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

IDTQS4A210

FEATURES:

- **Low ON resistance: $r_{DS(ON)}$ = 5Ω**
- **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: 3µA**
- **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.

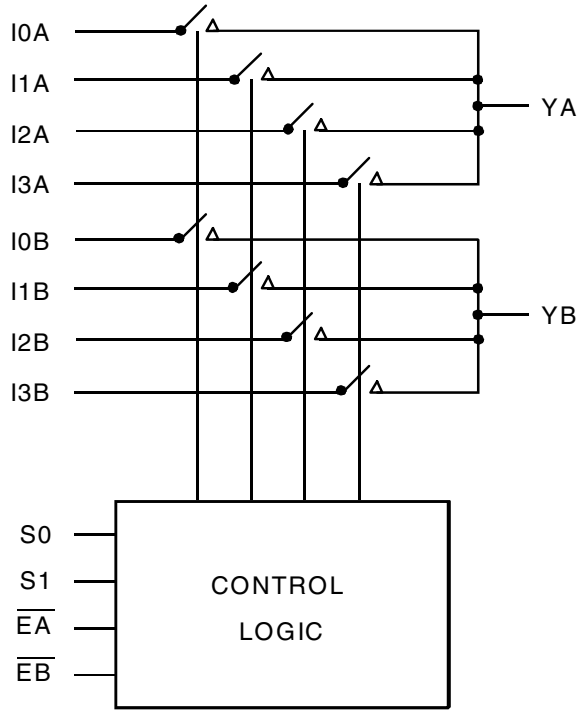
The QS4A210 with 700MHz bandwidth makes it ideal for high-performance video signal switching, audio signal switching, and telecom routing applications. Low power dissipation makes this device ideal for battery operated and remote instrumentation applications.

The QS4A210 is offered in the QSOP package which has several advantages over conventional packages such as PDIP and SOIC, including:

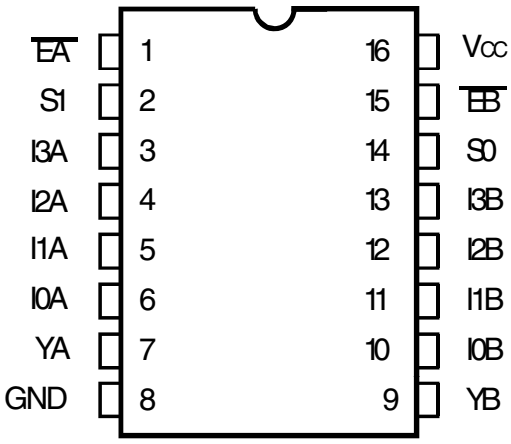
- Reduced signal delays due to denser component packaging on circuit boards
- Reduced system noise due to less pin inductance, resulting in lower ground bounce

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

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



QSOP
TOP VIEW

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Description	Max	Unit
V_{TERM}(2)	Supply Voltage to Ground	–0.5 to +7	V
V_{TERM}(3)	DC Switch Voltage V_S	–0.5 to +7	V
—	Analog Input Voltage	–0.5 to +7	V
V_{TERM}(3)	DC Input Voltage V_{IN}	–0.5 to +7	V
V_{AC}	AC Input Voltage (pulse width ≤20ns)	–3	V
I_{OUT}	DC Output Current	120	mA
P_{MAX}	Maximum Power Dissipation	0.7	W
T_{STG}	Storage Temperature	–65 to +150	° C

NOTES:
1. 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.
2. V_{CC} terminals.
3. All terminals except V_{CC} .

PIN DESCRIPTION

Pin Names	I/O	Description
IxA	I/O	Demux Port A
IxB	I/O	Demux Port B
$\overline{EA}$, $\overline{EB}$	I	Enable Inputs
S_0, S_1	I	Select Inputs
YA, YB	I/O	Mux Port A, B

FUNCTION TABLE(1)

Enable		Select		Mux/Demux Ports		
$\overline{EA}$	$\overline{EB}$	S_1	S_0	YA	YB	Function
H	X	X	X	Z	X	Disable A
X	H	X	X	X	Z	Disable B
L	L	L	L	1_0A	1_0B	S_1 - 0 = 0
L	L	L	H	1_1A	1_1B	S_1 - 0 = 1
L	L	H	L	1_2A	1_2B	S_1 - 0 = 2
L	L	H	H	1_3A	1_3B	S_1 - 0 = 3

NOTE:
1. 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°C to +85°C, V_{CC} = 5V ± 5%

Symbol	Parameter	Test Conditions	Min.	Typ.(1)	Max.	Unit
Analog Switch						
V_{IN}	Analog Signal Range(2)		–0.5	1	Vcc - 1	V
$r_{DS(ON)}$	Drain-source ON resistance(2,3)	Vcc = Min., V_{IN} = 0V, I_{ON} = 30mA	—	5	7	Ω
		Vcc = Min., V_{IN} = 2.4V, I_{ON} = 15mA	—	13	17	
$I_{C(OFF)}$	Channel Off Leakage Current	I_N = Vcc or 0V; Y_N = 0V or Vcc; $\overline{EA}$ = $\overline{EB}$ = Vcc	—	2	—	nA
$I_{C(ON)}$	Channel On Leakage Current	I_N = Y_N = 0V (each channel is turned on sequentially)	—	2	—	nA
Digital Control						
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
Dynamic Characteristics						
t_{TRANS}	Switching Time of Mux Sx to Y	R_L = 1KΩ, C_L = 100pF (See Transition Time)	0.5	—	6.6	ns
$t_{ON(\overline{EN})}$	Enable Turn-On Time $\overline{EA}$ = $\overline{EB}$ to Y	R_L = 1KΩ, C_L = 100pF (See Switching Time)	0.5	—	6	ns
$t_{OFF(\overline{EN})}$	Enable Turn-Off Time $\overline{EA}$ = $\overline{EB}$ to Y	R_L = 1KΩ, C_L = 100pF (See Switching Time)	0.5	—	6	ns
t_{PD}	Group Delay(2,4)	R_L = 1KΩ, C_L = 100pF	—	—	250	ps
f_{3dB}	-3dB Bandwidth	V_{IN} = 1Vp-p, R_L = 75Ω	—	700	—	MHz
	Off-isolation	V_{IN} = 1Vp-p, R_L = 75Ω, f = 5.5MHz	—	-60	—	dB
X_{TALK}	Crosstalk	V_{IN} = 1Vp-p, R_L = 75Ω, f = 5.5MHz	—	-68	—	dB
$C_{MUX(OFF)}$	Mux Off Capacitance	$\overline{EA}$ = $\overline{EB}$ = Vcc, V_{IN} = V_{OUT} = 0V	—	5.6	—	pF
$C_{DEMUX(OFF)}$	Demux Off Capacitance	$\overline{EA}$ = $\overline{EB}$ = Vcc, V_{IN} = V_{OUT} = 0V	—	7.4	—	pF
$C_{MUX(ON)}$	Mux On Capacitance	$\overline{EA}$ = $\overline{EB}$ = 0V, V_{IN} = V_{OUT} = 0V	—	12	—	pF
$C_{DEMUX(ON)}$	Demux On Capacitance	$\overline{EA}$ = $\overline{EB}$ = 0V, V_{IN} = V_{OUT} = 0V	—	15	—	pF
Q_{CI}	Charge Injection		—	1.5	—	pC

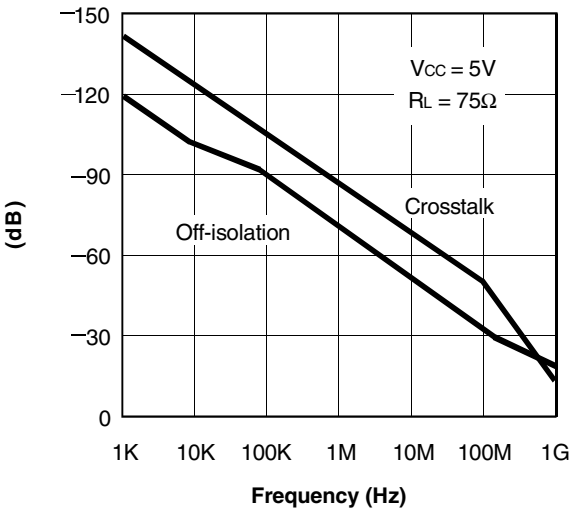
NOTES:

1. Typical values are at V_{CC} = 5.0V, T_A = 25°C.
2. Max value is guaranteed but not production tested.
3. 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.
4. 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

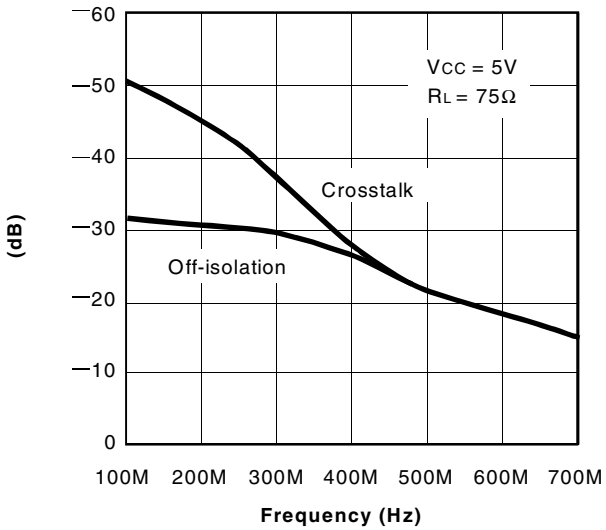
Symbol	Parameter	Test Conditions	Max.	Unit
I_{CCQ}	Quiescent Power	V_{CC} = Max., V_{IN} = GND or V_{CC}, f = 0	3	µA

TYPICAL CHARACTERISTICS



Off-isolation and Crosstalk vs. Frequency

NOTES:
1. Crosstalk = 20 log |Vo/Vs|
2. Off-isolation = 20 log |Vo/Vs|



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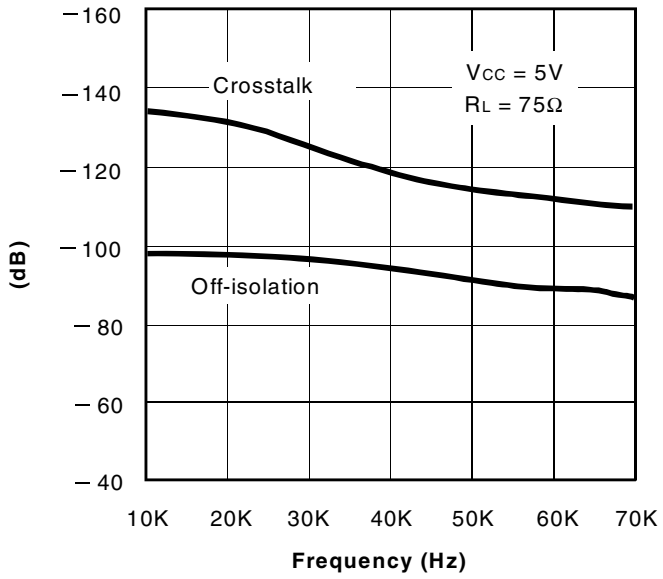

Off-isolation and Crosstalk vs. Frequency

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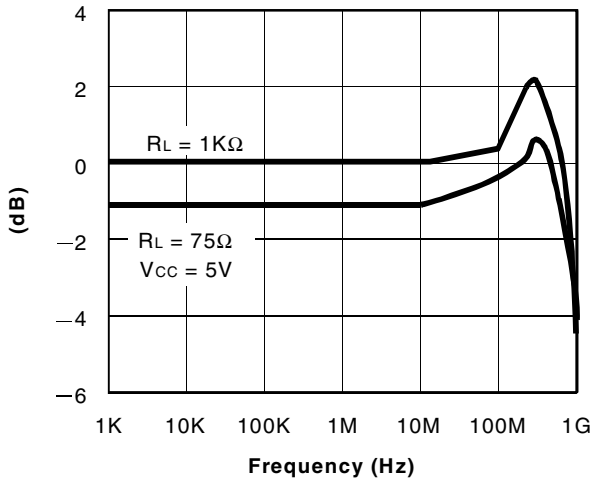
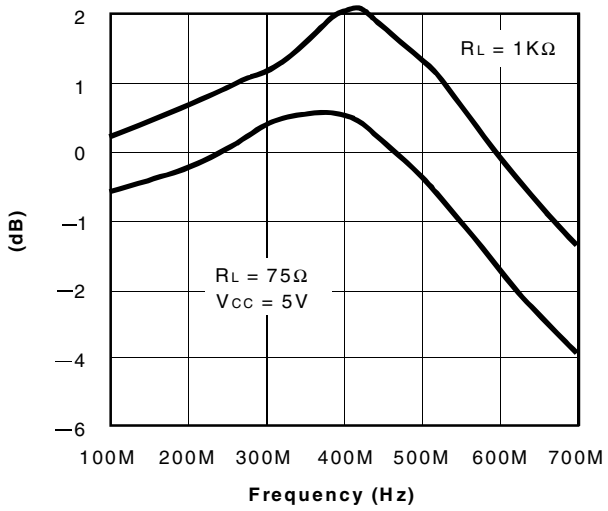


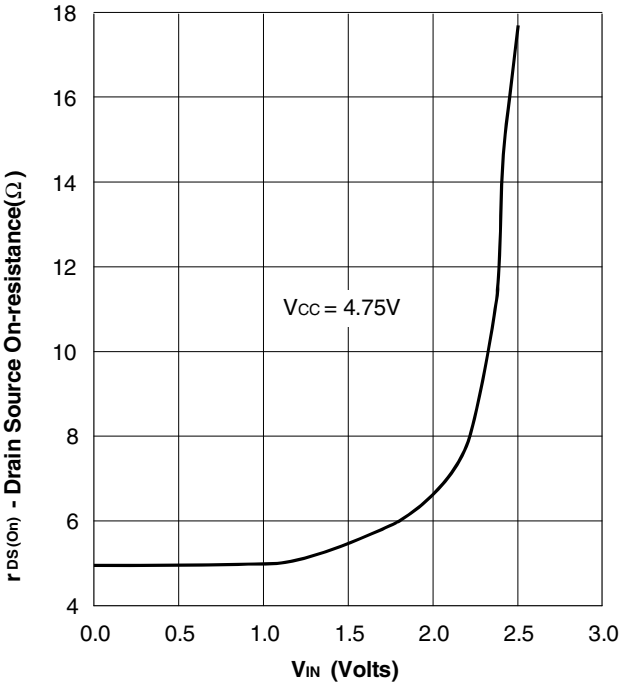
Insertion Loss vs. Frequency

NOTE:
1. Insertion Loss = 20 log |Vo/Vs|

TYPICAL CHARACTERISTICS (CONTINUED)



Insertion Loss vs. Frequency

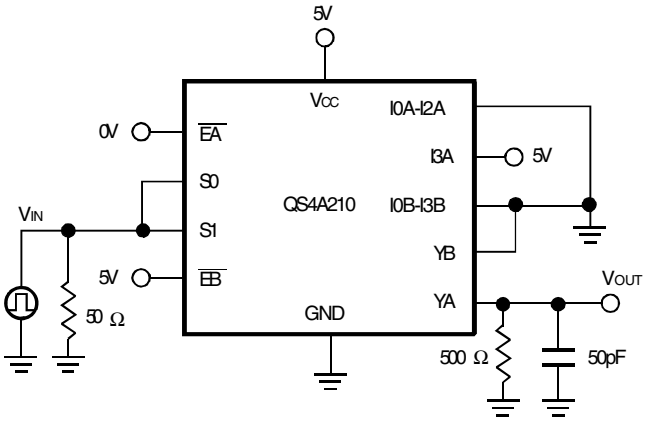


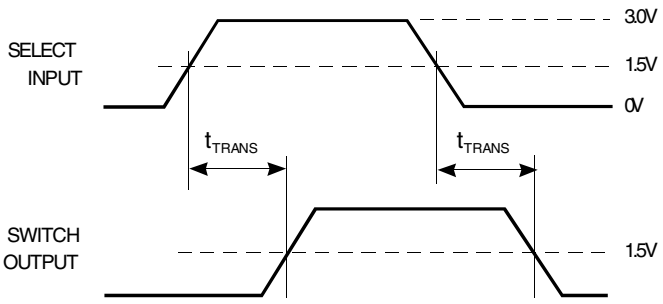
RON LINK

On-Resistance vs. VIN

NOTE:
1. Insertion Loss = 20 log |Vo/Vs|

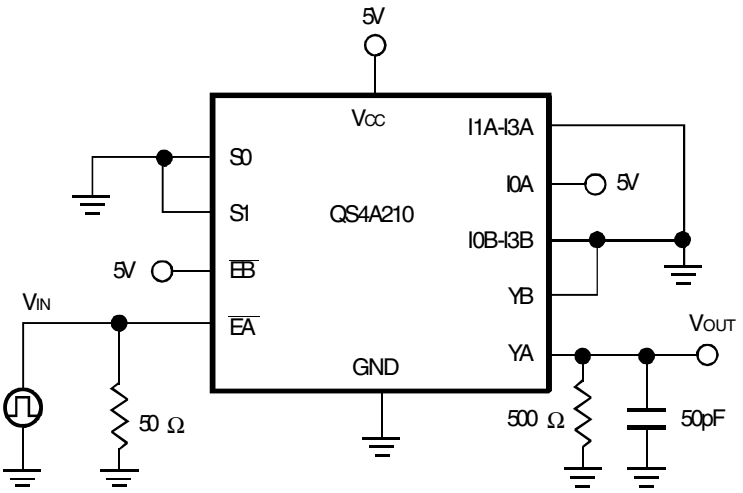
TEST CIRCUITS

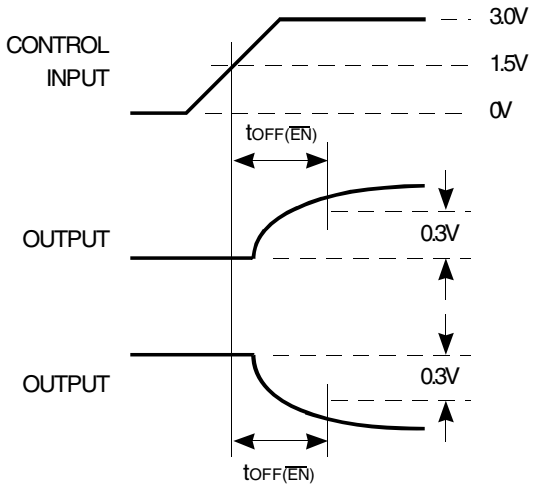




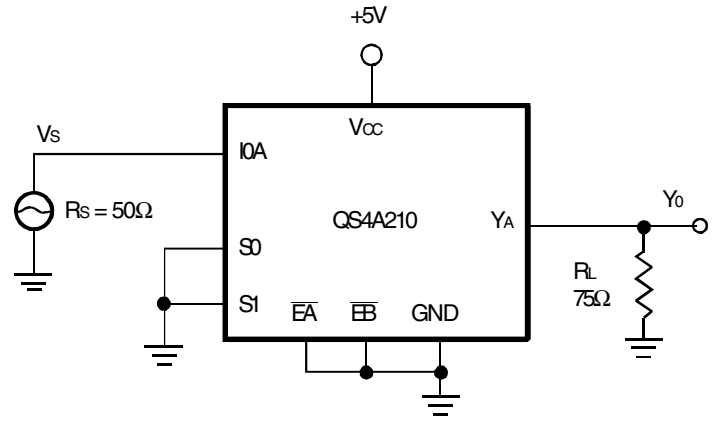
Transition Time

TEST CIRCUITS (CONTINUED)



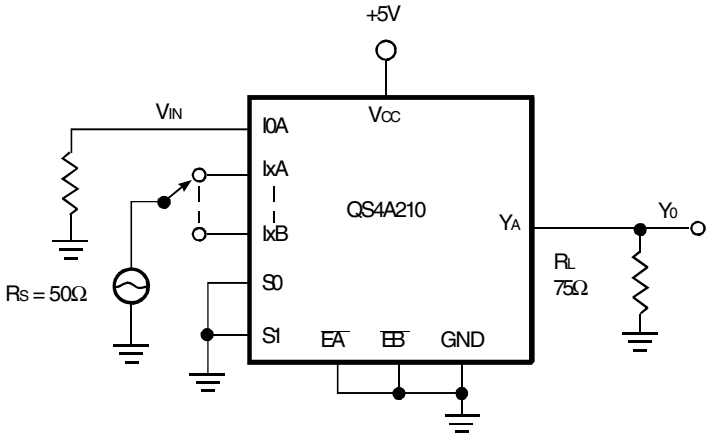


Enable Switching Time



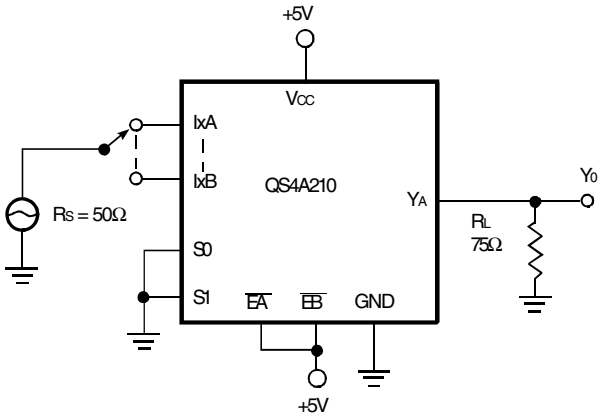
Insertion Loss

NOTE:
1. Insertion Loss = 20 log |Vo/Vs|



Crosstalk

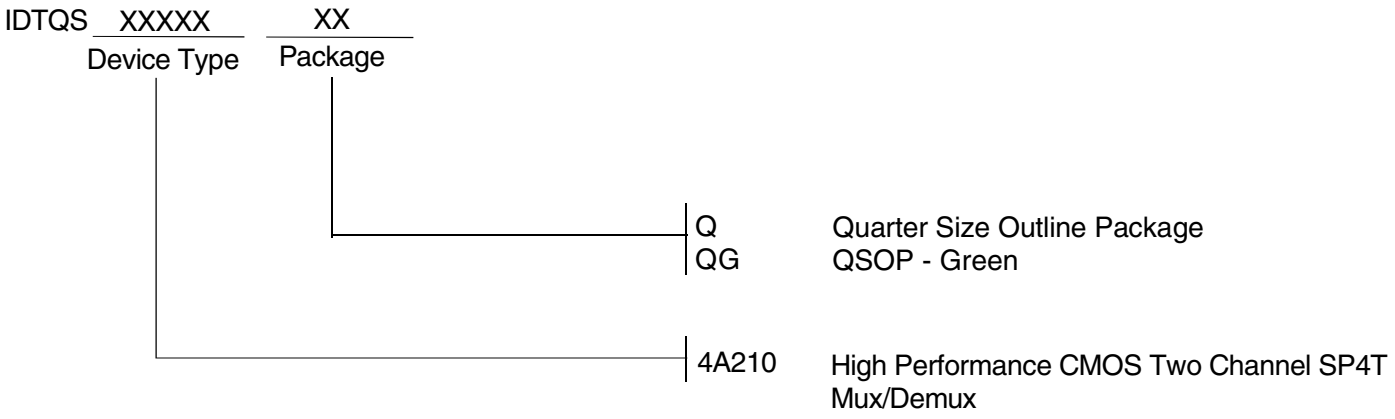
NOTE:
1. Crosstalk = 20 log |Vo/Vs|



Off-Isolation

NOTE:
1. Off-isolation = 20 log |Vo/Vs|

ORDERING INFORMATION



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