

Quad Bilateral Switch

IW4016B

General Description

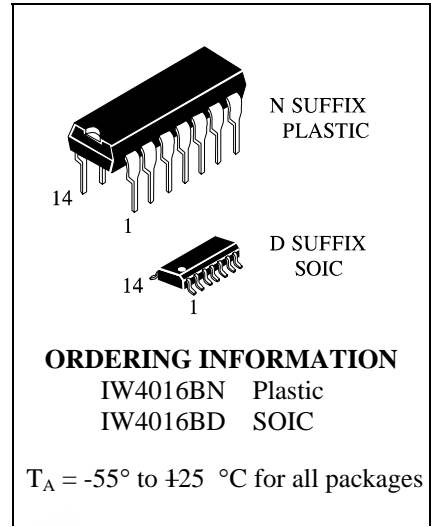
The IW4016B is a quad bilateral switch intended for the transmission or multiplexing of analog or digital signals.

Features

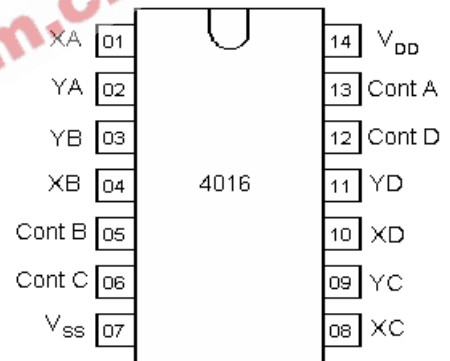
- Wide supply voltage range: 3V to 15V
- Wide range of digital and analog switching: $\pm 7.5 V_{PEAK}$
- "ON" resistance for 15V operation: 400Ω (typ.)
- Matched "ON" resistance over 15V signal input: $\Delta R_{ON} = 10 \Omega$ (typ.)
- High degree of linearity:
 - 0.4% distortion (typ.)
 - @ $f_{IS} = 1 \text{ kHz}$, $V_{IS} = 5 V_{p-p}$
 - $V_{DD} - V_{SS} = 10V$, $R_L = 10 \text{ k}\Omega$
- Extremely low "OFF" switch leakage:
 - 0.1 nA (typ.)
 - @ $V_{DD} - V_{SS} = 10V$
 - $T_A = 25^\circ C$
- Extremely high control input impedance: 10^{12} (typ.)
- Low crosstalk between switches:
 - 50 dB (typ.)
 - @ $f_{IS} = 0.9 \text{ MHz}$, $R_L = 1 \text{ k}\Omega$
- Frequency response, switch "ON": 40 MHz (typ.)

Applications

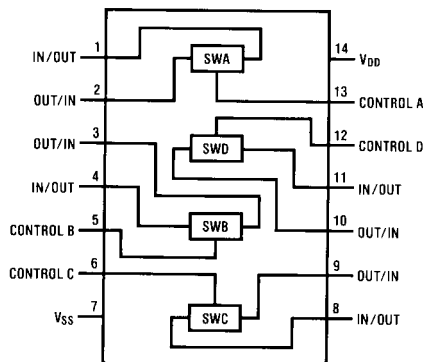
- Analog signal switching/multiplexing
 - Signal gating
 - Squelch control
 - Chopper
 - Modulator/Demodulator
 - Commutating switch
- Digital signal switching/multiplexing
- CMOS logic implementation
- Analog-to-digital/digital-to-analog conversion
- Digital control of frequency, impedance, phase, and analog-signal gain



Pin Assignment



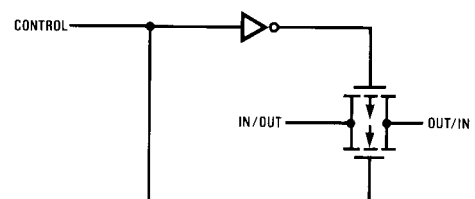
Functional Diagram



FUNCTION TABLE

INPUT of Control	Analog Switch Mode
L	Close
H	Open

Schematic Diagram



Absolute Maximum Ratings (Note 1)

(Note 2)

V_{DD} Supply Voltage	-0.5V to +18V
V_{IN} Input Voltage	-0.5V to $V_{DD} + 0.5V$
T_S Storage Temperature Range	-65°C to +150°C
Power Dissipation (P_D)	
Dual-In-Line	700 mW
Small Outline	500 mW
Lead Temperature	
(Soldering, 10 seconds)	260°C

Recommended Operating**Conditions** (Note 2)

V_{DD} Supply Voltage	3V to 15V
V_{IN} Input Voltage	0V to V_{DD}
T_A Operating Temperature Range	-40°C to +85°C

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Recommended Operating Conditions" and "Electrical Characteristics" provide conditions for actual device operation.

Note 2: $V_{SS} = 0V$ unless otherwise specified.

DC Electrical Characteristics (Note 2)

Parameter, Units	Symbol	Conditions, Units				Limits							
		V_{IL} , V	V_{IH} , V	I_O , mA	V_{DD} , V	-55°C		125°C		25°C			
						Min	Max	Min	Max	Min	Max		
Low Level Input Voltage, V	V_{ILC}		-	-	5.0	-	0.9	-	0.4	-	0.7		
			-	-	10	-	0.9	-	0.4	-	0.7		
			-	-	15	-	0.9	-	0.4	-	0.7		
High Level Input Voltage, V	V_{IHC}		-	-	5.0	3.5	-	3.5	-	3.5	-		
			-	-	10	7	-	7	-	7	-		
			-	-	15	11	-	11	-	11	-		
Switch Output Voltage, V	V_{OS}	$V_{IS}=0\text{ B}$		0.25	5.0	0.4	-	-	-	-	-		
				0.14	5.0	-	-	0.4	-	-	-		
				0.2	5.0	-	-	-	-	0.4	-		
				0.62	10	0.5	-	-	-	-	-		
				0.36	10	-	-	0.5	-	-	-		
				0.5	10	-	-	-	-	-	0.5		
				1.8	15	1.5	-	-	-	-	-		
				1.1	15	-	-	1.5	-	-	-		
				1.5	15	-	-	-	-	-	1.5		
				$V_{IS}=5.0\text{ V}$		-0.25	5.0	4.6	-	-	-	-	-
						-0.14	5.0	-	-	4.6	-	-	-
						-0.2	5.0	-	-	-	-	-	4.6
				$V_{IS}=10\text{ V}$		-0.62	10	9.5	-	-	-	-	-
						-0.36	10	-	-	9.5	-	-	-
						-0.5	10	-	-	-	-	-	9.5
$V_{IS}=15\text{ V}$		-1.8	15	13.5	-	-	-	-	-				
		-1.1	15	-	-	13.5	-	-	-				
		-1.5	15	-	-	-	-	-	13.5				

DC Electrical Characteristics (continue)

Parameter, Units	Symbol	Conditions, Units				Limits						
		V _{IL} , V	V _{IH} , V	I _O , mA	V _{DD} , V	-55°C		125°C		25°C		
						Min	Max	Min	Max	Min	Max	
Input/Output Overshoot Voltage Amplitude, mV	V _{AIO}	V _C =10 V, R _L =10 kOhm, t _{LH} =t _{HL} ≤20 nsec			10	-	-	-	-	-	50*	
Quiescent Device Current, uA	I _{DD}		-	-	5.0	-	0.25	-	7.5	-	0.25	
			-	-	10	-	0.5	-	15	-	0.5	
			-	-	15	-	1.0	-	30	-	1.0	
			-	-	20	-	5.0	-	150	-	5.0	
Input/Output Leakage, uA	I _{LIO}	0	18	-	18	-	±0.1	-	±1.0	-	±0.1	
Low Level Input Current, uA	I _{IL}	0	-	-	18	-	-0.1	-	-1.0	-	-0.1	
High Level Input Current, uA	I _{IH}		18	-	18	-	0.1	-	1.0	-	0.1	

Note 3: If the switch input is held at V_{DD}, V_{IHC} is the control input level that will cause the switch output to meet the standard "B" series V_{OH} and I_{OH} output levels. If the analog switch input is connected to V_{SS}, V_{IHC} is the control input level — which allows the switch to sink standard "B" series |I_{OH}|, high level current, and still maintain a V_{OL} ≤ "B" series. These currents are shown in Figure 8.

AC Electrical Characteristics (Note 4)

$T_A = 25^\circ\text{C}$, $t_r = t_f = 20\text{ ns}$ and $V_{SS} = 0\text{V}$ unless otherwise specified

Parameter, Units	Symbol	Conditions,				Limits					
		Units				-55°C		+125°C		+25°C	
		V_{IL} , V	V_{IH} , V	I_O , mA	V_{DD} , V	Min	Max	Min	Max	Min	Max
Propagation Delay Time Control Input to Signal Output Logical Level to High Impedance (Propagation Delay Time Control Input to Signal Output High Impedance to Logical Level), nsec	t_{PHZ} (t_{PZH}) t_{PLZ} (t_{PZL})	$t_{LH}=t_{HL}\leq 20\text{ nsec}$, $C_L=50\text{ pF}$ $R_L=1\text{ kOhm}$		5.0	-	70	-	140	-	70	
				10	-	40	-	80	-	40	
				15	-	30	-	60	-	30	
Capacitance, pF		$V_C=V_{SS}=-5\text{V}$		5.0	-	-	-	-	-	4*	
- Signal Input	C_{IS}				-	-	-	-	-	4*	
- Signal Output	C_{OS}				-	-	-	-	-	4*	
- Feedthrough Capacitance	C_{IOS}				-	-	-	-	-	0.2*	
- Control Input Capacitance	C_{IN}			5.0	-	-	-	-	-	7.5	

* Typical value

Note 4: AC Parameters are guaranteed by DC correlated testing.

Note 5: These devices should not be connected to circuits with the power "ON".

Note 6: In all cases, there is approximately 5 pF of probe and jig capacitance on the output; however, this capacitance is included in C_L wherever it is specified.

Note 7: V_{IS} is the voltage at the in/out pin and V_{OS} is the voltage at the out/in pin. V_C is the voltage at the control input.

AC Electrical Characteristics (continue)

$T_A = 25^\circ\text{C}$, $t_r = t_f = 20\text{ ns}$ and $V_{SS} = 0\text{V}$ unless otherwise specified

Parameter, Units	Symbol	Conditions,				Limits					
		Units				-55°C		+125°C		+25°C	
		V_{IL} , V	V_{IH} , V	I_O , mA	V_{DD} , V	Min	Max	Min	Max	Min	Max
Harmonic Factor, %	Kh	$V_C=5\text{ V}$, $V_{SS}=-5\text{ V}$, $V_{IS}=5\text{ V}$, $R_L=10\text{ k}\Omega$, $f_{IS}=1\text{ kHz}$			5.0	-	-	-	-	0.4*	
Frequency Response – Switch “ON” (Frequency at -3dB), MHz	BW	$V_C=5\text{ V}$, $V_{SS}=-5\text{ V}$, $V_{IS}=5\text{ V}$, $R_L=1\text{ k}\Omega$, $C_L=50\text{ pF}$, $t_{LH}=t_{HL}\leq 20\text{ nsec}$ (Figure 4)			5.0	-	-	-	-	40*	
Frequency Response – Switch “OFF” (Frequency at -50dB), MHz	f_1	$V_C=5\text{ V}$, $V_{SS}=-5\text{ V}$, $V_{IS}=5\text{ V}$, $R_L=1\text{ k}\Omega$, $C_L=50\text{ pF}$, $t_{LH}=t_{HL}\leq 20\text{ nsec}$ (Figure 4)			5.0	-	-	-	-	1.25*	
Crosstalk Between Any Two Switches (Frequency at -50dB), MHz	f_2	(Figure 5)			5.0	-	-	-	-	0.9*	
Switching Frequency, MHz	f_S	$V_C=10\text{ V}$, $V_{SS}=\text{GND}$, $V_{IS}=10\text{ V}$, $R_L=1\text{ k}\Omega$, $C_L=50\text{ pF}$, $t_{LH}=t_{HL}\leq 20\text{ nsec}$ $V_{OS}=1/2 V_{OS}$ under frequency 1 kHz			10	-	-	-	-	10*	
Propagation Delay Time Signal Input to Signal Output, nsec	t_{PHL} (t_{PLH})	$t_{LH}=t_{HL}\leq 20\text{ nsec}$,			5.0	-	70	-	200	-	100
		$C_L=50\text{ pF}$			10	-	40	-	80	-	40
		$R_L=200\text{ k}\Omega$			15	-	30	-	60	-	30

* Typical value

Note 4: AC Parameters are guaranteed by DC correlated testing.

Note 5: These devices should not be connected to circuits with the power “ON”.

Note 6: In all cases, there is approximately 5 pF of probe and jig capacitance on the output; however, this capacitance is included in C_L wherever it is specified.

Note 7: V_{IS} is the voltage at the in/out pin and V_{OS} is the voltage at the out/in pin. V_C is the voltage at the control input.

AC Test Circuits and Switching Time Waveforms

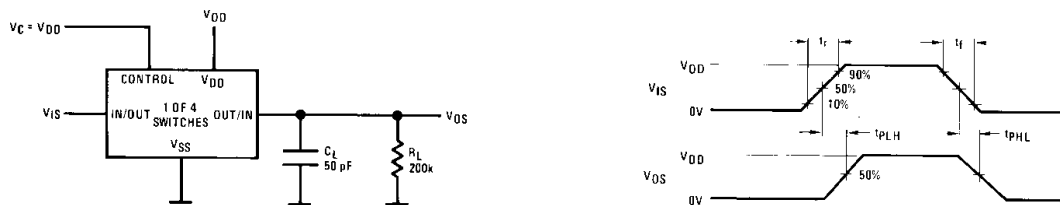


FIGURE 1. t_{PLH} , t_{PHL} Propagation Delay Time Control to Signal Output

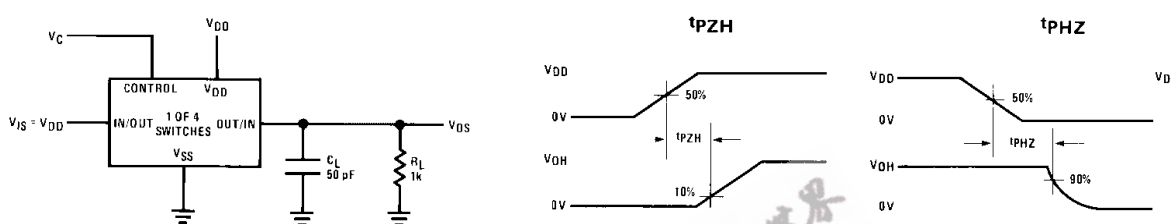


FIGURE 2. t_{PZH} , t_{PHZ} Propagation Delay Time Control to Signal Output

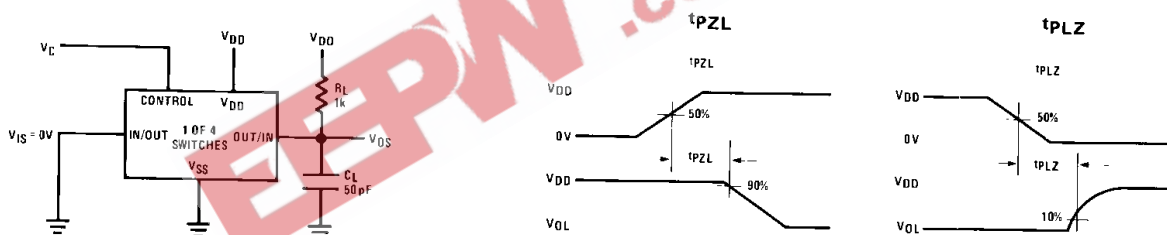
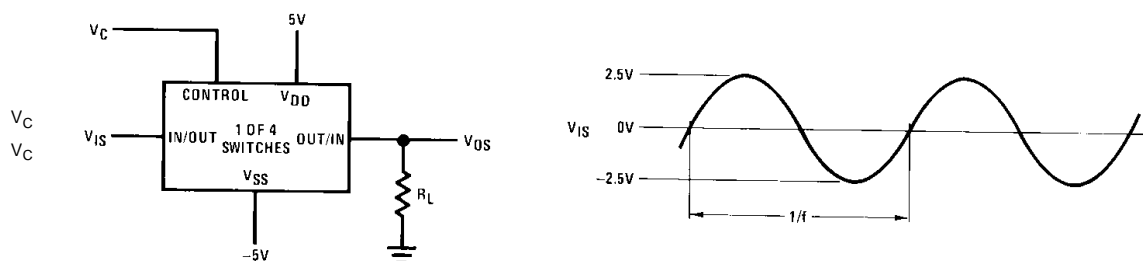


FIGURE 3. t_{PZL} , t_{PLZ} Propagation Delay Time Control to Signal Output



= V_{DD} for distortion and frequency response tests
 = V_{SS} for feedthrough test

FIGURE 4. Sine Wave Distortion, Frequency Response and Feedthrough

AC Test Circuits and Switching Time Waveforms (Continued)

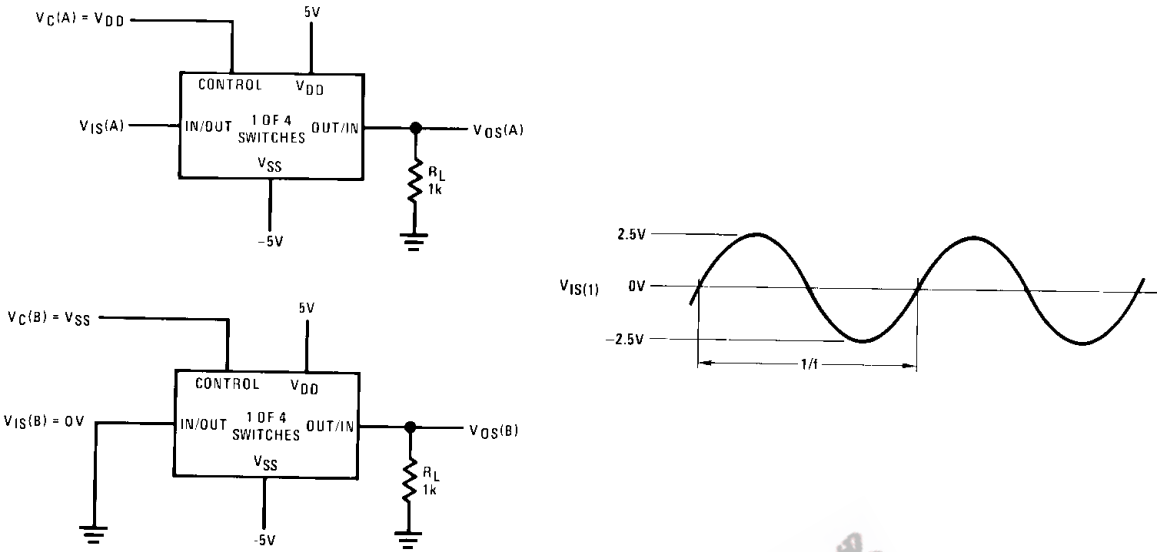


FIGURE 5. Crosstalk Between Any Two Switches

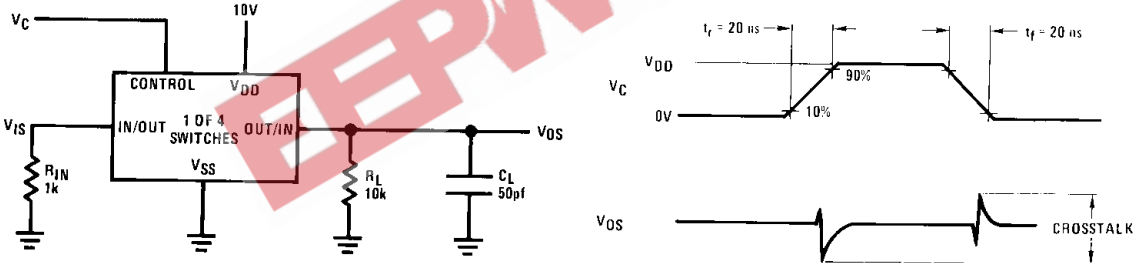


FIGURE 6. Crosstalk — Control to Input Signal Output

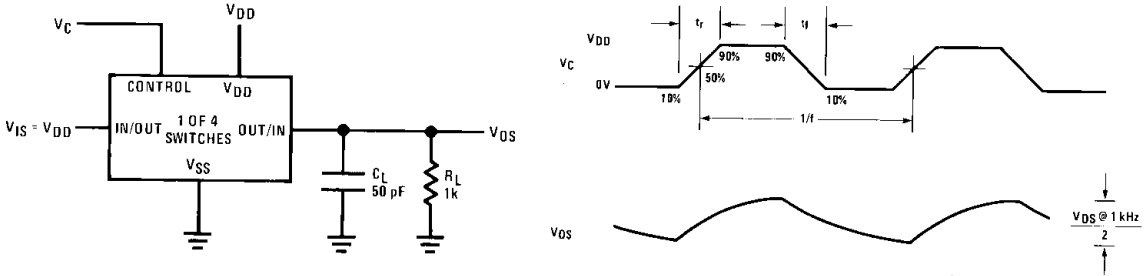
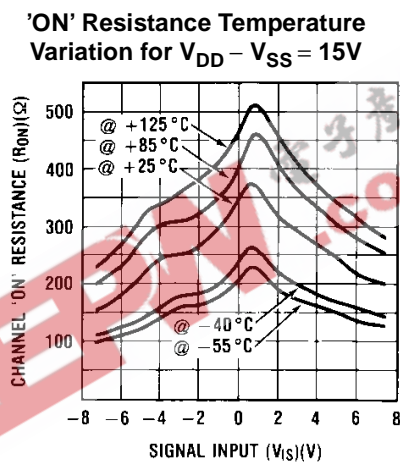
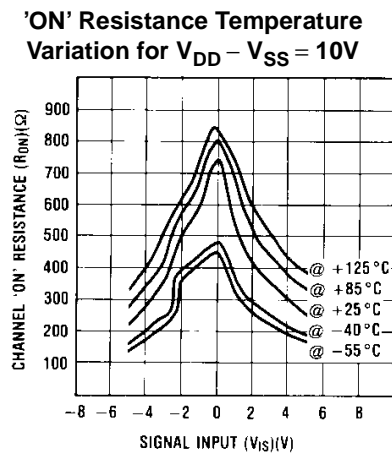
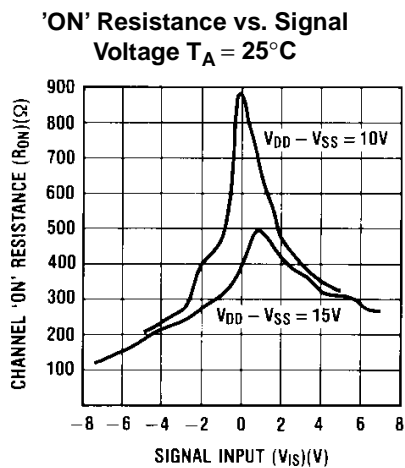
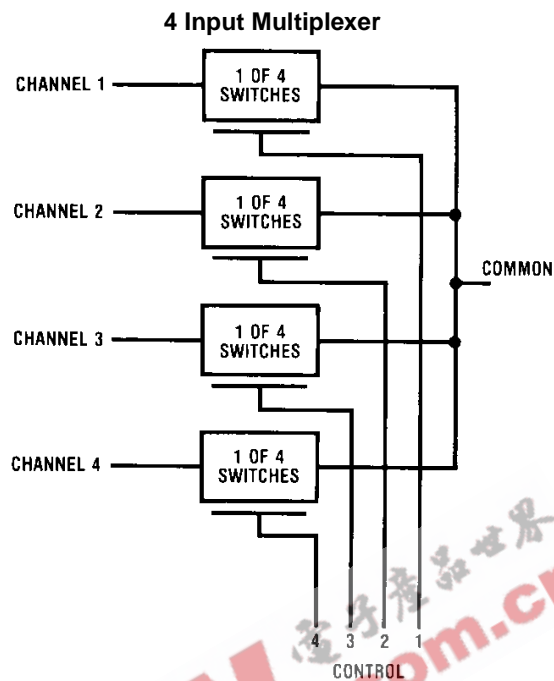


FIGURE 7. Maximum Control Input Frequency

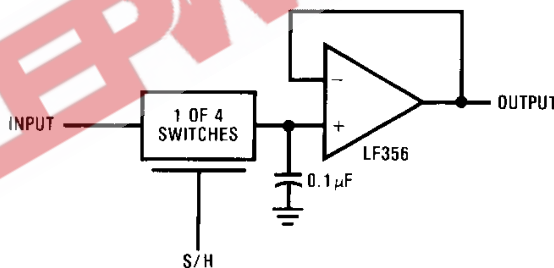
Typical Performance Characteristics



Typical Applications



Sample/Hold Amplifier

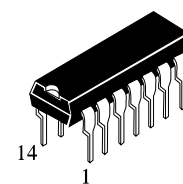
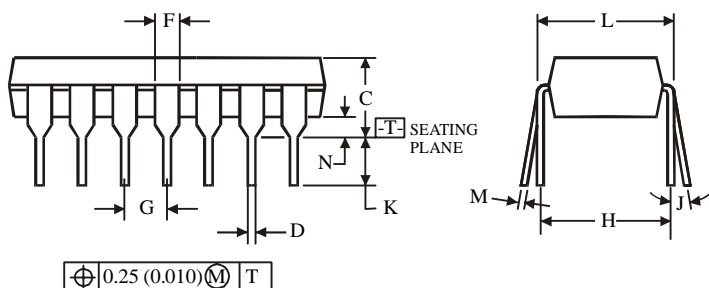
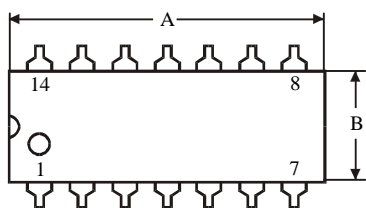


Special Considerations

The IW4016B is composed of 4, two-transistor analog switches. These switches do not have any linearization or compensation circuitry for "R_{ON}" as do the IW4066B's. Because of this, the special operating considerations for the IW4066B do not apply to the IW4016B, but at low supply voltages, $\leq 5V$, the IW4016B's on resistance becomes

non-linear. It is recommended that at 5V, voltages on the in/out pins be maintained within about 1V of either V_{DD} or V_{SS}; and that at 3V the voltages on the in/out pins should be at V_{DD} or V_{SS} for reliable operation.

N SUFFIX PLASTIC DIP
(MS - 001AA)

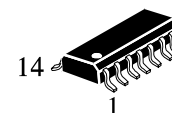
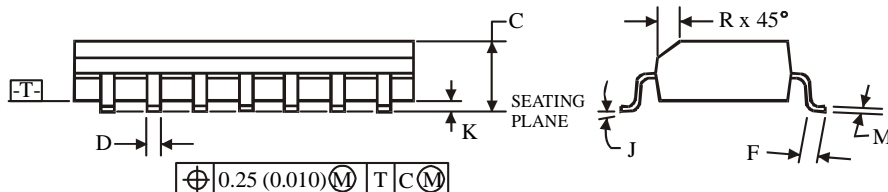
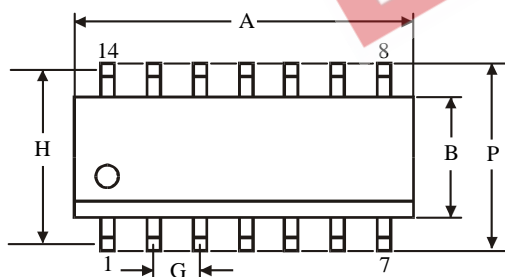


Symbol	Dimensions, mm	
	MIN	MAX
A	18.67	19.69
B	6.10	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.20	0.36
N	0.38	

NOTES:

- Dimensions "A", "B" do not include mold flash or protrusions. Maximum mold flash or protrusions 0.25 mm (0.010) per side.

D SUFFIX SOIC
(MS - 012AB)



Symbol.	Dimensions, mm	
	MIN	MAX
A	8.55	8.75
B	3.80	4.00
C	1.35	1.75
D	0.33	0.51
F	0.40	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.10	0.25
M	0.19	0.25
P	5.80	6.20
R	0.25	0.50

NOTES:

- Dimensions A and B do not include mold flash or protrusion.
- Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B - 0.25 mm (0.010) per side.