

## General Description

The IDTVS330 is a true bidirectional Quad 2-channel multiplexer/ demultiplexer recommended for both RGB and composite video switching applications. The video switch can be driven from a current output RAMDAC or voltage output composite video source.

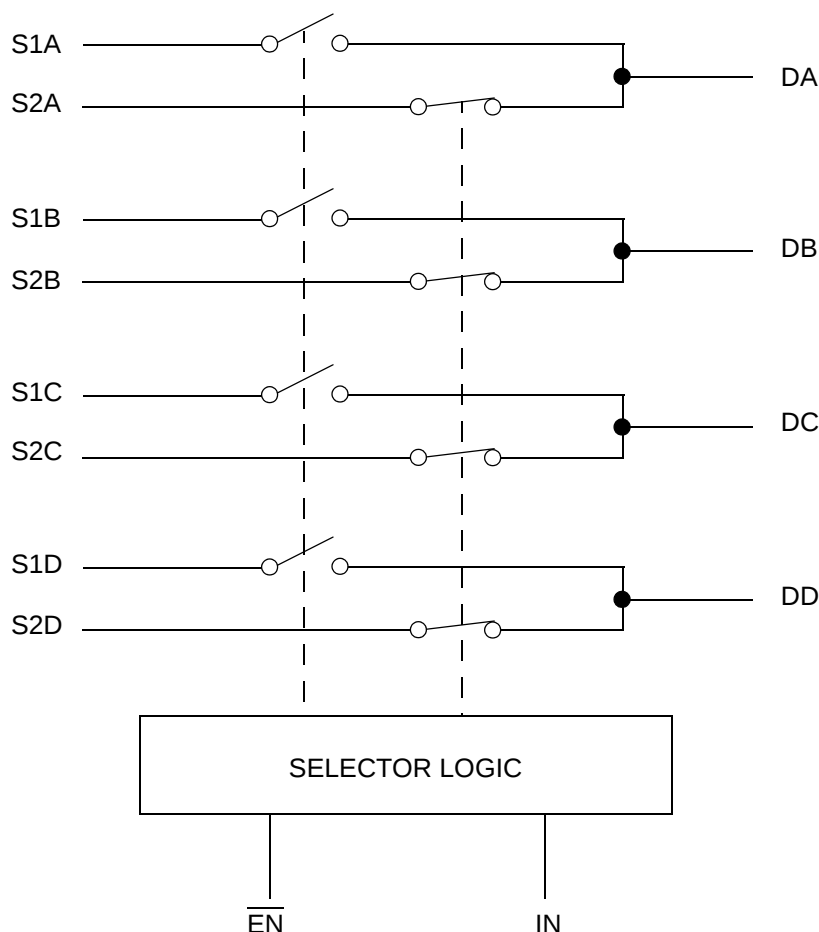
Low On-Resistance and wide bandwidth make it ideal for video and other applications. Also this device has exceptionally high current capability which is far greater than most analog switches offered today. A single 5V supply is all that is required for operation.

The IDTVS330 offers a high-performance, low-cost solution to switch between video sources. The application section describes the IDTVS330 replacing the HC4053 multiplier and buffer/ amplifier.

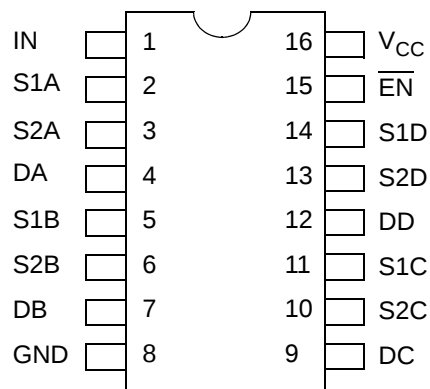
## Features

- High-performance solution to switch between video sources
- Wide bandwidth: 600MHz
- Low On-Resistance:  $5\Omega$  typical
- Low crosstalk at 10MHz:  $-80\text{dB}$
- Ultra-low quiescent power ( $0.1\mu\text{A}$  typical)
- Fast switching: 10ns
- 8KV ESD HBM on connector side
- Available in SOIC and QSOP packages

## Block Diagram



## Pin Configuration



SOIC/ QSOP  
TOP VIEW

## Absolute Maximum Ratings

| Symbol | Rating                                 | Min   | Max <sup>1</sup> | Unit |
|--------|----------------------------------------|-------|------------------|------|
| TSTG   | Storage Temperature Range              | – 65  | +150             | °C   |
|        | Ambient Temperature with Power Applied | 0     | +70              | °C   |
|        | Supply Voltage to GND Potential        | – 0.5 | +5.5             | V    |
|        | DC Input Voltage                       | – 0.5 | +5.5             | V    |
|        | DC Output Current                      | —     | 120              | mA   |
|        | Power Dissipation                      | —     | 0.5              | W    |

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.

## Truth Table

| $\overline{\text{EN}}$ | IN | ON Switch          |
|------------------------|----|--------------------|
| L                      | L  | S1A, S1B, S1C, S1D |
| L                      | H  | S2A, S2B, S2C, S2D |
| H                      | X  | Disabled           |

## Pin Description

| Name            | Function          |
|-----------------|-------------------|
| S1, S2          | Analog Video I/Os |
| IN              | Select Input      |
| EN              | Enable            |
| D               | Analog Video I/O  |
| GND             | Ground            |
| V <sub>CC</sub> | Power Supply      |

## DC Electrical Characteristics Over Operating Range

Following Conditions Apply Unless Otherwise Specified:

T<sub>A</sub> = 0°C to +70°C, V<sub>CC</sub> = 3.3V ± 5%.

| Symbol                       | Parameter                        | Conditions <sup>1</sup>                                              | Min. | Typ. <sup>2</sup> | Max.            | Unit |
|------------------------------|----------------------------------|----------------------------------------------------------------------|------|-------------------|-----------------|------|
| V <sub>ANALOG</sub>          | Analog Signal Range              |                                                                      | 0    | —                 | V <sub>CC</sub> | V    |
| V <sub>IH</sub>              | Input HIGH Voltage               | Guaranteed Logic HIGH level                                          | 2    | —                 | —               | V    |
| V <sub>IL</sub>              | Input LOW Voltage                | Guaranteed Logic LOW level                                           | 0    | —                 | 0.8             | V    |
| I <sub>IH</sub>              | Input HIGH Current               | V <sub>CC</sub> = Max., V <sub>IN</sub> = V <sub>CC</sub>            | —    | —                 | ±1              | μA   |
| I <sub>IL</sub>              | Input LOW Current                | V <sub>CC</sub> = Max., V <sub>IN</sub> = V <sub>SS</sub>            | —    | —                 | ±1              | μA   |
| I <sub>O</sub>               | Analog Output Leakage Current    | 0 ≤ S1, S2 or D ≤ V <sub>CC</sub> , Switch OFF                       | —    | —                 | ±1              | μA   |
| V <sub>IK</sub>              | Clamp Diode Voltage              | V <sub>CC</sub> = Min., I <sub>IN</sub> = -18mA                      | -0.7 | -1.2              | —               | V    |
| V <sub>H</sub>               | Input Hysteresis at Control Pins |                                                                      | —    | 150               | —               | mV   |
| R <sub>ON</sub> <sup>3</sup> | Switch On-Resistance             | V <sub>CC</sub> = Min., V <sub>IN</sub> = 1V, I <sub>ON</sub> = 13mA | —    | 5                 | 7               | Ω    |
|                              |                                  | V <sub>CC</sub> = Min., V <sub>IN</sub> = 2V, I <sub>ON</sub> = 26mA | —    | 7                 | 10              | Ω    |

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.

2. Typical values are at V<sub>CC</sub> = 3.3V, T<sub>A</sub> = 25°C ambient and maximum loading.

3. Measured by the voltage drop between S1, S2, and D I/O pins at indicated current through the switch. On-Resistance is determined by the lower of the voltages on the S1, S2, and D I/O pins.

## Dynamic Electrical Characteristics Over Operating Range

Following Conditions Apply Unless Otherwise Specified:

$T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 5\%$ .

| Symbol       | Parameter                | Conditions                               | Min. | Typ. | Max. | Unit |
|--------------|--------------------------|------------------------------------------|------|------|------|------|
| $t_{ON}$     | Turn On Time             | $R_L = 75\Omega$ , $C_L = 20\text{pF}$   | —    | 2.5  | 5    | ns   |
| $t_{OFF}$    | Turn Off Time            | $R_L = 75\Omega$ , $C_L = 20\text{pF}$   | —    | 1.1  | 5    |      |
| $B_W^1$      | –3dB Bandwidth           |                                          | —    | —    | 570  | MHz  |
| $X_{TALK}^1$ | Crosstalk                | 10MHz, $C_L = 0\text{pF}$                | —    | – 80 | —    | dB   |
| $C_{IN}^1$   | Input/Enable Capacitance | $V_{IN} = 0\text{V}$ , $f = 1\text{MHz}$ | —    | —    | 6    | pF   |
| $C_{OFF}^1$  | Capacitance, Switch Off  |                                          | —    | —    | 6    |      |
| $C_{ON}^1$   | Capacitance, Switch On   |                                          | —    | —    | 9    |      |
| $O_{IRR}$    | Off Isolation            | 10MHz, $C_L = 0\text{pF}$                | —    | – 48 | —    | dB   |

1. This parameter is determined by device characterization but is not production tested.

## DC Electrical Characteristics Over Operating Range

Following Conditions Apply Unless Otherwise Specified:

$T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 5\text{V} \pm 5\%$ .

| Symbol       | Parameter                        | Conditions <sup>1</sup>                                                                      | Min.  | Typ. <sup>2</sup> | Max.     | Unit          |
|--------------|----------------------------------|----------------------------------------------------------------------------------------------|-------|-------------------|----------|---------------|
| $V_{ANALOG}$ | Analog Signal Range              |                                                                                              | 0     | —                 | $V_{CC}$ | V             |
| $V_{IH}$     | Input HIGH Voltage               | Guaranteed Logic HIGH level                                                                  | 2     | —                 | —        | V             |
| $V_{IL}$     | Input LOW Voltage                | Guaranteed Logic LOW level                                                                   | – 0.5 | —                 | 0.8      |               |
| $I_{IH}$     | Input HIGH Current               | $V_{CC} = \text{Max.}$ , $V_{IN} = V_{CC}$                                                   | —     | —                 | $\pm 1$  | $\mu\text{A}$ |
| $I_{IL}$     | Input LOW Current                | $V_{CC} = \text{Max.}$ , $V_{IN} = V_{SS}$                                                   | —     | —                 | $\pm 1$  |               |
| $I_O$        | Analog Output Leakage Current    | $0 \leq S1, S2 \text{ or } D \leq V_{CC}$ , Switch OFF                                       | —     | —                 | $\pm 1$  | $\mu\text{A}$ |
| $V_{IK}$     | Clamp Diode Voltage              | $V_{CC} = \text{Min.}$ , $I_{IN} = -18\text{mA}$                                             | – 0.7 | – 1.2             | —        | V             |
| $I_{OS}^3$   | Short Circuit Current            |                                                                                              | 100   | —                 | —        | mA            |
| $V_H$        | Input Hysteresis at Control Pins | $V_{CC} = \text{Min.}$ , $V_{IN} = 1\text{V}$ , $R_L = 75\Omega$ ,<br>$I_{ON} = 13\text{mA}$ | —     | 150               | —        | mV            |
| $R_{ON}^4$   | Switch On-Resistance             | $V_{CC} = \text{Min.}$ , $V_{IN} = 2\text{V}$ , $R_L = 75\Omega$ ,<br>$I_{ON} = 26\text{mA}$ | 3     | 7                 | 10       | $\Omega$      |

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.

2. Typical values are at  $V_{CC} = 5\text{V}$ ,  $T_A = 25^\circ\text{C}$  ambient and maximum loading.

3. Not more than one output should be shorted at one time. Duration of the test should not exceed one second.

4. Measured by the voltage drop between S1, S2, and D I/O pins at indicated current through the switch. On-Resistance is determined by the lower of the voltages on the S1, S2, and D I/O pins.

## Dynamic Electrical Characteristics Over Operating Range

Following Conditions Apply Unless Otherwise Specified:

$T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 5\%$ .

| Symbol      | Parameter                | Conditions                                      | Min. | Typ. | Max. | Unit |
|-------------|--------------------------|-------------------------------------------------|------|------|------|------|
| $t_{ON}$    | Turn On Time             | $R_L = 75\Omega$ , $C_L = 20\text{pF}$          | —    | 2.5  | 5    | ns   |
| $t_{OFF}$   | Turn Off Time            | $R_L = 75\Omega$ , $C_L = 20\text{pF}$          | —    | 1.1  | 5    |      |
| $B_W^1$     | -3dB Bandwidth           | $R_L = 150\Omega$                               | —    | —    | 570  | MHz  |
| $X_{TALK}$  | Crosstalk                | $R_{IN} = 10\Omega$ , $R_L = 150\Omega$ , 10MHz | —    | - 58 | —    | dB   |
| $D_G$       | Differential Gain        | $R_L = 150\Omega$ , $f = 3.58\text{MHz}$        | —    | 0.64 | —    | %    |
| $D_P$       | Differential Phase       | $R_L = 150\Omega$ , $f = 3.58\text{MHz}$        | —    | 0.27 | —    | Deg. |
| $C_{IN}^1$  | Input/Enable Capacitance | $V_{IN} = 0\text{V}$ , $f = 1\text{MHz}$        | —    | —    | 6    | pF   |
| $C_{OFF}^1$ | Capacitance, Switch Off  |                                                 | —    | —    | 6    |      |
| $C_{ON}^1$  | Capacitance, Switch On   |                                                 | —    | —    | 8    |      |
| $O_{IRR}$   | Off Isolation            | $R_L = 150\Omega$ , 10MHz                       | —    | - 38 | —    | dB   |

1. This parameter is determined by device characterization but is not production tested.

## Power Supply Characteristics

| Symbol          | Parameter                                 | Conditions <sup>1</sup>                                                                                                       | Min. | Typ. <sup>2</sup> | Max. | Unit          |
|-----------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------|-------------------|------|---------------|
| $I_{CC}$        | Quiescent Power Supply Current            | $V_{CC} = \text{Max.}$ , $I_N = \text{GND}$ or $V_{CC}$                                                                       | —    | 0.1               | 3    | $\mu\text{A}$ |
| $\Delta I_{CC}$ | Power Supply Current per Input @ TTL HIGH | $V_{CC} = \text{Max.}$ , $I_N = 3.4\text{V}^3$                                                                                | —    | —                 | 2.5  | mA            |
| $I_{CCD}^4$     | Supply Current per Input per MHz          | $V_{CC} = \text{Max.}$ , S1, S2 and D Pins Open, $\overline{\text{EN}} = \text{GND}$<br>Control Input Toggling, 50%Duty Cycle | —    | —                 | 0.25 | mA/MHz        |

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.

2. Typical values are at  $V_{CC} = 5.0\text{V}$ ,  $+25^\circ\text{C}$  ambient.

3. Per TTL driven input ( $V_{IN} = 3.4\text{V}$ , control inputs only); S1, S2, and D pins do not contribute to  $I_{CC}$ .

4. This current applies to the control inputs only and represent the current required to switch internal capacitance at the specified frequency. The S1, S2, and D I/O pins generate no significant AC or DC currents as they transition. This parameter is not tested, but is guaranteed by design.

## Test Circuit for Electrical Characteristics

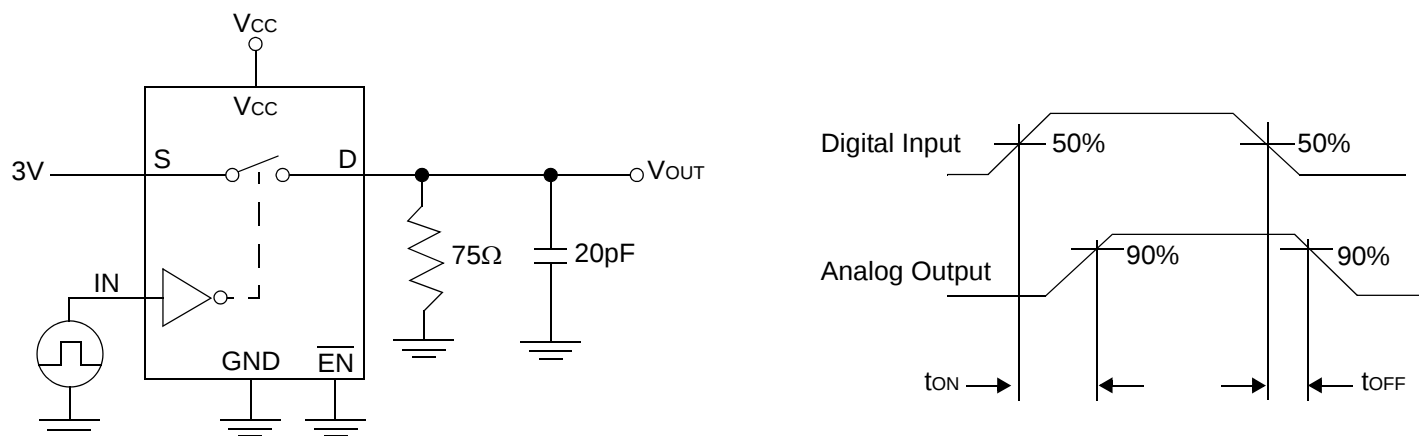


Figure 1. Switching Time

## Test Circuit for Dynamic Electrical Characteristics

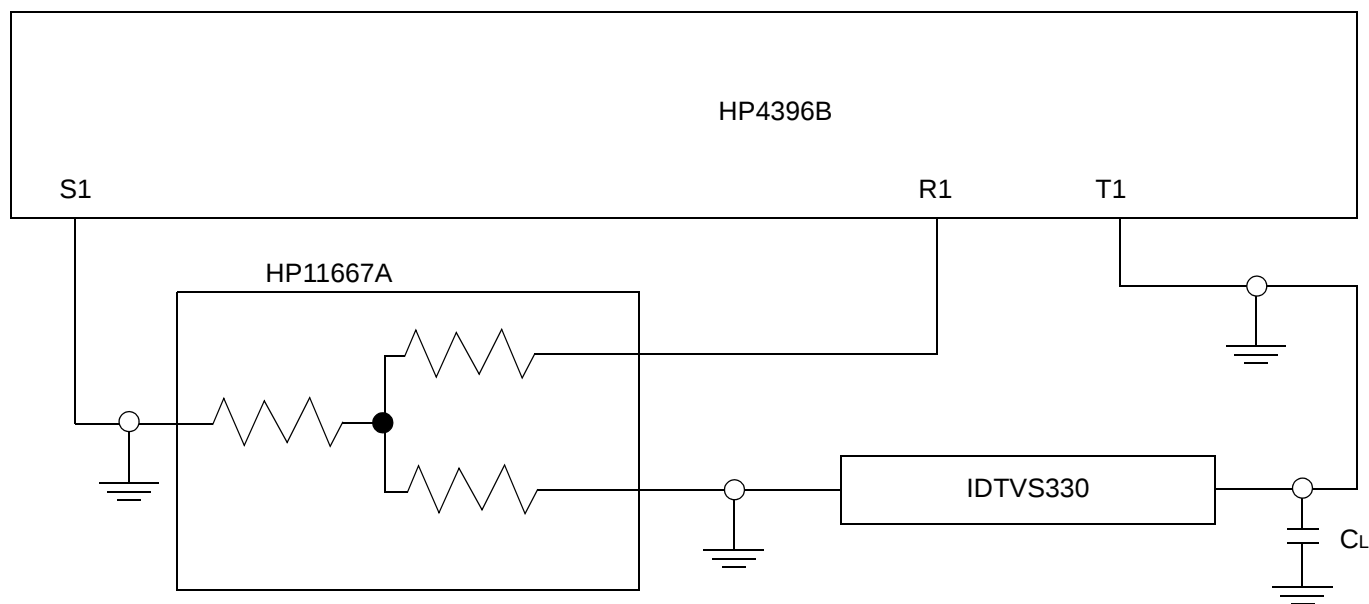
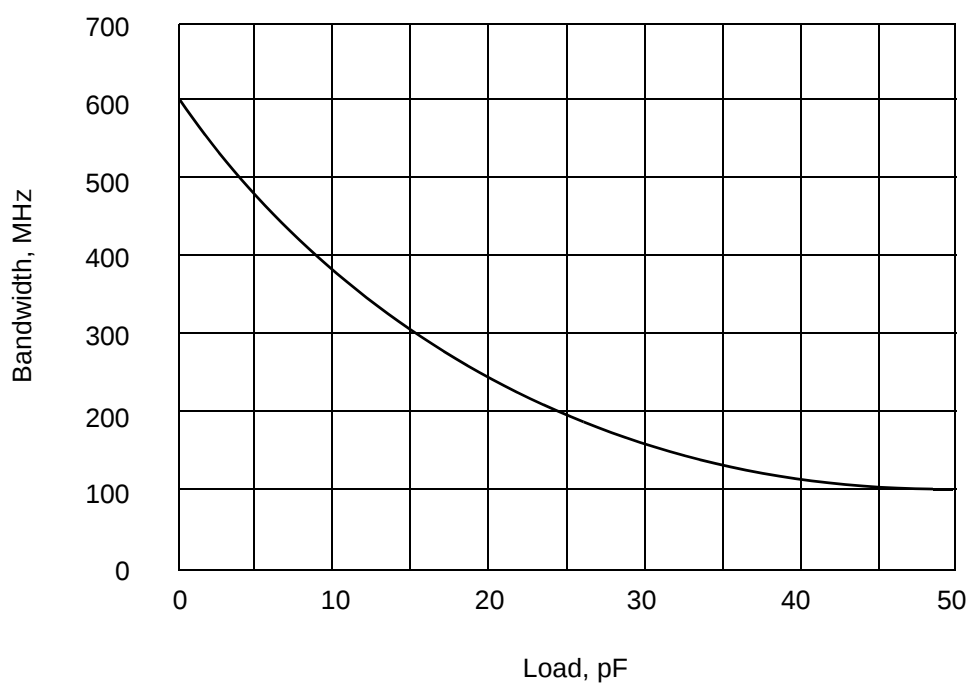
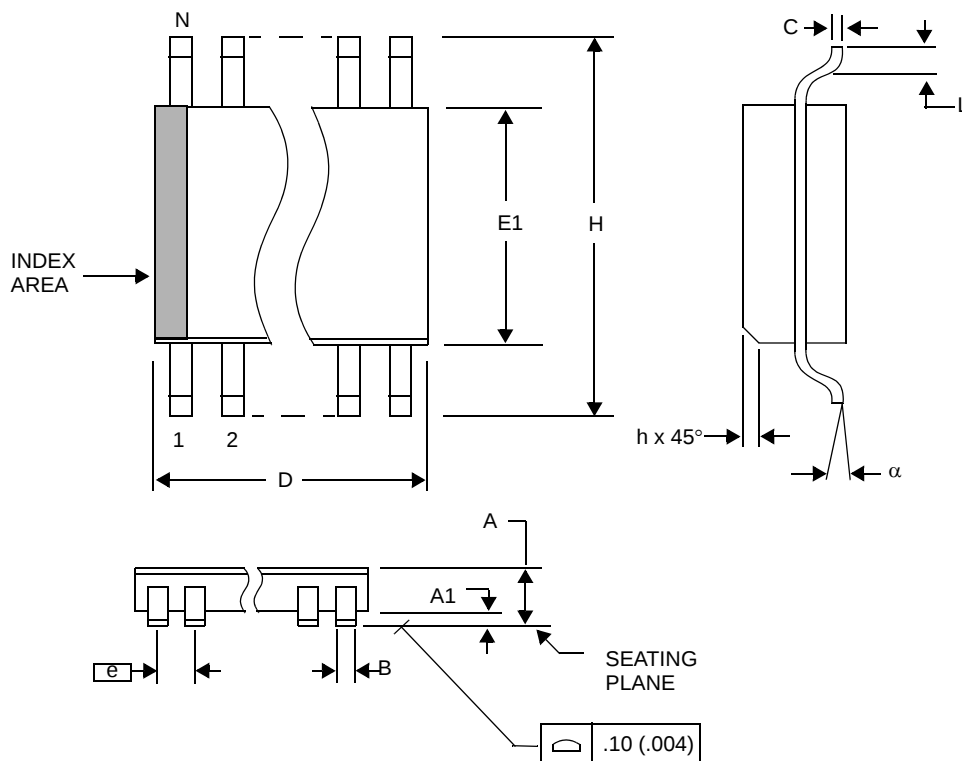


Figure 2. Gain/Phase, Crosstalk, Off-Isolation



**Figure 3.** Bandwidth vs Load

## Package Dimensions - SOIC

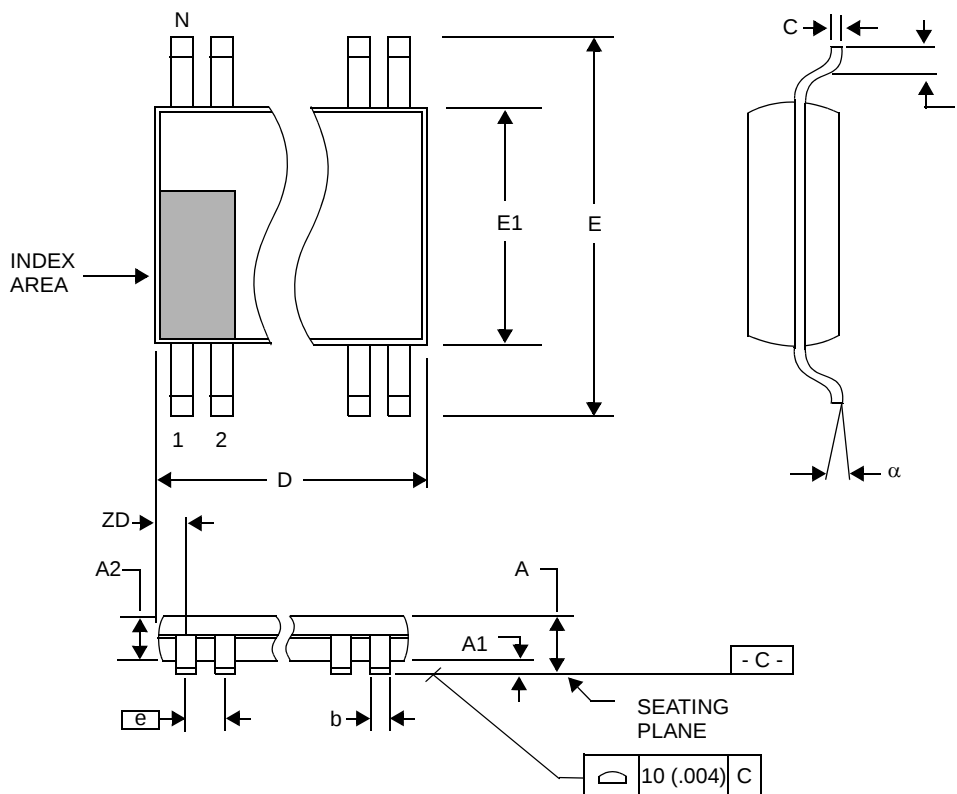


## 150 mil (Narrow Body) SOIC

| Symbol   | In Millimeters<br>Common Dimensions |       | In Inches<br>Common Dimensions <sup>1</sup> |       |
|----------|-------------------------------------|-------|---------------------------------------------|-------|
|          | MIN                                 | MAX   | MIN                                         | MAX   |
| A        | 1.35                                | 1.75  | .0532                                       | .0688 |
| A1       | 0.10                                | 0.25  | .0040                                       | .0098 |
| B        | 0.33                                | 0.51  | .0130                                       | .0200 |
| C        | 0.19                                | 0.25  | .0075                                       | .0098 |
| D        | 9.80                                | 10.00 | .3859                                       | .3937 |
| E        | 3.80                                | 4.00  | .1497                                       | .1574 |
| e        | 1.27 BASIC                          |       | 0.050 BASIC                                 |       |
| H        | 5.80                                | 6.20  | .2284                                       | .2440 |
| h        | 0.25                                | 0.50  | .010                                        | .020  |
| L        | 0.40                                | 1.27  | .016                                        | .050  |
| N        | 16                                  |       | 16                                          |       |
| $\alpha$ | 0°                                  | 8°    | 0°                                          | 8°    |

1. For reference only. Controlling dimensions are in mm.

## Package Dimensions - QSOP



## 150 mil SSOP (QSOP)

| Symbol | In Millimeters<br>Common Dimensions <sup>1</sup> |      | In Inches<br>Common Dimensions |      |
|--------|--------------------------------------------------|------|--------------------------------|------|
|        | MIN                                              | MAX  | MIN                            | MAX  |
| A      | 1.35                                             | 1.75 | .053                           | .069 |
| A1     | 0.10                                             | 0.25 | .004                           | .010 |
| A2     | —                                                | 1.50 | —                              | .059 |
| b      | 0.20                                             | 0.30 | .008                           | .012 |
| c      | 0.18                                             | 0.25 | .007                           | .010 |
| D      | 4.80                                             | 5.00 | .189                           | .197 |
| E      | 5.80                                             | 6.20 | .228                           | .244 |
| E1     | 3.80                                             | 4.00 | .150                           | .157 |
| e      | 0.635 BASIC                                      |      | 0.025 BASIC                    |      |
| L      | 0.40                                             | 1.27 | .016                           | .050 |
| N      | 16                                               |      | 16                             |      |
| α      | 0°                                               | 8°   | 0°                             | 8°   |
| ZD     | .23 Ref                                          |      | .009 Ref                       |      |

1. For reference only. Controlling dimensions are in inches.

Ordering Information

| IDTVS | XXXX        | XX      | X           | X                |       |                                                           |
|-------|-------------|---------|-------------|------------------|-------|-----------------------------------------------------------|
|       | Device Type | Package | Temp. Range | Shipping Carrier |       |                                                           |
|       |             |         |             |                  | 8     | Tape and Reel                                             |
|       |             |         |             |                  | Blank | Tray                                                      |
|       |             |         |             |                  | Blank | Commercial (0°C to +70°C)                                 |
|       |             |         |             |                  | DCG   | Shrink Outline IC -Green                                  |
|       |             |         |             |                  | QG    | Quarter-Sized Shrink Outline Package - Green              |
|       |             |         |             |                  | 330   | Low On-Resistance Wideband/Video Quad 2-Channel Mux/Demux |

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