

# CDCVF111 1:9 DIFFERENTIAL LVPECL CLOCK DRIVER

SCAS670B – SEPTEMBER 2001 – REVISED JUNE 2002

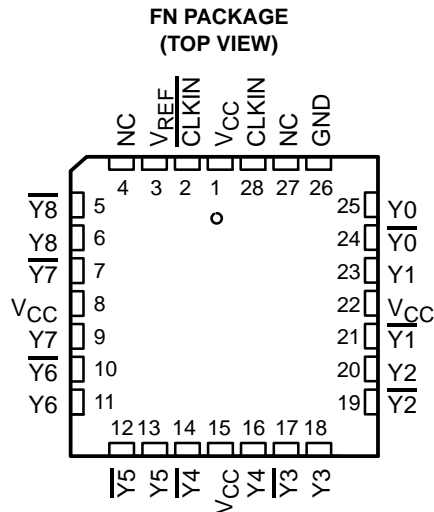
- Low-Output Skew for Clock-Distribution Applications
- Differential Low-Voltage Pseudo-ECL (LVPECL) Compatible Inputs and Outputs
- Distributes Differential Clock Inputs to Nine Differential Clock Outputs
- Output Reference Voltage ( $V_{REF}$ ) Allows Distribution From a Single-Ended Clock Input
- Packaged In a 28-Pin Plastic Chip Carrier

## description

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

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

The CDCVF111 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .



NC – No internal connection

FUNCTION TABLE

INPUTS		OUTPUTS	
$CLKIN$	$\overline{CLKIN}$	$Y_n$	$\overline{Y}_n$
X	X	L	H
L	H	L	H
H	L	H	L
L	$V_{REF}$	L	H
H	$V_{REF}$	H	L
$V_{REF}$	L	H	L
$V_{REF}$	H	L	H



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

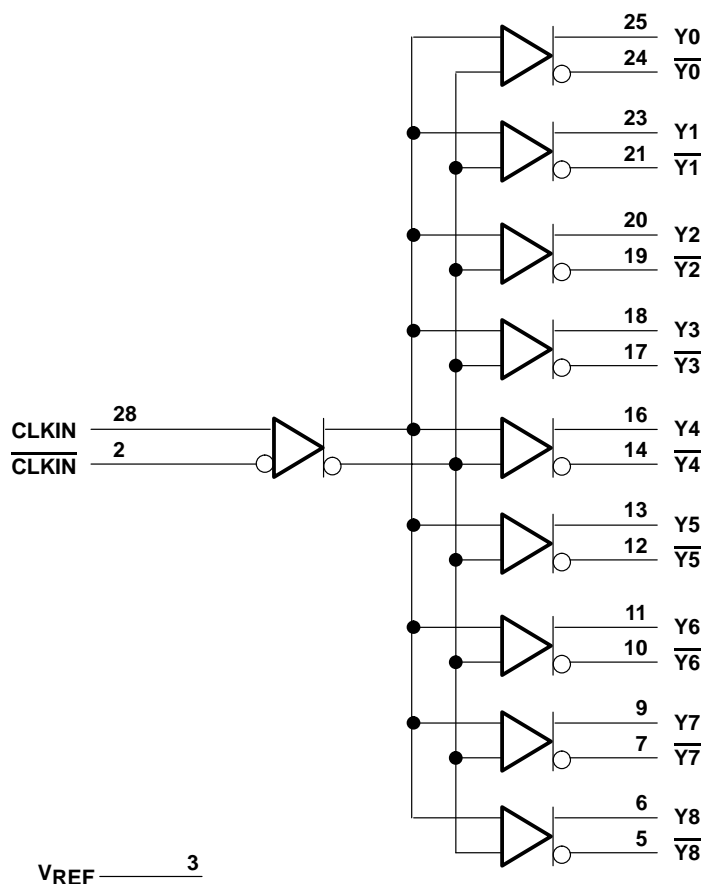
Copyright © 2002, Texas Instruments Incorporated

# CDCVF111

## 1:9 DIFFERENTIAL LVPECL CLOCK DRIVER

SCAS670B – SEPTEMBER 2001 – REVISED JUNE 2002

### 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 .....	$\pm 80$ mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2) .....	525 mW
Storage temperature range, $T_{stg}$ .....	$-65^\circ\text{C}$ to $150^\circ\text{C}$

† 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  $150^\circ\text{C}$  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.



# CDCVF111 1:9 DIFFERENTIAL LVPECL CLOCK DRIVER

SCAS670B – SEPTEMBER 2001 – REVISED JUNE 2002

## recommended operating conditions

			MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage		3	3.6	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 3 V to 3.6 V	V <sub>CC</sub> -1.165	V <sub>CC</sub> -0.88	V
		V <sub>CC</sub> = 3.3 V	2.135	2.42	V
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 3 V to 3.6 V	V <sub>CC</sub> -1.81	V <sub>CC</sub> -1.475	V
		V <sub>CC</sub> = 3.3 V	1.49	1.825	V
T <sub>A</sub>	Operating free-air temperature		-40	85	°C
f <sub>clock</sub>	Input frequency			650	MHz

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

PARAMETER	TEST CONDITIONS		MIN	MAX	UNIT
V <sub>REF</sub>	V <sub>CC</sub> = 3 V to 3.6 V	I <sub>REF</sub> = 100 μA	V <sub>CC</sub> -1.38	V <sub>CC</sub> -1.26	V
	V <sub>CC</sub> = 3.3 V		1.92	2.04	
V <sub>OH</sub>	V <sub>CC</sub> = 3 V to 3.6 V, T <sub>A</sub> = 0°C to 85°C, f <sub>(max)</sub> = 650 MHz		V <sub>CC</sub> -1.12	V <sub>CC</sub> -0.83	V
	V <sub>CC</sub> = 3 V to 3.6 V, T <sub>A</sub> = -40°C to 85°C, f <sub>(max)</sub> = 650 MHz		V <sub>CC</sub> -1.15	V <sub>CC</sub> -0.83	
	V <sub>CC</sub> = 3.3 V		2.275	2.42	
V <sub>OL</sub>	V <sub>CC</sub> = 3 V to 3.6 V, T <sub>A</sub> = 0°C to 85°C, f <sub>(max)</sub> = 650 MHz		V <sub>CC</sub> -1.86	V <sub>CC</sub> -1.49	V
	V <sub>CC</sub> = 3 V to 3.6 V, T <sub>A</sub> = -40°C to 85°C, f <sub>(max)</sub> = 650 MHz		V <sub>CC</sub> -1.86	V <sub>CC</sub> -1.52	
	V <sub>CC</sub> = 3.3 V		1.49	1.68	
I <sub>I</sub>	V <sub>I</sub> = 2.4 V,	V <sub>CC</sub> = 3.6 V		150	μA
I <sub>CC</sub> (Internal)	I <sub>O</sub> = 0,	V <sub>CC</sub> = 3.6 V		100	mA

## switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V ± 0.3 V (see Figure 1 and Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	MAX	UNIT
t <sub>PLH</sub>	CLKIN, $\overline{\text{CLKIN}}$	Y, $\overline{\text{Y}}$	450	600	ps
t <sub>PHL</sub>					
t <sub>sk(o)</sub>		Y, $\overline{\text{Y}}$		50	ps
t <sub>sk(pr)</sub>		Y, $\overline{\text{Y}}$		150	ps
t <sub>r</sub>		Y, $\overline{\text{Y}}$	200	600	ps
t <sub>f</sub>					

# CDCVF111

## 1:9 DIFFERENTIAL LVPECL CLOCK DRIVER

SCAS670B – SEPTEMBER 2001 – REVISED JUNE 2002

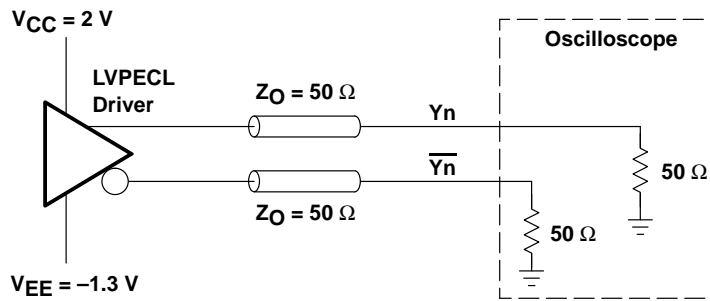
### ESD information

ESD MODELS	LIMIT
Human Body Model (HBM)	2.0 kV
Machine Model (MM)	200 V
Charge Device Model (CDM)	2.0 kV

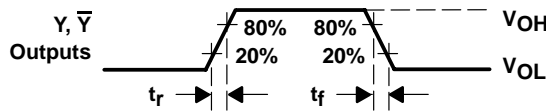
### thermal information

CDCVF111 28-PIN PLCC		THERMAL AIR FLOW (CFM)				UNIT
		0	150	250	500	
R $\theta$ JA	High K	48	44	42	39	°C/W
R $\theta$ JA	Low K	70	58	52	46	°C/W
R $\theta$ JC	High K	22				°C/W
R $\theta$ JC	Low K	28				°C/W

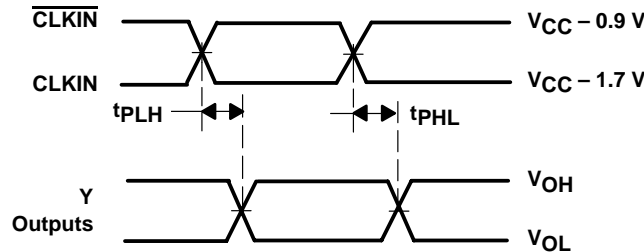
### PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT (See Note B)



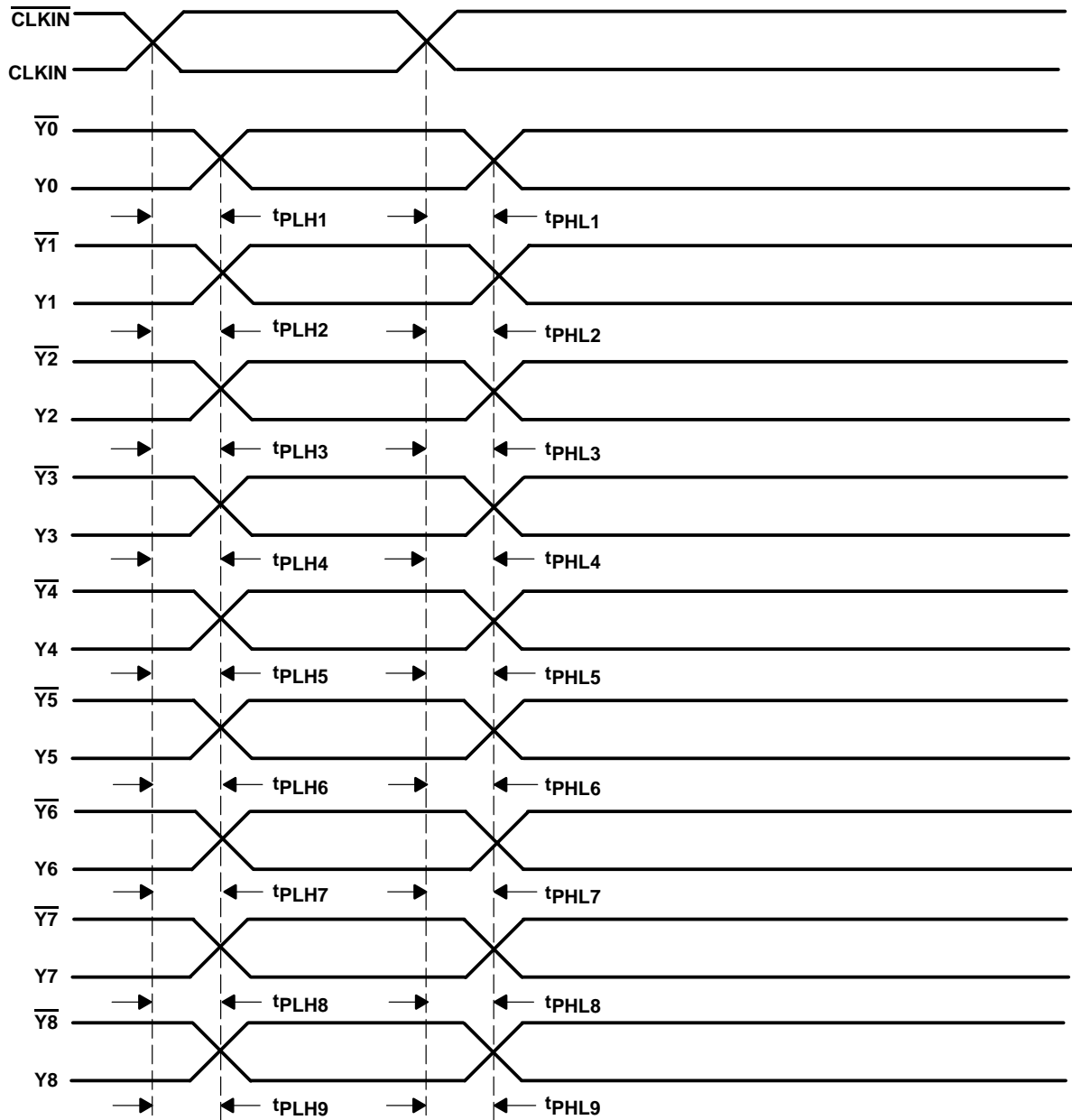
#### VOLTAGE WAVEFORMS RISE AND FALL TIMES



#### VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES

- NOTES: A. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  45 MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 1$  ns,  $t_f \leq 1$  ns.  
 B. For additional signal interface, see the *Interfacing Between LVPECL, LVDS, and CML* application note, Literature Number SCAA056.

Figure 1. Load Circuit and Voltage Waveforms



- NOTES: A. Output skew,  $t_{\text{sk}(o)}$ , is calculated as the greater of:
- The difference between the fastest and slowest  $t_{\text{PLH}n}$  ( $n = 1, 2, \dots, 9$ )
  - The difference between the fastest and slowest  $t_{\text{PHL}n}$  ( $n = 1, 2, \dots, 9$ )
- B. Process skew,  $t_{\text{sk}(pr)}$ , is calculated as the greater of:
- The difference between the fastest and slowest  $t_{\text{PLH}n}$  ( $n = 1, 2, \dots, 9$ )
  - The difference between the fastest and slowest  $t_{\text{PHL}n}$  ( $n = 1, 2, \dots, 9$ ) across multiple devices
- C. For additional information on skew and propagation delay parameters, see the *Defining Skew, Propagation Delay, Phase-Offset (Phase Error)* application note, literature number SCAA055.

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

**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
CDCVF111FN	ACTIVE	PLCC	FN	28	37	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CDCVF111	<a href="#">Samples</a>
CDCVF111FNR	ACTIVE	PLCC	FN	28	750	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CDCVF111	<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.

**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 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.

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.



**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
CDCVF111FNR	PLCC	FN	28	750	330.0	24.4	12.95	12.95	5.0	16.0	24.0	Q1



**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CDCVF111FNR	PLCC	FN	28	750	346.0	346.0	41.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
CDCVF111FN	FN	PLCC	28	37	506.98	12.95	5080	NA

**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

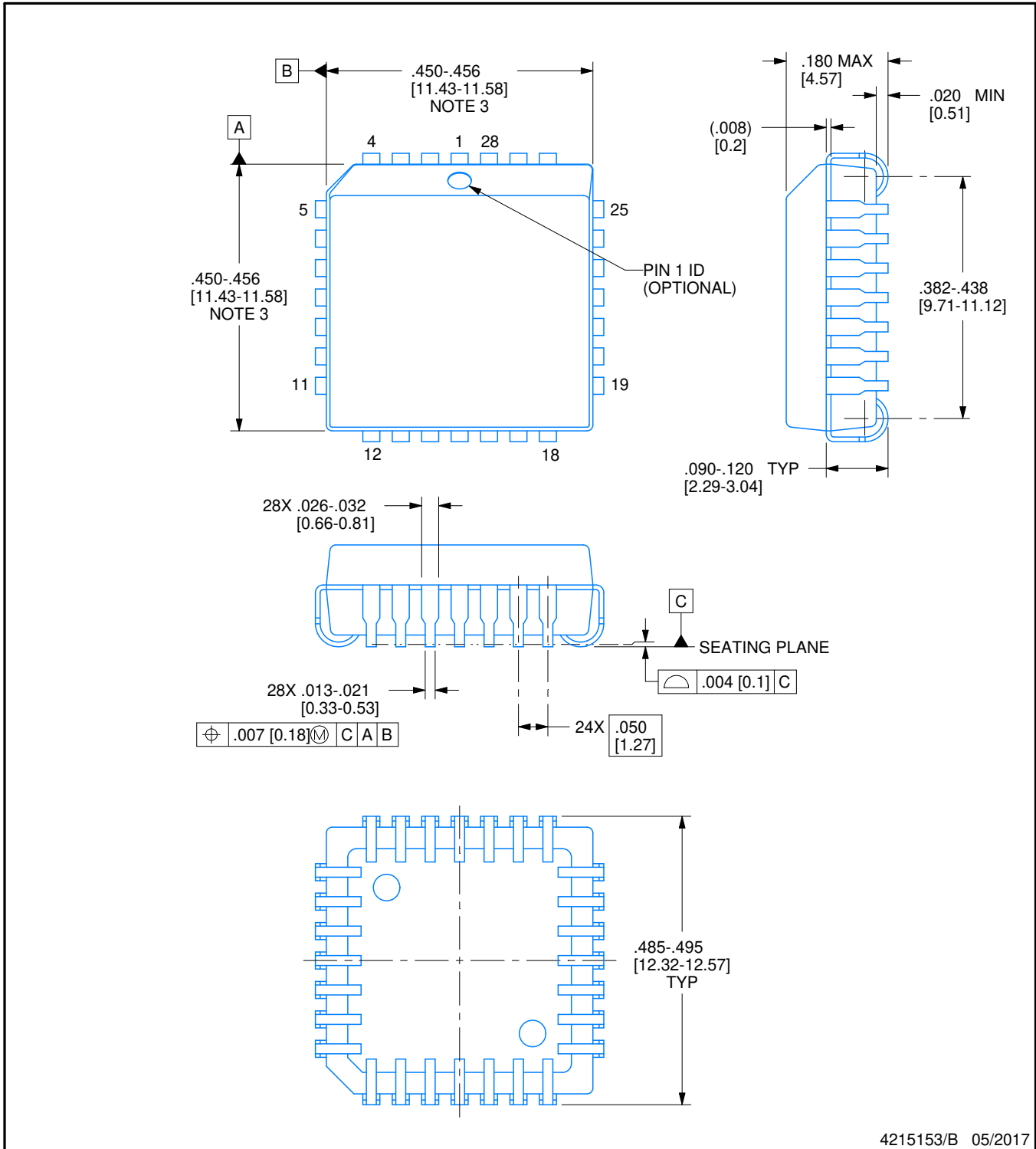
# FN0028A



# PACKAGE OUTLINE

## PLCC - 4.57 mm max height

PLASTIC CHIP CARRIER



4215153/B 05/2017

### NOTES:

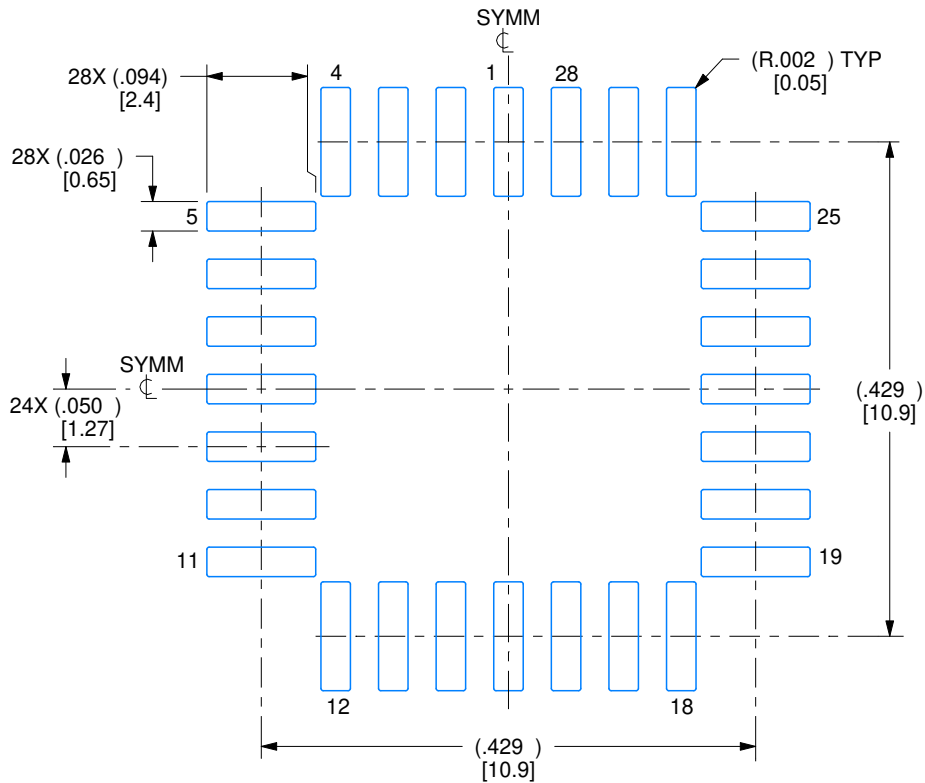
1. All linear dimensions are in inches. Any dimensions in brackets are in millimeters. Any dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Dimension does not include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

# EXAMPLE BOARD LAYOUT

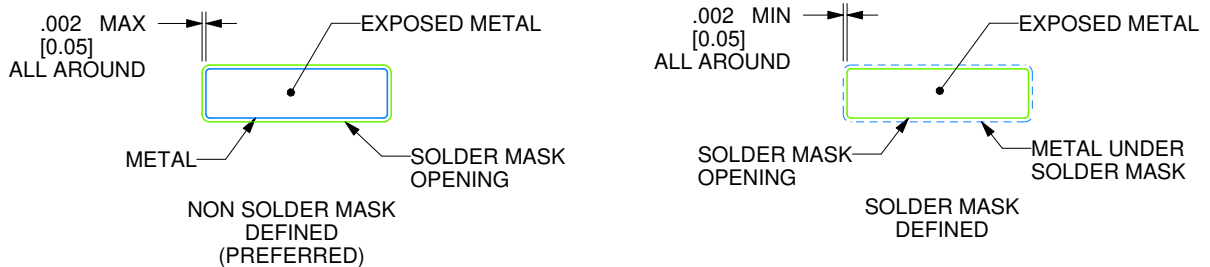
FN0028A

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)

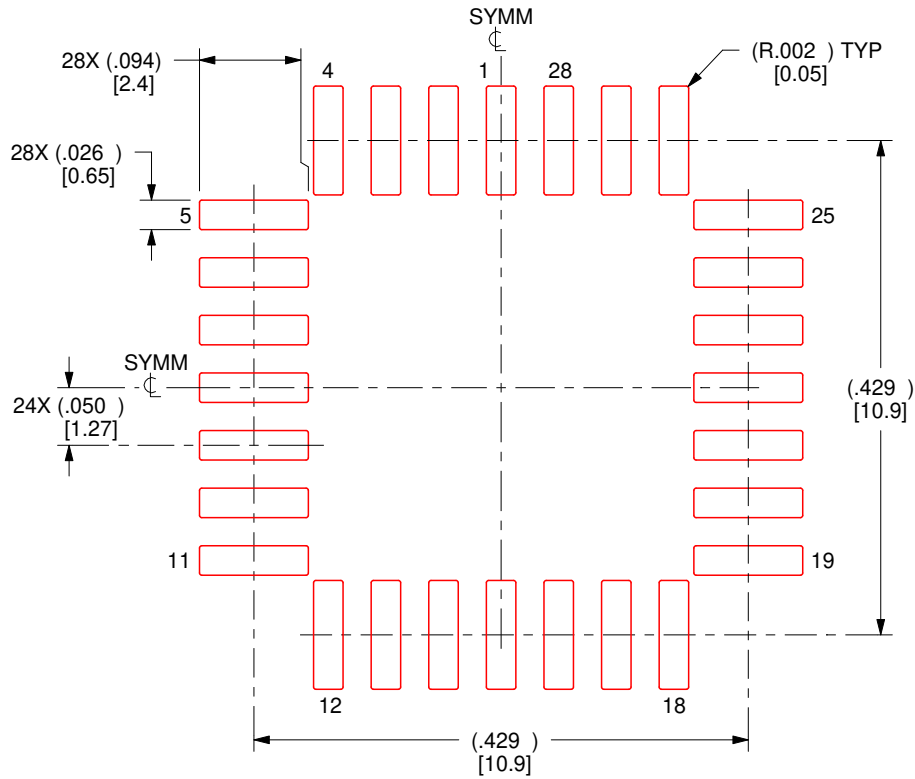
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# 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.

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2023, Texas Instruments Incorporated