# Dual Bidirectional I3C/I²C-bus Voltage-level Translator

## Description

The DIODES PI3CLS9606 is a 2-bit, dual supply translating transceiver with auto direction sensing, that enables bidirectional voltage level translation for traditional I2C-bus/SMBus applications, and 12.5 MHz I3C-bus applications. It features two 1-bit input-output ports (An and Bn), one output enable input (OE) and two supply pins ($V_{CCA}$ and $V_{CCB}$). $V_{CCA}$ can be supplied at any voltage between 0.72V and 1.98V and $V_{CCB}$ can be supplied at any voltage between 0.72V and 1.98V. $V_{CCA}$ must be ≤ $V_{CCB}$ to ensure proper operation.

PI3CLS9606 can be used for both open drain as well as push-pull application which allows for level translation applications using I3C and I2C protocols.

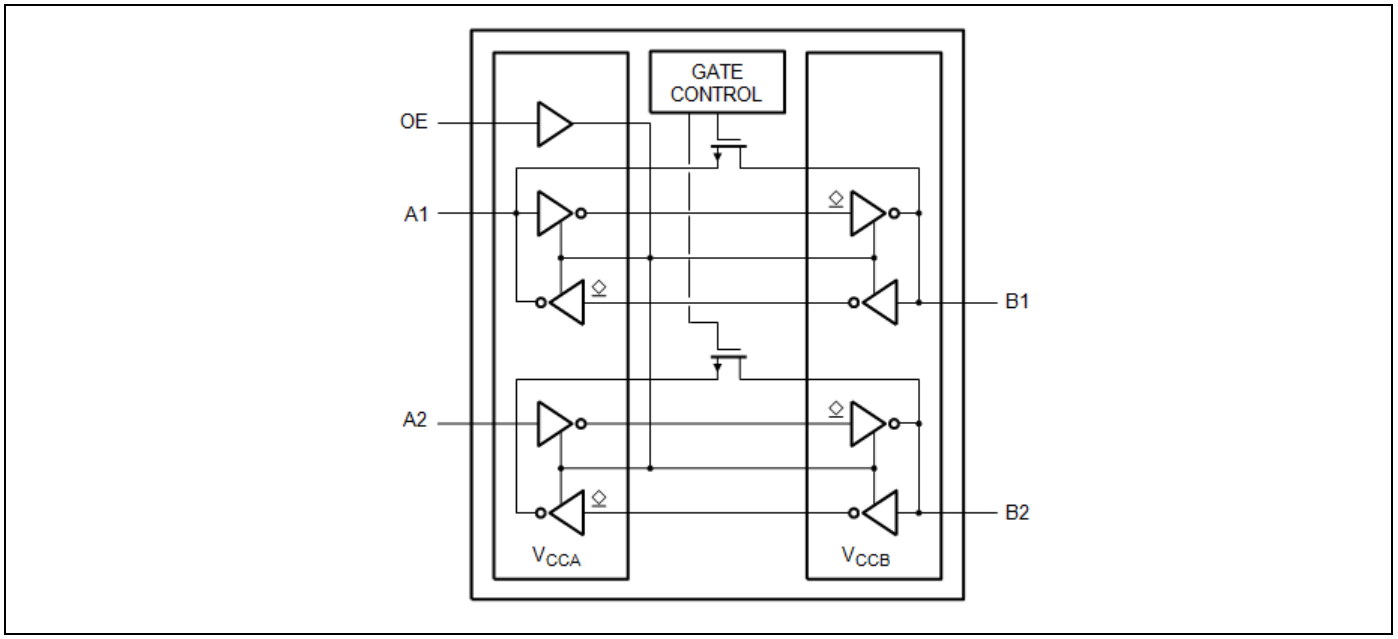
Port A is referenced to $V_{CCA}$ and port B is referenced to $V_{CCB}$. The active HIGH OE pin is referenced to $V_{CCA}$ and controllable by a signal in either VCCA or VCCB domain. A LOW level at pin OE causes the outputs to be in a high-impedance OFF-state. This device is fully specified for partial power-down applications using $I_{OFF}$. The $I_{OFF}$ circuitry disables the output, preventing the damaging backflow current through the device when it is in powered down.

## Features

- I3C/I²C-bus and SMBus bi-directional level translator
- Port A operating supply voltage $V_{CCA}$ range of 0.72V to 1.98V; Port B operating supply voltage $V_{CCB}$ range of 0.72V to 1.98V. $V_{CCA} \leq V_{CCB}$
- Active HIGH repeater enable input
- Lock-up free operation
- Powered-off high-impedance I²C-bus pins
- ESD protection exceeds 8KV HBM per JESD22-A114
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)
- For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.
  https://www.diodes.com/quality/product-definitions
- Packaging (Pb-free & Green available):
  - 8-Lead, 1.4mm x 1.0mm (HK)

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

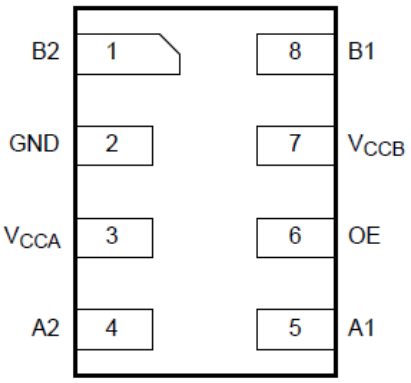
## Block Diagram




## Function Table

| OE | Function |
|---|---|
| H | An = Bn |
| L | Disconnect |

## Pin Configuration




**DFN1410-8L (Top View)**

## Pin Description

| Pin# | Name | Description |
|---|---|---|
| 1 | B2 | Data input or output (referenced to $V_{CCB}$) |
| 2 | GND | Supply ground (0V) |
| 3 | $V_{CCA}$ | Port A supply voltage (0.72V to 1.98V) |
| 4 | A2 | Data input or output (referenced to $V_{CCA}$) |
| 5 | A1 | Data input or output (referenced to $V_{CCA}$) |
| 6 | OE | Output enable input (active HIGH, referenced to $V_{CCA}$) |
| 7 | $V_{CCB}$ | Port B supply voltage (0.72V to 1.98V) |
| 8 | B1 | Data input or output (referenced to $V_{CCB}$) |

## Maximum Ratings

| | |
|---|---|
| Storage Temperature | -55°C to +125°C |
| Supply Voltage port A | -0.5V to +2.5V |
| Supply Voltage port B | -0.5V to+2.5V |
| DC Input Voltage | -0.5V to +2.5V |
| Control Input Voltage (OE) | -0.5V to+2.5V |
| Total Power Dissipation | 125mW |
| Input/Output Current (Port A & B) | ±50mA |
| Input Current ($V_{CCA}$, $V_{CCB}$, GND) | 100mA |
| ESD: HBM Mode | 8kV |

**Note:**
Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## Recommended Operation Conditions

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CCA}$ | Supply voltage A | $V_{CCA} \leq V_{CCB}$ | 0.72 | 1.98 | V |
| $V_{CCB}$ | Supply voltage B | $V_{CCA} \leq V_{CCB}$ | 0.72 | 1.98 | V |
| $V_I$ | Input voltage | A port, B port and OE | 0 | 1.98 | V |
| $V_O$ | Output voltage | Power-down or 3-state mode; $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | | |
| | | A port | 0 | 1.98 | V |
| | | B port | 0 | 1.98 | V |
| $T_{amb}$ | Ambient temperature | | -40 | +125 | °C |
| $T_J$ | Junction temperature[2] | | -40 | +125 | °C |
| $\Delta t/\Delta V$ | Input transition rise and fall rate | $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | - | <5.3 | ns/V |

## Typical Static Characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0V); Tamb = 25°C

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{OH}$ | HIGH-level output voltage | A port; $V_{CCA}$ = 1.2V; $I_O$ = -20µA | | 1.1 | | V |
| $V_{OL}$ | LOW-level output voltage | A port; $V_{CCA}$ = 1.2V; $I_O$ = 20µA | | 0.09 | | V |
| $I_I$ | Input leakage current | OE input; $V_I$ = 0V or 1.98V; $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 7.98V | | | ±1 | µA |
| $I_{OZ}$ | OFF-state output current | A or B port; $V_O$ = 0V to $V_{CCO}$(1); $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | | ±1 | µA |
| $I_{OFF}$ | Power-off leakage current | A port; $V_I$ or $V_O$ = 0V to 1.98V; $V_{CCA}$ = 0V; $V_{CCB}$ = 0V to 1.98V | | | ±1 | µA |
| | | B port; $V_I$ or $V_O$ = 0V to 1.98V; $V_{CCB}$ = 0V; $V_{CCA}$ = 0V to 1.98V | | | ±1 | |
| $I_{CC}$ | Supply current | $V_I$ = 0V or $V_{CCI}$(2); $I_O$ = 0V | | | | |
| | | $I_{CC(A)}$; $V_{CCA}$ = 0.72V; $V_{CCB}$ = 0.72V to 1.98V | | 0.05 | | µA |
| | | $I_{CC(B)}$; $V_{CCA}$ = 0.72V; $V_{CCB}$ = 0.72V to 1.98V | | 3.3 | | µA |
| | | $I_{CC(A)}$+ $I_{CC(B)}$; $V_{CCA}$ = 0.72V; $V_{CCB}$ = 0.72V to 1.98V | | 3.5 | | µA |

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $C_I$ | Input capacitance | OE input; $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | 1.0 | | pF |
| $C_{I/O}$ | Input/Output capacitance | A port; $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | 4.0 | | pF |
| | | B port; $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | 4.0 | | pF |

**Note:**
1. $V_{CCO}$ is the supply voltage associated with the output.
2. $V_{CCI}$ is the supply voltage associated with the input.

## DC Electrical Characteristics

VCCA, VCCB = 0.72 V to 1.98 V; GND = 0V; Tamb = -40 °C to +125 °C; unless otherwise specified

| Parameter | Description | Test Conditions | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|
| | | | Min. | Max. | Min. | Max. | |
| A port or B port | | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CCA}$ = 0.72V to 0.9V; $V_{CCB}$ = 0.72V to 0.9V | $V_{CCI}$ – 0.2 [1] | | $V_{CCI}$ -0.2 | | V |
| | | $V_{CCA}$ = 0.9V to 1.98V; $V_{CCB}$ = 0.9V to 1.98V | $V_{CCI}$ -0.4 | | $V_{CCI}$ -0.4 | | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | $0.3V_{CCA}$ | | $0.3V_{CCA}$ | V |
| $V_{OH}$ | HIGH-level output voltage | $I_O$ = -20µA; $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | $V_{CCO}$ - 0.4 [2] | | $V_{CCO}$ - 0.4 | | V |
| $V_{OL}$ | LOW-level output voltage | $I_O$ = 20µA; $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | 0.3 | | 0.3 | V |
| $I_{LI}$ | Input leakage current | OE input, $V_{CCA}$ = 0.72V to 1.98V, $V_{CCB}$ = 0.72V to 1.98V. | | ±2 | | ±5 | µA |
| $I_{OZ}$ | OFF-state output current | $V_O$ = 0V or $V_{CCO}$; $V_{CCA}$ = 0.72V to 1.98V $V_{CCB}$ = 0.72V to 1.98V | | ±2 | | ±10 | µA |
| $I_{OFF}$ | Power Off Leakage current | A port; $V_I$ or $V_O$ = 0V to 1.98V; $V_{CCA}$ = 0V; $V_{CCB}$ = 0V to 1.98V | | ±2 | | ±10 | µA |
| | | B port; $V_I$ or $V_O$ = 0V to 1.98V; $V_{CCB}$ = 0V; $V_{CCA}$ = 0V to 1.98V | | ±2 | | ±10 | µA |
| $I_{CCA}$ | Supply Current | $V_I$ = 0V or $V_{CCI}$; $I_O$ = 0A; OE = LOW; $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | 5 | | 15 | µA |
| | | $V_I$ = 0V or $V_{CCI}$; $I_O$ = 0A; OE = HIGH $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | 6 | | 20 | µA |
| | | $V_{CCA}$ = 1.98V; $V_{CCB}$ = 0V | | 3.5 | | 15 | µA |
| | | $V_{CCA}$ = 0V; $V_{CCB}$ = 1.98V | | -2 | | -15 | µA |

| Parameter | Description | Test Conditions | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|
| | | | Min. | Max. | Min. | Max. | |
| $I_{CCB}$ | Supply Current | $V_I$ = 0V or $V_{CCI}$; $I_O$ = 0A; OE = LOW; $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | 8 | | 29 | µA |
| | | $V_I$ = 0V or $V_{CCI}$; $I_O$ = 0A; OE = HIGH $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | 11 | | 36 | µA |
| | | $V_{CCA}$ = 1.98V; $V_{CCB}$ = 0V | | -2 | | -15 | µA |
| | | $V_{CCA}$ = 0V; $V_{CCB}$ = 1.98V | | 6 | - | 20 | µA |
| $I_{CCA}$ + $I_{CCB}$ | Supply Current | OE = LOW; $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | 16 | | 56 | µA |
| **Enable** | | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | 0.65$V_{CCA}$ | | 0.65$V_{CCA}$ | | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72V to 1.98V | | 0.3$V_{CCA}$ | | 0.3$V_{CCA}$ | V |
| $I_{LI}$ | Input leakage current | $V_I$ = 0V to 1.98V; $V_{CCA}$ = 0.72V to 1.98V; $V_{CCB}$ = 0.72Vto 1.98V | | ±2 | | ±5 | µA |

**Notes:**

1. $V_{CCI}$ is the supply voltage associated with the input.
2. $V_{CCO}$ is the supply voltage associated with the output.

## Dynamic Characteristics

**$V_{CCA}$ = 0.8V ± 10%**; GND = 0V; Tamb = -40℃ to +85℃; unless otherwise specified. [1][2]

| Symbol | Parameter | Test Conditions | $V_{CCB}$ = 1.2V ± 10% | | | $V_{CCB}$ = 1.8V ± 10% | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| $t_{PD}$ [1] | propagation delay | A to B, $C_L$ = 15pF | | 5.6 | 7.7 | | 3.9 | 5.3 | ns |
| | | B to A, $C_L$ = 15pF | | 10.6 | 19.9 | | 9.6 | 17.2 | |
| $t_{EN}$ | Enable time | OE to A, B; $C_L$ = 15pF | | 125 | 150 | | 120 | 160 | ns |
| $t_{DIS}$ | Disable time | OE to A, No external load [2] | | | 25 | | | 25 | ns |
| | | OE to B, No external load [2] | | | 25 | | | 25 | ns |
| | | OE to A; $C_L$ = 15pF | | | 50 | | | 50 | ns |
| | | OE to B; $C_L$ = 15pF | | | 50 | | | 50 | ns |
| tt | transition time | A port; $C_L$ = 15pF | | 8.5 | 17.5 | | 9 | 15.4 | ns |
| | | B port; $C_L$ = 15pF | | 4 | 5.8 | | 1.5 | 2.1 | |
| $t_{SKO}$ | Output Skew time | Delta between channel [3] | 0 | 0.2 | 0.4 | 0 | 0.2 | 0.4 | ns |
| $t_W$ | Pulse Width | Data input | 37 | | | 37 | | | ns |
| $f_{DATA}$ | Data rate | | 0.064 | | 26 | 0.064 | | 26 | Mbps |

**Notes:**

1. $t_{pd}$ is the same as $t_{PLH}$ and $t_{PHL}$; $t_{en}$ is the same as $t_{PZL}$ and $t_{PZH}$; $t_{dis}$ is the same as $t_{PLZ}$ and $t_{PHZ}$; $t_t$ is the same as $t_{THL}$ and $t_{TLH}$.
2. Guaranteed by design. Delay between OE going LOW and when the outputs are actually disabled.
3. Skew between any two outputs of the same package switching in the same direction. One channel is not always faster than the other.

**$V_{CCA}$ = 1.2V ± 10%**; GND = 0V; Tamb = -40℃ to +85℃; unless otherwise specified.

| Symbol | Parameter | Test Conditions | $V_{CCB}$ = 1.2V ± 10% | | | $V_{CCB}$ = 1.8V ± 10% | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| $t_{PD}$ | propagation delay | A to B, $C_L$ = 15pF | | 4.5 | 6.1 | | 2.5 | 3.5 | ns |
| | | B to A, $C_L$ = 15pF | | 3.9 | 5.3 | | 2.8 | 3.9 | ns |
| $t_{PDC}$ | propagation delay | A to B, $C_L$ = 80pF | NA | NA | NA | | 4.9 | 7 | ns |
| | | B to A, $C_L$ = 30pF | NA | NA | NA | | 3.4 | 5 | ns |
| $t_{EN}$ | Enable time | OE to A, B; $C_L$ = 15pF | | 50 | 100 | | 50 | 100 | ns |
| $t_{DIS}$ | Disable time | OE to A, No external load | | | 25 | | | 25 | ns |
| | | OE to B, No external load | | | 25 | | | 25 | ns |
| | | OE to A; $C_L$ = 15pF | | | 50 | | | 50 | ns |
| | | OE to B; $C_L$ = 15pF | | | 50 | | | 50 | ns |
| tt | transition time | A port; $C_L$ = 15pF | | 2.6 | 3.5 | | 1.5 | 2.5 | ns |
| | | B port; $C_L$ = 15pF | | 3.6 | 5.1 | | 1.3 | 2.2 | ns |
| ttC | transition time | A port; $C_L$ = 30pF | NA | NA | NA | | 2.2 | 3.6 | ns |
| | | B port; $C_L$ = 80pF | NA | NA | NA | | 4.3 | 6.3 | ns |
| $t_{SKO}$ | Output Skew time | Delta between channel | 0.0 | 0.1 | 0.2 | 0.0 | 0.1 | 0.3 | ns |
| $t_W$ | Pulse Width | Data input | 15 | | | 13.5 | | | ns |
| $f_{DATA}$ | Data rate | | 0.064 | | 52 | 0.064 | | 52 | Mbps |

**$V_{CCA}$ = 1.8V ± 10%**; GND = 0V; Tamb = -40℃ to +85℃; unless otherwise specified. (1)(2)

| Symbol | Parameter | Test Conditions | $V_{CCB}$ = 1.8V ± 10% | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $t_{PD}$ | propagation delay | A to B, $C_L$ = 15pF | | 2.5 | 3.4 | ns |
| | | B to A, $C_L$ = 15pF | | 2.3 | 3 | ns |
| $t_{EN}$ | Enable time | OE to A, B; $C_L$ = 15pF | | 25 | 50 | ns |
| $t_{DIS}$ | Disable time | OE to A, No external load | | | 25 | ns |
| | | OE to B, No external load | | | 25 | ns |
| | | OE to A; $C_L$ = 15pF | | | 50 | ns |
| | | OE to B; $C_L$ = 15pF | | | 50 | ns |
| tt | transition time | A port; $C_L$ = 15pF | | 1.2 | 1.7 | ns |
| | | B port; $C_L$ = 15pF | | 1.7 | 2.5 | ns |
| $t_{SKO}$ | Output Skew time | Delta between channel [3] | 0 | 0.1 | 0.2 | ns |
| $t_W$ | Pulse Width | Data input | 13.5 | | | ns |
| $f_{DATA}$ | Data rate | | 0.064 | | 52 | Mbps |

**$V_{CCA}$ = 0.8V ± 10%**; GND = 0V; Tamb = -40℃ to +125℃; unless otherwise specified. (1)(2)

| Symbol | Parameter | Test Conditions | $V_{CCB}$ = 1.2V ± 10% | | | $V_{CCB}$ = 1.8V ± 10% | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| $t_{PD}$ [1] | propagation delay | A to B, $C_L$ = 15pF | | 5.6 | 7.7 | | 3.9 | 5.3 | ns |
| | | B to A, $C_L$ = 15pF | | 10.6 | 19.9 | | 9.6 | 17.2 | ns |
| $t_{EN}$ | Enable time | OE to A, B; $C_L$ = 15pF | | 125 | 150 | | 120 | 160 | ns |
| $t_{DIS}$ | Disable time | OE to A, No external load [2] | | | 25 | | | 25 | ns |
| | | OE to B, No external load [2] | | | 25 | | | 25 | ns |
| | | OE to A; $C_L$ = 15pF | | | 50 | | | 50 | ns |

| Symbol | Parameter | Test Conditions | $V_{CCB}$ = 1.2V ± 10% | | | $V_{CCB}$ = 1.8V ± 10% | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| | | OE to B; $C_L$ = 15pF | | | 50 | | | 50 | ns |
| $t_t$ | transition time | A port; $C_L$ = 15pF | | 8.5 | 17.5 | | 9 | 15.4 | ns |
| | | B port; $C_L$ = 15pF | | 4 | 5.8 | | 1.5 | 2.1 | ns |
| $t_{SKO}$ | Output Skew time | Delta between channel [3] | 0 | 0.2 | 0.4 | 0 | 0.2 | 0.4 | ns |
| $t_W$ | Pulse Width | Data input | 37 | | | 37 | | | ns |
| $f_{DATA}$ | Data rate | | 0.064 | | 26 | 0.064 | | 26 | Mbps |

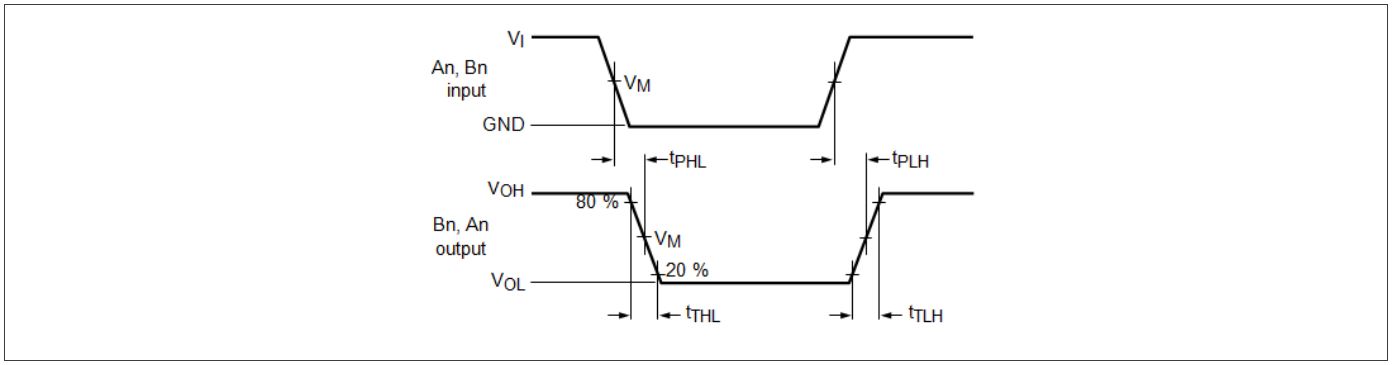
**Notes:**
1. $t_{pd}$ is the same as $t_{PLH}$ and $t_{PHL}$; $t_{en}$ is the same as $t_{PZL}$ and $t_{PZH}$; $t_{dis}$ is the same as $t_{PLZ}$ and $t_{PHZ}$; $t_t$ is the same as $t_{THL}$ and $t_{TLH}$.
2. Guaranteed by design. Delay between OE going LOW and when the outputs are actually disabled.
3. Skew between any two outputs of the same package switching in the same direction. One channel is not always faster than the other.

**$V_{CCA}$ = 1.2V ± 10%**; GND = 0V; Tamb = -40℃ to +125℃; unless otherwise specified. (1)(2)

| Symbol | Parameter | Test Conditions | $V_{CCB}$ = 1.2V ± 10% | | | $V_{CCB}$ = 1.8V ± 10% | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| $t_{PD}$ | propagation delay | A to B, $C_L$ = 15pF | | 4.5 | 6.2 | | 2.5 | 3.6 | ns |
| | | B to A, $C_L$ = 15pF | | 3.9 | 5.4 | | 2.8 | 4.0 | ns |
| $t_{PDC}$ | propagation delay | A to B, $C_L$ = 80pF | NA | NA | NA | | 4.9 | 7.4 | ns |
| | | B to A, $C_L$ = 30pF | NA | NA | NA | | 3.4 | 5.3 | ns |
| $t_{EN}$ | Enable time | OE to A, B; $C_L$ = 15pF | | 50 | 100 | | 50 | 100 | ns |
| $t_{DIS}$ | Disable time | OE to A, No external load | | | 25 | | | 25 | ns |
| | | OE to B, No external load | | | 25 | | | 25 | ns |
| | | OE to A; $C_L$ = 15pF | | | 50 | - | | 50 | ns |
| | | OE to B; $C_L$ = 15pF | | | 50 | - | | 50 | ns |
| tt | transition time | A port; $C_L$ = 15pF | | 2.6 | 3.5 | | 1.5 | 2.6 | ns |
| | | B port; $C_L$ = 15pF | | 3.6 | 5.1 | | 1.3 | 2.3 | ns |
| ttC | transition time | A port; $C_L$ = 30pF | NA | NA | NA | | 2.2 | 3.8 | ns |
| | | B port; $C_L$ = 80pF | NA | NA | NA | | 4.3 | 6.9 | ns |
| $t_{SKO}$ | Output Skew time | Delta between channel | 0 | 0.1 | 0.2 | 0 | 0.1 | 0.3 | ns |
| $t_W$ | Pulse Width | Data input | 15 | | | 13.5 | | | ns |
| $f_{DATA}$ | Data rate | | 0.064 | | 52 | 0.064 | | 52 | Mbps |

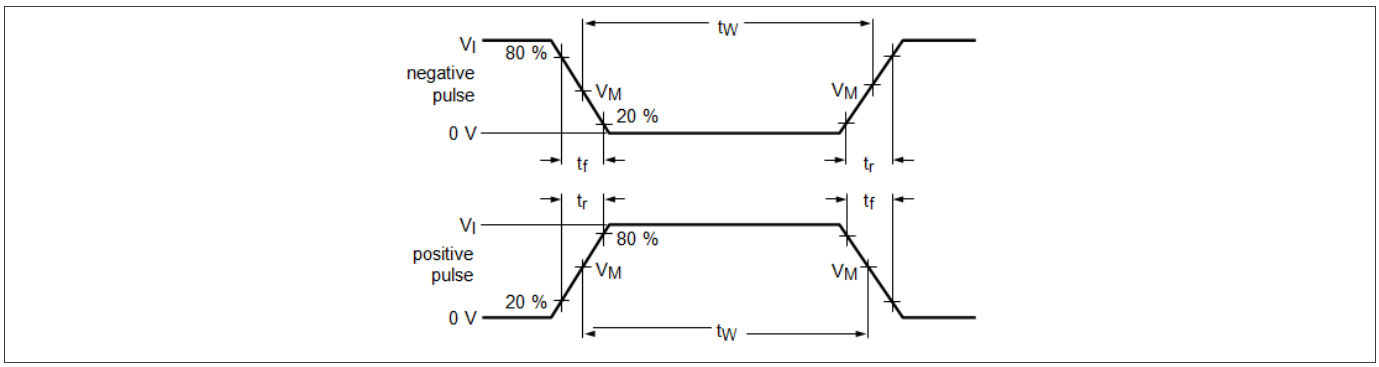
**$V_{CCA}$ = 1.8V ± 10%**; GND = 0V; Tamb = -40℃ to +125℃; unless otherwise specified. (1)(2)

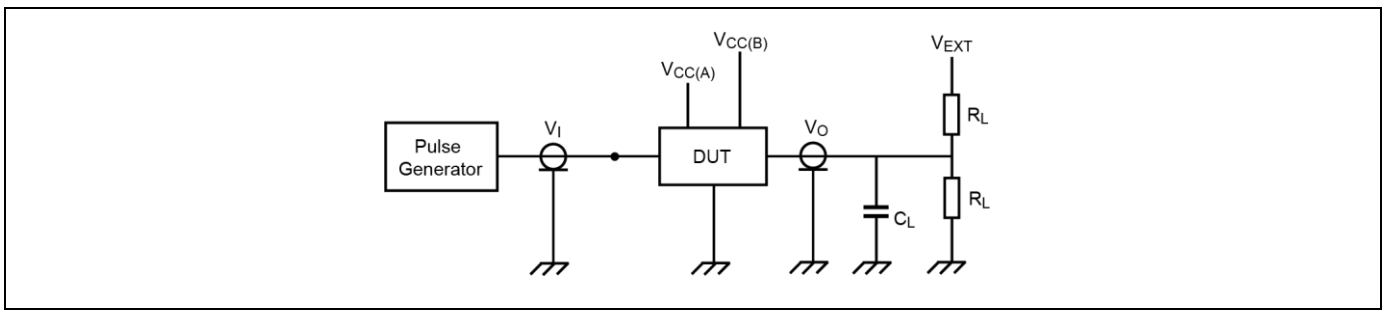
| Symbol | Parameter | Test Conditions | $V_{CCB}$ = 1.8V ± 10% | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $t_{PD}$ | propagation delay | A to B, $C_L$ = 15pF | | 2.5 | 3.5 | ns |
| | | B to A, $C_L$ = 15pF | | 2.3 | 3.1 | ns |
| $t_{EN}$ | Enable time | OE to A, B; $C_L$ = 15pF | | 25 | 50 | ns |
| $t_{DIS}$ | Disable time | OE to A, No external load | | | 25 | ns |
| | | OE to B, No external load | | | 25 | ns |
| | | OE to A; $C_L$ = 15pF | | | 50 | ns |
| | | OE to B; $C_L$ = 15pF | | | 50 | ns |
| tt | transition time | A port; $C_L$ = 15pF | | 1.2 | 1.7 | ns |
| | | B port; $C_L$ = 15pF | | 1.7 | 2.6 | ns |
| $t_{SKO}$ | Output Skew time | Delta between channel [3] | 0 | 0.1 | 0.2 | ns |
| $t_W$ | Pulse Width | Data input | 13.5 | | | ns |
| $f_{DATA}$ | Data rate | | 0.064 | | 52 | Mbps |




$V_{OL}$ and $V_{OH}$ are typical output voltage levels that occur with the output load.

| Supply Voltage | Input | Output | | |
|---|---|---|---|---|
| $V_{CCO}$ | $V_M$ | $V_M$ | $V_X$ | $V_Y$ |
| 0.8 V ± 10 % | $0.5V_{CCI}$ | $0.5V_{CCO}$ | $V_{OL}$ + 0.08 V | $V_{OH}$ - 0.08 V |
| 1.2 V ± 10 % | $0.5V_{CCI}$ | $0.5V_{CCO}$ | $V_{OL}$ + 0.12 V | $V_{OH}$ - 0.12 V |
| 1.8 V ± 10 % | $0.5V_{CCI}$ | $0.5V_{CCO}$ | $V_{OL}$ + 0.18 V | $V_{OH}$ - 0.18 V |




All input pulses are supplied by generators having the following characteristics: PRR ≤ 26 MHz; $Z_O$ = 50 Ω; dV/dt ≥ 1.0 V/ ns.

$R_L$ = Load resistance.

$C_L$ = Load capacitance including jig and probe capacitance.$V_{EXT}$ = External voltage for measuring switching times.

| Supply Voltage | | Input | | Load | | $V_{EXT}$ | | |
|---|---|---|---|---|---|---|---|---|
| $V_{CCA}$ | $V_{CCB}$ | $V_I$ | $\Delta t/\Delta V$ | $C_L$ | $R_L$ | $t_{PLH}$, $t_{PHL}$ | $t_{PZH}$, $t_{PHZ}$ | $t_{PZL}$, $t_{PLZ}$(3) |
| 0.72V to 1.98V | 0.72V to 1.98V | $V_{CCI}$ | ≤ 1.0 ns/V | 15pF | 50kΩ, 1MΩ | Open | Open | $2V_{CCO}$ |

1. $V_{CCI}$ is the supply voltage associated with the input.
2. For measuring data rate, pulse width, propagation delay and output rise and fall measurements, $R_L$ = 1 MΩ; for measuring enable and disable times, $R_L$ = 50 kΩ.
3. $V_{CCO}$ is the supply voltage associated with the output.

## Input Driver Requirements

The continuous DC current sinking or sourcing capability is determined by the external system-level; open-drain or push-pull drivers that are interfaced to the PI3CLS9606 IO pins.
The high bandwidth of these IO circuits used to facilitate this fast change from an input to an output and an output to an input, they have a modest sourcing capability of hundreds of micro-amperes, as determined by the pull-up resistor.
The fall time of a signal depends on the edge-rate and output impedance of the external driving the PI3CLS9606 data IOs, as well as the capacitive loading at the data lines.

### Power-up and Power-down

During operation, ensure that $V_{CCA} \leq V_{CCB}$ at all times. The sequencing of each power supply will not damage the device during the power up operation, so either power supply can be ramped up first. There is no special power-up sequencing required. The PI3CLS9606 includes circuitry that disables all output ports and puts the device into a power-down mode when either $V_{CCA}$ or $V_{CCB}$ is switched off.

### Enable and Disable

An output enable input (OE) is used to disable the device. Setting OE = LOW causes all I/Os to assume the high-impedance OFF-state. The disable time ($t_{dis}$ with no external load) indicates the delay between when OE goes LOW and when outputs actually become disabled. The enable time ($t_{en}$) indicates the amount of time the user must allow for one one-shot circuitry to become operational after OE is taken HIGH. To ensure the high-impedance OFF-state during power-up or power-down, pin OE should be tied to GND, OE pin should not be left floating in any condition.
OE $V_{IL}$ and $V_{IH}$ are referenced to $V_{CCA}$. The OE can be controlled by an external device that is powered by either $V_{CCA}$ or $V_{CCB}$. As $V_{CCB}$ is required to be greater than $V_{CCA}$, the OE pin has been designed to withstand a voltage equal to $V_{CCB}$ (up to 1.98V per recommended functional voltage range)

## Application Information

The PI3CLS9606 can be used to interface between devices or systems operating at different supply voltages. See the figures below for a typical operating circuit using the PI3CLS9606.

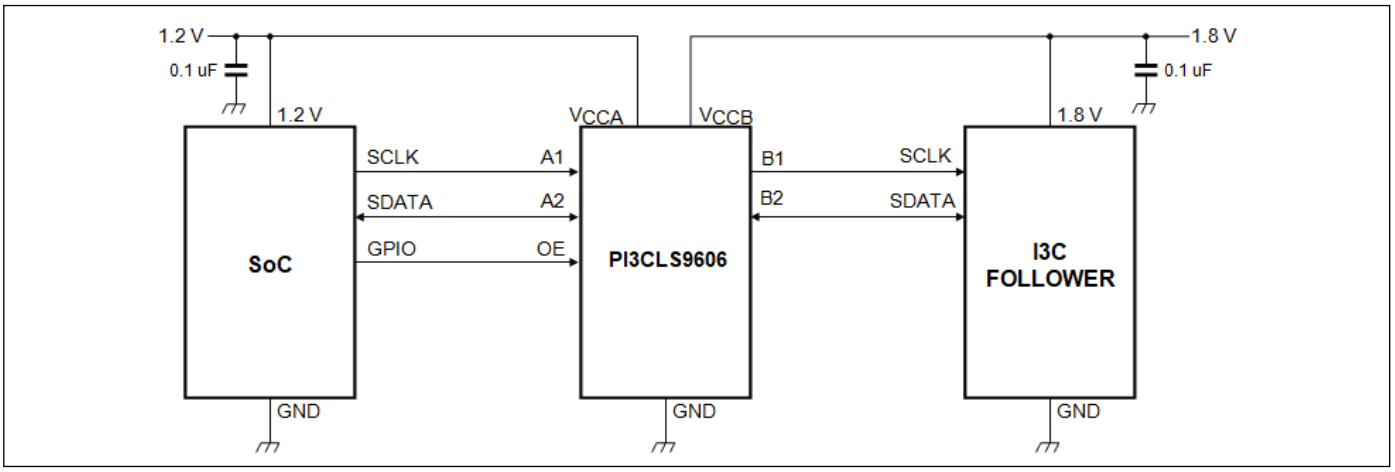



Figure 1. I3C Application

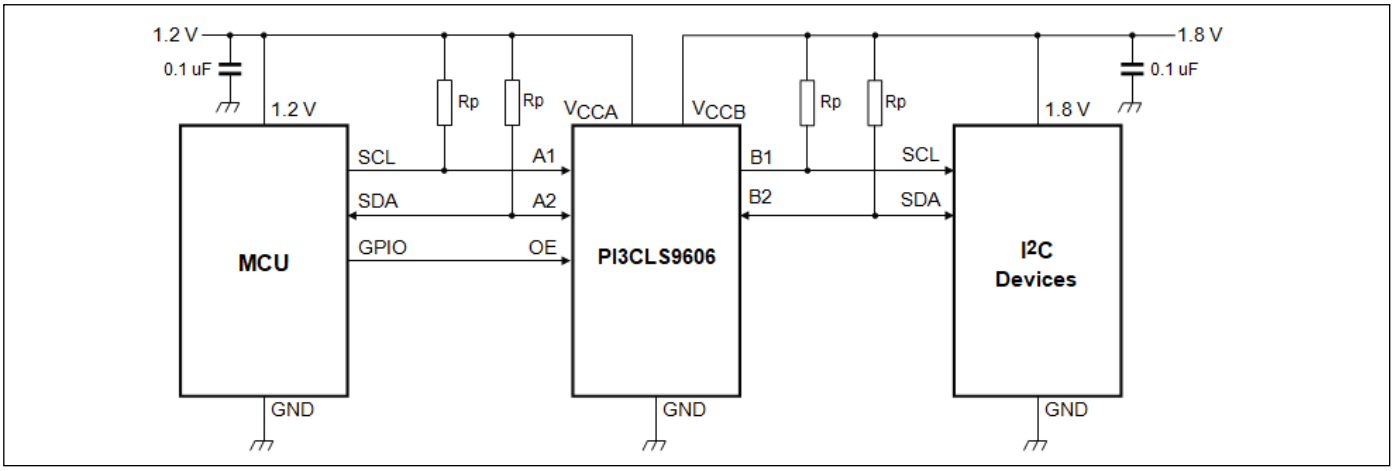
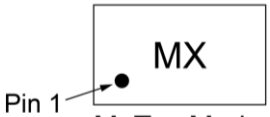



Figure 2. I2C Application

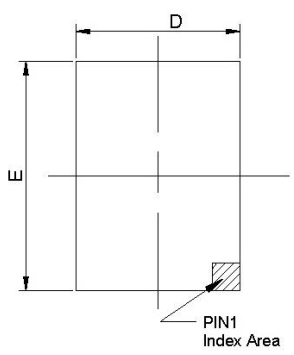
## Part Marking



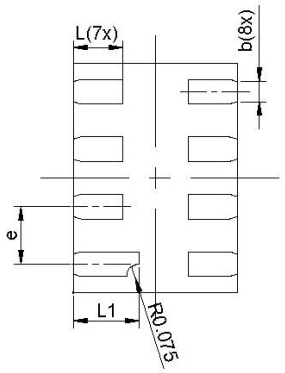

M: Top Mark
X: One Character Shorted Date Code

## Mechanical Information

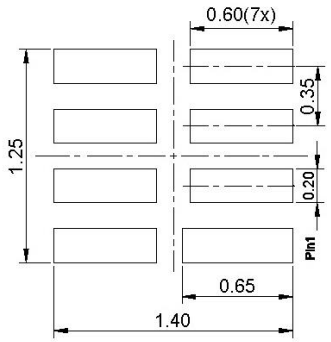
**8-X1-DFN1410-8 (HK)**



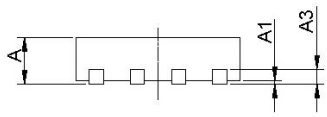

TOP VIEW




Bottom VIEW




RECOMMENDED LAND PATTERN(unit:mm)




SIDE VIEW

| PKG. DIMENSIONS(MM) | | | |
|---|---|---|---|
| SYMBOL | Min | Nom | Max |
| A | 0.36 | 0.40 | 0.43 |
| A1 | 0 | 0.02 | 0.05 |
| A3 | | 0.13 REF | |
| D | 0.95 | 1.00 | 1.05 |
| E | 1.35 | 1.40 | 1.45 |
| b | 0.12 | 0.15 | 0.20 |
| e | | 0.35 BSC | |
| L | 0.25 | 0.30 | 0.35 |
| L1 | 0.35 | 0.40 | 0.45 |

Notes:
1. Ref: JEDEC MO-288
2. LAND PATTERN REFERENCE DIODES X2-DFN1410-8 PACKAGE INFORMATION

DATE: 12/10/20

DESCRIPTION: 8-Pin, X1-DFN1410-8

PACKAGE CODE: HK (HK8)

DOCUMENT CONTROL#: PD-2264 REVISION:--

20-0540

**For latest package info.**

**please check: http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/**

## Ordering Information

| Part Number | Package Code | Description |
|---|---|---|
| PI3CLS9606HKEX | HK | 8-Pin, X1-DFN1410 |

**Notes:**

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. E = Pb-free and Green
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