

## Description

The ICS614-01 is a low cost, low jitter, high performance clock synthesizer for Intel's i752 graphics systems. It includes frequencies for video encoders and decoders. Using analog Phase-Locked Loop (PLL) techniques, the device accepts a 27 MHz fundamental mode crystal or clock input to produce multiple output clocks. The chip provides highly accurate video encoder and decoder clocks, as well as the 48 MHz necessary for the Intel graphics processor, and can produce a 24.576 MHz audio clock.

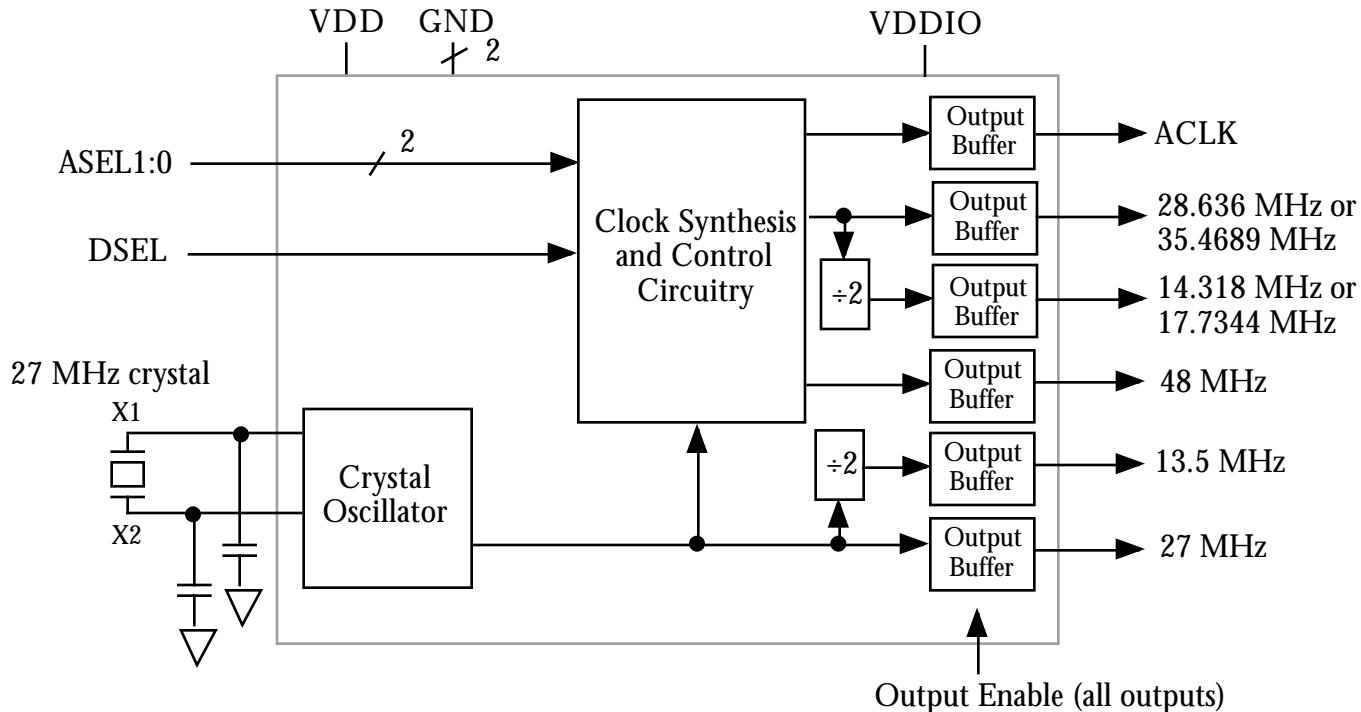
See the ICS604 or ICS513 for 8 pin devices that supply 48 MHz from a 14.31818 MHz input.

## Features

- Packaged in 16 pin SOIC
- Uses fundamental 27 MHz input crystal
- Supports Intel i752 graphics chip, popular video encoders and decoders, and audio
- Low jitter - 50 ps one sigma
- Output Enable function tri-states outputs
- 25mA output drive capability at TTL levels
- Advanced, low power, sub-micron CMOS process
- $5V \pm 10\%$  core voltage. Inputs and outputs can run 3.3V (or 5V) for easy system interface



## Block Diagram



**Pin Assignment**

OE	1	16	ASEL1
X2	2	15	ASEL0
X1/ICLK	3	14	13.5M
VDD	4	13	VDDIO
GND	5	12	GND
DSEL	6	11	ACLK
27M	7	10	DCLK
DCLK/2	8	9	48MHz

ICS614-01

**ACLK Select Table for Audio and Square Pixel**

ASEL1	ASEL0	ACLK
0	0	Off
0	1	29.4923 MHz
1	0	24.5454 MHz
1	1	24.576 MHz

**DCLK Select Table for NTSC/PAL**

DSEL	DCLK	DCLK/2
0	35.4689	17.73445
1	28.63636	14.31818

All Clock frequencies are in MHz.

0=connect directly to ground

1=connect directly to VDDIO

**Pin Descriptions**

Number	Name	Type	Description
1	OE	I	Output Enable. Tri-states all output clocks when low. All running when high (VDDIO).
2	X2	XO	Crystal connection. Connect to a 27 MHz fundamental parallel mode crystal.
3	X1/ICLK	XI	Crystal connection. Connect to a 27 MHz fundamental parallel mode crystal, or clock
4	VDD	P	Connect to +5V.
5	GND	P	Connect to ground.
6	DSEL	I	Input select. Determines DCLK and DCLK/2 per table above. Must be VDDIO.
7	27M	O	Buffered crystal oscillator 27 MHz clock output. Amplitude = VDDIO.
8	DCLK/2	O	NTSC or PAL 4X subcarrier frequency per table above. Amplitude = VDDIO.
9	48M	O	48.00 MHz clock output for Intel graphics processor. Amplitude = VDDIO.
10	DCLK	O	NTSC or PAL 8X subcarrier frequency per table above. Amplitude = VDDIO.
11	ACLK	O	Audio clock, or Square Pixel clock, per table above. Amplitude = VDDIO.
12	GND	P	Connect to ground.
13	VDDIO	P	Connect to +5V or +3.3V. Amplitude of output clocks will match this voltage.
14	13.5M	O	Buffered crystal oscillator divided by two 13.5 MHz clock output. Amplitude = VDDIO.
15	ASEL0	I	Input select 0 for ACLK. Determines ACLK frequency per table above. Must be VDDIO.
16	ASEL1	I	Input select 1 for ACLK. Determines ACLK frequency per table above. Must be VDDIO.

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



## Electrical Specifications

Parameter	Conditions	Minimum	Typical	Maximum	Units
<b>ABSOLUTE MAXIMUM RATINGS (note 1)</b>					
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
<b>DC CHARACTERISTICS (VDD = 5.0V unless noted)</b>					
Operating Voltage, VDD		4.50		5.50	V
Operating Voltage, VDDIO		3.13		VDD	V
Input High Voltage, VIH, X1 pin only		3.5	2.5		V
Input Low Voltage, VIL, X1 pin only			2.5	1.5	V
Input High Voltage, VIH		2			V
Input Low Voltage, VIL				0.8	V
Output High Voltage, VOH	IOH=-25mA	2.4			V
Output Low Voltage, VOL	IOL=25mA			0.4	V
Output High Voltage, VOH, CMOS level	IOH=-8mA	VDD-0.4			V
Operating Supply Current, IDD	No Load		35		mA
Short Circuit Current	Each output		±100		mA
Input Capacitance	OE, select pins		5		pF
VIN, VCXO control voltage		0		3	V
<b>AC CHARACTERISTICS (VDD = 5.0V unless noted)</b>					
Input Frequency			27.000000		MHz
Input Crystal Accuracy				30	ppm
Output Clock Accuracy (all but PAL square pixel)	Given exact input		0	1	ppm
Output Clock Rise Time	0.8 to 2.0V, no load			1.5	ns
Output Clock Fall Time	0.8 to 2.0V, no load			1.5	ns
Output Clock Duty Cycle	At VDD/2	40		60	%
Maximum Absolute Jitter, short term			±150		ps
Maximum Jitter, one sigma			50		ps

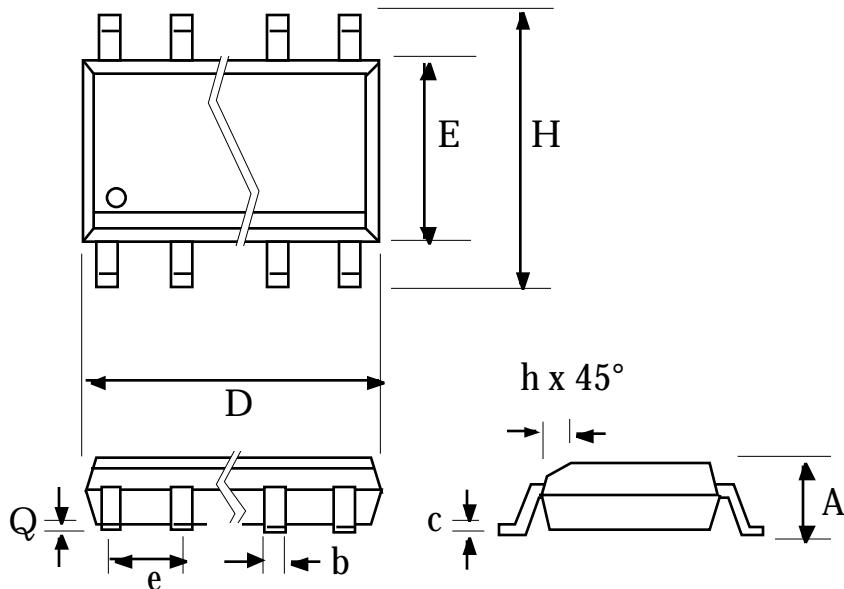
Notes: 1. Stresses beyond those listed under Absolute Maximum Ratings could cause permanent damage to the device. Prolonged exposure to levels above the operating limits but below the Absolute Maximums may affect device reliability.



## External Components/Crystal Selection

The ICS614-01 requires a minimum number of external components for proper operation. Decoupling capacitors of 0.01  $\mu$ F should be connected between VDD and GND, one between pins 4 and 5, and one between pins 13 and 12, as close to the part as possible. A series termination resistor of 33  $\Omega$  may be used for each clock output. The 27.000 MHz crystal must be connected as close to the chip as possible. The crystal should be a fundamental mode, parallel resonant, 30 ppm or better. Do not use third overtone. Crystal capacitors should be connected from pins X1 to ground and X2 to ground. In general, the value of these capacitors is given by the following equation, where  $C_L$  is the crystal load capacitance: Crystal caps (pF) =  $(C_L - 6) \times 2$ . So for a crystal with 16 pF load capacitance, two 20 pF caps can be used. For any given board layout, ICS can measure the board capacitance and recommend the exact capacitance value to use.

## Package Outline and Package Dimensions



16 pin SOIC narrow

Symbol	Inches		Millimeters	
	Min	Max	Min	Max
A	0.055	0.070	1.397	1.778
b	0.013	0.019	0.330	0.483
c	0.007	0.010	0.191	0.254
D	0.385	0.400	9.779	10.160
E	0.150	0.160	3.810	4.064
H	0.225	0.245	5.715	6.223
e	.050 BSC		1.27 BSC	
h		0.016		0.406
Q	0.004	0.01	0.102	0.254

## Ordering Information

Part/Order Number	Marking	Shipping packaging	Package	Temperature
ICS614M-01	ICS614M-01	tubes	16 pin narrow SOIC	0 to 70 C
ICS614M-01T	ICS614M-01	tape and reel	16 pin narrow SOIC	0 to 70 C

Rev. 12308, version A . First publication, Preliminary.

Rev. 2019, version B. Added jitter, IDD specifications, showed VDDIO on pin 13, added i752 designation.

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