



# QUICKSWITCH® PRODUCTS HIGH-PERFORMANCE CMOS TWO-BY-TWO ANALOG CROSS POINT SWITCH

**IDTQS4A201**

## FEATURES:

- Low ON resistance:  $r_{DS(ON)} = 5\Omega$
- Fast transition time:  $t_{TRAN} = 6ns$
- Wide bandwidth: 1.3GHz (-3dB point)
- Crosstalk: 90dB at 50KHz, -40dB at 5MHz, -30dB at 30MHz
- Off-isolation: -70dB at 50KHz, -40dB at 5MHz, -30dB at 30MHz
- Single 5V supply
- Can be used as multiplexer or demultiplexer
- TTL-compatible control inputs
- Ultra-low quiescent current: 3 $\mu$ A
- Switch turn on time of 6.5ns
- Available in QSOP package

## APPLICATIONS:

- High-speed video signal switching/routing
- HDTV-quality video signal routing
- Phase reversal
- Data acquisition
- ATE systems
- Telecomm routing
- Token Ring transceivers
- High-speed networking

## DESCRIPTION:

The QS4A201 is a high-performance CMOS two-by-two analog cross point switch. This device provides two sets of five high-speed CMOS switches providing "cross point" connection between inputs and outputs. The low ON resistance of the QS4A201 allows inputs to be connected to outputs with low insertion loss and high bandwidth. TTL-compatible control circuitry with "Break-Before-Make" feature prevents contention.

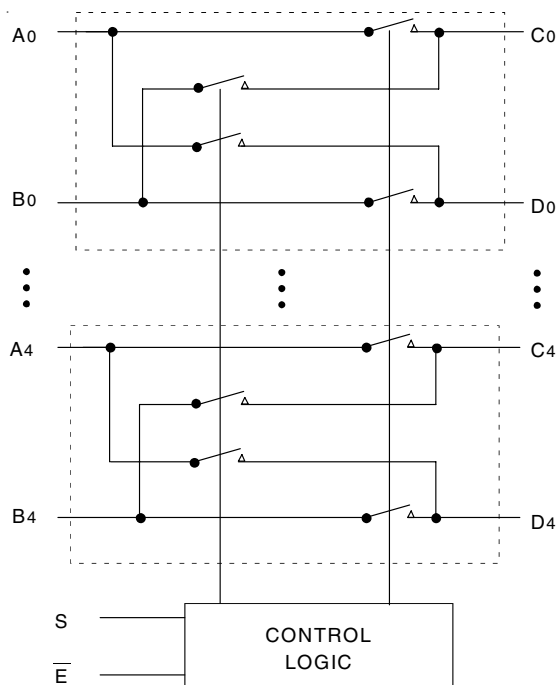
The QS4A201 with 1.3GHz bandwidth makes it ideal for high-performance video signal switching, audio signal switching, and telecomm routing applications. High performance and low power dissipation makes this device ideal for battery operated and remote instrumentation applications.

The QS4A201 is offered in the QSOP package and has several advantages over conventional packages such as PDIP and SOIC, including:

- Reduced signal delays due to denser component packaging on circuit boards
- Reduced system noise due to less pin inductance

The QS4A201 is characterized for operation at -40°C to +85°C.

## FUNCTIONAL BLOCK DIAGRAM

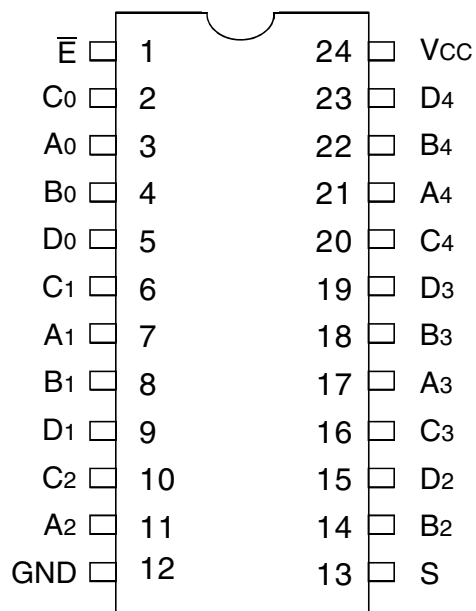


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**INDUSTRIAL TEMPERATURE RANGE**

**APRIL 2014**

## PIN CONFIGURATION



QSOP  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

| Symbol               | Description                          | Max         | Unit |
|----------------------|--------------------------------------|-------------|------|
| VTERM <sup>(2)</sup> | Supply Voltage to Ground             | -0.5 to +7  | V    |
| VTERM <sup>(3)</sup> | DC Switch Voltage Vs                 | -0.5 to +7  | V    |
| —                    | Analog Input Voltage                 | -0.5 to +7  | V    |
| VTERM <sup>(3)</sup> | DC Input Voltage VIN                 | -0.5 to +7  | V    |
| VAC                  | AC Input Voltage (pulse width ≤20ns) | -3          | V    |
| IOUT                 | DC Output Current                    | 120         | mA   |
| PMAX                 | Maximum Power Dissipation            | 0.7         | W    |
| TSTG                 | Storage Temperature                  | -65 to +150 | °C   |

### NOTES:

- Stresses greater than those listed under ABSOLUTE 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.
- VCC terminals.
- All terminals except VCC.

## PIN DESCRIPTION

| Pin Names | I/O | Description       |
|-----------|-----|-------------------|
| Ax, Bx    | I/O | Ports A, B        |
| Cx, Dx    | I/O | Ports C, D        |
| E-bar     | I   | Bus Switch Enable |
| S         | I   | Bus Exchange      |

## FUNCTION TABLE<sup>(1)</sup>

| E-bar | S | Ax | Bx | Function |
|-------|---|----|----|----------|
| H     | X | Z  | Z  | Disable  |
| L     | L | Cx | Dx | Enable   |
| L     | H | Dx | Cx | Exchange |

### NOTE:

- H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care  
Z = High-Impedance

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Industrial:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 5\text{V} \pm 5\%$

| Symbol                         | Parameter                                       | Test Conditions                                                                              | Min. | Typ. <sup>(1)</sup> | Max.         | Unit     |
|--------------------------------|-------------------------------------------------|----------------------------------------------------------------------------------------------|------|---------------------|--------------|----------|
| <b>Analog Switch</b>           |                                                 |                                                                                              |      |                     |              |          |
| $V_{IN}$                       | Analog Signal Range <sup>(2)</sup>              |                                                                                              | -0.5 | 1                   | $V_{CC} - 1$ | V        |
| $r_{DS(ON)}$                   | Drain-source ON resistance <sup>(2,3)</sup>     | $V_{CC} = \text{Min.}, V_{IN} = 0\text{V}, I_{ON} = 30\text{mA}$                             | —    | 5                   | 7            | $\Omega$ |
|                                |                                                 | $V_{CC} = \text{Min.}, V_{IN} = 2.4\text{V}, I_{ON} = 15\text{mA}$                           | —    | 13                  | 17           |          |
| $I_{C(OFF)}$                   | Channel Off Leakage Current                     | $A_x, B_x = V_{CC}$ or $0\text{V}$ ; $C_x, D_x = 0\text{V}$ or $V_{CC}$ ; $\bar{E} = V_{CC}$ | —    | 1                   | —            | nA       |
| $I_{C(ON)}$                    | Channel On Leakage Current                      | $A_x = B_x = 0\text{V}$<br>(each channel is turned on sequentially)                          | —    | 1                   | —            | nA       |
| <b>Digital Control</b>         |                                                 |                                                                                              |      |                     |              |          |
| $V_{IH}$                       | Input HIGH Voltage                              | Guaranteed Logic HIGH for Control Pins                                                       | 2    | —                   | —            | V        |
| $V_{IL}$                       | Input LOW Voltage                               | Guaranteed Logic LOW for Control Pins                                                        | —    | —                   | 0.8          | V        |
| <b>Dynamic Characteristics</b> |                                                 |                                                                                              |      |                     |              |          |
| $t_{TRANS}$                    | Exchange Switching Time<br>S to $C_x, D_x$      | $R_L = 1\text{K}\Omega, C_L = 100\text{pF}$<br>(See Transition Time)                         | 0.5  | —                   | 6.6          | ns       |
| $t_{ON(\bar{E})}$              | Enable Turn-On Time<br>$\bar{E}$ to $C_x, D_x$  | $R_L = 1\text{K}\Omega, C_L = 100\text{pF}$<br>(See Switching Time)                          | 0.5  | —                   | 6.5          | ns       |
| $t_{OFF(\bar{E})}$             | Enable Turn-Off Time<br>$\bar{E}$ to $C_x, D_x$ | $R_L = 1\text{K}\Omega, C_L = 100\text{pF}$<br>(See Switching Time)                          | 0.5  | —                   | 6            | ns       |
| $t_{PD}$                       | Group Delay <sup>(2,4a)</sup>                   | $R_L = 1\text{K}\Omega, C_L = 100\text{pF}$                                                  | —    | —                   | 250          | ps       |
| $f_{dB}$                       | -3dB Bandwidth                                  | $V_{IN} = 0$ to $1\text{V}$ , $1\text{Vp-p}$ , $R_L = 75\Omega$                              | —    | 1.3                 | —            | GHz      |
|                                | Off-isolation                                   | $V_{IN} = 0$ to $1\text{V}$ , $1\text{Vp-p}$ , $R_L = 75\Omega$ , $f = 5.5\text{MHz}$        | —    | -40                 | —            | dB       |
| X TALK                         | Crosstalk                                       | $V_{IN} = 0$ to $1\text{V}$ , $1\text{Vp-p}$ , $R_L = 75\Omega$ , $f = 5.5\text{MHz}$        | —    | -40                 | —            | dB       |
| $C_{(OFF)}$                    | Switch Off Capacitance                          | $\bar{E} = V_{CC}, V_{IN} = V_{OUT} = 0\text{V}$                                             | —    | 5                   | —            | pF       |
| $C_{(ON)}$                     | Switch On Capacitance                           | $\bar{E} = 0\text{V}, V_{IN} = V_{OUT} = 0\text{V}$                                          | —    | 10                  | —            | pF       |
| QCI                            | Charge Injection                                |                                                                                              | —    | 1.5                 | —            | pC       |

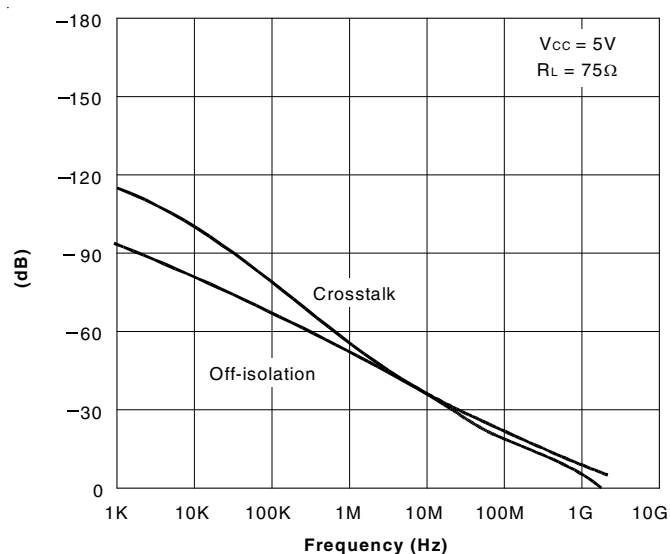
### NOTES:

- Typical values are at  $V_{CC} = 5.0\text{V}$ ,  $T_A = 25^{\circ}\text{C}$ .
- Max value is guaranteed but not production tested.
- Measured by voltage drop between A and C pins or B and D pins at indicated current through the switch. ON resistance is determined by the lower of the voltages on the two (A, C, or B, D) pins.
- The bus switch contributes no group delay other than the RC delay of the ON resistance of the switch and load capacitance. Group delay of the bus switch, when used in a system, is determined by the driving circuit on the driving side of the switch and its interaction with the load on the driven side.

## POWER SUPPLY CHARACTERISTICS

| Symbol   | Parameter      | Test Conditions                                        | Max. | Unit          |
|----------|----------------|--------------------------------------------------------|------|---------------|
| $I_{CC}$ | Supply Current | $V_{CC} = \text{Max.}, V_{IN} = \text{GND or } V_{CC}$ | 3    | $\mu\text{A}$ |

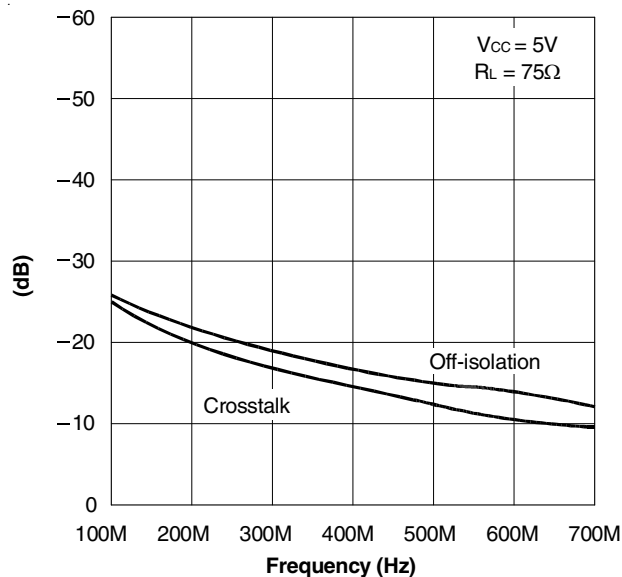
## TYPICAL CHARACTERISTICS



Off-isolation and Crosstalk vs. Frequency

**NOTES:**

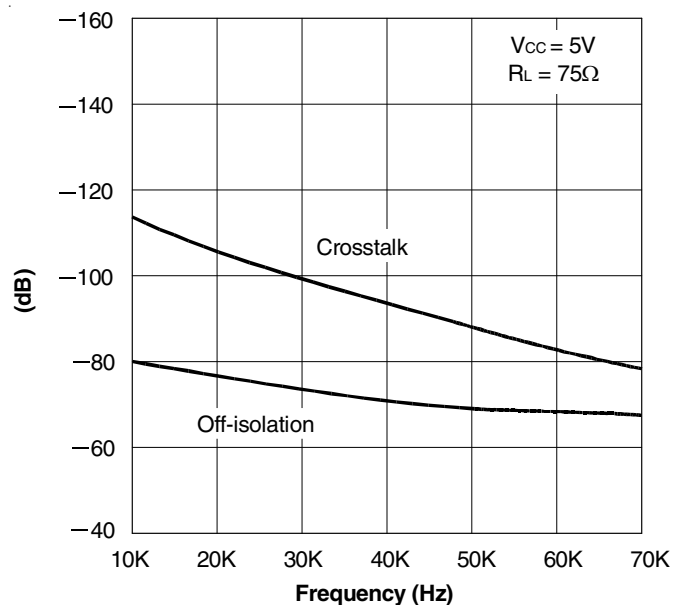
1. Crosstalk =  $20 \log |V_o/V_s|$
2. Off-isolation =  $20 \log |V_o/V_s|$



Off-isolation and Crosstalk vs. Frequency

**NOTES:**

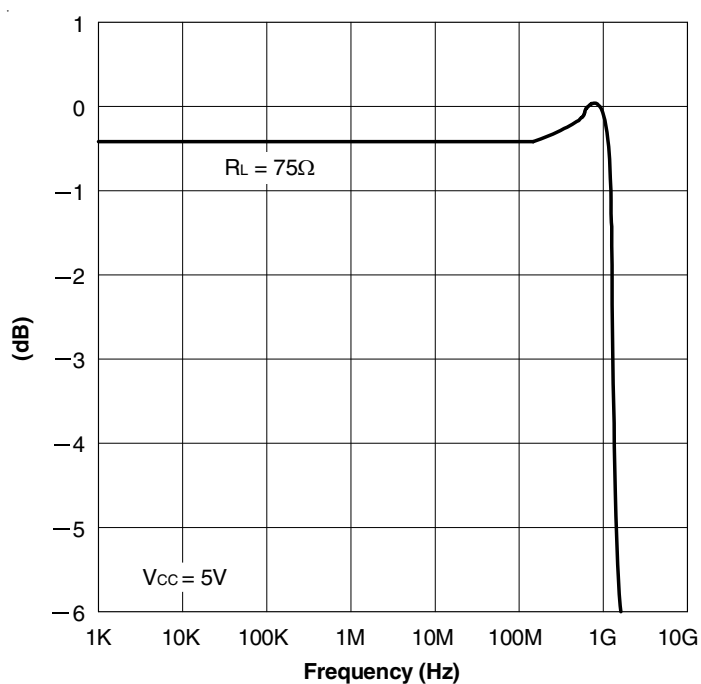
1. Crosstalk =  $20 \log |V_o/V_s|$
2. Off-isolation =  $20 \log |V_o/V_s|$



Off-isolation and Crosstalk vs. Frequency

**NOTES:**

1. Crosstalk =  $20 \log |V_o/V_s|$
2. Off-isolation =  $20 \log |V_o/V_s|$

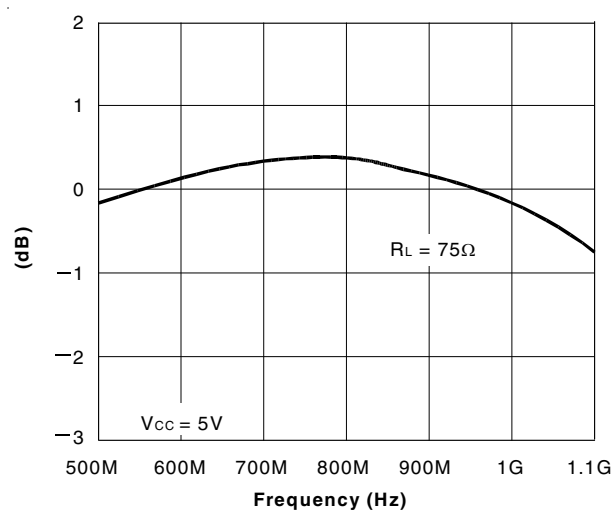


Insertion Loss vs. Frequency

**NOTE:**

1. Insertion Loss =  $20 \log |V_o/V_s|$

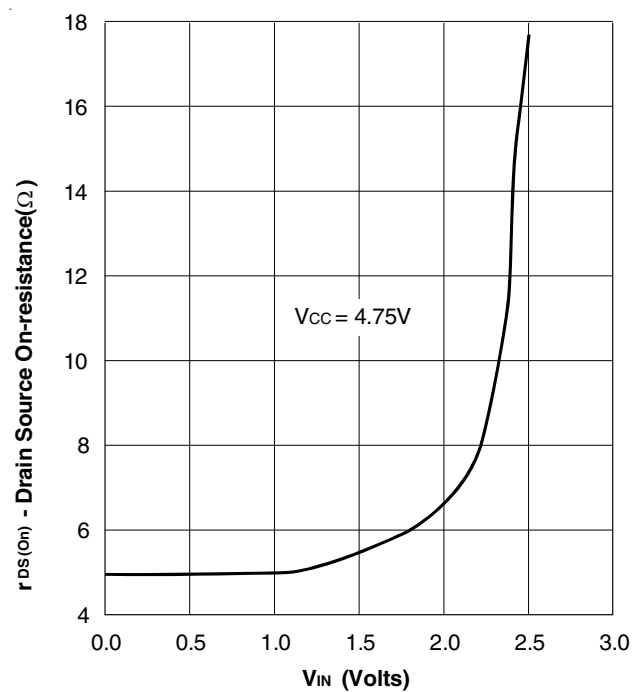
## TYPICAL CHARACTERISTICS (CONTINUED)



*Insertion Loss vs. Frequency*

**NOTE:**

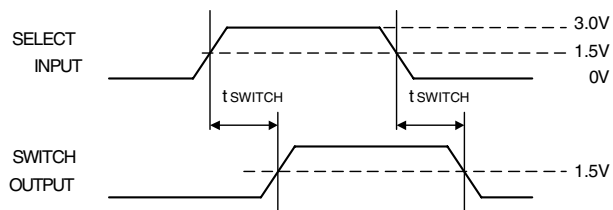
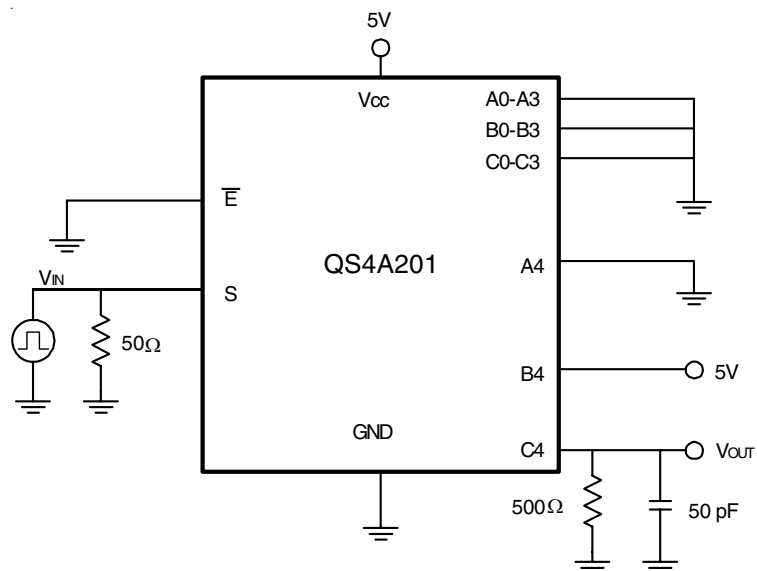
1. Insertion Loss =  $20 \log |V_o/V_s|$



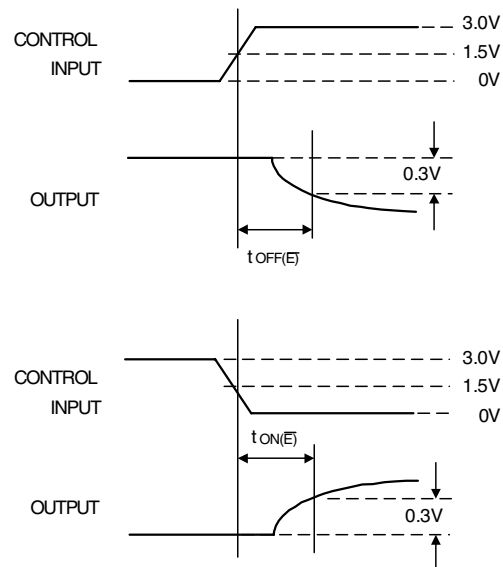
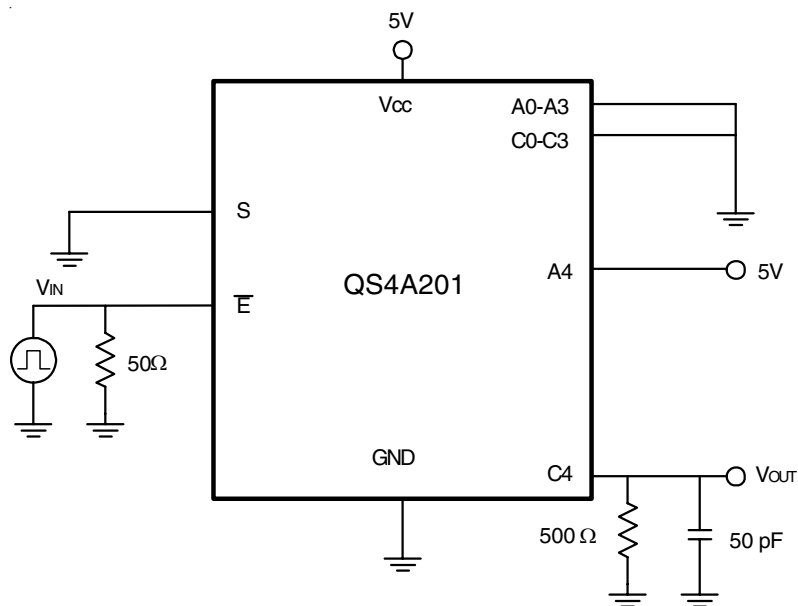
RON LINK

*On-Resistance vs.  $V_{IN}$*

## TEST CIRCUITS

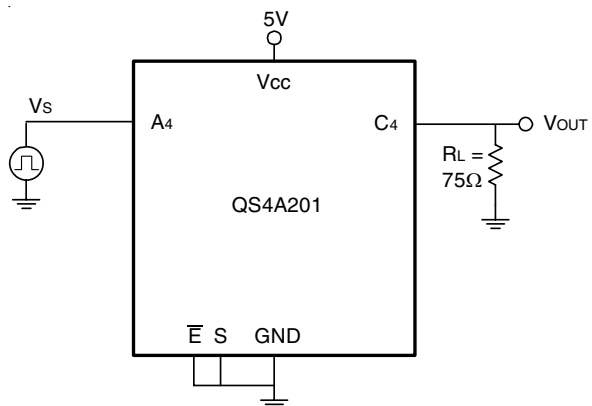


*Transition Time*



*Switching Time*

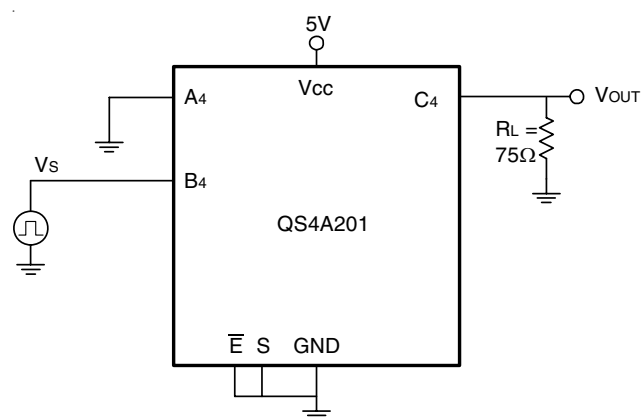
## TEST CIRCUITS (CONTINUED)



**Insertion Loss**

**NOTES:**

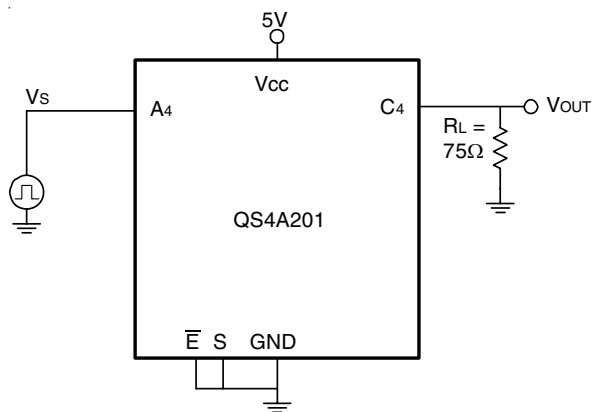
1. Insertion Loss =  $20 \log |V_o/V_s|$
2. All unused pins are grounded.



**Crosstalk**

**NOTES:**

1. Crosstalk =  $20 \log |V_o/V_s|$
2. All unused pins are grounded.

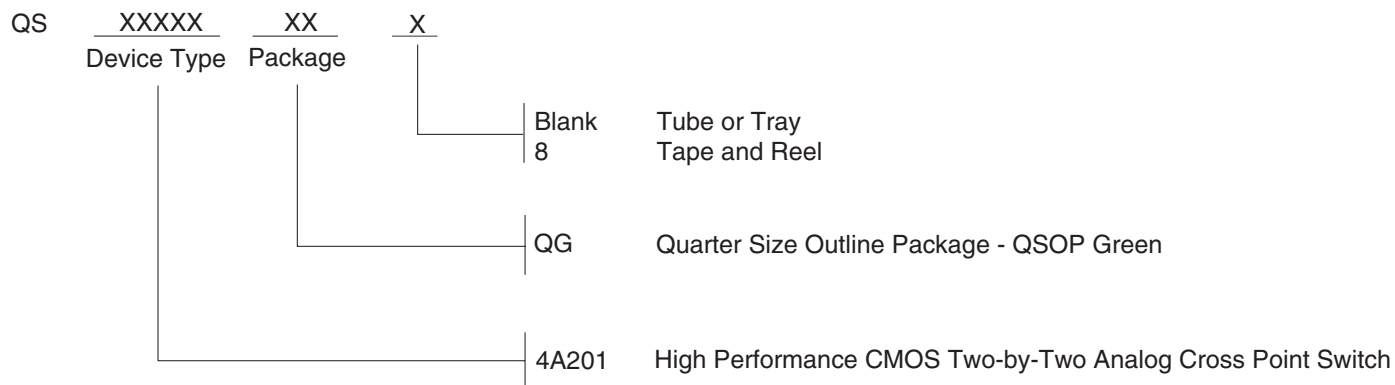


**Off-Isolation**

**NOTES:**

1. Off-isolation =  $20 \log |V_o/V_s|$
2. All unused pins are grounded.

## ORDERING INFORMATION



## DATASHEET DOCUMENT HISTORY

|            |       |                                                                                                                                  |
|------------|-------|----------------------------------------------------------------------------------------------------------------------------------|
| 04/13/2014 | Pg. 8 | Updated the Ordering Information by removing non green package version, the "IDT" notation and Adding Tape and Reel information. |
|------------|-------|----------------------------------------------------------------------------------------------------------------------------------|



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