# GT74LVC08A
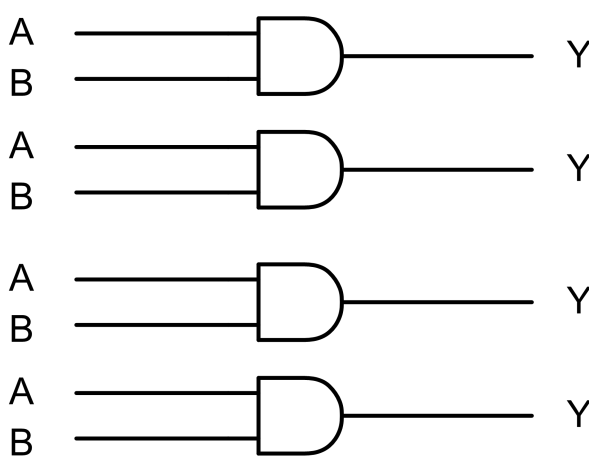# Quadruple 2-Input Positive-AND Gate

## 1 Features

- Supports 5V $V_{CC}$ operation
- Inputs accept voltages to 5.5 V
- Provides down translation to $V_{CC}$
- Low power consumption, 10-µA Max $I_{CC}$
- ±24-mA output drive at 3.3 V
- $I_{off}$ supports live insertion, partial-power-down mode, and back drive protection

## 2 Application

- Active noise cancellation (ANC)
- Barcode scanner
- Blood pressure monitor
- CPAP machine
- Fingerprint biometrics
- HVAC: heating, ventilating, and air conditioning
- Network-attached storage (NAS)
- Servers
- LED displays
- Network switches
- I/O expanders
- Base station processor board

## 3 Description

GT74LVC08A quadruple 2-input positive-AND gate is designed for 1.65-V to 5.5-V $V_{CC}$ operation.

The GT74LVC08A device performs the Boolean function $Y = A \times B$ or $Y = \overline{\overline{A} + \overline{B}}$ in positive logic.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these device as translators in a mixed 3.3-V/5-V system environment.

## Circuit Diagram

## 4 Revision History

| Revision | Date | Note |
|---|---|---|
| Rev. A1. 0 | 2023. 10. 23 | Original Version |
| Rev. A1. 1 | 2023. 10. 23 | 1.Updated 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 |

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
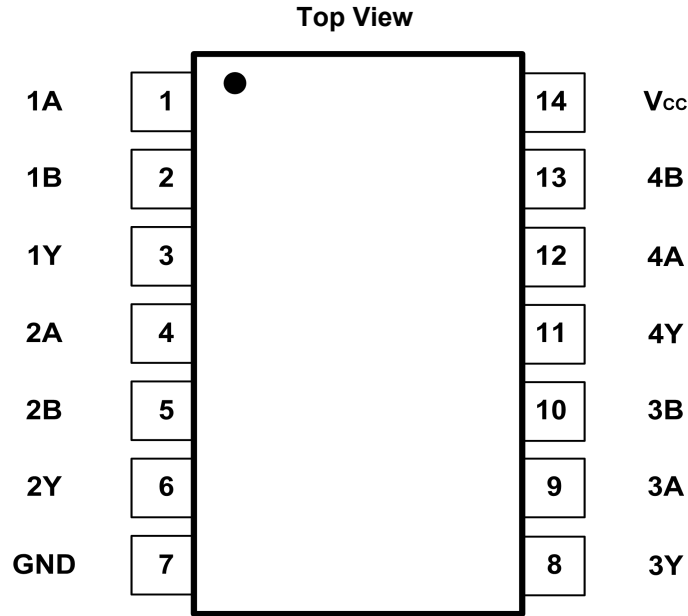
**Table 5-1. Device Summary[1]**

| Serial Name | Part Name | Package | Body Size (Nom) | Marking[2][4] | MSL[3] | Package Qty |
|---|---|---|---|---|---|---|
| GT74LVC08A | GT74LVC08APD | SOP14 | 8.65mm×3.90mm×1.75mm | GT74LVC08A XXXXXXX | 3 | Tape and Reel,4000 |
| | GT74LVC08ATD | TSSOP14 | 5.00mm×4.40mm×1.20mm | GT74LVC08A XXXXXXX | 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) "XXXXX" in Marking will be appeared as the batch code.

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

**Top View**

| 1A | 1 | ● | | 14 | Vcc |
|----|---|---|---|----|-----|
| 1B | 2 | | | 13 | 4B |
| 1Y | 3 | | | 12 | 4A |
| 2A | 4 | | | 11 | 4Y |
| 2B | 5 | | | 10 | 3B |
| 2Y | 6 | | | 9 | 3A |
| GND | 7 | | | 8 | 3Y |

**Fig.5-1. GT74LVC08A: PD (SOP14) Package**

**GT74LVC08A: TD (TSSOP14) Package**

**Table 5-1  Pin Definition**

| Pin | | Type | Description |
|-----|-----|------|-------------|
| Name | PD TD | | |
| 1A | 1 | I | A input for gate 1 |
| 1B | 2 | I | B input for gate 1 |
| 1Y | 3 | O | Output for gate 1 |
| 2A | 4 | I | A input for gate 2 |
| 2B | 5 | I | B input for gate 2 |
| 2Y | 6 | O | Output for gate 2 |
| GND | 7 | - | Ground |
| 3Y | 8 | O | Output for gate 3 |
| 3A | 9 | I | A input for gate 3 |
| 3B | 10 | I | B input for gate 3 |
| 4Y | 11 | O | Output for gate 4 |
| 4A | 12 | I | A input for gate 4 |
| 4B | 13 | I | B input for gate 4 |
| VCC | 14 | - | Power input |

# 6 Voltage, Temperature, ESD and Thermal Ratings

## 6.1 Absolute Maximum Ratings[1]

| Parameters | | Min | Max | Unit |
|---|---|---|---|---|
| $V_{CC}$ Supply voltage range | | -0.5 | 6.5 | V |
| $V_I$ Input voltage range | | -0.5 | 6.5 | V |
| $V_O$ Voltage range applied to any output in the high-impedance or power-off state[2] | | -0.5 | 6.5 | V |
| $V_O$ Voltage range applied to any output in the high or low state[2] | | -0.5 | $V_{CC}$+0.5 | V |
| $I_{IK}$ Input clamp current | $V_I$<0 | | -50 | mA |
| $I_{OK}$ Output clamp current | $V_O$<0 | | -50 | mA |
| $I_O$ Continuous output current | | | ±50 | mA |
| Continuous current through $V_{CC}$ or GND | | | ±100 | mA |
| $T_J$ Junction temperature under bias | | | 150 | °C |
| $T_{stg}$ Storage temperature range | | -55 | 150 | °C |

(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 under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability..

(2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.

## 6.2 ESD Ratings

| ESD | | | Value | Unit |
|---|---|---|---|---|
| V(ESD) | Electrostatic Discharge | Human-Body Model (HBM)[1] | 8 K | V |
| | | Charged-Device Model (CDM)[2] | 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 Voltage, Temperature, ESD and Thermal Ratings(Continued)

## 6.3 Recommended Operating Conditions

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

| Symbol | Parameter | | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | | 1.65 | 5.5 | V |
| $V_{IH}$ | High-Level Input Voltage | $V_{CC}$=1.65V to1.95V | 0.65×$V_{CC}$ | | V |
| | | $V_{CC}$=2.3V to 2.7V | 1.7 | | |
| | | $V_{CC}$=3V to 3.6V | 2 | | |
| | | $V_{CC}$=4.5V to 5.5V | 0.7×$V_{CC}$ | | |
| $V_{IL}$ | Low-Level Input Voltage | $V_{CC}$=1.65V to1.95V | | 0.35×$V_{CC}$ | V |
| | | $V_{CC}$=2.3V to 2.7V | | 0.7 | |
| | | $V_{CC}$=3V to 3.6V | | 0.8 | |
| | | $V_{CC}$=4.5V to 5.5V | | 0.3×$V_{CC}$ | |
| $V_I$ | Input Voltage | | 0 | 5.5 | V |
| $V_O$ | Output Voltage | | 0 | $V_{CC}$ | V |
| $I_{OH}$ | High-Level Output Current | $V_{CC}$=1.65V | | -4 | mA |
| | | $V_{CC}$=2.3V | | -8 | |
| | | $V_{CC}$=3V | | -16 | |
| | | | | -24 | |
| | | $V_{CC}$=4.5V | | -32 | |
| $I_{OL}$ | Low-Level Output Current | $V_{CC}$=1.65V | | 4 | mA |
| | | $V_{CC}$=2.3V | | 8 | |
| | | $V_{CC}$=3V | | 16 | |
| | | | | 24 | |
| | | $V_{CC}$=4.5V | | 32 | |
| $\Delta t/\Delta v$ | Input Transition Rise or Fall Rate | $V_{CC}$=1.8V±0.15V,2.5V±0.2V | | 20 | ns/V |
| | | $V_{CC}$=3.3V±0.3V | | 10 | |
| | | $V_{CC}$=5V±0.5V | | 5 | |
| TA | Operating Free-Air Temperature | | -40 | 125 | °C |

## 6.4 Thermal Information

| Package Type | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|---|---|---|---|
| TSSOP14 | 180 | 35 | °C/W |
| SOP14 | 120 | 36 | °C/W |

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# 7 Electrical Specifications

## 7.1 Electrical Characteristics [1]

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

| Parameter | | Test Conditions | $V_{CC}$ | −40°C to 85°C | | | −40°C to 125°C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Typ | Max | |
| $V_{OH}$ | | $I_{OH}$=-100 µA | 1.65 V to 5.5 V | $V_{CC}$-0.1 | | | $V_{CC}$-0.1 | | | V |
| | | $I_{OH}$=-4 mA | 1.65 V | 1.2 | | | 1.2 | | | |
| | | $I_{OH}$=-8 mA | 2.3 V | 1.9 | | | 1.9 | | | |
| | | $I_{OH}$=-16 mA | 3 V | 2.4 | | | 2.4 | | | |
| | | $I_{OH}$=-24 mA | | 2.3 | | | 2.3 | | | |
| | | $I_{OH}$=-32 mA | 4.5 V | 3.8 | | | 3.8 | | | |
| $V_{OL}$ | | $I_{OL}$=100 µA | 1.65 V to 5.5 V | | | 0.1 | | | 0.1 | V |
| | | $I_{OL}$=4 mA | 1.65 V | | | 0.45 | | | 0.45 | |
| | | $I_{OL}$=8 mA | 2.3 V | | | 0.3 | | | 0.3 | |
| | | $I_{OL}$=16 mA | 3 V | | | 0.4 | | | 0.4 | |
| | | $I_{OL}$=24 mA | | | | 0.55 | | | 0.55 | |
| | | $I_{OL}$=32 mA | 4.5 V | | | 0.55 | | | 0.55 | |
| $I_I$ | A or B Inputs | $V_I$=5.5 V or GND | 0 to 5.5 V | | | ±5 | | | ±5 | µA |
| $I_{off}$ | | $V_I$ or $V_O$=5.5 V | 0 | | | ±10 | | | ±10 | µA |
| $I_{CC}$ | | $V_I$=5.5 V or GND, $I_O$=0 | 1.65 V to 5.5 V | | | 10 | | | 10 | µA |
| $\Delta I_{CC}$ | | One Input at $V_{CC}$ − 0.6 V, Other Inputs at $V_{CC}$ or GND | 3 V to 5.5 V | | | 500 | | | 500 | µA |
| $C_i$ | | $V_I$=$V_{CC}$ or GND | 3.3 V | | 5 | | | 5 | | pF |

(1) All unused digital inputs of the device must be held at $V_{CC}$ or GND to ensure proper device operation.

# 7 Electrical Specifications (Continued)

## 7.2 Switching Characteristics, –40°C to 85°C

Over recommended operating free-air temperature range, CL=30 pF or 50 pF  (unless otherwise noted)

| Parameter | From (Input) | To (Output) | –40°C to 85°C | | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$=1.8 V ± 0.15 V | | $V_{CC}$=2.5 V ± 0.2 V | | $V_{CC}$=3.3 V ± 0.3 V | | $V_{CC}$=5 V ± 0.5 V | | |
| | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| tpd | A or B | Y | 1 | 9.8 | 1 | 6.9 | 1 | 4.8 | 1 | 4.1 | ns |

## 7.3 Switching Characteristics, –40°C to 125°C

Over recommended operating free-air temperature range, CL=30 pF or 50 pF  (unless otherwise noted)

| Parameter | From (Input) | To (Output) | –40°C to 125°C | | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$=1.8 V ± 0.15 V | | $V_{CC}$=2.5 V ± 0.2 V | | $V_{CC}$=3.3 V ± 0.3 V | | $V_{CC}$=5 V ± 0.5 V | | |
| | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| tpd | A or B | Y | 1 | 11.3 | 1 | 9 | 1 | 6 | 1 | 5.5 | ns |

## 7.4 Operating Characteristics

$T_A$=25°C

| | Parameter | Test Conditions | $V_{CC}$=1.8 V | $V_{CC}$=2.5 V | $V_{CC}$=3.3 V | $V_{CC}$=5 V | Unit |
|---|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | Typ | |
| Cpd | Power Dissipation Capacitance | f=10 MHz | 18 | 18 | 23 | 26 | pF |

## 8 Typical Characteristics

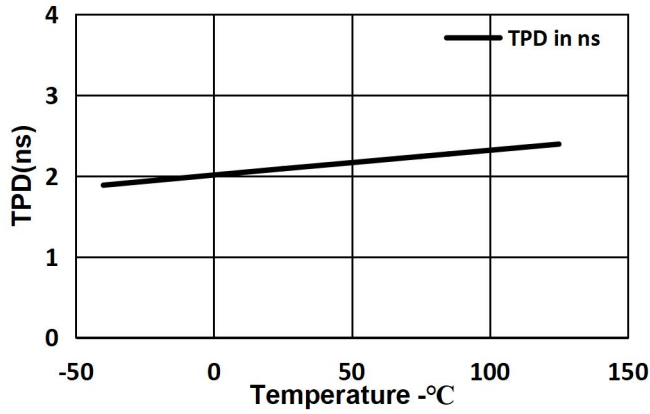Over recommended operating free-air temperature range, CL=30 pF or 50 pF  (unless otherwise noted)
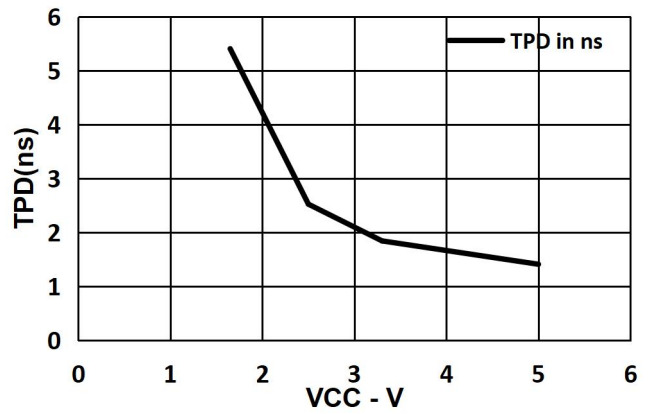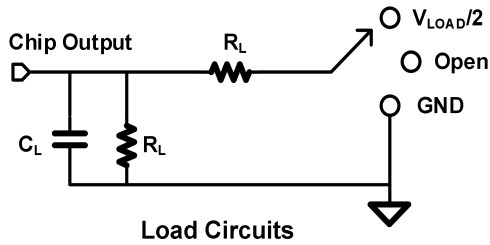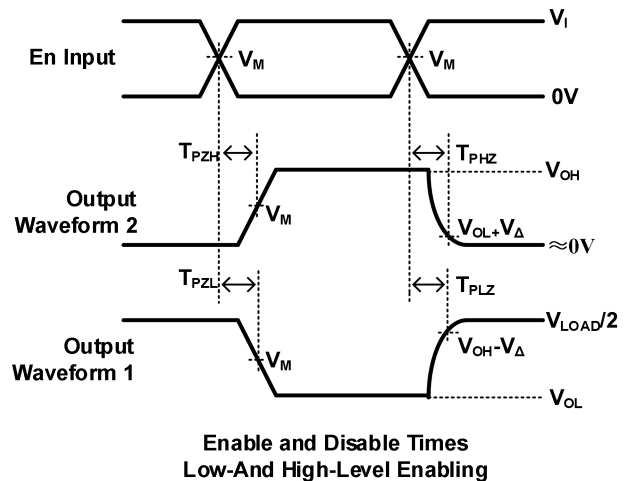


**Fig.8-1. T$_{PD}$ Across Temperature at 3.3 V V$_{CC}$**



**Fig.8-2. T$_{PD}$ Across V$_{CC}$ at 25℃**

# 9 Parameter Measurement Information

**Load Circuits**

| TEST | S1 |
|------|-----|
| $T_{PHL}/T_{PLH}$ | OPEN |
| $T_{PLZ}/T_{PZL}$ | $V_{LOAD}$ |
| $T_{PHZ}/T_{PZH}$ | GND |

| $V_{CC}$ | INPUTS | | $V_M$ | $V_{LOAD}$ | $C_L$ | $R_L$ | $V_\Delta$ |
|----------|--------|--------|-------|------------|-------|-------|------------|
| | $V_I$ | $T_r/T_f$ | | | | | |
| 1.8V±0.15V | $V_{CC}$ | ≤2ns | $V_{CC}/2$ | 2×$V_{CC}$ | 30pF | 1kΩ | 0.15V |
| 2.5V±0.15V | $V_{CC}$ | ≤2ns | $V_{CC}/2$ | 2×$V_{CC}$ | 30pF | 500Ω | 0.15V |
| 3.3V±0.15V | 3V | ≤2.5ns | 1.5V | 6V | 50pF | 500Ω | 0.3V |
| 5V±0.15V | $V_{CC}$ | ≤2.5ns | $V_{CC}/2$ | 2×$V_{CC}$ | 50pF | 500Ω | 0.3V |

**Period Time**

**Setup and Hold Times**

**Propagation Delay for Output and Inverted Output**

**Enable and Disable Times Low-And High-Level Enabling**

Notes: A. C includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR 10 MHz, Z=50.

D. The outputs are measured one at a time, with one transition per measurement.
E. $t_{PLZ}$ and $t_{PHZ}$ are the same as $t_{dis}$.
F. $t_{PZL}$ and $t_{PZH}$ are the same as $t_{en}$.
G. $t_{PLH}$ and $t_{PHL}$ are the same as $t_{pd}$.
H. All parameters and waveforms are not applicable to all device.

# 10 Detailed Description

## 10.1 Overview

The GT74LVC08A device contains four 2 -input positive AND gate devices and perform the Boolean function $Y=A \cdot B$ or $Y=\overline{\overline{A}+\overline{B}}$. This device is fully specified for partial-power-down applications using $I_{off}$. The $I_{off}$ circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.
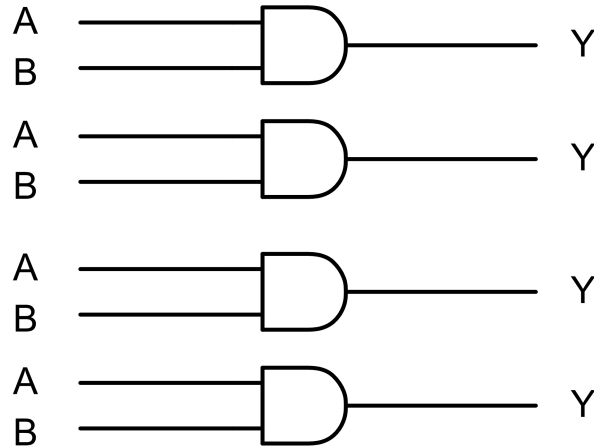
## 10.2 Functional Block Diagram



**Fig.10-1.Functional Block Diagram**

## 10.3 Feature Description

- Wide operating voltage range.
- Operates from 1.65 V to 5.5 V.
- Allows down voltage translation.
- Inputs accept voltages to 5.5 V.
- $I_{off}$ feature allows voltages on the inputs and outputs, when $V_{CC}$ is 0 V.

## 10.4 Device Functional Modes

| Inputs | | Output |
|---|---|---|
| **A** | **B** | **Y** |
| H | H | L |
| L | X | H |
| X | L | H |

# 11 Application Note

## 11.1 Application Information

The GT74LVC08A is a high drive CMOS device that can be used for implementing AND logic with high output drive, such as an LED application. It can produce 24 mA of drive current at 3.3 V making it Ideal for driving multiple outputs and good for high speed applications up to 100 MHz. The inputs are 5.5V tolerant allowing it to translate down to $V_{CC}$.
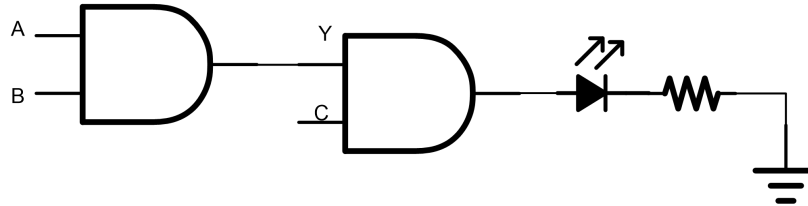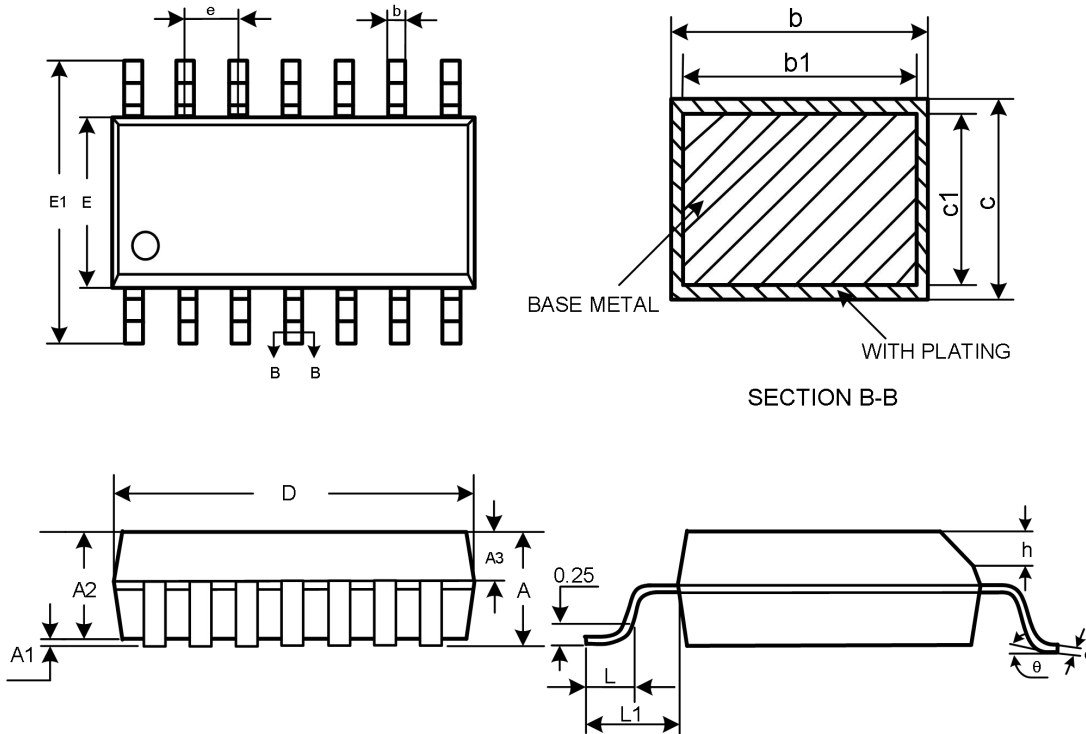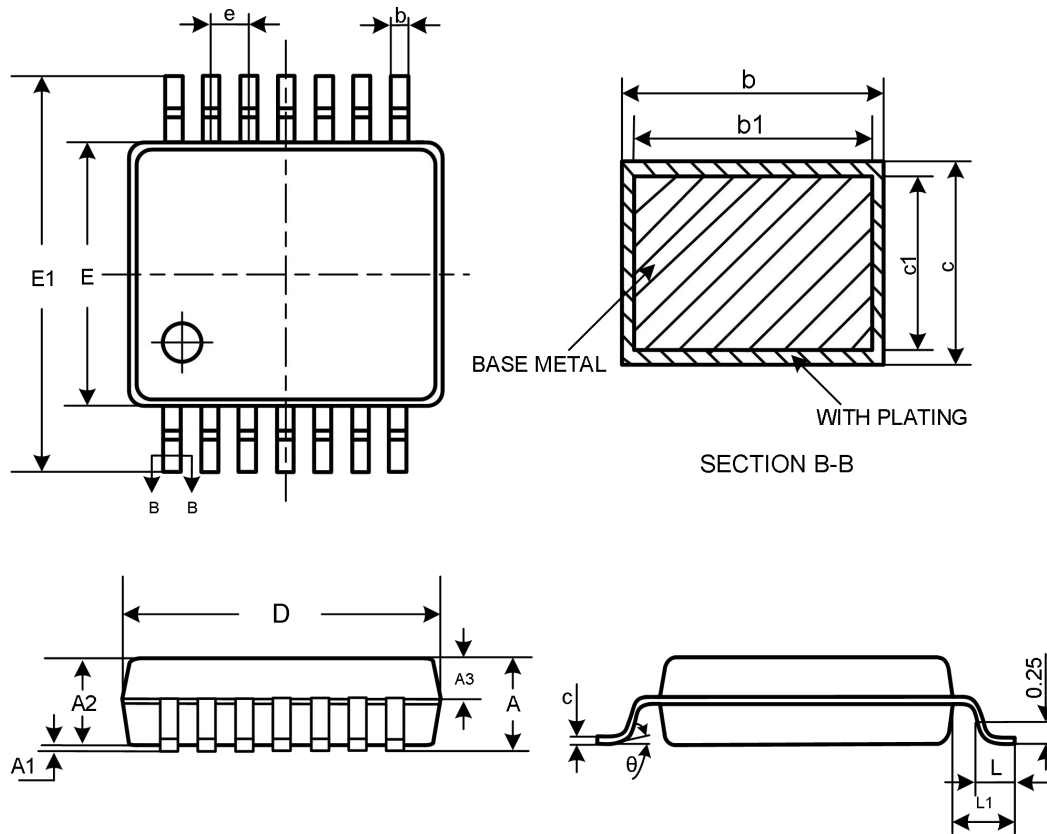
## 11.2 Typical Application
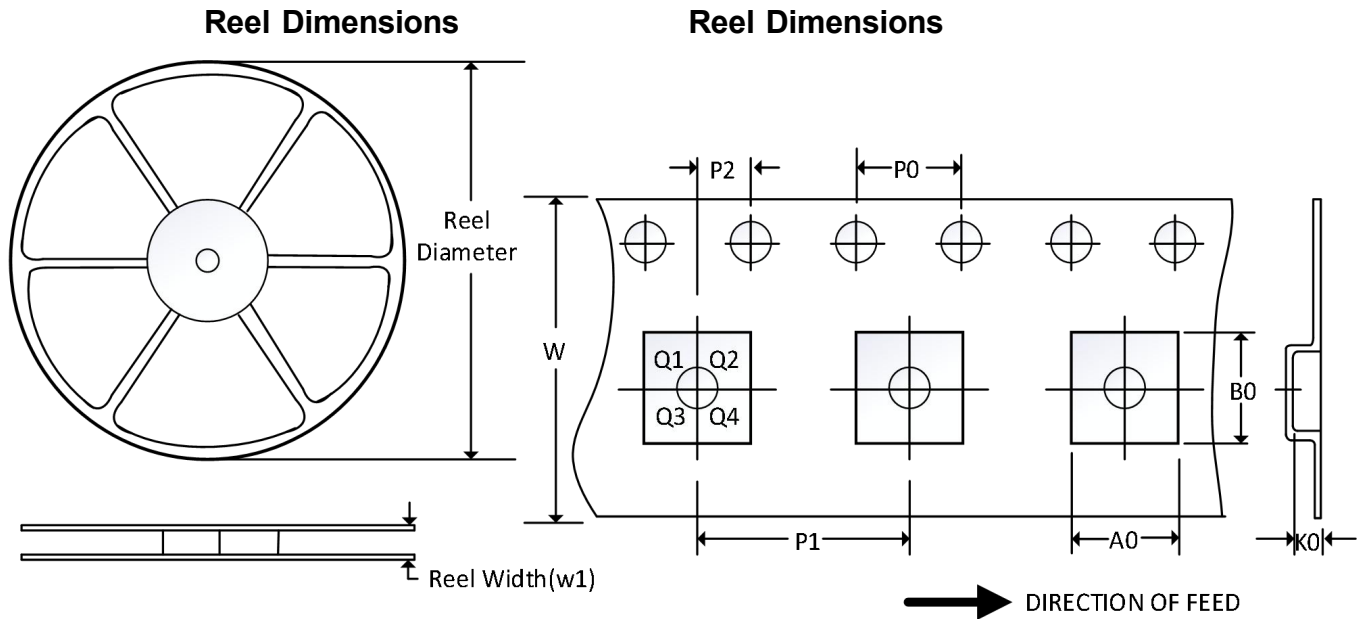


**Fig.11-1.Typical Application**

## 12 Package Outline Dimension

**SOP14**



BASE METAL

WITH PLATING

SECTION B-B

| 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° |

## 12 Package Outline Dimension(Continued)

TSSOP14



BASE METAL

WITH PLATING

SECTION B-B

| 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 | | |
| θ | 0 | —— | 8° | 0 | —— | 8° |

## 13 Tape and Reel Information

**Reel Dimensions**

**Reel Dimensions**

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 |
|---|---|---|---|---|---|---|---|---|---|---|
| TSSOP14 | 13'' | 12.4 | 6.95 | 5.60 | 1.20 | 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 |

NOTE:

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