

April 2000

1.0 Features

- Three PLLs with deep reference, feedback, and post dividers to provide precision clock frequencies
- Multiple outputs provide several clocking options
- Outputs may be tristated for board testing
- S0, S1, and S2 inputs modify output frequencies for design flexibility
- 3.3V operation
- Accepts 5 to 30MHz crystals (see Frequency Table for specific reference frequencies required)
- Custom frequency patterns, pinouts, and packages are available. Contact your local AMI Sales Representative for more information.

2.0 Description

The FS6322 is a ROM-based CMOS clock generator IC designed to minimize cost and component count in a variety of electronic systems.

Three low-jitter phase-locked loops (PLLs) drive up to five low-skew clock outputs to provide a high degree of flexibility. The device is packaged in a 16-pin SOIC to minimize board space.

High-resolution divider capability permits generation of desired frequencies.

Figure 1: Pin Configuration

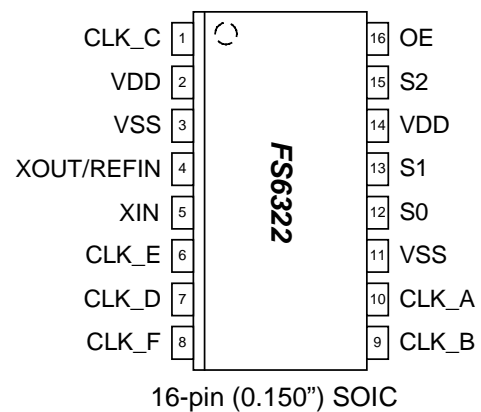
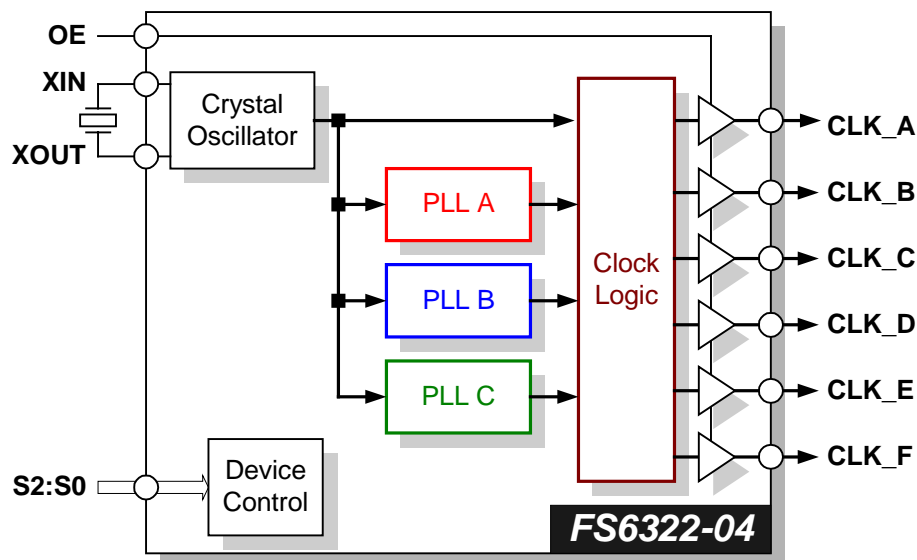


Figure 2: Block Diagram



FS6322-04

Three-PLL Clock Generator IC



April 2000

Table 1: Pin Descriptions

Key: AI = Analog Input; AO = Analog Output; DI = Digital Input; DI^U = Input with Internal Pull-Up; DI_D = Input with Internal Pull-Down; DIO = Digital Input/Output; DI-3 = Three-Level Digital Input, DO = Digital Output; P = Power/Ground; # = Active Low pin

PIN	TYPE	NAME	DESCRIPTION
1	DO	CLK_C	C clock output
2	P	VDD	Power supply (3.3V nominal – see version specific information)
3	P	VSS	Ground
4	AI	XOUT / REFIN	Crystal oscillator drive / external reference input
5	AO	XIN	Crystal oscillator feedback
6	DO	CLK_E	E clock output
7	DO	CLK_D	D clock output
8	DO	CLK_F	F clock output
9	DO	CLK_B	A clock output
10	DO	CLK_A	B clock output
11	P	VSS	Ground
12	DI ^U	S0	Frequency select control input
13	DI ^U	S1	Frequency select control input
14	P	VDD	Power supply (5V to 3.3V)
15	DI ^U	S2	Frequency select control input
16	DI ^U	OE	Output enable input: logic-high enables outputs; logic-low tristates outputs (high impedance)

Table 2: Frequency Table – FS6322-04 (3.3volt)

S2	S1	S0	FREF	CLK_A (pin 10)	CLK_B (pin 9)	CLK_C (pin 1)	CLK_D (pin 7)	CLK_E (pin 6)	CLK_F (pin 8)
0	0	0	29.838	0.00000	48.00026 (F _{REF} *37/23)	0.00000	24.61635 (F _{REF} *33/40)	29.83800 (F _{REF})	0.00000
0	0	1	27.000	2.81600 (F _{REF} *352/3375)	24.57600 (F _{REF} *1024/1125)	11.28960 (F _{REF} *784/1875)	0.00000	27.00000 (F _{REF})	0.00000
0	1	0	DO NOT USE						
0	1	1	DO NOT USE						
1	0	0	29.838	0.00000	48.00026 (F _{REF} *37/23)	29.49105 (F _{REF} *85/86)	24.61635 (F _{REF} *33/40)	29.83800 (F _{REF})	0.00000
1	0	1	27.000	2.81600 (F _{REF} *352/3375)	24.57600 (F _{REF} *1024/1125)	5.63200 (F _{REF} *704/3375)	0.00000	27.00000 (F _{REF})	0.00000
1	1	0	DO NOT USE						
1	1	1	DO NOT USE						

April 2000

3.0 Electrical Specifications

Table 3: Absolute Maximum Ratings

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. These conditions represent a stress rating only, and functional operation of the device at these or any other conditions above the operational limits noted in this specification is not implied. Exposure to maximum rating conditions for extended conditions may affect device performance, functionality, and reliability.

PARAMETER	SYMBOL	MIN.	MAX.	UNITS
Supply Voltage, dc ($V_{SS} = \text{ground}$)	V_{DD}	$V_{SS}-0.5$	7	V
Input Voltage, dc	V_I	$V_{SS}-0.5$	$V_{DD}+0.5$	V
Output Voltage, dc	V_O	$V_{SS}-0.5$	$V_{DD}+0.5$	V
Input Clamp Current, dc ($V_I < 0$ or $V_I > V_{DD}$)	I_{IK}	-50	50	mA
Output Clamp Current, dc ($V_I < 0$ or $V_I > V_{DD}$)	I_{OK}	-50	50	mA
Storage Temperature Range (non-condensing)	T_S	-65	150	°C
Ambient Temperature Range, Under Bias	T_A	-55	125	°C
Junction Temperature	T_J		150	°C
Lead Temperature (soldering, 10s)			260	°C
Input Static Discharge Voltage Protection (MIL-STD 883E, Method 3015.7)			2	kV



CAUTION: ELECTROSTATIC SENSITIVE DEVICE

Permanent damage resulting in a loss of functionality or performance may occur if this device is subjected to a high-energy electrostatic discharge.

Table 4: Operating Conditions

PARAMETER	SYMBOL	CONDITIONS/DESCRIPTION	MIN.	TYP.	MAX.	UNITS
Supply Voltage	V_{DD}	$3.3V \pm 10\%$	3	3.3	3.6	V
Ambient Operating Temperature Range	T_A		0		70	°C
Crystal Resonator Frequency	f_{XIN}		5		30	MHz
Output Load Capacitance	C_L				20	pF

FS6322-04

Three-PLL Clock Generator IC



April 2000

Table 5: DC Electrical Specifications

Unless otherwise stated, $V_{DD} = 3.3V \pm 10\%$, no load on any output, and ambient temperature range $T_A = 0^\circ C$ to $70^\circ C$. Parameters denoted with an asterisk (*) represent nominal characterization data and are not production tested to any specific limits. Where given, MIN and MAX characterization data are $\pm 3\sigma$ from typical. Negative currents indicate current flows out of the device.

PARAMETER	SYMBOL	CONDITIONS/DESCRIPTION	MIN.	TYP.	MAX.	UNITS
Overall						
Supply Current, Dynamic, with Loaded Outputs	I_{DD}	$f_{XTAL} = 27MHz$; $C_L = 0pF$, $V_{DD} = 3.3V$ FS6322-04: S[2:0]=[100]		20		mA
Digital Inputs (OE, S2, S0)						
High-Level Input Voltage	V_{IH}		2.4		$V_{DD}+0.3$	V
Low-Level Input Voltage	V_{IL}		$V_{SS}-0.3$		0.8	V
High-Level Input Current	I_{IH}	$V_{IN} = V_{DD}$	-1		1	μA
Low-Level Input Current (pull-up)	I_{IL}	$V_{IN} = 0V$		-8		μA
Digital Inputs (S1)						
High-Level Input Voltage	V_{IH}		2.4		$V_{DD}+0.3$	V
Low-Level Input Voltage	V_{IL}		$V_{SS}-0.3$		0.8	V
High-Level Input Current	I_{IH}	$V_{IN} = V_{DD}$	-1		1	μA
Low-Level Input Current (pull-up)	I_{IL}	$V_{IN} = 0V$		-16		μA
Crystal Oscillator						
Crystal Loading Capacitance	$C_{L(xtal)}$	As seen by a crystal connected to XIN and XOUT		16		pF
Crystal Drive Level		$R_{XTAL}=20\Omega$		200		μW
Clock Outputs (CLKA, CLKB)						
Output Current High	I_{OH}	$V_O = 2.4V$	-4			mA
Output Current Low	I_{OL}	$V_O = 0.4V$	4			mA
Short Circuit Source Current *	I_{OSH}	$V_O = 0V$; shorted for 30s, max.		-25		mA
Short Circuit Sink Current *	I_{OSL}	$V_O = 3.3V$; shorted for 30s, max.		30		mA
Output Impedance *	Z_{OH}	$V_O = 0.5V_{DD}$; output driving high		70		Ω
	Z_{OL}	$V_O = 0.5V_{DD}$; output driving low		55		

April 2000

Table 6: AC Timing Specifications

Unless otherwise stated, $V_{DD} = 3.3V \pm 10\%$, no load on any output, and ambient temperature range $T_A = 0^\circ C$ to $70^\circ C$. Parameters denoted with an asterisk (*) represent nominal characterization data and are not production tested to any specific limits. Where given, MIN and MAX characterization data are $\pm 3\sigma$ from typical.

PARAMETER	SYMBOL	CONDITIONS/DESCRIPTION	CLOCK (MHz)	MIN.	TYP.	MAX.	UNITS
Clock Output (CLK_X)							
Duty Cycle *		Crystal oscillator derived outputs Measured @ 1.4V; $C_L = 20pF$		43	51	57	%
Duty Cycle *		PLL derived outputs Measured @ 1.4V; $C_L = 20pF$		45	51	55	%
Rise Time *	t_r	$V_O = 0.4V$ to $2.4V$; $C_L = 20pF$			2.2		ns
Fall Time *	t_f	$V_O = 2.4V$ to $0.4V$; $C_L = 20pF$			1.8		ns
Jitter, Period (RMS) *	$t_{j(1\sigma)}$	From rising edge to next rising edge at $V_{DD}/2$, $C_L = 20pF$			50		ps
Jitter, Period (peak-peak) *	$t_{j(\Delta P)}$	From rising edge to next rising edge at $V_{DD}/2$, $C_L = 20pF$			400		ps
Jitter, Cumulative (RMS)*	$t_{j(LT)}$	PLL-derived outputs From 0-500 μs at $V_{DD}/2$, $C_L = 20pF$ compared to ideal clock source			100		ps
Phase Noise *		PLL derived outputs @ 100KHz offset from fundamental			-80		dBc/Hz

FS6322-04

Three-PLL Clock Generator IC



April 2000

4.0 Package Information

Table 7: 16-pin SOIC (0.150") Package Dimensions

	DIMENSIONS			
	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.061	0.068	1.55	1.73
A1	0.004	0.0098	0.102	0.249
A2	0.055	0.061	1.40	1.55
B	0.013	0.019	0.33	0.49
C	0.0075	0.0098	0.191	0.249
D	0.386	0.393	9.80	9.98
E	0.150	0.157	3.81	3.99
e	0.050 BSC		1.27 BSC	
H	0.230	0.244	5.84	6.20
h	0.010	0.016	0.25	0.41
L	0.016	0.035	0.41	0.89
Θ	0°	8°	0°	8°

Table 8: 16-pin SOIC (0.150") Package Characteristics

PARAMETER	SYMBOL	CONDITIONS/DESCRIPTION	TYP.	UNITS
Thermal Impedance, Junction to Free-Air 16-pin 0.150" SOIC	Θ_{JA}	Air flow = 0 m/s	95	°C/W
Lead Inductance, Self	L_{11}	Corner lead	4.0	nH
		Center lead	3.0	
Lead Inductance, Mutual	L_{12}	Any lead to any adjacent lead	0.4	nH
Lead Capacitance, Bulk	C_{11}	Any lead to V_{SS}	0.5	pF



FS6322-04

Three-PLL Clock Generator IC

April 2000

5.0 Ordering Information

ORDERING CODE	DEVICE NUMBER	PACKAGE TYPE	OPERATING TEMPERATURE RANGE	SHIPPING CONFIGURATION
11825-102	FS6322-04	16-pin (0.150") SOIC (Small Outline Package)	0° C to 70° C (Commercial)	Tape and Reel
11825-112	FS6322-04	16-pin (0.150") SOIC (Small Outline Package)	0° C to 70° C (Commercial)	Tubes

Copyright © 2000 American Microsystems, Inc.

Devices sold by AMI are covered by the warranty and patent indemnification provisions appearing in its Terms of Sale only. AMI makes no warranty, express, statutory implied or by description, regarding the information set forth herein or regarding the freedom of the described devices from patent infringement. AMI makes no warranty of merchantability or fitness for any purposes. AMI reserves the right to discontinue production and change specifications and prices at any time and without notice. AMI's products are intended for use in commercial applications. Applications requiring extended temperature range, unusual environmental requirements, or high reliability applications, such as military, medical life-support or life-sustaining equipment, are specifically not recommended without additional processing by AMI for such applications.

American Microsystems, Inc., 2300 Buckskin Rd., Pocatello, ID 83201, (208) 233-4690, FAX (208) 234-6796, WWW Address: <http://www.amis.com> E-mail: tgp@amis.com