



# QUICKSWITCH® PRODUCTS HIGH-PERFORMANCE CMOS ANALOG FOUR-CHANNEL SPDT MUX/DEMUX

**IDTQS4A205**

## FEATURES:

- Low On-resistance:  $r_{DS(on)} = 5\Omega$
- Fast Transition Time:  $t_{Tran} = 6ns$
- Wide bandwidth: 830MHz (–3dB point)
- Crosstalk: –115dB @ 50KHz, –100dB @ 5MHz, –66dB @ 30MHz
- Off-isolation: –90dB @ 50KHz, –60dB @ 5MHz, –50dB @ 30MHz
- Single 5V supply
- Can be used as a multiplexer or demultiplexer
- TTL compatible control inputs
- Ultra-low quiescent current: 3μA

## APPLICATIONS

- High-speed video signal switching/routing
- HDTV-quality video signal routing
- Audio signal switching/routing
- Data acquisition
- ATE systems
- Telecomm routing
- Switch between multiple video sources
- Token Ring transceivers
- High-speed networking

## DESCRIPTION:

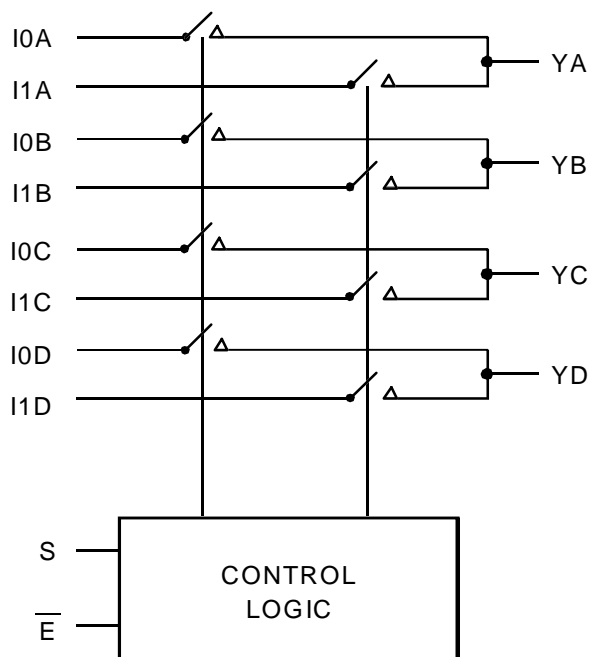
The QS4A205 is a high-performance CMOS analog Four-Channel SPDT multiplexer/demultiplexer with individual enables. The low On-resistance of the QS4A205 allows inputs to be connected to outputs with low insertion loss and high bandwidth. TTL-compatible control circuitry with "Break-Before-Make" feature prevents contention.

The QS4A205 with 830MHz 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.

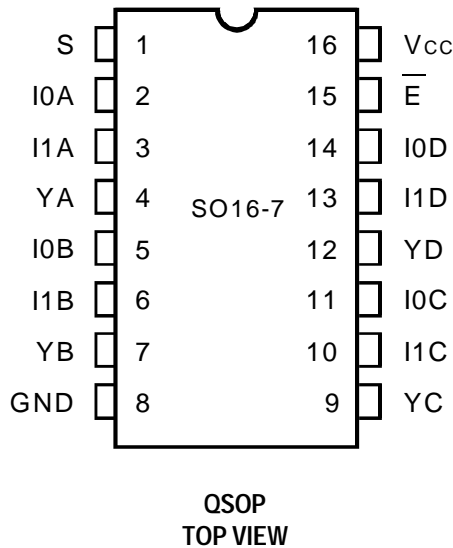
The QS4A205 is offered in the QSOP package and has several advantages over conventional packages such as PDIP and SOIC including:

- Reduced signal delays due to denser component packaging on circuit boards
- Reduced system noise due to less pin inductance resulting in lower ground bounce

## FUNCTIONAL BLOCK DIAGRAM



## PIN CONFIGURATION



## ABSOLUTE MAXIMUM RATINGS (1)

Symbol	Description	Max.	Unit
$V_{TERM}^{(2)}$	Supply Voltage to Ground	- 0.5 to 7	V
$V_{TERM}^{(2)}$	DC Switch Voltage $V_S$	- 0.5 to 7	V
	Analog Input Voltage	- 0.5 to 7	V
$V_{TERM}^{(2)}$	DC Input Voltage $V_{IN}$	- 0.5 to 7	V
$V_{AC}$	AC Input Voltage (for a pulse width $\leq 20ns$ )	- 3	V
$V_{OUT}$	DC Output Current	120	mA
$P_{MAX}$	Maximum Power Dissipation ( $T_A = 85^\circ C$ )	0.7	W
$T_{STG}$	Storage Temperature	-65 to 150	$^\circ C$

### 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.
- $V_{CC}$  terminals.
- All terminals except  $V_{CC}$ .

## CAPACITANCE ( $T_A = +25^\circ C$ , $f = 1MHz$ , $V_{IN} = 0V$ , $V_{OUT} = 0V$ )

Symbol	Parameter(1)	Conditions	Typ.	Max.	Unit
$C_{MUX(OFF)}$	MUX Off Capacitance	$\bar{E} = V_{CC}$ , $V_{IN} = V_{OUT} = 0V$	5.6	—	pF
$C_{DEMUX(OFF)}$	DEMUX Off Capacitance	$\bar{E} = V_{CC}$ , $V_{IN} = V_{OUT} = 0V$	7.4	—	pF
$C_{MUX(ON)}$	MUX On Capacitance	$\bar{E} = 0V$ , $V_{IN} = V_{OUT} = 0V$	12	—	pF
$C_{DEMUX(ON)}$	DEMUX On Capacitance	$\bar{E} = 0V$ , $V_{IN} = V_{OUT} = 0V$	15	—	pF

### NOTE:

- As applicable to the device type.

## PIN DESCRIPTION

Pin Names	I/O	Description
IxA	I/O	Demux Port A
IxB	I/O	Demux Port B
IxC	I/O	Demux Port C
IXD	I/O	Demux Port D
$\bar{E}$	I	Enable Input
S	I	Select Input
YA-YD	I/O	Mux Port A-D

## FUNCTION TABLE (1)

Enable	Select	MUX/DEMUX Ports				Function
$\bar{E}$	S	YA	YB	YC	YD	
H	X	High-Z	High-Z	High-Z	High-Z	Disable
L	L	I0A	I0B	I0C	I0D	Select 0
L	H	I1A	I1B	I1C	I1D	Select 1

### NOTE:

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

## 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	$\Omega$
$I_{C(OFF)}$	Channel Off Leakage Current	$I_N = V_{CC}$ or $0\text{V}$ , $Y_N = 0\text{V}$ or $V_{CC}$ , $\bar{E} = V_{CC}$	—	2	—	nA
$I_{C(ON)}$	Channel On Leakage Current	$I_N = Y_N = 0\text{V}$ , Each channel is turned on sequentially	—	2	—	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>						
$t_{TRANS}$	Switching Time of MUX S to Y	$R_L = 1\text{K}\Omega$ , $C_L = 100\text{pF}$	0.5	—	6.6	ns
$t_{ON}(\bar{E})$	Enable Turn-On Time, $\bar{E}$ to Y	$R_L = 1\text{K}\Omega$ , $C_L = 100\text{pF}$	0.5	—	6	ns
$t_{OFF}(\bar{E})$	Enable Turn-Off Time, $\bar{E}$ to Y	$R_L = 1\text{K}\Omega$ , $C_L = 100\text{pF}$	0.5	—	6	ns
$t_{PD}$	Group Delay <sup>(2, 4)</sup>	$R_L = 1\text{K}\Omega$ , $C_L = 100\text{pF}$	—	—	250	ps
$f_{3dB}$	-3dB Bandwidth	$V_{IN} = 1\text{Vp-p}$ , $R_L = 75\Omega$	—	830	—	MHz
	Off-Isolation	$V_{IN} = 1\text{Vp-p}$ , $R_L = 75\Omega$ , $f = 5\text{MHz}$	—	-60	—	dB
$X_{TALK}$	Crosstalk	$V_{IN} = 1\text{Vp-p}$ , $R_L = 75\Omega$ , $f = 5\text{MHz}$	—	-100	—	dB
$Q_{CI}$	Charge Injection		—	1.5	—	pC

### NOTES:

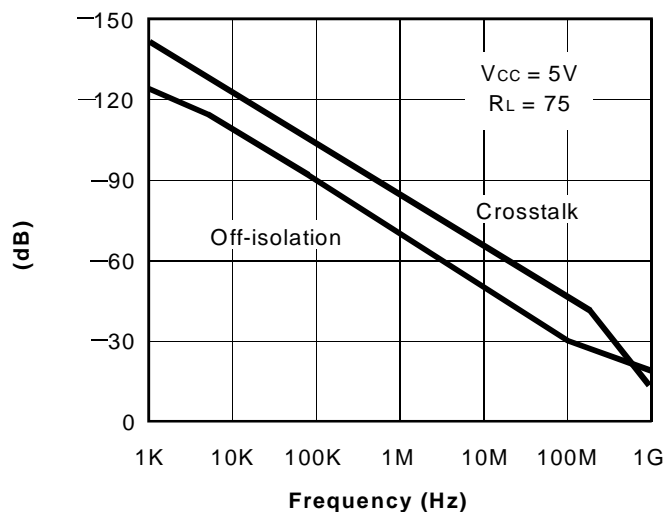
- Typical values are at  $V_{CC} = 5\text{V}$  and  $T_A = 25^{\circ}\text{C}$ .
- Guaranteed by design, not subject to production test.
- Measured by voltage drop between I and Y pins at indicated current through the switch. On-resistance is determined by the lower of the voltages on the two (I, Y) pins.
- The bus switch contributes no group delay other than the RC Delay of the On-Resistance of the switch and the load capacitance. Propagation 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

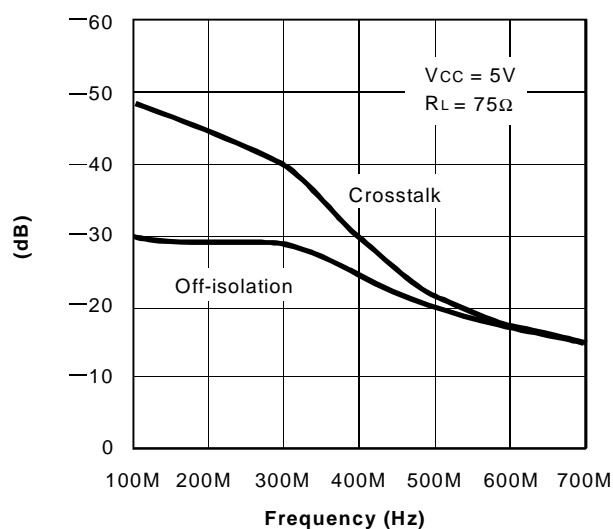
Symbol	Parameter	Test Conditions	Max.	Unit
$I_{CCQ}$	Quiescent Power	$V_{CC} = \text{Max.}, V_{IN} = \text{GND}$ or $V_{CC}$ , $f = 0$	3	$\mu\text{A}$

## TYPICAL CHARACTERISTICS

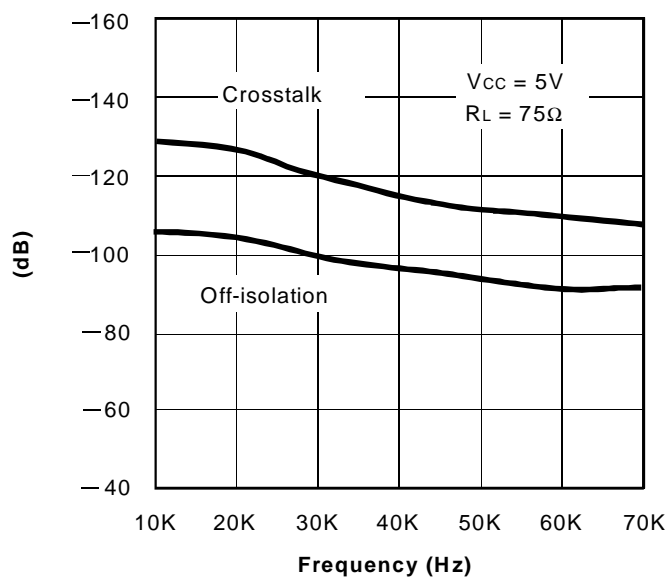
OFF-ISOLATION AND CROSSTALK VS. FREQUENCY



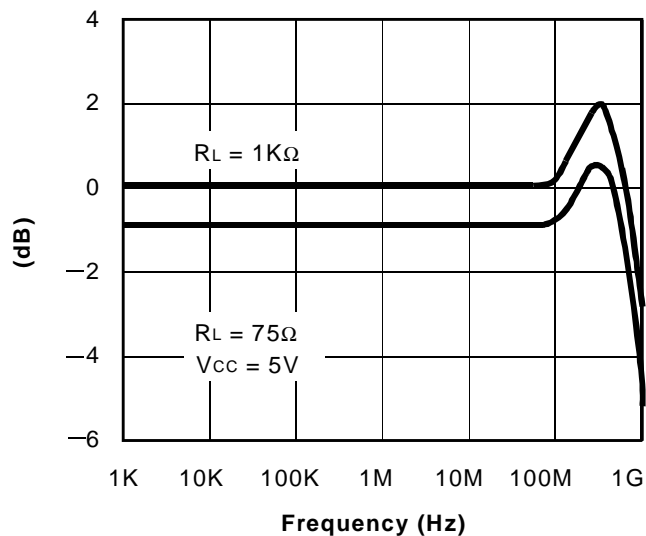
OFF-ISOLATION AND CROSSTALK VS. FREQUENCY



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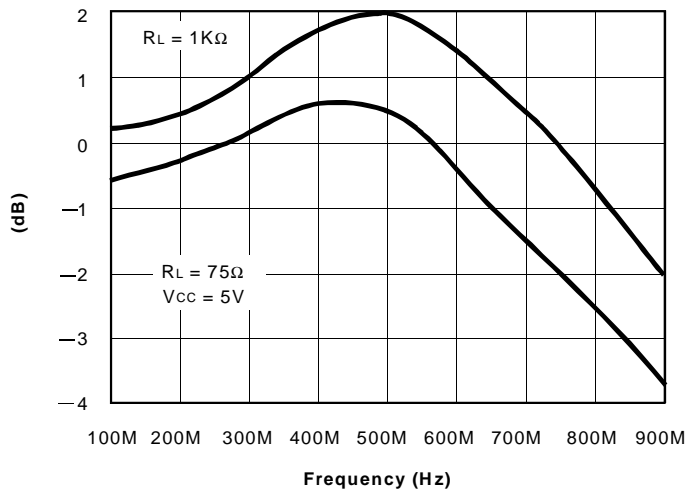


INSERTION LOSS VS. FREQUENCY

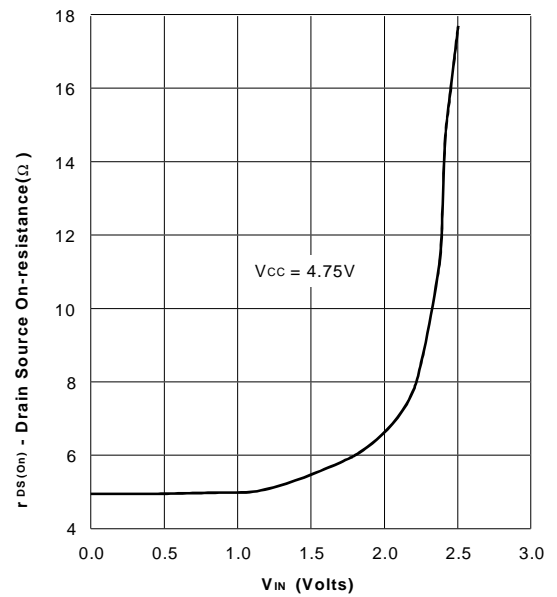


## **TYPICAL CHARACTERISTICS (CONTINUED)**

**INSERTION LOSS VS. FREQUENCY**



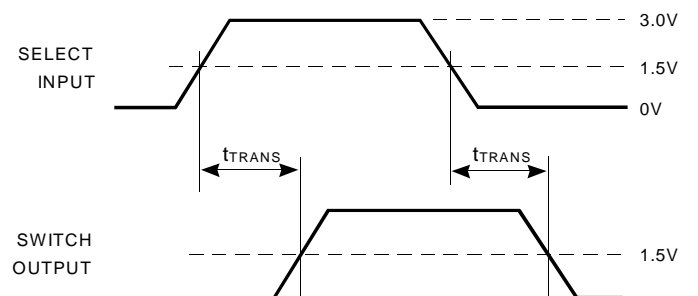
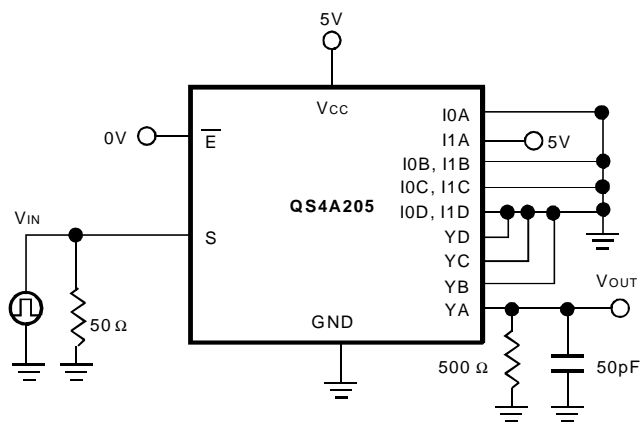
**ON-RESISTANCE VS.  $V_{IN}$**



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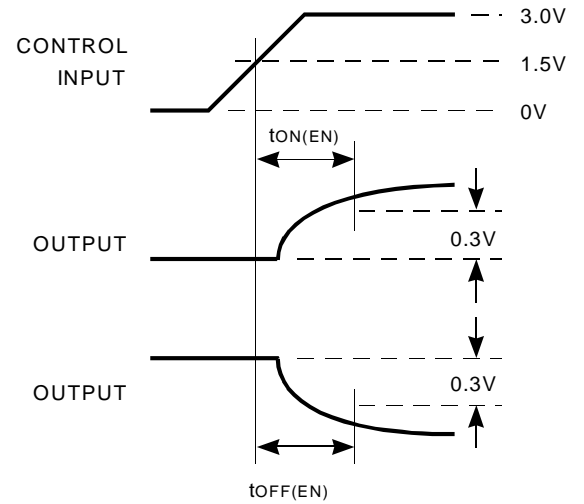
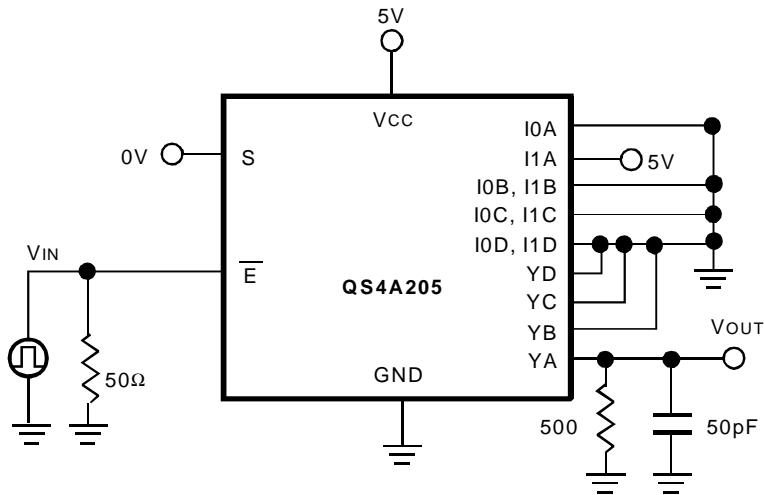
## **TEST CIRCUITS**

**TRANSITION TIME**

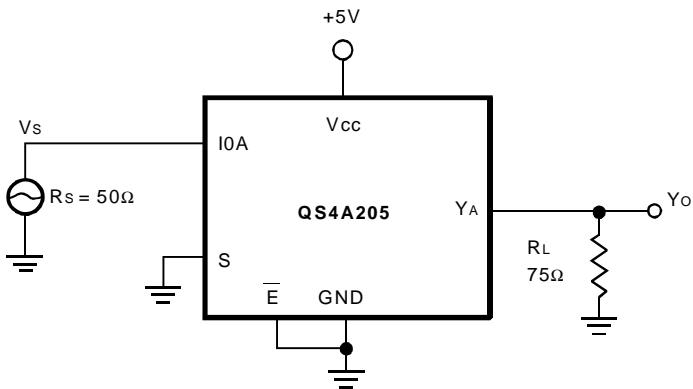


## **TEST CIRCUITS (CONTINUED)**

### **ENABLE SWITCHING TIME**



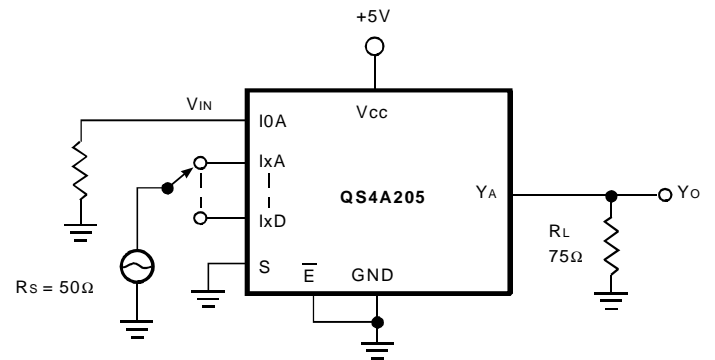
### **INSERTION LOSS**



**NOTE:**

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

### **CROSSTALK**

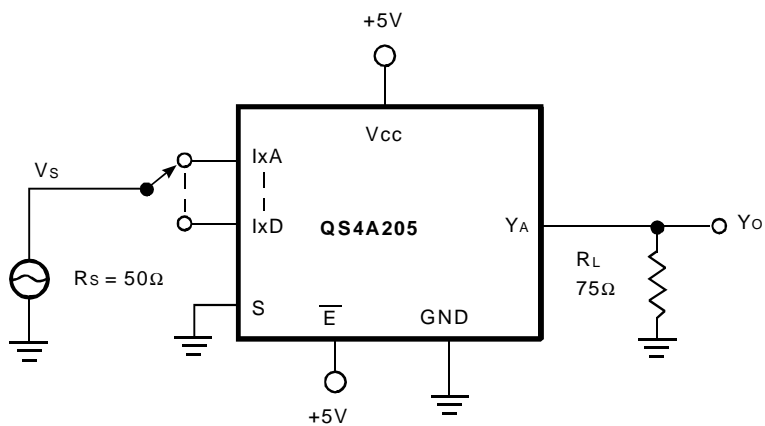


**NOTE:**

1. Crosstalk =  $20 \log |V_o/V_s|$

## **TEST CIRCUITS (CONTINUED)**

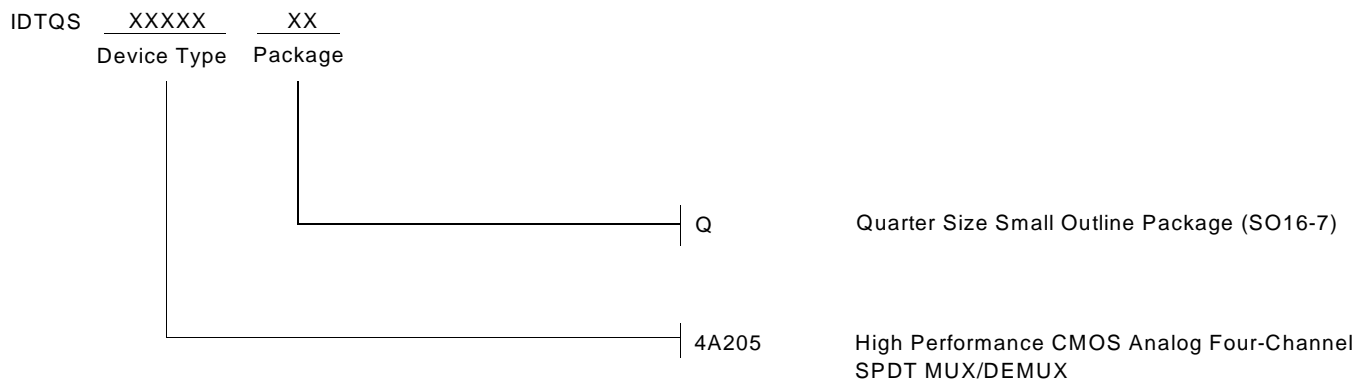
### OFF-ISOLATION



**NOTE:**

1. Off-Isolation =  $20 \log |V_o/V_s|$

## ORDERING INFORMATION



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Santa Clara, CA 95054

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