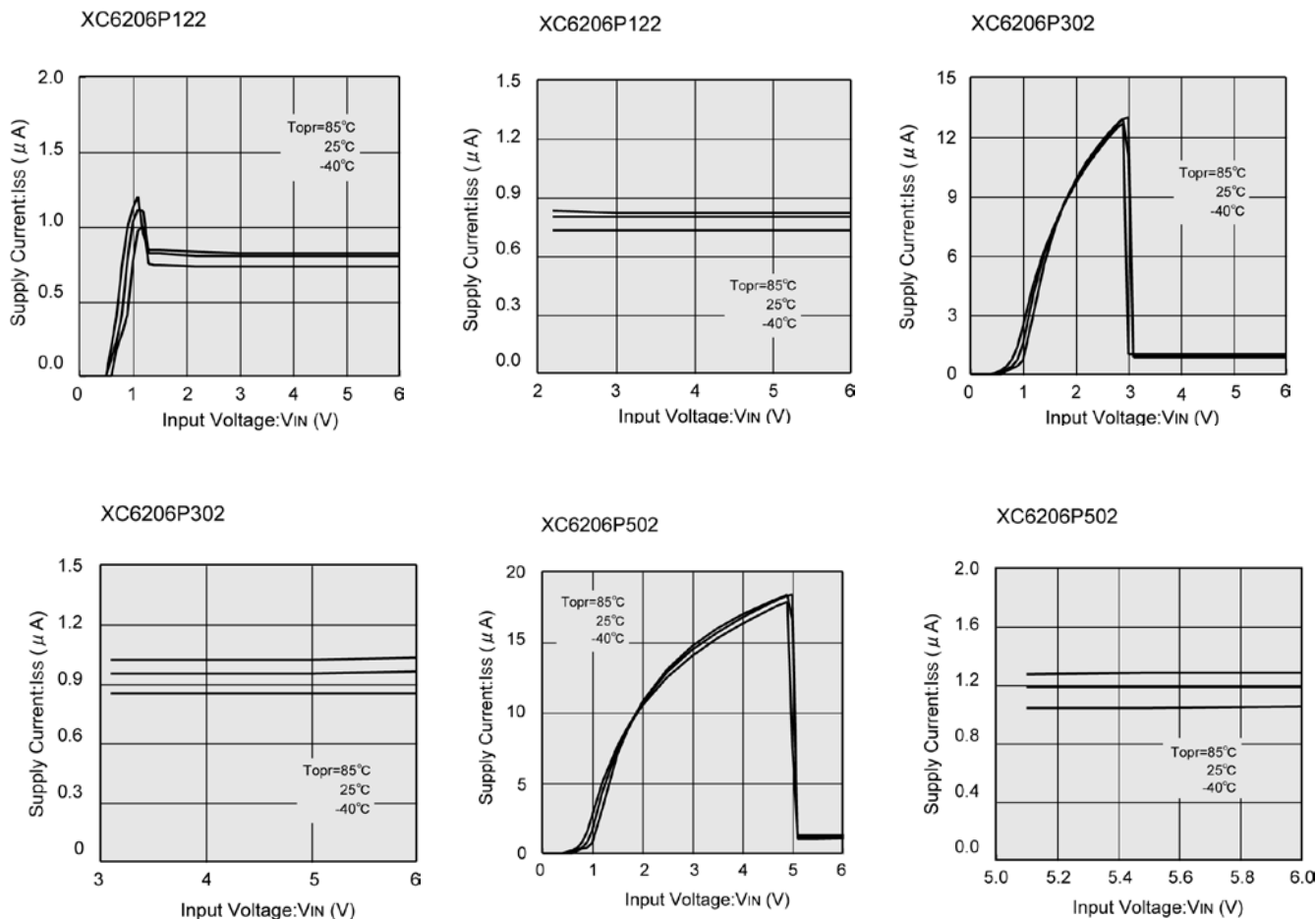


(4) Dropout Voltage vs. Output Current

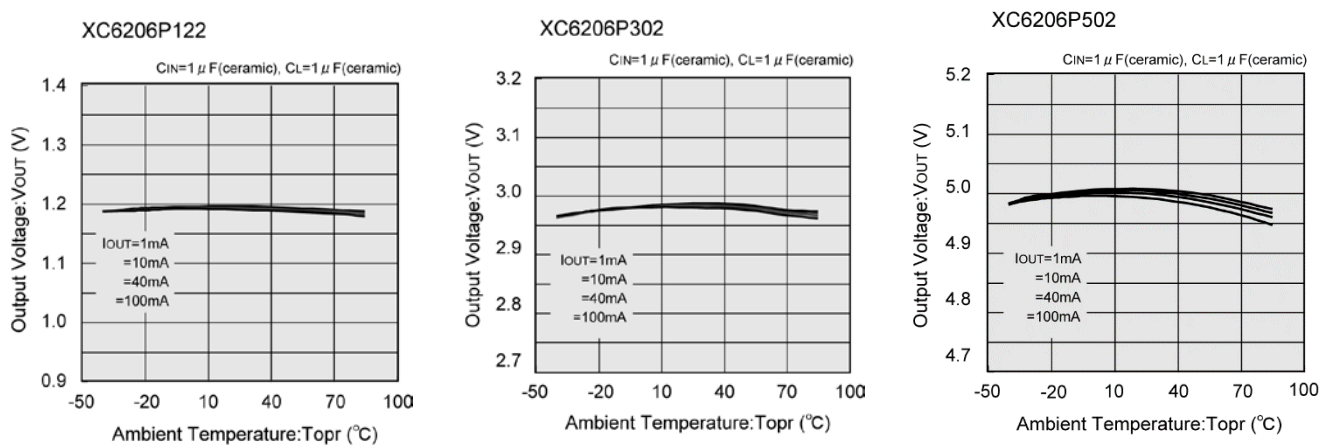


■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(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

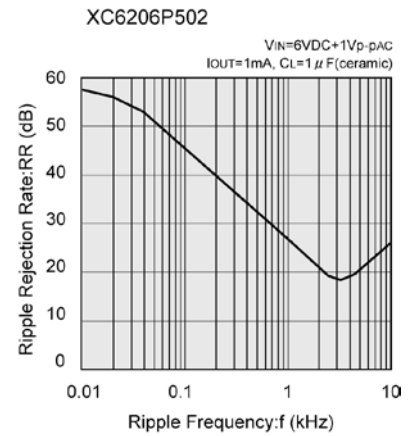
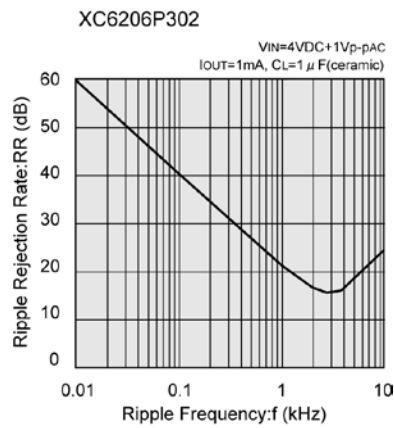
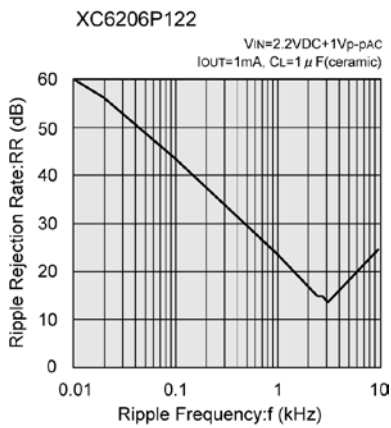
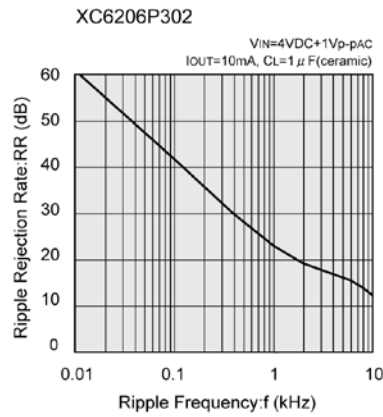
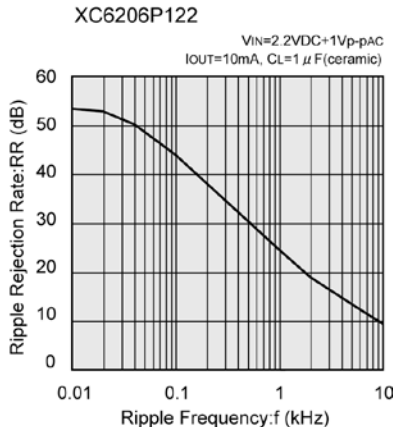


(10) Load Transient Response



TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(11) Ripple Rejection Rate



■ PACKAGING INFORMATION

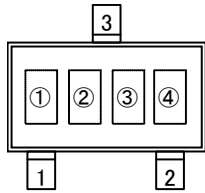
For the latest package information go to, www.torexsemi.com/technical-support/packages

| PACKAGE | OUTLIN / LAND PATTERN | THERMAL CHARACTERISTICS | |
|---------|----------------------------|-------------------------|--|
| SOT-23 | SOT-23 PKG | Standard Board | SOT-23 Power Dissipation |
| SOT-89 | SOT-89 PKG | Standard Board | SOT-89 Power Dissipation |
| USP-6B | USP-6B PKG | Standard Board | USP-6B Power Dissipation |

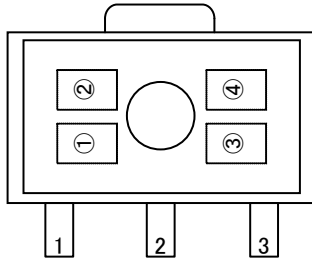
XC6206 Series

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)