

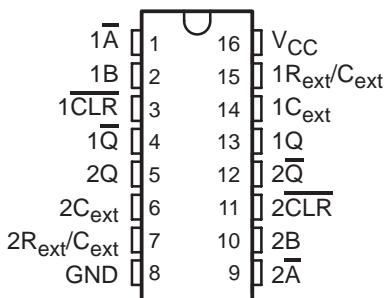
# SN54LV221A, SN74LV221A DUAL MONOSTABLE MULTIVIBRATORS WITH SCHMITT-TRIGGER INPUTS

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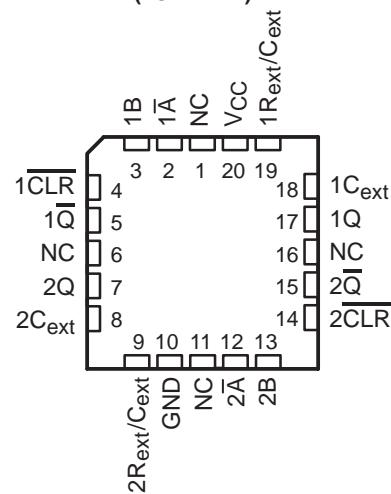
- 2-V to 5.5-V  $V_{CC}$  Operation
- Max  $t_{pd}$  of 11 ns at 5 V
- Support Mixed-Mode Voltage Operation on All Ports
- Schmitt-Trigger Circuitry on  $\overline{A}$ ,  $B$ , and  $\overline{CLR}$  Inputs for Slow Input Transition Rates
- Overriding Clear Terminates Output Pulse
- Glitch-Free Power-Up Reset on Outputs

- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

SN54LV221A . . . J OR W PACKAGE  
SN74LV221A . . . D, DB, DGV, NS, OR PW PACKAGE  
(TOP VIEW)



SN54LV221A . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## description/ordering information

### ORDERING INFORMATION

TA	PACKAGE <sup>†</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	SOIC – D	Tube of 40	SN74LV221AD	LV221A
		Reel of 2500	SN74LV221ADR	
	SOP – NS	Reel of 2000	SN74LV221ANSR	74LV221A
	SSOP – DB	Reel of 2000	SN74LV221ADBR	LV221A
	TSSOP – PW	Tube of 90	SN74LV221APW	LV221A
		Reel of 2000	SN74LV221APWR	
		Reel of 250	SN74LV221APWT	
-55°C to 125°C	TVSOP – DGV	Reel of 2000	SN74LV221ADGVR	LV221A
	CDIP – J	Tube of 25	SNJ54LV221AJ	SNJ54LV221AJ
	CFP – W	Tube of 150	SNJ54LV221AW	SNJ54LV221AW
	LCCC – FK	Tube of 55	SNJ54LV221AFK	SNJ54LV221AFK

<sup>†</sup> Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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## description/ordering information (continued)

The 'LV221A devices are dual multivibrators designed for 2-V to 5.5-V  $V_{CC}$  operation. Each multivibrator has a negative-transition-triggered ( $\bar{A}$ ) input and a positive-transition-triggered (B) input, either of which can be used as an inhibit input.

These edge-triggered multivibrators feature output pulse-duration control by three methods. In the first method, the  $\bar{A}$  input is low and the B input goes high. In the second method, the B input is high and the  $\bar{A}$  input goes low. In the third method, the  $\bar{A}$  input is low, the B input is high, and the clear ( $CLR$ ) input goes high.

The output pulse duration is programmable by selecting external resistance and capacitance values. The external timing capacitor must be connected between  $C_{ext}$  and  $R_{ext}/C_{ext}$ (positive) and an external resistor connected between  $R_{ext}/C_{ext}$  and  $V_{CC}$ . To obtain variable pulse durations, connect an external variable resistor between  $R_{ext}/C_{ext}$  and  $V_{CC}$ . The output pulse duration also can be reduced by taking  $CLR$  low.

Pulse triggering occurs at a particular voltage level and is not related directly to the transition time of the input pulse. The  $\bar{A}$ , B, and  $CLR$  inputs have Schmitt triggers with sufficient hysteresis to handle slow input transition rates with jitter-free triggering at the outputs.

Once triggered, the outputs are independent of further transitions of the  $\bar{A}$  and B inputs and are a function of the timing components, or the output pulses can be terminated by the overriding clear. Input pulses can be of any duration relative to the output pulse. Output pulse duration can be varied by choosing the appropriate timing components. Output rise and fall times are TTL compatible and independent of pulse duration. Typical triggering and clearing sequences are illustrated in the input/output timing diagram.

The variance in output pulse duration from device to device typically is less than  $\pm 0.5\%$  for given external timing components. An example of this distribution for the 'LV221A is shown in Figure 8. Variations in output pulse duration versus supply voltage and temperature are shown in Figure 5.

During power up, Q outputs are in the low state, and  $\bar{Q}$  outputs are in the high state. The outputs are glitch free, without applying a reset pulse.

These devices are fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down.

Pin assignments are identical to those of the 'AHC123A and 'AHCT123A devices, so the 'LV221A can be substituted for those devices not using the retrigger feature.

For additional application information on multivibrators, see the application report *Designing With The SN74AHC123A and SN74AHCT123A*, literature number SCLA014.



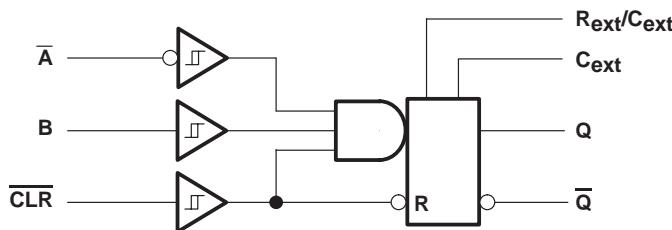
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FUNCTION TABLE  
 (each multivibrator)

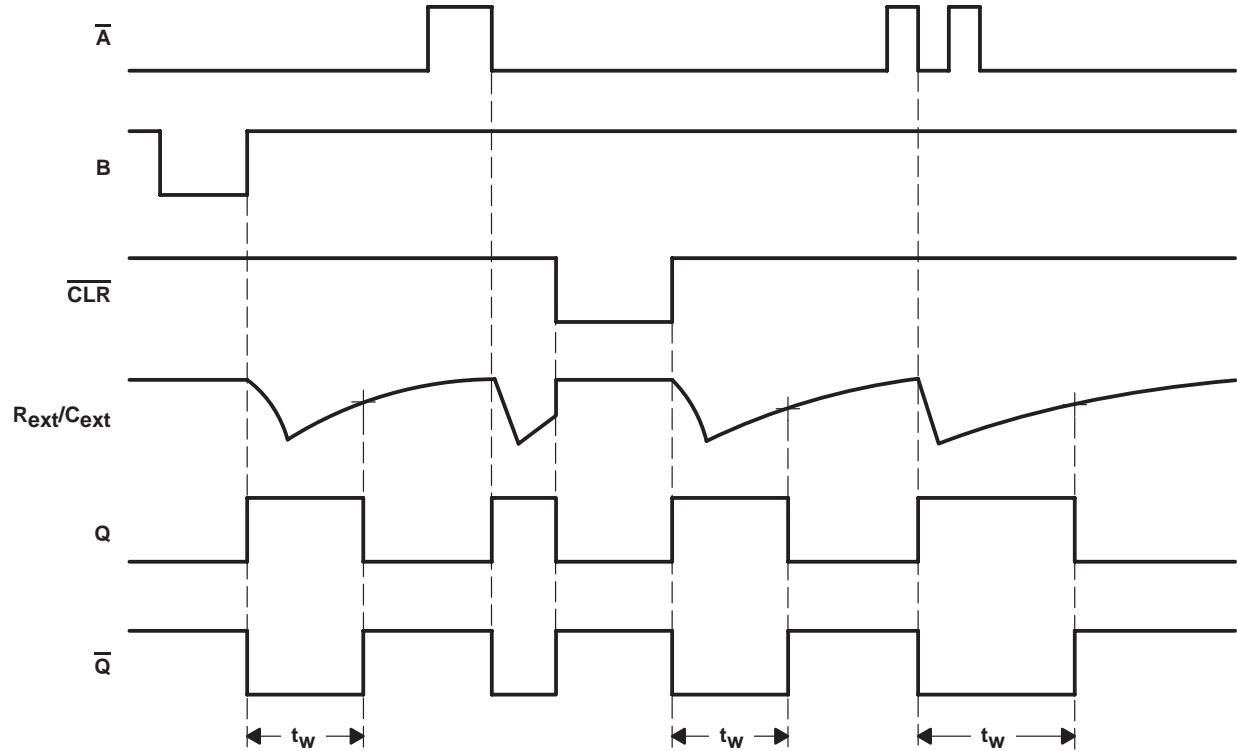
INPUTS			OUTPUTS		FUNCTION
CLR	$\bar{A}$	B	Q	$\bar{Q}$	
L	X	X	L	H	Reset
H	H	X	L	H	Inhibit
H	X	L	L	H	Inhibit
H	L	↑	↑	↑	Outputs enabled
H	↓	H	↑	↑	Outputs enabled
↑↑	L	H	↑	↑	Outputs enabled

<sup>†</sup>This condition is true only if the output of the latch formed by the NAND gate has been conditioned to the logic 1 state prior to CLR going high. This latch is conditioned by taking either A high or B low while CLR is inactive (high).

### logic diagram, each multivibrator (positive logic)



### input/output timing diagram



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**absolute maximum ratings over operating free-air temperature (unless otherwise noted)<sup>†</sup>**

Supply voltage range, $V_{CC}$ .....	-0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1) .....	-0.5 V to 7 V
Output voltage range in high or low state, $V_O$ (see Notes 1 and 2) .....	-0.5 V to $V_{CC}$ + 0.5 V
Output voltage range in power-off state, $V_O$ (see Note 1) .....	-0.5 V to 7 V
Input clamp current, $I_{IK}$ ( $V_I < 0$ ) .....	-20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ ) .....	-50 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) .....	$\pm 25$ mA
Continuous current through $V_{CC}$ or GND .....	$\pm 50$ mA
Package thermal impedance, $\theta_{JA}$ (see Note 3):	
D package .....	73°C/W
DB package .....	82°C/W
DGV package .....	120°C/W
NS package .....	64°C/W
PW package .....	108°C/W
Storage temperature range, $T_{stg}$ .....	-65°C to 150°C

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.  
2. This value is limited to 5.5 V maximum.  
3. The package thermal impedance is calculated in accordance with JESD 51-7.



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**recommended operating conditions (see Note 4)**

		SN54LV221A		SN74LV221A		UNIT
		MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage	2	5.5	2	5.5	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2 V	1.5	1.5	1.5	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	V <sub>CC</sub> × 0.7	V <sub>CC</sub> × 0.7	V <sub>CC</sub> × 0.7	
		V <sub>CC</sub> = 3 V to 3.6 V	V <sub>CC</sub> × 0.7	V <sub>CC</sub> × 0.7	V <sub>CC</sub> × 0.7	
		V <sub>CC</sub> = 4.5 V to 5.5 V	V <sub>CC</sub> × 0.7	V <sub>CC</sub> × 0.7	V <sub>CC</sub> × 0.7	
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2 V	0.5	0.5	0.5	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	V <sub>CC</sub> × 0.3	V <sub>CC</sub> × 0.3	V <sub>CC</sub> × 0.3	
		V <sub>CC</sub> = 3 V to 3.6 V	V <sub>CC</sub> × 0.3	V <sub>CC</sub> × 0.3	V <sub>CC</sub> × 0.3	
		V <sub>CC</sub> = 4.5 V to 5.5 V	V <sub>CC</sub> × 0.3	V <sub>CC</sub> × 0.3	V <sub>CC</sub> × 0.3	
V <sub>I</sub>	Input voltage	0	5.5	0	5.5	V
V <sub>O</sub>	Output voltage	0	V <sub>CC</sub>	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 2 V	-50	-50	-50	μA
		V <sub>CC</sub> = 2.3 V to 2.7 V	-2	-2	-2	mA
		V <sub>CC</sub> = 3 V to 3.6 V	-6	-6	-6	
		V <sub>CC</sub> = 4.5 V to 5.5 V	-12	-12	-12	
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 2 V	50	50	50	μA
		V <sub>CC</sub> = 2.3 V to 2.7 V	2	2	2	mA
		V <sub>CC</sub> = 3 V to 3.6 V	6	6	6	
		V <sub>CC</sub> = 4.5 V to 5.5 V	12	12	12	
R <sub>ext</sub>	External timing resistance	V <sub>CC</sub> = 2 V	5k	5k	5k	Ω
		V <sub>CC</sub> ≥ 3 V	1k	1k	1k	
C <sub>ext</sub>	External timing capacitance	No restriction		No restriction		pF
ΔI/ΔV <sub>CC</sub>	Power-up ramp rate	1		1		ms/V
T <sub>A</sub>	Operating free-air temperature	-55	125	-40	85	°C

NOTE 4: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	SN54LV221A			SN74LV221A			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -50 µA	2 V to 5.5 V	V <sub>CC</sub> -0.1			V <sub>CC</sub> -0.1			V
	I <sub>OH</sub> = -2 mA	2.3 V	2			2			
	I <sub>OH</sub> = -6 mA	3 V	2.48			2.48			
	I <sub>OH</sub> = -12 mA	4.5 V	3.8			3.8			
V <sub>OL</sub>	I <sub>OL</sub> = 50 µA	2 V to 5.5 V		0.1			0.1		V
	I <sub>OL</sub> = 2 mA	2.3 V		0.4			0.4		
	I <sub>OL</sub> = 6 mA	3 V		0.44			0.44		
	I <sub>OL</sub> = 12 mA	4.5 V		0.55			0.55		
I <sub>I</sub>	R <sub>ext</sub> /C <sub>ext</sub> <sup>†</sup>	V <sub>I</sub> = 5.5 V or GND	2 V to 5.5 V		±2.5			±2.5	µA
	A, B, and CLR	V <sub>I</sub> = 5.5 V or GND	0		±1			±1	
			0 to 5.5 V		±1			±1	
I <sub>CC</sub>	Quiescent	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V		20			20	µA
I <sub>CC</sub>	Active state (per circuit)	V <sub>I</sub> = V <sub>CC</sub> or GND, R <sub>ext</sub> /C <sub>ext</sub> = 0.5 V <sub>CC</sub>	2.3 V		220			220	µA
			3 V		280			280	
			4.5 V		650			650	
			5.5 V		975			975	
I <sub>off</sub>	V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5 V		0					5	µA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3 V		1.9			1.9		pF
		5 V		1.9			1.9		

<sup>†</sup> This test is performed with the terminal in the off-state condition.

**timing requirements over recommended operating free-air temperature range, V<sub>CC</sub> = 2.5 V ± 0.2 V (unless otherwise noted) (see Figure 1)**

t <sub>w</sub>	Pulse duration	CLR	T <sub>A</sub> = 25°C		SN54LV221A		SN74LV221A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>w</sub>	Pulse duration	CLR	6		6.5		6.5		ns
		A or B trigger	6		6.5		6.5		

**timing requirements over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)**

t <sub>w</sub>	Pulse duration	CLR	T <sub>A</sub> = 25°C		SN54LV221A		SN74LV221A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>w</sub>	Pulse duration	CLR	5		5		5		ns
		A or B trigger	5		5		5		

**timing requirements over recommended operating free-air temperature range, V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)**

t <sub>w</sub>	Pulse duration	CLR	T <sub>A</sub> = 25°C		SN54LV221A		SN74LV221A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>w</sub>	Pulse duration	CLR	5		5		5		ns
		A or B trigger	5		5		5		

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switching characteristics over recommended operating free-air temperature range,  $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	$T_A = 25^\circ\text{C}$			SN54LV221A		SN74LV221A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	$\bar{A}$ or B	Q or $\bar{Q}$	$C_L = 15 \text{ pF}$	14.6*	31.4*	1*	37*	1	37		ns
	$\overline{\text{CLR}}$	Q or $\bar{Q}$		13.2*	25*	1*	29.5*	1	29.5		
	CLR trigger	Q or $\bar{Q}$		15.2*	33.4*	1*	39*	1	39		
$t_{pd}$	$\bar{A}$ or B	Q or $\bar{Q}$	$C_L = 50 \text{ pF}$	16.7	36	1	42	1	42		ns
	$\overline{\text{CLR}}$	Q or $\bar{Q}$		15	32.8	1	34.5	1	34.5		
	CLR trigger	Q or $\bar{Q}$		17.4	38	1	44	1	44		
$t_w^{\dagger}$		Q or $\bar{Q}$	$C_L = 50 \text{ pF}$ , $C_{ext} = 28 \text{ pF}$ , $R_{ext} = 2 \text{ k}\Omega$	203	260		320		320		ns
			$C_L = 50 \text{ pF}$ , $C_{ext} = 0.01 \mu\text{F}$ , $R_{ext} = 10 \text{ k}\Omega$	90	100	110	90	110	90	110	$\mu\text{s}$
			$C_L = 50 \text{ pF}$ , $C_{ext} = 0.1 \mu\text{F}$ , $R_{ext} = 10 \text{ k}\Omega$	0.9	1	1.1	0.9	1.1	0.9	1.1	ms
$\Delta t_w^{\ddagger}$			$C_L = 50 \text{ pF}$	$\pm 1$							%

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

†  $t_w$  = Pulse duration at Q and  $\bar{Q}$  outputs

‡  $\Delta t_w$  = Output pulse-duration variation (Q and  $\bar{Q}$ ) between circuits in same package

switching characteristics over recommended operating free-air temperature range,  $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	$T_A = 25^\circ\text{C}$			SN54LV221A		SN74LV221A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	$\bar{A}$ or B	Q or $\bar{Q}$	$C_L = 15 \text{ pF}$	10.2*	20.6*	1*	24*	1	24		ns
	$\overline{\text{CLR}}$	Q or $\bar{Q}$		9.3*	15.8*	1*	18.5*	1	18.5		
	CLR trigger	Q or $\bar{Q}$		10.6*	22.4*	1*	26*	1	26		
$t_{pd}$	$\bar{A}$ or B	Q or $\bar{Q}$	$C_L = 50 \text{ pF}$	11.8	24.1	1	27.5	1	27.5		ns
	$\overline{\text{CLR}}$	Q or $\bar{Q}$		10.6	19.3	1	22	1	22		
	CLR trigger	Q or $\bar{Q}$		12.3	25.9	1	29.5	1	29.5		
$t_w^{\dagger}$		Q or $\bar{Q}$	$C_L = 50 \text{ pF}$ , $C_{ext} = 28 \text{ pF}$ , $R_{ext} = 2 \text{ k}\Omega$	186	240		300		300		ns
			$C_L = 50 \text{ pF}$ , $C_{ext} = 0.01 \mu\text{F}$ , $R_{ext} = 10 \text{ k}\Omega$	90	100	110	90	110	90	110	$\mu\text{s}$
			$C_L = 50 \text{ pF}$ , $C_{ext} = 0.1 \mu\text{F}$ , $R_{ext} = 10 \text{ k}\Omega$	0.9	1	1.1	0.9	1.1	0.9	1.1	ms
$\Delta t_w^{\ddagger}$			$C_L = 50 \text{ pF}$	$\pm 1$							%

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

†  $t_w$  = Pulse duration at Q and  $\bar{Q}$  outputs

‡  $\Delta t_w$  = Output pulse-duration variation (Q and  $\bar{Q}$ ) between circuits in same package

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switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	$T_A = 25^\circ\text{C}$			SN54LV221A		SN74LV221A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	$\bar{A}$ or B	Q or $\bar{Q}$	$C_L = 15 \text{ pF}$	7.1*	12*	1*	14*	1	14		ns
	$\overline{\text{CLR}}$	Q or $\bar{Q}$		6.5*	9.4*	1*	11*	1	11		
	CLR trigger	Q or $\bar{Q}$		7.3*	12.9*	1*	15*	1	15		
$t_{pd}$	$\bar{A}$ or B	Q or $\bar{Q}$	$C_L = 50 \text{ pF}$	8.2	14	1	16	1	16		ns
	$\overline{\text{CLR}}$	Q or $\bar{Q}$		7.4	11.4	1	13	1	13		
	CLR trigger	Q or $\bar{Q}$		8.6	14.9	1	17	1	17		
$t_W^\dagger$		Q or $\bar{Q}$	$C_L = 50 \text{ pF},$ $C_{\text{ext}} = 28 \text{ pF},$ $R_{\text{ext}} = 2 \text{ k}\Omega$	171	200		240		240		ns
				90	100	110	90	110	90	110	$\mu\text{s}$
				0.9	1	1.1	0.9	1.1	0.9	1.1	ms
$\Delta t_W^\ddagger$			$C_L = 50 \text{ pF}$	$\pm 1$							%

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

†  $t_W$  = Pulse duration at Q and  $\bar{Q}$  outputs

‡  $\Delta t_W$  = Output pulse-duration variation (Q and  $\bar{Q}$ ) between circuits in same package

**operating characteristics,  $T_A = 25^\circ\text{C}$**

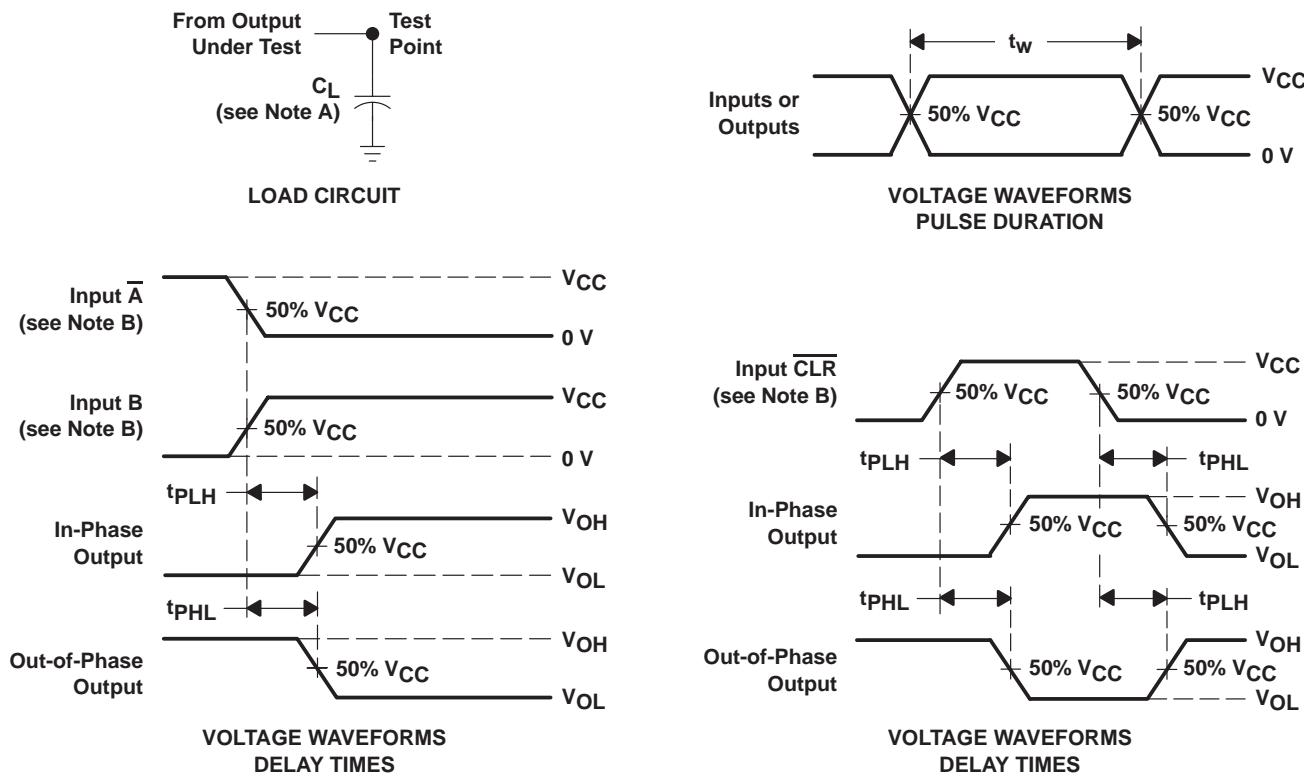
PARAMETER	TEST CONDITIONS	$V_{CC}$	TYP	UNIT
$C_{pd}$ Power dissipation capacitance	$C_L = 50 \text{ pF}, f = 10 \text{ MHz}$	3.3 V	50	pF
		5 V	51	

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**PARAMETER MEASUREMENT INFORMATION**



NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r = 3 \text{ ns}$ ,  $t_f = 3 \text{ ns}$ .  
 C. The outputs are measured one at a time, with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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## APPLICATION INFORMATION

### caution in use

To prevent malfunctions due to noise, connect a high-frequency capacitor between  $V_{CC}$  and GND, and keep the wiring between the external components and  $C_{ext}$  and  $R_{ext}/C_{ext}$  terminals as short as possible.

### power-down considerations

Large values of  $C_{ext}$  can cause problems when powering down the 'LV221A because of the amount of energy stored in the capacitor. When a system containing this device is powered down, the capacitor can discharge from  $V_{CC}$  through the protection diodes at pin 2 or pin 14. Current through the input protection diodes must be limited to 30 mA; therefore, the turn-off time of the  $V_{CC}$  power supply must not be faster than  $t = V_{CC} \times C_{ext}/30$  mA. For example, if  $V_{CC} = 5$  V and  $C_{ext} = 15$  pF, the  $V_{CC}$  supply must turn off no faster than  $t = (5 \text{ V}) \times (15 \text{ pF})/30 \text{ mA} = 2.5 \text{ ns}$ . Usually, this is not a problem because power supplies are heavily filtered and cannot discharge at this rate. When a more rapid decrease of  $V_{CC}$  to zero occurs, the 'LV221A can sustain damage. To avoid this possibility, use external clamping diodes.

### output pulse duration

The output pulse duration,  $t_w$ , is determined primarily by the values of the external capacitance ( $C_T$ ) and timing resistance ( $R_T$ ). The timing components are connected as shown in Figure 2.

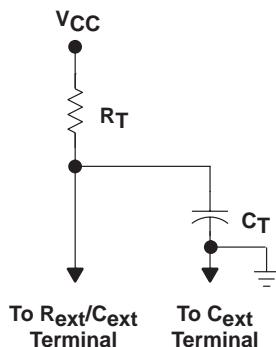


Figure 2. Timing-Component Connections

The pulse duration is given by:

$$t_w = K \times R_T \times C_T \quad (1)$$

if  $C_T \geq 1000$  pF,  $K = 1.0$

or

if  $C_T < 1000$  pF,  $K$  can be determined from Figure 7

where:

$t_w$  = pulse duration in ns

$R_T$  = external timing resistance in k $\Omega$

$C_T$  = external capacitance in pF

$K$  = multiplier factor

Equation 1 and Figure 3 or 4 can be used to determine values for pulse duration, external resistance, and external capacitance.

## APPLICATION INFORMATION<sup>†</sup>

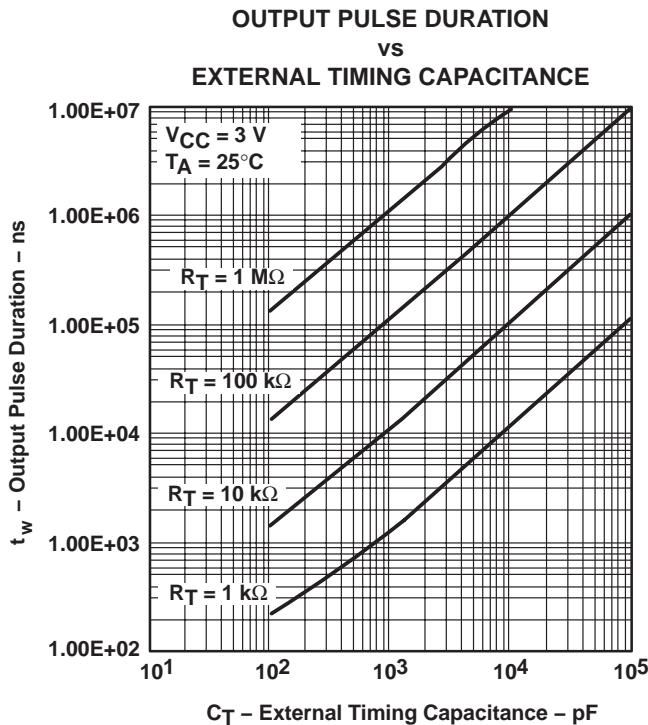


Figure 3

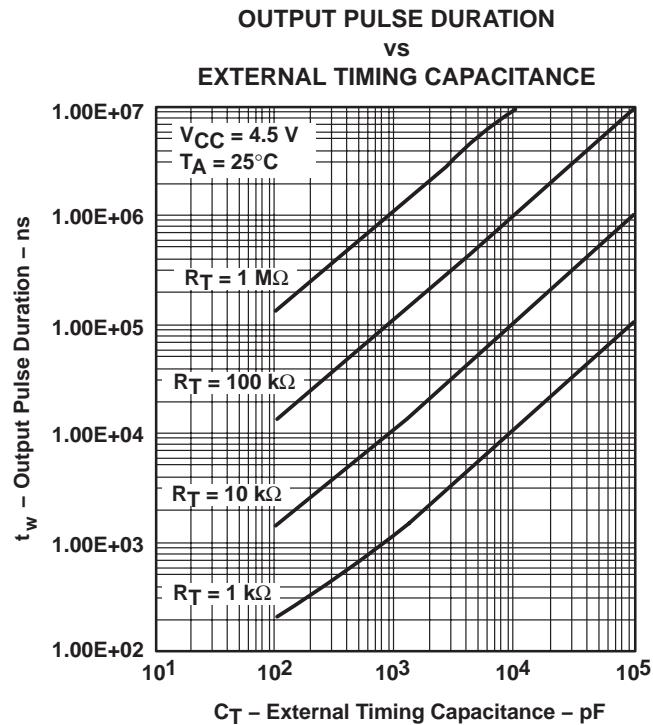


Figure 4

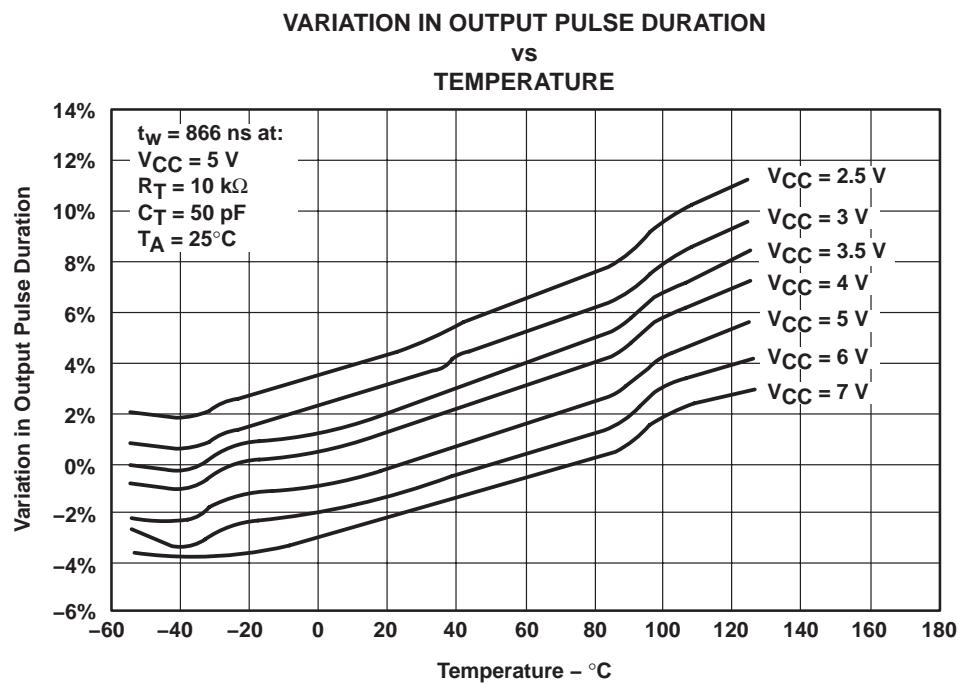


Figure 5

<sup>†</sup> Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

**SN54LV221A, SN74LV221A  
DUAL MONOSTABLE MULTIVIBRATORS  
WITH SCHMITT-TRIGGER INPUTS**

SCLS450G - DECEMBER 1999 - REVISED APRIL 2005

**APPLICATION INFORMATION<sup>†</sup>**

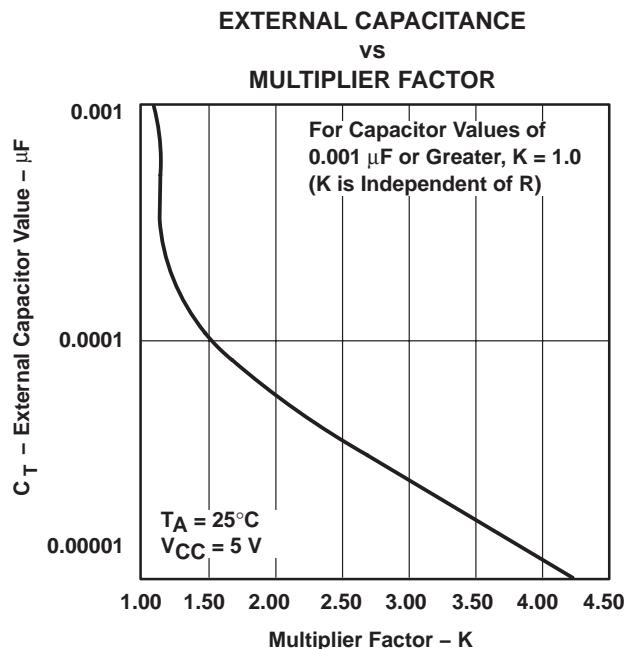


Figure 6

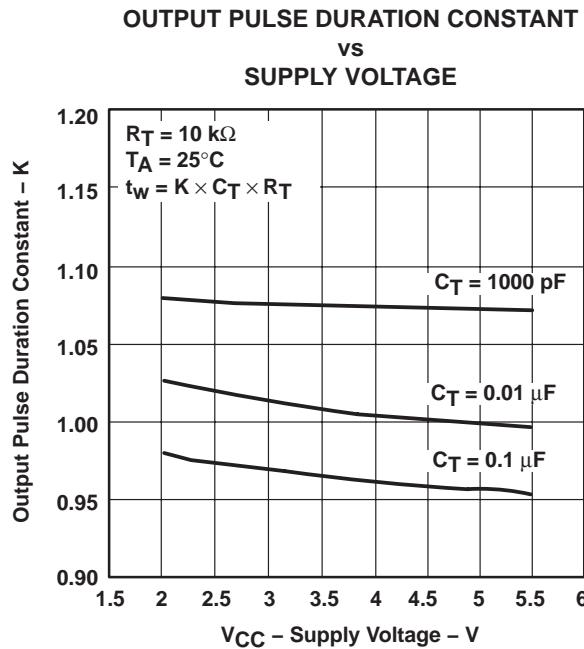


Figure 7

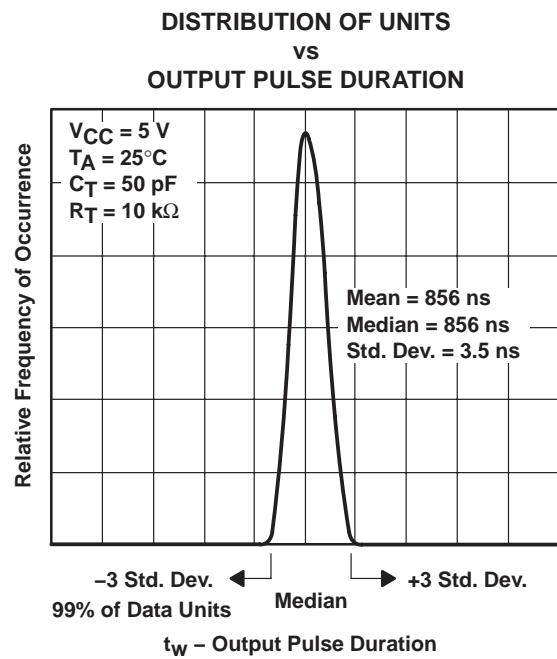


Figure 8

<sup>†</sup> Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LV221AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV221A	<span style="background-color: red; color: white; padding: 2px;">Samples</span>
SN74LV221ADG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV221A	<span style="background-color: red; color: white; padding: 2px;">Samples</span>
SN74LV221ADGVR	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV221A	<span style="background-color: red; color: white; padding: 2px;">Samples</span>
SN74LV221ADR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV221A	<span style="background-color: red; color: white; padding: 2px;">Samples</span>
SN74LV221ANSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	74LV221A	<span style="background-color: red; color: white; padding: 2px;">Samples</span>
SN74LV221APW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV221A	<span style="background-color: red; color: white; padding: 2px;">Samples</span>
SN74LV221APWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV221A	<span style="background-color: red; color: white; padding: 2px;">Samples</span>
SN74LV221APWT	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV221A	<span style="background-color: red; color: white; padding: 2px;">Samples</span>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBsolete:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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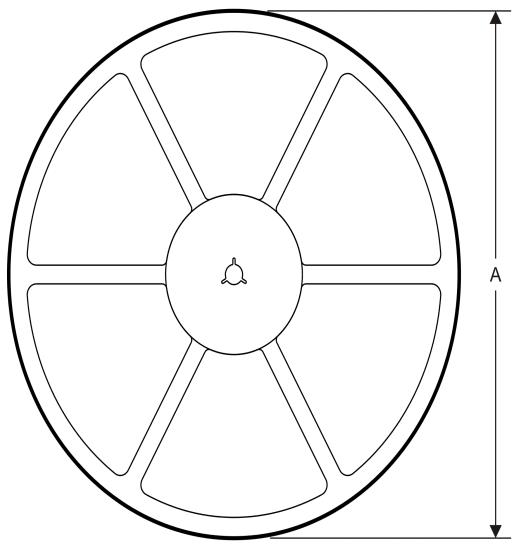
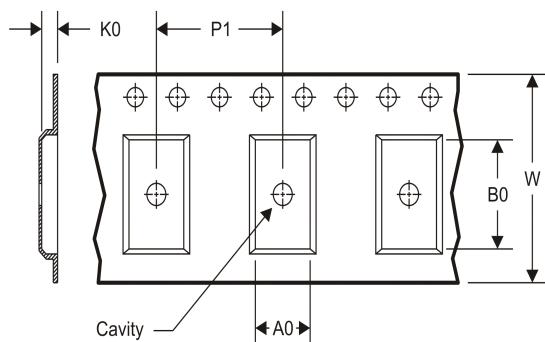
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF SN74LV221A :**

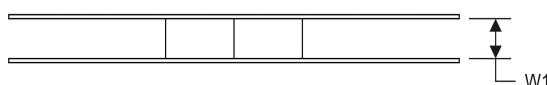
- Automotive: [SN74LV221A-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers


**TAPE AND REEL INFORMATION**

\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LV221ADGVR	TVSOP	DGV	16	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
SN74LV221ADR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74LV221ANSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74LV221APWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV221APWT	TSSOP	PW	16	250	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**

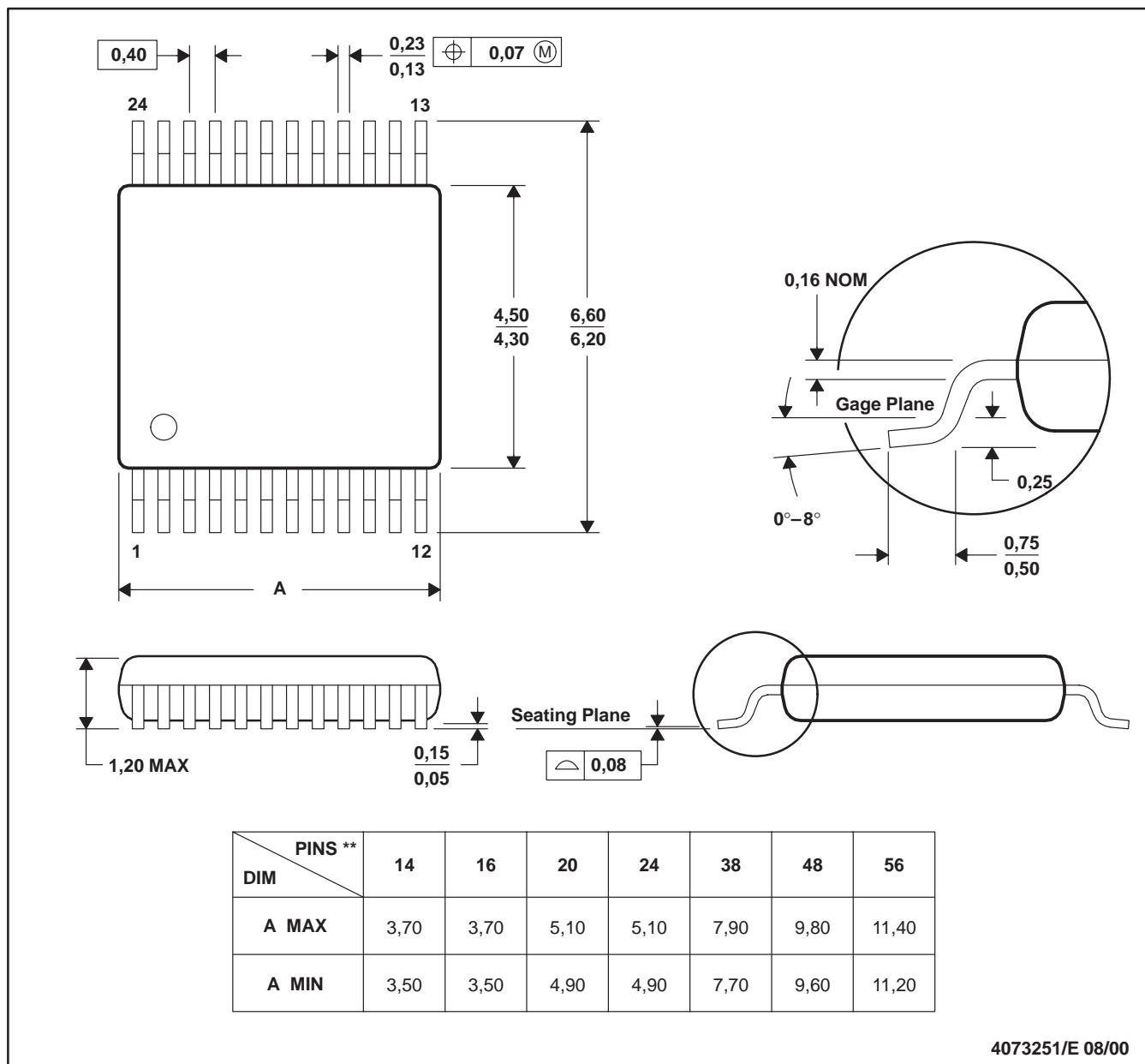

\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV221ADGVR	TVSOP	DGV	16	2000	367.0	367.0	35.0
SN74LV221ADR	SOIC	D	16	2500	333.2	345.9	28.6
SN74LV221ANSR	SO	NS	16	2000	367.0	367.0	38.0
SN74LV221APWR	TSSOP	PW	16	2000	367.0	367.0	35.0
SN74LV221APWT	TSSOP	PW	16	250	367.0	367.0	35.0

## DGV (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

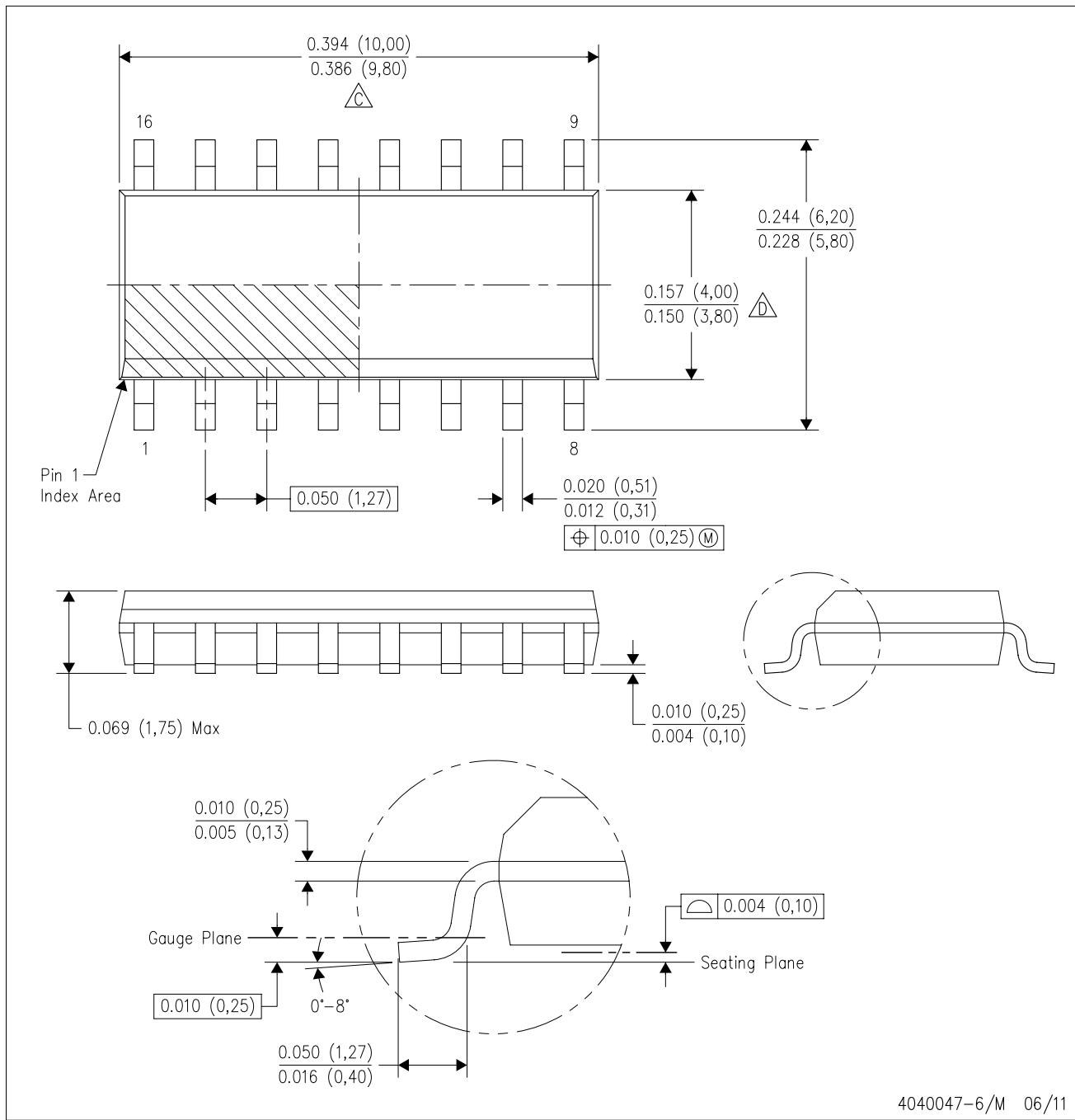
24 PINS SHOWN



NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).

B. This drawing is subject to change without notice.

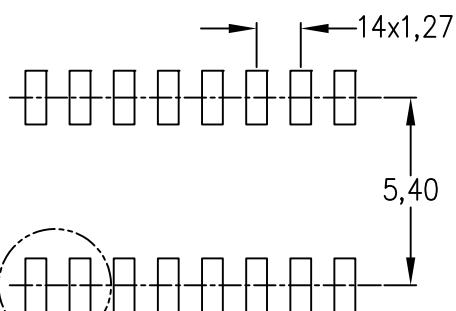
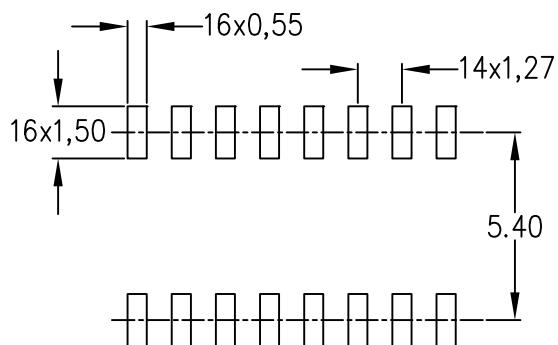
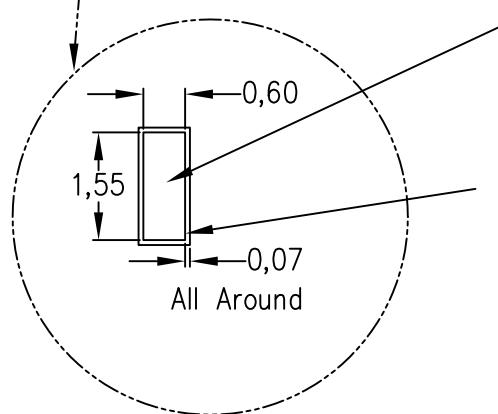
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.

D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.

E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE

Example Board Layout  
(Note C)Stencil Openings  
(Note D)Example  
Non Soldermask Defined PadExample  
Pad Geometry  
(See Note C)Example  
Solder Mask Opening  
(See Note E)

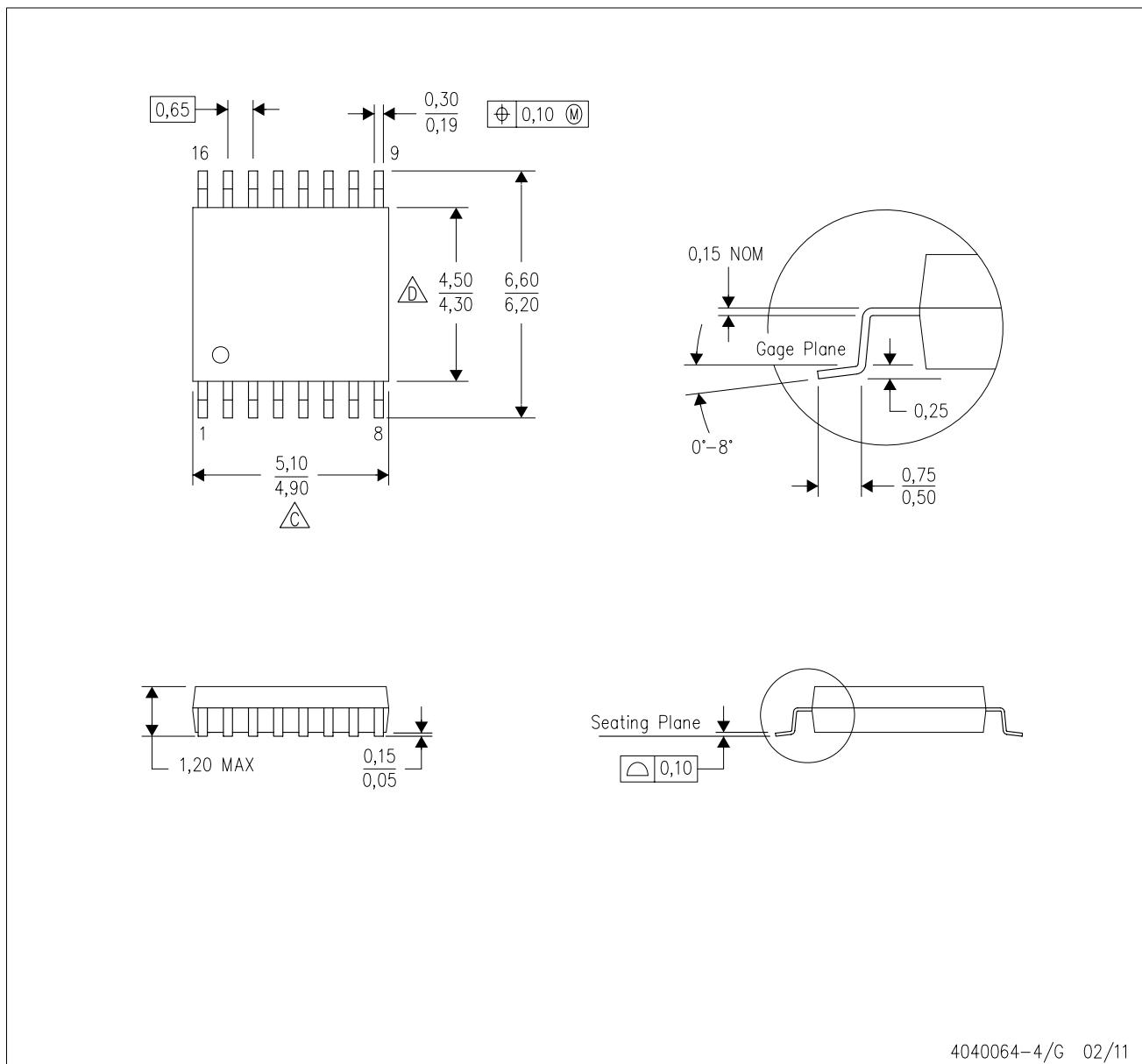
4211283-4/E 08/12

NOTES:

- All linear dimensions are in millimeters.
- This drawing is subject to change without notice.
- Publication IPC-7351 is recommended for alternate designs.
- Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
- Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040064-4/G 02/11

NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.

B. This drawing is subject to change without notice.

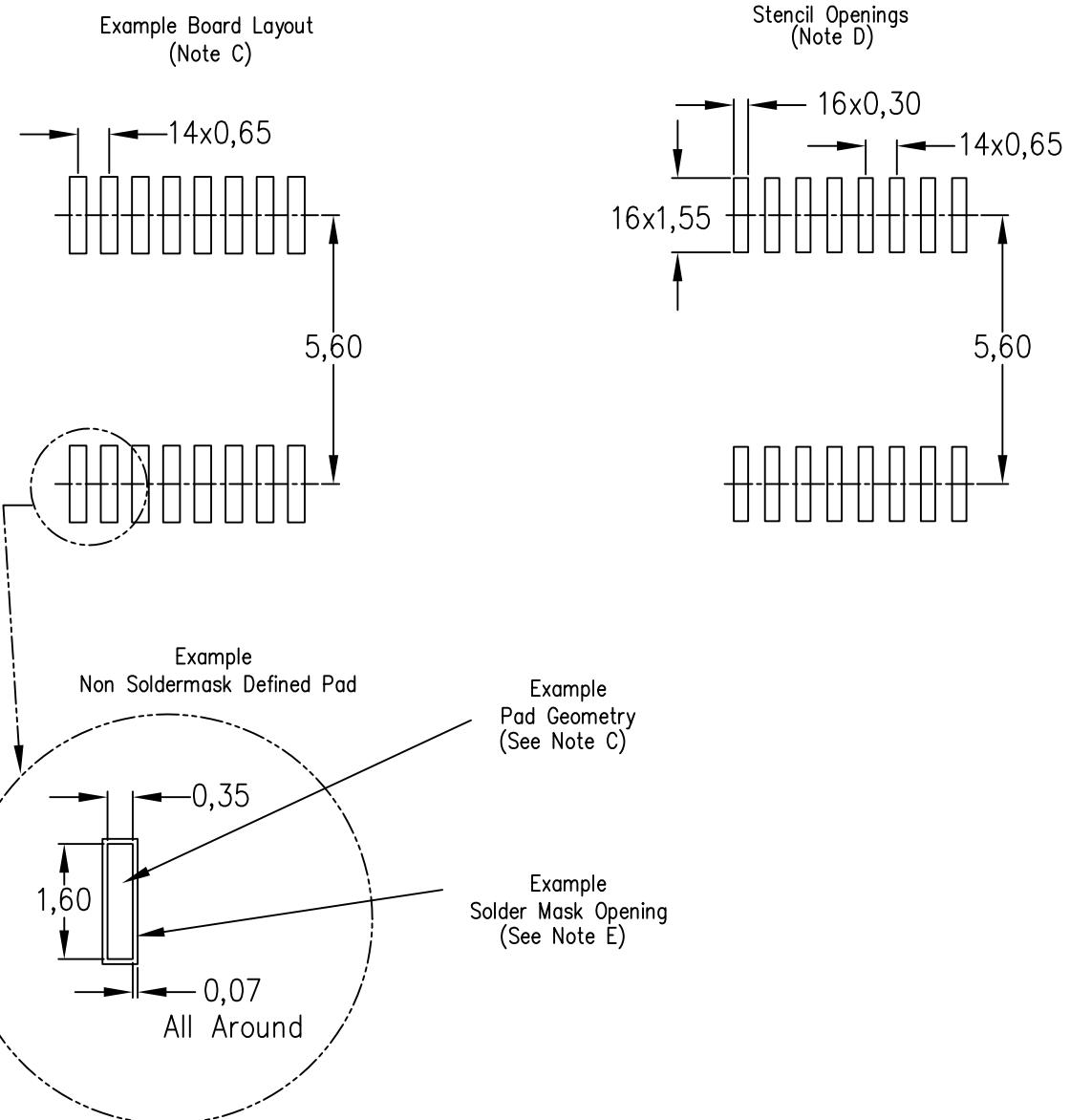
△C Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.

△D Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.

E. Falls within JEDEC MO-153

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4211284-3/F 12/12

NOTES:

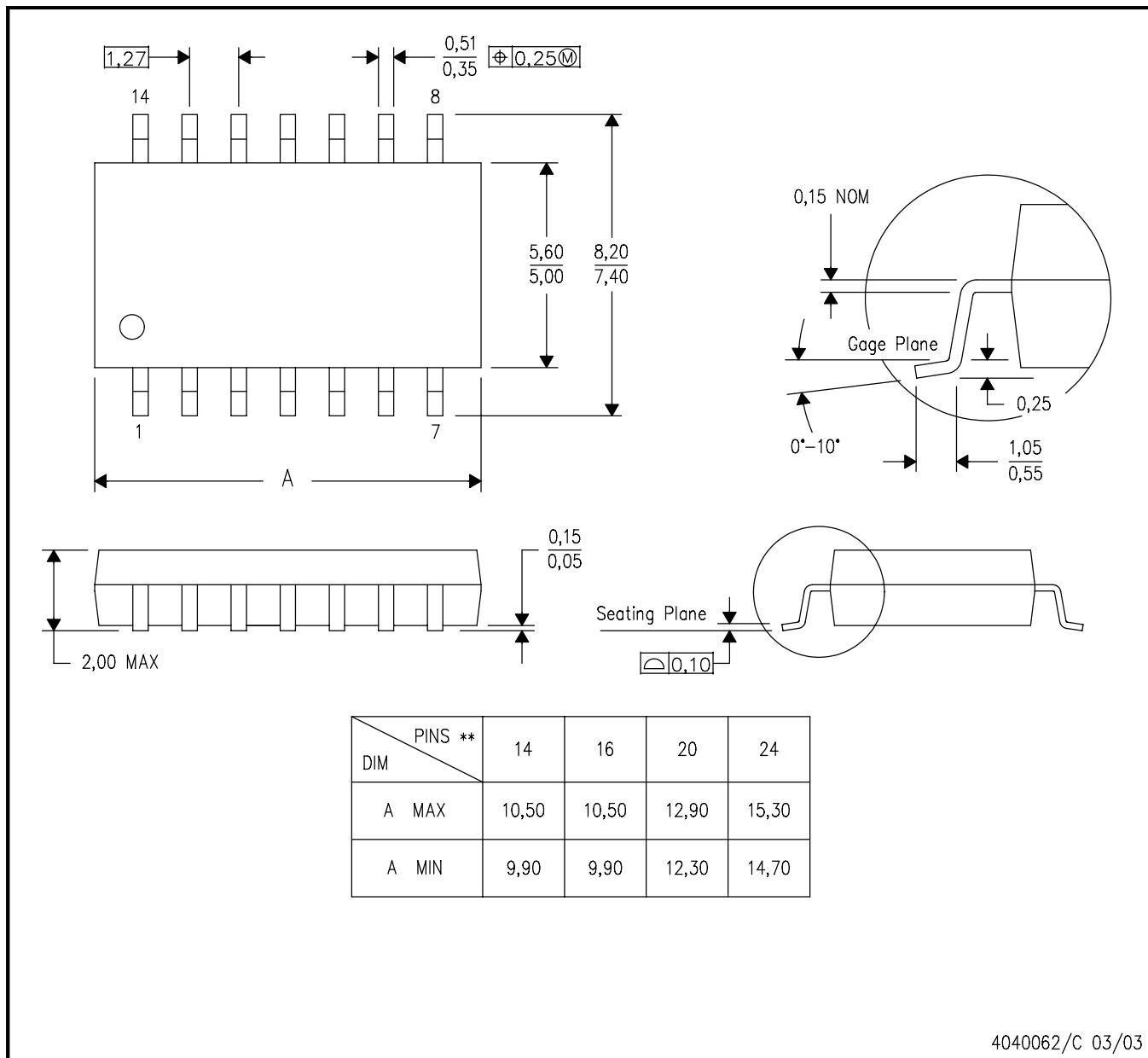
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

## MECHANICAL DATA

**NS (R-PDSO-G\*\*)**

## PLASTIC SMALL-OUTLINE PACKAGE

**14-PINS SHOWN**



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
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RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>
	<b>TI E2E Community</b>
	<a href="http://e2e.ti.com">e2e.ti.com</a>