## General Description

The operating voltage range of the SN74LVC2G14 single Schmitt-trigger buffer is 1.65 V to 5.5V. The SN74LVC2G14 device contains two inverters and performs the Boolean function $Y=\overline{A}$. Because of the Schmitt-Trigger inputs, the device may have different input threshold levels for positive-going ($V_{T+}$) and negative-going ($V_{T-}$) signals, to provide hysteresis ($\Delta V_T$) which makes the device tolerant to slow or noisy input signals.

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.

## Features

- Schmitt-Trigger inputs provide hysteresis
- Supports 5V $V_{CC}$ Operation
- Inputs Accept Voltages to 5.5V
- Max $t_{pd}$ of 5.4ns at 3.3V
- ±24-mA Output Drive at 3.3V
- $I_{off}$ Supports Partial-Power-Down Mode
- Typical $V_{OHV} > 2V$ at $V_{CC} = 3.3V$, $T_A = 25°C$
- Typical $V_{OLP} < 0.8V$ at $V_{CC} = 3.3V$, $T_A = 25°C$

## Applications

- AV Receivers
- Audio Docks: Portable
- Blu-ray Players and Home Theater
- MP3 Players/Recorders
- Personal Digital Assistants (PDAs)
- Power: Telecom/Server AC/DC Supply
- Solid State Drives (SSDs): Client and Enterprise
- TVs: LCD/Digital and High-Definition (HDTVs)
- Tablets: Enterprise
- Wireless Headsets, Keyboards, and Mice

## Functional Block Diagram
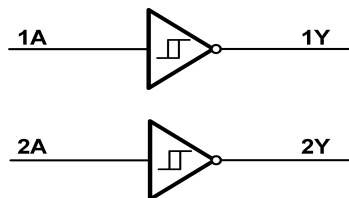


## Pinning and Pin Functions



SOT-23-6L/SO-70-6
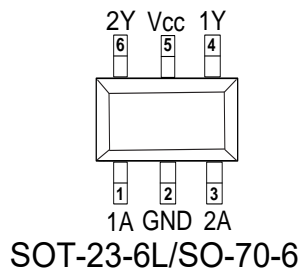
| Pin | | Type | Description |
|---|---|---|---|
| Name | SOT-23-6L/SC-70-6 | | |
| 1A | 1 | I | Input 1 |
| GND | 2 | — | Ground |
| 2A | 3 | I | Input 2 |
| 2Y | 4 | O | Output 2 |
| $V_{CC}$ | 5 | — | Positive Supply |
| 1Y | 6 | O | Output 1 |

## Absolute Maximum Ratings

| | 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 | | -0.5 | 6.5 | V |
| $V_O$ | Voltage range applied to any output in the high or low state | | -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 | ℃ |
| $T_{stg}$ | Storage temperature range | | -65 | 150 | ℃ |

(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.

## ESD Ratings

| ESD | | | Value | Unit |
|---|---|---|---|---|
| V(ESD) | Electrostatic discharge | Human-body model (HBM) | 4 K | V |
| | | Charge device model (CDM) | 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.

## 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 |
| $V_I$ | 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 | |
| $T_A$ | Operating free-air temperature | | -40 | 125 | ℃ |

## Thermal Information

| Package Type | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|---|---|---|---|
| SOT-23-6L | 250 | 81 | °C/W |
| SC-70-6 | 400 | 150 | °C/W |

## Electrical Characteristics

Vcc=5.0V or 3.3V, FULL=−40°C to +125°C, Typical values are at $T_A$=+25°C. (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 | |
| $V_{T+}$ Positive-going input threshold voltage | | 1.65 V | 0.7 | | 1.4 | 0.7 | | 1.4 | V |
| | | 2.3 V | 1.0 | | 1.7 | 1.0 | | 1.7 | |
| | | 3 V | 1.3 | | 2.0 | 1.3 | | 2.0 | |
| | | 4.5 V | 1.9 | | 3.1 | 1.9 | | 3.1 | |
| | | 5.5 V | 2.2 | | 3.7 | 2.2 | | 3.7 | |
| $V_{T-}$ Negative-going input threshold voltage | | 1.65 V | 0.25 | | 0.7 | 0.25 | | 0.7 | V |
| | | 2.3 V | 0.4 | | 1 | 0.4 | | 1.0 | |
| | | 3 V | 0.8 | | 1.3 | 0.8 | | 1.3 | |
| | | 4.5 V | 1.1 | | 2 | 1.1 | | 2.0 | |
| | | 5.5 V | 1.4 | | 2.5 | 1.4 | | 2.5 | |
| $\Delta V_T$ Hysteresis $(V_{T+} - V_{T-})$ | | 1.65 V | 0.3 | | 1 | 0.3 | | 1 | V |
| | | 2.3 V | 0.4 | | 1 | 0.4 | | 1 | |
| | | 3 V | 0.5 | | 1 | 0.5 | | 1 | |
| | | 4.5 V | 0.6 | | 1 | 0.6 | | 1 | |
| | | 5.5 V | 0.7 | | 1.1 | 0.7 | | 1.1 | |
| $V_{OH}$ | $I_{OH}$=− 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 input | $V_I$=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.

## Electrical Characteristics

Vcc=5.0V or 3.3V,  Typical values are at $T_A$=+25°C. (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 | |
| $t_{pd}$ | A | Y | 3.9 | 13.0 | 1.9 | 5.0 | 2.2 | 4.5 | 1.5 | 4.2 | ns |

$T_A$=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 | |
| $C_{pd}$ | Power dissipation capacitance | f=10 MHz | 20 | 25 | 30 | 50 | pF |

## Typical Characteristics

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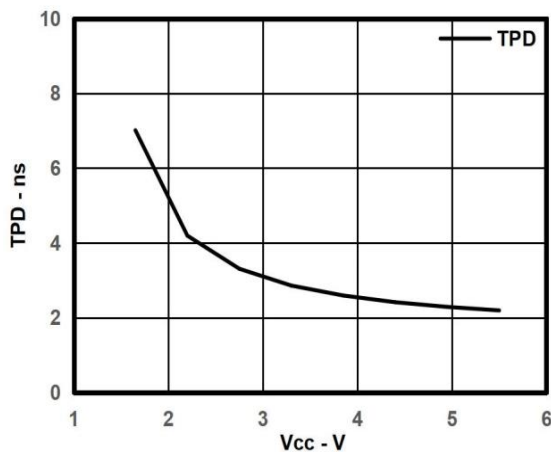


**Typical Tpd vs Vcc**
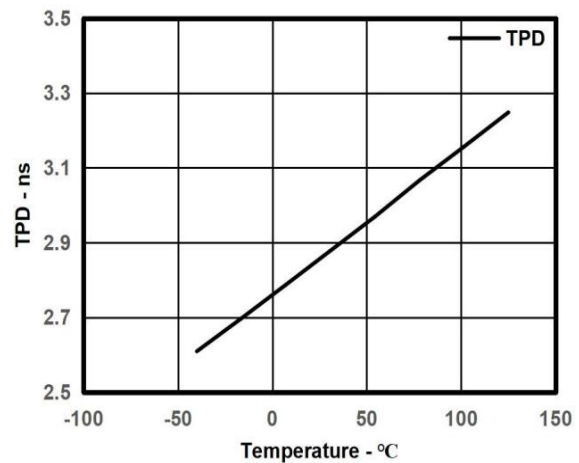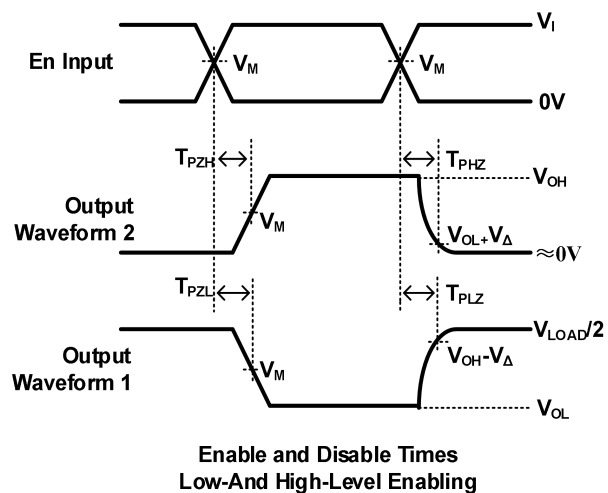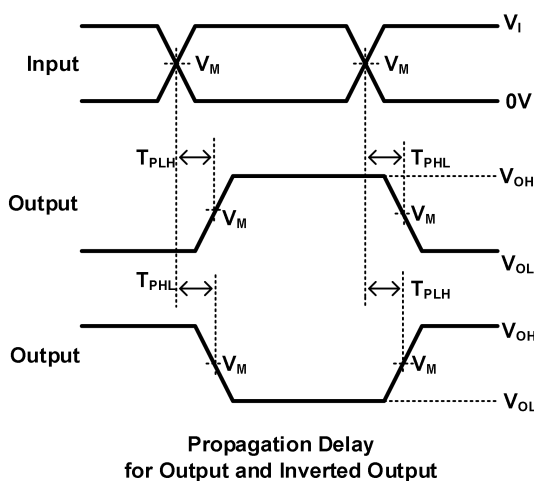


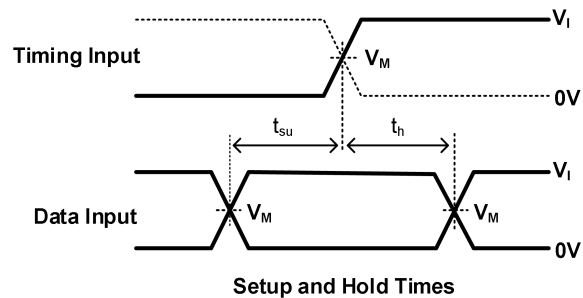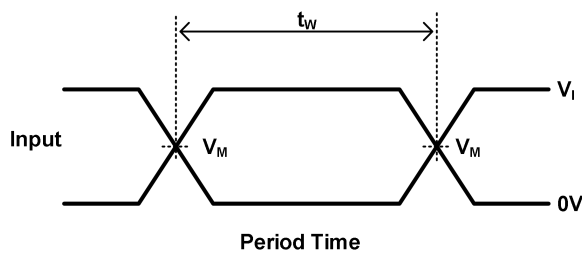**Typical Tpd vs Temp**

## Parameter Measurement Information



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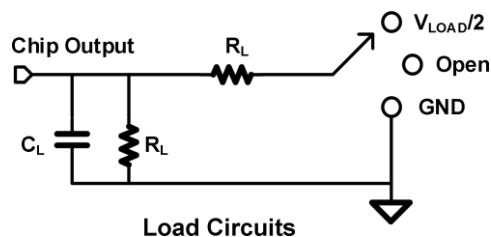
| TEST | S1 |
| --- | --- |
| $T_{PHL}$/$T_{PLH}$ | OPEN |
| $T_{PLZ}$/$T_{PZL}$ | $V_{LOAD}$ |
| $T_{PHZ}$/$T_{PZH}$ | GND |

## Parameter Measurement Information(Continued)

| Vcc | INPUTS | | VM | VLOAD | CL | RL | VΔ |
|---|---|---|---|---|---|---|---|
| | VI | Tr/Tf | | | | | |
| 1.8V±0.15V | Vcc | ≤2ns | Vcc/2 | 2×Vcc | 30pF | 1kΩ | 0.15V |
| 2.5V±0.15V | Vcc | ≤2ns | Vcc/2 | 2×Vcc | 30pF | 500Ω | 0.15V |
| 3.3V±0.15V | 3V | ≤2.5ns | 1.5V | 6V | 50pF | 500Ω | 0.3V |
| 5V±0.15V | Vcc | ≤2.5ns | Vcc/2 | 2×Vcc | 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. $C_L$ 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.

## Overview

This device is fully specified for partial-power-down applications using Ioff. The Ioff circuitry disables the outputs, preventing damaging current back flow through the device when it is powered down.

## Feature Description

The device is designed for 1.65V to 5.5V $V_{CC}$ operation and it allows down voltage translation from 5V to 3.3V, or 3.3V to 1.8V. Input signals to this device can be driven above the supply voltage so long as they remain below the maximum input voltage value.

The SN74LVC2G14 has power-down protection ($I_{off}$) and schmitt-trigger input.

The inputs and outputs for this device enter a high impedance state when the supply voltage is 0 V. The maximum leakage into or out of any input or output pin on the device is specified by $I_{off}$ in the Electrical Characteristics.

The Schmitt-Trigger input makes this device extremely tolerant to slow or noisy inputs. While the inputs can be driven much slower than standard CMOS inputs, it is still recommended to properly terminate unused inputs. Driving the inputs slowly will also increase dynamic current consumption of the device.

## Device Functional Modes

| Input A | Output Y |
|---------|----------|
| H | L |
| L | H |

## Application Information

Mechanical input elements, such as push buttons or rotary knobs, offer simple ways to interact with electronic systems. Typically, these elements have recoil or bouncing, where the mechanical element makes and breaks contact multiple times during human interaction. This bouncing can cause one or more repeated signals to be passed, triggering multiple actions when only a single input was intended. One potential solution to mitigating these multiple inputs is by utilizing a Schmitt-trigger to create a debounce circuit.
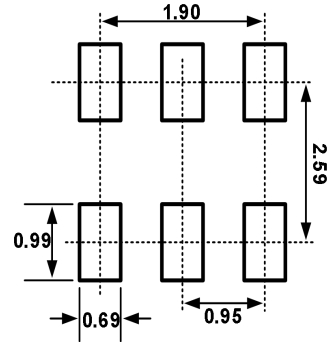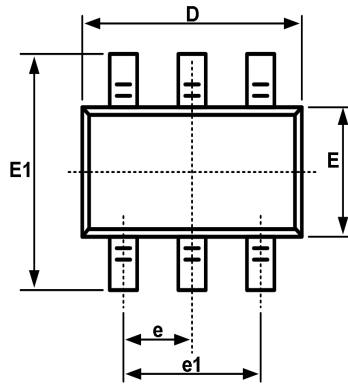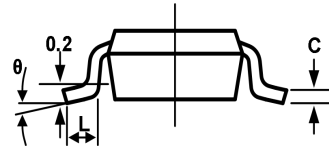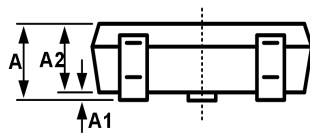
## Typical Power Button Circuit
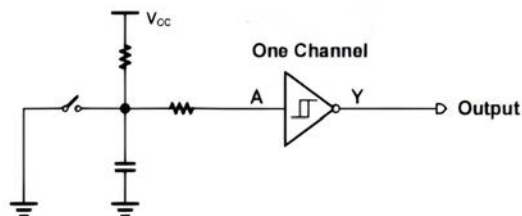


## Order information

| Package | Orderable Device | Packing Option |
|---------|------------------|----------------|
| SOT23-6 | SN74LVC2G14DBVR | 3000/Reel |
| SC70-6 | SN74LVC2G14DCKR | |

## Package Outline
**SOT-23-6L**



Recommended Land Pattern (Unit: mm)



| 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 | 0.950BSC | | 0.037BSC | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

## Package Outline
### SC-70-6
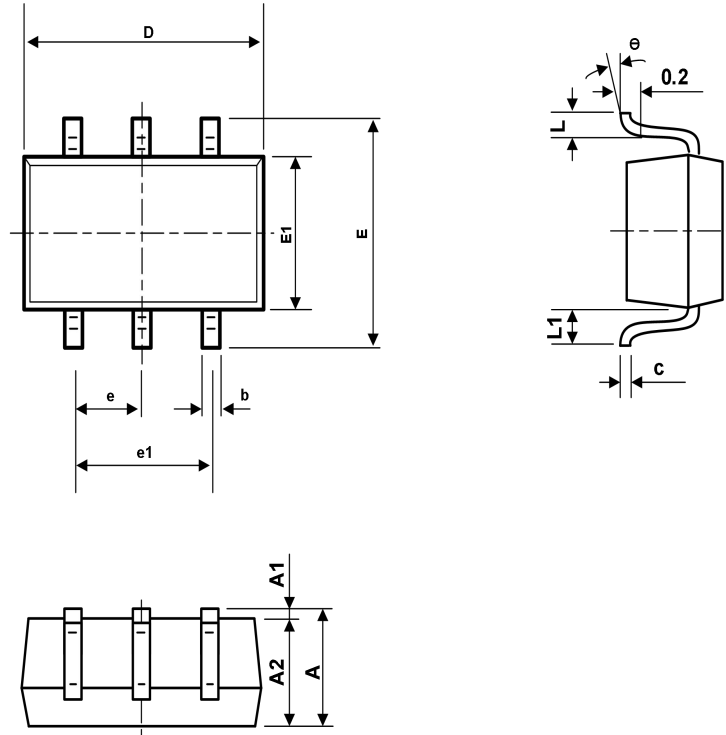


| symbol | Dimension In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.900 | 1.100 | 0.035 | 0.043 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.900 | 1.000 | 0.035 | 0.039 |
| b | 0.150 | 0.350 | 0.006 | 0.014 |
| c | 0.110 | 0.175 | 0.004 | 0.007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

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