

1.2V Input / Output Rail To Rail CMOS Op Amp

■ GENERAL DESCRIPTION

The XC221A series is an input / output rail to rail CMOS Op Amp.

With rail to rail functions, operation is guaranteed from power supplies as low as 1.2V. Moreover, since the XC221A series comes in an ultra small SOT-25 package, the series is particularly suited for use with various types of portable phones.

Bandwidths of 550kHz and slew rates of 0.5V can be achieved even with power consumption as low as 100 μ A.

Even with large capacitance levels of CL = 200pF (unity gain connection), the XC221A series will not be susceptible to oscillation.

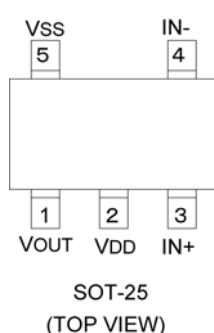
■ APPLICATIONS

- Palmtop computers, PDAs
- Cellular and portable phones
- Portable audio systems
- Various battery powered systems

■ FEATURES

- Operating Voltage Range:** 1.2 ~ 10V (single cell)
: $\pm 0.6 \sim 5V$ (+ve/-ve supply)
- Output Signal** : 0.1~2.9V (3V single cell, RL=2k Ω)
- Gain Bandwidth** : 550kHz (15 μ A: 210kHz)
- Slew Rate** : 0.5V/ μ s
- High Capacitance Load** : CL=200pF
- Low Supply Current** : 100 μ A, 15 μ A
- Input / Output Rail To Rail Operation**
- Package** : SOT-25
- Environmentally Friendly:** EU RoHS Compliant, Pb Free

■ PIN CONFIGURATION



■ PIN ASSIGNMENT

| PIN NUMBER | SYMBOL | FUNCTION |
|------------|--------|---------------------------|
| 1 | VOUT | Output Pin |
| 2 | VDD | Positive Power Supply Pin |
| 3 | IN+ | Positive Input |
| 4 | IN- | Negative Input |
| 5 | VSS | Negative Power Supply Pin |

■ PRODUCT CLASSIFICATION

● Ordering Information

XC221A①②③④⑤⑥-⑦^(*)

| DESIGNATOR | DESCRIPTION | SYMBOL | DESCRIPTION |
|------------|--|--------|----------------------------------|
| ① | The Number of Channels | 1 | One channel |
| ② | Supply Current | 1 | 15 μ A |
| | | 2 | 100 μ A |
| ③ | Internal Standard Number | 0 | Fixed |
| ④ | Load Capacitance | 0 | 200pF |
| ⑤⑥-⑦ | Packages Taping Type ^(*) | MR | SOT-25 |
| | | MR-G | SOT-25 (Halogen & Antimony free) |

^(*) The “-G” suffix indicates that the products are Halogen and Antimony free as well as being fully RoHS compliant.

⁽²⁾ The device orientation is fixed in its embossed tape pocket. For reverse orientation, please contact your local Torex sales office or representative. (Standard orientation: ⑤R-⑦, Reverse orientation: ⑤L-⑦)

■ ABSOLUTE MAXIMUM RATINGS

Ta = 25°C, Vss = 0V

| PARAMETER | SYMBOL | RATINGS | UNITS |
|-----------------------------|--------|--------------|-------|
| VDD Pin Voltage | VDD | -0.3 ~ 12.0 | V |
| OUT Pin Voltage | VOUT | -0.3 ~ 12.0 | V |
| IN Pin Voltage | VIN+ | -0.3~VDD+0.3 | V |
| IN/ Pin Voltage | VIN- | -0.3~VDD+0.3 | V |
| OUT Pin Current | IOUT | ±100 | mA |
| Power Dissipation | Pd | 150 | mW |
| Operating Temperature Range | Topr | -30 ~ +80 | °C |
| Storage Temperature Range | Tstg | -40 ~ +125 | °C |

RAIL-TO-RAIL is a trademark of Motorola.

■ ELECTRICAL CHARACTERISTICS

| XC221A1100 | | I _{DD} = 15 μ A | | Ta = 25°C | | |
|------------------------------|------------------|---|------|-----------|-----------------------|--------------|
| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Supply Voltage | V _{DD} | | 1.2 | - | 10.0 | V |
| Supply Current | I _{DD} | V _{DD} = 3V | 10 | 15 | 23 | μ A |
| | | V _{DD} = 1.2V | 2.5 | 8 | 23 | μ A |
| Input Offset Voltage | V _{OF} | | - | - | 20.0 | mV |
| Input Offset Current | I _{OF} | | - | 1 | - | pA |
| Input Bias Current | I _B | | - | 1 | - | pA |
| Input Resistance | R _{IN} | | - | 1 | - | T Ω |
| Large Signal Voltage Gain | A _{VD} | | 75 | 110 | - | dB |
| Common Mode Rejection Ratio | C _{MRR} | $0 \leq V_{CM} \leq 3.0V$ | 60 | 75 | - | dB |
| Power Supply Rejection Ratio | PSRR+ | V _{DD} = 3 to 10V, V _{SS} = 0V, V _{OUT} = 1.5V | 60 | 75 | - | dB |
| | PSRR- | V _{SS} = -3 to -10V, V _{DD} = 0V, V _{OUT} = -1.5V | 60 | 75 | - | dB |
| Output Voltage Range | V _{OUT} | R _L = ∞ | 0.05 | - | V _{DD} -0.05 | V |
| | | V _{DD} = 1.2V, R _L = 47k Ω (to V _{DD} /2) | 0.10 | - | 1.10 | V |
| | | V _{DD} = 3V, R _L = 2k Ω (to V _{DD} /2) | 0.10 | - | 2.90 | V |
| | | V _{DD} = 5V, R _L = 2k Ω (to V _{DD} /2) | 0.10 | - | 4.90 | V |
| | | V _{DD} = 10V, R _L = 2k Ω (to V _{DD} /2) | 0.10 | - | 9.80 | V |
| Gain Bandwidth | F _T | V _{DD} = 3V | - | 210 | - | kHz |
| Slew Rate | S _R | V _{DD} = 3V | - | 0.07 | - | V/ μ sec |

Test Conditions : Unless otherwise stated, V_{DD} = 3.0V, V_{SS} = 0V, V_{CM} = V_{OUT} = V_{DD} / 2, R_L = 1M Ω (to V_{SS}), C_L = 10pF (to V_{SS})

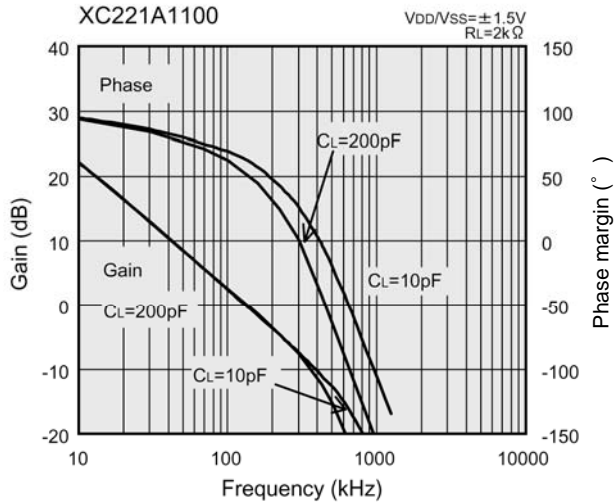
| XC221A1200 | | I _{DD} = 100 μ A | | Ta = 25°C | | |
|------------------------------|------------------|---|-------|-----------|-----------------------|--------------|
| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Supply Voltage | V _{DD} | | 1.2 | - | 10.0 | V |
| Supply Current | I _{DD} | V _{DD} = 3V | 67 | 100 | 150 | μ A |
| | | V _{DD} = 1.2V | 16.75 | 50.00 | 150.00 | μ A |
| Input Offset Voltage | V _{OF} | | - | - | 20.0 | mV |
| Input Offset Current | I _{OF} | | - | 1 | - | pA |
| Input Bias Current | I _B | | - | 1 | - | pA |
| Input Resistance | R _{IN} | | - | 1 | - | T Ω |
| Large Signal Voltage Gain | A _{VD} | | 75 | 110 | - | dB |
| Common Mode Rejection Ratio | C _{MRR} | $0 \leq V_{CM} \leq 3.0V$ | 60 | 75 | - | dB |
| Power Supply Rejection Ratio | PSRR+ | V _{DD} = 3 to 10V, V _{SS} = 0V, V _{OUT} = 1.5V | 60 | 75 | - | dB |
| | PSRR- | V _{SS} = -3 to -10V, V _{DD} = 0V, V _{OUT} = -1.5V | 60 | 75 | - | dB |
| Output Voltage Range | V _{OUT} | R _L = ∞ | 0.05 | - | V _{DD} -0.05 | V |
| | | V _{DD} = 1.2V, R _L = 47k Ω (to V _{DD} /2) | 0.10 | - | 1.10 | V |
| | | V _{DD} = 3V, R _L = 2k Ω (to V _{DD} /2) | 0.10 | - | 2.90 | V |
| | | V _{DD} = 5V, R _L = 2k Ω (to V _{DD} /2) | 0.10 | - | 4.90 | V |
| | | V _{DD} = 10V, R _L = 2k Ω (to V _{DD} /2) | 0.10 | - | 9.80 | V |
| Gain Bandwidth | F _T | V _{DD} = 3V | - | 550 | - | kHz |
| Slew Rate | S _R | V _{DD} = 3V | - | 0.50 | - | V/ μ sec |

Test Conditions : Unless otherwise stated, V_{DD} = 3.0V, V_{SS} = 0V, V_{CM} = V_{OUT} = V_{DD} / 2, R_L = 1M Ω (to V_{SS}), C_L = 10pF (to V_{SS})

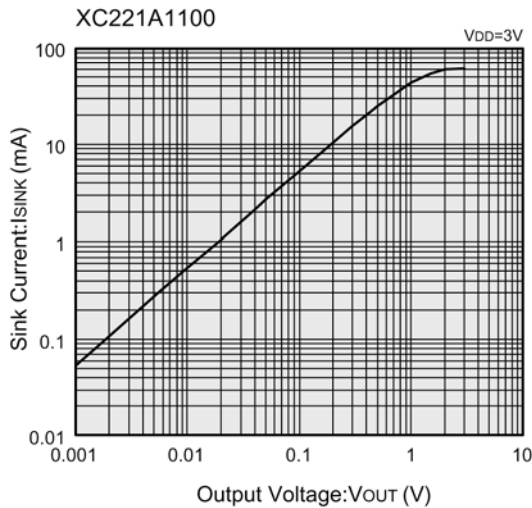
TYPICAL PERFORMANCE CHARACTERISTICS

●XC221A1100 <15 μ A>

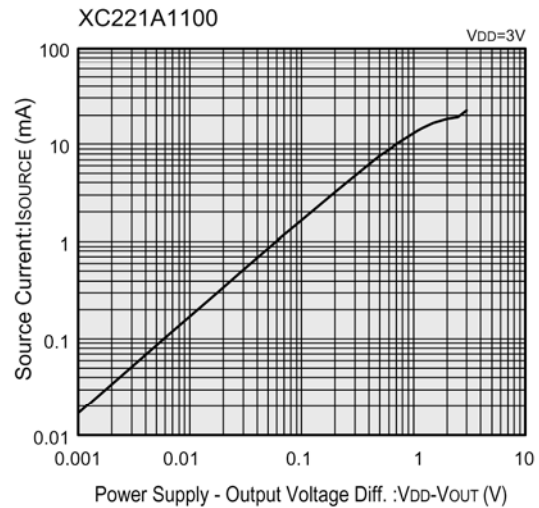
(1) Voltage Gain vs. Phase Margin



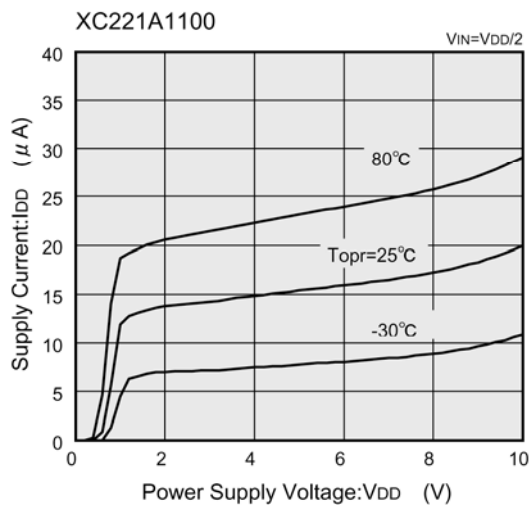
(2) Sink Current vs. Output Voltage



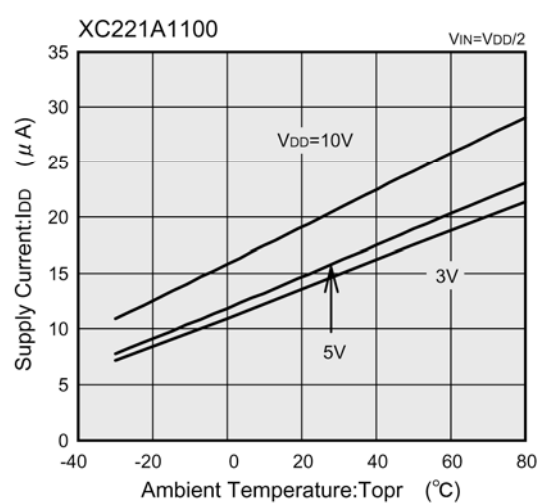
(3) Source Current vs. Output Voltage



(4) Supply Current vs. Power Supply Voltage



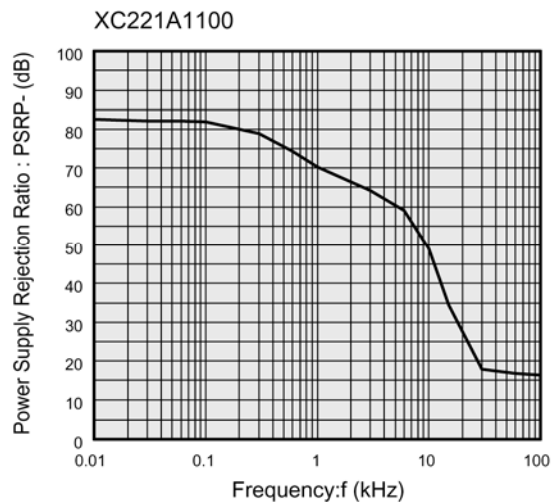
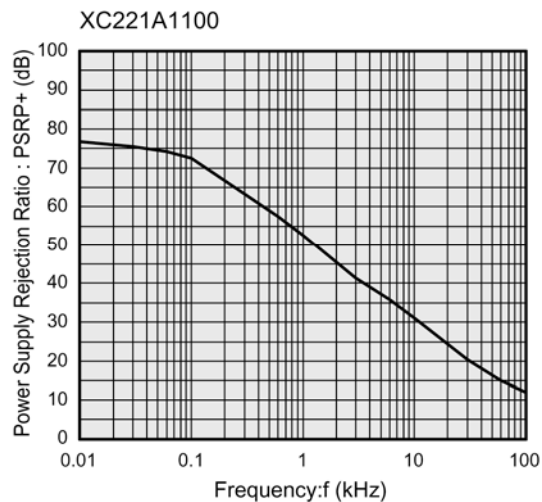
(5) Supply Current vs. Ambient Temperature



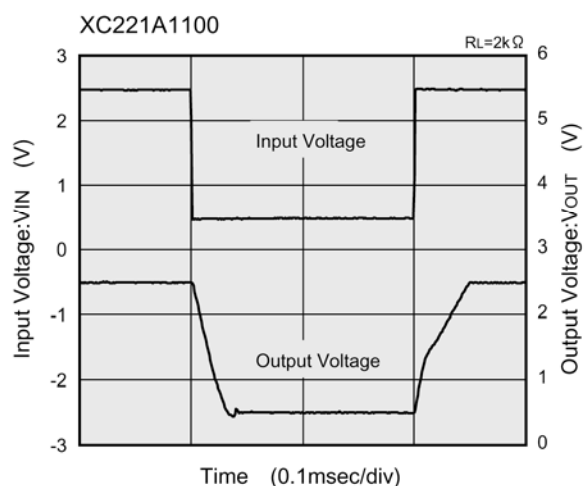
■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

● XC221A1100 <15 μ A> (Continued)

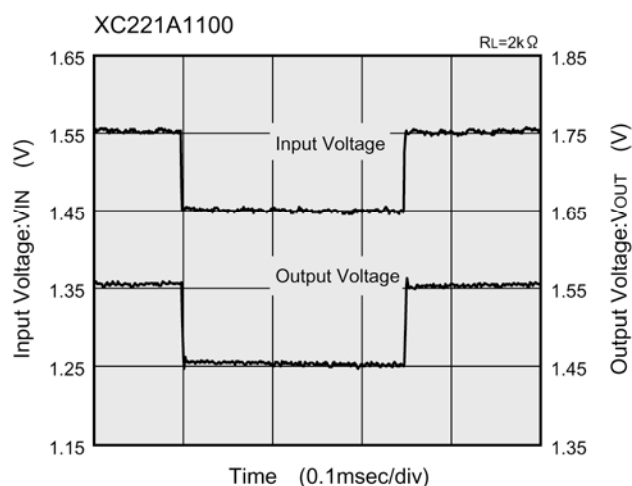
(6) Power Supply Rejection Ratio vs. Frequency



(7) Large Signal Input / Output Response



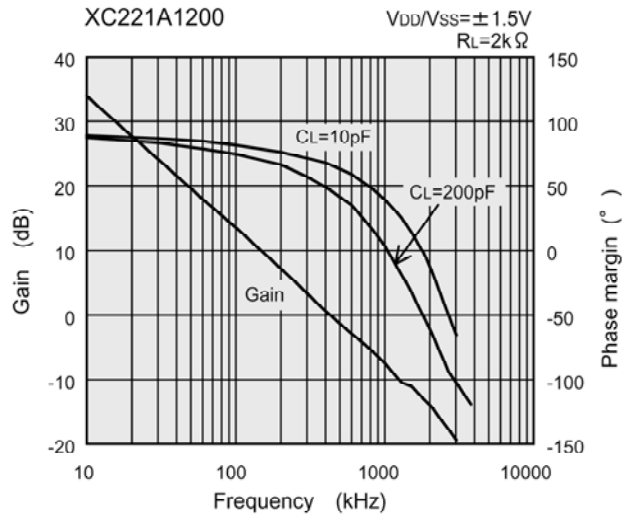
(8) Small Signal Input / Output Response



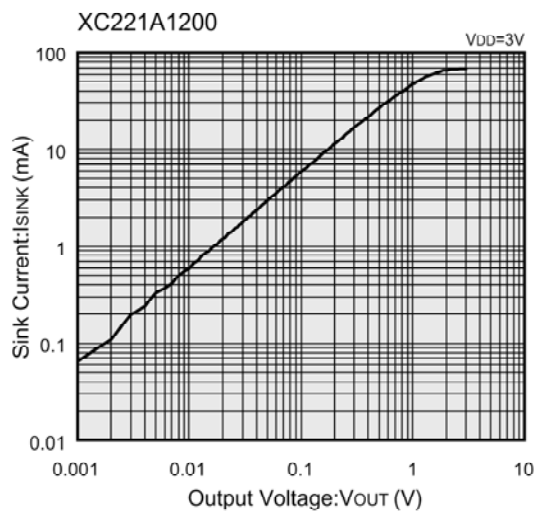
■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

● XC221A1200 <100 μ A>

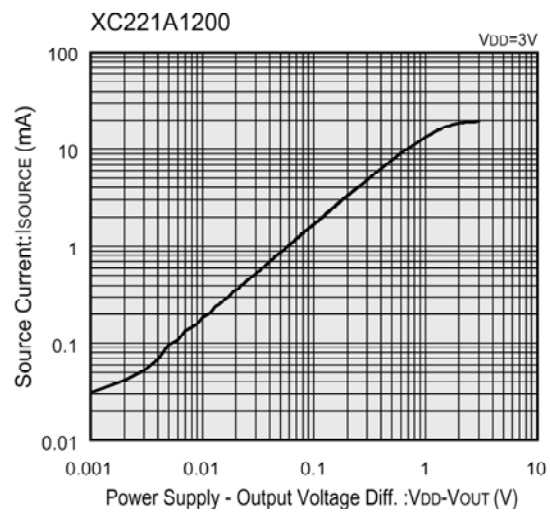
(1) Voltage Gain vs. Phase Margin



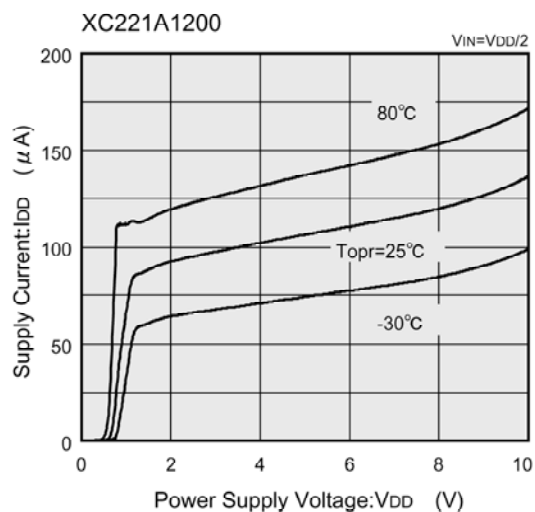
(2) Sink Current vs. Output Voltage



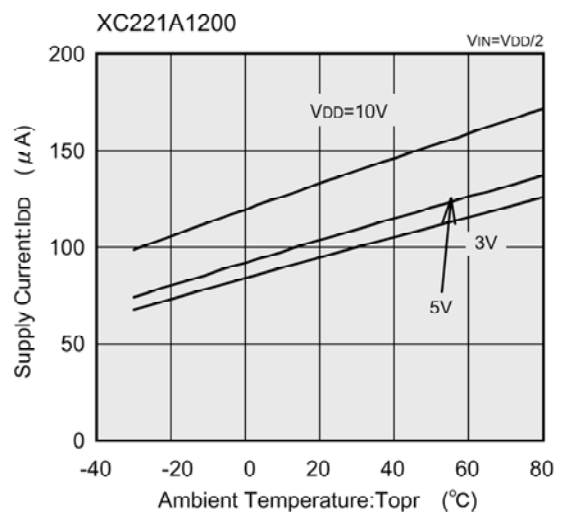
(3) Source Current vs. Output Voltage



(4) Supply Current vs. Power Supply Voltage



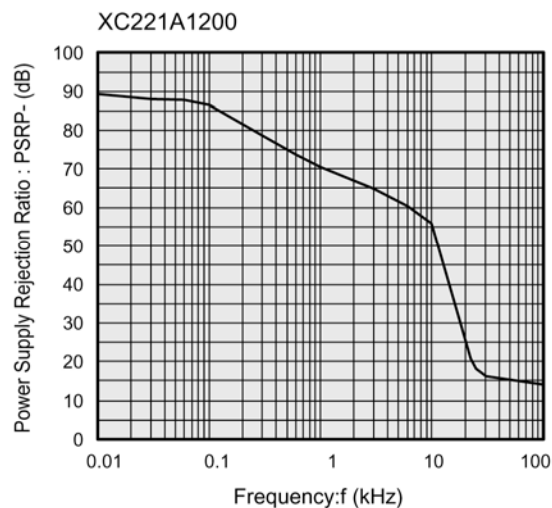
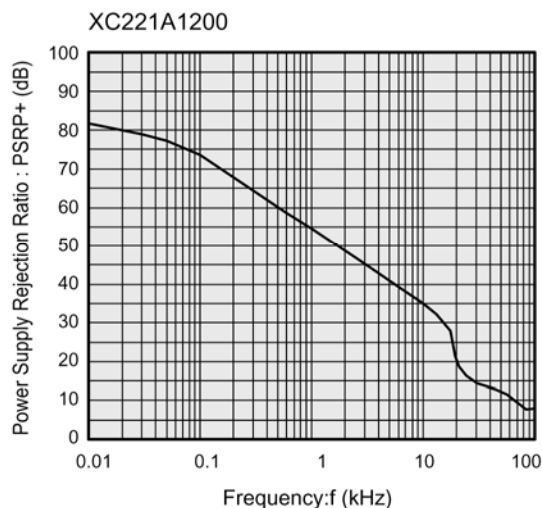
(5) Supply Current vs. Ambient Temperature



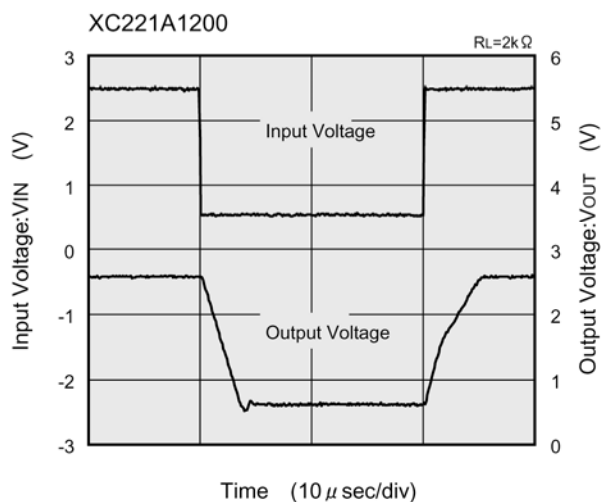
■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

● XC221A1200 <100 μ A> (Continued)

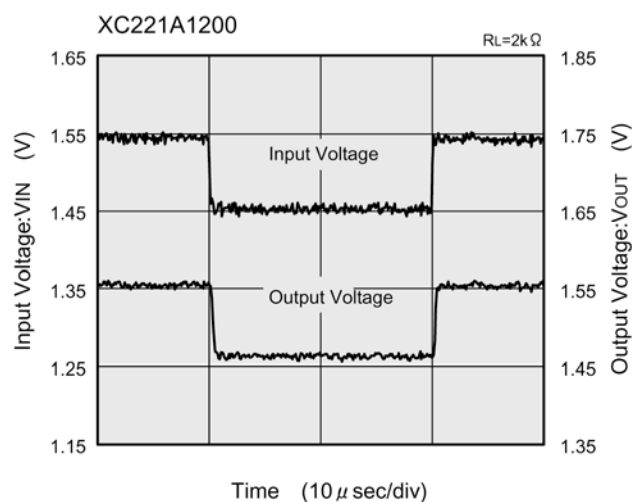
(6) Power Supply Rejection Ratio vs. Frequency



(7) Large Signal Input / Output Response

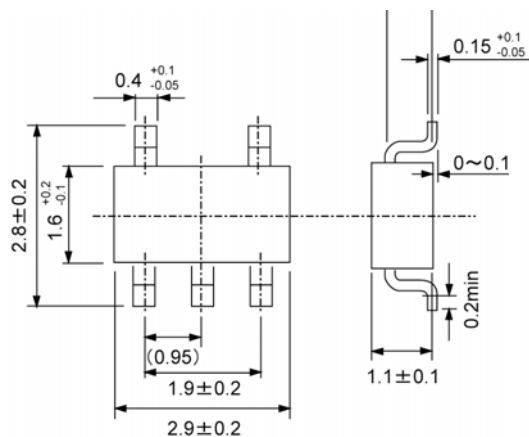


(8) Small Signal Input / Output Response

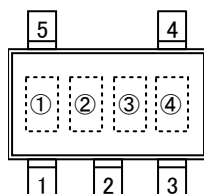


PACKAGING INFORMATION

● SOT-25



MARKING RULE



SOT-25
(TOP VIEW)

① represents product series and supply current

| MARK | PRODUCT SERIES | SUPPLY CURRENT |
|------|----------------|----------------|
| 1 | XC221A11 | $15 \mu A$ |
| 2 | XC221A12 | $100 \mu A$ |

② based on internal standards

③ represents load capacitance

| MARK | LOAD CAPACITANCE |
|------|------------------|
| 0 | 200pF |

④ represents the production lot number

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

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