8-Channel High Voltage Switch with Decoded Switch Selection

Ordering Information

V_{PP}	V_{NN}	V_{SIG}	Package Options		
			20-pin ceramic side-brazed DIP	20-pin Plastic DIP	Die in waffle pack
+70V	-70V	110V P-P	HV1414C	HV1414P	HV1414X
+80V	-80V	130V P-P	HV1416C	HV1416P	HV1416X

Features

- ☐ HVCMOS® Technology
- ☐ Up to 130V peak to peak switching capability
- ☐ Output On-resistance typically 40 ohms
- ☐ Low parasitic capacitances
- ☐ DC to 10MHz analog signal frequency
- ☐ 45 dB typical output off isolation at 5 MHz
- ☐ CMOS logic circuitry for low power and excellent noise immunity
- ☐ On-chip decode, latch and chip select logic circuitry

Absolute Maximum Ratings*

V_{DD} Logic power supply voltage	-0.5V to +18V
V_{PP} Positive high voltage supply	-0.5V to +90V
V_{NN} Negative high voltage supply	+0.5V to -90V
Logic input voltages	-0.5V to V_{DD} +0.3V
Peak analog signal current/channel	1.5A
Storage temperature	-65°C to +150°C
Power dissipation	800mW

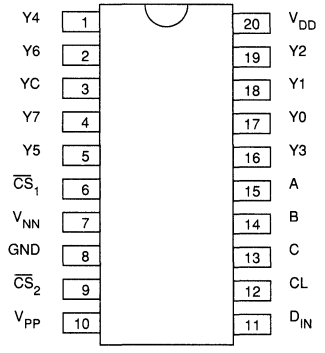
* Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability.

General Description

This device is an 8-channel high-voltage integrated circuit (HVIC), configured as a 1 of 8 decode function, intended for use in applications requiring high voltage switching controlled by low voltage signals; e.g., ultrasound imaging and printers. On-chip latches are provided for the decoded data.

The unique control logic on this device provides individual control of each switch, allowing more than one switch to be turned on at a time. The clear function turns off all switches simultaneously. The chip select inputs control the latches, holding the output stable while the address and data are changed. Using HVCMOS technology, this HVIC combines high voltage bi-lateral DMOS switches and low power CMOS logic to provide efficient control of high voltage analog signals.

Pin Configuration



top view

20-pin DIP

Electrical Characteristics (over recommended operating conditions unless noted)

DC Characteristics

Characteristics	Sym	0°C		+25°C			+70°C		Units	Test Conditions
		min	max	min	typ	max	min	max		
Switch (ON) Resistance	R_{SW}		50		40	50		60	ohms	I_{SW} = 5mA
Switch (ON) Resistance	R_{SW}		35		25	35		45	ohms	I_{SW} = 200mA
Switch (ON) Resistance	R_{SW}		55		45	55		65	ohms	V_{PP} = +50V V_{NN} = -50V I_{SW} = 5mA
Switch (ON) Resistance	R_{SW}		40		25	40		50	ohms	V_{PP} = +50V V_{NN} = -50V I_{SW} = 200mA
Switch (ON) Resistance Matching	R_{SW}		30		10	30		30	%	I_{SW} = 5mA V_{PP} = +50V, V_{NN} = -50V
Switch Off Leakage	I_{SWL}		50		0.5	50		150	µA	V_{OUT} = V_{PP} -10V thru 10K with 8 SWS in parallel
DC Offset Switch Off			500		100	500		500	mV	RL = 100K
DC Offset Switch On			500		100	500		500	mV	RL = 100K
Pole to Pole Switch Capacitance	C_{SW}		10		4.5	10		10	pF	DC Bias = 40V f = 1MHz
Logic Input Capacitance	C_{IN}				3.5				pF	
Pos. HV Supply Current Neg. HV Supply Current	I_{PPQ} I_{NNQ}		200 -200		50 -50	200 -200		200 -200	µA µA	ALL SWS OFF
Pos. HV Supply Current Neg. HV Supply Current	I_{PP} I_{NN}				0.8 -0.8	1.6 -1.6			mA mA	1 SW ON I_{SW} = 5mA
Pos. HV Supply Current Neg. HV Supply Current	I_{PP} I_{NN}				0.6 -0.6	1.2 -1.2			mA mA	V_{PP} = +50V V_{NN} = -50V 1 SW ON, I_{SW} = 5mA
Switch Output Peak Current					1.5				A	
Logic Supply Current	I_{DD}				0.001	0.5			mA	

AC Characteristics

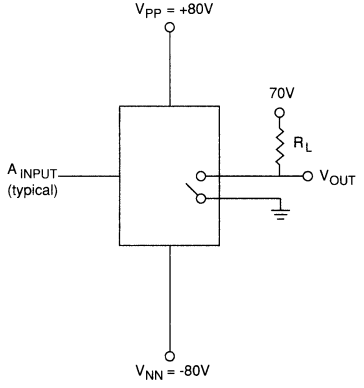
Characteristics	Sym	0°C		+25°C			+70°C		Units	Test Conditions
		min	max	min	typ	max	min	max		
D_{IN} Set Up Time Before $\overline{CS}$ Rises	t_{DSU}			260					ns	
Address Set Up Time Before $\overline{CS}$ Falls	t_{ASU}			120					ns	
Hold Time After $\overline{CS}$ Rises	t_h			35					ns	
Minimum Clear Pulse Width	t_{WCL}			150					ns	
Minimum Chip Select Low Pulse Width	t_{WCS}			300					ns	
Turn On Time	t_{ON}		5		2.5	5		5	µs	
Turn Off Time	t_{OFF}		10		5.0	10		10	µs	
Off Isolation	KO			35	45				dB	f = 5MHz

Recommended Operating Conditions

Symbol	Parameter	Device		Value
		HV1414	HV1416	
V_{DD}	Logic power supply voltage	X	X	+10.0V to +15.5V
V_{PP}	Positive high voltage supply	X		+50.0V to +70.0V
			X	+50.0V to +80.0V
V_{NN}	Negative high voltage supply	X		-50.0V to -70.0V
			X	-50.0V to -80.0V
V_{IH}	High level input voltage	X	X	V_{DD} -2V to V_{DD}
V_{IL}	Low-level input voltage	X	X	0 to 2.0V
V_{SIG}	Analog signal voltage peak to peak	X	X	V_{NN} +15V to V_{PP} -15V
T_A	Operating free air-temperature	X	X	0° to 70°C

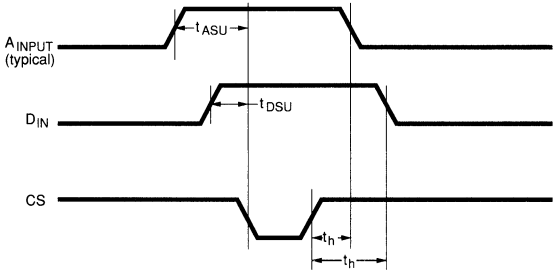
Note: For non-ground referenced systems the following must be used:
Power up sequence: GND VNN VDD VPP
Power down sequence: VPP VDD VNN GND

T_{ON}/T_{OFF} Measurement Circuit

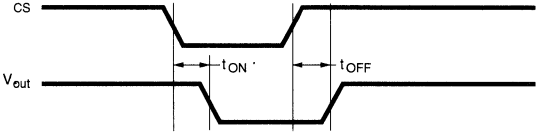


Switching Waveforms

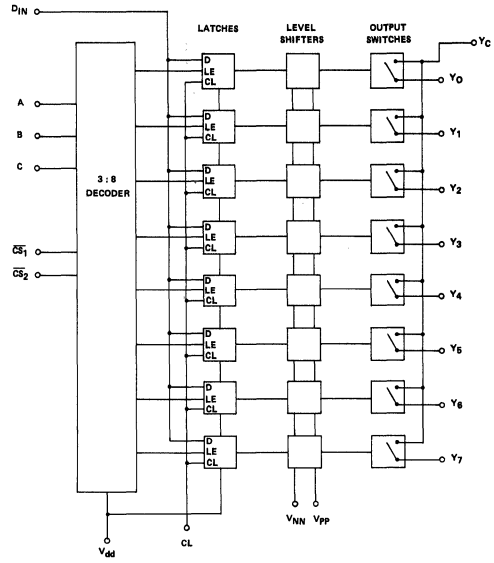
Logic Timing Waveforms



Output Timing Waveforms



Logic Diagram



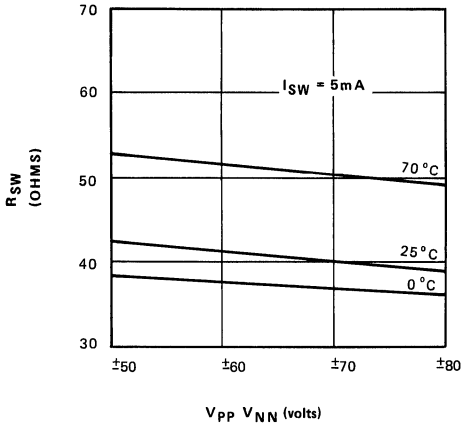
Truth Table

C	B	A	$\overline{CS}_1$	$\overline{CS}_2$	D_{IN}	CL	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
L	L	L	L	L	L	L	OFF							
L	L	L	L	L	H	L	ON							
L	L	H	L	L	L	L		OFF						
L	L	H	L	L	H	L		ON						
L	H	L	L	L	L	L			OFF					
L	H	L	L	L	H	L			ON					
L	H	H	L	L	L	L				OFF				
L	H	H	L	L	H	L				ON				
H	L	L	L	L	L	L					OFF			
H	L	L	L	L	H	L					ON			
H	L	H	L	L	L	L						OFF		
H	L	H	L	L	H	L						ON		
H	H	L	L	L	L	L							OFF	
H	H	L	L	L	H	L							ON	
H	H	H	L	L	L	L								OFF
H	H	H	L	L	H	L								ON
X	X	X	H	X	X	L	HOLDS PREVIOUS STATE							
X	X	X	X	H	X	L	HOLDS PREVIOUS STATE							
X	X	X	X	X	X	H	ALL OUTPUTS OFF							

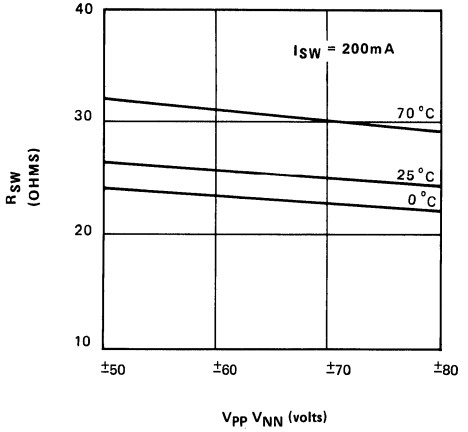
Notes: 1. D_{IN} controls the switches through flow-through latches, which are clocked (enabled) by an 8-way decoder controlled by A, B, C, $\overline{CS}_1$, and $\overline{CS}_2$. Therefore, the latch for a particular switch goes into the HOLD state when any of the above inputs prevents selection. $\overline{CS}_1$ or $\overline{CS}_2$ can be used as an active LOW clock input.
2. Spurious clocking may occur if A, B, or C is changed with $\overline{CS}_1$ and $\overline{CS}_2$ both low.
3. The clear input CL overrides all other inputs.
4. The eight switches operate independently.

Typical Performance Curves

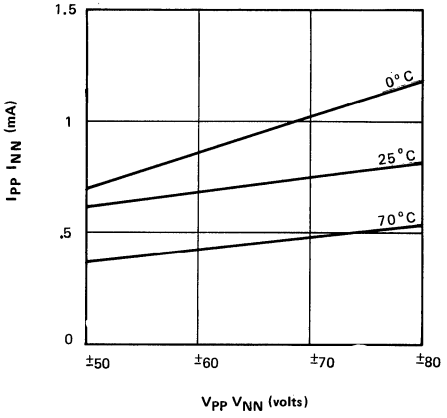
TYPICAL
R_{SW} vs. V_{PP} V_{NN}



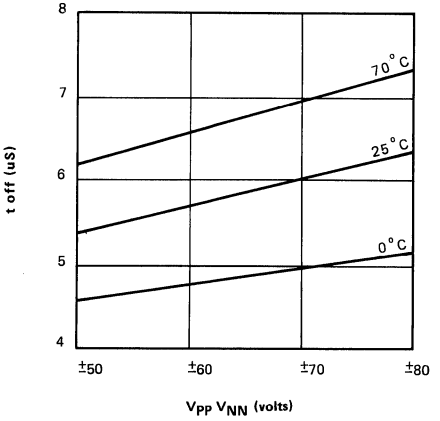
TYPICAL
R_{SW} vs. V_{PP} V_{NN}



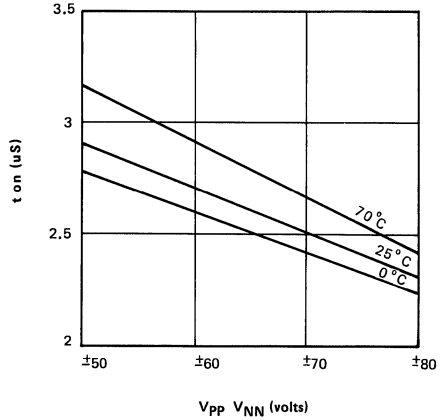
TYPICAL
I_{PP} I_{NN} vs. V_{PP} V_{NN} (ONE SWITCH ON)



TYPICAL
t_{off} vs. V_{PP} V_{NN}



TYPICAL
t on (uS) vs. V_{PP} V_{NN}



TYPICAL
SWITCH CURRENT vs VOLTAGE