

October 2017

GENERAL DESCRIPTION

The HI-8190 is a quad analog CMOS switch fabricated with Silicon-on-Insulator (SOI) technology for latch-up free operation and maximum switch isolation. The switch voltages can range from bipolar $\pm 3.3V$ to $\pm 15V$ or single ended from 3.3V to 15V. The logic supply can range from 3.3V to 5.0V. The HI-8190 provides four each normally open switches when the switch control inputs are Low. The HI-8191 provides four each normally closed switches when the switch control inputs are Low. The HI-8192 provides a combination of two normally On and two normally Off switches. The limits of the operating range are defined by the $V+/V-$ bias voltage.

On-resistance of each switch depends upon only the VLOGIC selection. At 5V, R_{ON} ranges from 10Ω to 17Ω while at 3.3V supply R_{ON} ranges from 10Ω to 22Ω . Each switch is designed using back to back high voltage transistors. Switch transistors are symmetrical and conduct equally well in either direction. Signal range can run the full rails. Off leakages are very low (1 nA typical) and charge injection is less than 3 pC. Switch ESD tolerance is greater than 4 KV.

The Off state is achieved first before any On condition is applied. Switching times with a 3.3V VLOGIC supply are typically 35 ns to the On state and 20 ns to the Off state.

Industry-standard plastic package options include 16-pin TSSOP, SO, DIP and 16-pin QFN. Ceramic packaging is available on request. All three products are offered in both Industrial ($-40^{\circ}C$ to $+85^{\circ}C$) and extended ($-55^{\circ}C$ to $+125^{\circ}C$) temperature range options.

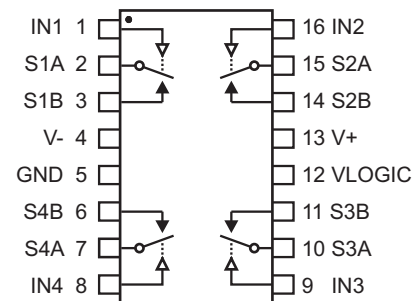
APPLICATIONS

- Data bus isolation
- Sample-and-Hold circuits
- Test Equipment
- Communications Systems
- Battery operated Systems
- PBX, PABX
- Audio Signal Routing
- Data Acquisition Systems
- xDSL Modems
- Avionics

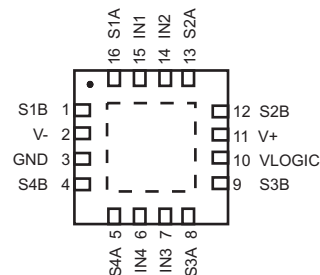
FEATURES

- $\pm 3.3V$ to $\pm 15V$ CMOS analog switches
- Low R_{ON} : 12Ω to 15Ω typical
- Robust CMOS Silicon-on-Insulator (SOI) technology
- SOI switch isolation with 1nA typical Off leakage
- Superior ESD protection > 4KV HBM
- Fast switching time with break-before-make
- Low power
- Extended Temperature Range ($-55^{\circ}C$ to $+125^{\circ}C$)

PIN CONFIGURATIONS (Top Views)



HI-8190PSx, HI-8190PDx
16-Pin SO or DIP package

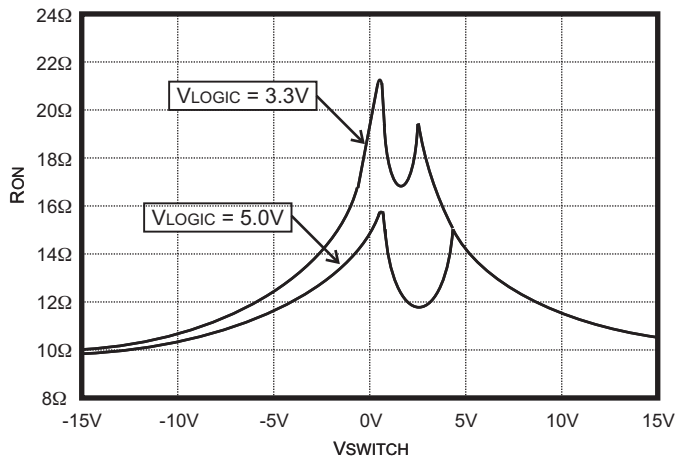


HI-8190PCx
16-pin 5mm x 5mm Chip-scale package

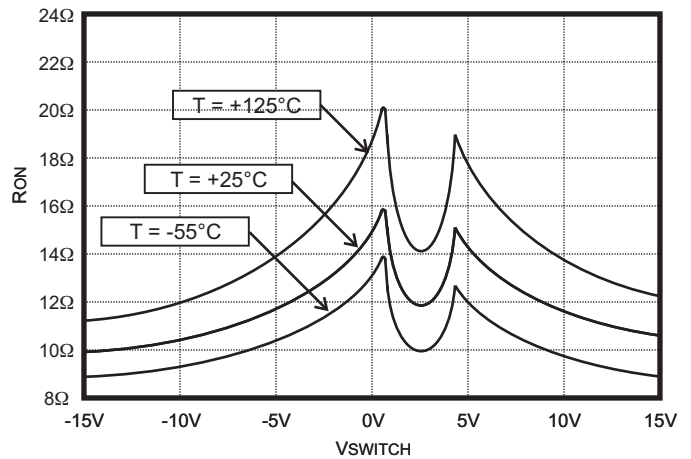
| PRODUCT OPTIONS | | | | | | | | |
|-----------------|-----|----------|-----|----------|-----|----------|-----|----------|
| PART TYPE | IN1 | Switch 1 | IN2 | Switch 2 | IN3 | Switch 3 | IN4 | Switch 4 |
| HI-8190 | 0 | Open | 0 | Open | 0 | Open | 0 | Open |
| | 1 | Closed | 1 | Closed | 1 | Closed | 1 | Closed |
| HI-8191 | 0 | Closed | 0 | Closed | 0 | Closed | 0 | Closed |
| | 1 | Open | 1 | Open | 1 | Open | 1 | Open |
| HI-8192 | 0 | Open | 0 | Closed | 0 | Closed | 0 | Open |
| | 1 | Closed | 1 | Open | 1 | Open | 1 | Closed |

PIN DESCRIPTIONS

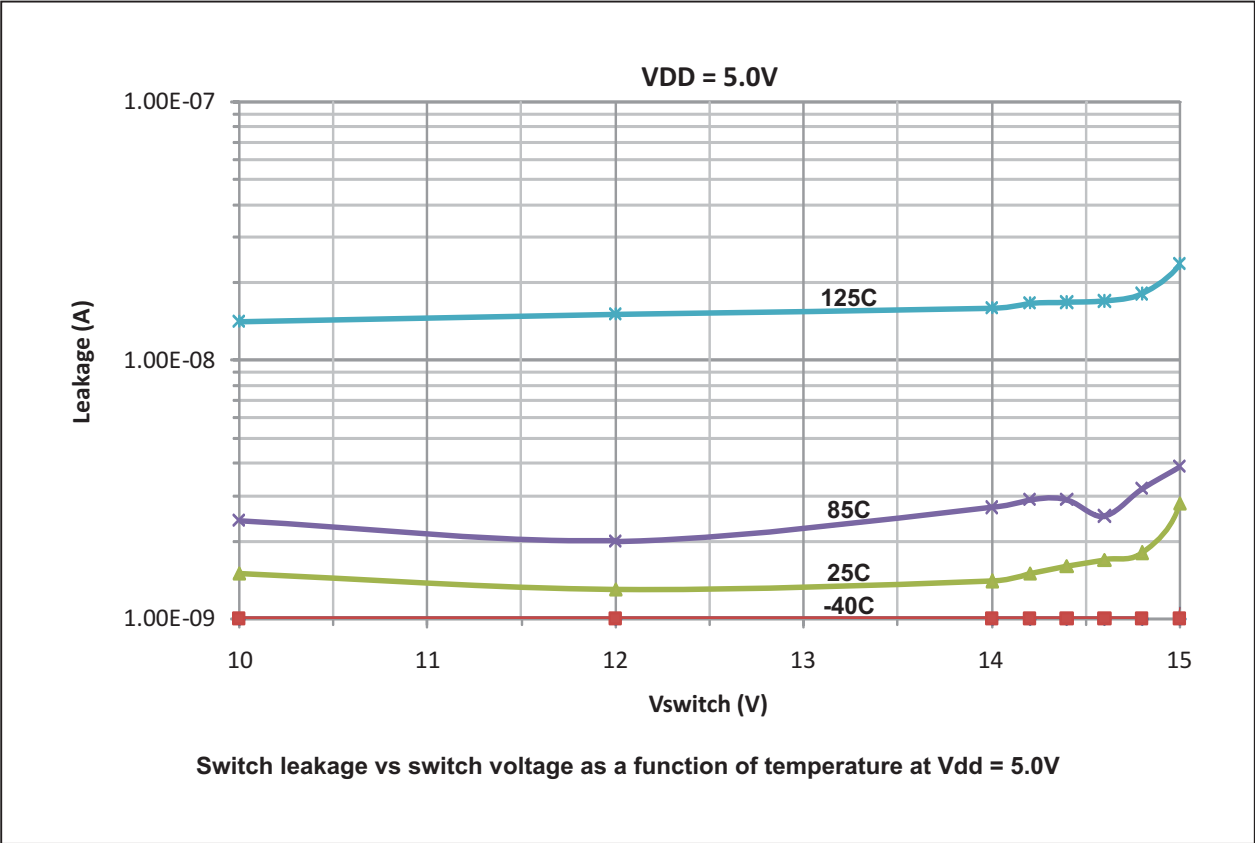
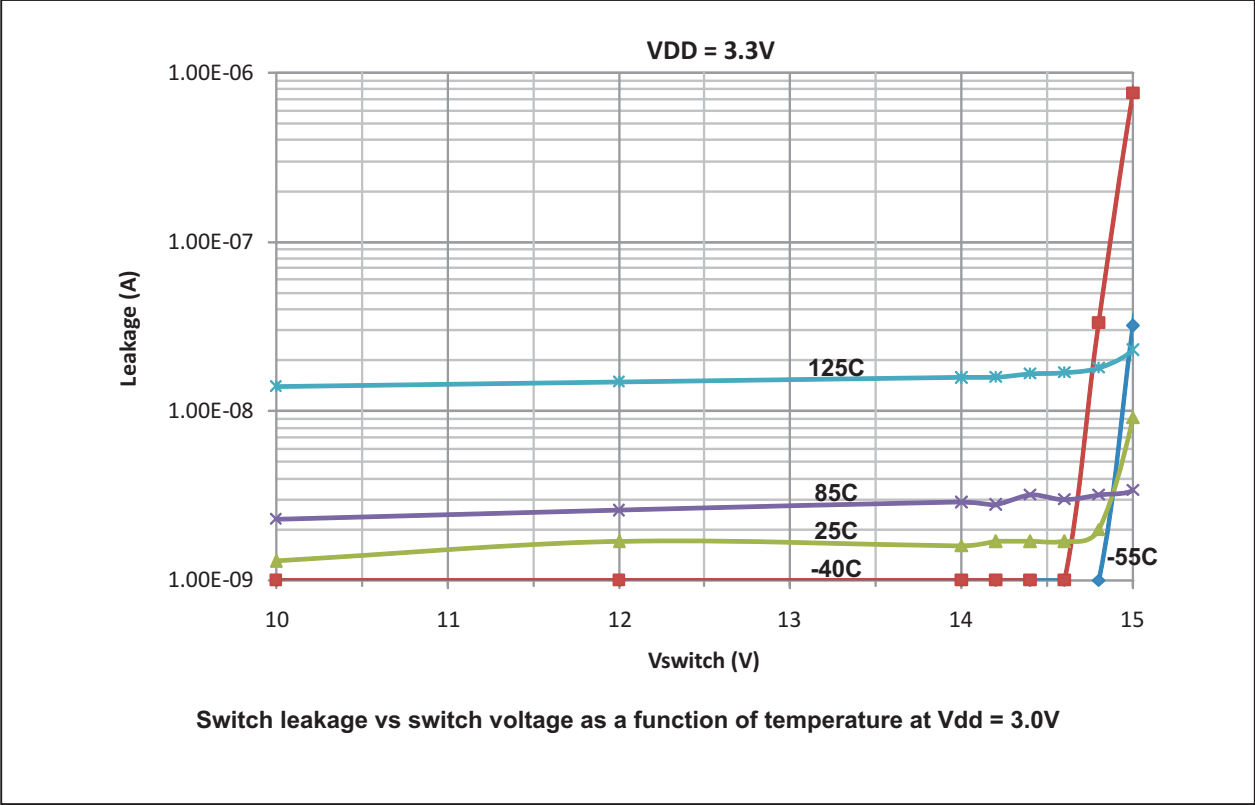
| SIGNAL | FUNCTION | DESCRIPTION |
|--------|-------------|---|
| IN1 | Logic Input | HI-8190 and HI-8192 are normally Open when input Low |
| S1A | Switch Node | Switch 1 Node |
| S1B | Switch Node | Switch 1 Node |
| V- | Supply | Negative supply for Bipolar configuration. GND for Unipolar use |
| GND | Supply | Reference Ground |
| S4B | Switch Node | Switch 4 Node |
| S4A | Switch Node | Switch 4 Node |
| IN4 | Logic Input | HI-8190 and HI-8192 are normally Open when input Low |
| IN3 | Logic Input | HI-8191 and HI-8192 are normally Closed when input Low |
| S3A | Switch Node | Switch 3 Node |
| S3B | Switch Node | Switch 3 Node |
| VLOGIC | Supply | 3.3V or 5.0V Logic supply |
| V+ | Supply | Positive supply for Bipolar and Unipolar configurations |
| S2B | Switch Node | Switch 2 Node |
| S1B | Switch Node | Switch 2 Node |
| IN2 | Logic input | HI-8191 and HI-8192 are normally Closed when input Low |



Typical RON as a function of VLOGIC and VSWITCH
(10mA switch current, 25°C)



Typical RON as a function of VSWITCH and Temperature (10mA switch current)
VLOGIC = 5V



ABSOLUTE MAXIMUM RATINGS

(Voltages referenced to GND = 0V)

| | | | |
|--|------------------------------------|--|-----------------|
| Supply Voltage, V+ : | 16.5V | Continuous Power Dissipation (TA=70°C): SO Package (derate 6.7mW/°C above 70°C).....696mW Plastic DIP (derate 10.53 mw/°C above 70°C)842mW Thin QFN (derate 21.3mW/°C above 70°C)1702mW | |
| Supply Voltage, V-:..... | -16.5V | | |
| Supply Voltage, V _{LOGIC} | 5.5V | | |
| Switch Current (either direction, DC): | 20mA | | |
| Peak Switch Current (1 ms pulse, 10% duty cycle max.)..... | 100mA | | |
| Digital Input Voltage (IN1-4):..... | -0.3V to V _{LOGIC} + 0.3V | Storage Temperature Range: | -65°C to +150°C |
| Operating Temperature Range: (Industrial)..... | -40°C to +85°C | Soldering Temperature: (Ceramic).....60 sec. at +300°C (Plastic - leads).....10 sec. at +280°C (Plastic - body)+260°C Max. | |
| (Hi-Temp)..... | -55°C to +125°C | | |
| Maximum Junction Temperature | 175°C | | |

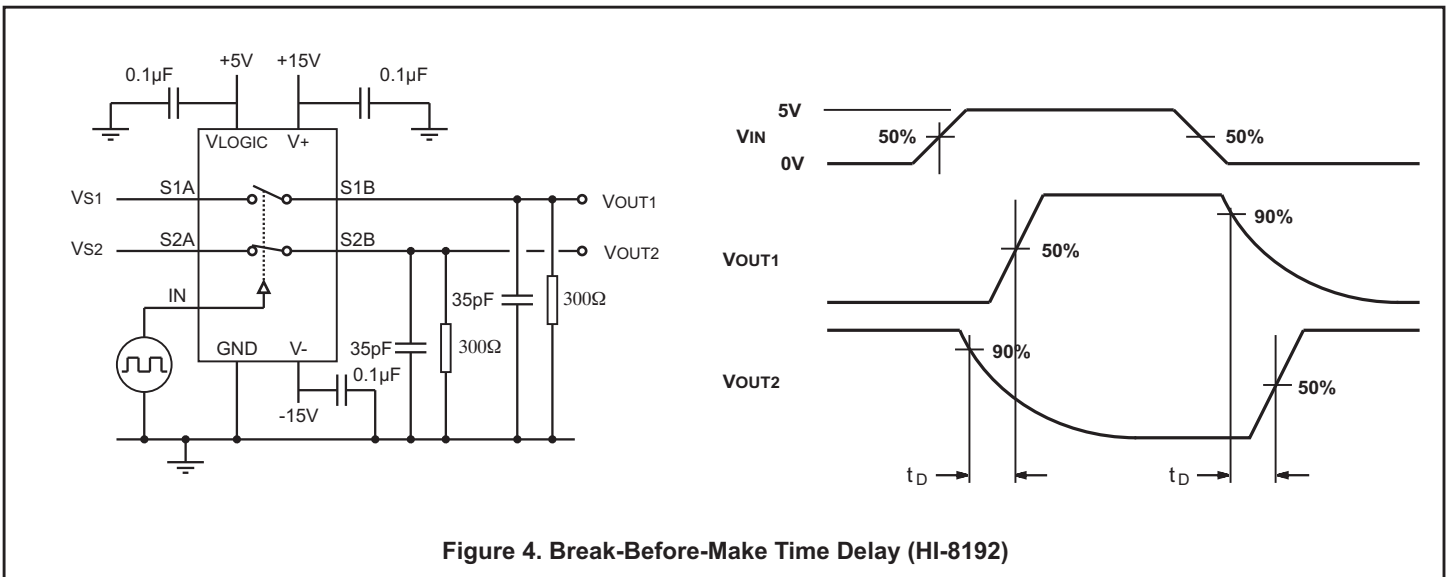
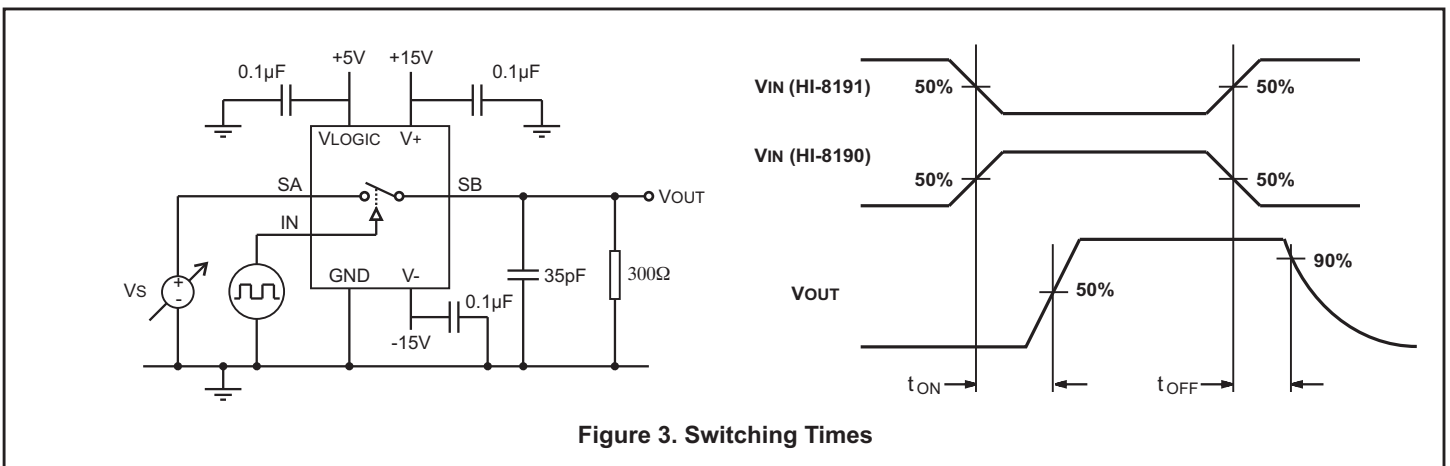
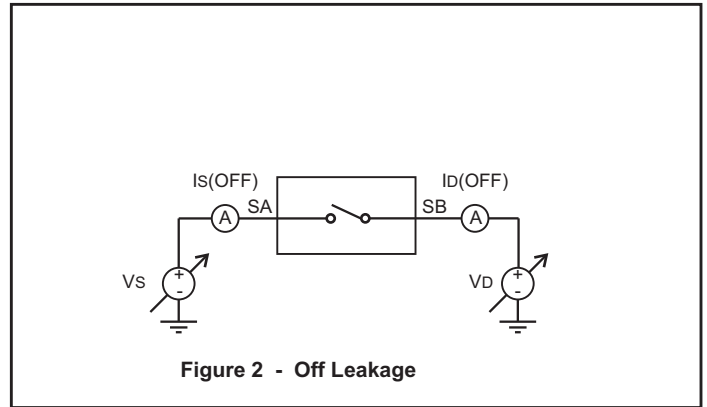
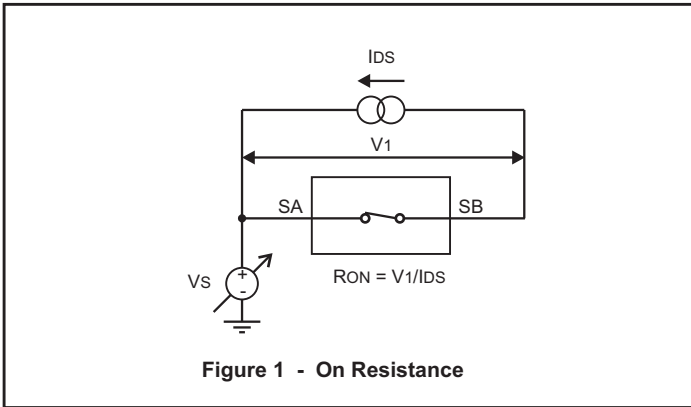
NOTE: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure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

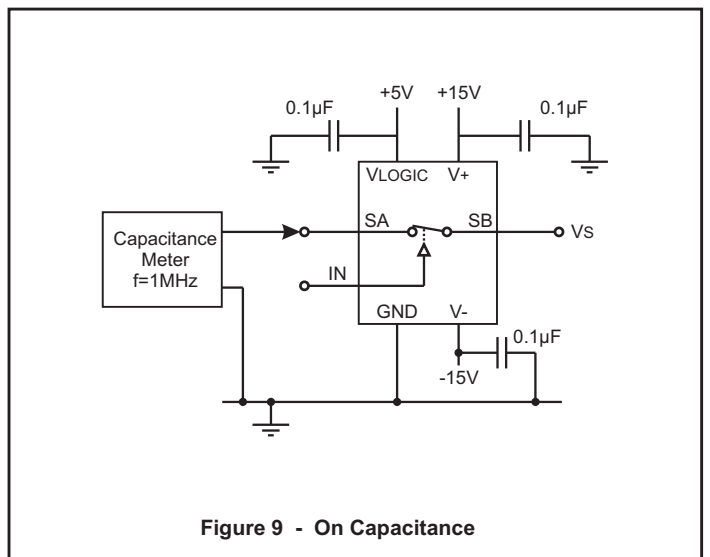
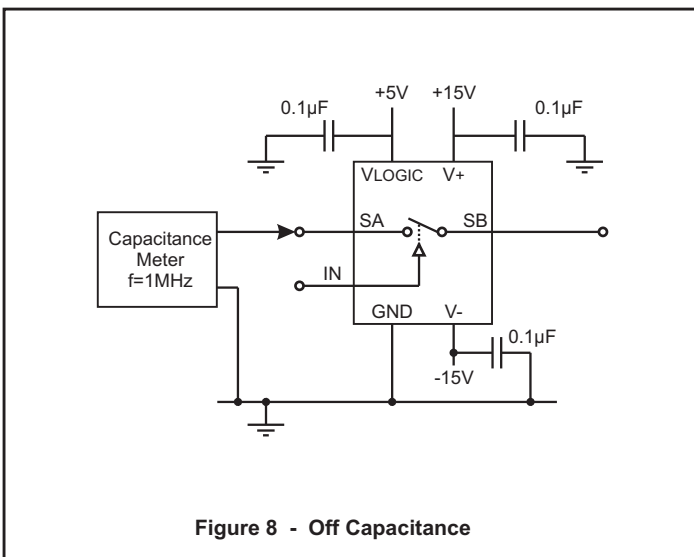
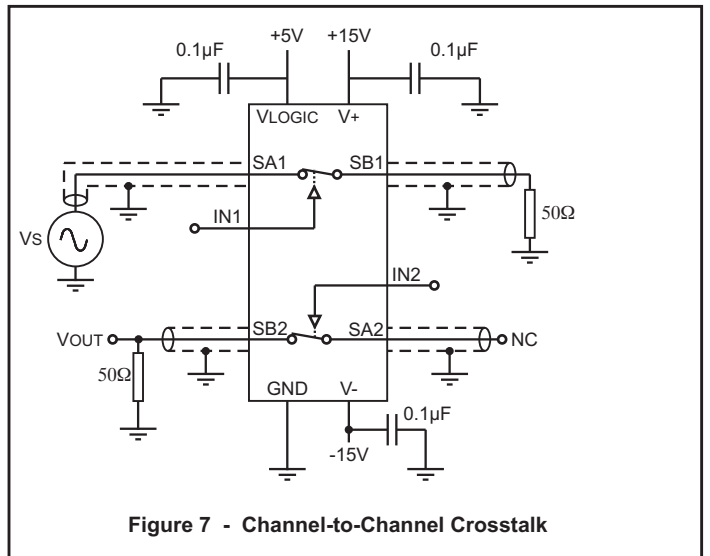
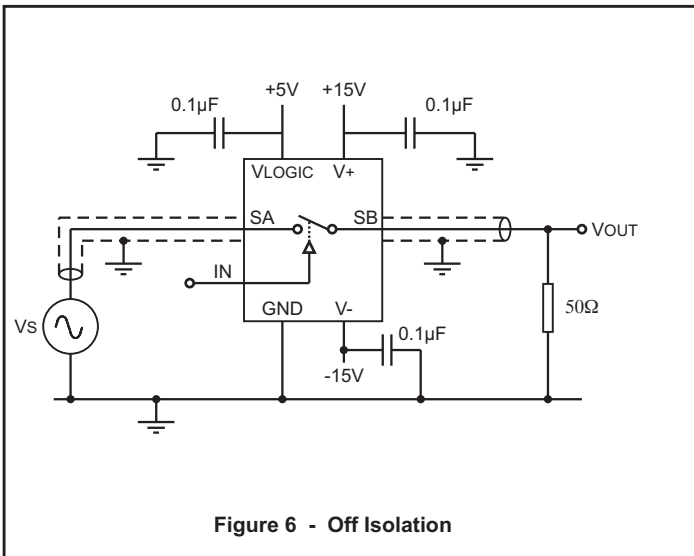
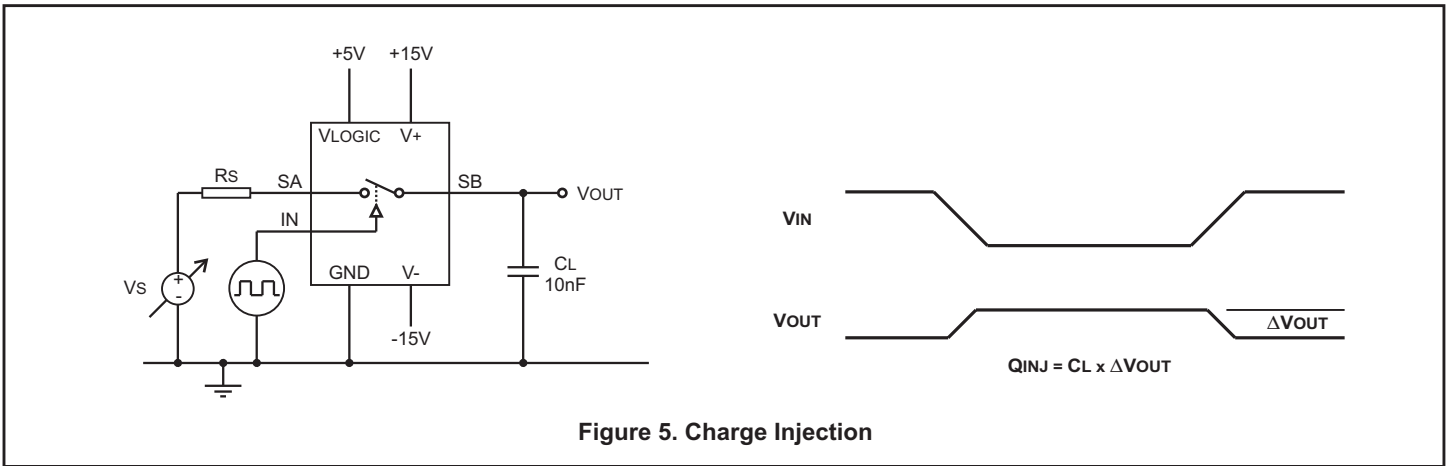
ELECTRICAL CHARACTERISTICS

V+ = 15V, V- = -15V, GND = 0V. Operating temperature range (unless otherwise noted).

| PARAMETER | SYMBOL | CONDITIONS | FIGURE | V _{LOGIC} = 3.3V | | | V _{LOGIC} = 5.0V | | | UNIT |
|----------------------------|-------------------------------------|---|--------|---------------------------|----------|---------|---------------------------|-----|-----|---------------------|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SWITCH PARAMETERS | | | | | | | | | | |
| Switch Signal Range | V _{RANGE} | | | | | | -15 | | +15 | V |
| Switch Resistance | R _{ON} | 25°C, 10mA -55°C to +125°C, 10mA | 1 1 | 10 8 | 22 26 | 10 8 | 17 20 | | | Ω Ω |
| Leakage | I _{SWLEAK} | Switch voltage ± 15V, 25°C | 2 | | 5 | | 5 | | | nA |
| | I _{SWLEAK} | Switch voltage ± 15V, 125° | 2 | | 20 | | 20 | | | nA |
| | I _{SWLEAK} | Switch voltage ± 15V, -55°C | 2 | | 150 | | 150 | | | nA |
| LOGIC INPUTS | | | | | | | | | | |
| Input High Voltage | V _{IH} | | | 70 | | | 70 | | | %V _{LOGIC} |
| Input Low Voltage | V _{IL} | | | | | 30 | | 30 | | %V _{LOGIC} |
| Input Current | I _{IN} | V _{IN} = 0V or V _{IN} =V _{LOGIC} | | -0.5 | 0.5 | -0.5 | 0.5 | | | μA |
| SUPPLY | | | | | | | | | | |
| V _{LOGIC} Current | I _{DD1} | Any state | | | 0.5 | | 0.5 | | | μA |
| V+ Current | I _{DD2} | Any state | | | 0.5 | | 0.5 | | | μA |
| V- Current | I _{EE} | Any state | | -0.5 | | -0.5 | | | | μA |
| DYNAMIC PARAMETERS | | | | | | | | | | |
| Turn On Time | T _{ON} | V+/- = ±10V, 25°C V _s = ±10V, -55°C to +125°C | 3 3 | | 55 75 | | 35 55 | | | ns ns |
| Turn Off time | T _{OFF} | V+/- = ±10V, 25°C V _s = ±10V, -55°C to +125°C | 3 3 | | 35 40 | | 20 25 | | | ns ns |
| Break-Before-Make Time | T _D | 10V signal, 25°C 10V signal, -55°C to +125°C | 4 4 | 4 | 8 | | 4 | 8 | | ns ns |
| Charge Injection | Q | V _s =0V, R _s =0Ω, 25°C | 5 | | 4 | | 4 | | | pC |
| Off Isolation | R _R | f = 1 MHz, 25°C | 6 | | 65 | | 65 | | | dB |
| Crosstalk | C _R | f = 1 MHz, 25°C | 7 | | 90 | | 90 | | | dB |
| Capacitance | C _{OFF} C _{ON} | Switch Off, 25°C Switch On, 25°C | 8 9 | | 5 20 | | 5 20 | | | pF pF |

TEST CIRCUITS





FREQUENCY RESPONSE

Figure 10 shows a typical frequency response.

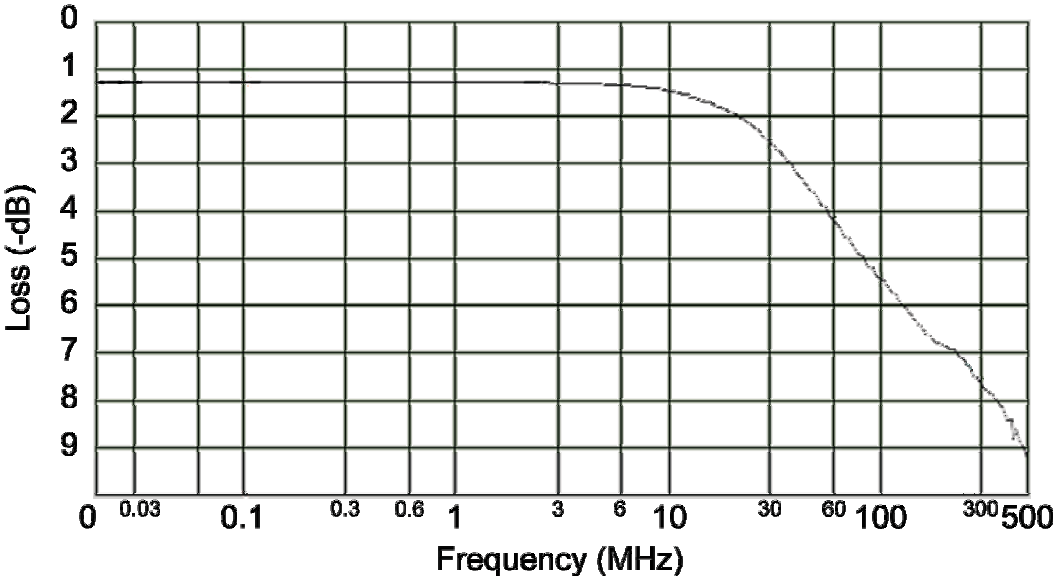


Figure 10. Frequency Response.

ORDERING INFORMATION

HI - 819x xx x x

| PART NUMBER | LEAD FINISH |
|-------------|--|
| Blank | Tin / Lead (Sn / Pb) Solder |
| F | 100% Matte Tin (Pb-free, RoHS compliant) |

| PART NUMBER | TEMPERATURE RANGE | FLOW | BURN IN |
|-------------|-------------------|------|---------|
| I | -40°C TO +85°C | I | NO |
| T | -55°C TO +125°C | T | NO |
| M | -55°C TO +125°C | M | YES |

| PART NUMBER | PACKAGE DESCRIPTION |
|-------------|---|
| PC | 16 PIN PLASTIC 5x5 mm CHIP SCALE (16PCS1) (No M-flow, Pb-free only) |
| PS | 16 PIN PLASTIC NARROW BODY SOIC (16HN) |
| PD | 16 PIN PLASTIC DIP (16P) |

| PART NUMBER | FUNCTION |
|-------------|---|
| 8190 | QUAD SWITCH, NORMALLY OPEN |
| 8191 | QUAD SWITCH, NORMALLY CLOSED |
| 8192 | QUAD SWITCH, TWO NORMALLY OPEN, TWO NORMALLY CLOSED |

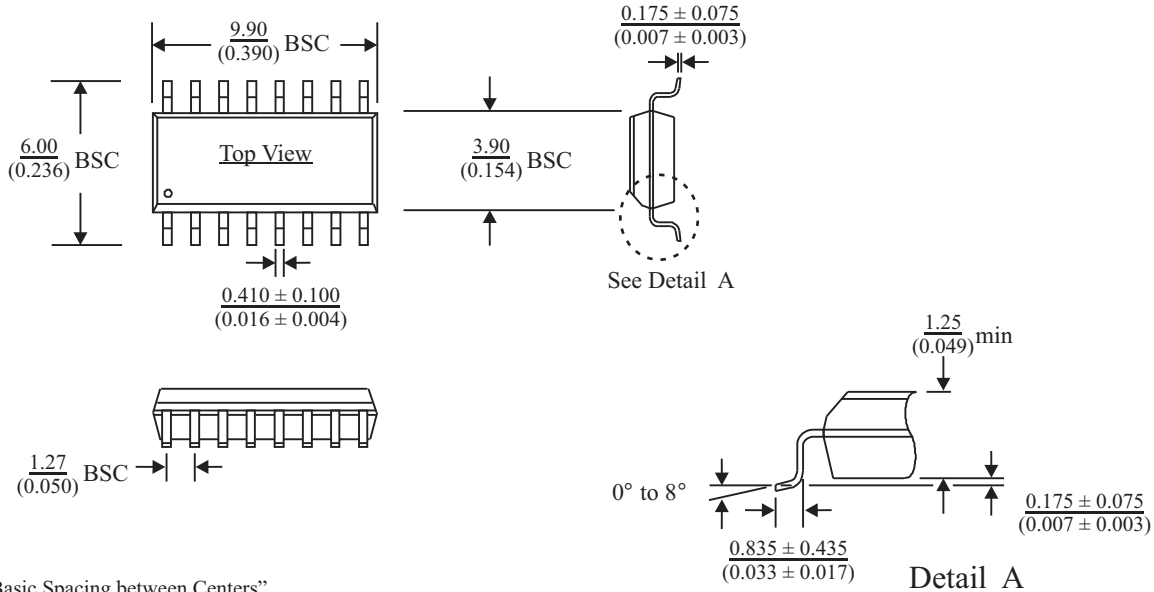
REVISION HISTORY

| P/N | Rev | Date | Description of Change |
|--------|-----|----------|---|
| DS8190 | New | 10/26/11 | Initial release |
| | A | 12/12/11 | Update DC and Peak switch current values in maximum ratings. Clarify QFN available only in Pb-free. |
| | B | 09/26/12 | Add frequency response curve. |
| | C | 12/05/13 | Add leakage vs switch voltage as a function of temperature curves. Update package drawings. |
| | D | 10/26/17 | Update frequency response curve. |

16-PIN PLASTIC SMALL OUTLINE (SOIC) - NB
(Narrow Body)

millimeters (inches)

Package Type: 16HN

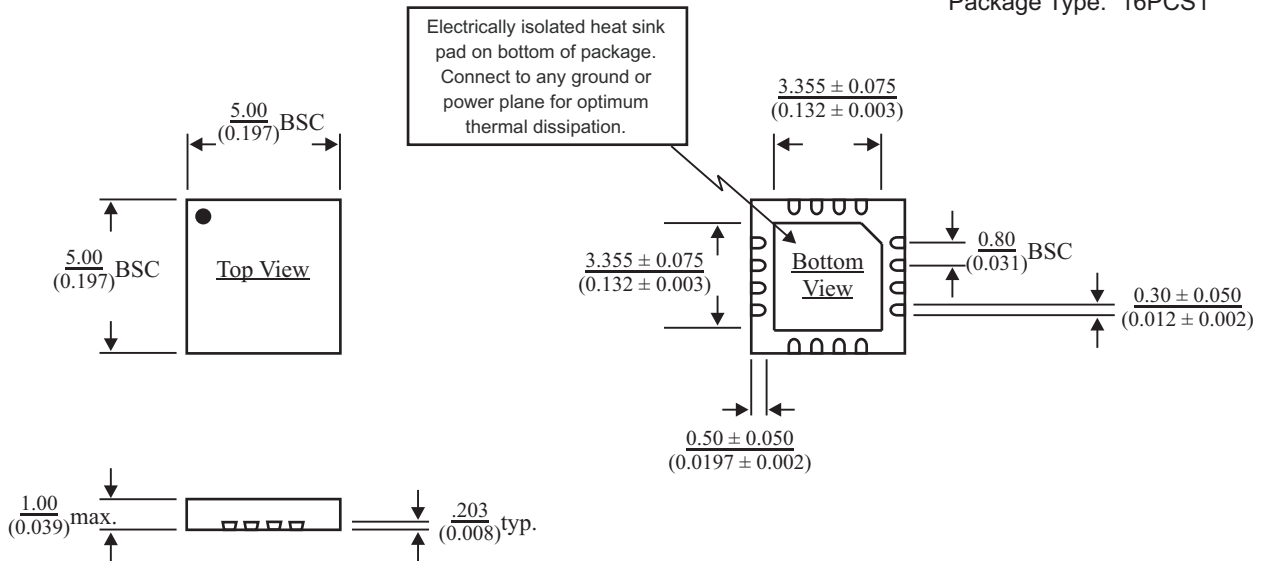


BSC = "Basic Spacing between Centers"
is theoretical true position dimension and
has no tolerance. (JEDEC Standard 95)

16-PIN PLASTIC CHIP-SCALE PACKAGE

millimeters (inches)

Package Type: 16PCS1

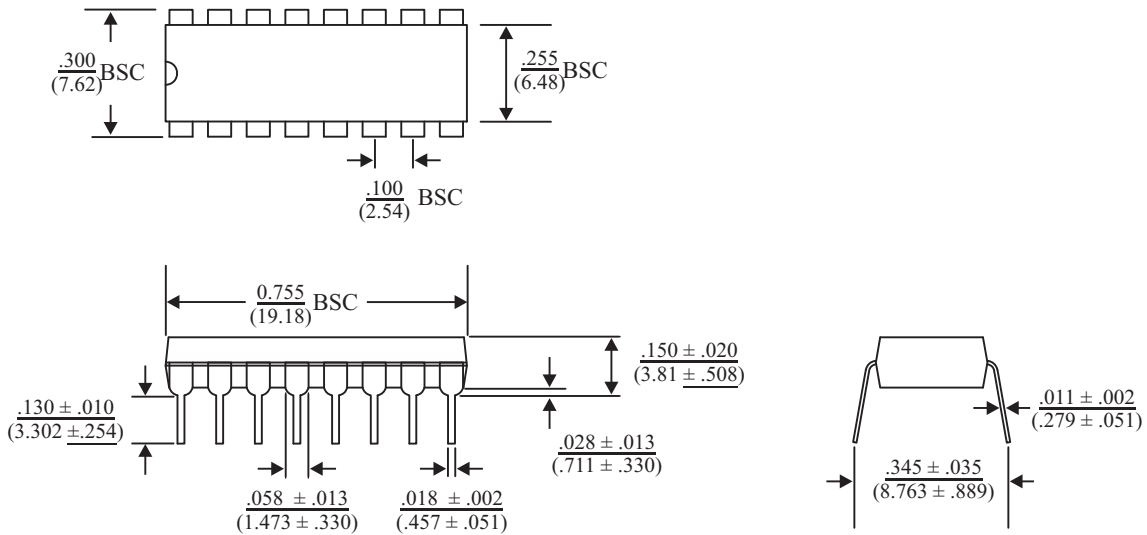


BSC = "Basic Spacing between Centers"
is theoretical true position dimension and
has no tolerance. (JEDEC Standard 95)

**16-PIN PLASTIC DUAL IN-LINE PACKAGE (PDIP)
(300mil Body)**

inches (millimeters)

Package Type: 16P



BSC = "Basic Spacing between Centers"
is theoretical true position dimension and
has no tolerance. (JEDEC Standard 95)