19-0946; Rev 1a; 12/94

MAXIM

# Dual/Quad RF/Video Switches



## General Description

The IH5341 and the IH5352 are dual and quad, single pole single throw (SPST) switches designed specifically for switching RF and video signals. Maxim's IH5341 and IH5352 incorporate an enhanced series-shunt-series structure, providing 70dB of OFF isolation and cross coupling rejection (an additional 10dB compared with other manufacturers' products).

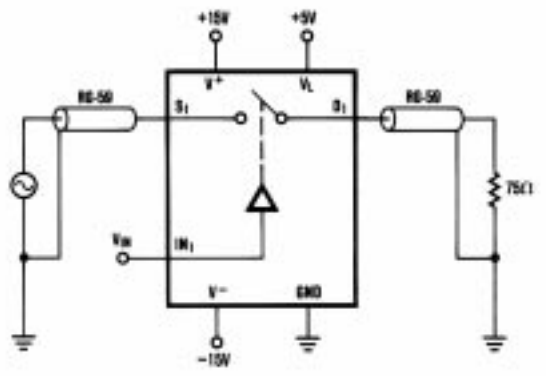
Both devices can be operated with supplies ranging from ±5V to ±15V. The switches typically have a $t_{ON}$ = 160ns and a $t_{OFF}$ = 70ns, assuring break-before-make switching. The channel thruput resistance of 50Ω provides excellent matching to video impedances. In the D.C. state, with switches being either on or off, power supply quiescent currents are typically 100nA. This limits the quiescent current drain to 3μ watts—ideal for portable equipment.

## Applications

These devices are used in applications requiring the routing, blocking or switching of video or RF signals such as:

Commercial TV Cameras
Video Special Effects
Low Power RF Switching
Radar Switching
Mil and Space Communications

## Typical Operating Circuit




75Ω Video Switch
*(Only one channel shown)*

## Features

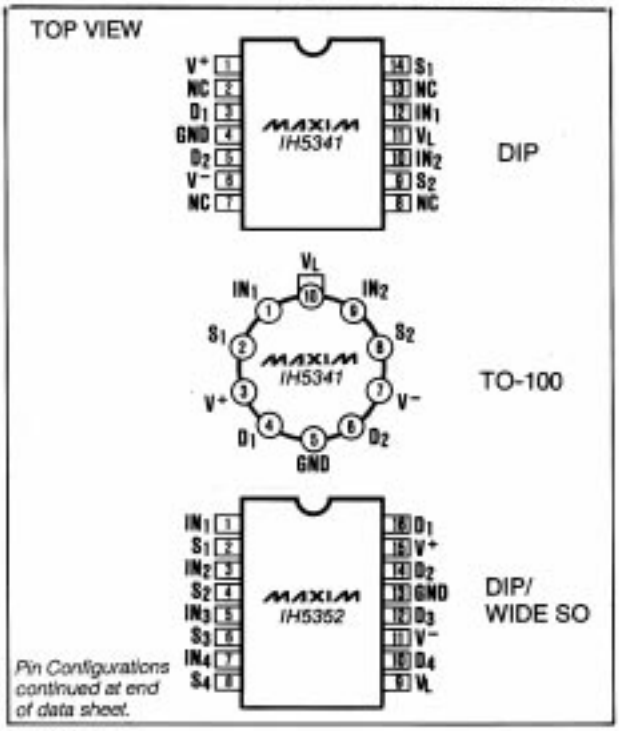
- "OFF" Isolation ≥ 70dB @ 10MHz
- Cross Coupling Isolation ≥ 70dB @ 10MHz
- rDS(ON) < 75Ω, < 3dB Loss from DC to 100MHz
- ±5V to ±15V Operating Supply Range
- Supply Currents < 1μA
- Fast, Break-Before-Make Switching (70ns/160ns typ.)
- Monolithic, Low Power CMOS Design

## Ordering Information

| PART | TEMP. RANGE | PIN-PACKAGE |
|---|---|---|
| **IH5341**CPD | 0°C to +70°C | 14 Plastic DIP |
| IH5341CWE | 0°C to +70°C | 16 Wide SO |
| IH5341C/D | 0°C to +70°C | Dice* |
| IH5341EPD | -40°C to +85°C | 14 Plastic DIP |
| IH5341EWE | -40°C to +85°C | 16 Wide SO |
| IH5341MJD | -55°C to +125°C | 14 CERDIP** |
| IH5341MTW | -55°C to +125°C | 10 TO-100 |
| **IH5352**CPE | 0°C to +70°C | 16 Plastic DIP |
| IH5352CWE | 0°C to +70°C | 16 Wide SO |
| IH5352C/D | 0°C to +70°C | Dice* |
| IH5352EPE | -40°C to +85°C | 16 Plastic DIP |
| IH5352EWE | -40°C to +85°C | 16 Wide SO |
| IH5352MJE | -55°C to +125°C | 16 CERDIP |

* *Contact factory for dice specifications.*
** *Contact factory for availability and processing to MIL-STD-883.*

## Pin Configurations




*Pin Configurations continued at end of data sheet.*



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# Dual/Quad RF/Video Switches

## ABSOLUTE MAXIMUM RATINGS

Supply Voltages V+ and V- ..... ±17V
Current in Terminal ..... 50mA
Analog Input Voltage ..... V+
Operational Temperature Range ..... ±30V
(M Version) ..... -55°C to +125°C
(E Version) ..... -40°C to +85°C
(C Version) ..... 0°C to +70°C

Continuous Power Dissipation ($T_A$ = +70°C)
14-Pin Plastic DIP (derate 10.00mW/°C above +70°C) ..... 800mW
16-Pin Plastic DIP (derate 10.53mW/°C above +70°C) ..... 842mW
16-Pin Wide SO (derate 9.52mW/°C above +70°C) ..... 762mW
10-Pin TO-100 (derate 6.67mW/°C above +70°C) ..... 533mW
Storage Temperature Range ..... -65°C to +150°C
Logic Control Voltage ..... V+ to V-
Voltage on VL Pin ..... V+ to V-
Lead Temperature (Soldering, 10sec) ..... +300°C

*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

## ELECTRICAL CHARACTERISTICS

($V^+$ = +15V, $V_L$ = +5V, $V^-$ = -15V, $T_A$ = 25°C unless otherwise specified)

| PARAMETER | SYMBOL | CONDITIONS | TYP (Note 1) | M GRADE DEVICE | | | I/C GRADE DEVICE | | | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | -55°C | +25°C | +125°C | -40/-20/ 0°C | +25°C | +85/ +70°C | |
| Supply Voltage Ranges<br>Positive Supply<br>Logic Supply<br>Negative Supply | <br>$V^+$<br>$V_L$<br>$V^-$ | <br>(Note 3) | <br>4.5 > 16<br>4.5 > $V^+$<br>-4 > -16 | | <br>5 to 15<br>5 to $V^+$<br>-5 to -15 | | | <br>5 to 15<br>5 to $V^+$<br>-5 to -15 | | V |
| Switch "ON" Resistance (Note 4) | $r_{ds(ON)}$ | $V_D$ = -5V to +5V | | 75 | 75 | 100 | 75 | 75 | 100 | Ω |
| | | $I_S$ = 10 mA, $V_{IN}$ = 2.4V<br>$V_D$ = -10V to +10V | | 125 | 125 | 175 | 150 | 150 | 175 | |
| Switch "ON" Resistance | $r_{ds(ON)}$ | $V^+$ = $V_L$ = 5V, $V_{IN}$ = 3V<br>$V^-$ = -5V, $V_D$ = ±3V | | 250 | 250 | 350 | 300 | 300 | 350 | |
| On Resistance Match | | $I_S$ = 10mA, $V_D$ = ±5V | 5 | | | | | | | |
| Switch "OFF" Leakage (Notes 2 and 4) | $I_{D(OFF)}$<br>or<br>$I_{S(OFF)}$ | $V_{S/D}$ = +5V to -5V<br>$V_{IN}$ = 0.8V<br>$V_{S/D}$ = +14V to -14V | | | ±1<br><br>±1 | 50<br><br>50 | | ±2<br><br>±2 | 100<br><br>100 | nA |
| Switch "ON" Leakage | $I_{D(ON)}$<br>+<br>$I_{S(ON)}$ | $V_D$ = +5V or -5V<br>$V_{IN}$ = 2.4V<br>$V_D$ = +14V to -14V | | | ±1<br><br>±1 | 100<br><br>100 | | ±2<br><br>±2 | 100<br><br>100 | |
| Input Logic Current | $I_{IN}$ | $V_{IN}$ > 2.4V or < 0 | 0.001 | 1 | 1 | 10 | 1 | 1 | 10 | µA |
| Positive Supply Quiescent Current | $I^+$ | $V_{IN}$ = 0V or +5V (Note 5) | 0.01 | 1 | 1 | 10 | 1 | 1 | 10 | |
| Negative Supply Quiescent Current | $I^-$ | $V_{IN}$ = 0V or +5V (Note 5) | 0.01 | 1 | 1 | 10 | 1 | 1 | 10 | |
| Logic Supply Quiescent Current | $I_L$ | $V_{IN}$ = 0V or +5V (Note 5) | 0.01 | 1 | 1 | 10 | 1 | 1 | 10 | |

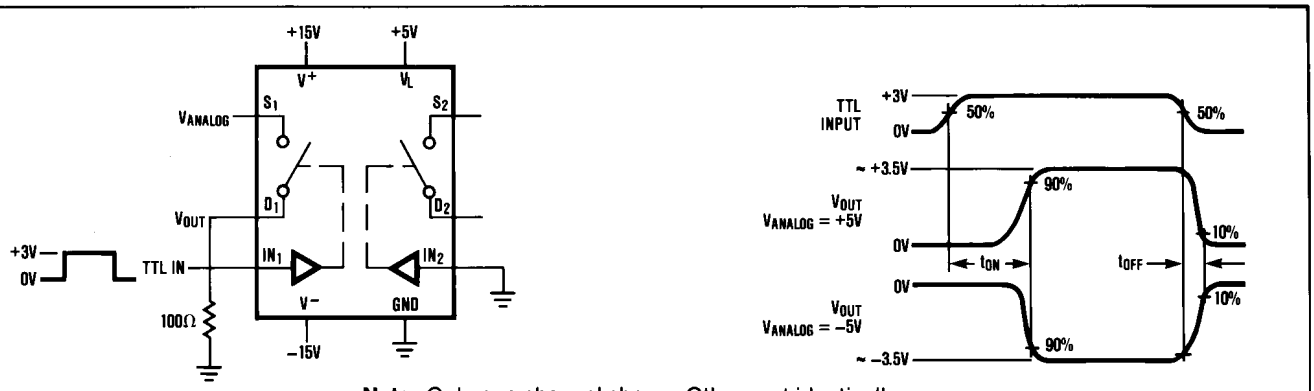
## AC ELECTRICAL CHARACTERISTICS

$V^+$ = +15V, $V_L$ = +5V, $V^-$ = 0V, $T_A$ = +25°C

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Switch "ON" Time | $t_{ON}$ | See Figure 1 | | 160 | 300 | ns |
| Switch "OFF" Time | $t_{OFF}$ | See Figure 1 | | 70 | 150 | |
| "OFF" Isolation Rejection Ratio | OIRR | See Figure 2 (Note 6) | 70 | 80 | | dB |
| Cross Coupling Rejection Ratio | CCRR | Figure 3 (Note 6) IH5341<br>IH5352 | 70<br>66 | 80<br>72 | | |
| Frequency where $r_{DS(ON)}$ = 0.7 x DC | | (Note 6) | 100 | | | MHz |

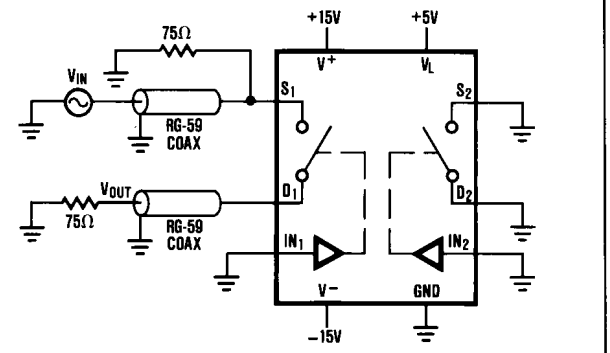
**Note 1:** Typical values are not tested in production. They are given as a design aid only.
**Note 2:** Positive and negative voltages applied to opposite sides of switch, in both directions successively.
**Note 3:** These are the operating voltages at which the other parameters are tested, and are not directly tested.
**Note 4:** The logic inputs are either greater than or equal to 2.4V or less than or equal to 0.8V, as required, for this test.
**Note 5:** Maximum values shown are for the dual (IH5341). They are doubled for the quad (IH5352).
**Note 6:** All AC parameters are sample tested only. Test circuits should be built on copper clad ground plane board, with correctly terminated coax leads, etc.

## Test Circuits




**Note:** Only one channel shown. Others act identically.

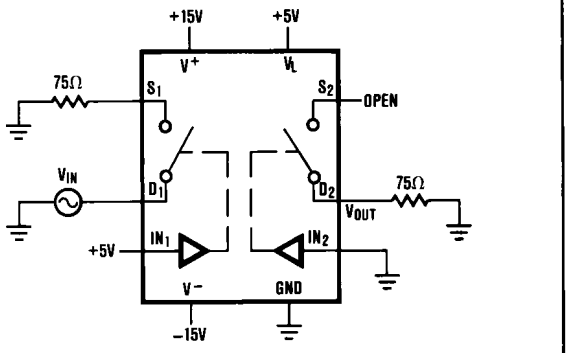
*Figure 1. Switching Time Test Circuit and Waveforms*




$V_{IN}$ = ±5V ($10V_{p-p}$) @ f = 10MHz  OIRR = $20 \log \frac{V_{IN}}{V_{OUT}}$

**Note:** Only one channel shown. Others act identically.

*Figure 2. OFF Isolation Test Circuit*



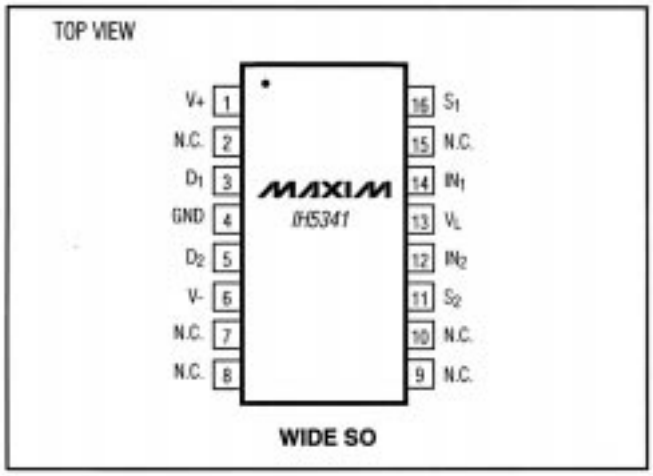

$V_{IN}$ 225mVrms @ f = 10MHz

CCRR = $20 \log \frac{V_{IN}}{V_{OUT}}$

*Figure 3. Cross-Coupling Rejection Test Circuit*

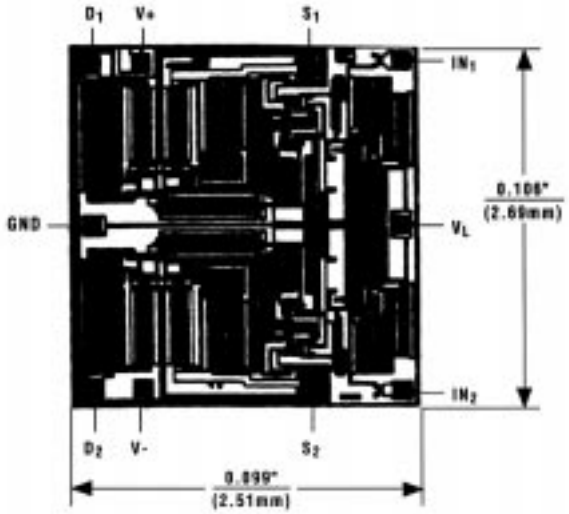
# Dual/Quad RF/Video Switches

## Pin Configurations (continued)



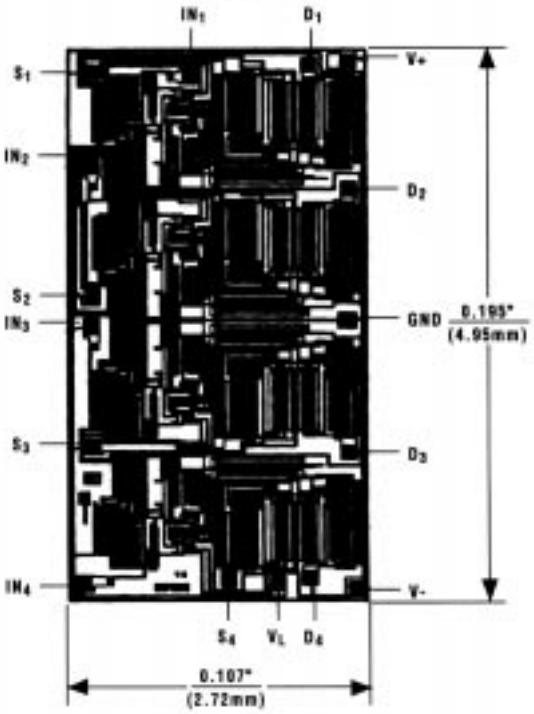

## Chip Topographies

**IH5341**




TRANSISTOR COUNT: 72
SUBSTRATED CONNECTED TO V+

**IH5352**




TRANSISTOR COUNT: 144
SUBSTRATED CONNECTED TO V+

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