

CD4518B, CD4520B Types

CMOS Dual Up-Counters

High-Voltage Types (20-Volt Rating)

CD4518B Dual BCD Up-Counter
CD4520B Dual Binary Up-Counter

■ CD4518 Dual BCD Up-Counter and CD4520 Dual Binary Up-Counter each consist of two identical, internally synchronous 4-stage counters. The counter stages are D-type flip-flops having interchangeable CLOCK and ENABLE lines for incrementing on either the positive-going or negative-going transition. For single-unit operation the ENABLE input is maintained high and the counter advances on each positive-going transition of the CLOCK. The counters are cleared by high levels on their RESET lines.

The counter can be cascaded in the ripple mode by connecting Q4 to the enable input of the subsequent counter while the CLOCK input of the latter is held low.

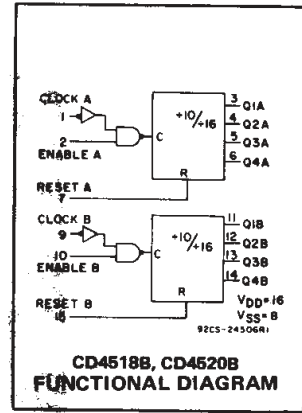
The CD4518B and CD4520B types are supplied in 16-lead hermetic dual-in-line ceramic packages (F3A suffix), 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (M, M96, and NSR suffixes), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).

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 | ±10mA |
| POWER DISSIPATION PER PACKAGE (P _D): | |
| For T _A = –55°C to +100°C | 500mW |
| For T _A = +100°C to +125°C | Derate Linearity 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 _{stg}) | –65°C to +150°C |
| LEAD TEMPERATURE (DURING SOLDERING): | |
| At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10s max | +265°C |

Features:

- Medium-speed operation – 6-MHz typical clock frequency at 10 V
- Positive- or negative-edge triggering
- Synchronous internal carry propagation
- 100% tested for quiescent current at 20 V
- Maximum input current of 1 μA at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- Noise margin (over full package-temperature range): 1 V at V_{DD} = 5 V, 2 V at V_{DD} = 10 V, 2.5 V at V_{DD} = 15 V
- 5-V, 10-V, and 15-V parametric ratings
- Standardized, symmetrical output characteristics
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"



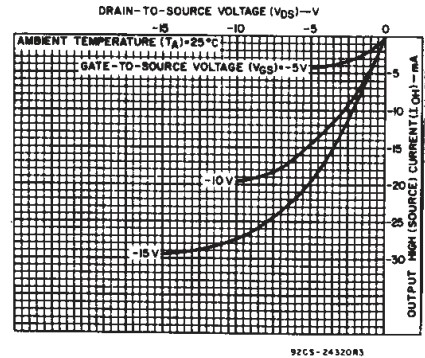
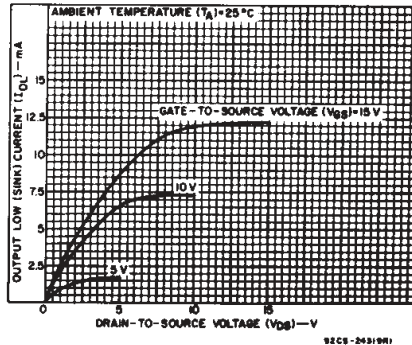
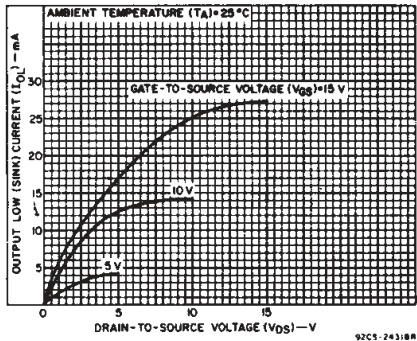
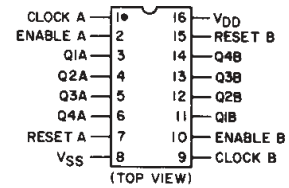
Applications:

- Multistage synchronous counting
- Multistage ripple counting
- Frequency dividers

TRUTH TABLE

| CLOCK | ENABLE | RESET | ACTION |
|-------|--------|-------|-------------------|
| | 1 | 0 | Increment Counter |
| 0 | | 0 | Increment Counter |
| | X | 0 | No Change |
| X | | 0 | No Change |
| | 0 | 0 | No Change |
| 1 | | 0 | No Change |
| X | X | 1 | Q1 thru Q4 = 0 |

X = Don't Care 1 ≡ High State 0 ≡ Low State



CD4518B, CD4520B Types

STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC | CONDITIONS | | | LIMITS AT INDICATED TEMPERATURES (°C) | | | | | | | UNITS |
|--|-----------------------|------------------------|------------------------|---------------------------------------|-------|-------|-------|-------|-------------------|------|-------|
| | V _O (V) | V _{IN} (V) | V _{DD} (V) | -55 | | | +25 | | | | |
| | | | | -55 | -40 | +85 | +125 | 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 | — | mA |
| | 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 | V |
| | — | 0,10 | 10 | 0,05 | | | — | | | 0 | |
| | — | 0,15 | 15 | 0,05 | | | — | | | 0 | |
| Output Voltage: High-Level, V _{OH} Min. | — | 0,5 | 5 | 4,95 | | | 4,95 | | | 5 | V |
| | — | 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 | V |
| | 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 | | | — | V |
| | 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 |

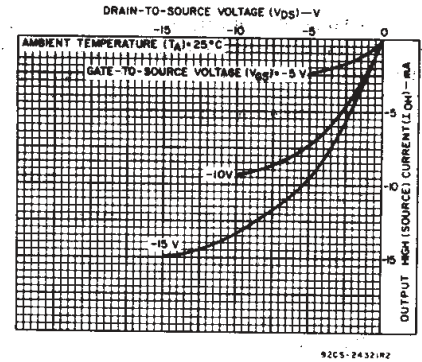


Fig. 4 — Minimum output high (source) current characteristics.

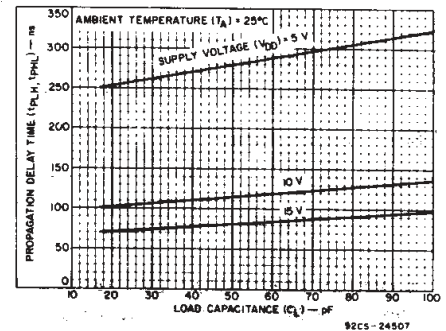


Fig. 5 — Typical propagation delay vs. load capacitance, clock or enable to output.

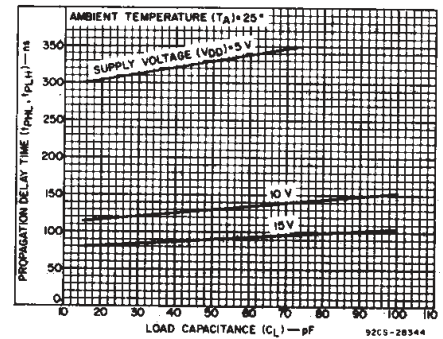


Fig. 6 — Typical propagation delay time vs. load capacitance, reset to output.

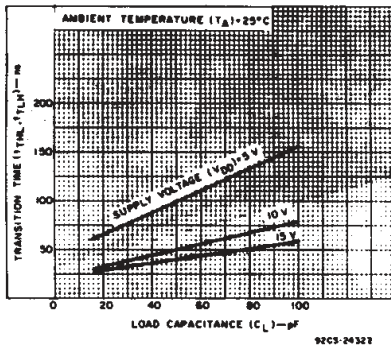


Fig. 7 — Typical transition time vs. load capacitance.

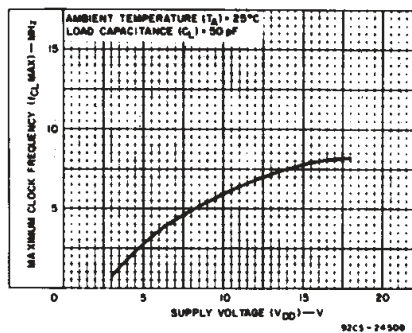


Fig. 8 — Typical maximum-clock-frequency vs. supply voltage.

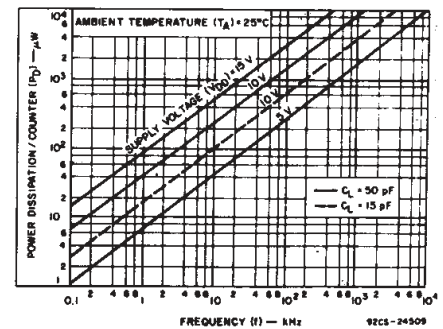


Fig. 9 — Typical power dissipation characteristics.

3
COMMERCIAL CMOS
HIGH VOLTAGE ICs

CD4518B, CD4520B Types

RECOMMENDED OPERATING CONDITIONS at $T_A = 25^\circ\text{C}$, Except as Noted.
For maximum reliability, nominal operating conditions should be selected so that operation 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 |
| Enable Pulse Width, t_W | 5 | 400 | — | ns |
| | 10 | 200 | — | |
| | 15 | 140 | — | |
| Clock Pulse Width, t_W | 5 | 200 | — | ns |
| | 10 | 100 | — | |
| | 15 | 70 | — | |
| Clock Input Frequency, f_{CL} | 5 | — | 1.5 | MHz |
| | 10 | dc | 3 | |
| | 15 | — | 4 | |
| Clock Rise or Fall Time, t_{rCL} or t_{fCL} : | 5 | — | 15 | μs |
| | 10 | — | 5 | |
| | 15 | — | 5 | |
| Reset Pulse Width, t_W | 5 | 250 | — | ns |
| | 10 | 110 | — | |
| | 15 | 80 | — | |

DYNAMIC ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$:

Input $t_r, t_f = 20 \text{ ns}$, $C_L = 50 \text{ pF}$, $R_L = 200 \text{ k}\Omega$

| CHARACTERISTIC | TEST CONDITIONS | LIMITS | | | UNITS | |
|--|-----------------|----------------------|------|------|-------|---------------|
| | | V _{DD} V | Min. | Typ. | | Max. |
| Propagation Delay Time, t_{PHL} , t_{PLH} : Clock or Enable to Output | | 5 | — | 280 | 560 | ns |
| | | 10 | — | 115 | 230 | |
| | | 15 | — | 80 | 160 | |
| Reset to Output | | 5 | — | 330 | 650 | ns |
| | | 10 | — | 130 | 225 | |
| | | 15 | — | 90 | 170 | |
| Transition Time, t_{THL} , t_{TLH} | | 5 | — | 100 | 200 | ns |
| | | 10 | — | 50 | 100 | |
| | | 15 | — | 40 | 80 | |
| Maximum Clock Input Frequency, f_{CL} | | 5 | 1.5 | 3 | — | MHz |
| | | 10 | 3 | 6 | — | |
| | | 15 | 4 | 8 | — | |
| Minimum Clock Pulse Width, t_W | | 5 | — | 100 | 200 | ns |
| | | 10 | — | 50 | 100 | |
| | | 15 | — | 35 | 70 | |
| Clock Rise or Fall Time, t_r or t_f : | | 5 | — | — | 15 | μs |
| | | 10, 15 | — | — | 5 | |
| Minimum Reset Pulse Width, t_W | | 5 | — | 125 | 250 | ns |
| | | 10 | — | 55 | 110 | |
| | | 15 | — | 40 | 80 | |
| Minimum Enable Pulse Width, t_W | | 5 | — | 200 | 400 | ns |
| | | 10 | — | 100 | 200 | |
| | | 15 | — | 70 | 140 | |
| Input Capacitance, C_{iN} | Any Input | | 5 | 7.5 | pF | |

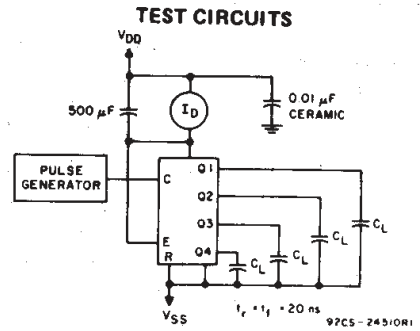


Fig. 10 — Dynamic power dissipation.

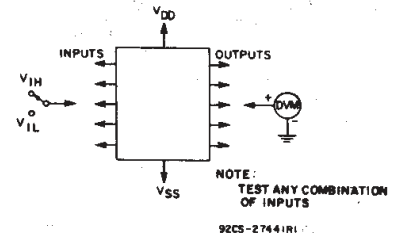


Fig. 11 — Input voltage.

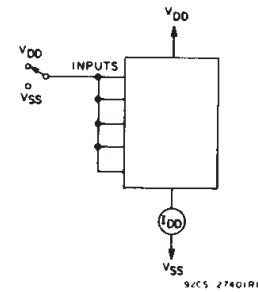


Fig. 12 — Quiescent device current test circuit.

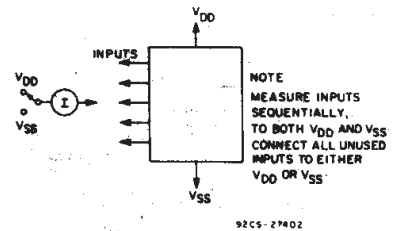


Fig. 13 — Input leakage-current test circuit.

CD4518B, CD4520B Types

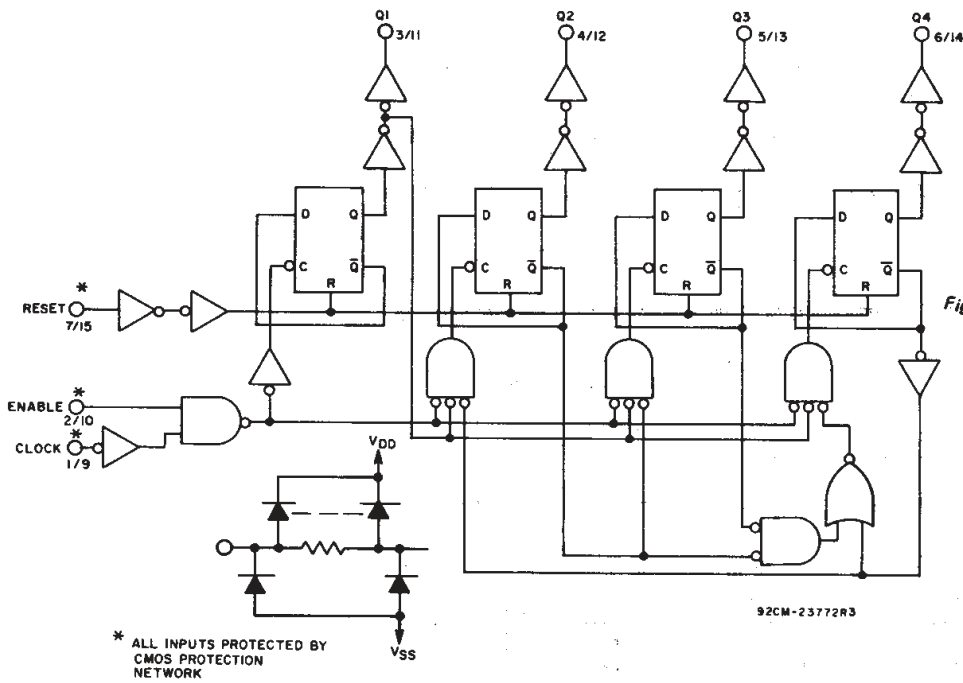


Fig. 14 — Decade counter (CD4518B) logic diagram for one of two identical counters.

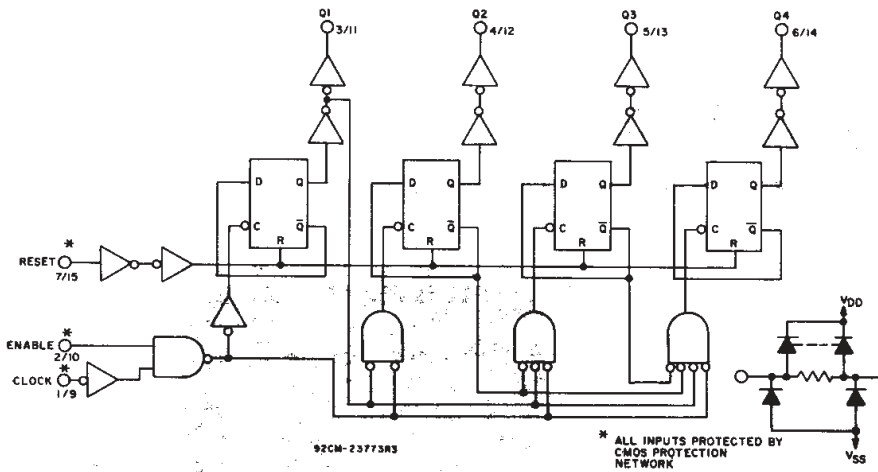


Fig. 15 — Binary counter (CD4520B) logic diagram for one of two identical counters.

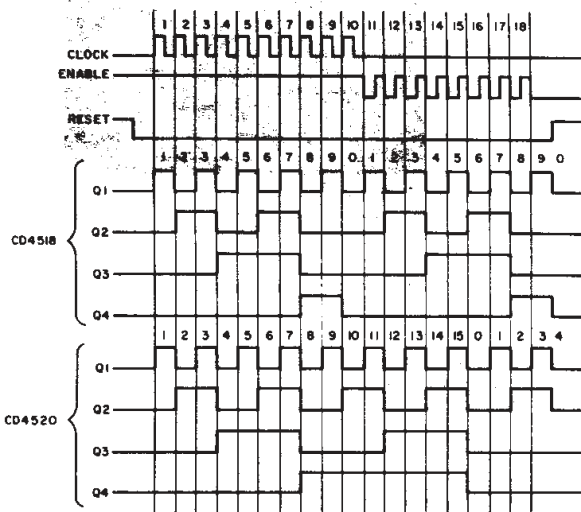


Fig. 16 — Timing diagrams for CD4518B and CD4520B.

92CM-23774R1

CD4518B, CD4520B Types

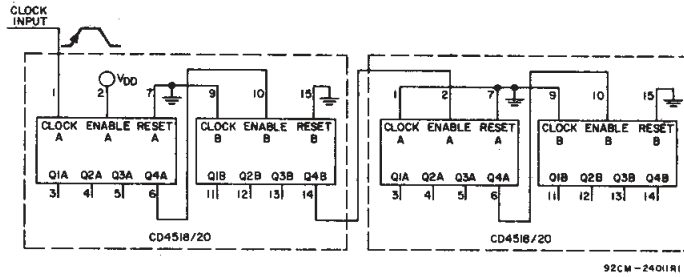
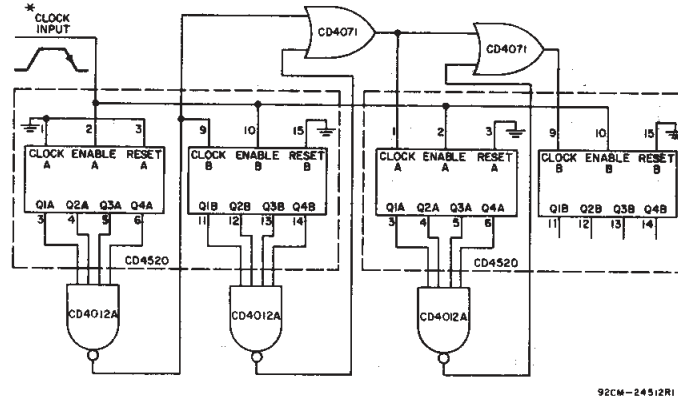
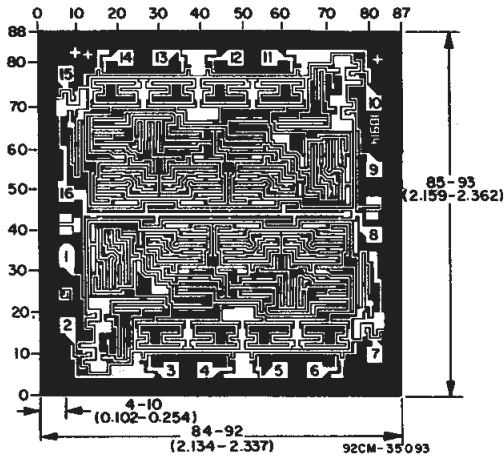


Fig. 17 - Ripple cascading of four counters with positive edge triggering.

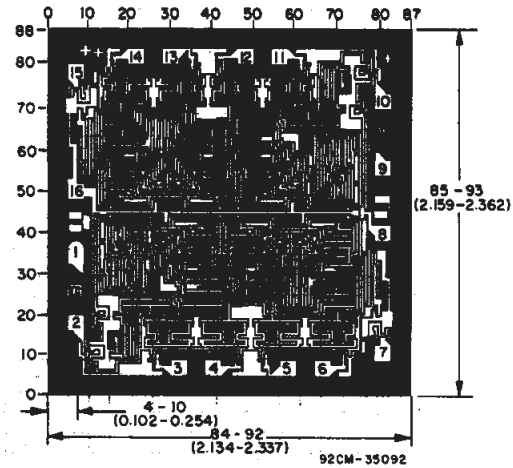


*NOTE:
FOR SYNCHRONOUS CASCADING, THE CLOCK TRANSITION TIME SHOULD BE MADE LESS THAN OR EQUAL TO THE SUM OF THE FIXED PROPAGATION DELAY AT 15 pF AND THE TRANSITION TIME OF THE OUTPUT DRIVER STAGE FOR THE ESTIMATED CAPACITATIVE LOAD.

Fig. 18 - Synchronous cascading of four binary counters with negative edge triggering.



Dimensions and pad layout for CD4518BH chip.



Dimensions and pad layout for CD4520BH chip.

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 Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| 7702301EA | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 7702301EA CD4520BF3A | Samples |
| CD4518BE | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | -55 to 125 | CD4518BE | Samples |
| CD4518BEE4 | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | -55 to 125 | CD4518BE | Samples |
| CD4518BF | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | CD4518BF | Samples |
| CD4518BF3A | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | CD4518BF3A | Samples |
| CD4518BM | LIFEBUY | SOIC | D | 16 | 40 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4518BM | |
| CD4518BM96 | ACTIVE | SOIC | D | 16 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4518BM | Samples |
| CD4518BNSR | ACTIVE | SO | NS | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4518B | Samples |
| CD4518BPW | LIFEBUY | TSSOP | PW | 16 | 90 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CM518B | |
| CD4518BPWE4 | LIFEBUY | TSSOP | PW | 16 | 90 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CM518B | |
| CD4518BPWG4 | LIFEBUY | TSSOP | PW | 16 | 90 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CM518B | |
| CD4518BPWR | ACTIVE | TSSOP | PW | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CM518B | Samples |
| CD4520BE | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | -55 to 125 | CD4520BE | Samples |
| CD4520BEE4 | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | -55 to 125 | CD4520BE | Samples |
| CD4520BF | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | CD4520BF | Samples |
| CD4520BF3A | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 7702301EA CD4520BF3A | Samples |
| CD4520BM96 | ACTIVE | SOIC | D | 16 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4520BM | Samples |
| CD4520BNSR | ACTIVE | SO | NS | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4520B | Samples |
| CD4520BPW | LIFEBUY | TSSOP | PW | 16 | 90 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CM520B | |
| CD4520BPWR | ACTIVE | TSSOP | PW | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CM520B | Samples |

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of ≤ 1000 ppm threshold. Antimony trioxide based flame retardants must also meet the ≤ 1000 ppm threshold requirement.

(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 finish/Ball material - Orderable Devices 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.

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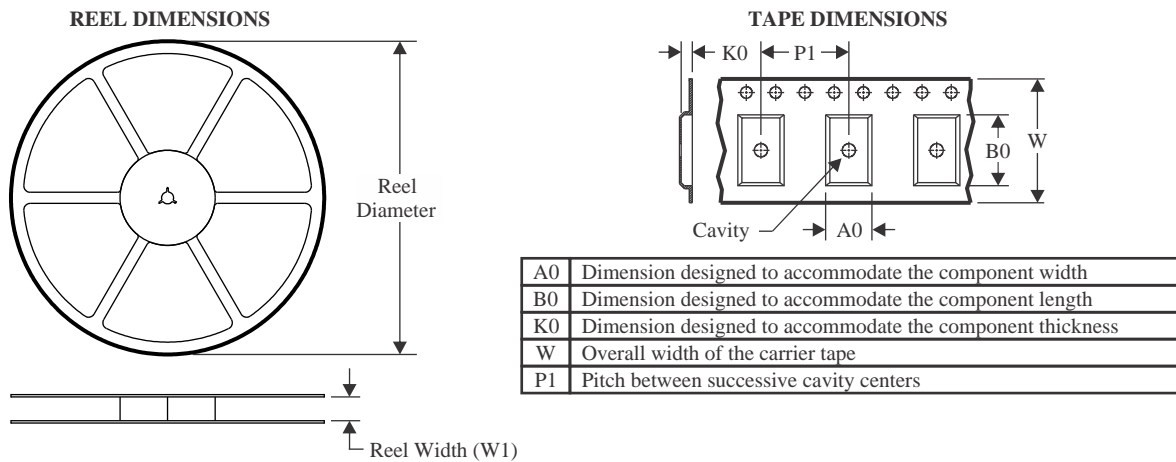
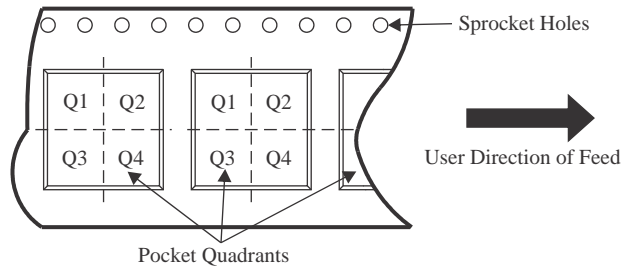
OTHER QUALIFIED VERSIONS OF CD4518B, CD4518B-MIL, CD4520B, CD4520B-MIL :

● Catalog : [CD4518B](#), [CD4520B](#)

● Military : [CD4518B-MIL](#), [CD4520B-MIL](#)

NOTE: Qualified Version Definitions:

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

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


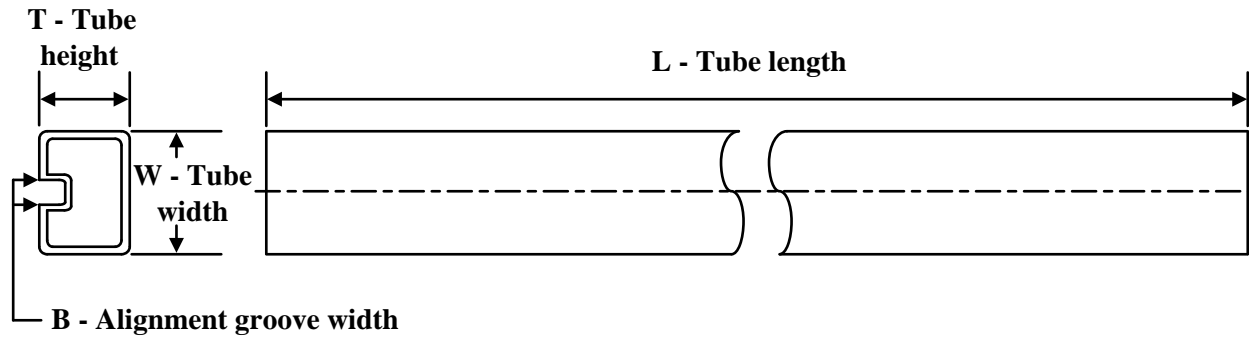
*All dimensions are nominal

| 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 |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD4518BM96 | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| CD4518BNSR | SO | NS | 16 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| CD4518BPWR | TSSOP | PW | 16 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |
| CD4520BM96 | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| CD4520BNSR | SO | NS | 16 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| CD4520BPWR | TSSOP | PW | 16 | 2000 | 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) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD4518BM96 | SOIC | D | 16 | 2500 | 340.5 | 336.1 | 32.0 |
| CD4518BNSR | SO | NS | 16 | 2000 | 356.0 | 356.0 | 35.0 |
| CD4518BPWR | TSSOP | PW | 16 | 2000 | 356.0 | 356.0 | 35.0 |
| CD4520BM96 | SOIC | D | 16 | 2500 | 340.5 | 336.1 | 32.0 |
| CD4520BNSR | SO | NS | 16 | 2000 | 356.0 | 356.0 | 35.0 |
| CD4520BPWR | TSSOP | PW | 16 | 2000 | 356.0 | 356.0 | 35.0 |

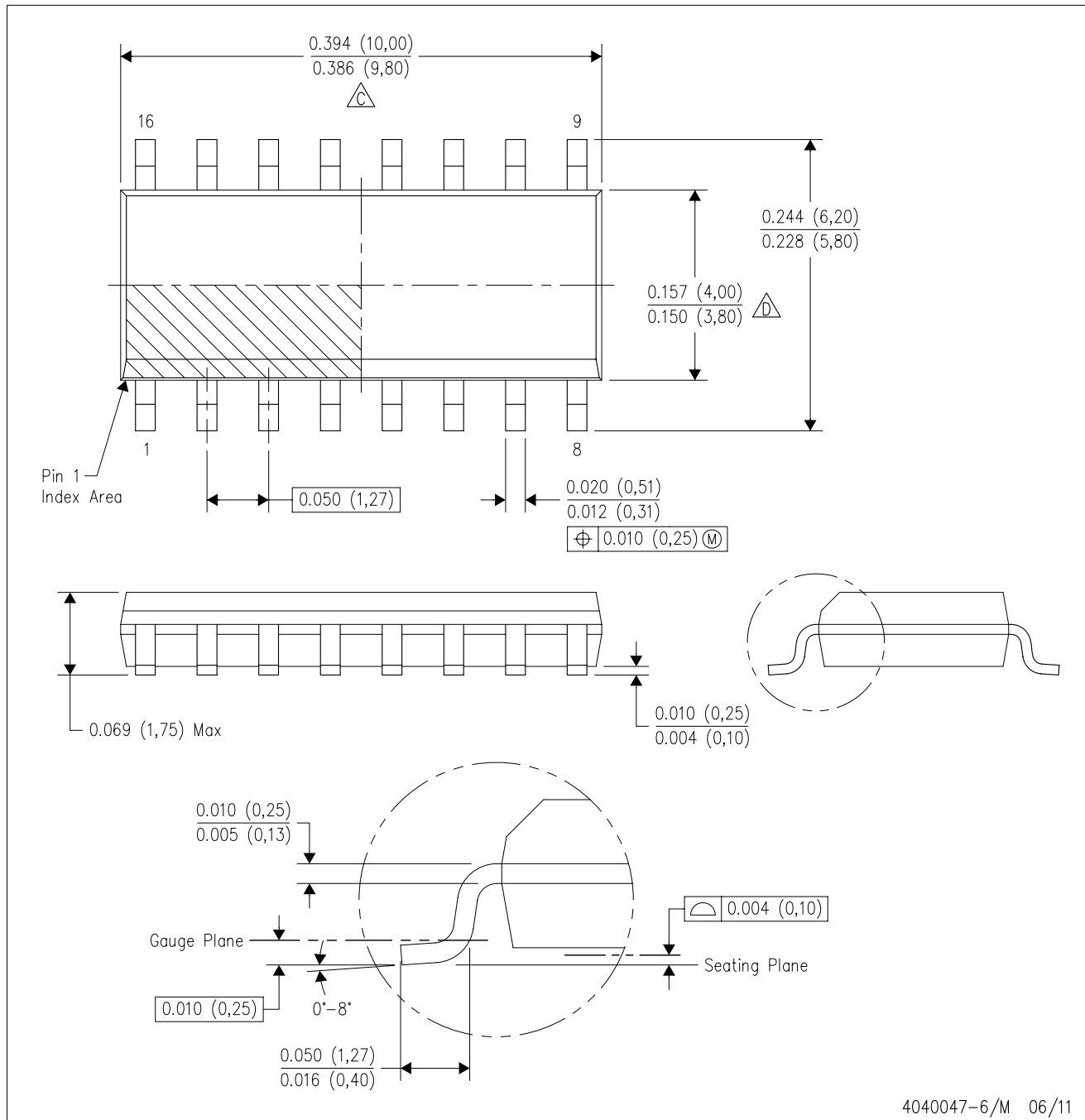
TUBE


*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| CD4518BE | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD4518BE | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD4518BEE4 | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD4518BEE4 | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD4518BM | D | SOIC | 16 | 40 | 507 | 8 | 3940 | 4.32 |
| CD4518BPW | PW | TSSOP | 16 | 90 | 530 | 10.2 | 3600 | 3.5 |
| CD4518BPWE4 | PW | TSSOP | 16 | 90 | 530 | 10.2 | 3600 | 3.5 |
| CD4518BPWG4 | PW | TSSOP | 16 | 90 | 530 | 10.2 | 3600 | 3.5 |
| CD4520BE | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD4520BE | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD4520BEE4 | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD4520BEE4 | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD4520BPW | PW | TSSOP | 16 | 90 | 530 | 10.2 | 3600 | 3.5 |

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.

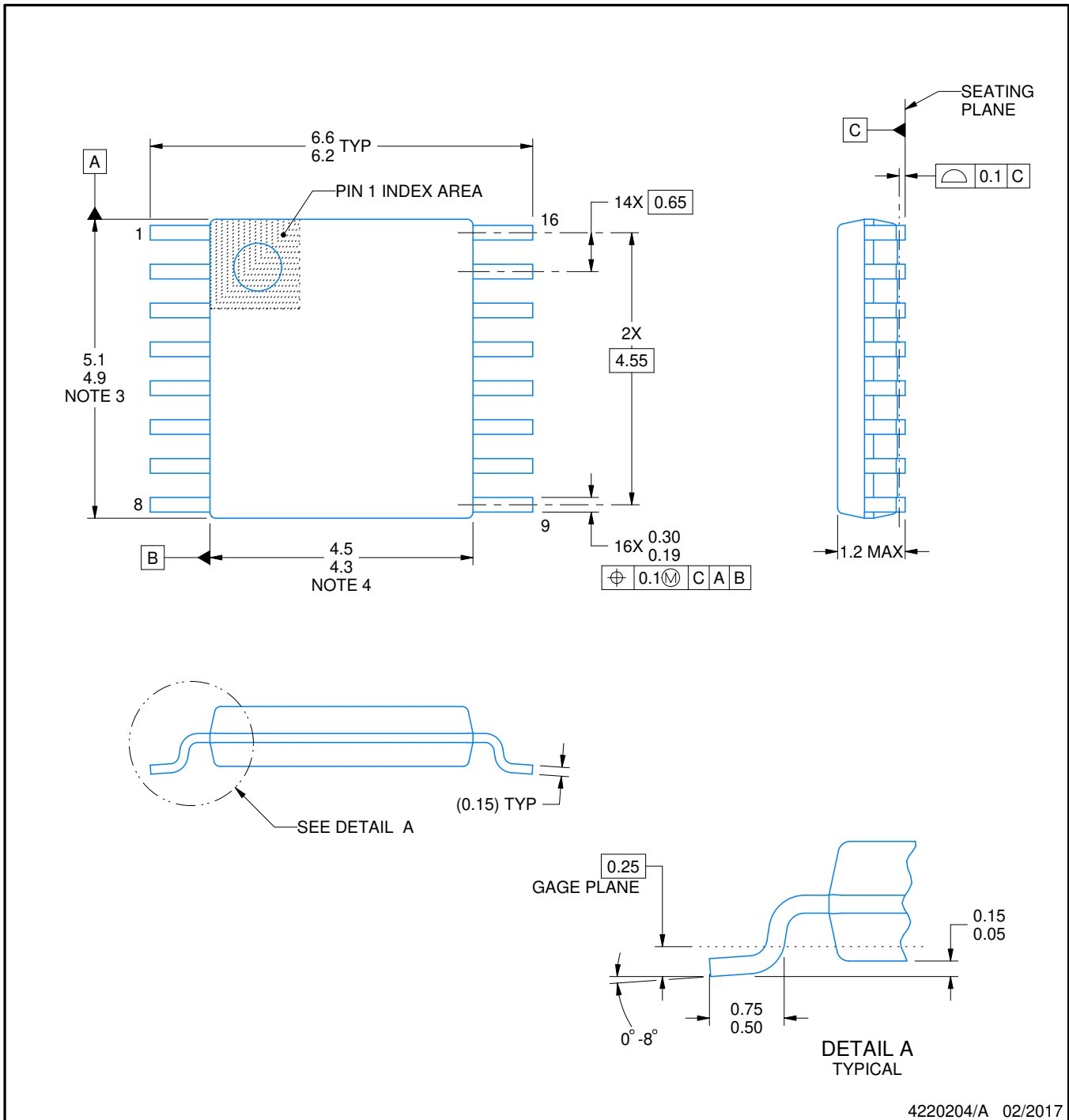
PW0016A



PACKAGE OUTLINE

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4220204/A 02/2017

NOTES:

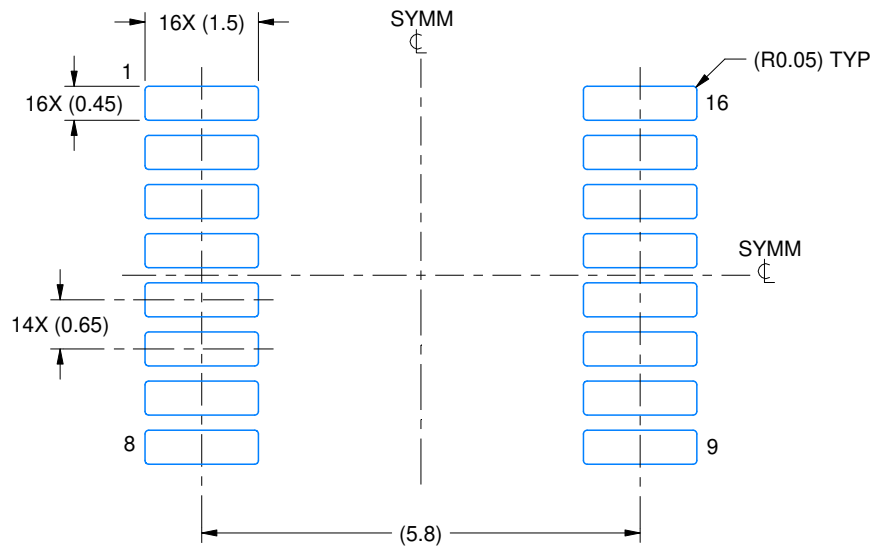
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or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

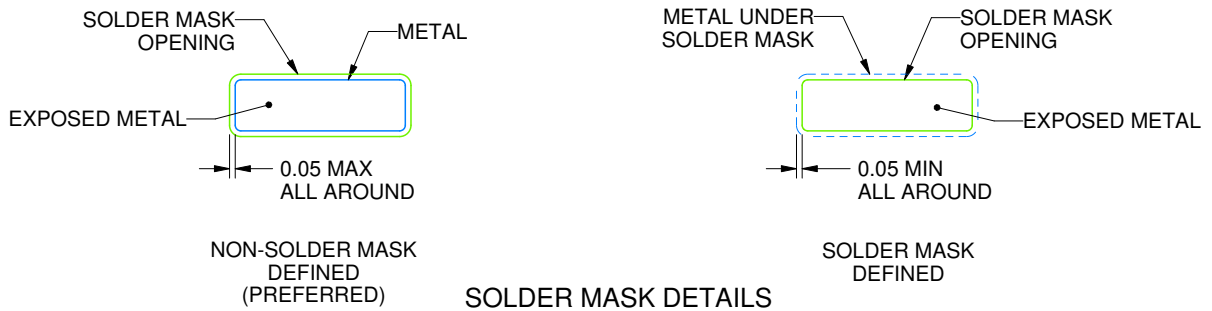
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220204/A 02/2017

NOTES: (continued)

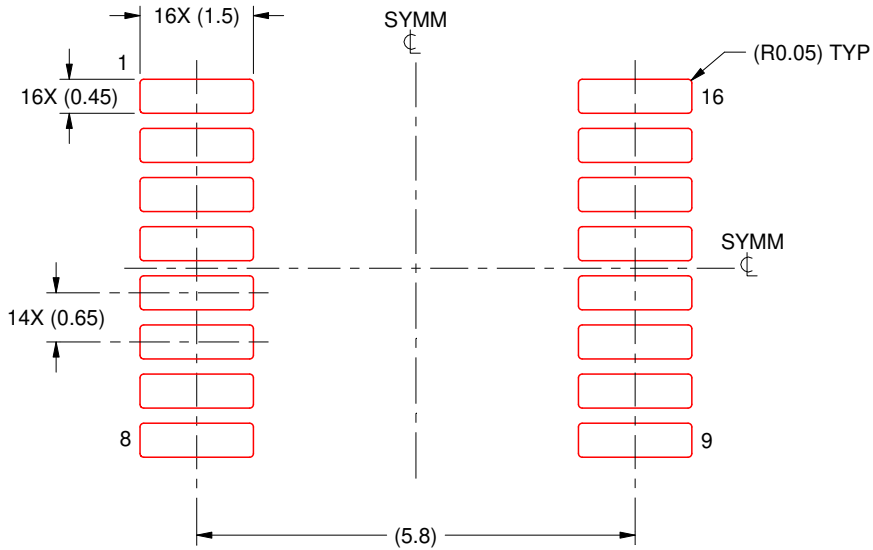
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

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

4220204/A 02/2017

NOTES: (continued)

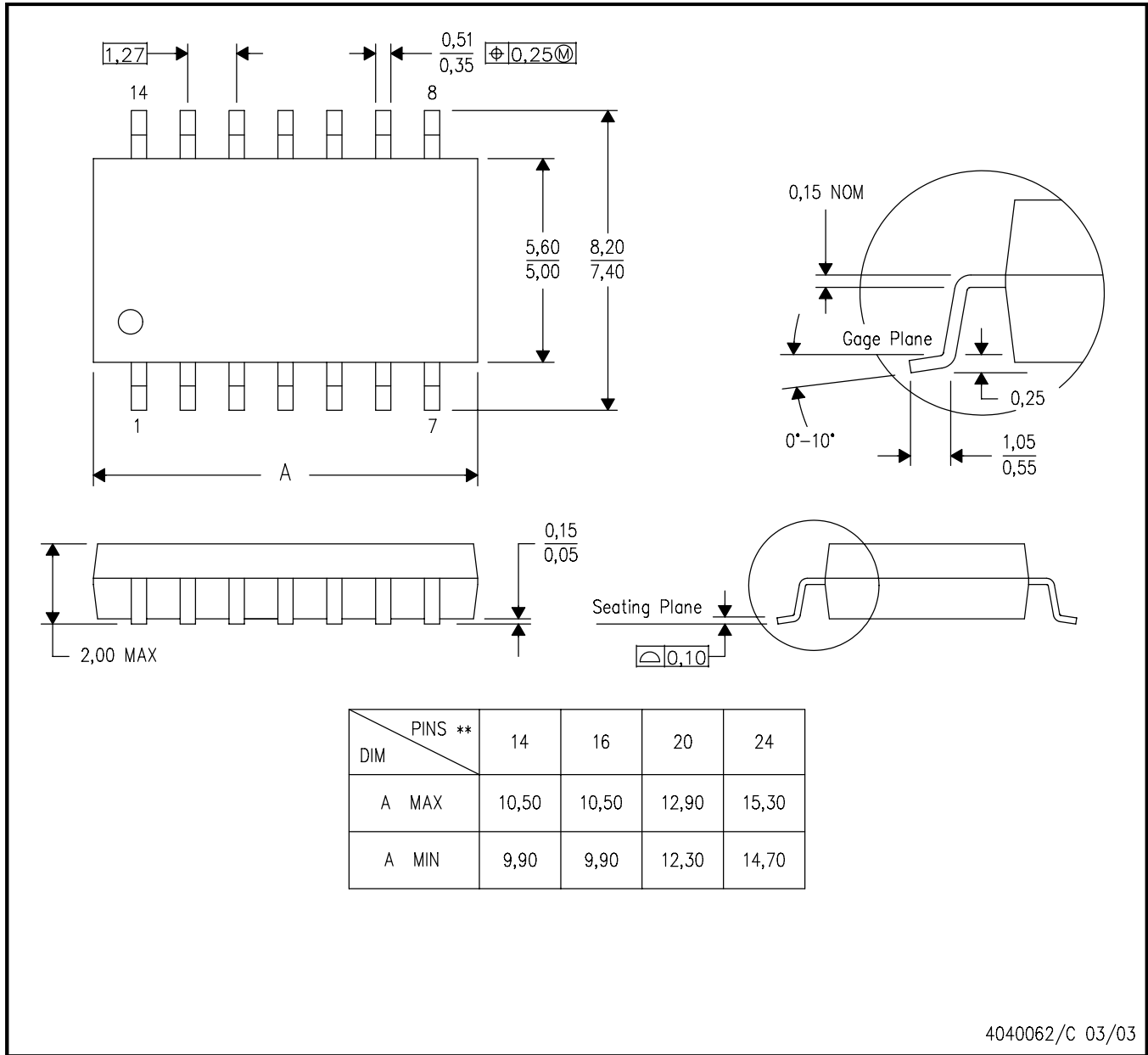
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

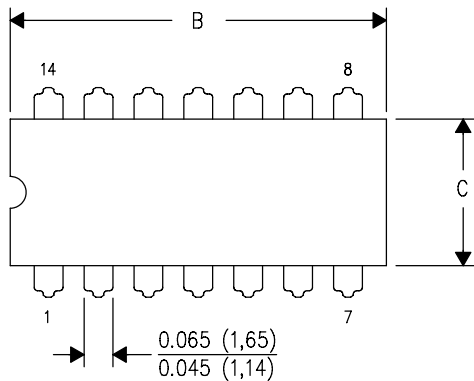


- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

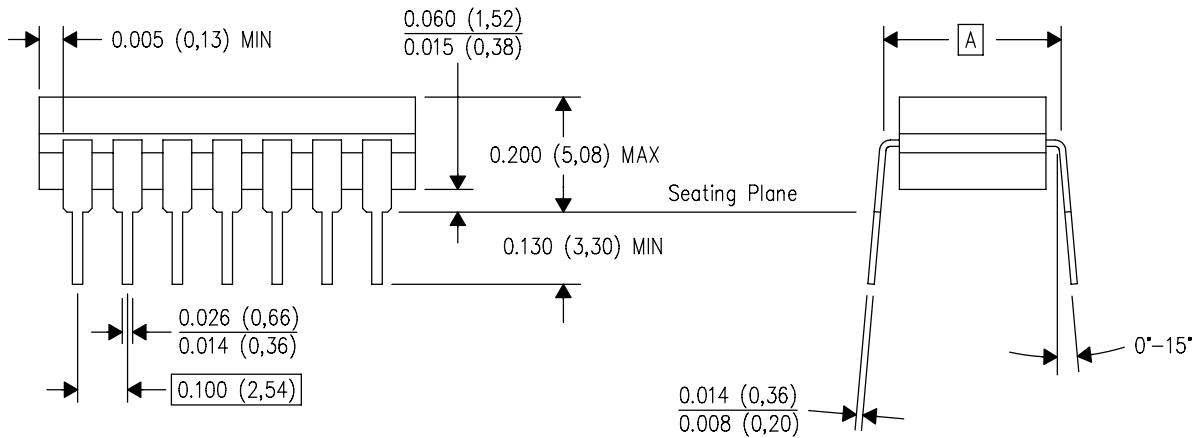
J (R-GDIP-T**)

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) |



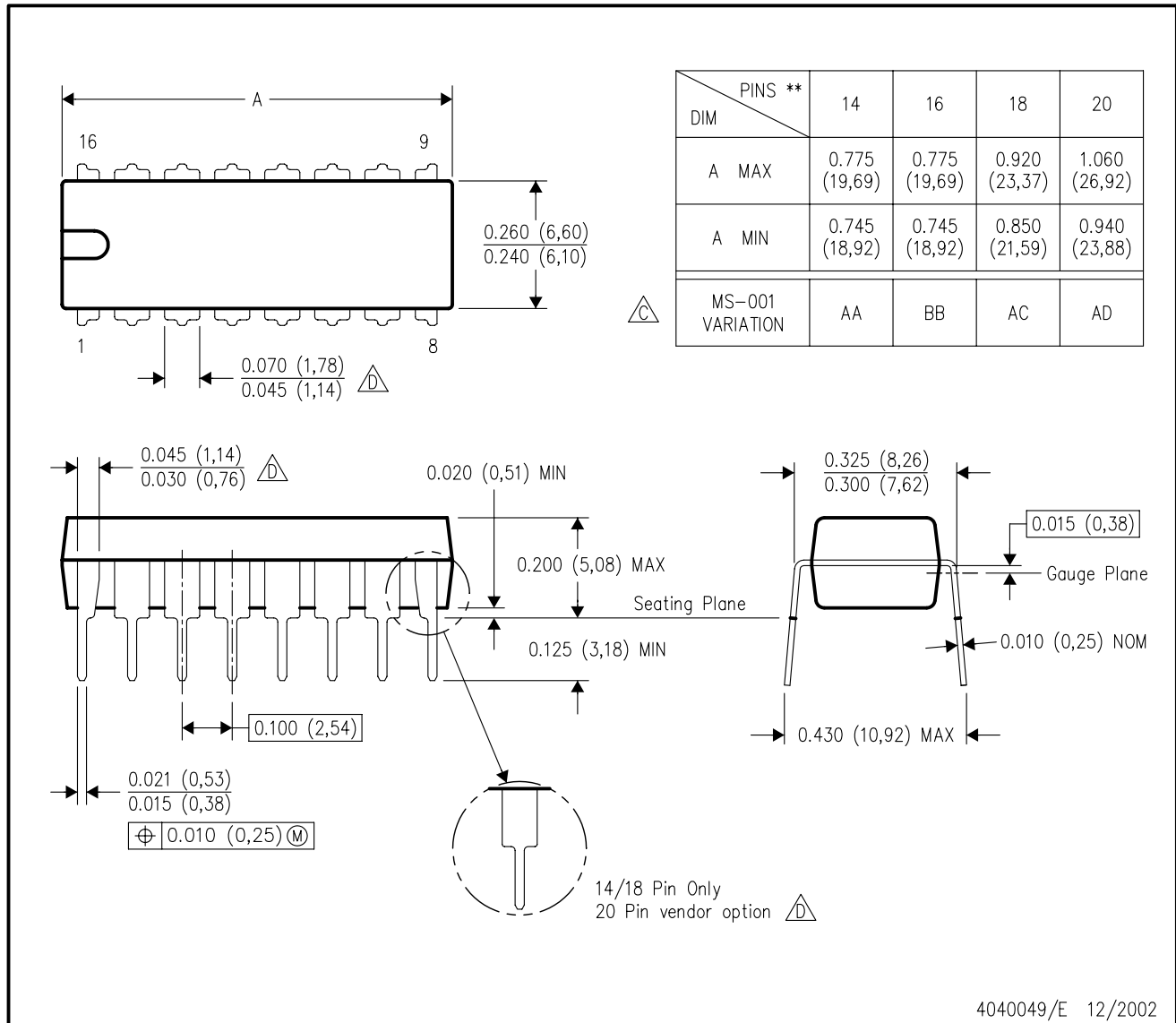
4040083/F 03/03

- 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.

N (R-PDIP-T**)

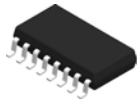
PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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.

4040049/E 12/2002

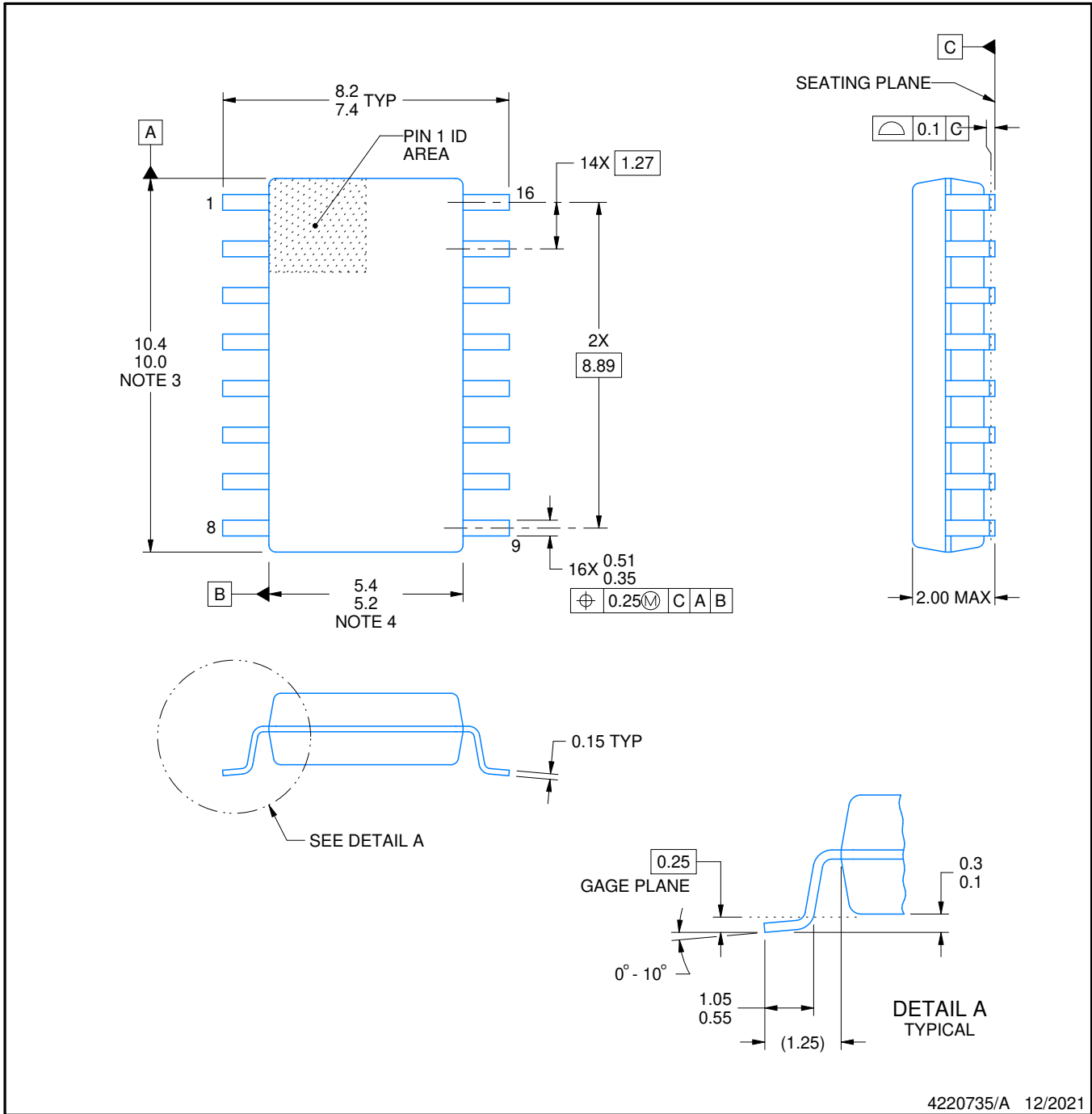


PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

NOTES:

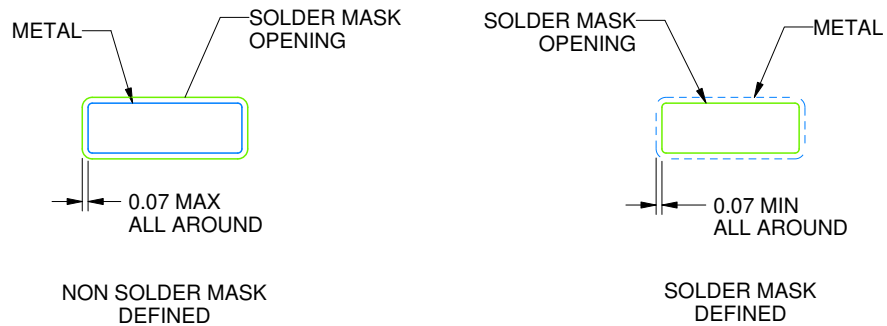
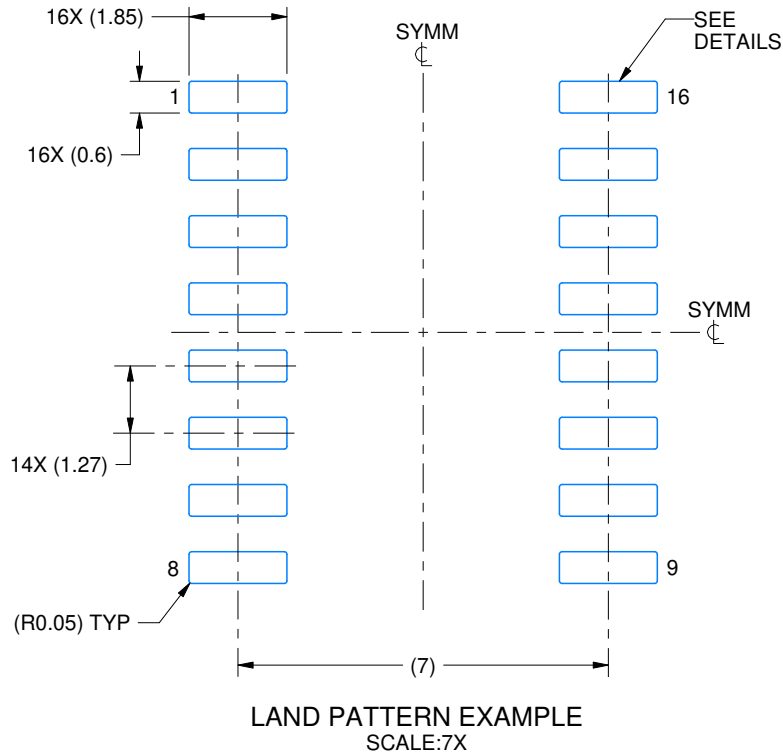
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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

EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



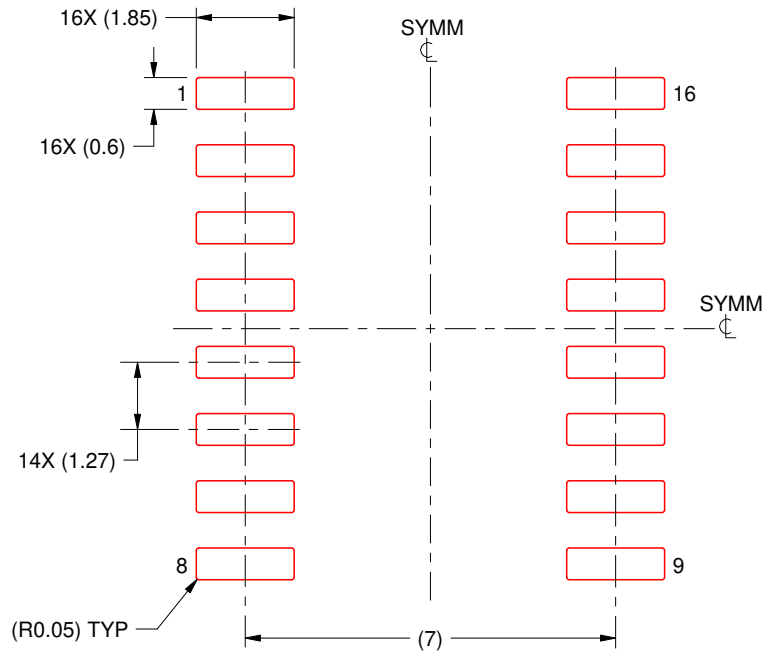
SOLDER MASK DETAILS

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.

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