CD54HC221, CD74HC221, CD74HCT221

Data sheet acquired from Harris Semiconductor
SCHS166F

November 1997 - Revised October 2003

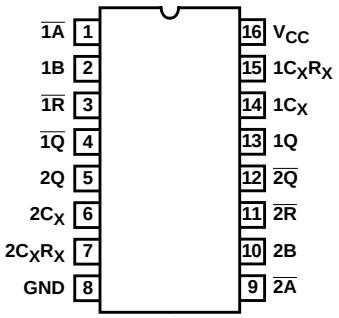
High-Speed CMOS Logic
Dual Monostable Multivibrator with Reset

Features

- **Overriding RESET Terminates Output Pulse**
- **Triggering from the Leading or Trailing Edge**
- **Q and $\overline{Q}$ 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^{o}C to 125^{o}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

CD54HC221
(CERDIP)
CD74HC221
(PDIP, SOIC, SOP, TSSOP)
CD74HCT221
(PDIP, SOIC)
TOP VIEW



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 $\overline{Q}$ 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 $\overline{A}$ and B. The output pulse can be terminated by a LOW level on the Reset ($\overline{R}$) pin. Trailing Edge triggering ($\overline{A}$) 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 500Ω. 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 (^{o}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.

CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

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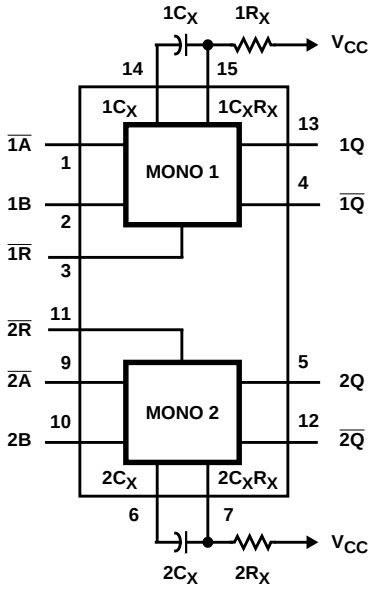
Functional Diagram



TRUTH TABLE

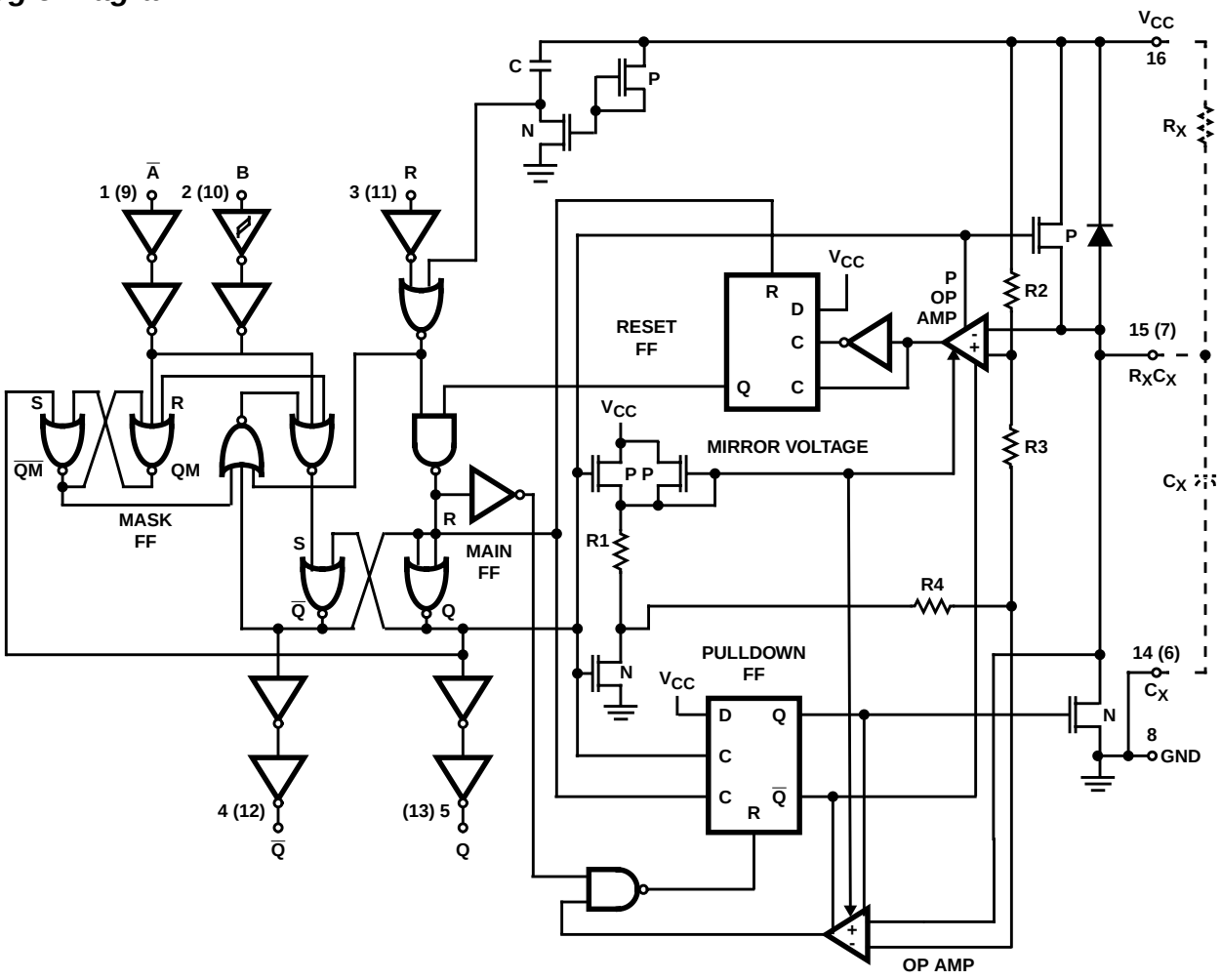
INPUTS			OUTPUTS	
$\overline{A}$	B	$\overline{R}$	Q	$\overline{Q}$
H	X	H	L	H
X	L	H	L	H
L	↑	H	⊓	⊔
↓	H	H	⊓	⊔
X	X	L	L	H
L	H	↑	⊓ (Note 3)	⊔ (Note 3)

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:

1. 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



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 . . . . . ±20mA
DC Output Diode Current, I_{OK}
For V_O < -0.5V or V_O > V_{CC} + 0.5V . . . . . ±20mA
DC Drain Current, per Output, I_O
For -0.5V < V_O < V_{CC} + 0.5V . . . . . ±25mA
DC Output Source or Sink Current per Output Pin, I_O
For V_O > -0.5V or V_O < V_{CC} + 0.5V . . . . . ±25mA
DC V_{CC} or Ground Current, I_{CC} . . . . . ±50mA

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 $\overline{A}$ and $\overline{R}$
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)

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)

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:

2. 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
High Level Output Voltage TTL Loads			-	-	-	-	-	-	-	-	-	V
			-4	4.5	3.98	-	-	3.84	-	3.7	-	V
			-5.2	6	5.48	-	-	5.34	-	5.2	-	V
Low Level Output Voltage CMOS Loads	V_{OL}	V_{IH} or V_{IL}	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 TTL Loads			-	-	-	-	-	-	-	-	-	V
			4	4.5	-	-	0.26	-	0.33	-	0.4	V
			5.2	6	-	-	0.26	-	0.33	-	0.4	V

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:

3. 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 $\overline{A}$	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

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 $\overline{R}$ to $\overline{A}$ 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 $\overline{Q}$ C_X = 0.1µF R_X = 10kΩ	t_W	5	630	-	770	602	798	595	805	µs
Output Pulse Width Q or Q 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 $\overline{A}$	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 $\overline{R}$ to $\overline{A}$ or B	t_{SU}	4.5	0	-	-	0	-	0	-	ns
Output Pulse Width Q or $\overline{Q}$ C_X = 0.1µF R_X = 10kΩ	t_W	5	630	-	770	602	798	595	805	µs
Output Pulse Width Q or Q 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

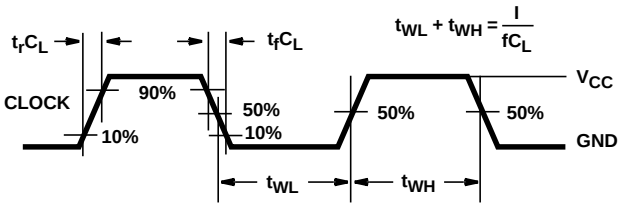
Switching Specifications Input t_r, t_f = 6ns **(Continued)**

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, $\overline{R}$ to Q	t_{PLH}	C_L = 50pF	2	-	-	160	-	200	-	240	ns
			4.5	-	-	32	-	40	-	48	ns
			6	-	-	27	-	34	-	41	ns
Propagation Delay, $\overline{R}$ to $\overline{Q}$	t_{PHL}	C_L = 50pF	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 = 50pF	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 = 1000pF, R_X = 10kΩ		-	4.5 to 5.5	-	±2	-	-	-	-	-	%
Power Dissipation Capacitance (Notes 4, 5)	CPD	-	5	-	166	-	-	-	-	-	pF
HCT TYPES											
Propagation Delay, Trigger $\overline{A}$, B, $\overline{R}$ to Q	t_{PLH}	C_L = 50pF	4.5	-	-	42	-	-	-	63	ns
		C_L = 15pF	5	-	18	-	-	-	-	-	ns
Propagation Delay, Trigger $\overline{A}$, B, $\overline{R}$ to $\overline{Q}$	t_{PHL}	C_L = 50pF	4.5	-	-	34	-	43	-	51	ns
		C_L = 15pF	5	-	14	-	-	-	-	-	ns
Propagation Delay, $\overline{R}$ to Q	t_{PLH}	C_L = 50pF	4.5	-	-	38	-	-	-	57	ns
Propagation Delay, $\overline{R}$ to $\overline{Q}$	t_{PHL}	C_L = 50pF	4.5	-	-	37	-	-	-	56	ns
Output Transition Time	t_{TLH}, t_{THL}	C_L = 50pF	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 = 1000pF, R_X = 10kΩ		-	4.5 to 5.5	-	±2	-	-	-	-	-	%
Power Dissipation Capacitance (Notes 4, 5)	CPD	-	5	-	166	-	-	-	-	-	pF

NOTES:

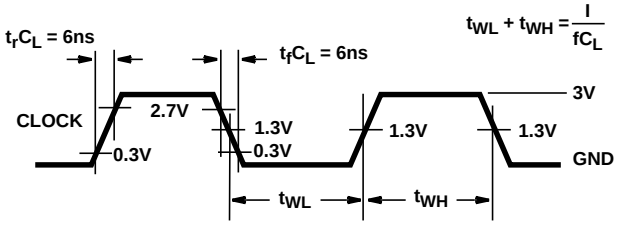
4. C_{PD} is used to determine the dynamic power consumption, per multivibrator.
5. $P_D = (C_{PD} + C_L) V_{CC}^2 f_i + \Sigma$ where f_i = input frequency, f_o = output frequency, C_L = output load capacitance, V_{CC} = supply voltage.

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

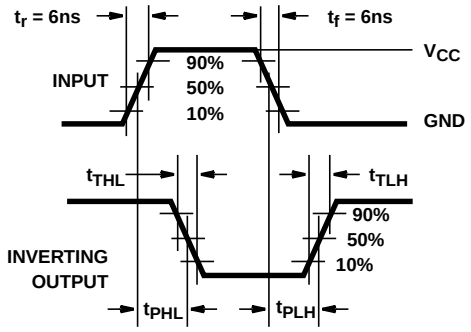


FIGURE 3. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

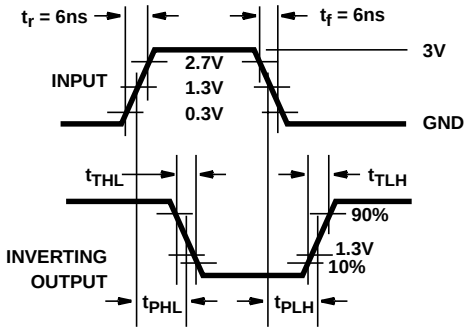


FIGURE 4. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

Typical Performance Curves

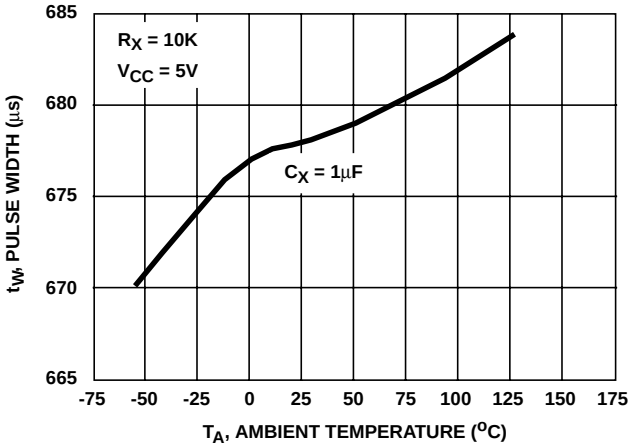


FIGURE 5. HC/HCT221 OUTPUT PULSE WIDTH vs TEMPERATURE

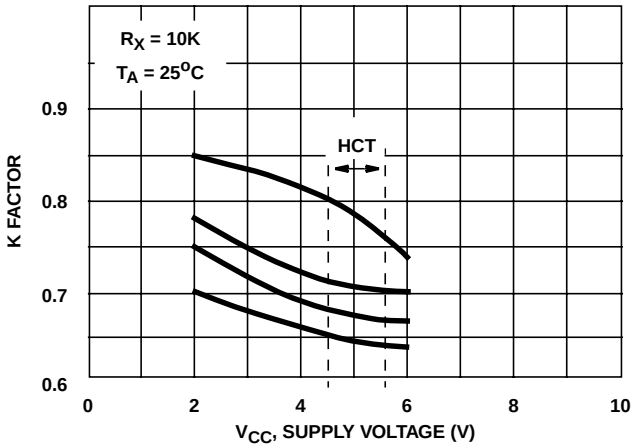


FIGURE 6. HC/HCT221 K FACTOR vs SUPPLY VOLTAGE

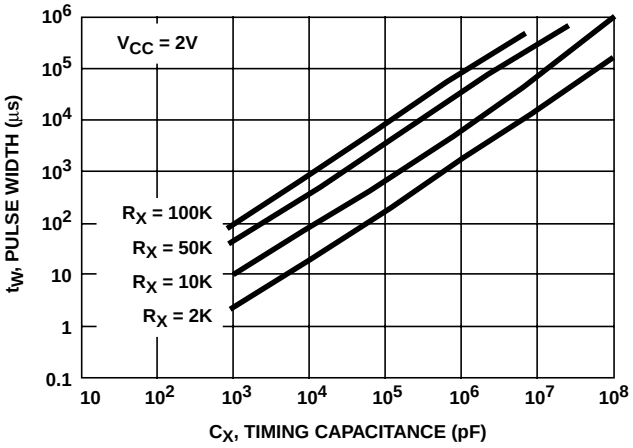


FIGURE 7. HC221 OUTPUT PULSE WIDTH vs C_X

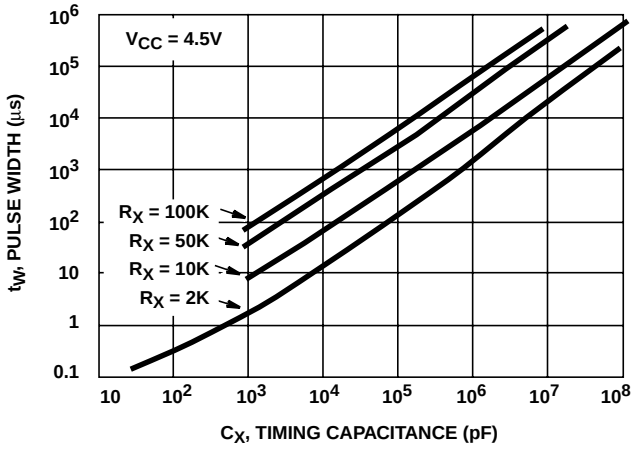


FIGURE 8. HC/HCT221 OUTPUT PULSE WIDTH vs C_X

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
5962-8780501EA	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8780501EA CD54HC221F3A
CD54HC221F	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD54HC221F
CD54HC221F.A	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD54HC221F
CD54HC221F3A	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8780501EA CD54HC221F3A
CD54HC221F3A.A	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8780501EA CD54HC221F3A
CD74HC221E	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74HC221E
CD74HC221E.A	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74HC221E
CD74HC221M	Obsolete	Production	SOIC (D) | 16	-	-	Call TI	Call TI	-55 to 125	HC221M
CD74HC221M96	Active	Production	SOIC (D) | 16	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC221M
CD74HC221M96.A	Active	Production	SOIC (D) | 16	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC221M
CD74HC221MT	Obsolete	Production	SOIC (D) | 16	-	-	Call TI	Call TI	-55 to 125	HC221M
CD74HC221NSR	Active	Production	SOP (NS) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC221M
CD74HC221NSR.A	Active	Production	SOP (NS) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC221M
CD74HC221PW	Obsolete	Production	TSSOP (PW) | 16	-	-	Call TI	Call TI	-55 to 125	HJ221
CD74HC221PWR	Active	Production	TSSOP (PW) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HJ221
CD74HC221PWR.A	Active	Production	TSSOP (PW) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HJ221
CD74HC221PWR.B	Active	Production	TSSOP (PW) | 16	2000 | LARGE T&R	-	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HJ221
CD74HC221PWT	Obsolete	Production	TSSOP (PW) | 16	-	-	Call TI	Call TI	-55 to 125	HJ221
CD74HCT221E	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74HCT221E
CD74HCT221E.A	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74HCT221E
CD74HCT221M	Obsolete	Production	SOIC (D) | 16	-	-	Call TI	Call TI	-55 to 125	HCT221M
CD74HCT221M96	Active	Production	SOIC (D) | 16	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HCT221M
CD74HCT221M96.A	Active	Production	SOIC (D) | 16	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HCT221M
CD74HCT221MT	Obsolete	Production	SOIC (D) | 16	-	-	Call TI	Call TI	-55 to 125	HCT221M

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

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

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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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 CD54HC221, CD74HC221 :

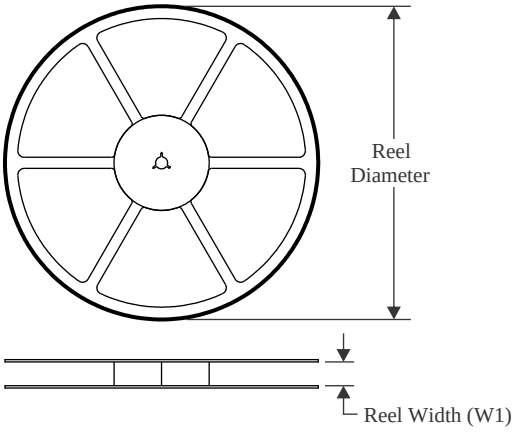
- Catalog : CD74HC221
- Military : CD54HC221

NOTE: Qualified Version Definitions:

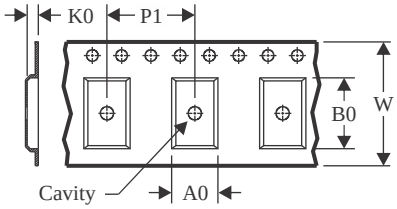
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

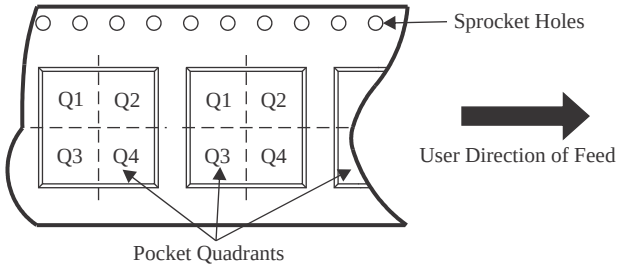


TAPE DIMENSIONS



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

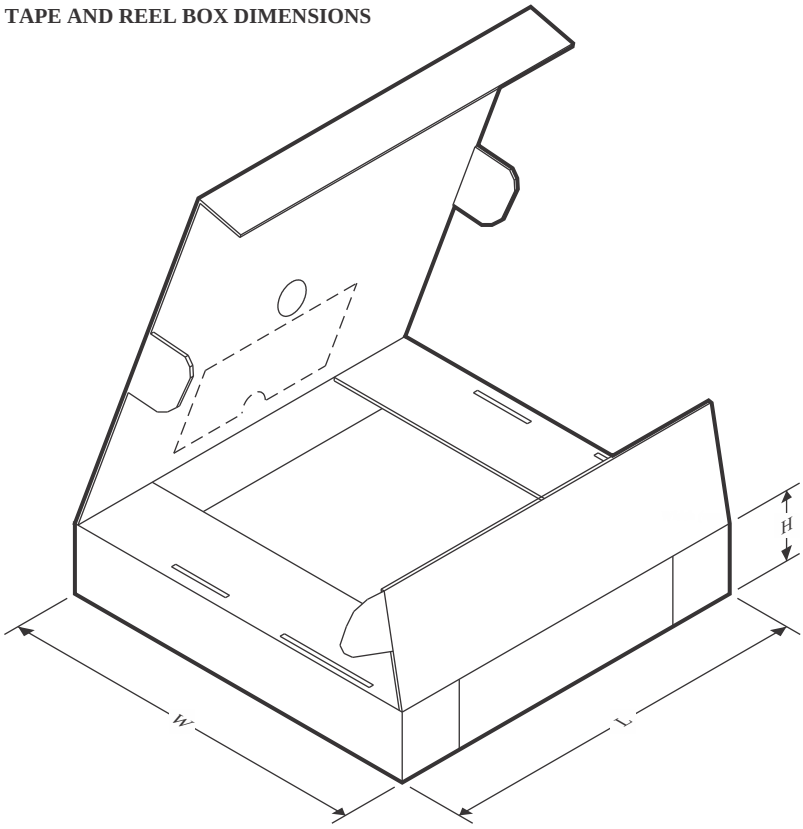
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CD74HC221M96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
CD74HC221NSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
CD74HC221PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
CD74HCT221M96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1

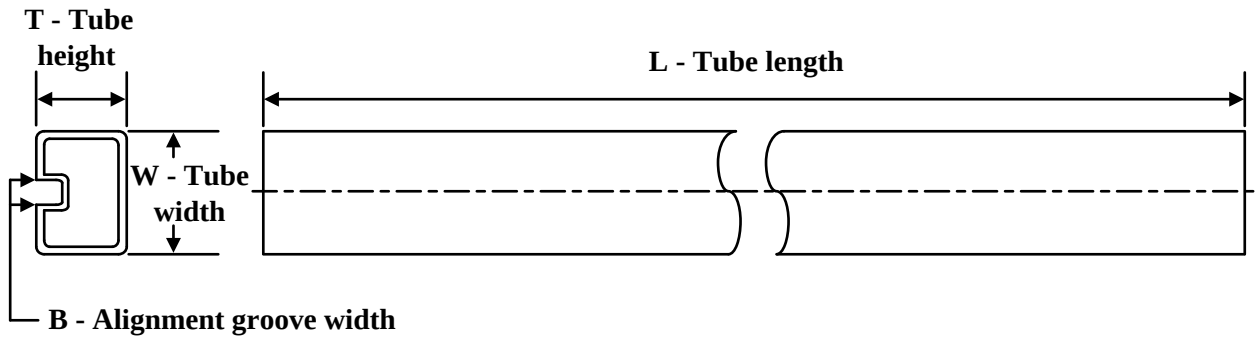
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

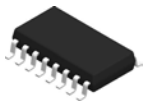
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD74HC221M96	SOIC	D	16	2500	353.0	353.0	32.0
CD74HC221NSR	SOP	NS	16	2000	353.0	353.0	32.0
CD74HC221PWR	TSSOP	PW	16	2000	353.0	353.0	32.0
CD74HCT221M96	SOIC	D	16	2500	353.0	353.0	32.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
CD74HC221E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HC221E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HC221E.A	N	PDIP	16	25	506	13.97	11230	4.32
CD74HC221E.A	N	PDIP	16	25	506	13.97	11230	4.32
CD74HCT221E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HCT221E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HCT221E.A	N	PDIP	16	25	506	13.97	11230	4.32
CD74HCT221E.A	N	PDIP	16	25	506	13.97	11230	4.32

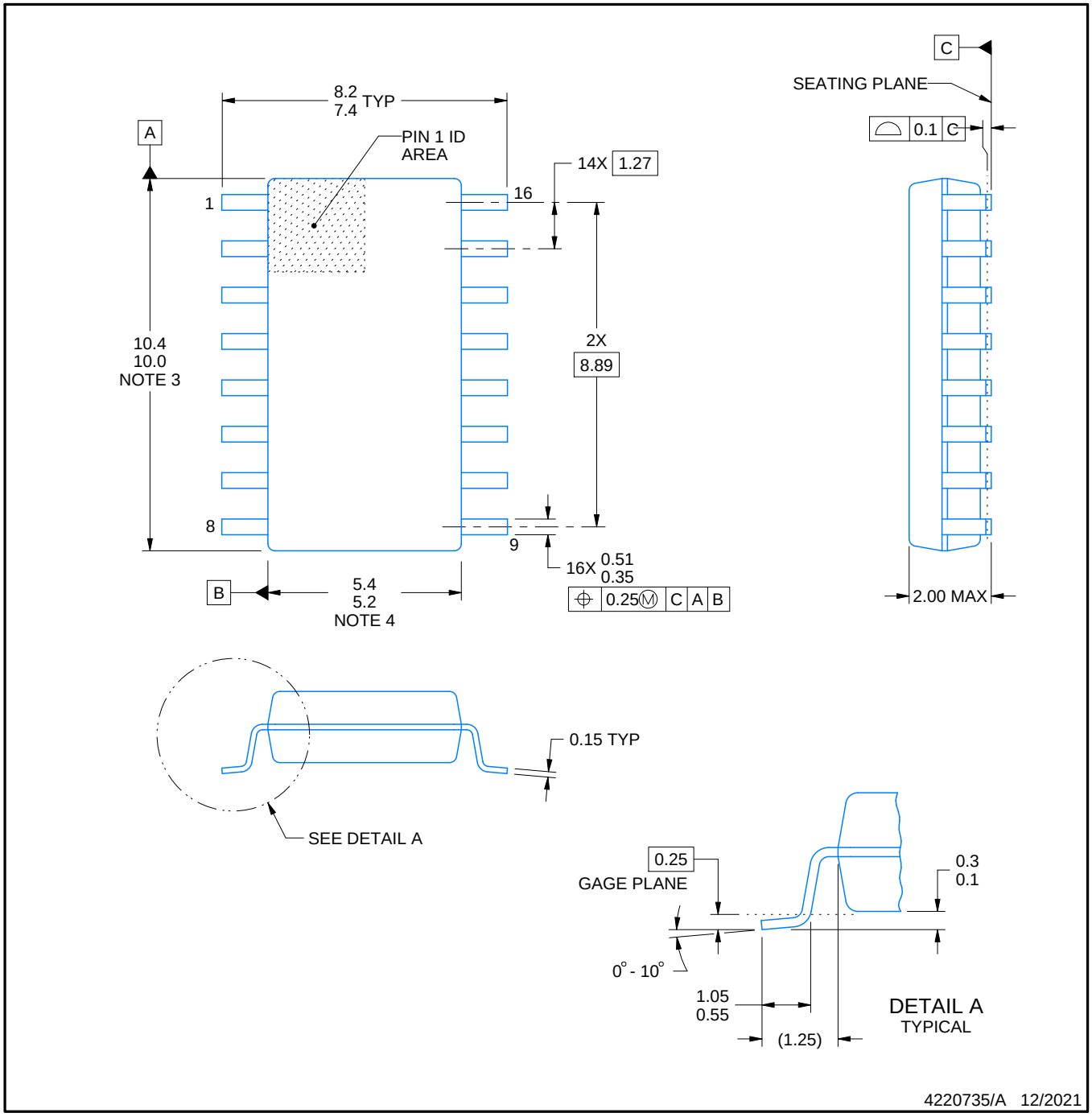


PACKAGE OUTLINE

NS0016A

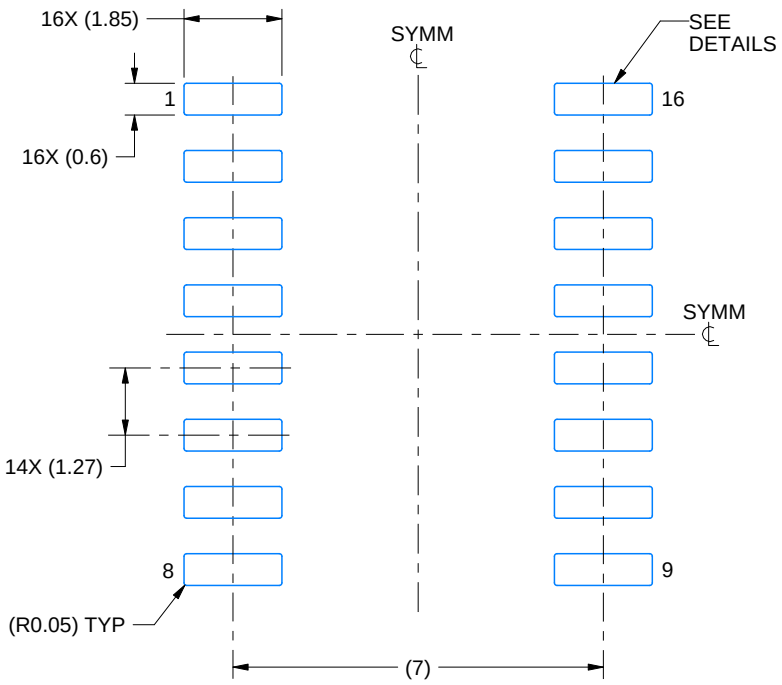
SOP - 2.00 mm max height

SOP

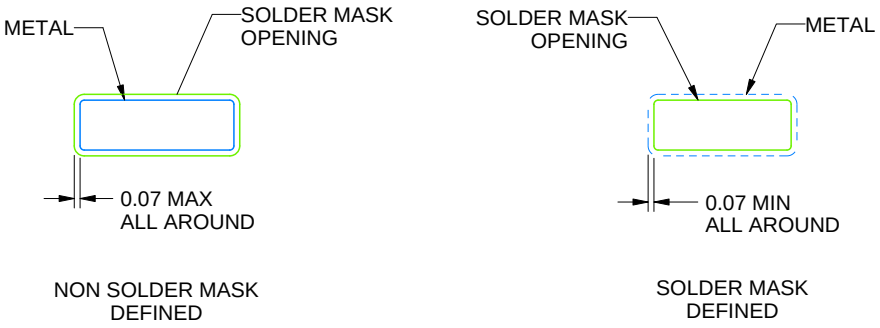


NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.



LAND PATTERN EXAMPLE
SCALE:7X



NON SOLDER MASK
DEFINED

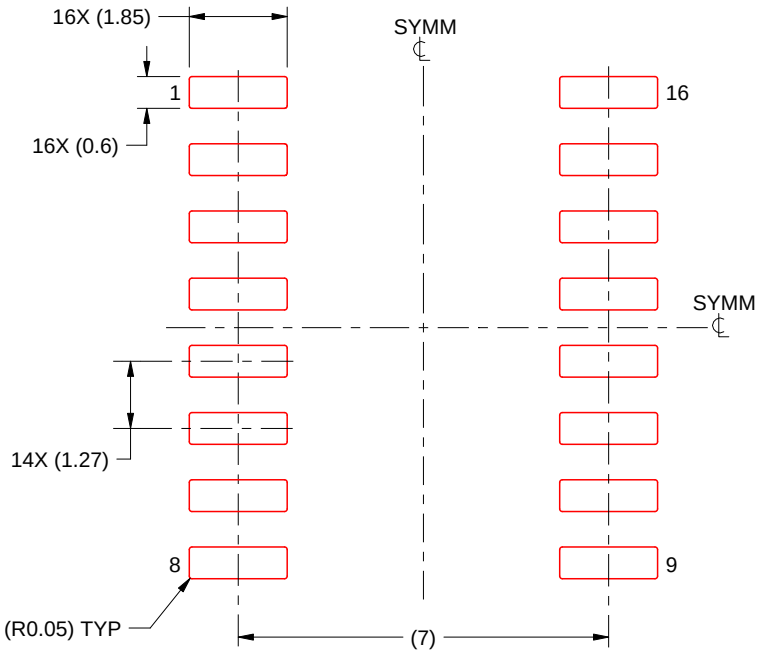
SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



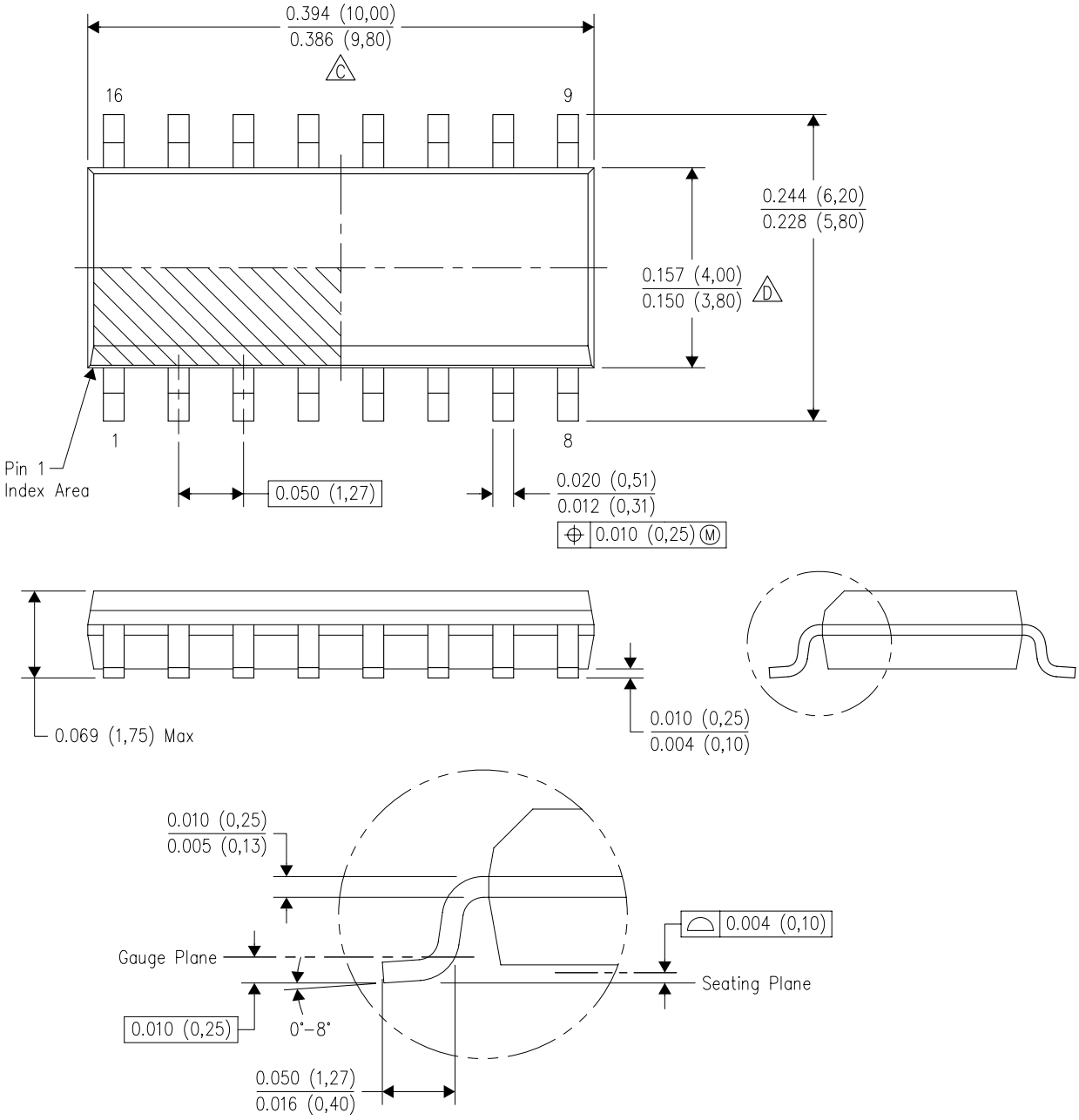
SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

4220735/A 12/2021

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

D (R–PDSO–G16) PLASTIC SMALL OUTLINE

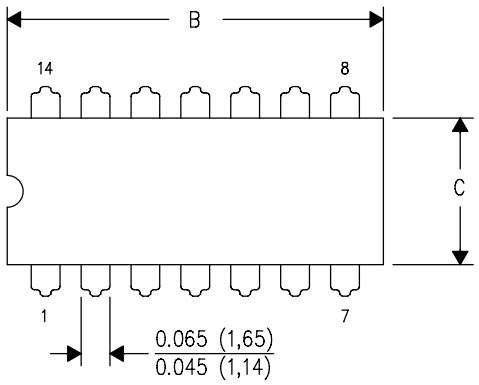


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AC.

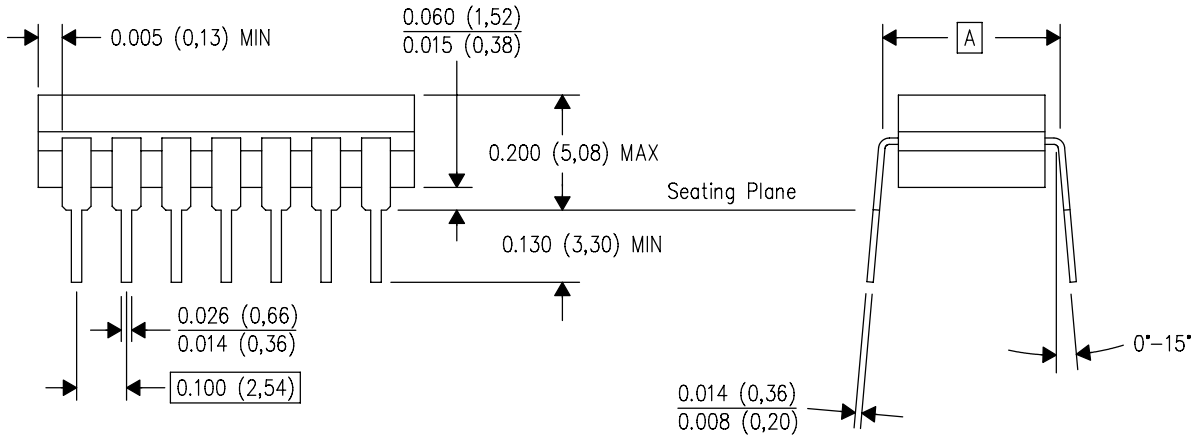
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



DIM \ PINS **	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

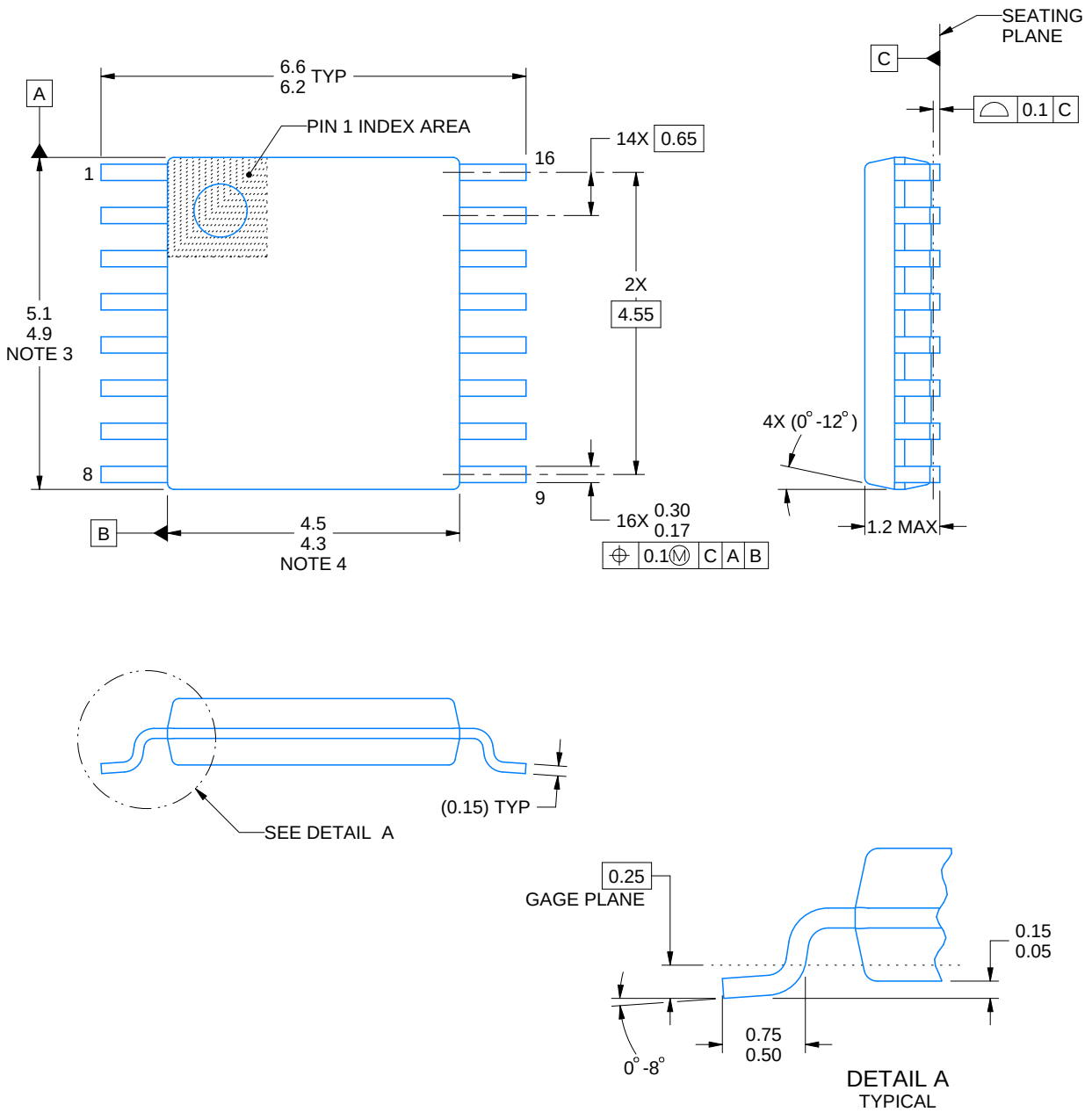
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls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

PACKAGE OUTLINE

PW0016A

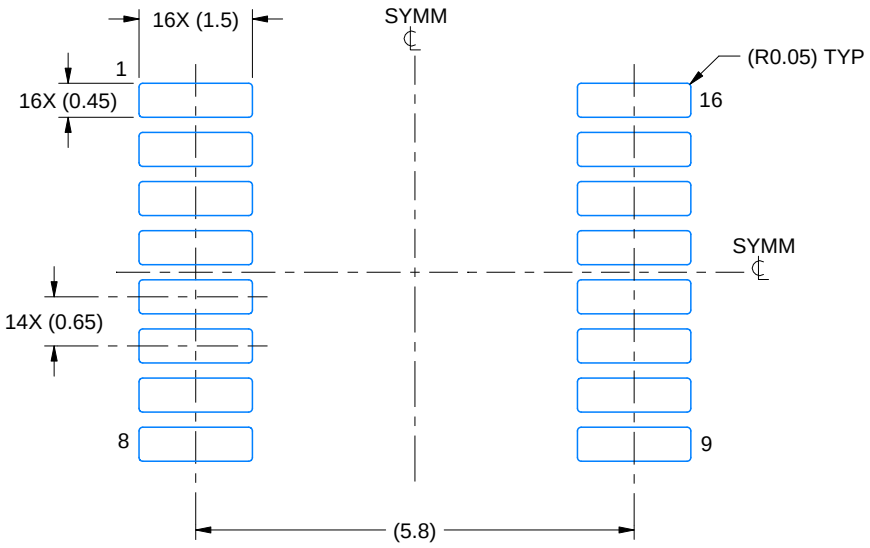
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.



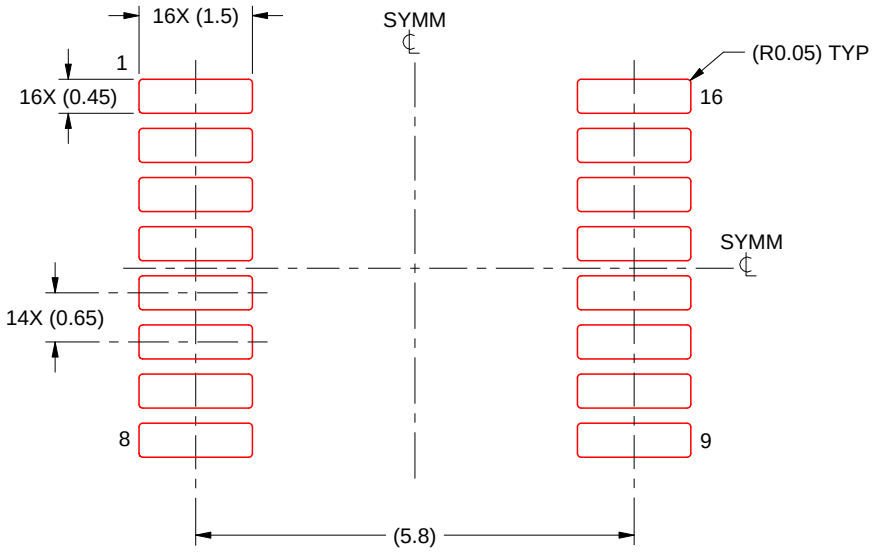
LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK DETAILS

4220204/B 12/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220204/B 12/2023

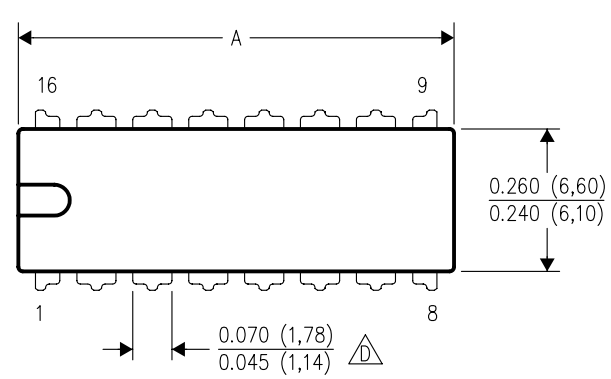
NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

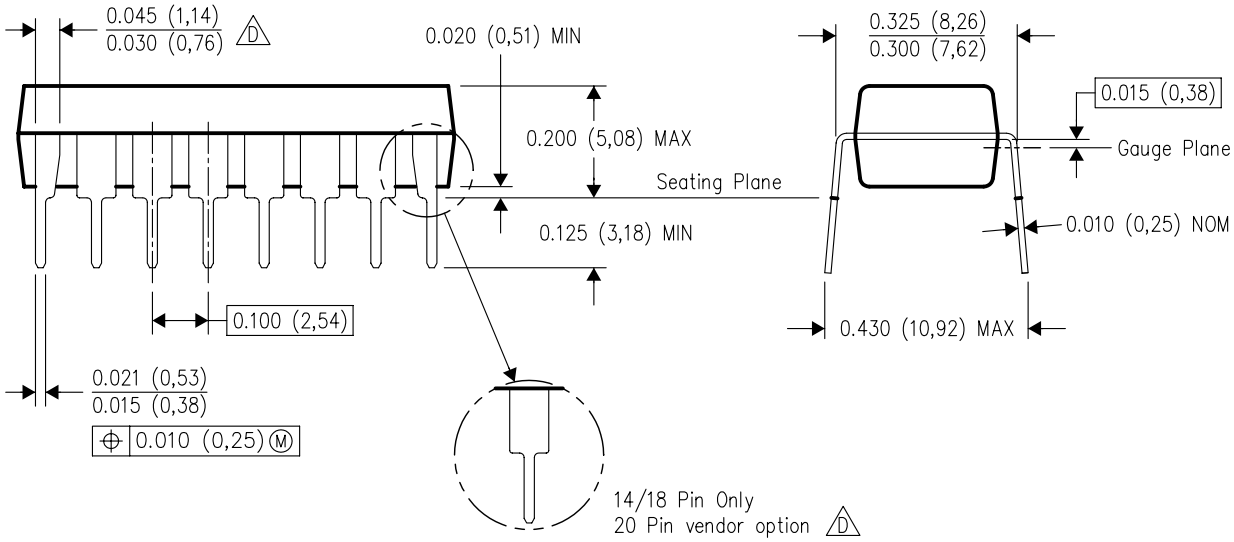
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



DIM \ PINS **	14	16	18	20
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 (C)	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.

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