QUALITY SEMICONDUCTOR, INC.

High-Performance CMOS Six-Channel SP4T Mux/Demux

QS4A215Q1

FEATURES

- Low On-resistance: $r_{DS(on)}$ = 5Ω
- Fast transition time: t_{TRAN} = 6ns
- Wide bandwidth: 700MHz (–3dB point)
- Crosstalk:
  –110dB @ 50KHz, –68dB @ 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: 9µA

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

GENERAL DESCRIPTION

The QS4A215Q1 is a high-performance CMOS Six-Channel multiplexer/demultiplexer with individual enables. The low on-resistance of the QS4A215Q1 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 QS4A215Q1 with 700MHz 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 QS4A215Q1 is offered in the QVSOP 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

Figure 1. Functional Block Diagram

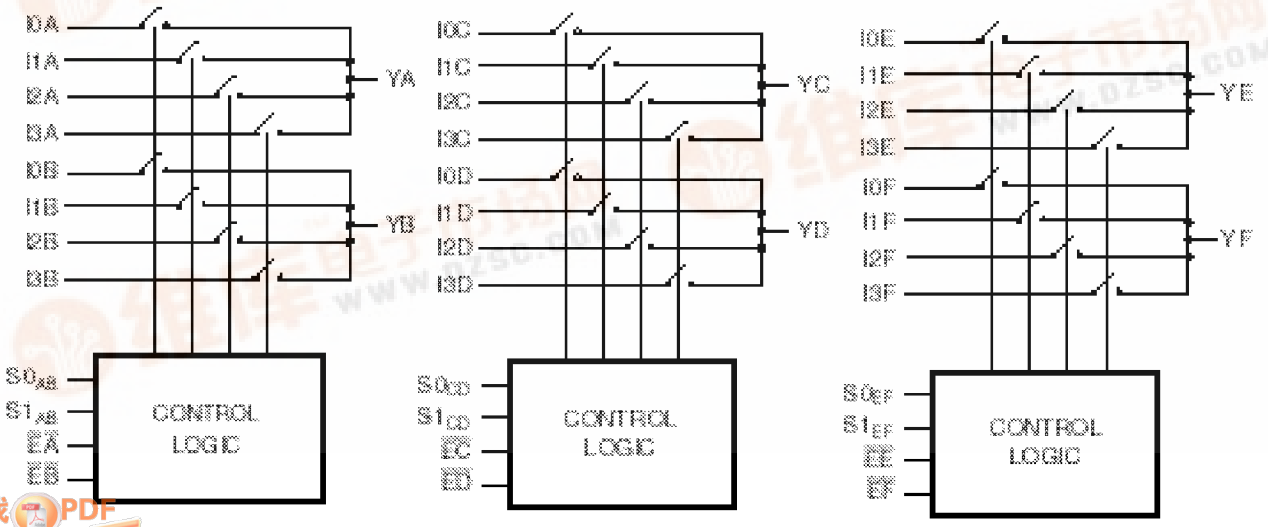


Table 1. Pin Definitions

Name	I/O	Description
IxA-F	I/O	DEMUX Ports, A-F
S0xx,S1xx	I	Select Input
EA-F	I	Enable Inputs, A-F
YA-F	I/O	MUX Ports, A-F

Figure 2. Pin Configuration

(All Pins Top View)

QVSOP (Q1)

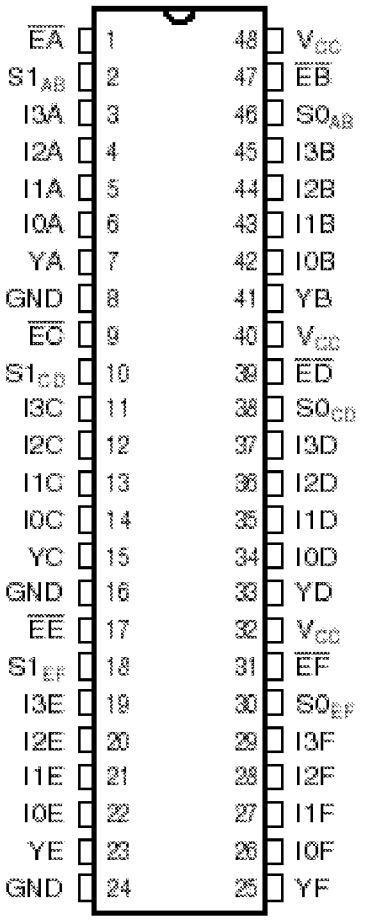


Table 2. Function Table

Enable		Select		MUX/DEMUX Ports		
EA	EB	S1	S0	YA	YB	Function
H	X	X	X	High-Z	X	Disable A
X	H	X	X	X	High-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: This function table represents the function for block "AB."
The "CD" block nomenclature substitutes "A" for "C" and "B" for "D".
The "EF" block nomenclature substitutes "A" for "E" and "B" for "F".

Table 3. Absolute Maximum Ratings

Supply Voltage to Ground	–0.5V to +7.0V
DC Switch Voltage V_S	–0.5V to +7.0V
Analog Input Voltage	–0.5V to +7.0V
DC Input Voltage V_{IN}	–0.5V to +7.0V
AC Input Voltage (for a pulse width ≤ 20ns)	–3.0V
DC Output Current Max. Sink Current/Pin	120mA
Maximum Power Dissipation	0.7 watts
T_{STG} Storage Temperature	–65° to +150°C

RATINGS are those conditions beyond which damage to the device may occur. Exposure to these conditions or beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum rating conditions is not implied.

Table 4. Electrical Characteristics Over Operating Range

Commercial: T_A = 0°C to 70°C, V_{CC} = 5.0V ± 5%

Symbol	Parameter	Test Conditions	Min	Typ(1)	Max	Unit
Analog Switch						
V_{IN}	Analog Signal Range(2)		–0.5	1.0	Vcc – 1	V
$r_{DS(on)}$	Drain-source On-resistance(2,3)	V_{CC} = Min., V_{IN} = 0.0V, I_{ON} = 30mA	—	5	7	Ω
		V_{CC} = Min., V_{IN} = 2.4V, I_{ON} = 15mA	—	10	15	Ω
$\Delta r_{DS(on)}$	$r_{DS(on)}$ Matching Between Channels(4)	V_{CC} = Min., V_{IN} = 0.0V, I_{ON} = 30mA	—	1	4	Ω
		V_{CC} = Min., V_{IN} = 2.4V, I_{ON} = 15mA	—	2	4	Ω
$I_{C(OFF)}$	Channel Off Leakage Current	I_N = V_{CC} or 0V, Y_N = 0V or V_{CC} $\overline{EX}$ = V_{CC}	—	10	—	nA
$I_{C(ON)}$	Channel On Leakage Current	I_N = Y_N = 0V, Each Channel is Turned On Sequentially	—	10	—	nA
Digital Control						
V_{IH}	Input HIGH Voltage	Guaranteed Logic HIGH for Control Pins	2.0	—	—	V
V_{IL}	Input LOW Voltage	Guaranteed Logic LOW for Control Pins	—	—	0.8	V
Dynamic Characteristics						
t_{TRANS}	Switching Time of MUX Sn to Y_N	R_L = 1KΩ, C_L = 100pF (See Figure 9)	0.5	—	6.6	ns
$t_{ON(\overline{EN})}$	Enable Turn-on Time $\overline{EX}$ to Y_N	R_L = 1KΩ, C_L = 100pF (See Figure 10)	0.5	—	6.0	ns
$t_{OFF(\overline{EN})}$	Enable Turn-off Time $\overline{EX}$ to Y_N	R_L = 1KΩ, C_L = 100pF (See Figure 10)	0.5	—	6.0	ns
t_{PD}	Group Delay(2,5)	R_L = 1KΩ, C_L = 100pF	—	—	250	ns
f_{3dB}	–3dB Bandwidth	V_{IN} = 1Vp–p, R_L = 75Ω	—	700	—	MHz
	Off-isolation	V_{IN} = 1Vp–p, R_L = 75Ω, f = 5MHz	—	–60	—	dB
X_{TALK}	Crosstalk	V_{IN} = 1Vp–p, R_L = 75Ω, f = 5MHz	—	–68	—	dB
$C_{Mux(off)}$	MUX Off Capacitance	$\overline{EX}$ = V_{CC}, V_{IN} = V_{OUT} = 0V	—	6	—	pF
$C_{Demux(off)}$	DEMUX Off Capacitance	$\overline{EX}$ = V_{CC}, V_{IN} = V_{OUT} = 0V	—	14	—	pF
$C_{Mux(on)}$	MUX On Capacitance	$\overline{EX}$ = 0V, V_{IN} = V_{OUT} = 0V	—	20	—	pF
$C_{Demux(off)}$	MUX On Capacitance	$\overline{EX}$ = 0V, V_{IN} = V_{OUT} = 0V	—	20	—	pF
Q_{CI}	Charge Injection	C_L = 1000pF	—	1.5	—	pC

Notes:
1. Typical values indicate V_{CC} = 5.0V and T_A = 25°C.
2. Guaranteed by design, not subject to production test.
3. 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.
4. $\Delta r_{DS(on)}$ compares on-resistance at the specified V_{IN} Values.
5. The bus switch contributes no propagation delay other than the RC delay of the on-resistance of the switch and 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.

Table 5. Power Supply Characteristics

Symbol	Parameter	Test Conditions[1]	Max	Unit
I_{CCQ}	Quiescent Power	V_{CC} = Max., V_{IN} = GND or V_{CC}, f = 0	9	µA

2

TYPICAL CHARACTERISTICS

Figure 3. Off-isolation and Crosstalk vs. Frequency

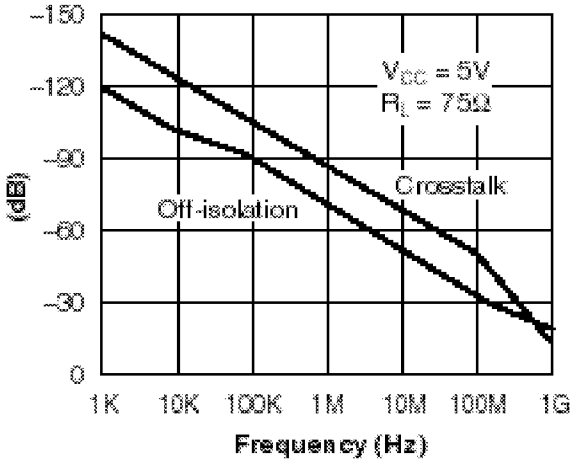
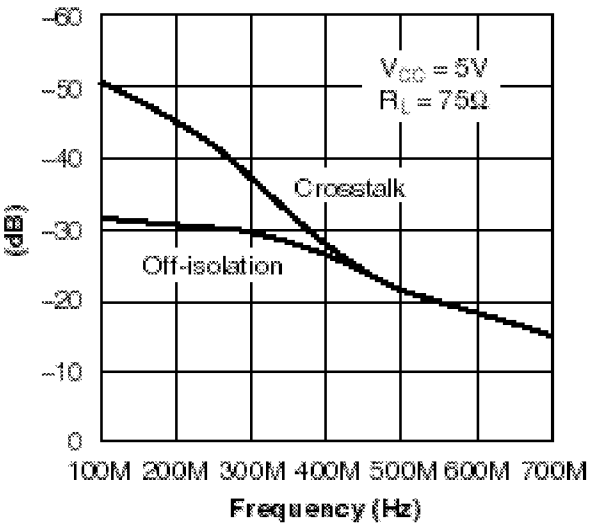


Figure 4. Off-isolation and Crosstalk vs. Frequency



TYPICAL CHARACTERISTICS (continued)

Figure 5. Off-isolation and Crosstalk vs. Frequency

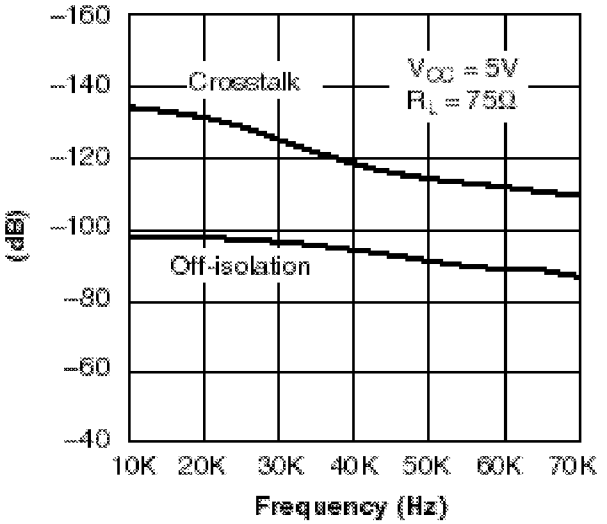


Figure 6. Insertion Loss vs. Frequency

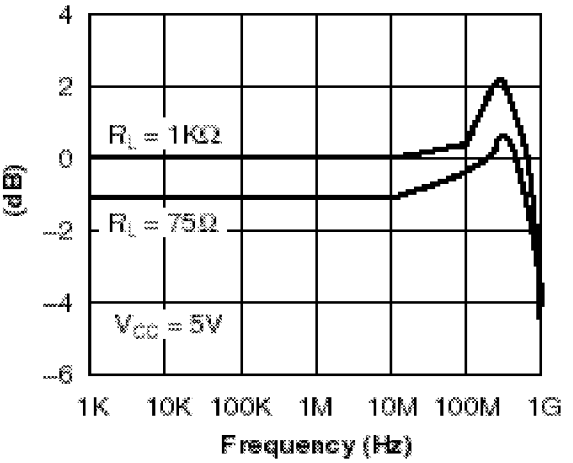


Figure 7. Insertion Loss vs. Frequency

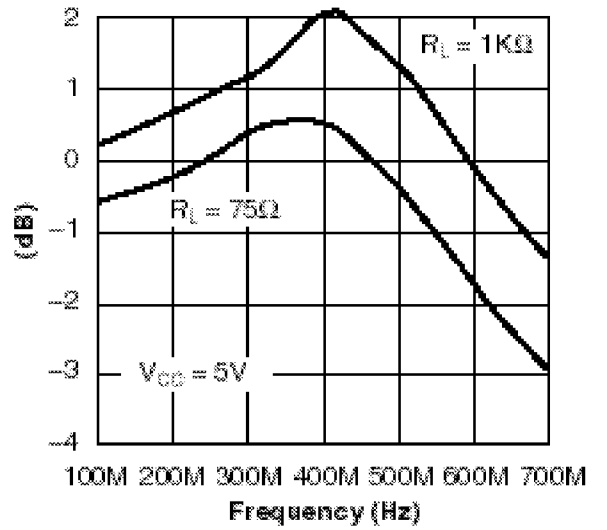
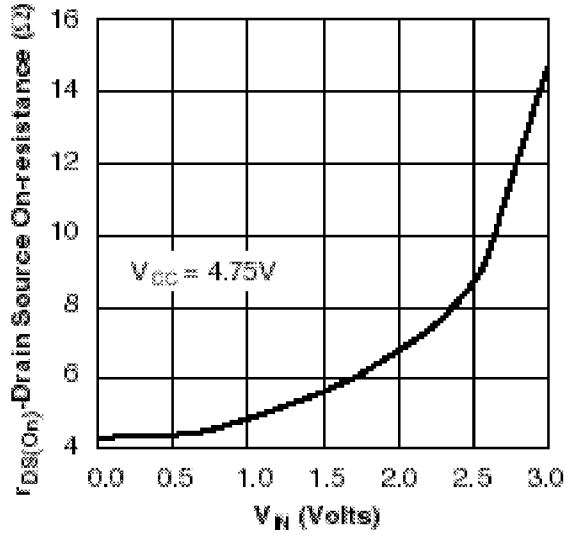


Figure 8. On-Resistance vs. V_{IN}



TEST CIRCUITS

Figure 9. Transition Time

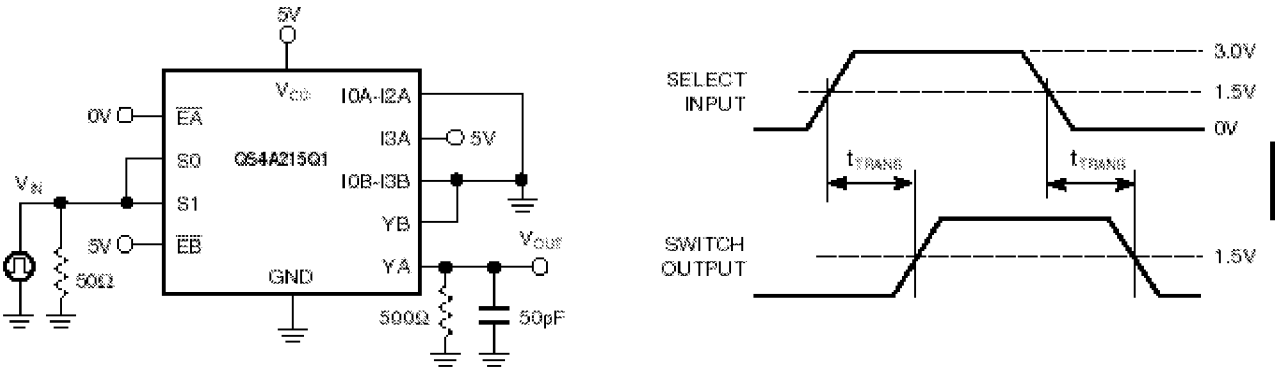


Figure 10. Enable Switching Time

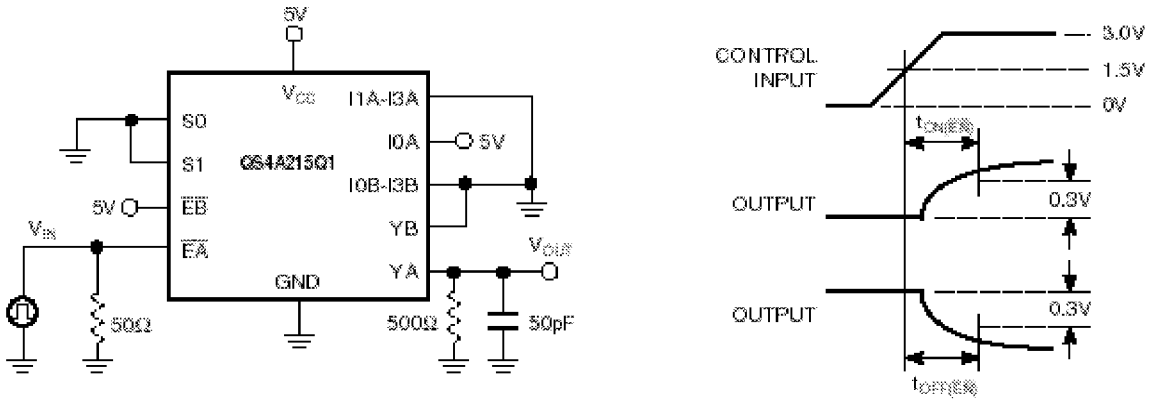
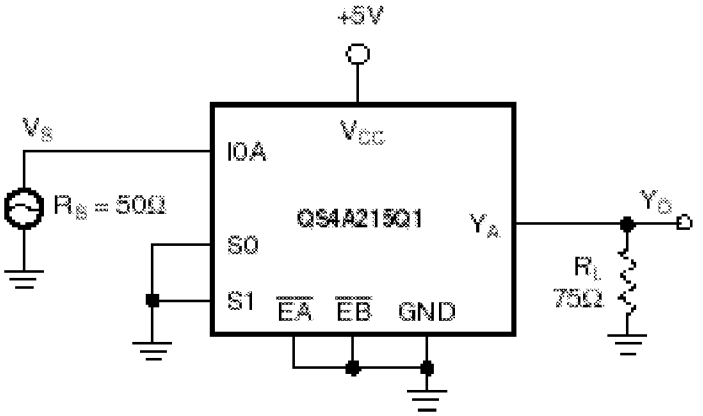


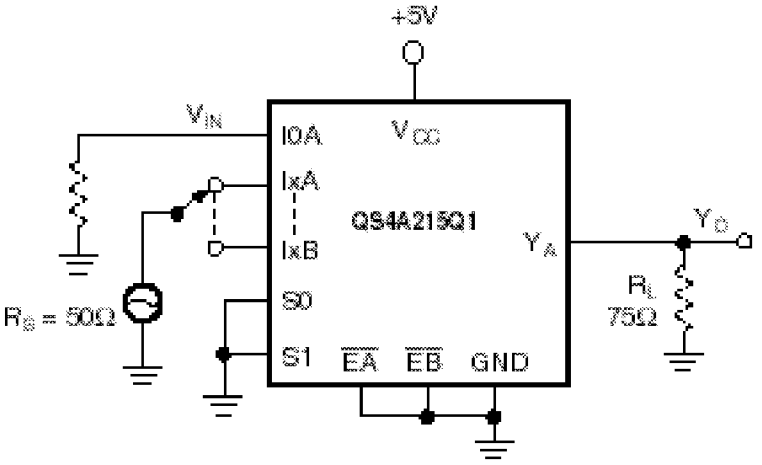
Figure 11. Insertion Loss



Note: Insertion Loss = 20 log $|V_O/V_S|$

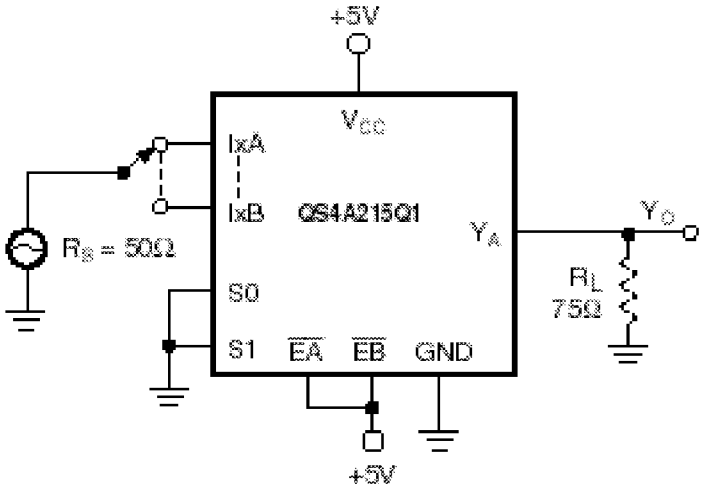
TEST CIRCUITS (continued)

Figure 12. Crosstalk



Note: Crosstalk = 20 log $|V_O/V_S|$

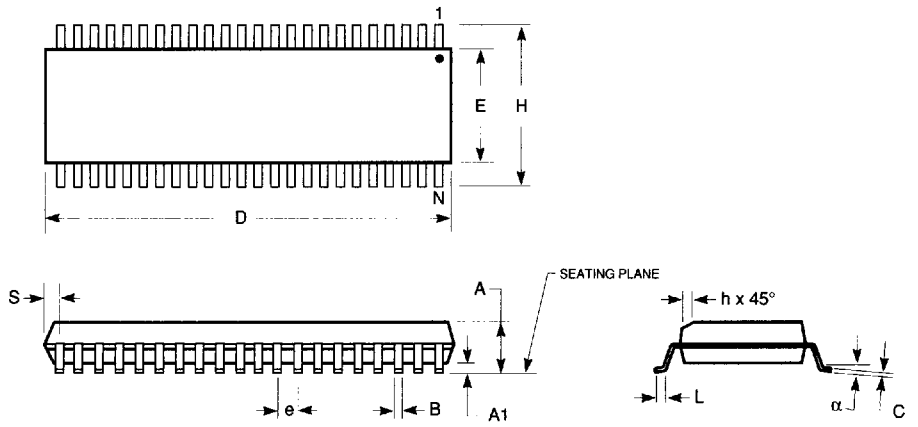
Figure 13. Off-isolation



Note: Off-isolation = 20 log $|V_O/V_S|$

150-MIL QVSOP™ - Package Code Q1/Q2

150-Mil Wide Plastic Small Outline Gull-Wing



JEDEC#	MO-154BB			MO-154AB		
DWG#	PSS-40A (Q2)			PSS-48A (Q1)		
Symbol	Min	Nom	Max	Min	Nom	Max
A	0.059	0.065	0.069	0.059	0.065	0.069
A1	0.004	0.006	0.008	0.004	0.006	0.008
B	0.0067	0.008	0.009	0.0051	0.0063	0.008
C	0.0075	0.008	0.0098	0.0075	0.008	0.0098
D	0.386	0.390	0.394	0.386	0.390	0.394
E	0.150	0.154	0.157	0.150	0.154	0.157
e	0.0197 BSC, 0.5mm			0.0157 BSC, 0.4mm		
H	0.228	0.236	0.244	0.228	0.236	0.244
h	0.010	0.013	0.016	0.010	0.013	0.016
L	0.020	0.024	0.030	0.020	0.024	0.030
N	40			48		
α	0°	5°	8°	0°	5°	8°
S	0.006	0.008	0.010	0.012	0.014	0.016

Notes:
1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006in. per side.
5. Lead coplanarity is 0.003in. maximum.