



**THE DATASHEET OF
CDC111FNR**

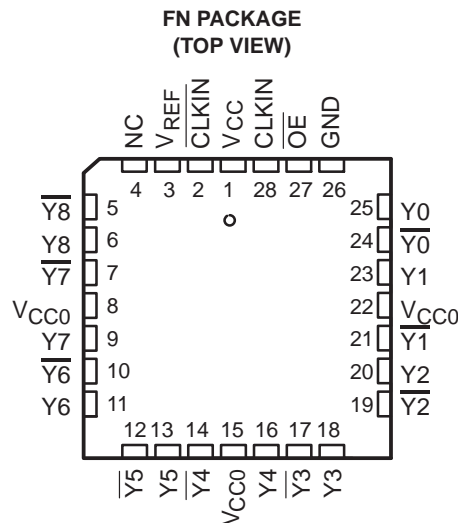


CDC111

1-LINE TO 9-LINE DIFFERENTIAL LVPECL CLOCK DRIVER

SCAS321G – SEPTEMBER 1993 – REVISED AUGUST 1999

- **Low-Output Skew for Clock-Distribution Applications**
- **Differential Low-Voltage Pseudo-ECL (LVPECL)-Compatible Inputs and Outputs**
- **Distributes Differential Clock Inputs to Nine Differential Clock Outputs**
- **Output Reference Voltage, V_{REF} , Allows Distribution From a Single-Ended Clock Input**
- **Single-Ended LVPECL-Compatible Output Enable**
- **Packaged in Plastic Chip Carrier**



NC – No internal connection

description

The differential LVPECL clock-driver circuit distributes one pair of differential LVPECL clock inputs (CLKIN, $\overline{\text{CLKIN}}$) to nine pairs of differential clock (Y, $\overline{\text{Y}}$) outputs with minimum skew for clock distribution. It is specifically designed for driving 50- Ω transmission lines.

When the output-enable ($\overline{\text{OE}}$) is low, the nine differential outputs switch at the same frequency as the differential clock inputs. When $\overline{\text{OE}}$ is high, the nine differential outputs are in static states (Y outputs are in the low state, $\overline{\text{Y}}$ outputs are in the high state).

The V_{REF} output can be strapped to the $\overline{\text{CLKIN}}$ input for a single-ended CLKIN input.

The CDC111 is characterized for operation from 0°C to 70°C.

FUNCTION TABLE

| INPUTS | | | OUTPUTS | |
|-----------|---------------------------|------------------------|---------|------------------------|
| CLKIN | $\overline{\text{CLKIN}}$ | $\overline{\text{OE}}$ | Yn | $\overline{\text{Yn}}$ |
| X | X | H | L | H |
| L | H | L | L | H |
| H | L | L | H | L |
| L | V_{REF} | L | L | H |
| H | V_{REF} | L | H | L |
| V_{REF} | L | L | H | L |
| V_{REF} | H | L | L | H |



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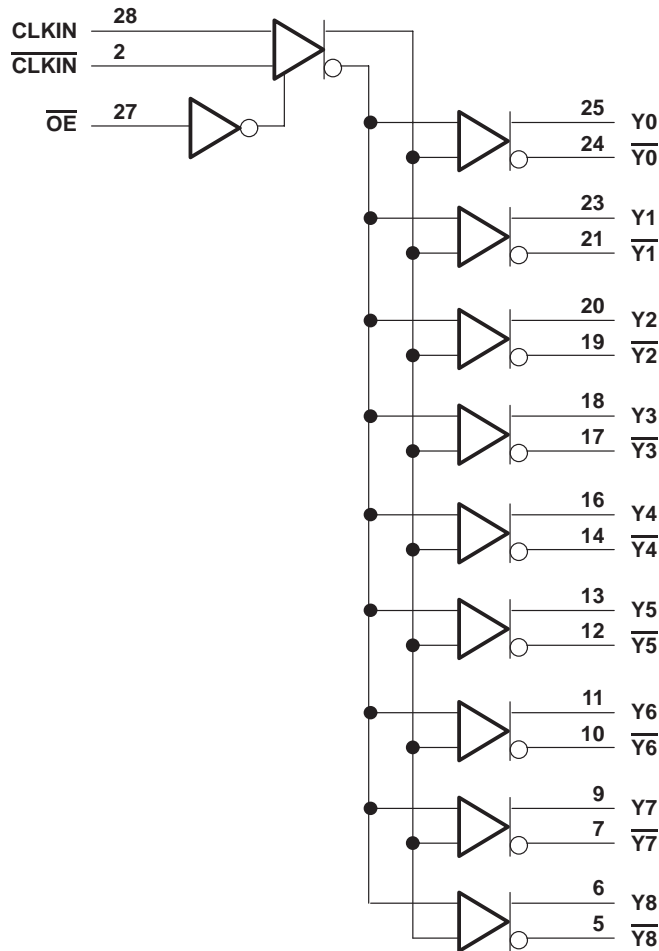
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logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

| | |
|---|--|
| Supply voltage range, V_{CC} | -0.5 V to 4.6 V |
| Input voltage range, V_I (see Note 1) | -0.5 V to $V_{CC} + 0.5$ V |
| Output voltage range, V_O (see Note 1) | -0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, I_{IK} ($V_I < 0$) | -18 mA |
| Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) | -18 mA |
| Continuous output current, I_O ($V_O = 0$ to V_{CC}) | -50 mA |
| Continuous current through V_{CC} or GND | ± 80 mA |
| Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2) | 525 mW |
| Storage temperature range, T_{stg} | -65°C to 150°C |

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
 2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils. For more information, refer to the *Package Thermal Considerations* application note in the *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002.



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recommended operating conditions (see Note 3)

| | | MIN | MAX | UNIT | |
|--------------------|--------------------------------|--------------------------------|------------------------|------------------------|---|
| V _{CC} | Supply voltage | 3 | 3.6 | V | |
| V _{IH} | High-level input voltage | V _{CC} = 3 V to 3.6 V | V _{CC} -1.165 | V _{CC} -0.88 | V |
| | | V _{CC} = 3.3 V | 2.135 | 2.420 | V |
| V _{IL} | Low-level input voltage | V _{CC} = 3 V to 3.6 V | V _{CC} -1.81 | V _{CC} -1.475 | V |
| | | V _{CC} = 3.3 V | 1.49 | 1.825 | V |
| T _A | Operating free-air temperature | 0 | 70 | °C | |
| f _{clock} | Input frequency | | 500 | MHz | |

NOTE 3: V_{CC} = V_{CCO}

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | MIN | MAX | UNIT |
|------------------|---|------------------------|-----------------------|------|
| V _{REF} | V _{CC} = 3 V to 3.6 V | V _{CC} -1.38 | V _{CC} -1.26 | V |
| | V _{CC} = 3.3 V | 1.92 | 2.04 | |
| V _{OH} | V _{CC} = 3 V to 3.6 V | V _{CC} -1.025 | V _{CC} -0.88 | V |
| | V _{CC} = 3.3 V | 2.275 | 2.42 | |
| V _{OL} | V _{CC} = 3 V to 3.6 V | V _{CC} -1.81 | V _{CC} -1.62 | V |
| | V _{CC} = 3.3 V | 1.49 | 1.68 | |
| I _I | V _I = 2.4 V, V _{CC} = 3.6 V | | 150 | μA |
| I _{CC} | I _O = 0, V _{CC} = 3.6 V | | 80 | mA |

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (see Figures 1 and 2)

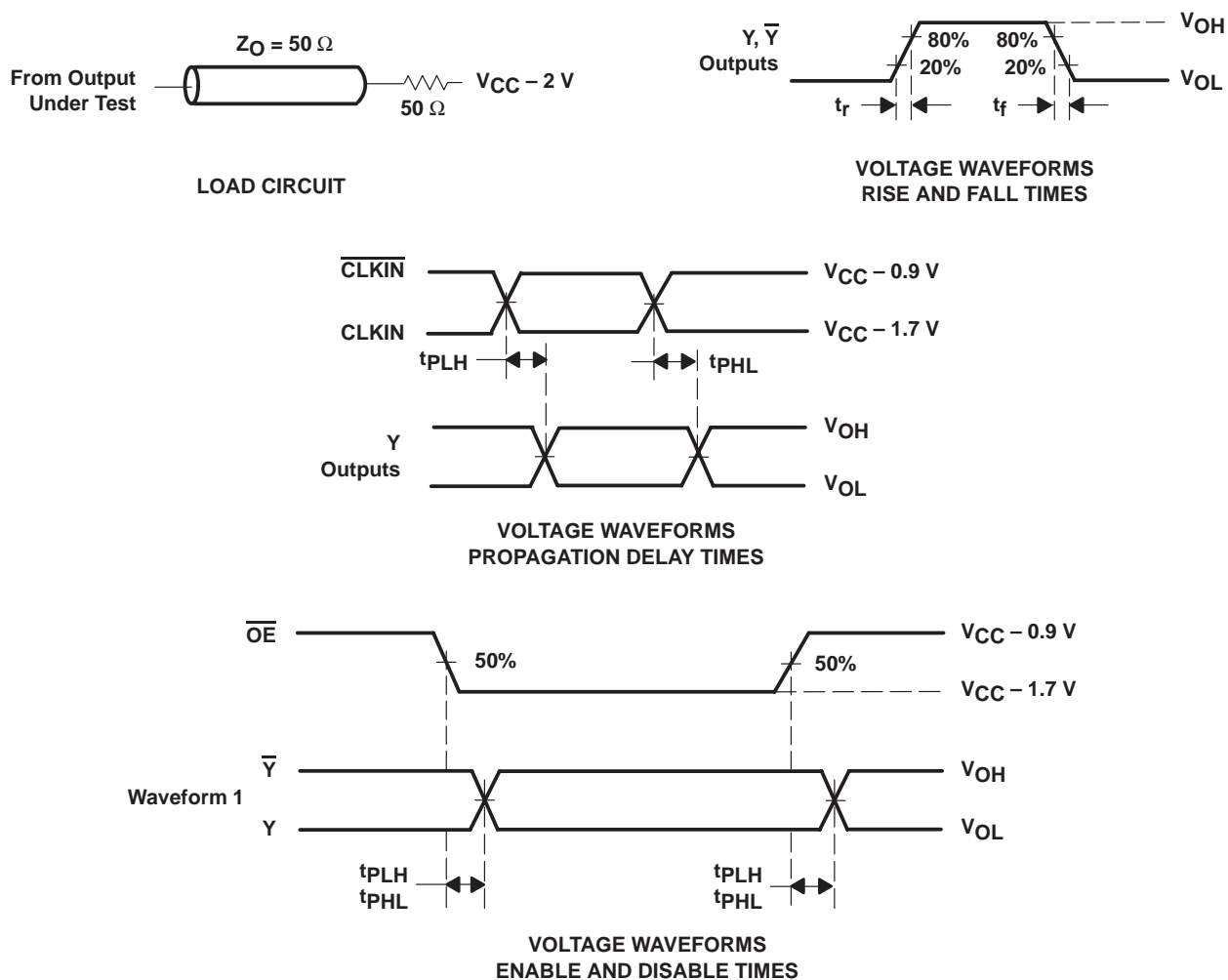
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | MIN | MAX | UNIT |
|---------------------|----------------------------------|--------------------------|-----|-----|------|
| t _{PLH} | CLKIN, $\overline{\text{CLKIN}}$ | Y, $\overline{\text{Y}}$ | 450 | 600 | ps |
| t _{PHL} | | | 450 | 600 | |
| t _{PHL} | $\overline{\text{OE}}$ | Y, $\overline{\text{Y}}$ | | 900 | ps |
| t _{sk(o)} | | Y, $\overline{\text{Y}}$ | | 50 | ps |
| t _{sk(pr)} | | Y, $\overline{\text{Y}}$ | | 150 | ps |
| t _r | | Y, $\overline{\text{Y}}$ | 200 | 600 | ps |
| t _f | | Y, $\overline{\text{Y}}$ | 200 | 600 | ps |

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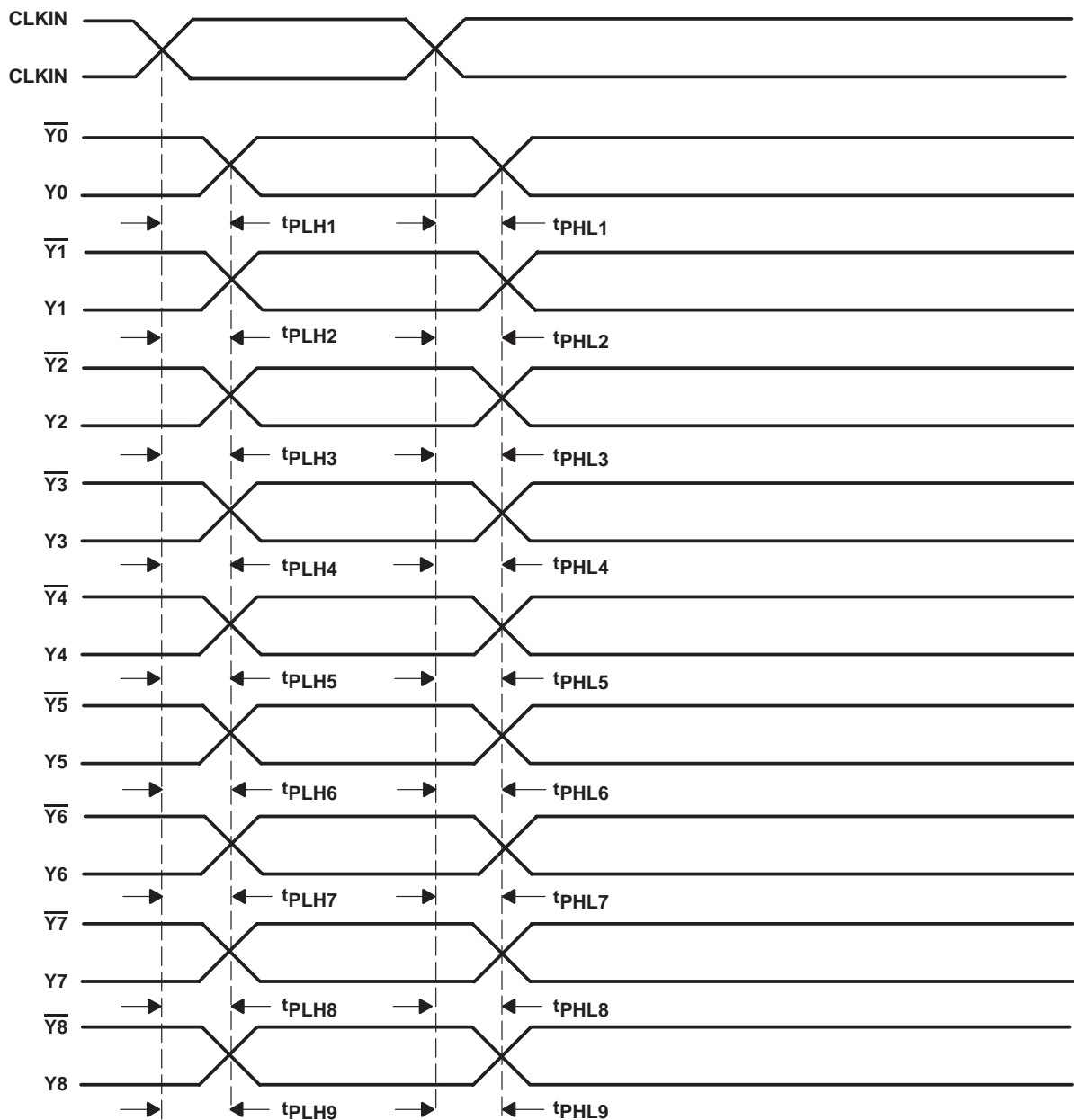
PARAMETER MEASUREMENT INFORMATION



- NOTES:
- All input pulses are supplied by generators having the following characteristics: $PRR \leq 45 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 1 \text{ ns}$, $t_f \leq 1 \text{ ns}$.
 - Waveform 1 is for a \bar{Y} output with internal conditions such that the output is high except when disabled by the output control, and for a Y output with internal conditions such that the output is low except when disabled by the output control.
 - The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. Output skew, $t_{sk(o)}$, is calculated as the greater of:
- The difference between the fastest and slowest t_{PLHn} ($n = 1, 2, \dots, 9$)
 - The difference between the fastest and slowest t_{PHLn} ($n = 1, 2, \dots, 9$)
- B. Process skew, $t_{sk(pr)}$, is calculated as the greater of:
- The difference between the fastest and slowest t_{PLHn} ($n = 1, 2, \dots, 9$)
 - The difference between the fastest and slowest t_{PHLn} ($n = 1, 2, \dots, 9$) across multiple devices

Figure 2. Waveforms for Calculation of $t_{sk(o)}$, $t_{sk(pr)}$

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| CDC111FN | ACTIVE | PLCC | FN | 28 | 37 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CDC111FNR | ACTIVE | PLCC | FN | 28 | 750 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CDC111FNRG4 | ACTIVE | PLCC | FN | 28 | 750 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

⁽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.

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PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

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⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| CDC111FN | ACTIVE | PLCC | FN | 28 | 37 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | CDC111FN | Samples |

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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 <=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.

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

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FN 28

GENERIC PACKAGE VIEW

PLCC - 4.57 mm max height

PLASTIC CHIP CARRIER



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4040005-3/C

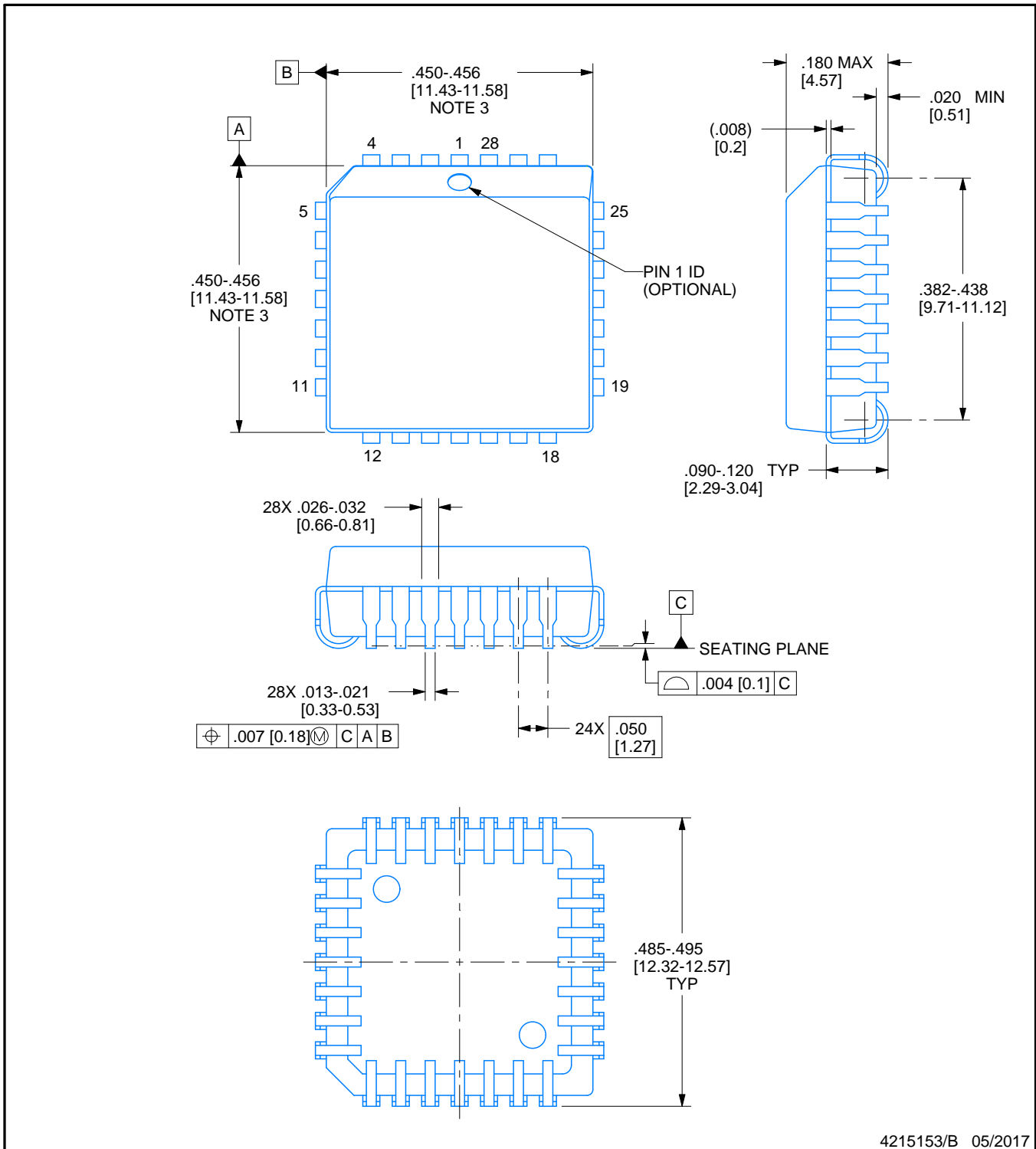


PACKAGE OUTLINE

FN0028A

PLCC - 4.57 mm max height

PLASTIC CHIP CARRIER



4215153/B 05/2017

NOTES:

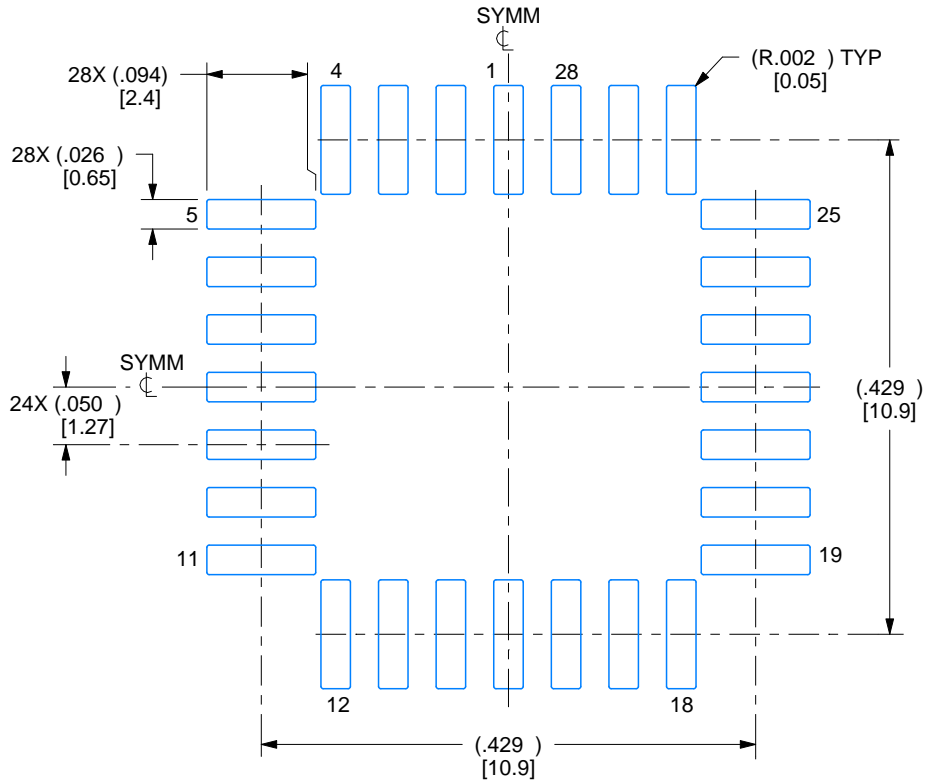
1. All linear dimensions are in inches. Any dimensions in brackets are in millimeters. Any dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Dimension does not include mold protrusion. Maximum allowable mold protrusion .01 in [0.25 mm] per side.
4. Reference JEDEC registration MS-018.

EXAMPLE BOARD LAYOUT

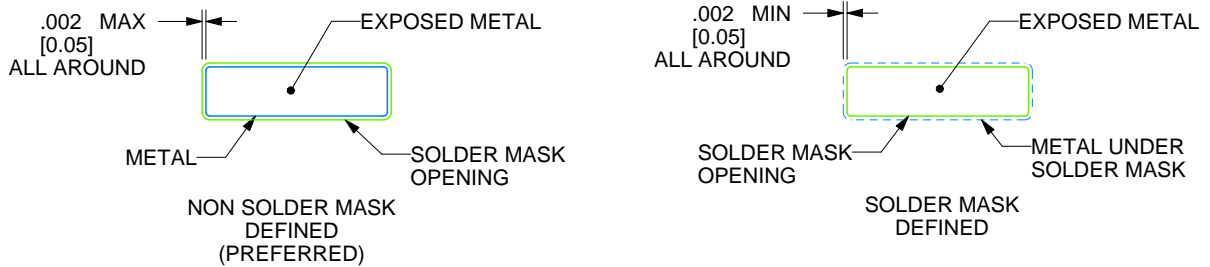
FN0028A

PLCC - 4.57 mm max height

PLASTIC CHIP CARRIER



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X



SOLDER MASK DETAILS

4215153/B 05/2017

NOTES: (continued)

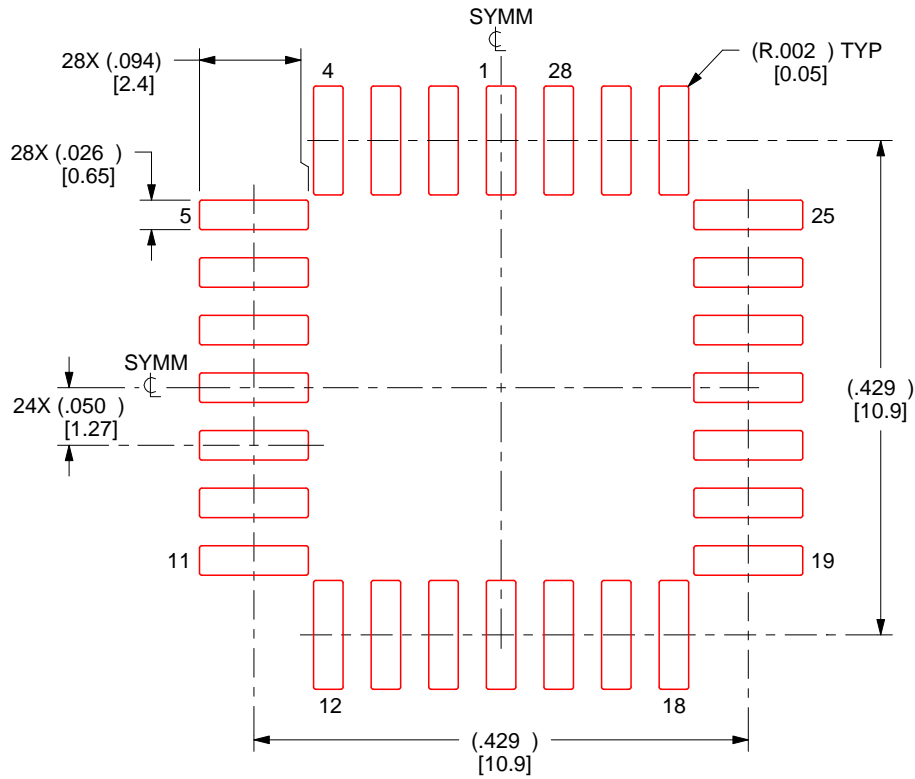
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

FN0028A

PLCC - 4.57 mm max height

PLASTIC CHIP CARRIER



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

4215153/B 05/2017

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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