Low Jitter Spectrum Clock Generator for PowerPC Designs.

Approved Product

PRODUCT FEATURES

- Supports Power PC CPU's.
- Supports simultaneous PCI and Fast PCI Buses.
- Uses external buffer to reduce EMI and Jitter
- PCI synchronous clock.
- Fast PCI synchronous clock
- Separated 3.3 volt power supplies for reduced Jitter
- < 500 pS skew between CPU and PCI clocks
- Programmable features:
  - frequency selection
  - margin testing frequency increases
  - Output Enable for board level testing
  - CPU to PCI clock offset selection
- Independent VDD supplies for all output clocks
- 28-pin SSOP 209 mil. package
- **Spread Spectrum Technology for EMI reduction**
- Internal Crystal Load Capacitors for 20 pF parallel resonant crystal support.

FREQUENCY TABLE (MHz)

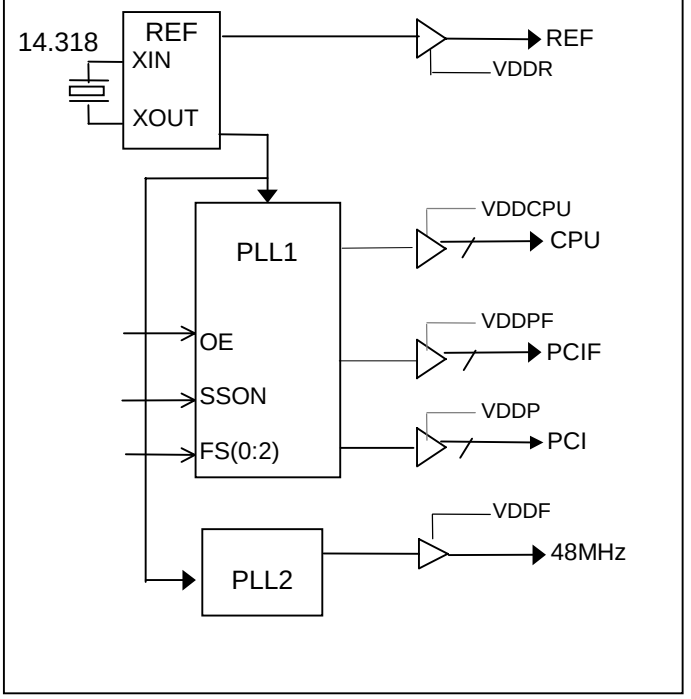
FS2	FS1	FS0	CPU	PCI	PCIF
0	0	0	90	30.0	60.0
0	0	1	94.5(90+5%)	31.5	63
0	1	0	66.6*	33.3*	66.6*
0	1	1	70(66+5%)**	35**	70**
1	0	0	100.0(99.6)*	33.3*	66.6*
1	0	1	105.0**	35.0**	69.9**
1	1	0	120.0(119.9)	30.0	60.0
1	1	1	133.0**	33.3**	66.6**

* indicates 0.5 % down spread spectrum capable

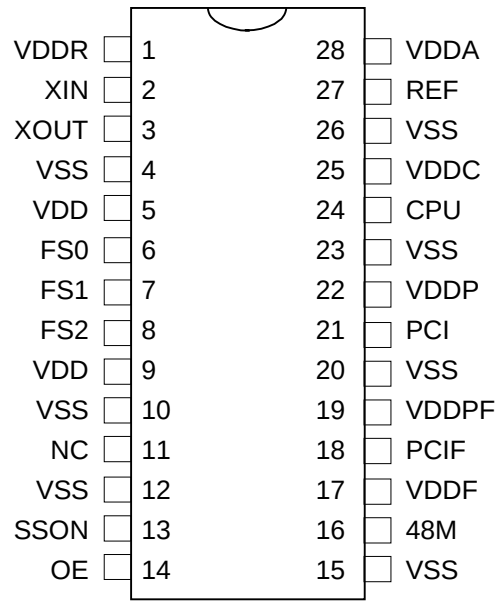
** See TEST MODE table for functional definition when SSON is low

TEST MODE. FUNCTIONALITY NOT GUARANTEED OVER FULL TEMPERATURE AND VOLTAGE

BLOCK DIAGRAM



CONNECTION DIAGRAM



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PIN DESCRIPTION

Pin Number	Pin Name	PWR	I/O	Description
2	**XIN**	VDD	I	These pins form an on-chip reference oscillator when connected to terminals of an external parallel resonant crystal (nominally 14.318 MHz). Xin may also serve as input for an externally generated reference signal. If the external input is used, Pin 3 is left unconnected.
3	**XOUT**	VDD	O	
18	**PCIF**	VDDP	O	66.6 Mhz FAST PCI clock rising edge synchronized to the CPU clock.
21	**PCI**	VDDP	O	33.3 Mhz PCI clock rising edge synchronized to the CPU clock.
17	**VDDF**	-	PWR	Power for 48 Mhz fixed clock buffer.
19	**VDDPF**	-	PWR	Power for FAST PCI (66 Mhz) clock buffer and PCIF (66 Mhz) clock buffer
22	**VDDP**	-	PWR	Power for PCI (33 Mhz) clock buffer and PCIF (66 Mhz) clock buffer
24	**CPU**	VDDC	O	CPU clock output. See table on page 1 for frequencies.
13	**SSON**	VDD	I PU	Spread Spectrum clock modulation pin. Enables Spread Spectrum EMI reduction when at a logic low (0) level. Has an internal pull-up resistor.
16	**48M**	VDDF	O	This pin is a fixed frequency 48 Mhz clock output.
14	**OE**	VDD	I	Output enable. When at logic level low causes all clock outputs to be in a Tri-state mode. Has internal pull-up resistor.
27	**REF**	VDD	O	This pin is a Buffered output copy of the crystal reference frequency.
6, 7, 8	**FS[0:2]**	VDD PU	I	Frequency selection input pins. See table on page 1 for functionality. Contain internal pull-up resistors.
4, 10, 12, 15, 20, 23, 26	**VSS**	-	PWR	Ground pins for the chip.
5, 9, 28	**VDD**	-	PWR	Power supply pins for analog circuit and core logic.
25	**VDDC**	-	PWR	Power supply for CPU clock output buffer.
1	**VDDR**	-	PWR	Power supply for reference clock output buffer.

A bypass capacitor (0.1μF) should be placed as close as possible to each Vdd pin. If these bypass capacitors are not close to the pins their high frequency filtering characteristic will be canceled by the lead inductance's of the traces.

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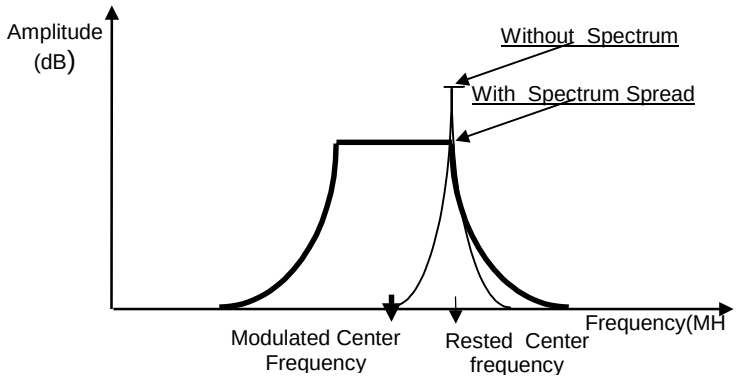
SPREAD SPECTRUM CLOCK GENERATION (SSCG)

Spread Spectrum is a modulation technique applied here for maximum efficiency in minimizing Electro-Magnetic Interference radiation generated from repetitive digital signals mainly clocks. A clock accumulates EM energy at the center frequency it is generating. Spread Spectrum distributes this energy over a small frequency bandwidth therefore spreading the same amount of energy over a spectrum. This technique is achieved by modulating the clock down from its resting frequency by a certain percentage (which also determines the energy distribution bandwidth). In this product, the modulation is 1.0% down from the resting frequency.



Spectrum Analysis

TEST MODE CONTROL TABLE

The FS0, 1 and 2 pin table on page 1 defines the function of these pins in setting the output clock frequencies. When the SSO# pin is brought to a logic low state the function of this table is modified. The following table indicates the effect of this signal when the SSON# pin is at low logic level

SSON	FS2	FS1	FS0	CPU	PCI	PCIF	48M	REF
0	0	0	0	90.0	30.0	60.0	48	14.318
0	0	0	1	94.5	31.5	63	48	14.318
0	0	1	0	66.6	33.3	66.6	48	14.318
0	0	1	1	TriState	TriState	TriState	TriState	TriState
0	1	0	0	100 SS	33.3 SS	66.6 SS	48	14.318
0	1	0	1	T2*	T2*	T2*	T2*	T2*
0	1	1	0	120	30	60	48	14.318
0	1	1	1	XIN/2	XIN/4	XIN/2	XIN	XIN

Note: (All frequencies are in Mhz, Xin defines the clock applied to the XIN pin for testing purposes, and SS = Spread Spectrum.) T2 is a IMI device test mode and is not intended for customer use.

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MAXIMUM RATINGS

Voltage Relative to VSS:	-0.3V
Voltage Relative to VDD:	0.3V
Storage Temperature:	-65ºC to + 150ºC
Operating Temperature:	0 ºC to +70 ºC
Maximum Power Supply:	7V

This device contains circuitry to protect the inputs against damage due to high static voltages or electric field; however, precautions should be taken to avoid application of any voltage higher than the maximum rated voltages to this circuit. For proper operation, Vin and Vout should be constrained to the range:

VSS<(Vin or Vout)<VDD

Unused inputs must always be tied to an appropriate logic voltage level (either VSS or VDD).

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Units	Conditions
Input Low Voltage	VIL	-	-	1.0	Vdc	-
Input High Voltage	VIH	2.3	-	-	Vdc	-
Input Low Current	IIL			-66	µA	
Input High Current	IIH			5	µA	
Tri-State leakage Current	Ioz	-	-	10	µA	
Dynamic Supply Current	Idd	-	-	100	mA	CPU = 100 MHz
Static Supply Current	Isdd	-	-	6	mA	OE = 0 (logic low)
Short Circuit Current	ISC	25	-	-	mA	1 output at a time - 30 seconds

VDD = VDDC = VDDP = VDDPF = VDDF = VDDR =3.15 - 3.45V , TA = 0ºC to +70ºC

SWITCHING CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Units	Conditions
Output Duty Cycle	-	45	50	55	%	Measured at 1.5V
Skew (CPU to CPU)	tSKEW1	-	-	±250	pS	30 pF Load Measured at 1.5V
Skew (CPU to PCI or PCIF)	tSKEW1	-	-	±375	pS	30 pF Load Measured at 1.5V
Skew (PCI or PCIF to PCI)	tSKEW2	-	-	±250	pS	30 pF Load Measured at 1.5V
ΔPeriod Adjacent Cycles	ΔPA	-	-	±250	pS	-
Jitter Spectrum Long term	ΔPL			±500	pS	Measured over 10 Seconds

VDD = VDDC= VDDP = VDDPF = VDDF = VDDR =3.15-3.45V, TA = 0ºC to +70ºC

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TB41 BUFFER CHARACTERISTICS FOR CPU, PCI, PCIF, REF and 48M						
Characteristic	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
Pull-Up Current Min	IOH_{min}	30	-	39	mA	Vout = Vdd - 0.5V
Pull-Up Current Max	IOH_{max}	75	-	109	mA	Vout = 1.5V
Pull-Down Current Min	IOL_{min}	30	-	40	mA	Vout = 0.4V
Pull-Down Current Max	IOL_{max}	75	-	103	mA	Vout = 1.2V
Rise/Fall Time Min Between 0.4 V and 2.4 V	TRF_{min}	0.5	-	-	nS	15 pF Load
Rise/Fall Time Max Between 0.4 V and 2.4 V	TRF_{max}	-	-	2.0	nS	30 pF Load
VDD = VDDP = VDDPF = VDDF = VDDR =3.15 - 3.45 V , TA = 0ºC to +70ºC						

CRYSTAL AND REFERENCE OSCILLATOR PARAMETERS						
Characteristic	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
Frequency	F_o	12.00	14.31818	16.00	MHz	
Tolerance	TC	-	-	+/-100	PPM	Calibration note 1
	TS	-	-	+/- 100	PPM	Stability (Ta -10 to +60C) note 1
	TA	-	-	5	PPM	Aging (first year @ 25C) note 1
Mode	OM	-	-	-		Parallel Resonant
Pin Capacitance	CP		36		pF	Capacitance of XIN and Xout pins to ground (each)
DC Bias Voltage	V_{BIAS}	0.3Vdd	Vdd/2	0.7Vdd	V	
Startup time	Ts	-	-	30	µS	
Load Capacitance	CL	-	20	-	pF	The crystals rated load. note 1
Effective Series resistance (ESR)	R1	-	-	40	Ohms	
Power Dissipation	DL	-	-	0.10	mW	note 1
Shunt Capacitance	CO	-	--	8	pF	crystals internal package capacitance (total)
For maximum accuracy, the total circuit loading capacitance should be equal to CL. This loading capacitance is the effective capacitance across the crystal pins and includes the device pin capacitance (CP) in parallel with any circuit traces, the clock generator and any onboard discrete load capacitors. Budgeting Calculations Typical trace capacitance, (< half inch) is 4 pF, Load to the crystal is therefore = 2.0 pF Clock generator internal pin capacitance of 36 pF, Load to the crystal is therefore = 18.0 pF the total parasitic capacitance would therefore be = 20.0 pF.						

Note 1: It is recommended but not mandatory that a crystal meets these specifications.

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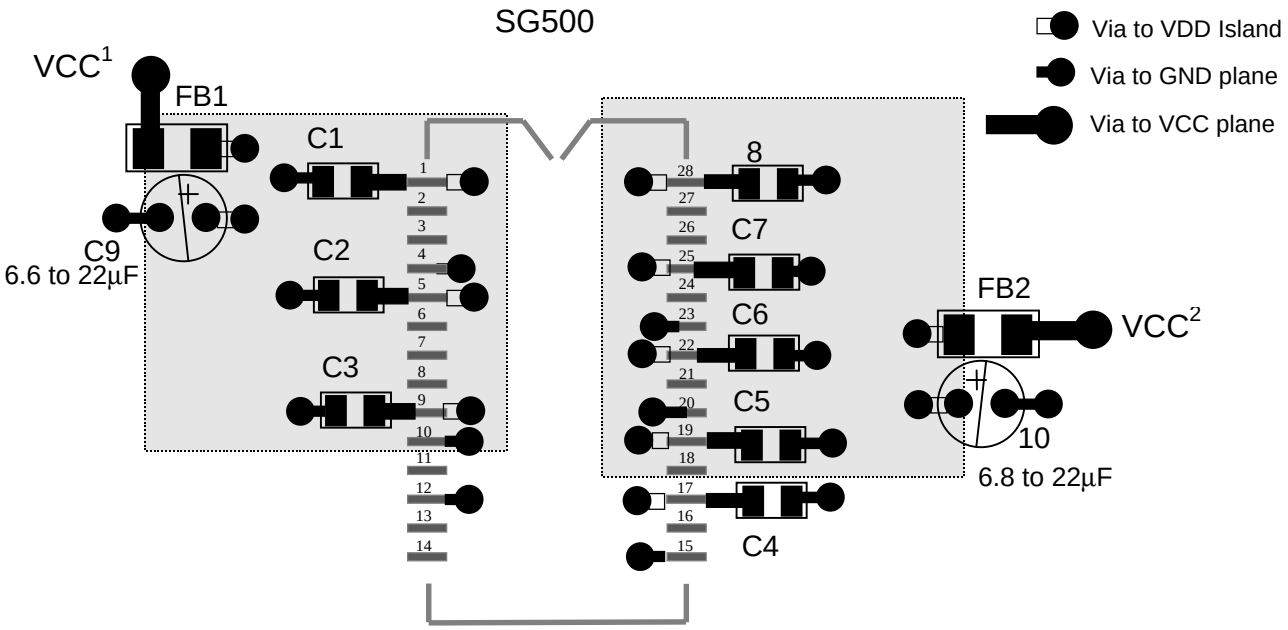
PCB LAYOUT SUGGESTION



This is only a layout recommendation for best performance and lower EMI. The designer may choose a different approach but C3, C4, C35, C36, C37, C38, C39 and C40 (all are 0.1µf) should always be used and placed as close as possible to their VDD pins.

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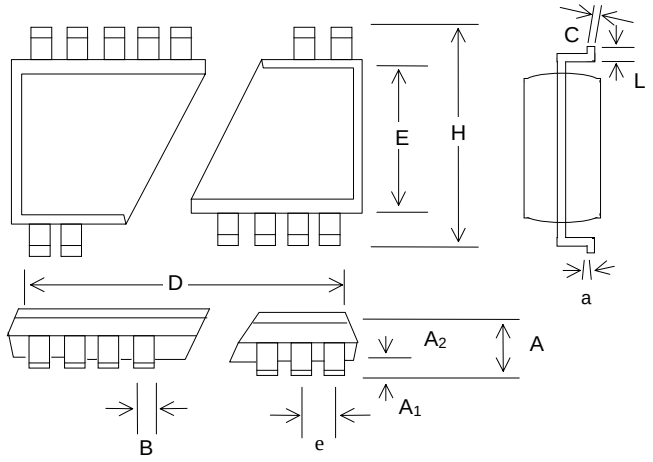
PACKAGE DRAWING AND DIMENSIONS



28 PIN SSOP OUTLINE DIMENSIONS

SYMBOL	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.068	0.073	0.078	1.73	1.86	1.99
A_1	0.002	0.005	0.008	0.05	0.13	0.21
A2	0.066	0.068	0.070	1.68	1.73	1.78
B	0.010	0.012	0.015	0.25	0.30	0.38
C	0.005	0.006	0.009	0.13	0.15	0.22
D	0.397	0.402	0.407	10.07	10.20	10.33
E	0.205	0.209	0.212	5.20	5.30	5.38
e	0.0256 BSC			0.65 BSC		
H	0.301`	0.307	0.311	7.65	7.80	7.90
a	0°	4°	8°	0°	4°	8°
L	0.022	0.030	0.037	0.55	0.75	0.95

ORDERING INFORMATION

Part Number	Package Type	Production Flow
SG500DYB	28 PIN SSOP	Commercial, 0ºC to +70ºC

Note: The ordering part number is formed by a combination of device number, device revision, package style, and screening as shown below.

Marking: Example: IMI
SG500DYB
Date Code, Lot #

SG500DYB

- Flow
  B = Commercial, 0ºC to + 70ºC
- Package
  Y = SSOP
- Revision
- IMI Device Number