

## Dual SPDT CMOS Analog Switch

The IH5043 analog switch uses an improved, high voltage CMOS monolithic technology. These devices provide ease of use and performance advantages not previously available from solid state switches.

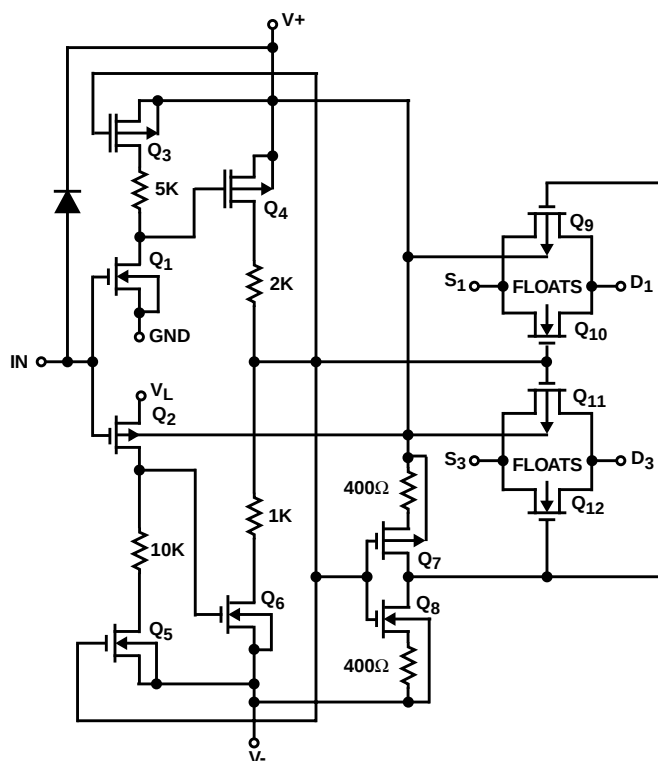
Key performance advantage is TTL compatibility and ultra low power operation. The quiescent current requirement is less than 1mA. Also, the IH5043 guarantees Break-Before-Make switching, accomplished by extending the  $t_{ON}$  time (300ns Typ), so that it exceeds  $t_{OFF}$  time (200ns Typ). This insures that an ON channel will be turned OFF before an OFF channel can turn ON. The need for external logic required to avoid channel to channel shorting during switching is eliminated.

## Part Number Information

| PART NUMBER | TEMP. RANGE (°C) | PACKAGE    | PKG. NO. |
|-------------|------------------|------------|----------|
| IH5043CPE   | 0 to 70          | 16 Ld PDIP | E16.3    |
| IH5043CY    | 0 to 70          | 16 Ld SOIC | M16.15   |

## Schematic Diagram

FUNCTIONAL DRIVER, TYPICAL DRIVER, GATE ( $\frac{1}{2}$  AS SHOWN)

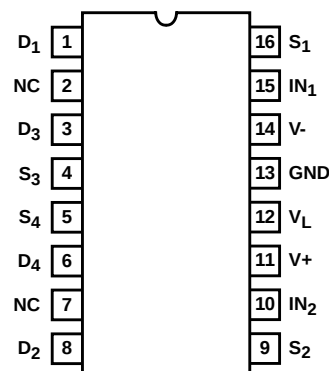


## Features

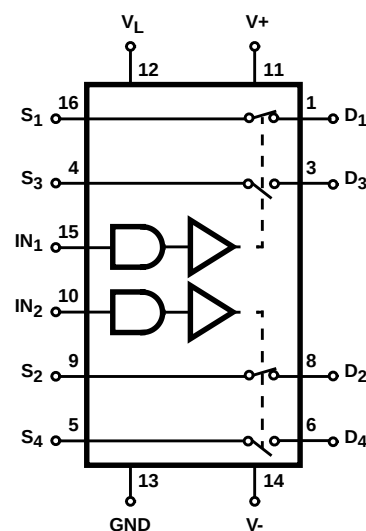
- See HI504X for Other Functions
- Dual SPDT
- Switches Greater than 20V<sub>P-P</sub> Signals with  $\pm 15V$  Supplies
- Quiescent Current Less than 1mA
- Break-Before-Make Switching  $t_{OFF}$  200ns,  $t_{ON}$  300ns (Typ)
- TTL, DTL, CMOS, PMOS Compatible

## Pinout

**IH5043  
(PDIP, SOIC)  
TOP VIEW**



## Functional Diagram



SWITCH STATES SHOWN ARE FOR LOGIC "1" INPUT

**TRUTH TABLE**

| LOGIC | SWITCH 1, 2 | SWITCH 3, 4 |
|-------|-------------|-------------|
| 0     | Off         | On          |
| 1     | On          | Off         |

**Absolute Maximum Ratings**

|                                                   |       |
|---------------------------------------------------|-------|
| V+ to V-                                          | <36V  |
| V+ to V <sub>D</sub>                              | <30V  |
| V <sub>D</sub> to V-                              | <30V  |
| V <sub>D</sub> to V <sub>S</sub>                  | <±22V |
| V <sub>L</sub> to V-                              | <33V  |
| V <sub>L</sub> to V <sub>IN</sub>                 | <30V  |
| V <sub>L</sub> to GND                             | <20V  |
| V <sub>IN</sub> to GND                            | <20V  |
| Continuous Current (S-D)                          | 30mA  |
| Peak Current S-D (Pulsed 1ms, 10% Duty Cycle Max) | 70mA  |

**Thermal Information**

|                                                 |                                  |
|-------------------------------------------------|----------------------------------|
| Thermal Resistance (Typical, Note 1)            | $\theta_{JA}$ (°C/W)             |
| PDIP Package                                    | 90                               |
| SOIC Package                                    | 115                              |
| Maximum Junction Temperature (Plastic Packages) | 150°C                            |
| Maximum Storage Temperature                     | -65°C to 150°C                   |
| Maximum Lead Temperature (Soldering 10s)        | 300°C<br>(SOIC - Lead Tips Only) |

**Operating Conditions**

Temperature Range . . . . . 0°C to 70°C

**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

**NOTE:**

1.  $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

**Electrical Specifications** V+ = +15V, V- = -15V, V<sub>L</sub> = +5V

| PER CHANNEL PARAMETER                                                 | TEST CONDITIONS                                                        | (NOTES 2, 3) |           |      | UNITS |
|-----------------------------------------------------------------------|------------------------------------------------------------------------|--------------|-----------|------|-------|
|                                                                       |                                                                        | 0°C          | 25°C      | 70°C |       |
| DYNAMIC CHARACTERISTICS                                               |                                                                        |              |           |      |       |
| Turn ON Time, t <sub>ON</sub>                                         | R <sub>L</sub> = 1kΩ, V <sub>ANALOG</sub> = -10V to +10V, See Figure 6 | -            | 1000      | -    | ns    |
| Turn OFF Time, t <sub>OFF</sub>                                       |                                                                        | -            | 500       | -    | ns    |
| Charge Injection, Q                                                   | See Figure 7                                                           | -            | 20 (Typ)  | -    | mV    |
| OFF Isolation, OIRR                                                   | f = 1MHz, R <sub>L</sub> = 100Ω, C <sub>L</sub> ≤ 5pF, See Figure 4    | -            | 50 (Typ)  | -    | dB    |
| Crosstalk, CCRR                                                       | One Channel Off; Any Other Channel Switches as per Figure 3            | -            | -50 (Typ) | -    | dB    |
| DIGITAL INPUT CHARACTERISTICS                                         |                                                                        |              |           |      |       |
| Input Logic Current, I <sub>IN(ON)</sub>                              | V <sub>IN</sub> = 2.4V                                                 | ±1           | ±1        | 10   | μA    |
| Input Logic Current, I <sub>IN(OFF)</sub>                             | V <sub>IN</sub> = 0.8V                                                 | ±1           | ±1        | 10   | μA    |
| ANALOG SWITCH CHARACTERISTICS                                         |                                                                        |              |           |      |       |
| Drain-Source ON Resistance, r <sub>DS(ON)</sub>                       | I <sub>S</sub> = 10mA, V <sub>ANALOG</sub> = -10V to +10V              | 80           | 80        | 130  | Ω     |
| Channel-to-Channel r <sub>DS(ON)</sub> Match, Δr <sub>DS(ON)</sub>    |                                                                        | -            | 30 (Typ)  | -    | Ω     |
| Minimum Analog Signal Handling Capability, V <sub>ANALOG</sub>        |                                                                        | -            | ±10 (Typ) | -    | V     |
| Switch OFF Leakage Current, I <sub>D(OFF)</sub> , I <sub>S(OFF)</sub> | V <sub>ANALOG</sub> = -10V to +10V                                     | -            | ±5        | 100  | nA    |
| Switch ON Leakage Current, I <sub>D(ON)</sub> +I <sub>S(ON)</sub>     | V <sub>D</sub> = V <sub>S</sub> = -10V to +10V                         | -            | ±10       | 100  | nA    |
| POWER SUPPLY CHARACTERISTICS                                          |                                                                        |              |           |      |       |
| + Power Supply Quiescent Current, I+                                  |                                                                        | 10           | 10        | 100  | μA    |
| - Power Supply Quiescent Current, I-                                  |                                                                        | 10           | 10        | 100  | μA    |
| +5V Supply Quiescent Current, I <sub>L</sub>                          |                                                                        | 10           | 10        | 100  | μA    |
| Ground Quiescent Current, I <sub>GND</sub>                            |                                                                        | 10           | 10        | 100  | μA    |

**NOTES:**

2. Typical values are for design aid only, not guaranteed and not subject to production testing.
3. Min or Max value unless otherwise specified.

## Test Circuits and Waveforms

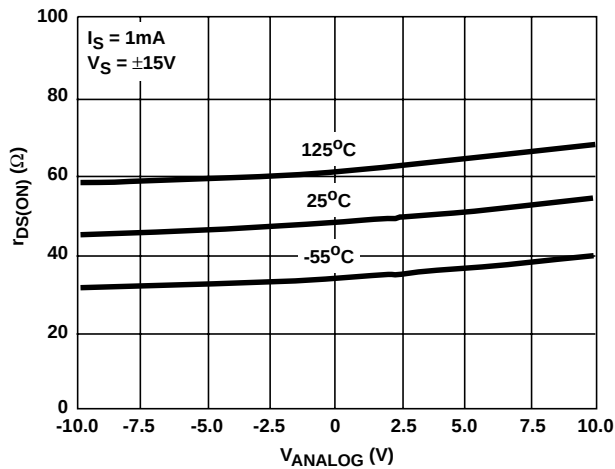
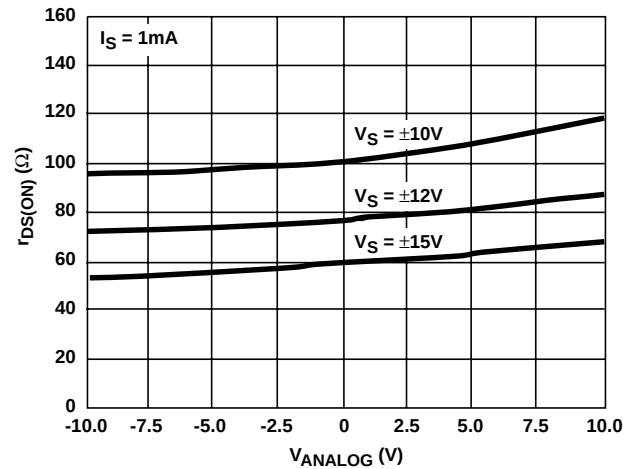
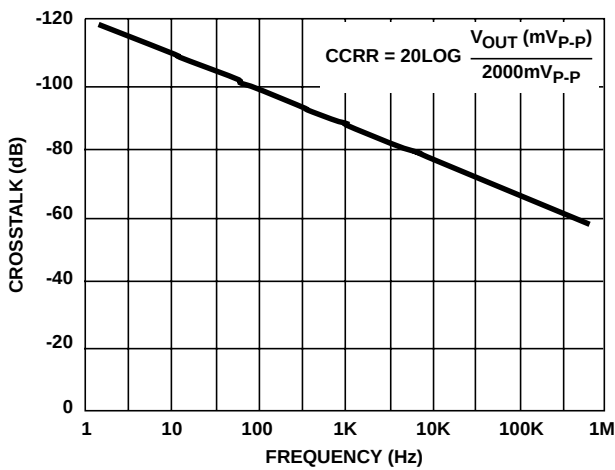
FIGURE 1.  $r_{DS(ON)}$  vs ANALOG INPUT VOLTAGEFIGURE 2.  $r_{DS(ON)}$  vs POWER SUPPLY VOLTAGE

FIGURE 3A. CROSSTALK vs FREQUENCY

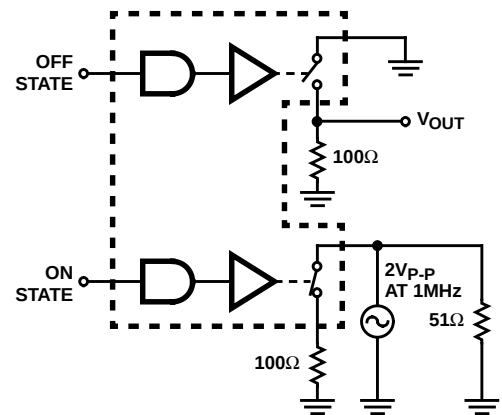


FIGURE 3B. TEST CIRCUIT

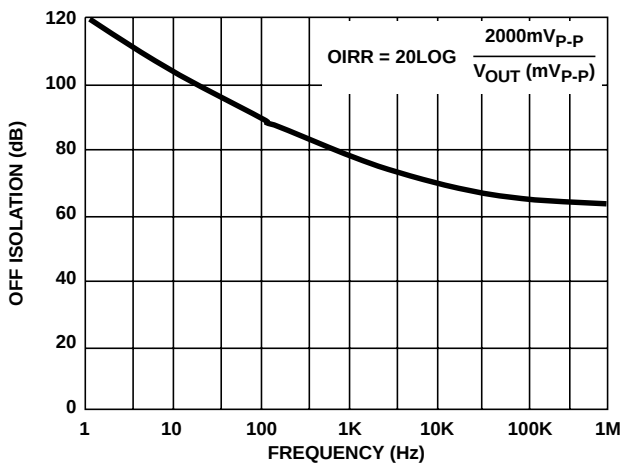


FIGURE 4A. OFF ISOLATION vs FREQUENCY

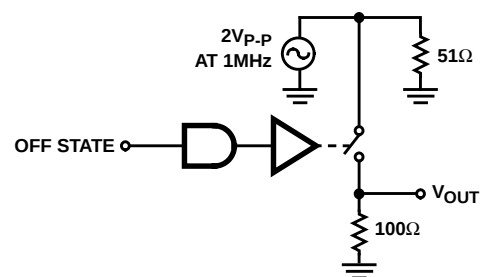


FIGURE 4B. TEST CIRCUIT

FIGURE 4. OFF ISOLATION

# Test Circuits and Waveforms (Continued)

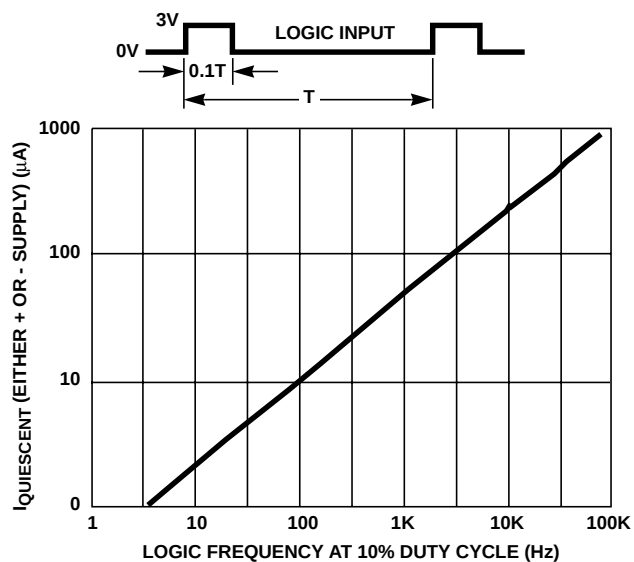


FIGURE 5. SUPPLY CURRENT vs LOGIC FREQUENCY

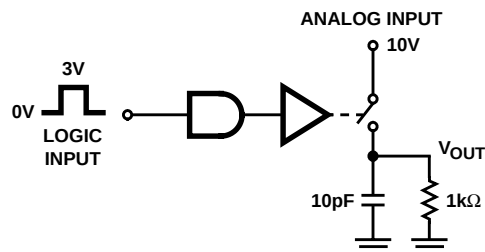
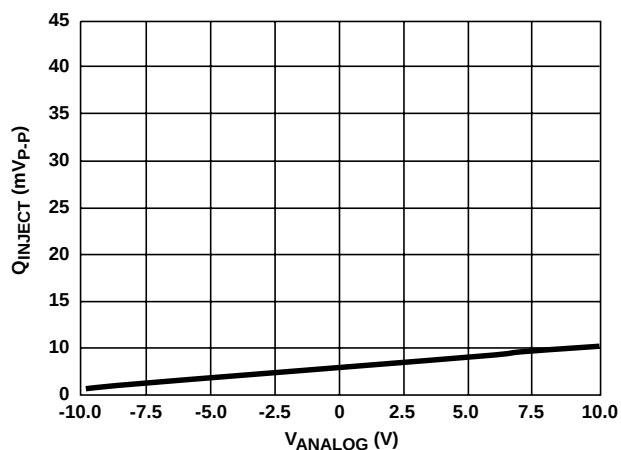
FIGURE 6.  $t_{\text{ON}}$  AND  $t_{\text{OFF}}$  TEST CIRCUIT

FIGURE 7A. CHARGE INJECTION vs ANALOG INPUT VOLTAGE

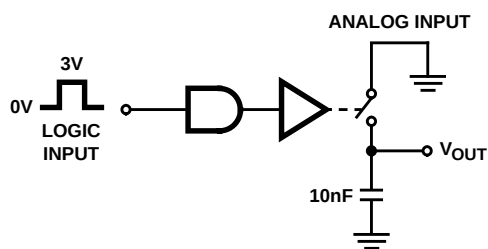


FIGURE 7B. TEST CIRCUIT

FIGURE 7. CHARGE INJECTION

## Typical Applications

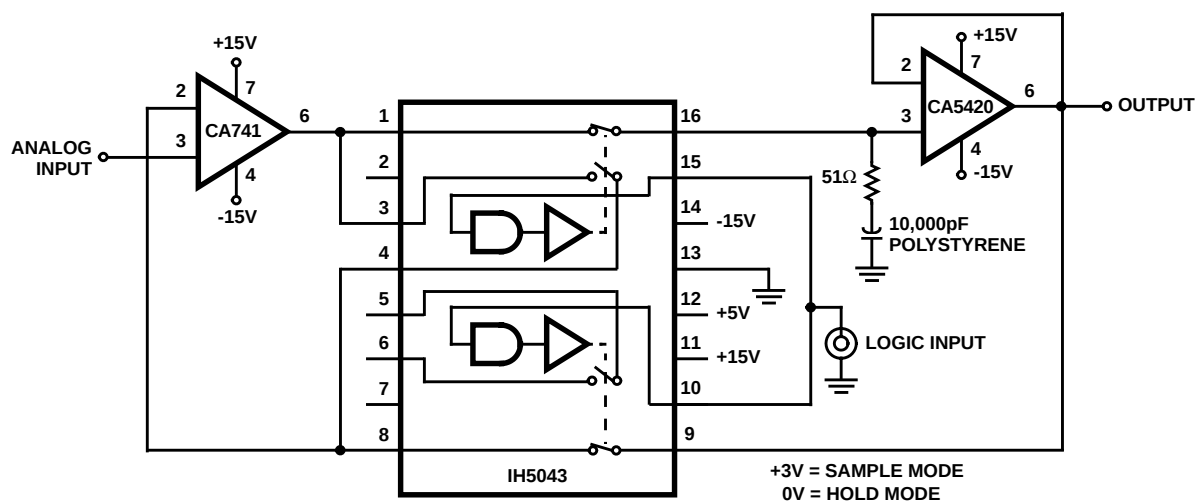


FIGURE 8. IMPROVED SAMPLE AND HOLD

EXAMPLE: If  $-V_{ANALOG} = -10V_{DC}$  and  $+V_{ANALOG} = +10V_{DC}$ , then Ladder Legs are switched between  $\pm 10V_{DC}$ , depending upon state of Logic Strobe.

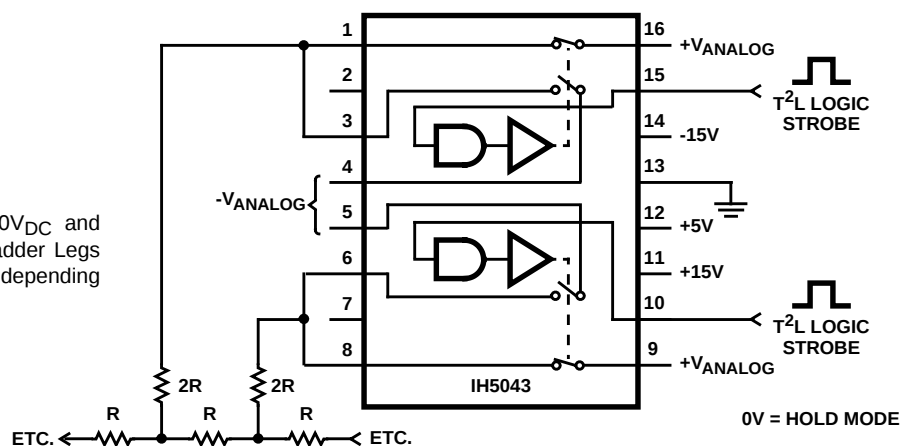


FIGURE 9. USING THE CMOS SWITCH TO DRIVE AN R/2R LADDER NETWORK (2 LEGS)

## Typical Applications (Continued)

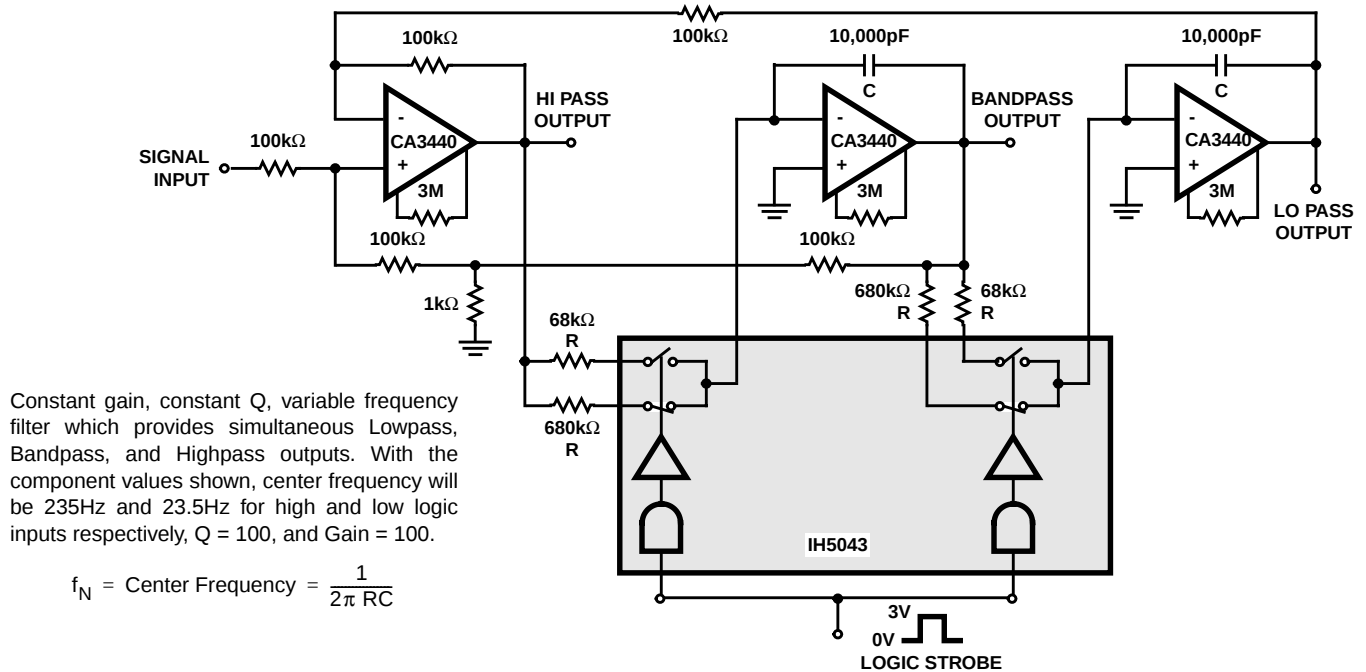


FIGURE 10. DIGITALLY TUNED LOW POWER ACTIVE FILTER

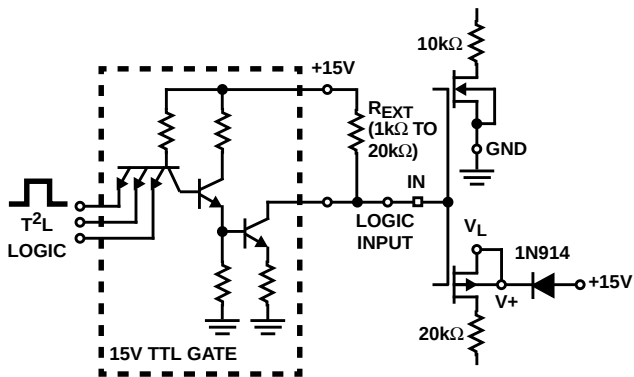


FIGURE 11. INTERFACING WITH TTL OPEN COLLECTOR LOGIC (TYP EXAMPLE FOR +15V CASE SHOWN)

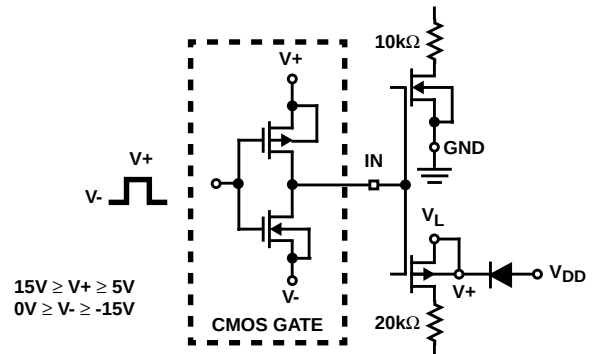


FIGURE 12. INTERFACING WITH CMOS LOGIC

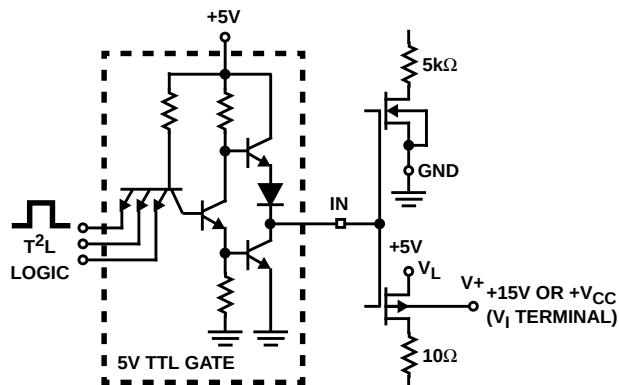


FIGURE 13. TTL LOGIC INTERFACE

## Die Characteristics

### DIE DIMENSIONS:

1778 $\mu$ m x 1905 $\mu$ m

### METALLIZATION:

Type: Al

Thickness: 10k $\text{\AA}$   $\pm$  1k $\text{\AA}$

### PASSIVATION:

Type: PSG/Nitride

PSG Thickness: 7k $\text{\AA}$   $\pm$  1.4k $\text{\AA}$

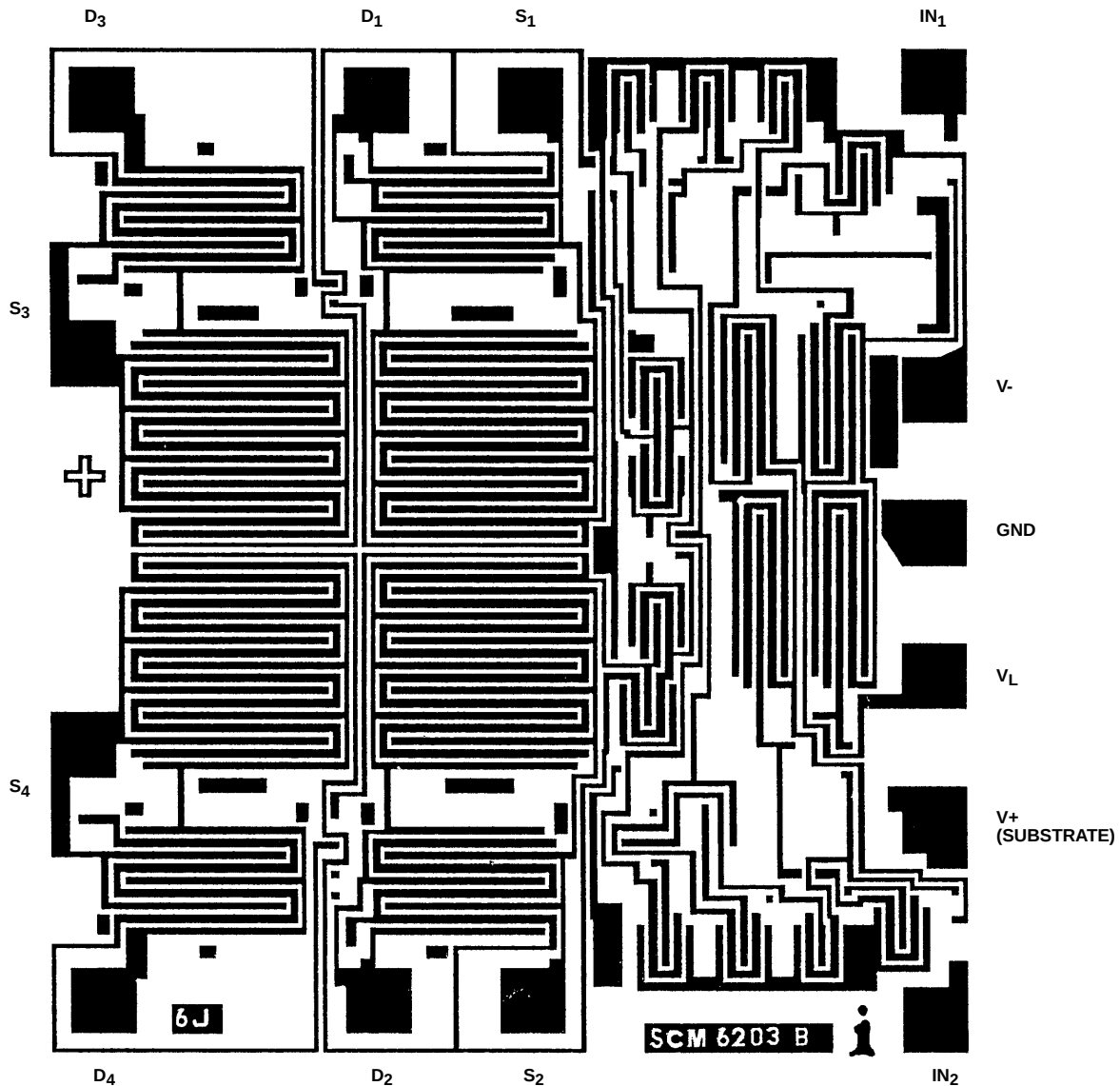
Nitride Thickness: 8k $\text{\AA}$   $\pm$  1.2k $\text{\AA}$

### WORST CASE CURRENT DENSITY:

9.1 x 10<sup>4</sup> A/cm<sup>2</sup>

## Metallization Mask Layout

IH5043



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