

16 Channel High Voltage Analog Switch

Ordering Information

| $V_{PP}-V_{NN}$ | Package Options | |
|-----------------|-----------------|----------|
| | 48-lead TQFP | Die |
| 220V | HV20822FG | HV20822X |

Features

- HVCMOS® technology for high performance
- 220V operating conditions
- Output On-resistance typically 22Ω
- 5.0V and 12.0V CMOS logic compatibility
- Very low quiescent power dissipation-10μA
- 45dB min off isolation at 7.5MHz
- Low parasitic capacitance
- Excellent noise immunity
- Flexible high voltage supplies

General Description

The Supertex HV208 is a 220V 16-channel high-voltage analog switch integrated circuit (IC) configured as 2 sets of 8 single pole single throw analog switches. It is intended for use in applications requiring high voltage switching controlled by low voltage control signals such as ultrasound imaging and printers. The 2 sets of 8 analog switches are controlled by 2 input logic controls, D_{IN1} and D_{IN2} . A logic high on D_{IN1} will turn ON switches 0 to 7 and a logic high on D_{IN2} will turn ON switches 8 to 15.

Absolute Maximum Ratings*

| | | |
|---------------------------------------|-------------------------|-------|
| V_{DD} Logic power supply voltage | -0.5V to +15V | |
| $V_{PP} - V_{NN}$ Supply voltage | +225V | |
| V_{PP} Positive high voltage supply | -0.5V to V_{NN} | +225V |
| V_{NN} Negative high voltage supply | +0.5V to V_{PP} | -225V |
| Logic input voltages | -0.5V to V_{DD} +0.3V | |
| V_{SIG} Analog Signal Range | V_{NN} to V_{PP} | |
| Peak analog signal current/channel | 3.0A | |
| Storage temperature | -65°C to +150°C | |
| Power dissipation | 48-lead TQFP | 1.0W |

* All voltages are referenced to ground. Absolute maximum ratings are those values which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability.

Electrical Characteristics

DC Characteristics (over recommended operating conditions unless otherwise noted)

| Characteristics | Sym | 0°C | | +25°C | | +70°C | | Units | Test Conditions | |
|--|-------------------|-----|------|-------|-----|-------|-----|-------|-----------------|---|
| | | min | max | min | typ | max | min | | | max |
| Small Signal Switch (ON) Resistance | R _{ONS} | | 30 | | 26 | 32 | | 40 | ohms | V _{SIG} = 0V, I _{SIG} = 5mA, V _{PP} = 50V, V _{NN} = -170V |
| | | | 25 | | 22 | 27 | | 35 | | V _{SIG} = 0V, I _{SIG} = 200mA, V _{PP} = 50V, V _{NN} = -170V |
| | | | 15 | | 22 | 27 | | 30 | | V _{SIG} = 0V, I _{SIG} = 5mA, V _{PP} = 110V, V _{NN} = -110V |
| | | | 20 | | 18 | 22 | | 25 | | V _{SIG} = 0V, I _{SIG} = 200mA, V _{PP} = 110V, V _{NN} = -110V |
| Small Signal Switch (ON) Resistance Matching | ΔR _{ONS} | | 20 | | 5.0 | 20 | | 20 | % | V _{SIG} = 0V, I _{SIG} = 5mA, V _{PP} = 110V, V _{NN} = -110V |
| Large Signal Switch (ON) Resistance | R _{ONL} | | | | 15 | | | | ohms | V _{SIG} = 0V, I _{SIG} = 1.0A |
| Switch Off Leakage Per Switch | I _{SOL} | | 5.0 | | 1.0 | 10 | | 15 | μA | V _{SIG} = V _{PP} -10V and V _{NN} +10V |
| DC Offset Switch OFF | | 300 | | | 100 | 300 | | 300 | mV | R _L = 100Kohms |
| DC Offset Switch ON | | 500 | | | 100 | 500 | | 500 | | R _L = 100Kohms |
| Pos. HV Supply Current | I _{PPQ} | | | | 10 | 50 | | | μA | All SWs OFF |
| Neg. HV Supply Current | I _{NNQ} | | | | -10 | -50 | | | | All SWs OFF |
| Pos. HV Supply Current | I _{PPQ} | | | | 10 | 50 | | | | All SWs ON, I _{SW} = 5 mA |
| Neg. HV Supply Current | I _{NNQ} | | | | -10 | -50 | | | | All SWs ON, I _{SW} = 5 mA |
| Switch Output Peak Current | | | 3.0 | | 3.0 | 2.0 | | 2.0 | A | V _{SIG} duty cycle ≤ 0.1% |
| Output Switch Frequency | f _{SW} | | | | | 50 | | | KHz | Duty Cycle = 50% |
| I _{PP} Supply Current | I _{PP} | | 8.1 | | | 8.8 | | 10 | mA | V _{PP} = 50V, V _{NN} = -170V, ALL SWs turning ON and OFF at 50KHz |
| I _{NN} Supply Current | I _{NN} | | -8.1 | | | -8.8 | | -10 | | |
| I _{PP} Supply Current | I _{PP} | | 5 | | | 6.3 | | 6.9 | | V _{PP} = 110V, V _{NN} = -110V, All SWs turning ON and OFF at 50kHz |
| I _{NN} Supply Current | I _{NN} | | -5 | | | -6.3 | | -6.9 | | |
| Logic Supply Quiescent Current | I _{DDQ} | | 10 | | | 10 | | 10 | μA | All logic states are at DC |
| Logic Supply Average Current | I _{DD} | | 2.0 | | | 2.0 | | 2.0 | mA | D _{IN1} = D _{IN2} = 3MHz, \overline{LE} = high |

Electrical Characteristics

AC Characteristics (over recommended operating conditions unless otherwise noted)

| Characteristics | Sym | 0°C | | +25°C | | | +70°C | | Units | Test Conditions |
|--|----------------|-----|-----|-------|------|-----|-------|-----|---------|--|
| | | min | max | min | typ | max | min | max | | |
| Time to Turn OFF V_{SIG}^* | $t_{SIG(OFF)}$ | 0 | | 0 | | | 0 | | ns | |
| Time Width of \overline{LE} | t_{WLE} | 150 | | 150 | | | 150 | | ns | |
| Time Width of D_{IN} | t_{WDIN} | 150 | | 150 | | | 150 | | ns | |
| Set Up Time Before \overline{LE} Rises | t_{SD} | 150 | | 150 | | | 150 | | ns | |
| Turn On Time | t_{ON} | | 2.0 | | | 2.0 | | 2.0 | μs | $V_{SIG}=V_{PP} - 10V, R_{LOAD}=10K\Omega$ |
| Turn Off Time | t_{OFF} | | 2.0 | | | 2.0 | | 2.0 | μs | $V_{SIG}=V_{PP} - 10V, R_{LOAD}=10K\Omega$ |
| Off Isolation | KO | -30 | | -30 | -33 | | -30 | | dB | $f = 5.0MHz, 1K\Omega/15pF$ Load |
| | | -45 | | -45 | -50 | | -45 | | dB | $f = 7.5MHz, R_{LOAD} = 50\Omega$ |
| Switch Crosstalk | K_{CR} | -45 | | -45 | | | -45 | | dB | $f = 5.0MHz, R_{LOAD} = 50\Omega$ |
| Off Capacitance Switch to GND | $C_{GS(OFF)}$ | 5.0 | 17 | 5.0 | 12 | 17 | 5.0 | 17 | pF | $V_{SIG} = 0V, 1MHz$ |
| On Capacitance Switch to GND | $C_{GS(ON)}$ | 25 | 50 | 25 | 38 | 50 | 25 | 50 | pF | $V_{SIG} = 0V, 1MHz$ |
| Output Voltage Spike | $+V_{SPK}$ | | | | 4.0 | | | | V | |
| | $-V_{SPK}$ | | | | -4.0 | | | | | |

*Time required for analog signal to turn off before output switch turns off.

Operating Conditions

| Symbol | Parameter | Value |
|-----------|---|----------------------------------|
| V_{PP} | Positive high voltage supply ¹ | +50V to +110V |
| V_{NN} | Negative high voltage supply ¹ | -10V to $V_{PP}-220V$ |
| V_{DD} | Logic power supply voltage ¹ | 4.75V to +12.6V |
| V_{IH} | High-level input voltage | $V_{DD} - 1.0V$ to V_{DD} |
| V_{IL} | Low-level input voltage | 0V to 1.0V |
| V_{SIG} | Analog signal voltage peak-to-peak ² | $V_{NN} + 10V$ to $V_{PP} - 10V$ |
| T_A | Operating free air-temperature | 0°C to 70°C |

Notes:

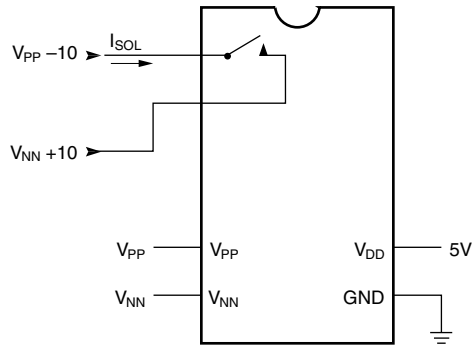
1 Power up/down sequence is arbitrary except GND must be powered-up first and powered-down last.

2 V_{SIG} must be $V_{NN} \leq V_{SIG} \leq V_{PP}$ or floating during power up/down transition.

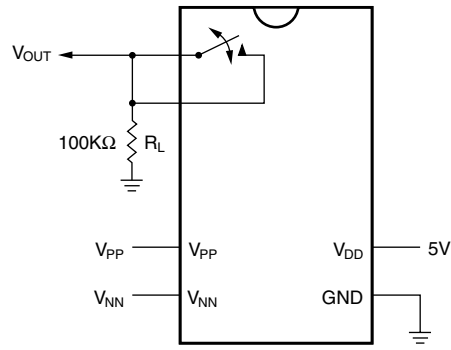
Truth Table

| $D_{IN,2}$ | $D_{IN,1}$ | \overline{LE} | SW0 to SW7 | SW8 to SW15 |
|------------|------------|-----------------|---------------------|-------------|
| L | L | L | OFF | OFF |
| L | H | L | ON | OFF |
| H | L | L | OFF | ON |
| H | H | L | ON | ON |
| X | X | H | HOLD PREVIOUS STATE | |

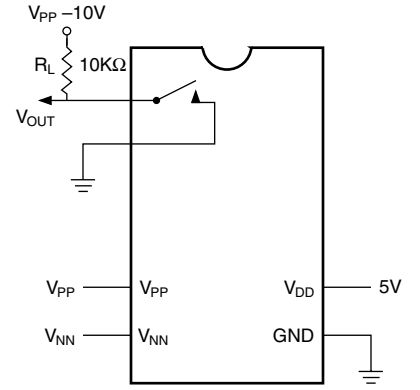
Test Circuits



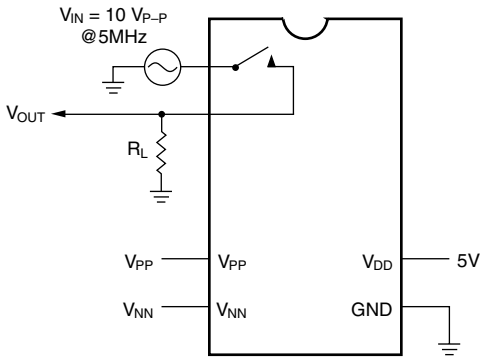
Switch OFF Leakage



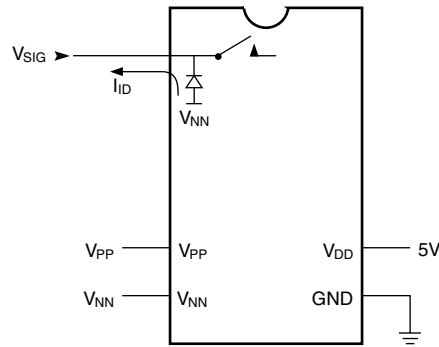
DC Offset ON/OFF



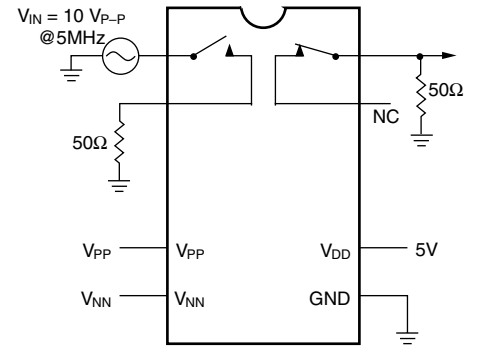
T_{ON}/T_{OFF} Test Circuit



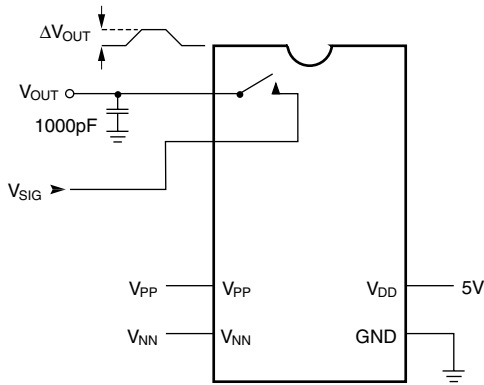
$K_O = 20 \text{Log} \frac{V_{OUT}}{V_{IN}}$
OFF Isolation



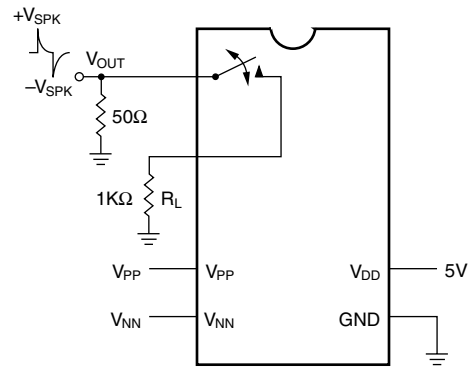
Isolation Diode Current



$K_{CR} = 20 \text{Log} \frac{V_{OUT}}{V_{IN}}$
Crosstalk

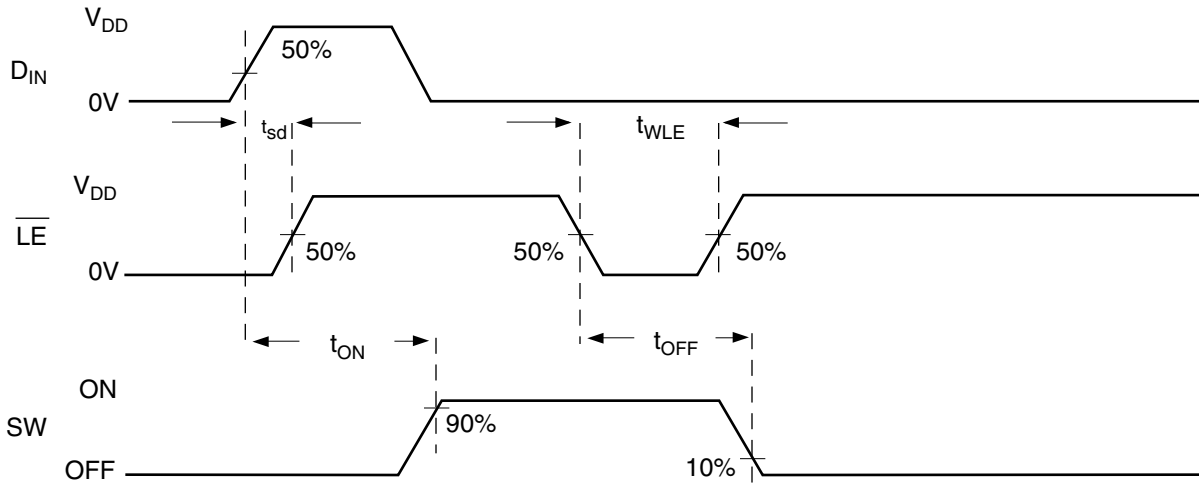


$Q = 1000pF \times \Delta V_{OUT}$
Charge Injection

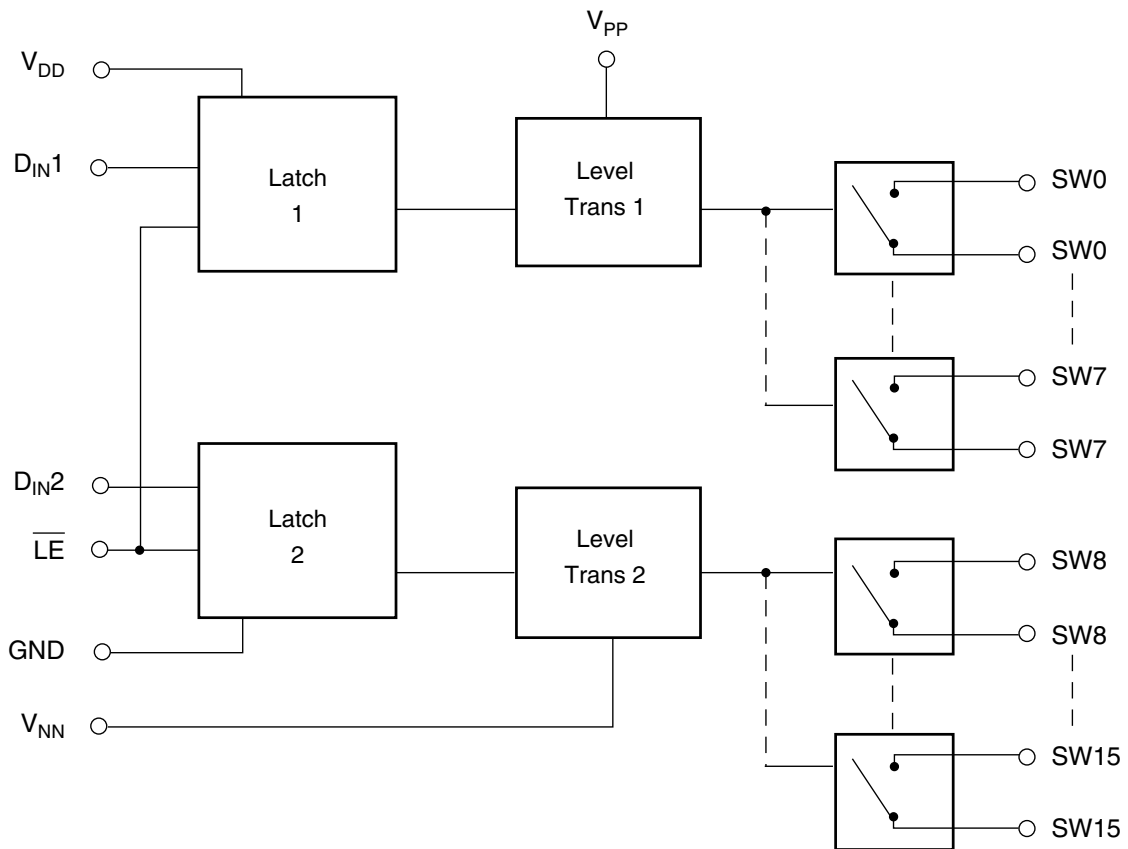


Output Voltage Spike

Logic Timing Waveform



Block Diagram

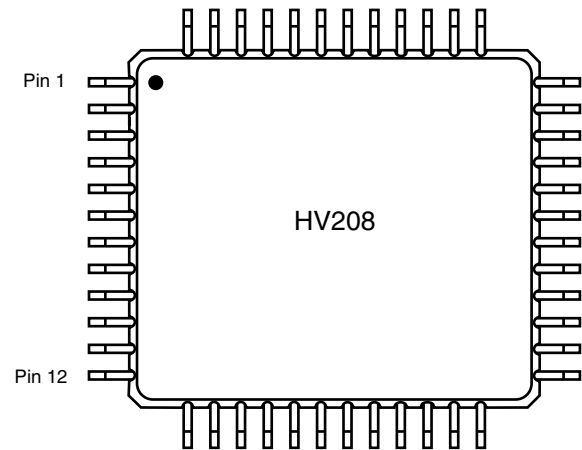


Pin Configuration

HV208 48-Pin TQFP

| Pin | Function | Pin | Function |
|-----|------------------|-----|----------|
| 1 | V _{NN} | 25 | SW10 |
| 2 | N/C | 26 | SW10 |
| 3 | V _{PP} | 27 | SW9 |
| 4 | N/C | 28 | SW9 |
| 5 | D _{IN1} | 29 | SW8 |
| 6 | LE | 30 | SW8 |
| 7 | D _{IN2} | 31 | SW7 |
| 8 | N/C | 32 | SW7 |
| 9 | N/C | 33 | SW6 |
| 10 | V _{DD} | 34 | SW6 |
| 11 | GND | 35 | SW5 |
| 12 | N/C | 36 | SW5 |
| 13 | N/C | 37 | SW4 |
| 14 | SW15 | 38 | N/C |
| 15 | SW15 | 39 | SW4 |
| 16 | SW14 | 40 | N/C |
| 17 | SW14 | 41 | SW3 |
| 18 | SW13 | 42 | SW3 |
| 19 | SW13 | 43 | SW2 |
| 20 | SW12 | 44 | SW2 |
| 21 | SW12 | 45 | SW1 |
| 22 | SW11 | 46 | SW1 |
| 23 | SW11 | 47 | SW0 |
| 24 | N/C | 48 | SW0 |

Package Outline



top view
48-pin TQFP