



ICS570 Multiplier and Zero Delay Buffer

Description

The ICS570 is a high performance Zero Delay Buffer (ZDB) which integrates ICS' proprietary analog/digital Phase Locked Loop (PLL) techniques. The A version is recommended for 5V designs and the B version for 3.3V designs. The chip is part of ICS' ClockBlocks™ family, and was designed as a performance upgrade to meet today's higher speed and lower voltage requirements. The zero delay feature means that the rising edge of the input clock aligns with the rising edges of both outputs, giving the appearance of no delay through the device. There are two outputs on the chip, one being a low-skew divide by two of the other output. The device incorporates an all-chip power down/tri-state mode that stops the internal PLL and puts both outputs into a high impedance state.

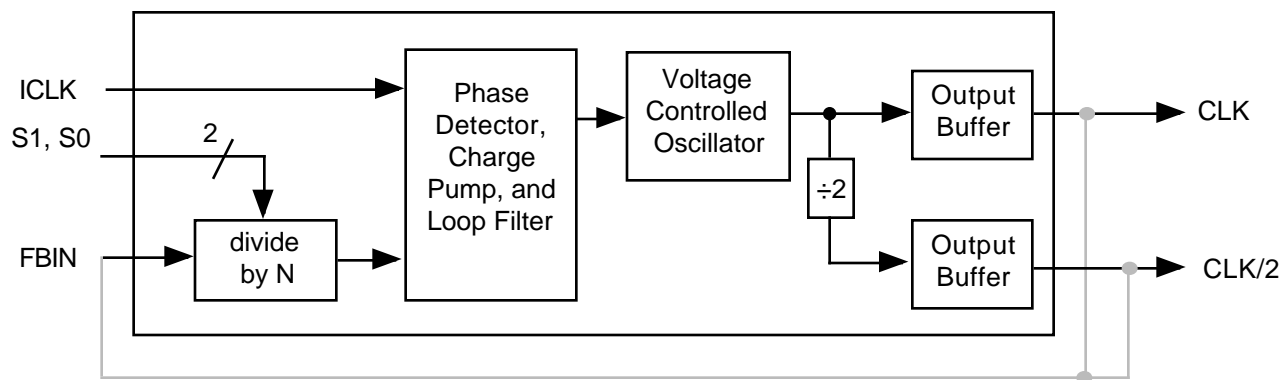
The ICS570 is ideal for synchronizing outputs in a large variety of systems, from personal computers to data communications to graphics/video. By allowing off-chip feedback paths, the device can eliminate the delay through other devices.

The ICS570 A and B versions were designed to improve input to output jitter from the original ICS570M version, and are recommended for all new designs.

Features

- Packaged in 8 pin SOIC.
- Pin-for-pin replacement and upgrade to ICS570M
- Functional equivalent to AV9170 (not a pin-for-pin replacement).
- Low input to output skew of 300 ps max (>60 MHz outputs).
- Low skew (100 ps) outputs.
- Ability to choose between 14 different multipliers from 0.5X to 32X.
- Output clock frequency up to 168 MHz at 3.3V.
- Can recover degraded input clock duty cycle.
- Output clock duty cycle of 45/55.
- Power Down and Tri-State Mode.
- Full CMOS clock swings with 25mA drive capability at TTL levels.
- Advanced, low power CMOS process.
- ICS570B has an operating voltage of 3.3 V ($\pm 5\%$)
- ICS570A has an operating voltage of 5.0 V ($\pm 5\%$)
- Industrial temperature version available

Block Diagram

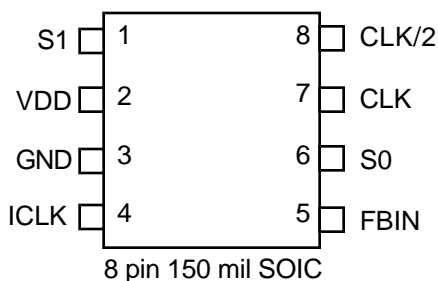


External feedback can come from CLK or CLK/2 (see table on page 2).



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Pin Assignment



Clock Multiplier Decoding Table (Multiplies input clock by shown amount)

S1	S0	FBIN from CLK		FBIN from CLK/2		ICS570B (3.3V)	ICS570A (5.0V)
		CLK	CLK/2	CLK	CLK/2	ICLK Input Range FB from CLK/2 *	ICLK Input Range FB from CLK/2 *
#1	#6	pin # 7	pin # 8	pin # 7	pin # 8		
0	0	Power Down and Tri-State				-	-
0	M	x3	x1.5	x6	x3	3.75 to 28	2.5 to 25
0	1	x4	x2	x8	x4	2.75 to 19	2.5 to 19
M	0	x8	x4	x16	x8	2.5 to 9.5	2.5 to 9.5
M	M	x6	x3	x12	x6	2.5 to 12.5	2.5 to 12.5
M	1	x10	x5	x20	x10	2.5 to 7.5	2.5 to 7.5
1	0	x1	÷2	x2	x1	11 to 75	5 to 75
1	M	x16	x8	x32	x16	2.5 to 5	2.5 to 5
1	1	x2	x1	x4	x2	5.5 to 37.5	2.5 to 37.5

0 = connect directly to ground.

M = leave unconnected (self-biases to VDD/2).

1 = connect directly to VDD.

*Input range with CLK feedback is double that for CLK/2.

Pin Descriptions

Number	Name	Type	Description
1	S1	I	Select 1 for output clock. Connect to GND, VDD, or float per decoding table above.
2	VDD	P	Connect to +3.3V (ICS570B). Connect to +5.0V (ICS570A).
3	GND	P	Connect to ground.
4	ICLK	I	Reference clock input.
5	FBIN	I	Feedback clock input.
6	S0	I	Select 0 for output clock. Connect to GND, VDD, or float per decoding table above.
7	CLK	O	Clock output per table above.
8	CLK/2	O	Clock output per table above. Low skew divide by two of pin 7 clock.

Key: I = input, O = output, P = power supply connection

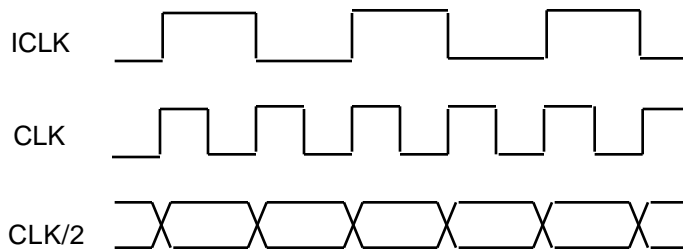
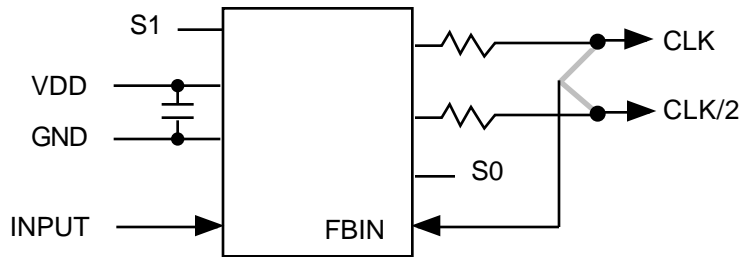
External Components

The ICS570 requires a 0.01 μ F decoupling capacitor to be connected between VDD and GND. It must be connected close to the part to minimize lead inductance. No external power supply filtering is required for this device. A 33 Ω series terminating resistor can be used next to each output pin.

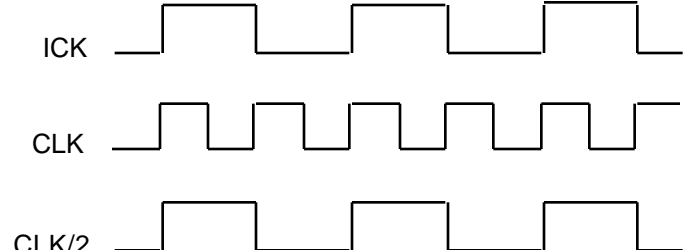


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Recommended Circuit:



**x2 Mode (S1, S0 = 1, 1)
CLK Feedback**



**x2 Mode (S1, S0 = 1, 0)
CLK/2 Feedback**

Using CLK as the feedback will always result in synchronized rising edges between ICLK and CLK. However, the CLK/2 could be a falling edge compared with ICLK. Therefore, whenever possible, we recommend the use of CLK/2 feedback. This will synchronize the rising edges of all 3 clocks.



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Clock Period Jitter Tables (ICS570A)

All jitter values are considered typical measured at 25°C with 27 Ω series termination resistor and 15pF loads on both CLK and CLK2. The feedback is from CLK2 to FBIN. Note that if an output is unused, it should be left unconnected to improve output jitter on the active output clocks.

Absolute and One Sigma Jitter (ps)

S1	S0	CLKIN (MHz)	CLK = 50M			CLK/2 = 25M		
			Multiplier	P to P	1 sigma	Multiplier	P to P	1 sigma
0	M	8.333	6x	± 115	80	3x	± 65	20
0	1	6.25	8x	± 115	80	4x	± 60	20
M	0	3.125	16x	± 120	80	8x	± 55	20
M	M	4.167	12x	± 120	90	6x	± 60	20
M	1	2.5	20x	± 120	80	10x	± 60	20
1	0	25	2x	± 120	70	1x	± 55	20
1	M	1.5625	32x	± 120	80	16x	± 50	20
1	1	12.5	4x	± 115	80	2x	± 55	20

Absolute and One Sigma Jitter (ps)

S1	S0	CLKIN (MHz)	CLK = 100M			CLK/2 = 50M		
			Multiplier	P to P	1 sigma	Multiplier	P to P	1 sigma
0	M	16.667	6x	± 135	100	3x	± 55	20
0	1	12.5	8x	± 140	100	4x	± 50	20
M	0	6.25	16x	± 140	110	8x	± 55	20
M	M	8.333	12x	± 140	110	6x	± 55	20
M	1	5	20x	± 135	100	10x	± 50	20
1	0	50	2x	± 120	90	1x	± 50	20
1	M	3.125	32x	± 135	100	16x	± 55	20
1	1	25	4x	± 130	90	2x	± 65	20

Absolute and One Sigma Jitter (ps)

S1	S0	CLKIN (MHz)	CLK = 150M			CLK/2 = 75M		
			Multiplier	P to P	1 sigma	Multiplier	P to P	1 sigma
0	M	25	6x	± 160	120	3x	± 55	20
0	1	18.375	8x	± 165	120	4x	± 55	20
M	0	9.375	16x	± 170	120	8x	± 50	20
M	M	12.5	12x	± 160	120	6x	± 55	20
M	1	7.5	20x	± 160	120	10x	± 55	20
1	0	75	2x	± 155	110	1x	± 55	20
1	M	4.6875	32x	± 165	120	16x	± 55	20
1	1	37.5	4x	± 160	110	2x	± 50	20



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Clock Period Jitter Tables (ICS570B)

All jitter values are considered typical measured at 25°C with 27 Ω series termination resistor and 15pF loads on both CLK and CLK2. The feedback is from CLK2 to FBIN. Note that if an output is unused, it should be left unconnected to improve output jitter on the active output clocks.

Absolute and One Sigma Jitter (ps)

S1	S0	CLKIN (MHz)	CLK = 50M			CLK/2 = 25M		
			Multiplier	Absolute	1 sigma	Multiplier	Absolute	1 sigma
0	M	8.333	6x	±110	80	3x	±55	20
0	1	6.25	8x	±125	90	4x	±50	20
M	0	3.125	16x	±130	90	8x	±55	20
M	M	4.167	12x	±120	90	6x	±55	20
M	1	2.5	20x	±115	90	10x	±55	20
1	0	25	2x	±130	50	1x	±55	20
1	M	1.5625	32x	±120	90	16x	±55	20
1	1	12.5	4x	±120	60	2x	±55	20

Absolute and One Sigma Jitter (ps)

S1	S0	CLKIN (MHz)	CLK = 100M			CLK/2 = 50M		
			Multiplier	Absolute	1 sigma	Multiplier	Absolute	1 sigma
0	M	16.667	6x	±100	70	3x	±45	20
0	1	12.5	8x	±100	70	4x	±45	20
M	0	6.25	16x	±110	80	8x	±45	20
M	M	8.333	12x	±100	70	6x	±45	20
M	1	5	20x	±105	70	10x	±40	20
1	0	50	2x	±90	60	1x	±40	20
1	M	3.125	32x	±95	70	16x	±45	20
1	1	25	4x	±105	70	2x	±60	30

Absolute and One Sigma Jitter (ps)

S1	S0	CLKIN (MHz)	CLK = 150M			CLK/2 = 75M		
			Multiplier	Absolute	1 sigma	Multiplier	Absolute	1 sigma
0	M	25	6x	±115	70	3x	±50	20
0	1	18.375	8x	±120	80	4x	±50	20
M	0	9.375	16x	±130	90	8x	±50	20
M	M	12.5	12x	±130	90	6x	±45	20
M	1	7.5	20x	±130	90	10x	±45	20
1	0	75	2x	±115	90	1x	±45	20
1	M	4.6875	32x	±130	90	16x	±50	20
1	1	37.5	4x	±110	70	2x	±60	20



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Electrical Specifications

Parameter	Conditions	Minimum	Typical	Maximum	Units
ABSOLUTE MAXIMUM RATINGS (Note 1)					
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	ICS570A, ICS570B	0		70	°C
	ICS570AI, ICS570BI	-40		85	°C
Soldering Temperature	Max of 10 seconds			260	°C
Storage temperature		-65		150	°C
DC CHARACTERISTICS					
Operating Voltage, VDD, ICS570B		3.15		3.45	V
Operating Voltage, VDD, ICS570A		4.75		5.25	V
Input High Voltage, VIH	ICLK, FBIN	2			V
Input Low Voltage, VIL	ICLK, FBIN			0.8	V
Input High Voltage, VIH	S0, S1	VDD-0.5			V
Input Low Voltage, VIM (mid-level)	S0, S1		VDD/2		V
Input Low Voltage, VIL	S0, S1			0.5	V
Output High Voltage, VOH, CMOS level	IOH=-4mA	VDD-0.4			V
Output High Voltage, VOH	IOH=-12mA	2.4			V
Output Low Voltage, VOL	IOL=12mA			0.4	V
IDD Operating Supply Current, 50 in, 100 out	No Load, ICS570B		16		mA
IDD Operating Supply Current, 50 in, 100 out	No Load, ICS570A		22		mA
Short Circuit Current	Each Output		±100		mA
Input Capacitance, S1, S0			5		pF
AC CHARACTERISTICS					
Input Frequency, ICLK (see table on page 2)	FBIN from CLK/2	See Table on Page 2			
Output Clock Frequency, CLK		10		168	MHz
Output to output skew, ICS570B	Note 2		100	175	ps
Output to output skew, ICS570A	Note 2		100	200	ps
Input to Output Jitter	40-150 MHz		100-250		ps
Input skew, ICLK to FBIN, ICS570B, Note 2	CLK>30MHz	-300		300	ps
Input skew, ICLK to FBIN, ICS570B, Note 2	VDD=3.3V, CLK<10MHz	-600		600	ps
Input skew, ICLK to FBIN, ICS570A, Note 2	CLK>30MHz	-1		1	ns
Input skew, ICLK to FBIN, ICS570A, Note 2	VDD=3.3V, CLK<10MHz	-1.5		1.5	ns
Output Clock Rise Time, 3.3V	0.8 to 2.0V, note 3		0.75		ns
Output Clock Fall Time, 3.3V	2.0 to 0.8V, note 3		0.75		ns
Output Clock Duty Cycle	at VDD/2	45	49 to 51	55	%

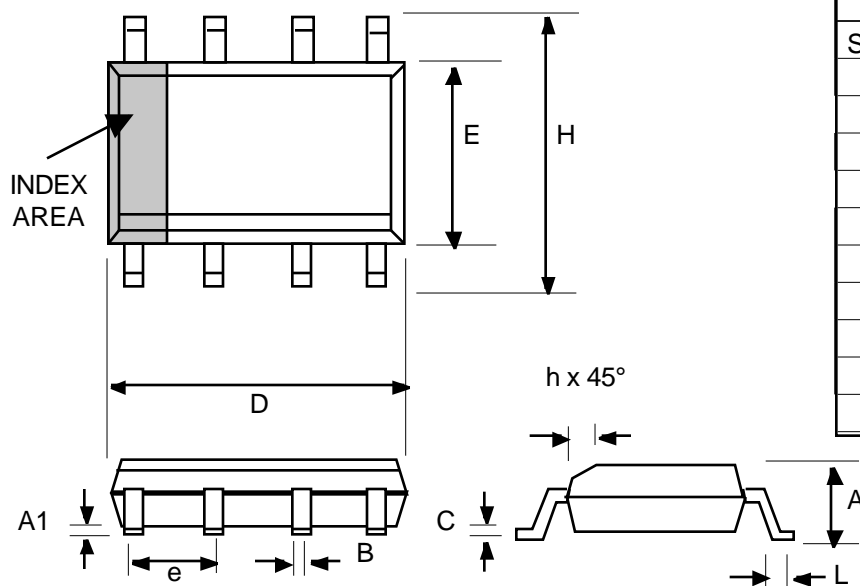
- Notes
1. Stresses beyond these can permanently damage the device
 2. Assumes clocks with same rise time, measured from rising edges at VDD/2.
 3. With 27 terminating resistor and 15 pF loads.



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

8 pin (150 mil) SOIC



Symbol	Inches		Millimeters	
	Min	Max	Min	Max
A	0.0532	0.0688	1.35	1.75
A1	0.004	0.0098	0.10	0.25
B	0.0130	0.0200	0.33	0.51
C	0.0075	0.0098	0.19	0.25
D	0.1890	0.1968	4.80	5.00
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/Comments	Temperature
ICS570A	ICS570A	8 pin SOIC	0 to 70 °C
ICS570AT	ICS570A	8 pin SOIC on tape and reel	0 to 70 °C
ICS570AI	ICS570AI	8 pin SOIC	-40 to +85 °C
ICS570AIT	ICS570AI	8 pin SOIC on tape and reel	-40 to +85 °C
ICS570B	ICS570B	8 pin SOIC	0 to 70 °C
ICS570BT	ICS570B	8 pin SOIC on tape and reel	0 to 70 °C
ICS570BI	ICS570BI	8 pin SOIC	-40 to +85 °C
ICS570BIT	ICS570BI	8 pin SOIC on tape and reel	-40 to +85 °C
ICS570M	ICS570M	8 pin SOIC	0 to 70 °C
ICS570MT	ICS570M	8 pin SOIC on tape and reel	0 to 70 °C
ICS570MI	ICS570MI	8 pin SOIC	-40 to +85 °C
ICS570MIT	ICS570MI	8 pin SOIC on tape and reel	-40 to +85 °C

The M version is not recommended for new designs.

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