

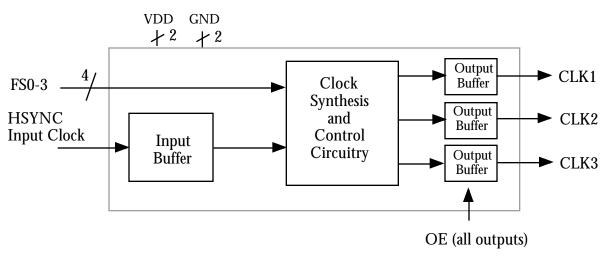
# Description

The MK1573 GenClock<sup>™</sup> provides genlock timing for video overlay systems. The device accepts the horizontal sync (HSYNC) signal as the input reference clock, and generates a frequencylocked high speed output. Stored in the device are the multipliers for 16 combinations of popular frequencies for analog and digital TV and set-top box systems. Frequency-locked outputs include 1X, 4X, and 8X the subcarrier frequencies of NTSC and PAL systems, and 27MHz plus 13.5MHz for digital video systems. In most selections, the chip recovers the HSYNC clock by outputting a low jitter 50% duty cycle version of HSYNC. Also available is an inverted recovered HSYNC clock, and a double speed recovered HSYNC clock.

MicroClock can customize this device for any other different frequencies.

#### Features

- Packaged in 16 pin narrow (150 mil) SOIC
- The -02 version has one frequency changed (32MHz was added), and tracks the HSYNC better than the -01 version.
- Exact ratios stored in the device eliminate the need for external dividers
- Accepts HSYNC of 15.625kHz or 15.73426kHz
- Highly accurate frequency generation within 1 ppm
- Generates NTSC/PAL subcarrier frequencies, and 4X and 8X of those frequencies
- Generates 27MHz and 13.5MHz
- 2X HSYNC clock available
- Recovered HSYNC clock available
- Inverted HSYNC clock available
- 4.5V to 5.5V operation



# **Block Diagram**



#### **Pin Assignment**

#### HSYNC □ 1 16 🛛 FS3 VDD $\square 2$ 15 🗆 N/C VDD $\square$ 3 14 🛛 FS2 CAP1 $\Box$ 4 13 🗆 FS1 12 🗖 CLK2 GND $\Box$ 5 CAP2 6 $11 \square OE$ GND 7 10 🗆 CLK1 FS0 8 9 CLK3 16 pin (150 mil) SOIC

#### **Output Clocks Decoding Table MK1573-02 (MHz)**

Decode	Address	HSYNC	Multiplier	CLK 1	CLK 2	CLK 3
FS3:0	(Hex)	pin 1	On-chip	pin 10	pin 12	pin 9
0000	0	15.625k	1536	24M	12M	15.625k
0001	1	15.734264k	1525 1/3	24M	12M	15.734264k
0010	2	15.625k	1728	27M	13.5M	15.625k
0011	3	15.734264k	1716	27M	13.5M	15.734264k
0100	4	15.625k	960	15M	7.5M	15.625k
0101	5	15.734264k	953 1/3	15M	7.5M	15.734264k
0110	6	15.625k	3840	60M	30M	15.625k
0111	7	15.734264k	3840	60.41957M	30.20979M	15.734264k
1000	8	15.625k	2270	35.46875M	17.734375M	4.433594M
1001	9	15.734264k	1820	28.63636M	14.31818M	3.579545M
1010	Α	15.625k	2270	35.46875M	15.625k	15.625k
1011	В	15.734264k	1820	28.63636M	15.734264k	15.734264k
1100	С	15.625k	2048	32M	16M	15.625k
1101	D	15.734264k	808	12.71329M	15.734264k	31.4685k
1110	Е	15.625k	2270	35.46875M	15.625k	31.25k
1111	F	15.734264k	1820	28.63636M	15.734264k	31.4685k

• 0 = connect directly to ground, 1 = connect directly to VDD.

• CLK2 is a recovered HSYNC (with 50% duty cycle) on selections in italic.

• HSYNC reference outputs on CLK3 (in italic) are inverted, recovered HSYNC.

# **Pin Descriptions**

Number	Name	Туре	Description	
1	HSYNC	Ι	HSYNC clock input. The output clocks are synchronized to the HSYNC falling edge.	
2	VDD	Р	Connect to +5V.	
3	VDD	Р	Connect to +5V.	
4	CAP1	Ι	Connect a 0.01µF ceramic capacitor and a 39k resistor in series between this pin and CAP2.	
5	GND	Р	Connect to ground.	
6	CAP2	Ι	Connect a 0.01µF ceramic capacitor and a 39k resistor in series between this pin and CAP1.	
7	GND	Р	Connect to ground.	
8	FS0	Ι	Frequency Select 0. Determines CLK outputs (with given input) per table above.	
9	CLK3	0	Clock 3 determined by status of FS3:0 per table above.	
10	CLK1	0	Clock 1 determined by status of FS3:0 per table above.	
11	OE	Ι	Output Enable. Tri-states the three output clocks when low.	
12	CLK2	0	Clock 2 determined by status of FS3:0 per table above.	
13	FS1	Ι	Frequency Select 1. Determines CLK outputs (with given input) per table above.	
14	FS2	Ι	Frequency Select 2. Determines CLK outputs (with given input) per table above.	
15	N/C	-	No Connect. Nothing is connected to this pin.	
16	FS3	Ι	Frequency Select 3. Determines CLK outputs (with given input) per table above.	

Type: I = Input, O = output, P = power supply connection



# **External Components/Crystal Selection**

The MK1573 requires a minimum number of external components for proper operation. A  $0.1\mu$ F low leakage capacitor (see Capacitor Selection on following page) should be connected between CAP1 and CAP2 as close to the chip as possible. A high quality ceramic capacitor is recommended. A decoupling capacitor of  $0.1\mu$ F must be connected between VDD and GND pins (pins 2 and 3, 5 and 7) close to the chip, and 33 terminating resistors can be used on clock outputs with traces longer than 1 inch.

# **Electrical Specifications**

Parameter	Conditions	Minimum	Typical	Maximum	Units
ABSOLUTE MAXIMUM RATINGS (1	Note 1)				
Supply Voltage, VDD	Referenced to GND			7	V
Inputs and Clock Outputs		-0.5		VDD+0.5	V
Ambient Operating Temperature		0		70	°C
Soldering Temperature	Max of 10 seconds			250	°C
Storage Temperature		-65		150	°C
DC CHARACTERISTICS (VDD = 5V	unless noted)				
Operating Voltage, VDD		4.5		5.5	V
Input High Voltage, VIH		2			V
Input Low Voltage, VIL				0.8	V
Output High Voltage	IOH=-4mA	VDD-0.4			V
Output High Voltage	IOH=-25mA	2.4			V
Output Low Voltage	IOL=25mA			0.4	V
Operating Supply Current, IDD	No Load, VDD=5.0V		15		mA
Short Circuit Current	Each output		±100		mA
Input Capacitance			7		pF
			0	1	ppm
AC CHARACTERISTICS (VDD = 5V	unless noted)				
Input Frequency, NTSC			15.734264		kHz
Input Frequency, PAL			15.625		kHz
Output Clock Rise Time	0.8 to 2.0V			1.5	ns
Output Clock Fall Time	2.0 to 0.8V			1.5	ns
Output Clock Duty Cycle, High Time	At VDD/2	40	49 to 51	60	%
Absolute Clock Period Jitter			TBD		ps
Output Enable Time, OE high to outputs on				50	ns
Output Disable Time, OE low to tri-state				3	μs

Notes:

1. Stresses beyond those listed under Absolute Maximum Ratings could cause permanent damage to the device. Prolonged exposure

to levels above the operating limits but below the Absolute Maximums may affect device reliability. 2. Most selections have zero ppm error. Some selections have a maximum of 1 ppm synthesis error .



# Loop Bandwidth and Loop Filter Component Selection

The series connected capacitor and resistor between CAP1 and CAP2 (pins 4 and 6) determine the dynamic characteristics of the phase-locked loop. The capacitor must have very low leakage, therefor a high quality ceramic capacitor is recommended. DO NOT use any type of polarized or electrolytic capacitor. The values of the RC network determine the bandwidth of the PLL.

The tracking of the jitter on the HSYNC input improves with increasing values of R and decreasing values of C, until a point is reached where the loop starts becoming unstable. At that point, HSYNC tracking becomes unreliable. Loop filter values between 470pF and 0.01 $\mu$ F, and 18k and 120k will work for most application where the PLL must track HSYNC jitter with minimum error. A good starting point is 680pF and 82k . The optimum values should be determined by the spectral characteristics of the HSYNC jitter.

The following formula gives the approximate loop bandwidth for the MK1573:

$$fbw = \frac{537}{\sqrt{fclk1 \cdot C}}$$
 where: fbw is the loop bandwidth in Hertz  
fclk1 is the frequency of CLK1 in Hertz

C is the value of capacitor in Farads

For example, if CLK1 is running at 24MHz and C=1000pF, then

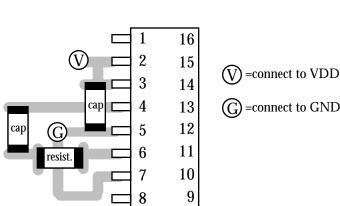
$$fbw = \frac{537}{\sqrt{24x10^6 \cdot 1x10^{-9}}} = 3.47 \text{kHz}$$

If minimum absolute jitter is required, the RC network should be replaced by a single capacitor with a value between  $0.01\mu$ F and  $2\mu$ F. Larger values will cause the PLL to start more slowly. For example, if C= $2\mu$ F, the loop may take several seconds to start.

### **PC Board Layout**

A proper board layout is critical to the successful use of the MK1573. In particular, the CAP1 and CAP2 pins are very sensitive to noise and leakage (CAP1 at pin 4 is the most sensitive). Traces must be as short as possible and the capacitor and resistor must be mounted next to the device as shown to the right. The capacitor connected between pins 3 and 5 is the power supply decoupling capacitor.

The high frequency output clocks on CLK1 and CLK2 may benefit from a series 33 resistor connected close to the pin (not shown).



# Video Clock Multipliers/Accuracies

In the table on page 2 are the actual multipliers stored in the MK1573-02 ROM, which shows that the accuracies are within one ppm for the output clocks.

MDS 1573-02 B	4	Revision 120497	Printed 11/15/00
Integrated Circuit Systems,	Inc. • 525 Race Street • San Jose • CA •	95126•(408)295-9800t	el•www.icst.com



### **Clock Waveforms**

In addition to generating the video clock on CLK1 (pin 10), the MK1573 also outputs the recovered HSYNC clocks. On certain selections, a double speed recovered HSYNC clock is also available. These recovered clocks will have lower jitter than the HSYNC input due to the filtering action of the PLL. The jitter spectrum of the recovered clocks will be reduced at frequencies higher than the loop bandwidth. The above section describes how to calculate the approximate loop bandwidth. The waveforms of the recovered clocks fall into one of three different groups depending on the address selection:

Addresses 0 to 7 and C	HSYNC		
	CLK3		

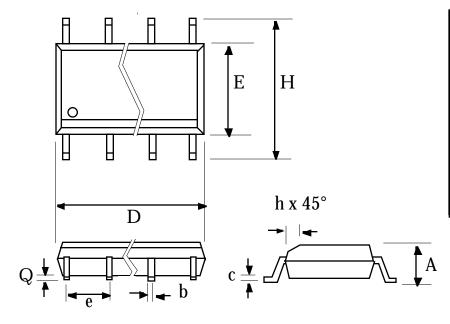
Addresses A and B	HSYNC	
	CLK2	
	CLK3	

Addresses D, E, and F	HSYNC	
	CLK2	

The recovered clocks are triggered by the falling edge of HSYNC and are delayed by about 100ns.



#### **Package Outline and Package Dimensions**



#### 16 pin SOIC narrow

	Inches		Millin	neters
Symbol	Min	Max	Min	Max
A	0.055	0.070	1.397	1.778
b	0.013	0.019	0.330	0.483
С	0.007	0.010	0.191	0.254
D	0.385	0.400	9.779	10.160
Е	0.150	0.160	3.810	4.064
Н	0.225	0.245	5.715	6.223
e	.050 B	SC	1.27 B	SC
h		0.016		0.406
Q	0.004	0.01	0.102	0.254

### **Ordering Information**

Part/Order Number	Marking	Package	Temperature
MK1573-02S	MK1573-02S	16 pin narrow SOIC	0-70°C
MK1573-02STR	MK1573-02S	Add Tape & Reel	0-70°C

While the information presented herein has been checked for both accuracy and reliability, MicroClock Incorporated assumes no responsibility for either its use or for the infringement of any patents or other rights of third parties, which would result from its use. No other circuits, patents, or licenses are implied. This product is intended for use in normal commercial applications. Any other applications such as those requiring extended temperature range, high reliability, or other extraordinary environmental requirements are not recommended without additional processing by MicroClock. MicroClock reserves the right to change any circuitry or specifications without notice. MicroClock does not authorize or warrant any MicroClock product for use in life support devices or critical medical instruments.

#### CHANGE HISTORY

Version	Date first published	<u>Comments</u>
Α	10/18/96	Original
В	12/4/97	Final version

GenClock is a trademark of MicroClock Incorporated

#### ©1996 MicroClock Incorporated