

## Features

- General Purpose, Low Cost
- Gain Bandwidth Product: 6MHz
- Input Offset Voltage: 2 $\mu$ V (Typ)
- Ultra Low Noise: 6nV/ $\sqrt{\text{Hz}}$  at 1kHz
- Zero Drift: 0.03 $\mu$ V/ $^{\circ}\text{C}$  (Typ)
- Input Bias Current: 500pA
- Rail-to-Rail Input and Output
- Single or Dual Supply Operation
- Supply Voltage Range: 2V to 5.5V
- Operating Temperature: -50 $^{\circ}\text{C}$  ~ +125 $^{\circ}\text{C}$
- Type Package:SOP-8

## Applications

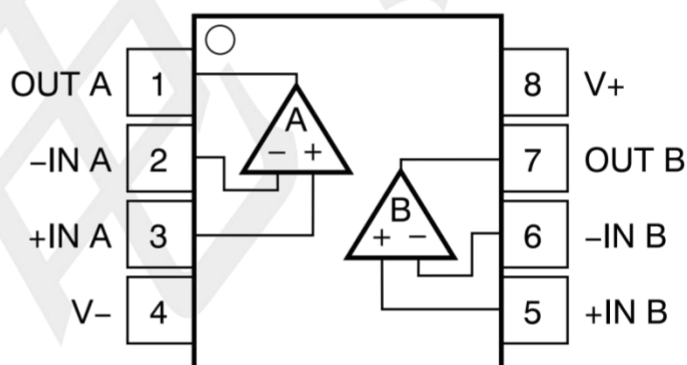
- Temperature Sensors
- Battery-Powered Instruments
- Smoke/Gas/Environment Sensors
- Medical Equipment
- Portable Instruments and Mobile Device
- Active Filters
- Piezo Electrical Transducer Amplifier
- Sensor Interface
- Handheld Test Equipment

## General Description

The OPA2376 family represents a new generation of low-noise operational amplifiers, offering outstanding dc precision and ac performance. Rail-to-Rail input and output, low offset (2 $\mu$ V), low noise (6nV/ $\sqrt{\text{Hz}}$ ), quiescent current of 600  $\mu$ A, and a 6-MHz bandwidth make this part very attractive for a variety of precision and portable applications.

In addition, this device has a reasonably wide supply range (2V to 5.5V) with excellent PSRR, making it attractive for applications that run directly from batteries without regulation.

## Pinout (top view)



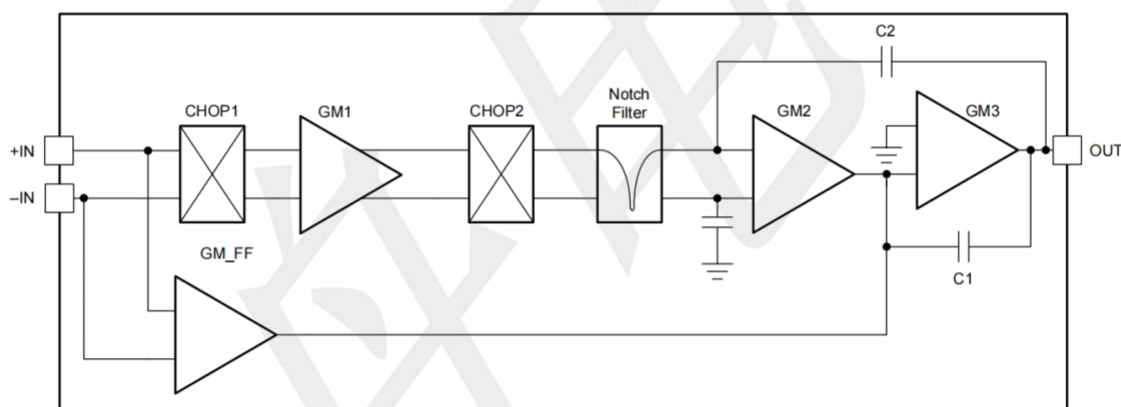
## Pin Configurations

| Pin Number | Pin Name | Pin Function                      |
|------------|----------|-----------------------------------|
| 1          | OUT A    | Output A                          |
| 2          | -IN A    | Reverse input A                   |
| 3          | +IN A    | In-phase input A                  |
| 4          | -V       | Chip Supply Voltage(Negative)/GND |
| 5          | +IN B    | In-phase input B                  |
| 6          | -IN B    | Reverse input B                   |
| 7          | OUT B    | Output B                          |
| 8          | +V       | Chip Supply Voltage(Positive)/VDD |

## Absolute Maximum Ratings (@TA = +25°C, unless otherwise specified.)

| Condition  |                                       | Rating            | UNIT |
|------------|---------------------------------------|-------------------|------|
| VDD to GND | Power Supply Voltage                  | 6V                | V    |
| IN+ or IN- | Signal Input Terminals Voltage        | GND-0.5V~VDD+0.5V | V    |
| IN+ or IN- | Signal Input Terminals Current        | -10~ +10          | mA   |
| OUT to GND | Output Short-Circuit                  | Continuous        | mA   |
| TJ         | Junction Temperature                  | 150               | °C   |
| LT         | Lead Temperature (Soldering, 10 sec.) | 260               | °C   |
| TA         | Operating Temperature Range           | -55      150      | °C   |
| Tstg       | Storage Temperature Range             | -65      150      | °C   |
| V(ESD)     | Human body model (HBM)                | ±4000             | V    |
| V(ESD)     | Charged-device model (CDM)            | ±500              | V    |

## BLOCK DIAGRAM



## Power Supply Bypassing

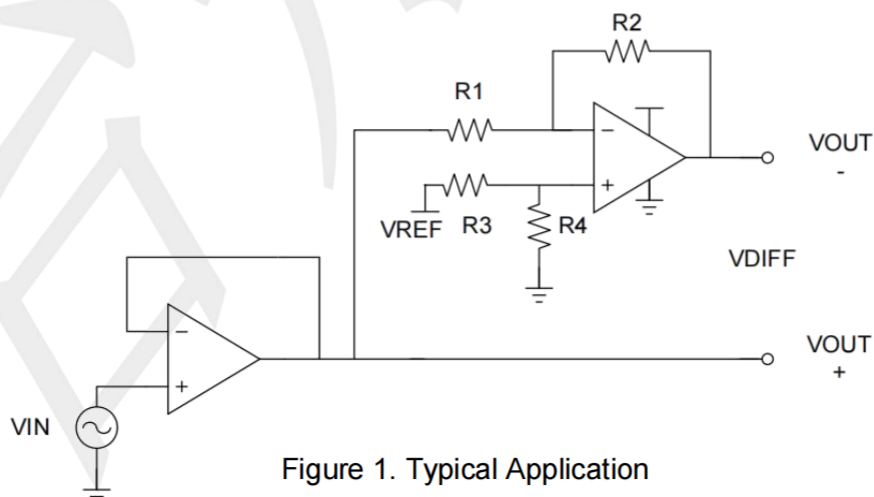


Figure 1. Typical Application

## Electrical Characteristics

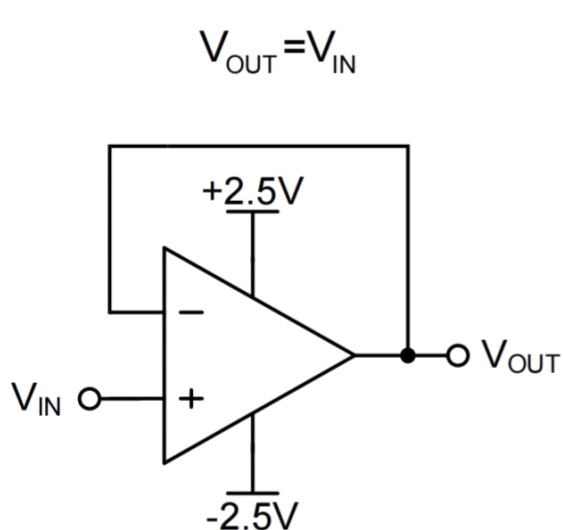
(At  $T_A = +25^\circ\text{C}$ ,  $V_S = +5\text{V}$ ,  $V_{IN} = 0\text{V}$ , unless otherwise noted.)

| PARAMETER                        | SYMBOL       | TEST Conditions                                                      | MIN     | TYP        | MAX          | UNIT                         |
|----------------------------------|--------------|----------------------------------------------------------------------|---------|------------|--------------|------------------------------|
| Supply-Voltage Range             | $V_{DD}$     | Single-supply                                                        | 2       | --         | 5.5          | V                            |
|                                  |              | Dual-supply                                                          | $\pm 1$ | --         | $\pm 2.75$   | V                            |
| Quiescent Current/Amplifier      | $I_Q$        | $I_O = 0\text{A}$                                                    | --      | 600        | 700          | $\mu\text{A}$                |
| Input Offset Voltage             | $V_{OS}$     |                                                                      | --      | 2          | 10           | $\mu\text{V}$                |
| Input Offset Voltage Tempco      | $dV_{OS}/dT$ | $T_A = -55^\circ\text{C}$ to $125^\circ\text{C}$                     | --      | 0.03       | --           | $\mu\text{V}/^\circ\text{C}$ |
| Input Bias Current               | $I_B$        | ( 2 )                                                                | --      | 500        | --           | PA                           |
| Input Offset Current             | $I_{OS}$     | ( 2 )                                                                | --      | 50         | --           | PA                           |
| Common-Mode Voltage Range        | $V_{CM}$     |                                                                      | GND-0.1 | --         | $V_{DD}+0.1$ | V                            |
| Common-Mode Rejection Ratio      | CMRR         | $V_{CM}=0.1\text{V}$ to $4\text{V}$                                  | 110     | 130        | --           | dB                           |
| Power-Supply Rejection Ratio     | PSRR         | $V_S=1.5\text{V}$ to $5.5\text{V}$                                   | 110     | 130        | --           | dB                           |
| Open-Loop Voltage Gain           | $A_v$        | $V_{OUT}=0.1\text{V}$ to $4.9\text{V}$ ,<br>$R_L=10\text{k}\Omega$   | 135     | 150        | --           | dB                           |
| High output voltage swing        | $V_{OH}$     | $R_L=10\text{k}\Omega$                                               | --      | 10         | 20           | mV                           |
|                                  |              | $R_L=2\text{k}\Omega$                                                | --      | 50         | 60           | mV                           |
| Low output voltage swing         | $V_{OL}$     | $R_L=10\text{k}\Omega$                                               | --      | 10         | 20           | mV                           |
|                                  |              | $R_L=2\text{k}\Omega$                                                | --      | 35         | 45           | mV                           |
| Capacitive Load Drive            | $C_{L(3)}$   | $G = +1$ , $V_{IN}=2\text{V}$ Step                                   | --      | --         | 560          | pF                           |
| Output Short-Circuit Current     | $I_{SC}$     | Source current                                                       | --      | 30         | --           | mA                           |
|                                  |              | Sink current                                                         | --      | 65         | --           | mA                           |
| Gain Bandwidth Product           | GBW          | $C_L=100\text{pF}$                                                   | --      | 6          | --           | MHz                          |
| Slew Rate                        | SR           | $G = +1$ , $V_{IN}=4\text{V}$ Step                                   | --      | 5          | --           | $\text{V}/\mu\text{s}$       |
| Settling Time to 0.1%            | $t_s$        | $G = +1$ , $V_{IN}=4\text{V}$ Step                                   | --      | 0.7        | --           | $\mu\text{s}$                |
| Total Harmonic Distortion +Noise | THD+N        | $G=1$ , $V_O=1V_{RMS}$ ,<br>$f=1\text{kHz}$ , $R_L=10\text{k}\Omega$ | --      | 0.00<br>04 | --           | %                            |
| Input Voltage Noise              | $V_N$        | $f=0.1\text{Hz}$ to $10\text{Hz}$                                    | --      | 0.3        | --           | $\mu\text{V}_{PP}$           |
| Input Voltage Noise PSD          | $e_n$        | $f=1\text{kHz}$                                                      | --      | 6          | --           | $\text{nV}/\sqrt{\text{Hz}}$ |
| Specified temperature            |              |                                                                      | -50     | --         | 125          | $^\circ\text{C}$             |

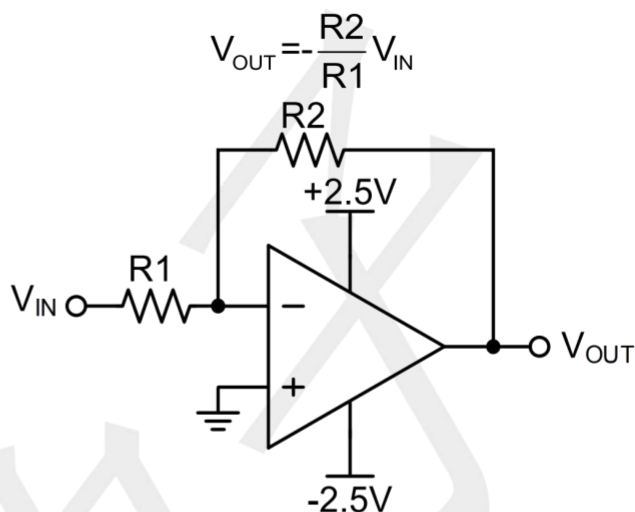
### Notes:

- 1: All devices are 100% production tested at  $T_A = +25^\circ\text{C}$ ; range is guaranteed by design, not production tested.
- 2: Parameter is guaranteed by design.
- 3: Capacitive load drive means that above a given maximum value, the output waveform will oscillate under the step response.

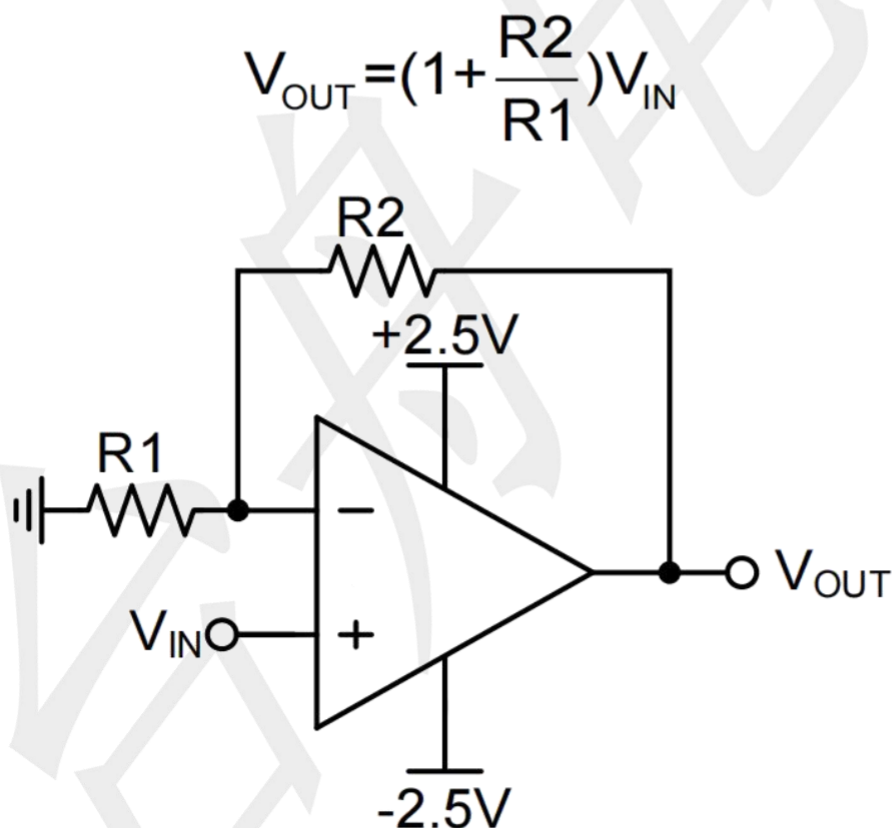
## Typical Application Circuit



**Voltage Follower**



**Inverting Proportional Amplifier**



**Noninverting Proportional Amplifier**

## Typical Performance Characteristics (@TA = +25°C, unless otherwise specified.)

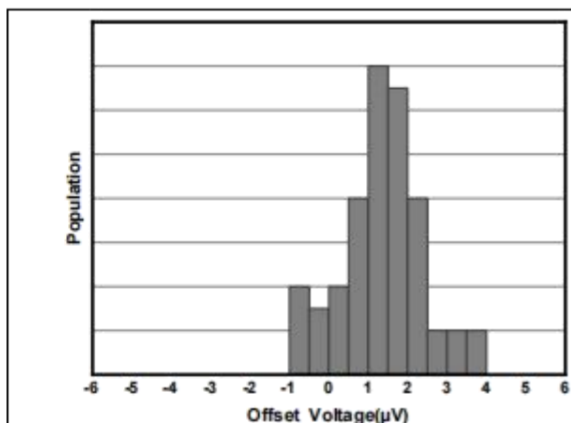


Figure 2. Offset Voltage Production Distribution

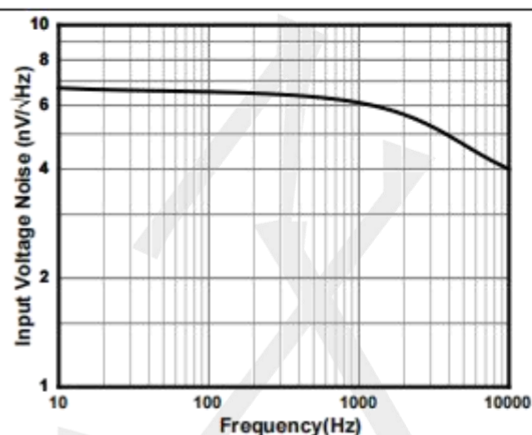


Figure 3. Input Voltage Noise Spectral Density

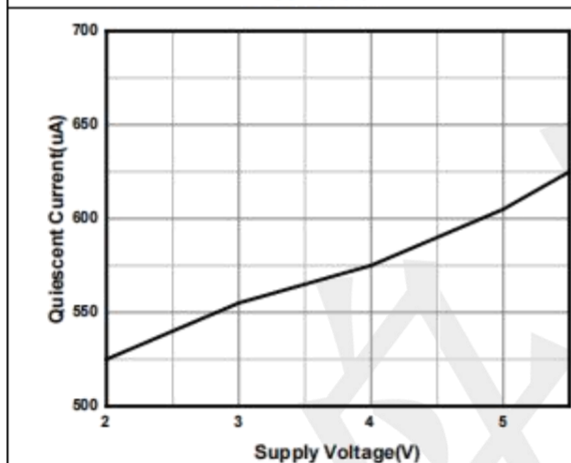


Figure 4. Quiescent Current vs Supply Voltage

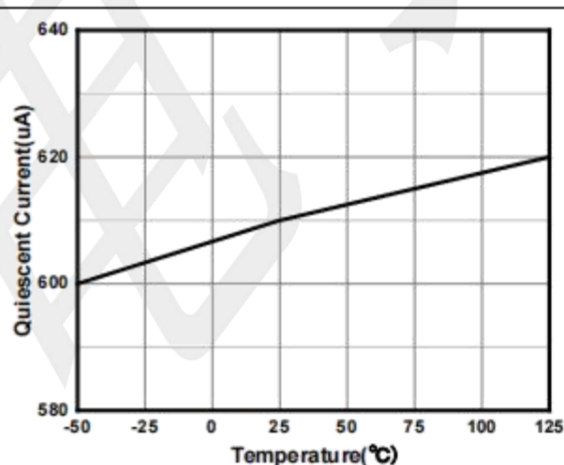


Figure 5. Quiescent Current vs Temperature

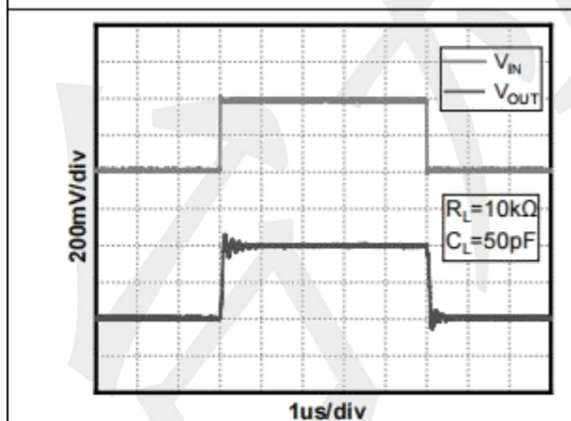


Figure 6. Small-Signal Step Response( $V_S=5V$ )

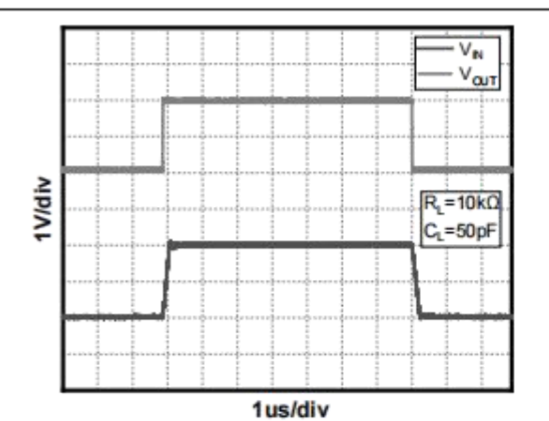
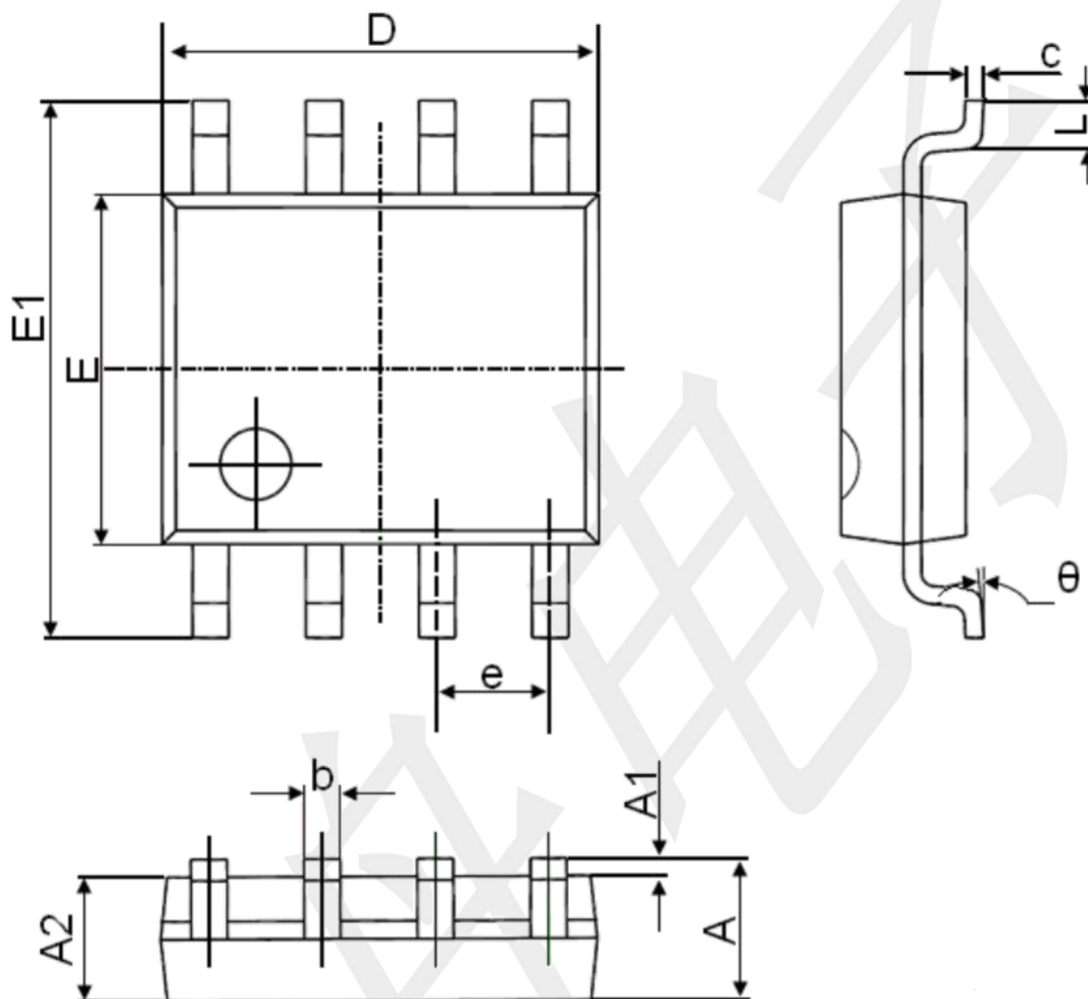


Figure 7. Large-Signal Step Response( $V_S=5V$ )

## Package information (Unit: mm)

### SOP-8



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 1.350                     | 1.750 | 0.053                | 0.069 |
| A1     | 0.100                     | 0.250 | 0.004                | 0.010 |
| A2     | 1.350                     | 1.550 | 0.053                | 0.061 |
| b      | 0.330                     | 0.510 | 0.013                | 0.020 |
| c      | 0.170                     | 0.250 | 0.006                | 0.010 |
| D      | 4.700                     | 5.100 | 0.185                | 0.200 |
| E      | 3.800                     | 4.000 | 0.150                | 0.157 |
| E1     | 5.800                     | 6.200 | 0.228                | 0.244 |
| e      | 1.270(BSC)                |       | 0.050(BSC)           |       |
| L      | 0.400                     | 1.270 | 0.016                | 0.050 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |