

**IN74HC221A**

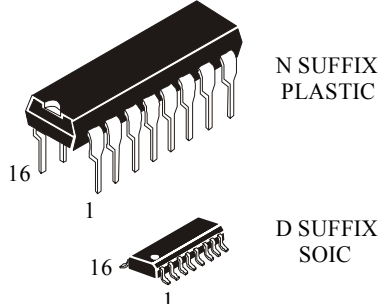
**Dual Monostable Multivibrator**

The IN74HC221A is identical in pinout to the LS/ALS221. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LS/ALSTTL outputs.

There are two trigger inputs,  $\overline{A}$  INPUT (negative edge) and B INPUT (positive edge). These inputs are valid for rising/falling signals

The device may also be triggered by using the RESET input (positive-edge) because of the Schmitt-trigger input; after triggering the output maintains the MONOSTABLE state for the time period determined by the external resistor  $R_{EXT}$  and capacitor  $C_{EXT}$ . Taking RESET low breaks this MONOSTABLE STATE. If the next trigger pulse occurs during the MONOSTABLE period it makes the MONOSTABLE period longer.

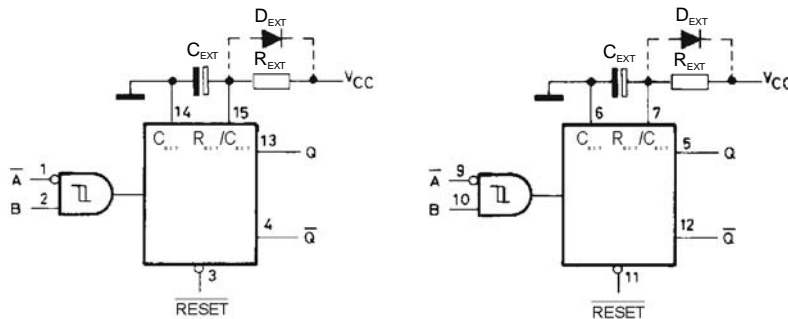
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 3.0 to 6.0 V
- Low Input Current: 1.0  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices



N SUFFIX PLASTIC  
D SUFFIX SOIC

**ORDERING INFORMATION**  
IN74HC221AN Plastic  
IN74HC221AD SOIC  
 $T_A = -55^\circ$  to  $125^\circ$  C for all packages

**LOGIC DIAGRAM**



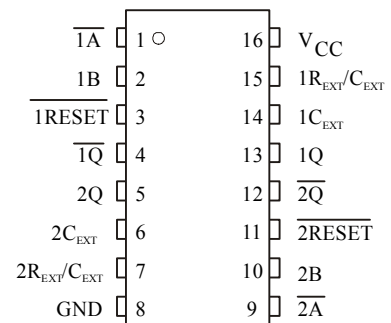
PIN 8 = GND

Note

- (1)  $C_{EXT}$ ,  $R_{EXT}$ ,  $D_{EXT}$  are external components.
- (2)  $D_{EXT}$  is a clamping diode.

The external capacitor is charged to  $V_{CC}$  in the stand-by state, i.e. no trigger. When the supply voltage is turned off  $C_X$  is discharged mainly through an internal parasitic diode. If  $C_X$  is sufficiently large and  $V_{CC}$  decreases rapidly, there will be some possibility of damaging the I.C. with a surge current or latch-up. If the voltage supply filter capacitor is large enough and  $V_{CC}$  decrease slowly, the surge current is automatically limited and damage the I.C. is avoided. The maximum forward current of the parasitic diode is approximately 20 mA.

**PIN ASSIGNMENT**



**FUNCTION TABLE**

Inputs			Outputs		Note
$\overline{A}$	B	$\overline{RESET}$	Q	$\overline{Q}$	
	H	H			Output Enable
X	L	H	L*	H*	Inhibit
H	X	H	L*	H*	Inhibit
L		H			Output Enable
L	H				Output Enable
X	X	L	L	H	Inhibit

X = don't care

\* - except for monostable period

**MAXIMUM RATINGS\***

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
V <sub>IN</sub>	DC Input Voltage (Referenced to GND)	-1.5 to V <sub>CC</sub> +1.5	V
V <sub>OUT</sub>	DC Output Voltage (Referenced to GND)	-0.5 to V <sub>CC</sub> +0.5	V
I <sub>IN</sub>	DC Input Current, per Pin A, B, RESET C <sub>EXT</sub> , R <sub>EXT</sub>	±20 ±30	mA
I <sub>OUT</sub>	DC Output Current, per Pin	±25	mA
I <sub>CC</sub>	DC Supply Current, V <sub>CC</sub> and GND Pins	±50	mA
P <sub>D</sub>	Power Dissipation in Still Air, Plastic DIP** SOIC Package**	750 500	mW
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP or SOIC Package)	260	°C

\*Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

\*\*Derating - Plastic DIP: - 10 mW/°C from 65° to 125°C  
SOIC Package: - 7 mW/°C from 65° to 125°C

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	DC Supply Voltage (Referenced to GND)	3.0 *	6.0	V
V <sub>IN</sub> , V <sub>OUT</sub>	DC Input Voltage, Output Voltage (Referenced to GND)	0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature, All Package Types	-55	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time - RESET (Figure 2)	V <sub>CC</sub> =2.0 V 0 0	1000 500 400	ns
	A or B	-	No Limit	
R <sub>X</sub>	External Timing Resistor	V <sub>CC</sub> <4.5 V 2.0	1000 1000	kΩ
C <sub>X</sub>	External Timing Capacitor	0	No Limit	μF

\* The IN74HC221A will function at 2.0 V but for optimum pulse width stability, V<sub>CC</sub> should be above 3.0 V.

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V<sub>IN</sub> and V<sub>OUT</sub> should be constrained to the range GND ≤ (V<sub>IN</sub> or V<sub>OUT</sub>) ≤ V<sub>CC</sub>.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.

**DC ELECTRICAL CHARACTERISTICS** (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V <sub>CC</sub> V	Guaranteed Limit			Unit
				-55°C to 25 °C	≤85 °C	≤125 °C	
V <sub>IL</sub>	Maximum Low-Level Input Voltage	V <sub>OUT</sub> ≤ 0.1 V or V <sub>CC</sub> = 0.1 V  I <sub>OUT</sub>   ≤ 20 μA	2.0 4.5 6.0	0.3 0.9 1.2	0.3 0.9 1.2	0.3 0.9 1.2	V
V <sub>IH</sub>	Minimum High-Level Input Voltage	V <sub>OUT</sub> ≤ 0.1 V or V <sub>CC</sub> = 0.1 V  I <sub>OUT</sub>   ≤ 20 μA	2.0 4.5 6.0	1.5 3.15 4.2	1.5 3.15 4.2	1.5 3.15 4.2	V
V <sub>OL</sub>	Maximum Low-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 20 μA	2.0 4.5 6.0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 4.0 mA	4.5	0.26	0.33	0.4	
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 5.2 mA	6.0	0.26	0.33	0.40	
V <sub>OH</sub>	Minimum High-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ -20 μA	2.0 4.5 6.0	1.9 4.4 5.9	1.9 4.4 5.9	1.9 4.4 5.9	V
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ -4.0 mA	4.5	3.98	3.84	3.70	
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ -5.2 mA	6.0	5.48	5.34	5.2	
I <sub>IL</sub>	Maximum Low-Level Output Current	V <sub>IL</sub> = GND V <sub>IH</sub> = V <sub>CC</sub>	6.0	-0.1	-1.0	-1.0	μA
I <sub>IH</sub>	Minimum High-Level Input Current	V <sub>IL</sub> = GND V <sub>IH</sub> = V <sub>CC</sub>	6.0	0.1	1.0	1.0	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current (per Package) Standby State	V <sub>IL</sub> = GND V <sub>IH</sub> = V <sub>CC</sub> I <sub>OUT</sub> = 0 μA	6.0	8.0	80	160	μA
I <sub>CC1</sub>	Maximum Supply Current (per Package) Active State	V <sub>IL</sub> = GND V <sub>IH</sub> = V <sub>CC</sub> I <sub>OUT</sub> = 0 μA V <sub>IN</sub> = 0.5 V <sub>CC</sub>	2.0 4.5 6.0	0.08 1.0 2.0	0.11 1.3 2.6	0.13 1.6 3.2	mA

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter		Test Conditions	V <sub>CC</sub> V	Guaranteed Limit			Unit	
					-55°C to 25°C	≤85 °C	≤125 °C		
t <sub>PHL</sub>	Maximum Propagation Delay	A, B - $\overline{Q}$	V <sub>IL</sub> =0 V	2.0	180	225	270	ns	
			V <sub>IH</sub> =V <sub>CC</sub>	4.5	36	45	54		
			t <sub>LH</sub> =t <sub>HL</sub> =6 ns	6.0	31	38	46		
		$\overline{\overline{\text{RESET}}}$ - Q	C <sub>L</sub> =50 pF	2.0	180	225	270		
			C <sub>EXT</sub> =0	4.5	36	45	54		
			R <sub>EXT</sub> =5 kΩ	6.0	31	38	46		
		$\overline{\overline{\text{RESET}}} - \overline{Q}$		2.0	195	245	295		
				4.5	39	49	59		
				6.0	33	42	50		
t <sub>PLH</sub>	Maximum Propagation Delay	A, B - Q	V <sub>IL</sub> =0 V	2.0	220	275	330	ns	
			V <sub>IH</sub> =V <sub>CC</sub>	4.5	44	55	66		
			t <sub>LH</sub> =t <sub>HL</sub> =6 ns	6.0	37	47	56		
		$\overline{\overline{\text{RESET}}}$ - Q	C <sub>L</sub> =50 pF	2.0	245	305	370		
			C <sub>EXT</sub> =0	4.5	49	61	74		
			R <sub>EXT</sub> =5 kΩ	6.0	42	52	63		
		$\overline{\overline{\text{RESET}}} - \overline{Q}$		2.0	200	250	300		
				4.5	40	50	60		
				6.0	34	43	51		
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output Transition Time, Any Output(Figures 2 and 3)		V <sub>IL</sub> =0 V	2.0	75	95	110	ns	
		V <sub>IH</sub> =V <sub>CC</sub>	4.5	16	20	22			
		t <sub>LH</sub> =t <sub>HL</sub> =6 ns C <sub>L</sub> =50 pF	6.0	14	17	20			
C <sub>IN</sub>	Maximum Input Capacitance	$\overline{A}$ , B, $\overline{\overline{\text{RESET}}}$ C <sub>X</sub> , R <sub>X</sub>		-	10 20	10 20	10 20	pF	
C <sub>PD</sub>	Power Dissipation Capacitance (Per Multivibrator) P <sub>D</sub> =C <sub>PD</sub> V <sub>CC</sub> <sup>2</sup> f+I <sub>CC</sub> V <sub>CC</sub>			5.0	180*			pF	
t <sub>rec</sub>	Minimum Recovery Time, Inactive to A or B (Figure 2)		V <sub>IL</sub> =0 V	2.0	100	125	150	ns	
			V <sub>IH</sub> =V <sub>CC</sub>	4.5	20	25	30		
			t <sub>LH</sub> =t <sub>HL</sub> =6 ns C <sub>L</sub> =50 pF	6.0	17	21	26		
t <sub>w</sub>	Minimum Pulse Width	A, RESET	V <sub>IL</sub> =0 V	2.0	25	95	110	ns	
			V <sub>IH</sub> =V <sub>CC</sub>	4.5	9	19	22		
			t <sub>LH</sub> =t <sub>HL</sub> =6 ns	6.0	7	16	19		
		B	C <sub>L</sub> =50 pF	2.0	30	115	135		
			C <sub>EXT</sub> =0	4.5	11	23	27		
			R <sub>EXT</sub> =5 kΩ	6.0	9	20	23		
t <sub>wQ</sub>	Minimum Pulse Width (Figure 4)		C <sub>EXT</sub> =0 pF R <sub>EXT</sub> =5 kΩ	5.0	105*			ns	
			C <sub>EXT</sub> =1 nF R <sub>EXT</sub> =10 kΩ	2.0	0.80*				μs
				4.5	0.75*				
				6.0	0.70*				
			C <sub>EXT</sub> =1 μF R <sub>EXT</sub> =10 kΩ	2.0	80*				
				4.5	75*				
				6.0	70*				

\* T<sub>A</sub>=25±10°C

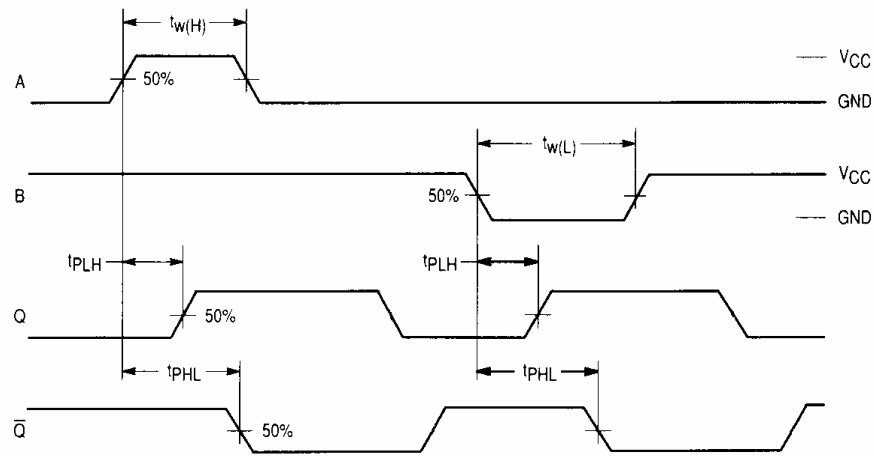


Figure 1. Switching Waveforms

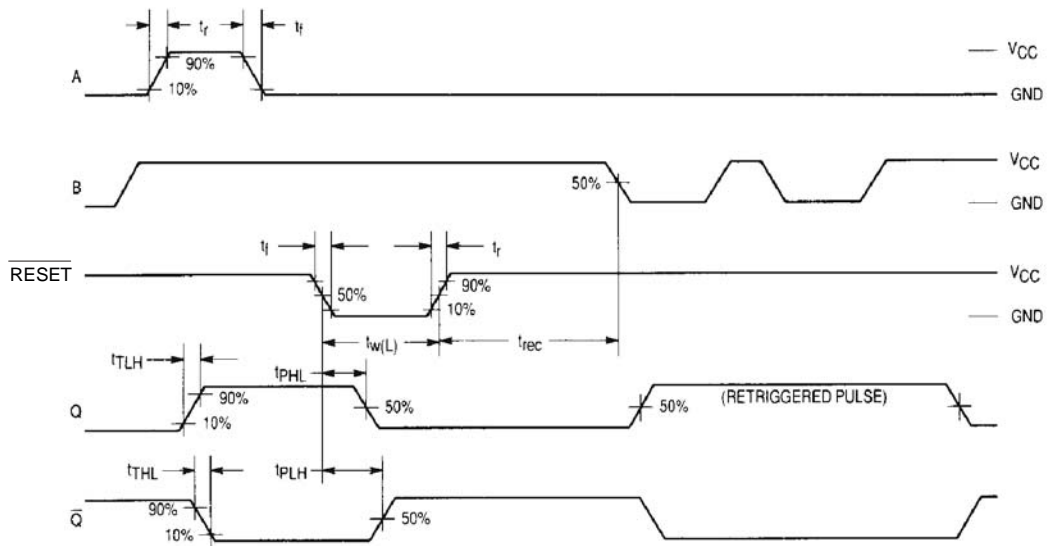
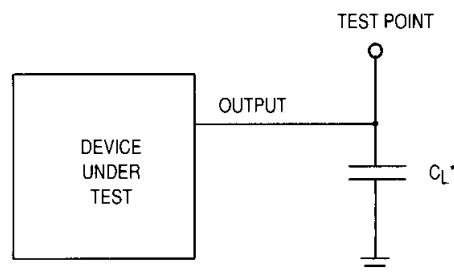


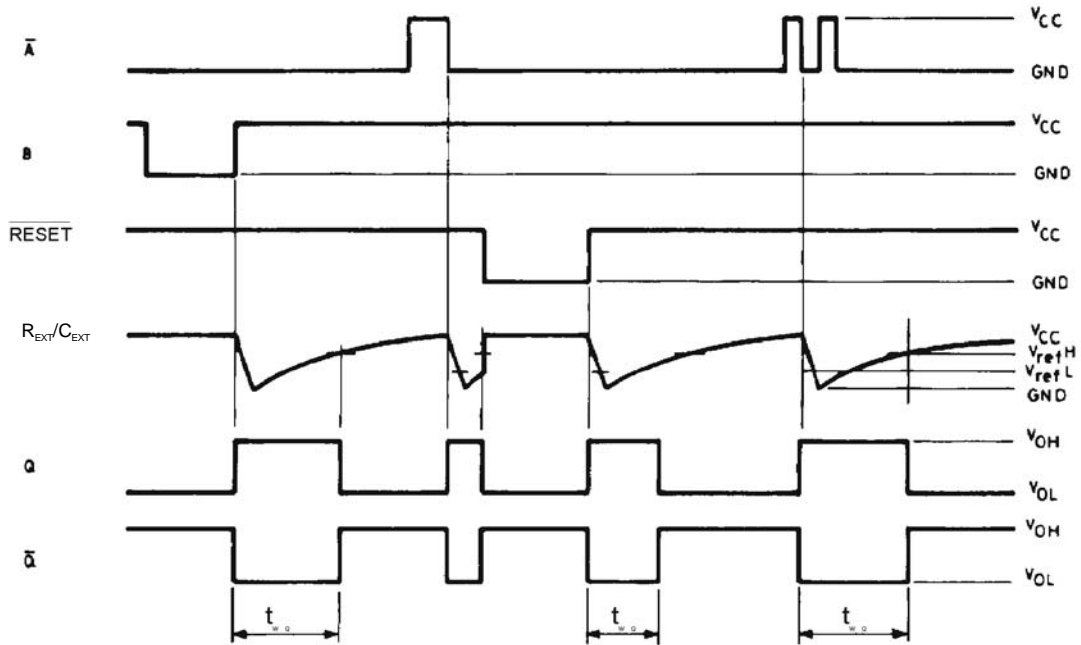
Figure 2. Switching Waveforms



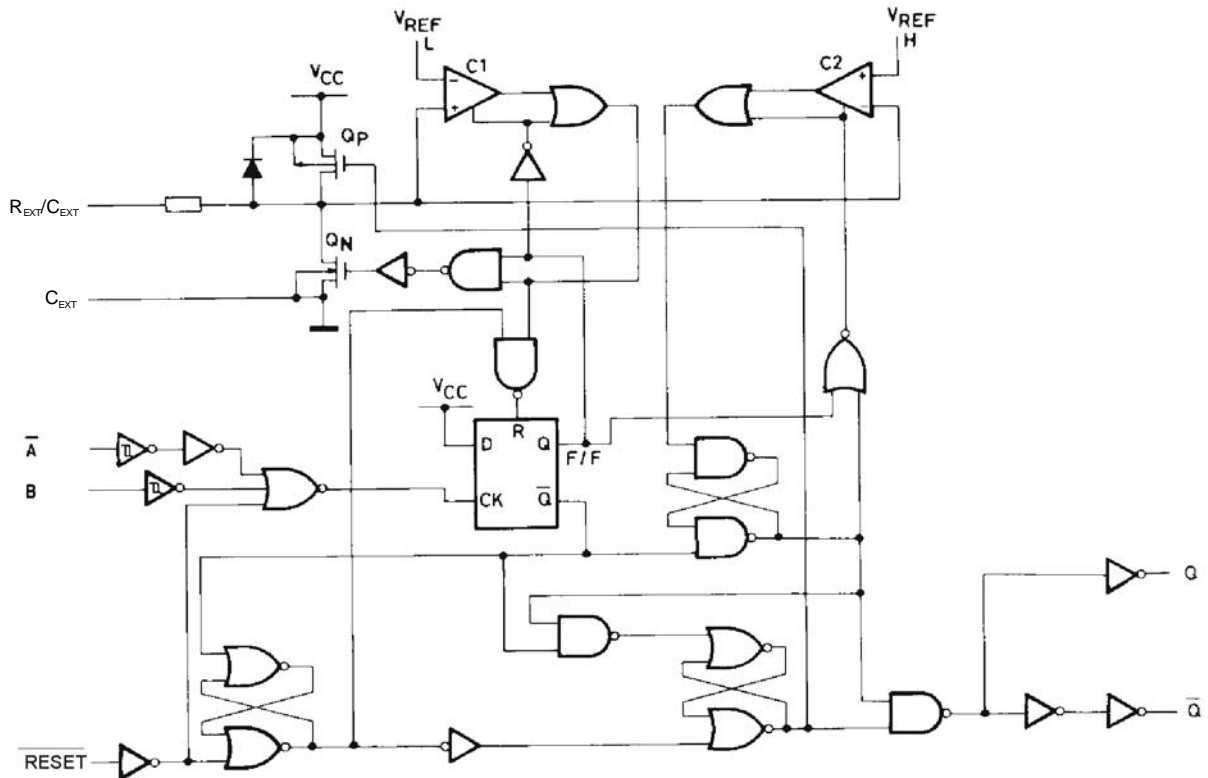
\*Includes all probe and jig capacitance

Figure 3. Test Circuit

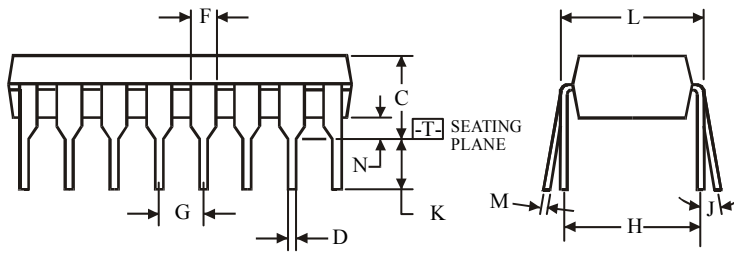
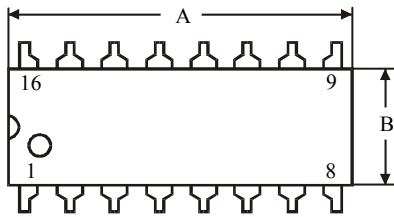
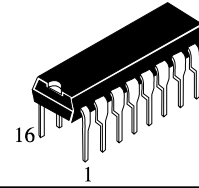
**TIMING DIAGRAM**



**EXPANDED LOGIC DIAGRAM**



**N SUFFIX PLASTIC DIP  
(MS - 001BB)**



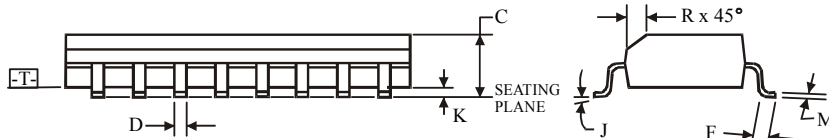
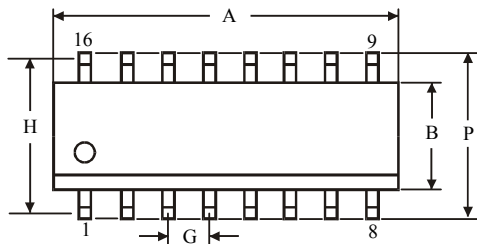
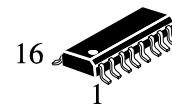
$\oplus 0.25 (0.010) \text{M} \text{T}$

**NOTES:**

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

Symbol	Dimension, mm	
	MIN	MAX
A	18.67	19.69
B	6.1	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	0.2	0.36
N	0.38	

**D SUFFIX SOIC  
(MS - 012AC)**



$\oplus 0.25 (0.010) \text{M} \text{T} \text{C} \text{M}$

**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.

Symbol	Dimension, mm	
	MIN	MAX
A	9.8	10
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5