

PCA9515B 双路双向 I²C 总线 和 SMBus 中继器

1 特性

- 两通道双向缓冲器
- I²C 总线和 SMBus 兼容
- 支持 I²C 标准模式 (100kHz) 和快速模式 (400kHz)
- 高电平有效的中继器启用输入
- 开漏 I²C 输入和输出
- 5.5V 耐压 I²C 输入和输出以及使能输入，支持混合模式信号操作
- 无死锁运行
- 支持标准模式、快速模式 I²C 器件、和多个主控制器
- 支持中继器上的仲裁及时钟延伸
- 断电高阻抗 I²C 引脚
- 锁存性能超过 100mA，符合 JESD 78 I 类规范要求
- 静电放电 (ESD) 保护性能超过 JESD 22 规范要求
 - 2000V 人体放电模式 (A114-A)
 - 1000V 充电器件模型 (C101)

2 应用

- 服务器
- 路由器（电信交换设备）
- 工业设备
- 具有多个 I²C 从器件且 PCB 走线较长的产品

3 说明

PCA9515B 是一款 BiCMOS 双路双向缓冲器集成电路，旨在满足 I²C 总线和 SMBus 应用的需求。该器件包含两个相同的双向开漏缓冲器电路，能够扩展 I²C 及相似总线系统（或添加从器件），同时不会降低系统性能。双路双向 I²C 缓冲区可由 2.3V 到 3.6V 的 V_{CC} 供电运行。

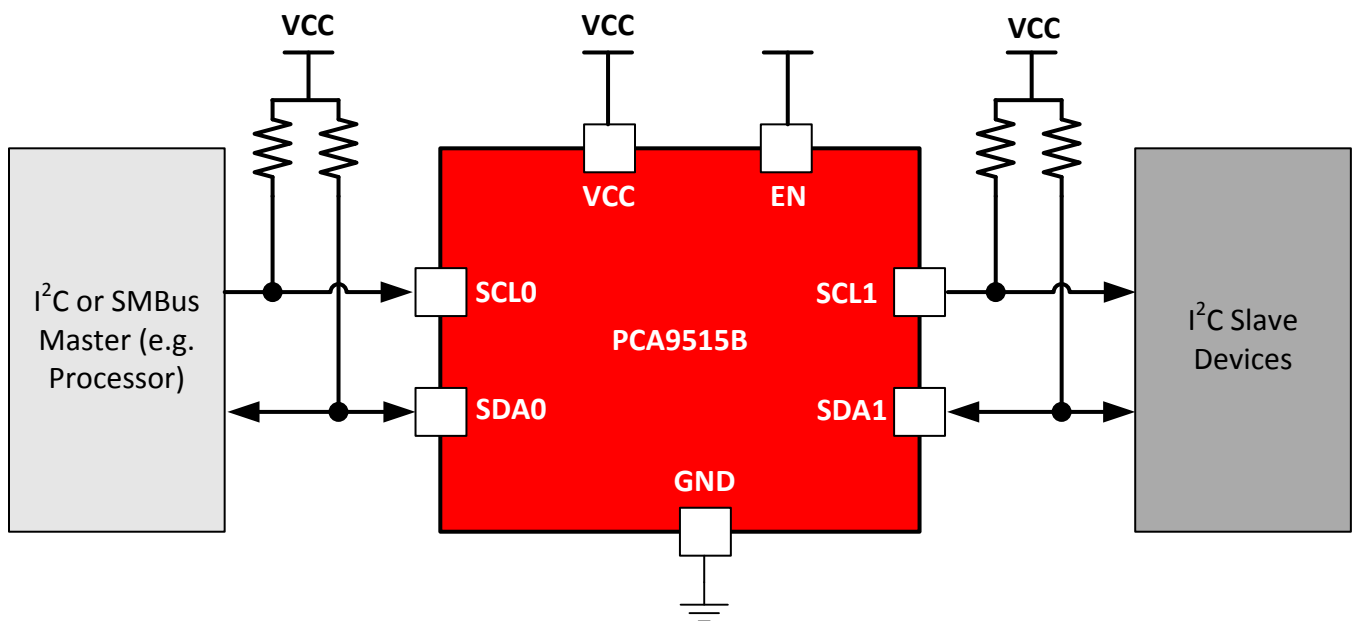
PCA9515B 能够缓冲 I²C 总线上的串行数据 (SDA) 和串行时钟 (SCL) 信号，同时保持 I²C 系统的所有工作模式和特性。该器件允许在 I²C 应用中连接两条电容为 400pF 的总线。

器件信息⁽¹⁾

器件型号	封装	封装尺寸（标称值）
PCA9515B	VSSOP (8)	3.00mm × 3.00mm

(1) 要了解所有可用封装，请见数据表末尾的可订购产品附录。

简化电路原理图



目录

1	特性	1	8.2	Functional Block Diagram	9
2	应用	1	8.3	Feature Description	9
3	说明	1	8.4	Device Functional Modes	10
4	修订历史记录	2	9	Application and Implementation	11
5	Pin Configuration and Functions	3	9.1	Application Information	11
6	Specifications	4	9.2	Typical Application	11
6.1	Absolute Maximum Ratings	4	10	Power Supply Recommendations	12
6.2	ESD Ratings	4	11	Layout	13
6.3	Recommended Operating Conditions	4	11.1	Layout Guidelines	13
6.4	Thermal Information	4	11.2	Layout Example	13
6.5	Electrical Characteristics	5	12	器件和文档支持	14
6.6	Timing Requirements	5	12.1	文档支持	14
6.7	Switching Characteristics	5	12.2	社区资源	14
6.8	Typical Characteristics	6	12.3	商标	14
7	Parameter Measurement Information	7	12.4	静电放电警告	14
8	Detailed Description	8	12.5	Glossary	14
8.1	Overview	8	13	机械、封装和可订购信息	14

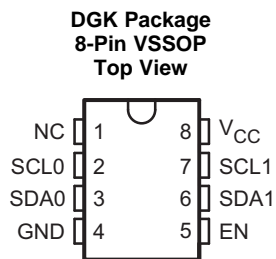
4 修订历史记录

注：之前版本的页码可能与当前版本有所不同。

Changes from Revision A (May 2013) to Revision B	Page
• 已添加器件信息表，ESD 额定值表，特性说明部分，器件功能模式，应用和实施部分，电源相关建议部分，布局部分，器件和文档支持部分以及机械、封装和可订购信息部分.	1
• 已删除订购信息。请参见数据表末尾的 POA。	1

Changes from Original (March 2012) to Revision A	Page
• Updated the V_{OL} and $V_{OL} - V_{ILC}$ specifications.	5

5 Pin Configuration and Functions



NC - No internal connection

Pin Functions

PIN		I/O	DESCRIPTION
NO.	NAME		
1	NC	—	No internal connection
2	SCL0	I/O	Serial clock bus 0
3	SDA0	I/O	Serial data bus 0
4	GND	—	Supply ground
5	EN	I	Active-high repeater enable input
6	SDA1	I/O	Serial data bus 1
7	SCL1	I/O	Serial clock bus 1
8	V _{CC}	—	Supply power

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

			MIN	MAX	UNIT
V _{CC}	Supply voltage		−0.5	7	V
V _I	Enable input voltage ⁽²⁾		−0.5	7	V
V _{I/O}	I ² C bus voltage ⁽²⁾		−0.5	7	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 _{stg}	Storage temperature		−65	150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. 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

			VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±1000	

- (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.

6.3 Recommended Operating Conditions

			MIN	MAX	UNIT
V _{CC}	Supply voltage		2.3	3.6	V
V _{IH}	High-level input voltage	SDA and SCL inputs	0.7 × V _{CC}	5.5	V
		EN input	2	5.5	
V _{IL} ⁽¹⁾	Low-level input voltage	SDA and SCL inputs	−0.5	0.3 × V _{CC}	V
		EN input	−0.5	0.8	
V _{ILC} ⁽¹⁾	SDA and SCL low-level input voltage contention		−0.5	0.4	V
I _{OL}	Low-level output current	V _{CC} = 2.3 V		6	mA
		V _{CC} = 3 V		6	
T _A	Operating free-air temperature		−40	85	°C

- (1) V_{IL} specification is for the EN input and the first low level seen by the SDAx and SCLx lines. V_{ILC} is for the second and subsequent low levels seen by the SDAx and SCLx lines. V_{ILC} must be at least 70 mV below V_{OL}.

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾		PCA9515B	UNIT
		DGK (VSSOP)	
		8 PINS	
R _{θJA}	Junction-to-ambient thermal resistance ⁽²⁾	170.8	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	62.9	°C/W
R _{θJB}	Junction-to-board thermal resistance	91.6	°C/W
ψ _{JT}	Junction-to-top characterization parameter	9.5	°C/W
ψ _{JB}	Junction-to-board characterization parameter	90.2	°C/W

- (1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).
- (2) The package thermal impedance is calculated in accordance with JEDEC 51-7.

6.5 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	V _{CC}	MIN	TYP ⁽¹⁾	MAX	UNIT
V _{IK}	Input diode clamp voltage	I _I = −18 mA	2.3 V to 3.6 V	−1.2			V
V _{OL}	Low-level output voltage	SDA _x , SCL _x I _{OL} = 20 μA or 6 mA	2.3 V to 3.6 V	0.47	0.52	0.6	V
V _{OL} − V _{ILc}	Low-level input voltage below low-level output voltage	SDA _x , SCL _x guaranteed by design	2.3 V to 3.6 V		120		mV
I _{CC}	Quiescent supply current	Both channels high, SDA _x = SCL _x = V _{CC}	2.7 V		0.5	3	mA
			3.6 V		0.5	3	
		Both channels low, SDA0 = SCL0 = GND and SDA1 = SCL1 = open; or SDA0 = SCL0 = open and SDA1 = SCL1 = GND	2.7 V		1	4	
			3.6 V		1	4	
		In contention, SDA _x = SCL _x = GND	2.7 V		1	4	
			3.6 V		1	4	
I _I	Input current	SDA _x , SCL _x V _I = 3.6 V	2.3 V to 3.6 V			±1	μA
		SDA _x , SCL _x V _I = 0.2 V				3	
		EN V _I = V _{CC}				±1	
		EN V _I = 0.2 V				−10 −20	
I _{off}	Leakage current	SDA _x , SCL _x V _I = 3.6 V	0 V			0.5	μA
		EN = L or H V _I = GND				0.5	
I _{I(ramp)}	Leakage current during power up	SDA _x , SCL _x V _I = 3.6 V	0 V to 2.3 V			1	μA
C _{in}	Input capacitance	EN V _I = 3 V or GND	3.3 V		7	9	pF
		SDA _x , SCL _x EN = H	3.3 V		7	9	

(1) All typical values are at nominal supply voltage (V_{CC} = 2.5 V or 3.3 V) and T_A = 25°C.

6.6 Timing Requirements

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

		V _{CC}	MIN	MAX	UNIT
t _{su}	Setup time, EN↑ before Start condition	2.5 V ± 0.2 V	100		ns
		3.3 V ± 0.3 V	100		
t _h	Hold time, EN↓ after Stop condition	2.5 V ± 0.2 V	130		ns
		3.3 V ± 0.3 V	100		

6.7 Switching Characteristics

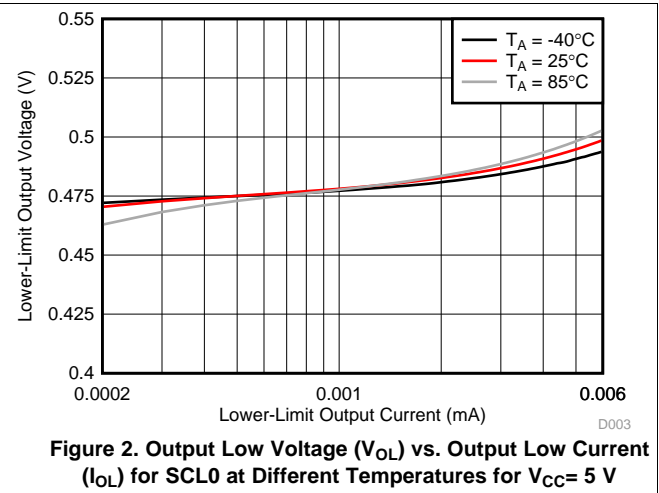
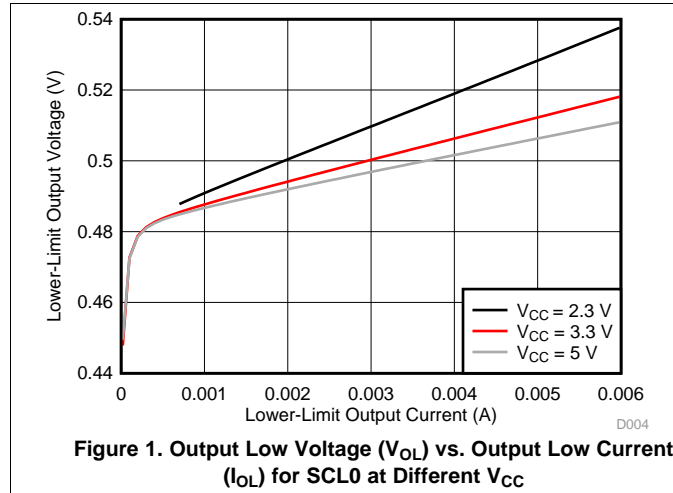
over recommended operating free-air temperature range, C_L ≤ 100 pF (unless otherwise noted)

PARAMETER		FROM (INPUT)	TO (OUTPUT)	V _{CC}	MIN	TYP ⁽¹⁾	MAX	UNIT
t _{PZL}	Propagation delay time ⁽²⁾	SDA0, SCL0 or SDA1, SCL1	SDA1, SCL1 or SDA0, SCL0	2.5 V ± 0.2 V	45	82	130	ns
				3.3 V ± 0.3 V	45	68	120	
t _{PLZ}				2.5 V ± 0.2 V	33	113	190	
				3.3 V ± 0.3 V	33	102	180	
t _{tHL}	Output transition time ⁽²⁾ (SDA _x , SCL _x)	80%	20%	2.5 V ± 0.2 V		57		ns
				3.3 V ± 0.3 V		58		
t _{tLH}		20%	80%	2.5 V ± 0.2 V		148		
				3.3 V ± 0.3 V		147		

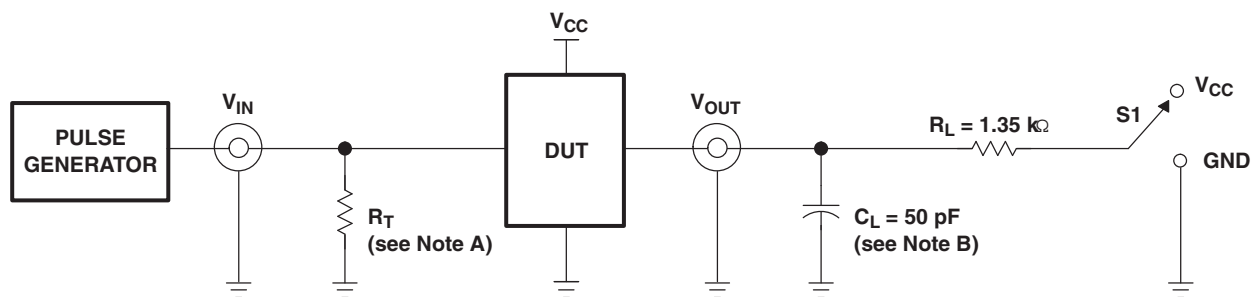
(1) All typical values are at nominal supply voltage (V_{CC} = 2.5 V or 3.3 V) and T_A = 25°C.

(2) Different load resistance and capacitance alter the RC time constant, thereby changing the propagation delay and transition times.

6.8 Typical Characteristics

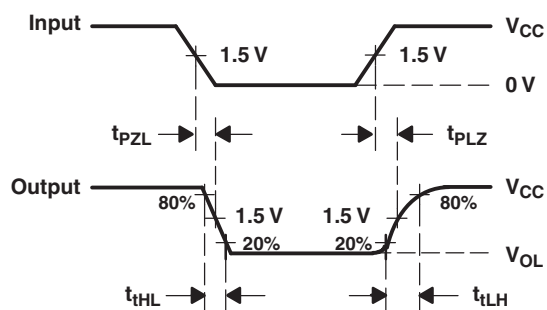


7 Parameter Measurement Information



TEST	S1
t_{PLZ}/t_{PZL}	V_{CC}

TEST CIRCUIT FOR OPEN-DRAIN OUTPUT



**VOLTAGE WAVEFORMS
PROPAGATION DELAY AND OUTPUT TRANSITION TIMES**

- R_T termination resistance should be equal to Z_{OUT} of pulse generators.
- C_L includes probe and jig capacitance.
- All input pulses are supplied by generators having the following characteristics: $PRR \leq 10\text{ MHz}$, $Z_O = 50\text{ }\Omega$, slew rate $\geq 1\text{ V/ns}$.
- The outputs are measured one at a time, with one transition per measurement.

Figure 3. Test Circuit and Voltage Waveforms

8 Detailed Description

8.1 Overview

The PCA9515B is a BiCMOS dual bidirectional buffer integrated circuit intended for I²C bus and SMBus applications. The device contains two identical bidirectional open-drain buffer circuits that enables I²C and similar bus systems to be extended without degrading system performance. This device enables I²C and similar bus systems to be extended (and add more slaves) without degradation of performance. The dual bidirectional I²C buffer is operational at 2.3 V to 3.6 V V_{CC}.

The PCA9515B buffers both the serial data (SDA) and serial clock (SCL) signals on the I²C bus, while retaining all the operating modes and features of the I²C system. The device allows two buses, of 400-pF bus capacitance, to be connected in an I²C application.

The I²C bus capacitance limit of 400 pF restricts the number of slave devices and bus length. Using the PCA9515B, a system designer can capacitively isolate two halves of a bus, thus accommodating more I²C devices and longer trace lengths.

The PCA9515B has an active-high enable (EN) input with an internal pull-up. This allows users to select when the repeater is active and isolate malfunctioning slaves on power-up reset. States should never be changed during an I²C operation. Disabling during a bus operation will hang the bus and enabling part way through a bus cycle may confuse the I²C parts being enabled. The EN input should only change state when the global bus and the repeater port are in an idle state to prevent system failures.

The PCA9515B can also be used to operate two buses, one at 5 V interface levels and the other at 3.3 V interface levels. The buses may also function at 400-kHz or 100-kHz operating frequency. If the two buses are operating at different frequencies, the 100-kHz bus must be isolated if the operation of the 400-kHz bus is required. If the master is running at 400-kHz, the maximum system operating frequency may be less than 400 kHz because of the delays added by the repeater.

The low level outputs for each internal buffer are approximately 0.5 V; however, the input voltage of each internal buffer must be 70 mV or more below the low level output when the output is driven low internally. This prevents a lockup condition from occurring when the input low condition is released.

Two or more PCA9515B devices cannot be used in series. Since there is no direction pin, different valid low-voltage levels are used to avoid lockup conditions between the input and the output of each repeater. A valid low, applied at the input of a PCA9515B, is propagated as a buffered low with a higher value on the enabled outputs. When this buffered low is applied to another PCA9515B-type device in series, the second device does not recognize it as a valid low and does not propagate it as a buffered low.

The device contains a power-up control circuit that sets an internal latch to prevent the output circuits from becoming active until V_{CC} is at a valid level (V_{CC} = 2.3 V).

As with the standard I²C system, pullup resistors are required to provide the logic high levels on the buffered bus. The PCA9515B has standard open-collector configuration of the I²C bus. The size of the pullup resistors depend on the system; however, each side of the repeater must have a pullup resistor. The device is designed to work with Standard Mode and Fast Mode I²C devices in addition to SMBus devices. Standard Mode I²C devices only specify a 3 mA termination current in a generic I²C system where Standard Mode devices and multiple masters are possible. Under certain conditions, high termination currents can be used.

8.2 Functional Block Diagram

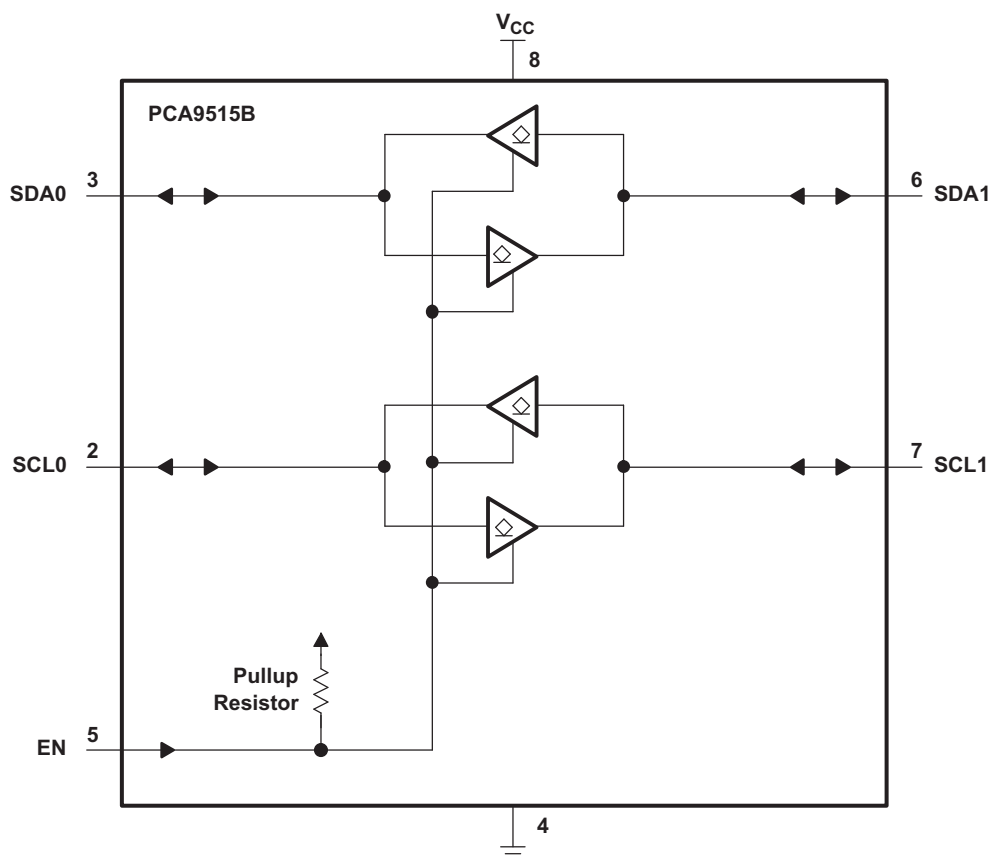


Figure 4. Logic Diagram (Positive Logic)

8.3 Feature Description

8.3.1 Two-Channel Bidirectional Buffer

The PCA9515B is a two-channel bidirectional buffer for open-drain applications like I²C and SMBus.

8.3.2 Bidirectional Voltage-Level Translation

The PCA9515B allows bidirectional voltage-level translation (up-translation and down-translation) between low voltages (down to 2.3 V) and higher voltages (up to 5.5 V).

8.3.3 Active-High Enable Input

The PCA9515B has an active-high enable (EN) input with an internal pull-up to V_{CC}. The enable input needs to be pulled to GND to disable the PCA9515B and isolate the I²C buses. Pulling-up the enable pin or floating the enable pin causes the PCA9515B to turn on and buffer the I²C bus.

8.4 Device Functional Modes

The PCA9515B has an active-high enable (EN) input with an internal pull-up to V_{CC} , which allows the user to select when the repeater is active. This can be used to isolate a badly behaved slave on power-up reset. It should never change state during an I^2C operation, because disabling during a bus operation may hang the bus, and enabling part way through the bus cycles could confuse the I^2C parts being enabled. The EN input should only change state when the global bus and repeater port are in the idle state to prevent system failures. [Table 1](#) lists the PCA9515B functions.

Table 1. Function Table

INPUT EN	FUNCTION
L	Outputs disabled
H	SDA0 = SDA1, SCL0 = SCL1

9 Application and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

The PCA9515B is typically used to buffer an I²C signal, isolating capacitance from two sides of the bus. This allows for longer traces and cables, and a more robust I²C communication. [Typical Application](#) section describes how the PCA9515B may be used to isolate a standard mode and fast mode I²C bus, to allow for faster communications when required, but maintaining compatibility with the slower standard mode slave device.

It is critical to keep the V_{OL} and V_{IL} requirements in mind when designing with buffers, especially when using multiple buffers/translators on the same node. Care must be taken to not violate the V_{IL} requirement of a buffer, otherwise I²C communication errors will occur. An example of this would be a buffer with a V_{OL} of ~0.5 V, and a device requires a V_{IL} of less than 0.4 V. Such a connection would result in the slave device being unable to recognize the output low signal as a valid low.

9.2 Typical Application

A typical application is shown in [Figure 5](#). In this example, the system master is running on a 3.3 V I²C bus, while the slave is connected to a 5-V bus. Both buses run at 100 kHz, unless the slave bus is isolated. If the slave bus is isolated (by pulling the EN pin low), the master bus can run at 400 kHz. Master devices can be placed on either bus, the PCA9515B does not care which side the master is on. Decoupling capacitors are required, but are not shown in [Figure 5](#) for simplicity.

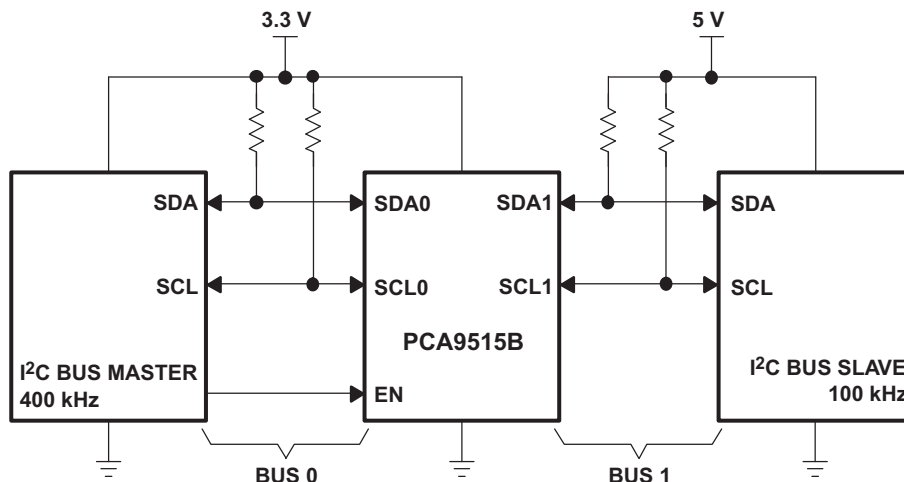


Figure 5. Typical Application

9.2.1 Design Requirements

[Table 2](#) lists the design requirements.

Table 2. Design Requirements

PARAMETER	VALUE
Input-side I ² C signal	3.3 V
Output-side I ² C signal	5 V

9.2.2 Detailed Design Procedure

The PCA9515B is 5.5 V tolerant, so it does not require any additional circuitry to translate between the different bus voltages. When one side of the PCA9515B is pulled low by a device on the I²C bus, a CMOS hysteresis-type input detects the falling edge and causes an internal driver on the other side to turn on, thus causing the other side also to go low. The side driven low by the PCA9515B typically is at $V_{OL} = 0.5$ V.

Figure 6 and Figure 7 show the waveforms that are seen in a typical application. If the bus master in Figure 5 writes to the slave through the PCA9515B, Bus 0 has the waveform shown in Figure 6. The waveform looks like a normal I²C transmission until the falling edge of the eighth clock pulse. At that point, the master releases the data line (SDA) while the slave pulls it low through the PCA9515B. Because the V_{OL} of the PCA9515B typically is around 0.5 V, a step in the SDA is seen. After the master has transmitted the ninth clock pulse, the slave releases the data line.

On the Bus 1 side of the PCA9515B, the clock and data lines have a positive offset from ground equal to the V_{OL} of the PCA9515B. After the eighth clock pulse, the data line is pulled to the V_{OL} of the slave device, which is very close to ground in the example.

9.2.3 Application Curves

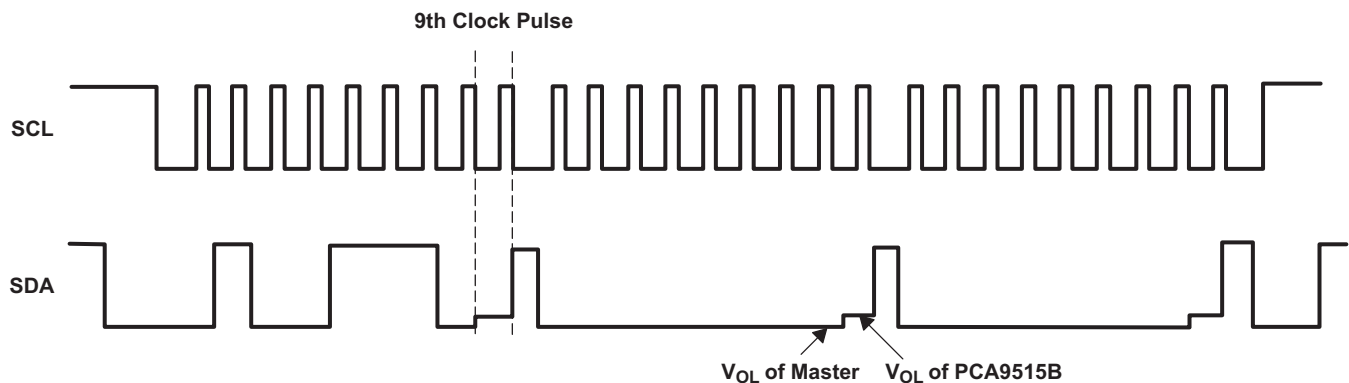


Figure 6. Bus 0 Waveforms

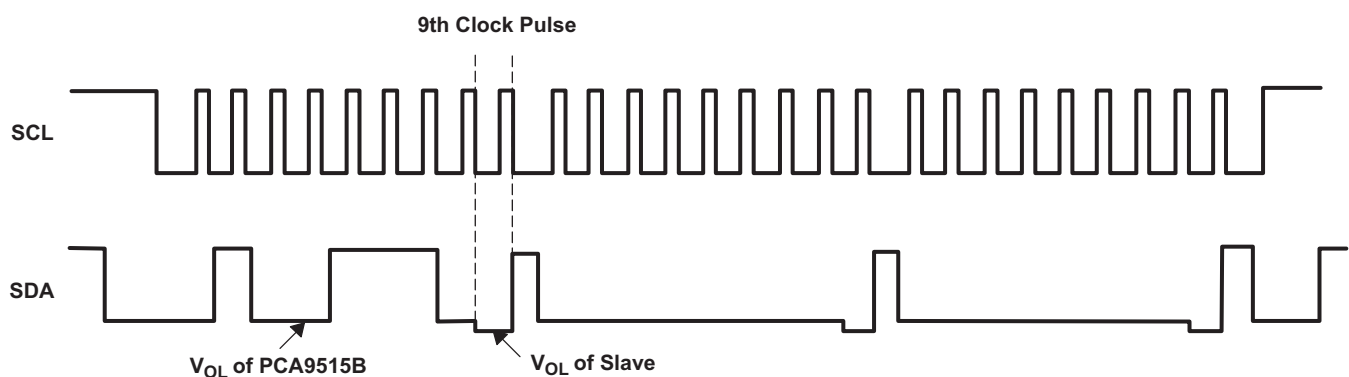


Figure 7. Bus 1 Waveforms

10 Power Supply Recommendations

For V_{CC} , a 2.3 V to 3.6 V power supply is required. Standard decoupling capacitors are recommended. These capacitors typically range from 0.1 μ F to 1 μ F, but the ideal capacitance depends on the amount of noise from the power supply.

11 Layout

11.1 Layout Guidelines

For printed circuit board (PCB) layout of the PCA9515B, common PCB layout practices should be followed. In all PCB layouts, it is a best practice to avoid right angles in signal traces, to fan out signal traces away from each other upon leaving the vicinity of an integrated circuit (IC), and to use thicker trace widths to carry higher amounts of current that commonly pass through power and ground traces. By-pass and de-coupling capacitors are commonly used to control the voltage on the V_{CC} pin, using a larger capacitor to provide additional power in the event of a short power supply glitch and a small capacitor to filter out high-frequency ripple. These decoupling capacitors should be placed as close to the V_{CC} pin of PCA9515B as possible.

The layout example shown in Figure 8 shows a 4 layer board, which is preferable for boards with higher density signal routing. On a 4 layer PCB, it is common to route signals on the top and bottom layer, dedicate one internal layer to a ground plane, and one to power plane. In a board layout using planes or split planes for power and ground, vias are placed directly next to the surface mount component pad which needs to attach to V_{CC} or GND and the via is connected electrically to the internal layer on the other side of the board. Vias are also used when a signal trace needs to be routed to the opposite side of the board. This routing and via is not necessary if V_{CC} and GND are both full planes as opposed to the partial planes depicted.

11.2 Layout Example

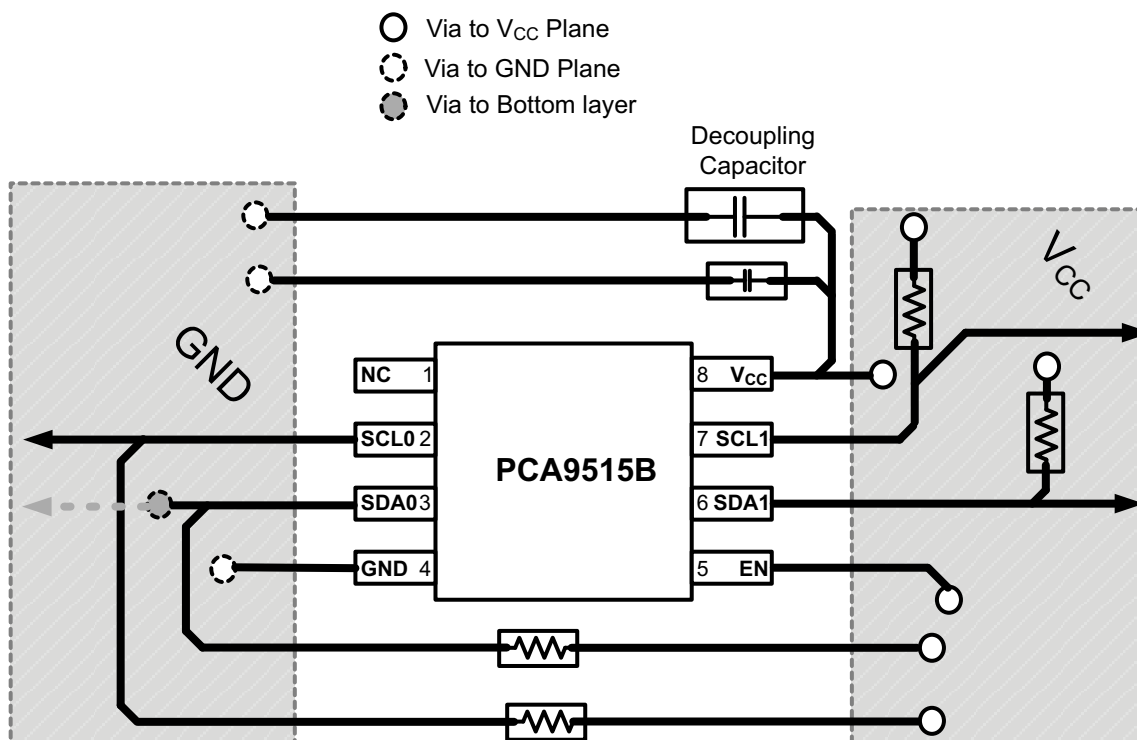


Figure 8. Layout Schematic

12 器件和文档支持

12.1 文档支持

12.1.1 相关文档

相关文档请参见以下部分：

- 《I2C 总线上拉电阻计算》， [SLVA689](#)
- 《I2C 总线在采用中继器时的最高时钟频率》， [SLVA695](#)
- 《逻辑器件简介》， [SLVA700](#)
- 《理解 I2C 总线》， [SLVA704](#)

12.2 社区资源

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

TI E2E™ Online Community *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At [e2e.ti.com](#), you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

12.3 商标

E2E is a trademark of Texas Instruments.

All other trademarks are the property of their respective owners.

12.4 静电放电警告



ESD 可能会损坏该集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理措施和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

12.5 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

13 机械、封装和可订购信息

以下页中包括机械、封装和可订购信息。这些信息是针对指定器件可提供的最新数据。这些数据会在无通知且不对本文档进行修订的情况下发生改变。欲获得该数据表的浏览器版本，请查阅左侧的导航栏。

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
PCA9515BDGKR	Active	Production	VSSOP (DGK) 8	2500 LARGE T&R	Yes	NIPDAU NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	(7SE, 7SF)
PCA9515BDGKR.A	Active	Production	VSSOP (DGK) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(7SE, 7SF)

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
PCA9515BDGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
PCA9515BDGKR	VSSOP	DGK	8	2500	364.0	364.0	27.0

DGK0008A**PACKAGE OUTLINE****VSSOP - 1.1 mm max height**

SMALL OUTLINE PACKAGE



4214862/A 04/2023

NOTES:

PowerPAD is a trademark of Texas Instruments.

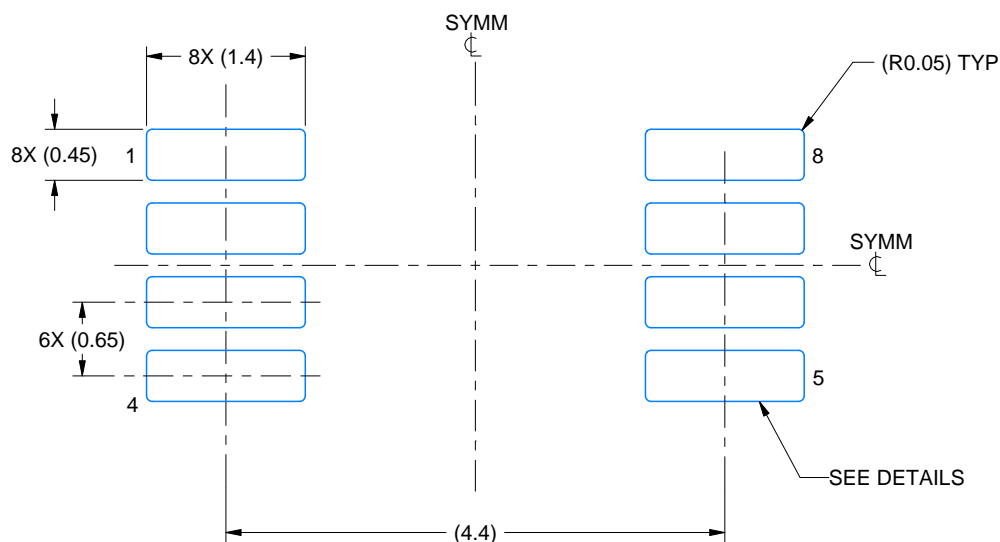
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-187.

EXAMPLE BOARD LAYOUT

DGK0008A

™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 15X



SOLDER MASK DETAILS

4214862/A 04/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.
9. Size of metal pad may vary due to creepage requirement.

EXAMPLE STENCIL DESIGN

DGK0008A

TM VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
SCALE: 15X

4214862/A 04/2023

NOTES: (continued)

11. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
12. Board assembly site may have different recommendations for stencil design.

重要通知和免责声明

TI“按原样”提供技术和可靠性数据（包括数据表）、设计资源（包括参考设计）、应用或其他设计建议、网络工具、安全信息和其他资源，不保证没有瑕疵且不做任何明示或暗示的担保，包括但不限于对适销性、与某特定用途的适用性或不侵犯任何第三方知识产权的暗示担保。

这些资源可供使用 TI 产品进行设计的熟练开发人员使用。您将自行承担以下全部责任：(1) 针对您的应用选择合适的 TI 产品，(2) 设计、验证并测试您的应用，(3) 确保您的应用满足相应标准以及任何其他安全、安保法规或其他要求。

这些资源如有变更，恕不另行通知。TI 授权您仅可将这些资源用于研发本资源所述的 TI 产品的相关应用。严禁以其他方式对这些资源进行复制或展示。您无权使用任何其他 TI 知识产权或任何第三方知识产权。对于因您对这些资源的使用而对 TI 及其代表造成的任何索赔、损害、成本、损失和债务，您将全额赔偿，TI 对此概不负责。

TI 提供的产品受 [TI 销售条款](#)、[TI 通用质量指南](#) 或 [ti.com](#) 上其他适用条款或 TI 产品随附的其他适用条款的约束。TI 提供这些资源并不会扩展或以其他方式更改 TI 针对 TI 产品发布的适用的担保或担保免责声明。除非德州仪器 (TI) 明确将某产品指定为定制产品或客户特定产品，否则其产品均为按确定价格收入目录的标准通用器件。

TI 反对并拒绝您可能提出的任何其他或不同的条款。

版权所有 © 2025，德州仪器 (TI) 公司

最后更新日期：2025 年 10 月