



# QUICKSWITCH® PRODUCTS HIGH-PERFORMANCE CMOS TWO CHANNEL SP4T MUX/DEMUX

**IDTQS4A210**

## FEATURES:

- Low ON resistance:  $r_{DS(on)} = 5\Omega$
- Fast transition time:  $t_{TRAN} = 6ns$
- Wide bandwidth: 700MHz (-3dB point)
- Crosstalk: -110dB at 50KHz, -68dB at 5MHz, -66dB at 30MHz
- Off-isolation: -90dB at 50KHz, -60dB at 5MHz, -50dB at 30MHz
- Single 5V supply
- Can be used as multiplexer or demultiplexer
- TTL-compatible control inputs
- Ultra-low quiescent current: 3 $\mu$ A
- Available in QSOP package

## APPLICATIONS:

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

## DESCRIPTION:

The QS4A210 is a high-performance CMOS two-channel SP4T multiplexer/demultiplexer with individual enables. The low On-resistance of the QS4A210 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.

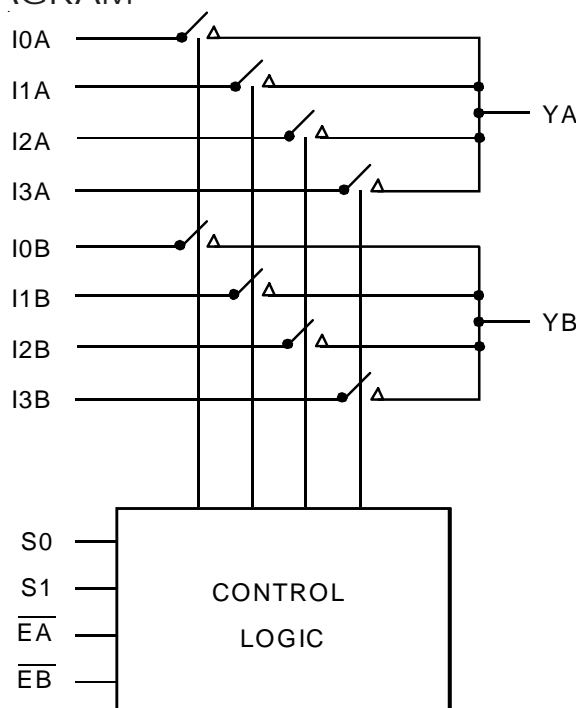
The QS4A210 with 700MHz bandwidth makes it ideal for high-performance video signal switching, audio signal switching, and telecom routing applications. Low power dissipation makes this device ideal for battery operated and remote instrumentation applications.

The QS4A210 is offered in the QSOP package which 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

The QS4A210 is characterized for operation at -40°C to +85°C.

## FUNCTIONAL BLOCK DIAGRAM

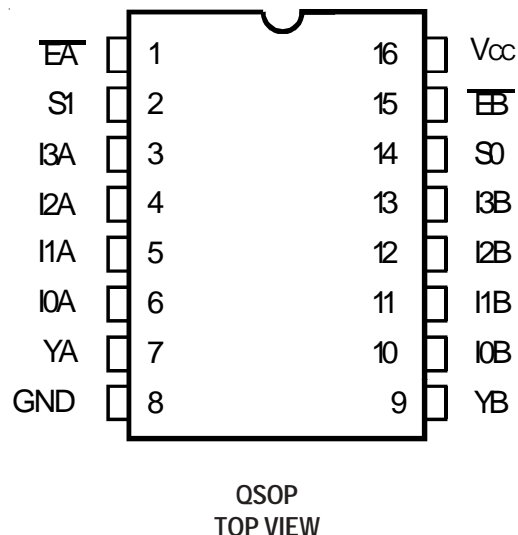


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INDUSTRIAL TEMPERATURE RANGE

AUGUST 2000

## PIN CONFIGURATION



## 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
IxA	I/O	Demux Port A
IxB	I/O	Demux Port B
EA, EB	I	Enable Inputs
S0, S1	I	Select Inputs
YA, YB	I/O	Mux Port A, B

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

Enable		Select		Mux/Demux Ports		Function
EA	EB	S1	S0	YA	YB	
H	X	X	X	Z	X	Disable A
X	H	X	X	X	Z	Disable B
L	L	L	L	I0A	I0B	S1 - 0 = 0
L	L	L	H	I1A	I1B	S1 - 0 = 1
L	L	H	L	I2A	I2B	S1 - 0 = 2
L	L	H	H	I3A	I3B	S1 - 0 = 3

### 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	$I_N = V_{CC}$ or $0\text{V}$ ; $Y_N = 0\text{V}$ or $V_{CC}$ ; $\overline{EA} = \overline{EB} = V_{CC}$	—	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 Sx to Y	$R_L = 1\text{K}\Omega$ , $C_L = 100\text{pF}$ (See Transition Time)	0.5	—	6.6	ns
$t_{ON(EN)}$	Enable Turn-On Time $\overline{EA} = \overline{EB}$ to Y	$R_L = 1\text{K}\Omega$ , $C_L = 100\text{pF}$ (See Switching Time)	0.5	—	6	ns
$t_{OFF(EN)}$	Enable Turn-Off Time $\overline{EA} = \overline{EB}$ to Y	$R_L = 1\text{K}\Omega$ , $C_L = 100\text{pF}$ (See Switching Time)	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	$V_{IN} = 1\text{Vp-p}$ , $R_L = 75\Omega$	—	700	—	MHz
	Off-isolation	$V_{IN} = 1\text{Vp-p}$ , $R_L = 75\Omega$ , $f = 5.5\text{MHz}$	—	-60	—	dB
XTALK	Crosstalk	$V_{IN} = 1\text{Vp-p}$ , $R_L = 75\Omega$ , $f = 5.5\text{MHz}$	—	-68	—	dB
$C_{MUX(OFF)}$	Mux Off Capacitance	$\overline{EA} = \overline{EB} = V_{CC}$ , $V_{IN} = V_{OUT} = 0\text{V}$	—	5.6	—	pF
$C_{DEMUX(OFF)}$	Demux Off Capacitance	$\overline{EA} = \overline{EB} = V_{CC}$ , $V_{IN} = V_{OUT} = 0\text{V}$	—	7.4	—	pF
$C_{MUX(ON)}$	Mux On Capacitance	$\overline{EA} = \overline{EB} = 0\text{V}$ , $V_{IN} = V_{OUT} = 0\text{V}$	—	12	—	pF
$C_{DEMUX(ON)}$	Demux On Capacitance	$\overline{EA} = \overline{EB} = 0\text{V}$ , $V_{IN} = V_{OUT} = 0\text{V}$	—	15	—	pF
QCI	Charge Injection		—	1.5	—	pC

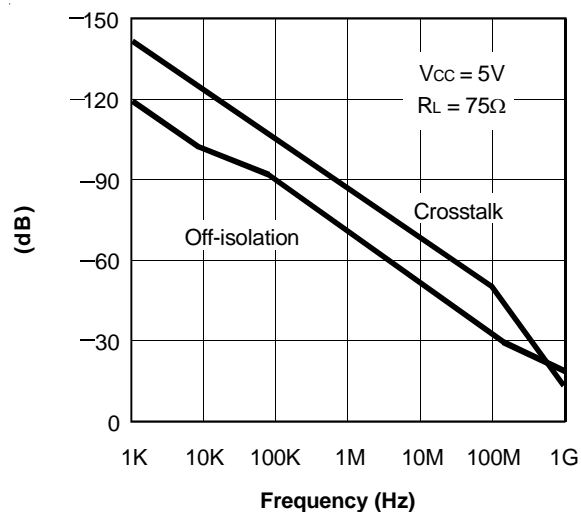
### NOTES:

- 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 (I, Y) 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
$I_{CCQ}$	Quiescent Power	$V_{CC} = \text{Max.}$ , $V_{IN} = \text{GND}$ or $V_{CC}$ , $f = 0$	3	$\mu\text{A}$

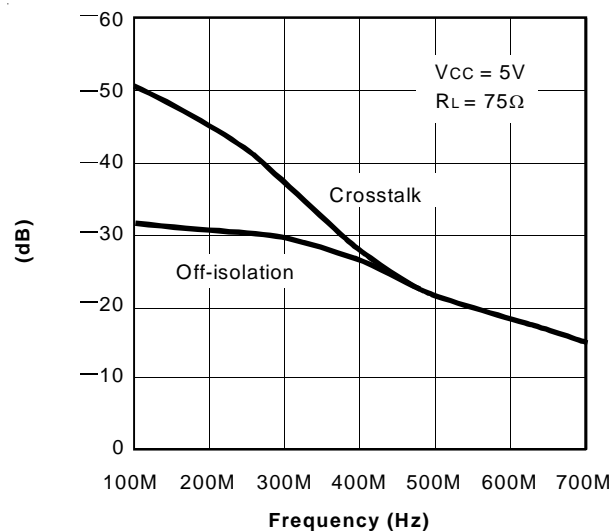
## TYPICAL CHARACTERISTICS



*Off-isolation and Crosstalk vs. Frequency*

**NOTES:**

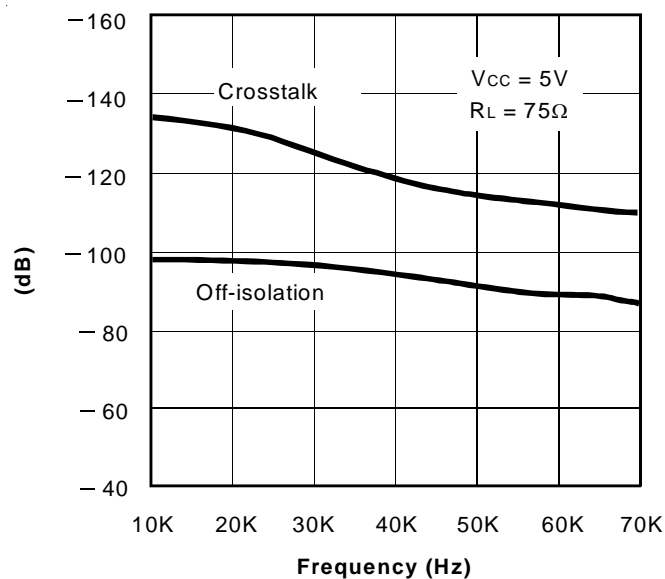
1. Crosstalk =  $20 \log |V_o/V_s|$
2. Off-isolation =  $20 \log |V_o/V_s|$



*Off-isolation and Crosstalk vs. Frequency*

**NOTES:**

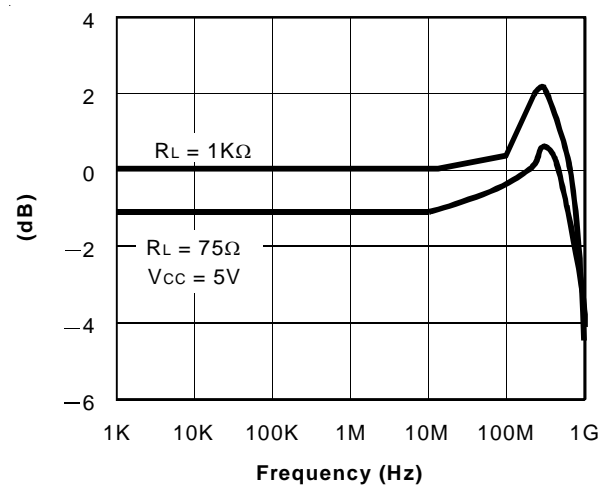
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*Off-isolation and Crosstalk vs. Frequency*

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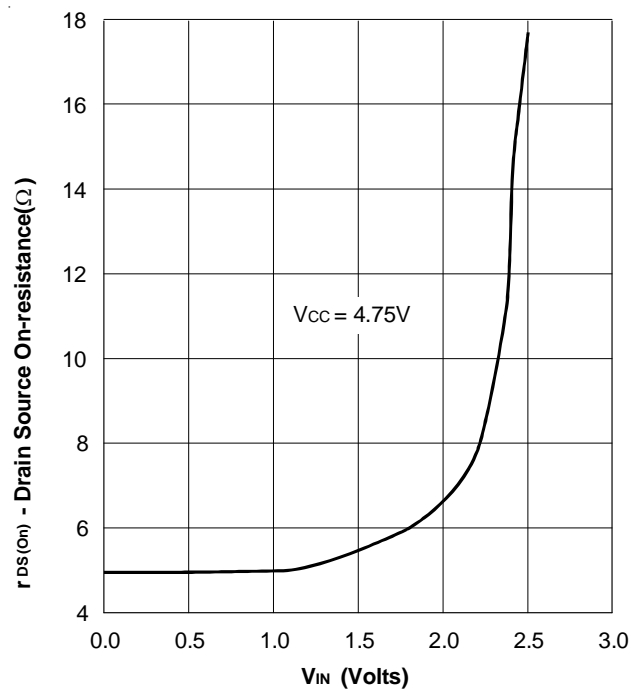
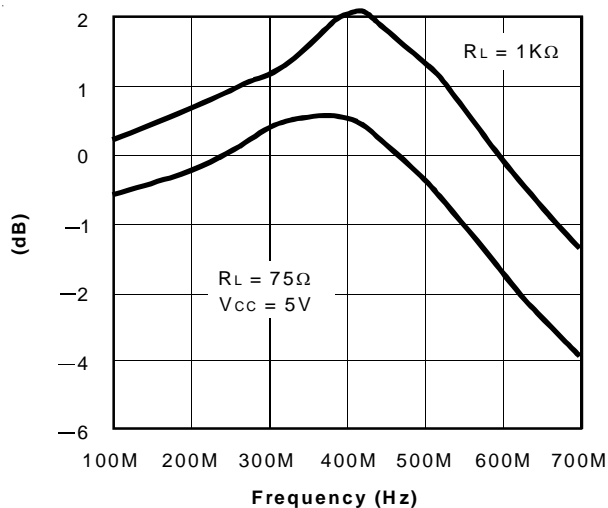


*Insertion Loss vs. Frequency*

**NOTE:**

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

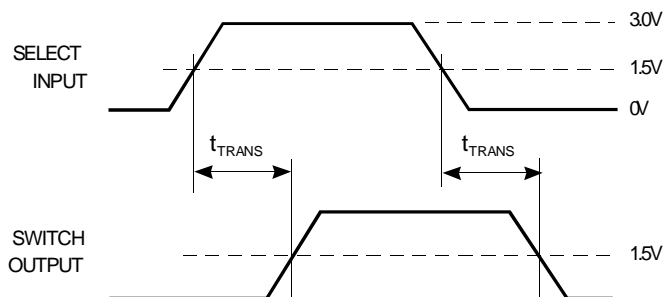
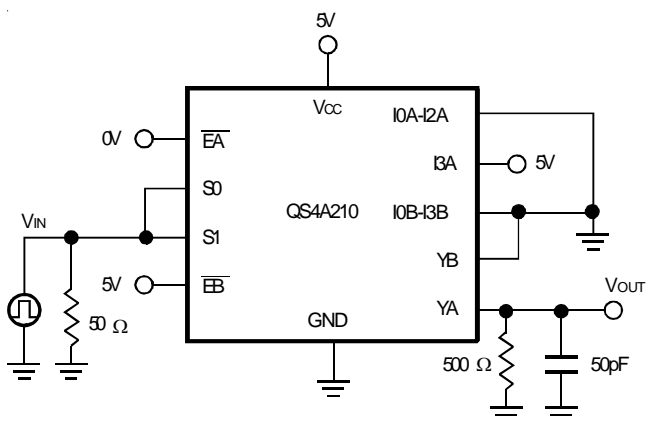
## TYPICAL CHARACTERISTICS (CONTINUED)



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

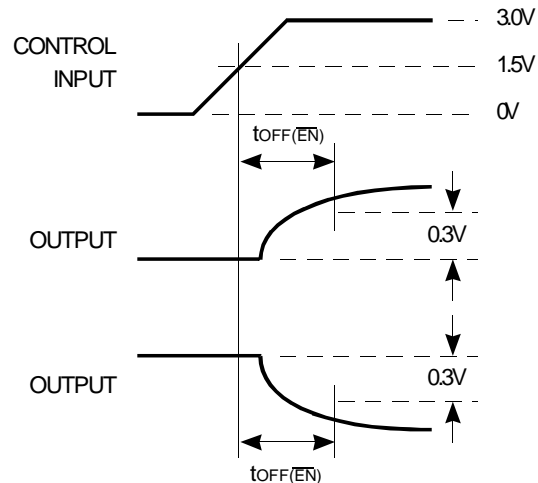
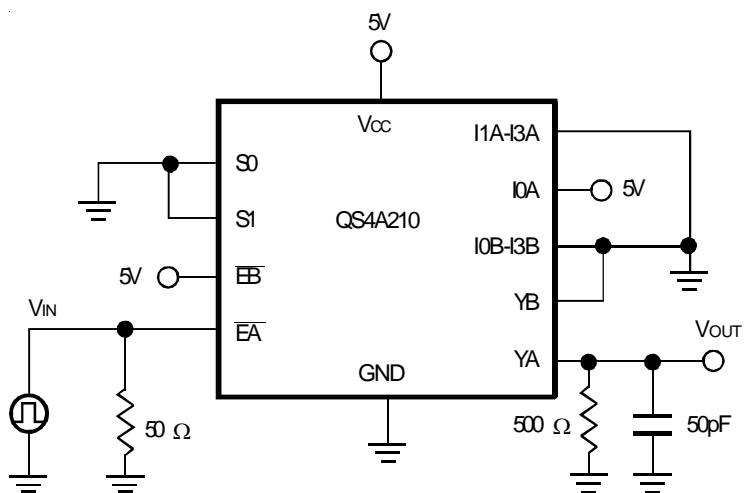
RON LINK

## TEST CIRCUITS

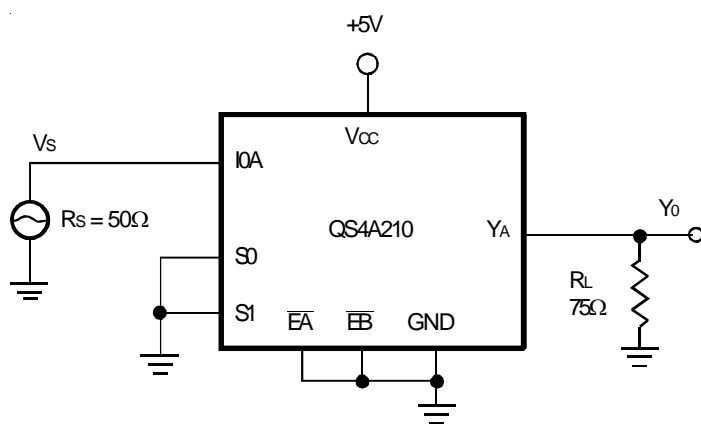


Transition Time

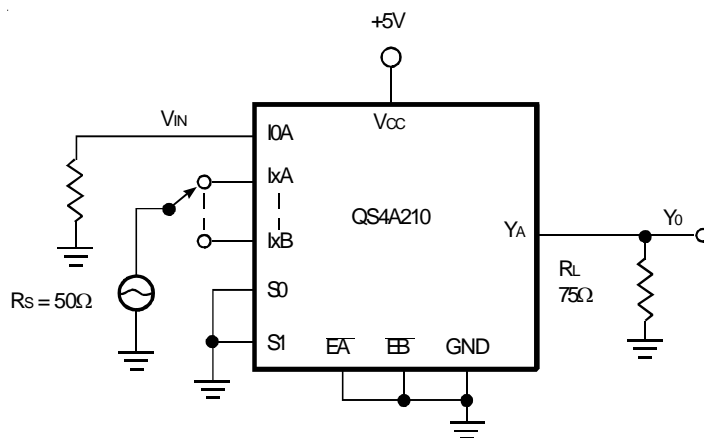
## TEST CIRCUITS (CONTINUED)



Enable Switching Time



Insertion Loss



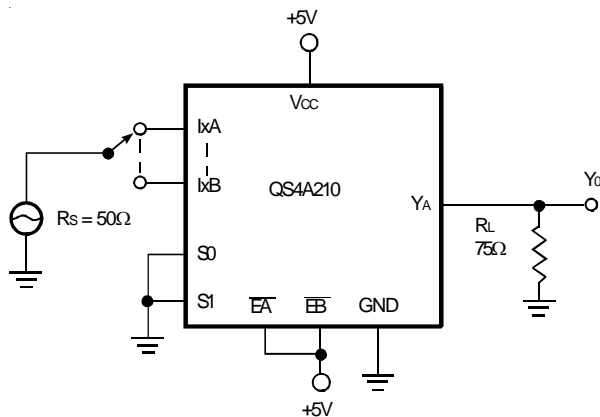
Crosstalk

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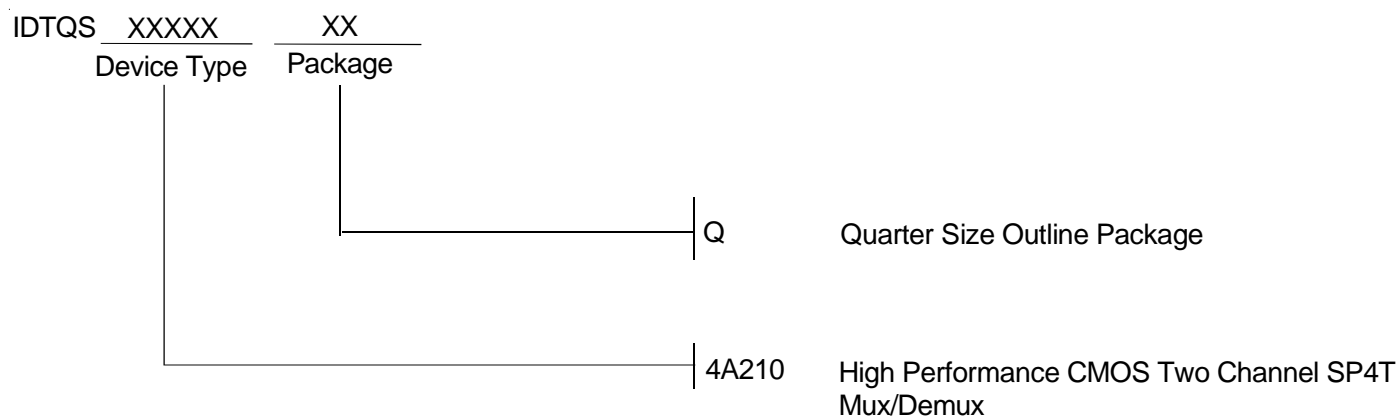


Off-Isolation

NOTE:

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

## ORDERING INFORMATION



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