**Dual 2-Input NAND Gate with Open-Drain Outputs**

**General Description**

The ET74LVC2G38 is designed for 1.65V to 5.5V VCC operation.

This device is a dual two-input NAND buffer gate with open-drain outputs. It performs the Boolean function Y= or Y= in positive logic.

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

**Features**

* Supports 5V VCC Operation
* Inputs Accept Voltages to 5.5V
* Max tPD of 4ns at 3.3V
* Low Power Consumption, 10µA Max ICC
* ±24mA Output Drive at 3.3V
* Typical VOLP (Output Ground Bounce) < 0.8 V at VCC = 3.3V, TA = 25°C
* Typical VOHV (Output VOH Undershoot) > 2 V at VCC = 3.3V, TA = 25°C
* IOFF Supports Live insertion, Partial-Power-Down Mode Operation and Back Drive Protection
* Latch-up Performance Exceeds 100mA Per JESD78, Class II
* ESD protection exceeds JESD22

-- 2000V Human-Body Model (A114-A)

-- 1000V Charged-Device Model (C101)

**Applications**

* Mobile Device

**Device Information**

|  |  |  |
| --- | --- | --- |
| **Part No.** | **Package** | **Size** |
| ET74LVC2G38U | VSSOP8 | 4mm \* 2.95mm |
| ET74LVC2G38V | TSSOP8 | 3.1mm \* 2mm |

**Pin Configuration**

|  |
| --- |
| Figure1. Top View |

**Pin Function**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Pin No.** | **I/O** | **Description** |
| 1A | 1 | Input | Channel 1, Input A |
| 1B | 2 | Input | Channel 1, Input B |
| 2Y | 3 | Output | Channel 2, Output Y |
| GND | 4 | — | Ground |
| 2A | 5 | Input | Channel 2, Input A |
| 2B | 6 | Input | Channel 2, Input B |
| 1Y | 7 | Output | Channel 1, Output Y |
| VCC | 8 | — | Positive Power Supply |

**Block Diagram**

|  |
| --- |
| Figure2. Logic Symbol |

**Functional Description**

**Function Table**

|  |  |  |
| --- | --- | --- |
| **Input** | | **Output** |
| **xA** | **xB** | **xY** |
| L | L | H |
| L | H | H |
| H | L | H |
| H | H | L |

###### Absolute Maximum Ratings(1)

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Symbol** | **Parameter** | | **Value** | **Unit** |
| VCC | Supply Voltage range | | −0.5 to 6.5 | V |
| VI | Input Voltage range**(2)** | | −0.5 to 6.5 | V |
| VO | Voltage range applied to any output in the high-impedance or power-off state**(2)** | | −0.5 to 6.5 | V |
| VO | Voltage range applied to any output in the high or low state**(2) (3)** | | −0.5 to VCC+0.5 | V |
| IIK | Input Clamp Current | VI < 0 | -50 | mA |
| IOK | Output Clamp Current | VO < 0 | -50 | mA |
| IO | Continuous Output Current | | ±50 | mA |
| ICC | Continuous Current through VCC or GND | | ±100 | mA |
| TSTG | Storage Temperature | | −65 to 150 | °C |
| VESD | Human Body Model (EIA/JESD22−A114−A) | | ±2000 | V |
| Charged Device Model (JESD22−C101−A) | | ±1000 |
| ILU | Max Latch up Current Above VCC and GND at 125°C (EIA/JESD78) | | ±100 | mA |

***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 under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

***Note 2*:** The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

***Note 3*:** The value of VCC is provided in the recommended operating conditions table.

###### Thermal Characteristics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Symbol | Package | Ratings | Value | Unit |
| RθJA | VSSOP8 | Thermal Characteristics, Thermal Resistance, Junction-to-Air |  | °C/W |
| TSSOP8 |  |
| PD | VSSOP8 | Power Dissipation  in Still Air at 85°C |  | mW |
| TSSOP8 |  |

Recommended Operating Conditions(4)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Symbol** | **Parameter** | **Conditions** | **Min** | **Max** | **Unit** |
| VCC | Supply Voltage | Operating | 1.65 | 5.5 | V |
| Data retention only | 1.5 |  | V |
| VIH | High-level Input Voltage | VCC = 1.65V to 1.95V | 0.65 × VCC |  | V |
| VCC = 2.3V to 2.7V | 1.7 |  | V |
| VCC = 3V to 3.6V | 2 |  | V |
| VCC = 4.5V to 5.5V | 0.7 × VCC |  | V |
| VIL | Low-level Input Voltage | VCC = 1.65V to 1.95V |  | 0.35 × VCC | V |
| VCC = 2.3V to 2.7V |  | 0.7 | V |
| VCC = 3V to 3.6V |  | 0.8 | V |
| VCC = 4.5V to 5.5V |  | 0.3 × VCC | V |
| VI | Input Voltage |  | 0 | 5.5 | V |
| VO | Output Voltage |  | 0 | VCC | V |
| IOL | Low-level Output Current | VCC = 1.65V |  | 4 | mA |
| VCC = 2.3V |  | 8 | mA |
| VCC = 3V |  | 16 | mA |
|  | 24 | mA |
| VCC = 4.5V |  | 32 | mA |
| Δt/Δv | Input Transition Rise or Fall Rate | VCC = 1.8V ± 0.15V,  2.5V ± 0.2V |  | 20 | ns/V |
| VCC = 3.3V ± 0.3V |  | 10 |
| VCC = 5V ± 0.5V |  | 5 |
| TA | Ambient Temperature | operating in free air | -40 | 125 | °C |

***Note 4*:** All unused inputs of the device must be held at VCC or GND to ensure proper device operation.

**Electrical Characteristics**

**DC Electrical Characteristics**

Over recommended operating free-air temperature range; Typical values measured at TA = 25°C (unless otherwise noted)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Symbol** | **Parameter** | **Condition** | **VCC** | **Operating Free-air Temperature (TA)** | | | | | | **Unit** |
| **-40oC≤TA≤85oC** | | | **-40oC≤TA≤125oC** | | |
| **Min** | **Typ(5)** | **Max** | **Min** | **Typ(5)** | **Max** |
| VOL | Low−Level Output Voltage | IOL =100 µA | 1.65V  to  5.5V |  |  | 0.1 |  |  | 0.1 | V |
| IOL =4 mA | 1.65V |  |  | 0.45 |  |  | 0.45 |
| IOL =8 mA | 2.3V |  |  | 0.3 |  |  | 0.3 |
| IOL =16 mA | 3V |  |  | 0.4 |  |  | 0.4 |
| IOL =24 mA |  |  | 0.55 |  |  | 0.55 |
| IOL =32 mA | 4.5V |  |  | 0.55 |  |  | 0.55 |
| II | Input Leakage  Current | VI = 5.5 or 0 | 0 to 5.5V |  |  | ±1 |  |  | ±10 | µA |
| IOFF |  | VI or VO =5.5 V | 0 |  |  | ±10 |  |  | ±10 | µA |
| ICC | Supply Current | VI =VCC or 0V,  IO = 0V | 1.65  to 5.5V |  |  | 10 |  |  | 100 | µA |
| ΔICC |  | One input at  VCC - 0.6V, Other inputs at VCC or GND | 3V  to 5.5V |  |  | 500 |  |  | 500 | µA |
| CI | Input  Capacitance | VI = VCC or 0V | 3.3V |  | 4 |  |  |  |  | pF |
| CO | Output  Capacitance | VO = VCC or 0V | 3.3V |  | 4.5 |  |  |  |  | pF |

***Note 5*:** All typical values are at VCC = 3.3V, TA = 25°C.

###### Switching Characteristics

Over recommended operating free-air temperature range; CL = 15pF (unless otherwise noted) (see Figure 3)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Symbol** | **Parameter** | **From** | **To** | **VCC** | **Operating Free-air Temperature (TA)** | | | **Unit** |
| **40oC≤TA≤85oC** | | |
| **Min** | **Typ** | **Max** |
| tPD | Propagation Delay | A or B | Y | 1.8V ± 0.15V | 2.5 |  | 8.5 | ns |
| 2.5V ± 0.2V | 1.5 |  | 5.2 |
| 3.3V ± 0.3V | 1.3 |  | 4 |
| 5V ± 0.5V | 0.9 |  | 3 |

###### Switching Characteristics

Over recommended operating free-air temperature range; CL = 30 or 50pF (unless otherwise noted) (see Figure 2)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Symbol** | **Parameter** | **From** | **To** | **VCC** | **Operating Free-air Temperature (TA)** | | | **Unit** |
| **40oC≤TA≤85oC** | | |
| **Min** | **Typ** | **Max** |
| tPD | Propagation Delay | A or B | Y | 1.8V ± 0.15V | 2.8 |  | 10 | ns |
| 2.5V ± 0.2V | 1.5 |  | 6 |
| 3.3V ± 0.3V | 1.4 |  | 4.5 |
| 5V ± 0.5V | 1 |  | 3.9 |

###### Switching Characteristics

Over recommended operating free-air temperature range; CL = 30 or 50pF (unless otherwise noted) (see Figure 2)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Symbol** | **Parameter** | **From** | **To** | **VCC** | **Operating Free-air Temperature (TA)** | | | **Unit** |
| **40oC≤TA≤125oC** | | |
| **Min** | **Typ** | **Max** |
| tPD | Propagation Delay | A or B | Y | 1.8V ± 0.15V | 2.6 |  | 10.8 | ns |
| 2.5V ± 0.2V | 1.6 |  | 6.7 |
| 3.3V ± 0.3V | 1.4 |  | 5.1 |
| 5V ± 0.5V | 1 |  | 4.3 |

###### Operating Characteristics

Over operating free-air temperature range; Typical values measured at TA = 25°C (unless otherwise noted)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Symbol** | **Parameter** | **Condition** | **VCC** | **Min** | **Typ** | **Max** | **Unit** |
| CPD | Power Dissipation Capacitance Gate | f = 10MHz | 1.8 V |  | 6 |  | pF |
| 2.5 V |  | 7 |  | pF |
| 3.3 V |  | 7 |  | pF |
| 5 V |  | 9 |  | pF |

**Parameter measurement information**

|  |
| --- |
| Figure 3. Load Circuit and Voltage Waveforms |

***Notes:*** A. CL 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 ≤10MHz, ZO = 50Ω.

D. The outputs are measured one at a time, with one transition per measurement.

E. Because this device has open-drain outputs, tPLZ and tPZL are the same as tPD.

F. tPZL is measured at VM.

G. tPLZ is measured at VOL + VΔ.

H. All parameters and waveforms are not applicable to all devices.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **VCC** | **Input** | | **VM** | **VLOAD** | **CL** | **RL** | **VΔ** |
| **VI** | **tr/tf** |
| 1.8V ± 0.15V | VCC | ≤ 2ns | VCC/2 | 2 × VCC | 15pF | 1MΩ | 0.15V |
| 2.5V ± 0.2V | VCC | ≤ 2ns | VCC/2 | 2 × VCC | 15pF | 1MΩ | 0.15V |
| 3.3V ± 0.3V | 3V | ≤ 2.5ns | 1.5V | 6V | 15pF | 1MΩ | 0.3V |
| 5V ± 0.5V | VCC | ≤ 2.5ns | VCC/2 | 2 × VCC | 15pF | 1MΩ | 0.3V |

**Parameter measurement information**

|  |
| --- |
| Figure 4. Load Circuit and Voltage Waveforms |

***Notes:*** A. CL 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:

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E. Because this device has open-drain outputs, tPLZ and tPZL are the same as tPD.

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H. All parameters and waveforms are not applicable to all devices.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **VCC** | **Input** | | **VM** | **VLOAD** | **CL** | **RL** | **VΔ** |
| **VI** | **tr/tf** |
| 1.8V ± 0.15V | VCC | ≤ 2ns | VCC/2 | 2 × VCC | 30pF | 1KΩ | 0.15V |
| 2.5V ± 0.2V | VCC | ≤ 2ns | VCC/2 | 2 × VCC | 30pF | 500Ω | 0.15V |
| 3.3V ± 0.3V | 3V | ≤ 2.5ns | 1.5V | 6V | 50pF | 500Ω | 0.3V |
| 5V ± 0.5V | VCC | ≤ 2.5ns | VCC/2 | 2 × VCC | 50pF | 500Ω | 0.3V |

**Package Dimension**

VSSOP8

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| TBD |

TSSOP8

|  |
| --- |
| TBD |

**Revision History and Checking Table**

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| --- | --- | --- | --- | --- | --- |
| **Version** | **Date** | **Revision Item** | **Modifier** | **Function &**  **Spec Checking** | **Package &**  **Tape Checking** |
| 0.0 | 2025-02-07 | Preliminary Version | ZhangZW | LuH |  |