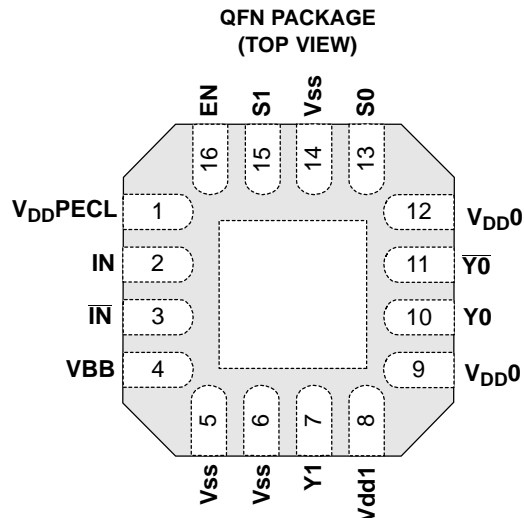


# CDCM1802

## CLOCK BUFFER WITH PROGRAMMABLE DIVIDER, LVPECL I/O + ADDITIONAL LVCMOS OUTPUT

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- Distributes One Differential Clock Input to One LVPECL Differential Clock Output and One LVCMOS Single-Ended Output
- Programmable Output Divider for Both LVPECL and LVCMOS Outputs
- 1.6-ns Output Skew Between LVCMOS and LVPECL Transitions Minimizing Noise
- 3.3-V Power Supply (2.5-V Functional)
- Signaling Rate Up to 800-MHz LVPECL and 200-MHz LVCMOS
- Differential Input Stage for Wide Common-Mode Range Also Provides VBB Bias Voltage Output for Single-Ended Input Signals
- Receiver Input Threshold  $\pm 75$  mV
- 16-Pin QFN Package (3 mm x 3 mm)



### description

The CDCM1802 clock driver distributes one pair of differential clock input to one LVPECL differential clock output pair  $Y0$  and  $\overline{Y0}$  and one single-ended LVCMOS output  $Y1$ . It is specifically designed for driving 50- $\Omega$  transmission lines. The LVCMOS output is delayed by 1.6 ns over the PECL output stage to minimize noise impact during signal transitions.

The CDCM1802 has two control pins,  $S0$  and  $S1$ , to select different output mode settings. The  $S[1:0]$  pins are 3-level inputs. Additionally, an enable pin  $EN$  is provided to disable or enable all outputs simultaneously. The CDCM1802 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

For single-ended driver applications, the CDCM1802 provides a  $VBB$  output pin that can be directly connected to the unused input as a common-mode voltage reference.



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**TEXAS  
INSTRUMENTS**

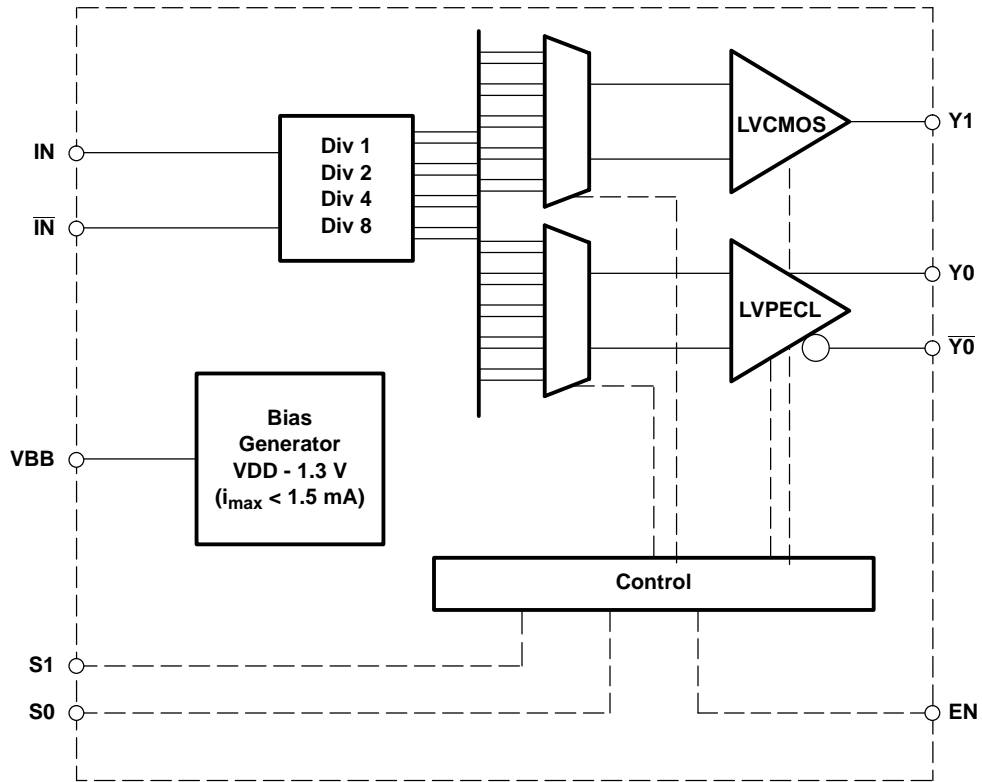
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# CDCM1802 CLOCK BUFFER WITH PROGRAMMABLE DIVIDER, LVPECL I/O + ADDITIONAL LVCMOS OUTPUT

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## functional block diagram



**CDCM1802**  
**CLOCK BUFFER WITH PROGRAMMABLE DIVIDER,**  
**LVPECL I/O + ADDITIONAL LVCMOS OUTPUT**

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### Terminal Functions

TERMINAL		I/O	DESCRIPTION
NAME	NO.		
EN	16	I (with 60-kΩ pullup)	ENABLE. Enables or disables all outputs simultaneously; The EN pin offers three different configurations: tie to GND (logic 0), external 60-kΩ pulldown resistor (pull to $V_{DD}/2$ ) or left floating (logic 1); EN = 1: outputs on according to S0 and S1 setting EN = $V_{DD}/2$ : outputs on according to S0 and S1 setting EN = 0; outputs Y[1:0] off (high-impedance) see Table 1 for details.
IN $\overline{IN}$	2 3	I Differential input	Differential input clock. Input stage is sensitive and has a wide common mode range. Therefore, almost any type of differential signal can drive this input (LVPECL, LVDS, CML, HSTL). Since the input is high-impedance, it is recommended to terminate the PCB transmission line before the input (e.g. with 100-Ω across input). The input can also be driven by a single-ended signal, if the complementary input is tied to a dc reference voltage (e.g. $V_{CC}/2$ ). The inputs deploy an ESD structure protecting the inputs in case of an input voltage exceeding the rails by more than ~0.7 V. Reverse biasing of the IC through this inputs is possible and must be prevented by limiting the input voltage < VDD
S0 S1	13 15	I I (with 60-kΩ pullup)	Select mode of operation. Defines the output configuration of Y0 and Y1. Each pin offers three different configurations: tied to GND (logic 0), external 60-kΩ pulldown resistor (pull to $V_{DD}/2$ ) or left floating (logic 1); see Table 1 for details
Y1	7	O	LVCMOS clock output. This output provides a copy of IN or a divided down copy of clock IN based on the selected mode of operation: S0, S1, and EN. Also, this output can be disabled by tying $V_{DD1}$ to GND.
Y0 $\overline{Y0}$	10 11	O LVPECL	LVPECL clock output. This output provides a copy of IN or a divided down copy of clock IN based on the selected mode of operation: S1, S0, and EN. If Y0 output is unused, the output can simply be left open to save power and minimize noise impact to Y1.
VBB	4	O	Output bias voltage used to bias unused complementary input $\overline{IN}$ for single-ended input signals. The output voltage of VBB is $V_{DD} - 1.3$ V. When driving a load, the output current drive is limited to about 1.5 mA.
$V_{SS}$	5, 6, 14	Supply	Device ground
$V_{DDPECL}^1$	1	Supply	Supply voltage PECL input + internal logic
$V_{DD0}^1$	9, 12	Supply	PECL output supply voltage for output Y0; Y0 can be disabled by pulling $V_{DD0}$ to GND. Caution: In this mode no voltage from outside may be forced because internal diodes could be forced in a forward direction. Thus, it is recommended to leave the output disconnect
$V_{DD1}$	8	Supply	Supply voltage CMOS output; The CMOS output can be disabled by pulling $V_{DD1}$ to GND. Caution: In this mode no voltage from outside may be forced, because internal diodes could be forced in forward direction. Thus, it is recommended to leave Y1 unconnected, tied to GND or terminated into GND

NOTE 1:  $V_{DD0}$ ,  $V_{DD1}$ , and  $V_{DDPECL}$  should have the same value.

# CDCM1802 CLOCK BUFFER WITH PROGRAMMABLE DIVIDER, LVPECL I/O + ADDITIONAL LVCMOS OUTPUT

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## control pin settings

The CDCM1802 has three control pins, S0, S1, and the enable pin (EN) to select different output mode settings. All three inputs (S0, S1, EN) are 3-level inputs. In addition, the EN input allows disabling all outputs and place them into a high-z (or tristate) output state when pulled to GND.

### Setting for Mode 4:

EN =  $V_{DD}/2$

S1 = 0

S0 = 1

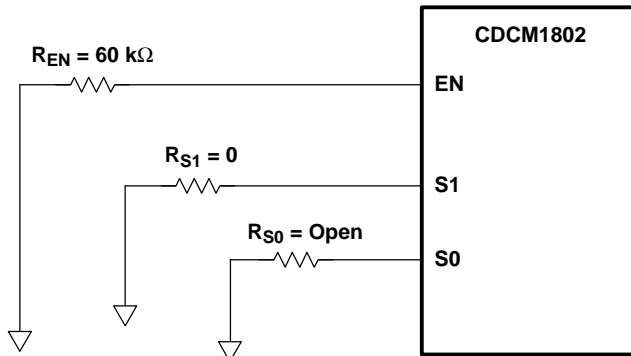


Figure 1. Control Pin Setting for Example

Each control input incorporates a 60-kΩ pullup resistor. Thus, it is easy to choose the input setting by designing a resistor pad between the control input and GND. To choose a logic zero, the resistor value must be zero. Setting the input high requires leaving the resistor pad empty (no resistor installed). For setting the input to  $V_{DD}/2$ , the installed resistor needs a value of 60 kΩ with a tolerance better or equal to 10%.

Table 1. Selection Mode Table

MODE				LVPECL	LVCMOS
	EN	S1	S0	Y0	Y1
0	0	X	X	Off (high-z)	Off (high-z)
1	$V_{DD}/2$	0	$V_{DD}/2$	÷ 1	÷ 1
2	$V_{DD}/2$	$V_{DD}/2$	1	÷ 1	÷ 2
3	1	0	0	÷ 1	÷ 4
4	$V_{DD}/2$	0	1	÷ 2	÷ 2
5	1	0	1	÷ 2	÷ 4
6	$V_{DD}/2$	0	0	÷ 4	÷ 4
7	$V_{DD}/2$	1	0	÷ 4	÷ 8
8	$V_{DD}/2$	$V_{DD}/2$	$V_{DD}/2$	÷ 8	÷ 1
9	1	1	0	÷ 8	÷ 4
10	1	1	1	Off (high-z)	÷ 4

NOTE: The LVPECL outputs are open emitter stages. Thus, if you leave the unused LVPECL output Y0 unconnected, then the current consumption is minimized and noise impact to remaining outputs is neglectable. Also, each output can be individually disabled by connecting the corresponding  $V_{DD}$  input to GND.

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**absolute maximum ratings over operating free-air temperature (unless otherwise noted)†**

$V_{DD}$	Supply voltage	-0.3 V to 3.8 V
$V_I$	Input voltage	-0.2 V to ( $V_{DD} + 0.2$ V)
$V_O$	Output voltage	-0.2 V to ( $V_{DD} + 0.2$ V)
$Y_n, \bar{Y}_n, I_{OSD}$	Differential short circuit current	Continuous
ESD	Electrostatic discharge (HBM 1.5 k $\Omega$ , 100 pF)	>2000 V
	Moisture level 16-pin QFN package (solder reflow temperature of 235°C) MSL	1
$T_{stg}$	Storage temperature	-65°C to 150°C
$T_J$	Maximum junction temperature	125°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.

**recommended operating conditions**

	MIN	TYP	MAX	UNIT
Supply voltage, $V_{DD}$	3	3.3	3.6	V
Supply voltage, $V_{DD}$ (only functionality)	2.375		3.6	V
Operating free-air temperature, $T_A$	-40		85	°C

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>LVPECL INPUT IN, <math>\bar{I}N</math></b>						
$f_{clk}$	Input frequency		0		800	MHz
$V_{CM}$	High-level input common mode		1		$V_{DD} - 0.3$	V
$V_{IN}$	Input voltage swing between IN and $\bar{I}N$ , See Note 1		500		1300	mV
$V_{IN}$	Input voltage swing between IN and $\bar{I}N$ , See Note 2		150		1300	mV
$I_{IN}$	Input current	$V_I = V_{DD}$ or 0 V			$\pm 10$	$\mu A$
$R_{IN}$	Input impedance		300			k $\Omega$
$C_I$	Input capacitance at IN, $\bar{I}N$			1		pF
<b>LVPECL OUTPUT DRIVER <math>Y_0, \bar{Y}_0</math></b>						
$f_{clk}$	Output frequency, See Figure 4		0		800	MHz
$V_{OH}$	High-level output voltage	Termination with 50 $\Omega$ to $V_{DD} - 2$ V	$V_{DD} - 1.18$		$V_{DD} - 0.81$	V
$V_{OL}$	Low-level output voltage	Termination with 50 $\Omega$ to $V_{DD} - 2$ V	$V_{DD} - 1.98$		$V_{DD} - 1.55$	V
$V_O$	Output voltage swing between Y and $\bar{Y}$ , See Figure 4	Termination with 50 $\Omega$ to $V_{DD} - 2$ V	500			mV
$I_{OZL}$	Output 3-state	$V_{DD} = 3.6$ V, $V_O = 0$ V			5	$\mu A$
$I_{OZH}$	Output 3-state	$V_{DD} = 3.6$ V, $V_O = V_{DD} - 0.8$ V			10	$\mu A$
$t_r/t_f$	Rise and fall time	20% to 80% of $V_{OUTPP}$ , see Figure 9	200		350	ps
$t_{Duty}$	Output duty cycle distortion, See Note 3	Crossing point-to-crossing point distortion	-50		50	ps
$t_{sk(pp)}$	Part-to-part skew	Any $Y_0$ , See Note A in Figure 8		50		ps
$C_O$	Output capacitance	$V_O = V_{DD}$ or GND		1		pF
LOAD	Expected output load			50		$\Omega$



# CDCM1802

## CLOCK BUFFER WITH PROGRAMMABLE DIVIDER, LVPECL I/O + ADDITIONAL LVCMOS OUTPUT

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>LVPECL INPUT-TO-LVPECL OUTPUT PARAMETER</b>						
$t_{pd(lh)}$	Propagation delay rising edge	VOX to VOX	320		600	ps
$t_{pd(hl)}$	Propagation delay falling edge	VOX to VOX	320		600	ps
$t_{sk(p)}$	LVPECL pulse skew, See Note B in Figure 8	VOX to VOX			100	ps

- NOTES: 1. Is required to maintain ac specifications  
 2. Is required to maintain device functionality  
 3. For a 800-MHz signal, the 50-ps error would result into a duty cycle distortion of  $\pm 4\%$  when driven by an ideal clock input signal.

### LVCMOS OUTPUT PARAMETER, Y1

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$f_{clk}$	Output frequency, see Note 4 and Figure 5		0		200	MHz
$t_{skLVCMOS(o)}$	Output skew between the LVCMOS output Y1 and LVPECL output Y0	VOX to $V_{DD}/2$ , See Figure 8		1.6		ns
$t_{sk(pp)}$	Part-to-part skew	Y1, See Note A in Figure 8		300		ps
$V_{OH}$	High-level output voltage	$V_{DD} = \text{min to max, } I_{OH} = -100 \mu\text{A}$	$V_{DD}-0.1$			V
		$V_{DD} = 3 \text{ V, } I_{OH} = -6 \text{ mA}$	2.4			
		$V_{DD} = 3 \text{ V, } I_{OH} = -12 \text{ mA}$	2			
$V_{OL}$	Low-level output voltage	$V_{DD} = \text{min to max, } I_{OL} = 100 \mu\text{A}$			0.1	V
		$V_{DD} = 3 \text{ V, } I_{OL} = 6 \text{ mA}$			0.5	
		$V_{DD} = 3 \text{ V, } I_{OL} = 12 \text{ mA}$			0.8	
$I_{OH}$	High-level output current	$V_{DD} = 3.3 \text{ V, } V_O = 1.65 \text{ V}$		-29		mA
$I_{OL}$	Low-level output current	$V_{DD} = 3.3 \text{ V, } V_O = 1.65 \text{ V}$		37		mA
$I_{OZ}$	High-impedance state output current	$V_{DD} = 3.6 \text{ V, } V_O = V_{DD} \text{ or } 0 \text{ V}$			$\pm 5$	$\mu\text{A}$
$C_O$	Output capacitance	$V_{DD} = 3.3 \text{ V}$		2		pF
Load	Expected output loading, see Figure 10			10		pF
$t_{Duty}$	Output duty cycle distortion, see Note 5	Measured at $V_{DD}/2$	-150		150	ps
$t_{pd(lh)}$	Propagation delay rising edge from IN to Y1	VOX to $V_{DD}/2$ load, see Figure 10	1.6		2.6	ns
$t_{pd(hl)}$	Propagation delay falling edge from IN to Y1	VOX to $V_{DD}/2$ load, see Figure 10	1.6		2.6	ns
$t_r$	Output rise slew rate	20% to 80% of swing, see Figure 10	1.4	2.3		V/ns
$t_f$	Output fall slew rate	80% to 20% of swing, see Figure 10	1.4	2.3		V/ns

- NOTES: 4. Operating the CDCM1802 LVCMOS output above the maximum frequency will not cause a malfunction to the device, but the Y1 output signal swing will not achieve enough signal swing to meet the output specification. Therefore, the CDCM1802 can be operated at higher frequencies, while the LVCMOS output Y1 becomes unusable.  
 5. For a 200-MHz signal, the 150-ps error would result in a duty cycle distortion of  $\pm 3\%$  when driven by an ideal clock input signal.

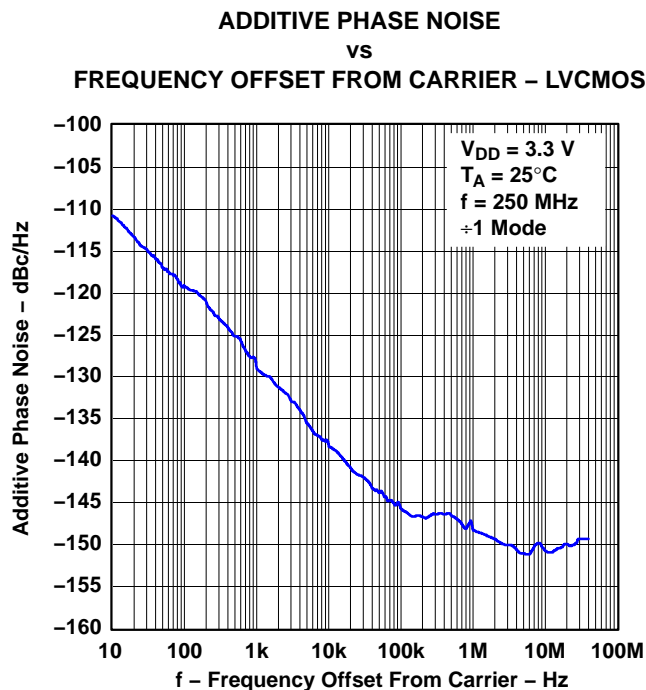
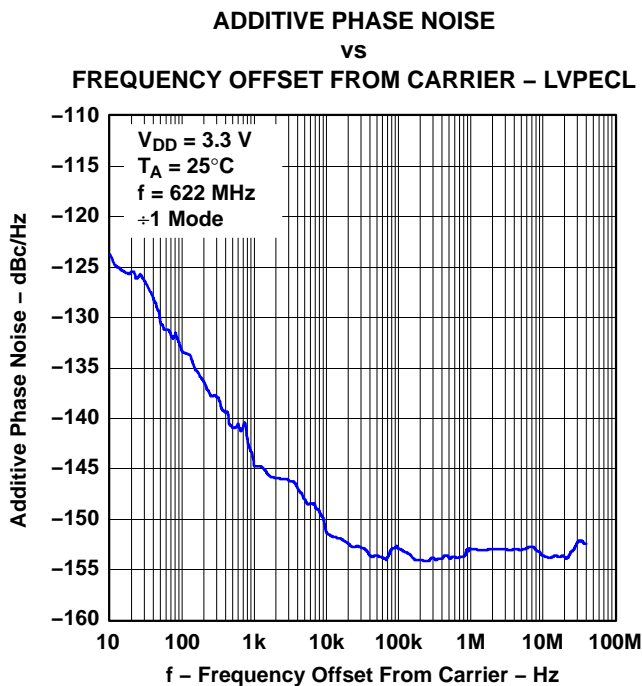


# CDCM1802 CLOCK BUFFER WITH PROGRAMMABLE DIVIDER, LVPECL I/O + ADDITIONAL LVCMOS OUTPUT

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## jitter characteristics

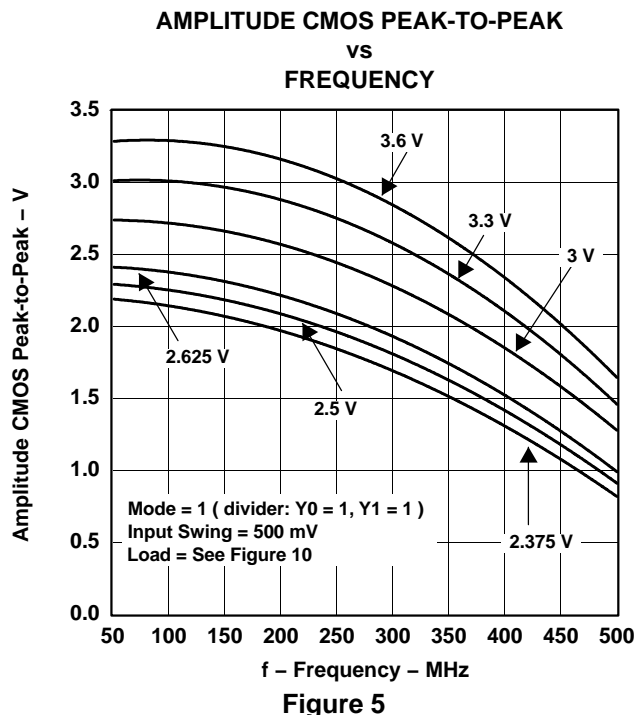
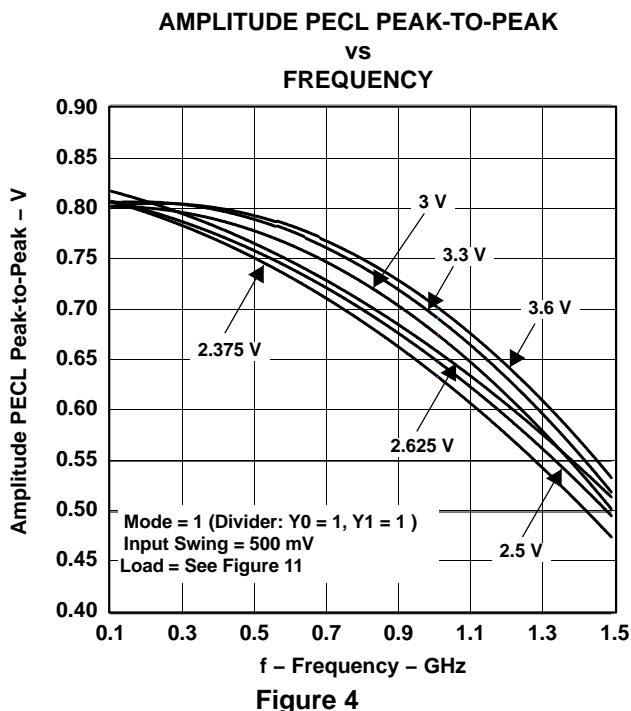
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{\text{jitterLVPECL}}$	12 kHz to 20 MHz, $f_{\text{out}} = 250 \text{ MHz to } 800 \text{ MHz}$ , divide by 1 mode			0.15	ps rms
	50 kHz to 40 MHz, $f_{\text{out}} = 250 \text{ MHz to } 800 \text{ MHz}$ , divide by 1 mode			0.25	
$t_{\text{jitterLVCMOS}}$	12 kHz to 20 MHz, $f_{\text{out}} = 250 \text{ MHz}$ , divide by 1 mode			0.25	ps rms
	50 kHz to 40 MHz, $f_{\text{out}} = 250 \text{ MHz}$ , divide by 1 mode			0.4	ps rms



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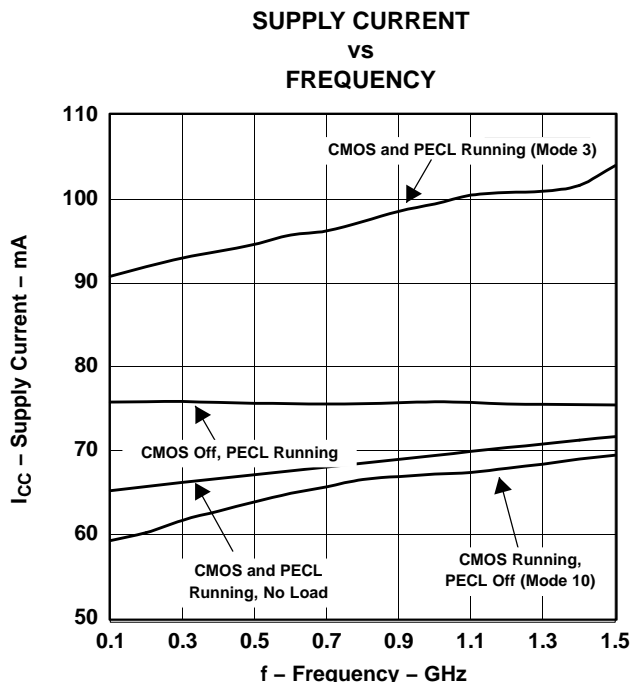
**jitter characteristics (continued)**



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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNITS
I <sub>DD</sub>	Supply current	All outputs enabled and terminated with 50 Ω to V <sub>DD</sub> - 2 V on LVPECL outputs and 10 pF on LVCMOS output, f = 800 MHz for LVPECL outputs and 200 MHz for LVCMOS, V <sub>DD</sub> = 3.3 V		100		mA
		Outputs enabled, no output load, f = 800 MHz for LVPECL outputs and 200 MHz for LVCMOS, V <sub>DD</sub> = 3.6 V			85	
I <sub>DDZ</sub>	Supply current, 3-state	All outputs 3-state by control logic, f = 0 Hz, V <sub>DD</sub> = 3.6 V			0.5	mA





NOTE: Input swing = 500 mV

**Figure 6**

**Package Thermal Resistance**

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$\theta_{JA}$	QFN-16 package thermal resistance with thermal vias in PCB, See Note 1	4-layer JEDEC test board (JESD51-7) with four thermal vias of 22-mil diameter each, airflow = 0 ft/min		40.8		°C/W

NOTE 1: It is recommended to provide four thermal vias to connect the thermal pad of the package effectively with the PCB and ensure a good heat sink.

**Example:**

Calculation of the junction-lead temperature with a 4-layer JEDEC test board using four thermal vias:

$$T_{\text{Chassis}} = 85^{\circ}\text{C} \text{ (temperature of the chassis)}$$

$$P_{\text{effective}} = I_{\text{max}} \times V_{\text{max}} = 85 \text{ mA} \times 3.6 \text{ V} = 306 \text{ mW} \text{ (max power consumption inside the package)}$$

$$\Delta T_{\text{Junction}} = \theta_{JA} \times P_{\text{effective}} = 40.8^{\circ}\text{C/W} \times 306 \text{ mW} = 12.48^{\circ}\text{C}$$

$$T_{\text{Junction}} = \Delta T_{\text{Junction}} + T_{\text{Chassis}} = 12.48^{\circ}\text{C} + 85^{\circ}\text{C} = 97.48^{\circ}\text{C} \text{ (the maximum junction temperature of } T_{\text{die-max}} = 125^{\circ}\text{C is not violated)}$$

# CDCM1802 CLOCK BUFFER WITH PROGRAMMABLE DIVIDER, LVPECL I/O + ADDITIONAL LVCMOS OUTPUT

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## control input characteristics over recommended operating free-air temperature range

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
$t_{su}$	Setup time, S0, S1, and EN pin before clock IN	25			ns
$t_h$	Hold time, S0, S1, and EN pin after clock IN	0			ns
$t_{(disable)}$	Time between latching the EN low transition and when all outputs are disabled (how much time is required until the outputs turn off)		10		ns
$t_{(enable)}$	Time between latching the EN low-to-high transition and when outputs are enabled based on control settings (how much time passes before the outputs carry valid signals)		1		$\mu s$
Rpullup	Internal pullup resistor on S0, S1, and EN input	42	60	78	k $\Omega$
$V_{IH(H)}$	Three level input high, S0, S1, and EN pin, see Note 1	$0.9 \times V_{DD}$			V
$V_{IM(M)}$	Three level input MID, S0, S1, and EN pin	$0.3 \times V_{DD}$		$0.7 \times V_{DD}$	V
$V_{IL(L)}$	Three level low, S0, S1, and EN pin			$0.1 \times V_{DD}$	V
$I_{IH}$	Input current, S0, S1, and EN pin	$V_I = V_{DD}$		-5	$\mu A$
$I_{IL}$	Input current, S0, S1, and EN pin	$V_I = GND$	38	85	$\mu A$

NOTES: 1. Leaving this pin floating automatically pulse the logic level high to  $V_{DD}$  through an internal pullup resistor of 60 k $\Omega$ .

## bias voltage $V_{BB}$ over recommended operating free-air temperature range

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
$V_{BB}$	Output reference voltage	$V_{DD} = 3 V - 3.6 V$ , $I_{BB} = -0.2 mA$	$V_{DD} - 1.4$	$V_{DD} - 1.2$	V

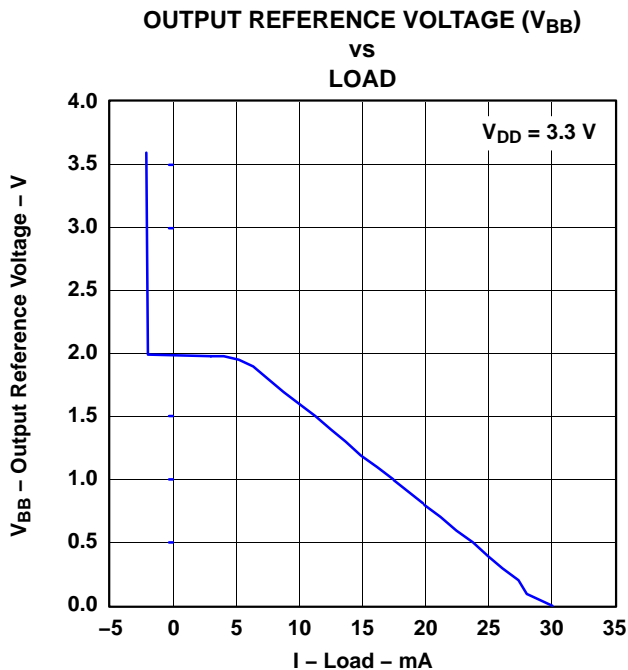
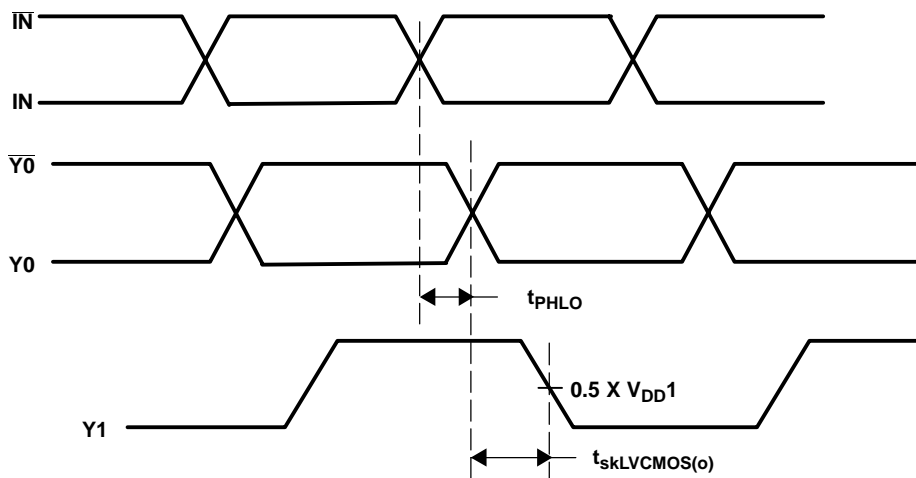


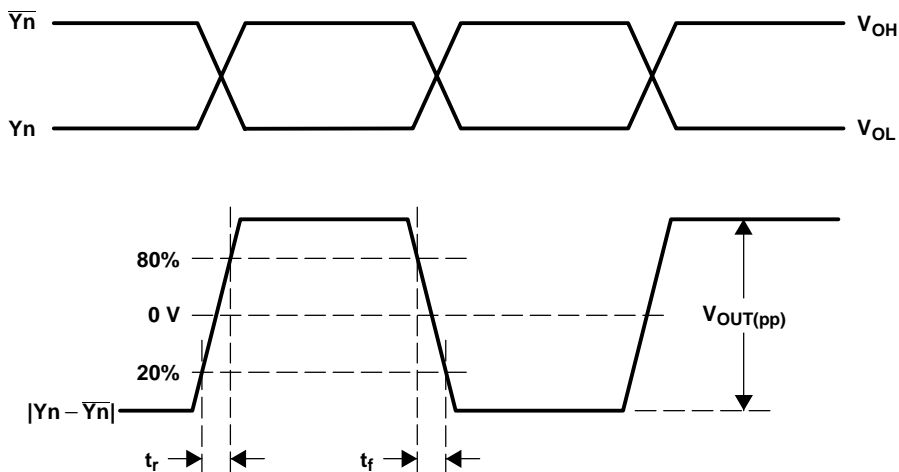
Figure 7

**PARAMETER MEASUREMENT INFORMATION**



- NOTES: A. Part-to-part skew,  $t_{sk(pp)}$ , is calculated as the greater of:
- The difference between the fastest and the slowest  $t_{pd(LH)n}$  across multiple devices
  - The difference between the fastest and the slowest  $t_{pd(HL)n}$  across multiple devices
- B. Pulse skew,  $t_{sk(p)}$ , is calculated as the magnitude of the absolute time difference between the high-to-low ( $t_{pd(HL)}$ ) and the low-to-high ( $t_{pd(LH)}$ ) propagation delays when a single switching input causes Y0 to switch,  $t_{sk(p)} = |t_{pd(HL)} - t_{pd(LH)}|$ . Pulse skew is sometimes referred to as *pulse width distortion* or *duty cycle skew*.

**Figure 8. Waveforms for Calculation of  $t_{sk(o)}$  and  $t_{sk(pp)}$**



**Figure 9. LVPECL Differential Output Voltage and Rise/Fall Time**

# CDCM1802 CLOCK BUFFER WITH PROGRAMMABLE DIVIDER, LVPECL I/O + ADDITIONAL LVCMOS OUTPUT

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## PARAMETER MEASUREMENT INFORMATION

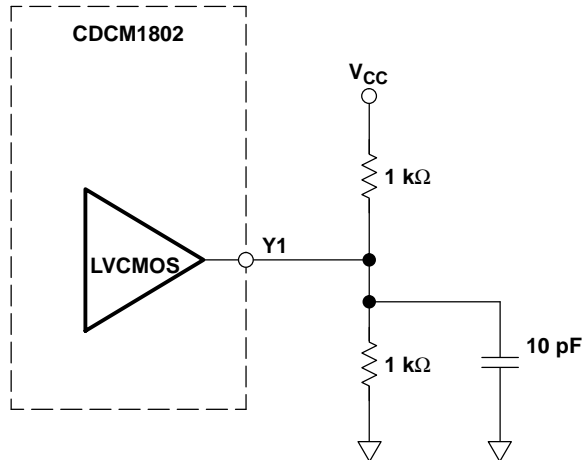


Figure 10. LVCMOS Output Loading During Device Test

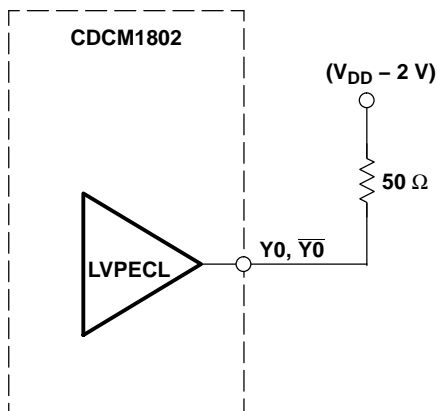


Figure 11. LVPECL Output Loading During Device Test

### PCB design for thermal functionality

It is recommended to take special care of the PCB design for good thermal flow from the QFN-16 pin package to the PCB. The current consumption of the CDCM1802 is fixed. JEDEC JESD51-7 specifies thermal conductivity for standard PCB boards.

Modeling the CDCM1802 with a 4-layer JEDEC board (including four thermal vias) results into 37.5°C max temperature with a  $\theta_{JA}$  of 40.84°C for 25°C ambient temperature.

To ensure sufficient thermal flow, it is recommended to design with four thermal vias in applications.

PARAMETER MEASUREMENT INFORMATION

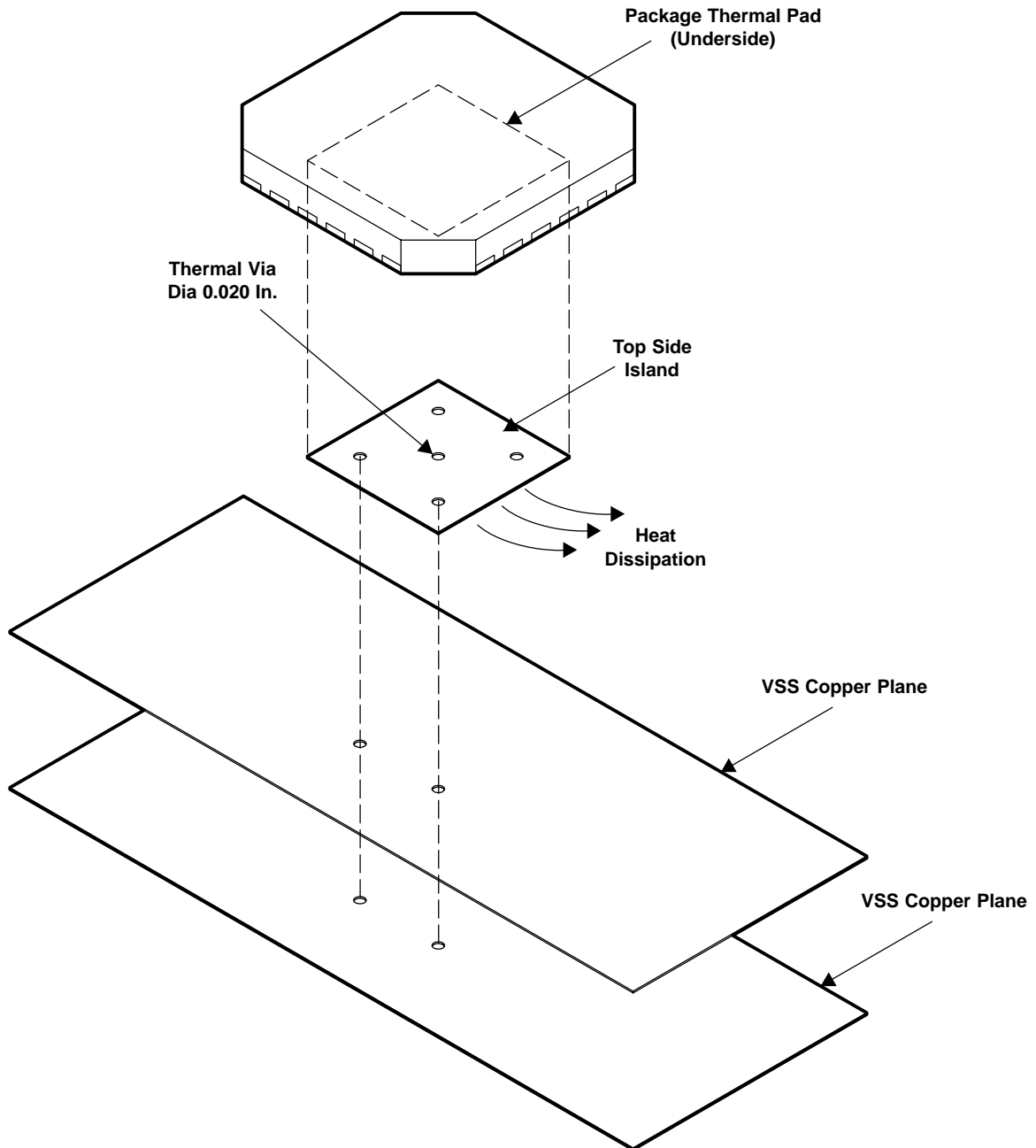


Figure 12. Recommended Thermal Via Placement

See the SCBA017 and the SLUA271 application notes for further package related information.

**CDCM1802**  
**CLOCK BUFFER WITH PROGRAMMABLE DIVIDER,**  
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**APPLICATION INFORMATION**

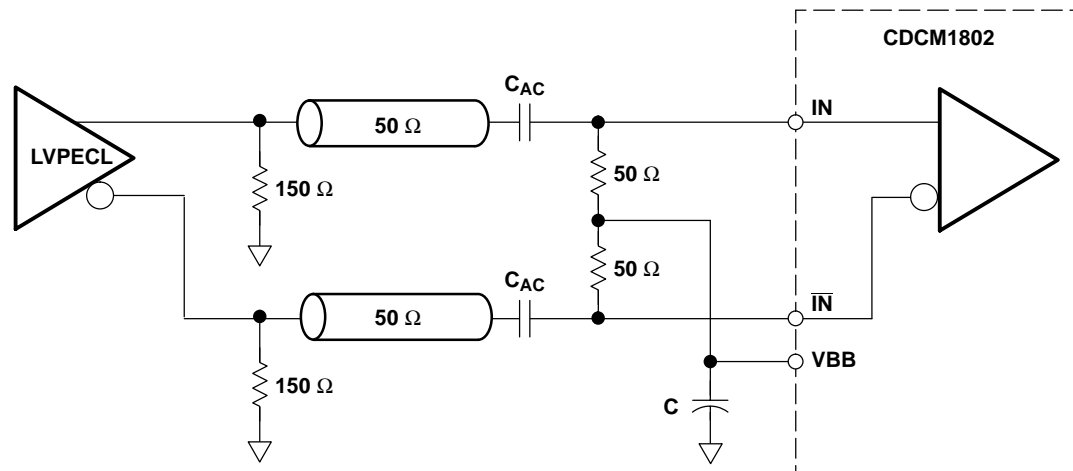
**LVPECL receiver input termination**

The input of the CDCM1802 has high impedance and comes with a very large common mode voltage range. For optimized noise performance it is recommended to properly terminate the PCB trace (transmission line).

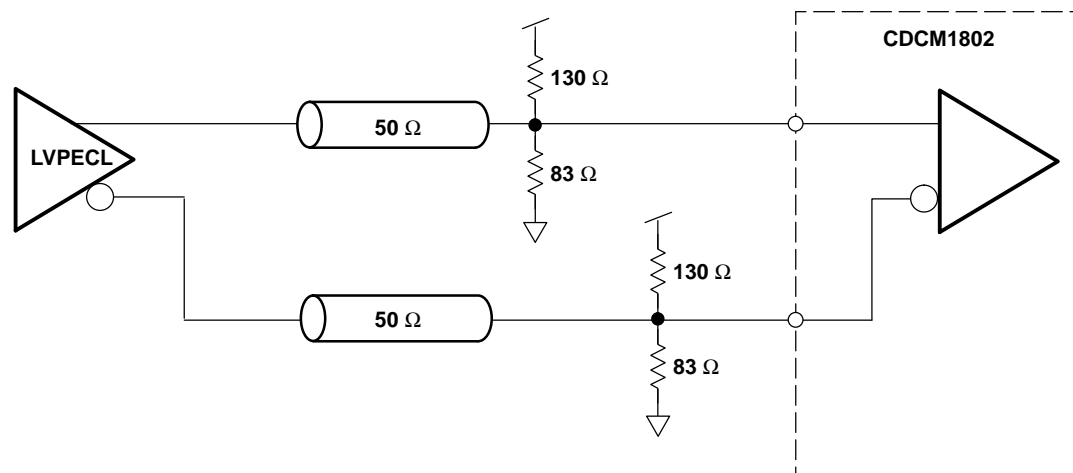
Additional termination techniques can be found in the following application notes: SCAA062 and SCAA059.

<http://focus.ti.com/docs/apps/catalog/resources/appnoteabstract.jhtml?abstractName=scaa062>

<http://focus.ti.com/docs/apps/catalog/resources/appnoteabstract.jhtml?abstractName=scaa059>

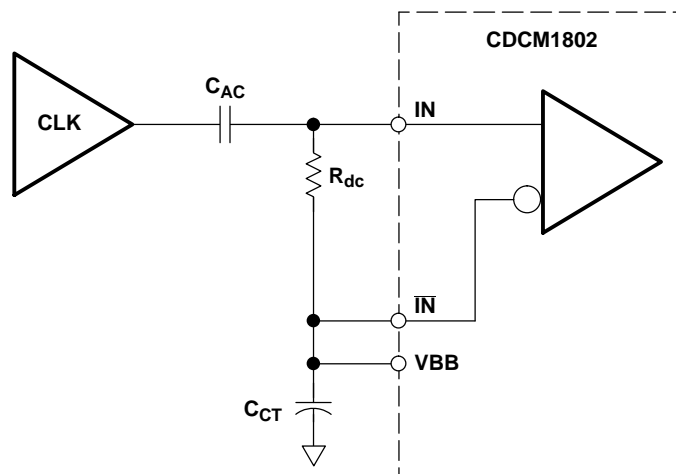


**Figure 13. Recommended AC-Coupling LVPECL Receiver Input Termination**



**Figure 14. Recommended DC-Coupling LVPECL Receiver Input Termination**

**APPLICATION INFORMATION**



NOTE: C<sub>AC</sub> – AC-coupling capacitor (e.g., 10 nF)  
 C<sub>CT</sub> – Capacitor keeps voltage at  $\overline{\text{IN}}$  constant (e.g., 10 nF)  
 R<sub>dc</sub> – Load and correct duty cycle (e.g., 50  $\Omega$ )  
 V<sub>BB</sub> – Bias voltage output

**Figure 15. Typical Application Setting for Single-Ended Input Signals Driving the CDCM1802**

**device behavior during RESET and control pin switching**

**output behavior when enabling the device (EN = 0  $\Rightarrow$  1)**

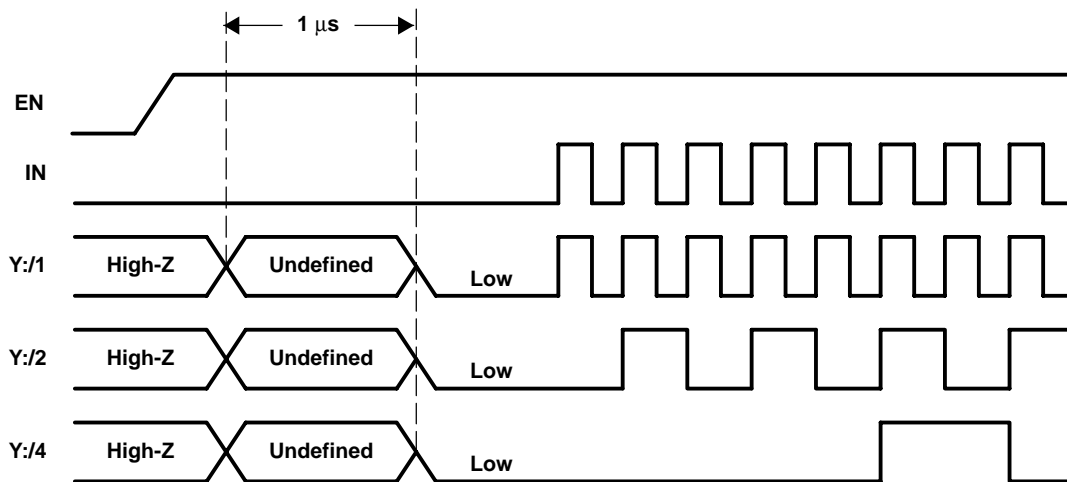
In disable mode (EN = 0), all output drivers are switched in high-Z mode. The bandgap, current references, the amplifier, and the S0 and S1 control inputs are also switched off. In the same mode, all flip-flops will be reset. The typical current consumption is likely below 500  $\mu\text{A}$  (to be measured).

When the device will be enabled again it takes maximal 1  $\mu\text{s}$  for the settling of the reference voltage and currents. During this time the output Y0 and  $\overline{\text{Y0}}$  drive a high signal. Y1 is unknown (could be high or low). After the settle time, the outputs go into the low state. Due to the synchronization of each output driver signal with the input clock, the state of the waveforms after enabling the device look like those shown in Figure 16. The inverting input and output signal is not included. The Y:1 waveform is the undivided output driver state.

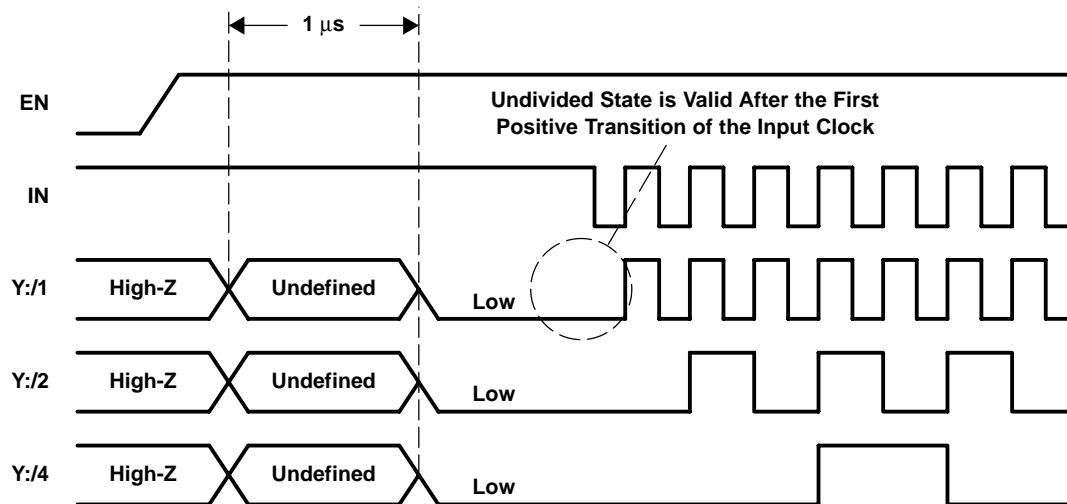
**CDCM1802**  
**CLOCK BUFFER WITH PROGRAMMABLE DIVIDER,**  
**LVPECL I/O + ADDITIONAL LVCMOS OUTPUT**

SCAS759A – APRIL 2004 – JULY 2009

**APPLICATION INFORMATION**



Signal State After the Device is Enabled (IN = Low)



Signal State After the Device is Enabled (IN = High)

**Figure 16. Waveforms**



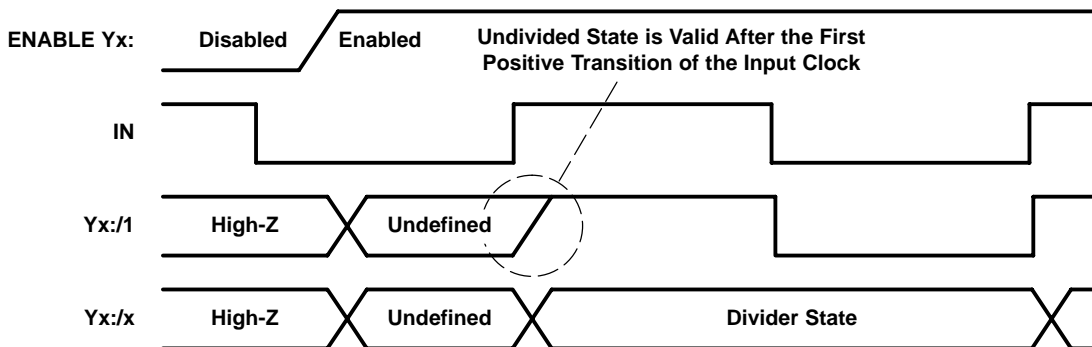
**APPLICATION INFORMATION**

**enabling a single output stage**

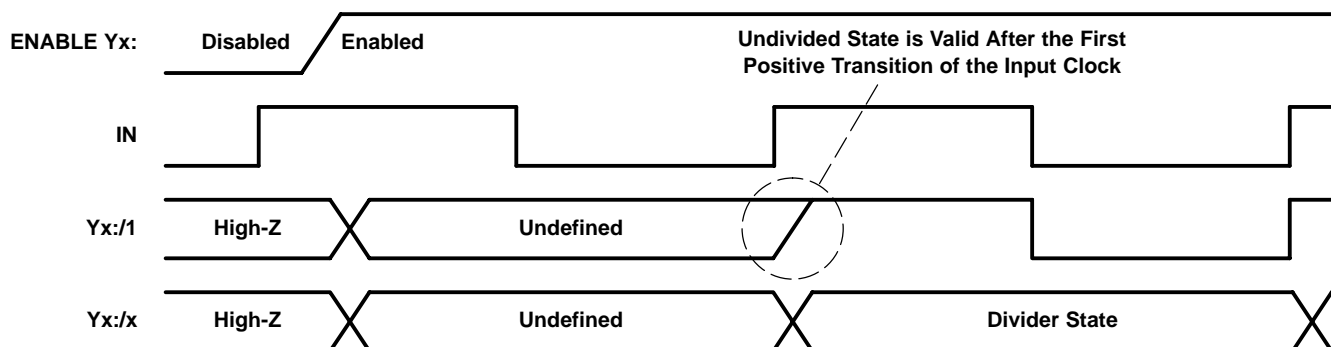
If a single output stage becomes enabled:

1. Y0 will either be low or high (undefined).
2.  $\overline{Y0}$  will be the inverted signal of Y0.

With the first positive clock transition, the undivided output becomes the input clock state. If a divide mode is used, the divided output states are equal to the actual internal divider. The internal divider does not get a reset while enabling single output drivers.



**Figure 17. Signal State After an Output Driver Becomes Enabled While IN = 0**



**Figure 18. Signal State After an Output Driver Becomes Enabled While IN = 1**

**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>
CDCM1802RGTR	ACTIVE	QFN	RGT	16	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDCM1802RGTRG4	ACTIVE	QFN	RGT	16	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDCM1802RGTT	ACTIVE	QFN	RGT	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CDCM1802RGTTG4	ACTIVE	QFN	RGT	16	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.

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**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
CDCM1802RGTR	QFN	RGT	16	3000	330.0	12.4	3.3	3.3	1.6	8.0	12.0	Q2
CDCM1802RGTT	QFN	RGT	16	250	330.0	12.4	3.3	3.3	1.6	8.0	12.0	Q2

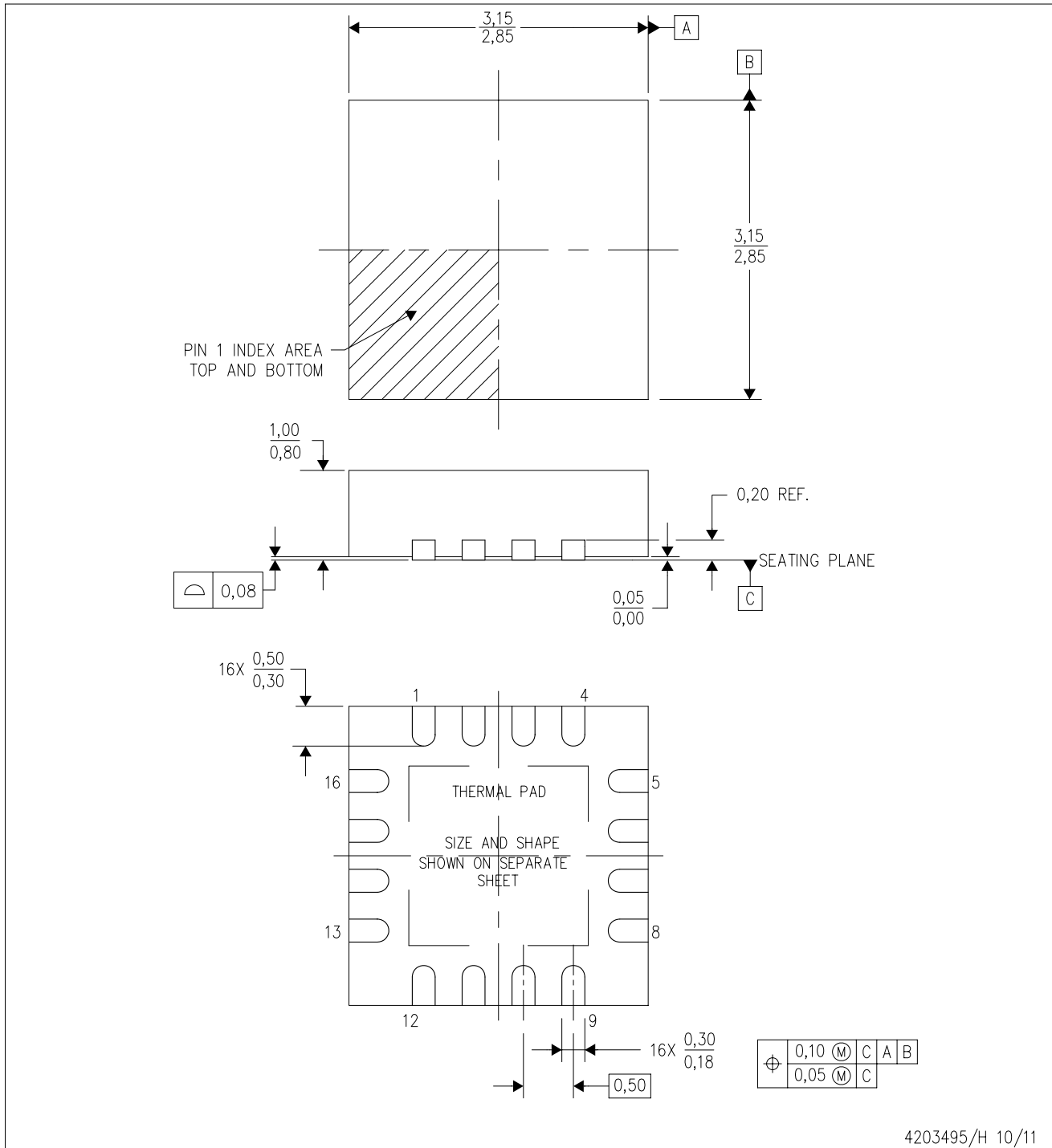
**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CDCM1802RGTR	QFN	RGT	16	3000	340.5	338.1	20.6
CDCM1802RGTT	QFN	RGT	16	250	340.5	338.1	20.6

RGT (S-PVQFN-N16)

PLASTIC QUAD FLATPACK NO-LEAD



- 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

RGT (S-PVQFN-N16)

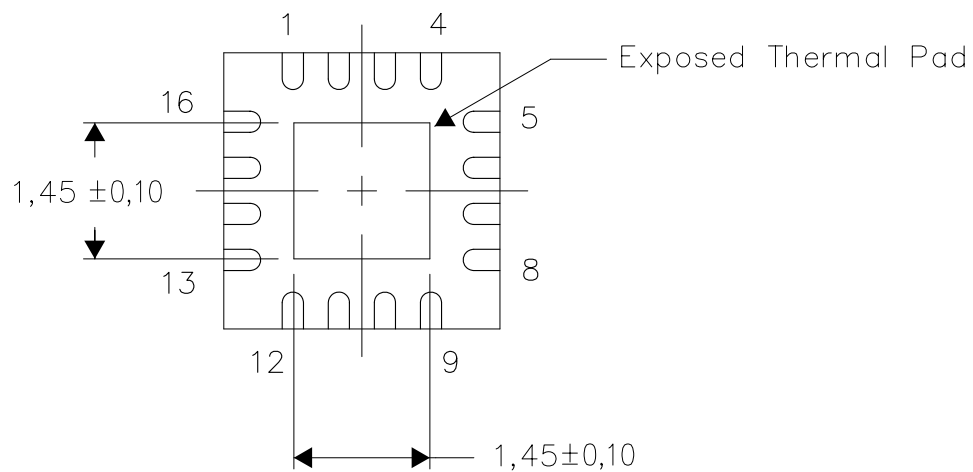
PLASTIC QUAD FLATPACK NO-LEAD

### 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.



Bottom View

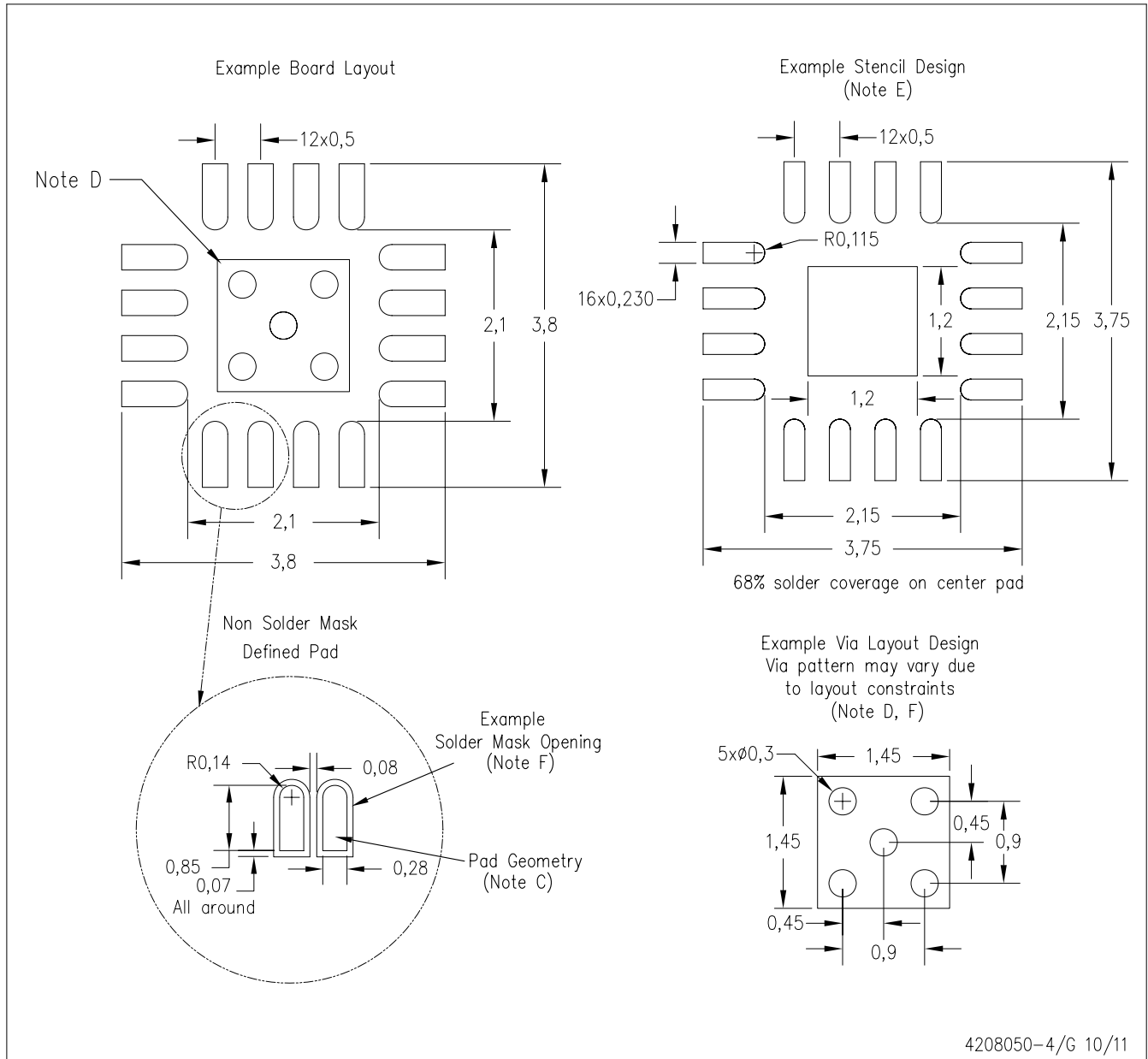
Exposed Thermal Pad Dimensions

4206349-2/Q 10/11

NOTE: All linear dimensions are in millimeters

RGT (S-PVQFN-N16)

PLASTIC QUAD FLATPACK NO-LEAD



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, QFN/SON PCB Attachment, 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>>.
  - E. 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.
  - F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

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