



# ICS507-01/02 PECL Clock Synthesizer

## Description

The ICS507-01 and ICS507-02 are inexpensive ways to generate a low jitter 155.52 MHz (or other high speed) differential PECL clock output from a low frequency crystal input. Using Phase-Locked-Loop (PLL) techniques, the devices use a standard fundamental mode crystal to produce output clocks up to 200 MHz.

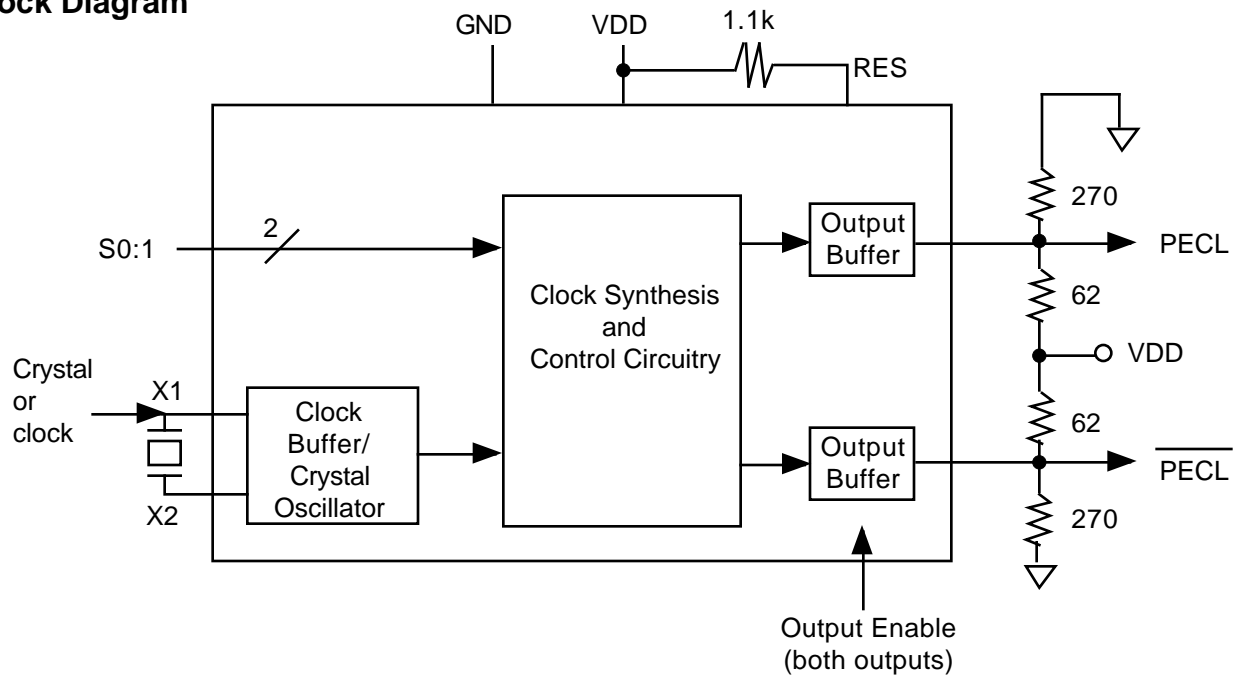
Stored in each chip's ROM is the ability to generate a selection of different multiples of the input reference frequency, including an exact 155.52 MHz clock from common crystals. For lowest jitter and phase noise on a 155.52 MHz clock, a 19.44 MHz crystal and the x8 selection can be used.

This product is intended for clock generation. It has low output jitter (variation in the output period), but input to output skew and jitter are not defined nor guaranteed. For applications which require defined input to output timing, use the ICS527-02.

## Features

- Packaged as 16 pin narrow SOIC
- Input crystal frequency of 5 - 27 MHz
- Input clock frequency of 5 - 52 MHz
- Enable usage of common low-cost crystal
- Differential PECL output clock frequencies up to 200 MHz
- Duty cycle of 49/51
- Operation voltage of 3.3 V or 5.0 V ( $\pm 5\%$ )
- Ideal for SONET applications and oscillator manufacturers
- Advanced, low power CMOS process
- Industrial temperature versions available
- Available in die form

## Block Diagram

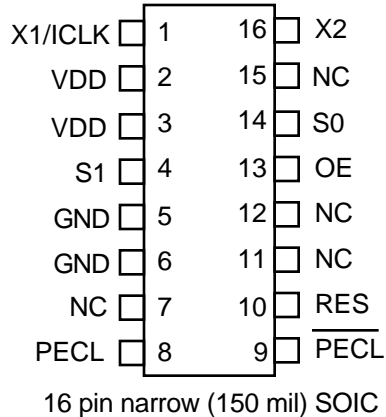


Output resistor values shown are for unterminated lines. Refer to MAN09 for additional information.



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## Pin Assignment



## Clock Multiplier Select Table

S1	S0	Multiplier
0	0	9.72X*
0	M	10X
0	1	12X
M	0	6.25X
M	M	8X
M	1	5X
1	0	2X
1	M	3X
1	1	4X

\*For ICS 507-01 or ICS507-02 at 3.3V, use this selection to get 155.52 MHz from a 16 MHz input. ICS507-02 at 5V requires a minimum input of 17.5 MHz on this setting.

For lowest phase noise generation of 155.52 MHz, use a 19.44 MHz crystal and the 8X selection.

0 = connect pin directly to ground  
 1 = connect pin directly to VDD  
 M = leave unconnected (floating)

## Pin Descriptions

Number	Name	Type	Description
1	X1/ICLK	XI	Crystal or clock connection. Connect to a fundamental parallel mode crystal, or clock.
2	VDD	P	VDD. Connect to +3.3 V or +5 V, and to VDD on pin 3.
3	VDD	P	VDD. Connect to VDD on pin 2. Decouple with pin 5.
4	S1	TI	Multiplier select pin 1. Determines output frequency per table above.
5	GND	P	Connect to ground.
6	GND	P	Connect to ground.
7	NC	-	No connect. No internal connection.
8	PECL	O	PECL Output. Connect to resistor load as shown on page one.
9	PECL	O	Complementary PECL Output. Connect to resistor load as shown on page one.
10	RES	I	Bias Resistor Input. Connect a resistor between this pin and VDD.
11	NC	-	No connect. No internal connection.
12	NC	-	No connect. No internal connection.
13	OE	I	Output Enable. Tri-states both outputs when low. Internal pull-up.
14	S0	TI	Multiplier select pin 0. Determines output frequency per table above.
15	NC	-	No connect. No internal connection.
16	X2	XO	Crystal connection. Connect to crystal, or leave unconnected for clock input.

Key: I=Input, O=output, TI=tri-level input, P=power supply connection; XI, XO=crystal connections



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## Electrical Specifications

Parameter	Conditions	Minimum	Typical	Maximum	Units
<b>ABSOLUTE MAXIMUM RATINGS (stresses beyond these can permanently damage the device)</b>					
Supply Voltage, VDD	Referenced to GND			7	V
Inputs	Referenced to GND	-0.5		VDD+0.5	V
Clock Output	Referenced to GND	-0.5		VDD+0.5	V
Ambient Operating Temperature	ICS507M-0x	0		70	°C
	ICS507M-0xl	-40		85	°C
Soldering Temperature	Max of 20 seconds			260	°C
Storage temperature		-65		150	°C
<b>DC CHARACTERISTICS (VDD = 5.0 V unless otherwise noted)</b>					
Operating Voltage, VDD		3.0		5.5	V
Input High Voltage, VIH	ICLK only	VDD/2 + 1	VDD/2		V
Input Low Voltage, VIL	ICLK only		VDD/2	VDD/2-1	V
Input High Voltage, VIH	S0, S1	VDD-0.5			V
Input Low Voltage, VIL	S0, S1			0.5	V
Output High Voltage, VOH	Note 2	VDD-1.2			V
Output Low Voltage, VOL	Note 2			VDD-2.0	V
IDD Operating Supply Current, note 3	No Load, 155.52MHz		63		mA
Internal Crystal Capacitance, X1 and X2	Pins 1, 8		26		pF
Input Capacitance	S0, S1		5		pF
<b>AC CHARACTERISTICS (VDD = 3.3, 5.0 V unless otherwise noted)</b>					
Input Crystal Frequency		5		27	MHz
Input Clock Frequency		5		52	MHz
Output Frequency, ICS507-01	0 to 70°C	VDD = 5.0 V	10	200	MHz
	0 to 70°C	VDD = 3.3 V	10	156	MHz
Output Frequency, ICS507-011	-40 to 85°C	VDD = 3.3 V or 5.0 V	10	125	MHz
Output Frequency, ICS507-021 Note 5	0 to 70°C	VDD = 5.0 V	125	200	MHz
	0 to 70°C	VDD = 3.3 V	125	200	MHz
	-40 to 85°C	VDD = 3.3 V or 5.0 V	125	185	MHz
Output Clock Duty Cycle			48	52	%
PLL Bandwidth			10		kHz
Absolute Clock Period Jitter	Deviation from mean		±75		ps
One Sigma Clock Period Jitter			20		ps

- Notes: 1) All typical values are at 5.0 V and 25°C unless otherwise noted.  
 2) VOH and VOL can be set by the external resistor values on the PECL outputs.  
 3) IDD includes the current through the external resistors, which can be modified.  
 4) The phase relationship between input and output can change at power up. For a fixed phase relationship, see one of the ICS zero delay buffers.  
 5) Except S1=0, S0=0 setting (This setting specific to 16 MHz in, 155.52 MHz out).



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## Applications

**High Frequency Differential PECL Oscillators:** The ICS507 plus a low frequency, fundamental mode crystal can build a high frequency differential output oscillator. For example, a 10 MHz crystal connected to the ICS507 with the 12X output selected (S1=0, S0=1) produces a 120 MHz PECL output clock.

**High Frequency TCXO:** Extending the previous application, an inexpensive, low frequency TCXO can be built and the output frequency can be multiplied using the ICS507. Since the output of the chip is phase-locked to the input, the ICS507 has no temperature dependence, and the temperature coefficient of the combined system is the same as that of the low frequency TCXO.

**High Frequency VCXO:** The bandwidth of the PLL is guaranteed to be greater than 10 kHz. This means that the PLL will track any modulation on the input with a frequency of less than 10 kHz. By using this property, a low frequency VCXO can be built, and the output can then be multiplied with the ICS507 to give a high frequency output, thereby producing a high frequency VCXO.

## Decoupling and External Components

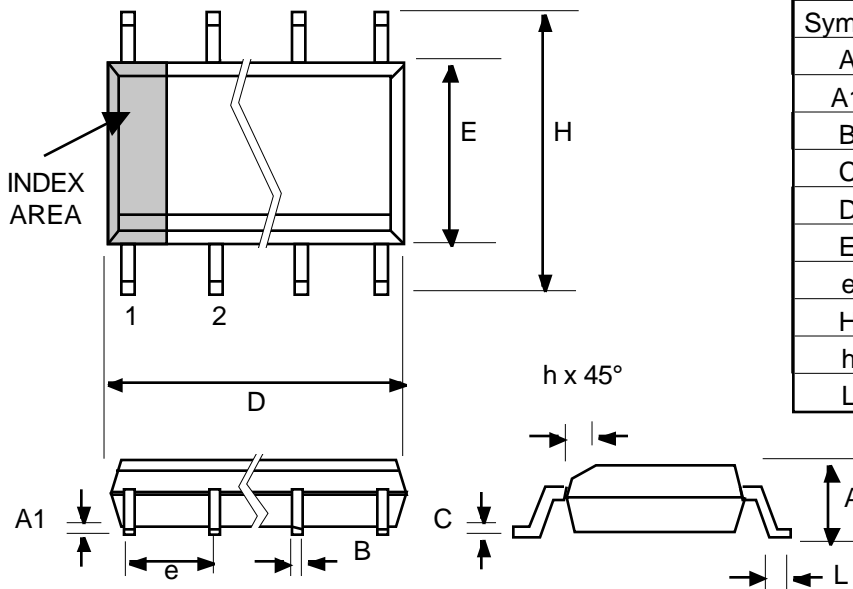
The ICS507 requires a 0.01 $\mu$ F decoupling capacitor to be connected between VDD and GND on pins 2 and 5. It must be connected close to the ICS507. Other VDD and GND connections should be connected to those pins, or to the VDD and GND planes on the board. A resistor must be connected between the RES (pin 10) and VDD. Another four resistors are needed for the PECL outputs as shown on the block diagram on page 1. Suggested values of these resistors are shown in the Block Diagram, but they can be varied to change the differential pair output swing, and the DC level; refer to MAN09.



# ICS507-01/02 PECL Clock Synthesizer

## Package Outline and Package Dimensions (For current dimensional specifications, see JEDEC Publication No. 95.)

16 pin SOIC narrow



Symbol	Inches		Millimeters	
	Min	Max	Min	Max
A	0.0532	0.0688	1.35	1.75
A1	0.0040	0.0098	0.10	0.24
B	0.0130	0.0200	0.33	0.51
C	0.0075	0.0098	0.19	0.24
D	0.3859	0.3937	9.80	10.00
E	0.1497	0.1574	3.80	4.00
e	.050 BSC		1.27 BSC	
H	0.2284	0.2440	5.80	6.20
h	0.0099	0.0195	0.25	0.50
L	0.0160	0.0500	0.41	1.27

## Ordering Information

Part/Order Number	Marking	Package	Temperature	Minimum Quantities
ICS507M-01	ICS507M-01	16 pin narrow SOIC	0 to 70°C	-
ICS507M-01T	ICS507M-01	16 pin SOIC on tape and reel	0 to 70°C	2500 pieces
ICS507M-01I	ICS507M-01I	16 pin narrow SOIC	-40 to 85°C	-
ICS507M-01IT	ICS507M-01I	16 pin SOIC on tape and reel	-40 to 85°C	2500 pieces
ICS507-01-DSW	-	Probed wafers, cut, on sticky tape	0 to 70°C	1 wafer
ICS507-01-DPK	-	Tested die in waffle pack	0 to 70°C	1000 pieces
ICS507-01-DWF	-	Die on uncut, probed wafers	0 to 70°C	1 wafer
ICS507M-02I	ICS507M-02I	16 pin narrow SOIC	-40 to 85°C	-
ICS507M-02IT	ICS507M-02I	16 pin SOIC on tape and reel	-40 to 85°C	2500 pieces

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