PECL CLOCK SYNTHESIZER

ICS507-01

Description

The ICS507-01 is an inexpensive, simple way 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.

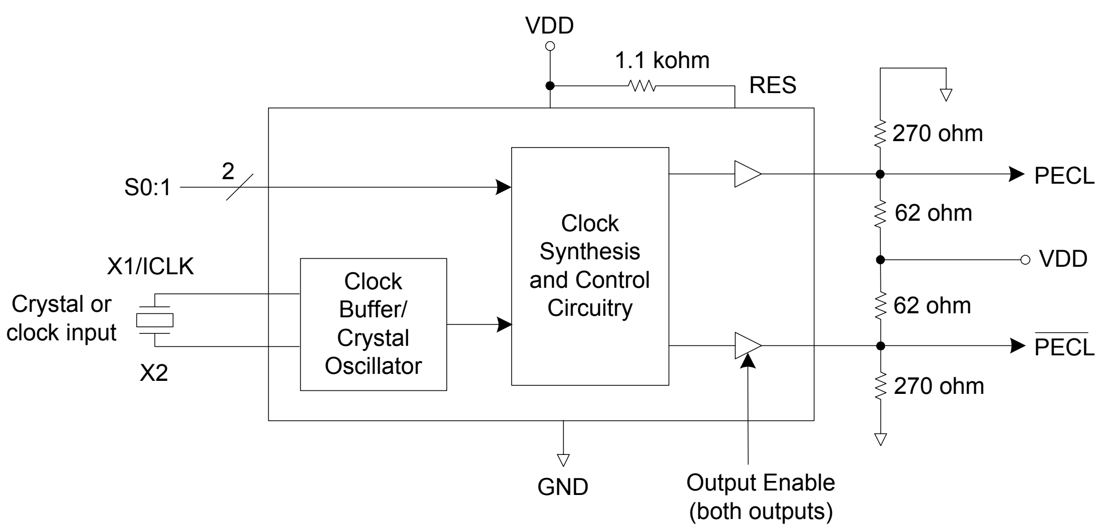
Stored in each chip's ROM is the ability to generate a selection of different multiples of the input reference frequency, including an exact 155.52 MHz clock from common crystals. For lowest jitter and phase noise on a 155.52 MHz clock, a 19.44 MHz crystal and the x8 selection can be used.

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.

Features

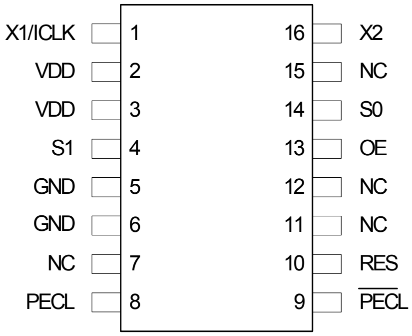
- Packaged in 16 pin SOIC
- Available in Pb (lead) free package
- Input crystal frequency of 5 - 27 MHz
- Input clock frequency of 5 - 52 MHz
- Enable usage of common low-cost crystal
- Differential PECL output clock frequencies up to 200 MHz
- Duty cycle of 49/51
- Operation voltage of 3.3 V or 5.0 V (±5%)
- Ideal for SONET applications and oscillator manufacturers
- Available in die form
- Industrial temperature versions available
- ICS507-02 is no longer available

Block Diagram



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

Pin Assignment



16 Pin (150 mil) SOIC

* At 3.3V, use this selection to get 155.52 MHz from a 16 MHz input.

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

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

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

Pin Descriptions

Number	Name	Type	Description
1	XI/ICLK	Input	Crystal Connection. Connect to a fundamental parallel mode crystal, or clock.
2	VDD	Power	Connect to +3.3 V or 5 V, and to VDD on pin 3.
3	VDD	Power	Connect to VDD on pin 2. Decouple with pin 5.
4	S1	Input	Multiplier select pin 1. Determines output frequency per table above.
5	GND	Power	Connect to ground.
6	GND	Power	Connect to ground.
7	NC	—	No connect. Do not connect this pin to anything.
8	PECL	Output	PECL output. Connect to resistor load as shown on page 1.
9	$\overline{\text{PECL}}$	Output	Complimentary PECL output. Connect to resistor load as shown on page 1.
10	RES	Input	Bias resistor input. Connect a resistor between this pin and VDD.
11	NC	—	No connect. Do not connect this pin to anything.
12	NC	—	No connect. Do not connect this pin to anything.
13	OE	Input	Output Enable. Tri-states both outputs when low. Internal pull-up.
14	S0	Input	Multiplier select pin 0. Determines output frequency per table above.
15	NC	—	No connect. Do not connect this pin to anything.
16	X2	Output	Crystal Connection. Connect to crystal, or leave unconnected for clock input.

External Component Selection

The ICS507-01 requires a minimum number of external components for proper operation.

Decoupling Capacitors

Decoupling capacitors of 0.01µF should be connected between VDD and GND on pins 2 and 5, as close to the ICS507-01 as possible. 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.

High Frequency Differential PECl Oscillators

The ICS507-01 plus a low frequency, fundamental mode crystal can build a high frequency differential output oscillator. For example, a 10 MHz crystal connected to the ICS507-01 with the 12X output selected (S1=0, S0=1) produces a 120 MHz PECL output clock.

Hi Frequency TCXO

Extending the previous application, an inexpensive, low frequency TCXO can be built and the output frequency can be multiplied using the ICS507-01. Since the output of the chip is phase-locked to the input, the ICS507-01 has no temperature dependence, and the temperature coefficient of the combined system is the same as that of the low frequency TCXO.

Hi 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 ICS507-01 to give a high frequency output, thereby producing a high frequency VCXO.

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the ICS507-01. These ratings, which are standard values for ICS commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.

Item	Rating
Supply Voltage, VDD	7 V
All Inputs and Outputs	-0.5 V to VDD+0.5 V
Ambient Operating Temperature (commercial)	0 to +70° C
Ambient Operating Temperature (industrial)	-40 to +85° C
Storage Temperature	-65 to +150° C
Soldering Temperature	260° C

Recommended Operation Conditions

Parameter	Min.	Typ.	Max.	Units
Ambient Operating Temperature (commercial)	0	–	+70	°C
Ambient Operating Temperature (industrial)	-40	–	+85	°C
Power Supply Voltage (measured in respect to GND)	+3.15		+3.45	V

DC Electrical Characteristics

VDD=5 V, unless stated otherwise

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Operating Voltage	VDD		3.0		5.5	V
Input High Voltage	V_{IH}	ICLK only	VDD/2+1	VDD/2		V
Input Low Voltage	V_{IL}	ICLK only		VDD/2	VDD/2-1	V
Input High Voltage	V_{IH}	S0, S1	VDD-0.5			V
Input Low Voltage	V_{IL}	S0, S1			0.5	V
Output High Voltage	V_{OH}	Note 2	VDD-1.2			V
Output Low Voltage	V_{OL}	Note 2			VDD-2.0	V
Operating Supply Current	IDD	No load, 155.52 MHz, Note 3		63		mA
Internal Crystal Capacitance, X1 and X2		Pins 1, 8		26		pF
Input Capacitance		S0, S1		5		pF

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).

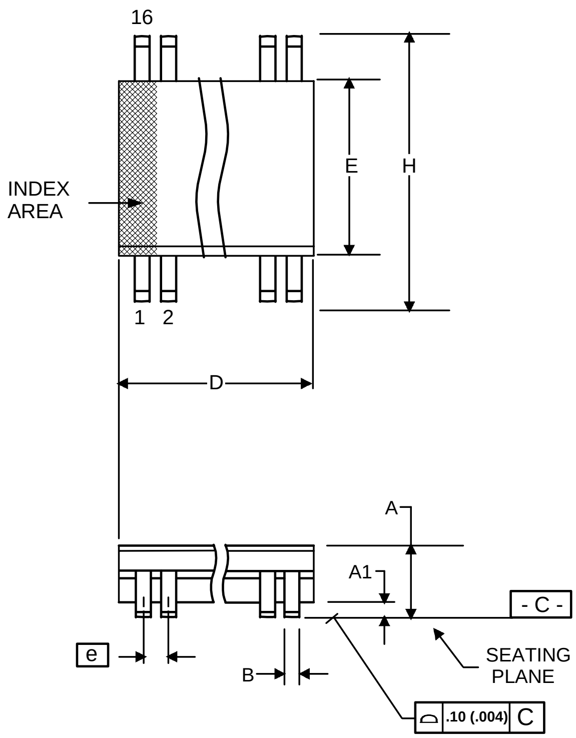
AC Electrical Characteristics

VDD = 3.3 V, 5 V unless stated otherwise

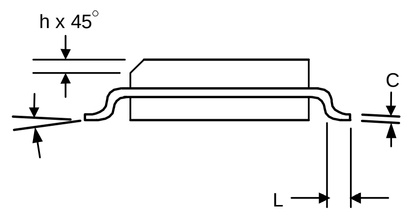
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Crystal Frequency			5		27	MHz
Input Clock Frequency			5		52	MHz
Output Frequency, ICS507-01	f_{out}	VDD = 5 V	10		200	MHz
		VDD = 3.3 V	10		156	MHz
Output Frequency, ICS507-01I	f_{out}	VDD = 3.3 V or 5 V	10		125	MHz
Output Clock Duty Cycle	t_D		48		52	%
PLL Bandwidth			10			kHz
Absolute Clock Period Jitter		Deviation from Mean		±75		ps
One Sigma Clock Period Jitter				20		ps

Package Outline and Package Dimensions (16-pin SOIC, 150 Mil. Narrow Body)

Package dimensions are kept current with JEDEC Publication No. 95



	Millimeters		Inches	
Symbol	Min	Max	Min	Max
A	1.35	1.75	.0532	.0688
A1	0.10	0.25	.0040	.0098
B	0.33	0.51	.013	.020
C	0.19	0.25	.0075	.0098
D	9.80	10.00	.3859	.3937
E	3.80	4.00	.1497	.1574
e	1.27 BASIC		0.050 BASIC	
H	5.80	6.20	.2284	.2440
h	0.25	0.50	.010	.020
L	0.40	1.27	.016	.050
α	0°	8°	0°	8°



Ordering Information

Part/Order Number	Marking	Packaging	Package	Temperature	Min. Qty.
507M-01	ICS507M-01	Tubes	16-pin SOIC	0 to +70° C	—
507M-01T	ICS507M-01	Tape and Reel	16-pin SOIC	0 to +70° C	2500 pieces
507M-01I	ICS507M-01I	Tubes	16-pin SOIC	-40 to +85° C	—
507M-01IT	ICS507M-01I	Tape and Reel	16-pin SOIC	-40 to +85° C	2500 pieces
507M-01LF	ICS507M-01LF	Tubes	16-pin SOIC	0 to +70° C	—
507M-01LFT	ICS507M-01LF	Tape and Reel	16-pin SOIC	0 to +70° C	2500 pieces
507M-01ILF	ICS507M01ILF	Tubes	16-pin SOIC	-40 to +85° C	—
507M-01ILFT	ICS507M01ILF	Tape and Reel	16-pin SOIC	-40 to +85° C	2500 pieces
507M-01DSW	—	Probed wafers, cut, on sticky tape		0 to +70° C	1 wafer
507M-01DPK	—	Tested die in waffle pack		0 to +70° C	1000 pieces
507M-01DWF	—	Die on uncut, probed wafers		0 to +70° C	1 wafer

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Corporate Headquarters
Integrated Device Technology, Inc.
6024 Silver Creek Valley Road
San Jose, CA 95138
United States
800 345 7015
+408 284 8200 (outside U.S.)

Asia Pacific and Japan
Integrated Device Technology
Singapore (1997) Pte. Ltd.
Reg. No. 199707558G
435 Orchard Road
#20-03 Wisma Atria
Singapore 238877
+65 6 887 5505

Europe
IDT Europe, Limited
Prime House
Barnett Wood Lane
Leatherhead, Surrey
United Kingdom KT22 7DE
+44 1372 363 339

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