

# ELM852xA CMOS operational amplifier

<http://www.elm-tech.com>

## ■ General description

ELM852xA is low voltage and low power CMOS single operational amplifier with wide range of common mode signal input voltage and push-pull output stage. With 1.2V single power supply, ELM852xA makes it easy to design power circuit. ELM852xA is suitable for circuit of portable equipments which require low power consumption or single power.

## ■ Features

- Operation from a single power source
- Low voltage operation :  $1.2V \leq V_{dd} \leq 6.0V$
- Low current consumption : Typ.  $150\mu A$  ( $V_{dd}=3.0V$ )
- Common-mode input voltage range
  - :  $V_{ss}$  to  $V_{dd}-0.3V$  ( $V_{dd}=1.5V$ )
  - :  $V_{ss}$  to  $V_{dd}-0.1V$  ( $V_{dd}=3.0V$ )
- Output stage : Push-pull
- Unity gain bandwidth : Typ.  $1MHz$  ( $V_{dd} \geq 1.5V$ )
- Package : SOT-25, SC-70-5(SOT-353)

## ■ Application

- Battery-operated portable devices
- Micropower signal process
- Low voltage analog circuit

## ■ Maximum absolute ratings

| Parameter             | Symbol           | Limit                        | Unit |
|-----------------------|------------------|------------------------------|------|
| Power supply voltage  | V <sub>dd</sub>  | 7.0                          | V    |
| Input voltage         | V <sub>in</sub>  | $V_{ss}-0.3$ to $V_{dd}+0.3$ | V    |
| Output voltage        | V <sub>out</sub> | $V_{ss}-0.3$ to $V_{dd}+0.3$ | V    |
| Output short circuit  |                  | Continuous                   | Sec. |
| Power dissipation     | P <sub>d</sub>   | 300 (SOT-25)                 | mW   |
|                       |                  | 150 ((SC-70-5)(SOT-353))     |      |
| Operating temperature | T <sub>op</sub>  | -40 to +85                   | °C   |
| Storage temperature   | T <sub>stg</sub> | -55 to +125                  | °C   |

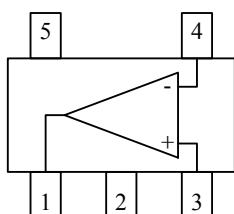
## ■ Selection guide

ELM852xA-x

| Symbol |                  |                                  |
|--------|------------------|----------------------------------|
| a      | Package          | B: SOT-25<br>C: SC-70-5(SOT-353) |
| b      | Product version  | A                                |
| c      | Taping direction | S, N: Refer to PKG file          |

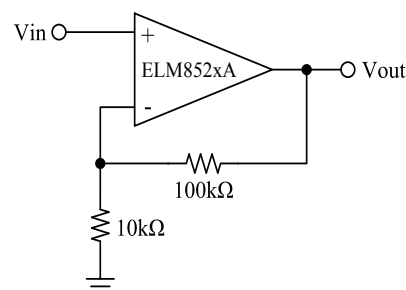
ELM852 x A - x  
 ↑ ↑ ↑  
 a b c

## ■ Pin configuration



| Pin No. | Pin name |
|---------|----------|
| 1       | OUT      |
| 2       | VDD      |
| 3       | IN+      |
| 4       | IN-      |
| 5       | VSS      |

## ■ Standard circuit



# ELM852xA CMOS operational amplifier

<http://www.elm-tech.com>

## ■ Electrical characteristics

V<sub>ss</sub>=0V, Top=-40~+85°C

| Parameter         | Symbol          | Condition | Min. | Typ. | Max. | Unit |
|-------------------|-----------------|-----------|------|------|------|------|
| Operating voltage | V <sub>dd</sub> |           | 1.2  |      | 6.0  | V    |

V<sub>dd</sub>=1.5V

V<sub>ss</sub>=0V, Top=25°C

| Parameter                       | Symbol              | Condition   | Min. | Typ. | Max. | Unit |
|---------------------------------|---------------------|---|------|------|------|------|
| Input offset voltage            | V <sub>io</sub>     | V <sub>cm</sub> =V <sub>dd</sub> /2,<br>Unity gain follower       |      |      | ±6   | mV   |
| Input bias current              | I <sub>ib</sub>     |   |      |      | 1.0  | nA   |
| Common-mode input voltage range | V <sub>cmr</sub>    | For CMRR≥45dB   | 0.00 |      | 1.20 | V    |
| Maximum output voltage swing    | V <sub>outsh</sub>  | V <sub>id</sub> =100mV, R <sub>L</sub> =10kΩ to V <sub>ss</sub>   | 1.40 |      |      | V    |
| Minimum output voltage swing    | V <sub>outsl</sub>  | V <sub>id</sub> =100mV, R <sub>L</sub> =10kΩ to V <sub>dd</sub>   |      |      | 0.10 | V    |
| Source current                  | I <sub>source</sub> | V <sub>out</sub> =1.2V, V <sub>id</sub> =100mV                    | 0.4  | 1.0  |      | mA   |
| Sink current                    | I <sub>sink</sub>   | V <sub>out</sub> =0.3V, V <sub>id</sub> =100mV                    | 1.0  | 2.5  |      | mA   |
| Large-signal voltage gain       | A <sub>vd</sub>     | R <sub>L</sub> =10kΩ to V <sub>ss</sub> , V <sub>cm</sub> =0.75V  |      | 115  |      | dB   |
| Common-mode rejection ratio     | CMRR                | R <sub>L</sub> =100kΩ to V <sub>ss</sub> , V <sub>cm</sub> =0.75V |      | 95   |      | dB   |
| Supply voltage rejection ratio  | PSRR                | R <sub>L</sub> =100kΩ to V <sub>ss</sub> , V <sub>cm</sub> =0.75V |      | 90   |      | dB   |
| Current consumption             | I <sub>ss</sub>     | V <sub>cm</sub> =V <sub>dd</sub> /2,<br>Unity gain follower       |      | 140  | 280  | μA   |
| Short current                   | I <sub>shortp</sub> | V <sub>out</sub> to V <sub>ss</sub> shrot, V <sub>id</sub> =100mV |      | 1.4  |      | mA   |
|                                 | I <sub>shortn</sub> | V <sub>out</sub> to V <sub>dd</sub> shrot, V <sub>id</sub> =100mV |      | 4.0  |      | mA   |
| Unity gain bandwidth            | GBW                 |   |      | 1    |      | MHz  |
| Slew rate                       | SR                  | R <sub>L</sub> =100kΩ, C <sub>L</sub> =20pF                       | 0.55 | 1.00 |      | V/μs |

V<sub>dd</sub>=3.0V

V<sub>ss</sub>=0V, Top=25°C

| Parameter                       | Symbol              | Condition   | Min. | Typ. | Max. | Unit |
|---------------------------------|---------------------|---|------|------|------|------|
| Input offset voltage            | V <sub>io</sub>     | V <sub>cm</sub> =V <sub>dd</sub> /2,<br>Unity gain follower       |      |      | ±6   | mV   |
| Input bias current              | I <sub>ib</sub>     |   |      |      | 1.0  | nA   |
| Common-mode input voltage range | V <sub>cmr</sub>    | For CMRR≥45dB   | 0.00 |      | 2.90 | V    |
| Maximum output voltage swing    | V <sub>outsh</sub>  | V <sub>id</sub> =100mV, R <sub>L</sub> =10kΩ to V <sub>ss</sub>   | 2.90 |      |      | V    |
| Minimum output voltage swing    | V <sub>outsl</sub>  | V <sub>id</sub> =100mV, R <sub>L</sub> =10kΩ to V <sub>dd</sub>   |      |      | 0.10 | V    |
| Source current                  | I <sub>source</sub> | V <sub>out</sub> =2.7V, V <sub>id</sub> =100mV                    | 1.5  | 4.0  |      | mA   |
| Sink current                    | I <sub>sink</sub>   | V <sub>out</sub> =0.3V, V <sub>id</sub> =100mV                    | 3.0  | 7.5  |      | mA   |
| Large-signal voltage gain       | A <sub>vd</sub>     | R <sub>L</sub> =10kΩ to V <sub>ss</sub> , V <sub>cm</sub> =1.5V   |      | 120  |      | dB   |
| Common-mode rejection ratio     | CMRR                | R <sub>L</sub> =10kΩ to V <sub>ss</sub> , V <sub>cm</sub> =1.5V   |      | 85   |      | dB   |
| Supply voltage rejection ratio  | PSRR                | R <sub>L</sub> =10kΩ to V <sub>ss</sub> , V <sub>cm</sub> =1.5V   |      | 100  |      | dB   |
| Current consumption             | I <sub>ss</sub>     | V <sub>cm</sub> =V <sub>dd</sub> /2,<br>Unity gain follower       |      | 150  | 300  | μA   |
| Short current                   | I <sub>shortp</sub> | V <sub>out</sub> to V <sub>ss</sub> shrot, V <sub>id</sub> =100mV |      | 14   |      | mA   |
|                                 | I <sub>shortn</sub> | V <sub>out</sub> to V <sub>dd</sub> shrot, V <sub>id</sub> =100mV |      | 25   |      | mA   |
| Unity gain bandwidth            | GBW                 |   |      | 1    |      | MHz  |
| Slew rate                       | SR                  | R <sub>L</sub> =100kΩ, C <sub>L</sub> =20pF                       | 0.40 | 1.00 |      | V/μs |

# ELM852xA CMOS operational amplifier

<http://www.elm-tech.com>

## ■Note

### 1) Common mode input voltage range

ELM852xA common mode input voltage range is fixed under the condition of  $CMRR \geq 45dB$ ; ELM852xA is able to accept the input above its specification if the degradation of CMRR is not considered. Even if the input voltage exceeds either positive or negative power voltage, troubles such as reverse of output will not occur.

As maximum absolute rating, the input voltage is possible within  $(V_{ss}-0.3)V$  to  $(V_{dd}+0.3)V$ .

### 2) Operation from single power source

ELM852xA is designed to be most suitable for single power source; therefore, ELM852xA is able to share power supply with logic circuit one. Meanwhile, ELM852xA can also operate from double power sources. To protect power supplies of ELM852xA and logic circuit from noise, please separate wire from power supply and use decoupling (bypass) capacitor. Using the capacitor can improve PSRR characteristics, especially on 10kHz to 100kHz or more.

### 3) Feedback

When OP-AMP circuit is used with feedback resistor, oscillation may happen in the circuit with loop-gain like unity gain follower.

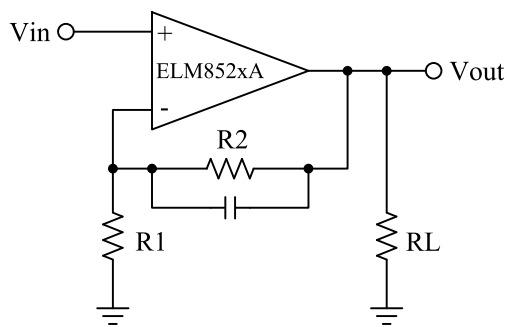
a) When large feedback resistance is used, the phase margin is decreased by its combination with the parasitic capacitance of the input part of OP-AMP. In this situation, please connect small capacitor in parallel with feedback resistor as shown in fig-1.

b) For capacitive load, external resistor in series connection will be effective as shown in fig-2.

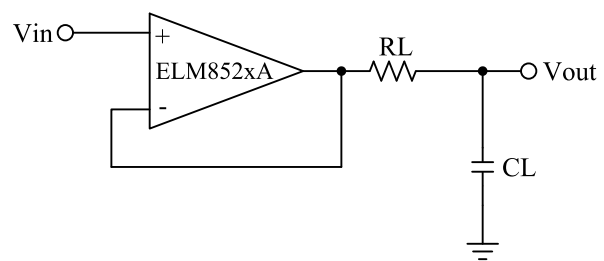
( $R_L=300$  to  $500\Omega$ )

c) Being used as an unity gain follow, ELM852xA is able to drive capacitive load of 100pF directly without oscillation.

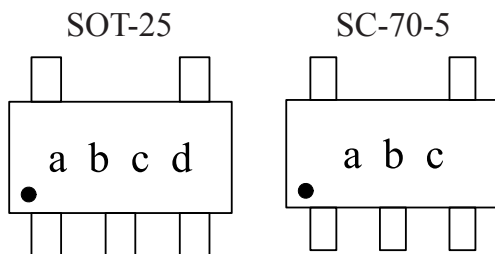
a) fig-1



b) fig-2



## ■Marking

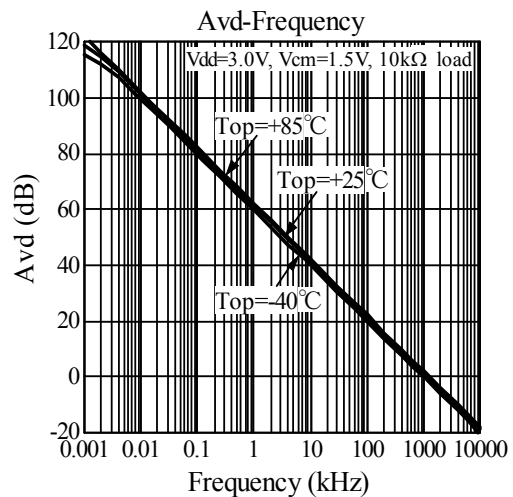
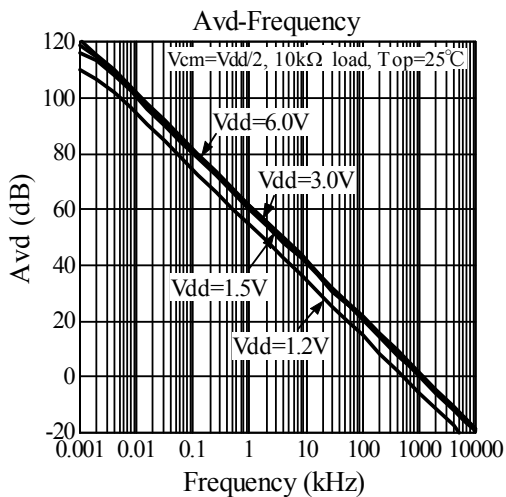
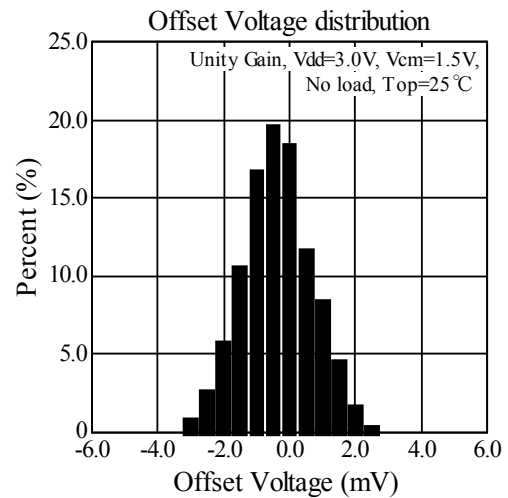
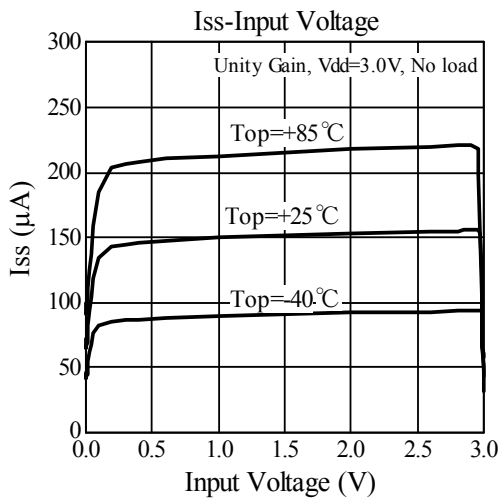
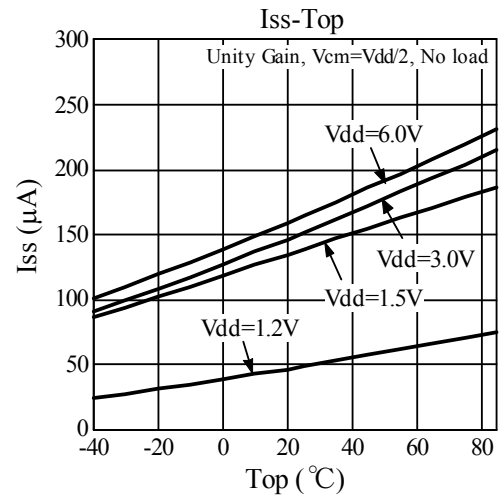
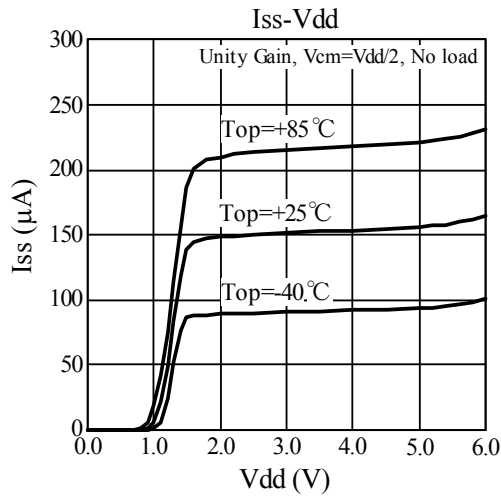


| Symbol | Mark                                     | Content            |
|--------|--|--------------------|
| a, b   | 5 D                                      | ELM852BA (SOT-25)  |
|        | > 3                                      | ELM852CA (SC-70-5) |
| c      | 0 to 9 and A to Z<br>(I, O, X excepted.) | Lot No.            |
| d      | 0 to 9 and A to Z<br>(I, O, X excepted.) | Lot No.            |

# ELM852xA CMOS operational amplifier

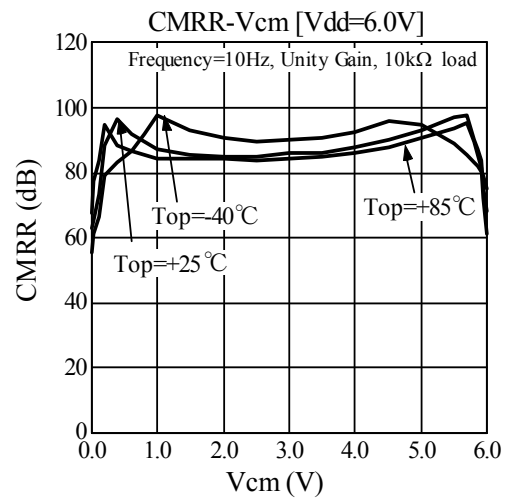
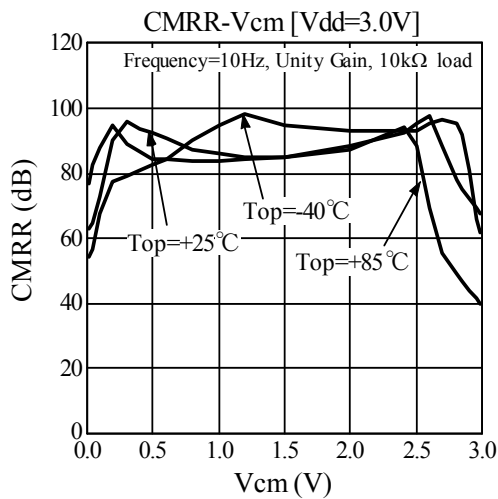
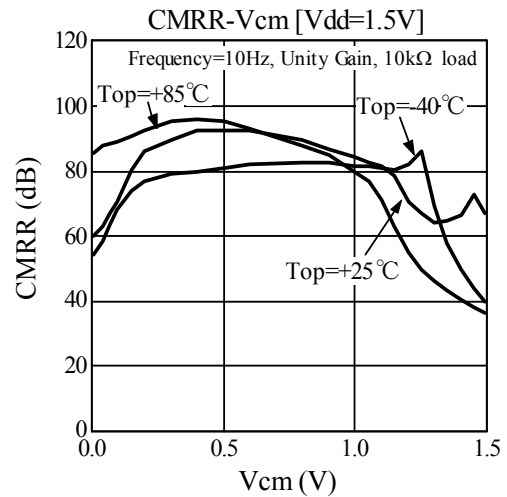
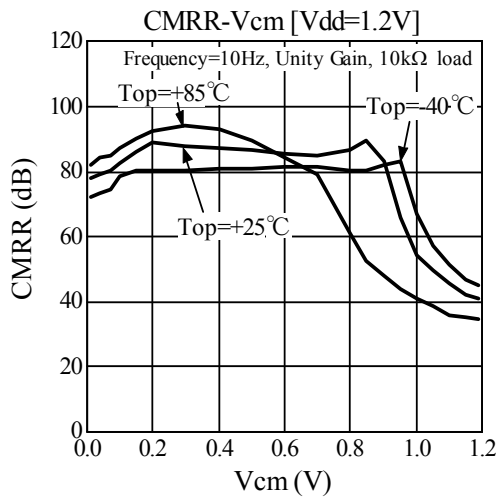
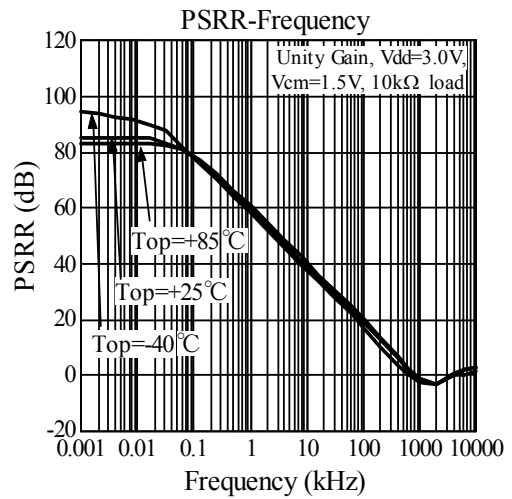
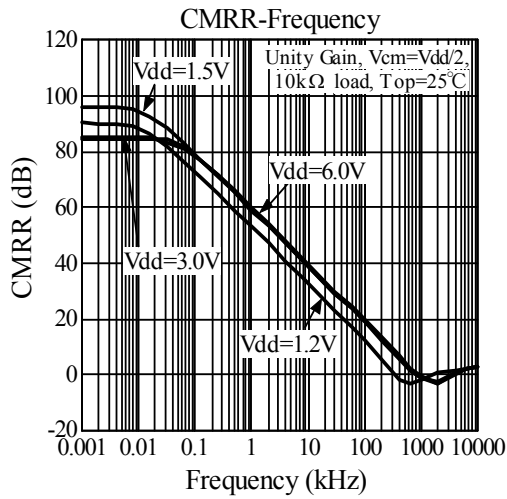
<http://www.elm-tech.com>

## ■ Typical characteristics



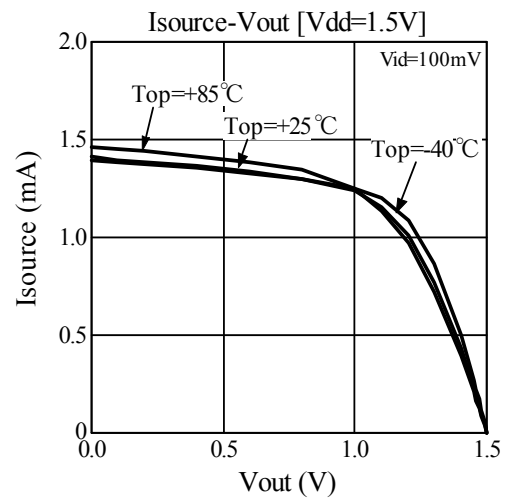
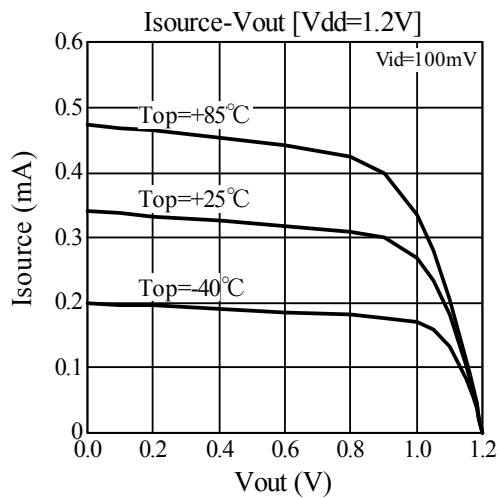
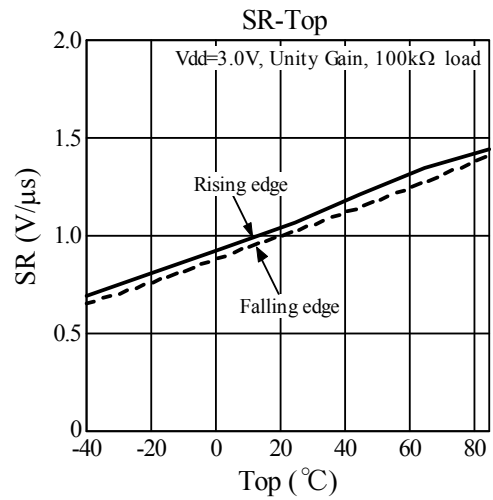
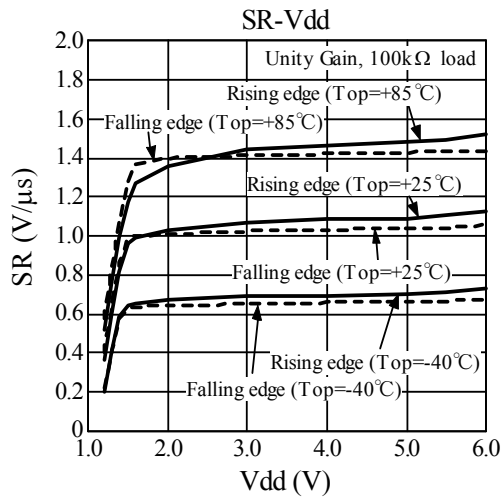
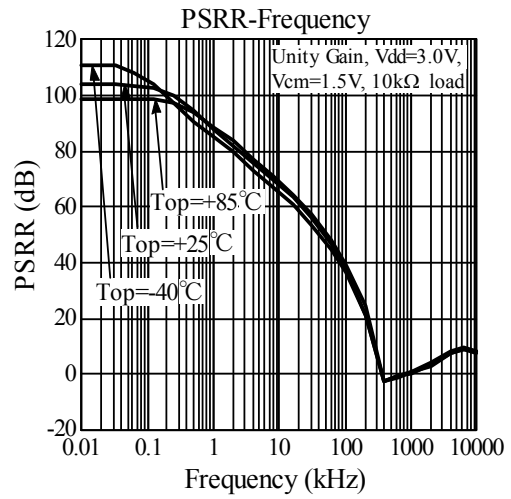
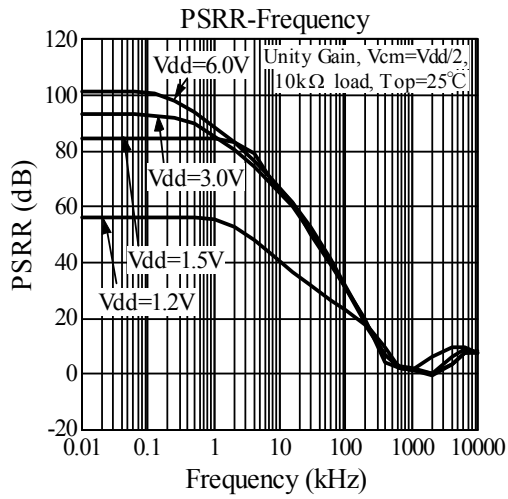
# ELM852xA CMOS operational amplifier

<http://www.elm-tech.com>



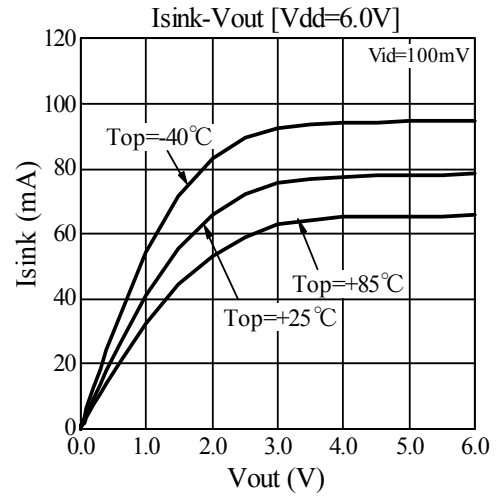
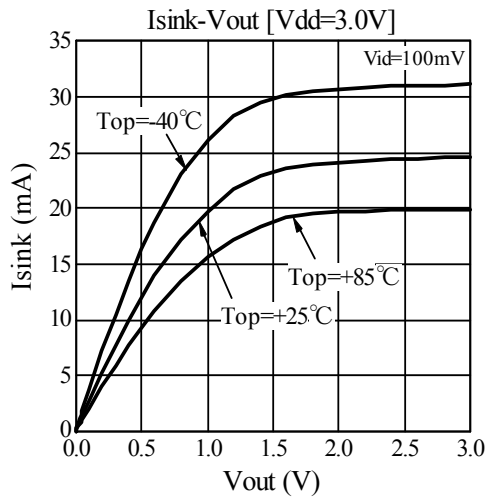
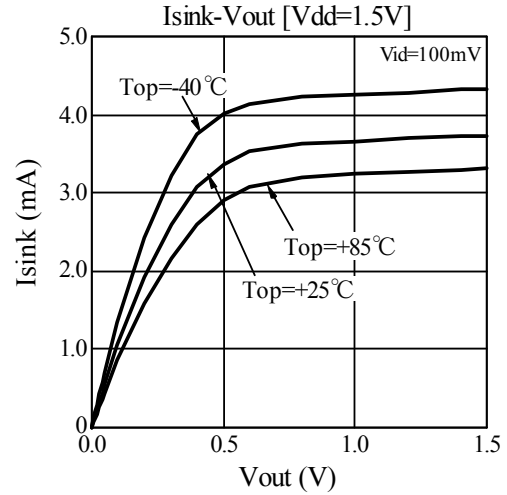
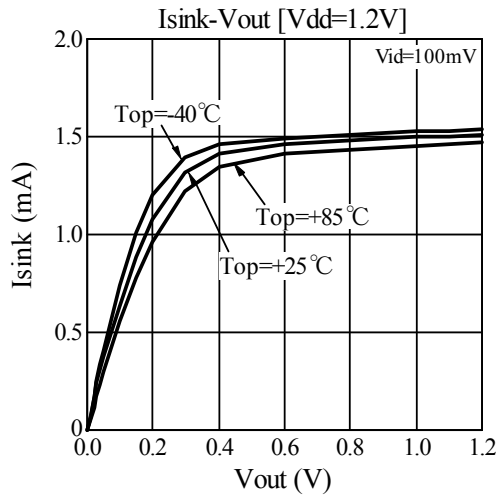
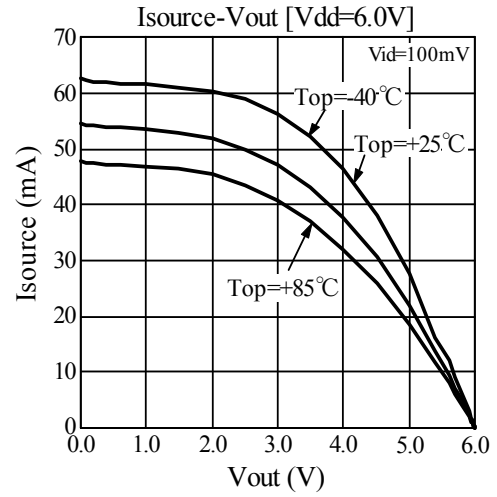
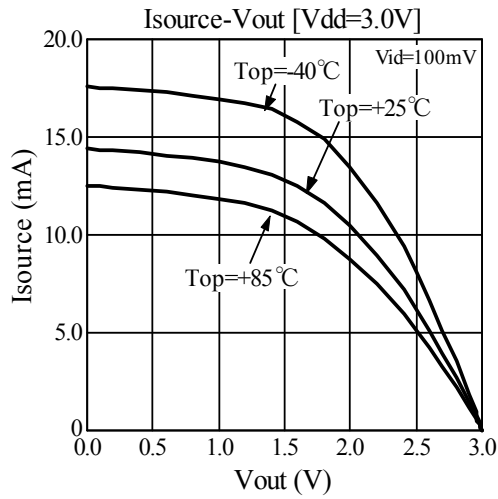
# ELM852xA CMOS operational amplifier

<http://www.elm-tech.com>



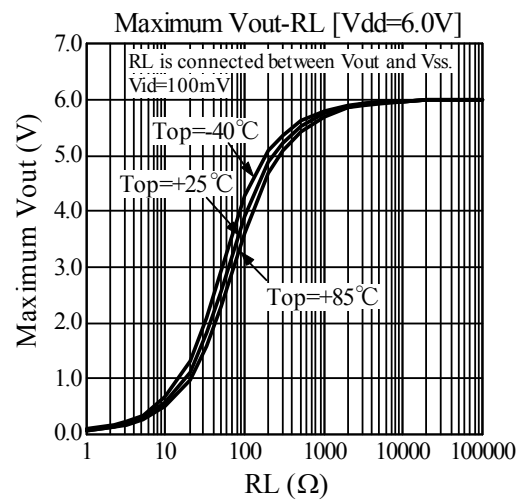
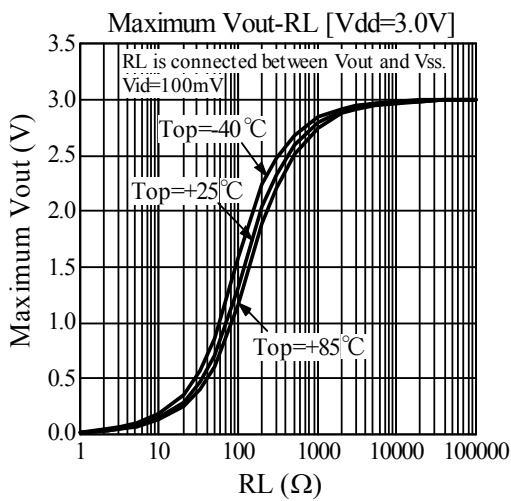
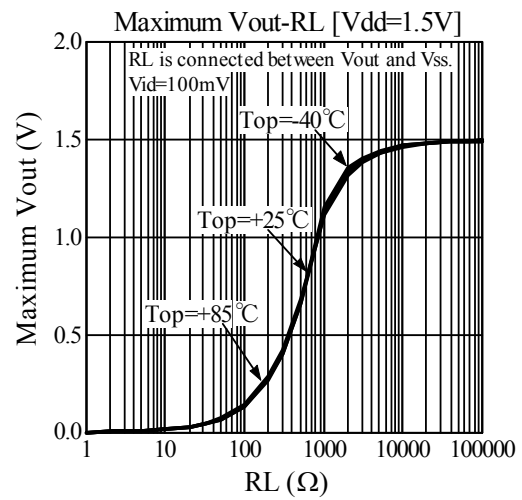
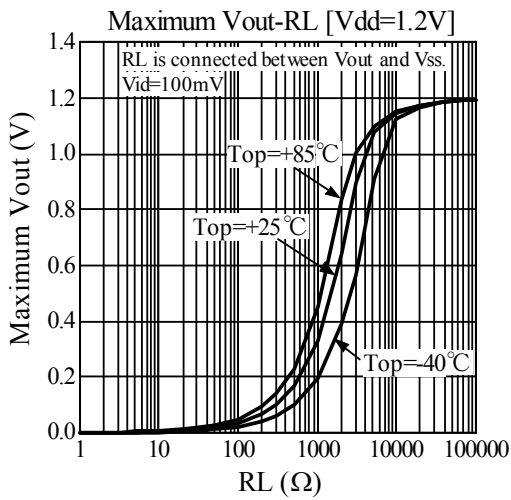
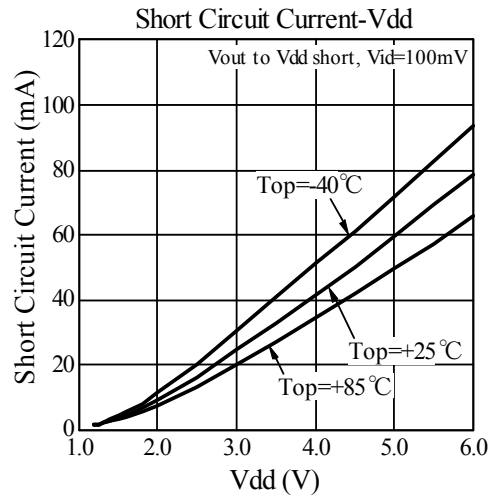
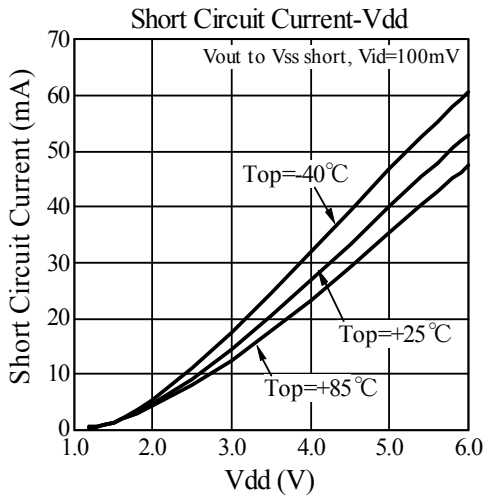
# ELM852xA CMOS operational amplifier

<http://www.elm-tech.com>



# ELM852xA CMOS operational amplifier

<http://www.elm-tech.com>





# ELM852xA CMOS operational amplifier

<http://www.elm-tech.com>

