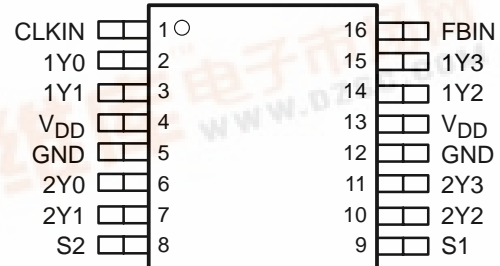


3.3-V 1:8 ZERO DELAY (PLL) x4 CLOCK MULTIPLIER

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- **Phase-Locked Loop-Based Multiplier by Four**
- **Input Frequency Range: 2.5 MHz to 45 MHz**
- **Output Frequency Range: 10 MHz to 180 MHz**
- **LVC MOS/LVTTL I/O Compatible**
- **Low Jitter (Cycle-Cycle): ± 120 ps Over the Range 75 MHz to 180 MHz**
- **Distributes One Clock Input to Two Banks of Four Outputs**
- **Auto Frequency Detection to Disable Device (Power-Down Mode)**
- **Operates From Single 3.3-V Supply**
- **Industrial Temperature Range -40°C to 85°C**
- **25- Ω On-Chip Series Damping Resistors**
- **No External RC Network Required**
- **Spread Spectrum Clock Compatible (SSC)**
- **Available in 16-Pin TSSOP Package**

PW PACKAGE (TSSOP)
(TOP VIEW)

description

The CDCVF25084 is a high-performance, low-skew, low-jitter, phase-lock loop clock multiplier. It uses a PLL to precisely align, in both frequency and phase, the output clocks to the input clock signal including a multiplication factor of four. The CDCVF25084 operates from a nominal supply voltage of 3.3 V. The device also includes integrated series-damping resistors in the output drivers that make it ideal for driving point-to-point loads.

Two banks of four outputs each provide low-skew, low-jitter copies of CLKIN x four. All outputs operate at the same frequency. Output duty cycles are adjusted to 50%, independent of duty cycle at CLKIN. The device automatically goes into power-down mode when no input signal is applied to CLKIN and the outputs go into a low state. Unlike many products containing PLLs, the CDCVF25084 does not require an external RC network. The loop filter for the PLL is included on-chip, minimizing component count, space, and cost.

Because it is based on a PLL circuitry, the CDCVF25084 requires a stabilization time to achieve phase lock of the feedback signal to the reference signal. This stabilization is required following power up and application of a fixed-frequency signal at CLKIN and any following changes to the PLL reference.

The CDCVF25084 is characterized for operation from -40°C to 85°C .

FUNCTION TABLE

S2	S1	1Y0–1Y3	2Y0–2Y3	OUTPUT SOURCE	PLL SHUTDOWN
0	0	Hi-Z	Hi-Z	N/A	Yes
0	1	Active	Hi-Z	PLL [†]	No
1	0	Active	Active	Input clock (PLL bypass)	Yes
1	1	Active	Active	PLL [†]	No

[†] A CLK input frequency < 2 MHz switches the outputs to low level.

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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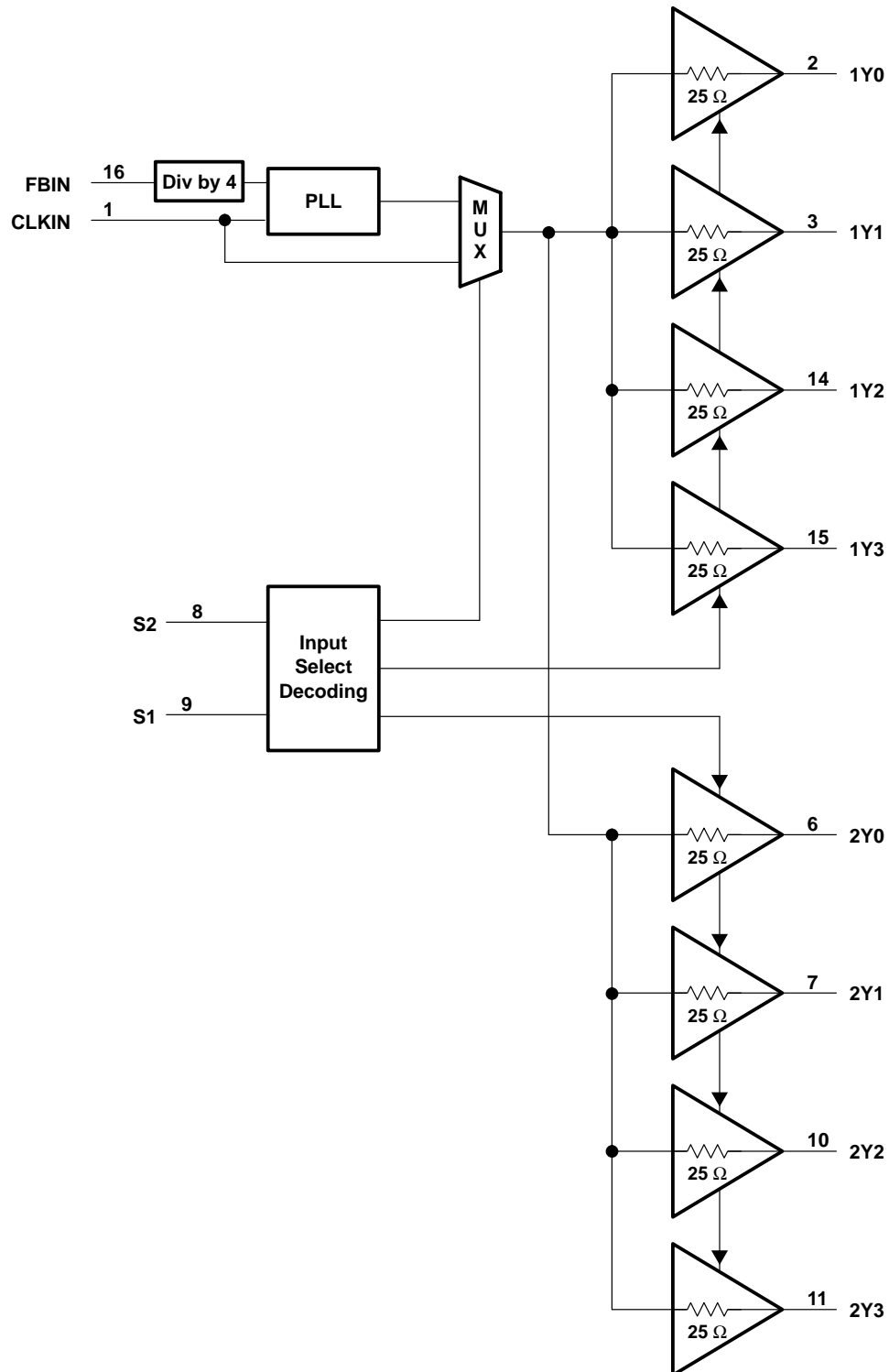
Terminal Functions

TERMINAL NAME PIN NO.		TYPE	DESCRIPTION
1Y[0:3]	2, 3, 14, 15	O	Bank 1Yn clock outputs. These outputs are low-skew copies of CLKIN. Each output has an integrated 25- Ω series-damping resistor.
2Y[0:3]	6, 7, 10, 11	O	Bank 2Yn clock outputs. These outputs are low-skew copies of CLKIN. Each output has an integrated 25- Ω series-damping resistor.
CLKIN	1	I	Clock input. CLKIN provides the clock signal to be distributed by the CDCVF25084 clock driver. CLKIN is used to provide the reference signal to the integrated PLL that generates the output signal. CLKIN must have a fixed frequency and phase in order for the PLL to acquire lock. Once the circuit is powered up and a valid signal is applied, a stabilization time is required for the PLL to phase lock the feedback signal to CLKIN.
FBIN	16	I	Feedback input. FBIN provides the feedback signal to the internal PLL. FBIN must be wired to one of the outputs to complete the feedback loop of the internal PLL. The integrated PLL synchronizes the FBIN and output signal so there is nominally zero-delay from input clock to output clock.
GND	5, 12	Ground	Ground
S1, S2	9, 8	I	Select pins to determine mode of operation. See the <i>FUNCTION TABLE</i> for mode selection options.
VDD	4, 13	Power	Supply voltage. The supply voltage range is 3 V to 3.6 V

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functional block diagram



CDCVF25084

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

Supply voltage range, V_{DD}	–0.5 V to 4.6 V
Input voltage range, V_I (see Notes 1 and 2)	–0.5 V to 4.6 V
Output voltage range, V_O (see Notes 1 and 2)	–0.5 V to $V_{DD} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Continuous total output current, I_O ($V_O = 0$ to V_{DD})	± 50 mA
Package thermal impedance, θ_{JA} (see Note 3): PW package	147°C/W
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. This value is limited to 4.6 V maximum.
3. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V_{DD}	3	3.3	3.6	V
Low level input voltage, V_{IL}			0.8	V
High level input voltage, V_{IH}	2			V
Input voltage, V_I	0		3.6	V
High-level output current, I_{OH}			–12	mA
Low-level output current, I_{OL}			12	mA
Operating free-air temperature, T_A	–40		85	°C

timing requirements over recommended ranges of supply voltage, load and operating free-air temperature

	MIN	NOM	MAX	UNIT
Input clock frequency, f_{CLKIN}	2.5		45	MHz
Input clock duty cycle	40%		60%	
Clock frequency, f_{CLKOUT} $C_L = 15$ pF	10		180	MHz

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

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V _{IK}	Input voltage	V _{DD} = 3 V, I _I = -18 mA			-1.2	V
I _I	Input current	V _I = 0 V or V _{DD}			±5	μA
I _{PD}	Power-down current	f _{CLKIN} = 0 MHz, V _{DD} = 3.3 V			100	μA
I _{DD} ‡	Dynamic current	f _{out} = 80 MHz, C _L = 15 pF		60	80	mA
I _{OZ}	Output 3-state	V _O = 0 V or V _{DD} , V _{DD} = 3.6 V			±5	μA
C _I	Input capacitance at FBIN, CLKIN	V _I = 0 V or V _{DD}		4		pF
C _I	Input capacitance at S1, S2	V _I = 0 V or V _{DD}		2.2		pF
C _O	Output capacitance	V _I = 0 V or V _{DD}		3		pF
V _{OH}	High-level output voltage	V _{DD} = min to max, I _{OH} = -100 μA	V _{DD} - 0.2			V
		V _{DD} = 3 V, I _{OH} = -12 mA	2.1			
		V _{DD} = 3 V, I _{OH} = -6 mA	2.4			
V _{OL}	Low-level output voltage	V _{DD} = min to max, I _{OL} = 100 μA	0.2			V
		V _{DD} = 3 V, I _{OL} = 12 mA	0.8			
		V _{DD} = 3 V, I _{OL} = 6 mA	0.55			
I _{OH}	High-level output current	V _{DD} = 3 V, V _O = 1 V	-24			mA
		V _{DD} = 3.3 V, V _O = 1.65 V	-30			
		V _{DD} = 3.6 V, V _O = 3.135 V	-15			
I _{OL}	Low-level output current	V _{DD} = 3 V, V _O = 1.95 V	26			mA
		V _{DD} = 3.3 V, V _O = 1.65 V	33			
		V _{DD} = 3.6 V, V _O = 0.4 V	14			

† All typical values are at respective nominal V_{DD}.

‡ All outputs are switching; for I_{DD} over frequency see Figure 9.

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3.3-V 1:8 ZERO DELAY (PLL) x4 CLOCK MULTIPLIER

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

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$t_{\text{(lock)}}$ PLL lock time	$f_{\text{out}} = 100 \text{ MHz}$		2		μs
$t_{\text{(phoffset)}}$ Phase offset (CLKIN to FBIN), (see Note 5)	$f_{\text{out}} = 40 \text{ MHz to } 75 \text{ MHz}, V_{\text{th}} = V_{\text{DD}}/2$			± 200	ps
	$f_{\text{out}} = 75 \text{ MHz to } 180 \text{ MHz}, V_{\text{th}} = V_{\text{DD}}/2$			± 100	
$t_{\text{PLH}}, t_{\text{PHL}}$ Propagation delay	S2 = High, S1 = Low (PLL bypass mode)	2.3		4.5	ns
$t_{\text{sk(o)}}$ Output skew (Yn to Yn) (see Note 4)	See Figure 3		75	150	ps
$t_{\text{sk(pp)}}$ Part-to-part skew (low-to-high transition)	PLL bypass mode			900	ps
	PLL mode, $f_{\text{out}} = 40 \text{ MHz to } 75 \text{ MHz}$			350	
	PLL mode, $f_{\text{out}} = 75 \text{ MHz to } 180 \text{ MHz}$			300	
$t_{\text{jit(cc)}}$ Jitter (cycle-to-cycle)	$f_{\text{out}} = 40 \text{ MHz to } 75 \text{ MHz}$			± 220	ps
	$f_{\text{out}} = 75 \text{ MHz to } 180 \text{ MHz}$			± 120	ps
$t_{\text{jit(per)}}$ Period jitter	$f_{\text{out}} = 40 \text{ MHz to } 75 \text{ MHz}$			260	ps
	$f_{\text{out}} = 75 \text{ MHz to } 180 \text{ MHz}$			140	ps
$t_{\text{jit}(\theta)}$ Phase jitter	$f_{\text{out}} = 75 \text{ MHz to } 180 \text{ MHz}$, peak-to-peak (see Note 6)			± 110	ps
	$f_{\text{out}} = 75 \text{ MHz to } 180 \text{ MHz}$, RMS (see Note 6)			26	ps
odc Output duty cycle	$f_{\text{out}} = 10 \text{ MHz to } 180 \text{ MHz}$	45%		55%	
$t_{\text{sk(p)}}$ Pulse skew	S2 = High, S1 = low (PLL bypass mode)			0.3	ns
t_r, t_f Rise / fall time rate	See Figure 4	1		3	V/ns

† All typical values are at respective nominal V_{DD} .

NOTES: 4. The $t_{\text{sk(o)}}$ specification is only valid for equal loading of all outputs.

5. Similar waveform at CLKIN and FBIN are required. Output 1Y3 is used as a feedback to FBIN loaded with 11 pF and all other outputs have 15 pF. For phase displacement between CLKIN and Y-outputs, see Figure 5.

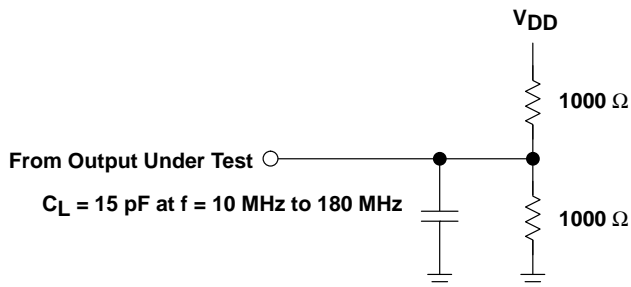
6. Input phase jitter < ± 50 ps; output sample size is 20000 cycles.

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PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
 B. All input pulses are supplied by generators having the following characteristics: $Z_O = 50 \Omega$, $t_r < 1.2 \text{ ns}$, $t_f < 1.2 \text{ ns}$
 C. The outputs are measured one at a time with one transition per measurement.

Figure 1. Test Load Circuit

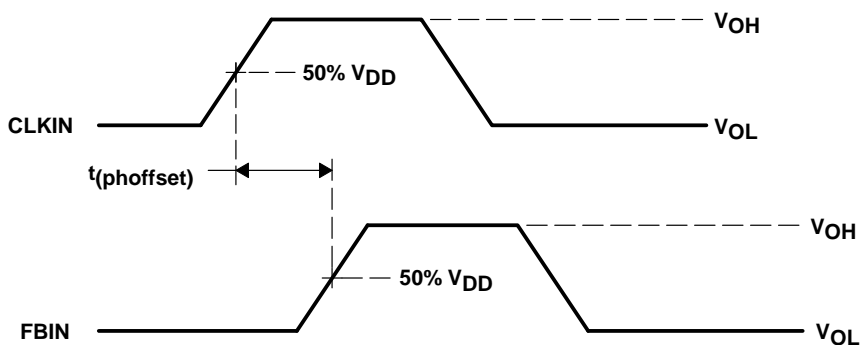
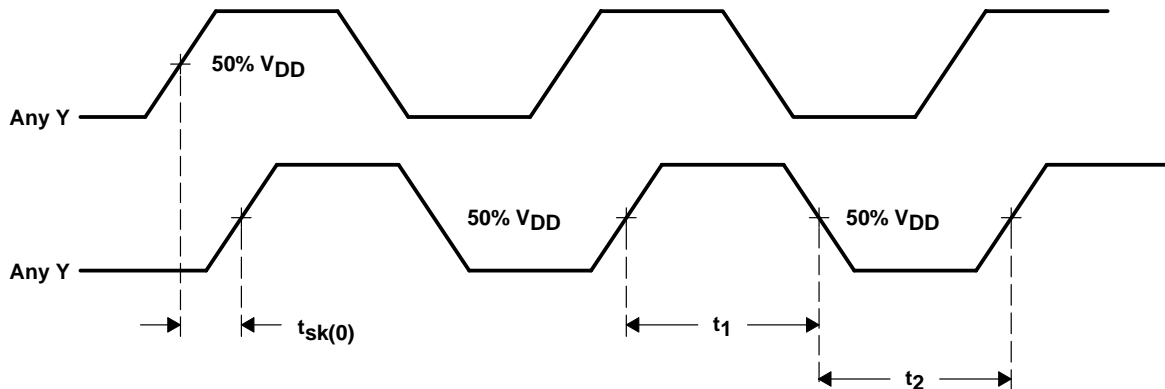


Figure 2. Voltage Thresholds for Measurements, Phase Offset (PLL Mode)



NOTE: $odc = t_1 / (t_1 + t_2) \times 100\%$

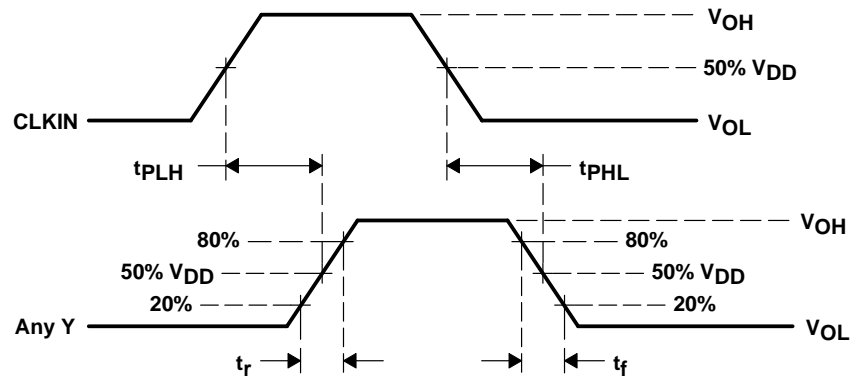
Figure 3. Output Skew and Output Duty Cycle (PLL Mode)

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3.3-V 1:8 ZERO DELAY (PLL) x4 CLOCK MULTIPLIER

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PARAMETER MEASUREMENT INFORMATION



NOTE: $t_{sk(p)} = |t_{PLH} - t_{PHL}|$

Figure 4. Propagation Delay and Pulse Skew (Non-PLL Mode)

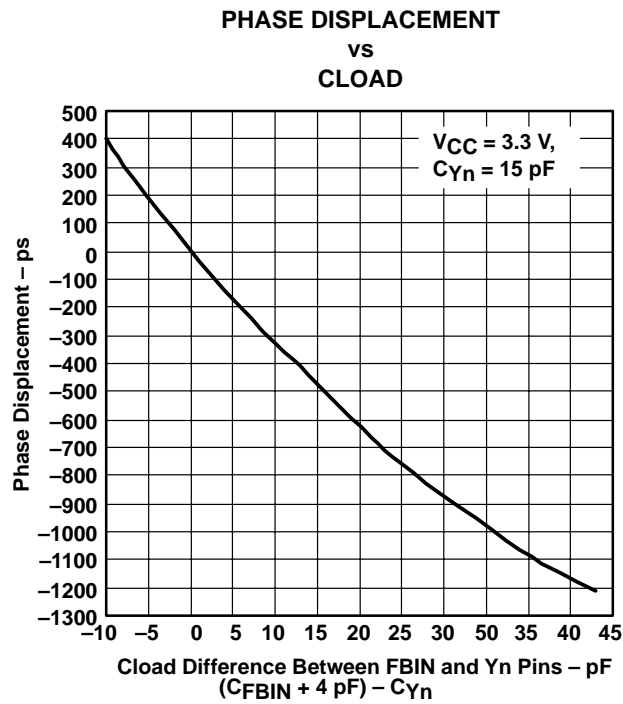


Figure 5

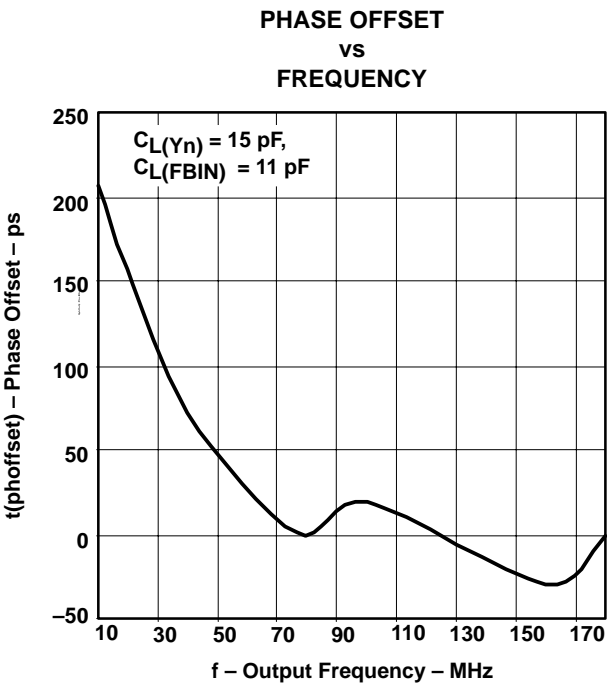


Figure 6

CDCVF25084 3.3-V 1:8 ZERO DELAY (PLL) x4 CLOCK MULTIPLIER

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PARAMETER MEASUREMENT INFORMATION

CYCLE-TO-CYCLE / PERIOD JITTER
vs
FREQUENCY

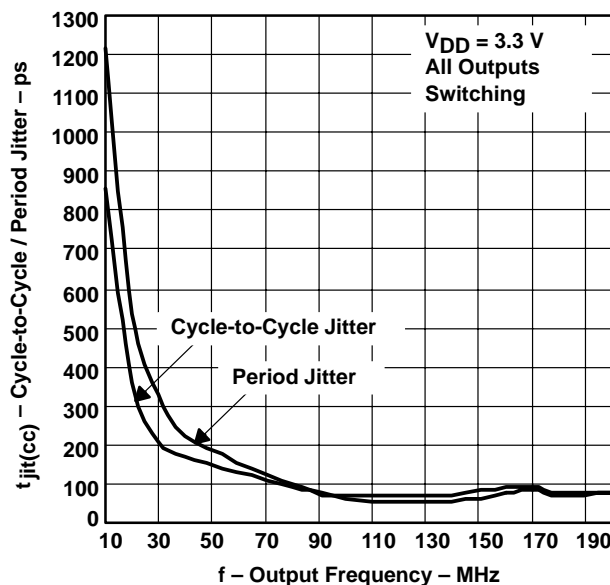


Figure 7

TRANSFER CHARACTERISTIC FROM CLKIN TO Yn

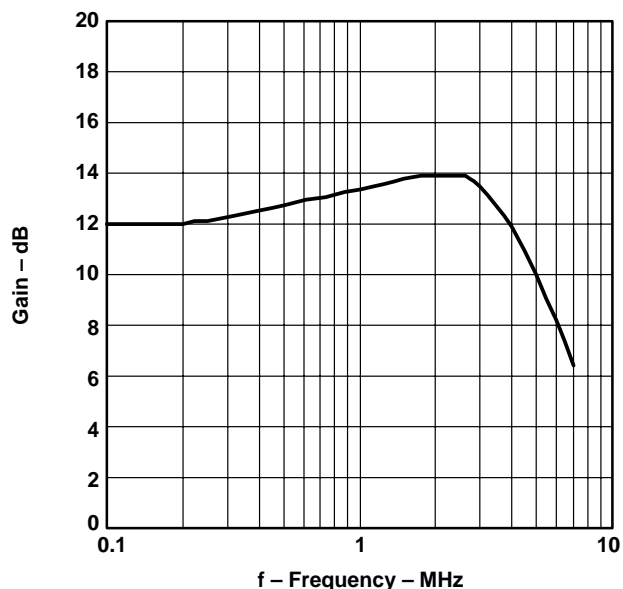


Figure 8

SUPPLY CURRENT
vs
FREQUENCY

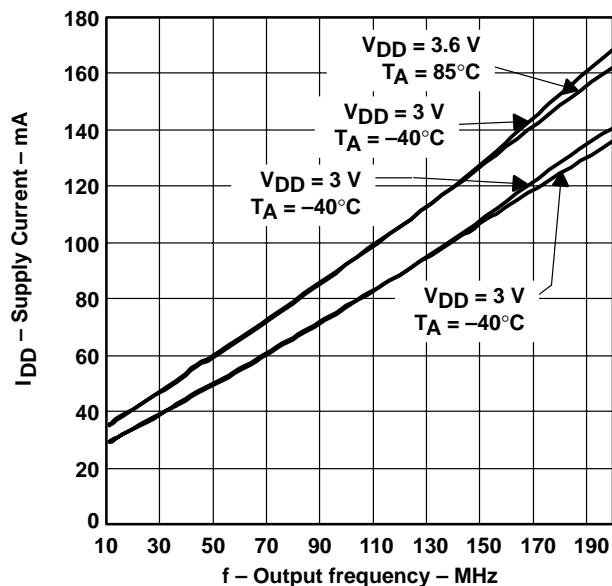


Figure 9

CDCVF25084
3.3-V 1:8 ZERO DELAY (PLL) x4 CLOCK MULTIPLIER

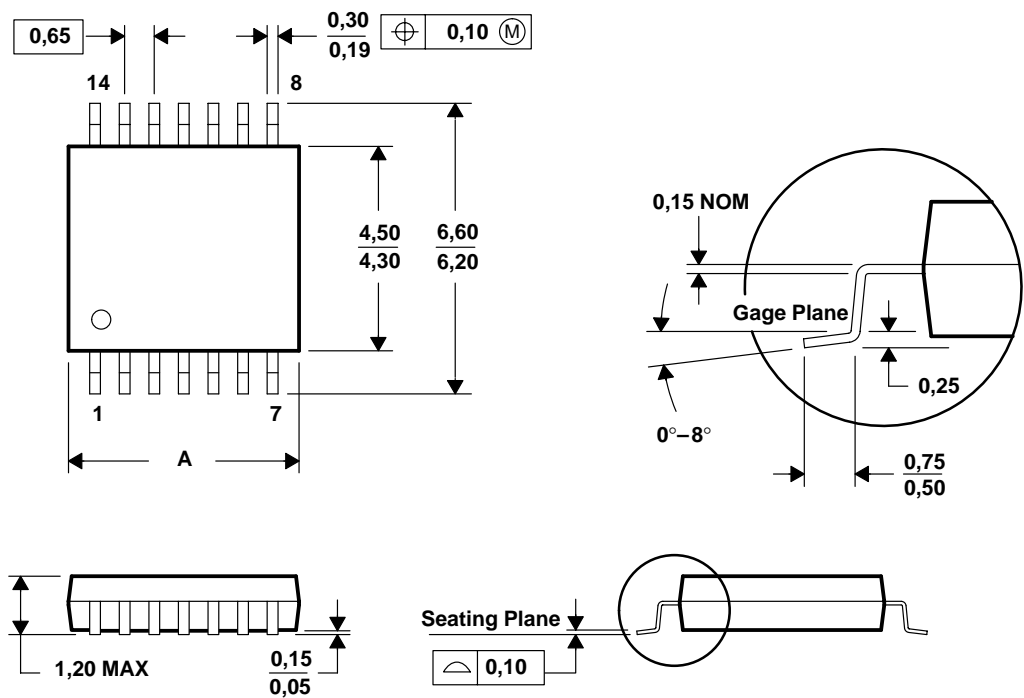
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MECHANICAL DATA

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



PINS ** DIM	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

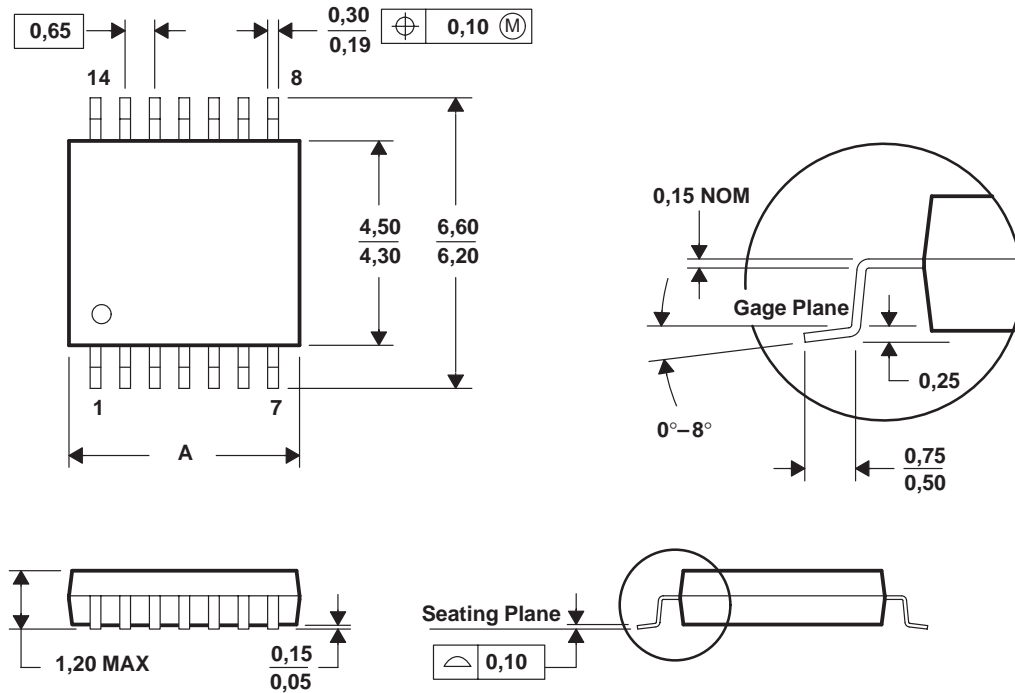
MECHANICAL DATA

MTSS001C – JANUARY 1995 – REVISED FEBRUARY 1999

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



PINS ** DIM	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

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