

# CMOS 4-Stage Parallel In/Parallel Out Shift Register

with J-K Serial Inputs and True/  
Complement Outputs

High-Voltage Types (20-Volt Rating)

■ CD4035B is a four-stage clocked signal serial register with provision for synchronous PARALLEL inputs to each stage and SERIAL inputs to the first stage via JK logic. Register stages 2, 3, and 4 are coupled in a serial D flip-flop configuration when the register is in the serial mode (PARALLEL/SERIAL control low).

Parallel entry into each register stage is permitted when the PARALLEL/SERIAL control is high.

In the parallel or serial mode information is transferred on positive clock transitions.

When the TRUE/COMPLEMENT control is high, the true contents of the register are available at the output terminals. When the TRUE/COMPLEMENT control is low, the outputs are the complements of the data in the register. The TRUE/COMPLEMENT control functions asynchronously with respect to the CLOCK signal.

JK input logic is provided on the first stage SERIAL input to minimize logic requirements particularly in counting and sequence-generation applications. With JK inputs connected together, the first stage becomes a D flip-flop. An asynchronous common RESET is also provided.

The CD4035B 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, MT, 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)

INPUT VOLTAGE RANGE, ALL INPUTS ..... -0.5V to +20V

DC INPUT CURRENT, ANY ONE INPUT ..... -0.5V to  $V_{DD}$  +0.5V

POWER DISSIPATION PER PACKAGE ( $P_D$ ):

For  $T_A = -55^\circ\text{C}$  to  $+100^\circ\text{C}$  ..... 500mW

For  $T_A = +100^\circ\text{C}$  to  $+125^\circ\text{C}$  ..... Derate Linearity at 12mW/ $^\circ\text{C}$  to 200mW

DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR  $T_A = \text{FULL PACKAGE-TEMPERATURE RANGE (All Package Types)}$  ..... 100mW

OPERATING-TEMPERATURE RANGE ( $T_A$ ) ..... -55 $^\circ\text{C}$  to  $+125^\circ\text{C}$

STORAGE TEMPERATURE RANGE ( $T_{stg}$ ) ..... -65 $^\circ\text{C}$  to  $+150^\circ\text{C}$

LEAD TEMPERATURE (DURING SOLDERING):

At distance 1/16  $\pm$  1/32 inch (1.59  $\pm$  0.79mm) from case for 10s max ..... +265 $^\circ\text{C}$

## Features:

- 4-Stage clocked shift operation
- Synchronous parallel entry on all 4 stages
- JK inputs on first stage
- Asynchronous True/Complement control on all outputs
- Static flip-flop operation; Master-slave configuration
- Buffered inputs and outputs
- High speed – 12 MHz (typ.) at  $V_{DD} = 10\text{ V}$
- 100% tested for quiescent current at 20 V
- Standardized, symmetrical output characteristics
- 5-V, 10-V, and 15-V parametric ratings
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of "B" Series CMOS Devices"

## Applications:

- Counters, Registers
- Arithmetic-unit registers
- Shift-left – shift right registers
- Serial-to-parallel/parallel-to-serial conversions
- Sequence generation
- Control circuits
- Code conversion

FIRST STAGE TRUTH TABLE

| CL | $t_{n-1}$ (INPUTS) |   |   |           | $t_n$ (OUTPUTS)       |
|----|--------------------|---|---|-----------|-----------------------|
|    | J                  | K | R | $Q_{n-1}$ |                       |
|    | 0                  | X | 0 | 0         | 0                     |
|    | 1                  | X | 0 | 0         | 1                     |
|    | X                  | 0 | 0 | 1         | 0                     |
|    | 1                  | 0 | 0 | $Q_{n-1}$ | $Q_{n-1}$ TOGGLE MODE |
|    | X                  | 1 | 0 | 1         | 1                     |
|    | X                  | X | 0 | $Q_{n-1}$ | $Q_{n-1}$             |
|    | X                  | X | 1 | X         | 0                     |

# CD4035B Types

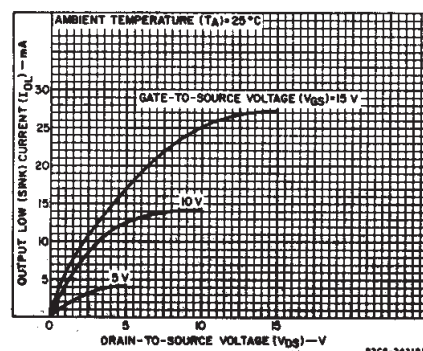
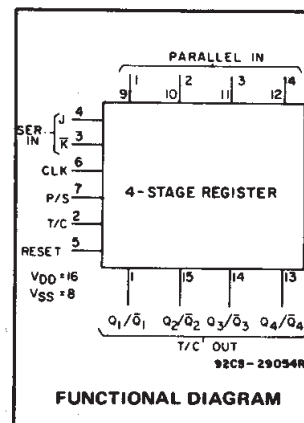


Fig. 1 – Typical output low (sink) current characteristics.

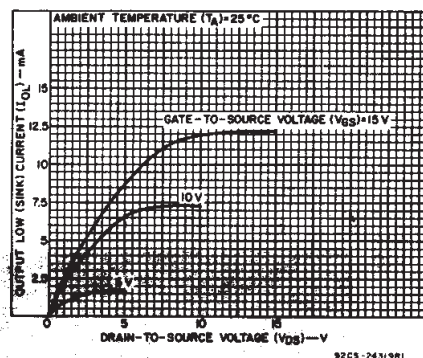


Fig. 2 – Minimum output low (sink) current characteristics.

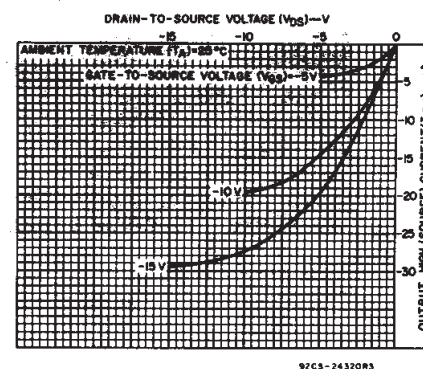


Fig. 3 – Typical output high (source) current characteristics.

## CD4035B Types

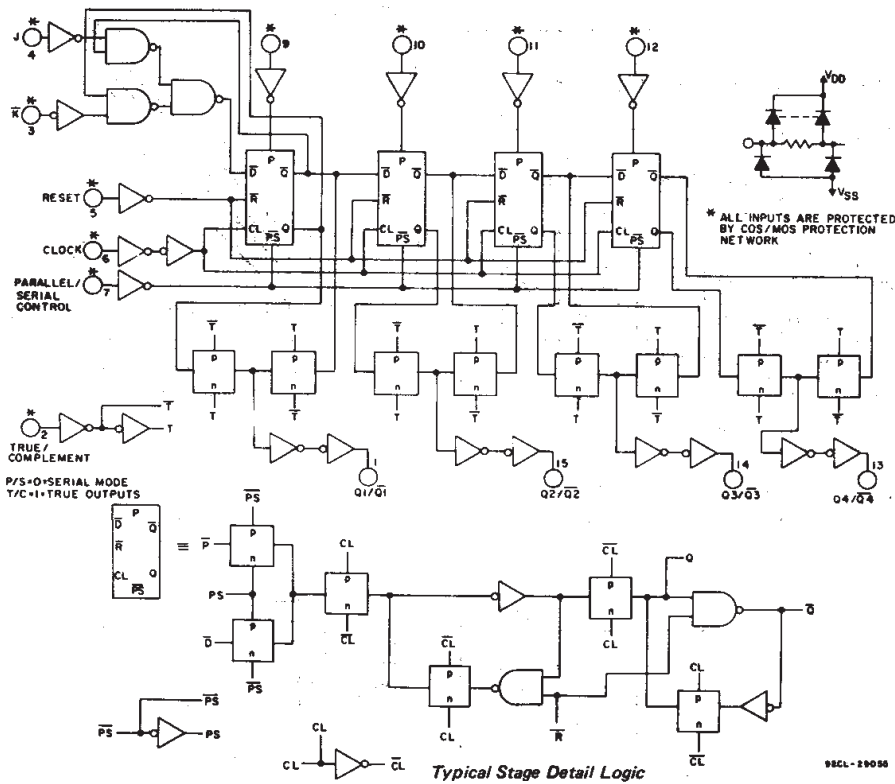


Fig. 4 – Logic diagram.

**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                                                    | $V_{DD}$<br>(V) | LIMITS |      | UNITS         |
|-------------------------------------------------------------------|-----------------|--------|------|---------------|
|                                                                   |                 | MIN.   | MAX. |               |
| Supply-Voltage Range (For $T_A$ = Full Package-Temperature Range) |                 | 3      | 18   | V             |
| Data Setup Time, $t_S$ :<br>J/ $\bar{K}$ Lines                    | 5               | 220    | —    | ns            |
|                                                                   | 10              | 80     | —    |               |
|                                                                   | 15              | 60     | —    |               |
| Parallel-In Lines                                                 | 5               | 140    | —    | ns            |
|                                                                   | 10              | 50     | —    |               |
|                                                                   | 15              | 40     | —    |               |
| Clock Pulse Width, $t_W$                                          | 5               | 200    | —    | ns            |
|                                                                   | 10              | 90     | —    |               |
|                                                                   | 15              | 60     | —    |               |
| Clock Input Frequency, $f_{CL}$                                   | 5               | —      | 2    | MHz           |
|                                                                   | 10              | dc     | 6    |               |
|                                                                   | 15              | —      | 8    |               |
| Clock Rise or Fall Time, $t_{rCL}$ , $t_{fCL}$ :                  | 5               | —      | 15   | $\mu\text{s}$ |
|                                                                   | 10              | —      | 15   |               |
|                                                                   | 15              | —      | 15   |               |
| Reset Pulse Width, $t_W$                                          | 5               | 250    | —    | ns            |
|                                                                   | 10              | 110    | —    |               |
|                                                                   | 15              | 80     | —    |               |

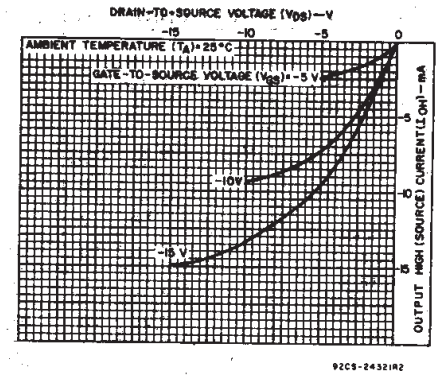


Fig. 5 – Minimum output high (source) current characteristics.

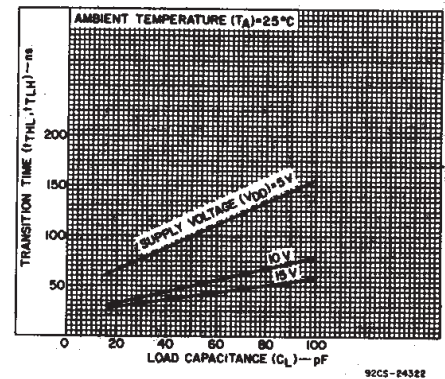


Fig. 6 – Typical transition time as a function of load capacitance.

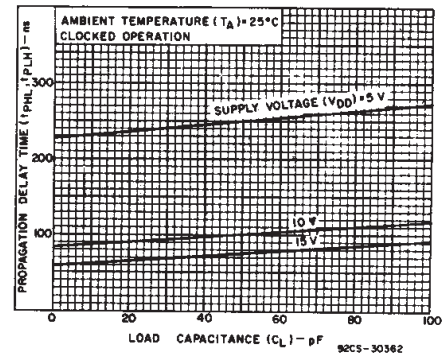


Fig. 7 – Typical propagation delay times as a function of load capacitance (Q output).

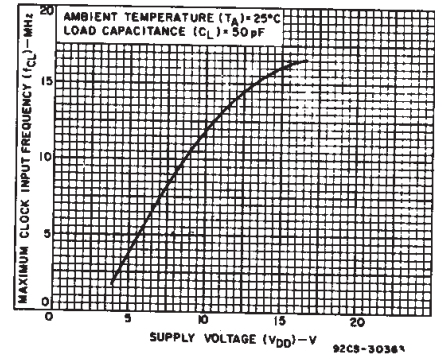


Fig. 8 – Typical maximum clock input frequency as a function of supply voltage.

# CD4035B Types

## STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC                                     | CONDITIONS            |                        |                        | LIMITS AT INDICATED TEMPERATURES (°C) |       |       |       |       |                   |      | UNITS |
|----------------------------------------------------|-----------------------|------------------------|------------------------|---------------------------------------|-------|-------|-------|-------|-------------------|------|-------|
|                                                    | V <sub>O</sub><br>(V) | V <sub>IN</sub><br>(V) | V <sub>DD</sub><br>(V) | -55                                   | -40   | +85   | +125  | +25   |                   |      |       |
|                                                    |                       |                        |                        |                                       |       |       |       | Min.  | Typ.              | Max. |       |
| Quiescent Device Current, I <sub>DD</sub> 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 <sub>OL</sub> 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 <sub>OH</sub> 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 <sub>OL</sub> 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 <sub>OH</sub> 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 <sub>IL</sub> 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 <sub>IH</sub> 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 <sub>IN</sub> Max.                 | —                     | 0,18                   | 18                     | ±0.1                                  | ±0.1  | ±1    | ±1    | —     | ±10 <sup>-5</sup> | ±0.1 | μA    |

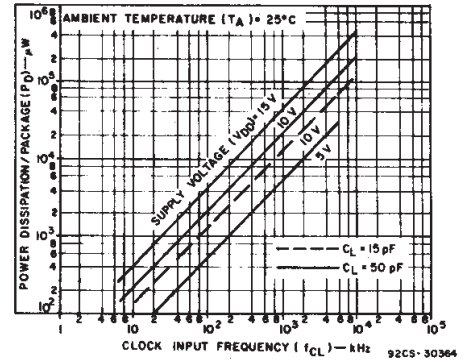


Fig. 9 – Typical dynamic power dissipation as a function of clock input frequency.

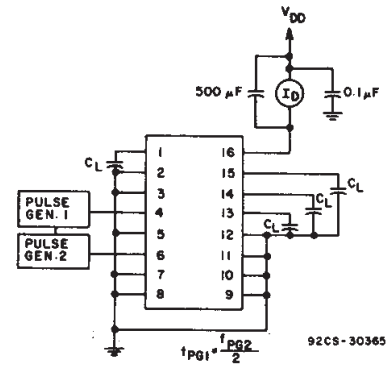


Fig. 10 – Dynamic power dissipation test circuit.

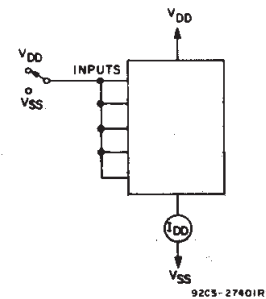


Fig. 11 – Quiescent-device current test circuit.

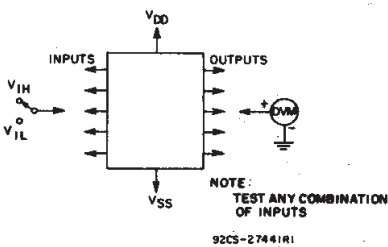


Fig. 12 – Input-voltage test circuit.

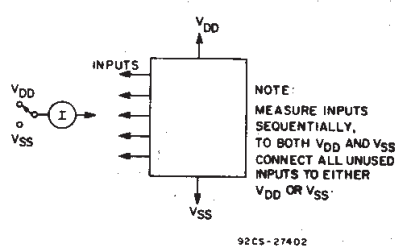


Fig. 13 – Input-current test circuit.

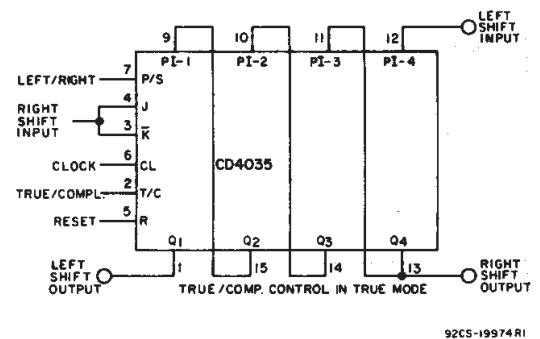
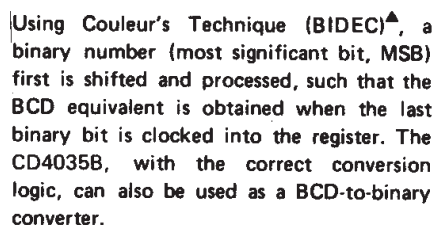


Fig. 14 – Shift left/shift right register.

## COMMERCIAL CMOS HIGH VOLTAGE ICs



<sup>4</sup> The basic rule is: If a 4 or less is in a decade, shift with the next clock pulse; if a 5 or greater is in a decade, add 3 and then shift at the next clock pulse. For more information refer to "IRE TRANSACTIONS ON ELECTRONIC COMPUTERS", Dec. 1958, Pages 313-316.

**Fig. 15 – BIDEDEC logic.**



**Fig. 16(a) — Double sequence generator.**

At  $T_A = 25^\circ\text{C}$ , Input  $t_r, t_f = 20\text{ ns}$ ,  $C_l = 50\text{ pF}$ ,  $R_l = 200\text{ k}\Omega$

| CHARACTERISTICS                                                | TEST<br>CONDITIONS | LIMITS                 |      |      |      | UNITS |
|----------------------------------------------------------------|--------------------|------------------------|------|------|------|-------|
|                                                                |                    | V <sub>DD</sub><br>(V) | Min. | Typ. | Max. |       |
| CLOCKED OPERATION                                              |                    |                        |      |      |      |       |
| Propagation Delay Time:<br>t <sub>PHL</sub> , t <sub>PLH</sub> |                    | 5                      | —    | 250  | 500  | ns    |
|                                                                |                    | 10                     | —    | 100  | 200  |       |
|                                                                |                    | 15                     | —    | 75   | 150  |       |
| Transition Time:<br>t <sub>THL</sub> , t <sub>TLH</sub>        |                    | 5                      | —    | 100  | 200  | ns    |
|                                                                |                    | 10                     | —    | 50   | 100  |       |
|                                                                |                    | 15                     | —    | 40   | 80   |       |
| Minimum Clock Pulse Width, t <sub>W</sub>                      |                    | 5                      | —    | 100  | 200  | ns    |
|                                                                |                    | 10                     | —    | 45   | 90   |       |
|                                                                |                    | 15                     | —    | 30   | 60   |       |
| Clock Rise or Fall Time, t <sub>rCL</sub> , t <sub>fCL</sub> * |                    | 5,10,<br>15            | —    | —    | 15   | μs    |
| Minimum Setup Time:<br>J/ $\overline{K}$ Lines                 |                    | 5                      | —    | 110  | 220  | ns    |
|                                                                |                    | 10                     | —    | 40   | 80   |       |
|                                                                |                    | 15                     | —    | 30   | 60   |       |
| Parallel-In Lines                                              |                    | 5                      | —    | 70   | 140  | ns    |
|                                                                |                    | 10                     | —    | 25   | 50   |       |
|                                                                |                    | 15                     | —    | 20   | 40   |       |
| Maximum Clock Frequency, f <sub>CL</sub>                       |                    | 5                      | 2    | 4    | —    | MHz   |
|                                                                |                    | 10                     | 6    | 12   | —    |       |
|                                                                |                    | 15                     | 8    | 16   | —    |       |
| Input Capacitance, C <sub>IN</sub>                             | Any Input          |                        | —    | 5    | 7.5  | pF    |
| RESET OPERATION                                                |                    |                        |      |      |      |       |
| Propagation Delay Time:<br>t <sub>PHL</sub> , t <sub>PLH</sub> |                    | 5                      | —    | 230  | 460  | ns    |
|                                                                |                    | 10                     | —    | 100  | 200  |       |
|                                                                |                    | 15                     | —    | 80   | 160  |       |
| Minimum Reset Pulse Width, t <sub>W</sub>                      |                    | 5                      | —    | 125  | 250  | ns    |
|                                                                |                    | 10                     | —    | 55   | 110  |       |
|                                                                |                    | 15                     | —    | 40   | 40   |       |

\*If more than one unit is cascaded, CL should be made less than or equal to the sum of the transition time and the fixed propagation delay of the output of the driving stage for the estimated capacitive load.

| Control # E = 0 |                |                |                |  | 1              |                |                |                |  |
|-----------------|----------------|----------------|----------------|--|----------------|----------------|----------------|----------------|--|
| Q <sub>1</sub>  | Q <sub>2</sub> | Q <sub>3</sub> | Q <sub>4</sub> |  | Q <sub>1</sub> | Q <sub>2</sub> | Q <sub>3</sub> | Q <sub>4</sub> |  |
| A               | B              | C              | D              |  | A              | B              | C              | D              |  |
| 0               | 0              | 0              | 0              |  | 15             | 1              | 1              | 1              |  |
| 1               | 1              | 0              | 0              |  | 14             | 0              | 1              | 1              |  |
| 2               | 0              | 1              | 0              |  | 13             | 1              | 0              | 1              |  |
| 5               | 1              | 0              | 1              |  | 10             | 0              | 1              | 0              |  |
| 10              | 0              | 1              | 0              |  | 5              | 1              | 0              | 1              |  |
| 4               | 0              | 0              | 1              |  | 11             | 1              | 1              | 0              |  |
| 9               | 1              | 0              | 0              |  | 6              | 0              | 1              | 1              |  |
| 3               | 1              | 1              | 0              |  | 12             | 0              | 0              | 1              |  |
| 6               | 0              | 1              | 1              |  | 9              | 1              | 0              | 0              |  |
| 13              | 1              | 0              | 1              |  | 2              | 0              | 1              | 0              |  |
| 11              | 1              | 1              | 0              |  | 4              | 0              | 0              | 1              |  |
| 7               | 1              | 1              | 1              |  | 8              | 0              | 0              | 0              |  |
| 14              | 0              | 1              | 1              |  | 1              | 1              | 0              | 0              |  |
| 12              | 0              | 0              | 1              |  | 3              | 1              | 1              | 0              |  |
| 8               | 0              | 0              | 0              |  | 7              | 1              | 1              | 1              |  |

Using a control line (E) two different state sequences can be generated. For example, suppose the following two sequences are desired on command (control line E)

**Fig. 16(b) – State sequences.**

## CD4035B Types

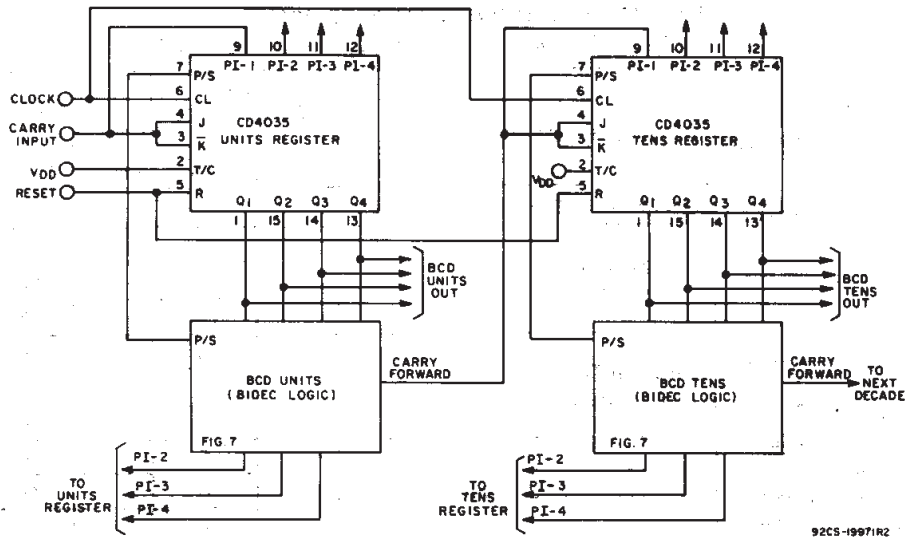
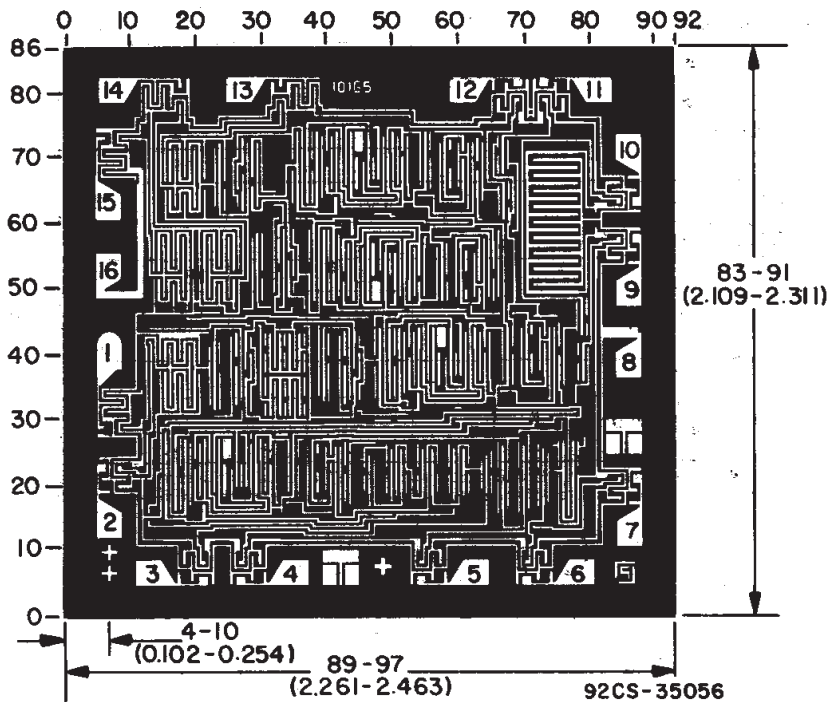
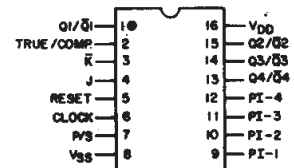


Fig. 17 — Binary-to-BCD converter.



TERMINAL DIAGRAM  
Top View



92CS-20749M

Dimensions and pad layout for CD4035BH.

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<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)     | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|---------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| 8101701EA        | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 8101701EA<br>CD4035BF3A | <a href="#">Samples</a> |
| CD4035BE         | ACTIVE        | PDIP         | N                  | 16   | 25             | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | -55 to 125   | CD4035BE                | <a href="#">Samples</a> |
| CD4035BF         | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | CD4035BF                | <a href="#">Samples</a> |
| CD4035BF3A       | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 8101701EA<br>CD4035BF3A | <a href="#">Samples</a> |
| CD4035BM         | ACTIVE        | SOIC         | D                  | 16   | 40             | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | CD4035BM                | <a href="#">Samples</a> |
| CD4035BM96       | ACTIVE        | SOIC         | D                  | 16   | 2500           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | CD4035BM                | <a href="#">Samples</a> |
| CD4035BPWR       | ACTIVE        | TSSOP        | PW                 | 16   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | CM035B                  | <a href="#">Samples</a> |

(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.

**OBSELETE:** 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 <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm 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.

<sup>(6)</sup> 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 CD4035B, CD4035B-MIL :**

- Catalog: [CD4035B](#)
- Military: [CD4035B-MIL](#)

**NOTE: Qualified Version Definitions:**

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

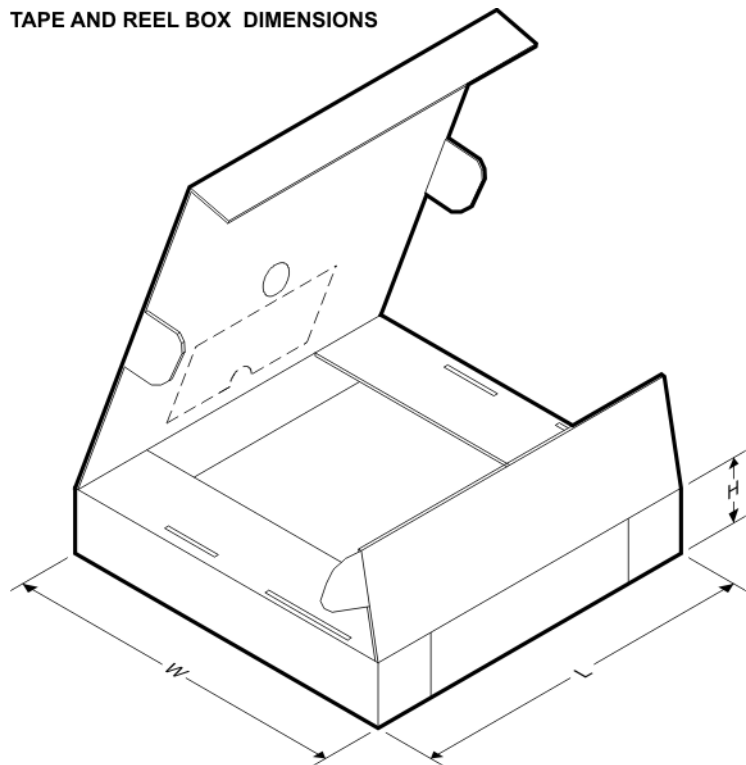
## TAPE AND REEL INFORMATION



\*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 |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD4035BM96 | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| CD4035BPWR | 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) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD4035BM96 | SOIC         | D               | 16   | 2500 | 340.5       | 336.1      | 32.0        |
| CD4035BPWR | TSSOP        | PW              | 16   | 2000 | 853.0       | 449.0      | 35.0        |

## TUBE



\*All dimensions are nominal

| Device   | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|----------|--------------|--------------|------|-----|--------|--------|--------|--------|
| CD4035BE | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD4035BE | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD4035BM | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |

J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| PINS **<br>DIM | 14                     | 16                     | 18                     | 20                     |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A              | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX          | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN          | —                      | —                      | —                      | —                      |
| C MAX          | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN          | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(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<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



14/18 Pin Only  
20 Pin vendor option

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.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



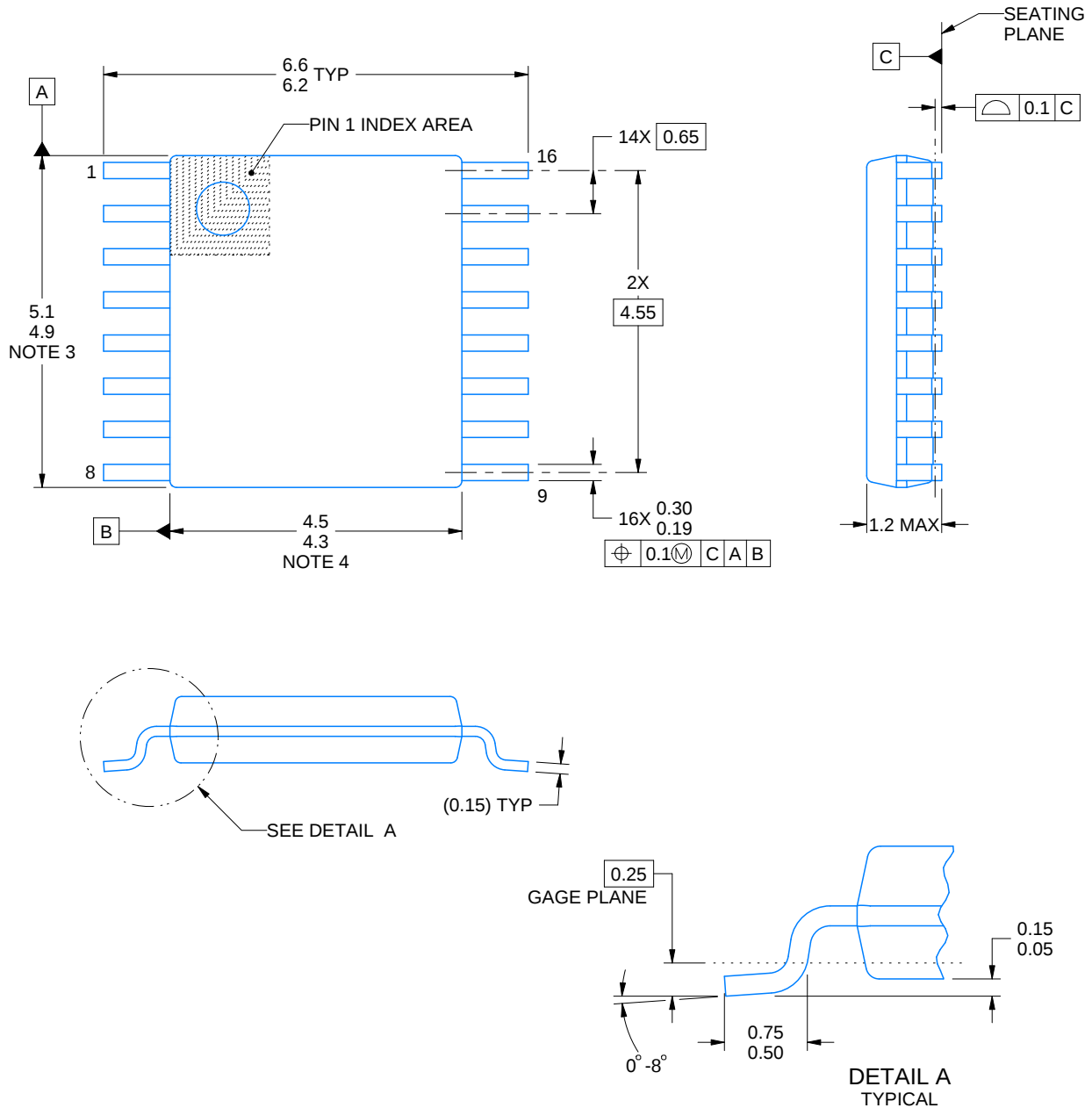
- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - $\triangle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

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



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



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## NOTES:

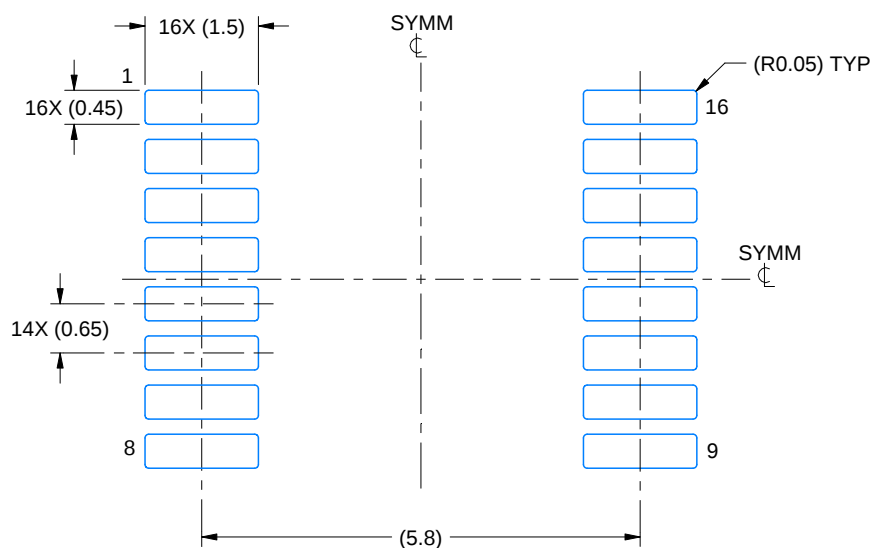
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or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

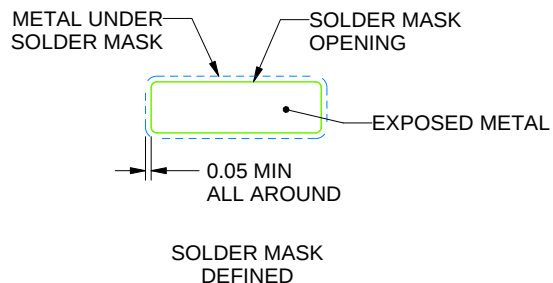
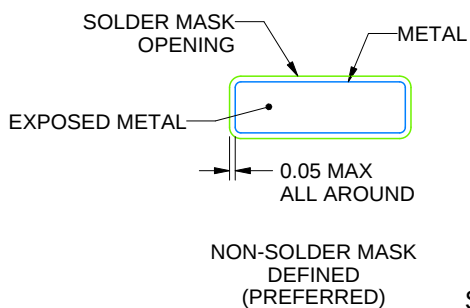
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

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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.

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