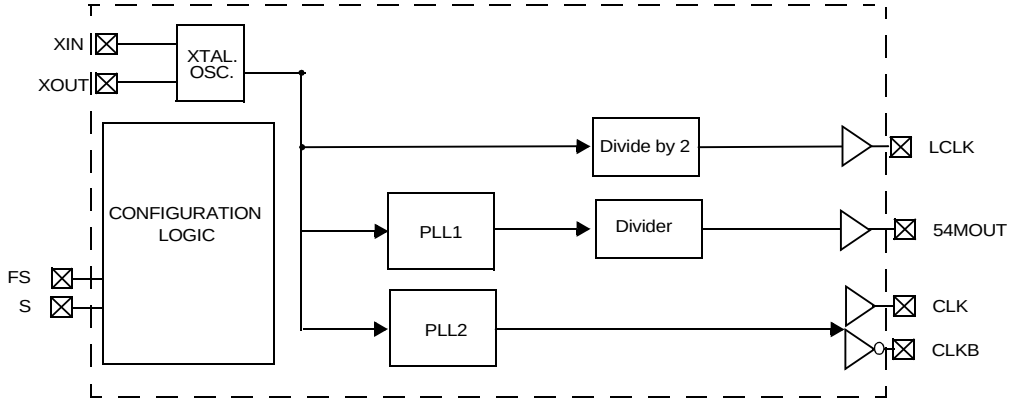
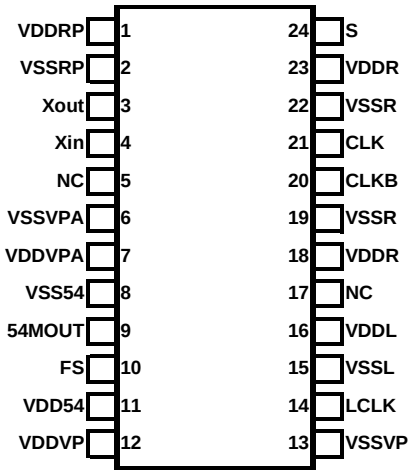
Two-PLL Clock Generator with Direct Rambus™ (Lite) Support

Features	Benefits
Two integrated phase-locked loops (PLLs)	High-performance PLL tailored for multimedia applications
Ultra-accurate PLLs	Frequency tolerance within 1 PPM on all frequencies
Direct Rambus™ clock support	One pair of differential output drivers, identical specification to CY2212
Two input selects	Selectable 54.0-/53.946-MHz output and 294.912-/393.216-MHz Rambus® output
3.45V core; 3.45V, 2.5V, 1.8V, and 1.675V outputs	Supports output voltage requirements
24-pin TSSOP package	Industry-standard packaging saves on board space

Block Diagram



Pin Configuration



Frequency Select Tables

FS	54MOUT	Unit	PPM
0	54	MHz	0
1	53.94605395	MHz	–1

S	CLK, CLKB	Unit	PPM
0	294.912	MHz	0
1	393.216	MHz	0

LCLK	Unit	PPM
9.216	MHz	0

Pin Description

Name	Pin Numbers	Pin Description
V_{DDRP}	1	**Power for DRCG PLL**
V_{SSRP}	2	**Ground for DRCG PLL**
X_{out}	3	**Crystal Output**
X_{in}	4	**Crystal Input**
NC	5	**Do Not Connect, Leave Floating**
V_{SSVPA}	6	**Analog Ground For Video PLL**
V_{DDVPA}	7	**Analog Power for Video PLL**
V_{SS54}	8	**Ground for 54MOUT**
54MOUT	9	**54-MHz/53.94605395-MHz Output**
FS	10	**Frequency Select Pin for 54MOUT** (internal pull-down resistor)
V_{DD54}	11	**Power for 54MOUT**
V_{DDVP}	12	**Power for Video PLL**
V_{SSVP}	13	**Ground for Video PLL**
LCLK	14	**LCLK Output**
V_{SSL}	15	**Ground for LCLK**
V_{DDL}	16	**Power for LCLK**
NC	17	**Do Not Connect**, Leave Floating
V_{DDR}	18	**Power for DRCG CLK/CLKB**
V_{SSR}	19	**Ground for DRCG CLK/CLKB**
CLKB	20	**Output Clock to Rambus** (complement)
CLK	21	**Output Clock to Rambus**
V_{SSR}	22	**Ground for DRCG CLK/CLKB**
V_{DDR}	23	**Power for DRCG CLK/CLKB**
S	24	**Frequency Select Pin for DRCG CLK/CLKB** (internal pull-up resistor)

Absolute Maximum Conditions

(Above which the useful life may be impaired. For user guidelines; not tested.)

Supply Voltage ..... –0.5V to +4.0V

DC Input Voltage ..... –0.5V to + (V_{DD} + 0.5V)

Storage Temperature ..... –65°C to +125°C

Static Discharge Voltage (per MIL-STD-883, Method 3015) 2000V

Latch-up (per JEDEC 17) ..... ≥ ±200 mA

Recommended Operating Conditions[1]

Parameter	Description	Min.	Typ	Max.	Unit
V_{DDRP}, V_{DDVPA}, V_{DDVP}, V_{DDR}	Supply Voltage for PLL's, Crystal Oscillator, and 3.45V Outputs	3.15	3.45	3.6	V
V_{DD54} (2.5V)	Supply Voltage for 2.5V Outputs	2.25	2.5	2.75	V
V_{DD54} (1.675V)	Supply Voltage for 1.675V Outputs	1.6	1.675	1.75	V
V_{DDL}	Supply Voltage for 1.8V Outputs	1.6	1.8	2.0	V
t_{PU}	Power-up time for all V_{DDS} to reach minimum specified voltage (power ramps must be monotonic)	0.05		500	ms
T_A	Operating Temperature, Ambient	0		+85	°C
C_{LOAD_54MOUT}	Max. Load Capacitance, CMOS Output			15	pF
f_{REF}	External Reference Crystal		18.432		MHz

Electrical Specifications

Parameter	Description	Conditions	Min.	Typ.	Max.	Unit
I_{OH}[2]	Output High Current, 2.5V outputs[3]	$V_{OH} = V_{DD} – 0.5$, $V_{DD} = 2.5V$	8	16		mA
	Output High Current, 1.8V outputs[3]	$V_{OH} = V_{DD} – 0.5$, $V_{DD} = 1.8V$	6	12		mA
	Output High Current, 1.675V outputs[3]	$V_{OH} = V_{DD} – 0.5$, $V_{DD} = 1.675V$	5	10		mA
I_{OL}[2]	Output Low Current, 2.5V outputs[3]	$V_{OL} = 0.5V$, $V_{DD} = 2.5V$	8	16		mA
	Output Low Current, 1.8V outputs[3]	$V_{OL} = 0.5V$, $V_{DD} = 1.8V$	6	12		mA
	Output Low Current, 1.675V outputs[3]	$V_{OL} = 0.5V$, $V_{DD} = 1.675V$	5	10		mA
C_{XTAL}	Crystal Load Capacitance[3]	Total effective load of internal load caps		11[4]		pF
C_{LOAD_IN}	Input Pin Capacitance[3]	Except crystal pins		7		pF
V_{IH}	HIGH-Level Input Voltage	CMOS levels,% of $V_{DDRP}/V_{DDVPA}/V_{DDVP}$	70%			V_{DD}
V_{IL}	LOW-Level Input Voltage	CMOS levels,% of $V_{DDRP}/V_{DDVPA}/V_{DDVP}$			30%	V_{DD}
R_{I_FS}	FS Input Resistor	Pull-down resistor on FS	60	150	225	kΩ
R_{I_S}	S Input Resistor	Pull-up resistor on S	10		100	kΩ
I_{DD}	Total Power Supply Current	Sum of all supply currents			125	mA

Direct Rambus Electrical Specifications[3]

Parameter	Description	Min.	Typ.	Max.	Unit
V_{CM}	Differential output common-mode voltage	1.35		1.75	V
V_X	Differential output crossing-point voltage[5]	1.25		1.85	V
V_{COS}	Output Voltage swing (p-p single-ended)[6]	0.4		0.7	V
V_{COH}	Output high voltage			2.1	V
V_{COL}	Output low voltage	1.0			V
r_{OUT}	Output dynamic resistance (at pins)[7]	12		50	Ω

Notes:

1. Unless otherwise noted, Electrical and Switching Characteristics are guaranteed across these operating conditions.
2. LCLK and 54MOUT outputs only.
3. Guaranteed by design, not 100% tested.
4. Identical Crystal Load Capacitance as CY2212ZC-2. Use the same crystal and X_{IN} / X_{OUT} board layout as implemented with the original crystal-driven CY2212ZC-2.
5. Differential output crossing point voltages shown in *Figure 1.*
6. $V_{COS} = V_{OH} – V_{OL}$.
7. $r_{OUT} = \Delta V_O / \Delta I_O$. This is defined at the output pins, not at the measurement point of *Figure 9*.

Switching Characteristics[3]

Parameter	Description	Conditions	Min.	Typ.	Max.	Unit
F_{PPM}	Frequency Error	Part to Part, does not include PCB variation[8]		±5	±10	PPM
		Over commercial temperature range[9]		±2	±5	PPM
DC	Output Duty Cycle	Duty cycle for all outputs, measured at $V_{DD}/2$	45	50	55	%
$t_{3\_54,\ 2.5}$	54MOUT Rising Edge Slew Rate	20% to 80% of V_{DD54}, V_{DD54} = 2.5V	0.75	1.2	4.0	V/ns
$t_{3\_54,\ 1.675}$	54MOUT Rising Edge Slew Rate	20% to 80% of V_{DD54}, V_{DD54} = 1.675V	0.35	0.5	2.5	V/ns
$t_{4\_54,\ 2.5}$	54MOUT Falling Edge Slew Rate	80% to 20% of V_{DD54}, V_{DD54} = 2.5V	0.75	1.2	4.0	V/ns
$t_{4\_54,\ 1.675}$	54MOUT Falling Edge Slew Rate	80% to 20% of V_{DD54}, V_{DD54} = 1.675V	0.35	0.5	2.5	V/ns
t_{CR}, t_{CF}	CLK/CLKB Rise and Fall Times	20% to 80% of output voltage	160		400	ps
t_{CR-CF}	CLK/CLKB Rise and Fall Difference[10]	20% to 80% of output voltage			100	ps
t_5	Lock Time[11]	PLL lock time from power-up		1.0	3.0	ms

Phase Noise Specifications

Parameter	Description	Conditions	Min.	Typ.	Max.	Unit
	Phase Noise	54 MHz at 10-kHz offset		–95		dBc
	Phase Noise	53.946 MHz at 10-kHz offset		–92		dBc

Jitter Specifications[3]

Parameter	Description	Conditions	Typ.	Max.	Unit
t_{6_LCLK}	LCLK Jitter[12]	Cycle-Cycle Jitter – 9.216 MHz		250	ps
$t_{6\_54,\ 2.5}$	54MOUT Jitter[12]	Cycle-Cycle Jitter – 54 MHz, V_{DD} = 2.5V		150	ps
		Cycle-Cycle Jitter – 53.946 MHz, V_{DD} = 2.5V		150	ps
$t_{6\_54,\ 1.675}$		Cycle-Cycle Jitter – 54 MHz, V_{DD} = 1.675V		250	ps
		Cycle-Cycle Jitter – 53.946 MHz, V_{DD} = 1.675V		250	ps
t_{7_LCLK}	LCLK 1000 Cycle Jitter[13]	1000 Cycle Jitter – 9.216 MHz		250	ps
t_{7_54}	54MOUT 1000 Cycle Jitter[13]	1000 Cycle Jitter – 54 MHz,		400	ps
		1000 Cycle Jitter – 53.946 MHz,		400	ps
t_8	CLK/CLKB 1–6 Cycle Jitter[14]	Cycle-Cycle Jitter, 1–6 Cycles, 400 MHz		50	ps
		Cycle-Cycle Jitter, 1–6 Cycles, 300 MHz		70	ps
t_9	CLK/CLKB Long-term Jitter[15]	Long-term Jitter, 400 MHz		300	ps
		Long-term Jitter, 300 MHz		400	ps
t_{10}	CLK/CLKB Duty Cycle Error[16]	Cycle-Cycle Duty Cycle Error, 400 MHz		50	ps
		Cycle-Cycle Duty Cycle Error, 300 MHz		70	ps

Notes:

8. Tested across three lots on same board, PCB boards can vary more than ± 5 PPM.
9. Crystal should not be heated for this test, only IC.
10. Measured on same pin of a single device.
11. Lock Time shown in *Figure 2*.
12. LCLK and 54MOUT Cycle-Cycle Jitter shown in *Figure 3.*
13. LCLK and 54MOUT 1000 Cycle Jitter shown in *Figure 4.*
14. CLK/CLKB 1-6 Cycle Jitter specification is absolute value of worst case deviation, and is shown in *Figure 5* and *Figure 6*.
15. CLK/CLKB Long Term Jitter shown in *Figure 7*.
16. CLK/CLKB Duty Cycle Error shown in *Figure 8*.

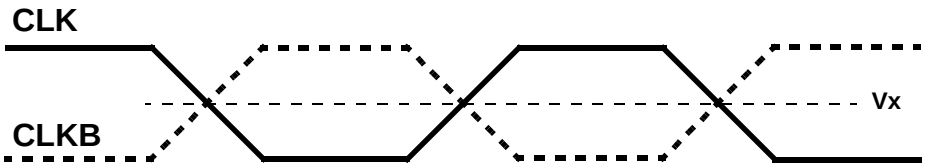


Figure 1. Direct Rambus Crossing Point Voltage

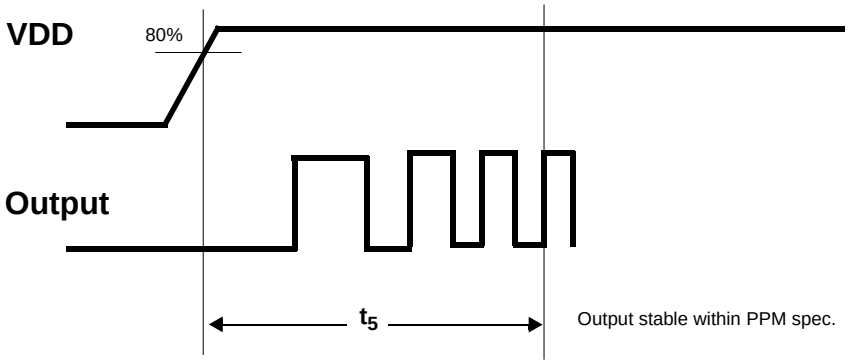
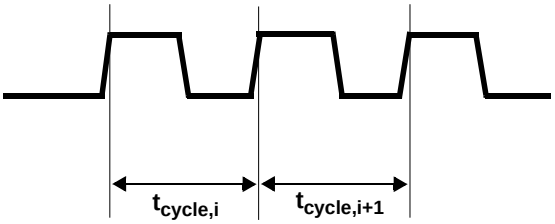
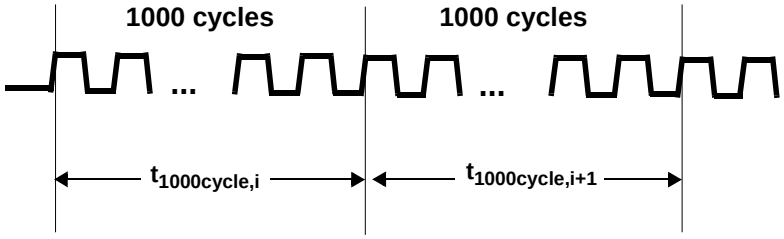


Figure 2. PLL Lock Time



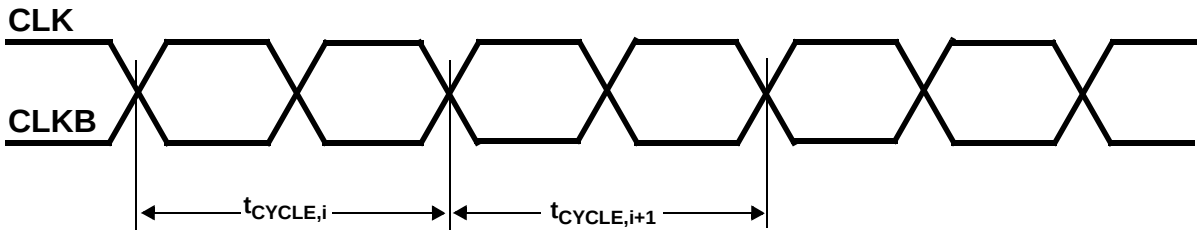
$t_6 = t_{cycle,i} - t_{cycle,i+1}$

Figure 3. 54MOUT, LCLK Cycle-to-Cycle Jitter



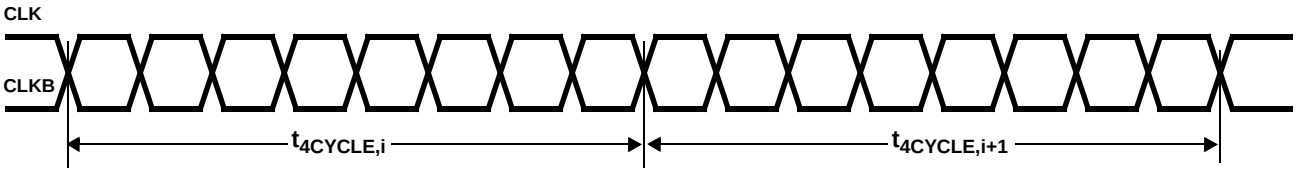
$t_7 = t_{1000cycle,i} - t_{1000cycle,i+1}$

Figure 4. 54MOUT, LCLK 1000 Cycle Jitter



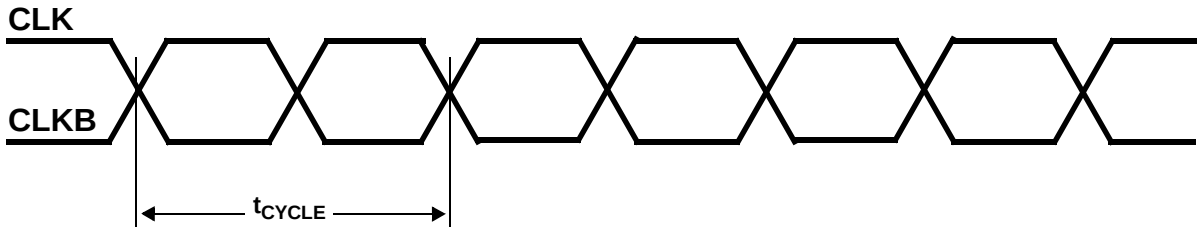
$t_8 = t_{CYLCE,i} - t_{CYCLE,i+1}$ over 10000 consecutive cycles

Figure 5. CLK, CLKB Cycle-to-Cycle Jitter



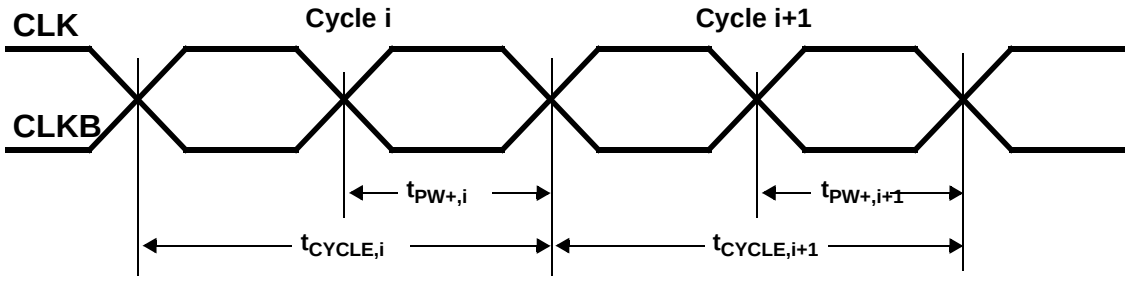
$t_8 = t_{4CYCLE,i} - t_{4CYCLE,i+1}$ over 10000 consecutive cycles

Figure 6. CLK, CLKB 4-Cycle-to-Cycle Jitter



$t_9 = t_{CYCLE,max} - t_{CYCLE,min}$ over 10000 cycles

Figure 7. CLK, CLKB Long-term Jitter



$t_{10} = t_{PW+,i} - t_{PW+,i+1}$

Figure 8. CLK, CLKB Duty Cycle Error

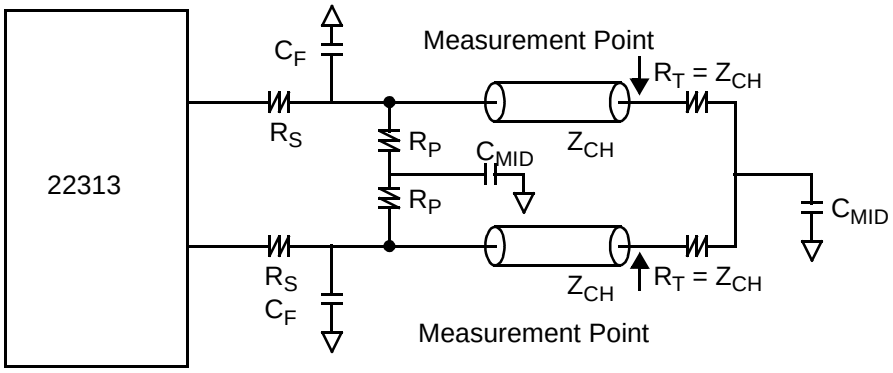


Figure 9. Direct Rambus Test Circuit

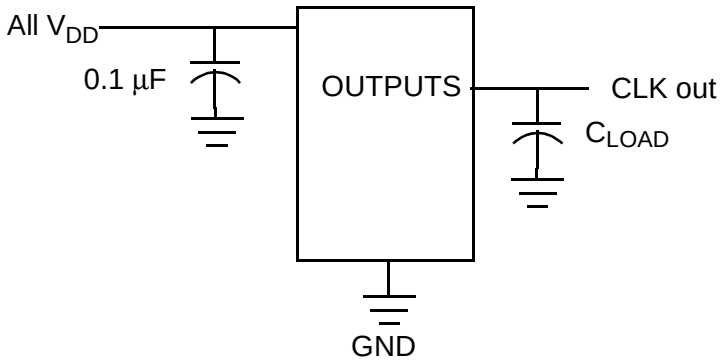


Figure 10. LCLK, 54MOUT Output Test Circuits

Table 1. Direct Rambus Test Circuit Component Values

Parameter	Description	Value	Tolerance	Unit
R_S	Series Resistor	68	±5%	Ω
R_P	Parallel Resistor	39	±5%	Ω
C_F	Edge-Rate Filter Capacitor[17]	15	±10%	pF
C_{MID}	AC Ground Capacitor	0.01	±20%	µF

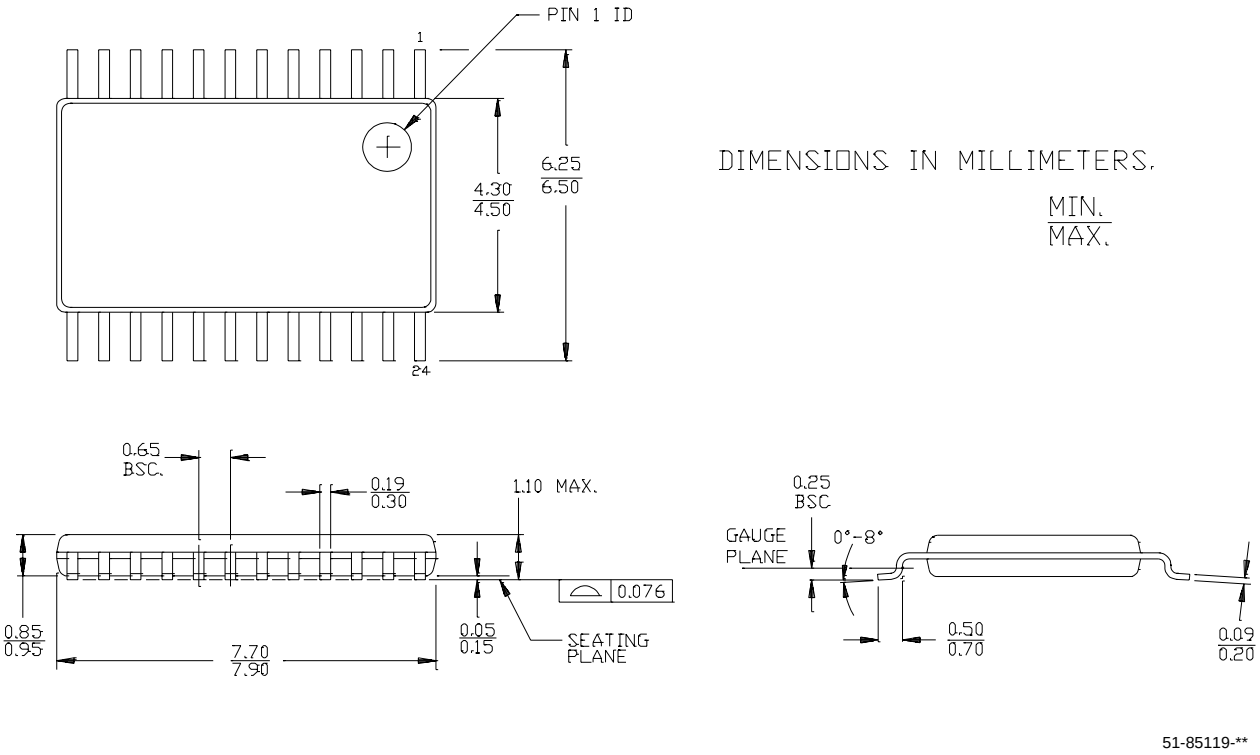
Ordering Information

Ordering Code	Package Name	Package Type	Operating Range	Operating Voltages
CY22313ZC	Z24	24-lead TSSOP	Commercial (T_A = 0°C to 85°C)	3.45V
CY22313ZCT	Z24	24-lead TSSOP – Tape and Reel	Commercial (T_A = 0°C to 85°C)	3.45V
CY22313LFZC[18]	Z24	24-lead TSSOP	Commercial (T_A = 0°C to 85°C)	3.45
CY22313LFZCT[18]	Z24	24-leadTSSOP – Tape and Reel	Commercial (T_A = 0°C to 85°C)	3.45

Notes:
17. CF is OPTIONAL filter capacitor for adjusting edge rates and EMI. No filter capacitors are used for characterization and test data.
18. This device is Pb free

Package Drawing and Dimensions

24-lead Thin Shrunk Small Outline Package (4.40-mm Body) Z24



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Document History Page

Document Title: CY22313 Two-PLL Clock Generator with Direct Rambus™ (Lite) Support Document Number: 38-07434				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	117092	07/02/02	CKN	New Data Sheet
*A	121365	11/15/02	CKN	Reordered Pin Description table Changed all 3.3V references to 3.45V Changed RI_FS min. spec to 60 KOhms Changed note 4 Inserted max. spec for Edge Rates Reduced min. spec for Edge Rates on 1.8V and 1.675V outputs Inserted phase noise specifications Created separate specs for Jitter, depending on output voltage Correctly specified CF in *Table 1*
*B	121773	02/17/03	CKN	Added t_{PU} row to the Recommended Operating Conditions table
*C	125454	05/19/03	CKN	Updated Switching Characteristics table Added CY22313LF ordering information and corresponding note