

# LOW-VOLTAGE 1:10 LVPECL WITH SELECTABLE INPUT CLOCK DRIVER

Check for Samples: [CDCLVP111-EP](#)

## FEATURES

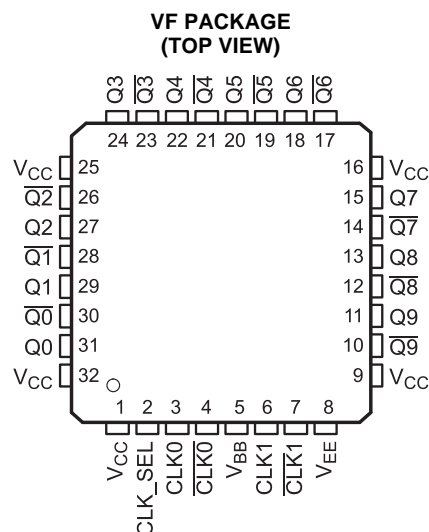
- Distributes One Differential Clock Input Pair LVPECL to 10 Differential LVPECL
- Fully Compatible With LVECL and LVPECL
- Supports a Wide Supply Voltage Range From 2.375 V to 3.8 V
- Selectable Clock Input Through CLK\_SEL
- Low-Output Skew (Typ 15 ps) for Clock-Distribution Applications
  - Additive Jitter Less Than 1 ps
  - Propagation Delay Less Than 355 ps
  - Open Input Default State
  - LVDS, CML, SSTL input compatible
- $V_{BB}$  Reference Voltage Output for Single-Ended Clocking
- Available in a 32-Pin LQFP Package
- Frequency Range From DC to 3.5 GHz
- Pin-to-Pin Compatible With MC100 Series EP111, ES6111, LVEP111, PTN1111

## APPLICATIONS

- Designed for Driving 50  $\Omega$  Transmission Lines
- High Performance Clock Distribution

## SUPPORTS DEFENSE, AEROSPACE, AND MEDICAL APPLICATIONS

- Controlled Baseline
- One Assembly and Test Site
- One Fabrication Site
- Available in Military ( $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ) Temperature Range <sup>(1)</sup>
- Extended Product Life Cycle
- Extended Product-Change Notification
- Product Traceability



(1) Custom temperature ranges available

## DESCRIPTION

The CDCLVP111 clock driver distributes one differential clock pair of LVPECL input, (CLK0, CLK1) to ten pairs of differential LVPECL clock (Q0, Q9) outputs with minimum skew for clock distribution. The CDCLVP111 can accept two clock sources into an input multiplexer. The CDCLVP111 is specifically designed for driving 50- $\Omega$  transmission lines. When an output pin is not used, leaving it open is recommended to reduce power consumption. If only one of the output pins from a differential pair is used, the other output pin must be identically terminated to 50  $\Omega$ .

The  $V_{BB}$  reference voltage output is used if single-ended input operation is required. In this case, the  $V_{BB}$  pin should be connected to CLK0 and bypassed to GND via a 10-nF capacitor.

However, for high-speed performance up to 3.5 GHz, the differential mode is strongly recommended.

The CDCLVP111 is characterized for operation from  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ .



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.

**CDCLVP111-EP**

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[www.ti.com](http://www.ti.com)**Table 1. FUNCTION TABLE**

CLK_SEL	ACTIVE CLOCK INPUT
0	CLK0, $\overline{\text{CLK0}}$
1	CLK1, $\overline{\text{CLK1}}$

**Table 2. ORDERING INFORMATION<sup>(1)</sup>**

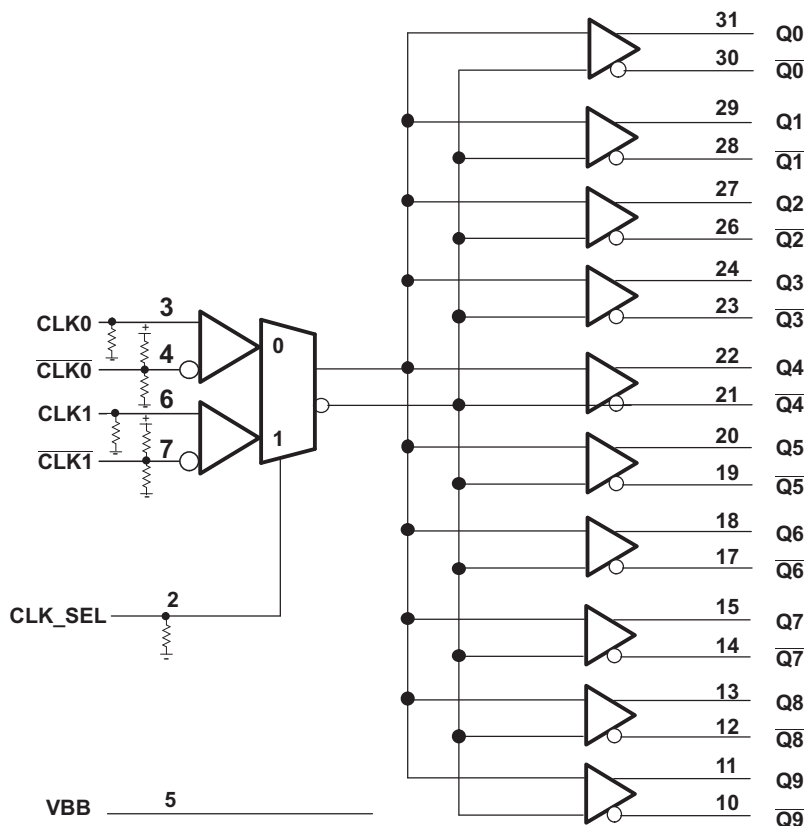
T <sub>J</sub>	PACKAGE	ORDERABLE PART NUMBER	TOP-SIDE MARKING	VID NUMBER
–55°C to 125°C	LQFP - VF	CDCLVP111MVFREP	LVP111MEP	V62/12624-01XE

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI Web site at [www.ti.com](http://www.ti.com).



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## DEVICE INFORMATION



## PIN FUNCTIONS<sup>(1)</sup>

PIN		DESCRIPTION
NAME	NO.	
CLK_SEL	2	Clock select. Used to select between CLK0 and CLK1 input pairs. LVTTTL/LVCMOS functionality compatible.
CLK0, $\overline{\text{CLK0}}$	3, 4	Differential LVECL/LVPECL input pair
CLK1, $\overline{\text{CLK1}}$	6, 7	
Q [9:0]	11, 13, 15, 18, 20, 22, 24, 27, 29, 31	LVECL/LVPECL clock outputs, these outputs provide low-skew copies of CLK <sub>n</sub> .
$\overline{\text{Q}}[9:0]$	10, 12, 14, 17, 19, 21, 23, 26, 28, 30	LVECL/LVPECL complementary clock outputs, these outputs provide copies of $\overline{\text{CLK}}_n$ .
V <sub>BB</sub>	5	Reference voltage output for single-ended input operation
V <sub>CC</sub>	1, 9, 16, 25, 32	Supply voltage
V <sub>EE</sub>	8	Device ground or negative supply voltage in ECL mode

(1) CLK<sub>n</sub>, CLK\_SEL pull down resistor = 75 kΩ;  $\overline{\text{CLK}}_n$  pull up resistor = 37.5 kΩ;  $\overline{\text{CLK}}_n$  pull down resistor = 50 kΩ.

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## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

		VALUE	UNIT
$V_{CC}$	Supply voltage (Relative to $V_{EE}$ )	–0.3 to 4.6	V
$V_I$	Input voltage	–0.3 to $V_{CC} + 0.5$	V
$V_O$	Output voltage	–0.3 to $V_{CC} + 0.5$	V
$I_{IN}$	Input current	±20	mA
$V_{EE}$	Negative supply voltage (Relative to $V_{CC}$ )	–4.6 to 0.3	V
$I_{BB}$	Sink/source current	–1 to 1	mA
$I_O$	DC output current	–50	mA
$T_{stg}$	Storage temperature range	–65 to 150	°C
$T_J$	Maximum operating junction temperature	150	°C

- (1) 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.

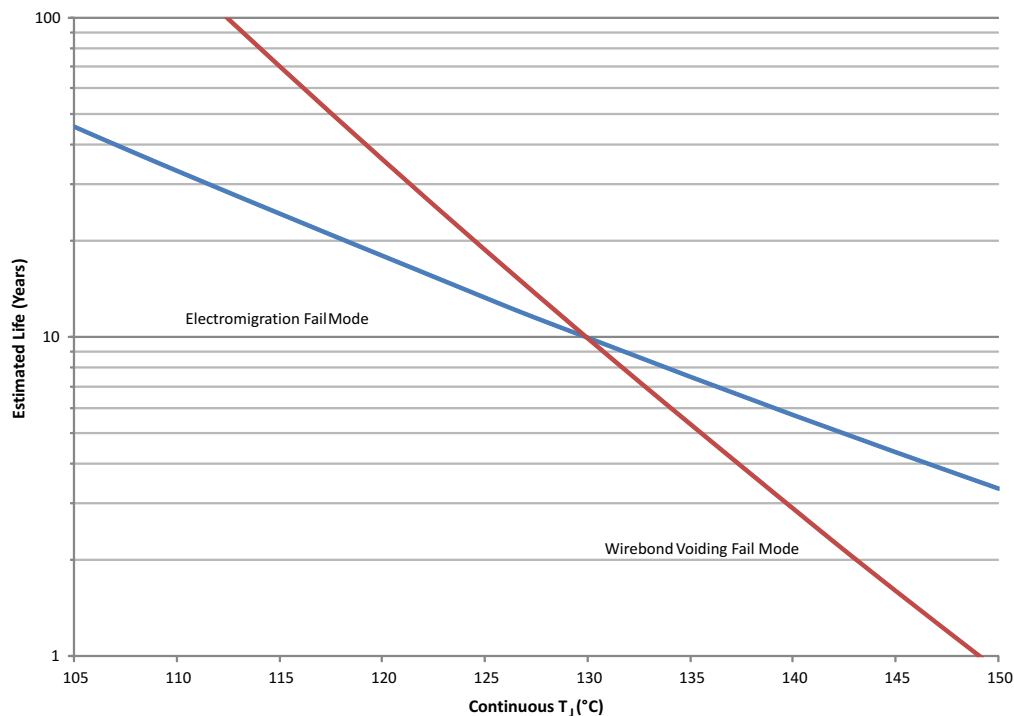
## RECOMMENDED OPERATING CONDITIONS

		MIN	NOM	MAX	UNIT
$V_{CC}$	Supply voltage (relative to $V_{EE}$ )	2.375	2.5/3.3	3.8	V
$T_J$	Operating junction temperature	–55		125	°C

## PACKAGE THERMAL IMPEDANCE, VF (LQFP)

		TEST CONDITION	VALUE	UNIT
$\theta_{JA}$	Thermal resistance junction to ambient <sup>(1)</sup>	0 LFM	74	°C/W
		150 LFM	66	°C/W
		250 LFM	64	°C/W
		500 LFM	61	°C/W
$\theta_{JC}$	Thermal resistance junction to case		39	°C/W

- (1) According to JESD 51-7 standard.



- (1) See data sheet for absolute maximum and minimum recommended operating conditions.
- (2) Silicon operating life design goal is 10 years at 105°C junction temperature (does not include package interconnect life).

**Figure 1. CDCLVP111 in 32/VF Package Operating Life Derating Chart**

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## LVECL DC ELECTRICAL CHARACTERISTICS

Vsupply:  $V_{CC} = 0\text{ V}$ ,  $V_{EE} = -2.375\text{ V}$  to  $-3.8\text{ V}$  over operating temperature range  $T_J = -55^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{EE}$ Supply internal current	Absolute value of current $-55^\circ\text{C}$ , $25^\circ\text{C}$ , $125^\circ\text{C}$	35		85	mA
$I_{CC}$ Output and internal supply current	All outputs terminated $50\ \Omega$ to $V_{CC} - 2\text{ V}$	$-55^\circ\text{C}$ , $25^\circ\text{C}$		385	mA
		$125^\circ\text{C}$		405	
$I_{IN}$ Input current	Includes pullup/pulldown resistors, $V_{IH} = V_{CC}$ , $V_{IL} = V_{CC} - 2\text{ V}$ $-55^\circ\text{C}$ , $25^\circ\text{C}$ , $125^\circ\text{C}$	-150		150	$\mu\text{A}$
$V_{BB}$ Internally generated bias voltage	For $V_{EE} = -3$ to $-3.8\text{ V}$ , $I_{BB} = -0.2\text{ mA}$ $-55^\circ\text{C}$ , $25^\circ\text{C}$ , $125^\circ\text{C}$	-1.45	-1.3	-1.125	V
	$V_{EE} = -2.375$ to $-2.75\text{ V}$ , $I_{BB} = -0.2\text{ mA}$ $-55^\circ\text{C}$ , $25^\circ\text{C}$ , $125^\circ\text{C}$	-1.4	-1.25	-1.1	
$V_{IH}$ High-level input voltage (CLK_SEL)	$-55^\circ\text{C}$ , $25^\circ\text{C}$ , $125^\circ\text{C}$	-1.165		-0.88	V
$V_{IL}$ Low-level input voltage (CLK_SEL)	$-55^\circ\text{C}$ , $25^\circ\text{C}$ , $125^\circ\text{C}$	-1.81		-1.475	V
$V_{ID}$ Input amplitude (CLKn, CLKn)	Difference of input, See <sup>(1)</sup> $ V_{IH} - V_{IL} $ $-55^\circ\text{C}$ , $25^\circ\text{C}$ , $125^\circ\text{C}$	0.5		1.3	V
$V_{CM}$ Common-mode voltage (CLKn, CLKn)	DC offset relative to $V_{EE}$ $-55^\circ\text{C}$ , $25^\circ\text{C}$ , $125^\circ\text{C}$	$V_{EE} + 1$		-0.3	V
$V_{OH}$ High-level output voltage	$I_{OH} = -21\text{ mA}$	$-55^\circ\text{C}$		-0.85	V
		$25^\circ\text{C}$		-0.85	
		$125^\circ\text{C}$		-0.8	
$V_{OL}$ Low-level output voltage	$I_{OL} = -5\text{ mA}$	$25^\circ\text{C}$		-1.425	V
		$-55^\circ\text{C}$ , $125^\circ\text{C}$		-1.25	
$V_{OD}$ Differential output voltage swing	Terminated with $50\ \Omega$ to $V_{CC} - 2\text{ V}$ , See <a href="#">Figure 4</a> $-55^\circ\text{C}$ , $25^\circ\text{C}$ , $125^\circ\text{C}$	400			mV

(1)  $V_{ID}$  minimum and maximum is required to maintain ac specifications, actual device function tolerates a minimum  $V_{ID}$  of 100 mV.

## LVPECL DC ELECTRICAL CHARACTERISTICS

Vsupply:  $V_{CC} = 2.375\text{ V to }3.8\text{ V}$ ,  $V_{EE} = 0\text{ V}$  over operating temperature range  $T_J = -55^\circ\text{C to }125^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{EE}$ Supply internal current	Absolute value of current	-55°C, 25°C, 125°C	35	85	mA
$I_{CC}$ Output and internal supply current	All outputs terminated 50 $\Omega$ to $V_{CC} - 2\text{ V}$	-55°C, 25°C		385	mA
		125°C		405	
$I_{IN}$ Input current	Includes pullup/pulldown resistors $V_{IH} = V_{CC}$ , $V_{IL} = V_{CC} - 2\text{ V}$	-55°C, 25°C, 125°C	-150	150	$\mu\text{A}$
$V_{BB}$ Internally generated bias voltage	$V_{CC} = 3\text{ to }3.8\text{ V}$ , $I_{BB} = -0.2\text{ mA}$	-55°C, 25°C, 125°C	$V_{CC} - 1.45$	$V_{CC} - 1.3$	V
	$V_{CC} = 2.375\text{ to }2.75\text{ V}$ , $I_{BB} = -0.2\text{ mA}$	-55°C, 25°C, 125°C	$V_{CC} - 1.4$	$V_{CC} - 1.25$	
$V_{IH}$ High-level input voltage (CLK_SEL)		-55°C, 25°C, 125°C	$V_{CC} - 1.165$	$V_{CC} - 0.88$	V
$V_{IL}$ Low-level input voltage (CLK_SEL)		-55°C, 25°C, 125°C	$V_{CC} - 1.81$	$V_{CC} - 1.475$	V
$V_{ID}$ Input amplitude (CLKn, CLKn)	Difference of input, see (1), $ V_{IH} - V_{IL} $	-55°C, 25°C, 125°C	0.5	1.3	V
$V_{CM}$ Common-mode voltage (CLKn, CLKn)	DC offset relative to $V_{EE}$	-55°C, 25°C, 125°C	1	$V_{CC} - 0.3$	V
$V_{OH}$ High-level output voltage	$I_{OH} = -21\text{ mA}$	-55°C	$V_{CC} - 1.26$	$V_{CC} - 0.85$	V
		25°C	$V_{CC} - 1.2$	$V_{CC} - 0.85$	
		125°C	$V_{CC} - 1.15$	$V_{CC} - 0.8$	
$V_{OL}$ Low-level output voltage	$I_{OL} = -5\text{ mA}$	25°C	$V_{CC} - 1.85$	$V_{CC} - 1.425$	V
		-55°C, 125°C	$V_{CC} - 1.85$	$V_{CC} - 1.25$	
$V_{OD}$ Differential output voltage swing	Terminated with 50 $\Omega$ to $V_{CC} - 2\text{ V}$ , See Figure 4	-55°C, 25°C, 125°C	400		mV

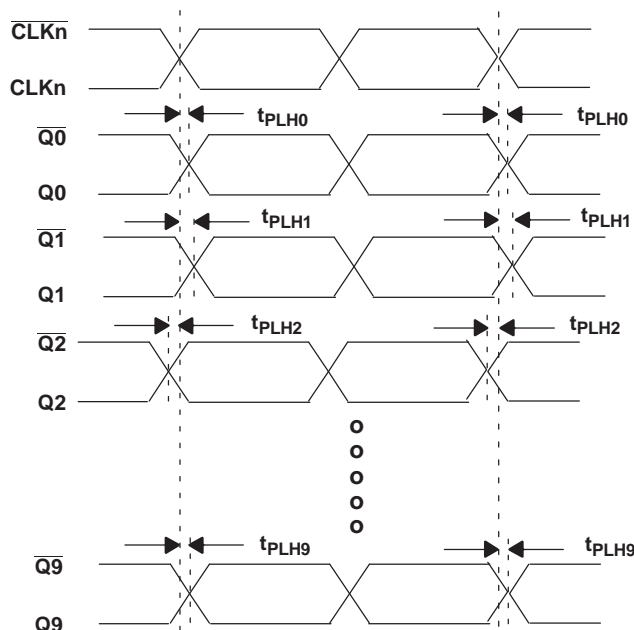
(1)  $V_{ID}$  minimum and maximum is required to maintain ac specifications, actual device function tolerates a minimum  $V_{ID}$  of 100 mV.

## AC ELECTRICAL CHARACTERISTICS

Vsupply:  $V_{CC} = 2.375\text{ V to }3.8\text{ V}$ ,  $V_{EE} = 0\text{ V}$  or LVECL/LVPECL input  $V_{CC} = 0\text{ V}$ ,  $V_{EE} = -2.375\text{ V to }-3.8\text{ V}$  over operating temperature range  $T_J = -55^\circ\text{C to }125^\circ\text{C}$  (unless otherwise noted)

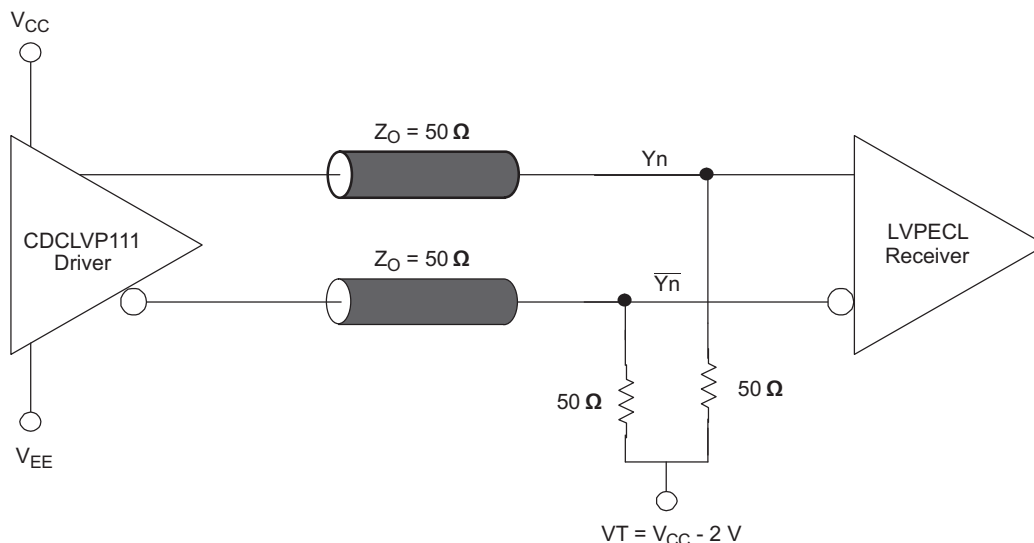
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{pd}$ Differential propagation delay CLKn, CLKn to all Q0, Q0... Q9, Q9	See Note D in Figure 2	200		355	ps
$t_{sk(o)}$ Output-to-output skew	See Notes A and D in Figure 2		15	50	ps
$t_{sk(pp)}$ Part-to-part skew	See Notes B and D in Figure 2		70		ps
$t_{aj}$ Additive phase jitter <sup>(1)</sup>	Integration bandwidth of 20 kHz to 20 MHz, $f_{out} = 200\text{ MHz}$ at 25°C		0.125	0.8	ps
$f_{(max)}$ Maximum frequency <sup>(1)</sup>	Functional up to 3.5 GHz, see Figure 4			3500	MHz
$t_r/t_f$ Output rise and fall time (20%, 80%)	See Note D in Figure 2			240	ps

(1) Specification is guaranteed by bench characterization and is not tested in production.



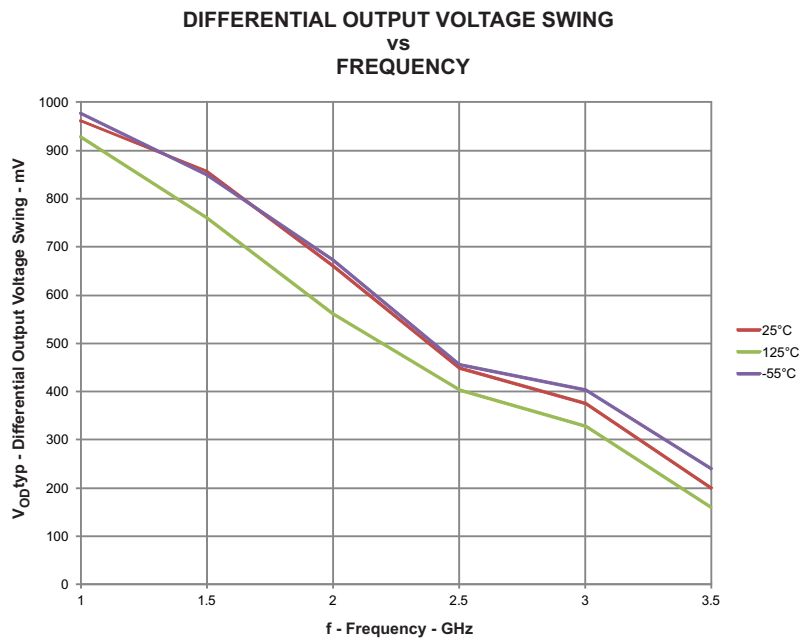
- Output skew is calculated as the greater of: The difference between the fastest and the slowest  $t_{PLHn}$  ( $n = 0, 1, \dots, 9$ ) or the difference between the fastest and the slowest  $t_{PHLn}$  ( $n = 0, 1, \dots, 9$ ).
- Part-to-part skew, is calculated as the greater of: The difference between the fastest and the slowest  $t_{PLHn}$  ( $n = 0, 1, \dots, 9$ ) across multiple devices or the difference between the fastest and the slowest  $t_{PHLn}$  ( $n = 0, 1, \dots, 9$ ) across multiple devices.
- Typical value measured at ambient when clock input is 155.52 MHz for an integration bandwidth of 20 kHz to 5 MHz.
- Input conditions:  $V_{CM} = 1$  V,  $V_{ID} = 0.5$  V and  $F_{IN} = 1$  GHz.

**Figure 2. Waveform for Calculating Both Output and Part-to-Part Skew**



**Figure 3. Typical Termination for Output Driver (See the Interfacing Between LVPECL, LVDS, and CML Application Note, Literature Number [SCAA056](#))**





**Figure 4. LVPECL Input Using CLK0 Pair,  $V_{CC} = 2.375$  V,  $V_{CM} = 1$  V,  $V_{ID} = 0.5$  V**

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
CDCLVP111MVFREP	ACTIVE	LQFP	VF	32	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-55 to 125	LVP111MEP	<a href="#">Samples</a>
V62/12624-01XE	ACTIVE	LQFP	VF	32	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-55 to 125	LVP111MEP	<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) 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.

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**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.

(4) Only one of markings shown within the brackets will appear on the physical device.

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**OTHER QUALIFIED VERSIONS OF CDCLVP111-EP :**

- Catalog: [CDCLVP111](#)

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NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

**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
CDCLVP111MVFREP	LQFP	VF	32	1000	330.0	16.4	9.6	9.6	1.9	12.0	16.0	Q2

## TAPE AND REEL BOX DIMENSIONS

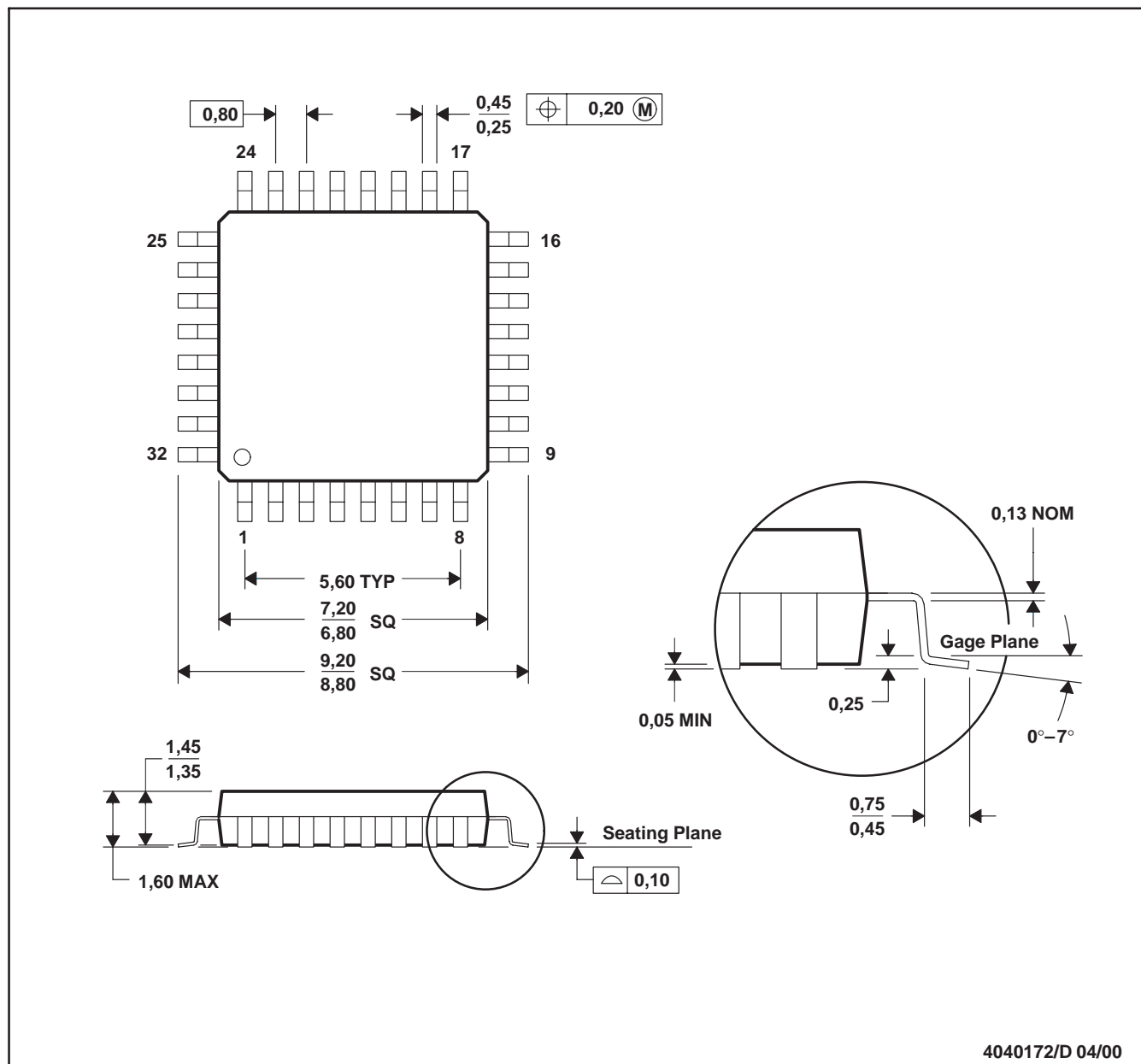


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CDCLVP111MVFREP	LQFP	VF	32	1000	367.0	367.0	38.0

## VF (S-PQFP-G32)

## PLASTIC QUAD FLATPACK



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### Applications

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Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
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