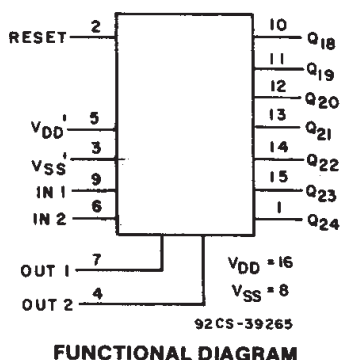


CD4521B Types

CMOS 24-Stage Frequency Divider

High-Voltage Types (20-Volt Rating)

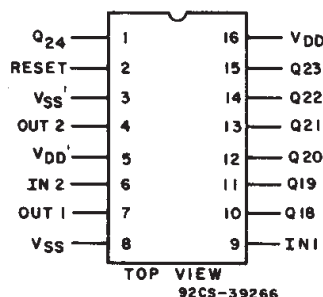


Features:

- Reset disables the RC oscillator for low-power standby condition
- V_{DD}' and V_{SS}' pins are brought out from the crystal oscillator to allow use of external resistors for low-power operation
- Maximum input current of 1 μ A at 18 V over full package-temperature range: 100 nA at 18 V and 25°C
- Common reset
- 100% tested for 20-V quiescent current
- 5, 10 and 15 V parametric ratings
- Standardized symmetrical output characteristics
- Meets all requirements of JEDEC Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

■ CD4521B consists of an oscillator section and 24 ripple-carry binary counter stages. The oscillator configuration (using IN1) allows design of either RC or crystal oscillator circuits. IN1 should be tied either HIGH or LOW when not in use. A HIGH on the RESET causes the counter to go to the all-0's state and disables the oscillator. The count is advanced on the negative transition of IN1 (and IN2). A time-saving test mode is described in the Functional Test Sequence Table and in Fig. 6.

The CD4521B types are supplied in 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (M, M96, MT, and NSR suffixes), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).



TERMINAL ASSIGNMENT

OUTPUT	COUNT CAPACITY
Q18	2 ¹⁸ = 262,144
Q19	2 ¹⁹ = 524,288
Q20	2 ²⁰ = 1,048,576
Q21	2 ²¹ = 2,097,152
Q22	2 ²² = 4,194,304
Q23	2 ²³ = 8,388,608
Q24	2 ²⁴ = 16,777,216

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE RANGE, (V_{DD})

Voltages referenced to V_{SS} Terminal) -0.5V to +20V

INPUT VOLTAGE RANGE, ALL INPUTS -0.5V to V_{DD} + 0.5V

DC INPUT CURRENT, ANY ONE INPUT ± 10 mA

POWER DISSIPATION PER PACKAGE (P_D):

For T_A = -55°C to +100°C 500mW

For T_A = +100°C to +125°C Derate Linearly at 12mW/°C to 200mW

DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR T_A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types) 100mW

OPERATING-TEMPERATURE RANGE (T_A) -55°C to +125°C

STORAGE TEMPERATURE RANGE (T_{sto}) -65°C to +150°C

LEAD TEMPERATURE (DURING SOLDERING):

At distance 1/16 $\pm$ 1/32 inch (1.59 $\pm$ 0.79mm) from case for 10s max +265°C

CD4521B Types

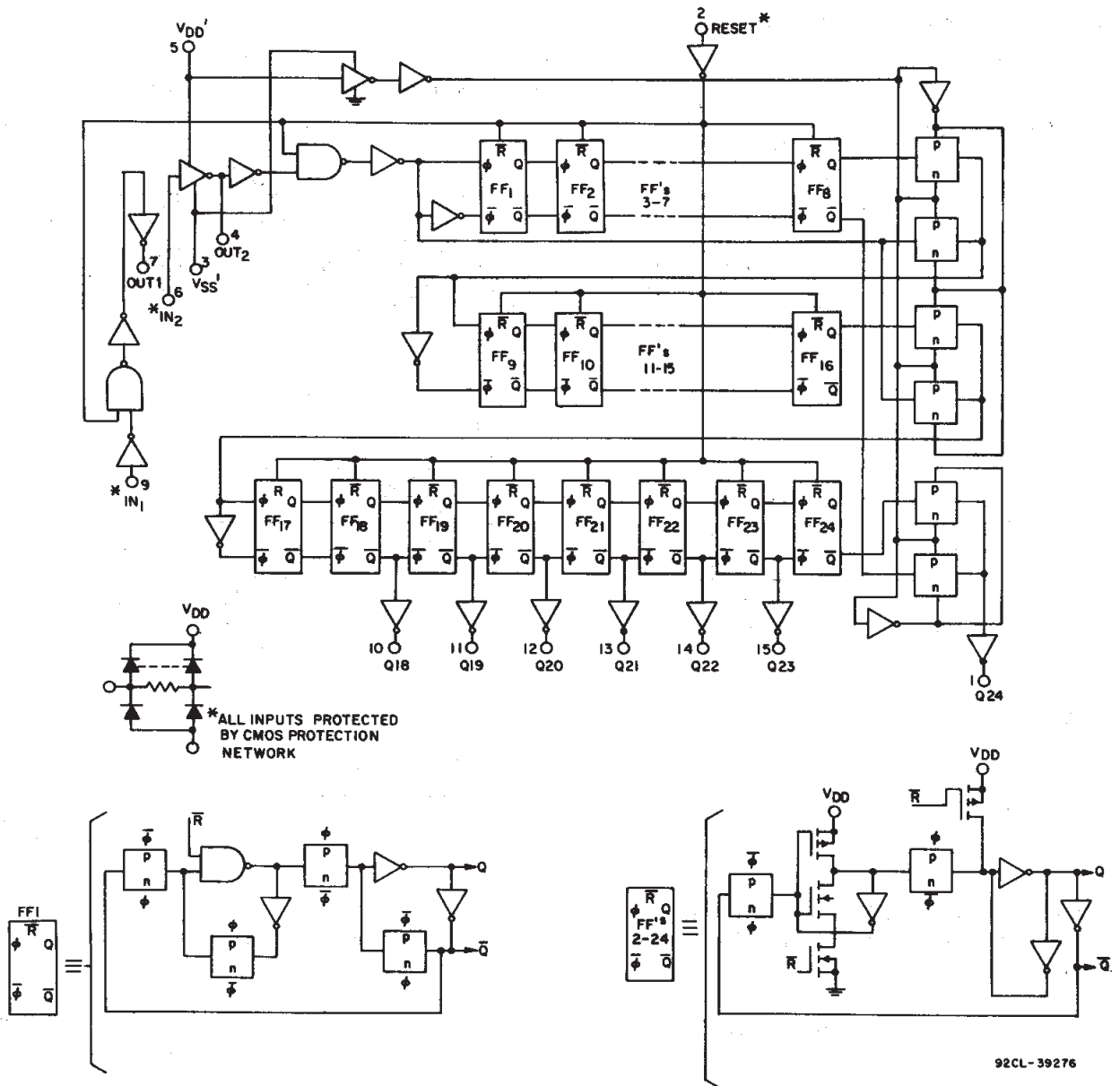


Fig. 1 - Logic diagram for CD4521B.

3
COMMERCIAL CMOS
HIGH VOLTAGE ICs

CD4521B Types

STATIC ELECTRICAL CHARACTERISTICS

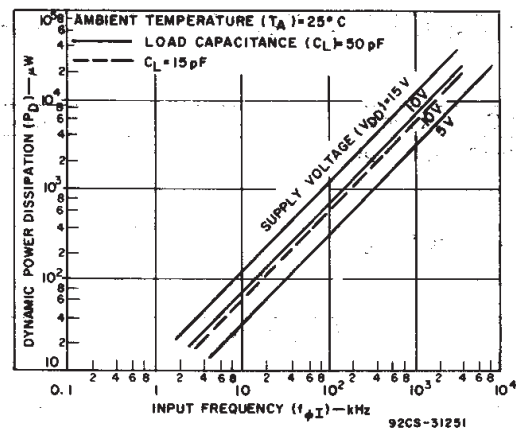
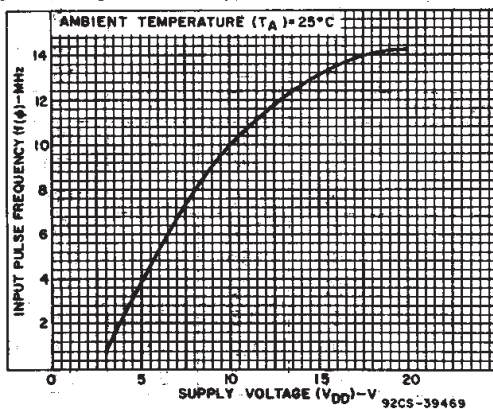
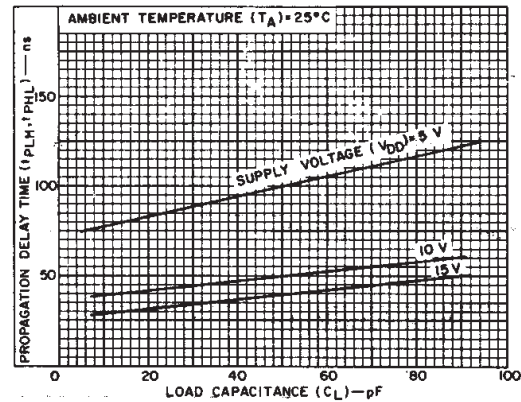
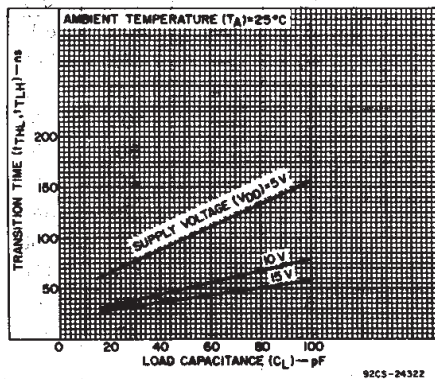
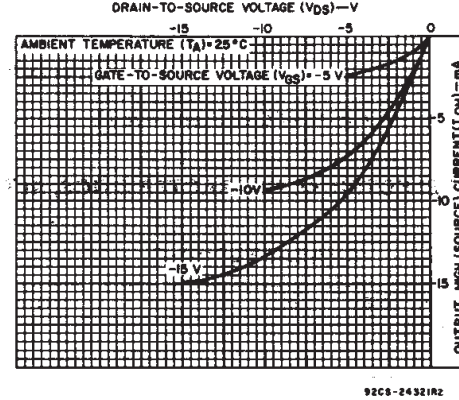
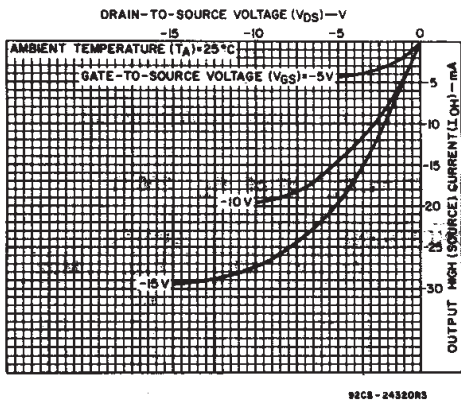
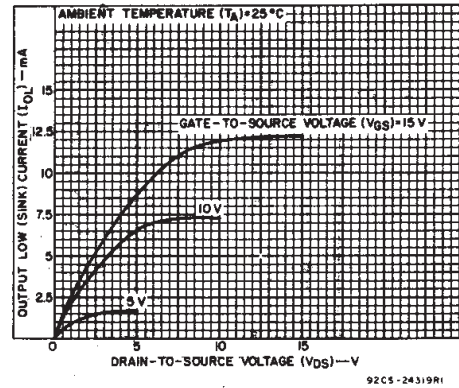
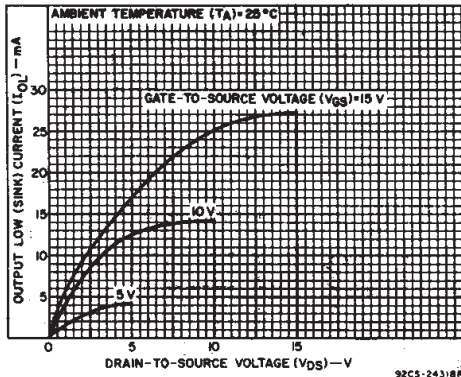
CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
	V _O (V)	V _{IN} (V)	V _{DD} (V)	-55	-40	+85	+125	+25			
								Min.	Typ.	Max.	
Quiescent Device Current, I _{DD} Max.	—	0, 5	5	5	5	150	150	—	0.04	5	μA
	—	0, 10	10	10	10	300	300	—	0.04	10	
	—	0, 15	15	20	20	600	600	—	0.04	20	
	—	0, 20	20	100	100	3000	3000	—	0.08	100	
Output Low (Sink) Current, I _{OL} Min.	0.4	0, 5	5	0.64	0.61	0.42	0.36	0.51	1	—	mA
	0.5	0, 10	10	1.6	1.5	1.1	0.9	1.3	2.6	—	
	1.5	0, 15	15	4.2	4	2.8	2.4	3.4	6.8	—	
Output High (Source) Current, I _{OH} Min.	4.6	0, 5	5	-0.64	-0.61	-0.42	-0.36	-0.51	-1	—	
	2.5	0, 5	5	-2	-1.8	-1.3	-1.15	-1.6	-3.2	—	
	9.5	0, 10	10	-1.6	-1.5	-1.1	-0.9	-1.3	-2.6	—	
	13.5	0, 15	15	-4.2	-4	-2.8	-2.4	-3.4	-6.8	—	
Output Voltage: Low-Level, V _{OL} Max.	—	0, 5	5	0.05				—	0	0.05	V
	—	0, 10	10	0.05				—	0	0.05	
	—	0, 15	15	0.05				—	0	0.05	
Output Voltage: High-Level, V _{OH} Min.	—	0, 5	5	4.95				4.95	5	—	
	—	0, 10	10	9.95				9.95	10	—	
	—	0, 15	15	14.95				14.95	15	—	
Input Low Voltage, V _{IL} Max.	0.5, 4.5	—	5	1.5				—	—	1.5	
	1, 9	—	10	3				—	—	3	
	1.5, 13.5	—	15	4				—	—	4	
Input High Voltage, V _{IH} Min.	0.5, 4.5	—	5	3.5				3.5	—	—	
	1, 9	—	10	7				7	—	—	
	1.5, 13.5	—	15	11				11	—	—	
Input Current, I _{IN} Max.	—	0, 18	18	±0.1	±0.1	±1	±1	—	±10 ⁻⁵	±0.1	μA

RECOMMENDED OPERATING CONDITIONS

For maximum reliability, nominal operating conditions should be selected so that operating is always within the following ranges:

CHARACTERISTIC	V _{DD} (V)	LIMITS		UNITS
		Min.	Max.	
Supply-Voltage Range (For T _A = Full Package-Temperature Range)	—	3	18	V
Input Pulse Width $t_{w\phi}$	5	340	—	ns
	10	150	—	
	15	120	—	
Reset Pulse Width $t_{w(R)}$	5	180	—	ns
	10	80	—	
	15	50	—	
Input Pulse Frequency $f\phi$	5	—	2	MHz
	10	—	5	
	15	—	6.5	
Input Pulse Rise or Fall Time $t_r\phi, t_f\phi$	5	—	15	μs
	10	—	15	
	15	—	15	
R _T Operating Range	5	1K	10M	Ω
	10	1K	10M	
	15	1K	10M	
C _T Operating Range	5	15p	10M	F
	10	15p	10M	
	15	15p	10M	

CD4521B Types



CD4521B Types

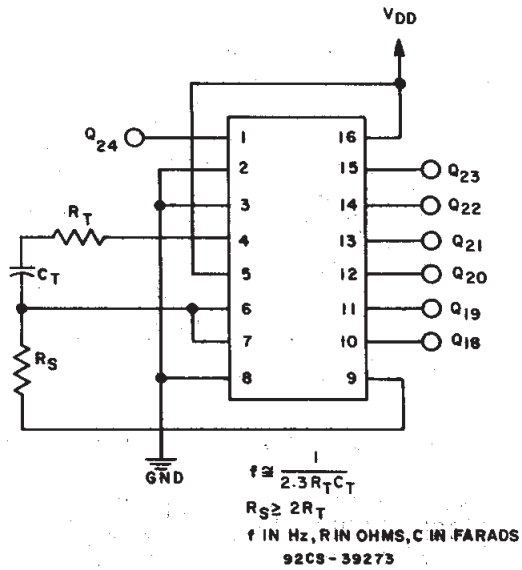


Fig. 10 - RC oscillator circuit.

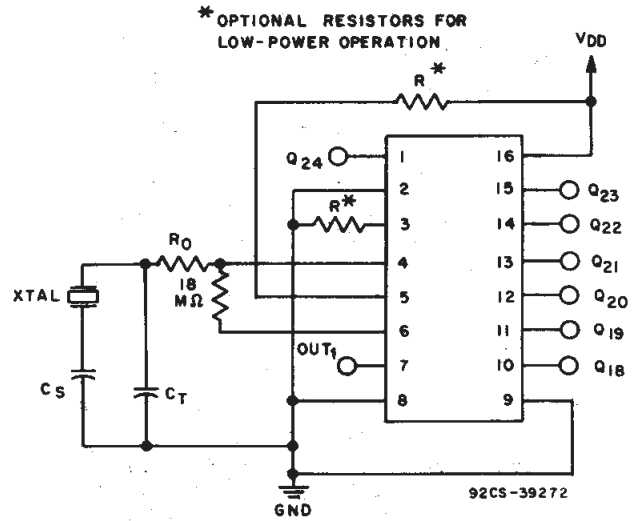


Fig. 11 - Crystal oscillator circuit.

DYNAMIC ELECTRICAL CHARACTERISTICS, At $T_A = 25^\circ\text{C}$; Input $t_r, t_f = 20\text{ ns}$, $C_L = 50\text{ pF}$, $R_L = 200\ \Omega$

CHARACTERISTIC	TEST CONDITIONS	LIMITS				UNITS
		$V_{DD}(V)$	Min.	Typ.	Max.	
Propagation Delay Time: Input to Q18	t_{PLH}, t_{PHL}	5	—	4.5	9	μs
		10	—	1.7	3.5	
		15	—	1.3	2.7	
Input to Q24		5	—	6	12	μs
		10	—	2.2	4.5	
		15	—	1.7	3.5	
Reset to Qn		5	—	400	800	μs
		10	—	170	340	
		15	—	120	240	
Transition Time*	t_{HL}, t_{LH}	5	—	100	200	ns
		10	—	50	100	
		15	—	40	80	
Minimum Input Pulse Width	$t_{w\phi}$	5	—	170	340	ns
		10	—	75	150	
		15	—	60	120	
Minimum Reset Pulse Width	$t_{w(R)}$	5	—	90	180	ns
		10	—	40	80	
		15	—	25	50	
Maximum Input Pulse Frequency	$f\phi$	5	2	4	—	MHz
		10	5	10	—	
		15	6.5	13	—	
Input Pulse Rise or Fall Time	$t_r\phi, t_f\phi$	5	—	—	15	μs
		10	—	—	15	
		15	—	—	15	
Input Capacitance	C_{IN}	Any Input	—	5	7.5	pF
R_T Operating Range		5	1K	—	10M	Ω
		10	1K	—	10M	
		15	1K	—	10M	
C_T Operating Range		5	15p	—	10 μ	F
		10	15p	—	10 μ	
		15	15p	—	10 μ	
Maximum Oscillator Frequency	$R_T=1\text{ K}\Omega$ $C_T=15\text{ pF}$ $R_S=30\text{ K}\Omega$	5	0.5	0.7	0.9	MHz
		10	1.2	1.5	1.8	
		15	1.7	2.1	2.5	

*Not applicable for pin 4 (OUT2).

CD4521B Types

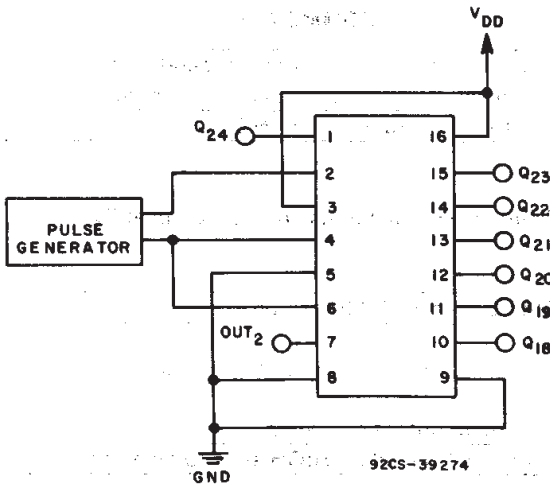


Fig. 12 - Functional test circuit.

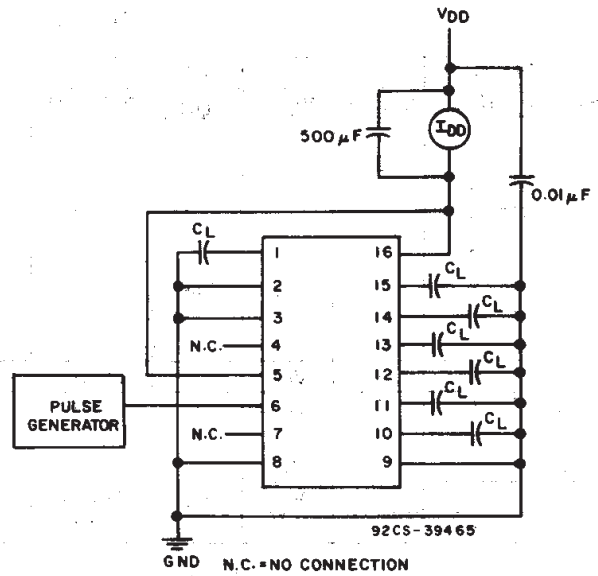


Fig. 13 - Dynamic power dissipation test circuit.

3
COMMERCIAL CMOS
HIGH VOLTAGE ICs

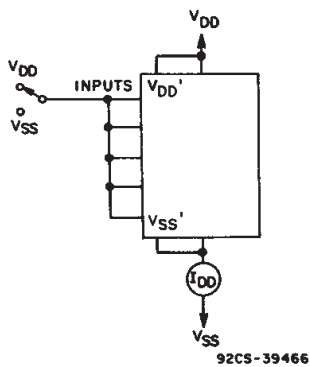


Fig. 14 - Quiescent device current.

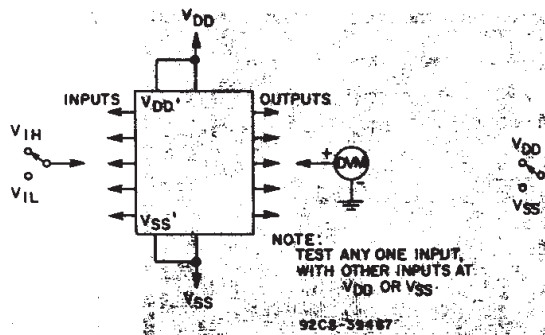


Fig. 15 - Input voltage.

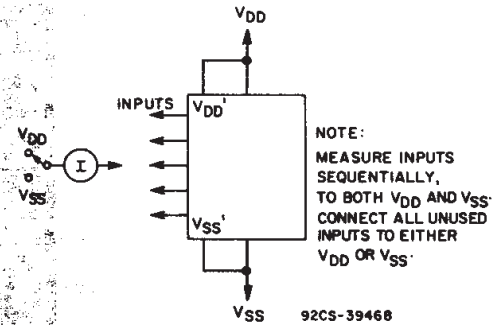


Fig. 16 - Input current.

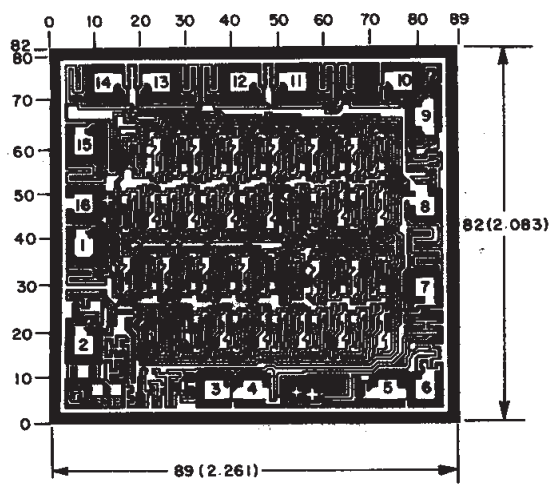
CD4521B Types

FUNCTIONAL TEST SEQUENCE

INPUTS		OUTPUTS				COMMENTS
RESET	IN 2	OUT 2	V _{SS}	V _{DD}	Q18-Q24	
1	0	0	V _{DD}	V _{SS}	LOW	Counter is in three 8-stage sections in parallel mode. Counter is reset. IN 2 and OUT 2 are tied together.
0	1	1	V _{DD}	V _{SS}		First LOW-to-HIGH transition at IN 2.
0	0 1 — — —	0 1 — — —	V _{DD}	V _{SS}		255 LOW-to-HIGH transitions are clocked in at IN 2.
0	1	1	V _{DD}	V _{SS}	HIGH	The 255th LOW-to-HIGH transition.
0	0	0	V _{DD}	V _{SS}	HIGH	Counter is converted back to 24-stage serial-mode operation.
0	0	0	V _{SS}	V _{SS}	HIGH	
0	1	0	V _{SS}	V _{DD}	HIGH	
0	1		V _{SS}	V _{DD}	HIGH	OUT 2 reverts to output operation.
0	0		V _{SS}	V _{DD}	LOW	Counter ripples from an all-HIGH state to an all-LOW state.

A test function, which divides, has been included to reduce the time required to test all 24 stages of the counter. Three sections are loaded in parallel to 255 counts, forcing all the outputs to be in the HIGH state. The counter is changed

back to serial-mode operation and one additional LOW-to-HIGH transition is entered at IN 2, which causes the outputs to ripple from an all-HIGH state to an all-LOW state.



Dimensions and pad layout for CD4521BH.

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10^{-3} inch).

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)
CD4521BE	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4521BE
CD4521BE.A	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4521BE
CD4521BEE4	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4521BE
CD4521BM	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4521BM
CD4521BM96	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4521BM
CD4521BM96.A	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4521BM
CD4521BMT	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4521BM
CD4521BNSR	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4521B
CD4521BNSR.A	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4521B
CD4521BPW	Active	Production	TSSOP (PW) 16	90 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM521B
CD4521BPW.A	Active	Production	TSSOP (PW) 16	90 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM521B

⁽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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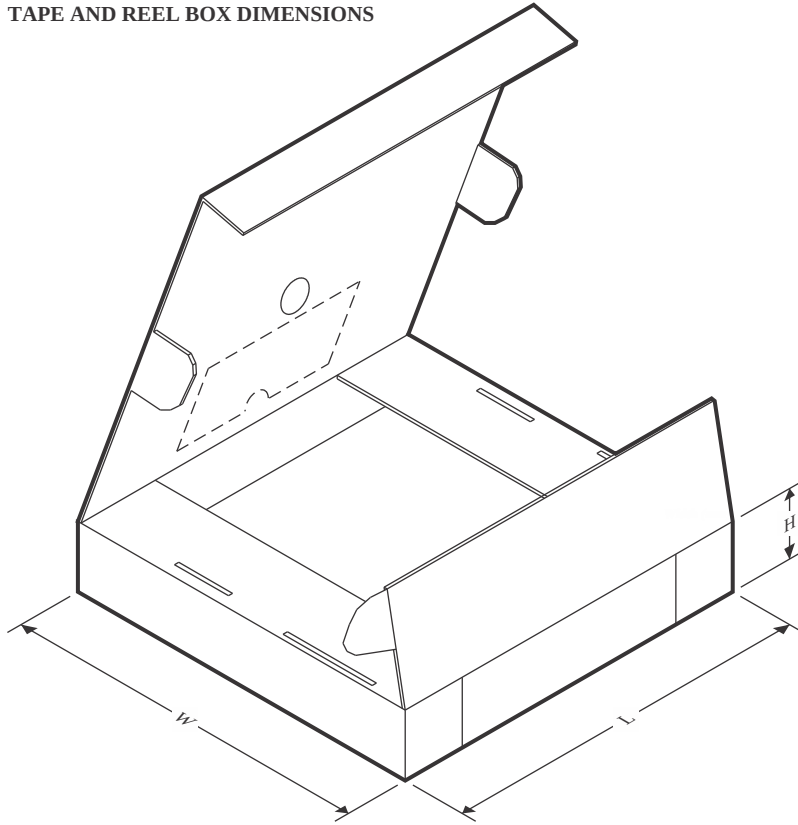
TAPE AND REEL INFORMATION



*All dimensions are nominal

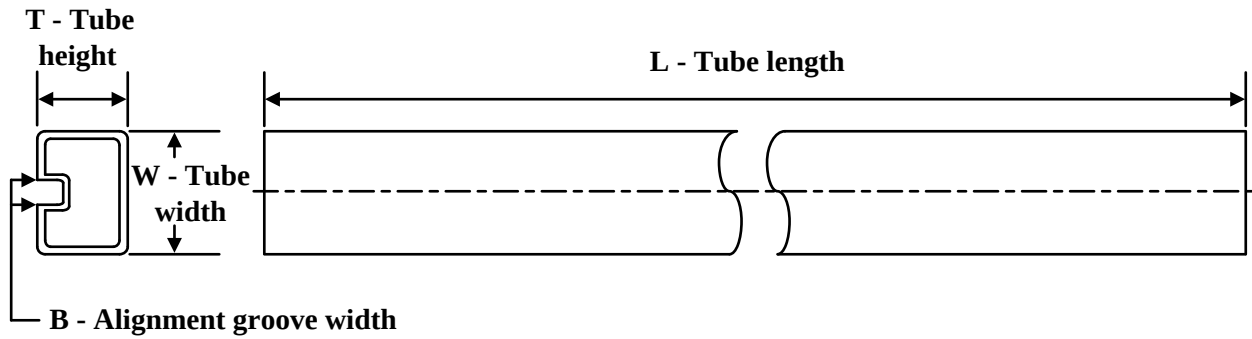
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CD4521BM96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
CD4521BNSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



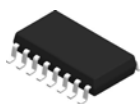
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD4521BM96	SOIC	D	16	2500	353.0	353.0	32.0
CD4521BNSR	SOP	NS	16	2000	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)
CD4521BE	N	PDIP	16	25	506	13.97	11230	4.32
CD4521BE	N	PDIP	16	25	506	13.97	11230	4.32
CD4521BE.A	N	PDIP	16	25	506	13.97	11230	4.32
CD4521BE.A	N	PDIP	16	25	506	13.97	11230	4.32
CD4521BEE4	N	PDIP	16	25	506	13.97	11230	4.32
CD4521BEE4	N	PDIP	16	25	506	13.97	11230	4.32
CD4521BPW	PW	TSSOP	16	90	530	10.2	3600	3.5
CD4521BPW.A	PW	TSSOP	16	90	530	10.2	3600	3.5

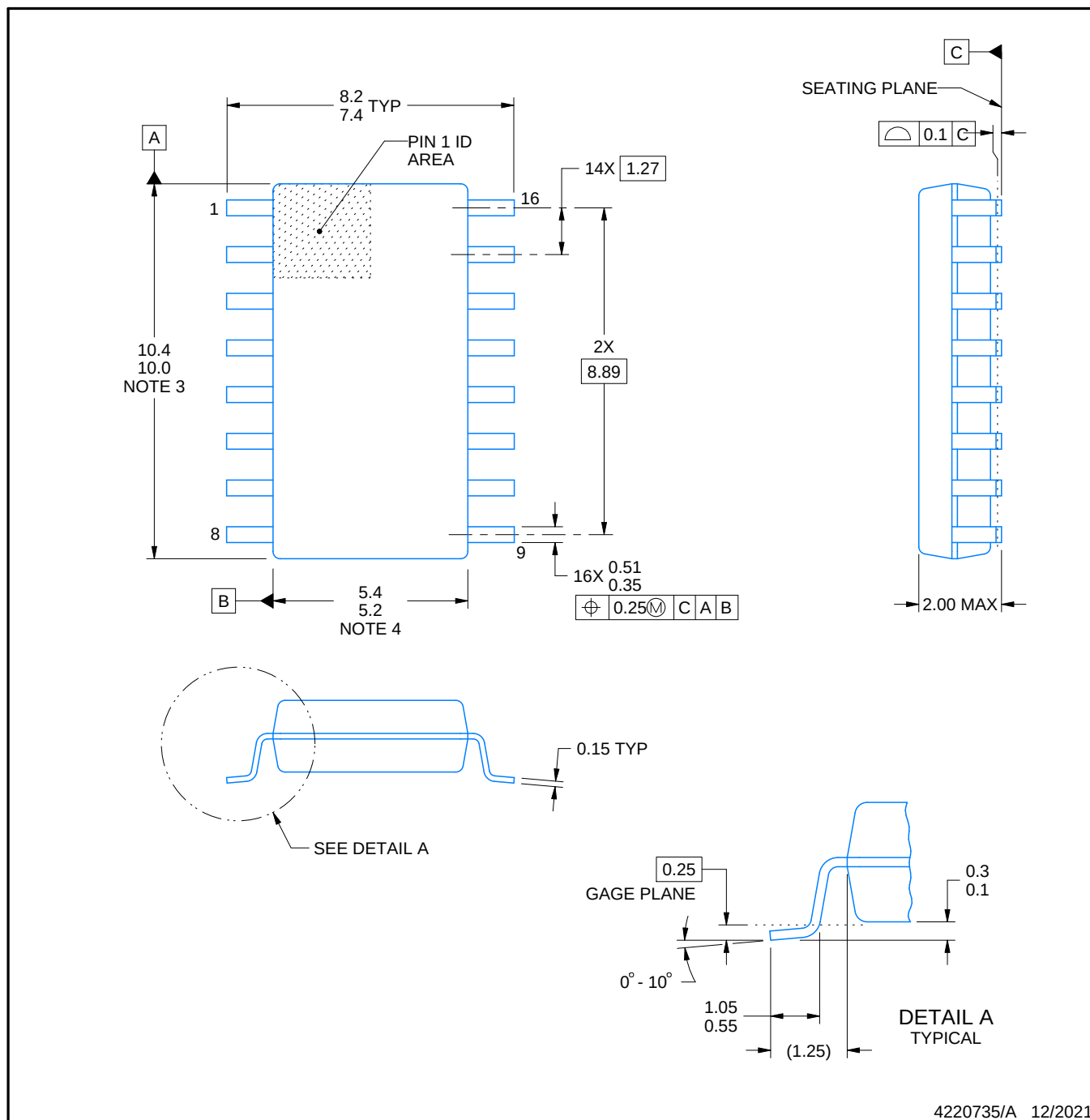


PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

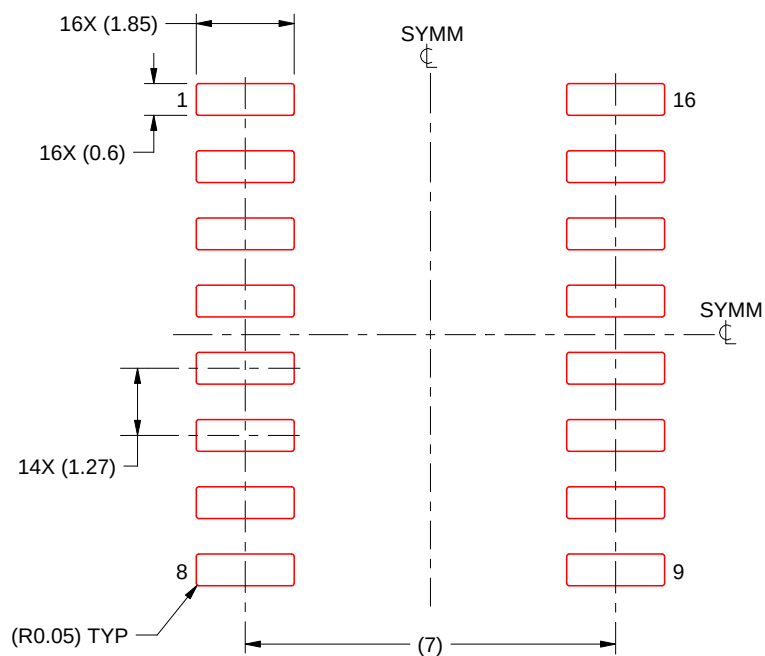
SOP



4220735/A 12/2021

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.



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

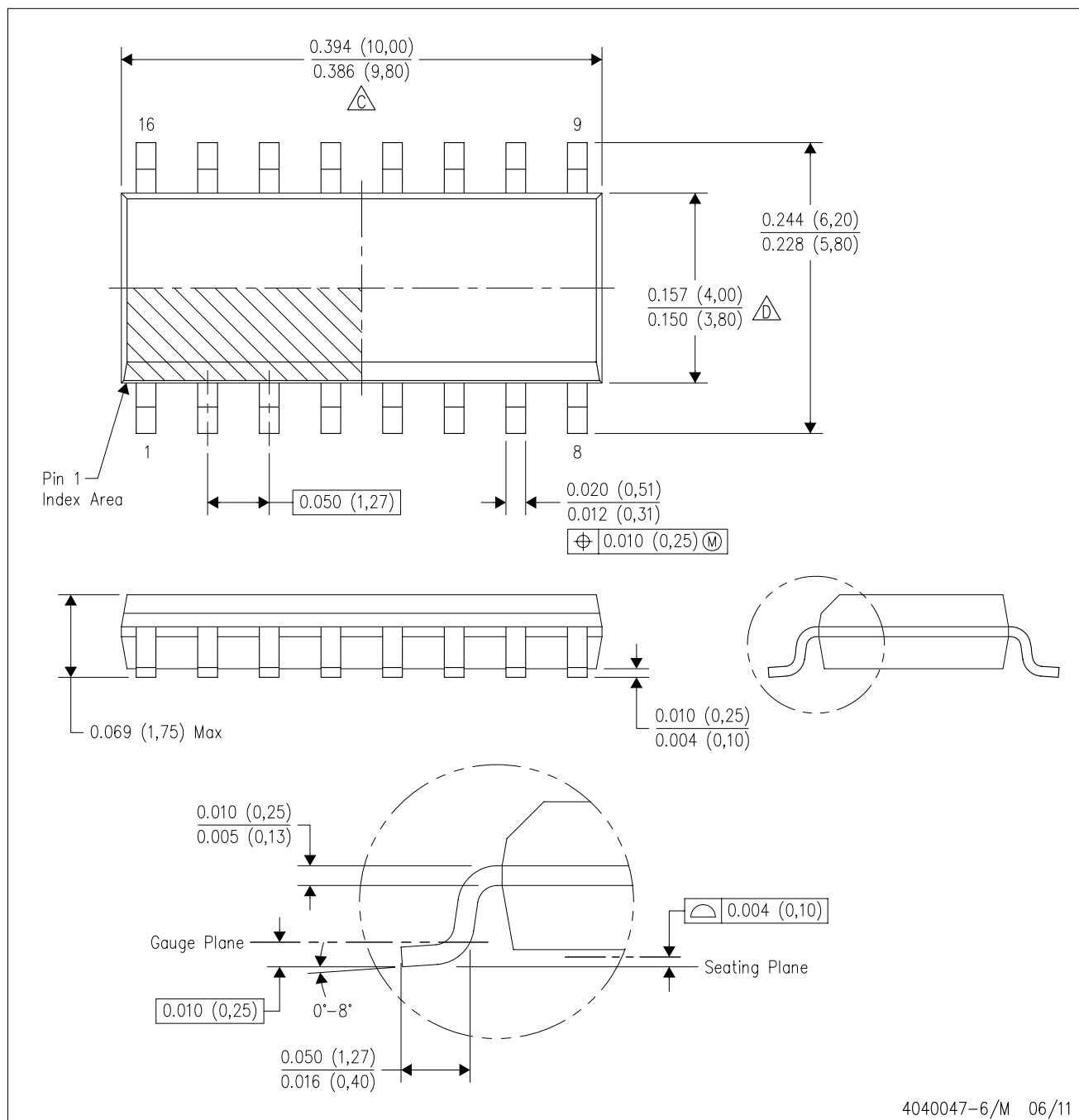
4220735/A 12/2021

NOTES: (continued)

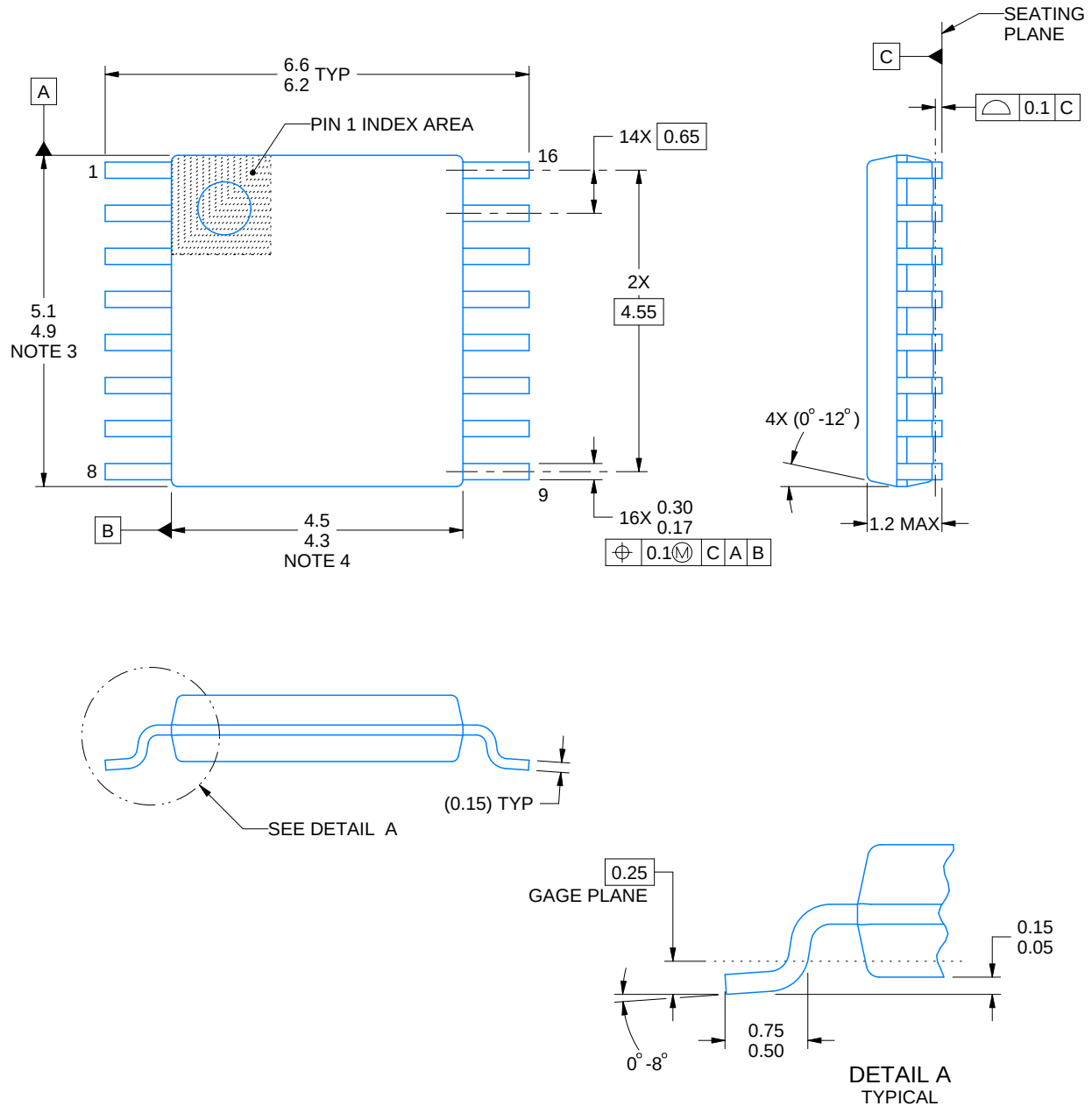
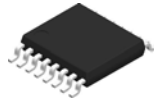
7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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.



4220204/B 12/2023

NOTES:

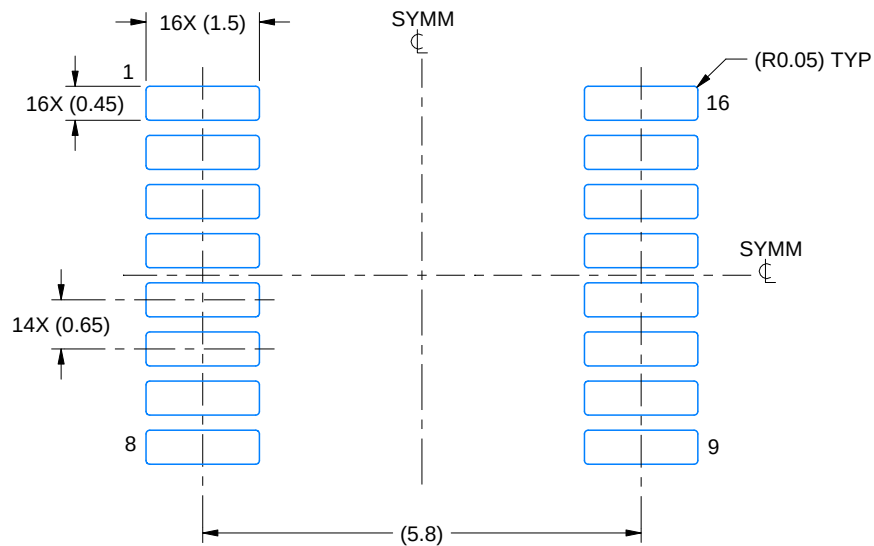
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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.

EXAMPLE BOARD LAYOUT

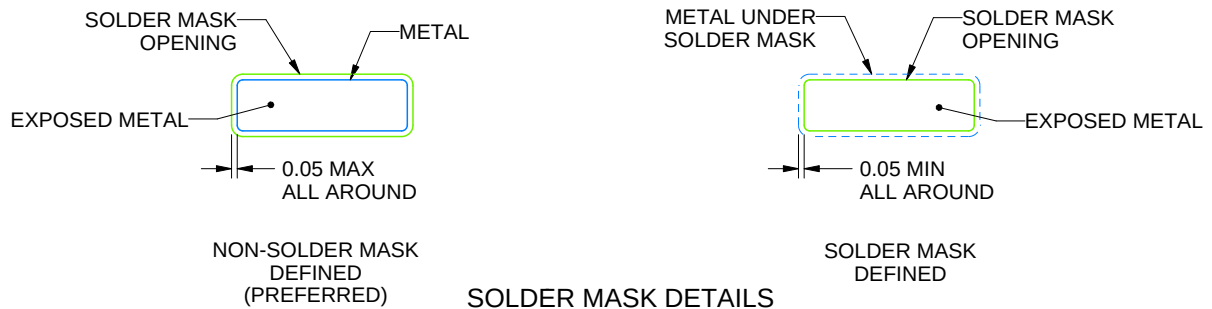
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

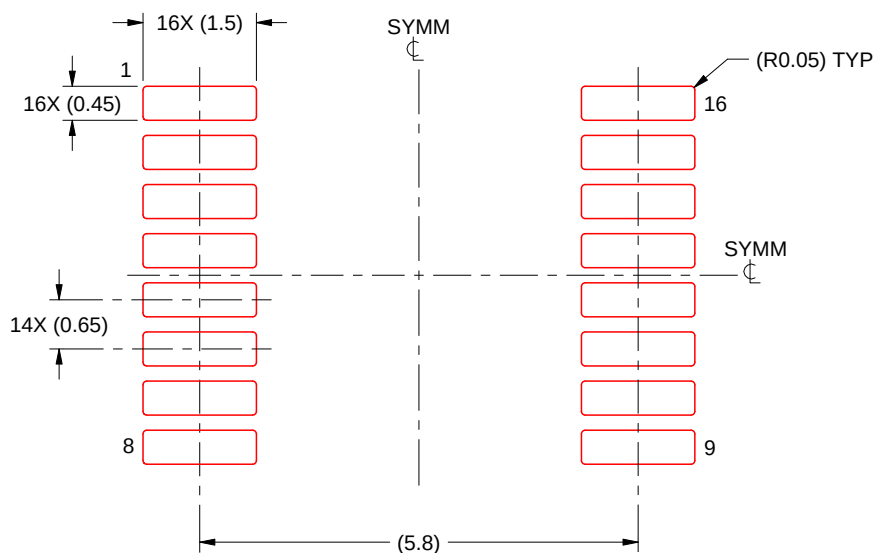
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

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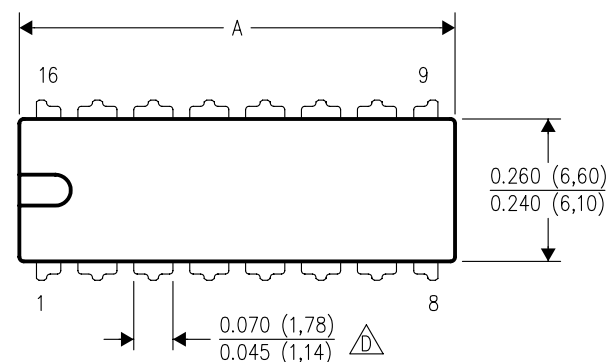
NOTES: (continued)

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.

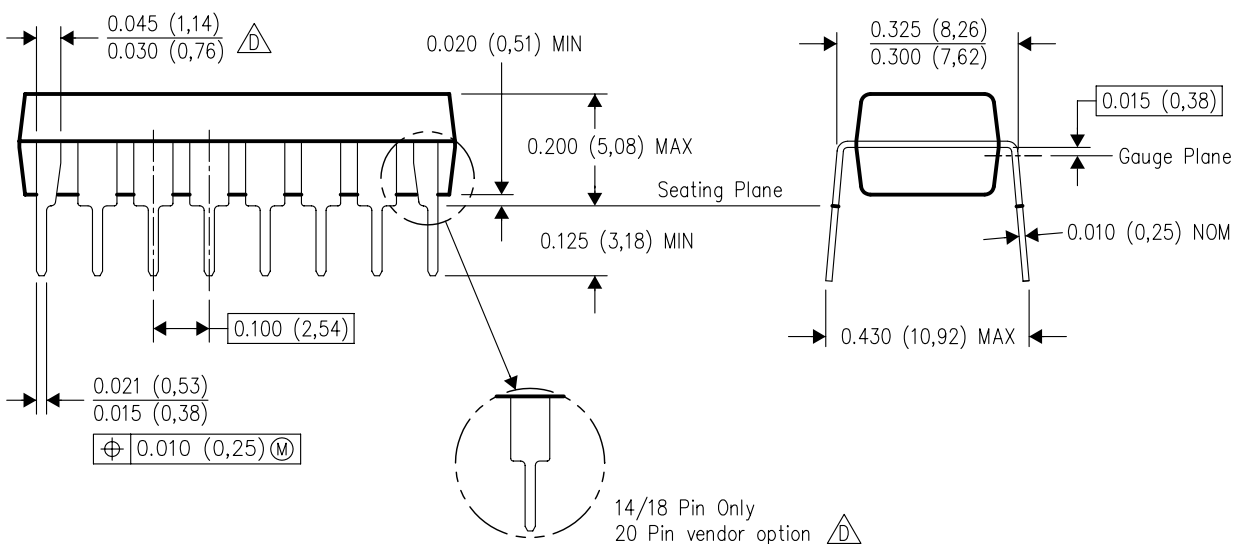
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	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	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.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

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