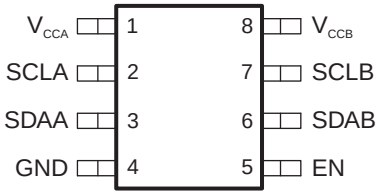
LEVEL-TRANSLATING FM+ I²C BUS REPEATER

Check for Samples: TCA9617A

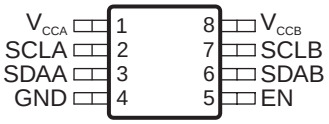
FEATURES

- **Two-Channel Bidirectional Buffer**
- **Operating Supply Voltage Range of 0.8 V to 5.5 V on A Side**
- **Operating Supply Voltage Range of 2.2 V to 5.5 V on B Side**
- **Voltage-Level Translation From 0.8 V to 5.5 V and 2.2 V to 5.5 V**
- **Footprint and Function Replacement for TCA9517**
- **Active-High Repeater-Enable Input**
- **Open-Drain I²C I/O**
- **5.5-V Tolerant I²C and Enable Input Support**
- **Mixed-Mode Signal Operation**
- **Lockup-Free Operation**
- **Accommodates Standard Mode and Fast Mode I²C Devices and Multiple Masters**
- **Powered-Off High-Impedance I²C Pins**
- **1 Mhz FastMode+ I²C Bus**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114-A)**
  - **200-V Machine Model (A115-A)**
  - **1000-V Charged-Device Model (C101)**

D PACKAGE
(TOP VIEW)



DGK PACKAGE
(TOP VIEW)



PRODUCT PREVIEW

DESCRIPTION

This dual bidirectional I²C™ buffer is operational at 2.2 V to 5.5 V.

The TCA9617A is a BiCMOS integrated circuit intended for I²C bus and SMBus systems. It can provide bidirectional voltage-level translation (up-translation and down-translation) between low voltages (down to 0.8 V) and higher voltages (2.2 V to 5.5 V) in mixed-mode applications. This device enables I²C and similar bus systems to be extended, without degradation of performance even during level shifting.

The TCA9617A buffers both the serial data (SDA) and the serial clock (SCL) signals on the I²C bus, thus allowing two buses of 400-pF bus capacitance to be connected in an I²C application. This device can also be used to isolate two halves of a bus for voltage and capacitance.

The TCA9617A has two types of drivers—A-side drivers and B-side drivers. All inputs and I/Os are overvoltage tolerant to 5.5 V, even when the device is unpowered (V_{CCB} and/or V_{CCA} = 0 V).

ORDERING INFORMATION

For package and ordering information, see the Package Option Addendum at the end of this document.

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

DESCRIPTION (CONTINUED)

The B-side drivers operate from 2.2 V to 5.5 V . The output low level for this internal buffer is approximately 0.5 V, but the input voltage must be 70 mV or more below the output low level when the output internally is driven low. The higher-voltage low signal is called a buffered low. When the B-side I/O is driven low internally, the low is not recognized as a low by the input. This feature prevents a lockup condition from occurring when the input low condition is released.

This type of design on the B side prevents it from being used in series with the PCA9515A and another PCA9517 (B side). This is because these devices do not recognize buffered low signals as a valid low and do not propagate it as a buffered low again.

The A-side drivers operate from 0.8 V to 5.5 V and drive more current. They do not require the buffered low feature (or the static offset voltage). This means that a low signal on the B side translates to a nearly 0-V low on the A side, which accommodates smaller voltage swings of lower-voltage logic. The output pulldown on the A side drives a hard low, and the input level is set at 0.3 V_{CCA} to accommodate the need for a lower low level in systems where the low-voltage-side supply voltage is as low as 0.9 V.

The A side of two or more TCA9617As can be connected together to allow a star topography, with the A side on the common bus. Also, the A side can be connected directly to any other buffer with static- or dynamic-offset voltage. Multiple TCA9617As can be connected in series, A side to B side, with no buildup in offset voltage and with only time-of-flight delays to consider.

The TCA9617A drivers are enabled when V_{CCA} is above 0.7 V and V_{CCB} is above 2.5 V.

The TCA9617A has an active-high enable (EN) input with an internal pullup to V_{CCB}, 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 hangs the bus, and enabling part way through a bus cycle could confuse the I^2C parts being enabled. The EN input should change state only when the global bus and repeater port are in an idle state, to prevent system failures.

The TCA9617A includes a power-up circuit that keeps the output drivers turned off until V_{CCB} is above 2.5 V and the V_{CCA} is above 0.7 V. V_{CCB} and V_{CCA} can be applied in any sequence at power up. After power up and with the EN high, a low level on the A side (below 0.3 V_{CCA}) turns the corresponding B-side driver (either SDA or SCL) on and drives the B side down to approximately 0.5 V. When the A side rises above 0.3 V_{CCA}, the B-side pulldown driver is turned off and the external pullup resistor pulls the pin high. When the B side falls first and goes below 0.3 V_{CCB}, the A-side driver is turned on and the A side pulls down to 0 V. The B-side pulldown is not enabled unless the B-side voltage goes below 0.4 V. If the B-side low voltage does not go below 0.5 V, the A-side driver turns off when the B-side voltage is above 0.7 V_{CCB}. If the B-side low voltage goes below 0.4 V, the B-side pulldown driver is enabled, and the B side is able to rise to only 0.5 V until the A side rises above 0.3 V_{CCA}. Then the B side continues to rise, being pulled up by the external pullup resistor. V_{CCA} is only used to provide the 0.3 V_{CCA} reference to the A-side input comparators and for the power-good-detect circuit. The TCA9617A logic and all I/Os are powered by the V_{CCB} pin.

As with the standard I^2C system, pullup resistors are required to provide the logic-high levels on the buffered bus. The TCA9617A has standard open-collector configuration of the I^2C bus. The size of these pullup resistors depends on the system, but each side of the repeater must have a pullup resistor. The device is designed to work with Standard mode, Fast mode and Fast Mode+ I^2C devices.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TCA9617ADGKR	PREVIEW	VSSOP	DGK	8	2500	TBD	Call TI	Call TI	-40 to 85		

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

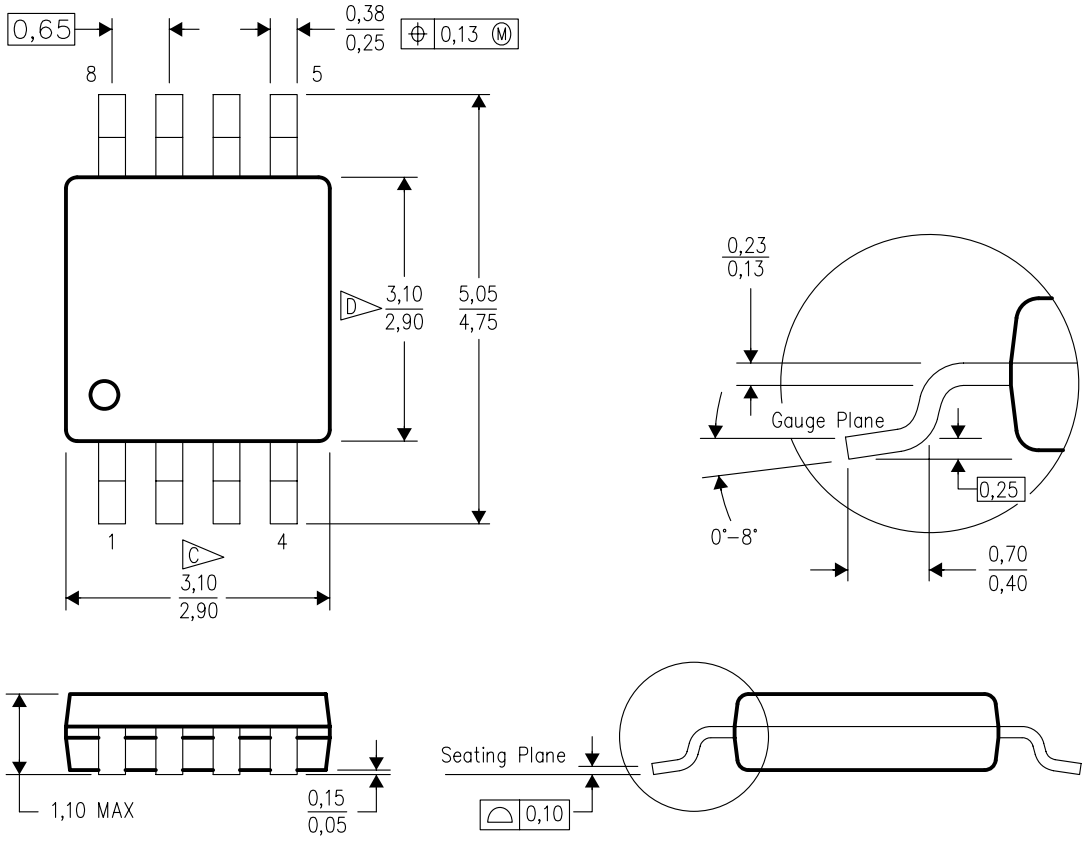
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

DGK (S–PDSO–G8) PLASTIC SMALL–OUTLINE PACKAGE



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NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per end.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
E. Falls within JEDEC MO–187 variation AA, except interlead flash.

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