

# High-Speed Analog N-Channel DMOS FETs Improved On-Resistance



## SD310 / SD312 / SD314

### FEATURES

- High Input to Output Isolation ..... 120dB
- Low On Resistance ..... 15 Ohms @ 15V
- Low Feedthrough and Feedback Transients
- Low Capacitance:
  - Input (Gate) ..... 2.4pF typ.
  - Output ..... 1.3pF typ.
  - Feedback ..... 0.3pF typ.
- No Protection Diode from Gate to Substrate for very high impedance applications
- Maximum Gate Voltage .....  $\pm 40V$

### APPLICATIONS

#### SD310:

- Analog Switch Driver

#### SD312 and SD314:

- Analog Switches
- High-Speed Digital Switches
- Multiplexers
- A to D Converters
- D to A Converters
- Choppers
- Sample & Hold

### DESCRIPTION

The Calogic SD310 is a 30V analog switch driver without a built-in protection diode from gate to substrate for use with SD312 and SD314 DMOS analog switches.

The SD312 is a high performance, high-speed, high-voltage, and low resistance analog switch capable of switching  $\pm 5V$  signals. The maximum threshold of 2V permits simple direct TTL or CMOS driving for small applications.

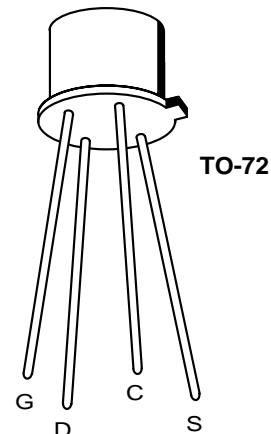
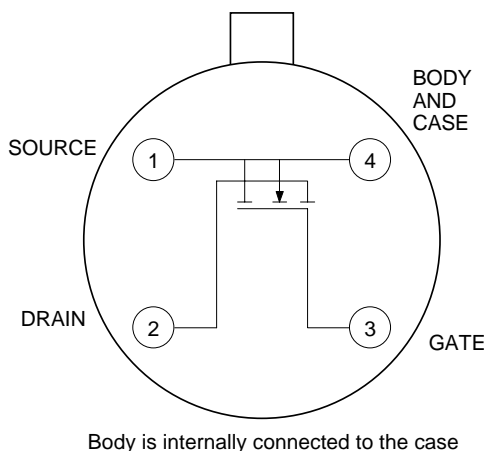
The SD314 is DMOS analog switch capable of switching  $\pm 10V$  analog signals with all other parameters identical to those of SD312.

All three devices are manufactured with an implanted high-speed, high-voltage, and low resistance double-diffused MOS (DMOS) process. SD310, SD312 and SD314 devices also have no built-in protection diode to enhance performance in high impedance circuits. The devices are available in 4-lead hermetic TO-72 package and in die form for hybrid applications. Custom devices based on SD310, SD312 and SD314 can also be ordered.

### ORDERING INFORMATION

| Part    | Package                  | Temperature Range |
|---------|--------------------------|-------------------|
| SD310DE | Hermetic TO-72 Package   | -55°C to +125°C   |
| SD312DE | Hermetic TO-72 Package   | -55°C to +125°C   |
| SD314DE | Hermetic TO-72 Package   | -55°C to +125°C   |
| XSD310  | Sorted Chips in Carriers | -55°C to +125°C   |
| XSD312  | Sorted Chips in Carriers | -55°C to +125°C   |
| XSD314  | Sorted Chips in Carriers | -55°C to +125°C   |

### SCHEMATIC DIAGRAM (Top View)





**ABSOLUTE MAXIMUM RATINGS**

Drain Current . . . . . 50mA  
 Total Device Dissipation at 25°C Case Temperature . . . 1.2W  
 Storage Temperature Range . . . . . -65° to +200°C  
 Lead Temperature (1/16" from case for 10 sec.) . . . . . 300°C  
 Operating Temperature Range . . . . . -55°C to +125°C

| PARAMETER       |                  | SD310 | SD312 | SD314 | UNIT            |
|-----------------|------------------|-------|-------|-------|-----------------|
| V <sub>DS</sub> | Drain-to-source  | +30   | +10   | +20   | V <sub>dc</sub> |
| V <sub>SD</sub> | Source-to-drain* | +10   | +10   | +20   | V <sub>dc</sub> |
| V <sub>DB</sub> | Drain-to-body    | +30   | +15   | +25   | V <sub>dc</sub> |
| V <sub>SB</sub> | Source-to-body   | +15   | +15   | +25   | V <sub>dc</sub> |
| V <sub>GS</sub> | Gate-to-source   | ±40   | ±40   | ±40   | V <sub>dc</sub> |
| V <sub>GB</sub> | Gate-to-body     | ±40   | ±40   | ±40   | V <sub>dc</sub> |
| V <sub>GD</sub> | Gate-to-drain    | ±40   | ±40   | ±40   | V <sub>dc</sub> |

**DC ELECTRICAL CHARACTERISTICS** (T<sub>A</sub> = 25°C, unless other specified.)

| SYMBOL                   | PARAMETER                  | SD310 |     |     | SD312 |     |     | SD314 |     |     | UNITS | TEST CONDITIONS   |   |
|--------------------------|----------------------------|-------|-----|-----|-------|-----|-----|-------|-----|-----|-------|---|---|
|                          |                            | MIN   | TYP | MAX | MIN   | TYP | MAX | MIN   | TYP | MAX |       |   |   |
| <b>BREAKDOWN VOLTAGE</b> |                            |       |     |     |       |     |     |       |     |     |       |   |   |
| BV <sub>DS</sub>         | Drain-to-source            | 30    | 35  |     |       |     |     |       |     |     | V     | V <sub>GS</sub> = V <sub>BS</sub> = 0V, I <sub>D</sub> = 10μA                                   |   |
|                          |                            | 10    | 25  |     | 10    | 25  |     | 20    | 25  |     |       | V <sub>GS</sub> = V <sub>BS</sub> = -5V, I <sub>S</sub> = 10nA                                  |   |
| BV <sub>SD</sub>         | Source-to drain            | 10    |     |     | 10    |     |     | 20    |     |     |       | V <sub>GD</sub> = V <sub>BD</sub> = -5V, I <sub>D</sub> = 10nA                                  |   |
| BV <sub>DB</sub>         | Drain-to-body              | 15    |     |     | 15    |     |     | 25    |     |     |       | V <sub>GB</sub> = 0V, source OPEN, I <sub>D</sub> = 10nA  |   |
| BV <sub>SB</sub>         | Source-to-body             | 15    |     |     | 15    |     |     | 25    |     |     |       | V <sub>GB</sub> = 0V, drain OPEN, I <sub>S</sub> = 10μA   |   |
| <b>LEAKAGE CURRENT</b>   |                            |       |     |     |       |     |     |       |     |     |       |   |   |
| I <sub>DS</sub> (OFF)    | Drain-to-source            |       | 1   | 10  |       | 1   | 10  |       |     | 1   | 10    | nA  | V <sub>GS</sub> = V <sub>BS</sub> = -5V, V <sub>DS</sub> = +10V |
|                          |                            |       |     |     |       |     |     |       |     |     |       |   | V <sub>GS</sub> = V <sub>BS</sub> = -5V, V <sub>DS</sub> = +20V |
| I <sub>SD</sub> (OFF)    | Source-to-drain            |       | 1   | 10  |       | 1   | 10  |       |     |     |       |   | V <sub>GS</sub> = V <sub>BD</sub> = -5V, V <sub>SD</sub> = +10V |
|                          |                            |       |     |     |       |     |     |       | 1   | 10  |       |   | V <sub>GS</sub> = V <sub>BD</sub> = -5V, V <sub>SD</sub> = +20V |
| I <sub>GBS</sub>         | Gate                       |       |     | 0.1 |       |     | 0.1 |       |     |     | 0.1   |   | V <sub>DB</sub> = V <sub>SB</sub> = 0V, V <sub>GS</sub> = ±40V  |
| V <sub>T</sub>           | Threshold voltage          | 0.5   | 1.0 | 2.0 | 0.5   | 1.0 | 2.0 | 0.5   | 1.0 | 2.0 | V     | V <sub>DS</sub> = V <sub>GS</sub> = V <sub>T</sub> , I <sub>S</sub> = 1μA, V <sub>SB</sub> = 0V |   |
| r <sub>DS</sub> (ON)     | Drain-to-source resistance |       | 30  | 50  |       | 30  | 50  |       | 30  | 50  | Ω     | I <sub>D</sub> = 1.0mA, V <sub>SB</sub> = 0, V <sub>GS</sub> = +5V                              |   |
|                          |                            |       | 20  | 35  |       | 20  | 35  |       | 20  | 35  |       | I <sub>D</sub> = 1.0mA, V <sub>SB</sub> = 0, V <sub>GS</sub> = +10V                             |   |
|                          |                            |       | 15  | 25  |       | 15  |     |       | 15  |     |       | I <sub>D</sub> = 1.0mA, V <sub>SB</sub> = 0, V <sub>GS</sub> = +15V                             |   |

**AC ELECTRICAL CHARACTERISTICS**

| SYMBOL   | PARAMETER                | SD310 |     |     | SD312 |     |     | SD314 |     |     | UNITS | TEST CONDITIONS  |
|--|--------------------------|-------|-----|-----|-------|-----|-----|-------|-----|-----|-------|--|
|  |                          | MIN   | TYP | MAX | MIN   | TYP | MAX | MIN   | TYP | MAX |       |  |
| g <sub>fs</sub>  | Forward transconductance | 15    | 20  |     | 15    | 20  |     | 15    | 20  |     | mmhos | V <sub>DS</sub> = 10V, V <sub>SB</sub> = 0V, I <sub>D</sub> = 20mA, f = 1kHz |
| <b>SMALL SIGNAL CAPACITANCES (See capacitance model)</b> |                          |       |     |     |       |     |     |       |     |     |       |  |
| C <sub>(GS+GD+GB)</sub>                                  | Gate node                |       | 2.4 | 3.7 |       | 2.4 | 3.7 |       | 2.4 | 3.7 | pF    | V <sub>DS</sub> = 10V, f = 1MHz<br>V <sub>GS</sub> = V <sub>BS</sub> = -15V  |
| C <sub>(GD+DB)</sub>                                     | Drain node               |       | 1.3 | 1.7 |       | 1.3 | 1.7 |       | 1.3 | 1.7 |       |  |
| C <sub>(GS+SB)</sub>                                     | Source node              |       | 3.5 | 4.5 |       | 3.5 | 4.5 |       | 3.5 | 4.5 |       |  |
| C <sub>DG</sub>  | Reverse transfer         |       | 0.3 | 0.7 |       | 0.3 | 0.7 |       | 0.3 | 0.7 |       |  |

Package Dimensions TO-72

