



**THE DATASHEET OF  
CCBTLV3861IPWRG4Q1**



# SN74CBTLV3861-Q1 LOW-VOLTAGE 10-BIT FET BUS SWITCH

SCDS160B – MARCH 2004 – REVISED JANUARY 2008

- Qualified for Automotive Applications
- 5-Ω Switch Connection Between Two Ports
- Rail-to-Rail Switching on Data I/O Ports
- I<sub>off</sub> Supports Partial-Power-Down Mode Operation
- Flowthrough Architecture Optimizes PCB Layout
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II

## description/ordering information

The SN74CBTLV3861 provides ten bits of high-speed bus switching. The low on-state resistance of the switch allows connections to be made with minimal propagation delay.

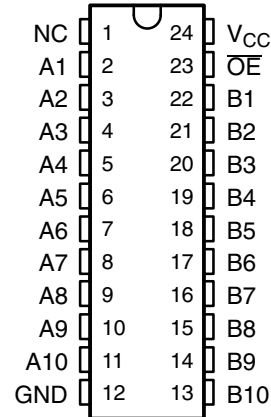
The device is organized as one 10-bit bus switch.

When output enable ( $\overline{OE}$ ) is low, the 10-bit bus switch is on, and port A is connected to port B. When  $\overline{OE}$  is high, the switch is open, and the high-impedance state exists between the two ports.

This device is fully specified for partial-power-down applications using I<sub>off</sub>. The I<sub>off</sub> feature ensures that damaging current will not backflow through the device when it is powered down. The device has isolation during power off.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to V<sub>CC</sub> through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

DW OR PW PACKAGE  
(TOP VIEW)



NC – No internal connection

## ORDERING INFORMATION†

T <sub>A</sub>	PACKAGE‡		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SOIC – DW	Tape and reel	CCBTLV3861IDWRQ1	CL3861Q1
	TSSOP – PW	Tape and reel	CCBTLV3861IPWRQ1	CL3861Q1

† For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

‡ Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).

## FUNCTION TABLE

INPUT $\overline{OE}$	FUNCTION
L	A port = B port
H	Disconnect



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

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# SN74CBTLV3861-Q1

## LOW-VOLTAGE 10-BIT FET BUS SWITCH

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### recommended operating conditions (see Note 3)

			MIN	MAX	UNIT
$V_{CC}$	Supply voltage		2.3	3.6	V
$V_{IH}$	High-level control input voltage	$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.7		V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	2		
$V_{IL}$	Low-level control input voltage	$V_{CC} = 2.3\text{ V to }2.7\text{ V}$		0.7	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$		0.8	
$T_A$	Operating free-air temperature		-40	85	°C

NOTE 3: All unused control inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

### electrical characteristics over recommended operating free-air temperature range $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
$V_{IK}$		$V_{CC} = 3\text{ V}$ ,	$I_I = -18\text{ mA}$			-1.2	V
$I_I$		$V_{CC} = 3.6\text{ V}$ ,	$V_I = V_{CC}$ or GND			±1	μA
$I_{off}$		$V_{CC} = 0$ ,	$V_I$ or $V_O = 0$ to 3.6 V			10	μA
$I_{CC}$		$V_{CC} = 3.6\text{ V}$ ,	$I_O = 0$ ,			10	μA
$\Delta I_{CC}^\ddagger$	Control inputs	$V_{CC} = 3.6\text{ V}$ ,	One input at 3 V, Other inputs at $V_{CC}$ or GND			300	μA
$C_i$	Control inputs	$V_I = 3\text{ V}$ or 0				3	pF
$C_{io(OFF)}$		$V_O = 3\text{ V}$ or 0,	$\overline{OE} = V_{CC}$			5	pF
$r_{on}^\S$	$V_{CC} = 2.3\text{ V}$ , TYP at $V_{CC} = 2.5\text{ V}$	$V_I = 0$	$I_I = 64\text{ mA}$	5	8	Ω	
			$I_I = 24\text{ mA}$	5	8		
		$V_I = 1.7\text{ V}$ ,	$I_I = 15\text{ mA}$	27	40		
	$V_{CC} = 3\text{ V}$	$V_I = 0$	$I_I = 64\text{ mA}$	5	7		
			$I_I = 24\text{ mA}$	5	7		
		$V_I = 2.4\text{ V}$ ,	$I_I = 15\text{ mA}$	10	15		

† All typical values are at  $V_{CC} = 3.3\text{ V}$  (unless otherwise noted),  $T_A = 25^\circ\text{C}$ .

‡ This is the increase in supply current for each input that is at the specified voltage level, rather than  $V_{CC}$  or GND.

§ Measured by the voltage drop between the A and B terminals at the indicated current through the switch. On-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

### switching characteristics over recommended operating free-air temperature range $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	
$t_{pd}^{\parallel}$	A or B	B or A	0.15		0.25		ns
$t_{en}$	$\overline{OE}$	A or B	2.1	5.5	2.1	4.9	ns
$t_{dis}$	$\overline{OE}$	A or B	1.7	5.5	2.5	5.8	ns

<sup>||</sup> The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

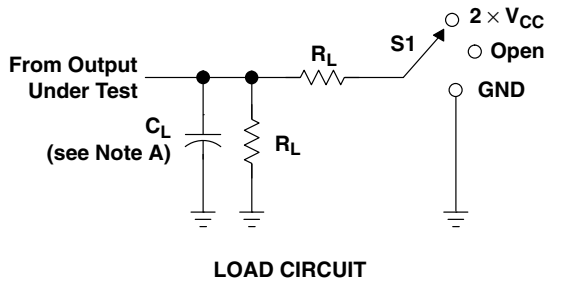


# SN74CBTLV3861-Q1

## LOW-VOLTAGE 10-BIT FET BUS SWITCH

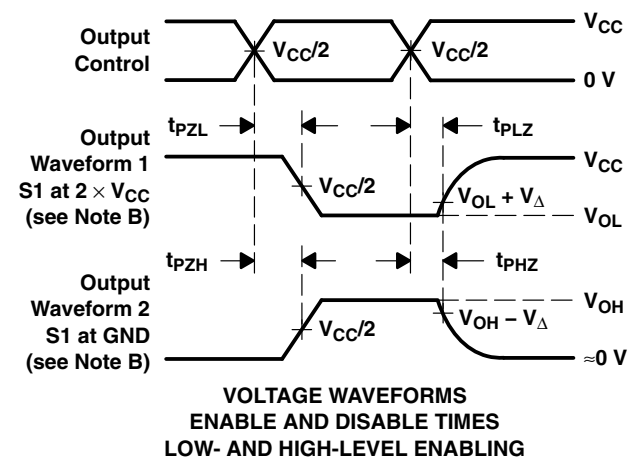
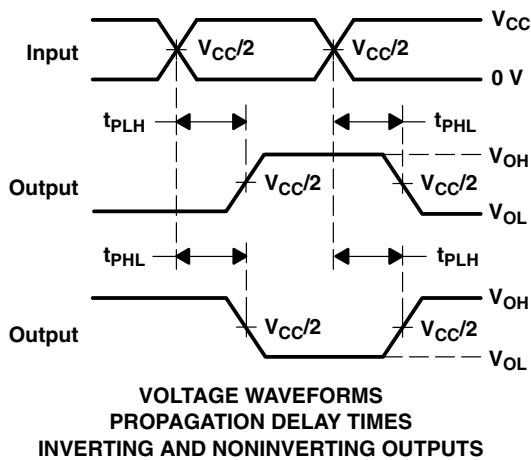
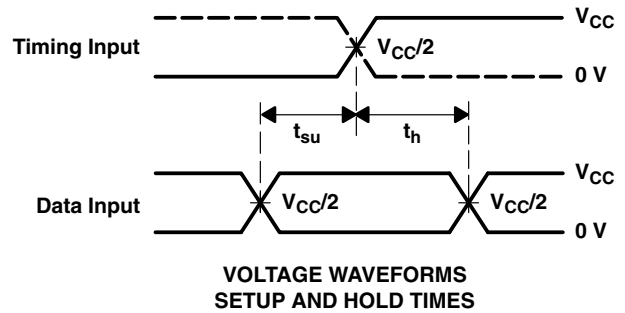
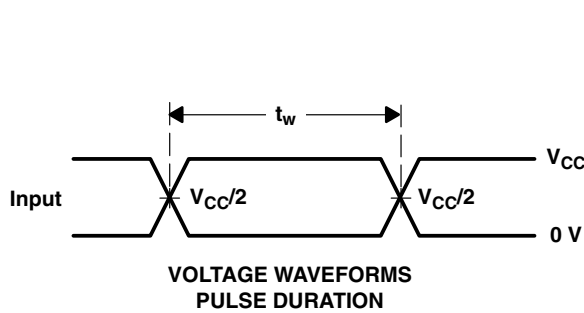
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### PARAMETER MEASUREMENT INFORMATION



TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ}/t_{PZH}$	GND

$V_{CC}$	$C_L$	$R_L$	$V_{\Delta}$
$2.5 \text{ V} \pm 0.2 \text{ V}$	30 pF	500 $\Omega$	0.15 V
$3.3 \text{ V} \pm 0.3 \text{ V}$	50 pF	500 $\Omega$	0.3 V



- NOTES:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2 \text{ ns}$ ,  $t_f \leq 2 \text{ ns}$ .
  - The outputs are measured one at a time, with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms



**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CCBTLV3861IPWRG4Q1	ACTIVE	TSSOP	PW	24	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CL3861Q1	<a href="#">Samples</a>
CCBTLV3861IPWRQ1	ACTIVE	TSSOP	PW	24	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CL3861Q1	<a href="#">Samples</a>

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

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**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(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.

(6) Lead finish/Ball material - Orderable Devices 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.

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**OTHER QUALIFIED VERSIONS OF SN74CBTLV3861-Q1 :**

- Catalog: [SN74CBTLV3861](#)

## NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*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
CCBTLV3861IPWRG4Q1	TSSOP	PW	24	2000	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1
CCBTLV3861IPWRQ1	TSSOP	PW	24	2000	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CCBTLV3861IPWRG4Q1	TSSOP	PW	24	2000	356.0	356.0	35.0
CCBTLV3861IPWRQ1	TSSOP	PW	24	2000	356.0	356.0	35.0

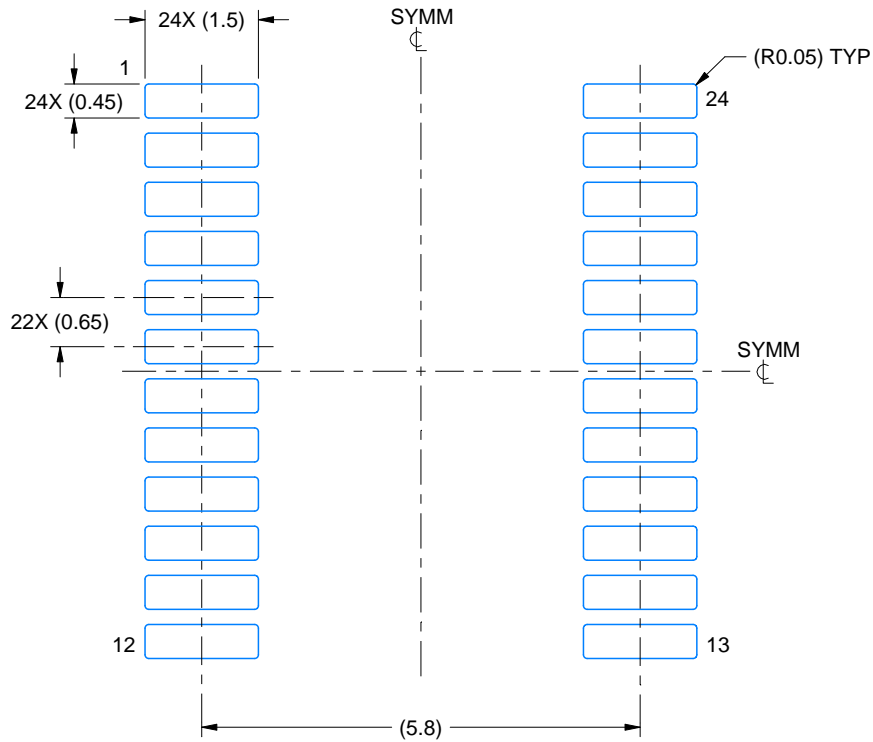


# EXAMPLE BOARD LAYOUT

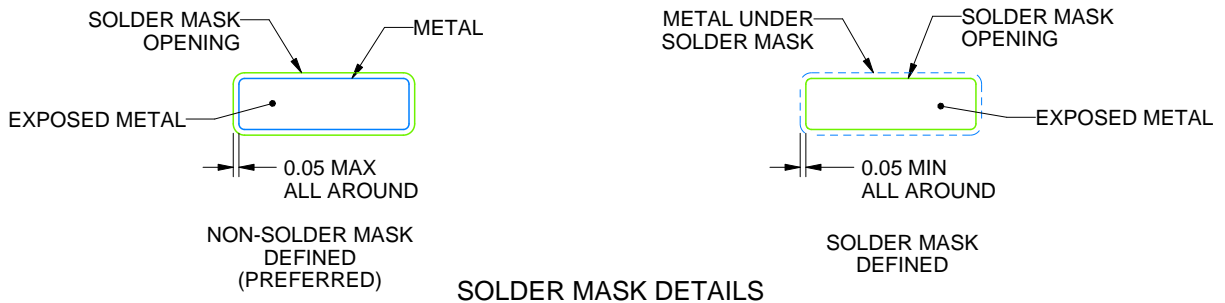
PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220208/A 02/2017

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.

# EXAMPLE STENCIL DESIGN

PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES: (continued)

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

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