ICS650-01
System Peripheral Clock Source

Description

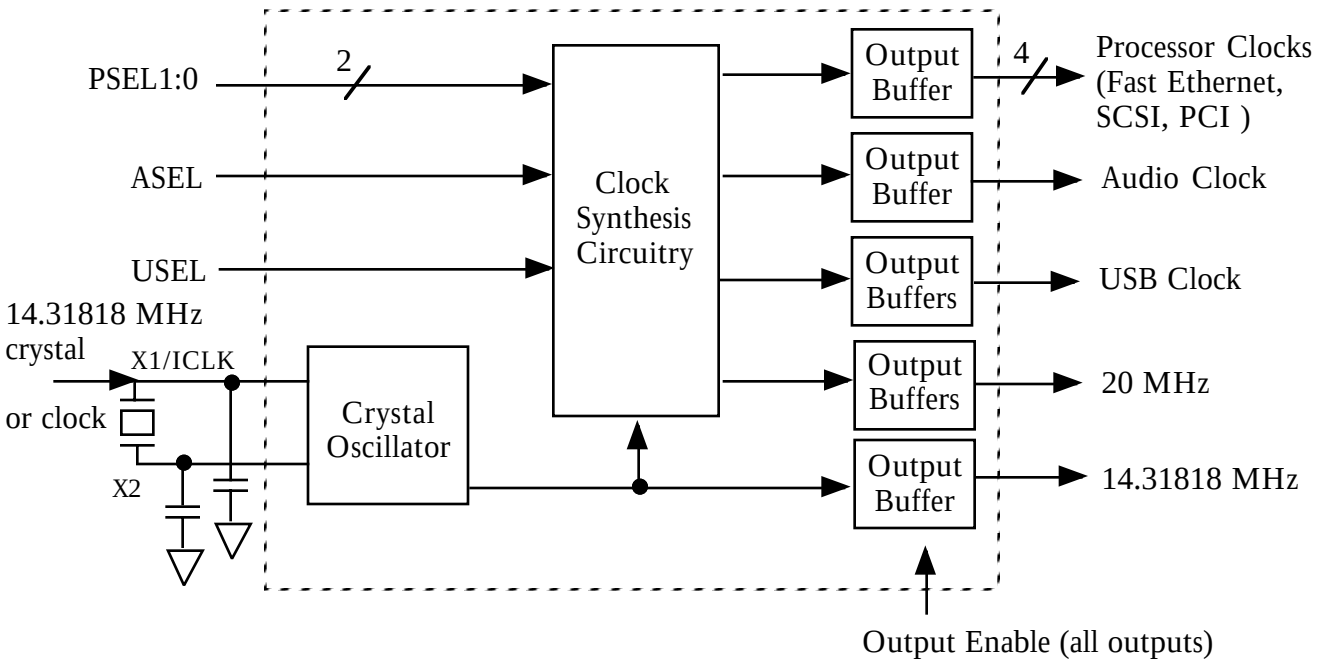
The ICS650-01 is a low cost, low jitter, high performance clock synthesizer for system peripheral applications. Using analog/digital Phase-Locked Loop (PLL) techniques, the device accepts a parallel resonant 14.31818 MHz crystal input to produce up to eight output clocks. The device provides clocks for PCI, SCSI, Fast Ethernet, Ethernet, USB, and AC97. The user can select one of three USB frequencies, and also one of three AC97 audio frequencies. The OE pin puts all outputs into a high impedance state for board level testing. All frequencies are generated with less than one ppm error, meeting the demands of SCSI and Ethernet clocking.

The ICS650 can be mask customized to produce any frequencies from 1 to 150 MHz.

Features

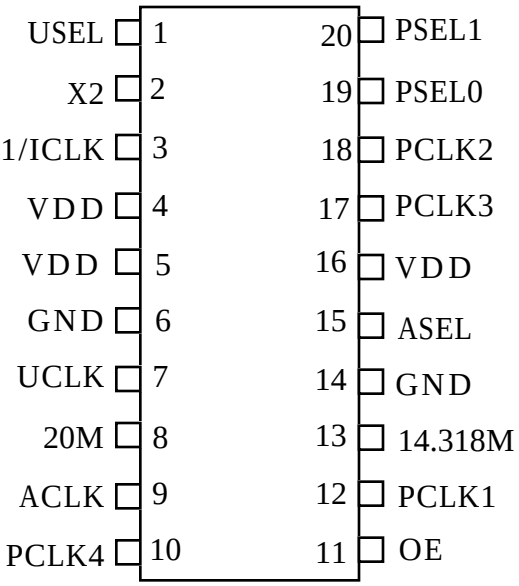
- Packaged in 20 pin tiny SSOP (QSOP)
- Operating VDD of 3.3V or 5V
- Less than one ppm synthesis error in all clocks
- Inexpensive 14.31818 MHz crystal or clock input
- Provides Ethernet and Fast Ethernet clocks
- Provides SCSI clocks
- Provides PCI clocks
- Selectable AC97 audio clock
- Selectable USB clock
- OE pin tri-states the outputs for testing
- Selectable frequencies on three clocks
- Duty cycle of 40/60
- Advanced, low power CMOS process

Block Diagram



Integrated Circuit Systems • 525 Race Street • San Jose •CA•95126• (408) 295-9800tel • (408) 295-9818fax

Pin Assignment



20 pin (150 mil) SSOP

Processor Clock (MHz)

PSEL1	PSEL0	PCLK1	PCLK2,3	PCLK4
0	0	25.00	50.00	18.75
0	M	TEST	TEST	TEST
0	1	TEST	TEST	TEST
M	0	40.00	80.00	20.00
M	M	33.3334	66.6667	25.00
M	1	20.00	40.00	25.00
1	0	20.00	33.3334	25.00
1	M	20.00	66.6667	25.00
1	1	Stops low all clocks except 20M		

Audio Clock (MHz)

ASEL	ACLK
0	49.152
M	24.576
1	12.288

USB Clock (MHz)

USEL	UCLK
0	12
M	24
1	48

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

Pin Descriptions

Pin #	Name	Type	Description
1	USEL	I	UCLK Select pin. Determines frequency of USB clock per table above.
2	X2	XO	Crystal connection. Connect to parallel mode 14.31818 MHz crystal. Leave open for clock.
3	X1/ICLK	XI	Crystal connection. Connect to parallel mode 14.31818 MHz crystal, or clock.
4	VDD	P	Connect to VDD. Must be same value as other VDD. Decouple with pin 6.
5	VDD	P	Connect to VDD. Must be same value as other VDD.
6	GND	P	Connect to ground.
7	UCLK	O	USB clock output per table above.
8	20M	O	Fixed 20 MHz output for Ethernet. Only clock that runs when PSEL1=PSEL0=1.
9	ACLK	O	AC97 Audio clock output per table above.
10	PCLK4	O	PCLK output number 4 per table above.
11	OE	I	Output Enable. Tri-states all outputs when low.
12	PCLK1	O	PCLK output number 1 per table above.
13	14.318M	O	14.31818 MHz buffered reference clock output.
14	GND	P	Connect to ground.
15	ASEL	I	ACLK Select pin. Determines frequency of Audio clock per table above.
16	VDD	P	Connect to VDD. Must be same value as other VDD. Decouple with pin 14.
17	PCLK3	O	PCLK output number 3 per table above.
18	PCLK2	O	PCLK output number 2 per table above.
19	PSEL0	I	Processor Select pin #0. Determines frequencies on PCLKs 1-4 per table above.
20	PSEL1	I	Processor Select pin #1. Determines frequencies on PCLKs 1-4 per table above.

Key: I = Input; XO/XI = crystal connections; O = output; P = power supply connection

Integrated Circuit Systems • 525 Race Street • San Jose •CA•95126• (408) 295-9800tel • (408) 295-9818fax

Electrical Specifications

Parameter	Conditions	Minimum	Typical	Maximum	Units
ABSOLUTE MAXIMUM RATINGS (note 1)					
Supply voltage, VDD	Referenced to GND			7	V
Inputs and Clock Outputs	Referenced to GND	-0.5		VDD+0.5	V
Ambient Operating Temperature		0		70	C
Soldering Temperature	Max of 10 seconds			260	C
Storage temperature		-65		150	C
DC CHARACTERISTICS (VDD = 3.3V or 5V unless noted)					
Operating Voltage, VDD		3.0		5.5	V
Input High Voltage, VIH	Select inputs, OE	2			V
Input Low Voltage, VIL	Select inputs, OE			0.8	V
Output High Voltage, VOH	VDD=3.3V, IOH=-8mA	2.4			V
Output Low Voltage, VOL	VDD=3.3V, IOL=8mA			0.4	V
Output High Voltage, VOH, VDD = 3.3 or 5V	IOH=-8mA	VDD-0.4			V
Operating Supply Current, IDD, at 5V	No Load, note 2		50		mA
Operating Supply Current, IDD, at 3.3V	No Load, note 2		30		mA
Short Circuit Current, VDD = 3.3	Each output		±50		mA
Input Capacitance	Except X1		7		pF
AC CHARACTERISTICS (VDD = 3.3V or 5V unless noted)					
Input Crystal or Clock Frequency			14.31818		MHz
Output Clocks Accuracy (synthesis error)	All clocks			1	ppm
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	At VDD/2	40	50	60	%
One Sigma Jitter, except ACLK			75		ps
One Sigma Jitter, ACLK			170		ps
Absolute Clock Period Jitter PCLK, UCLK, 20M		- 500		500	ps

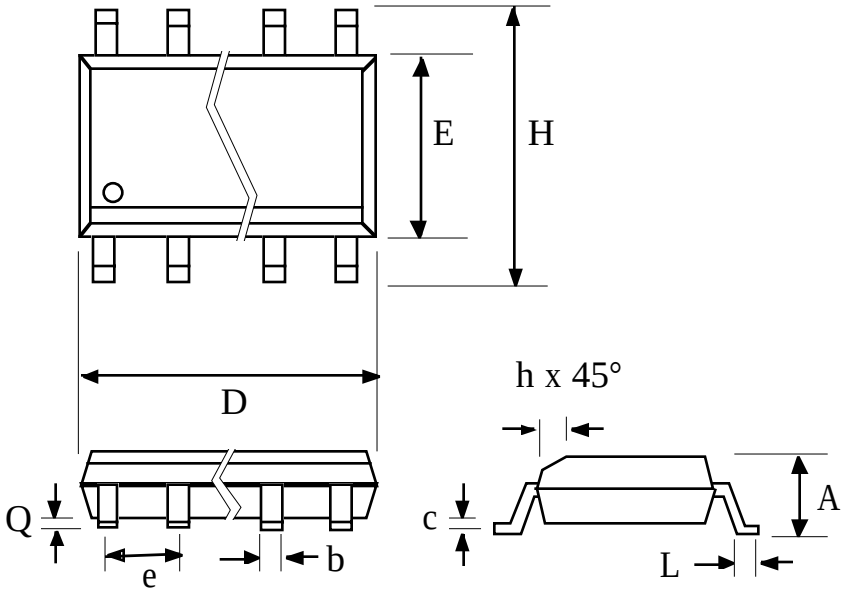
Notes: 1. Stresses beyond those listed under Absolute Maximum Ratings could cause permanent damage to the device. Prolonged exposure to levels above the operating limits but below the Absolute Maximums may affect device reliability.
2. With all clocks at highest frequencies.

External Components

The ICS650 requires a minimum number of external components for proper operation. Decoupling capacitors of 0.1µF should be connected between VDD and GND (on pins 4 and 6, and pins 16 and 14), as close to the chip as possible. A series termination resistor of 33Ω may be used for each clock output. The 14.31818 MHz crystal must be connected as close to the chip as possible. The crystal should be a fundamental mode, parallel resonant, 30ppm or better (to meet the Ethernet specs). Crystal capacitors should be connected from pins X1 to ground and X2 to ground. The value of these capacitors is given by the following equation, where C_L is the crystal load capacitance: Crystal caps (pF) = (C_L-12) x 2. So for a crystal with 16pF load capacitance, two 8pF caps should be used. If a clock input is used, drive it into X1 and leave X2 unconnected.

Integrated Circuit Systems • 525 Race Street • San Jose •CA•95126• (408) 295-9800tel • (408) 295-9818fax

Package Outline and Package Dimensions



20 pin SSOP

	Millimeters	
Symbol	Min	Max
A	1.55	1.73
b	0.203	0.305
c	0.190	0.254
D	8.560	8.740
E	3.810	4.000
H	5.840	6.200
e	0.635 BSC	
h		0.410
L	0.406	0.889
Q	0.127	0.250

Ordering Information

Part/Order Number	Marking	Package	Shipping	Temperature
ICS650R-01	ICS650R-01	20 pin SSOP	Tubes	0 to 70 C
ICS650R-01T	ICS650R-01	20 pin SSOP	Tape and Reel	0 to 70 C
ICS650R-01I	ICS650R-01I	20 pin SSOP	Tubes	-40 to 85 C
ICS650R-01IT	ICS650R-01I	20 pin SSOP	Tape and Reel	-40 to 85 C