GLOBALTECH SEMICONDUCTOR

GS324

# Low Power QUAD Operational Amplifiers

## Product Description

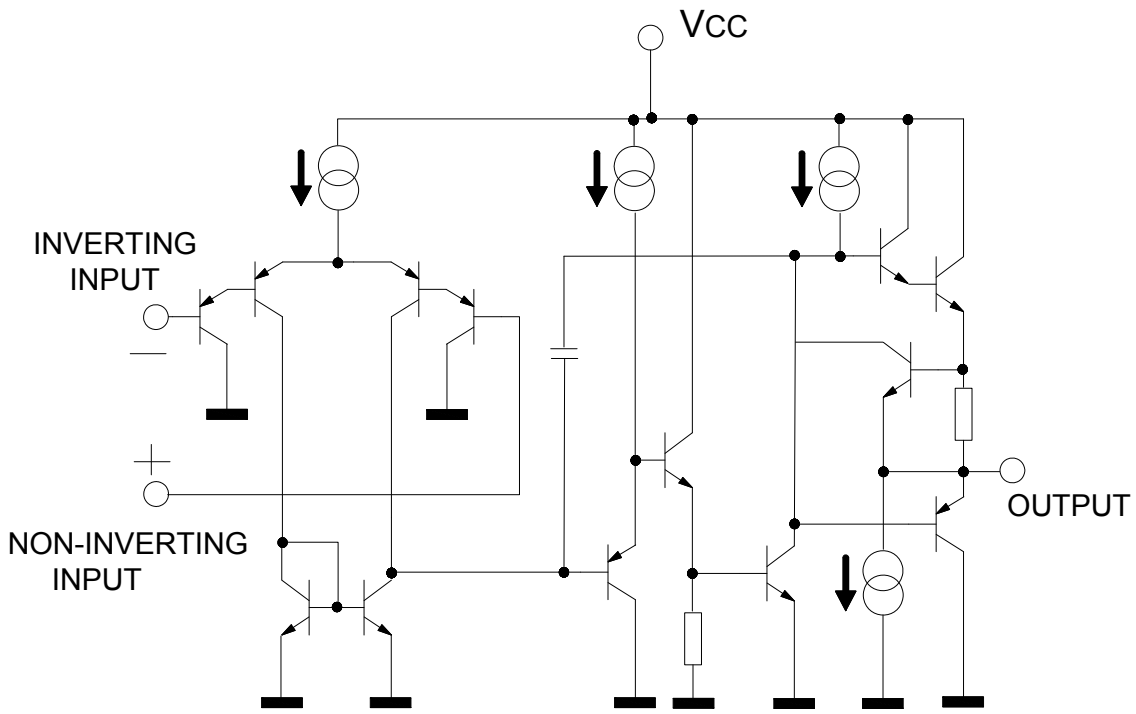
The GS324 consists of four independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drains in independent of the magnitude of the power supply voltage.

Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits, which now can be more easily implemented in single power supply systems. For example, the GS324 can be directly operated off of the standard +5V power supply voltage which is used in digital systems and will easily provide the required interface electronics without requiring the additional ±15V power supplies.

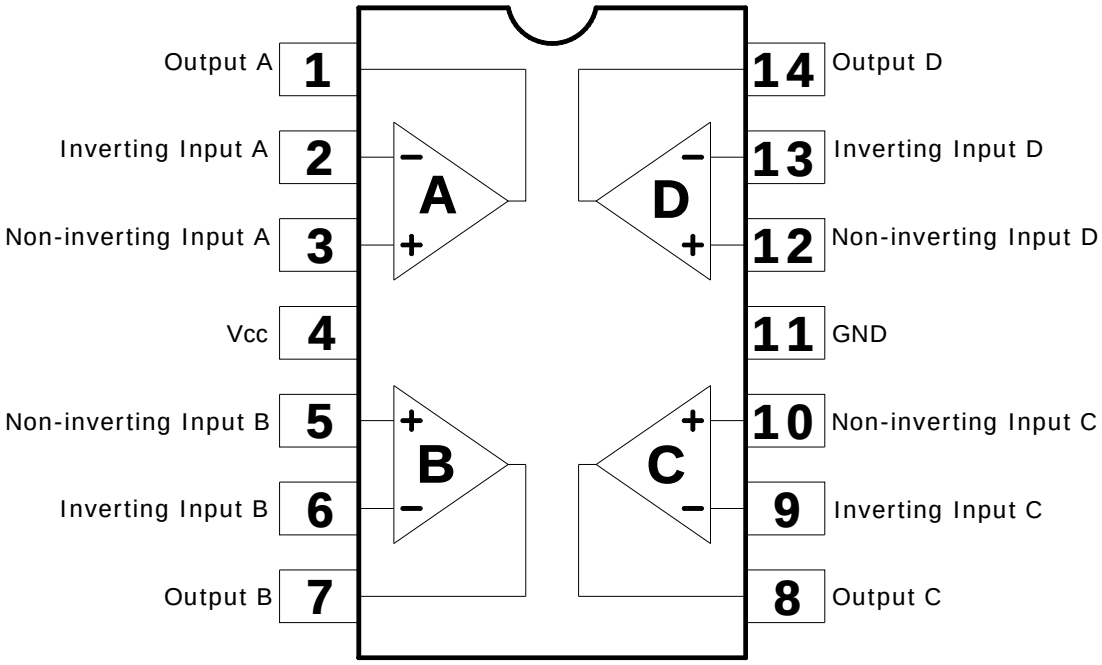
## Features

- Wide range of supply voltages 3V to 30V
- Low supply current drain independent of supply voltage 1.5mA TYP.
- Low input biasing current
- Low input offset voltage and offset current
- Input common-mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- DC voltage gain: 100V/mV TYP.
- Internally frequency compensation

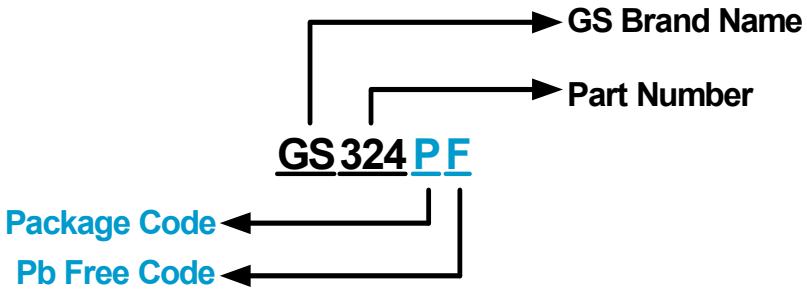
## Block Diagram



## Pin Assignments

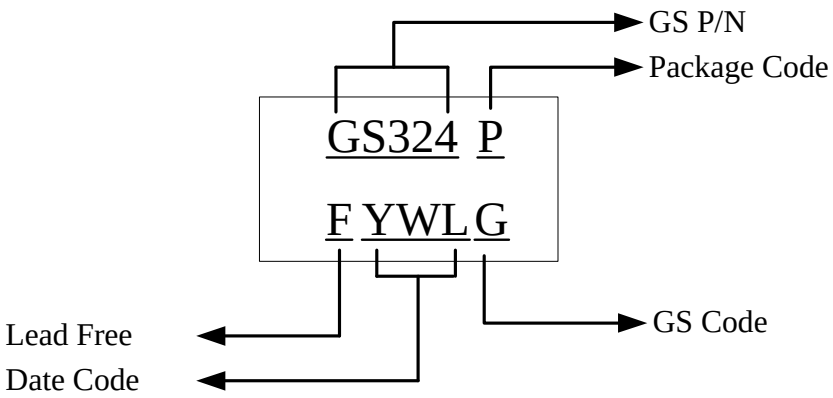



## Ordering Information




| Device | Package |
|---|---|
| GS324PF | DIP-14 |
| GS324SF | SOP-14 |

## Marking Information



## Absolute Maximum Ratings

| Parameter | Symbol | Value | | Unit |
|---|---|---|---|---|
| Single supply | $V_{CC}$ | 32 | | V |
| Split supply | $V_{CC}$, $V_{EE}$ | ±16 | | V |
| Input differential voltage range | $V_{IDR}$ | ±32 | | V |
| Output short-circuit to GND | $I_{OS}$ | Continuous | | |
| Junction temperature | $T_J$ | 150 | | °C |
| Storage temperature range | $T_{STG}$ | -65 to +150 | | °C |
| Operating ambient temperature range | $T_A$ | 0 to 70 | | °C |
| Junction to ambient Thermo Resistance | $\theta_{JA}$ | DIP-14 | 115 | °C/W |
| | | SOP-14 | 160 | |
| Junction to Case Thermo Resistance | $\theta_{JC}$ | DIP-14 | 41 | °C/W |
| | | SOP-14 | 23 | |
| ESD Rating (HBM) | ESD | 2K | | V |

## Electrical Characteristics

at specified free-air temperature, $V_{CC}$=5V (Unless Otherwise Noted)

| Parameter | Symbol | Test Conditions* | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Input offset voltage | $V_{IO}$ | $V_{CC}$=5V to Max.<br>$V_{IC}$=$V_{ICR}$ min, Vo=1.4V | 25℃ | | 3 | 7 | mV |
| | | | Full range | | | 9 | |
| Average temperature coefficient of input offset voltage | $\alpha V_{IO}$ | | Full range | | 7 | | μV/℃ |
| Input offset current | $I_{IO}$ | Vo=1.4V | 25℃ | | 2 | 50 | nA |
| | | | Full range | | | 150 | |
| Average temperature coefficient of input offset current | $\alpha I_{IO}$ | | Full range | | 10 | | pA/℃ |
| Input bias current | $I_{IB}$ | Vo=1.4V | 25℃ | | -20 | -250 | nA |
| | | | Full range | | | -500 | |
| Common-mode input voltage range | $V_{ICR}$ | $V_{CC}$ =5V to MAX | 25℃ | 0 to $V_{CC}$-1.5 | | | V |
| | | | Full range | 0 to $V_{CC}$-2 | | | |
| High-level output voltage | $V_{OH}$ | $R_L$≥2kΩ | 25℃ | $V_{CC}$ -1.5 | | | V |
| | | $V_{CC}$=MAX, $R_L$=2kΩ | Full range | 26 | | | |
| | | $V_{CC}$=MAX, $R_L$≥10kΩ | Full range | 27 | 28 | | |
| Low-level output voltage | $V_{OL}$ | $R_L$≥10kΩ | Full range | | 5 | 20 | mV |
| Large-signal differential voltage amplification | $A_{VD}$ | $V_{CC}$=15V<br>Vo=1V to 11V<br>$R_L$≥2kΩ | 25℃ | 25 | 100 | | V/mV |
| | | | Full range | 15 | | | |
| Common-mode rejection ratio | CMRR | $V_{CC}$=5V to MAX<br>$V_{IC}$=$V_{ICR}$ min | 25℃ | 65 | 80 | | dB |
| Supply voltage rejection ratio ($\Delta V_{CC}/\Delta V_{IO}$) | $K_{SVR}$ | $V_{CC}$=5V to MAX | 25℃ | 65 | 100 | | dB |
| Crosstalk attenuation | $V_{O1}/V_{O2}$ | f=1kHz to 20kHz | 25℃ | | 120 | | dB |
| Output current | Io | $V_{CC}$=15V,<br>$V_{ID}$=1V, Vo=0V | 25℃ | -20 | -30 | | mA |
| | | | Full range | -10 | | | |
| | | $V_{CC}$=15V<br>$V_{ID}$=-1V, Vo=15V | 25℃ | 10 | 20 | | |
| | | | Full range | 5 | | | |
| | | $V_{ID}$=-1V, Vo=200mV | 25℃ | 12 | 30 | | μA |

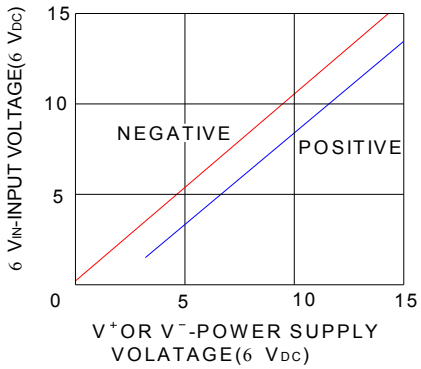
## Electrical Characteristics (Continue)

| Parameter | Symbol | Test Conditions* | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Short-circuit output current | $I_{OS}$ | $V_{CC}$ at 5V, GND at -5V, Vo=0V | 25℃ | | ±40 | ±60 | mA |
| Supply current (two amplifiers) | $I_{CC}$ | Vo=2.5V, No load | Full range | | 1.5 | 2.4 | mA |
| | | $V_{CC}$=MAX, Vo=0.5Vcc, No load | Full range | | 1.1 | 3 | |

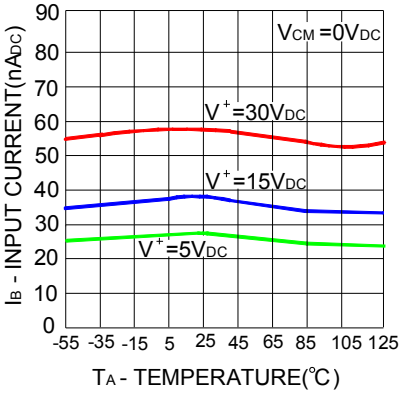
*All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. "MAX" $V_{CC}$ for testing Purposes is 30V. Full range is 0℃ to 70℃.

## Typical Performance Characteristics

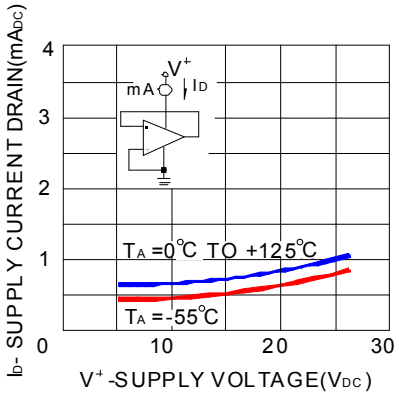
### Input Voltage Range



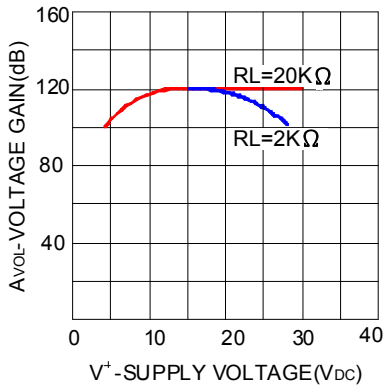

### Input Current



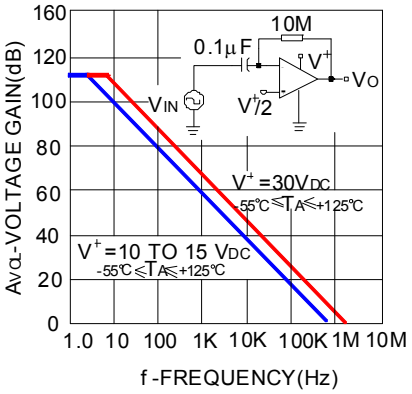

### Supply Current



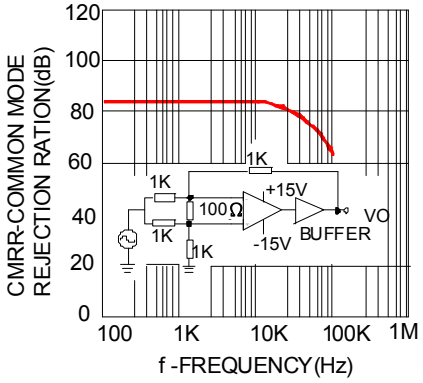

### Voltage Gain




### Open Loop Frequency Response

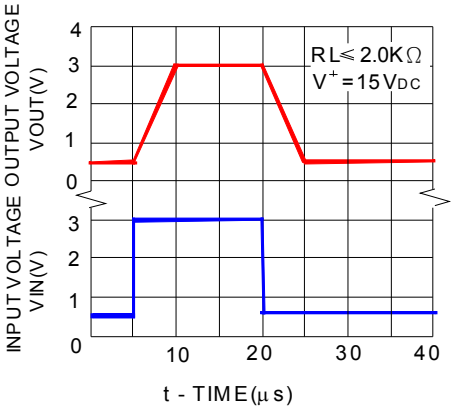



### Common Mode Rejection Ratio

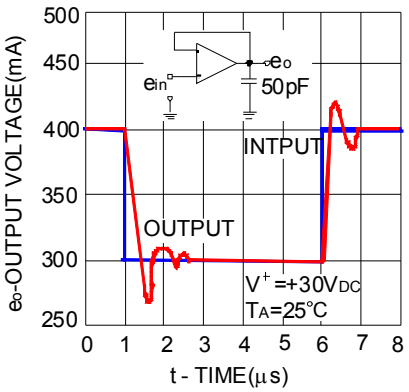


## Typical Performance Characteristics (Continue)

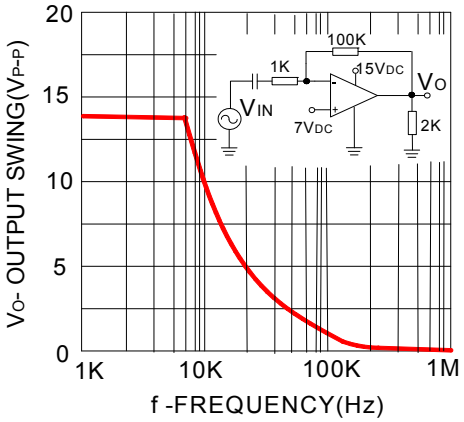
### Voltage Follower Pulse Response



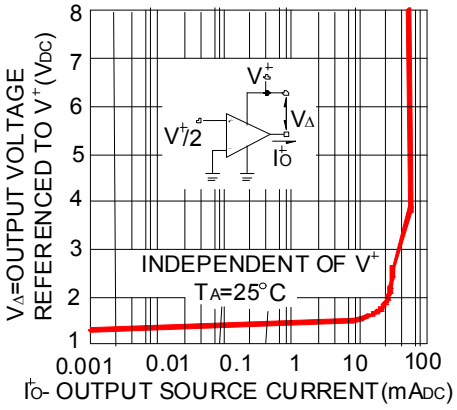

### Voltage Follower Pulse Response (Small Signal)



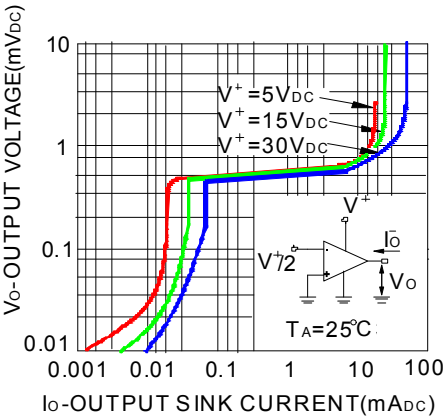

### Large Signal Frequency Response



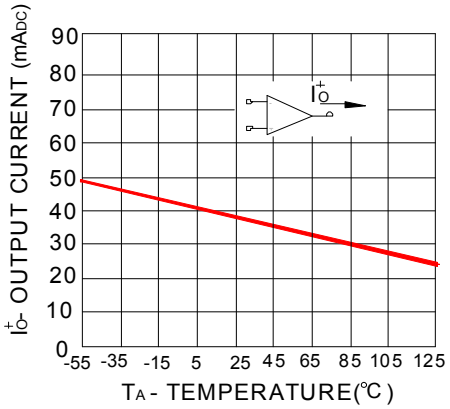

### Output Characteristics urrent Sourcing




### Output Characteristics Current Sinking

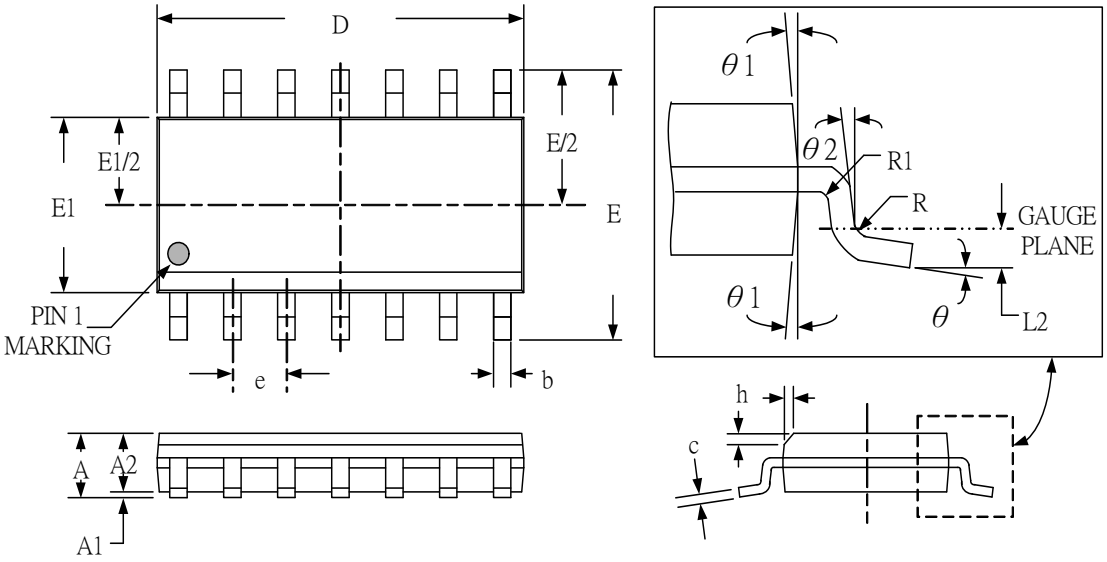



### Current Limiting



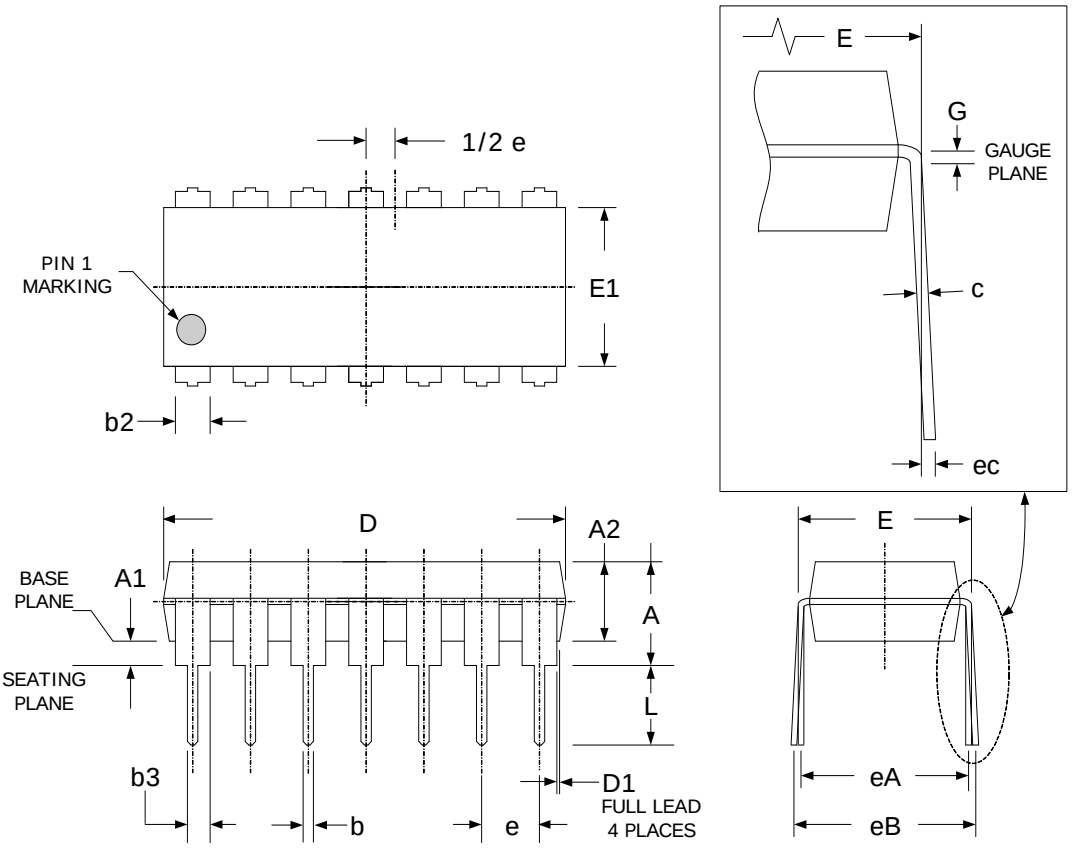
## Package Dimension

# SOP-14 PLASTIC PACKAGE




| Dimensions | | | | |
|---|---|---|---|---|
| SYMBOL | Millimeters | | Inches | |
| | MIN | MAX | MIN | MAX |
| A | 1.35 | 1.75 | .053 | .069 |
| A1 | 0.10 | 0.25 | .004 | .010 |
| A2 | 1.25 | 1.65 | .049 | .065 |
| b | 0.31 | 0.51 | .012 | .020 |
| b1 | 0.28 | 0.48 | .011 | .019 |
| c | 0.17 | 0.25 | .007 | .010 |
| D | 8.65 (TYP) | | .341 (TYP) | |
| E | 6.00 (TYP) | | .236 (TYP) | |
| E1 | 3.90 (TYP) | | .154 (TYP) | |
| e | 1.27 (TYP) | | .050 (TYP) | |
| L | 0.40 | 1.27 | .016 | .050 |
| L1 | 1.04 (TYP) | | .041 (TYP) | |
| L2 | 0.25 (TYP) | | .010 (TYP) | |
| R | 0.07 | - | .003 | - |
| R1 | 0.07 | - | .003 | - |
| h | 0.25 | 0.50 | .010 | .020 |
| θ | 0° | 8° | 0° | 8° |
| θ1 | 5° | 15° | 5° | 15° |
| θ2 | 0° | - | 08 | - |

# DIP-14 PLASTIC PACKAGE




| Dimensions | | | | |
|---|---|---|---|---|
| SYMBOL | Millimeters | | Inches | |
| | MIN | MAX | MIN | MAX |
| A | - | 5.33 | - | .210 |
| A1 | 0.38 | - | .015 | - |
| A2 | 2.92 | 4.95 | .115 | .195 |
| b | 0.36 | 0.56 | .014 | .022 |
| b2 | 1.14 | 1.78 | .045 | .070 |
| b3 | 0.76 | 1.14 | .030 | .045 |
| c | 0.20 | 0.36 | .008 | .014 |
| D | 18.67 | 19.69 | .735 | .775 |
| D1 | 0.13 | - | .005 | - |
| E | 7.62 | 8.26 | .300 | .325 |
| E1 | 6.10 | 7.11 | .240 | .280 |
| e | 2.54 (TYP) | | .100 (TYP) | |
| eA | 7.62 (TYP) | | .300 (TYP) | |
| eB | - | 10.92 | - | .430 |
| eC | 0.00 | 1.52 | .000 | .060 |
| L | 2.92 | 3.81 | .115 | .150 |
| G | 0.38 (TYP) | | .015 (TYP) | |

## NOTICE

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