

CMOS 8 x 8 x 1 Crosspoint Switches with Memory Control

The CD74HC22106 is a digitally controlled analog switch which utilize silicon-gate CMOS technology. The CD74HC22106 features CMOS input-voltage-level compatibility.

The Master Reset has an internal pull-up resistor and is normally used with a 0.1μF capacitor. During power up all switches are automatically reset. The crosspoint switches will reset with MR = 0 even if CE is high. A 6-bit address through a 6 line to 64 line decoder selects the transmission gate which can be turned on by applying a logic ONE to the DATA input and logic ZERO to the STROBE. Similarly, any transmission gate can be turned OFF by applying a logic ZERO to the DATA input while strobing the STROBE with a logic ZERO.

The CE pin allows the crosspoint array to be cascaded for matrix expansion in both the X and Y directions.

Ordering Information

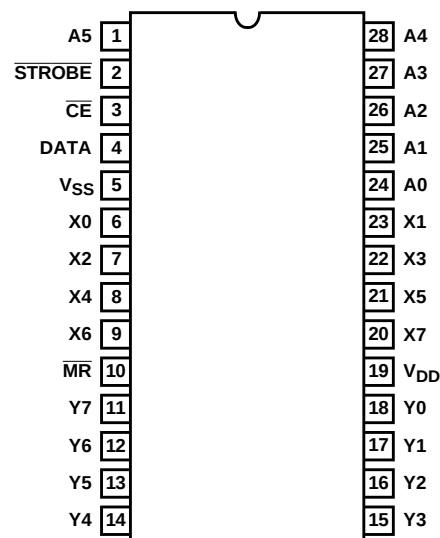
PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CD74HC22106E	-40 to 85	28 Ld PDIP	E28.6

Features

- 64 Analog Switches in an 8 x 8 x 1 Array
- On-Chip Line Decoder and Control Latches
- Automatic Power-Up Reset by Using a 0.1μF Capacitor at the MR Pin
- R_{ON} Resistanced 95Ω at V_{CC} = 4.5V
- Analog Signal Capability: V_{DD}/2
- Wide Operating Temp. Range: -40°C to 85°C
- 2V to 10V Operation
- High Noise Immunity: N_{IL} = 30%, N_{IH} = 30% of V_{DD}; at V_{DD} = 5V and 10V

Pinout

**CD74HC22106
(PDIP)
TOP VIEW**



Absolute Maximum Ratings

DC Supply Voltage (V_{DD})
 Voltage Reference to V_{SS} Terminal -0.5V to 11V
 DC Input Diode Current
 I_{IK} (for $V_I < -0.5$ or $V_I > V_{DD} 0.5V$) $\pm 20mA$
 DC Output Diode Current
 I_{OK} (For $V_O < -0.5$ or $V_O > V_{DD} 0.5V$) $\pm 20mA$
 DC Transmission Gate Current $\pm 25mA$
 Power Dissipation per Package (P_D)
 For $T_A = -40^\circ C$ to $60^\circ C$ (Package Type E) 500mW
 For $T_A = -60^\circ C$ to $85^\circ C$ (Package Type E) Derate Linearly at
 12mW/ $^\circ C$ to 200mW

Thermal Information

Maximum Junction Temperature $175^\circ C$
 Maximum Junction Temperature (Plastic Package) $150^\circ C$
 Maximum Storage Temperature Range $-65^\circ C \leq T_A \leq 150^\circ C$
 Maximum Lead Temperature (Soldering 10s) $300^\circ C$

Operating Conditions

Temperature Range (T_A)
 Package Type E $-40^\circ C$ to $85^\circ C$
 Supply Voltage Range (for $T_A =$ Full Package Temp. Range) V_{DD}
 CD74HC22106 2V to 10V
 DC Input or Output Voltage V_I, V_O 0V to V_{DD}

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.

Electrical Specifications $V_{SS} = GND$

PARAMETER	TEST CONDITIONS		25°C			-40°C TO 85°C		UNITS
	V _{IS} (V)	V _{DD} (V)	MIN	TYP	MAX	MIN	MAX	
STATIC SPECIFICATIONS								
High-Level Input Voltage, V _{IH}	-	2	1.5	-	-	1.5	-	V
	-	4.5	3.15	-	-	3.5	-	
	-	9	6.3	-	-	6.3	-	
Low-Level Input Voltage, V _{IL}	-	2	-	-	0.5	-	0.5	V
	-	4.5	-	-	1.35	-	1.35	
	-	9	-	-	2.7	-	2.7	
Input Leakage Current (Any Control), I _L	V _{DD} or GND	10	-	-	±0.1	-	±1	μA
Quiescent Device Current, I _{CC} (with $\overline{MR}$ = 1)	V _{DD} or GND	10	-	-	5	-	50	μA
Off Leakage Current, I _L (with $\overline{MR}$ = 1)	All Switches OFF	10	-	-	0.1	-	1	μA
“On” Resistance, R _{ON}	V _{DD} to GND Figures 7, 8	2	-	470	700	-	875	Ω
		4.5	-	64	95	-	120	
		9	-	45	70	-	90	
	V _{DD} /2	-	-	-	-	-	-	Ω
		4.5	-	58	85	-	110	
		9	-	40	60	-	80	
“On” Resistance Between Any Two Channels ΔR _{ON}	V _{DD} to GND	-	-	-	-	-	-	Ω
		4.5	-	25	-	-	-	
		9	-	23	-	-	-	

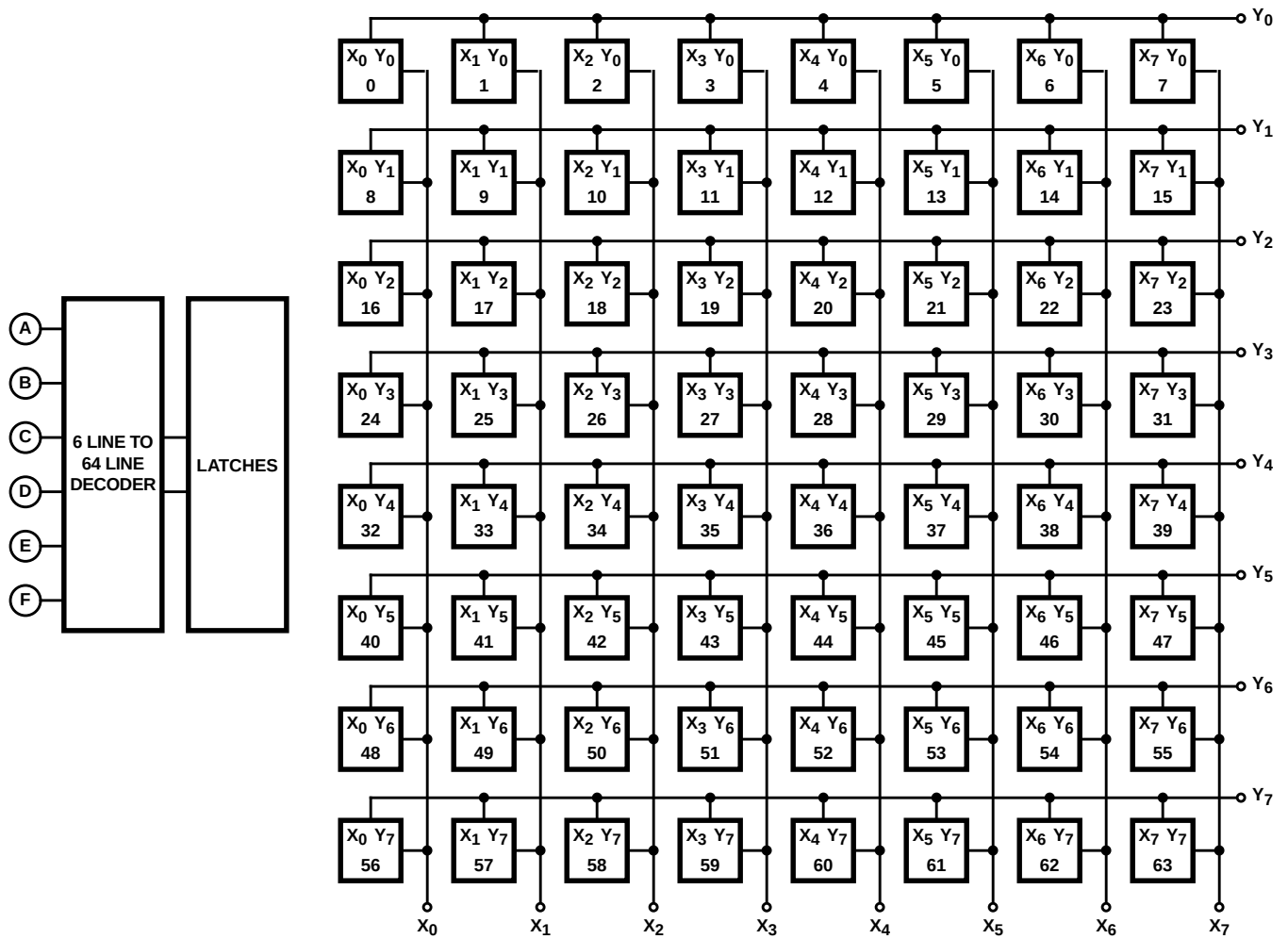
Electrical Specifications $V_{SS} = 0V$

PARAMETER	SYMBOL	TEST CONDITIONS			25°C		-40°C TO 85°C		UNITS
			FIG.	V _{DD} (V)	MIN	MAX	MIN	MAX	
DYNAMIC CONTROLS									
Propagation Delay Time:	t _{PZH}	R _L = 10kΩ C _L = 50pF t _R , t _F = 6ns	1	2	-	370	-	385	ns
Strobe to Output (Switch Turn-On to High Level)				4.5	-	110	-	125	ns
				9	-	65	-	70	ns
Data-In to Output (Turn-On to High Level)	t _{PZH}		2	2	-	240	-	255	ns
				4.5	-	75	-	85	ns
				9	-	50	-	55	ns
Address to Output (Turn-On to High Level)	t _{PZH}		3	2	-	380	-	400	ns
				4.5	-	110	-	125	ns
				9	-	65	-	75	ns
Propagation Delay Time:	t _{PHZ}		1	2	-	400	-	420	ns
Strobe to Output Switch Turn-Off				4.5	-	135	-	155	ns
				9	-	90	-	100	ns
Data-In to Output (Turn-On to Low Level)	t _{PZL}		2	2	-	240	-	255	ns
				4.5	-	75	-	85	ns
				9	-	50	-	55	ns
Address to Output (Turn-Off)	t _{PHZ}		3	2	-	420	-	440	ns
				4.5	-	140	-	155	ns
				9	-	95	-	100	ns
Minimum Setup Time (Data-In to Strobe, Address to Strobe)	t _{SU}		-	2	35	-	40	-	ns
				4.5	20	-	20	-	ns
				9	15	-	15	-	ns
Minimum Hold Time (Data-In to Strobe, Address to Strobe)	t _H		-	2	85	-	90	-	ns
				4.5	25	-	25	-	ns
				9	20	-	20	-	ns
Minimum Strobe Pulse Width	t _W		-	2	200	-	210	-	ns
				4.5	45	-	55	-	ns
				9	25	-	30	-	ns
Maximum Switching Frequency	F _O	-	2	0.7	-	0.6	-	MHz	
			4.5	3.0	-	2.8	-	MHz	
			9	7	-	6.5	-	MHz	
Input (Control) Capacitance	C _I		-	-	-	10	-	10	pF

Electrical Specifications

PARAMETER	SYMBOL	TEST CONDITIONS	V _{IS} (V _{P-P})	V _{SS} (V)	V _{DD} (V)	25°C		-40°C TO 85°C		UNITS
						MIN	MAX	MIN	MAX	
DYNAMIC SPECIFICATIONS										
Propagation Delay Time, Signal Input to Output	t _{PLH} , t _{PHL}	R _L = 10kΩ C _L = 50pF t _R , t _F = 6ns	-	0	2	-	30	-	33	ns
			-	0	4.5	-	20	-	22	ns
			-	-	9	-	15	-	17	ns
						Typical				
Switch Frequency Response at -3dB	f _{3dB}	R _S = R _L = 600Ω	2	-2.25	2.25	5		-	-	MHz
			2	-4.5	4.5	6		-	-	MHz
Crosstalk Between Any Two Channels	F _{CT}	R _S = R _L = 600Ω f = 1kHz	2	-2.25	2.25	-110		-	-	dB
			R _S = R _L = 600Ω f = 1MHz	2	-2.25	2.25	-53		-	-
		2		-4.5	4.5	-55		-	-	dB
Switch “OFF” -40dB Feed Through Frequency	F _{DT}	R _S = R _L = 600Ω	2	-2.25	2.25	7		-	-	MHz
			2	-4.5	4.5	8		-	-	MHz
Total Harmonic Distortion	THD	R _L = 10kΩ f = 1kHz sinewave	4	-2.25	2.25	0.05		-	-	%
			8	-4.5	4.5	0.05		-	-	%
		R _L = 600Ω f = 1kHz sinewave	4	-2.25	2.25	0.25		-	-	%
			7	-4.5	4.5	0.12		-	-	%
Control to Switch FeedThrough Noise (DATA IN, Strobe, Address)		R _L = 10kΩ t _R , t _F = 6ns	V _{DD}	0	5	35		-	-	mV
			V _{DD}	0	10	65		-	-	mV
Capacitance,	C _{IS}									
Xn to GND		f = 1MHz	-	0	10	48		-	-	pF
Yn to GND			-	0	10	44		-	-	pF

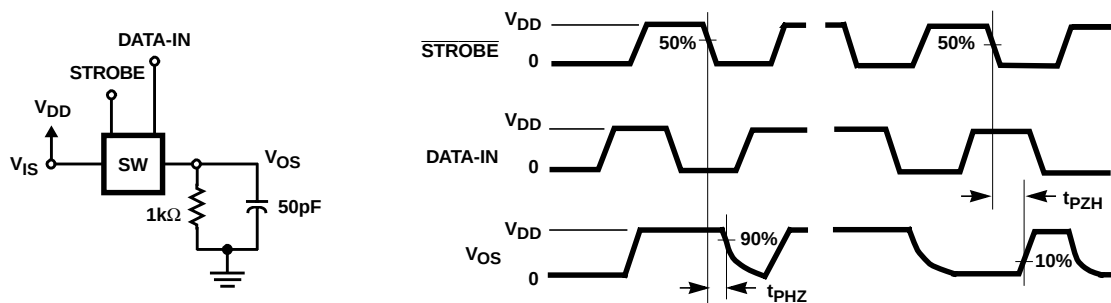
Functional Diagram



TRUTH TABLE

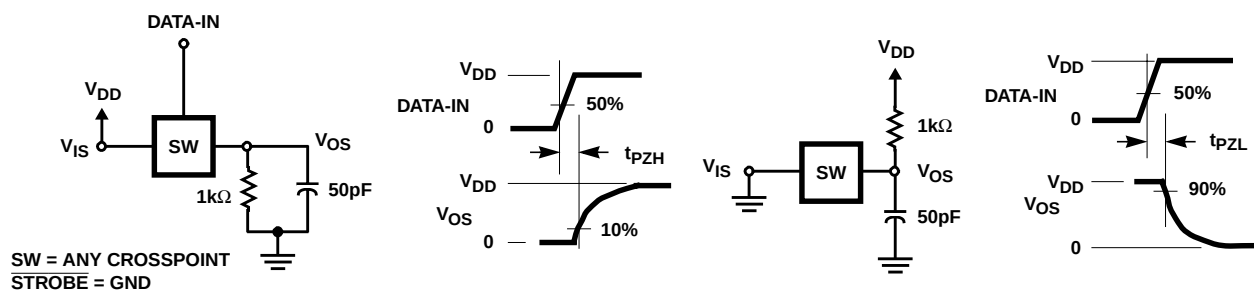
A ₅	A ₄	A ₃	A ₂	A ₁	A ₀	SWITCH SELECT	A ₅	A ₄	A ₃	A ₂	A ₁	A ₀	SWITCH SELECT
0	0	0	0	0	0	X ₀ Y ₀	1	0	0	0	0	0	X ₀ Y ₄
0	0	0	0	0	1	X ₁ Y ₀	1	0	0	0	0	1	X ₁ Y ₄
0	0	0	0	1	0	X ₂ Y ₀	1	0	0	0	1	0	X ₂ Y ₄
0	0	0	0	1	1	X ₃ Y ₀	1	0	0	0	1	1	X ₃ Y ₄
0	0	0	1	0	0	X ₄ Y ₀	1	0	0	1	0	0	X ₄ Y ₄
0	0	0	1	0	1	X ₅ Y ₀	1	0	0	1	0	1	X ₅ Y ₄
0	0	0	1	1	0	X ₆ Y ₀	1	0	0	1	1	0	X ₆ Y ₄
0	0	0	1	1	1	X ₇ Y ₀	1	0	0	1	1	1	X ₇ Y ₄
0	0	1	0	0	0	X ₀ Y ₁	1	0	1	0	0	0	X ₀ Y ₅
0	0	1	0	0	1	X ₁ Y ₁	1	0	1	0	0	1	X ₁ Y ₅
0	0	1	0	1	0	X ₂ Y ₁	1	0	1	0	1	0	X ₂ Y ₅
0	0	1	0	1	1	X ₃ Y ₁	1	0	1	0	1	1	X ₃ Y ₅
0	0	1	1	0	0	X ₄ Y ₁	1	0	1	1	0	0	X ₄ Y ₅
0	0	1	1	0	1	X ₅ Y ₁	1	0	1	1	0	1	X ₅ Y ₅
0	0	1	1	1	0	X ₆ Y ₁	1	0	1	1	1	0	X ₆ Y ₅
0	0	1	1	1	1	X ₇ Y ₁	1	0	1	1	1	1	X ₇ Y ₅
0	1	0	0	0	0	X ₀ Y ₂	1	1	0	0	0	0	X ₀ Y ₆
0	1	0	0	0	1	X ₁ Y ₂	1	1	0	0	0	1	X ₁ Y ₆
0	1	0	0	1	0	X ₂ Y ₂	1	1	0	0	1	0	X ₂ Y ₆
0	1	0	0	1	1	X ₃ Y ₂	1	1	0	0	1	1	X ₃ Y ₆
0	1	0	1	0	0	X ₄ Y ₂	1	1	0	1	0	0	X ₄ Y ₆
0	1	0	1	0	1	X ₅ Y ₂	1	1	0	1	0	1	X ₅ Y ₆
0	1	0	1	1	0	X ₆ Y ₂	1	1	0	1	1	0	X ₆ Y ₆
0	1	0	1	1	1	X ₇ Y ₂	1	1	0	1	1	1	X ₇ Y ₆
0	1	1	0	0	0	X ₀ Y ₃	1	1	1	0	0	0	X ₀ Y ₇
0	1	1	0	0	1	X ₁ Y ₃	1	1	1	0	0	1	X ₁ Y ₇
0	1	1	0	1	0	X ₂ Y ₃	1	1	1	0	1	0	X ₂ Y ₇
0	1	1	0	1	1	X ₃ Y ₃	1	1	1	0	1	1	X ₃ Y ₇
0	1	1	1	0	0	X ₄ Y ₃	1	1	1	1	0	0	X ₄ Y ₇
0	1	1	1	0	1	X ₅ Y ₃	1	1	1	1	0	1	X ₅ Y ₇
0	1	1	1	1	0	X ₆ Y ₃	1	1	1	1	1	0	X ₆ Y ₇
0	1	1	1	1	1	X ₇ Y ₃	1	1	1	1	1	1	X ₇ Y ₇

Test Circuits and Waveforms



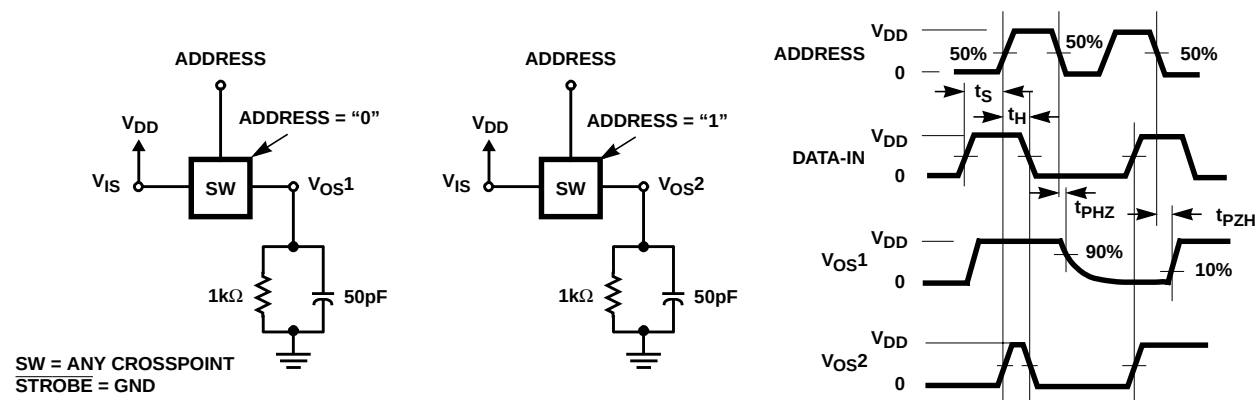
SW = ANY CROSSPOINT

FIGURE 1. PROPAGATION DELAY TIME TEST CIRCUIT AND WAVEFORMS (STROBE TO SIGNAL OUTPUT, SWITCH TURN-ON OR TURN-OFF)



SW = ANY CROSSPOINT
STROBE = GND

FIGURE 2. PROPAGATION DELAY TIME TEST CIRCUIT AND WAVEFORMS (DATA-IN TO SIGNAL OUTPUT, SWITCH TURN-ON TO HIGH OR LOW LEVEL)



SW = ANY CROSSPOINT
STROBE = GND

FIGURE 3. PROPAGATION DELAY TIME TEST CIRCUIT AND WAVEFORMS (ADDRESS TO SIGNAL OUTPUT, SWITCH TURN-ON OR TURN-OFF)

Typical Application Information

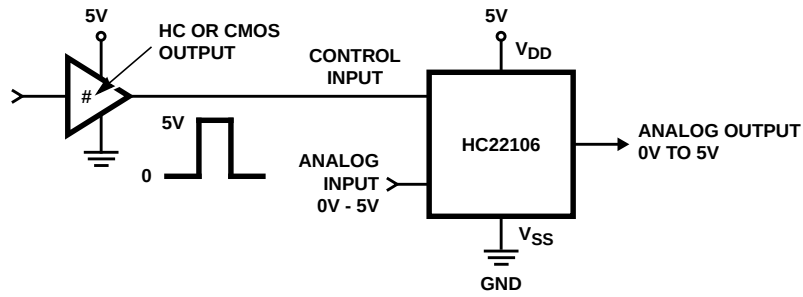


FIGURE 4. TYPICAL SINGLE SUPPLY CONNECTION FOR HC22106

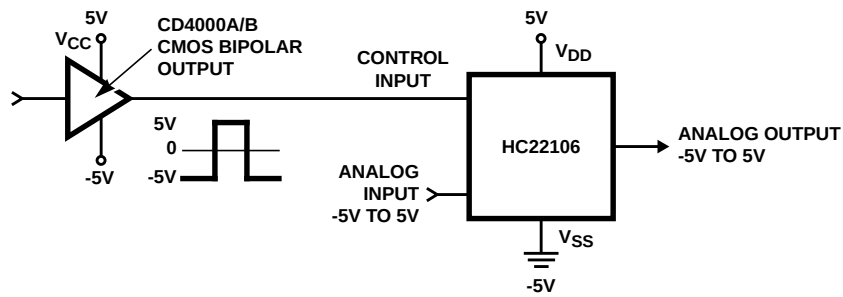


FIGURE 5. TYPICAL DUAL SUPPLY CONNECTION FOR HC22106

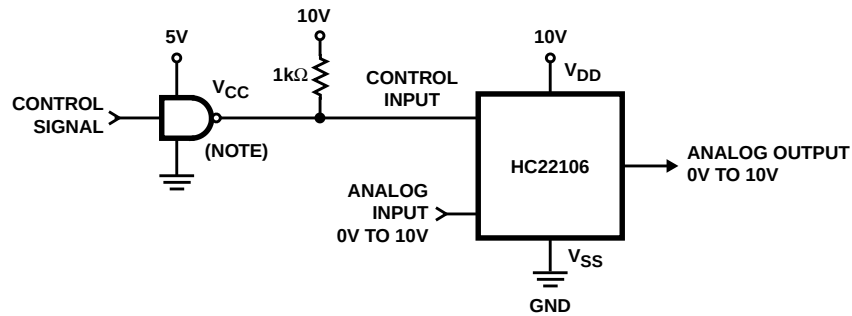


FIGURE 6. USE OF HC22106 WHEN CONTROL IS 0V TO 5V AND ANALOG SIGNAL IS 0V TO 10V

Typical Performance Curves

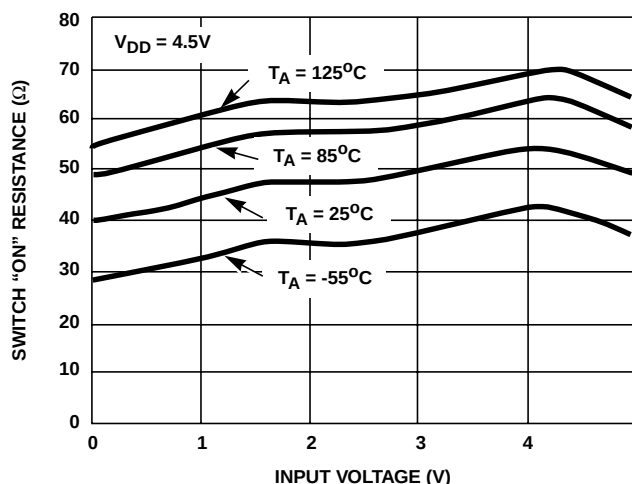


FIGURE 7. TYPICAL "ON" RESISTANCE AS A FUNCTION OF INPUT SIGNAL VOLTAGE vs TEMPERATURE

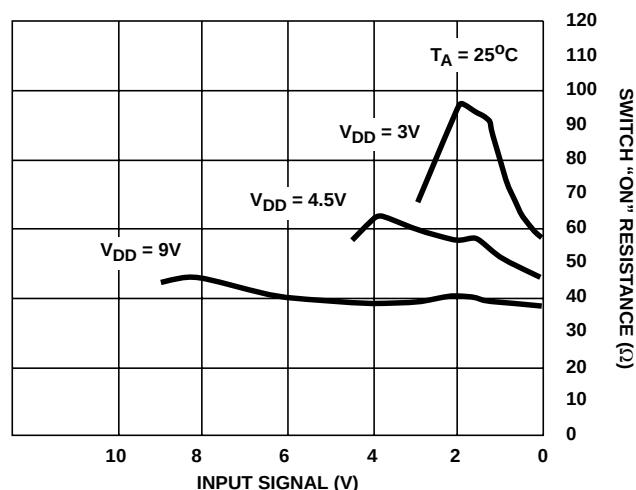


FIGURE 8. TYPICAL "ON" RESISTANCE AS A FUNCTION OF INPUT SIGNAL VOLTAGE vs V_{DD}

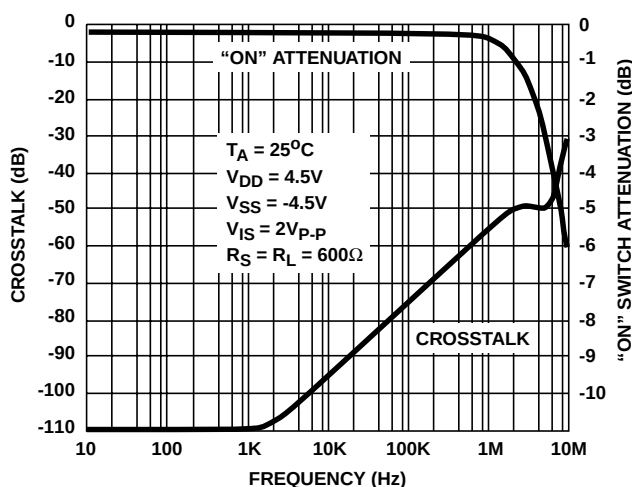


FIGURE 9. TYPICAL "ON" SWITCH ATTENUATION AND CROSSTALK AS A FUNCTION OF FREQUENCY

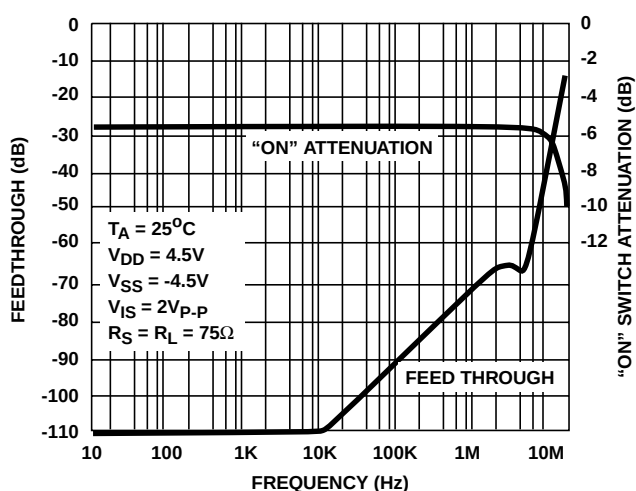


FIGURE 10. TYPICAL "ON" SWITCH ATTENUATION AND "OFF" SWITCH FEED THROUGH AS A FUNCTION OF FREQUENCY

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