# 2-Bit Bidirectional Voltage Level Translator for I²C-Bus and SMBus Interfaces

## PCA9306

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The PCA9306 is a dual bidirectional I²C-bus and SMBus voltage-level translator with an enable (EN) input, and is operational from 1.0 V to 3.6 V (Vref(1)) and 1.8 V to 5.5 V (Vbias(ref)(2)).

The PCA9306 allows bidirectional voltage translations between 1.0 V and 5 V without the use of a direction pin. The low ON-state resistance (Ron) of the switch allows connections to be made with minimal propagation delay. When EN is HIGH, the translator switch is on, and the SCL1 and SDA1 I/O are connected to the SCL2 and SDA2 I/O, respectively, allowing bidirectional data flow between ports. When EN is LOW, the translator switch is off and a high-impedance state exists between ports.

The PCA9306 is not a bus buffer like the PCA9509 or PCA9517A that provide both level translation and physically isolates the capacitance to either side of the bus when both sides are connected. The PCA9306 only isolates both sides when the device is disabled and provides voltage level translation when active.

The PCA9306 can also be used to run two buses, one at 400 kHz operating frequency and the other at 100 kHz operating frequency. If the two buses are operating at different frequencies, the 100 kHz bus must be isolated when the 400 kHz operation of the other bus is required. If the leader is running at 400 kHz, the maximum system operating frequency may be less than 400 kHz because of the delays added by the translator.

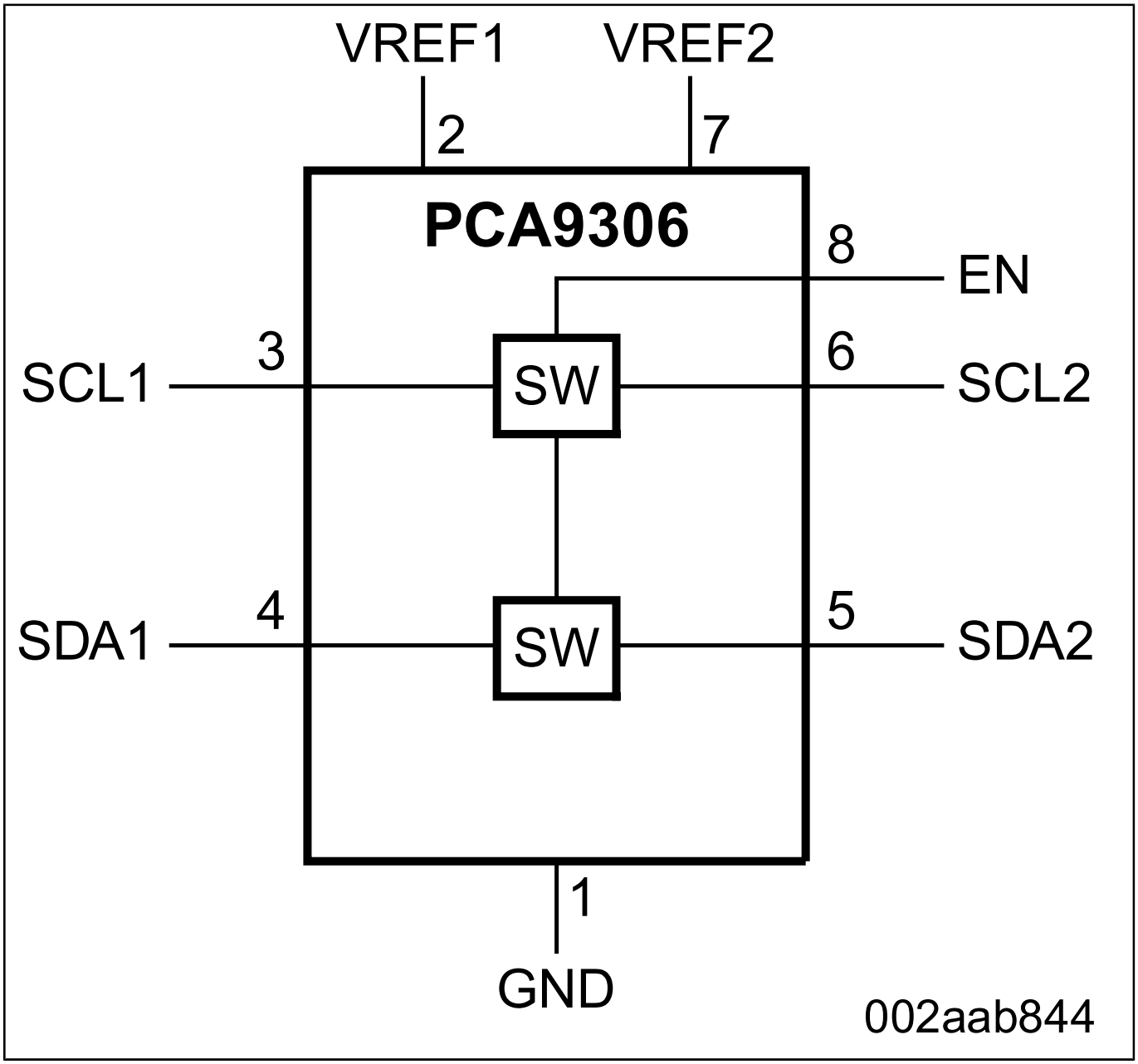
As with the standard I²C-bus system, pull-up resistors are required to provide the logic HIGH levels on the translator's bus. The PCA9306 has a standard open-collector configuration of the I²C-bus. The size of these pull-up resistors depends on the system, but each side of the translator must have a pull-up resistor. The device is designed to work with standard-mode, fast-mode and fast-mode plus I²C-bus devices in addition to SMBus devices. The maximum frequency is dependent on the RC time constant, but generally supports > 2 MHz.

When the SDA1 or SDA2 port is LOW, the clamp is in the ON-state and a low resistance connection exists between the SDA1 and SDA2 ports. Assuming the higher voltage is on the SDA2 port when the SDA2 port is HIGH, the voltage on the SDA1 port is limited to the voltage

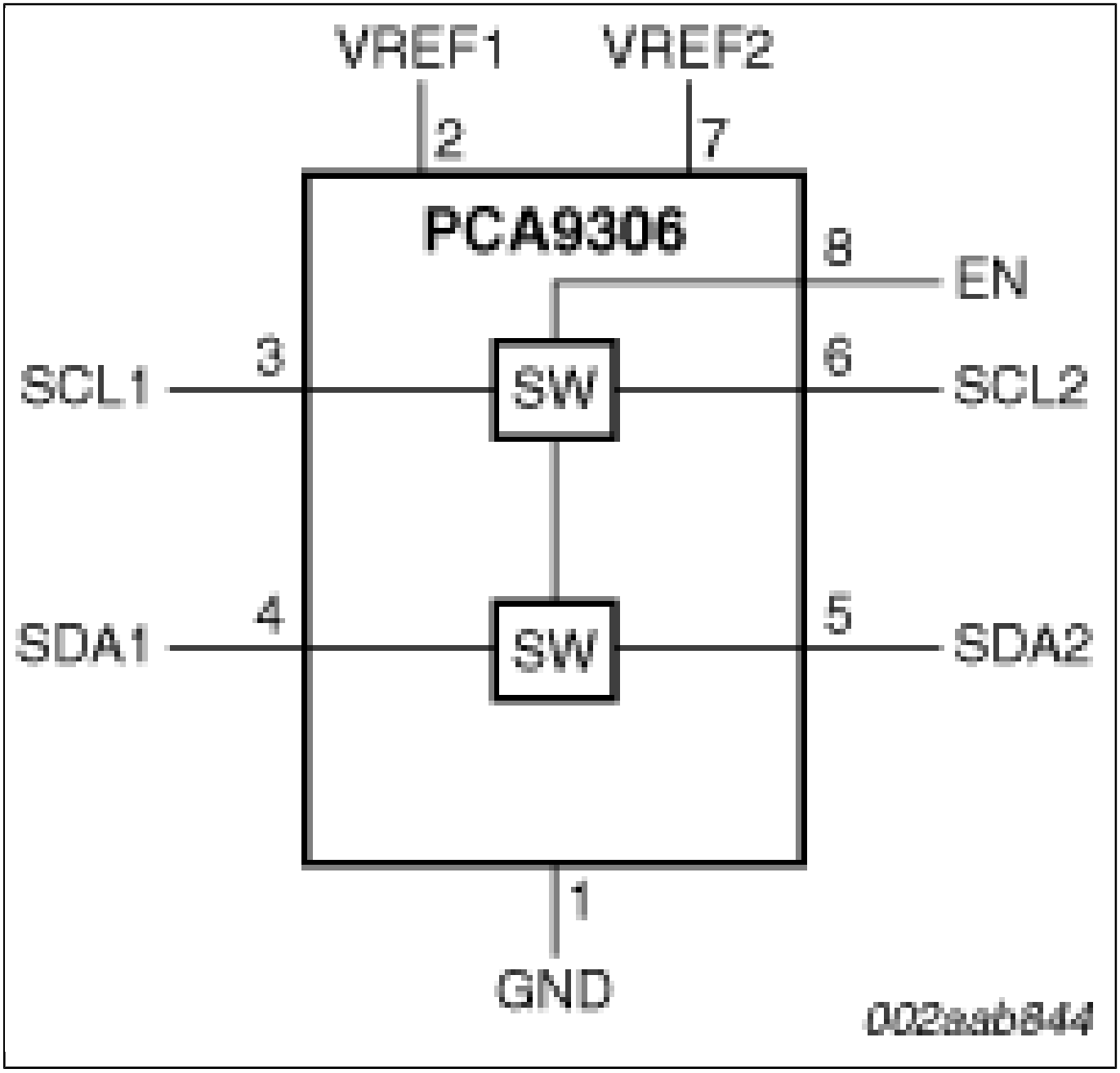
set by VREF1. When the SDA1 port is HIGH, the SDA2 port is pulled to the drain pull-up supply voltage (Vpu(D)) by the pull-up resistors. This functionality allows a seamless translation between higher and lower voltages selected by the user without the need for directional control. The SCL1/SCL2 channel also functions as the SDA1/SDA2 channel.

All channels have the same electrical characteristics and there is minimal deviation from one output to another in voltage or propagation delay. This is a benefit over discrete transistor voltage translation solutions, since the fabrication of the switch is symmetrical. The translator provides excellent ESD protection to lower voltage devices, and at the same time protects less ESD-resistant devices.

**PCA9306 Block Diagram**



## PCA9306D, PCA9306DC, PCA9306DC1, PCA9306DP, PCA9306DP1, PCA9306GM Block Diagram

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