

High-Speed CMOS Logic Decade Counter/Divider with 10 Decoded Outputs

Features

- Fully Static Operation
- Buffered Inputs
- Common Reset
- Positive Edge Clocking
- Typical $f_{MAX} = 50\text{MHz}$ at $V_{CC} = 5\text{V}$, $C_L = 15\text{pF}$, $T_A = 25^\circ\text{C}$
- Fanout (Over Temperature Range)
 - Standard Outputs 10 LSTTL Loads
 - Bus Driver Outputs 15 LSTTL Loads
- Wide Operating Temperature Range . . . -55°C to 125°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
 - 2V to 6V Operation
 - High Noise Immunity: $N_{IL} = 30\%$, $N_{IH} = 30\%$ of V_{CC} at $V_{CC} = 5\text{V}$

Description

The 'HC4017 is a high speed silicon gate CMOS 5-stage Johnson counter with 10 decoded outputs. Each of the decoded outputs is normally low and sequentially goes high on the low to high transition clock period of the 10 clock period cycle. The CARRY (TC) output transitions low to high after OUTPUT 10 goes from high to low, and can be used in conjunction with the CLOCK ENABLE (CE) to cascade several stages. The CLOCK ENABLE input disables counting when in the high state. A RESET (MR) input is also provided which when taken high sets all the decoded outputs, except "0", low.

The device can drive up to 10 low power Schottky equivalent loads.

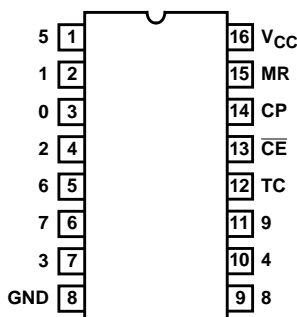
Ordering Information

| PART NUMBER | TEMP. RANGE (°C) | PACKAGE |
|---------------|------------------|--------------|
| CD54HC4017F3A | -55 to 125 | 16 Ld CERDIP |
| CD74HC4017E | -55 to 125 | 16 Ld PDIP |
| CD74HC4017M | -55 to 125 | 16 Ld SOIC |
| CD74HC4017MT | -55 to 125 | 16 Ld SOIC |
| CD74HC4017M96 | -55 to 125 | 16 Ld SOIC |
| CD74HC4017NSR | -55 to 125 | 16 Ld SOP |
| CD74HC4017PW | -55 to 125 | 16 Ld TSSOP |
| CD74HC4017PWR | -55 to 125 | 16 Ld TSSOP |

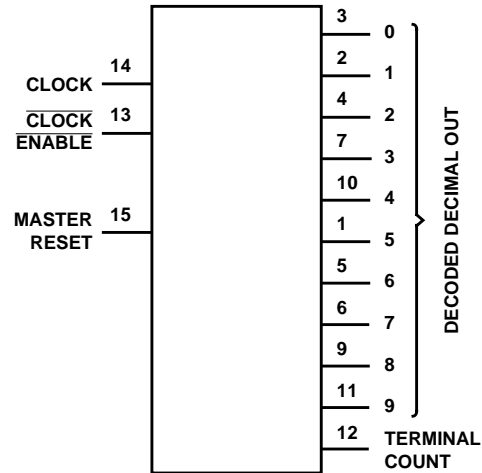
NOTE: When ordering, use the entire part number. The suffixes 96 and R denote tape and reel. The suffix T denotes a small-quantity reel of 250.

Pinout

CD54HC4017 (CERDIP)
CD74HC4017 (PDIP, SOIC, SOP, TSSOP)
TOP VIEW



Functional Diagram



TRUTH TABLE

| CP | \overline{CE} | MR | OUTPUT STATE † |
|----|-----------------|----|-----------------------|
| L | X | L | No Change |
| X | H | L | No Change |
| X | X | H | "0" = H, "1"- "9" = L |
| ↑ | L | L | Increments Counter |
| ↓ | X | L | No Change |
| X | ↑ | L | No Change |
| H | ↓ | L | Increments Counter |

H = High Level

L = Low Level

↑ = High to Low Transition

↓ = Low to High Transition

X = Don't Care.

† If $n < 5$ TC = H, Otherwise = L

CD54HC4017, CD74HC4017

Absolute Maximum Ratings

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

Thermal Information

Package Thermal Impedance, θ_{JA} (see Note 1):
 E (PDIP) Package $67^{\circ}C/W$
 M (SOIC) Package $73^{\circ}C/W$
 NS (SOP) Package $64^{\circ}C/W$
 PW (TSSOP) Package $108^{\circ}C/W$
 Maximum Junction Temperature $150^{\circ}C$
 Maximum Storage Temperature Range $-65^{\circ}C$ to $150^{\circ}C$
 Maximum Lead Temperature (Soldering 10s) $300^{\circ}C$
 (SOIC - Lead Tips Only)

Operating Conditions

Temperature Range, T_A $-55^{\circ}C$ to $125^{\circ}C$
 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
 2V 1000ns (Max)
 4.5V 500ns (Max)
 6V 400ns (Max)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

1. 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 | |
| High Level Input Voltage | V _{IH} | - | - | 2 | 1.5 | - | - | 1.5 | - | 1.5 | - | V |
| | | | | 4.5 | 3.15 | - | - | 3.15 | - | 3.15 | - | V |
| | | | | 6 | 4.2 | - | - | 4.2 | - | 4.2 | - | V |
| Low Level Input Voltage | V _{IL} | - | - | 2 | - | - | 0.5 | - | 0.5 | - | 0.5 | V |
| | | | | 4.5 | - | - | 1.35 | - | 1.35 | - | 1.35 | V |
| | | | | 6 | - | - | 1.8 | - | 1.8 | - | 1.8 | V |
| High Level Output Voltage CMOS Loads | V _{OH} | V _{IH} or V _{IL} | -0.02 | 2 | 1.9 | - | - | 1.9 | - | 1.9 | - | V |
| | | | -0.02 | 4.5 | 4.4 | - | - | 4.4 | - | 4.4 | - | V |
| | | | -0.02 | 6 | 5.9 | - | - | 5.9 | - | 5.9 | - | V |
| - | | | - | - | - | - | - | - | - | - | V | |
| -4 | | | 4.5 | 3.98 | - | - | 3.84 | - | 3.7 | - | V | |
| -5.2 | | | 6 | 5.48 | - | - | 5.34 | - | 5.2 | - | V | |
| 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 |
| - | | | - | - | - | - | - | - | - | - | V | |
| 4 | | | 4.5 | - | - | 0.26 | - | 0.33 | - | 0.4 | V | |
| 5.2 | | | 6 | - | - | 0.26 | - | 0.33 | - | 0.4 | V | |
| 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 |

CD54HC4017, CD74HC4017

Prerequisite for Switching Specifications

| 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 | |
| Maximum Clock Frequency | f _{MAX} | - | 2 | 6 | - | - | 5 | - | 4 | - | MHz |
| | | | 4.5 | 30 | - | - | 35 | - | 20 | - | MHz |
| | | | 6 | 35 | - | - | 49 | - | 23 | - | MHz |
| CP Pulse Width | t _W | - | 2 | 80 | - | - | 100 | - | 120 | - | ns |
| | | | 4.5 | 16 | - | - | 20 | - | 24 | - | ns |
| | | | 6 | 14 | - | - | 17 | - | 20 | - | ns |
| MR Pulse Width | t _W | - | 2 | 80 | - | - | 100 | - | 120 | - | ns |
| | | | 4.5 | 16 | - | - | 20 | - | 24 | - | ns |
| | | | 6 | 14 | - | - | 17 | - | 20 | - | ns |
| Set-up Time, CE to CP | t _{SU} | - | 2 | 75 | - | - | 95 | - | 110 | - | ns |
| | | | 4.5 | 15 | - | - | 19 | - | 22 | - | ns |
| | | | 6 | 13 | - | - | 16 | - | 19 | - | ns |
| Hold Time, CE to CP | t _H | - | 2 | 0 | - | - | 0 | - | 0 | - | ns |
| | | | 4.5 | 0 | - | - | 0 | - | 0 | - | ns |
| | | | 6 | 0 | - | - | 0 | - | 0 | - | ns |
| MR Removal Time | t _{REM} | - | 2 | 5 | - | - | 5 | - | 5 | - | ns |
| | | | 4.5 | 5 | - | - | 5 | - | 5 | - | ns |
| | | | 6 | 5 | - | - | 5 | - | 5 | - | ns |

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 | |
| Propagation Delay CP to any Dec. Out | t _{PLH} , t _{PHL} | C _L = 50pF | 2 | - | - | 230 | - | 290 | - | 345 | ns |
| | | C _L = 50pF | 4.5 | - | - | 46 | - | 58 | - | 69 | ns |
| | | C _L = 15pF | 5 | - | 19 | - | - | - | - | - | ns |
| | | C _L = 50pF | 6 | - | - | 39 | - | 49 | - | 59 | ns |
| CP to TC | t _{PLH} , t _{PHL} | C _L = 50pF | 2 | - | - | 230 | - | 290 | - | 345 | ns |
| | | C _L = 50pF | 4.5 | - | - | 46 | - | 58 | - | 69 | ns |
| | | C _L = 15pF | 5 | - | 19 | - | - | - | - | - | ns |
| | | C _L = 50pF | 6 | - | - | 39 | - | 49 | - | 59 | ns |
| CE to any Dec. Out | t _{PLH} , t _{PHL} | C _L = 50pF | 2 | - | - | 250 | - | 315 | - | 375 | ns |
| | | C _L = 50pF | 4.5 | - | - | 50 | - | 63 | - | 75 | ns |
| | | C _L = 15pF | 5 | - | 21 | - | - | - | - | - | ns |
| | | C _L = 50pF | 6 | - | - | 43 | - | 54 | - | 64 | ns |
| CE to TC | t _{PLH} , t _{PHL} | C _L = 50pF | 2 | - | - | 250 | - | 315 | - | 375 | ns |
| | | C _L = 50pF | 4.5 | - | - | 50 | - | 63 | - | 75 | ns |
| | | C _L = 15pF | 5 | - | 21 | - | - | - | - | - | ns |
| | | C _L = 50pF | 6 | - | - | 43 | - | 54 | - | 64 | ns |

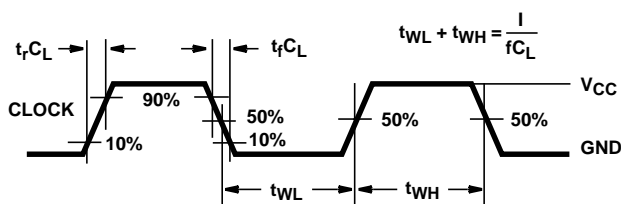
Switching Specifications Input t_r , $t_f = 6\text{ns}$ (Continued)

| PARAMETER | SYMBOL | TEST CONDITIONS | V_{CC} (V) | 25°C | | | -40°C TO 85°C | | -55°C TO 125°C | | UNITS |
|---|--------------------------|---------------------|-----------------|------|-----|-----|---------------|-----|----------------|-----|-------|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| MR to any Dec. Out | t_{PLH} , t_{PHL} | $C_L = 50\text{pF}$ | 2 | - | - | 230 | - | 290 | - | 345 | ns |
| | | $C_L = 50\text{pF}$ | 4.5 | - | - | 46 | - | 58 | - | 69 | ns |
| | | $C_L = 15\text{pF}$ | 5 | - | 19 | - | - | - | - | - | ns |
| | | $C_L = 50\text{pF}$ | 6 | - | - | 39 | - | 49 | - | 59 | ns |
| MR to TC | t_{PLH} , t_{PHL} | $C_L = 50\text{pF}$ | 2 | - | - | 230 | - | 290 | - | 345 | ns |
| | | $C_L = 50\text{pF}$ | 4.5 | - | - | 46 | - | 58 | - | 69 | ns |
| | | $C_L = 15\text{pF}$ | 5 | - | 19 | - | - | - | - | - | ns |
| | | $C_L = 50\text{pF}$ | 6 | - | - | 39 | - | 49 | - | 59 | ns |
| Transition Time TC, Dec. Out | t_{TLH} , t_{THL} | $C_L = 50\text{pF}$ | 2 | - | - | 75 | - | 95 | - | 110 | ns |
| | | $C_L = 50\text{pF}$ | 4.5 | - | - | 15 | - | 19 | - | 22 | ns |
| | | $C_L = 50\text{pF}$ | 6 | - | - | 13 | - | 16 | - | 19 | ns |
| Input Capacitance | C_{IN} | $C_L = 50\text{pF}$ | - | - | - | 10 | - | 10 | - | 10 | pF |
| Maximum CP Frequency | f_{MAX} | $C_L = 15\text{pF}$ | 5 | - | 60 | - | - | - | - | - | MHz |
| Power Dissipation Capacitance (Notes 2, 3) | C_{PD} | $C_L = 15\text{pF}$ | 5 | - | 39 | - | - | - | - | - | pF |

NOTES:

2. C_{PD} is used to determine the dynamic power consumption, per package.
3. $P_D = V_{CC}^2 f_i \sum C_L V_{CC}^2 f_o$ 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

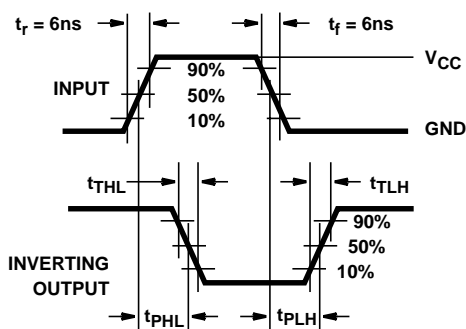


FIGURE 2. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

Test Circuits and Waveforms (Continued)

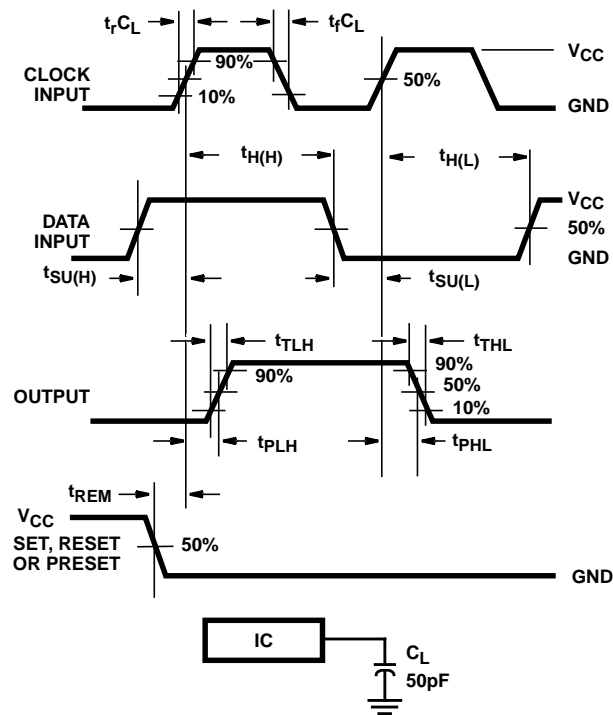


FIGURE 3. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

Timing Diagrams

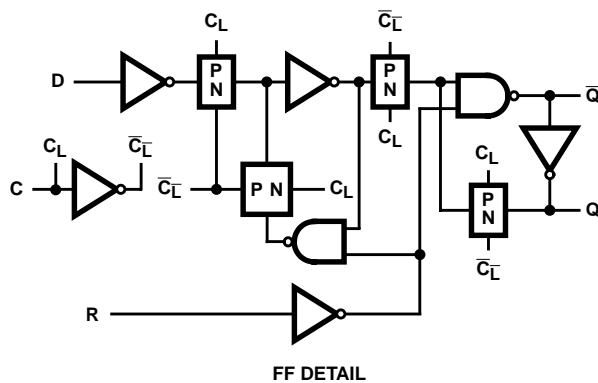


FIGURE 4.

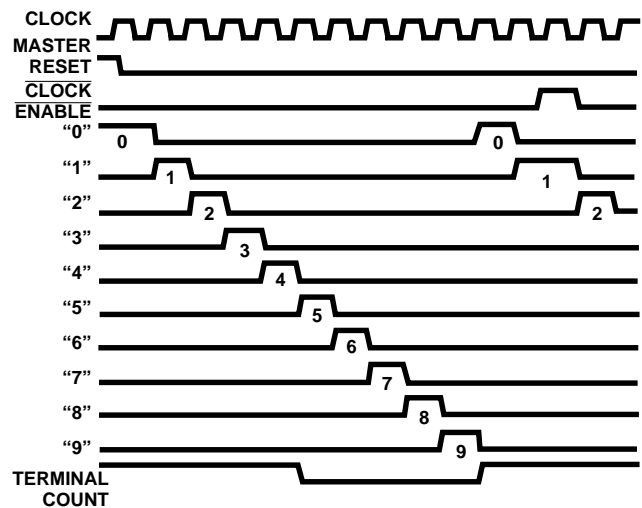


FIGURE 5.

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 |
|------------------|---------------|--------------|--------------------|------|----------------|---------------------|--------------------------------------|----------------------|--------------|----------------------------|-------------------------|
| 8601101EA | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8601101EA CD54HC4017F3A | Samples |
| CD54HC4017F3A | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8601101EA CD54HC4017F3A | Samples |
| CD74HC4017E | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | -55 to 125 | CD74HC4017E | Samples |
| CD74HC4017EE4 | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | -55 to 125 | CD74HC4017E | Samples |
| CD74HC4017M | ACTIVE | SOIC | D | 16 | 40 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HC4017M | Samples |
| CD74HC4017M96 | ACTIVE | SOIC | D | 16 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HC4017M | Samples |
| CD74HC4017MT | ACTIVE | SOIC | D | 16 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HC4017M | Samples |
| CD74HC4017MTE4 | ACTIVE | SOIC | D | 16 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HC4017M | Samples |
| CD74HC4017NSR | ACTIVE | SO | NS | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HC4017M | Samples |
| CD74HC4017NSRE4 | ACTIVE | SO | NS | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HC4017M | Samples |
| CD74HC4017PW | ACTIVE | TSSOP | PW | 16 | 90 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HJ4017 | Samples |
| CD74HC4017PWR | ACTIVE | TSSOP | PW | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HJ4017 | Samples |
| CD74HC4017PWRE4 | ACTIVE | TSSOP | PW | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HJ4017 | Samples |
| CD74HC4017PWT | ACTIVE | TSSOP | PW | 16 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HJ4017 | 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 CD54HC4017, CD74HC4017 :

- Catalog : [CD74HC4017](#)
- Automotive : [CD74HC4017-Q1](#), [CD74HC4017-Q1](#)
- Enhanced Product : [CD74HC4017-EP](#), [CD74HC4017-EP](#)
- Military : [CD54HC4017](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

- 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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD74HC4017M96 | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| CD74HC4017NSR | SO | NS | 16 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| CD74HC4017PWR | TSSOP | PW | 16 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |
| CD74HC4017PWT | TSSOP | PW | 16 | 250 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |

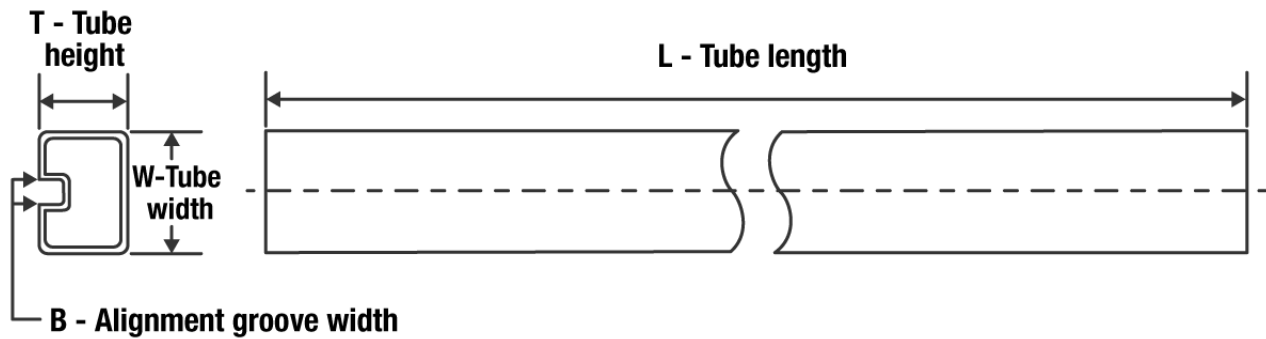
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD74HC4017M96 | SOIC | D | 16 | 2500 | 340.5 | 336.1 | 32.0 |
| CD74HC4017NSR | SO | NS | 16 | 2000 | 853.0 | 449.0 | 35.0 |
| CD74HC4017PWR | TSSOP | PW | 16 | 2000 | 853.0 | 449.0 | 35.0 |
| CD74HC4017PWT | TSSOP | PW | 16 | 250 | 853.0 | 449.0 | 35.0 |

TUBE

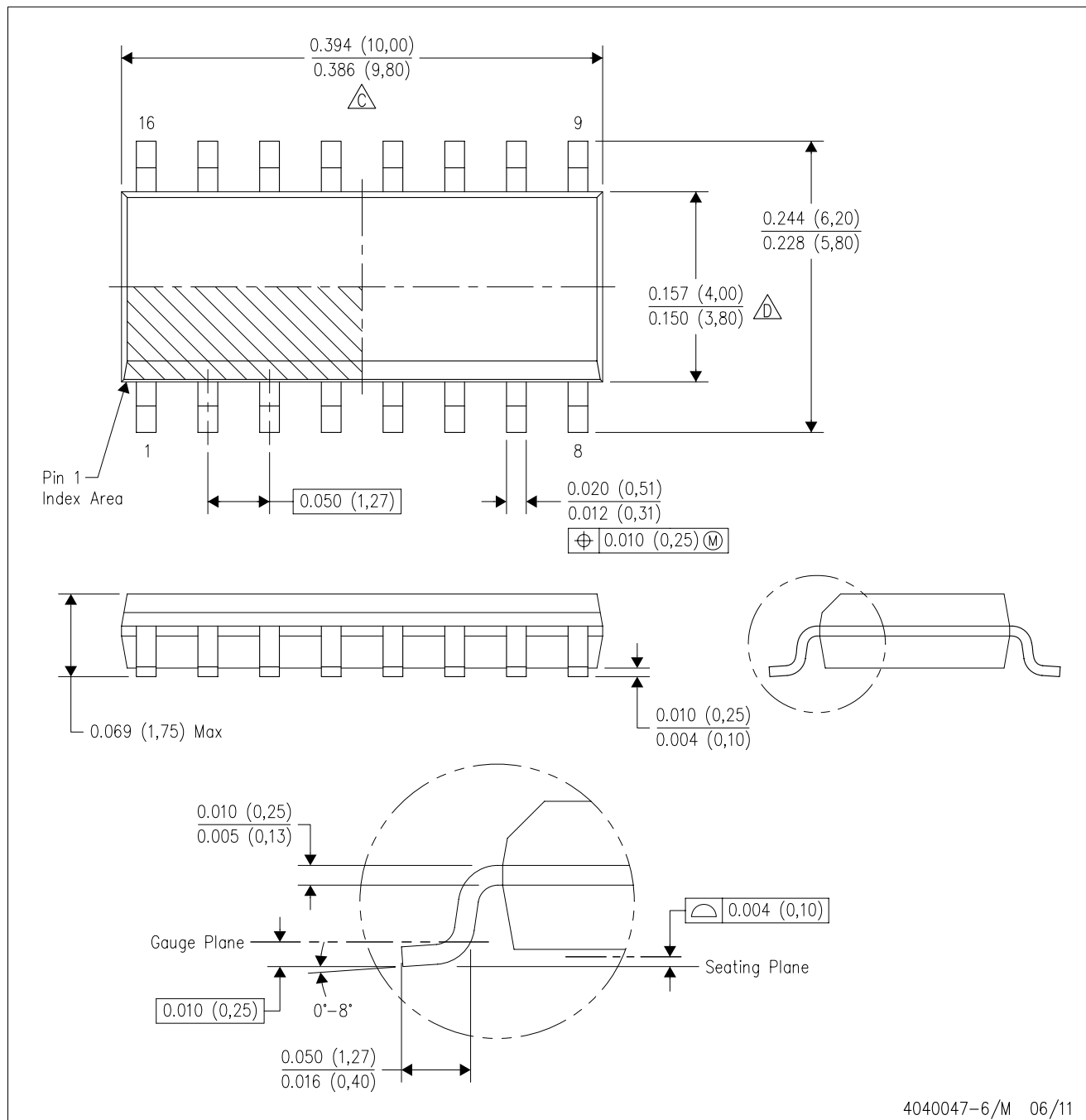


*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|---------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| CD74HC4017E | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD74HC4017E | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD74HC4017EE4 | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD74HC4017EE4 | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD74HC4017M | D | SOIC | 16 | 40 | 507 | 8 | 3940 | 4.32 |
| CD74HC4017PW | PW | TSSOP | 16 | 90 | 530 | 10.2 | 3600 | 3.5 |

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



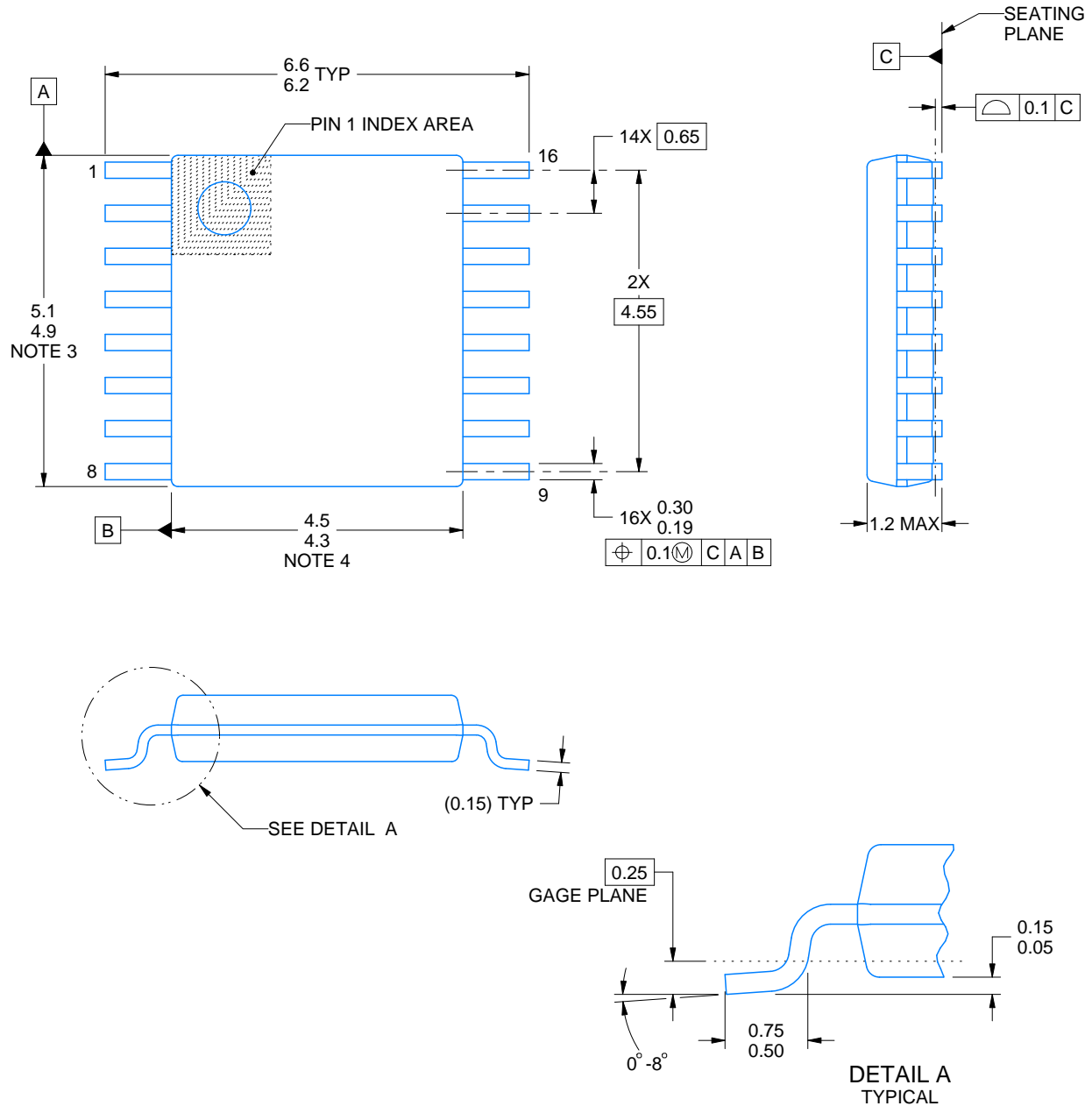
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D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - 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.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



4220204/A 02/2017

NOTES:

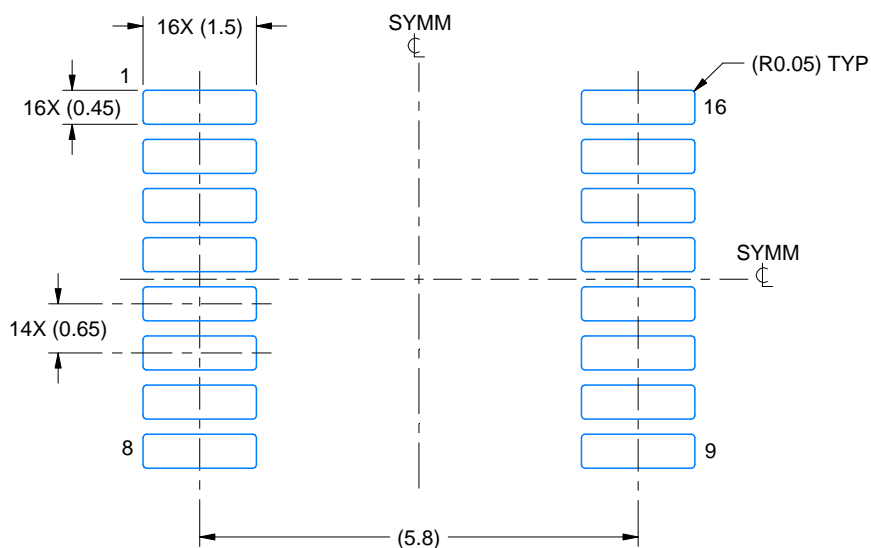
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or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

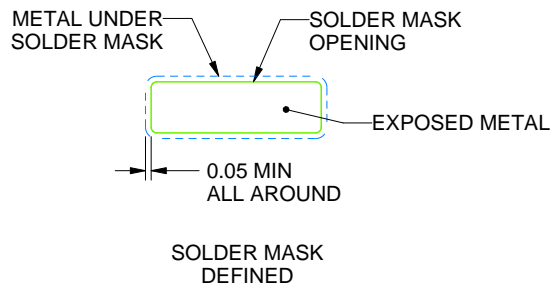
PW0016A

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:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - 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



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



4040083/F 03/03

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

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



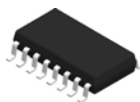
| PINS ** DIM | 14 | 16 | 18 | 20 |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX | 0.775 (19,69) | 0.775 (19,69) | 0.920 (23,37) | 1.060 (26,92) |
| A MIN | 0.745 (18,92) | 0.745 (18,92) | 0.850 (21,59) | 0.940 (23,88) |
| MS-001 VARIATION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

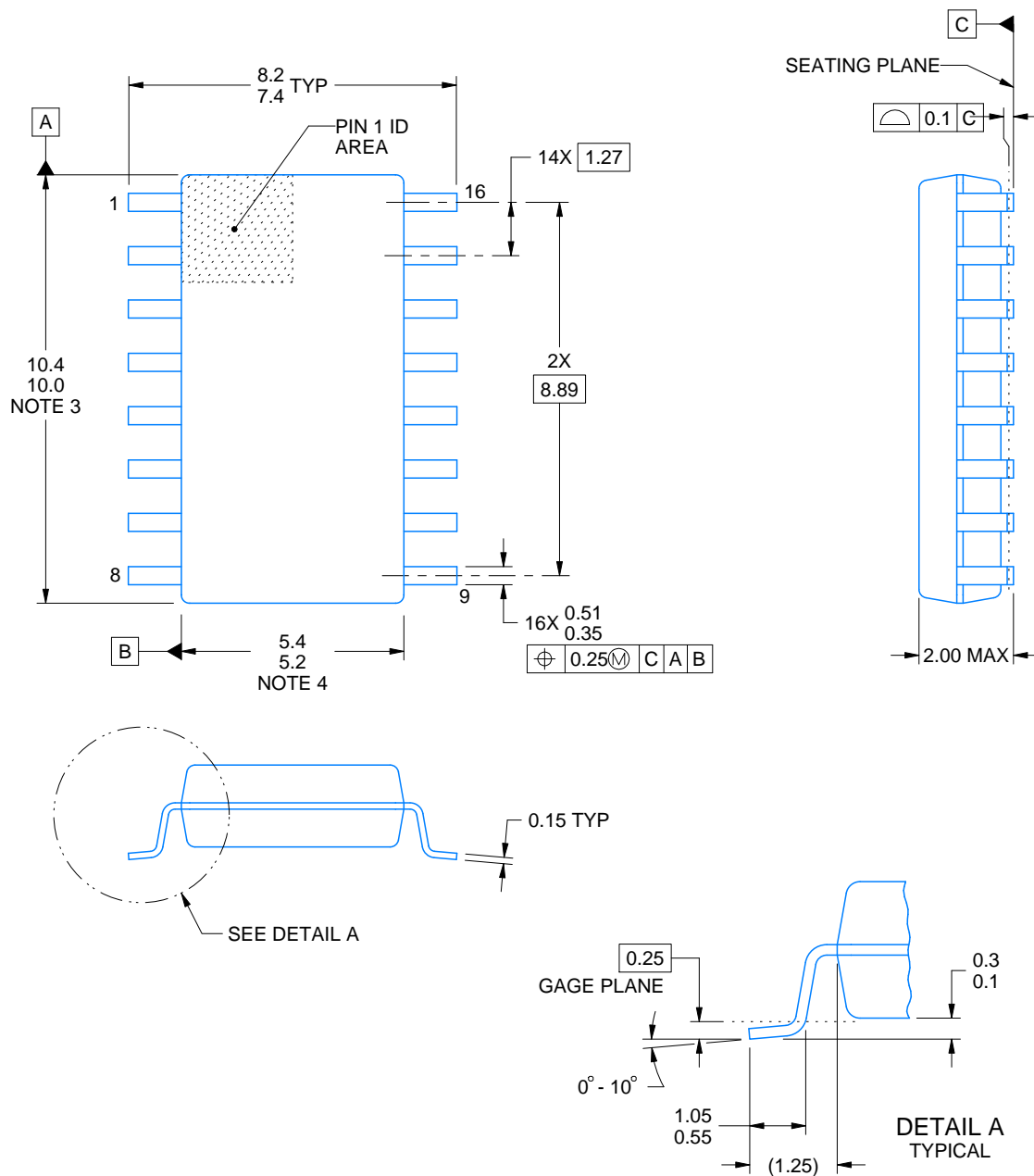


NS0016A

PACKAGE OUTLINE

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

NOTES:

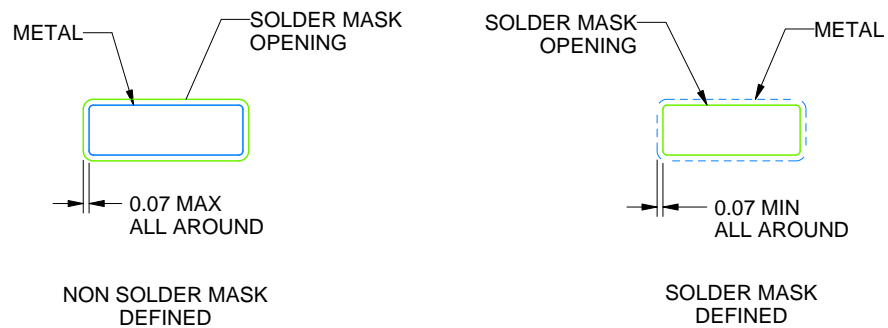
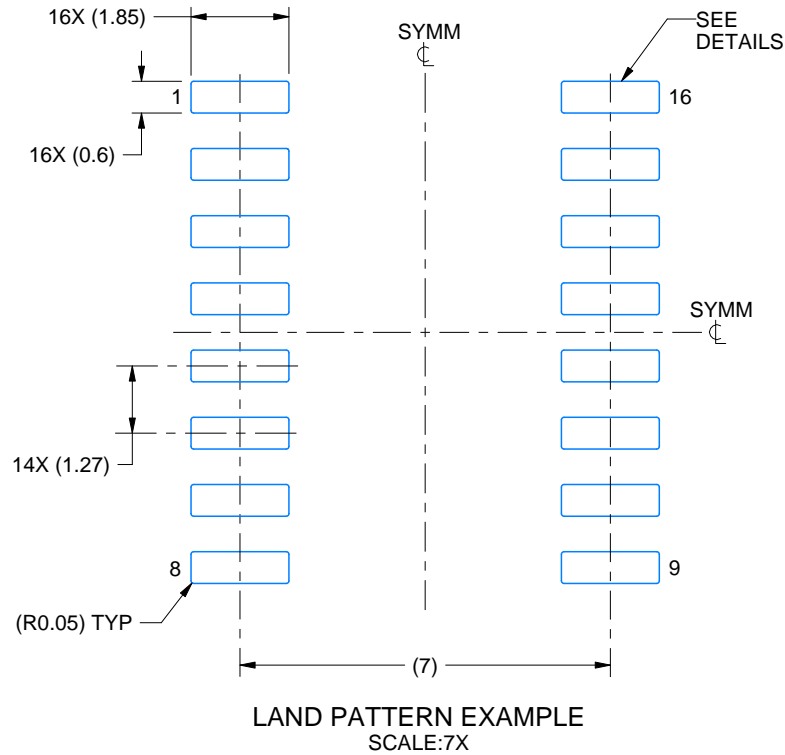
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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



4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

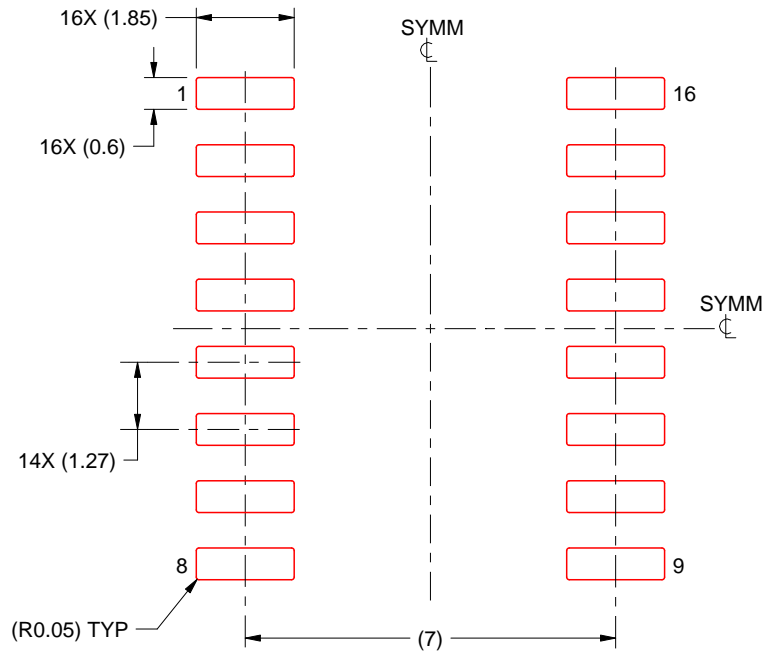
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



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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