

# GP103A

## Dual Operational Amplifier and Voltage Reference

### Description

The GP103A is a monolithic IC that includes one independent op-amp and another op-amp for which the non inverting input is wired to a 2.5V fixed Voltage Reference. This device is offering space and cost saving in many applications like power supply management or data acquisition system.

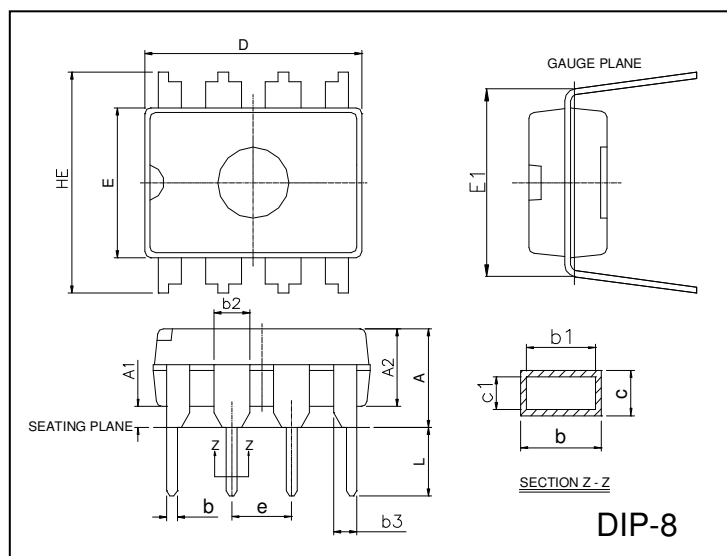
### Operational Amplifier

- Low Input Offset Voltage: 0.5mV(typ.)
- Low Supply Current :350uA/op. (@V<sub>CC</sub>=5V)
- Medium Bandwidth (unity gain) : 0.9MHz
- Large Output Voltage Swing: 0V to (V<sub>CC</sub>-1.5V)
- Input Common Mode voltage Range Includes Ground
- Wide Power Supply Range: 3 to 32V±1.5 to ±16V

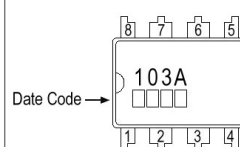
### Voltage Reference

- Fixed Output Voltage Reference 2.5V
- 0.4% Voltage Precision
- Sink Current Capability: 1 to 100mA
- Typical Output Impedance: 0.2Ω

### Package Dimensions

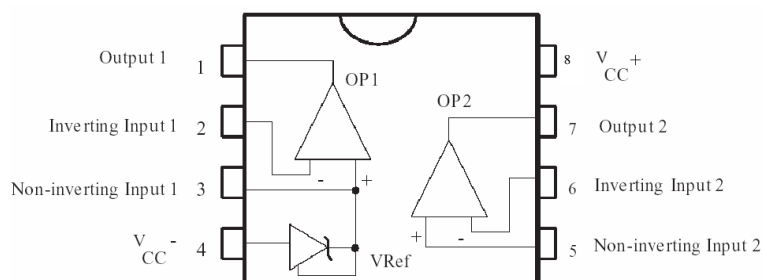


### Marking :



| REF. | Millimeter |        | REF. | Millimeter |       |
|------|------------|--------|------|------------|-------|
|      | Min.       | Max.   |      | Min.       | Max.  |
| A    | -          | 0.5334 | c1   | 0.203      | 0.279 |
| A1   | 0.381      | -      | D    | 9.017      | 10.16 |
| A2   | 2.921      | 4.953  | E    | 6.096      | 7.112 |
| b    | 0.356      | 0.559  | E1   | 7.620      | 8.255 |
| b1   | 0.356      | 0.508  | e    | 2.540 BSC  |       |
| b2   | 1.143      | 1.778  | HE   | -          | 10.92 |
| b3   | 0.762      | 1.143  | L    | 2.921      | 3.810 |
| c    | 0.203      | 0.356  |      |            |       |

### Pin Connections



**Absolute Maximum Ratings**

| Parameter                                       | Symbol            | Value       | Unit |
|-------------------------------------------------|-------------------|-------------|------|
| Supply Voltage                                  | V <sub>CC</sub>   | 36          | V    |
| Differential Input Voltage                      | V <sub>id</sub>   | 36          | V    |
| Input Voltage                                   | V <sub>i</sub>    | -0.3 ~ +36V | V    |
| Maximum Junction Temperature                    | T <sub>J</sub>    | 150         | °C   |
| Operating Ambient Temperature Range             | T <sub>oper</sub> | -40 ~ + 105 | °C   |
| Thermal Resistance junction Ambient Temperature | R <sub>θJA</sub>  | 150         | °C/W |

**Electrical Characteristics**

| Parameter                                                              | Symbol          | Test Conditions                                                                                  | Min | Typ | Max | Unit |
|------------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| Total Supply Current,<br>Excluding Current in the<br>Voltage Reference | I <sub>CC</sub> | V <sub>CC</sub> <sup>+</sup> =5V, no load, T <sub>min</sub> < T <sub>A</sub> < T <sub>max</sub>  | -   | 0.7 | 1.2 | mA   |
|                                                                        |                 | V <sub>CC</sub> <sup>+</sup> =30V, no load, T <sub>min</sub> < T <sub>A</sub> < T <sub>max</sub> | -   | -   | 2   | mA   |

**Operator2 (independent op-amp)**V<sub>CC</sub><sup>+</sup>=+5V, V<sub>CC</sub>=Ground, V<sub>O</sub>=1.4V T<sub>A</sub>=25°C (unless otherwise specified)

| Parameter                       | Symbol              | Test Conditions                                                                                                                      | Min      | Typ      | Max                                                                        | Unit  |
|---------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------------------------------------------------------------------------|-------|
| Input Offset Voltage            | V <sub>io</sub>     | T <sub>A</sub> =25°C<br>T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub>                                                         | -<br>-   | 0.5<br>- | 3<br>5                                                                     | mV    |
| Input Offset Voltage Drift      | DV <sub>io</sub>    |                                                                                                                                      | -        | 7        | -                                                                          | uV/°C |
| Input Offset Current            | I <sub>io</sub>     | T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub>                                                                                 | -<br>-   | 2<br>-   | 30<br>50                                                                   | nA    |
| Input Bias Current              | I <sub>ib</sub>     | T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub>                                                                                 | -<br>-   | 20<br>-  | 150<br>200                                                                 | nA    |
| Large Signal Voltage Gain       | A <sub>vd</sub>     | V <sub>CC</sub> =15V, R <sub>L</sub> =2k, V <sub>O</sub> =1.4V to 11.4V<br>T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub>      | 50<br>25 | 100<br>- | -<br>-                                                                     | V/mV  |
| Supply Voltage Rejection Ratio  | SVR                 | V <sub>CC</sub> =5V to 30V                                                                                                           | 65       | 100      | -                                                                          | dB    |
| Input Common Mode Voltage Range | V <sub>icm</sub>    | V <sub>CC</sub> =+30V (note1)<br>T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub>                                                | 0<br>0   | -<br>-   | (V <sub>CC</sub> <sup>+</sup> )-1.5<br>(V <sub>CC</sub> <sup>+</sup> )-2.0 | V     |
| Common Mode Rejection Ratio     | CMR                 | T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub>                                                                                 | 70<br>60 | 85<br>-  | -<br>-                                                                     | dB    |
| Output Current Source           | I <sub>source</sub> | V <sub>CC</sub> =+15V, V <sub>O</sub> =2V, V <sub>id</sub> =+1V                                                                      | 20       | 40       | -                                                                          | mA    |
| Short Circuit to Ground         | I <sub>o</sub>      | V <sub>CC</sub> =+15V                                                                                                                | -        | 40       | 60                                                                         | mA    |
| Output Current Sink             | I <sub>sink</sub>   | V <sub>CC</sub> =+15V, V <sub>O</sub> =2V, V <sub>id</sub> =-1V                                                                      | 10       | 20       | -                                                                          | mA    |
| High Level Output Voltage       | V <sub>OH</sub>     | V <sub>CC</sub> <sup>+</sup> =30V, R <sub>L</sub> =10k, T <sub>A</sub> =25°C<br>T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub> | 27<br>27 | 28<br>-  | -<br>-                                                                     | V     |
| Low Level Output Voltage        | V <sub>OL</sub>     | R <sub>L</sub> =10k<br>T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub>                                                          | -<br>-   | 5<br>-   | 20<br>20                                                                   | mV    |
| Slew Rate at Unity Gain         | SR                  | V <sub>i</sub> =0.5V to 3V, V <sub>CC</sub> =15V, R <sub>L</sub> =2k,<br>C <sub>L</sub> =100pF, Unity Gain                           | 0.2      | 0.4      | -                                                                          | V/μs  |
| Gain Bandwidth Product          | GBP                 | V <sub>CC</sub> =30V, R <sub>L</sub> =2k, C <sub>L</sub> =100pF<br>f=100kHz, V <sub>in</sub> =10mV                                   | 0.5      | 0.9      | -                                                                          | MHz   |
| Total Harmonic Distortion       | THD                 | V <sub>CC</sub> =30V, R <sub>L</sub> =2k, C <sub>L</sub> =100pF<br>V <sub>O</sub> =2V <sub>PP</sub> , f=1kHz, A <sub>v</sub> =20dB   | -        | 0.02     | -                                                                          | %     |

Note1: The common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V<sub>CC</sub><sup>+</sup> - 1.5V. But either of both input can go to +36V without damage.

**Operator1 (op-amp with non-inverting input connected to the internal Vref)**VCC<sup>+</sup>=+5V, VCC=Ground, VO=1.4V TA=25°C (unless otherwise specified)

| Parameter                      | Symbol              | Test Conditions                                                                                                                      | Min      | Typ      | Max      | Unit  |
|--------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|-------|
| Input Offset Voltage           | V <sub>io</sub>     | V <sub>icm</sub> =0V, T <sub>A</sub> =25°C<br>T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub>                                   | -<br>-   | 0.5<br>- | 3<br>5   | mV    |
| Input Offset Voltage Drift     | DV <sub>io</sub>    |                                                                                                                                      | -        | 7        | -        | uV/°C |
| Input Bias Current             | I <sub>ib</sub>     | Negative input                                                                                                                       | -        | 20       | -        | nA    |
| Large Signal Voltage Gain      | A <sub>vd</sub>     | V <sub>icm</sub> =0V<br>V <sub>CC</sub> =15V, R <sub>L</sub> =2k                                                                     | -        | 100      | -        | V/mV  |
| Supply Voltage Rejection Ratio | SVR                 | V <sub>icm</sub> =0V<br>V <sub>CC</sub> <sup>+</sup> =5V to 30V                                                                      | 65       | 100      | -        | dB    |
| Output Current Source          | I <sub>source</sub> | V <sub>CC</sub> =+15V, V <sub>O</sub> =2V, V <sub>id</sub> =+1V                                                                      | 20       | 40       | -        | mA    |
| Short Circuit to Ground        | I <sub>o</sub>      | V <sub>CC</sub> =+15V                                                                                                                | -        | 40       | 60       | mA    |
| Output Current Sink            | I <sub>sink</sub>   | V <sub>CC</sub> =+15V, V <sub>O</sub> =2V, V <sub>id</sub> =-1V                                                                      | 10       | 20       | -        | mA    |
| High Level Output Voltage      | V <sub>OH</sub>     | V <sub>CC</sub> <sup>+</sup> =30V, R <sub>L</sub> =10k, T <sub>A</sub> =25°C<br>T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub> | 27<br>27 | 28<br>-  | -<br>-   | V     |
| Low Level Output Voltage       | V <sub>OL</sub>     | R <sub>L</sub> =10k<br>T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub>                                                          | -<br>-   | 5<br>-   | 20<br>20 | mV    |
| Slew Rate at Unity Gain        | SR                  | V <sub>i</sub> =0.5V to 2V, V <sub>CC</sub> =15V, R <sub>L</sub> =2k,<br>C <sub>L</sub> =100pF, Unity Gain                           | 0.2      | 0.4      | -        | V/μs  |
| Gain Bandwidth Product         | GBP                 | V <sub>CC</sub> =30V, R <sub>L</sub> =2k, C <sub>L</sub> =100pF<br>f=100kHz, V <sub>in</sub> =10mV                                   | 0.5      | 0.9      | -        | MHz   |
| Total Harmonic Distortion      | THD                 | V <sub>CC</sub> =30V, R <sub>L</sub> =2k, C <sub>L</sub> =100pF<br>V <sub>O</sub> =2V <sub>PP</sub> , f=1kHz, A <sub>v</sub> =20dB   | -        | 0.02     | -        | %     |

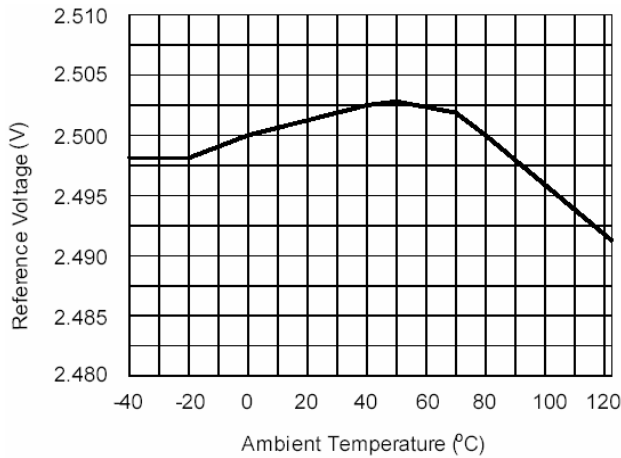
**Voltage Reference**

| Parameter       | Symbol         | Test Conditions | Value    | Unit |
|-----------------|----------------|-----------------|----------|------|
| Cathode Current | I <sub>k</sub> |                 | 1 to 100 | mA   |

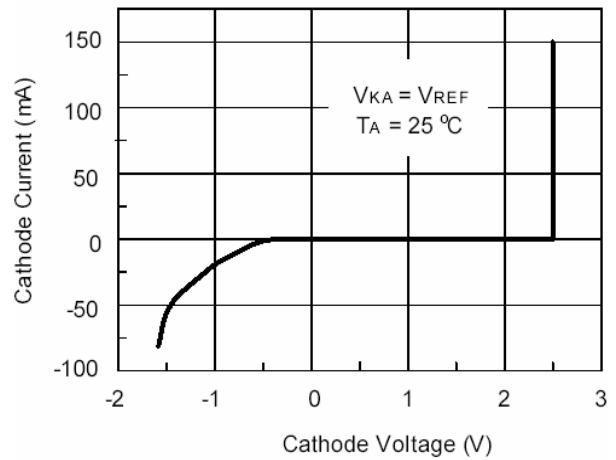
| Parameter                                          | Symbol            | Test Conditions                                                                                                | Min          | Typ      | Max          | Unit |
|----------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------|--------------|----------|--------------|------|
| Reference Input Voltage                            | V <sub>ref</sub>  | T <sub>A</sub> =25°C<br>T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub>                                   | 2.49<br>2.48 | 2.5<br>- | 2.51<br>2.52 | V    |
| Reference Input Voltage Deviation Over Temp. Range | ΔV <sub>ref</sub> | V <sub>KA</sub> =V <sub>ref</sub> , I <sub>k</sub> =10mA, T <sub>min</sub> ≤ T <sub>A</sub> ≤ T <sub>max</sub> | -            | 5        | 24           | mV   |
| Minimum Cathode Current for Regulation             | I <sub>min</sub>  | V <sub>KA</sub> =V <sub>ref</sub>                                                                              | -            | 0.5      | 1            | mA   |
| Dynamic Impedance (note2)                          | Z <sub>KA</sub>   | V <sub>KA</sub> =V <sub>ref</sub> , ΔI <sub>k</sub> =1 to 100mA, f<1kHz                                        | -            | 0.2      | 0.5          | Ω    |

Note2: The Dynamic impedance is defined as  $|Z_{KA}| = \Delta V_{KA} / \Delta I_k$

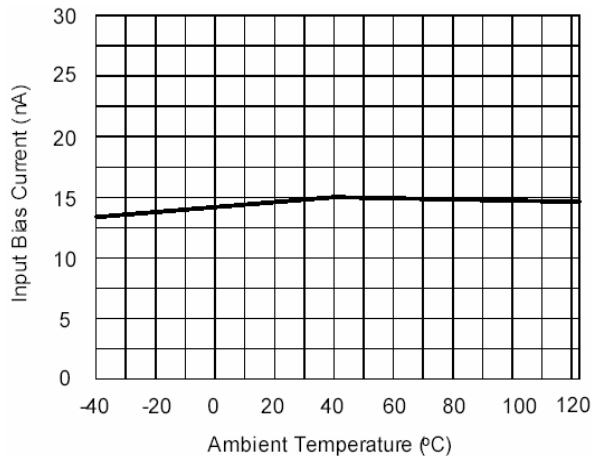
## Characteristics Curve



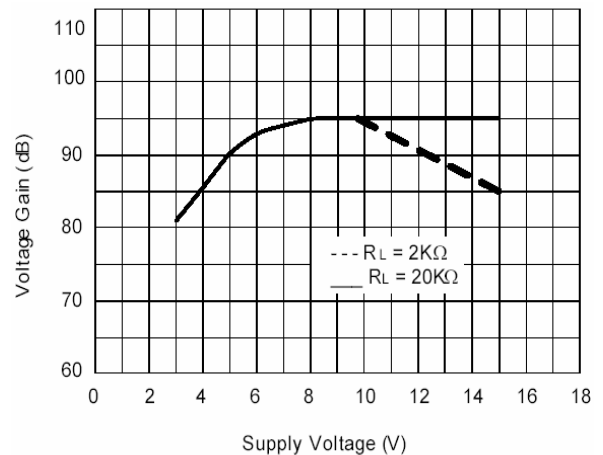
**Fig 1. Reference Voltage vs. Ambient Temperature**



**Fig 2. Cathode Current vs. Cathode Voltage**



**Fig 3. Input Bias Current vs. Ambient Temperature**



**Fig 4. Operational Amplifier Voltage Gain**

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