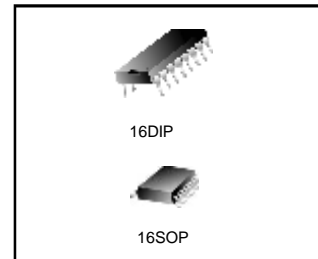


### DESCRIPTION

The IP102/A is a monolithic IC that includes two operational amplifiers, two comparators and an adjustable shunt regulator. This device is offering space and cost saving in many applications like power supply management or data acquisition systems.



### FEATURES

#### Operational Amplifiers

- Low Supply Current : 200uA/amp
- Medium Speed : 1.5MHz
- Low Level Output Voltage Close to VEE : 0.1V Typ.

#### Comparators

- Low Supply Current : 200uA/amp (Vcc = 5V)
- Low Output Saturation Voltage 0.1V (Io = 4mA)

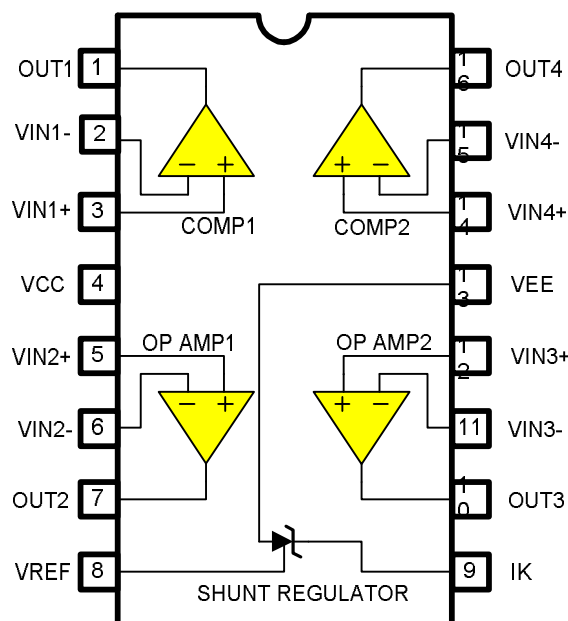
#### Adjustable Shunt Regulator

- Adjustable Output Voltage : Vref to 18V
- Sink Current Capability : 0.5 to 150mA
- 1% Voltage Precision
- Latch-up Immunity

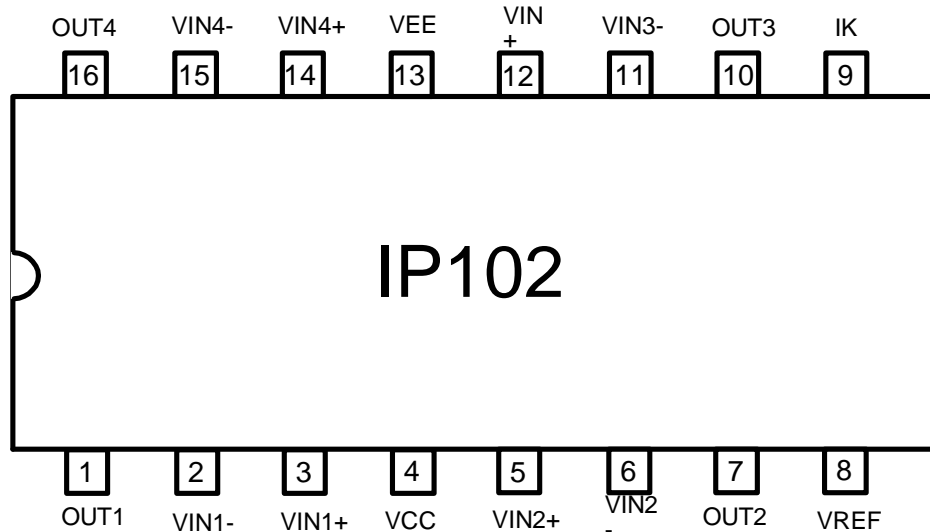
### ORDERING INFORMATION

| Device | Package | Operating Temp |
|--------|---------|----------------|
| IP102A | 16DIP   | -40°C ~ +85°C  |
| IP102A | 16SOP   |                |

### BLOCK DIAGRAM



### PIN CONNECTIONS



### PIN DESCRIPTIONS

| NO | SYMBOL | I/O | DESCRIPTION                                  |
|----|--------|-----|----------------------------------------------|
| 1  | OUT1   | O   | Comparator 1 Output                          |
| 2  | VIN1-  | I   | Comparator 1 Inverting Input                 |
| 3  | VIN1+  | I   | Comparator 1 Non-Inverting Input             |
| 4  | VCC    | -   | Positive Supply Voltage                      |
| 5  | VIN2+  | I   | OP-Amp 1 Non-Inverting Input                 |
| 6  | VIN2-  | I   | OP-Amp 1 Inverting Input                     |
| 7  | OUT2   | O   | OP-Amp 1 Output                              |
| 8  | VREF   | -   | Adjustable Shunt Regulator Voltage Reference |
| 9  | IK     | I   | Adjustable Shunt Regulator Cathode           |
| 10 | OUT3   | O   | OP-Amp 2 Output                              |
| 11 | VIN3-  | I   | OP-Amp 2 Inverting Input                     |
| 12 | VIN3+  | I   | OP-Amp 2 Non-Inverting Input                 |
| 13 | VEE    | -   | Negative Supply Voltage                      |
| 14 | VIN4+  | I   | Comparator 2 Non-Inverting Input             |
| 15 | VIN4-  | I   | Comparator 2 Inverting Input                 |
| 16 | OUT4   | O   | Comparator 2 Output                          |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER             | SYMBOL | VALUE     | UNIT |
|-----------------------|--------|-----------|------|
| Supply Voltage        | Vcc    | 18        | V    |
| Operating temperature | Topr   | -40 ~ +85 | °C   |
| Storage temperature   | Tstg   | -65 ~ 150 | °C   |

### ELECTRICAL CHARACTERISTICS

Ta = 25°C, Vcc = 5V, VEE = GND (unless otherwise specified. )

#### TOTAL SUPPLY VOLTAGE SECTION

| CHARACTERISTICS      | SYMBOL | CONDITIONS        | MIN | TYP | MAX | UNIT |
|----------------------|--------|-------------------|-----|-----|-----|------|
| Total Supply Current | Icc    | Vee = 0V, No Load |     | 0.8 | 1.5 | mA   |

#### Operational Amplifiers

|                                |         |                                              |     |      |     |        |
|--------------------------------|---------|----------------------------------------------|-----|------|-----|--------|
| Input Offset Voltage           | Vio     |                                              |     | 1    | 4.5 | mV     |
| Input Offset Current           | Iio     |                                              |     |      | 50  | nA     |
| Input Bias Current             | Iib     |                                              |     | 50   | 150 | nA     |
| Large Signal Voltage Gain      | Avd     | Vcc=15V, Vo=5~10V,<br>Rload =10K             | 60  | 100  |     | dB     |
| Supply Voltage Rejection Ratio | SVRR    | Vcc= 5V to 15V                               | 65  | 100  |     | dB     |
| Common Mode Rejection Ratio    | CMRR    | Vcc=15V,<br>Vicm=0~(Vcc)-1.8V                | 70  | 90   |     | dB     |
| Output Source Current          | Isource | Vo=2.5V, Vid=+-1V                            | 3   | 6    |     | mA     |
| Output Sink Current            | Isink   | Vo=2.5V,<br>Vid=+-1V                         | 3   | 6    |     | mA     |
| Phase Margin                   | PM      | Rload=10K,Clod=100pF                         |     | 55   |     | Degree |
| Output Voltage High            | Voh     | Vcc=15V, Rload=10K                           | 12  | 13   |     | V      |
| Output Voltage Low             | Vol     | Rload=10K                                    |     | 100  | 150 | mV     |
| Slew Rate                      | SR      | Vi=10V,<br>Vcc=12V,Rload=10K,Cloa<br>d=100pF | 0.5 | 0.75 |     | V/us   |
| Gain Bandwidth                 | GB      | Rload=10K,Clod=100pF,f<br>=100khz            | 1.0 | 1.5  |     | MHz    |
| Total Harmonic Distortion      | THD     |                                              |     | 0.05 |     | %      |

**ELECTRICAL CHARACTERISTICS**

Ta = 25°C, Vcc = 5V, VEE=GND (unless otherwise specified. )

| <b>Comparators</b>                     |               |                                        |            |            |             |             |
|----------------------------------------|---------------|----------------------------------------|------------|------------|-------------|-------------|
| <b>CHARACTERISTICS</b>                 | <b>SYMBOL</b> | <b>CONDITIONS</b>                      | <b>MIN</b> | <b>TYP</b> | <b>MAX</b>  | <b>UNIT</b> |
| Input Offset Voltage                   | Vio           |                                        |            |            | 5           | mV          |
| Input Offset Current                   | Iio           |                                        |            |            | 50          | nA          |
| Input Bias Current                     | Iib           |                                        |            |            | 200         | nA          |
| High Level Output Current              | Ioh           | Vid = +1V, Vcc=Vo=15V                  |            | 0.1        | 1           | uA          |
| Large Signal Voltage Gain              | Avd           | Vcc+=15V, Rload =15K, Vo=1V to 11V     |            | 200        |             | V/mV        |
| Low Level Output Voltage               | Vol           | Vid = -1V, Isc = 4mA                   |            | 100        | 400         | mV          |
| Output Sink Current                    | Isc           | Vid = -1V, Vo = 1.5V                   | 6          | 16         |             | mA          |
| Input Common Mode Voltage Range        | Vicm          |                                        | 0          |            | (Vcc) - 1.5 | V           |
| Differential Input Voltage             | Vid           |                                        |            |            | Vcc         | V           |
| <b>Adjustable Shunt Regulator</b>      |               |                                        |            |            |             |             |
| Cathode to Anode Voltage               | Vka           |                                        | Vref       |            | 18          | V           |
| Cathode Current                        | Ik            |                                        | 0.5        |            | 150         | mA          |
| Reference Input Voltage                | Vref          | IP102                                  | 2.475      | 2.5        | 2.525       | V           |
| Reference Input Voltage Deviation      | dVref         | Vka=Vref, Ik=10mA<br>-40°C < Ta < 85°C |            | 7          | 30          | mV          |
| Load Regulation                        | Rload         | Vka=Vref, Ik=10mA~100mA                |            | 20         | 50          | mV          |
| Minimum Cathode Current for Regulation | Imin          | Vka = Vref                             |            | 0.2        | 0.5         | mA          |
| Off-State Cathode Current              | Ioff          | Vka=18V, Vref=0V                       |            | 0.1        | 1           | uA          |



**ELECTRICAL DIAGRAMS**

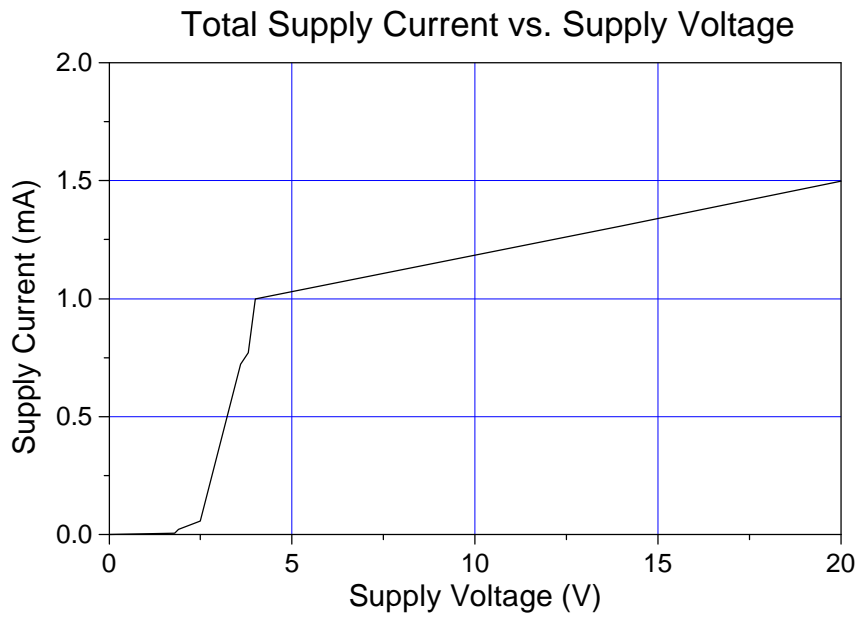


Fig.1 : Total Supply Current vs. Supply Voltage

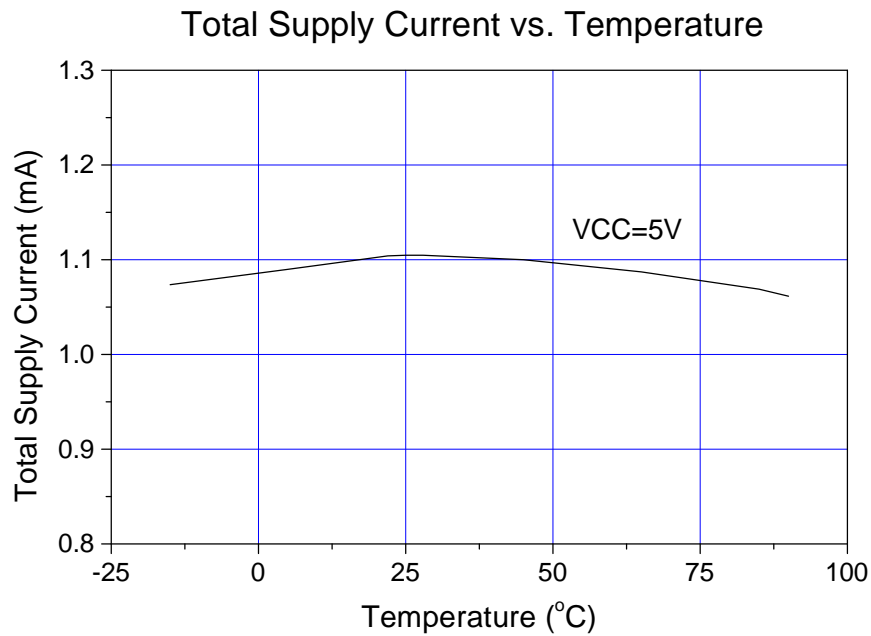


Fig.2 : Total Supply Current vs. Temperature

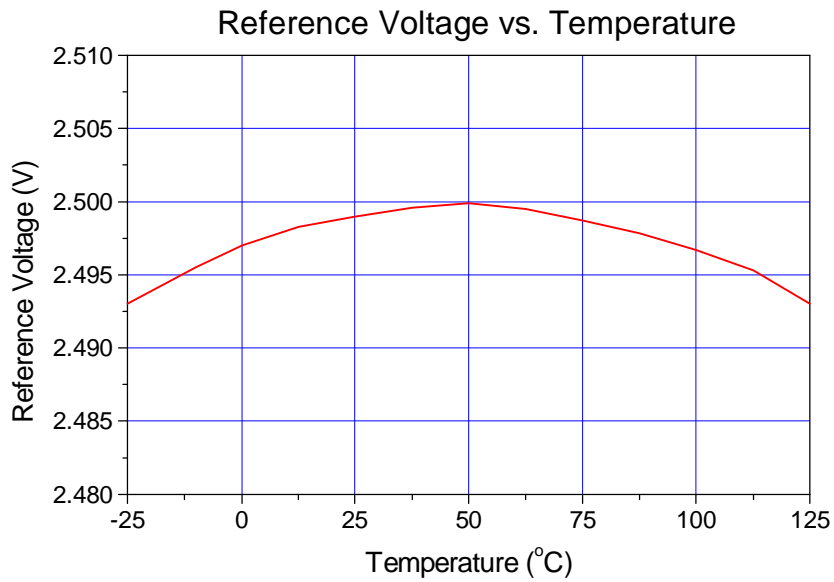


Fig.3 : Reference Voltage vs. Temperature

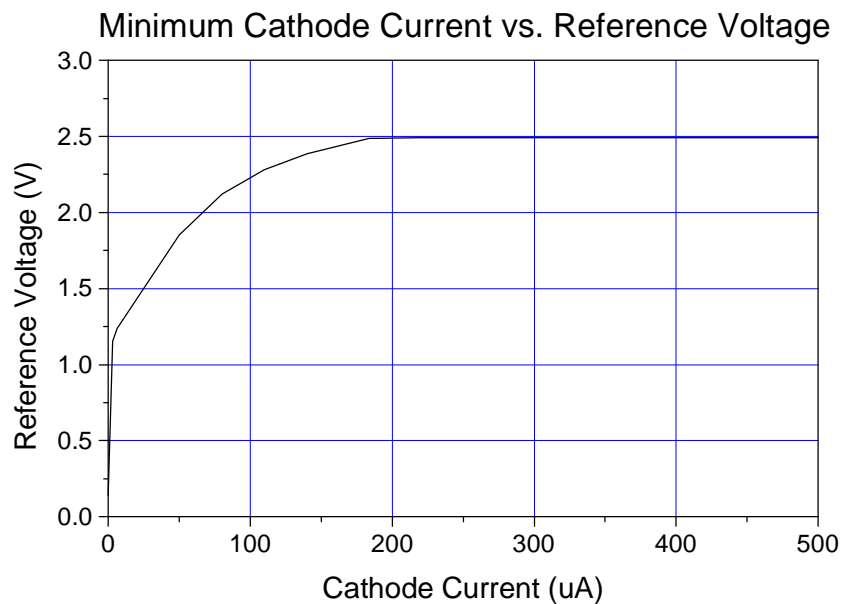


Fig.4 : Minimum Cathode Current VS. Reference Voltage

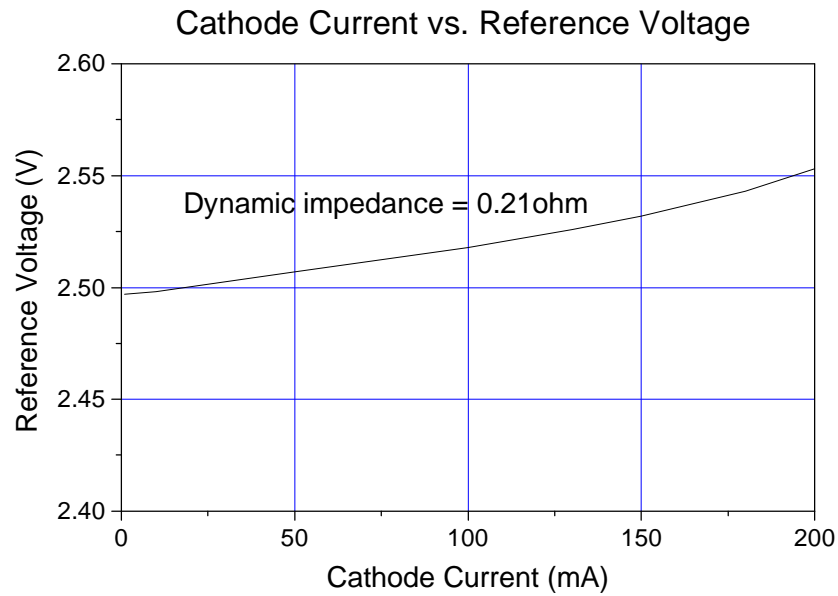


Fig.5 : Cathode Current vs. Reference Voltage

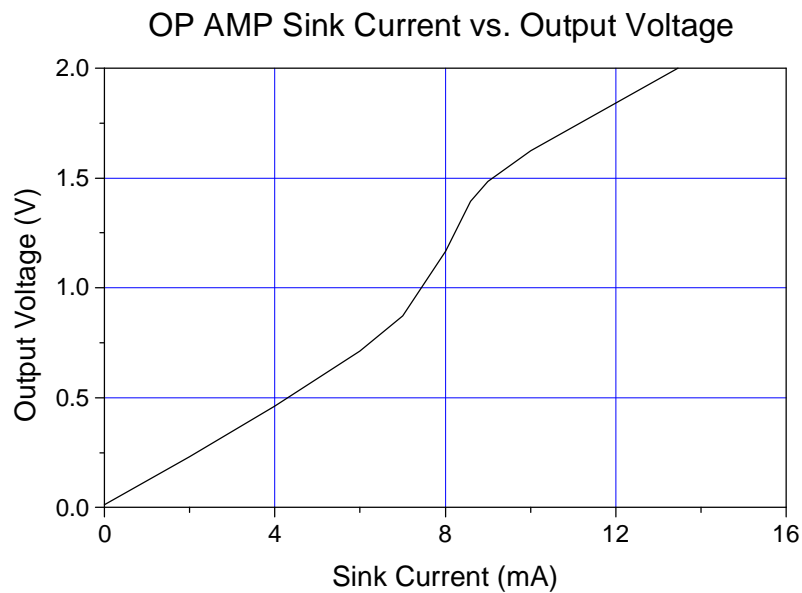


Fig.6 : OP AMP Sink Current vs. Output Voltage



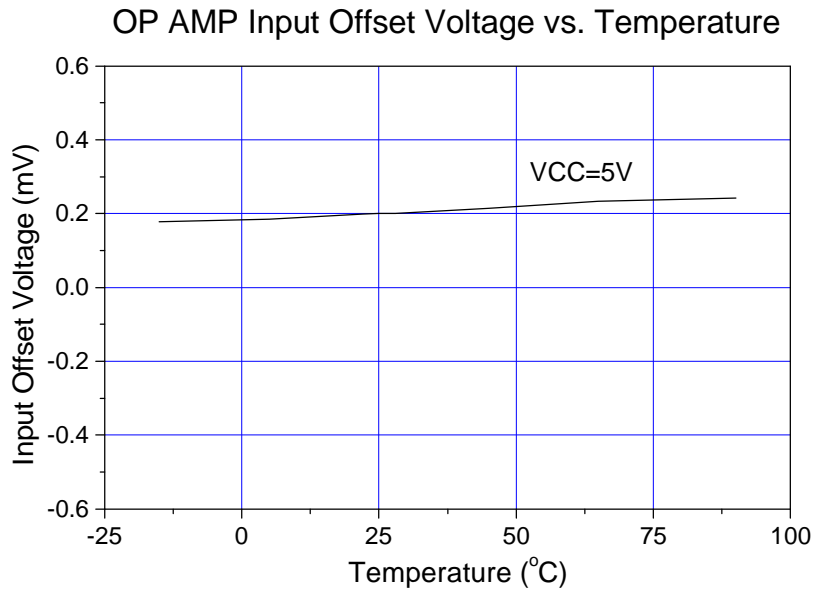


Fig.7 : OP AMP Input Offset Voltage vs. Temperature

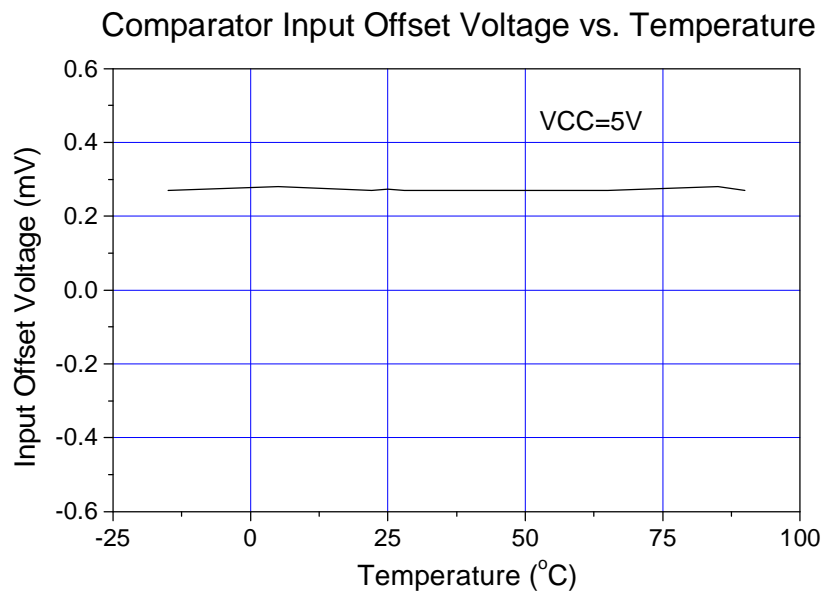


Fig.8 : Comparator Input Offset Voltage vs. Temperature

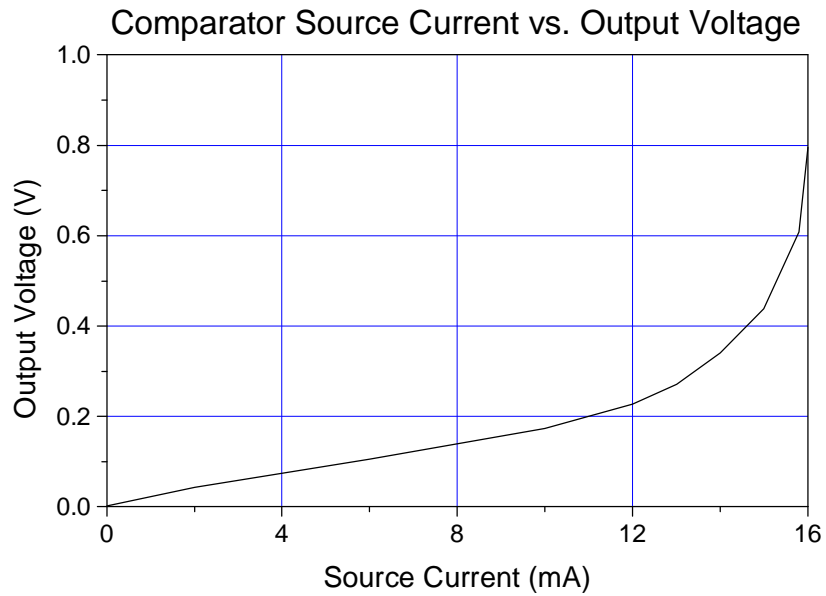
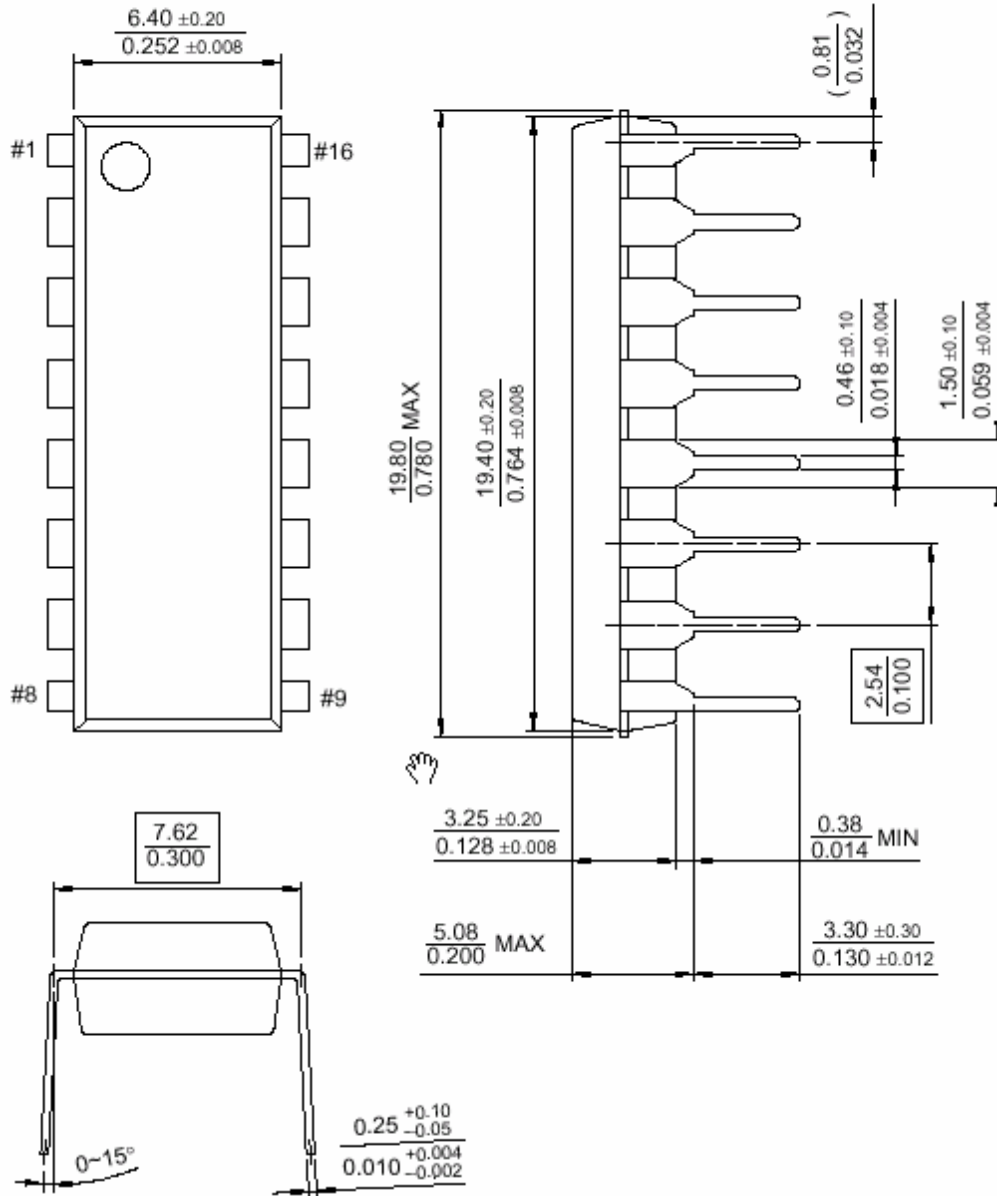


Fig.9 : Comparator Source Current vs. Output Voltage

**PACKAGE DIMENSION**

**16-DIP**



**PACKAGE DIMENSION**

**16-SOP**

