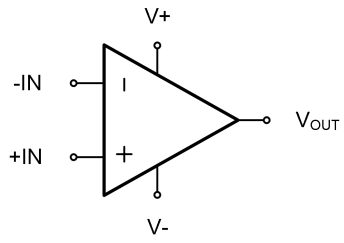


## GT8051 GT8052 GT8054

### 250MHz, Rail-to-Rail Output CMOS Operational Amplifier

| 1 Features                                                                                                                                                                                                                                                                                                    | 2 Application                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>- High gain bandwidth: 250 MHz</li> <li>- Rail-to-rail output</li> <li>- 1.5 mV typical <math>V_{os}</math></li> <li>- High slew rate: 180 V/<math>\mu</math>s</li> <li>- Supply range: +2.5 V to +5.5 V</li> <li>- Quiescent current: 3.1 mA per amplifier</li> </ul> | <ul style="list-style-type: none"> <li>- Audio ADC input buffers</li> <li>- Active filters</li> <li>- High-density systems</li> <li>- Video processing</li> <li>- Driving A/D converters</li> </ul> |

| 3 Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Circuit Diagram                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <p>The GT805X series of high-speed, voltage-feedback CMOS operational amplifiers are designed for video and other applications requiring wide bandwidth. They are unity-gain stable and can drive large output currents. Quiescent current is only 3.1mA per channel. The GT805X series of op amps are optimized for operation on single or dual supplies as low as 2.5V (<math>\pm 1.25</math>V) and up to 5.5V (<math>\pm 2.75</math>V). Common-mode input range extends beyond the supplies. The output swing is within 20mV of the rails, supporting wide dynamic range.</p> <p>All features are specified over the extended <math>-40^{\circ}\text{C}</math> to <math>+125^{\circ}\text{C}</math> temperature range.</p> |  |

#### 4 Revision History

| Revision   | Date         | Note                                                                                  |
|------------|--------------|---------------------------------------------------------------------------------------|
| Rev. A1. 0 | 2023. 09. 02 | Original Version                                                                      |
| Rev. A1. 1 | 2023. 12. 15 | 1.Update Package Qty<br>2.Added Tape and Reel Information<br>3.Added Application Note |
| Rev. A1. 2 | 2023. 12. 26 | 1.Added Marking<br>2.Added MSL                                                        |
| Rev. A1. 3 | 2024. 01. 26 | Updated Part Name                                                                     |
| Rev. A1. 4 | 2025. 02. 26 | Added Input Impedance                                                                 |
| Rev. A1. 5 | 2025. 06. 17 | Updated Input Voltage Noise Density                                                   |

The latest datasheet version should be checked on the GTIC official website, as the company does not actively inform customers about updates to the datasheet.

## 5 Device Summary, Pin and Packages

**Table 5-1. Device Summary<sup>(1)</sup>**

| Serial Name | Part Name | Package | Body Size (Nom)      | Marking <sup>(2)</sup> | MSL <sup>(3)</sup> | Package Qty        |
|-------------|-----------|---------|----------------------|------------------------|--------------------|--------------------|
| GT8051      | GT8051C5  | SC70-5  | 2.10mm×1.25mm×1.00mm | GT8051<br>XXXXXX       | 3                  | Tape and Reel,3000 |
|             | GT8051BC5 | SC70-5  | 2.10mm×1.25mm×1.00mm | GT8051B<br>XXXXXX      | 3                  | Tape and Reel,3000 |
|             | GT8051S5  | SOT23-5 | 2.90mm×1.60mm×1.10mm | GT8051<br>XXXXXX       | 3                  | Tape and Reel,3000 |
|             | GT8051BS5 | SOT23-5 | 2.90mm×1.60mm×1.10mm | GT8051B<br>XXXXXX      | 3                  | Tape and Reel,3000 |
|             | GT8051M8  | MSOP8   | 3.00mm×3.00mm×1.10mm | GT8051<br>XXXXXXXX     | 3                  | Tape and Reel,4000 |
|             | GT8051P8  | SOP8    | 6.00mm×3.90mm×1.75mm | GT8051<br>XXXXXXXX     | 3                  | Tape and Reel,4000 |
| GT8052      | GT8052M8  | MSOP8   | 3.00mm×3.00mm×1.10mm | GT8052<br>XXXXXXXX     | 3                  | Tape and Reel,4000 |
|             | GT8052T8  | TSSOP8  | 3.00mm×4.40mm×1.10mm | GT8052<br>XXXXXXXX     | 3                  | Tape and Reel,4000 |
|             | GT8052P8  | SOP8    | 6.00mm×3.90mm×1.75mm | GT8052<br>XXXXXXXX     | 3                  | Tape and Reel,4000 |
| GT8054      | GT8054TD  | TSSOP14 | 5.00mm×4.40mm×1.20mm | GT8054<br>XXXXXXXX     | 3                  | Tape and Reel,4000 |
|             | GT8054PD  | SOP14   | 8.65mm×3.90mm×1.75mm | GT8054<br>XXXXXXXX     | 3                  | Tape and Reel,4000 |

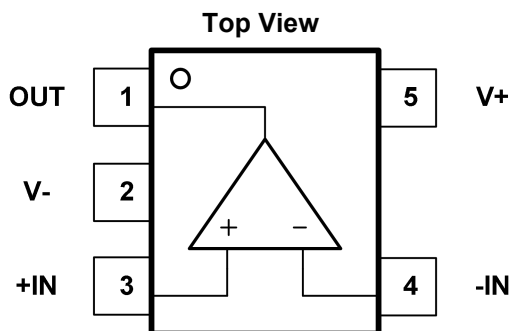
(1) For all available packages, please contact product sales.

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

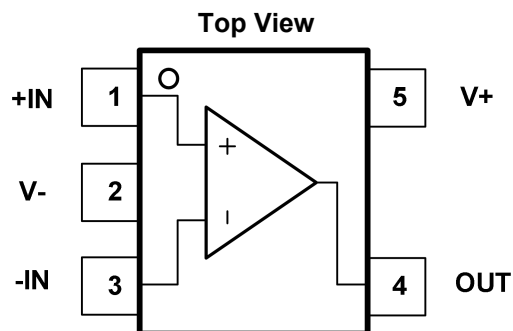
(4) "XXXXXX" in Marking will be appeared as the batch code.

## 5 Device Summary, Pin and Packages(Continued)



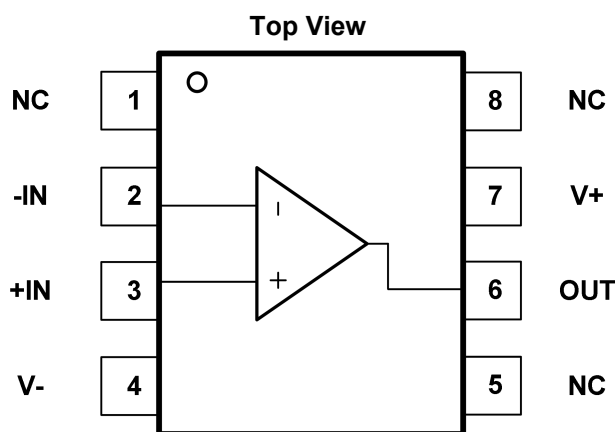
**Fig.5-1. GT8051: C5(SC70-5) Package**

**GT8051: S5(SOT23-5) Package**



**Fig.5-2. GT8051: BC5(SC70-5) Package**

**GT8051: BS5(SOT23-5) Package**



**Fig.5-3. GT8051: M8(MSOP8) Package**

**GT8051: P8(SOP8) Package**

**Table 5-2 Pin Definition**

| Name | Pin      |            |          | I/O | Description                                   |
|------|----------|------------|----------|-----|-----------------------------------------------|
|      | C5<br>S5 | BC5<br>BS5 | P8<br>M8 |     |                                               |
| -IN  | 4        | 3          | 2        | I   | Negative (inverting) input                    |
| +IN  | 3        | 1          | 3        | I   | Positive(noninverting) input                  |
| NC   | -        | -          | 1,5,8    | -   | No internal connection (can be left floating) |
| OUT  | 1        | 4          | 6        | O   | Output                                        |
| V-   | 2        | 2          | 4        | -   | Negative (lowest) power supply                |
| V+   | 5        | 5          | 7        | -   | Positive (highest) power supply               |

\* It is suggested to leave the unconnected pins floating.

## 5 Device Summary, Pin and Packages(Continued)

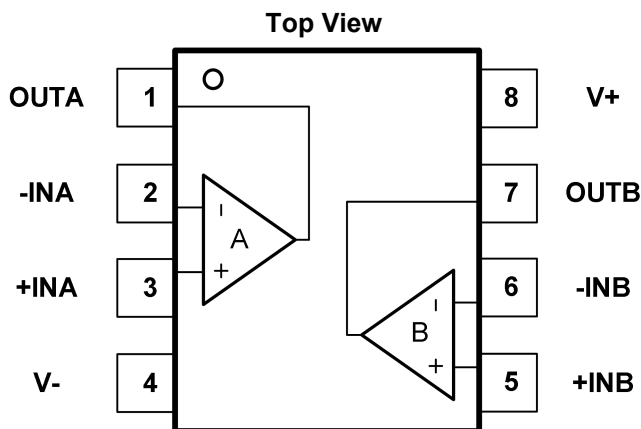


Fig.5-4. GT8052: P8(SOP8) Package

GT8052: M8(MSOP8) Package

GT8052: T8(TSSOP8) Package

Table 5-3 Pin Definition

| Name | Pin |    |    | I/O | Description                     |
|------|-----|----|----|-----|---------------------------------|
|      | P8  | M8 | T8 |     |                                 |
| -INA | 2   |    |    | I   | Inverting input, channel A      |
| +INA | 3   |    |    | I   | Noninverting input, channel A   |
| -INB |     | 6  |    | I   | Inverting input, channel B      |
| +INB |     | 5  |    | I   | Noninverting input, channel B   |
| OUTA | 1   |    |    | O   | Output, channel A               |
| OUTB |     | 7  |    | O   | Output, channel B               |
| V-   | 4   |    |    | -   | Negative (lowest) power supply  |
| V+   |     | 8  |    | -   | Positive (highest) power supply |

\* It is suggested to leave the unconnected pins floating.

## 5 Device Summary, Pin and Packages(Continued)

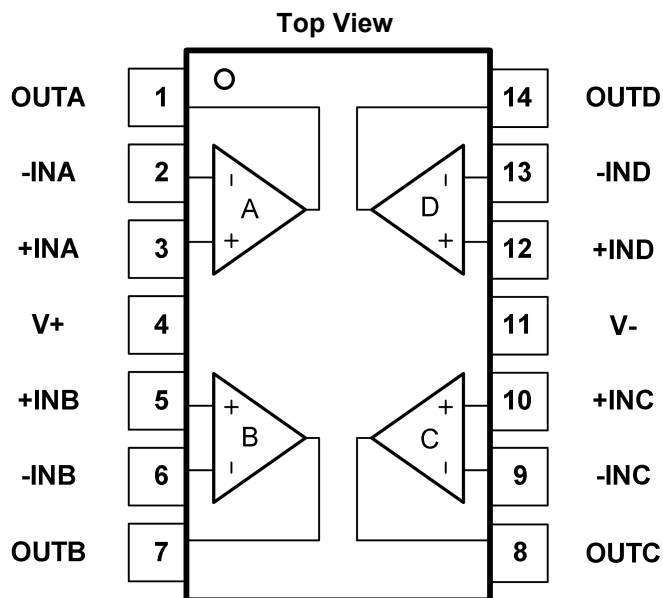


Fig.5-5. GT8054: TD(TSSOP14) Package

GT8054: PD(SOP14) Package

Table 5-4 Pin Definition

| Name | Pin   | I/O | Description                     |
|------|-------|-----|---------------------------------|
|      | PD TD |     |                                 |
| -INA | 2     | I   | Inverting input, channel A      |
| +INA | 3     | I   | Noninverting input, channel A   |
| -INB | 6     | I   | Inverting input, channel B      |
| +INB | 5     | I   | Noninverting input, channel B   |
| -INC | 9     | I   | Inverting input, channel C      |
| +INC | 10    | I   | Noninverting input, channel C   |
| -IND | 13    | I   | Inverting input, channel D      |
| +IND | 12    | I   | Noninverting input, channel D   |
| OUTA | 1     | O   | Output, channel A               |
| OUTB | 7     | O   | Output, channel B               |
| OUTC | 8     | O   | Output, channel C               |
| OUTD | 14    | O   | Output, channel D               |
| V-   | 11    | -   | Negative (lowest) power supply  |
| V+   | 4     | -   | Positive (highest) power supply |

\* It is suggested to leave the unconnected pins floating.

## 6 Voltage, Temperature, ESD and Thermal Ratings

### 6.1 Absolute Maximum Ratings<sup>(1)</sup>

| Parameters                          | Min.     | Max.     | Unit |
|-------------------------------------|----------|----------|------|
| Supply Voltage, $V_S=(V+) - (V-)$   |          | 6.5      | V    |
| Select Input Voltage <sup>(2)</sup> | (V-)-0.5 | (V+)+0.5 | V    |
| Maximum Junction Temperature        | -55      | 150      | °C   |
| Storage Temperature Range           | -55      | 150      | °C   |

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.3V beyond the supply rails should be current-limited to 10mA or less.

### 6.2 ESD Ratings

| ESD    |                         |                                           | Value | Unit |
|--------|-------------------------|-------------------------------------------|-------|------|
| V(ESD) | Electrostatic Discharge | Human-Body Model (HBM) <sup>(1)</sup>     | 2 K   | V    |
|        |                         | Charged-Device Model (CDM) <sup>(2)</sup> | 2 K   | V    |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 6.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

| Symbol   | Parameters                       | Min   | Max   | Unit |
|----------|----------------------------------|-------|-------|------|
| $V_{CC}$ | Single-Supply, $V_S=(V+) - (V-)$ | 2.5   | 5.5   | V    |
| $V_{CC}$ | Dual-Supply, $V_S=(V+) - (V-)$   | ±1.25 | ±2.75 | V    |
| TA       | Operating Temperature            | -40   | 125   | °C   |

### 6.4 Thermal Information

| Package Type | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|--------------|---------------|---------------|------|
| SC70-5       | 400           | 150           | °C/W |
| SOT23-5      | 250           | 81            | °C/W |
| MSOP8        | 210           | 45            | °C/W |
| SOP8         | 158           | 43            | °C/W |
| TSSOP8       | 191           | 50            | °C/W |
| TSSOP14      | 180           | 35            | °C/W |
| SOP14        | 120           | 36            | °C/W |

## 7 Electrical Specifications

$V_{CC}=5V$ ,  $G=+2$ ,  $R_F=1k\Omega$ , and  $R_L=1k\Omega$  connected to  $V_{CC}/2$ ,  $V_{IN\_CM}=V_{CC}/2$ . FULL= $-40^{\circ}C$  to  $+125^{\circ}C$ . Typical values are at  $T_A=+25^{\circ}C$ . (unless otherwise noted)

| Parameter                            | Symbol       | Test Conditions                               | Vcc          | TA             | Min  | Typ             | Max       | Units             |
|--------------------------------------|--------------|-----------------------------------------------|--------------|----------------|------|-----------------|-----------|-------------------|
| Power Supply                         |              |                                               |              |                |      |                 |           |                   |
| Operating Voltage                    | $V_S$        |                                               | 2.5V to 5.5V | FULL           | 2.5  |                 | 5.5       | V                 |
| Quiescent Current<br>(per Amplifier) | IQ           | $T_A=25^{\circ}C$ , $V_{CC}=5V$ , $I_O=0$     | 5V           | $+25^{\circ}C$ |      | 3.1             |           | mA                |
|                                      |              | $T_A=-40^{\circ}C$ to $+125^{\circ}C$         |              | FULL           |      |                 | 4.5       | mA                |
| Power-Supply Rejection Ratio         | PSRR         | $V_{CC}=2.5V$ to $5.5V$ , $V_{CM}=(V_-)+0.5V$ | 2.5V to 5.5V | $+25^{\circ}C$ | 70   | 95              |           | dB                |
| Input                                |              |                                               |              |                |      |                 |           |                   |
| Input Bias Current                   | $I_B$        |                                               | 5V           | $+25^{\circ}C$ |      | $\pm 1$         | $\pm 10$  | pA                |
| Input Offset Current                 | $I_{OS}$     |                                               | 5V           | $+25^{\circ}C$ |      | $\pm 1$         | $\pm 10$  | pA                |
| Input Offset Voltage                 | $V_{OS}$     | $V_{CC}=5V$                                   | 5V           | $+25^{\circ}C$ |      | $\pm 1.5$       | $\pm 7.5$ | mV                |
|                                      |              |                                               |              | FULL           |      |                 | $\pm 7.5$ | mV                |
| Input Offset Voltage vs Temperature  | $dV_{OS}/dT$ | $V_{CC}=5V$                                   | 5V           | FULL           |      | 2.6             |           | $\mu V/^{\circ}C$ |
| Input Impedance                      | Differential |                                               | 5V           | $+25^{\circ}C$ |      | $10^{13}  0.25$ |           | $\Omega  pF$      |
|                                      | Common-Mode  |                                               | 5V           | $+25^{\circ}C$ |      | $10^{13}  2.55$ |           | $\Omega  pF$      |
| Common-Mode Voltage                  | $V_{CM}$     | $V_{CC}=5V$                                   | 5V           | FULL           | -0.3 |                 | 3.6       | V                 |
| Common-Mode Rejection Ratio          | CMRR         | $V_{CC}=5.5V$ , $-0.1V < V_{CM} < 3.5V$       | 5.5V         | $+25^{\circ}C$ | 66   | 85              |           | dB                |
| Input Voltage Noise Density          | $e_n$        | $f=1MHz$                                      | 2.5V to 5.5V | $+25^{\circ}C$ |      | 8               |           | nV/ $\sqrt{Hz}$   |
| Open-loop Gain                       |              |                                               |              |                |      |                 |           |                   |
| Open-Loop Gain                       | $A_{OL}$     | $V_{CC}=5V$ , $V_O=4.8V$ , $R_L=1k\Omega$     | 5V           | FULL           | 94   | 110             |           | dB                |
|                                      |              | $V_{CC}=5V$ , $V_O=4.7V$ , $R_L=150\Omega$    | 5V           | FULL           | 90   | 100             |           | dB                |



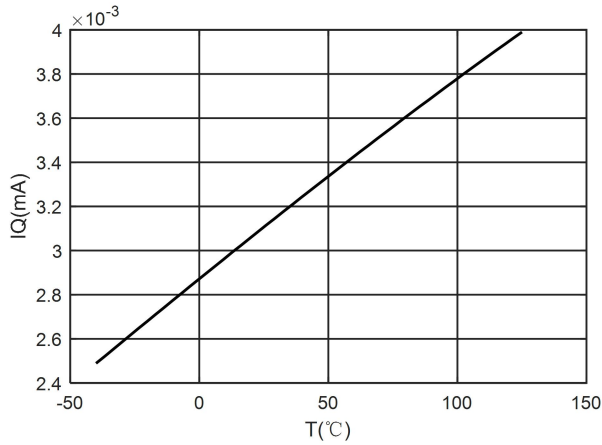
## 7 Electrical Specifications(Continued)

$V_{CC}=5V$ ,  $G=+2$ ,  $R_F=1k\Omega$ , and  $R_L=1k\Omega$  connected to  $V_{CC}/2$ ,  $V_{IN\_CM}=V_{CC}/2$ . FULL= $-40^{\circ}C$  to  $+125^{\circ}C$ . Typical values are at  $T_A=+25^{\circ}C$ . (unless otherwise noted)

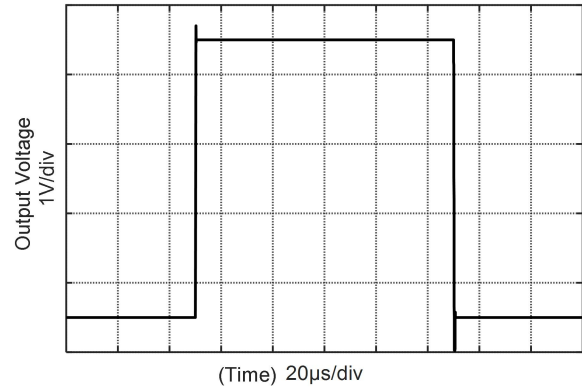
| Parameter                      | Symbol          | Test Conditions                                | Vcc          | TA             | Min | Typ | Max | Units      |
|--------------------------------|-----------------|------------------------------------------------|--------------|----------------|-----|-----|-----|------------|
| Frequency Response             |                 |                                                |              |                |     |     |     |            |
| Small-Signal Bandwidth         | $f_{-3dB}$      | At $G=+1$ , $V_O=100mV_{PP}$ , $R_F=25\Omega$  | 5V           | $+25^{\circ}C$ |     | 250 |     | MHz        |
|                                |                 | At $G=+2$ , $V_O=100mV_{PP}$ , $R_F=1k\Omega$  | 5V           | $+25^{\circ}C$ |     | 140 |     | MHz        |
|                                |                 | At $G=+5$ , $V_O=100mV_{PP}$ , $R_F=4k\Omega$  | 5V           | $+25^{\circ}C$ |     | 50  |     | MHz        |
|                                |                 | At $G=+10$ , $V_O=100mV_{PP}$ , $R_F=9k\Omega$ | 5V           | $+25^{\circ}C$ |     | 20  |     | MHz        |
| Slew Rate                      | SR              | $V_{CC}=5V$ , $G=+2$ , 4-V Step Output         | 5V           | $+25^{\circ}C$ |     | 180 |     | V/ $\mu s$ |
| Gain Bandwidth Product         | GBP             |                                                | 5V           | $+25^{\circ}C$ |     | 220 |     | MHz        |
| Phase Margin                   | PM              |                                                | 5V           | $+25^{\circ}C$ |     | 62  |     | $^{\circ}$ |
| Output                         |                 |                                                |              |                |     |     |     |            |
| Voltage Output Swing From Rail | Swing           | $R_L=1k\Omega$                                 | 2.5V to 5.5V | FULL           |     | 20  |     | mV         |
| Output Current Source          | $I_{O\_SOURCE}$ | $V_{CC}=5V$                                    | 5V           | $+25^{\circ}C$ |     | 160 |     | mA         |
| Output Current Sink            | $I_{O\_SINK}$   | $V_{CC}=5V$                                    | 5V           | $+25^{\circ}C$ |     | 110 |     | mA         |

## 8 Typical Characteristics

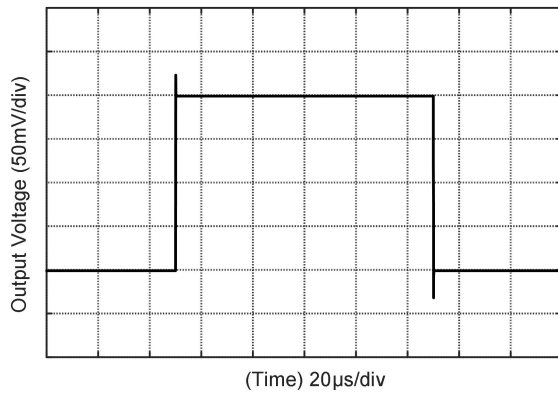
$V_{CC}=5V$ ,  $G=+2$ ,  $R_F=1K\Omega$ , and  $R_L=1K\Omega$  connected to  $V_{CC}/2$ ,  $V_{IN\_CM}=V_{CC}/2$ .  $T_A=+25^{\circ}C$ . (unless otherwise noted)



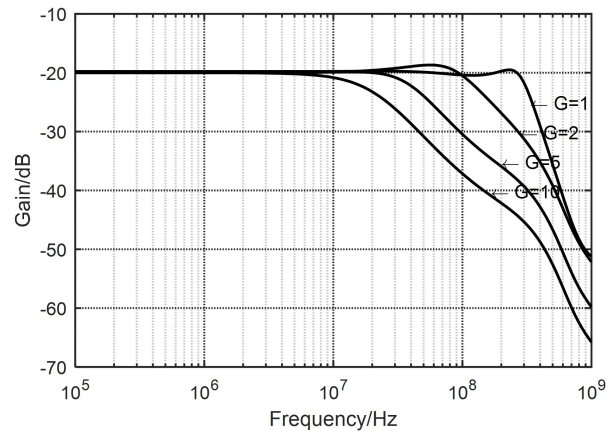
**Fig.8-1. IQ vs Temperature**



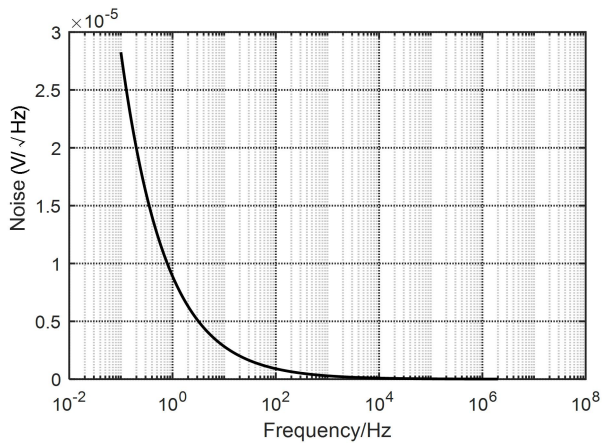
**Fig.8-2. Large Signal Response**



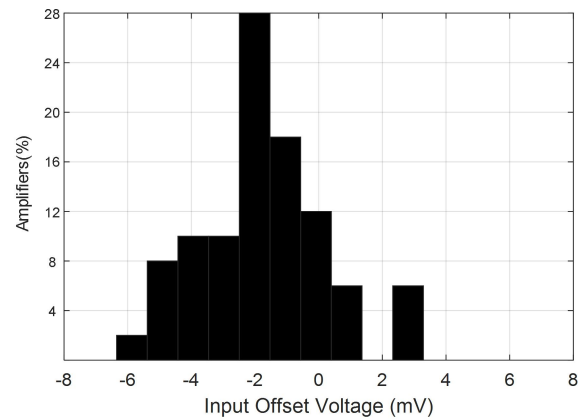
**Fig.8-3. Small Signal Response**



**Fig.8-4. Small Signal Frequency Response**



**Fig.8-5. Noise Response**



**Fig.8-6. Offset Voltage**

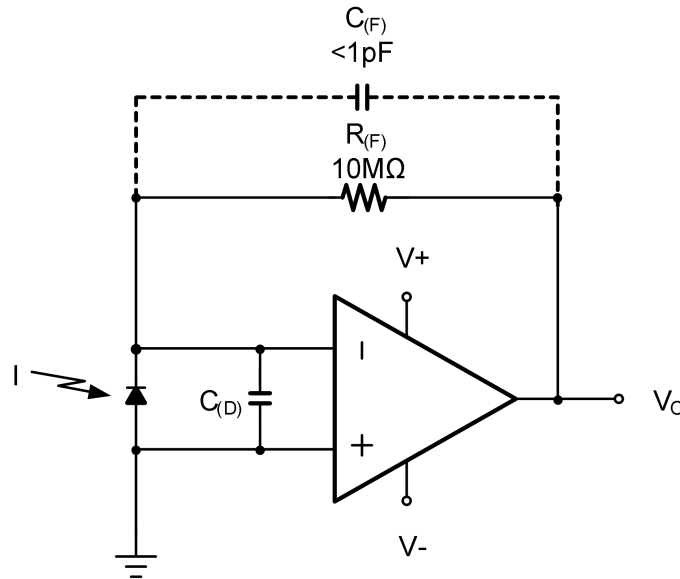
## **9 Detailed Description**

The GT805X is a CMOS, rail-to-rail output, high-speed, voltage feedback operational amplifier designed for video, high-speed, and other applications. It is available as a single, dual, or quad op amp. The amplifier features a 250-MHz gain bandwidth, and 180-V/ $\mu$ s slew rate.

A class AB output stage with common-source transistors achieves rail-to-rail output. For high-impedance loads ( $>200\Omega$ ), the output voltage swing is typically 20mV from the supply rails. With 10- $\Omega$  loads, a useful output swing is achieved while maintaining high open-loop gain.

## 10 Application Note

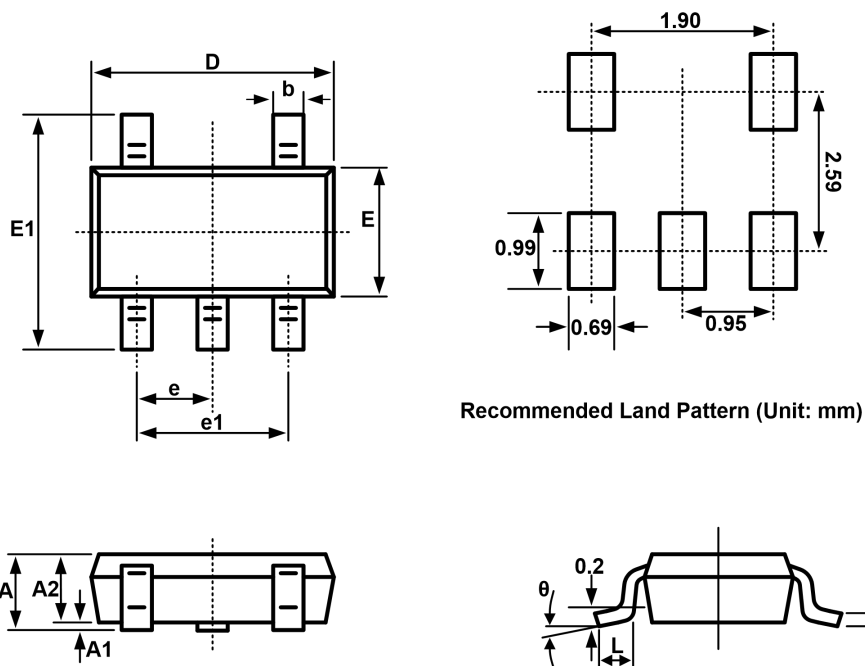
Wide gain bandwidth, low input bias current, low input voltage, and current noise make the GT805X family of devices an ideal wideband photodiode transimpedance amplifier. Low-voltage noise is important because photodiode capacitance causes the effective noise gain of the circuit to increase at high frequency. The key elements to a transimpedance design, as shown in Figure.10-1, are the expected diode capacitance, (which include the parasitic input common-mode and differential-mode input capacitance) the desired transimpedance gain, and the gain-bandwidth (GBW) for the GT805X family of devices (250MHz). With these three variables set the feedback capacitor value is set to control the frequency response. Feedback capacitance includes the stray capacitance, which is 0.2pF for a typical surface-mount resistor.



**Fig.10-1. Dual-Supply Amplifier**

# 11 Package Outline Dimension

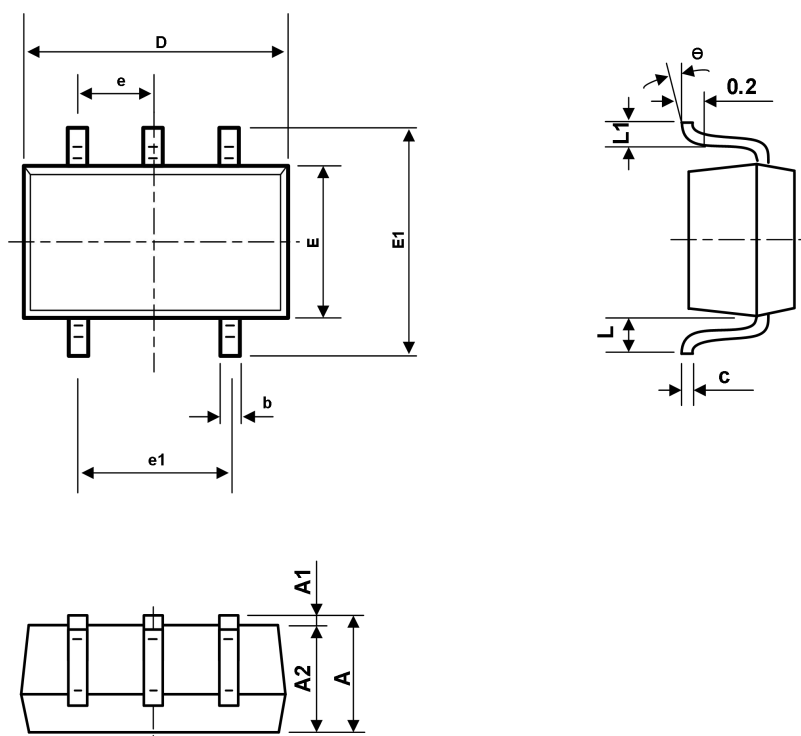
SOT23-5



| Symbol   | Dimensions in Millimeters |       | Dimensions in Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min.                      | Max.  | Min.                 | Max.  |
| A        | 1.050                     | 1.250 | 0.041                | 0.049 |
| A1       | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2       | 1.050                     | 1.150 | 0.041                | 0.045 |
| b        | 0.300                     | 0.500 | 0.012                | 0.020 |
| c        | 0.100                     | 0.200 | 0.004                | 0.008 |
| D        | 2.820                     | 3.020 | 0.111                | 0.119 |
| E        | 1.500                     | 1.700 | 0.059                | 0.067 |
| E1       | 2.650                     | 2.950 | 0.104                | 0.116 |
| e        | 0.950(BSC)                |       | 0.037(BSC)           |       |
| e1       | 1.800                     | 2.000 | 0.071                | 0.079 |
| L        | 0.300                     | 0.600 | 0.012                | 0.024 |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |

# 11 Package Outline Dimension(Continued)

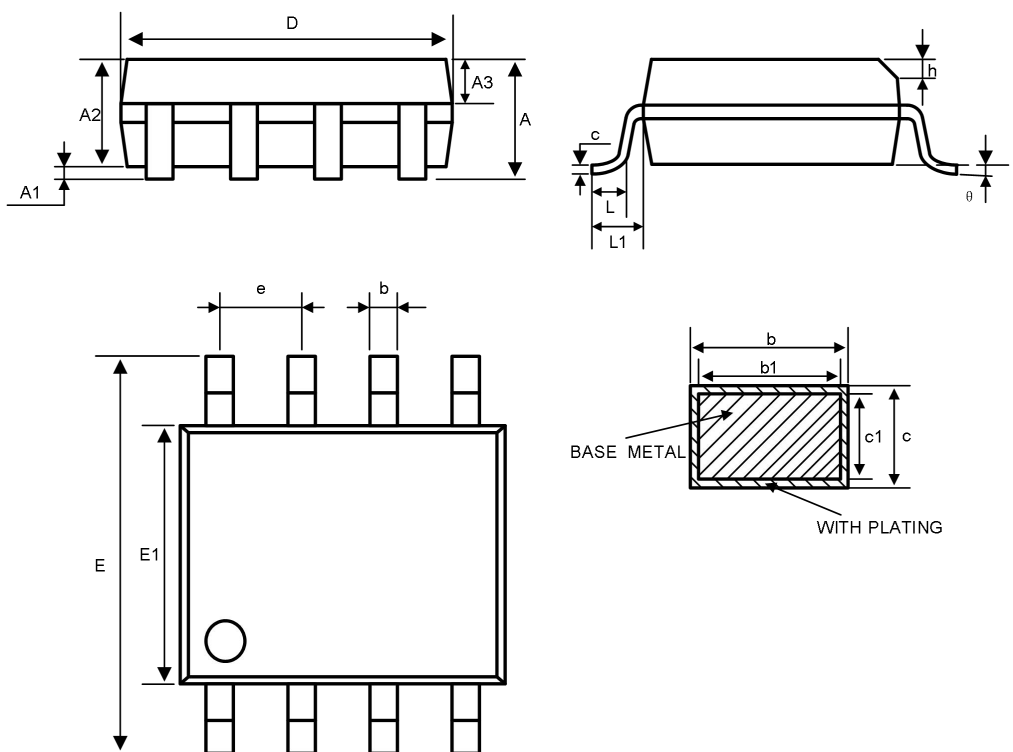
SC70-5



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 0.900                     | 1.100 | 0.035                | 0.043 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 0.900                     | 1.000 | 0.035                | 0.039 |
| b      | 0.150                     | 0.350 | 0.006                | 0.014 |
| c      | 0.110                     | 0.175 | 0.004                | 0.007 |
| D      | 2.000                     | 2.200 | 0.079                | 0.087 |
| E      | 1.150                     | 1.350 | 0.045                | 0.053 |
| E1     | 2.150                     | 2.450 | 0.085                | 0.096 |
| e      | 0.650TYP                  |       | 0.026TYP             |       |
| e1     | 1.200                     | 1.400 | 0.047                | 0.055 |
| L      | 0.525REF                  |       | 0.021REF             |       |
| L1     | 0.260                     | 0.460 | 0.010                | 0.018 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

# 11 Package Outline Dimension(Continued)

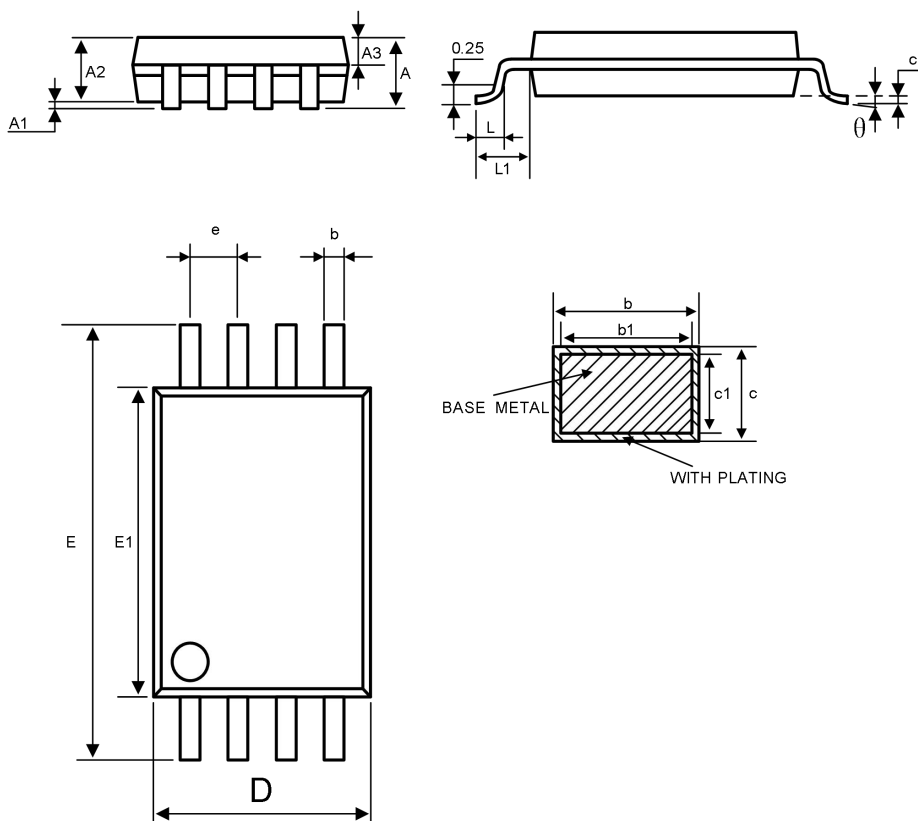
SOP8



| Symbol | Dimensions In Millimeters |       |       | Dimensions In Inches |       |       |
|--------|---------------------------|-------|-------|----------------------|-------|-------|
|        | Min                       | Nom   | Max   | Min                  | Nom   | Max   |
| A      | —                         | —     | 1.750 |                      |       | 0.069 |
| A1     | 0.100                     | —     | 0.225 | 0.004                |       | 0.009 |
| A2     | 1.300                     | 1.400 | 1.500 | 0.051                | 0.055 | 0.059 |
| A3     | 0.600                     | 0.650 | 0.700 | 0.024                | 0.026 | 0.028 |
| b      | 0.390                     | —     | 0.470 | 0.015                |       | 0.019 |
| b1     | 0.380                     | 0.410 | 0.440 | 0.015                | 0.016 | 0.017 |
| c      | 0.200                     | —     | 0.210 | 0.008                |       | 0.008 |
| c1     | 4.800                     | 4.900 | 5.000 | 0.189                | 0.193 | 0.197 |
| D      | 5.800                     | 6.000 | 6.200 | 0.228                | 0.236 | 0.244 |
| E      | 5.800                     | 6.000 | 6.200 | 0.228                | 0.236 | 0.244 |
| E1     | 3.800                     | 3.900 | 4.000 | 0.150                | 0.154 | 0.157 |
| e      | 1.270BSC                  |       |       | 0.050BSC             |       |       |
| h      | 0.250                     | —     | 0.500 | 0.010                |       | 0.020 |
| L      | 0.500                     | —     | 0.800 | 0.020                |       | 0.031 |
| L1     | 1.050REF                  |       |       | 0.041REF             |       |       |
| θ      | 0°                        | —     | 8°    | 0°                   | —     | 8°    |

# 11 Package Outline Dimension(Continued)

## TSSOP8

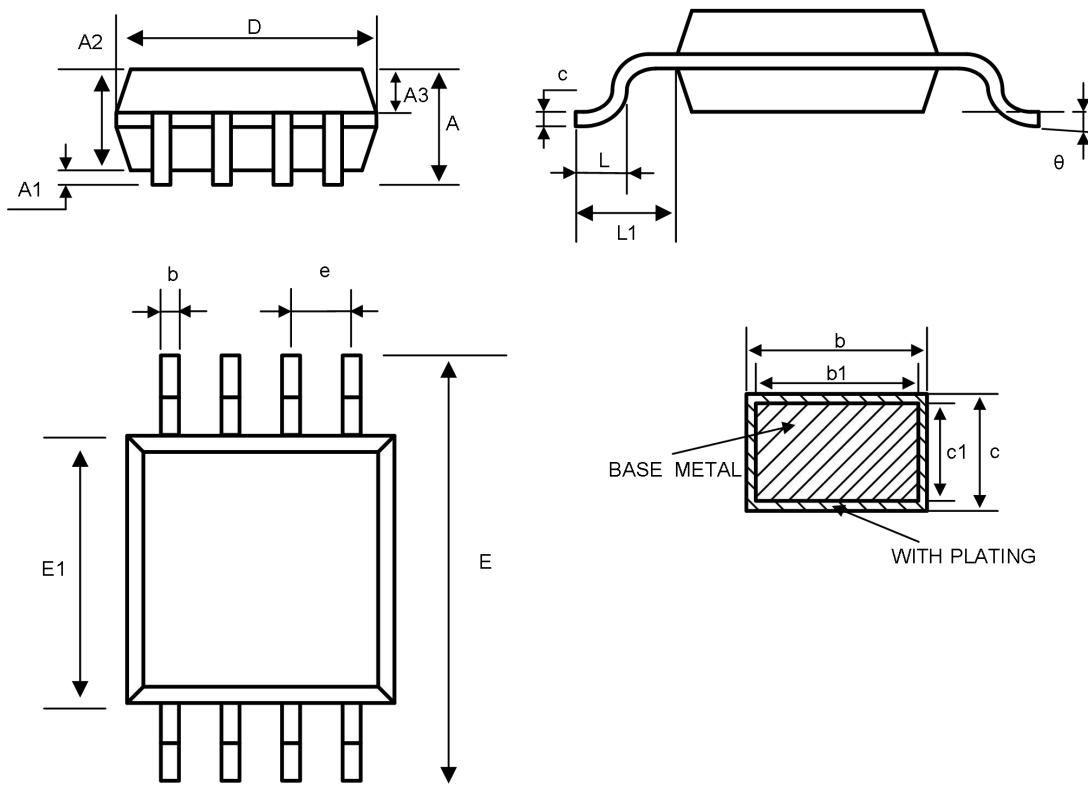


| Symbol   | Dimensions In Millimeters |       |       | Dimensions In Inches |       |       |
|----------|---------------------------|-------|-------|----------------------|-------|-------|
|          | Min                       | Nom   | Max   | Min                  | Nom   | Max   |
| A        | —                         | —     | 1.200 | —                    | —     | 0.047 |
| A1       | 0.050                     | —     | 0.150 | 0.002                | —     | 0.06  |
| A2       | 0.900                     | 1.000 | 1.050 | 0.035                | 0.039 | 0.041 |
| A3       | 0.390                     | 0.440 | 0.490 | 0.015                | 0.017 | 0.019 |
| b        | 0.200                     | —     | 0.280 | 0.008                | —     | 0.011 |
| b1       | 0.190                     | 0.220 | 0.250 | 0.007                | 0.009 | 0.010 |
| c        | 0.130                     | —     | 0.170 | 0.005                | —     | 0.007 |
| c1       | 0.120                     | 0.130 | 0.140 | 0.005                | 0.005 | 0.005 |
| D        | 2.900                     | 3.000 | 3.100 | 0.114                | 0.118 | 0.122 |
| E1       | 4.300                     | 4.400 | 4.500 | 0.169                | 0.173 | 0.177 |
| E        | 6.200                     | 6.400 | 6.600 | 0.244                | 0.252 | 0.260 |
| e        | 0.650BSC                  |       |       | 0.026BSC             |       |       |
| L        | 0.450                     | —     | 0.750 | 0.018                | —     | 0.030 |
| L1       | 1.000REF                  |       |       | 0.039REF             |       |       |
| $\theta$ | 0°                        | —     | 8°    | 0°                   | —     | 8°    |



# 11 Package Outline Dimension(Continued)

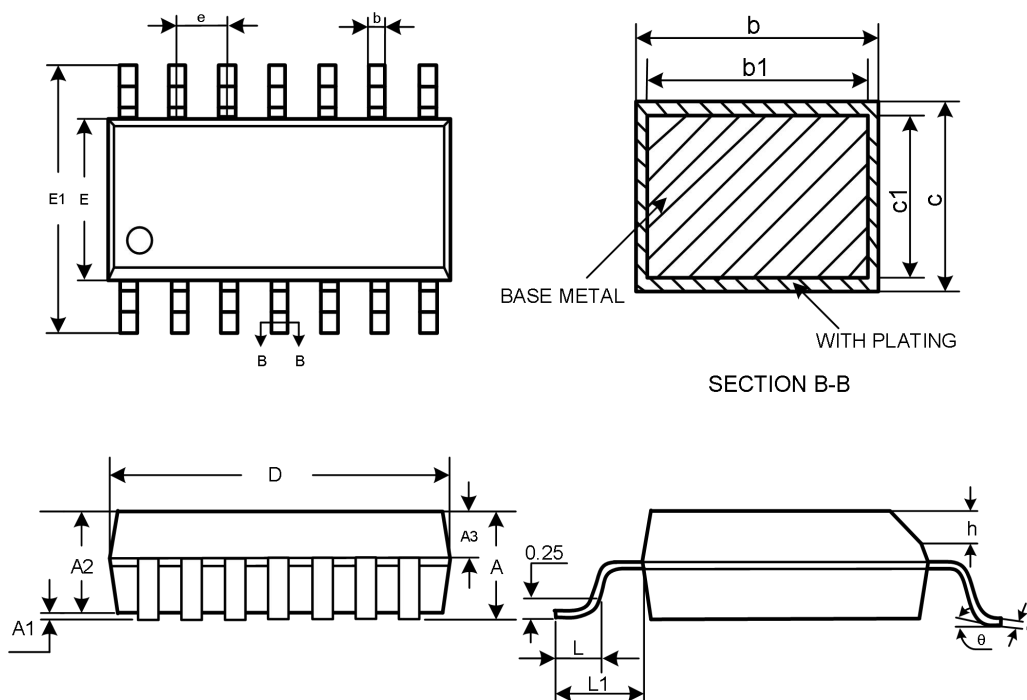
## MSOP8



| Symbol   | Dimensions In Millimeters |       |       | Dimensions In Inches |       |       |
|----------|---------------------------|-------|-------|----------------------|-------|-------|
|          | Min                       | Nom   | Max   | Min                  | Nom   | Max   |
| A        | —                         | —     | 1.100 | —                    | —     | 0.043 |
| A1       | 0.050                     | —     | 0.150 | 0.002                | —     | 0.006 |
| A2       | 0.750                     | 0.850 | 0.950 | 0.030                | 0.033 | 0.037 |
| A3       | 0.300                     | 0.350 | 0.400 | 0.012                | 0.014 | 0.016 |
| b        | 0.280                     | —     | 0.360 | 0.011                | —     | 0.014 |
| b1       | 0.270                     | 0.300 | 0.330 | 0.011                | 0.012 | 0.013 |
| c        | 0.150                     | —     | 0.190 | 0.006                | —     | 0.007 |
| c1       | 0.140                     | 0.150 | 0.160 | 0.006                | 0.006 | 0.006 |
| D        | 2.900                     | 3.000 | 3.100 | 0.114                | 0.118 | 0.122 |
| E        | 4.700                     | 4.900 | 5.100 | 0.185                | 0.193 | 0.201 |
| E1       | 2.900                     | 3.000 | 3.100 | 0.114                | 0.118 | 0.122 |
| e        | 0.650BSC                  |       |       | 0.026BSC             |       |       |
| L        | 0.400                     | —     | 0.700 | 0.016                | —     | 0.028 |
| L1       | 0.950REF                  |       |       | 0.037REF             |       |       |
| $\theta$ | 0°                        | —     | 8°    | 0°                   | —     | 8°    |

# 11 Package Outline Dimension(Continued)

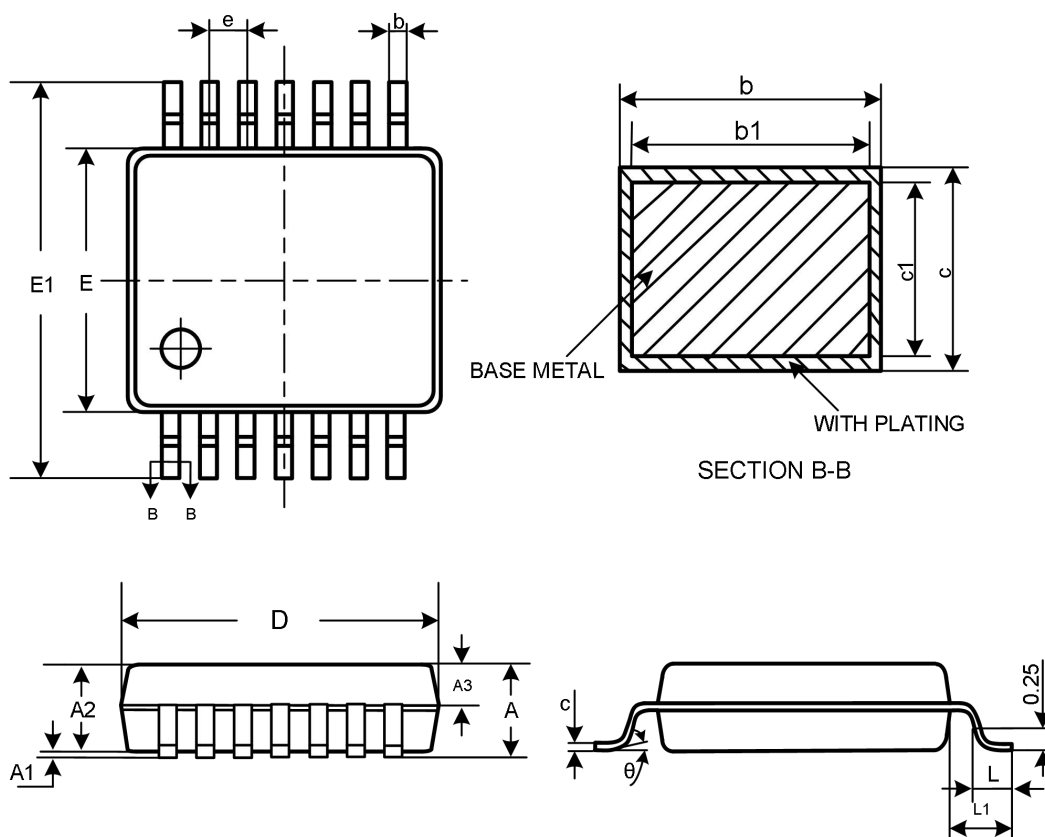
## SOP14



| Symbol | Dimensions in Millimeters |      |       | Dimensions in Inches |       |       |
|--------|---------------------------|------|-------|----------------------|-------|-------|
|        | Min                       | Nom  | Max   | Min                  | Nom   | Max   |
| A      | —                         | —    | 1.75  | —                    | —     | 0.069 |
| A1     | 0.10                      | —    | 0.225 | 0.004                | —     | 0.009 |
| A2     | 1.30                      | 1.40 | 1.50  | 0.051                | 0.055 | 0.059 |
| A3     | 0.60                      | 0.65 | 0.70  | 0.024                | 0.026 | 0.028 |
| b      | 0.39                      | —    | 0.47  | 0.015                | —     | 0.019 |
| b1     | 0.38                      | 0.41 | 0.44  | 0.015                | 0.016 | 0.017 |
| c      | 0.20                      | —    | 0.24  | 0.008                | —     | 0.009 |
| c1     | 0.19                      | 0.20 | 0.21  | 0.007                | 0.008 | 0.008 |
| D      | 8.55                      | 8.65 | 8.75  | 0.337                | 0.341 | 0.344 |
| E1     | 5.80                      | 6.00 | 6.20  | 0.228                | 0.236 | 0.244 |
| E      | 3.80                      | 3.90 | 4.00  | 0.150                | 0.154 | 0.157 |
| e      | 1.27BSC                   |      |       | 0.05BSC              |       |       |
| h      | 0.25                      | —    | 0.50  | 0.010                | —     | 0.020 |
| L      | 0.50                      | —    | 0.80  | 0.020                | —     | 0.031 |
| L1     | 1.05REF                   |      |       | 0.041REF             |       |       |
| θ      | 0                         | —    | 8°    | 0                    | —     | 8°    |

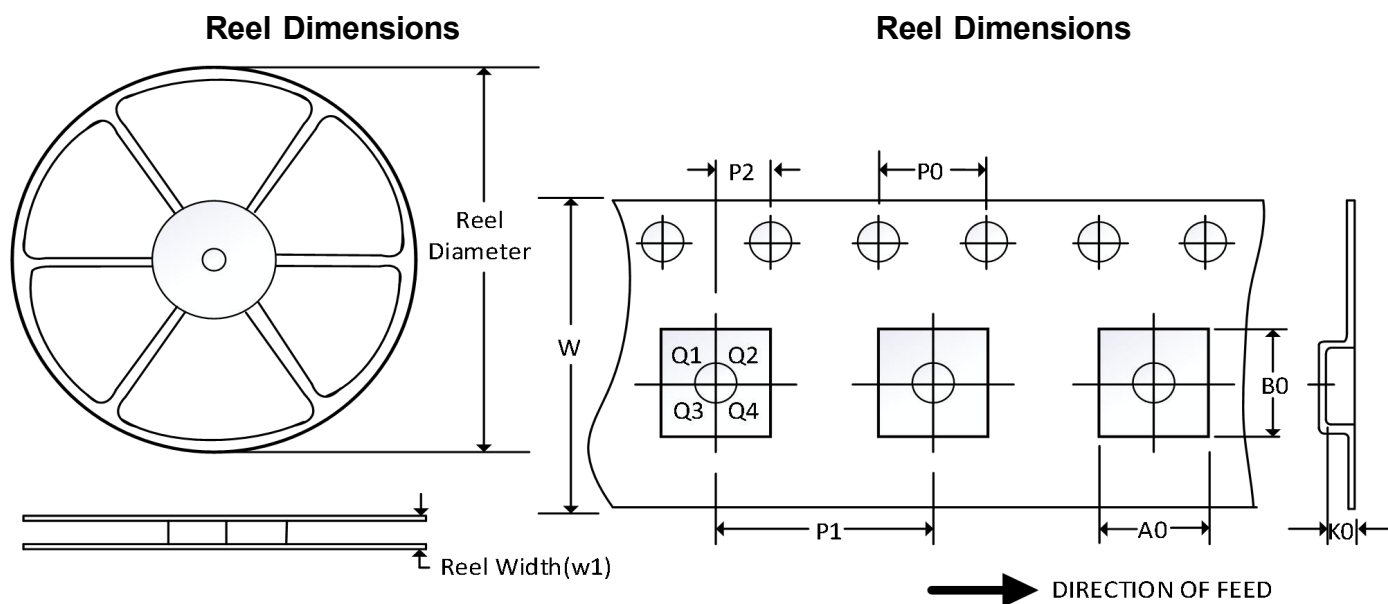
# 11 Package Outline Dimension(Continued)

## TSSOP14



| Symbol   | Dimensions in Millimeters |      |      | Dimensions in Inches |       |       |
|----------|---------------------------|------|------|----------------------|-------|-------|
|          | Min                       | Nom  | Max  | Min                  | Nom   | Max   |
| A        | —                         | —    | 1.20 | —                    | —     | 0.047 |
| A1       | 0.05                      | —    | 0.15 | 0.002                | —     | 0.006 |
| A2       | 0.90                      | 1.00 | 1.05 | 0.035                | 0.039 | 0.041 |
| A3       | 0.39                      | 0.44 | 0.49 | 0.015                | 0.017 | 0.019 |
| b        | 0.20                      | —    | 0.28 | 0.008                | —     | 0.011 |
| b1       | 0.19                      | 0.22 | 0.25 | 0.007                | 0.009 | 0.010 |
| c        | 0.13                      | —    | 0.17 | 0.005                | —     | 0.007 |
| c1       | 0.12                      | 0.13 | 0.14 | 0.005                | 0.005 | 0.006 |
| D        | 4.90                      | 5.00 | 5.10 | 0.193                | 0.197 | 0.201 |
| E        | 4.30                      | 4.40 | 4.50 | 0.169                | 0.173 | 0.177 |
| E1       | 6.20                      | 6.40 | 6.60 | 0.244                | 0.252 | 0.260 |
| e        | 0.65BSC                   |      |      | 0.026BSC             |       |       |
| L        | 0.45                      | 0.60 | 0.75 | 0.018                | 0.024 | 0.030 |
| L1       | 1.00BCS                   |      |      | 0.039BSC             |       |       |
| $\theta$ | 0                         | —    | 8°   | 0                    | —     | 8°    |

## 12 Tape and Reel Information



NOTE: The picture is only for reference. Please make the object as the standard.

### Key Parameter List of Tape and Reel

| Package Type | Reel Diameter | Reel Width (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|--------------|---------------|-----------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| SOT23-5      | 7"            | 9.5             | 3.20    | 3.20    | 1.40    | 4.0     | 4.0     | 2.0     | 8.0    | Q3            |
| SC70-5       | 7"            | 9.5             | 2.25    | 2.55    | 1.20    | 4.0     | 4.0     | 2.0     | 8.0    | Q3            |
| MSOP8        | 13"           | 12.4            | 5.20    | 3.30    | 1.50    | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |
| TSSOP14      | 13"           | 12.4            | 6.95    | 5.60    | 1.20    | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |
| SOP8         | 13"           | 12.4            | 6.40    | 5.40    | 2.10    | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |
| SOP14        | 13"           | 16.4            | 6.60    | 9.30    | 2.10    | 4.0     | 8.0     | 2.0     | 16.0   | Q1            |
| TSSOP8       | 13"           | 12.4            | 6.90    | 3.45    | 1.65    | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |

NOTE:

1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.