

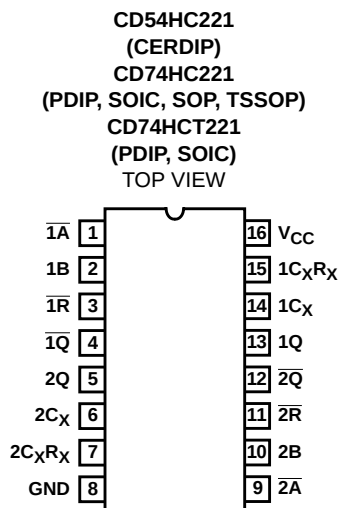
November 1997 - Revised October 2003

High-Speed CMOS Logic Dual Monostable Multivibrator with Reset

Features

- Overriding RESET Terminates Output Pulse
- Triggering from the Leading or Trailing Edge
- Q and $\bar{Q}$ Buffered Outputs
- Separate Resets
- Wide Range of Output-Pulse Widths
- Schmitt Trigger on B Inputs
- Fanout (Over Temperature Range)
 - Standard Outputs 10 LSTTL Loads
 - Bus Driver Outputs 15 LSTTL Loads
- Wide Operating Temperature Range . . . -55°C to 125°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
 - 2V to 6V Operation
 - High Noise Immunity: $N_{IL} = 30\%$, $N_{IH} = 30\%$ of V_{CC} at $V_{CC} = 5V$
- HCT Types
 - 4.5V to 5.5V Operation
 - Direct LSTTL Input Logic Compatibility, $V_{IL} = 0.8V$ (Max), $V_{IH} = 2V$ (Min)
 - CMOS Input Compatibility, $I_I \leq 1\mu A$ at V_{OL} , V_{OH}

Pinout



Description

The 'HC221 and CD74HCT221 are dual monostable multivibrators with reset. An external resistor (R_X) and an external capacitor (C_X) control the timing and the accuracy for the circuit. Adjustment of R_X and C_X provides a wide range of output pulse widths from the Q and $\bar{Q}$ terminals. Pulse triggering on the B input occurs at a particular voltage level and is not related to the rise and fall time of the trigger pulse.

Once triggered, the outputs are independent of further trigger inputs on A and B. The output pulse can be terminated by a LOW level on the Reset ($\bar{R}$) pin. Trailing Edge triggering ($\bar{A}$) and leading-edge-triggering (B) inputs are provided for triggering from either edge of the input pulse. On power up, the IC is reset. If either Mono is not used each input (on the unused device) must be terminated either high or low.

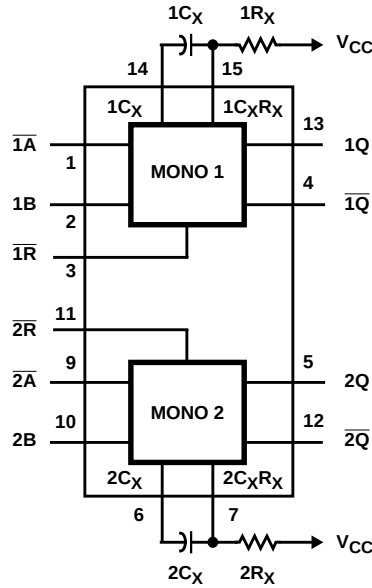
The minimum value of external resistance, R_X , is typically 500 Ω . The minimum value of external capacitance, C_X , is 0pF. The calculation for the pulse width is $t_W = 0.7 R_X C_X$ at $V_{CC} = 4.5V$.

Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54HC221F3A	-55 to 125	16 Ld CERDIP
CD74HC221E	-55 to 125	16 Ld PDIP
CD74HC221M	-55 to 125	16 Ld SOIC
CD74HC221MT	-55 to 125	16 Ld SOIC
CD74HC221M96	-55 to 125	16 Ld SOIC
CD74HC221NSR	-55 to 125	16 Ld SOP
CD74HC221PW	-55 to 125	16 Ld TSSOP
CD74HC221PWR	-55 to 125	16 Ld TSSOP
CD74HC221PWT	-55 to 125	16 Ld TSSOP
CD74HCT221E	-55 to 125	16 Ld PDIP
CD74HCT221M	-55 to 125	16 Ld SOIC
CD74HCT221MT	-55 to 125	16 Ld SOIC
CD74HCT221M96	-55 to 125	16 Ld SOIC

NOTE: When ordering, use the entire part number. The suffixes 96 and R denote tape and reel. The suffix T denotes a small-quantity reel of 250.

Functional Diagram



TRUTH TABLE

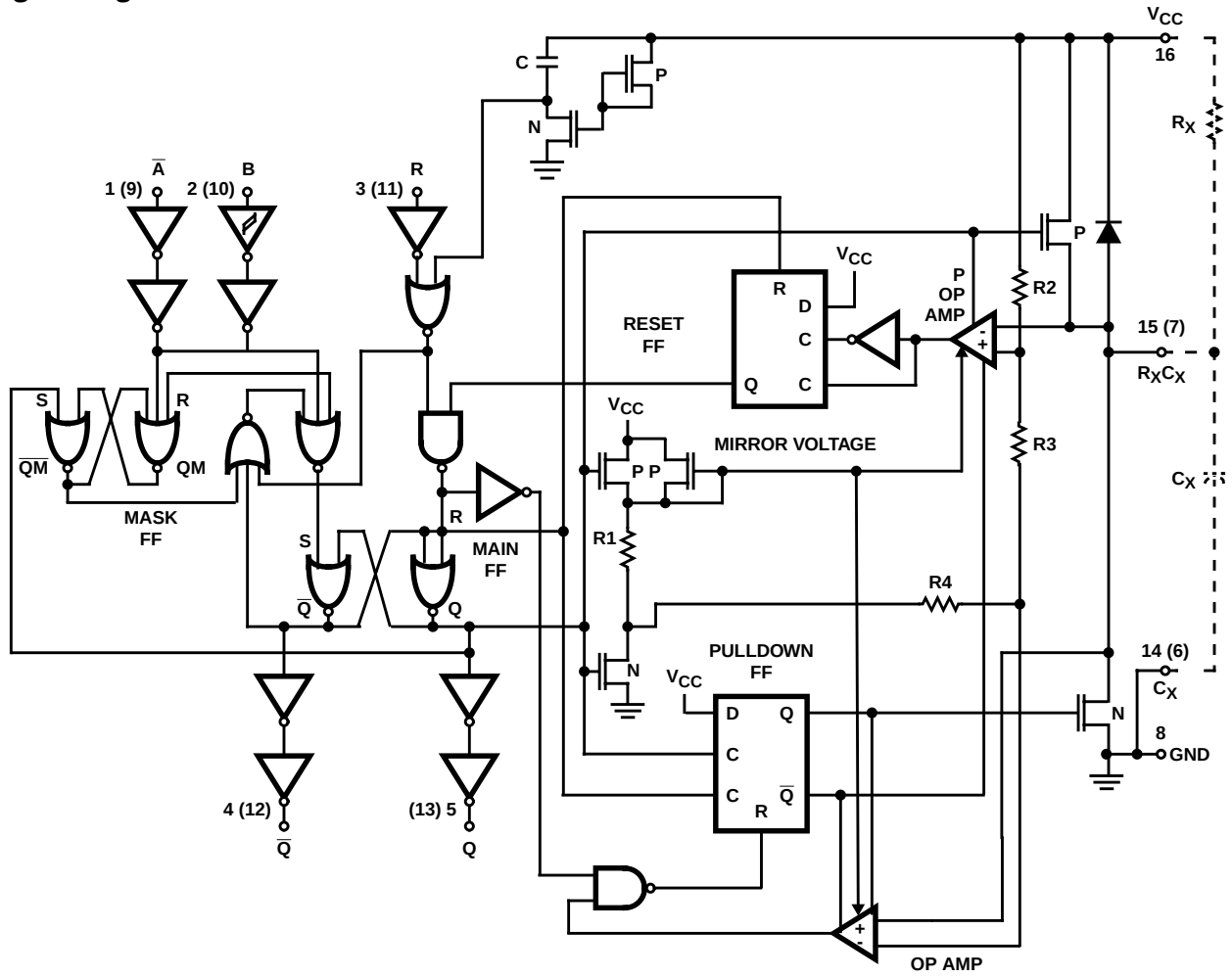
INPUTS			OUTPUTS	
$\bar{A}$	B	$\bar{R}$	Q	$\bar{Q}$
H	X	H	L	H
X	L	H	L	H
L	↑	H		
↓	H	H		
X	X	L	L	H
L	H	↑	 (Note 3)	 (Note 3)

H = High Voltage Level, L = Low Voltage Level, X = Irrelevant, ↑ = Transition from Low to High Level, ↓ = Transition from High to Low Level,  = One High Level Pulse,  = One Low Level Pulse

NOTE:

- For this combination the reset input must be low and the following sequence must be used: pin 1 (or 9) must be set high or pin 2 (or 10) set low; then pin 1 (or 9) must be low and pin 2 (or 10) set high. Now the reset input goes from low-to-high and the device will be triggered.

Logic Diagram



CD54HC221, CD74HC221, CD74HCT221

Absolute Maximum Ratings

DC Supply Voltage, V_{CC}	-0.5V to 7V
DC Input Diode Current, I_{IK}	
For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$	$\pm 20mA$
DC Output Diode Current, I_{OK}	
For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$	$\pm 20mA$
DC Drain Current, per Output, I_O	
For $-0.5V < V_O < V_{CC} + 0.5V$	$\pm 25mA$
DC Output Source or Sink Current per Output Pin, I_O	
For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$	$\pm 25mA$
DC V_{CC} or Ground Current, I_{CC}	$\pm 50mA$

Thermal Information

Package Thermal Impedance, θ_{JA} (see Note 2):	
E (PDIP) Package	67°C/W
M (SOIC) Package	73°C/W
NS (SOP) Package	64°C/W
PW (TSSOP) Package	108°C/W
Maximum Junction Temperature (Plastic Package)	150°C
Maximum Storage Temperature Range	-65°C to 150°C
Maximum Lead Temperature (Soldering 10s)	300°C
(SOIC - Lead Tips Only)	

Operating Conditions

Temperature Range, T_A	-55°C to 125°C
Supply Voltage Range, V_{CC}	
HC Types	.2V to 6V
HCT Types	.4.5V to 5.5V
DC Input or Output Voltage, V_I, V_O	0V to V_{CC}
Input Rise and Fall Time, t_r, t_f on Inputs $\bar{A}$ and $\bar{R}$	
2V	1000ns (Max)
4.5V	500ns (Max)
6V	400ns (Max)
Input Rise and Fall Time, t_r, t_f on Input B	
2V	Unlimited ns (Max)
4.5V	Unlimited ns (Max)
6V	Unlimited ns (Max)

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.

NOTE:

- The package thermal impedance is calculated in accordance with JESD 51-7.

DC Electrical Specifications

PARAMETER	SYMBOL	TEST CONDITIONS		V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS	
		V _I (V)	I _O (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX		
HC TYPES													
High Level Input Voltage	V _{IH}	-	-	2	1.5	-	-	1.5	-	1.5	-	V	
				4.5	3.15	-	-	3.15	-	3.15	-	V	
				6	4.2	-	-	4.2	-	4.2	-	V	
Low Level Input Voltage	V _{IL}	-	-	2	-	-	0.5	-	0.5	-	0.5	V	
				4.5	-	-	1.35	-	1.35	-	1.35	V	
				6	-	-	1.8	-	1.8	-	1.8	V	
High Level Output Voltage CMOS Loads	V _{OH}	V _{IH} or V _{IL}	-0.02	2	1.9	-	-	1.9	-	1.9	-	V	
			-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V	
			-0.02	6	5.9	-	-	5.9	-	5.9	-	V	
-			-	-	-	-	-	-	-	-	V		
-4			4.5	3.98	-	-	3.84	-	3.7	-	V		
-5.2			6	5.48	-	-	5.34	-	5.2	-	V		
High Level Output Voltage TTL Loads	V _{OL}	V _{IH} or V _{IL}	-	-	-	-	-	-	-	-	-	V	
			-4	4.5	3.98	-	-	3.84	-	3.7	-	V	
			-5.2	6	5.48	-	-	5.34	-	5.2	-	V	
0.02			2	-	-	0.1	-	0.1	-	0.1	V		
0.02			4.5	-	-	0.1	-	0.1	-	0.1	V		
0.02			6	-	-	0.1	-	0.1	-	0.1	V		
Low Level Output Voltage CMOS Loads	V _{OL}	V _{IH} or V _{IL}	-	-	-	-	-	-	-	-	-	V	
			4	4.5	-	-	0.26	-	0.33	-	0.4	V	
			5.2	6	-	-	0.26	-	0.33	-	0.4	V	
-			-	-	-	-	-	-	-	-	V		
4			4.5	-	-	0.26	-	0.33	-	0.4	V		
5.2			6	-	-	0.26	-	0.33	-	0.4	V		
Low Level Output Voltage TTL Loads	V _{OL}	V _{IH} or V _{IL}	-	-	-	-	-	-	-	-	-	V	
			4	4.5	-	-	0.26	-	0.33	-	0.4	V	
				5.2	6	-	-	0.26	-	0.33	-	0.4	V

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DC Electrical Specifications (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS		V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
		V _I (V)	I _O (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX	
Input Leakage Current	I _I	V _{CC} or GND	-	6	-	-	±0.1	-	±1	-	±1	μA
Quiescent Device Current	I _{CC}	V _{CC} or GND	0	6	-	-	8	-	80	-	160	μA
HCT TYPES												
High Level Input Voltage	V _{IH}	-	-	4.5 to 5.5	2	-	-	2	-	2	-	V
Low Level Input Voltage	V _{IL}	-	-	4.5 to 5.5	-	-	0.8	-	0.8	-	0.8	V
High Level Output Voltage CMOS Loads	V _{OH}	V _{IH} or V _{IL}	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
High Level Output Voltage TTL Loads			-4	4.5	3.98	-	-	3.84	-	3.7	-	V
Low Level Output Voltage CMOS Loads	V _{OL}	V _{IH} or V _{IL}	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads			4	4.5	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I _I	V _{CC} and GND	0	5.5	-	-	±0.1	-	±1	-	±1	μA
Quiescent Device Current	I _{CC}	V _{CC} or GND	0	5.5	-	-	8	-	80	-	160	μA
Additional Quiescent Device Current Per Input Pin: 1 Unit Load	ΔI _{CC} (Note 3)	V _{CC} -2.1	-	4.5 to 5.5	-	100	360	-	450	-	490	μA

NOTE:

- For dual-supply systems theoretical worst case (V_I = 2.4V, V_{CC} = 5.5V) specification is 1.8mA.

HCT Input Loading Table

INPUT	UNIT LOADS
All Inputs	0.3

NOTE: Unit Load is ΔI_{CC} limit specified in DC Electrical Table, e.g., 360μA max at 25°C.

Prerequisite For Switching Function

PARAMETER	SYMBOL	V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HC TYPES										
Input Pulse Width A	t _{WL}	2	70	-	-	90	-	105	-	ns
		4.5	14	-	-	18	-	21	-	ns
		6	12	-	-	15	-	18	-	ns
Input Pulse Width B	t _{WH}	2	70	-	-	90	-	105	-	ns
		4.5	14	-	-	18	-	21	-	ns
		6	12	-	-	15	-	18	-	ns

CD54HC221, CD74HC221, CD74HCT221

Prerequisite For Switching Function (Continued)

PARAMETER	SYMBOL	V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
Input Pulse Width Reset	t _{WL}	2	70	-	-	90	-	105	-	ns
		4.5	14	-	-	18	-	21	-	ns
		6	12	-	-	15	-	18	-	ns
Recovery Time R̄ to Ā or B	t _{SU}	2	0	-	-	0	-	0	-	ns
		4.5	0	-	-	0	-	0	-	ns
		6	0	-	-	0	-	0	-	ns
Output Pulse Width Q or Q̄ C _X = 0.1μF R _X = 10kΩ	t _W	5	630	-	770	602	798	595	805	μs
Output Pulse Width Q or Q̄ C _X = 28pF, R _X = 2kΩ	t _W	4.5	-	140	-	-	-	-	-	ns
C _X = 1000pF, R _X = 2kΩ	t _W	4.5	-	1.5	-	-	-	-	-	μs
C _X = 1000pF, R _X = 10kΩ	t _W	4.5	-	7	-	-	-	-	-	μs
HCT TYPES										
Input Pulse Width A	t _{WL}	4.5	14	-	-	18	-	21	-	ns
Input Pulse Width B	t _{WH}	4.5	14	-	-	18	-	21	-	ns
Input Pulse Width Reset	t _{WL}	4.5	18	-	-	23	-	27	-	ns
Recovery Time R̄ to Ā or B	t _{SU}	4.5	0	-	-	0	-	0	-	ns
Output Pulse Width Q or Q̄ C _X = 0.1μF R _X = 10kΩ	t _W	5	630	-	770	602	798	595	805	μs
Output Pulse Width Q or Q̄ C _X = 28pF, R _X = 2kΩ	t _W	4.5	-	140	-	-	-	-	-	ns
C _X = 1000pF, R _X = 2kΩ	t _W	4.5	-	1.5	-	-	-	-	-	μs
C _X = 1000pF, R _X = 10kΩ	t _W	4.5	-	7	-	-	-	-	-	μs

Switching Specifications Input t_r, t_f = 6ns

PARAMETER	SYMBOL	TEST CONDITIONS	V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HC TYPES											
Propagation Delay, Trigger $\overline{A}$, B, $\overline{R}$ to Q	t _{PLH}	C _L = 50pF	2	-	-	210	-	265	-	315	ns
		C _L = 50pF	4.5	-	-	42	-	53	-	63	ns
		C _L = 50pF	6	-	-	36	-	45	-	54	ns
		C _L = 15pF	5	-	18	-	-	-	-	-	ns
Propagation Delay, Trigger $\overline{A}$, B, $\overline{R}$ to $\overline{Q}$	t _{PHL}	C _L = 50pF	2	-	-	170	-	215	-	255	ns
		C _L = 50pF	4.5	-	-	34	-	43	-	51	ns
		C _L = 50pF	6	-	-	29	-	37	-	43	ns
		C _L = 15pF	5	-	14	-	-	-	-	-	ns

CD54HC221, CD74HC221, CD74HCT221

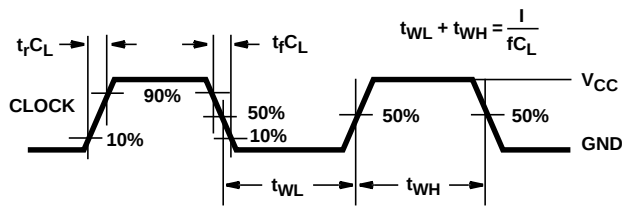
Switching Specifications Input $t_r, t_f = 6\text{ns}$ (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS	V_{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
Propagation Delay, $\bar{R}$ to Q	t_{PLH}	$C_L = 50\text{pF}$	2	-	-	160	-	200	-	240	ns
			4.5	-	-	32	-	40	-	48	ns
			6	-	-	27	-	34	-	41	ns
Propagation Delay, $\bar{R}$ to $\bar{Q}$	t_{PHL}	$C_L = 50\text{pF}$	2	-	-	180	-	225	-	270	ns
			4.5	-	-	36	-	45	-	54	ns
			6	-	-	31	-	38	-	46	ns
Output Transition Time	t_{TLH}, t_{THL}	$C_L = 50\text{pF}$	2	-	-	75	-	95	-	110	ns
			4.5	-	-	15	-	19	-	22	ns
			6	-	-	13	-	16	-	19	ns
Input Capacitance	C_{IN}	-	-	-	-	10	-	10	-	10	pF
Pulse Width Match Between Circuits in the Same Package $C_X = 1000\text{pF}$, $R_X = 10\text{k}\Omega$		-	4.5 to 5.5	-	± 2	-	-	-	-	-	%
Power Dissipation Capacitance (Notes 4, 5)	CPD	-	5	-	166	-	-	-	-	-	pF
HCT TYPES											
Propagation Delay, Trigger $\bar{A}$, B, $\bar{R}$ to Q	t_{PLH}	$C_L = 50\text{pF}$	4.5	-	-	42	-	-	-	63	ns
		$C_L = 15\text{pF}$	5	-	18	-	-	-	-	-	ns
Propagation Delay, Trigger $\bar{A}$, B, $\bar{R}$ to $\bar{Q}$	t_{PHL}	$C_L = 50\text{pF}$	4.5	-	-	34	-	43	-	51	ns
		$C_L = 15\text{pF}$	5	-	14	-	-	-	-	-	ns
Propagation Delay, $\bar{R}$ to Q	t_{PLH}	$C_L = 50\text{pF}$	4.5	-	-	38	-	-	-	57	ns
Propagation Delay, $\bar{R}$ to $\bar{Q}$	t_{PHL}	$C_L = 50\text{pF}$	4.5	-	-	37	-	-	-	56	ns
Output Transition Time	t_{TLH}, t_{THL}	$C_L = 50\text{pF}$	2	-	-	75	-	95	-	110	ns
			4.5	-	-	15	-	19	-	22	ns
			6	-	-	13	-	16	-	19	ns
Input Capacitance	C_{IN}	-	-	-	-	10	-	10	-	10	pF
Pulse Width Match Between Circuits in the Same Package $C_X = 1000\text{pF}$, $R_X = 10\text{k}\Omega$		-	4.5 to 5.5	-	± 2	-	-	-	-	-	%
Power Dissipation Capacitance (Notes 4, 5)	CPD	-	5	-	166	-	-	-	-	-	pF

NOTES:

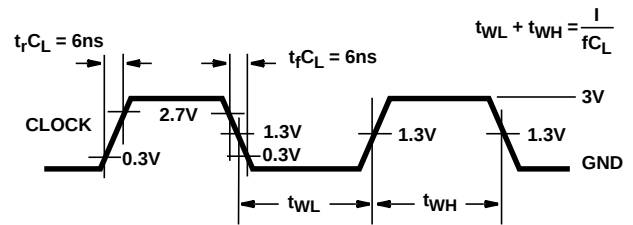
4. C_{PD} is used to determine the dynamic power consumption, per multivibrator.
5. $P_D = (C_{PD} + C_L) V_{CC}^2 f_i + \Sigma$ where f_i = input frequency, f_o = output frequency, C_L = output load capacitance, V_{CC} = supply voltage.

Test Circuits and Waveforms



NOTE: Outputs should be switching from 10% V_{CC} to 90% V_{CC} in accordance with device truth table. For f_{MAX} , input duty cycle = 50%.

FIGURE 1. HC CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH



NOTE: Outputs should be switching from 10% V_{CC} to 90% V_{CC} in accordance with device truth table. For f_{MAX} , input duty cycle = 50%.

FIGURE 2. HCT CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH

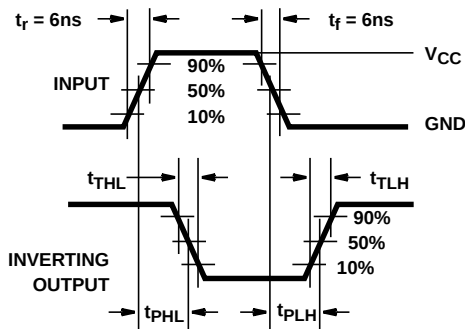


FIGURE 3. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

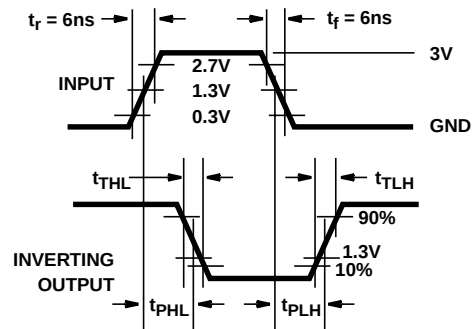


FIGURE 4. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

Typical Performance Curves

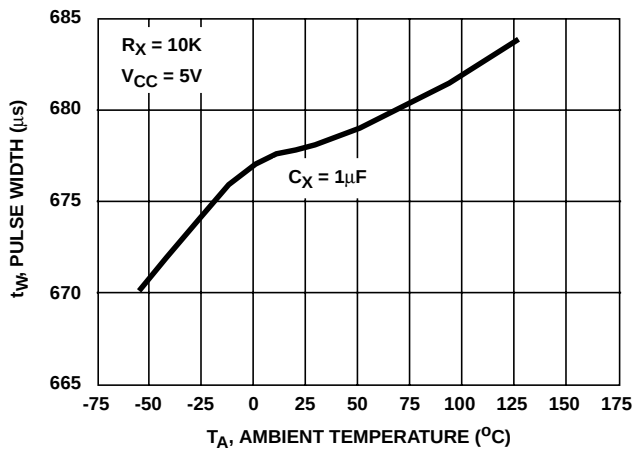


FIGURE 5. HC/HCT221 OUTPUT PULSE WIDTH vs TEMPERATURE

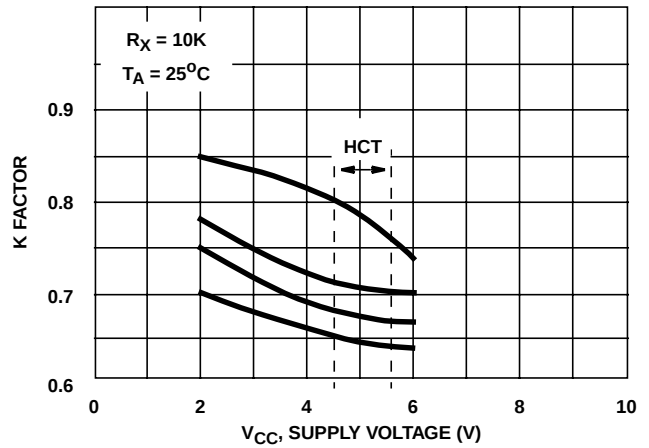


FIGURE 6. HC/HCT221 K FACTOR vs SUPPLY VOLTAGE

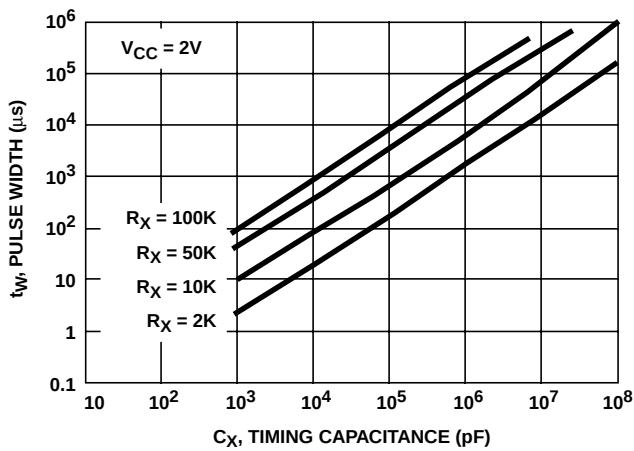


FIGURE 7. HC221 OUTPUT PULSE WIDTH vs C_X

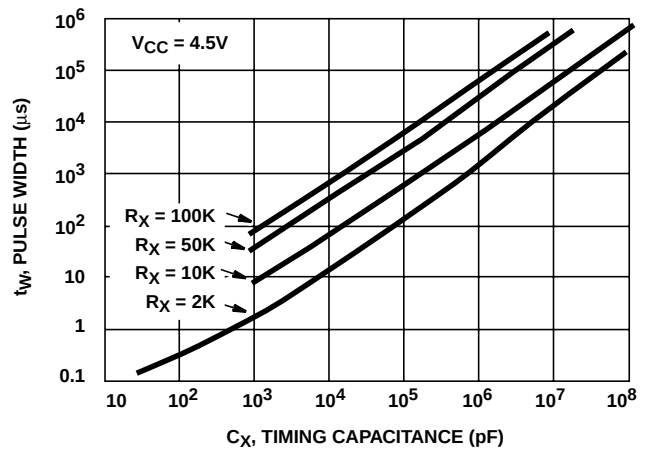
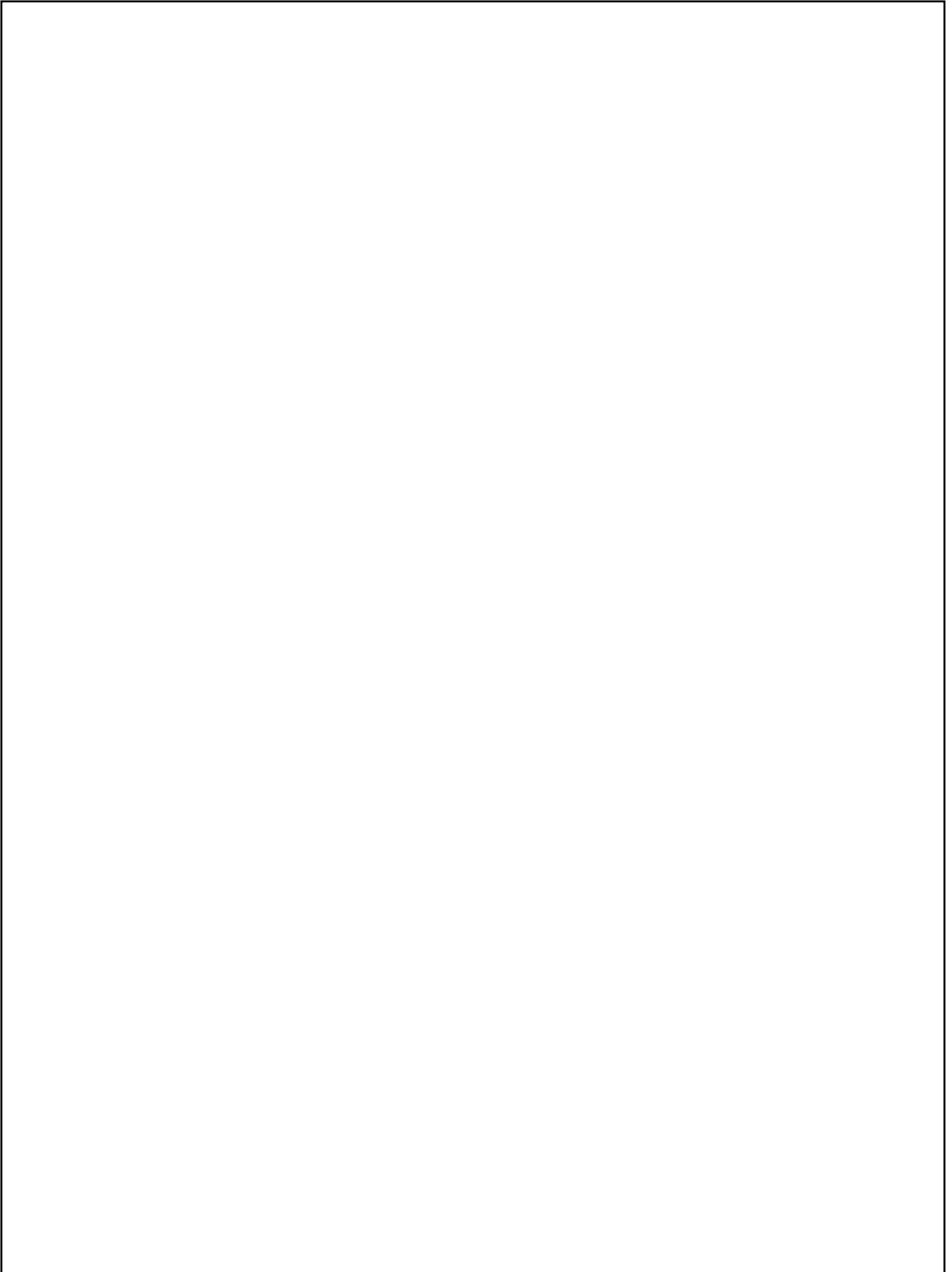


FIGURE 8. HC/HCT221 OUTPUT PULSE WIDTH vs C_X



PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-8780501EA	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
CD54HC221F	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
CD54HC221F3A	ACTIVE	CDIP	J	16	1	TBD	A42 SNPB	N / A for Pkg Type
CD74HC221E	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CD74HC221EE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CD74HC221M	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221M96	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221M96E4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221ME4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221MT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221MTE4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221PWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221PWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221PWT	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HC221PWTE4	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HCT221E	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CD74HCT221EE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CD74HCT221M	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HCT221M96	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HCT221M96E4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HCT221ME4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD74HCT221MT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
CD74HCT221MTE4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

⁽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.

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J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD

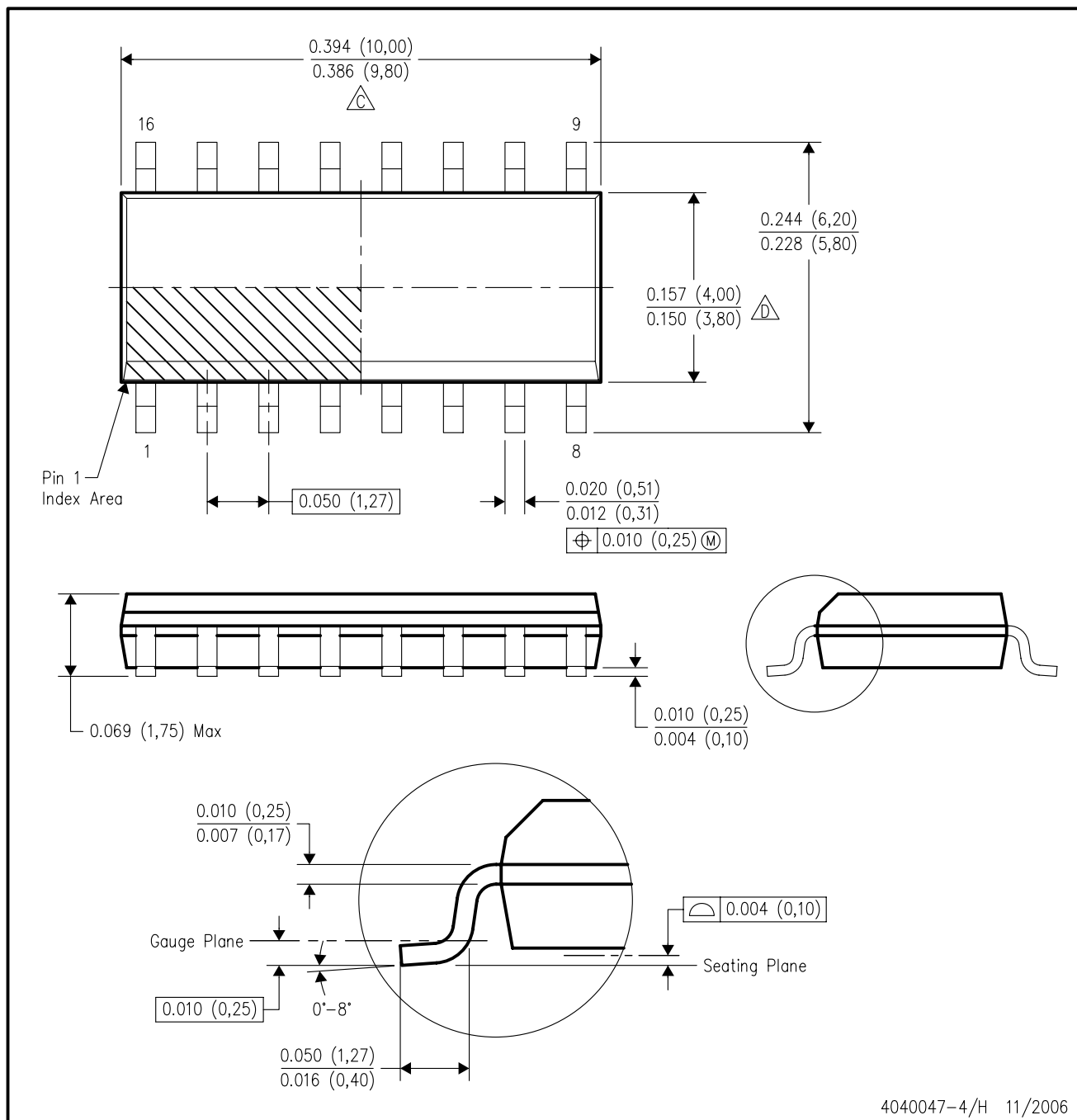


4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



NOTES:

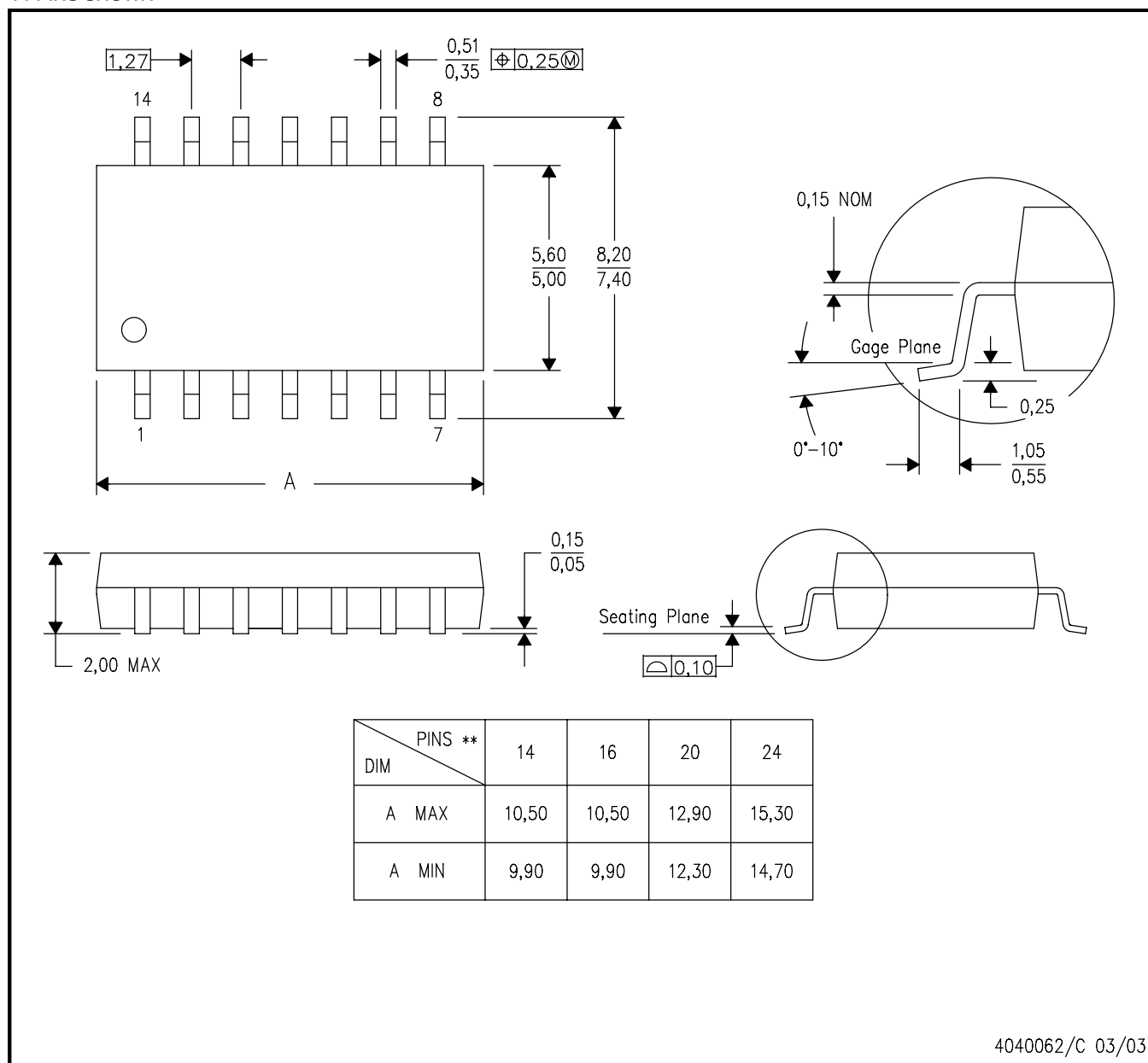
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
- D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
- E. Reference JEDEC MS-012 variation AC.

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.

PW (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.
 D. Falls within JEDEC MO-153

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