## General Description

The IDTVS512 is a bi-directional 5-Port 2:1
multiplexer/demultiplexer with $\mathrm{Hi}-\mathrm{Z}$ outputs for both RGB and composite video switching applications. With the additional two ports, vertical and horizontal synchronous signals can be switched in addition to switching the RGB and composite signals between different components (DVDs, VCRs, PCs, etc.). The VideoSwitch can be driven from a current output RAMDAC or voltage output composite video source.
Low on-resistance, low crosstalk, low OFF isolation and wide bandwidth features make it ideal for video and other applications. The IDTVS512 offers a high-performance ( 600 MHz ), low-cost solution to switch between video sources.

## Features

- Ron is $4 \Omega$ typical
- Bidirectional switch
- Low bit-to-bit skew: 200ps
- Low crosstalk: -65dB @ 10MHz
- Near-Zero propagation delay: 250ps
- Fast switching speed: 9ns
- Channel On-Capacitance: 6pF (typical)
- 8KV ESD HBM on connector side
- Wide bandwidth $(600 \mathrm{MHz})$
- Available in QSOP package


## Applications

- Projection TV and LCD TV
- Video consumer applications
- Analog video signal routing


## Block Diagram



## Pin Configuration



## Absolute Maximum Ratings

| Symbol | Rating | Min | Max $^{\mathbf{1}}$ | Unit |
| :--- | :--- | :---: | :---: | :---: |
| TSTG | Storage Temperature Range | -65 | +150 | ${ }^{\circ} \mathrm{C}$ |
|  | Supply Voltage to GND Potential | -0.5 | +4 | 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.

Capacitance ( $\mathrm{TA}=+25^{\circ} \mathrm{C}, \mathrm{f}=1.0 \mathrm{MHz}$ )

| Symbol | Parameter | Conditions | Typ | Max $^{1}$ | Unit |
| :--- | :--- | :---: | :---: | :---: | :---: |
| $\mathrm{C}_{\mathbb{I N}}$ | Input Capacitance | $\mathrm{V}_{\mathbb{I N}}=0 \mathrm{~V}$ | 2 | 3 | pF |
| $\mathrm{C}_{\mathrm{OFF}(\mathbb{N O}, \mathbf{I N} 1)}$ | Port I Capacitance, Switch OFF | $\mathrm{V}_{\mathbb{I N}}=0 \mathrm{~V}$ | 4 | 6 | pF |
| $\mathrm{C}_{\mathrm{ON}(\mathrm{Y} / \mathrm{I})}$ | $\mathrm{Y} / \mathrm{I}$ Port Capacitance, Switch ON | $\mathrm{V}_{\mathbb{I N}}=0 \mathrm{~V}$ | 6 | 10 | pF |

1. As applicable to the device type.

## Pin Description

| Name | Pin \# | Function |
| :---: | :---: | :--- |
| $\mathrm{V}_{\mathrm{DD}}$ | $1,4,9,19$ | Positive power supply |
| GND | $3,7,10,20$ | Ground |
| Xn | $2,5,6,8,11,13,14,15$, | Data and CLK |
|  | $16,17,18,21,22,23,24$ |  |
| CTL | 12 | Control |

## Truth Table

| Function | SEL |
| :---: | :---: |
| Yn to Y0 | L |
| Yn to X1 | H |

## Dynamic Electrical Characteristics Over Operating Range

Following Conditions Apply Unless Otherwise Specified:
$\mathrm{T}_{\mathrm{A}}=0^{\circ} \mathrm{C}$ to $+70^{\circ} \mathrm{C}, \mathrm{Vcc}=3.3 \mathrm{~V} \pm 10 \%, \mathrm{GND}=0 \mathrm{~V}$..

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{X}_{\text {TALK }}{ }^{1}$ | Crosstalk | $\mathrm{t}=10 \mathrm{MHz}$ | - | -65 | - | dB |
| $\mathrm{O}_{\text {IRR }}{ }^{2}$ | Off Isolation | $\mathrm{t}=10 \mathrm{MHz}$ | - | -70 | - |  |
| $\mathrm{B}_{\mathrm{W}}$ | Bandwidth -3 dB | $\mathrm{C}_{\mathrm{L}}=0 \mathrm{pF}$ | - | 600 | - | MHz |

1. See CROSSTALK SETUP for Measurement Setup.
2. See OFF-ISOLATION SETUP for Measurement Setup.

## DC Electrical Characteristics Over Operating Range

Following Conditions Apply Unless Otherwise Specified:
$\mathrm{T}_{\mathrm{A}}=0^{\circ} \mathrm{C}$ to $+70^{\circ} \mathrm{C}, \mathrm{Vcc}=3.3 \mathrm{~V} \pm 10 \%$.

| Symbol | Parameter | Conditions ${ }^{1}$ | Min. | Typ. ${ }^{2}$ | Max. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{V}_{1 H^{3}}$ | Input HIGH Voltage | Guaranteed Logic HIGH level | 2 | - | - | V |
| $\mathrm{V}_{\text {IL }}$ | Input LOW Voltage | Guaranteed Logic LOW level | -0.5 | - | 0.8 |  |
| $\mathrm{V}_{\mathrm{IK}}$ | Clamp Diode Voltage | $\mathrm{V}_{\mathrm{CC}}=$ Max., $\mathrm{I}_{\mathrm{IN}}=-18 \mathrm{~mA}$ | - | -0.7 | -1.2 |  |
| $\mathrm{I}_{\mathrm{H}}$ | Input HIGH Current | $\mathrm{V}_{\mathrm{CC}}=$ Max., $\mathrm{V}_{\text {IN }}=\mathrm{V}_{\text {CC }}$ | - | - | $\pm 5$ | $\mu \mathrm{A}$ |
| $1 / \mathrm{L}$ | Input LOW Current | $\mathrm{V}_{\text {CC }}=$ Max., $\mathrm{V}_{\text {IN }}=\mathrm{GND}$ | - | - | $\pm 5$ |  |
| IOFF | Power Down Leakage Current | $\mathrm{V}_{\mathrm{CC}}=0 \mathrm{~V}, \mathrm{~V}_{\mathrm{A}}=0 \mathrm{~V}, \mathrm{~V}_{\mathrm{B}} \leq 3.6$ | - | - | - |  |
| $\mathrm{R}_{\mathrm{ON}}{ }^{4}$ | Switch On-Resistance | $\mathrm{V}_{\mathrm{CC}}=$ Min., $1.5 \leq \mathrm{V}_{\text {IN }} \leq \mathrm{V}_{\mathrm{CC}}, \mathrm{l}_{\text {IN }}=-40 \mathrm{~mA}$ | - | 4 | 8 |  |
| $\mathrm{R}_{\text {FLAT(ON) }}$ | On-Resistance Flatness | $\mathrm{V}_{\mathrm{CC}}=$ Min., $\mathrm{V}_{\mathrm{IN}} @ 1.5 \mathrm{~V}$ and $\mathrm{V}_{\mathrm{CC}}, \mathrm{I}_{\mathrm{IN}}=-40 \mathrm{~mA}$ | - | 1 | - | $\Omega$ |
| $\Delta \mathrm{R}_{\mathrm{ON}}$ | On-Resistance match from center ports to any other port | $\mathrm{V}_{\mathrm{CC}}=$ Min., $1.5 \leq \mathrm{V}_{\text {IN }} \leq \mathrm{V}_{\text {CC }}, \mathrm{l}_{\text {IN }}=-40 \mathrm{~mA}$ | - | 0.9 | 2 |  |

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}, \mathrm{~T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ ambient and maximum loading.
3. Measured by the voltage drop between Y and $I$ pins at indicated current through the switch. On-Resistance is determined by the lower of the voltages on the two ( Y \& I) pins.
4. This parameter is determined by device characterization but is not production tested.

## Power Supply Characteristics

| Symbol | Parameter | Conditions $^{1}$ | Min. | Typ. ${ }^{2}$ | Max. | Unit |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: |
| $I_{C C}$ | Quiescent Power Supply Current | $\mathrm{V}_{\mathrm{CC}}=$ Max., $\mathrm{V}_{\mathrm{IN}}=\mathrm{GND}$ or $\mathrm{V}_{\mathrm{CC}}$ | - | - | 800 | $\mu \mathrm{~A}$ |

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.
2. Typical values are at $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}, \mathrm{t}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ ambient and maximum loading.

## Switching Characteristics Over Operating Range

Following Conditions Apply Unless Otherwise Specified:
$\mathrm{T}_{\mathrm{A}}=0^{\circ} \mathrm{C}$ to $+70^{\circ} \mathrm{C}, \mathrm{Vcc}=3.3 \mathrm{~V} \pm 10 \%, \mathrm{GND}=0 \mathrm{~V}$.

| Symbol | Description | Min. | Typ. ${ }^{\mathbf{1}}$ | Max. | Unit |
| :--- | :--- | :---: | :---: | :---: | :---: |
| $\mathrm{t}_{\text {PD }}$ | Propagation Delay ${ }^{2,3}$ | - | 0.25 | - | ns |
| $\mathrm{t}_{\text {PZH, }}, \mathrm{t}_{\text {PZL }}$ | Line Enable Time - SEL to Yn, In | 0.5 | - | 15 | ns |
| $\mathrm{t}_{\text {PHZ }}, \mathrm{t}_{\text {PLZ }}$ | Line Disable Time - SEL to Yn, In | 0.5 | - | 9 | ns |
| $\mathrm{t}_{\text {SK(O) }}$ | Output Skew between center port (YC to YD) to any other port(2) | - | 0.1 | 0.2 | ns |
| $\mathrm{t}_{\text {SK(P) }}$ | Skew between opposite transitions of the same output (tPHL- tPLH)(2) | - | 0.1 | 0.2 | ns |

1. For max. or min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Guaranteed by design.,
3. The bus switch contributes no propagational delay other than the RC delay of the On-Resistance of the switch and the load capacitance. The time constant for the switch alone is of the order of 0.25 ns for 10 pF load. Since this time constant is much smaller than the rise/fall times of typical driving signals, it adds very little propagational delay to the system. Propagational 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 interactions with the load on the driven side.

## Switching Waveforms




## Applications Information

## Logic Inputs

The logic control inputs can be driven up to +3.6 V regardless of the supply voltage. For example, given a +3.3 V supply, the output enables or select pins may be driven low to 0 V and high to 3.6V. Driving IN Rail-to-RailÆ minimizes power consumption.

## Power-supply Sequencing

Proper power-supply sequencing is advised for all CMOS devices. It is recommended to always apply $\mathrm{V}_{\mathrm{CC}}$ before applying signals to the input/output or control pins.


Bandwidth vs. Capacitance

## Test Circuit For Electrical Characteristics



Switch Position

| Test | Switch |
| :--- | :---: |
| $\mathrm{t}_{\mathrm{PZH}}, \mathrm{t}_{\text {PZL }}$ (output on I-side) | 6 V |
| $\mathrm{t}_{\mathrm{PHZ}}, \mathrm{t}_{\text {PLZ }}$ (output on I-side) | GND |
| Prop Delay | Open |

$1 \mathrm{CL}=$ Load capacitance: includes jig and probe capacitance.
2 RT = Termination resistance: should be equal to Zout of the Pulse Generator.
3 Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
4 All input impulses are supplied by generators having the following characteristics: $\mathrm{PRR} \leq \mathrm{MHz}, \mathrm{Zo}=50 \Omega$, $\mathrm{tR} \leq 2.5 \mathrm{~ns}, \mathrm{tF} \leq 2.5 \mathrm{~ns}$.
5 The outputs are measured one at a time with one transition per measurement.

Test Circuit for Dynamic Electrical Characteristics


## Package Dimensions - QAOP



## 150 mil SSOP (QSOP))

| Symbol | In Millimeters Common Dimensions |  | In Inches Common Dimensions ${ }^{1}$ |  |
| :---: | :---: | :---: | :---: | :---: |
|  | 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 | 8.55 | 8.75 | . 337 | . 344 |
| E | 5.80 | 6.20 | . 228 | . 244 |
| E1 | 3.80 | 4.00 | . 150 | . 157 |
| e | . 635 BASIC |  | 0.025 BASIC |  |
| L | 0.40 | 1.27 | . 016 | . 050 |
| N | 24 |  | 24 |  |
| $\alpha$ | $0^{\circ}$ | $8^{\circ}$ | $0^{\circ}$ | $8^{\circ}$ |
| ZD | 0.84 REF |  | . 394 REF |  |

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

## Ordering Information



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