

## Fully-Integrated, Fixed-Frequency, Low-Jitter Crystal Oscillator Clock Generator

### FEATURES

- Single 3.3-V Supply
- High-Performance Clock Generator, Incorporating Crystal Oscillator Circuitry with Integrated Frequency Synthesizer
- Low Output Jitter: As low as 380 fs (RMS integrated between 10 kHz to 20 MHz)
- Low Phase Noise at 312.5 MHz:
  - Less than  $-120$  dBc/Hz at 10 kHz and  $-147$  dBc/Hz at 10-MHz offset from carrier
- Supports Crystal or LVCMOS Input Frequencies at 31.25 MHz, 33.33 MHz, and 35.42 MHz
- Output Frequencies: 100 MHz, 106.25 MHz, 125 MHz, 156.25 MHz, 212.5 MHz, 250 MHz, and 312.5 MHz
- Differential Low-Voltage Positive Emitter Coupled Logic (LVPECL) Outputs
- Fully-Integrated Voltage-Controlled Oscillator (VCO): Runs from 1.75 GHz to 2.35 GHz
- Typical Power Consumption: 300 mW
- Chip Enable Control Pin
- Available in 4-mm x 4-mm QFN-24 Package
- ESD Protection Exceeds 2 kV (HBM)
- Industrial Temperature Range:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### APPLICATIONS

- Low-Cost, Low-Jitter Frequency Multiplier

### DESCRIPTION

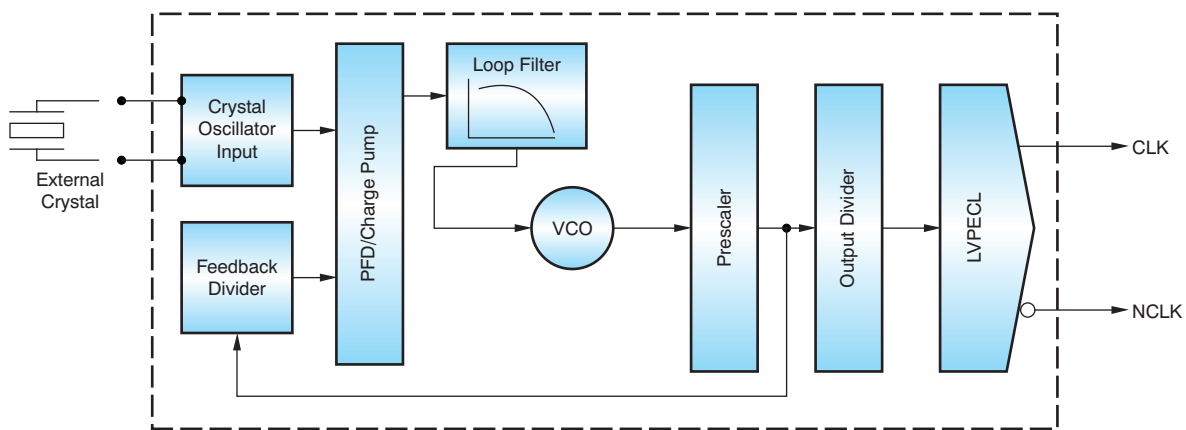
The CDC421Axxx is a high-performance, low-phase-noise clock generator. It has an integrated low-noise, LC-based voltage-controlled oscillator (VCO) that operates within the 1.75 GHz to 2.35 GHz frequency range. It has an integrated crystal oscillator that operates in conjunction with an external AT-cut crystal to produce a stable frequency reference for a phase-locked loop (PLL)-based frequency synthesizer. The output frequency ( $f_{\text{OUT}}$ ) is proportional to the frequency of the input crystal ( $f_{\text{XTAL}}$ ).

The device operates in 3.3-V supply environment and is characterized for operation from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . The CDC421Axxx is available in a QFN-24 4-mm x 4-mm package.

**The CDC421Axxx differs from the CDC421xxx in the following ways:**

- **Device Startup**

The CDC421Axxx has an improved startup circuit to enable correct operation for all power-supply ramp times.



**CDC421Axxx**



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.

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This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

**AVAILABLE OPTIONS<sup>(1)</sup>**

PRODUCT	INPUT FREQUENCY OR CRYSTAL VALUE (MHz)	OUTPUT FREQUENCY FOR SPECIFIED INPUT FREQUENCY (MHz)	PACKAGE-LEAD	PACKAGE MARKING	ORDERING INFORMATION	TRANSPORT MEDIA, QUANTITY
CDC421A100	33.3333	100.00	QFN-24	421A100	CDC421A100RGET	Tape and reel, 250
					CDC421A100RGER	Tape and reel, 2500
CDC421A106	35.4167	106.25	QFN-24	421A106	CDC421A106RGET	Tape and reel, 250
					CDC421A106RGER	Tape and reel, 2500
CDC421A125	31.2500	125.00	QFN-24	421A125	CDC421A125RGET	Tape and reel, 250
					CDC421A125RGER	Tape and reel, 2500
CDC421A156	31.2500	156.25	QFN-24	421A156	CDC421A156RGET	Tape and reel, 250
					CDC421A156RGER	Tape and reel, 2500
CDC421A212	35.4167	212.50	QFN-24	421A212	CDC421A212RGET	Tape and reel, 250
					CDC421A212RGER	Tape and reel, 2500
CDC421A250	31.2500	250.00	QFN-24	421A250	CDC421A250RGET	Tape and reel, 250
					CDC421A250RGER	Tape and reel, 2500
CDC421A312	31.2500	312.50	QFN-24	421A312	CDC421A312RGET	Tape and reel, 250
					CDC421A312RGER	Tape and reel, 2500

(1) For the most current specifications and package information, see the Package Option Addendum located at the end of this data sheet or refer to our web site at [www.ti.com](http://www.ti.com).

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

Over operating free-air temperature range (unless otherwise noted).

PARAMETER		CDC421Axxx	UNIT
V <sub>CC</sub>	Supply voltage <sup>(2)</sup>	-0.5 to 4.6	V
V <sub>I</sub>	Voltage range for all other input pins <sup>(2)</sup>	-0.5 to V <sub>CC</sub> to +0.5	V
I <sub>O</sub>	Output current for LVPECL	-50	mA
ESD	Electrostatic discharge (HBM)	2	kV
T <sub>A</sub>	Specified free-air temperature range (no airflow)	-40 to +85	°C
T <sub>J</sub>	Maximum junction temperature	+125	°C
T <sub>STG</sub>	Storage temperature range	-65 to +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 condition* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltage values are with respect to network ground terminal.

**RECOMMENDED OPERATING CONDITIONS**

Over operating free-air temperature range (unless otherwise noted).

		MIN	NOM	MAX	UNIT
V <sub>CC</sub>	Supply voltage	3.0	3.30	3.60	V
T <sub>A</sub>	Ambient temperature (no airflow, no heatsink)	-40		+85	°C

## ELECTRICAL CHARACTERISTICS

Over recommended operating conditions (unless otherwise noted).

PARAMETER	TEST CONDITIONS	CDC421Axxx			UNIT
		MIN	TYP	MAX	
$V_{CC}$	Supply voltage	3.00	3.30	3.60	V
$I_{VCC}$	Total current		91	110	mA
<b>LVPECL OUTPUT</b>					
$f_{CLK}$	Output frequency		100	312.5	MHz
$V_{OH}$	LVPECL high-level output voltage		$V_{CC} - 1.20$	$V_{CC} - 0.81$	V
$V_{OL}$	LVPECL low-level output voltage		$V_{CC} - 2.17$	$V_{CC} - 1.36$	V
$ V_{OD} $	LVPECL differential output voltage		407	1076	mV
$t_R$	Output rise time	20% to 80% of $V_{OUT(PP)}$		230	ps
$t_F$	Output fall time	20% to 80% of $V_{OUT(PP)}$		230	ps
	Duty cycle of the output waveform		45	55	%
$t_j$	RMS jitter	10 kHz to 20 MHz		1	ps, RMS
<b>LVCMOS INPUT</b>					
$V_{IL, CMOS}$	Low-level CMOS input voltage	$V_{CC} = 3.3 V$		$0.3 \times V_{CC}$	V
$V_{IH, CMOS}$	High-level CMOS input voltage	$V_{CC} = 3.3 V$	$0.7 \times V_{CC}$		V
$I_{L, CMOS}$	Low-level CMOS input current	$V_{CC} = V_{CC, max}, V_{IL} = 0.0 V$		-200	$\mu A$
$I_{H, CMOS}$	High-level CMOS input current	$V_{CC} = V_{CC, min}, V_{IH} = 3.7 V$		200	$\mu A$

## FUNCTIONAL BLOCK DIAGRAM

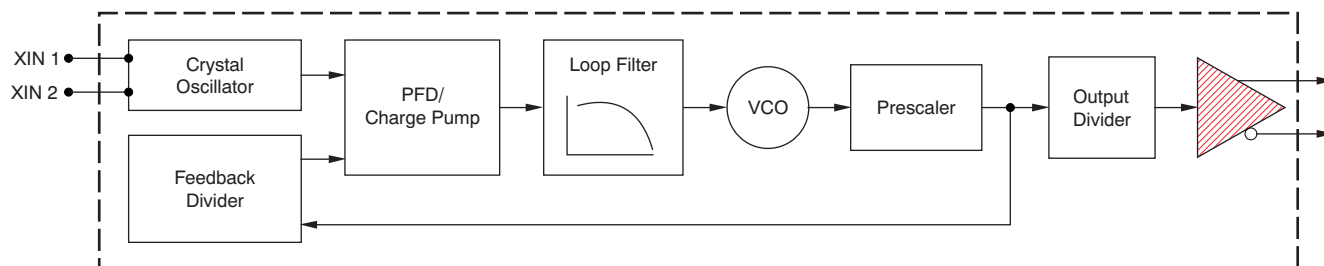
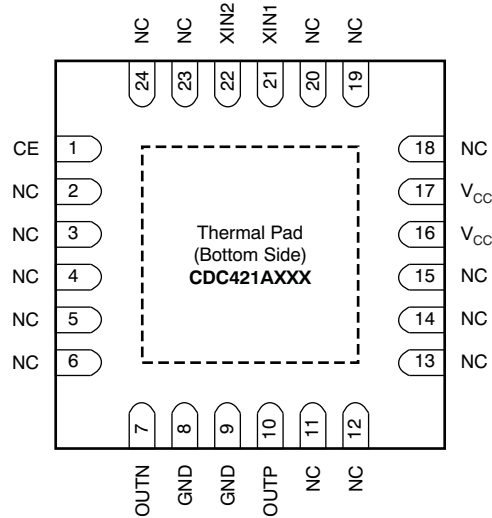


Figure 1. CDC421Axxx: High-Level Block Diagram

DEVICE INFORMATION

RGE PACKAGE  
QFN-24  
(TOP VIEW)



CDC421Axxx Pin Descriptions

TERMINAL		TYPE	ESD PROTECTION	DESCRIPTION
NAME	NO.			
V <sub>CC</sub>	16, 17	Power	Y	3.3-V power supply
GND	8, 9	Ground	Y	Ground
XIN1	21	I	Y	In crystal input mode, connect XIN1 to one end of the crystal and XIN2 to the other end of the crystal. In LVC MOS single-ended driven mode, XIN1 (pin 21) acts as input reference and XIN2 should connect to GND.
XIN2	22	I	N	
CE	1	I	Y	Chip enable (LVC MOS input) CE = 1 enables the device and the outputs. CE = 0 disables all current sources (LVPECLP = LVPECLN = Hi-Z).
OUTP	10	O	Y	High-speed positive differential LVPECL output. (Outputs are enabled by CE pin.)
OUTN	7	O	Y	High-speed negative differential LVPECL output. (Outputs are enabled by CE pin.)
NC	2–6, 11–15, 18–20, 23, 24	—	Y	TI test pin. Do not connect; leave floating.

## JITTER CHARACTERISTICS IN INPUT CLOCK MODE

Jitter characterization tests are performed using an LVCMOS input signal driving the CDC421Axxx device, as Figure 2 illustrates.

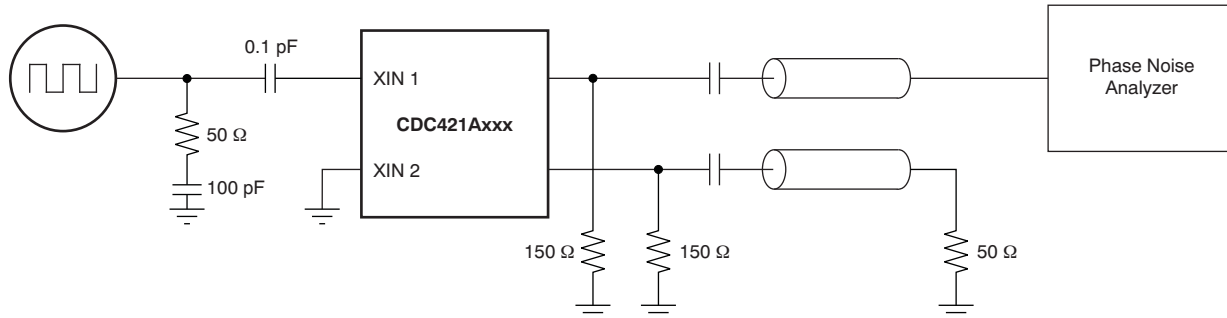


Figure 2. Jitter Test Configuration for an LVTTTL Input Driving CDC421Axxx

When the CDC421Axxx is referenced by an external, clean LVCMOS input of 31.25 MHz, 33.33 MHz, and 35.4167 MHz, Table 1 to Table 7 list the measured SSB phase noise of all the outputs supported by the CDC421Axxx device (100 MHz, 106.25 MHz, 125 MHz, 156.25 MHz, 212.5 MHz, 250 MHz, and 312.5 MHz) from 100 Hz to 20 MHz from the carrier.

Table 1. Phase Noise Data with LVCMOS Input of 33.3333 MHz and LVPECL Output at 100.00 MHz<sup>(1)</sup>

PARAMETER		MIN	TYP	MAX	UNIT
phn <sub>100</sub>	Phase noise at 100 Hz		-111		dBc/Hz
phn <sub>1k</sub>	Phase noise at 1 kHz		-121		dBc/Hz
phn <sub>10k</sub>	Phase noise at 10 kHz		-131		dBc/Hz
phn <sub>100k</sub>	Phase noise at 100 kHz		-133		dBc/Hz
phn <sub>1M</sub>	Phase noise at 1 MHz		-142		dBc/Hz
phn <sub>10M</sub>	Phase noise at 10 MHz		-149		dBc/Hz
phn <sub>20M</sub>	Phase noise at 20 MHz		-149		dBc/Hz
J <sub>RMS</sub>	RMS jitter integrated from 12 kHz to 20 MHz		507		fs
T <sub>j</sub>	Total jitter		35.33		ps
D <sub>j</sub>	Deterministic jitter		11.54		ps

(1) Phase noise specifications under following conditions: input frequency = 33.3333 MHz, output frequency = 100.00 MHz.

Table 2. Phase Noise Data with LVCMOS Input of 35.4167 MHz and LVPECL Output at 106.25 MHz<sup>(1)</sup>

PARAMETER		MIN	TYP	MAX	UNIT
phn <sub>100</sub>	Phase noise at 100 Hz		-112		dBc/Hz
phn <sub>1k</sub>	Phase noise at 1 kHz		-121		dBc/Hz
phn <sub>10k</sub>	Phase noise at 10 kHz		-125		dBc/Hz
phn <sub>100k</sub>	Phase noise at 100 kHz		-129		dBc/Hz
phn <sub>1M</sub>	Phase noise at 1 MHz		-142		dBc/Hz
phn <sub>10M</sub>	Phase noise at 10 MHz		-151		dBc/Hz
phn <sub>20M</sub>	Phase noise at 20 MHz		-151		dBc/Hz
J <sub>RMS</sub>	RMS jitter integrated from 12 kHz to 20 MHz		530		fs
T <sub>j</sub>	Total jitter		30.39		ps
D <sub>j</sub>	Deterministic jitter		11		ps

(1) Phase noise specifications under following conditions: input frequency = 35.4167 MHz, output frequency = 106.25 MHz.

**Table 3. Phase Noise Data with LVCMOS Input of 31.2500 MHz and LVPECL Output at 125.00 MHz<sup>(1)</sup>**

PARAMETER		MIN	TYP	MAX	UNIT
phn <sub>100</sub>	Phase noise at 100 Hz		-108		dBc/Hz
phn <sub>1k</sub>	Phase noise at 1 kHz		-118		dBc/Hz
phn <sub>10k</sub>	Phase noise at 10 kHz		-127		dBc/Hz
phn <sub>100k</sub>	Phase noise at 100 kHz		-130		dBc/Hz
phn <sub>1M</sub>	Phase noise at 1 MHz		-139		dBc/Hz
phn <sub>10M</sub>	Phase noise at 10 MHz		-147		dBc/Hz
phn <sub>20M</sub>	Phase noise at 20 MHz		-147		dBc/Hz
J <sub>RMS</sub>	RMS jitter integrated from 12 kHz to 20 MHz		529		fs
T <sub>j</sub>	Total jitter		47.47		ps
D <sub>j</sub>	Deterministic jitter		25.2		ps

(1) Phase noise specifications under following conditions: input frequency = 31.2500 MHz, output frequency = 125.00 MHz.

**Table 4. Phase Noise Data with LVCMOS Input of 31.2500 MHz and LVPECL Output at 156.25 MHz<sup>(1)</sup>**

PARAMETER		MIN	TYP	MAX	UNIT
phn <sub>100</sub>	Phase noise at 100 Hz		-106		dBc/Hz
phn <sub>1k</sub>	Phase noise at 1 kHz		-117		dBc/Hz
phn <sub>10k</sub>	Phase noise at 10 kHz		-126		dBc/Hz
phn <sub>100k</sub>	Phase noise at 100 kHz		-128		dBc/Hz
phn <sub>1M</sub>	Phase noise at 1 MHz		-139		dBc/Hz
phn <sub>10M</sub>	Phase noise at 10 MHz		-147		dBc/Hz
phn <sub>20M</sub>	Phase noise at 20 MHz		-147		dBc/Hz
J <sub>RMS</sub>	RMS jitter integrated from 12 kHz to 20 MHz		472		fs
T <sub>j</sub>	Total jitter		31.54		ps
D <sub>j</sub>	Deterministic jitter		9.12		ps

(1) Phase noise specifications under following conditions: input frequency = 31.2500 MHz, output frequency = 156.25 MHz.

**Table 5. Phase Noise Data with LVCMOS Input of 35.4167 MHz and LVPECL Output at 212.50 MHz<sup>(1)</sup>**

PARAMETER		MIN	TYP	MAX	UNIT
phn <sub>100</sub>	Phase noise at 100 Hz		-105		dBc/Hz
phn <sub>1k</sub>	Phase noise at 1 kHz		-115		dBc/Hz
phn <sub>10k</sub>	Phase noise at 10 kHz		-119		dBc/Hz
phn <sub>100k</sub>	Phase noise at 100 kHz		-123		dBc/Hz
phn <sub>1M</sub>	Phase noise at 1 MHz		-135		dBc/Hz
phn <sub>10M</sub>	Phase noise at 10 MHz		-148		dBc/Hz
phn <sub>20M</sub>	Phase noise at 20 MHz		-148		dBc/Hz
J <sub>RMS</sub>	RMS jitter integrated from 12 kHz to 20 MHz		512		fs
T <sub>j</sub>	Total jitter		33.96		ps
D <sub>j</sub>	Deterministic jitter		13.78		ps

(1) Phase noise specifications under following conditions: input frequency = 35.4167 MHz, output frequency = 212.50 MHz.

**Table 6. Phase Noise Data with LVCMOS Input of 31.2500 MHz and LVPECL Output at 250.00 MHz<sup>(1)</sup>**

PARAMETER		MIN	TYP	MAX	UNIT
phn <sub>100</sub>	Phase noise at 100 Hz		-105		dBc/Hz
phn <sub>1k</sub>	Phase noise at 1 kHz		-112		dBc/Hz
phn <sub>10k</sub>	Phase noise at 10 kHz		-121		dBc/Hz
phn <sub>100k</sub>	Phase noise at 100 kHz		-124		dBc/Hz
phn <sub>1M</sub>	Phase noise at 1 MHz		-134		dBc/Hz
phn <sub>10M</sub>	Phase noise at 10 MHz		-148		dBc/Hz
phn <sub>20M</sub>	Phase noise at 20 MHz		-149		dBc/Hz
J <sub>RMS</sub>	RMS jitter integrated from 12 kHz to 20 MHz		420		fs
T <sub>j</sub>	Total jitter		36.98		ps
D <sub>j</sub>	Deterministic jitter		18.52		ps

(1) Phase noise specifications under following conditions: input frequency = 31.2500 MHz, output frequency = 250.00 MHz.

**Table 7. Phase Noise Data with LVCMOS Input of 31.2500 MHz and LVPECL Output at 312.50 MHz<sup>(1)</sup>**

PARAMETER		MIN	TYP	MAX	UNIT
phn <sub>100</sub>	Phase noise at 100 Hz		-102		dBc/Hz
phn <sub>1k</sub>	Phase noise at 1 kHz		-111		dBc/Hz
phn <sub>10k</sub>	Phase noise at 10 kHz		-120		dBc/Hz
phn <sub>100k</sub>	Phase noise at 100 kHz		-123		dBc/Hz
phn <sub>1M</sub>	Phase noise at 1 MHz		-135		dBc/Hz
phn <sub>10M</sub>	Phase noise at 10 MHz		-147		dBc/Hz
phn <sub>20M</sub>	Phase noise at 20 MHz		-147		dBc/Hz
J <sub>RMS</sub>	RMS jitter integrated from 12 kHz to 20 MHz		378		fs
T <sub>j</sub>	Total jitter		29.82		ps
D <sub>j</sub>	Deterministic jitter		11		ps

(1) Phase noise specifications under following conditions: input frequency = 31.2500 MHz, output frequency = 312.50 MHz.

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
CDC421A100RGER	ACTIVE	VQFN	RGE	24	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A100RGET	ACTIVE	VQFN	RGE	24	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A106RGER	ACTIVE	VQFN	RGE	24	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A106RGET	ACTIVE	VQFN	RGE	24	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A125RGER	ACTIVE	VQFN	RGE	24	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A125RGET	ACTIVE	VQFN	RGE	24	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A156RGER	ACTIVE	VQFN	RGE	24	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A156RGET	ACTIVE	VQFN	RGE	24	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A212RGER	ACTIVE	VQFN	RGE	24	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A212RGET	ACTIVE	VQFN	RGE	24	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A250RGER	ACTIVE	VQFN	RGE	24	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A250RGET	ACTIVE	VQFN	RGE	24	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A312RGER	ACTIVE	VQFN	RGE	24	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDC421A312RGET	ACTIVE	VQFN	RGE	24	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

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

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is



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**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**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
CDC421A100RGER	VQFN	RGE	24	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A100RGET	VQFN	RGE	24	250	180.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A106RGER	VQFN	RGE	24	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A106RGET	VQFN	RGE	24	250	180.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A125RGER	VQFN	RGE	24	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A125RGET	VQFN	RGE	24	250	180.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A156RGER	VQFN	RGE	24	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A156RGET	VQFN	RGE	24	250	180.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A212RGER	VQFN	RGE	24	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A212RGET	VQFN	RGE	24	250	180.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A250RGER	VQFN	RGE	24	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A250RGET	VQFN	RGE	24	250	180.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A312RGER	VQFN	RGE	24	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
CDC421A312RGET	VQFN	RGE	24	250	180.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2

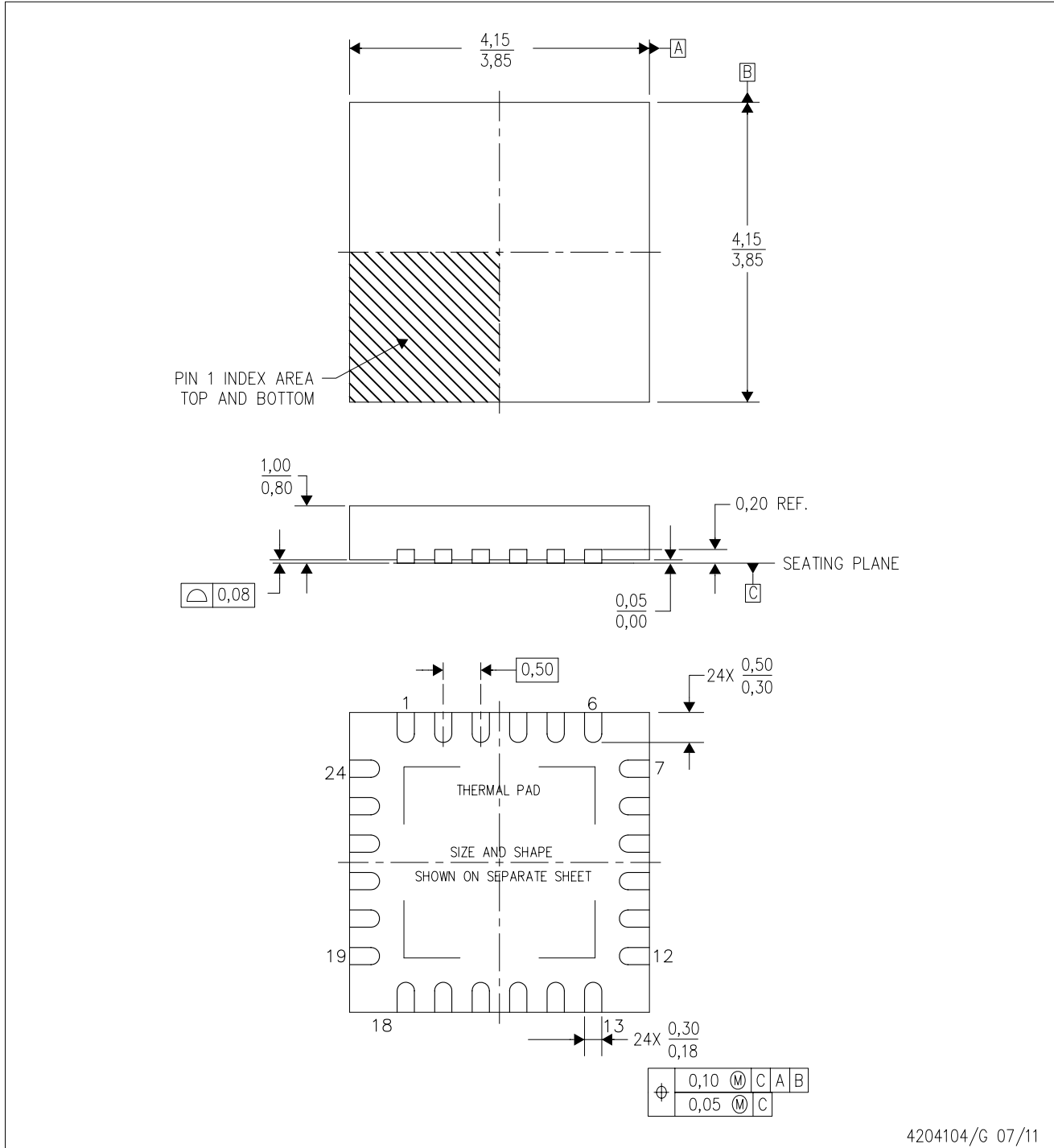
**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CDC421A100RGER	VQFN	RGE	24	3000	367.0	367.0	35.0
CDC421A100RGET	VQFN	RGE	24	250	210.0	185.0	35.0
CDC421A106RGER	VQFN	RGE	24	3000	367.0	367.0	35.0
CDC421A106RGET	VQFN	RGE	24	250	210.0	185.0	35.0
CDC421A125RGER	VQFN	RGE	24	3000	367.0	367.0	35.0
CDC421A125RGET	VQFN	RGE	24	250	210.0	185.0	35.0
CDC421A156RGER	VQFN	RGE	24	3000	367.0	367.0	35.0
CDC421A156RGET	VQFN	RGE	24	250	210.0	185.0	35.0
CDC421A212RGER	VQFN	RGE	24	3000	367.0	367.0	35.0
CDC421A212RGET	VQFN	RGE	24	250	210.0	185.0	35.0
CDC421A250RGER	VQFN	RGE	24	3000	367.0	367.0	35.0
CDC421A250RGET	VQFN	RGE	24	250	210.0	185.0	35.0
CDC421A312RGER	VQFN	RGE	24	3000	367.0	367.0	35.0
CDC421A312RGET	VQFN	RGE	24	250	210.0	185.0	35.0

RGE (S-PVQFN-N24)

PLASTIC QUAD FLATPACK NO-LEAD



4204104/G 07/11

- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - This drawing is subject to change without notice.
  - Quad Flatpack, No-Leads (QFN) package configuration.
  - The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
  - Falls within JEDEC MO-220.

## THERMAL PAD MECHANICAL DATA

RGE (S-PVQFN-N24)

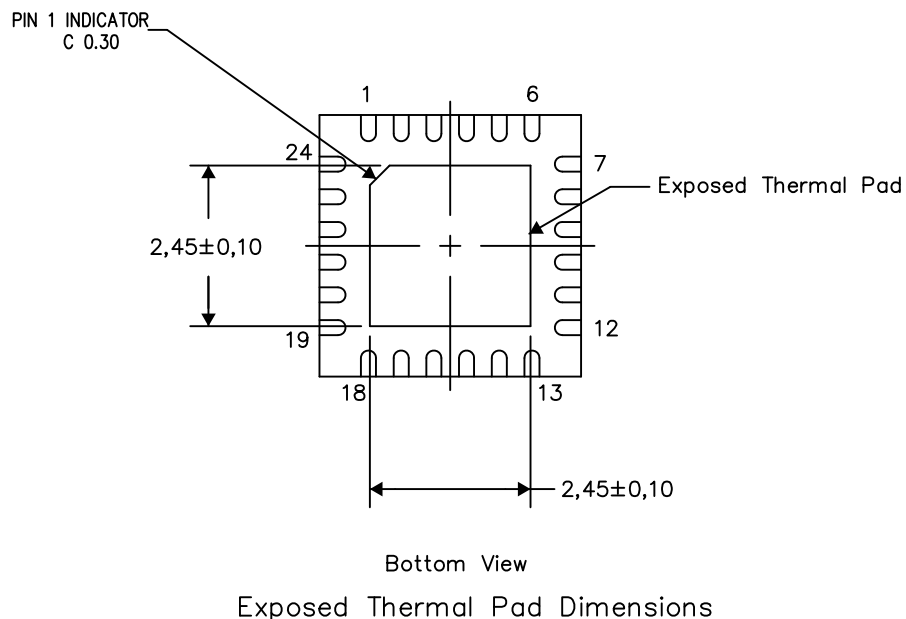
PLASTIC QUAD FLATPACK NO-LEAD

### THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at [www.ti.com](http://www.ti.com).

The exposed thermal pad dimensions for this package are shown in the following illustration.

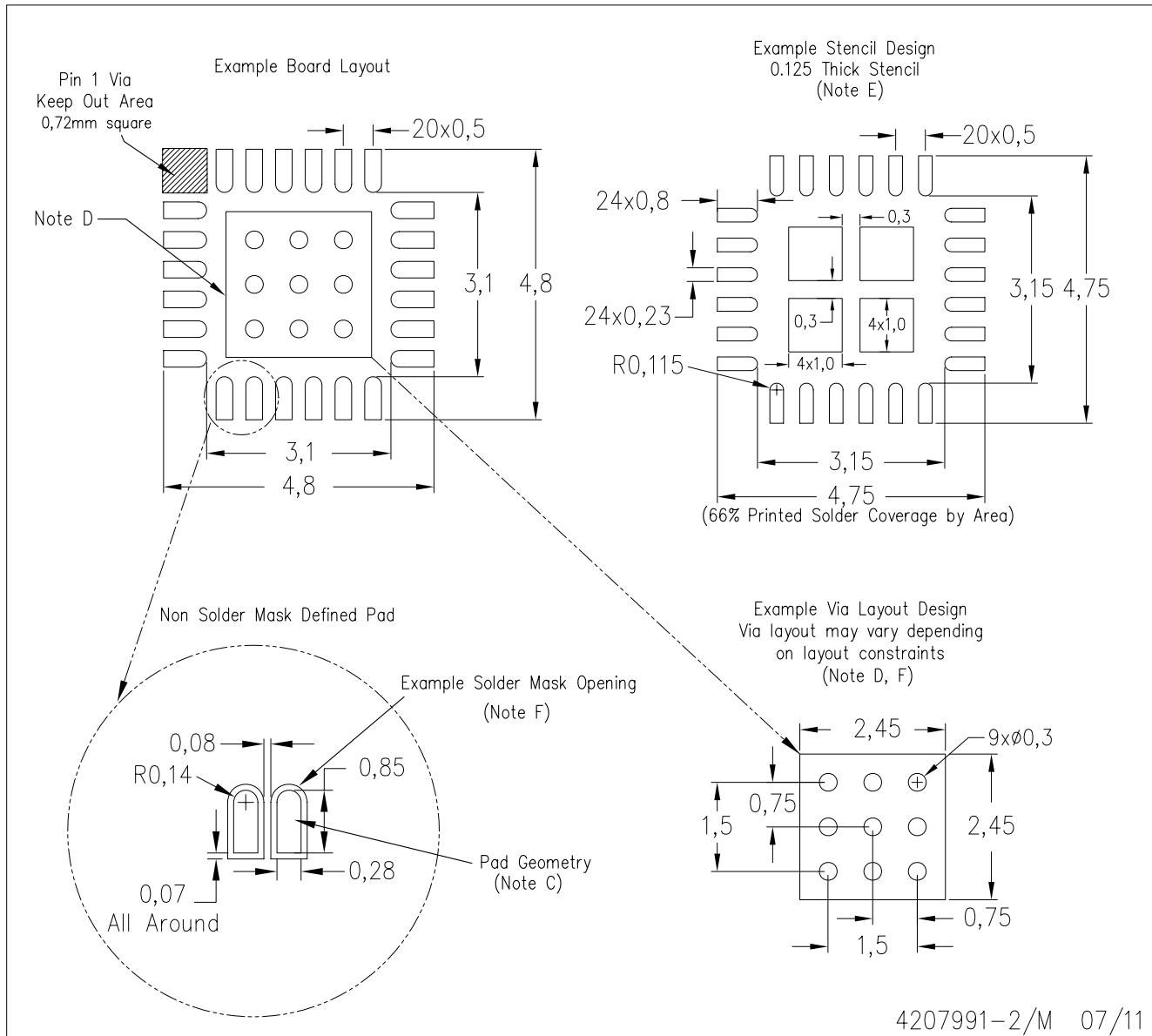


4206344-3/AA 04/12

NOTES: A. All linear dimensions are in millimeters

RGE (S-PVQFN-N24)

PLASTIC QUAD FLATPACK NO-LEAD



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack Packages, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at [www.ti.com](http://www.ti.com) <<http://www.ti.com>>.
  - 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 stencil design considerations.
  - Customers should contact their board fabrication site for recommended solder mask tolerances and via tenting recommendations for vias placed in the thermal pad.

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