



# BCT8721/21B/22/24

## High-Output-Drive, 15MHz, 9V/ $\mu$ s, Rail-to-Rail I/O Op Amps

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#### GENERAL DESCRIPTION

The BCT872X, high-output drive CMOS op amps, rail-to-rail input and output capability from a single 2.1V to 5.5V supply. These amplifiers exhibit a high slew rate of 9V/ $\mu$ s and a gain-bandwidth (GBW) of 15MHz. The BCT872X can drive headset levels, as well as bias an RF power amplifier (PA) in wireless handset applications.

The BCT872X offers low offsets, wide bandwidth, and high-output drive in a space-saving SOT23-5/SOP8/DFN2x2-8L/SOP14 package. These parts are offered over the industrial temperature range (-40°C to +85°C).




#### FEATURES

- Rail-to-Rail Input and Output
- 15MHz Gain-Bandwidth Product
- High Slew Rate: 9V/ $\mu$ s
- 2.1V to 5.5V Single-Supply Operation
- 1.1mA Supply Current per Amplifier
- 100dB Voltage Gain (RL = 100k $\Omega$ )
- 85dB Power-Supply Rejection Ratio
- 50mA Output Drive Capability
- Available in SOT23-5/SOP8/DFN2x2-8L /SOP14 package

#### APPLICATIONS

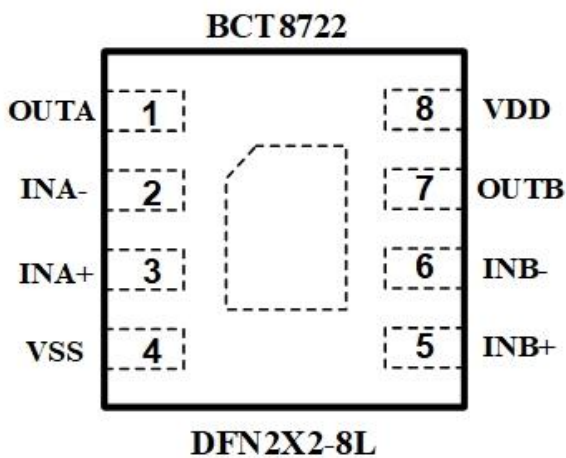
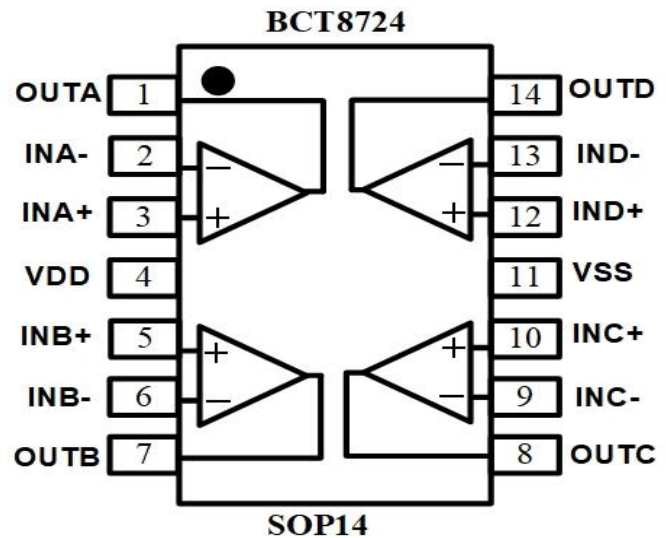
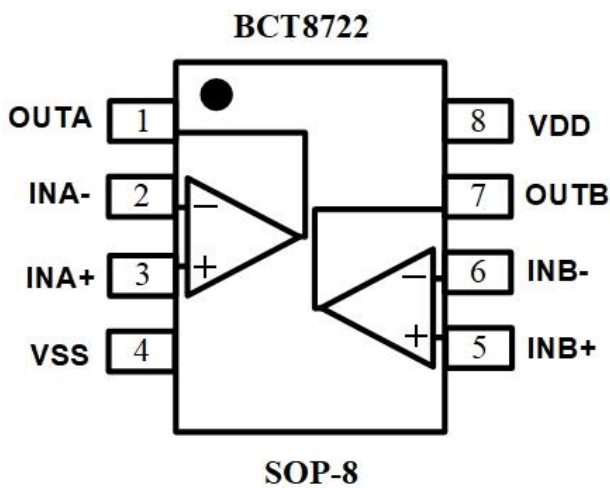
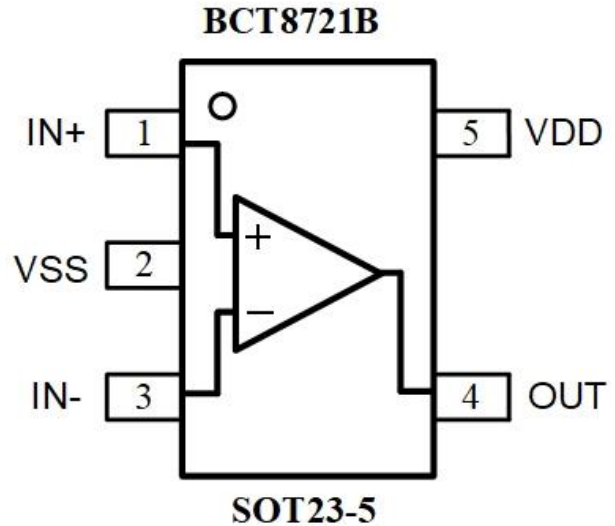
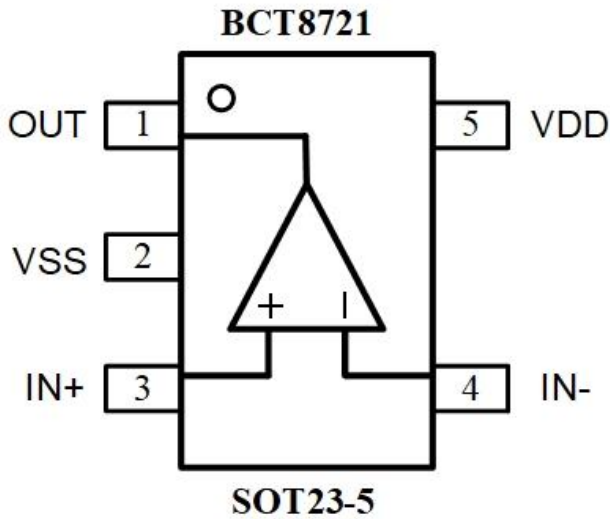
- RF PA Biasing Controls
- Portable/Battery-Powered Audio Applications
- Audio Hands-Free Car Phones (Kits)
- Laptop/Notebook Computers/TFT Panels
- Set-Top Boxes
- Digital-to-Analog Converter Buffers
- Transformer/Line Drivers
- Motor Drivers

#### ORDERING INFORMATION

| Order Number   | Package Type | Temperature Range | Marking  | QTY/Reel |
|----------------|--------------|-------------------|--|----------|
| BCT8721EUK-TR  | SOT23-5      | -40°C to +85°C    | TAXX   | 3000     |
| BCT8721BEUK-TR | SOT23-5      | -40°C to +85°C    | TBXX   | 3000     |
| BCT8722ESA-TR  | SOP8         | -40°C to +85°C    | <br>8722<br>XXXXX | 4000     |
| BCT8722ELA-TR  | DFN2x2-8L    | -40°C to +85°C    | <br>8722<br>XXXXX | 3000     |
| BCT8724ESD-TU  | SOP14        | -40°C to +85°C    | <br>8724<br>XXXXX | 10000    |

Note: "XX" & "XXXXX" of Marking is batch code.

### PIN CONFIGURATION (TOP VIEW)





# BCT8721/21B/22/24

## High-Output-Drive, 15MHz, 9V/ $\mu$ s, Rail-to-Rail I/O Op Amps

### PIN DESCRIPTION

#### BCT8721

| Pin | Name | Function  |
|-----|------|---|
| 1   | OUT  | Amplifier Output  |
| 2   | VSS  | Negative Supply Input. Connect to ground for single-supply operation. |
| 3   | IN+  | Non inverting Input to Amplifier                                      |
| 4   | IN-  | Inverting Input to Amplifier  |
| 5   | VDD  | Positive Supply Input   |

#### BCT8721B

| Pin | Name | Function  |
|-----|------|---|
| 1   | IN+  | Non inverting Input to Amplifier                                      |
| 2   | VSS  | Negative Supply Input. Connect to ground for single-supply operation. |
| 3   | IN-  | Inverting Input to Amplifier  |
| 4   | OUT  | Amplifier Output  |
| 5   | VDD  | Positive Supply Input   |

#### BCT8722

| Pin | Name | Function  |
|-----|------|---|
| 1   | OUTA | Amplifier A Output  |
| 2   | INA- | Inverting Input to Amplifier A  |
| 3   | INA+ | Non inverting Input to Amplifier A                                    |
| 4   | VSS  | Negative Supply Input. Connect to ground for single-supply operation. |
| 5   | INB+ | Non inverting Input to Amplifier B                                    |
| 6   | INB- | Inverting Input to Amplifier B  |
| 7   | OUTB | Amplifier B Output  |
| 8   | VDD  | Positive Supply Input   |

#### BCT8724

| Pin | Name | Function                           |
|-----|------|------------------------------------|
| 1   | OUTA | Amplifier A Output                 |
| 2   | INA- | Inverting Input to Amplifier A     |
| 3   | INA+ | Non inverting Input to Amplifier A |
| 4   | VDD  | Positive Supply Input              |
| 5   | INB+ | Non inverting Input to Amplifier B |
| 6   | INB- | Inverting Input to Amplifier B     |
| 7   | OUTB | Amplifier B Output                 |



# BCT8721/21B/22/24

## High-Output-Drive, 15MHz, 9V/ $\mu$ s, Rail-to-Rail I/O Op Amps

|    |      |   |
|----|------|---|
| 8  | OUTC | Amplifier C Output  |
| 9  | INC- | Inverting Input to Amplifier C  |
| 10 | INC+ | Non inverting Input to Amplifier C                                    |
| 11 | VSS  | Negative Supply Input. Connect to ground for single-supply operation. |
| 12 | IND+ | Non inverting Input to Amplifier D                                    |
| 13 | IND- | Inverting Input to Amplifier D  |
| 14 | OUTD | Amplifier D Output  |

### ABSOLUTE MAXIMUM RATINGS

|   |                             |
|---|-----------------------------|
| Supply Voltage (VDD to VSS) .....                 | 6V                          |
| All Other Pins .....                              | (VSS - 0.3V) + (VDD + 0.3V) |
| Output Short-Circuit Duration to VDD or VSS ..... | 1s                          |
| Continuous Power Dissipation (TA = +70°C)         |                             |
| SOT23-5 (derate 3.85mW/°C above +70°C) .....      | 308mW                       |
| SOP8 (derate 5.55mW/°C above +70°C) .....         | 444mW                       |
| DFN2x2-8L (derate 10.5mW/°C above +70°C) .....    | 840mW                       |
| SOP14 (derate 9.09mW/°C above +70°C) .....        | 727mW                       |
| Operating Temperature Range .....                 | -40°C to +85°C              |
| Junction Temperature.....                         | +150°C                      |
| Storage Temperature Range .....                   | -65°C to +150°C             |
| Lead Temperature (soldering, 10s) .....           | +260°C                      |
| ESD Susceptibility (HBM) .....                    | 8KV                         |

#### Note 1:

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



# BCT8721/21B/22/24

## High-Output-Drive, 15MHz, 9V/ $\mu$ s, Rail-to-Rail I/O Op Amps

### DC ELECTRICAL CHARACTERISTICS

(VDD = 5.0V, VSS = 0V, VCM = VDD/2, VOUT = (VDD/2), RL = connected to (VDD/2), TA = +25°C )

| PARAMETER                                   | SYMBOL | CONDITIONS                      | MIN                | TYP        | MAX       | UNITS |    |
|---|--------|---------------------------------|--------------------|------------|-----------|-------|----|
| Operating Supply Voltage Range              | VDD    | Inferred from PSRR test         | 2.1                |            | 5.5       | V     |    |
| Input Offset Voltage                        | VOS    |                                 |                    | $\pm 0.85$ | $\pm 6.0$ | mV    |    |
| Input Bias Current                          | IB     | VCM = VSS to VDD                |                    | 50         |           | pA    |    |
| Input Offset Current                        | IOS    | VCM = VSS to VDD                |                    | 50         |           | pA    |    |
| Common-Mode Input Voltage Range             | VCM    | Inferred from CMRR test         | VSS                |            | VDD       | V     |    |
| Common-Mode Rejection Ratio                 | CMRR   | VSS < VCM < VDD                 | 52                 | 70         |           | dB    |    |
| Power-Supply Rejection Ratio                | PSRR   | VDD = 2.1V to 5.5V              | 73                 | 85         |           | dB    |    |
| Large-Signal Voltage Gain                   | AVOL   | VSS + 0.20 < VOUT < VDD - 0.20V | RL = 100k $\Omega$ |            | 100       |       | dB |
|   |        |                                 | RL = 2k $\Omega$   | 85         | 98        |       |    |
|   |        |                                 | RL = 200 $\Omega$  | 74         | 80        |       |    |
| Output Voltage Swing                        | VOUT   | RL = 200 $\Omega$               | VDD - VOH          |            | 85        | 130   | mV |
|   |        |                                 | VOL - VSS          |            | 105       | 160   |    |
|   |        | RL = 2k $\Omega$                | VDD - VOH          |            | 10        | 15    |    |
|   |        |                                 | VOL - VSS          |            | 12        | 18    |    |
| Output Source/<br>Sink Current              | IOUT   | VOUT short to VDD/2             | VDD = 2.1V         |            | 50        |       | mA |
|   |        |                                 | VDD = 5.5V         |            | 70        |       |    |
| Quiescent Supply Current<br>(per Amplifier) | IDD    | VDD = 5.5V, VCM = VDD / 2       |                    |            | 1.2       | 2.3   | mA |
|   |        | VDD = 2.1V, VCM = VDD / 2       |                    |            | 1.1       | 2.0   |    |



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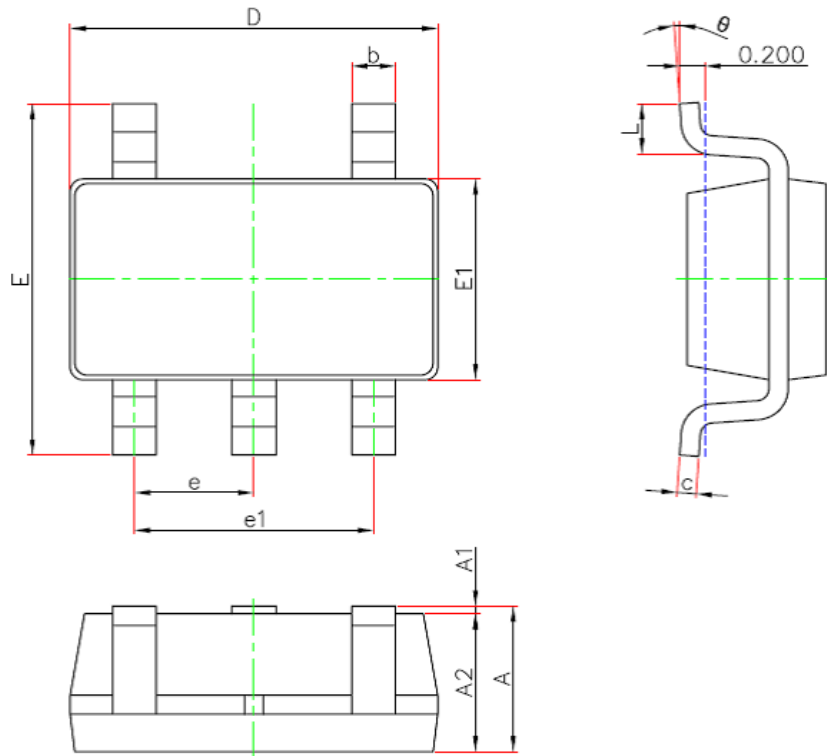
### AC ELECTRICAL CHARACTERISTICS

(VDD = 5.0V, VSS = 0V, VCM = VDD/2, VOUT = (VDD/2), RL = connected to (VDD/2), TA = +25°C )

| PARAMETER              | SYMBOL | CONDITIONS                             | MIN | TYP | MAX | UNITS          |
|------------------------|--------|--|-----|-----|-----|----------------|
| Gain-Bandwidth Product | GBWP   | VCM = VDD/2, VOUT = 0.1VP-P, CL=100pF, |     | 15  |     | MHz            |
| Slew Rate              | SR     | G=+1, 2V Step, RL=10K, CL=100PF        |     | 9.0 |     | V/ $\mu$ s     |
| Phase Margin           | PM     |  |     | 51  |     | Degrees        |
| Input Capacitance      | CIN    |  |     | 8   |     | pF             |
| Voltage Noise Density  | en     | f = 1kHz                               |     | 15  |     | nV/ $\sqrt$ Hz |
|                        |        | f = 10kHz                              |     | 12  |     |                |
| Power-Up Time          | tON    |  |     | 5   |     | $\mu$ s        |

**PACKAGE OUTLINE DIMENSIONS**

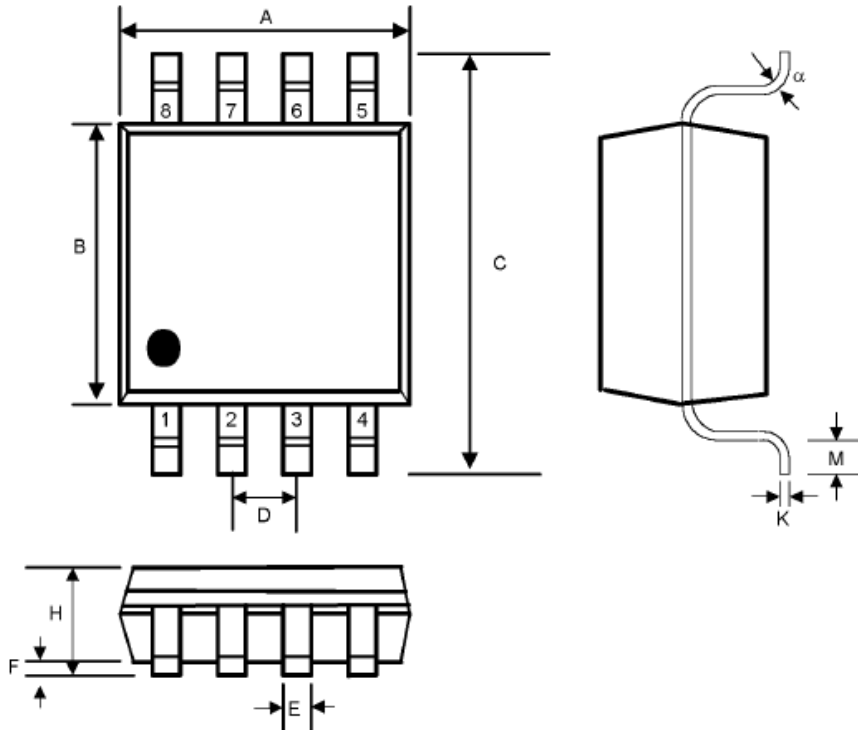
SOT23-5



| Symbol   | Dimensions In Millimeters |      |
|----------|---------------------------|------|
|          | Min                       | Max  |
| A        | 1.05                      | 1.3  |
| A1       | 0                         | 0.15 |
| A2       | 1.05                      | 1.15 |
| b        | 0.28                      | 0.5  |
| c        | 0.1                       | 0.23 |
| D        | 2.82                      | 3.02 |
| E1       | 1.5                       | 1.7  |
| E        | 2.65                      | 3.05 |
| e        | 0.95(BSC)                 |      |
| e1       | 1.8                       | 2    |
| L        | 0.3                       | 0.6  |
| $\theta$ | 0                         | 8°   |

SOT23-5 Surface Mount Package

### SOP8

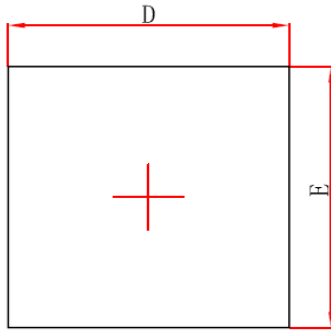


| Symbol   | Dimensions In Millimeters |      | Dimensions In Inches |       |
|----------|---------------------------|------|----------------------|-------|
|          | Min                       | Max  | Min                  | Max   |
| A        | 4.80                      | 5.00 | 0.188                | 0.197 |
| B        | 3.80                      | 4.00 | 0.149                | 0.158 |
| C        | 5.80                      | 6.20 | 0.228                | 0.244 |
| D        | 1.27 BSC                  |      | 0.050                |       |
| E        | 0.33                      | 0.51 | 0.013                | 0.020 |
| F        | 0.10                      | 0.25 | 0.004                | 0.010 |
| H        | 1.35                      | 1.75 | 0.053                | 0.069 |
| K        | 0.19                      | 0.25 | 0.007                | 0.010 |
| M        | 0.40                      | 1.27 | 0.016                | 0.050 |
| $\alpha$ | 0°                        | 8°   | 0°                   | 8°    |

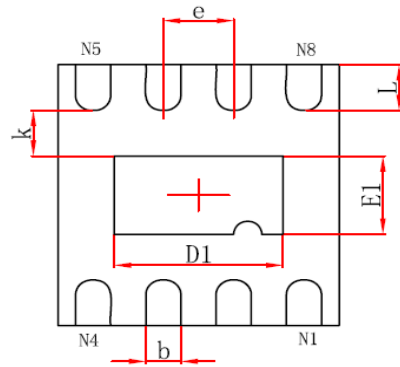
SOP8 Surface Mount Package



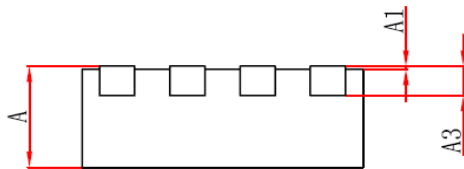
### DFN2x2-8L



**Top View**



**Bottom View**

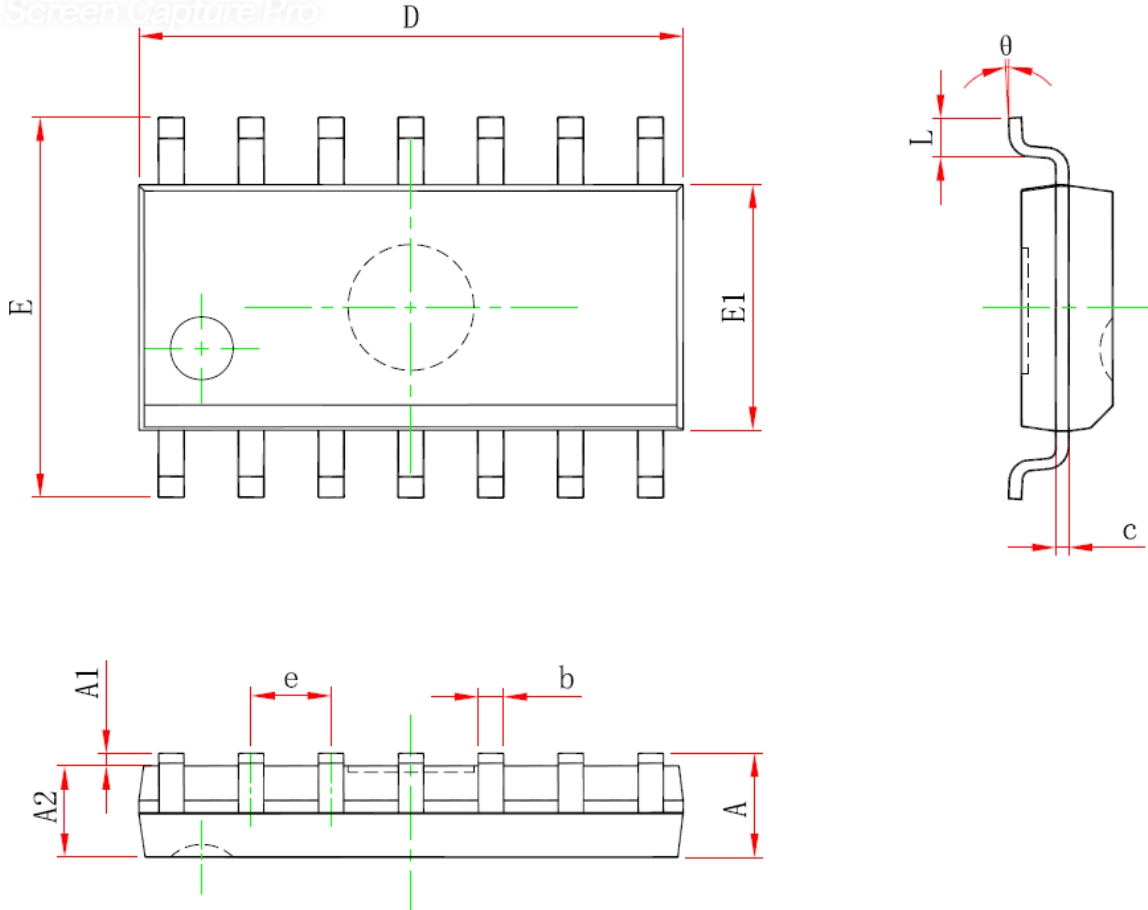


**Side View**

| Symbol | Dimensions In Millimeters |             | Dimensions In Inches |             |
|--------|---------------------------|-------------|----------------------|-------------|
|        | Min                       | Max         | Min                  | Max         |
| A      | 0.700/0.800               | 0.800/0.900 | 0.028/0.031          | 0.031/0.035 |
| A1     | 0.000                     | 0.050       | 0.000                | 0.002       |
| A3     | 0.203REF.                 |             | 0.008REF.            |             |
| D      | 1.924                     | 2.076       | 0.076                | 0.082       |
| E      | 1.924                     | 2.076       | 0.076                | 0.082       |
| D1     | 1.100                     | 1.300       | 0.043                | 0.051       |
| E1     | 0.500                     | 0.700       | 0.020                | 0.028       |
| k      | 0.200MIN.                 |             | 0.008MIN.            |             |
| b      | 0.200                     | 0.300       | 0.008                | 0.012       |
| e      | 0.500TYP.                 |             | 0.020TYP.            |             |
| L      | 0.274                     | 0.426       | 0.011                | 0.017       |

DFN2x2-8L Surface Mount Package

### SOP14

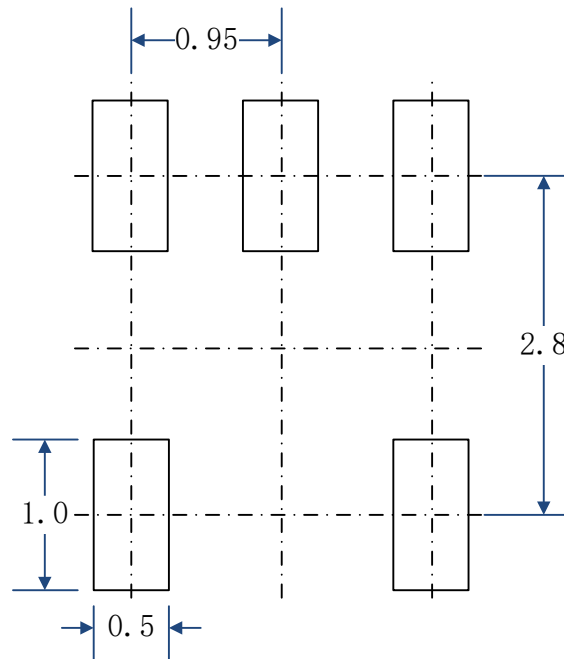


| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min                       | Max   | Min                  | Max   |
| A        | —                         | 1.750 | —                    | 0.069 |
| A1       | 0.100                     | 0.250 | 0.004                | 0.010 |
| A2       | 1.250                     | —     | 0.049                | —     |
| b        | 0.310                     | 0.510 | 0.012                | 0.020 |
| c        | 0.100                     | 0.250 | 0.004                | 0.010 |
| D        | 8.450                     | 8.850 | 0.333                | 0.348 |
| E        | 5.800                     | 6.200 | 0.228                | 0.244 |
| E1       | 3.800                     | 4.000 | 0.150                | 0.157 |
| e        | 1.270(BSC)                |       | 0.050(BSC)           |       |
| L        | 0.400                     | 1.270 | 0.016                | 0.050 |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |

SOP14 Surface Mount Package

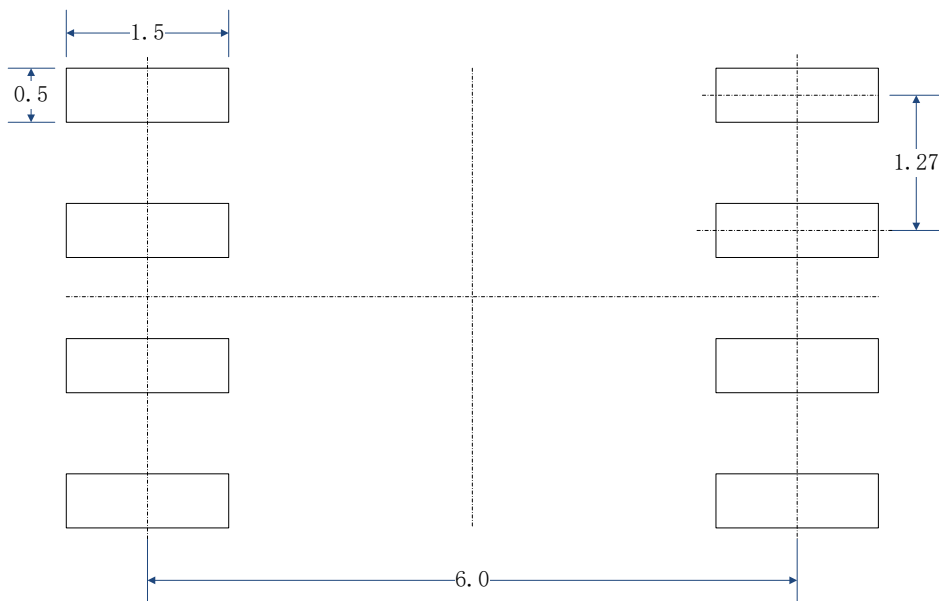
**LAND PATTERN DATA**

**SOT23-5**



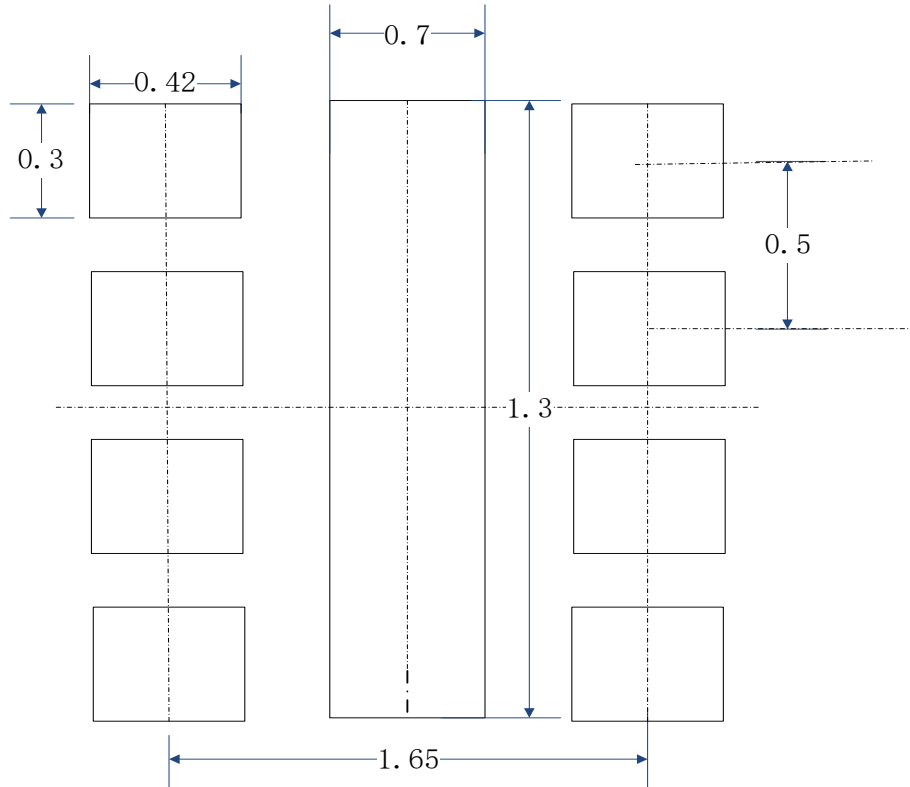
**RECOMMENDED PCB LAYOUT PATTERN (Unit: mm)**

**SOP8**



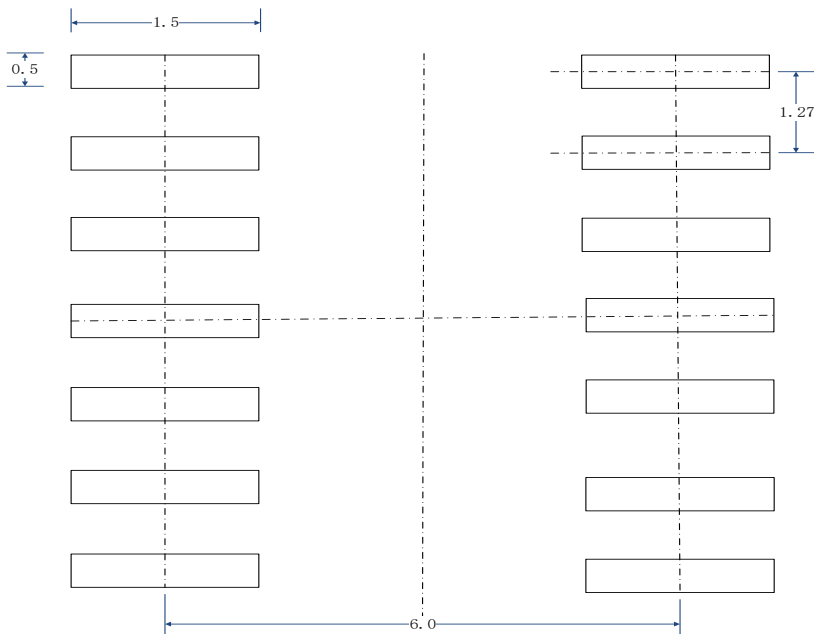
**RECOMMENDED PCB LAYOUT PATTERN (Unit: mm)**

**DFN2x2-8L**



**RECOMMENDED PCB LAYOUT PATTERN (Unit: mm)**

**SOP14**



**RECOMMENDED PCB LAYOUT PATTERN (Unit: mm)**